Errata

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HP References in this Manual

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User's Guide

HP 85726B PHS Measurements Personality

Including Digital Demodulation

HEWLETT
PACKARD

HP Part No. 85726-90004
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Safety Notes

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

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

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

General Safety Considerations

Warning **Before the spectrum analyzer is switched on, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.**

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

Caution Before the spectrum analyzer is switched on, make sure its primary power circuitry has been adapted to the voltage of the ac power source.

Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

What Is the PHS Communication System?

Personal Handy Phone System (PHS) is a digital cordless telephone communication system.

There are three types of PHS transceivers: personal stations, which are hand-held units; public cell stations, which are high-power public accessible units and other cell stations, which are low power units for residential and office use.

The PHS system is a digital system that employs a combination of frequency division multiple access (FDMA), time division multiple access (TDMA), and time division duplex (TDD). The TDMA/TDD frame structure has eight timeslots per frame, which means that each channel frequency can support up to eight timeslots. A frame is 5 ms long and each timeslot is 625 μs long. The digital modulation is $\pi/4$ differential quadrature phase shift keying (DQPSK). The $\pi/4$ DQPSK modulation causes both phase and amplitude variations in the RF signal.

The quadrature nature of this modulation permits two bits to be transmitted at the same time on orthogonal carriers. There are 120 symbol periods in each slot, and each symbol contains 2 bits of information. Thus, there are 240 bits per timeslot. Since there are 1920 bits for all 8 timeslots in the frame, at 200 frames per second the transmission rate is 384,000 bits per second.

The PHS communication system is defined in the Research and Development Center for Radio Systems document:

RCR STD-28, the Personal Handy Phone System Standard.

What Does the HP 85726B PHS Measurements Personality Do?

The HP 85726B PHS measurements personality can help determine if a PHS transmitter is working correctly. The HP 85726B adapts HP 8590 E-Series spectrum analyzer hardware for the testing of a PHS transmitter according to the Research and Development Center for Radio Systems (RCR) document, RCR STD-28. This document defines complex, multi-part measurements used to maintain an interference-free environment. For example, the documents include measuring the adjacent-channel power of a carrier. The HP 85726B automatically makes these measurements using the measurement methods and limits that are defined in RCR STD-28. In addition to the RCR standard for PHS, the Radio Equipment Inspection and Certification Institute (MKK) has a technical standard conformity certification which is described in their document entitled “Characteristic Test Methods for Radio Equipment, Part 2,” January 1994. Many of the HP 85726B measurements are also based on the measurement methods and limits described in the MKK document. The detailed results displayed by the measurements allow you to analyze PHS system performance. You may alter the measurement parameters for specialized analysis.

The HP 85726B was developed for making measurements on burst carriers of the personal or cell station transmitters. It can also make measurements on continuous carrier signals.

The HP 85726B operates with the following options to make modulation accuracy measurements and to demodulate the transmitted bits of a PHS transmitter:

Option 151 Fast ADC and Digital Demodulator Hardware

and

Option 160 PDC/PHS/NADC/CDMA Firmware ROMs for Option 151

These tests help you to assess the quality of digital modulation to ensure transmitted voice quality. The digital demodulator based tests include: RMS and peak error vector magnitude, RMS magnitude error, RMS phase error, carrier frequency error, and I-Q origin offset. The demodulated bits are also available. Note that these bits are not decoded, or de-interleaved. Other digital demodulation displays include: I-Q constellation graph, I-Q pattern graph, and EVM versus symbol number graph.

Digital demodulator-based tests are internally triggered on the unique word. Power versus time measurements use a different technique of unique word synchronization; the end result is a video-triggered sweep.

The digital demodulator option also supplies a trigger signal with a period of 5 ms, the PHS frame rate. This trigger signal is called the frame trigger. The frame trigger signal is synchronized relative to the unique word occurrence in the data stream. Carrier off power and spurious measurements may be triggered using the frame trigger via the rear panel FRAME TRIG OUTPUT signal, or by using an alternate synchronized triggering scheme. Note that the PHS frame trigger frequency is locked to the spectrum analyzer reference, and may drift slowly relative to the PHS timeslots.

In This Guide

The first two chapters of this guide provide all the information needed to install the PHS measurements personality and start making measurements. This helps you be productive as quickly as possible. The remaining chapters provide key descriptions, programming reference, troubleshooting, and verification.

To use this guide:

1. Perform the procedures in Chapter 1, "Getting Started." These procedures explain how to load the measurements personality, and prepare the spectrum analyzer for making PHS measurements.
2. See Chapter 2, "Making Measurements," for examples of making different types of measurements. This chapter will help you start making measurements right away, without long explanations or details about the key functions.
3. Refer to the remaining chapters of this guide as needed.

The remaining chapters are as follows:

- Chapter 3, "Menu Map and Softkey Descriptions," explains all softkeys in the PHS measurements personality. This chapter also provides menu maps showing all softkeys to help you navigate between functions.
- Chapter 4, "Error Messages and Troubleshooting," contains information about what to do if you have a problem with the PHS measurements personality, including how to contact HP for service.
- Chapter 5, "Programming Commands," is a reference chapter for details about the PHS personality remote programming commands, including default values of setup and limit variables.
- Chapter 6, "Programming Examples," contains information about how to use a computer to operate and customize the PHS measurements personality. It also lists default limits for the pass/fail message.
- Chapter 7, "Specifications," contains all the specifications and characteristics for the HP 85726B.
- Chapter 8, "Verifying Operation," has test procedures that confirm the electrical performance of the following options:

  Option 052, improved amplitude accuracy over the PHS frequency range
  Option 105, time-gated spectrum analysis
  Options 151 and 160, digital demodulator hardware and firmware

  The verification tests should be performed at least once per year.
- The "Glossary" contains descriptions of words and terms specific to PHS, and digital communications in general.

Key Conventions

The following key conventions are used in this guide:

Front-panel key	Boxed text represents a key physically located on the front panel of the spectrum analyzer.
Softkey or SOFTKEY	Shaded text represents a softkey. A softkeys label appears on the right-hand side of the spectrum analyzer display, next to the associated softkey. If a softkey label consists of uppercase and lowercase letters, pressing that softkey will access more softkeys. If a softkey label consists entirely of uppercase letters, pressing that softkey will perform an immediate action.
Screen Text	Text printed in this typeface indicates a message that appears on the spectrum analyzer display.

Spectrum Analyzer Operation

If you are not familiar with your spectrum analyzer, refer to its manuals; they describe spectrum analyzer preparation and verification, and explain what to do if something goes wrong. These manuals also describe spectrum analyzer features and tell you how to make spectrum analyzer measurements. Consult these manuals whenever you have a question about standard spectrum analyzer use.

Contents

2. Making Measurements

3. Menu Map and Softkey Descriptions

7. Specifications

8. Verifying Operation

Glossary

Index

Figures

Tables

1

Getting Started

This chapter helps acquaint you with the spectrum analyzer features that you will be using, and also contains the procedures for preparing the spectrum analyzer to measure a Personal Handy Phone System (PHS) transmission. This chapter contains the following information:

- descriptions of the equipment needed
- descriptions of the HP 8590 E-Series spectrum analyzer features that you will be using
- procedures for accessing the PHS analyzer mode
- procedures for accessing the spectrum analyzer functions
- information about the changes to the spectrum analyzer operation caused by the HP 85726B PHS measurements personality
- lists of the recommended accessories and spectrum analyzer options for use with the HP 85726B PHS measurements personality

Complete all the steps in “Preparing to Make a Measurement” later in this chapter before actually making measurements. This procedure will help you avoid errors in loading and configuring the PHS personality.

Equipment Needed

To prepare the spectrum analyzer to measure a signal from a PHS transmitter, you need the following equipment:

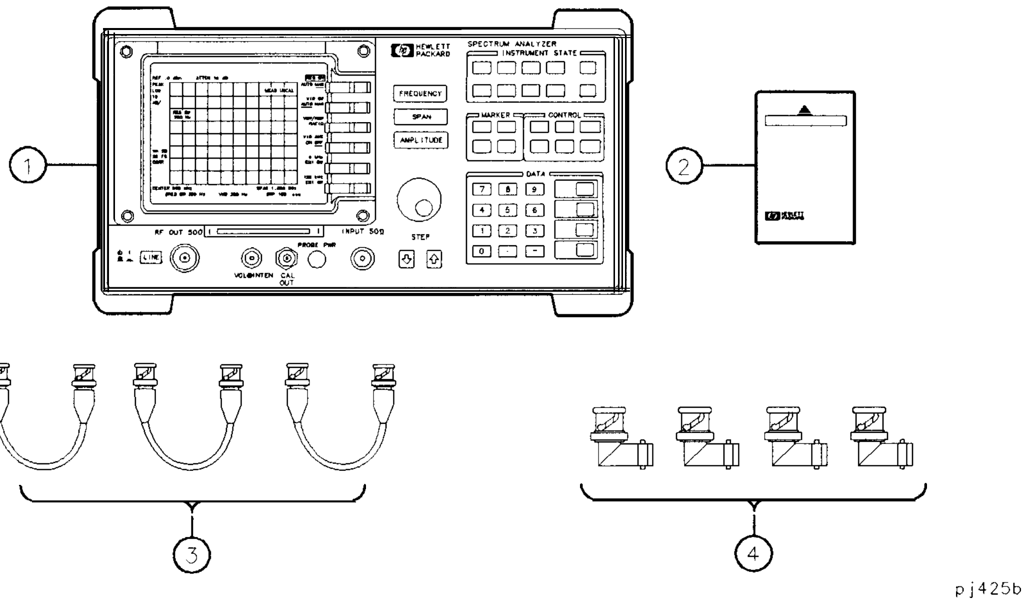


Figure l-l. Required Equipment

1 An HP 8593E, HP 8594E, HP 8595E, or HP 8596E spectrum analyzer. The spectrum analyzer firmware must be dated 940822 or later. The options described in Table l-l are required or recommended, and should be installed in the spectrum analyzer.

2 The HP 85726B PHS measurements personality read-only memory (ROM) card. The PHS measurements personality is a program contained in this ROM card.

3 Three short BNC cables, each having HP part number 8120-2682, used for the following purposes:

One short BNC cable for calibrating the spectrum analyzer using the front panel CAL OUT connector.

One short BNC cable, necessary for Option 105 operation.

One short BNC cable, necessary for Option 151 operation.

4 Four BNC-male to BNC-female right-angle adapters, each having HP part number 1250-0076, used for the following purposes:

Two right-angle adapters, necessary for Option 105 operation.

Two right-angle adapters, necessary for Option 151 operation.

Table l-l. Required and Recommended Options

Required Options	
Option	**Description**
Option 004	The precision frequency reference provides increased frequency accuracy. If Option 004 is not installed in the spectrum analyzer, you must use an external 10 MHz precision frequency reference when performing a PHS measurement.
Option 101	The fast time domain sweeps option card provides 20 μs to 20 ms sweep times in zero span and is used for many of the PHS measurements. It also provides a trigger delay function which is used to synchronize the PHS measurement to the frame time of the PHS transmission. Option 101 is not required if Option 151 is installed.
Option 105	The time-gated spectrum analyzer option card provides the time gating needed in the carrier-off leakage power gated method measurement and the externally-triggered digital demodulation measurement.
Recommended Options	
Option 041	The HP-IB and parallel interface provides a Hewlett-Packard interface bus (HP-IB), an external keyboard interface, and a parallel printer interface.
Option 052	The improved amplitude accuracy is recommended for use with the HP 85726B, but not required. This option improves the spectrum analyzer amplitude accuracy specifications for PHS measurements made in the PHS frequency range. This option Is available for the HP 85933, HP 85943, HP 85953, or HP 85963 spectrum analyzer.
Options 151 and 160	The digital demodulator RF card and digital demodulator digital signal processor (DSP) card (Option 151), and a set of three PDC/PHS/NADC/CDMA ROMs (Option 160). Option 101 is not required if Option 151 is installed.
All options are available as retrofit kits after the purchase of your spectrum analyzer. Contact your nearest Hewlett-Packard Sales and Service Office for more information. These offices are listed at the end of Chapter 4, "Error Messages and Troubleshooting." Refer to "Spectrum Analyzer Options Used with the PHS Measurements Personality," later in this chapter for more information about these, and other options.	

List spectrum analyzer options and firmware revision

HP.8590 Series spectrum analyzers can display the numbers and descriptions of most installed spectrum analyzer options, including other information about your spectrum analyzer. To do this, press (CONFIG) MORE 1 of 3 SHOW OPTIONS. Option 052 will not be shown. To confirm that Option 052 is installed, look at the serial number plate attached to the rear panel of the spectrum analyzer.

For more information about SHOW OPTIONS , see Chapter 6, "Key Descriptions," in the ***HP 8590 E-Series and L-Series Spectrum Analyzers User's Guide***

Note The HP 85726B PHS measurements personality automatically displays an error message if you access a measurement that requires an option that is not installed.

The HP 8590 Series Spectrum Analyzer Front Panel Features

Familiarize yourself with the following features before using the PHSmeasurements personality.

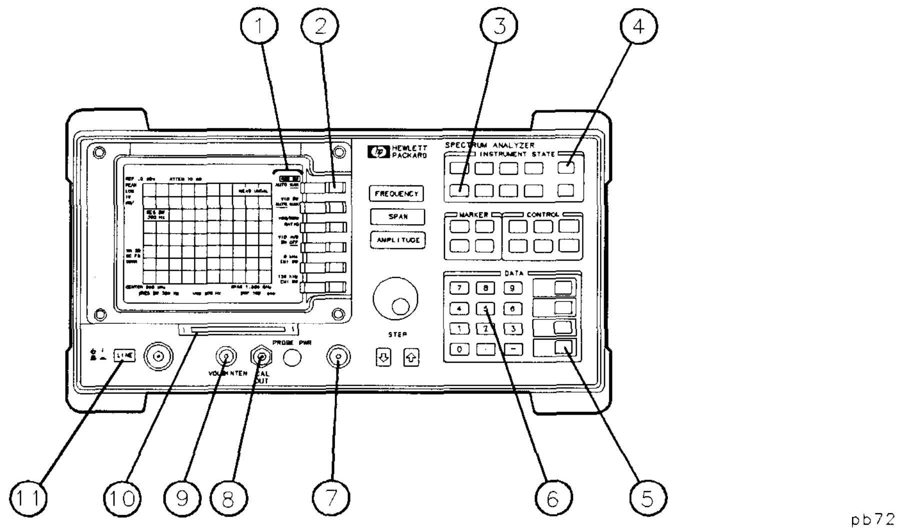


Figure 1-2. Front Panel Features

1 The annotations on the right side of the spectrum analyzer display are the softkey labels. The softkey labels display the functions that you can select. In this guide, the softkey labels are shown as text in shaded boxes (for example, PHS **ANALYZER**).

2 The dark grey keys next to the spectrum analyzer display are softkeys. To select a function, press the softkey that is next to the softkey label.

3 (MODE) accesses the spectrum analyzer mode or the PHS analyzer mode. In this guide, the front panel keys are shown in text as boxes (for example, (MODE)).

4 (COPY) prints the screen display on a printer or plots the screen display on a plotter.

5 (ENTER) is often used to terminate entries made with the data keys. (ENTER) is used to terminate unitless entries, or entries that use the Hz, μV, and μs units. For entries that have units other than Hz, μV or μs, you need to terminate the entry with one of the keys that are directly above (ENTER).

6 The data keys are used to enter numbers.

7 The INPUT 50 Ω connector is where the signal to be measured is input.

8 The CAL OUT connector provides a 300 MHz, -20 dBm calibration signal. The calibration signal is used by the spectrum analyzer to perform the spectrum analyzer amplitude and frequency self-calibration routines.

9 The outer knob controls the volume of the speaker, and the inner knob controls intensity of the spectrum analyzer display.

10 The card reader is where a RAM (random-access memory) or ROM (read-only memory) card is inserted.

11 (LINE) turns the spectrum analyzer on or off.

Preparing to Make a Measurement

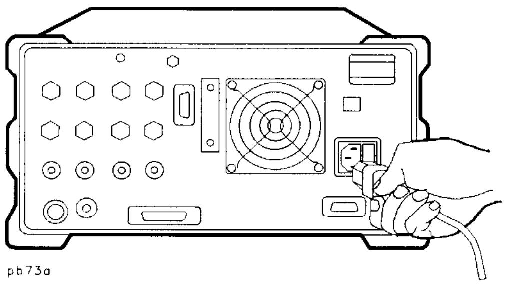
This section explains the steps that are necessary to prepare the spectrum analyzer for making PHS measurements. The steps are:

1. Load the PHS measurements personality into the spectrum analyzer memory.
2. Perform the spectrum analyzer self-calibration routines. *
3. Make the cable connections for triggering the spectrum analyzer.
4. Make the cable connections for unique word frame triggering.
5. Connect the external precision frequency reference (if Option 004 is *not* installed).
6. Access the PHS analyzer mode.

* Do not confuse this calibration with the ***optional*** EVM calibration explained in Chapter 2, "Making Measurements." The EVM calibration improves EVM measurement accuracy by calibrating to a high-quality external source, but is *not* necessary before making an EVM measurement.

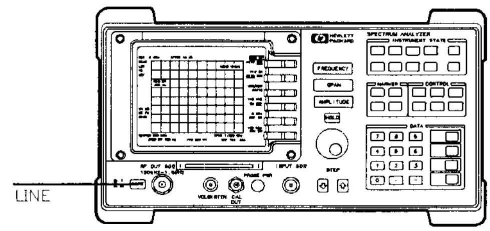
Step 1. Load the PHS measurements personality

1. Plug the spectrum analyzer into an ac power supply.



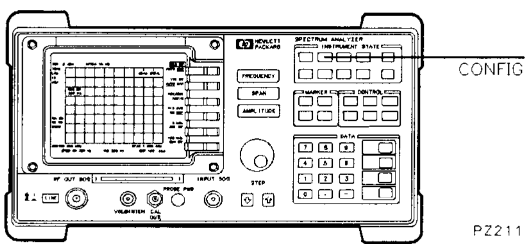
pb73a

2. Press the (LINE) key and wait for the power-on routine to finish.



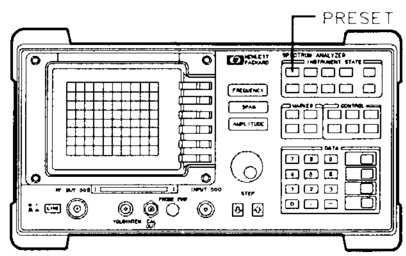
PZ28

3. Press (CONFIG) More 1 of 3 `Dispose User Mem ERASE DLP MEM` ERASE DLP MEN to erase any previously-installed program. Wait for the dispose routine to finish.



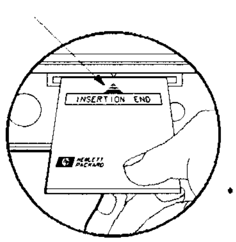
PZ211

4. Press (PRESET).



PZ212

3. Locate the arrow printed on the PHS measurements personality card label.



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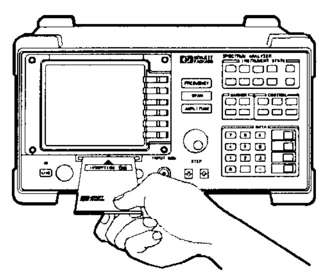
6. Insert the card into the spectrum analyzer with the card arrow matching the raised arrow on the bezel around the card-insertion slot.



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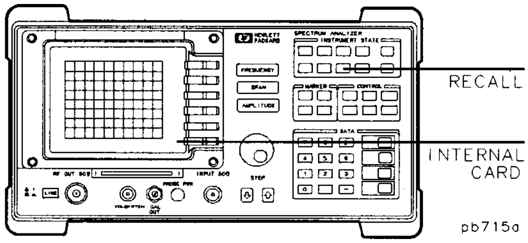
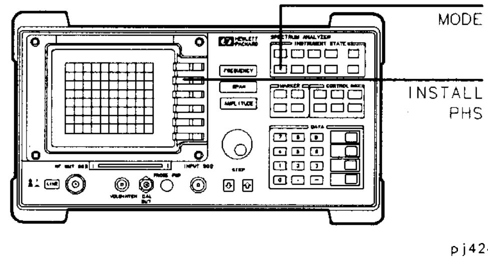
7. Press (RECALL). Press the INTERNAL CARD softkey so that CARD is underlined.



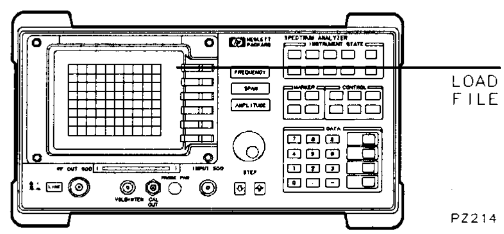
8. Press Catalog Card CATALOG ALL.



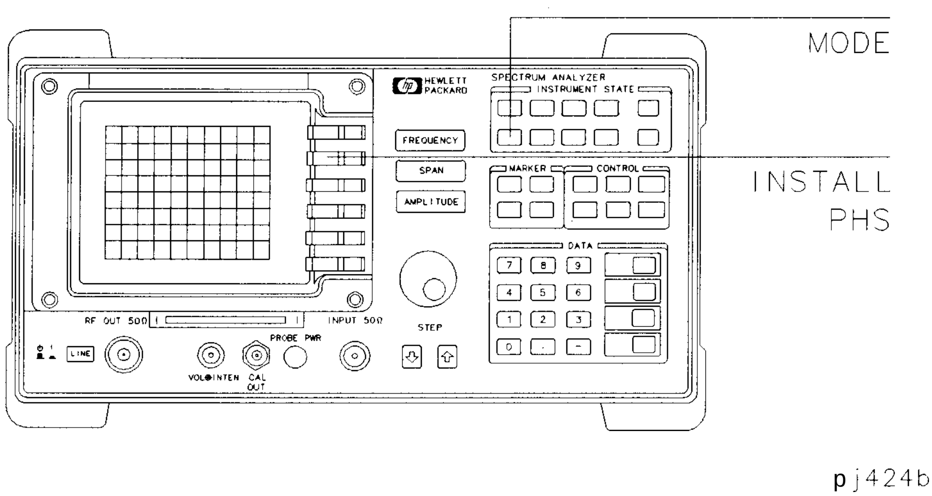
9. Make sure that dPHS is highlighted on the spectrum analyzer display. If necessary, use the large knob on the spectrum analyzer front panel so that dPHS is highlighted.

PHS	1024
dPHS	DLP
dS	DLP
dCID	DLP

10. Press LOAD FILE. When the spectrum analyzer has finished loading the dPHS file, the catalog entries are blanked from the display.

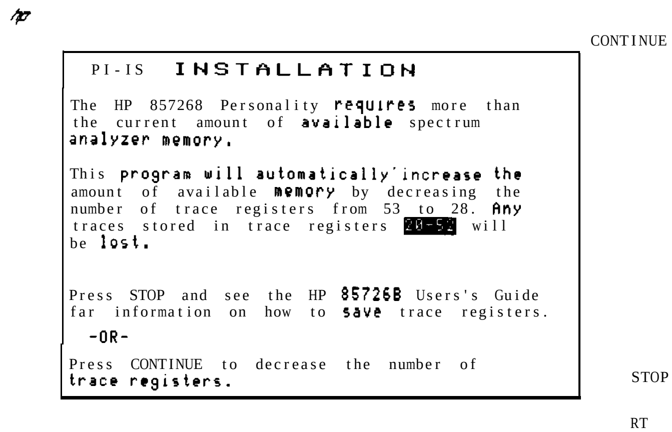


11. Press (MODE) INSTALL PHS to access the PHS installation mode.



12. The message Please wait, Loading PHS . . . will appear on the screen if enough spectrum analyzer memory is available to load the PHS main file. It takes several minutes to load the PHS main file. PHS Loaded will appear when done. * In this case, continue with the procedure “Step 2. Perform the spectrum analyzer self-calibration routines.”

If there is not enough available spectrum analyzer memory to load the PHS main file, a memory usage message appears as shown below.



If you need to save any previously-stored traces which are in the highlighted range of trace registers to be lost, make a note of this range, press STOP , and continue with number 13 on the next page.

If you don’t need to save any traces in the highlighted range, press CONTINUE to delete the isted trace registers and make room in memory for the main PHSfile.† The message Please wait, Loading PHS . . . appears. It takes several minutes to load the main PHS file, at which ime the message PHS Loaded appears. * Continue with the procedure “Step 2. Perform the spectrum analyzer self-calibration routines. ”

* Once the main PHS file has been loaded, the PHS measurements personality will remain in spectrum analyzer memory, even if the instrument is preset or turned off. The personality will remain in memory until it is deleted with ERASE DLP MEM .

† Spectrum analyzers with firmware revisions 930506 or 930923 require an extra step after pressing CONTINUE. In this case, follow the additional on-screen instructions.

13. The following procedure is necessary only if you want to save previously-stored traces.

There are two different ways to save a desired trace:

- You can save the trace to one of the trace registers which won't be lost. For example, if trace registers 0 through 32 will be lost, and you want to save the trace in trace register 1, you can save it to trace register 33.
- You can save the trace to a RAM card such as the HP 85700A RAM card.

Either of these methods require that you first recall the trace that you want to save.

To Recall a Trace from a Trace Register

1. Press (RECALL). If CARD is underlined, press INTERNAL CARD to select INTERNAL.
2. Press Internal → Trace . This accesses a menu displaying TRACE A , TRACE B , TRACE C , LIMIT LINES , and AMP COR .
3. Press TRACE A , TRACE B , or TRACE C to select the trace in which you want to place the trace data.
4. Enter the register number of the trace you want to save.
5. Press (ENTER). The recalled trace is placed in the view mode and the spectrum analyzer state is changed to the state that was saved. Next, follow either of the next two procedures "To Save a Trace to a Trace Register, " or "To Save a Trace to a RAM memory card."

To Save a Trace to a Trace Register

1. Press (SAVE. If CARD is underlined, press INTERNAL CARD to select INTERNAL.
2. Press Trace → Intrnl . This accesses a menu displaying TRACE A , TRACE B , and TRACE C.
3. Press the softkey for the trace that you want to save: TRACE A, TRACE B , or TRACE C . REGISTER # and MAX REG # = are displayed on the spectrum analyzer display. The number after MAX REG # = indicates the maximum register number that can be entered for trace storage in spectrum analyzer memory.
4. Use the numeric keypad to enter the number of a trace register ***outside*** the range of trace registers which will be lost, and then press (ENTER).

To Save a Trace to a RAM Card

1. Press (DISPLAY) or (CONFIG), and then Change Prefix to enter a new prefix or change the existing prefix.

   If you do not specify a prefix, the trace will be saved with a file name consisting of t-(register number).

2. Press (SAVE). If INTERNAL is underlined, press INTERNAL CARD to select CARD. Press Trace → Card to access the menu that displays TRACE A, TRACE B, and TRACE C.

3. Press the softkey label of the trace that you want to save: TRACE A, TRACE B, or TRACE C. REGISTER # andPREFIX= are displayed on the spectrum analyzer display.

4. Use the numeric keypad to enter a register number and then press (ENTER).

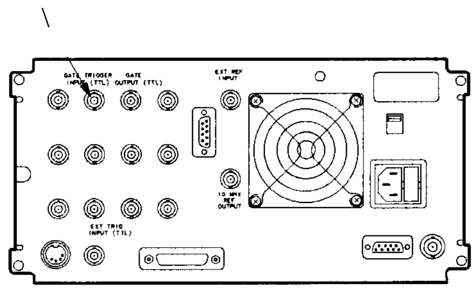
   The trace data is saved with a file name consisting of a "t," the current prefix, an underscore (-), and the register number. The "t" denotes that the file contains trace data. See "Save and recall data from the memory card" in Chapter 5, "Using Analyzer Features," of the ***HP 8590 E-Series and L-Series Spectrum Analyzers*** User's Guide for additional information about using memory cards.

Return to number 11 of Step 1. "Load the PHS measurements personality."

Step 2. Perform the spectrum analyzer self-calibration routines

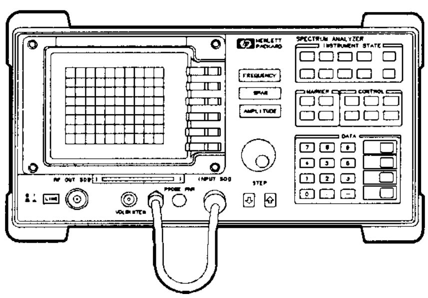
Leave the spectrum analyzer turned on for at least 30 minutes before performing this procedure. (To meet specifications, the spectrum analyzer must be allowed to warm up for 30 minutes before performing the self-calibration routines.)

1. If the analyzer contains Option 105, then make sure nothing is connected to the GATE TRIGGER INPUT connector on the spectrum analyzer rear panel.



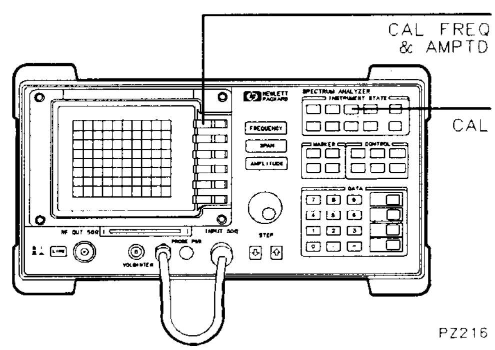
pj411a

2. Attach the calibration cable from the CAL OUT connector to the INPUT connector with the appropriate adapters.



PZ215

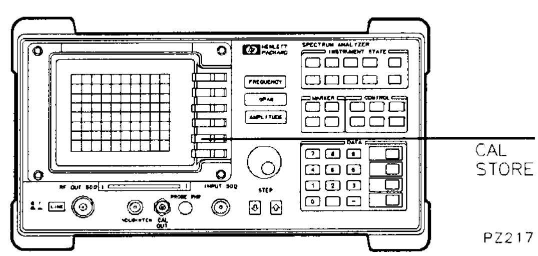
3. Press (CAL), then CAL FREQ & AMPTD .



PZ216

The frequency and amplitude self-calibration routines are completed in 3 to 9 minutes. (The time required for the self-calibration routines depends on the options installed in the spectrum analyzer, and the spectrum analyzer model.) A message is displayed when the self-calibration routines are finished. If an error message is displayed, refer to the spectrum analyzer service documentation for troubleshooting.

4. Press CAL STORE .



PZ217

For the spectrum analyzer to meet its specifications, the self-calibration routines should be performed periodically or whenever the ambient temperature changes. For practical advice on when and how often the self-calibration routines should be performed, refer to the spectrum analyzer calibration guide.

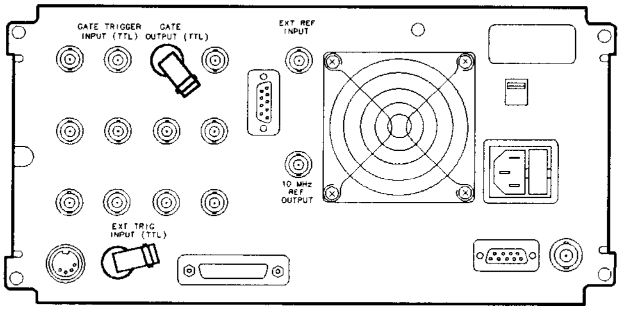
Step 3. Make the cable connections for triggering the spectrum analyzer

Perform this procedure if the following two things are true:

- Option 101 or 151 is installed in your analyzer. See "Tell the analyzer to list its own options" in the beginning part of this chapter to quickly determine the options installed in your analyzer.
- You want to perform power versus time, carrier-off power, or spurious measurements.

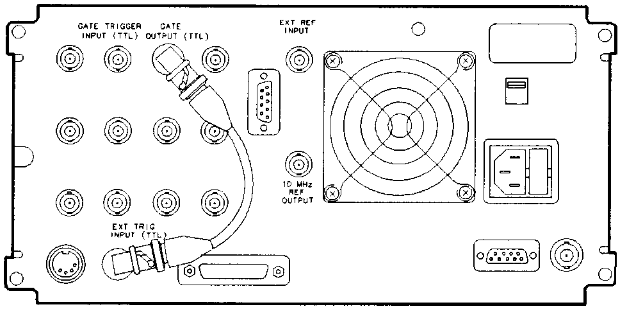
If these things are not true, then continue with the procedure "Step 5. Connect the external precision frequency reference."

1. If Option 105 is installed in your analyzer, perform this procedure. If Option 105 is ***not*** installed, continue with number 3 on the next page. Attach two right-angle BNC adapters to the GATE OUTPUT and the EXT TRIG INPUT connectors located on the rear panel of the spectrum analyzer.



pb753b

2. Connect a short BNC cable between the two adapters.

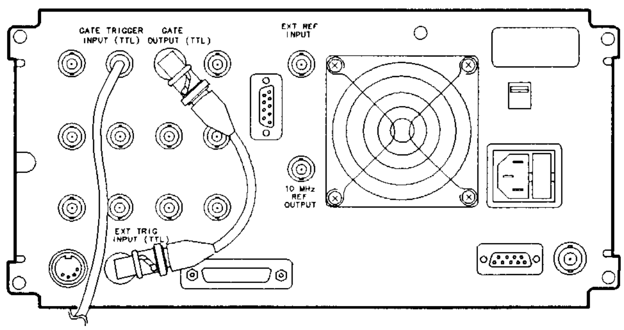


pb754b

It is not necessary to remove the BNC cable after you have connected it to the right-angle adapters. This cable can remain attached to the spectrum analyzer for all the PHS measurements, all the self-calibration routines, and all the conventional spectrum analyzer functions. If you need to set the spectrum analyzer onto its rear feet, the right-angle adapters protect the BNC cable from damage.

3. To use an external trigger signal, continue with this procedure. If Options 151 (and 160) are installed and you want to use unique word frame triggering (using digital demodulation), proceed to the procedure "Step 4. Make the cable connections for unique word frame triggering."

If the spectrum analyzer is equipped with Option 105, connect a transistor-transistor logic (TTL) trigger signal to the GATE TRIGGER INPUT connector on the rear panel of the spectrum analyzer. Option 105 is required ***only*** for the carrier-off leakage power gated method measurement (COP TYPE ZSP GTD set to GTD). If Option 105 is not installed, connect the trigger signal directly to the EXT TRIG INPUT connector.



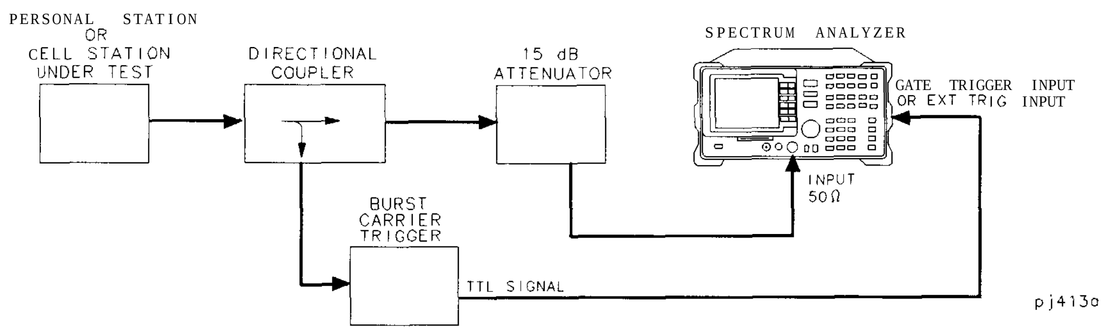
pb756b

This TTL trigger signal provides an external trigger for the spectrum analyzer. The trigger signal should be a TTL pulse at least 1 μs wide that occurs once for every PHS frame (once per burst of the unit under test).

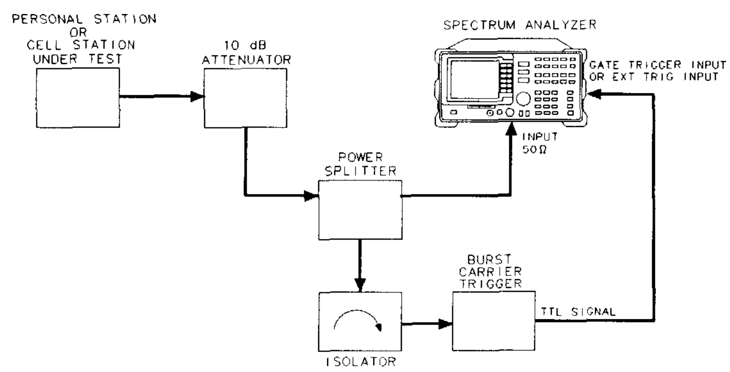
The TTL trigger signal can be supplied directly by the unit under test or by an associated piece of test equipment, or indirectly, by converting the RF carrier into a TTL signal. A burst carrier trigger device such as the HP 85902A Burst Carrier Trigger can be used for this conversion. (See example setups on the following page.)

Example setups for using the HP 85902A Burst Carrier Trigger

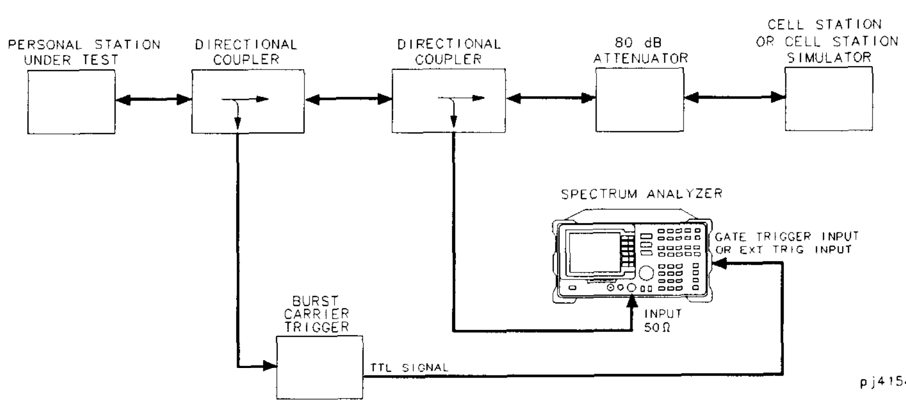
Below are some examples of connecting the HP 85902A Burst Carrier Trigger to a spectrum analyzer to use an external signal for triggering the carrier off leakage power, spurious, and power versus time measurements.



Personal Station or Cell Station in Self-Test Mode, Using a Directional Coupler



Personal Station or Cell Station in Self-Test Mode, Using a Power Splitter



Personal Station with a Cell Station

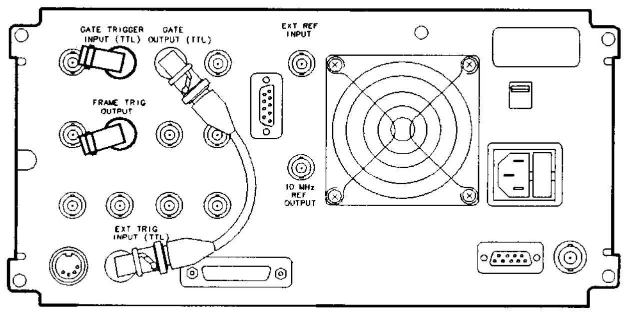
Step 4. Make the cable connections for unique word frame triggering

Perform this procedure if Options 151 and 160 are installed and you wish to trigger the spectrum analyzer using unique word frame trigger using digital demodulation for power versus time, carrier-off power, and spurious measurements.

See “Tell the analyzer to list its own options” in the beginning part of this chapter to quickly determine the options installed in your analyzer.

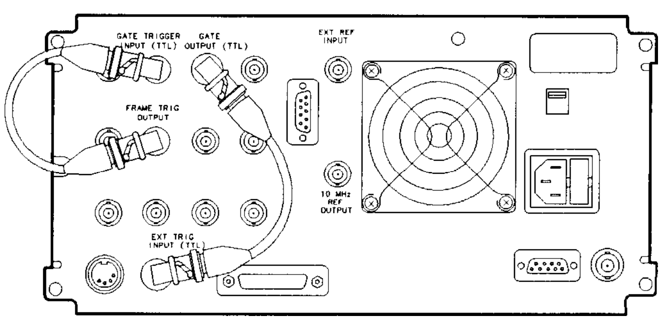
1. If the spectrum analyzer is equipped with Option 105, attach two right-angle BNC adapters to the FRAME TRIG OUTPUT and the GATE TRIG INPUT connectors located on the rear panel of the spectrum analyzer. Option 105 is required ***only*** for the carrier-off leakage power gated method measurement (COP TYPE ZSP GTD) set to GTD.

   If Option 105 is not installed, attach two right-angle BNC adapters to the FRAME TRIG OUTPUT and the EXT TRIG input connectors located on the rear panel of the spectrum analyzer.



pb747b

2. Connect a short BNC cable between the two adapters.



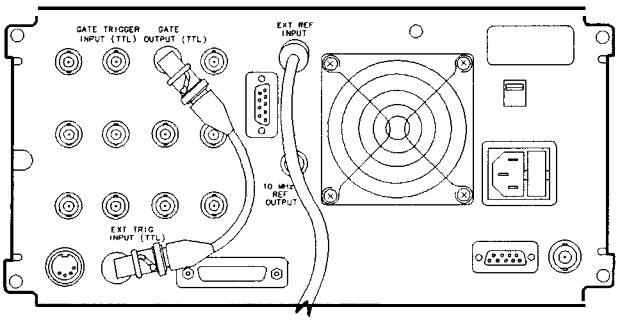
pb748b

You do not need to remove the BNC cable after you have connected it to the right-angle adapters, unless you are executing self calibration (CAL AMPTD or CAL FREQ & AMPTD). This cable can remain attached to the spectrum analyzer for all the PHS measurements and all the conventional spectrum analyzer functions. When executing self calibration routines, remove the frame trigger output from the GATE TRIGGER INPUT. Reconnect them after the calibration is complete. If you need to set the spectrum analyzer onto its rear feet, the right-angle adapters protect the BNC cable from damage.

Step 5. Connect the external precision frequency reference

Perform this procedure if Option 004 is not installed in your spectrum analyzer.

1. Disconnect the connector from the 10 MHz REF OUTPUT and EXT REF IN connectors on the rear panel.
2. Connect the 10 MHz signal from a precision external frequency reference to the EXT REF IN connector.



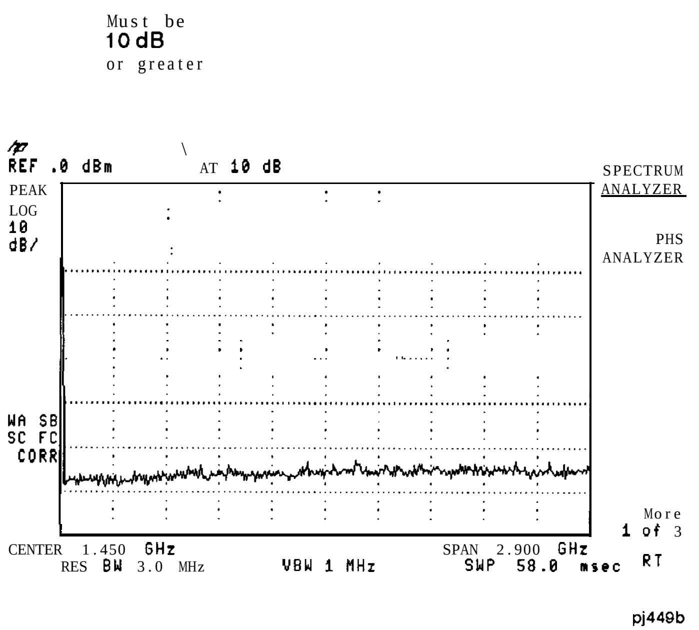
pb757b

Step 6. Access the PHS analyzer mode

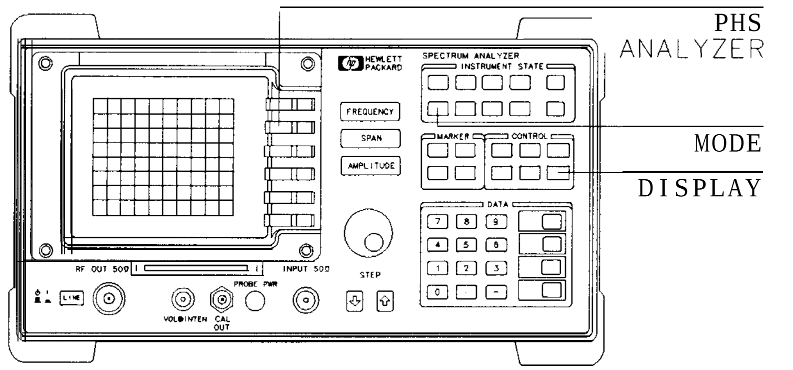
Caution

If you select 0 dB internal input attenuation manually while the instrument is in spectrum analyzer mode, then access the PHS mode, this attenuation value will be recalled automatically when you exit PHS mode and enter spectrum analyzer mode using the (MODE) key. Instrument damage may occur if total input power at the spectrum analyzer front panel is greater than +20 dBm with 0 dB internal input attenuation.

To avoid accidentally recalling 0 dB internal attenuation, always verify 10 dB or greater internal input attenuation is selected in spectrum analyzer mode, *before you* access the PHS mode. Pressing (PRESET) will guarantee that at least 10 dB internal attenuation will be used.

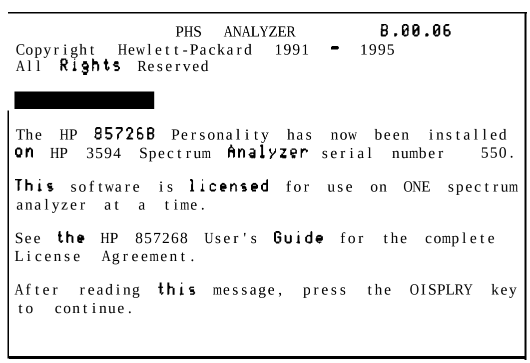


1. Press (MODE) PHS ANALYZER to access the PHS analyzer mode. You will see the copyright message for the HP 85726B. This message is only displayed the first time you access the PHS analyzer mode.



pj450b

3. After reading the copyright message, press (DISPLAY) to erase this message.



PHS ANALYZER B.00.06
Copyright Hewlett-Packard 1991 - 1995
All Rights Reserved

[redacted]

The HP 85726B Personality has now been installed
on HP 3594 Spectrum Analyzer serial number 550.

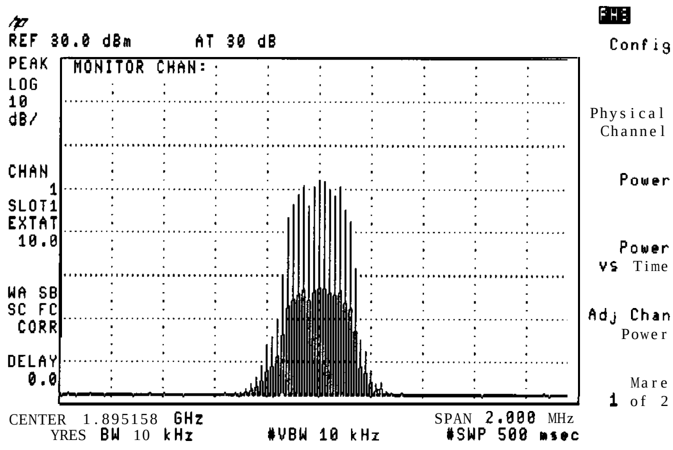
This software is licensed for use on ONE spectrum
analyzer at a time.

See the HP 857268 User's Guide for the complete
License Agreement.

After reading this message, press the OISPLRY key
to continue.

RT

3. When the spectrum analyzer is using the PHS analyzer mode, `PHS` appears in the upper right corner of the spectrum analyzer display.



The PHS Measurements Personality Main Menu

4. If Option 004 is not installed in your spectrum analyzer, the message `Ext precision freq reference required` will be displayed. This message is a reminder that you must use an external frequency reference when using the PHS measurements personality. See the previous procedure, "Step 5. Connect the external precision frequency reference" for information about connecting an external frequency reference to the spectrum analyzer.

If any other messages are displayed, see Chapter 4, "Error Messages and Troubleshooting."

PHS Measurements Personality Screen Annotations

The PHS personality displays additional annotations that supplies information related to PHS measurements settings. Refer to Figure l-3 through Figure 1-5 and Table l-2 through Table l-4 to identify PHS measurements personality screen annotations.

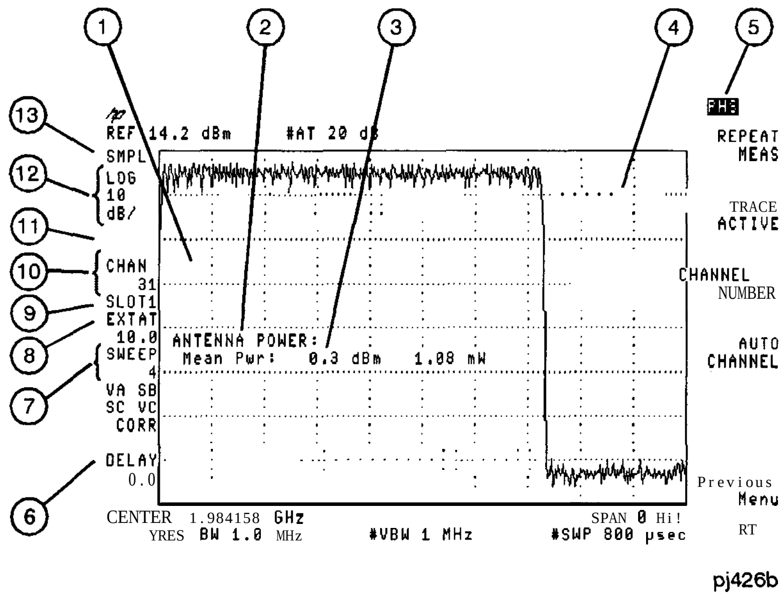


Figure 1-3. PHS Screen Annotations

Table l-2. PHS Screen Annotations

Item	Display Annotations	Description
1	Active function or error message	Indicates either the active function that has been selected or an error message.
2	Measurement	The current PHS measurement.
3	Measurement results	The measurement results.
4	Pass/fail message	Indicates if the personal station or cell station passed or failed the measurement if PASSFAIL ON OFF is set to on.
5	PHS	Indicates the spectrum analyzer is using the PHS measurements personality (also referred to as the PHS analyzer mode).
6	DELAY	Displays the trigger delay time.
7	SWEEP	Displays the number of sweeps that were used for the measurement.
8	EXTAT	Displays the external attenuation.
9	SLOT	Displays the slot number.
10	CHAN	Displays the channel number.
11	HIPWR or none	Indicates the current setting of TX PWR HI LOW
12	LOG	Displays the amplitude scale.
13	GTSMP, GTPOS, SMPL, PEAK	Detector mode for measurement. The detectors are: gated-sample mode (GTSMP), gated-positive mode (GTPOS), sample mode (SMPL), and peak mode (PEAK).

Digital demodulation screen annotations

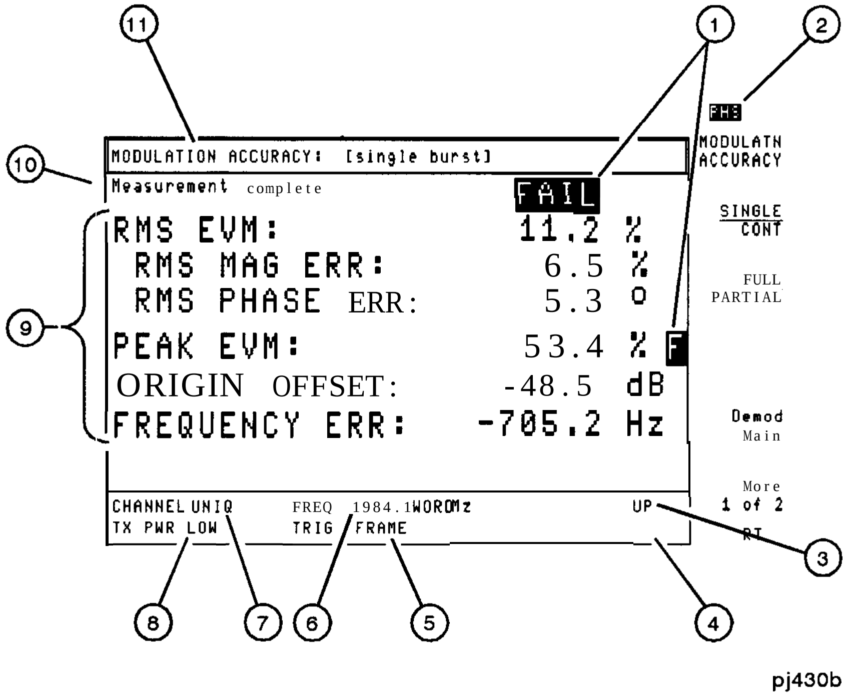


Figure 1-4. Digital Demodulation Screen Annotations 1

Table 1-3. Digital Demodulation Screen Annotations 1

Item	Display Annotations	Description
1	Pass/fail message	When **PASSFAIL** ON **OFF** is set to ON, indicates if device passed or failed the measurement and which parameters failed.
2	Mode indicator (PHS)	Indicates the mode in which the analyzer is operating.
3	UNIQ WORD	Indicates the unique word being used for sync (uplink, or downlink).
4	EVM CORR	Indicates EVM correction is being used.
5	TRIG	Indicates current digital demodulator trigger mode FRAME, FREE RUN, or EXTERNAL.
6	FREQ	Indicates current channel center frequency.
7	CHANNEL	Indicates current channel number.
8	The selected transmission power	High = high power, Low = low power.
9	Measurement results	The measurement results.
10	Messages	Indicates progress of measurements or flags errors.
11	Measurement	Indicates the current measurement being performed.

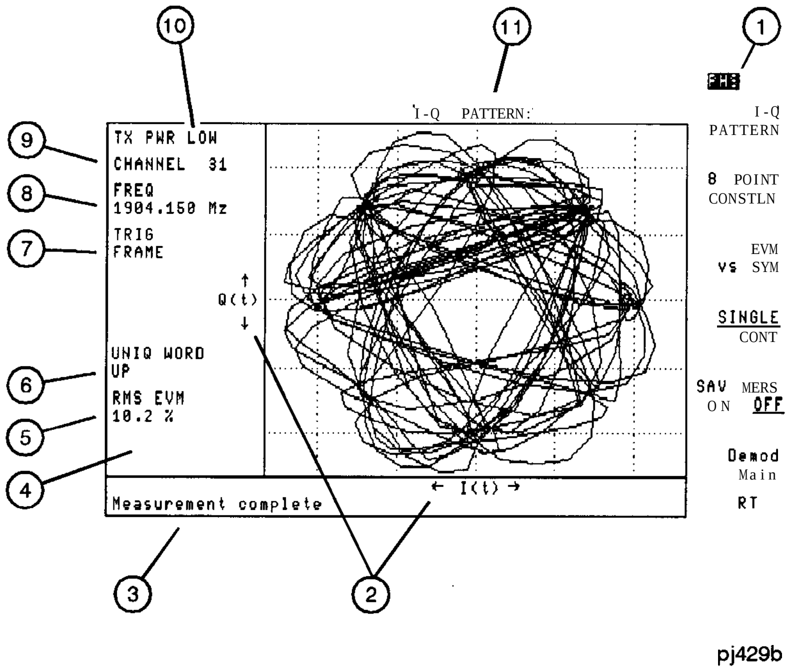


Figure 1-5. Digital Demodulation Screen Annotations 2

Table l-4. Digital Demodulation Screen Annotations 2

Item	Display Annotations	Description
1	Mode indicator (PHS)	Indicates the mode in which the analyzer is operating.
2	I(*t*), Q (*t*)	I and Q axis labels.
3	Messages	Indicates progress of measurement or flags errors.
4	EVM CORR	Indicates EVM correction is being used.
5	RMS EVM	RMS error vector magnitude corresponding to current plot.
6	UNIQ WORD	Indicates the unique word being used for sync (uplink, or downlink).
7	TRIG	Indicates current digital demodulator trigger mode FRAME, FREE RUN, or EXTERNAL.
8	FREQ	Indicates current channel center frequency.
9	CHANNEL	Indicates current channel number.
10	The selected transmission power	High= high power, Low = low power.
11	Measurement	Indicates the current measurement being performed.

Accessing the Spectrum Analyzer Functions

The menus of the Personal Handy Phone System (PHS) measurements personality provide the softkeys that are normally needed for making PHS measurements. You may want to use some spectrum analyzer functions without leaving the PHS analyzer mode, or you may want to exit the PHS analyzer mode. This section contains the procedures for accessing the spectrum analyzer functions. The section contains the following procedures:

- Access the spectrum analyzer functions while you are using the PHS analyzer mode.
- Exit PHS analyzer mode and access the spectrum analyzer mode.

To access the spectrum analyzer functions while using the PHS analyzer mode

1. To use a spectrum analyzer function without leaving the PHS analyzer mode, just press the front panel key, and then the softkey. For example, to use the marker normal function, press (MKR), then press MARKER NORMAL . You can also use (COPY) to print or plot the screen display (you need to connect a printer or plotter to the spectrum analyzer and then configure the spectrum analyzer). Refer to the spectrum analyzer user's guide for more information.
2. To return to a PHS analyzer menu, do ***either*** of the following:
   - To return to the PHS measurements personality menu that was displayed before the spectrum analyzer front panel key was pressed, press the (MODE) key twice.
   - To return to the main menu of the PHS measurements personality, press (MODE) PHS ANALYZER.

Some spectrum analyzer front panel keys can provide useful, supplemental functions for PHS measurements, and most spectrum analyzer functions can be used while using the PHS analyzer mode. See "Changes to the Spectrum Analyzer Functions with the Measurements Personality Loaded" later in this chapter for the list of functions that cannot be used while in the PHS analyzer mode.

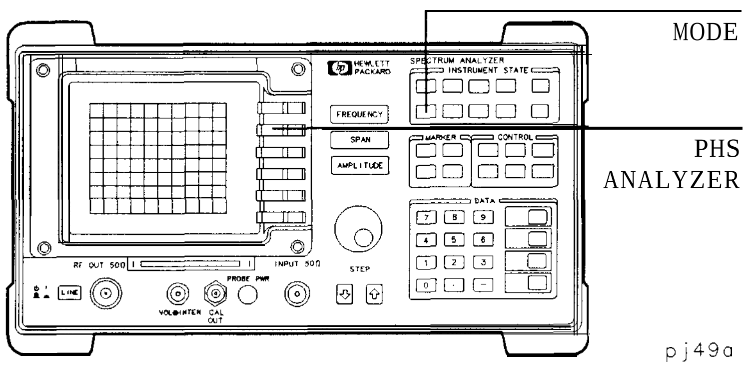


Figure 1-6. PHS Analyzer Mode Functions

To exit PHS mode and access the spectrum analyzer mode

There are two ways to access spectrum analyzer mode:

1. Press (PRESET). (PRESET) changes all of the PHS measurements personality functions back to their default values, except for channel number, functions in the configuration menu, and functions in the demodulation configuration menu. Channel number and the functions in the configuration menu keep their current values even if (PRESET) is pressed or the analyzer power is turned off.

2. Press (MODE), then SPECTRUM ANALYZER. Unlike (PRESET), SPECTRUM ANALYZER does not change any of the PHS measurements personality softkey settings.

When SPECTRUM ANALYZER or (PRESET) is pressed, the spectrum analyzer will exit the PHS measurements personality and use the spectrum analyzer mode instead. When the spectrum analyzer is in the spectrum analyzer mode, PHS no longer appears in the upper right corner of the spectrum analyzer display.

The PHS analyzer mode can be reaccessed by pressing (MODE) PHS ANALYZER.

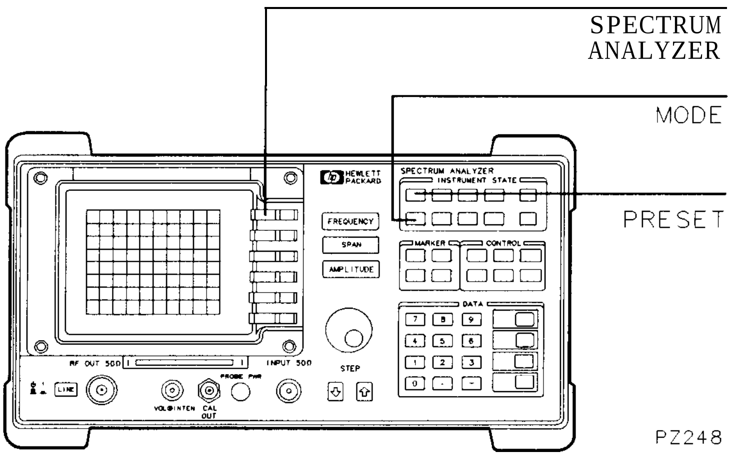


Figure 1-7. Accessing spectrum analyzer mode

Now that the spectrum analyzer is set up to make a measurement, refer to Chapter 2, "Making Measurements," for examples of various measurement tasks.

Changes to the Spectrum Analyzer Functions with the Measurements Personality Loaded

Most of the spectrum analyzer functions perform the same function regardless of whether the spectrum analyzer is using the PHS analyzer mode or the spectrum analyzer mode. Some spectrum analyzer functions either are not available or are changed when using the PHS analyzer mode.

The following spectrum analyzer functions are NOT available when using the PHS analyzer mode:

- Amptd Units The PHS measurements personality provides only dBm units.
- REF LVL OFFSET The PHS measurement personality offsets the reference level whenever a value is entered into the EXT ATTEN function.
- VID AVG ON OFF The PHS measurements personality uses its own averaging function,

The following spectrum analyzer functions are changed when using the PHS analyzer mode:

SCALE LOG/LIN becomes SCALE LOG (linear scale is not available in the PHS analyzer mode).

(FREQUENCY) Depending on the current PHS measurement, (FREQUENCY) accesses either the spectrum analyzer frequency functions, or the PHS Physical Channel menu.

- Press (FREQUENCY) to access the physical channel menu softkeys if the current PHS measurement is power, adjacent channel power, power versus time, monitor channel, or digital demodulation.
- Press (FREQUENCY) to access the spectrum analyzer frequency menu softkeys if the current PHS measurement is monitor band or one of the spurious measurements.

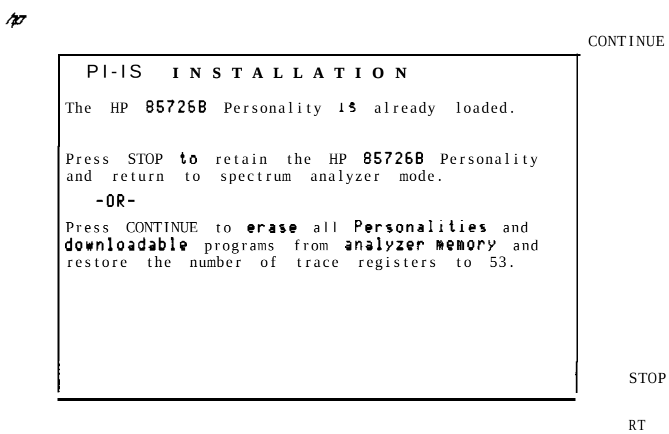
The number of trace registers in the spectrum analyzer may be changed

For spectrum analyzers with insufficient memory, the PHS installation mode decreases the number of spectrum analyzer trace registers to increase the amount of available memory so that the PHS measurements personality will fit. The number of trace registers is decreased from its default quantity of 53.

The number of trace registers can be restored to 53 by re-entering the install PHS mode as follows:

Note The PHS measurements personality and any other down-loadable programs will be ***erased*** if the number of trace registers is restored to 53.

Press (MODE) INSTALL PHS to access the PHS installation mode. The following message will be shown:



Press CONTINUE to restore the number of trace registers back to 53.

Spectrum Analyzer Options used with the PHS Measurements Personality

Precision frequency reference (Option 004)

Option 004 provides increased absolute frequency-reference accuracy by using an ovenized reference oscillator.

Option 004 installed in your spectrum analyzer, or an external 10 MHz precision frequency reference, is required for accurate measurements with the PHS measurements personality.

Option 004 is also available as a retrofit kit (Option R04) after the purchase of your spectrum analyzer, or as a kit HP part number 5062-6459.

Front panel protective cover (Option 040)

The impact cover assembly snaps onto the front of your spectrum analyzer to protect the front panel during travel and when the unit is not in use.

Option 040 is also available as a kit (Impact Cover Assembly, HP part number 5062-4805).

HP-IB and parallel interface (Option 041)

Option 041 allows you to control your spectrum analyzer from a computer that uses a Hewlett-Packard interface bus (HP-IB). Such computers include the HP 9000 Series 300, and the HP Vectra PC. Option 041 includes a connector for an external keyboard, an HP-IB connector, a parallel interface connector for printers, and the ***HP 8590 E-Series, L-Series Spectrum Analyzers, and HP 8591C Cable TV Analyzer Programmer's Guide.***

Option 041 allows the spectrum analyzer to copy its screen to a printer or plotter and includes a separate connector that accepts programming commands from an external keyboard.

Option 041 is also available as a retrofit kit (Option R41) after the purchase of your spectrum analyzer, or as a kit HP part number 08590-60380.

Note Option 041 can be converted to an Option 043 by ordering the RS-232 and parallel interface connector assembly HP part number 08590- 60369.

Protective soft carrying case/back pack (Option 042)

A soft carrying case/backpack with a pouch for accessories. Option 042 can be used to provide additional protection during travel. (Cannot operate instrument while installed in case.)

RS-232 and parallel interface (Option 043)

Option 043 allows you to control your spectrum analyzer from a computer that uses an RS-232 interface bus. Such computers include the HP Vectra PC, the IBM PC, the AT, and compatibles. It includes a connector for an external keyboard, an RS-232 9-pin connector, a parallel interface connector for printers, and the ***HP 8590 E-Series, L-Series Spectrum Analyzers, and HP 8591C Cable TV Analyzer Programmer's Guide***.

Option 043 allows the spectrum analyzer to copy its screen to a printer or plotter and includes a separate connector that accepts programming commands from an external keyboard.

Option 043 is also available as a retrofit kit (Option R43) after the purchase of your spectrum analyzer, or as a kit HP part number 08590-60381.

Note Option 043 can be converted to an Option 041 by ordering the HP-IB and parallel interface connector assembly HP part number 08590-60368.

Improved amplitude accuracy for PHS (Option 052)

Option 052 is an HP 8593E, HP 8594E, HP 8595E, or HP 8596E with improved amplitude accuracy specifications over the PHS measurements personality default frequency range and is recommended for PHS measurements. Refer to "Specifications for Option 052 (Available for HP 8593E, HP 8594E, HP 8595E, or HP 8596E Spectrum Analyzer)" in Chapter 7 for information about the specifications for Option 052.

An improved amplitude accuracy option retrofit kit is available for spectrum analyzers without Option 052. Contact your HP sales and service office for more information about Option R52, the improved amplitude accuracy upgrade for PHS.

Past time domain sweeps (Option 101)

This option provides fast time domain measurements. Option 101 allows sweep times down to 20 μs in zero span. In fast sweep times (sweep times less than 20 ms), time domain sweeps are digitized. All trace functions are available for these fast zero-span sweeps.

Option 101 also adds the analog+ display mode and negative peak detection. The analog+ display mode provides traditional analog display operation combined with the advantages of digital display features like markers, screen titles, and hard copy output. The negative peak detector capability is useful for video modulator balance adjustments and intermodulation distortion measurements.

If Option 151 is not installed in your spectrum analyzer, you must have Option 101 installed to use the PHS measurements personality to perform time domain measurements. If Option 151 is installed, Option 101 is not required for the HP 85726B PHS measurements personality and should *not* be installed.

Option 101 is also available as a retrofit kit (Option R01) after the purchase of your spectrum analyzer, or as a kit HP part number 5062-6458.

Time-gated spectrum analysis (Option 105)

Option 105 allows you to select and measure the spectrum of signals that may overlap in the frequency domain, but can be separated in the time domain. By adjusting a time gate based on an external trigger signal, you can significantly increase the diagnostic capability of your spectrum analyzer for time-interleaved signals.

You must have Option 105 installed in your spectrum analyzer to perform the carrier off leakage power gated method measurement.

Option 105 is also available as a retrofit kit (Option R15) after the purchase of your spectrum analyzer, or as a kit 5062-8218.

DSP, Fast ADC and Digital Demodulator (Option 151)

Option 151 supplies the hardware required for fast time domain sweeps, digital demodulation measurements, and digital signal processor-assisted (DSP) measurements.

Option 151 provides a subset of Option 101 fast time domain sweep functions. Option 101 allows zero span sweep times as short as 20μs with a step resolution of 20 μs (20 μs, 40 μs, 60 μs, and so forth). Option 151 allows zero span sweep times as short as 40 μs with a sequence of 40 μs, 80 μs, 160 μs, 320 μs, and 160 μs step size thereafter. All trace functions are available for these fast zero-span sweeps.

Since the sweep times offered by Option 151 are a subset of those offered by Option 101, the analog+ display mode is not supported for Option 151.

Option 101 or Option 151 supports negative peak detection. The negative peak detector capability is useful for video modulator balance adjustments and intermodulation distortion measurements. Option 101 allows negative peak detection with sweep times as long as 200 ms. Option 151 allows negative peak detection with sweep times as long as 800 ms.

Option 151 with 160 allows PHS digital modulator-based metric measurements for an HP 8593E, HP 8594E, HP 8595E and HP 8596E. You can measure error vector magnitude, carrier frequency error, and I-Q origin offset using the HP 85726B PHS measurements personality. I-Q pattern diagrams, EVM versus symbol, and demodulated bits are also available. All modulation measurements are automatically synchronized to the unique word.

In addition, the unique word frame trigger (using digital demodulation) is available on the spectrum analyzer rear panel. This signal can be used as a trigger source for transmitter power versus time, carrier-off power and spurious measurements. This minimizes the need for an external trigger signal.

You must have an Option 151 and 160 installed in your spectrum analyzer to use the HP 85726B PHS measurements personality to make digital demodulator-based measurements.

For analyzers that do not have Option 151 installed, a retrofit kit (Option R70) is available to provide both options 151 and 160.

Note The HP 8591E analyzer with Options 151 and 160 is offered and supported only for use with the HP 85725B CDMA Measurements Personality.

PDC/PHS/NADC/CDMA firmware for Option 151 (Option 160)

Option 160 provides the digital signal processing (DSP) firmware ROMs necessary to perform PDC, PHS, or NADC-TDMA digital demodulation-based measurements. It implements a coherent downconversion, and calculates the minimum RMS error vector magnitude of a timeslot. Carrier frequency error and I-Q origin offset are also extracted from sampled data. Option 160 also includes DSP-assisted measurements for CDMA.

Option 151 with Option 160 and the HP 85718B NADC-TDMA measurements personality provide a complete NADC-TDMA transmitter RF measurement solution, including modulation metrics.

Option 151 with Option 160 and the HP 8572OC PDC measurements personality provide a complete PDC transmitter RF measurement solution, including modulation metrics.

Option 151 with Option 160 and the HP 85725B CDMA measurements personality provide a CDMA transmitter measurement solution with fast DSP-assisted measurements.

Option 151 with Option 160 and the HP 85726B PHS measurements personality provide a complete PHS transmitter RF measurement solution, including modulation metrics.

Option 160 is also available as a retrofit kit (Option R60) for spectrum analyzers that already have Option 151 installed. For analyzers that do not have Option 151 installed, a retrofit kit (Option R70) is available to provide both options 151 and 160.

Accessories for the PHS Measurements Personality

AC power source

The HP 85901A provides 200 watts of continuous power for field and mobile application. The self-contained ac power source has outputs for either 115 V or 230 V and runs on its own internal battery, an external battery, or on another 12 Vdc source. Typical operating time exceeds 1 hour for 100 watt continuous use at room temperature.

AC probe

The HP 85024A high frequency probe performs in-circuit measurements without adversely loading the circuit under test. The probe has an input capacitance of 0.7 pF shunted by 1 M Ω of resistance and operates over a frequency range of 300 kHz to 3 GHz. High probe sensitivity and low distortion levels allow measurements to be made while taking advantage of the full dynamic range of the spectrum analyzer.

Caution Do not use dc-coupled probes on an HP 8593E analyzer; they may cause damage to the spectrum analyzer input circuit.

When using a dc-coupled probe with an HP 8594E, HP 8595E, or HP 8596E, the spectrum analyzer must be set to ac coupling. To set the analyzer to ac coupling, press (AMPLITUDE) More 1 of 3 More 2 of 3 COUPLE AC DC so that AC is underlined.

Broadband preamplifiers and power amplifiers

Preamplifiers and power amplifiers can be used with your spectrum analyzer to enhance measurements of very low-level signals.

- The HP 10855A preamplifier provides a minimum of 22 dB gain from 2 MHz to 1300 MHz.
- The HP 8449B preamplifier provides a minimum of 30 dB gain from 1 GHz to 26.5 GHz.
- The HP 8447D preamplifier provides a minimum of 25 dB gain from 100 kHz to 1.3 GHz.
- The HP 8447E power amplifier provides a minimum of 22 dB gain from 0.1 GHz to 1.3 GHz.
- The HP 87405A preamplifier provides a minimum of 22 dB gain from 10 MHz to 3 GHz.

Burst carrier trigger/RF preamplifier

The HP 85902A Burst Carrier Trigger and RF Preamplifier unit samples a burst TDMA (Time Division Multiple Access) or TDD (Time Division Duplex) RF carrier signal and provides a TTL output trigger to synchronize a spectrum analyzer. This triggering function is especially useful when performing time-dependent measurements such as power versus time, carrier-off leakage power, and spurious measurements.

The HP 85902A can be used to make measurements when an external TTL trigger signal from the device under test is not available.

Separate from the triggering circuitry but included inside the HP 85902A is a 10 MHz to 2 GHz preamplifier. It provides a typical 10 to 18 dB gain for added triggering sensitivity, if required. DC power for the unit is supplied through the probe power connector located on the front panel of the HP 8590 Series.

Close field probes

The HP 11945A close field probe set contains the HP 11940A and HP 11941A close-field probes. These are small, hand-held, electromagnetic-field sensors that provide repeatable, absolute, magnetic-field measurements over a wide frequency range. The HP 11941A operates from 9 kHz to 30 MHz. The HP 11940A from 30 MHz to 1 GHz. When attached to a source, the probes generate a localized magnetic field for electromagnetic interference (EMI) susceptibility testing.

The HP 11945A Option E51 also includes the HP 8447F Option H64 preamplifier and a convenient carrying bag.

External keyboard

For use with Option 041 or 043. The HP C1405B keyboard is an IBM AT compatible keyboard that can be connected to the external keyboard connector, using a C1405-60015 cable adapter, on the rear panel of the spectrum analyzer. Any IBM AT compatible keyboard with a small DIN connector will work. Screen titles and remote programming commands can be entered easily with the external keyboard.

Memory cards

Blank random access memory (RAM) cards are available for the storage and transfer of data and programs. Several different sizes of cards are available for use with the memory card reader. See Table 1-5. The memory card reader is standard for the HP 8591E, HP 8593E, HP 8594E, HP 8595E, and HP 8596E.

Table 1-5. Memory Card Model Numbers

Model Number	Size of Memory Card
HP 85700A	32 kilobytes
HP 85702A	128 kilobytes
HP 85704A	256 kilobytes
HP 85705A	512 kilobytes

Plotter

For use with Option 041 or *043*. The HP ColorPro 7440A graphics plotter adds a color plot capability to the spectrum analyzer for permanent records of important measurements. The eight-pen HP ColorPro plotter produces color plots with 0.025 mm (0.001 inch) resolution on either 8.5 by 11 inch paper or transparency film. The plotter can be ordered with HP-IB or RS-232 interfaces to correspond to the interface option installed on the spectrum analyzer.

Printers

For use with Option 041 or 043. The DeskJet personal printers provide black and white or color printing for another form of permanent records of your test results. The HP LaserJet series printers are also compatible. The printers can be ordered with RS-232 or parallel interfaces to correspond to the interface option installed on the spectrum analyzer. Figure 1-8 shows the methods of connecting different types of printers to the spectrum analyzer using the various analyzer interface options.

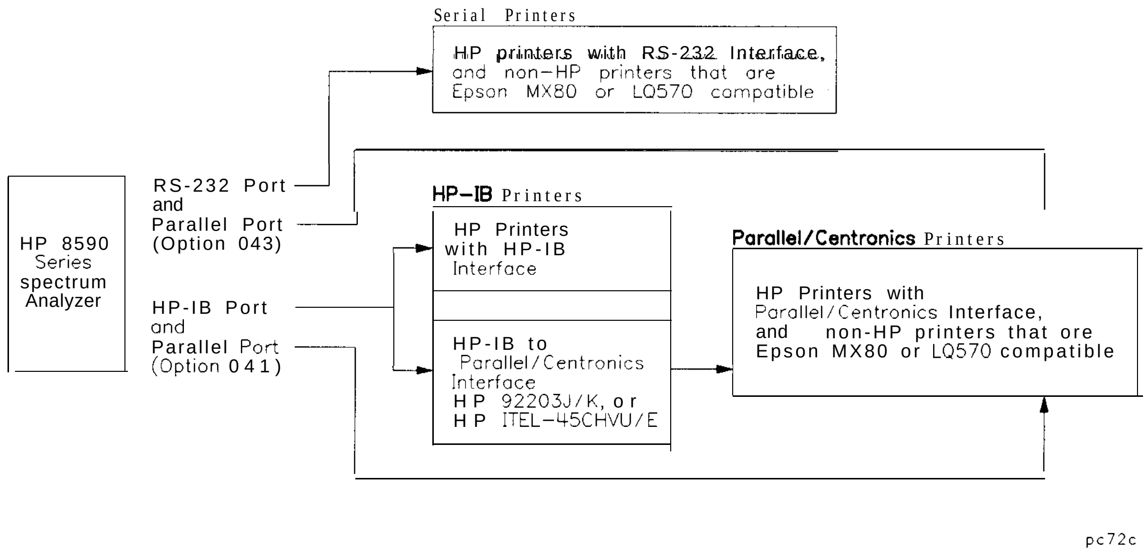


Figure 1-8. Connecting Printers Using Various Interface Options

Transit case

The transit case (HP part number 9211-5604) provides extra protection for your spectrum analyzer for frequent travel situations. The HP transit case protects your instrument from hostile environments, shock, vibration, moisture, and impact while providing a secure enclosure for shipping.

2

Making Measurements

This chapter demonstrates how to make measurements with the Personal Handy Phone System (PHS) measurements personality. This chapter contains procedures for performing the following measurements:

- configuring the personality for your test setup
- measuring power:
  - antenna power, carrier-off leakage power, occupied bandwidth, and monitoring the channel
- measuring the time domain characteristics of a TDMA/TDD burst:
  - power versus time, view frame, measure burst, ramp-up/ramp-down
- measuring the adjacent channel power and channel power
- measuring the modulation accuracy, average EVM
- monitoring the PHS frequency bands, and measuring the spurious emissions

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Note Before you begin any of the measurements in this chapter, you need to:

1. Load the HP 85726B PHS measurements personality into the spectrum analyzer and perform the spectrum analyzer self-calibration routines as described in "Preparing to Make a Measurement" in Chapter 1.
2. Perform the procedures in "Configuring the Personality for Your Test Setup."

Configuring the Personality for Your Test Setup

Before making a measurement, configure the personality according to the test setup that you are using. To configure the personality, use the functions that are in the Conf ig and Physical Channel menus. The next few pages contain information about selecting the amount of external attenuation to use, and the procedures for configuring the personality for your test setup.

To select the optimum external attenuation value

The amount of external attenuation that you select affects the accuracy and dynamic range of the test measurement.

Caution You must provide hardware with sufficient external attenuation so that the actual total power at the spectrum analyzer input is less than the spectrum analyzer absolute maximum input power of + 30 dBm (1 watt). Hewlett-Packard recommends that you use enough external attenuation so that there is a "margin" of at least 3 dB, based on the highest possible input power.

For Option 052

- For specified amplitude accuracy with Option 052, use enough external attenuation so that the spectrum analyzer input attenuation is within the 10 to 40 dB range.
- For best amplitude accuracy with Option 052, use enough external attenuation so that the spectrum analyzer input attenuation is within the 10 to 30 dB range.

For the carrier-off measurement, or spurious emissions measurement with no carrier present

For the best sensitivity, select the lowest possible value of external attenuation without exceeding the spectrum analyzer maximum input power.

For spurious emissions measurements with a carrier present

For the best sensitivity for spurious emissions measurements with a carrier present, select the external attenuation to minimize the total attenuation. The total attenuation is the sum of the external attenuation and the spectrum analyzer input attenuation. The spectrum analyzer input attenuation is set automatically, in 10 dB increments. By choosing the proper amount of external attenuation, the input attenuation can be set one 10 dB step lower, thus reducing total attenuation.

- For the best sensitivity for in-band and out-of-band spurious emissions, set the external attenuation at or slightly greater than the value given by the following equation:

$$\textbf{external attenuation}\ (dB) \geq \textbf{mean carrier power}\ (dBm) - \textbf{input attenuation}\ (dB) + 22\ dB$$

  Where the input attenuation is 10, 20, 30, or 40 dB.

To configure the personality

1. If Config is not displayed, you need to access the Main menu of the PHS measurements personality by pressing (MODE) PHS ANALYZER.

2. Press Conf ig , then perform the step that applies to your station:

   - When testing a personal station, ensure that the transmission power is set to LOW by pressing TX PWR HI LOW to underline LOW. Note that the default transmission power setting is low (LOW is underlined).

   - When testing a public cell station press TX PWR HI LOW to underline HI.

Caution You must provide hardware with sufficient external attenuation so that the actual total power at the spectrum analyzer input is less than the spectrum analyzer absolute maximum input power of +30 dBm (1 watt). Hewlett-Packard recommends that you use enough external attenuation so that there is a "margin" of at least 3 dB, based on the highest possible input power.

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3. Because you need to use an external piece of equipment (for example, an attenuator, test fixture, or directional coupler) to connect the transmitter output to the spectrum analyzer input, you need to enter the attenuation of that equipment into the EXT ATTEN function. For overall optimum performance, use the following values for external attenuation:

Station	Maximum Power	External Attenuation
Public Cell	500 mW average (4 W peak)	19 dB
Other Cell and Personal	10 mW average (80 mW peak)	12 dB

Note For the best absolute amplitude accuracy, the entered value for EXT ATTEN (external attenuation) must be equal to the actual total external attenuation of the attenuators, couplers, and cables that are connected between the transmitter output and the spectrum analyzer input.

To determine the overall system absolute amplitude accuracy, add the accuracy of the total external attenuation to the accuracy for the measurement of the personality. See "Specifications and Characteristics" in Chapter 7 for the amplitude accuracy of each measurement.

To enter the attenuation, press EXT ATTEN , use the data keys to enter the attenuation of the external equipment, then press (dB) or (ENTER).

4. The PHS station is normally tested in a burst mode, so make sure that BURST is underlined in BURST CONT. If necessary, press BURST CONT so that BURST is underlined. If the PHS station is in a continuous carrier test mode, press BURST CONT so that CONT is underlined.

5. Press Trigger Config to configure the measurement trigger.

6. Select a measurement trigger source. Press TRIG SRC UW EXT to underline UW (Unique Word) to trigger power versus time, carrier off power, and spurious measurements using the digital demodulator unique word trigger from Option 151. If the input signal contains unique words, the digital demodulator unique word trigger will automatically align the measurement interval with the unique word.

   This assumes the following:

   DD TRIG FRAME in the DD Trigger menu is selected.

   WRD SYNC ON OFF in the Frame Config menu is set to ON.

   UNIQ WRD UP DOWN is set to UP if measuring an uplink signal (personal station), or DOWN if measuring a downlink signal (public cell station, or "other" cell station). If the transmitter unique word is unknown, you can set UNIQ WRD UP DOWN to UP DOWN, provided the incident signal contains *only* either uplink or downlink unique words.

   See "To Configure a digital demodulator-based test" in this chapter for more information.

   Set TRIG SRC UW EXT to EXT to trigger power versus time, carrier off power, and spurious measurements using an external trigger.

   See "Step 3. Make the cable connections for triggering the spectrum analyzer" in Chapter 1, "Getting Started," for more information. Also, refer to the following procedures later in this chapter:

   "To set up triggering for MKK zero span carrier-off leakage power measurements"
   "To set up triggering for MKK gated carrier-off leakage power measurements"
   "To set up triggering for power versus time measurements"
   "To set up triggering for spurious emission measurements"

7. When using Option 105 (Time-gated spectrum analysis), you can select the trigger signal polarity using the TRIG POL NEG POS softkey as described below. Note that when not using Option 105 you must connect the external trigger signal directly to the EXT TRIG INPUT. In this case, the trigger signal must be a positive edge trigger and TRIG POL MEG POS has no effect.

   - To trigger the spectrum analyzer on the positive edge of the external trigger press TRIG POL MEG POS to underline POS.
   - To trigger the spectrum analyzer on the negative edge of the external trigger press TRIG POL NEG POS to underline NEG.

   When TRIG SRC UW EXT is set to UW, TRIG POL POS NEG is automatically set to POS.

8. Enter the trigger delay time value. When positive edge triggering is selected, this is defined as the time from the positive edge of the trigger pulse to the start of point 0. (See Figure 2-2.) When negative edge triggering is selected, this is defined as the time from the negative edge of the trigger pulse to the start of point 0. (See Figure 2-2.) To enter the trigger delay time, press TRIG DELAY, enter the trigger delay time by using the data keys, then press a units key ((sec), (ms), or (μs)).

   When TRIG SRC UW EXT is set to UW, use a value of 0. If TRIG SRC UW EXT is set to EXT, an adjustment of trigger delay is usually required. When using an HP 85902A Burst Carrier Trigger, a value of approximately 15 μs is usually needed.

   When the test setup trigger delay time is unknown, P vs T BURST can be used to adjust the trigger delay time. Complete the rest of the procedures through "To select a channel and slot number to test," and then see "To measure the burst," later in this chapter.

9. Press Previous Menu More 1 of 2.

10. Many of the PHS measurements display either "PASS" or "FAIL" to indicate if the test passed the test limits. To display a pass/fail message, press PASSFAIL ON OFF so that ON is underlined. (The test limits can be changed; see "To change the value of limit variables" in Chapter 6 for more information.)

11. To tune by channel number:

    - Press Define Channels to access the Define Channels menu.
    - Press DEFINE CHAN and enter the lowest channel number using the front panel knob, step keys, or data keys followed by (ENTER).
    - Press DEFINE FREQ and enter the frequency that corresponds to the lowest channel number using the front panel knob, step keys, or data keys followed by (MHz) or (GHz).
    - Press Previous Menu.

12. Press More 2 of 2 Main Menu to return to the Main Menu.

Pressing `Config` accesses the configuration softkeys. Because the PHS measurements personality uses the setting of the configuration softkeys when performing the measurements, you need to set the configuration softkeys whenever you initially test a transmitter or change your test setup. The settings for the configuration softkeys are retained until you change them or press `DEFAULT CONFIG` twice. Pressing (PRESET) or turning the spectrum analyzer off does *not* change the settings of the configuration softkeys. Figure 2-l shows the Configuration menu and annotation.

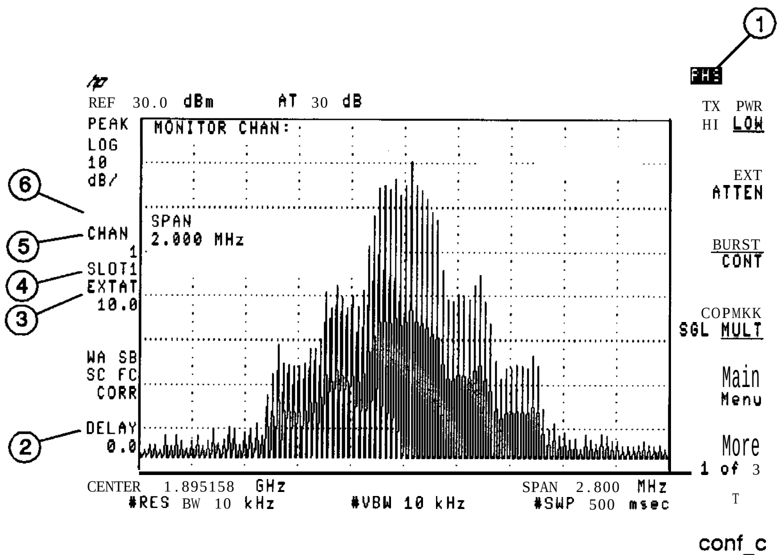

Figure 2-l. The Configuration Menu

Item	Description
1	Indicates the spectrum analyzer is using the PHS measurements personality (also referred to as the PHS mode).
2	The trigger delay time.
3	The current value for external attenuation.
4	The slot number.
5	The current channel number.
6	The selected transmission power (high = HIPWR, low = no annotation).

Figure 2-2 shows the relationship between the external trigger signal and the trigger delay time.

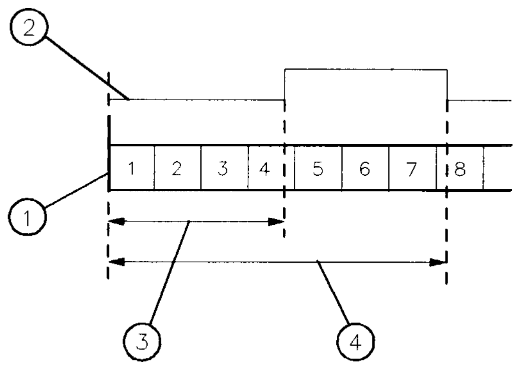

Figure 2-2. Timing Diagram Showing 8 PHS Timeslots

Item	Description
1	Indicates point 0 (the start of the first symbol in timeslot 1).
2	The external trigger signal.
3	The trigger delay time if TRIG POL POS NEG is set to POS.
4	The trigger delay time TRIG POL **POS** NEG is set to NEG. (Available only if Option 105 is installed and the externally generated trigger signal is connected to the GATE TRIGGER INPUT.)

To configure a digital demodulator-based test (for systems with Option 151)

See "Tell the analyzer to list its own options" in the beginning part of Chapter 1, "Getting Started," to quickly determine the options installed in your analyzer.

Before making a digital demodulator-based measurement (modulation accuracy, I-Q diagram, EVM versus symbol, or demodulated data bits), you must configure the digital demodulator according to the test setup being used. After using the functions in the Config menus to complete the main personality setup, use the Demod Config menu functions to configure the digital demodulator. The next few procedures describe how to configure the digital demodulator.

Note Digital demodulator measurements are specified with only one carrier incident to the analyzer.

The digital demodulator setup includes:

- Turning measurement error messages on or off.
- Selecting frame, free run, or external triggering mode for the measurement.
- Configuring the frame trigger.

1. If the Digital Demodulator Main menu is not displayed, press (MODE) PHS ANALYZER More 1 of 2 Digital Demod.
2. Press Demod Conf ig to access the Demodulation Configuration menu.
3. Press ERR MSG ON OFF to enable or disable error messages. If necessary, press ERR MSG ON OFF until ON is underlined to enable all error messages related to digital demodulator measurements, including triggering errors. See Chapter 4, "Error Messages and Troubleshooting," for an explanation of the error states. To make a measurement without being interrupted or stopped by error messages, press ERR MSG ON OFF until OFF is underlined, to suppress all error messages. Note that making a measurement with an incorrect setup and with error messages off can yield incorrect measurement results. The default for ERR MSG ON OFF is ON.
4. Press DD Trigger to access the Digital Demodulator Trigger menu.

5. Press DD TRIG FRAME, DD TRIG FREE RUN , or DD TRIG EXTERNAL to select the digital demodulator trigger mode you want. FRAME trigger is the default trigger mode.

The digital demodulator trigger should be selected according to the characteristics of the PHS signal:

- If the signal contains either of the two possible 16-bit PHS timeslot unique words (sync words), the frame trigger is the best choice (see the next step, "Configuring the frame trigger").

Note The frame trigger synchronization only works with traffic channels. It will not synchronize to control channels.

- If the unique word is not present and your signal is a continuous (non-burst) signal, the free run trigger is the best choice.
- If the unique word is not present and your signal is bursted, there are two choices:
  1. External trigger. External trigger requires you to route a trigger signal to the rear panel EXT TRIG INPUT. If Option 105 (Time-gated spectrum analysis) is present, the trigger signal should be connected to the GATE INPUT, and the GATE OUTPUT should be connected to the EXT TRIG INPUT. The trigger signal should be positioned such that the digital demodulator is measuring the correct portion of the time record. This can be achieved with external trigger delay, or if Option 105 is present, TRIG DELAY and SLOT NUMBER can be used.
  2. Frame trigger with WRD SYNC ON OFF set to OFF in the Frame Config menu (see next step, "Configuring the frame trigger"). The frame trigger case with WRD SYNC OFF assumes that the midpoint of the burst rising edge is ***approximately*** the start of symbol 2.

If free run or external trigger has been selected, skip the following step.

6. If DD TRIG FRAME is selected, press Frame Config to configure the frame trigger.

- The WRD SYNC ON OFF softkey enables and disables the frame trigger unique word (sync word) search. If necessary, press WRD SYNC ON OFF until ON is underlined. Selecting DD TRIG FRAME automatically sets the WRD SYNC ON OFF softkey to ON. Selecting free run or external trigger will set WRD SYNC ON OFF to the OFF position. To use the frame trigger without including automatic synchronization to a unique word (sync word), press WRD SYNC ON OFF until OFF is underlined. The default for WRD SYNC ON OFF is ON.

- Press UNIQ WRD UP DOWN to select the desired unique word search setting. Select UP to cause the digital demodulator to synchronize only with the timeslot that contains the uplink unique word.

  The digital demodulator searches for an exact bit match with the selected 16-bit unique word. An exact bit match terminates the acquisition. If an exact bit match is not found, the best bit match is used to synchronize the frame trigger. Frame trigger acquisition is successful if the best unique word match can be properly positioned in the data record.

If the transmitter unique word is unknown, you can set UNIQ WRD UP DOWN to UP DOWN, provided the incident signal contains ***only*** either uplink or downlink unique words. In this case, the digital demodulator will search for both the uplink and downlink unique words, starting with the uplink word. If an exact bit match is not found with either of the unique words, it will sync to the closest possible match to either of these unique words.

The unique word that the frame trigger is synchronized to is reported on each digital demodulation measurement screen, and on the status screen. The number of bit errors for this unique word is shown on the status screen. The default for UNIQ WRD UP DOWN is UP.

- Press FT ERR ON OFF to enable or disable the error messages associated with the process of acquiring the frame trigger. If necessary, press FT ERR ON OFF until ON is underlined to enable the frame trigger error messages. See Chapter 4, "Error Messages and Troubleshooting," for a description of the frame trigger error states. If you want to make a measurement without being interrupted or stopped by frame trigger acquisition errors, press FT ERR ON OFF until OFF is underlined. The default for FT ERR ON OFF is ON.

Note Frame trigger error messages will not be displayed unless the ERR MSG ON OFF softkey in the Demod Config menu is also set to ON.

7. Press Demod Main to return to the Digital Demodulator Main menu.

To select a channel and slot number to test

Caution Be sure that the total power level of the signal input to the spectrum analyzer is less than +30 dBm (1 watt).

1. Connect the RF signal from the transmitter to the spectrum analyzer input.
2. If Physical Channel is not displayed, you need to access the Main menu of the PHS measurements personality by pressing (MODE) PHS ANALYZER.
3. Press Physical Channel . (You can also press (FREQUENCY). When the spectrum analyzer is in the PHS mode, (FREQUENCY) accesses the Physical Channel softkeys.)
4. Select the channel to test.
   - If the channel number is known, and the channels have been defined under the Config menu, press CHANNEL NUMBER, enter the channel number using the data keys, and then press (ENTER).
   - To cause the spectrum analyzer to find and select the channel with the highest signal level, press AUTO CHANNEL .
   - If you know the frequency of the channel, or want to define a channel for a unique frequency, press CHAN X CTR FREQ , enter the frequency, then press (MHz). The channel number will be set to X and the frequency will be set to the entered value. CHAN X CTR FREQ allows you to set the channel frequency anywhere within the spectrum analyzer frequency range.
5. Select the slot number to test.
   - The slot number selection only applies if the BURST CONT softkey in the Configuration menu has BURST selected (for a burst transmission).
   - For digital demodulator-based measurements when DD TRIG FRAME is set to FRAME in the DD Trigger menu, a slot number setting of 1 (the default) is correct.
   - When TRIG SRC UW EXT is set to UW in the Trigger Configuration menu, a slot number setting of 1 (the default) is correct for carrier-off leakage power, power versus time, and spurious emissions measurements.
   - When TRIG SRC UW EXT is set to EXT and the external trigger signal is a TTL signal obtained from a Burst Carrier Trigger (for example, the HP 85902A) connected to a personal or cell station RF output, the correct slot number setting is 1.
   - When TRIG SRC UW EXT is set to EXT and the external start of frame trigger signal is from a direct connection to a personal or cell station, a personal or cell station control box, or a call station simulator: Enter the number of the slot that you want to examine by pressing SLOT NUMBER, enter the number of the slot with the data keys, and press (ENTER). If no slot number is entered, the slot number defaults to 1.
   - SLOT NUMBER only has affect with externally triggered digital demodulator-based measurements (DD TRIG EXTERNAL) if Option 105 (Time-gated spectrum analysis) is installed.
6. Press Main Menu.

The functions accessed by Physical Channel allow you to select the channel that you want tested. Notice that the channel number (CHAN 1) and slot number (SLOT 1) are displayed on the left side of the spectrum analyzer display. This is true unless the PHS personality has been put into fast mode by a remote command.

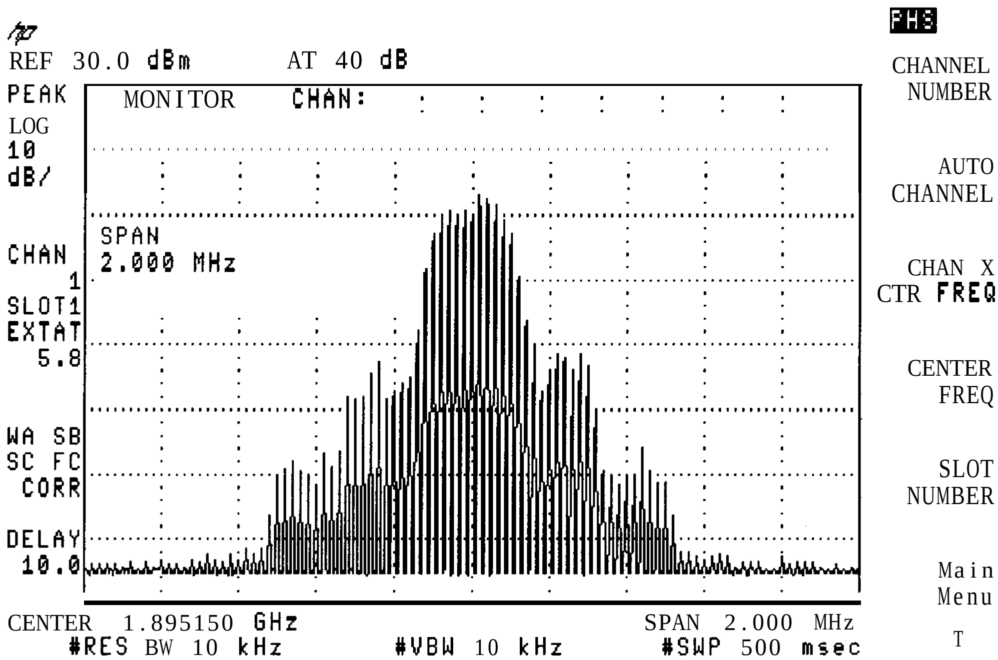

Figure 2-3. Selecting a Channel

Measuring Power

To make a power measurement, use the functions that are accessed by pressing Power. The next few pages contain procedures for performing the following measurements:

- Measure the antenna power
- Measure the carrier-off leakage power
- Measure the occupied bandwidth
- Monitor the channel

The power measurements make measurements for digital carriers according to the RCR STD-28 standard. The power measurement routines were specifically designed for measurements on $\pi/4$ DQPSK burst carriers.

Once a power measurement has been completed, the softkeys change to the "post-measurement" softkeys. The post-measurement softkeys allow you to repeat the previous measurement or change various testing parameters. For more information about the post-measurement softkeys, see "The Post-Measurement Menu" in Chapter 3.

To measure the antenna power

1. Make sure that the channel number selection agrees with the transmitter RF output. See "To select a channel and slot number to test" earlier in this chapter for more information.

   Press Power Setup to access the power setup functions. If Power Setup is not displayed, press Power . (If Power is not displayed, press (MODE) PHS ANALYZER to access Power .)

2. Select a trigger for the antenna power measurement as described below.

   - To trigger on the video envelope, press PWR TRIG EXT VID to underline VID. VID is the default setting.
   - To use an external trigger signal, press PWR TRIG EXT VID to underline EXT.

   Video triggering is the default and for this case the slot number selection has no effect. If external triggering from a direct connection to a station or station simulator is used (PWR TRIG EXT VID is set to EXT) and the personal or cell station is being tested in burst mode, ensure that the slot number (SLOT NUMBER) corresponds to the slot number of the burst signal. (See the description for PWR TRIG EXT VID in the Configuration menu part of Chapter 3 for more information about external triggering.)

3. Press Previous Menu.

4. Press ANTENNA POWER . The personality will measure the mean carrier power during the burst and then display the result which is the computed mean antenna power over the entire frame.

5. Press Previous Menu when done with the antenna power measurement, or use one of the post-measurement functions.

ANTENNA POWER automatically sets the reference level and input attenuation based upon the measured power level of the carrier. ANTENNA POWER then measures the true mean carrier power over several sweeps, and displays the results. To measure the true mean carrier power for a burst carrier, the personality measures the mean power of the transmitter carrier envelope during a burst transmission (when the carrier is "on"). The personality measures the time waveform of the envelope, converts the trace data from dB to power units, and then averages the power trace data. The results are shown in dBm and in watts.

Note that the measured value displayed is the average power over the entire frame. Thus, the displayed value is smaller than the average power in just the "on" part of the burst.

Because the power levels of stations vary, a pass/fail message is not displayed for the antenna power measurement, even if PASSFAIL ON OFF is set to ON, unless you specify the upper limit (or upper and lower limits) for the antenna power. The limits can be entered remotely; see "To change the value of limit variables" in Chapter 6 for more information. See Figure 2-4 for an example of the antenna power measurement.

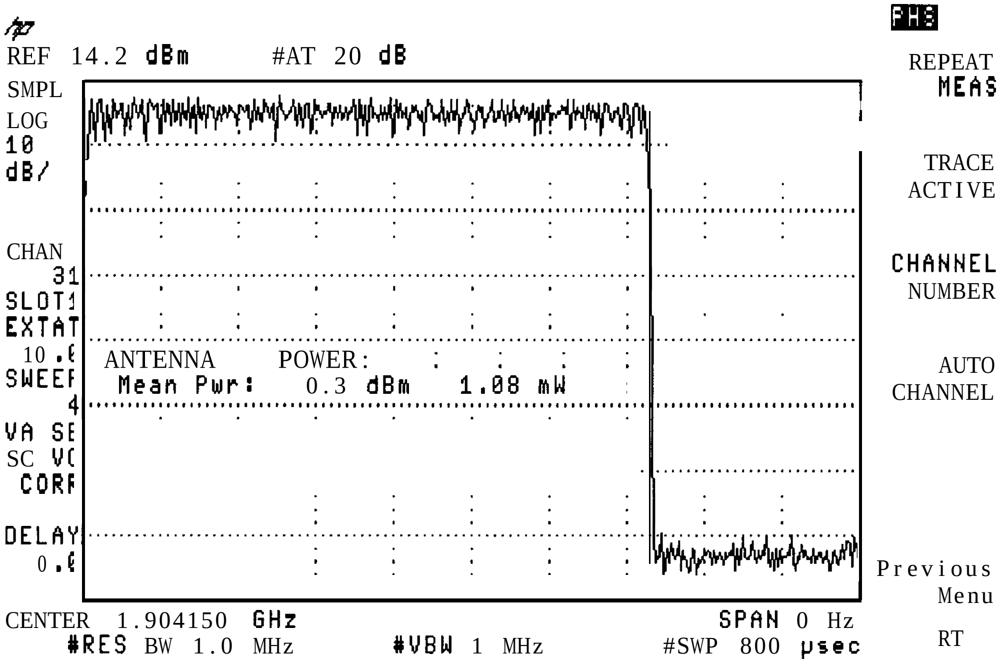

Figure 2-4. Antenna Power Measurement

RCR reference: The antenna power measurement is based on RCR STD-28 7.1.4.2, "Antenna power" (2) and 3.4.2.1 "Transmission power."

To measure the carrier-off leakage power

1. Make sure that the channel number selection agrees with the transmitter RF output. See "To select a channel and slot number to test" earlier in this chapter for more information.

   If Power Setup is not displayed, press Power. If Power is not displayed, press (MODE) PHS ANALYZER to access Power.

2. Press Power Setup to access the power setup functions.

   - Press COP TYPE ZSP GTD to underline ZSP for the normal MKK zero span carrier-off power method. Press COP TYPE ZSP GTD to underline GTD for the MKK gated carrier-off power method.
   - Press COP ZSP SGL MULT to underline MULT for the normal zero-span (MKK) method for carrier-off leakage power measurements. (These measurements are taken at the carrier frequency and at multiple frequency offsets from the carrier frequency). Press COP ZSP SGL MULT to underline SGL to test at the carrier frequency only.

Note A rear panel trigger signal is required for either carrier-off leakage power measurement type. Please refer to "To set up triggering for MKK zero span carrier-off leakage power measurements," or "To set up triggering for MKK gated carrier-off leakage power measurements, " later in this chapter.

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3. Measure the antenna power as previously described in this chapter.

Note The last measured antenna power is used in calculating the carrier off leakage power absolute result from the carrier off relative result. It is not necessary to repeat the antenna power measurement, provided that it was previously done for the current carrier frequency and power level.

---

4. Press Previous Menu.

5. Press CARRIER OFF PWR . The personality will make the carrier-off leakage power measurement and display the results either by the MKK zero span, or MKK gated method, as selected by COP TYPE ZSP GTD in the Power Setup menu.

6. Press Previous Menu when done with the carrier-off leakage power measurement, or use one of the post-measurement functions.

Carrier-off leakage power measures the mean carrier power when the carrier is "off. " (The carrier is off between burst transmissions.)

CARRIER OFF PWR , with ZSP selected for COP TYPE (carrier off power type), searches for the "off" timeslot with the highest carrier power. It first measures at the carrier frequency, then at offsets of f300 kHz, ±600 kHz, and ±900 kHz. Finally, it measures at the frequency with the maximum leakage power in the PHS band. Thus, to find the highest power "off" timeslot a total of 56 timeslots are measured. If COP ZSP SGL MULT (in the Power Setup menu) is set to SGL, only the carrier frequency is searched.

CARRIER OFF PWR , with GTD selected for COP TYPE (carrier off power type), uses the time-selective spectrum analysis capability of Option 105 to make a frequency domain measurement of the maximum power in the PHS band when the carrier is off. The carrier power in the band is first measured, then the time-gate function is enabled and a second sweep is taken to measure the power when the carrier is off. A relative value, or ratio, is calculated from the two sweeps. Then, an absolute value for carrier-off power is computed from the ratio and the last measured antenna power. If the absolute value is under the limit, the absolute and relative test results are immediately displayed. If the absolute result is at or over the limit, a zero-span measurement at the frequency and timeslot of the maximum leakage will be performed to compute results having increased accuracy over the frequency-domain measurement results. The more accurate results are then displayed.

For either method, two values are displayed. They are a ratio (in dB) and an absolute value (in dBm) which is computed from the ratio and the last measured antenna power (corrected to include only the on-portion of the burst). For zero-span measurements, several sweeps are averaged to obtain a more accurate result.

If PASS FAIL ON OFF is set to ON, a message is displayed that indicates if the measurement passed (PASS) or failed (FAIL) the test limits. Pass/fail checking gives a pass if the absolute result is less than the corresponding limit value.

See Figure 2-5 and Figure 2-6 for examples of carrier-off power measurements.

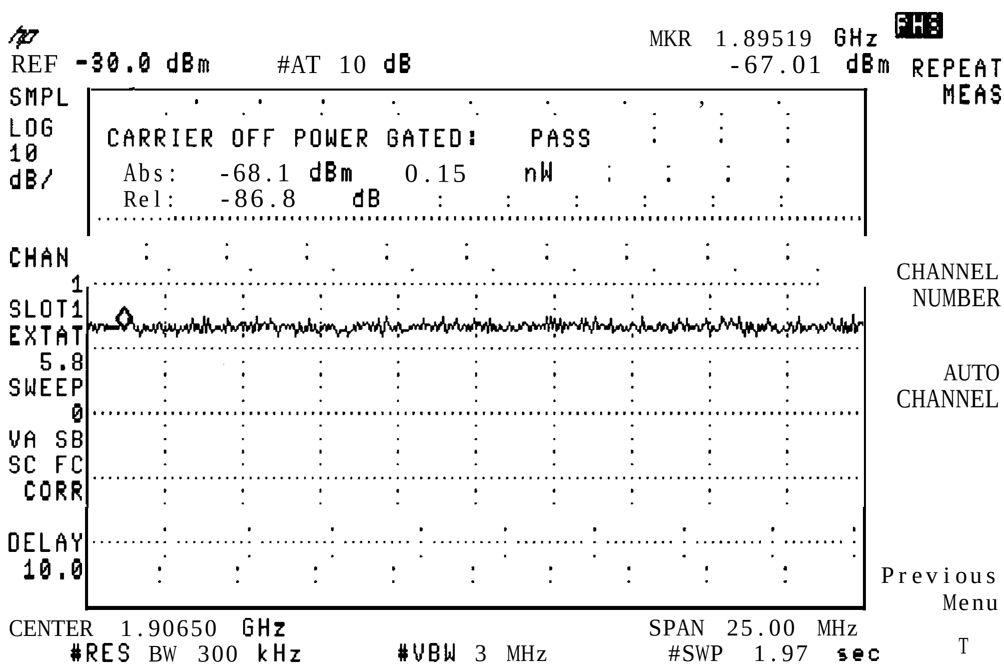

Figure 2-5. Carrier-off Leakage Power Measurement (Gated Method)

RCR reference: The gated method for carrier-off leakage power is based on RCR STD-28 7.1.5, “Carrier off time leakage power” and 3.4.2.5, “Carrier off leakage power.”

MKK reference: Test item (3), “Power when not transmitting carrier,” II, “Measurement by spectrum analyzer using gate function. ”

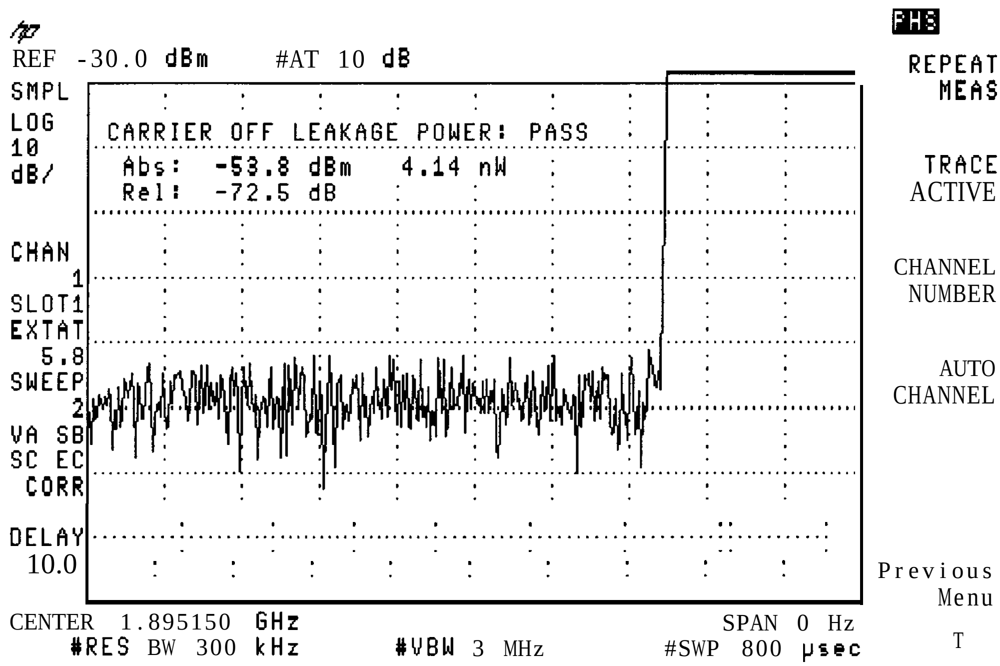

Figure 2-6. Carrier Off Leakage Power Measurement (zero span method)

MKK reference: Test item (3), "Power when not transmitting carrier," I, "Measurement by spectrum analyzer in zero span method. "

To set up triggering for MKK zero span carrier-off leakage power measurements

If TRIG SRC UW EXT is set to UW (under Conf ig Trigger Conf ig), the unique word in the data stream is used as the trigger source.

- Set FT ACQ ON OFF to ON (frame trigger acquisition ON) to force the measurement to locate the unique word within the frame and appropriately delay the Frame Trigger output on the rear panel. This synchronized frame trigger procedure will be done prior to every carrier-off power measurement, unless REPEAT MEAS is used.

- Set FT ACQ ON OFF to OFF to allow a measurement to be made using the previous unique word timing. This will decrease the measurement time, but may allow the frame trigger to drift away from the desired timeslot.

- The rear panel Frame Trigger Output must be routed to the rear panel External Trigger Input. Connect FRAME TRIGGER OUTPUT directly to EXT TRIG INPUT. If Option 105 (Time-gated spectrum analysis) is installed, an alternate setup is to connect FRAME TRIGGER OUTPUT to GATE TRIGGER INPUT, and connect GATE OUTPUT to EXT TRIG INPUT.

If TRIG SRC UW EXT is set to EXT, a trigger signal external to the spectrum analyzer is used as the trigger source, and the FT ACQ ON OFF softkey is not displayed. The external trigger may come from the PHS unit under test, from a PHS unit that has a link established with the PHS unit under test, or from a device such as the HP 85902A Burst Carrier Trigger.

- The externally-derived trigger signal must be routed to the rear panel External Trigger Input. Connect the external trigger signal directly to EXT TRIG INPUT. If Option 105 (Time-gated spectrum analysis) is installed, an alternate setup is to connect the external trigger to GATE TRIGGER INPUT, and connect GATE OUTPUT to EXT TRIG INPUT.

Note

If you have trouble performing the spurious emission measurements, make sure that the selections for TRIG POL MEG POS and TRIG DELAY are correct. For more information, see “Step 3. Make the cable connection for triggering the spectrum analyzer” in Chapter 1, and “To configure the personality” earlier in this chapter.

The correct slot number (SLOT NUMBER) must also be selected (usually set to 1). For more information, see “To select a channel and slot number to test” earlier in this chapter.

For frame trigger acquisition to be successful, the carrier frequency must not be more than 10 kHz from the nominal channel center frequency.

To set up triggering for MKK gated carrier-off leakage power measurements

If TRIG SRC UW EXT is set to UW (under Conf ig Trigger Conf ig), the unique word in the data stream is used as the trigger source.

- Set FT ACQ ON OFF to ON (frame trigger acquisition ON) to force the measurement to locate the unique word within the frame and appropriately delay the Frame Trigger output on the rear panel. This synchronized frame trigger procedure will be done prior to every carrier-off power measurement, unless REPEAT MEAS is used.
- Set FT ACQ ON OFF to OFF to allow a measurement to be made using the previous unique word timing. This will decrease the measurement time, but may allow the frame trigger to drift away from the desired timeslot.
- Option 105 (Time-gated spectrum analysis) is required and the rear panel Frame Trigger Output must be routed to the rear panel Gate Trigger Input. Connect FRAME TRIGGER OUTPUT to GATE TRIGGER INPUT, and connect GATE OUTPUT to EXT TRIG INPUT.

If TRIG SRC UW EXT is set to EXT, a trigger signal external to the spectrum analyzer is used as the trigger source, and the FT ACQ ON OFF softkey is not displayed. The external trigger may come from the PHS unit under test, from a PHS unit that has a link established with the PHS unit under test, or from a device such as the HP 85902A Burst Carrier Trigger.

- Option 105 (Time-gated spectrum analysis) is required and the externally-derived trigger signal must be routed to the rear panel Gate Trigger Input. Connect the external trigger signal to GATE TRIGGER INPUT, and connect GATE OUTPUT to EXT TRIG INPUT.

Note

If you have trouble performing the spurious emission measurements, make sure that the selections for TRIG POL NEG POS and TRIG DELAY are correct. For more information, see "Step 3. Make the cable connection for triggering the spectrum analyzer" in Chapter 1, and "To configure the personality" earlier in this chapter.

The correct slot number (SLUT NUMBER) must also be selected (usually set to 1). For more information, see "To select a channel and slot number to test" earlier in this chapter.

For frame trigger acquisition to be successful, the carrier frequency must not be more than 10 kHz from the nominal channel center frequency.

To measure the occupied bandwidth

1. Make sure that the channel number selection agrees with the transmitter RF output. See "To select a channel and slot number to test" earlier in this chapter for more information.
2. If OCCUPIED BANDWDTH is not displayed, press Power . (If Power is not displayed, press (MODE) PHS ANALYZER to access Power .)
3. Press OCCUPIED BANDWDTH . The PHS measurements personality automatically sets the reference level and input attenuation based upon the measured carrier, measures the 99 percent occupied power bandwidth and the delta frequency offset of the transmitted signal, and then displays the results. The delta frequency offset gives an approximate indication of the frequency error of the transmitted signal.
4. Press Previous **Menu** when done with the occupied bandwidth measurement, or use one of the post-measurement functions.

OCCUPIED BANDWDTH measures the bandwidth that contains 99 percent of the total carrier power. Markers are placed on the signal; 0.5 percent of the total power is below the lower marker and 0.5 percent of the total power is above the upper marker. OCCUPIED BANDWDTH also indicates the delta frequency offset by finding the difference between the mid point between the upper and lower limit frequency values for the occupied bandwidth and the center frequency of the spectrum analyzer (the assigned frequency for the channel under test). If **PASSFAIL** OH OFF is set to ON, a message is displayed that indicates if the measurement passed (PASS) or failed (FAIL) the test limits. See Figure 2-7 for an example of an occupied bandwidth measurement.

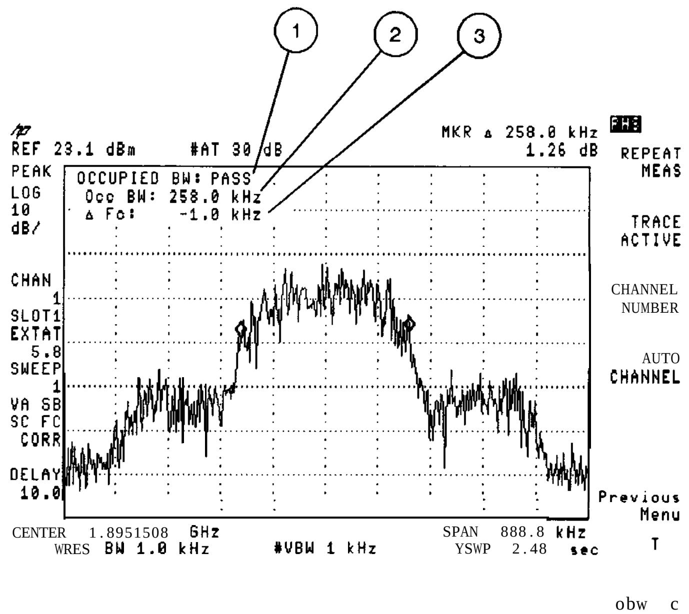

Figure 2-7. Occupied Bandwidth Measurement

Item	Description
1	Indicates whether the occupied bandwidth measurement passed or failed the test limit.
2	The bandwidth that 99 percent of the total carrier power occupies.
3	The delta frequency offset.

RCR reference: The occupied bandwidth measurement is based on RCR STD-28 7.1.3, “Occupied bandwidth” and 3.4.2.7 “Allowed value for occupied bandwidth.”

MKK reference: Test item (6), “Occupied bandwidth.”

To monitor the channel

1. Make sure that the channel number selection agrees with the transmitter RF output. See "To select a channel and slot number to test" earlier in this chapter for more information.
2. If MONITOR CHAN is not displayed, press Power. (If Power is not displayed, press (MODE) PHS ANALYZER to access Power .)
3. Press MONITOR CHAN . The personality will change the center frequency and span of the spectrum analyzer so that the selected channel is displayed.

MONITOR GHAN displays the RF spectrum of the channel that you select. See Figure 2-8 for an example of viewing channel 1.

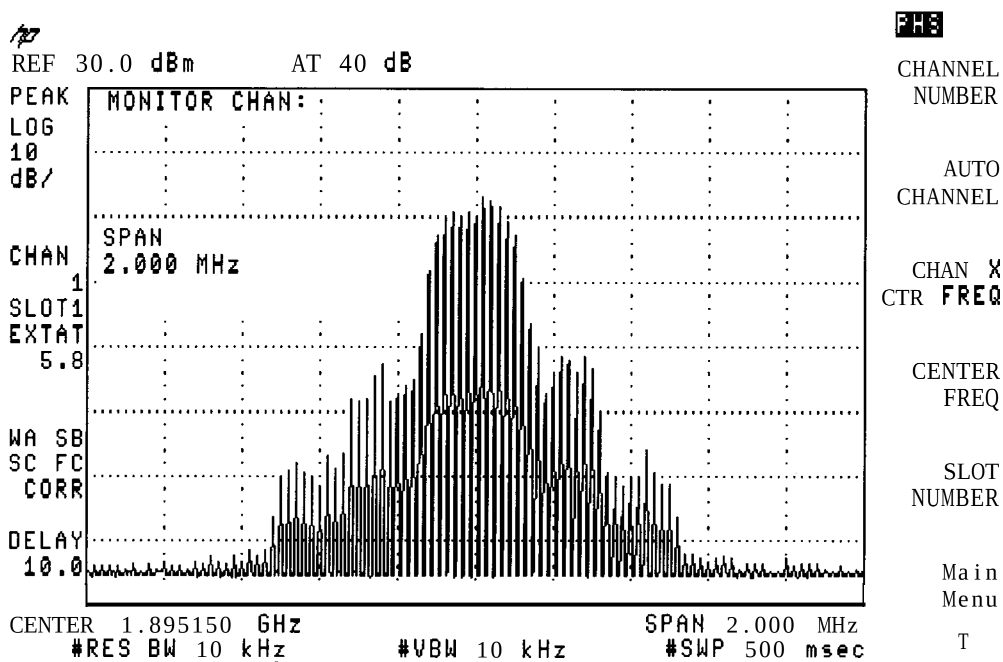

Figure 2-8. Viewing Channel 1

Measuring the Time Domain Characteristics of a TDMA/TDD Burst

The power versus time measurements analyze the amplitude profile and timing of the burst of a personal or cell station transmission. The next few pages contain procedures for the following measurements:

- Set up a power versus time measurement
- View a frame
- Measure the burst
- Measure the ramp-up or ramp-down of a burst

To set up a power versus time measurement

1. Make sure that the channel number selection agrees with the transmitter RF output. See "To select a channel and slot number to test" earlier in this chapter for more information.
2. Press Power vs Time . If Power vs Time is not displayed, press (MODE) PHS ANALYZER to access Power vs Time.
3. Press P vs T Setup to access the power versus time setup functions.
4. To obtain a trace that is an average of the trace data over the number of sweeps, press MEASURE AVG PKS until AVG is underlined. Averaging applies only if the number of sweeps is set to more than 1. To obtain a trace containing the maximum trace peaks and a trace containing the minimum trace peaks (over the number of sweeps), press MEASURE AVG PKS until PKS is underlined. The default for this function is average (AVG).
5. To select the number of sweeps the spectrum analyzer measures, press NUMBER SWEEPS , enter the number of measurement sweeps (each sweep measures a burst) to be measured with the data keys, and then press (ENTER). If you do not specify the number of sweeps, a default of five sweeps is used. Increasing the number of sweeps will result in better averaging if MEASURE AVG PKS is set to AVG (average), and measures more bursts if MEASURE AVG PKS is set to PKS (peaks).
6. To set an amplitude measurement range of 70 dB, press RANGE dB 70 110 so that 70 is underlined. Or, to set an amplitude range of 110 dB, press RANGE dB 70 110 so that 110 is underlined. The default for this function is 70 dB.
7. Press Limit Edit to access the power versus time limit line functions. See "To adjust limit lines," later in this chapter.

Note A rear panel trigger signal is required for power versus time measurements. Refer to "To set up triggering for power versus time measurements," later in this chapter, for triggering setup information.

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8. Press Previous Menu when done with the P vs T Setup functions.

P vs T Setup allows you to choose how the Power versus Time measurements will be measured and displayed. P vs T Setup allows you to select the following:

- Either maximum and minimum peaks or averaged trace data.
- The number of sweeps.
- Either a 70 or a 110 dB amplitude range. (If the 110 dB amplitude range is selected, the personality obtains a display range of 110 dB by combining measurements made at two different reference level settings, and sets the amplitude scale to 15 dB/div.) .
- Limit-line values other than the default RCR STD-28 values.
- Either frame trigger acquisition ON, or OFF.

See Figure 2-9 for an example of the trace results of averaging 20 bursts. See Figure 2-10 for an example of the trace results of the maximum and minimum peaks of 20 bursts. After the measurement has been completed, the number of sweeps used for the measurement is displayed on the left side of the spectrum analyzer display.

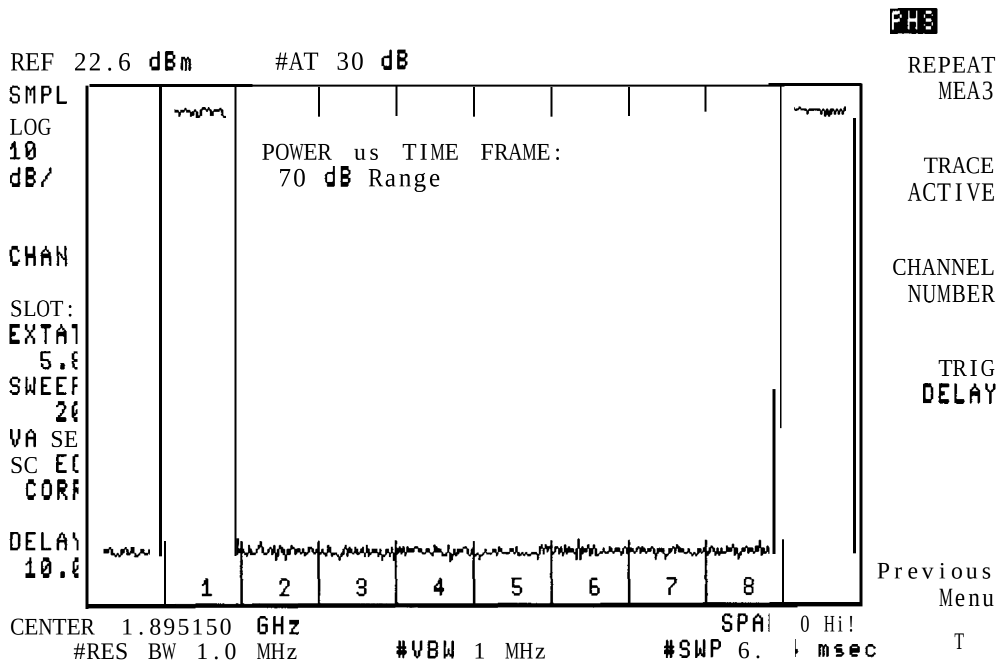


Figure 2-9. Measuring the Average of 20 Bursts

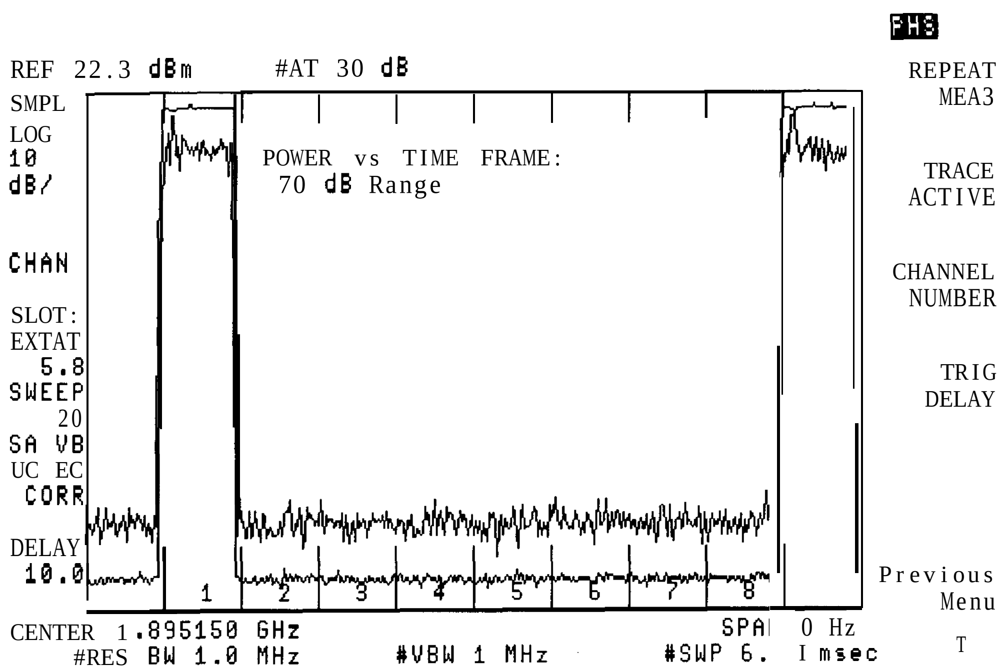


Figure 2-10. Measuring the Maximum and Minimum Peaks of 20 Bursts

To set up triggering for power versus time measurements

If TRIG SRC UW EXT is set to UW (under Config and Trigger Config menus), the unique word in the data stream is used as the trigger source, and the FT ACQ ON OFF softkey is displayed in the P vs T Setup menu.

- Set FT ACQ ON OFF to ON (frame trigger acquisition ON) to force the measurement to locate the unique word within the frame and appropriately delay the video trigger. This synchronized video trigger procedure will be done prior to every power versus time measurement, unless REPEAT MEAS is used. It is recommended that FT ACQ ON OFF be set to ON for at least the first power versus time measurement made on a given unit under test.
- Set FT ACQ ON OFF to OFF to allow a measurement to be made using the previous unique word timing. This will decrease the measurement time.

- The rear panel Frame Trigger Output must be routed to the rear panel External Trigger Input. Connect FRAME TRIGGER OUTPUT directly to EXT TRIG INPUT. If Option 105 (Time-gated spectrum analysis) is installed, an alternate setup is to connect FRAME TRIGGER OUTPUT to GATE TRIGGER INPUT, and connect GATE OUTPUT to EXT TRIG INPUT.

If TRIG SRC UW EXT is set to EXT, a trigger signal external to the spectrum analyzer is used as the trigger source, and the FT ACQ ON OFF softkey is not displayed. The external trigger may come from the PHS unit under test, from a PHS unit that has a link established with the PHS unit under test, or from a device such as the HP 85902A Burst Carrier Trigger.

- The externally-derived trigger signal must be routed to the rear panel External Trigger Input. Connect the external trigger signal directly to EXT TRIG INPUT. If Option 105 (Time-gated spectrum analysis) is installed, an alternate setup is to connect the external trigger to GATE TRIGGER INPUT, and connect GATE OUTPUT to EXT TRIG INPUT.

Note If you have trouble performing the power versus time measurements, make sure that the selections for TRIG POL NEG POS and TRIG DELAY are correct. For more information, see "Step 3. Make the cable connection for triggering the spectrum analyzer" in Chapter 1, and "To configure the personality" earlier in this chapter.

The correct slot number (SLOT NUMBER) must also be selected (usually set to 1). For more information, see "To select a channel and slot number to test" earlier in this chapter.

For frame trigger acquisition to be successful, the carrier frequency must not be more than 10 kHz from the nominal channel center frequency.

To view the frame

1. Make sure that the channel number selection agrees with the transmitter RF output. See "To select a channel and slot number to test" earlier in this chapter for more information.
2. If P vs T FRAME is not displayed, press Power vs Time . (If Power vs Time is not displayed, press (MODE) PHS ANALYZER to access Power vs Time .)
3. Press P vs T FRAME . If a trace is not displayed on the screen, the spectrum analyzer may not be triggering correctly. See "To configure the personality" in this chapter for more information about setting the trigger time delay and trigger polarity.
4. When using an external trigger source (TRIG SRC UW EXT that is set to EXT in the Trigger Config menu), and the burst is not aligned with respect to the limit lines, press TRIG DELAY . Then turn the large knob on the spectrum analyzer front panel to adjust the trigger delay until the bursts are centered between the timeslot lines. You need to adjust the trigger delay because the actual trigger can occur at a different point in time than the point 0 reference point. (The point 0 reference point is the start of the first symbol of the timeslot.)

   When using the unique word in the data stream as the trigger source (TRIG SRC UW EXT set to UW), and frame trigger acquisition ON (FT ACQ OH OFF set to ON), the trigger delay should be set to zero. This synchronized video trigger method accurately positions the burst with respect to the limit lines by the demodulated unique word position, making trigger delay adjustment unnecessary.
5. Press Previous Menu when done with the P vs T FRAME measurement, or use one of the post-measurement functions.

P vs T FRAME displays one time division multiple access time division duplex (TDMA/TDD) frame. Because one TDMA/TDD frame contains eight slots, P vs T FRAME is a convenient way to determine which slots are off, and in which slot the burst occurs. The results from P vs T FRAME can also help you to check your test setup for problems. For more accurate measurements you should use P vs T BURST , P vs T RISING, or P vs T FALLING. See Figure 2-11 for an example of viewing a frame.

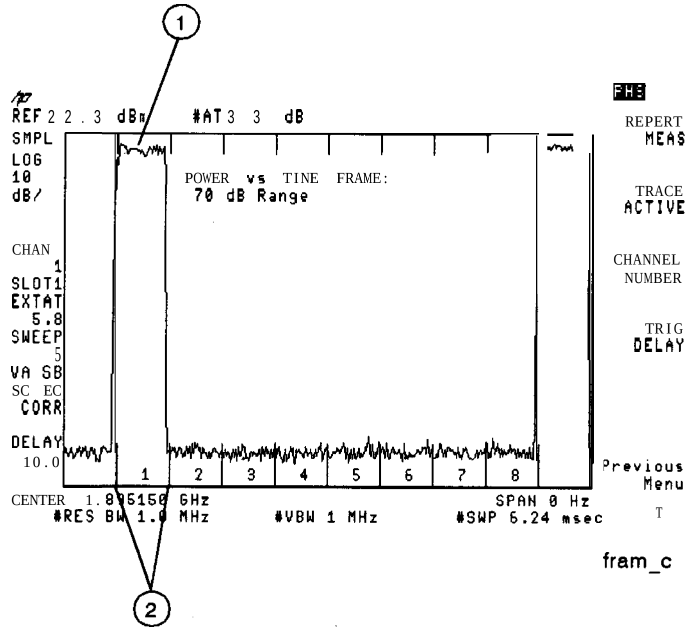


Figure 2-11. Viewing a Frame

Item	Description
1	The burst signal.
2	Indicates the starting and ending points for slot number 1.

To measure the burst

1. Make sure that the slot number corresponds to the slot number of the burst signal. See "To select a channel and slot number to test" earlier in this chapter for more information about selecting the slot.
2. If P vs T BURST is not displayed, press Power vs Time. (If Power vs Time is not displayed, press (MODE) PHS ANALYZER to access Power vs Time .)
3. Press P vs T BURST to display the transmission burst.
4. When using the unique word in the data stream as the trigger source (TRIG SRC UW EXT set to UW), and frame trigger acquisition ON (FT ACQ ON OFF set to ON), the trigger delay should be set to zero. This synchronized video trigger method accurately positions the burst with respect to the limit lines by the demodulated unique word position, making trigger delay adjustment unnecessary.

   When using an external trigger source (TRIG SRC UW EXT that is set to EXT in the Trigger Config menu), and the burst is not symmetrical with respect to the limit lines, press TRIG DELAY . Then turn the large knob on the spectrum analyzer front panel to adjust the trigger delay until the bursts are centered between the timeslot lines. You need to adjust the trigger delay because the actual trigger can occur at a different point in time than the point 0 reference point. (The point 0 reference point is the start of the first symbol of the timeslot.)
5. Press Previous Menu when done with the P vs T BURST measurement, or use one of the post-measurement functions.

P vs T BURST measures the burst width at -14 dB from the mean carrier power, and checks that the burst is between the upper and lower limit lines. The primary purpose for P vs T BURST is to help you to examine the modulation during the "on" part of a burst. The pass/fail message for the upper and lower limit lines is always displayed, unless PKS is selected under P v T Setup MEASURE AVG PKS . The results from P vs T BURST can help you check your test setup, but for accurate measurements of the burst transitions, you should use P vs T RISING or P vs T FALLING . See Figure 2-12 for an example of measuring a burst.

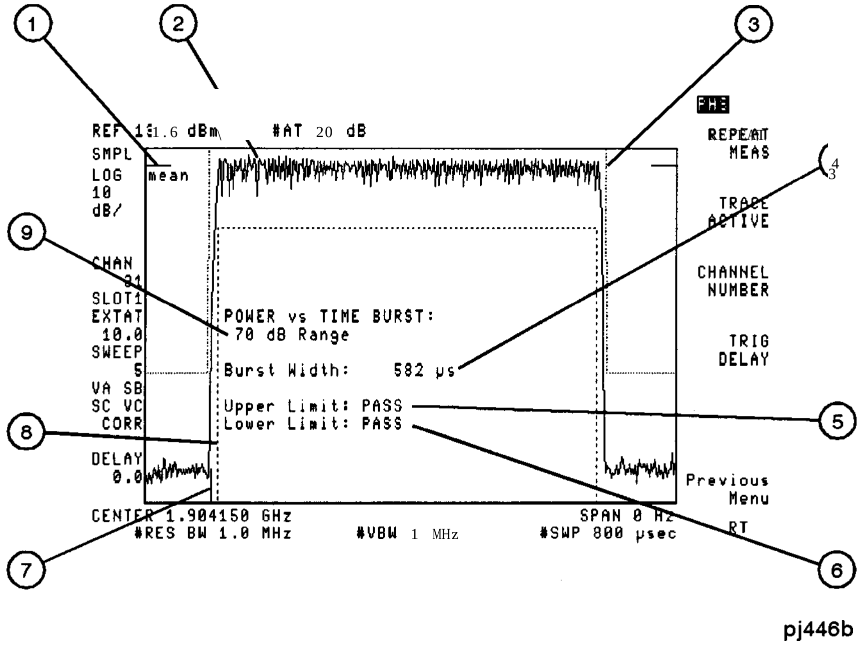


Figure 2-12. Measure a Burst

Item	Description
1	The mean value of the burst.
2	The burst signal.
3	The upper limit line.
4	The width of the burst waveform. The burst width is measured – 14 dB from the mean of the burst.
5	Indicates whether the burst was below the upper limit line.
6	Indicates whether the burst was above the lower limit line.
7	The position of point 0. Point 0 is the start of the first symbol in timeslot 1
8	The lower limit line.
9	The selected display range (either 70 dB or 110 dB)

RCR reference: The power versus time measurements are based on RCR STD-28 7.1.6, “Transient response characteristics of burst transmission” and 3.4.2.4 “Transient response characteristics of burst transmission.”

To measure the ramp-up or ramp-down of a burst

1. Make sure that the slot number corresponds to the slot number of the burst signal. See "'lb select a channel and slot number to test" earlier in this chapter for more information about selecting the slot.
2. Press Power vs Time . (If Power vs Time is not displayed, press (MODE) PHS ANALYZER to access Power vs Time .)
3. Measure the ramp-up or ramp-down of a burst. To measure the ramp-up, press P vs T RISING. To measure the ramp-down, press P vs T FALLING . The personality will measure the attack or release time, and then display the results. The waveform is also compared against an upper and a lower limit line.
4. When using the unique word in the data stream as the trigger source (TRIG SRC UW EXT set to UW), and frame trigger acquisition ON (FT ACQ ON OFF set to ON), the trigger delay should be set to zero. This synchronized video trigger method accurately positions the burst with respect to the limit lines by the demodulated unique word position, making trigger delay adjustment unnecessary.

   When using an external trigger source (TRIG SRC UW EXT that is set to EXT in the Trigger Config menu), and the edge of the burst is not within the display limit lines, press TRIG DELAY . Then turn the large knob on the spectrum analyzer front panel to adjust the trigger delay until the waveform is centered between the lines.
5. Press Previous Menu when done with the measurement, or use one of the post-measurement functions.

If PASSFAIL ON OFF is set to ON, a message is displayed that indicates if the ramp-up time or ramp-down time measurement passed (PASS) or failed (FAIL) the numeric test limits. The pass/fail message for the upper and lower limit lines is always displayed, unless PKS is selected under P v T Setup MEASURE AVG PKS .

P vs T RISING measures the ramp-up time and allows you view the ramp-up of a burst. The ramp-up time is the time difference between the point 14 dB below the mean carrier level and the closest -37 dBm point. The markers are positioned at the -14 dB and -37 dBm points. See Figure 2-13 for an example of measuring the ramp-up of a burst.

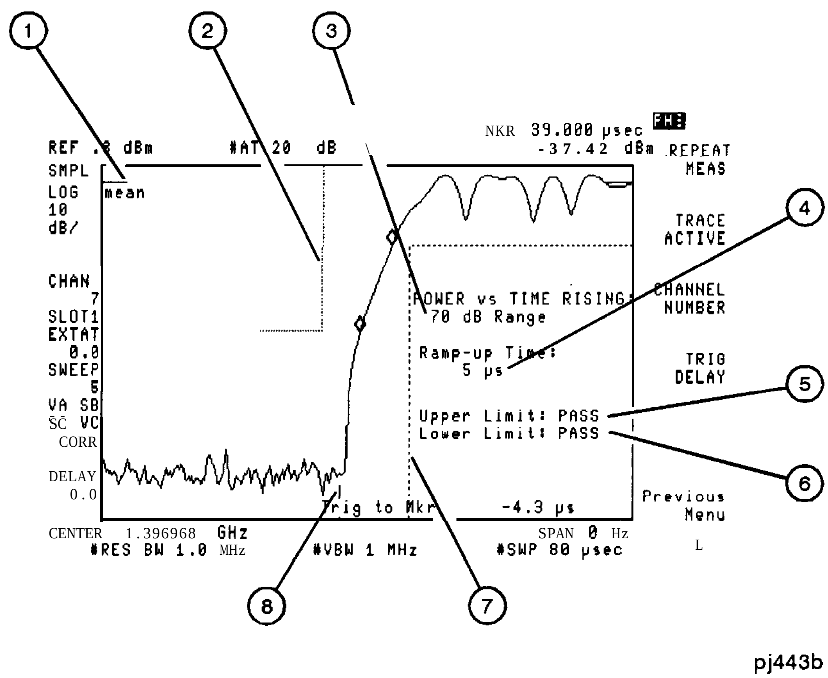
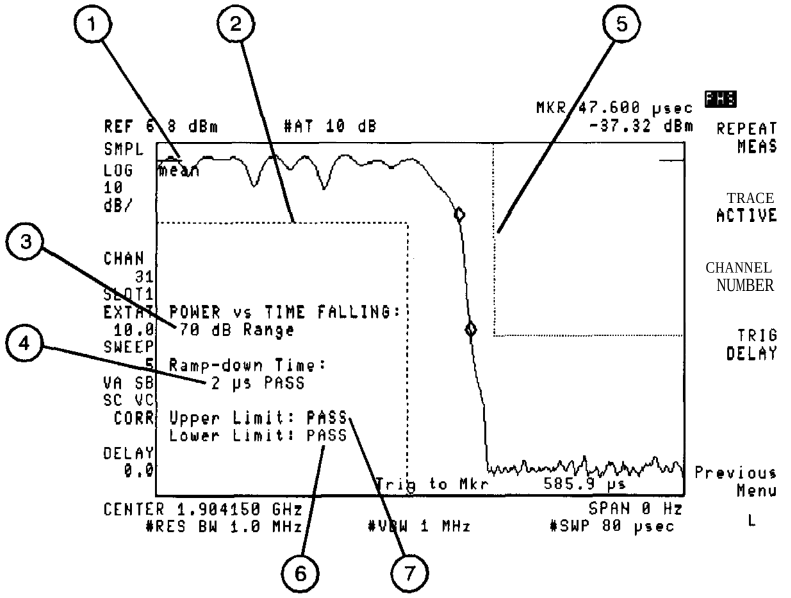


Figure 2-13. Measuring the Ramp-up of a Burst

Item	Description
1	The position of the mean power level for the burst.
2	The upper limit line. (The upper limit line indicates the boundary for the maximum ramp-up for the burst.:
3	The selected display range (either 70 dB or 110 dB).
4	The ramp-up time. The ramp-up time is the time it takes the burst to transition from -37 dBm to -14 dB from the mean of the burst.
5	Indicates whether the burst was below the upper limit line. If the burst was below the upper limit line, PASS is displayed; otherwise, FAIL is displayed.
6	Indicates whether the burst was above the lower limit line. If the burst was above the lower limit line, PASS is displayed; otherwise, FAIL is displayed.
7	The lower limit line. (The lower limit line indicates the boundary for the minimum ramp-up for the burst.]
8	The position of point 0. Point 0 is the start of the first symbol in timeslot 1.

RCR reference: The power versus time measurements are based on RCR STD-28 7.1.6, “Transient response characteristics of burst transmission” and 3.4.2.4 “Transient response characteristics of burst transmission. ”

`P vs T FALLING` measures the ramp-down time and allows you view the ramp-down of a burst. The ramp-down time is the time difference between the point 14 dB below the mean carrier level and the closest -37 dBm point (the markers are positioned at the -14 dB and -37 dBm points). See Figure 2-14 for an example of measuring the ramp-down of a burst.



pj428b

Figure 2-14. Measuring the Ramp-down of a Burst

Item	Description
1	The position of the mean power level for the burst.
2	The lower limit line. (The lower limit line indicates the boundary for the minimum ramp-up for the burst.)
3	The selected display range (either 70 dB or 110 dB).
4	The release time. The release time is the time it takes the ramp-down of the burst to transition from -14 dB from the mean of the burst to -37 dBm.
5	The upper limit line. (The upper limit line indicates the boundary for the maximum ramp-down for the burst.)
6	Indicates whether the burst was above the lower limit line. If the burst was above the lower limit line, PASS is displayed; otherwise, FAIL is displayed.
7	Indicates whether the burst was below the upper limit line. If the burst was below the upper limit line, PASS is displayed; otherwise, FAIL is displayed.

RCR reference: The power versus time measurements are based on RCR STD-28 7.1.6, “Transient response characteristics of burst transmission” and 3.4.2.4 “Transient response characteristics of burst transmission. ”

To adjust the limit lines

Press Limit Edit under the P vs T Setup menu to access the limits part of the Power versus Time Setup menu. Refer to Figure 2-15 to adjust the limit lines as described below. If the power versus time burst measurement is made just before editing limits, the limit line mask is displayed, and updated, as changes are made to the limit values.

1. PRE LIMIT sets the absolute (dBm) value for the rising edge upper limit. The default is -37 dBm, and the range is 0 to -80.
2. POST LIMIT sets the absolute (dBm) value for the falling edge upper limit. The default is -37 dBm, and the range is 0 to -80.
3. UPPER LIMIT sets the relative (dB) value for the difference between the burst upper (outer) limit (located at the top horizontal graticule in Figure 2-15), and the mean power in the "on" part of the burst. The default is 4 dB, and the range is 0 to 10 dB.
4. LOWER LIMIT sets the relative (dB) value for the difference between the burst lower (inner) limit and the mean power in the "on" part of the burst. The default is -14 dB, and the range is 0 to -30 dB.
5. TIME MARGIN adds or subtracts time (in μs) to both sides of the 13 μs time between the rising edge or falling edge boundaries. For example, if TIME MARGIN is set to 2 μs there will be 17 μs between the boundaries. The default is 0 (zero), which means that there is 13 μs between the rising edge or falling edge boundaries, and the range is -7 to 26.

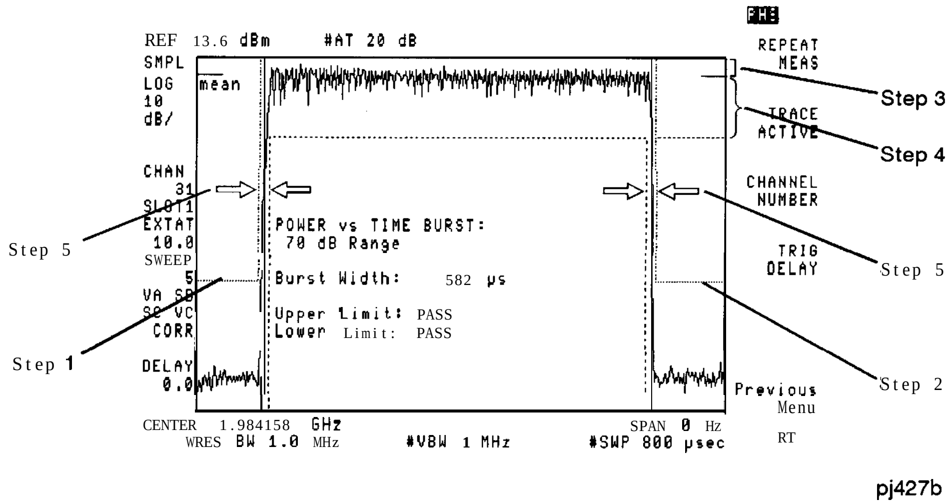


Figure 2-15. Adjusting the Limit Lines

Measuring Adjacent Channel Leakage Power

To make an adjacent channel leakage power (ACP) measurement, use the functions that are accessed by pressing Adj Chan Power . The next few pages contain procedures for making the following measurements:

- Adjacent Channel Power Fast (ACP FAST)

  A fast measurement method using a single sweep. This measures adjacent channel power with a wide span that includes the carrier and adjacent channels. The spectrum analyzer power integration method is used.

- Adjacent Channel Power Standard (ACP STD)

  This is the RCR and MKK recommended multi-sweep method to measure adjacent channel leakage power. A separate sweep is used for the carrier and each adjacent channel. Other than that it is the same as ACP FAST.

- Channel Power

  This measures channel power using the spectrum analyzer power integration method.

Once an ACP measurement has been completed, the softkeys change to the "post-measurement" softkeys. The post-measurement softkeys allow you to repeat the previous measurement or change various testing parameters. For more information about the post-measurement softkeys, see "The Post-Measurement Menu" in Chapter 3.

To measure the adjacent channel leakage power

1. Make sure that the channel number selection agrees with the transmitter RF output. See "To select a channel and slot number to test" earlier in this chapter for more information.
2. Press Adj Chan Power . (If Adj Chan Power is not displayed, press (MODE) PHS ANALYZER to access Adj Chan Power .)
3. Make the ACP measurement.

   For a fast measurement made with a single sweep:

   a. Press ACP FAST . The personality measures the total transmitted power, as well as the power in the upper and lower adjacent (±600 kHz) and alternate (±900 kHz) channels. One measurement sweep is taken, using peak detection.

   b. To view the spectrum (trace) results of the single sweep ACP measurement, press VIEW TBL TRCE so that TRCE is underlined. Notice that the scale per division is 13 dB/div instead of the usual 10 dB/div. The personality is able to provide a real-time display of the spectrum and a display range of 100 dB instead of the normal 70 dB by shifting the reference level during the sweep; a lower reference level is used for measuring the adjacent channels, and a higher reference level is used for measuring the carrier channel.

   or

   For a measurement using multi-sweeps (RCR and MKK recommended):

   a. For a slower but more accurate (and more repeatable) measurement, press ACP STD . ACP STD performs one measurement sweep for each channel (carrier, f600 kHz, ±900 kHz) using a 1 kHz resolution bandwidth, a 3 kHz video bandwidth, and 192 kHz span.

   b. If desired, fewer data points can be specified for ACP STD . To select the number of data points, press POINTS/SWEEP , enter a number from 120 to 401 (the lower the number the faster the measurement) with the data keys, press (ENTER), and then press ACP STD . Decreasing the number of data points makes ACP STD faster, but less accurate. Decreasing the number of data points also truncates the displayed trace. The default number of data points is 401.
4. Press Previous Menu when done with the ACP measurement, or use one of the post-measurement functions.

For either method, relative and absolute results are displayed for the ±600 kHz and ±900 kHz channels. They are a ratio (in dB) and an absolute value (in dBm and nW) which is computed from the ratio and the last measured antenna power.

If PASSFAIL ON OFF is set to ON, a message is displayed that indicates if the measurement passed (PASS) or failed (FAIL) the numeric test limits for the absolute results.

An ACP measurement measures the power that "leaks" from the channel into adjacent and alternate channels. ACP FAST and ACP STD do not separate the spectrum due to modulation, from the full spectrum. The random power integration equation is applied to both the modulation (random) and transient (impulsive) components. The personality uses the spectrum analyzer peak detector and a 192 kHz integration bandwidth to measure the power in the adjacent channels.

Figure 2-16 shows the table results for a single-sweep ACP measurement. The table results for a multi-sweep ACP measurement look the same. Figure 2-17 shows the spectrum results for an ACP FAST (single-sweep) measurement.

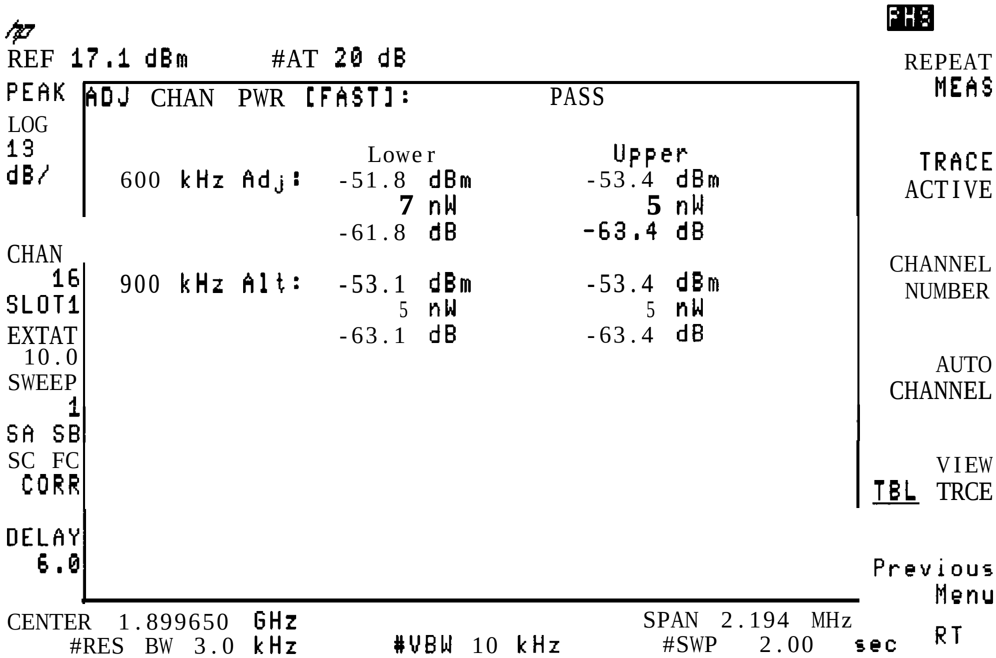


Figure 2-16. Table Results for a Single-Sweep ACP Measurement

RCR reference: The adjacent channel power is based on RCR STD-28 7.1.8, "Adjacent channel power" and 3.4.2.3 "Adjacent channel power."

MKK reference: Test item (4), "Adjacent channel power spectrum analyzer method."

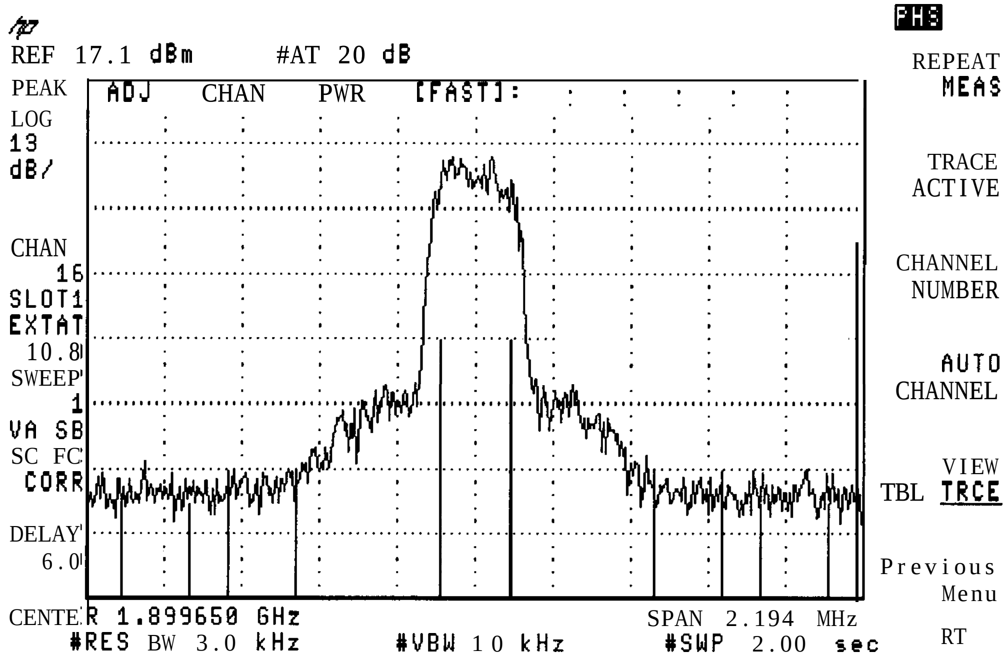


Figure 2-17. Spectrum Results for a Single-Sweep ACP Measurement

To measure the channel power

1. Set the channel number to the desired channel. See "To select a channel and slot number to test" earlier in this chapter for more information.
2. *If a carrier is not present:* The spectrum analyzer reference level should be adjusted so that the noise is positioned above the second graticule from the bottom graticule on the spectrum analyzer display. To adjust the reference level, press (AMPLITUDE), then use the large knob on the spectrum analyzer front panel to adjust the noise level so that it is above the second graticule from the bottom graticule. (If the Post-Measurement menu is displayed, you must first press TRACE ACTIVE before you press (AMPLITUDE).) Press (MODE) (MODE) after the reference level has be adjusted.
3. *If* a carrier is *present:* To avoid signal compression, you should perform the antenna power measurement on the carrier channel before the channel power measurement. You need to perform the antenna power measurement because the channel power measurement does *not* adjust the reference level and input attenuator. See "To measure the antenna power" for information about performing the antenna power measurement.
4. If CHAN POWER is not displayed, press Adj Chan Power . (If Adj Chan Power is not displayed, press (MODE) PHS ANALYZER to access Adj Chan Power .)
5. Make the channel power measurement.
   a. Press CHAN POWER . The personality will measure the total power in any channel. The absolute channel power will be displayed.
   b. If desired, fewer data points can be specified for CHAN POWER . To select the number of data points, press POINTS/SWEEP , enter a number from 120 to 401 (the lower the number the faster the measurement) with the data keys, press (ENTER), and then press CHAN POWER. Decreasing the number of data points makes CHAN POWER faster, but less accurate. Decreasing the number of data points also truncates the displayed trace. The default number of data points is 401.
6. Press Previous Menu when done with the channel power measurement, or use one of the post-measurement functions.

CHAN POWER is a rms-like power responding measurement, meaning that the measurement gives correct results for both noise and tonal signals for the selected channel. The channel power measurement uses the spectrum analyzer peak detector and a 192 kHz integration bandwidth to measure the power in the channel.

Generally, the channel power measurement is used to determine the absolute leakage power or noise power in an arbitrary channel (a channel other than the carrier channel).

See Figure 2-18 for an example of a channel power measurement on an unoccupied channel.

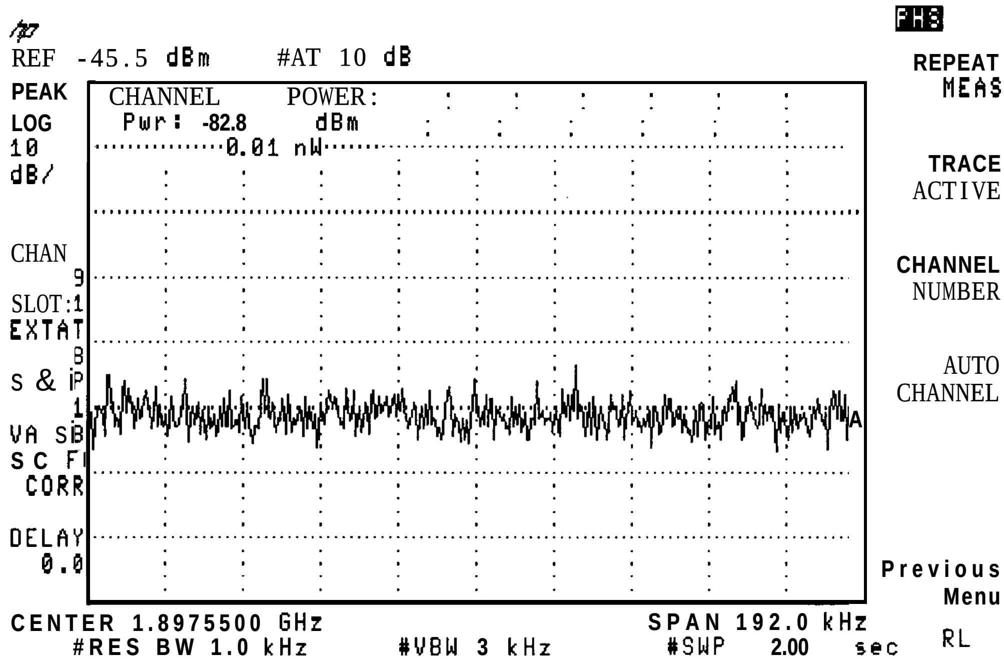


Figure 2-18. A Channel Power Measurement

Measuring Modulation Accuracy

To make modulation accuracy measurements, use the functions accessed by pressing the Modulatn softkey in the Digital Demodulator Main menu.

You must have Options 151 and 160 installed to perform these measurements.

See "Tell the analyzer to list its own options" in the beginning part of Chapter 1, "Getting Started," to quickly determine the options installed in your analyzer.

The next few pages contain the following procedures:

- Measure the modulation accuracy of a PHS digital transmitter.

  A complete accuracy measurement includes the RMS error vector magnitude (EVM), RMS magnitude error, RMS phase error, peak EVM, I-Q origin offset, and carrier frequency error.

- Average a set of modulation accuracy measurements. Obtain information based on a set of modulation accuracy measurements. This includes the mean, standard deviation, maximum and minimum EVM for the sample set. Display the range of RMS EVM uncertainty for the measured signal.

- Calibrate the modulation accuracy measurement to correct for the inaccuracies of the spectrum analyzer hardware.

Note If the carrier frequency is more than 10 kHz away from the nominal channel center frequency, the measurement results may not be accurate.

To perform a modulation accuracy measurement

1. Make sure that the channel number selection and slot number agree with the transmitter RF output. See "To select a channel and slot number to test" earlier in this chapter for more information.
2. If the Digital Demodulator Main menu is not displayed, press (MODE) PHS ANALYZER MORE 1 OF 2 Digital Demod.
3. Press Modulatn . This accesses the Modulation Accuracy Measurements menus.
4. Press SINGLE CONT until SINGLE is underlined to select single measurements. Underlining CONT will select continuous measurements. Continuous measurements measure and update the screen continuously until the STOP MEAS softkey is pressed, or an error state stops the measurement. The default is SINGLE.
5. Press FULL PARTIAL until FULL is underlined to select the full measurement set. Underlining PARTIAL selects a partial measurement set, which omits carrier frequency relocking. The default setting is FULL.
6. Press More 1 of 2.
7. Disable averaging by pressing AVERAGE ON OFF until OFF is underlined. See "To find the average error vector magnitude" for details on making an averaged measurement. The default setting is OFF.
8. Choose between making a new measurement and displaying existing measurement data in a new display format. New measurement data is always required for the first measurement, and the SAV MEAS ON OFF softkey is not displayed.

   Press SAVE MEAS ON OFF until OFF is underlined to acquire new measurement data and display the results. To display results in a new format for the current measurement data, press SAV MEAS ON OFF to underline ON.

   With SAV MEAS ON OFF set to ON, modulation accuracy, I-Q graphs, EVM versus symbol, and data bits may be viewed without making a separate measurement. See "To measure and display a graph or demodulated data bits" in this chapter.
9. Press More 2 of 2 to return to the previous menu.
10. Press MODULATN ACCURACY to start the modulation accuracy measurement. The modulation metrics screen will appear with values for RMS error vector magnitude (EVM), RMS magnitude error, RMS phase error, peak EVM, I-Q origin offset, and carrier frequency error.

    To stop a measurement in progress, press STOP MEAS . To repeat the measurement, press MODULATN ACCURACY . To change the measurement to a different channel or frequency, use the CHANNEL NUMBER or CHAN X CTR FREQ keys by pressing Demod Main, Demod Conf ig , or (FREQUENCY). Press (MODE) twice to return to the previous menu if using the (FREQUENCY) key. Press MODULATN ACCURACY to repeat the measurement.

A modulation accuracy measurement provides a summary of the metrics that describe the quality of digital modulation. The modulation accuracy measurement complies with the procedures outlined in RCR STD-28. EVM is calculated after I-Q origin offset and carrier frequency error have been extracted from the measured data. The measurement interval includes 111 of the transmitted symbols of a transmitter burst. Modulation metrics are calculated using measured data only at decision points.

Note that the analyzer will adjust reference level and attenuation to automatically optimize measurement dynamic range. This level setting is done at the first repetition of the measurement after entering the Modulation Accuracy menu by pressing **Modulatn** . It is also done automatically if the signal amplitude is detected to be outside of the optimal range for the measurement.

The center frequency will be tuned using 10 Hz resolution to optimize the accuracy of the carrier frequency error measurement.

The spectrum analyzer is retuned, or “relocked,” each time the measurement is repeated.

If the digital demodulator trigger is set to FRAME, frame trigger synchronization to the unique word will be acquired at every single measurement, and the first continuous measurement. Since the frame trigger is based on an internal clock that is not locked to the time base of the station under test, the frame trigger may drift slowly away from the desired synchronization. The personality will detect this drift, and automatically initiate a re-acquisition of the frame trigger before the trigger position drifts out of valid measurement range. Normal measurements will continue after a successful reacquisition of the frame trigger.

See Figure 2-19 for an example of the full modulation accuracy measurement screen.

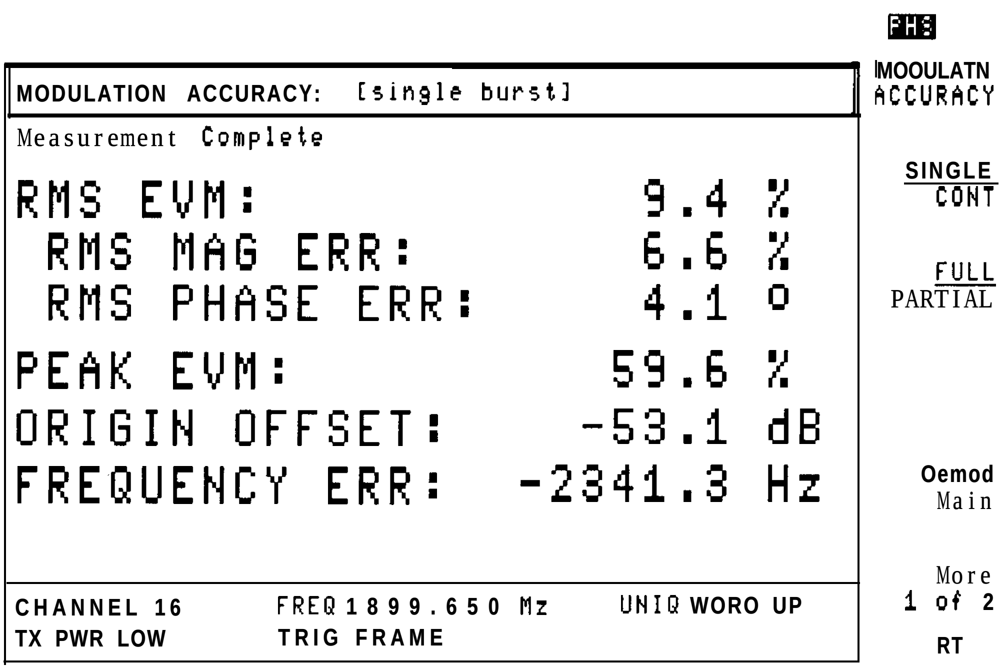


Figure 2-19. A Full Modulation Accuracy Measurement

RCR reference Modulation accuracy measurements are based on RCR STD-28 7.1.7 “Modulation Accuracy, ” and 3.4.2.9 “Modulation Precision.”

To find the average error vector magnitude

1. Make sure that the channel number selection and slot number agree with the transmitter RF output. See "To select a channel and slot number to test" earlier in this chapter for more information.
2. If the Digital Demodulator Main menu is not displayed, press (MODE) PHS ANALYZER MORE 1 OF 2 Digital Demod.
3. Press Modulatn to access the Modulation Accuracy Measurements menus.
4. Press More 1 of 2 ,
5. Enable averaging by pressing AVERAGE ON OFF until ON is underlined. When averaging is turned ON, the number of bursts measured becomes an active function displayed on screen. Enter the number of bursts to include in the average by using the data key pad, then press (ENTER). You may enter any integer value from 1 to 999.

   The default setting is 10.
6. Press More 2 of 2 to return to the previous menu.
7. Press MODULATN ACCURACY to start the averaged modulation accuracy measurement. The modulation metrics screen will appear

   with values for RMS error vector magnitude (EVM), RMS magnitude error, RMS phase error, peak EVM, I-Q origin offset, and carrier frequency error.

   To stop a measurement in progress, press STOP MEAS .

   To repeat the measurement, press MDDULATN ACCURACY .

The modulation metrics of a mobile station may fluctuate during transmission. The automatic averaging function of the personality allows you to find the mean level and standard deviation of key modulation metrics, such as EVM, quickly and easily. As the averaged modulation accuracy measurement progresses, results for each individual measurement will be displayed on the modulation accuracy screen, until the selected number of bursts to average is reached. The display will then change to a screen with a summary of statistical information calculated from the set of measured bursts. This summary includes the mean, standard deviation, maximum and minimum values for RMS EVM, RMS magnitude error, and RMS phase error. Mean I-Q origin offset and mean carrier frequency error are also displayed. The accuracy of the statistical values (the repeatability) depends on the number of bursts included in the calculations. To further improve EVM measurement accuracy, you can perform the procedure "To calibrate and correct for spectrum analyzer EVM inaccuracies due to uncertainty in the phase error measurement," later in this chapter.

Uncertainty ranges for RMS EVM for room and full temperature measurement conditions are also displayed. The true RMS EVM of the measured signal will lie between these limits. The uncertainty ranges for an averaged measurement include the measured standard deviation of the signal. The *accuracy* of the uncertainty range will depend on the number of bursts averaged. If the number of bursts to average is set to 1, no standard deviation information is available. In this case, spectrum analyzer specified limits for measurement repeatability are used to calculate uncertainty ranges. If the number of bursts to average is greater than 1, uncertainty ranges are calculated from the measured standard deviation, which includes the variation of the measured source.

Setting AVERAGE ON OFF to ON will set SAV MEAS ON OFF to OFF, and SINGLE CONT will be set to SINGLE. Note that the SAV MEAS ON OFF function is not available after executing an averaged measurement. See “To perform a full modulation accuracy measurement” in this chapter for details on the automatic measurement process.

See Figure 2-20 for an example of the statistics screen for a measurement.

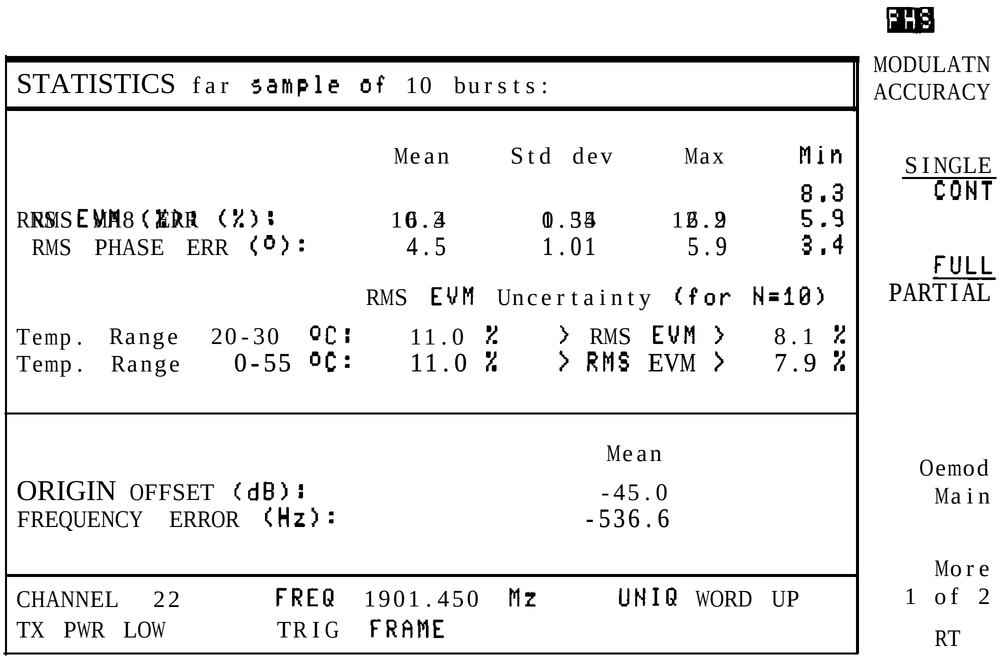


Figure 2-20. An Averaged Full Modulation Accuracy Measurement Statistics Screen

To calibrate and correct for spectrum analyzer EVM inaccuracies due to uncertainty in the phase error measurement

The following is an *optional* calibration procedure that can provide more accurate results when measuring EVM. This method requires an external high-quality, low-EVM source with known phase error. The accuracy of this calibration depends on the accuracy and stability of the calibration signal phase error.

It is *not* necessary to perform this procedure before making an EVM measurement that requires accuracy less than or equal to the published EVM specifications for your spectrum analyzer.

1. If the Digital Demodulator Main menu is not displayed, press (MODE) PHS ANALYZER MORE 1 OF 2 Digital Demod.

Note The calibration requires complete modulation accuracy measurements to be made on the calibration signal. See "To configure a digital demodulator-based test" for details on how to configure the personality to measure your calibration signal.

2. Press Modulatn to access the Modulation Accuracy Measurements menus.
3. Press More 1 of 2.
4. Press Evm Cal to access the EVM Calibration menu. A screen containing instructions is also displayed. See Figure 2-21 for the EVM calibration instructions screen.

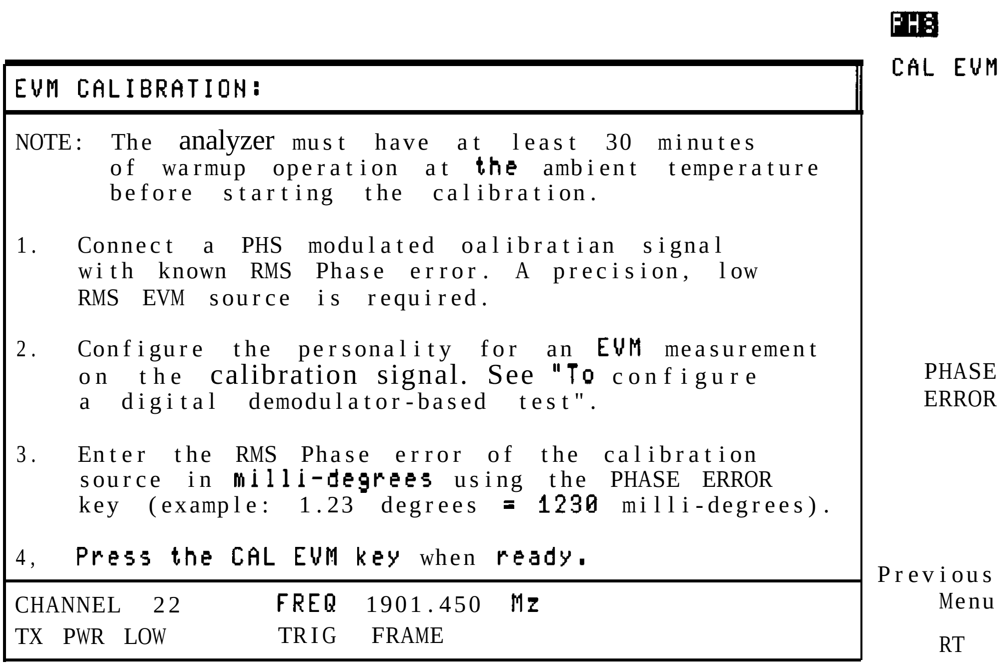


Figure 2-21. EVM Calibration Instructions

5. Press PHASE ERROR . The source phase error becomes an active function displayed on screen. Enter the phase error of the precision source (in milli-degrees) using the data key pad, then press (ENTER). You may enter any integer value from 0 to 9999.

   The default setting for PHASE ERROR is 0.

6. Press CAL EVM to execute the calibration by measuring the precision source.

A 20-measurement average error vector magnitude measurement is done followed by a screen containing the results of the calibration. See Figure 2-22 for an example of an EVM calibration results screen.

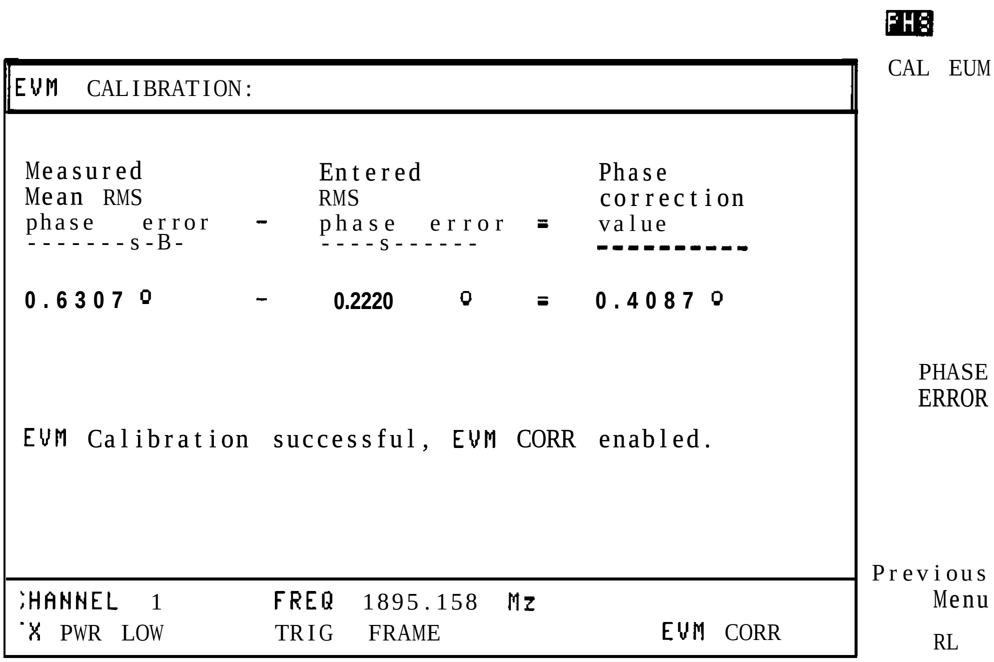


Figure 2-22. EVM Calibration Results

If the calibration was successful, the EVM CORR ON OFF softkey will be displayed in the previous menu and will be set to ON.

While EVM CORR ON OFF is set to ON, the phase correction value generated by the EVM calibration is used to automatically correct all measured RMS phase error and RMS EVM results. This correction only corrects errors due to the uncertainty in the phase error measurement. Magnitude error uncertainty is not corrected. See Chapter 7, "Specifications," for details on system performance.

The phase correction value is saved. Its value will be retained through analyzer power cycles, as will the state of the EVM CORR ON OFF softkey.

Note that the "EVM CORR" annotation will be present on all digital demodulator-based measurement result screens while EVM CORR ON OFF is set to ON.

To disable correction, press EVM CORR ON OFF until OFF is underlined.

Measuring or Displaying Digital Demodulation Graphical Results

To measure or display the EVM versus symbol, I-Q pattern, eight-point constellation diagrams, or data bits, use the functions that are accessed by pressing Graphs , in the Digital Demodulator Main menu.

Note If the carrier frequency is more than 10 kHz away from the nominal channel center frequency, the measurement results may not be accurate.

To measure and display a graph or demodulated data bits

1. Make sure that the channel number selection and slot number agree with the transmitter RF output. See "To select a channel and slot number to test" earlier in this chapter for more information.
2. If the Digital Demodulator Main menu is not displayed, press (MODE) PHS ANALYZER MORE 1 OF 2 Digital Demod.
3. Press Graphs to access the functions that produce a graph of measurement results, or press Data to access the functions that display the demodulated data.
4. Press SINGLE CONT until SINGLE is underlined to select single measurements. Underlining CONT will select continuous measurements. Continuous measurements measure and update the screen continuously until the STOP MEAS softkey is pressed, or an error state stops the measurement. The default is SINGLE.
5. Choose between making a new measurement and displaying existing measurement data in a new display format. New measurement data is always required for the first measurement, and the SAV MEAS ON OFF softkey is not displayed.

   Press SAVE MEAS ON OFF until OFF is underlined to acquire new measurement data and display the results. To display results in a new format for the current measurement data, press SAV MEAS ON OFF to underline ON.

   With SAV MEAS ON OFF set to ON, modulation accuracy, I-Q graphs, EVM versus symbol, and data bits may be viewed without making a separate measurement. See "To perform a modulation accuracy measurement" in this chapter.
6. If Graphs was selected, the display formats available are I-Q PATTERN , 8 POINT CONSTLN , or EVM vs SYM .

   To stop a measurement in progress, press STOP MEAS .

   To repeat the measurement, press the appropriate display format key again.
7. Press I-Q PATTERN to measure and display the I-Q pattern graph.

   An I-Q pattern displays the phase and amplitude trajectory of the baseband digital modulation.

   Data from 111 symbols of the burst are plotted on the I-Q graphs, with five samples-per-symbol resolution. They are plotted after correction for I-Q origin offset and carrier frequency error. The corresponding EVM is also displayed on the screen.

   The I-Q pattern graph is a qualitative tool for quick diagnosis of modulator problems. I-Q modulator imbalance will appear as an un-circular pattern. Large amplitude errors at single decision points will appear as aberrations in the trajectory.
8. Press 8 POINT CONSTLN to measure and display the 8 point constellation graph. An eight-point constellation displays the phase and amplitude of the baseband digital modulation only at the decision points.

   The eight-point constellation is plotted after correction for I-Q origin offset and carrier frequency error. The eight decision states of the $\pi/4$ DQPSK modulation will be indicated by the " + " symbol. The magnitude and phase of 111 decision points in a burst are plotted on the I-Q axes as pixel points. The corresponding EVM is also displayed on the screen.

The eight-point constellation graph is a qualitative tool for quick diagnosis of modulator problems. I-Q modulator imbalance will appear as an un-circular pattern of points. Large amplitude errors or phase errors at single decision points will appear as pixels far from the target constellation points (+). The clustering of the pixels about the target constellation points provides a qualitative view of the quality of digital modulation.

9. Press EVM VS SYM to measure and display a graph of EVM versus symbol number. This displays the measured EVM values for symbol number 2 through 112.

   The peak EVM value is a useful quantitative indication of modulation performance. The peak value and its symbol location can aid in design and troubleshooting.

10. If Data was selected in the Digital Demod Main menu, DATA BITS is available to display the demodulated data.

11. Press DATA BITS to measure and display the data bits. The data bits display shows the data bits demodulated from the timeslot measured, after correction for carrier frequency error and I-Q origin offset. The 16-bit unique word (synch word) is highlighted. The 240 bits for a full burst are displayed.

    For the above data measurements and graphical displays, the spectrum analyzer is optimized for maximum measurement accuracy. Note that the analyzer will adjust reference level and attenuation to automatically optimize measurement dynamic range. This level setting is done at the first repetition of the measurement after entering the Graphs menu by pressing Graphs . It is also done if the signal amplitude is detected to be outside of the optimal range for the measurement.

    The center frequency will be tuned using 10 Hz resolution to optimize the accuracy of the measurement. The center frequency will be re-tuned at each graph measurement.

    If the digital demodulator trigger is set to FRAME, frame trigger will be synchronized to the unique word at every single measurement and the first continuous measurement. Since the frame trigger is based on an internal clock which is not locked to the mobile station time base, the frame trigger may drift slowly away from the desired synchronization. The personality will detect this drift, and automatically initiate a re-acquisition of the frame trigger before the trigger position drifts out of valid measurement range. Normal measurement will continue after a successful reacquisition of the frame trigger.

Figure 2-25, Figure 2-23, Figure 2-24, and Figure 2-26 show examples of various digital demodulation graphs and a tabular data bits screen.

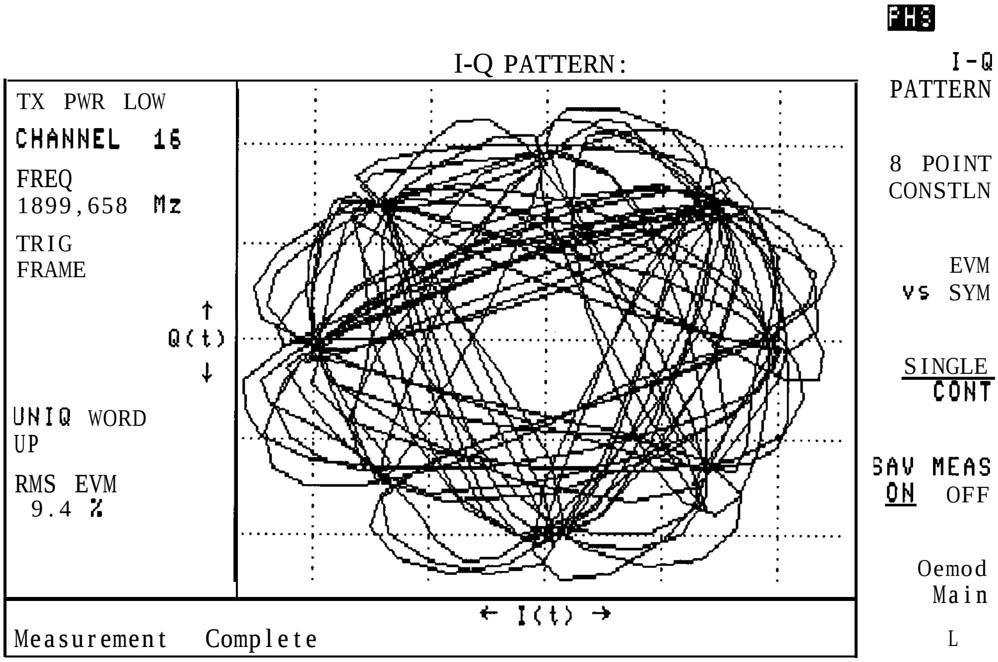


Figure 2-23. I-Q Pattern Graph Screen

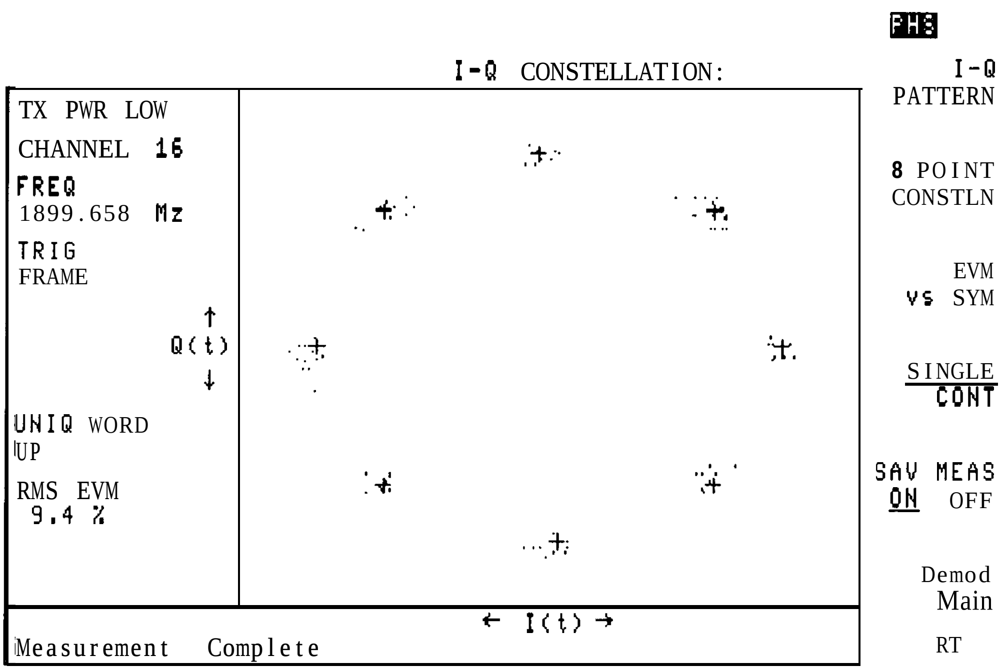


Figure 2-24. I-Q Constellation Graph Screen

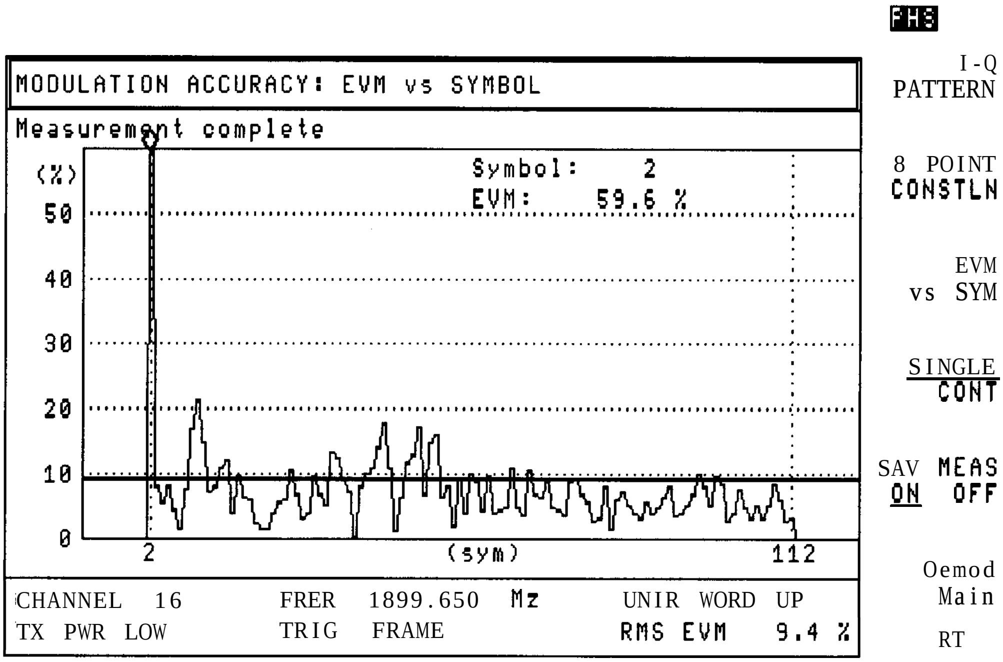


Figure 2-25. EVM Symbol Graph Screen

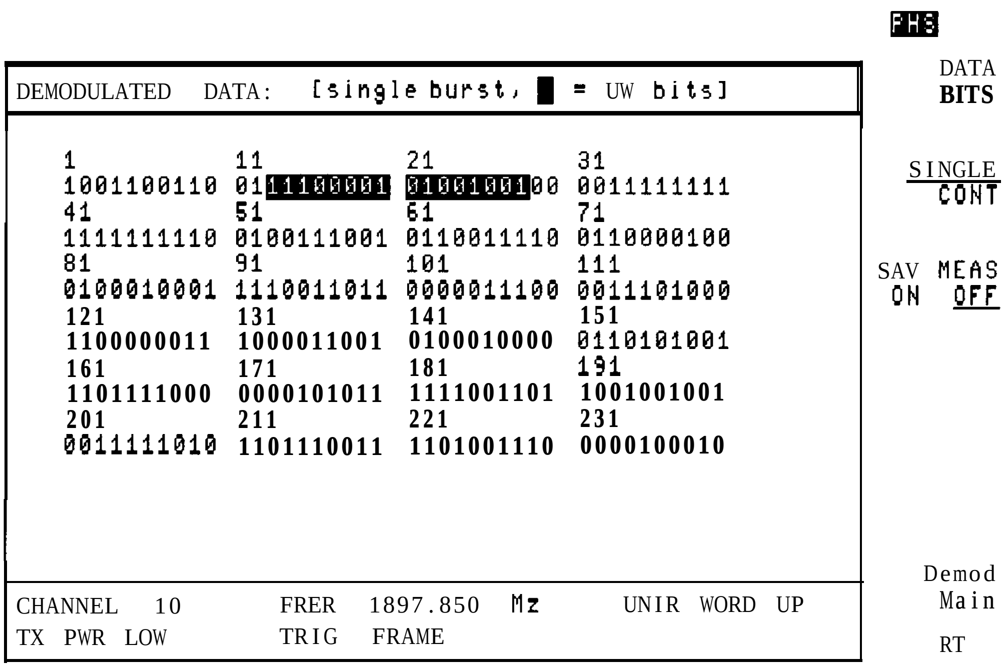


Figure 2-26. Data Bits Screen

To hold measurement data for viewing modulation accuracy, graphs, and demodulated data bits

1. Perform a complete Modulatn (modulation), Graphs , or Data measurement. Note that a halted measurement cannot be held.
2. Press SAV MEAS ON OFF until ON is underlined. When SAV MEAS ON OFF is set to ON, the current measurement data is held in memory. New measurement data cannot be obtained until SAV MEAS ON OFF is set to OFF.
3. Select another Modulatn (modulation), Graphs , or Data measurement. The results of the current data will be displayed in the other measurement format.

The Modulatn Graphs and Data screens may be viewed in any order, and as many times as you want.

Press SAVE MEAS ON OFF until OFF is underlined to enable making a measurement with new data.

SAVE MEAS ON OFF will be set to OFF if you return to the personality Main menu.

Note The measurement data is held in temporary storage. If the analyzer power is cycled, the measurement results will be lost.

Performing the System Measurements

The next few pages demonstrate how you can use the System and Spurious functions. System accesses the function that allows you to view the spectrum of the PHS frequency band. Spurious accesses the functions that allow you to measure spurious emissions.

The following procedures show you how to:

- View the PHS band spectrum
- Measure spurious emissions

To view the PHS band spectrum

1. If System is not displayed, press (MODE) PHS ANALYZER More 1 of 2 .
2. Press System.
3. Press MONITOR BAND . The personality will change the start and stop frequency of the spectrum analyzer so that the PHS band is displayed. The reference level is set to +30 dBm, unless TX PWR HI LOW in the Configuration menu is set to HI, in which case the reference level is set to + 50 dBm.
4. The sweep time is set for fast trace updates, but it is too fast to make an accurate amplitude measurement. If a different sweep time is desired, you can change the sweep time by pressing (SWEEP), entering in the sweep time with the data keys, and then pressing (sec) (for seconds), or (ms) (for milliseconds). Press (MODE) twice to return to the previous PHS menu.
5. Press MONITOR CHAN . The personality will change the center frequency and span of the spectrum analyzer so that the selected channel is displayed.

   MONITOR CHAN displays the RF spectrum of the channel that you select. See Figure 2-27 for an example of viewing channel 1.

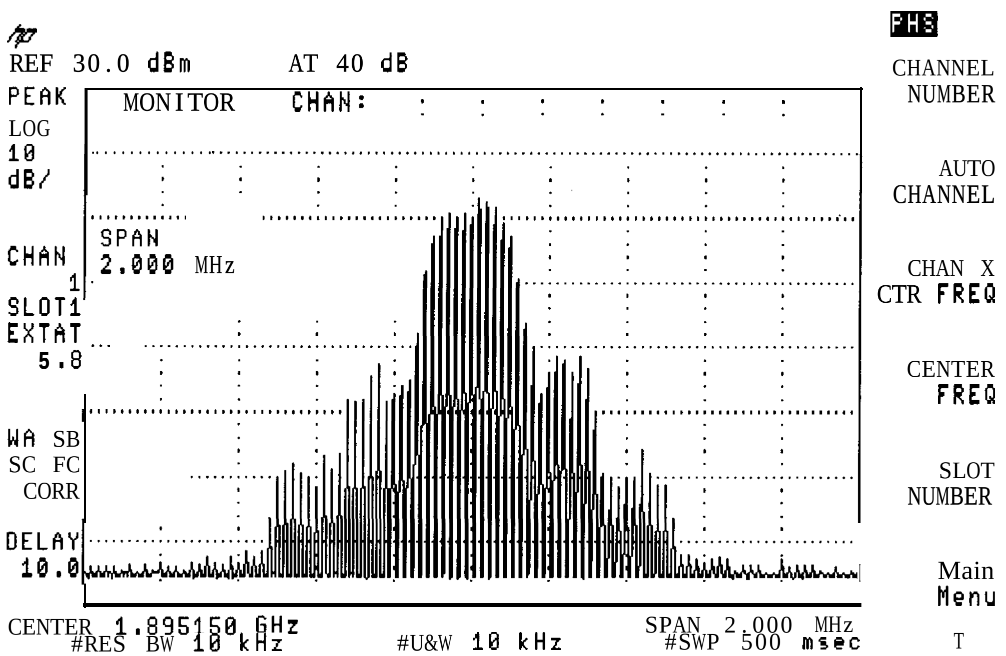


Figure 2-27. Viewing Channel 1

6. Press **Main** Menu when you are done.

MONITOR BAND displays the PHS frequency band. If the spectrum analyzer start and stop frequencies are changed using softkeys under the (FREQUENCY) menu, note that the sweep time remains at 500 ms and may need to be adjusted manually. The start and stop frequencies will be reset back to the PHS band edges by pressing (MODE), (MODE), MONITOR BAND. See Figure 2-28 for an example display of the PHS band.

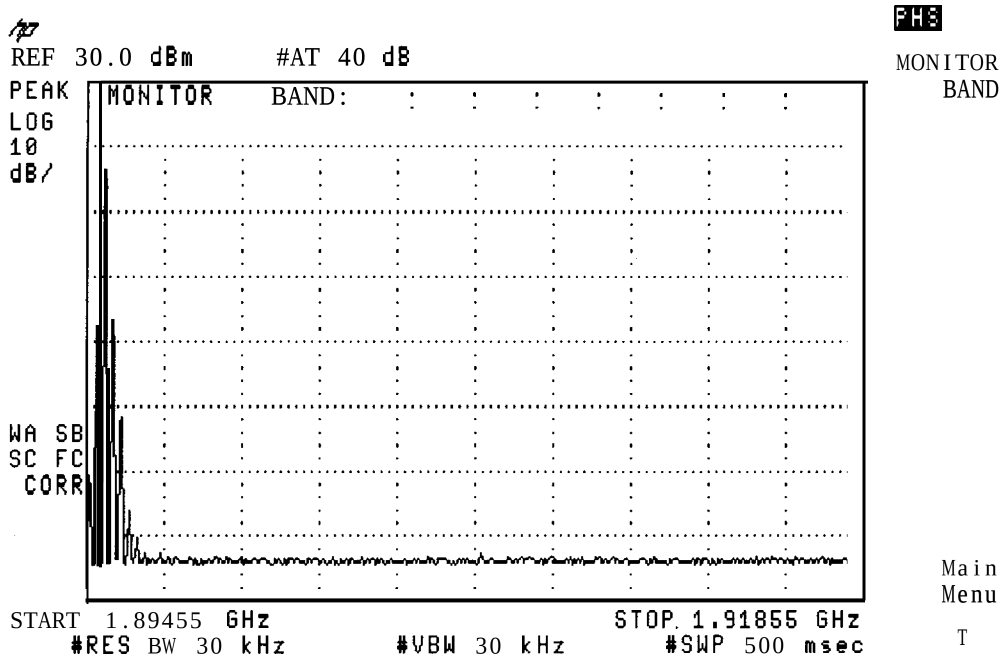


Figure 2-28. PHS Band Trace

Measuring Spurious Emissions

To make spurious emission measurements, use the functions that are accessed by pressing Spurious . The next few pages contain the following measurements and procedures:

- Setup for triggering spurious emission measurements
- In-band spurious emissions
- Out-of-band spurious emissions (This measurement can be performed on the PHS unit under test in its transmit or receive state.)
- Spurious and harmonic emissions

To set up triggering for spurious emission measurements

If TRIG SRC UW EXT is set to UW (under Config Trigger Config), the unique word in the data stream is used as the trigger source, and the FT ACQ ON OFF softkey is displayed in the Spurious Menu.

- Set FT ACQ ON OFF to ON (frame trigger acquisition ON) to force the measurement to locate the unique word within the frame and delay the Frame Trigger output on the rear panel, appropriately. This synchronized frame trigger procedure will be done prior to every spurious measurement.
- Set FT ACQ ON OFF to OFF to allow a measurement to be made using the previous unique word timing. This will decrease the measurement time, but may allow the frame trigger to drift away from the desired timeslot.
- The rear panel Frame Trigger Output must be routed to the rear panel External Trigger Input. Connect FRAME TRIGGER OUTPUT directly to EXT TRIG INPUT. If Option 105 (Time-gated spectrum analysis) is installed, an alternate setup is to connect FRAME TRIGGER OUTPUT to GATE TRIGGER INPUT, and connect GATE OUTPUT to EXT TRIG INPUT.

If TRIG SRC UW EXT is set to EXT, a trigger signal external to the spectrum analyzer is used as the trigger source, and the FT ACQ ON OFF softkey is not displayed. The external trigger may come from the PHS unit under test, from a PHS unit that has a link established with the PHS unit under test, or from a device such as the HP 85902A Burst Carrier Trigger.

- The externally-derived trigger signal must be routed to the rear panel External Trigger Input. Connect the external trigger signal directly to EXT TRIG INPUT. If Option 105 (Time-gated spectrum analysis) is installed, an alternate setup is to connect the external trigger signal to GATE TRIGGER INPUT, and connect GATE OUTPUT to EXT TRIG INPUT.

Note If you have trouble performing the spurious emission measurements, make sure that the selections for TRIG POL MEG POS and TRIG DELAY are correct. For more information, see "Step 3. Make the cable connection for triggering the spectrum analyzer" in Chapter 1, and "To configure the personality" earlier in this chapter.

The correct slot number (SLOT NUMBER) must also be selected (usually set to 1). For more information, see "To select a channel and slot number to test" earlier in this chapter.

For frame trigger acquisition to be successful, the carrier frequency must not be more than 10 kHz from the nominal channel center frequency.

To measure in-band spurious emissions

1. Measure the antenna power as previously described in this chapter.

Note The last measured antenna power will be used in calculating the spurious emission absolute result (in dBm and watts). It is not necessary to repeat the antenna power measurement, provided that it was previously done for the current carrier frequency and power level.

---

2. If the SPURIOUS IN BAND is not displayed, press (MODE) PHS ANALYZER More 1 of 2 Spurious.
3. Press SPURIOUS IN BAND to measure transmitter spurious emissions (in dB). The personality will measure carrier power first with the same settings used by the spurious measurement. The measurement value obtained will be used to calculate the spurious emission ratio result (in dB). The personality will set the start and stop frequencies and set the input attenuator to a value determined by the antenna power.
4. If desired, use the START FREQ and STOP FREQ keys to adjust the frequency range to a range that is narrower than the boundaries of the in-band spurious measurement (1.894 to 1.919 GHz). If a wider frequency range is selected, the measurement will automatically use the default frequency boundaries.

Note The carrier must *not* be in the search band.

---

5. Press MEASURE SPUR to start the measurement. The spectrum analyzer will search for the maximum spurious emission (except near the carrier)*. If the maximum value is greater than 5 dB below the test limit it will use zero span to measure the mean power of the spurious emission in the same time slot as the burst carrier; otherwise the value found in the frequency domain search will be used. Two values are then displayed: a value relative to the carrier power as measured in this test (in dB), and an absolute value (in dBm and watts), which is computed from the relative value and the last measured antenna power.
6. Press Previous Menu when done with the spurious emissions measurement, or use one of the post-measurement functions.

If PASSFAIL ON OFF is set to ON, a message is displayed that indicates if the measurement passed (PASS) or failed (FAIL) the test limit for the absolute result.

See Figure 2-29 for an example of an in-band spurious emission measurement.

Note A rear panel trigger signal is required for the in-band spurious emission measurement. The spurious emission spectrum is first obtained by a frequency domain sweep. If the maximum spurious level is less than the frequency domain test limit, the test is passed and the measurement is stopped; no trigger signal is used. If the maximum spurious emission is greater than the allowed frequency domain limit, zero span sweeps are taken; this requires a rear panel trigger signal.

---

* **This is set to within ±2 MHz of the carrier based on the MKK test method. MKK uses the peak value obtained during the frequency-domain sweep for the emission between ±1 and ±2 MHz offset from the carrier, and only uses zero-span for spun at greater than ±2 MHz offset. If the RCR method is preferred (using zero-span except for within ±1 MHz from the carrier), the variable _SSIZL may be changed. Refer to Table 5-2 and "To change the value of parameter variables" in Chapter 6.**

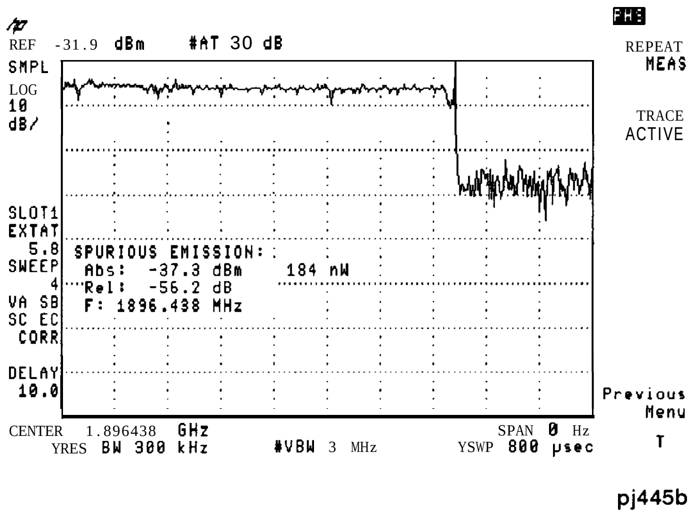


Figure 2-29. In-band Spurious Emission Measurement

RCR reference: The in-band spurious emission measurement is based on RCR STD-28 7.1.2, “Spurious Radiation” and RCR STD-28 3.4.2.6, “Transmitter Spurious (Emission).”

MKK reference: Test item (7), “Spurious emission intensity.”

To measure out-of-band spurious emissions

Transmitter or receiver out-of-band spurious emissions may be measured with this procedure.

1. Measure the antenna power as previously described in this chapter.

Note The last measured antenna power will be used in calculating the spurious emission absolute result (in dBm and watts). It is not necessary to repeat the antenna power measurement, provided that it was previously done for the current carrier frequency and power level.

---

2. If the SPURIOUS OUT BAND is not displayed, press (MODE) PHS ANALYZER More 1 of 2 Spurious .
3. Select the transmitter or receiver spurious emissions to be measured. To select transmitter spurious emissions press SPUR TX RX so that TX is underlined. To select receiver spurious emissions press SPUR TX RX so that RX is underlined. TX is the default setting.
4. Press SPURIOUS OUT BAND . The personality will measure carrier power first with the same settings used by the spurious emission measurement. The personality value obtained will be used to calculate the spurious emission ratio result (in dB). The personality will set the start and stop frequencies to the second harmonic with respect to the carrier and set the input attenuator to a value determined by the antenna power.
5. If desired, use the START FREQ and STOP FREQ keys to adjust the frequency range.
6. Press MEASURE SPUR to start the measurement. The spectrum analyzer will search for the maximum spurious emission in the specified frequency range. If the maximum value is larger than the test limit it will use zero span to measure the mean power of the spurious emission; otherwise the value found in the frequency-domain search will be used. For transmitter spurious, the zero-span measurement is made in the time slot with the highest emissions which may not be the same time slots as the burst carrier. For receiver spurious, the zero-span measurement is made over an entire frame time. Two values are then displayed: a value relative to the carrier power as measured in this test (in dB), and an absolute value (in dBm and watts), which is computed from the relative value and the last measured antenna power.
7. Press Previous Menu when done with the spurious emissions measurement, or use one of the post-measurement functions.

If PASSFAIL ON OFF is set to ON, a message is displayed that indicates if the measurement passed (PASS) or failed (FAIL) the test limit for the absolute results.

See Figure 2-30 for an example of an out-of-band spurious emission measurement.

Note A rear panel trigger signal is required for the out-of-band spurious emission measurement. The spurious emission spectrum is first obtained by a frequency domain sweep. If the maximum spurious level is less than the frequency domain test limit, the test is passed and the measurement is stopped; no trigger signal is used. If the maximum spurious emission is greater than the allowed frequency domain limit, zero span sweeps are taken; this requires a rear panel trigger signal.

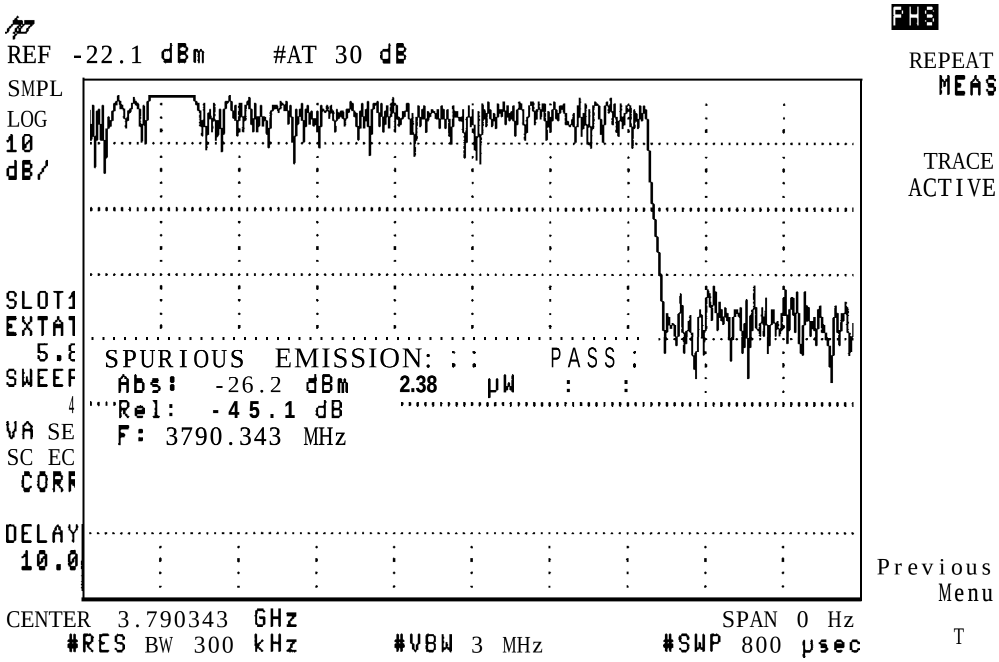


Figure 2-30. Out-of-band Spurious Emission Measurement

RCR reference: The out-of-band spurious emission measurement is based on RCR STD-28 7.1.2, "Spurious Radiation" and RCR STD-28 3.4.2.6, "Transmitter Spurious (Emission)."

MKK reference: Test item (7), "Spurious emission intensity."

Note The result for the receiver out-of-band spurious emission measurement (SPUR TX RX is set to RX) is similar and is based on RCR STD-28 7.2.5, "Conducted spurious component" and RCR STD-28 3.4.3.7, "Conducted spurious component."

To measure spurious and harmonic emissions

1. Measure the antenna power as previously described in this chapter.

Note The last measured antenna power will be used in calculating the spurious emission absolute result (in dBm and watts). It is not necessary to repeat the antenna power measurement, provided that it was previously done for the current carrier frequency and power level.

---

2. If the SPURIOUS HARMONIC is not displayed, press (MODE) PHS ANALYZER More 1 of 2 Spurious .

3. Press SPURIOUS HARMONIC to measure transmitter spurious and harmonic emissions. The personality will measure carrier power first with the same settings used by the spurious measurement. The personality will then search the PHS band for the maximum spurious emission (except near the carrier)*. It will then use zero span to measure the mean power of the spurious emission. Next it measures (also using zero span) the 1/2 sub-harmonic, 2nd harmonic, and 3rd harmonic. The results are displayed as absolute in both dBm and Watts.

If PASSFAIL ON OFF is set to ON, a message is displayed that indicates if the measurement passed (PASS) or failed (FAIL) the test limits for in- and out-of-band spurious emissions.

* **This is set to within ±2 MHz of the carrier based on the MKK test method. MKK uses the peak value obtained during the frequency-domain sweep for the emission between ±1 and ±2 MHz offset from the carrier, and only uses zero-span for spurs at greater than ±2 MHz offset. If the RCR method is preferred (using zero-span except for within ±1 MHz from the carrier), the variable _SSIZL may be changed. Refer to Table 5-2 and "'lb change the value of parameter variables" in Chapter 6.**

Note A rear panel trigger signal is required for the spurious and harmonic emission measurement. Zero span sweeps are always taken; this requires a rear panel trigger signal.

See Figure 2-31 for an example of a spurious harmonics emissions measurement.

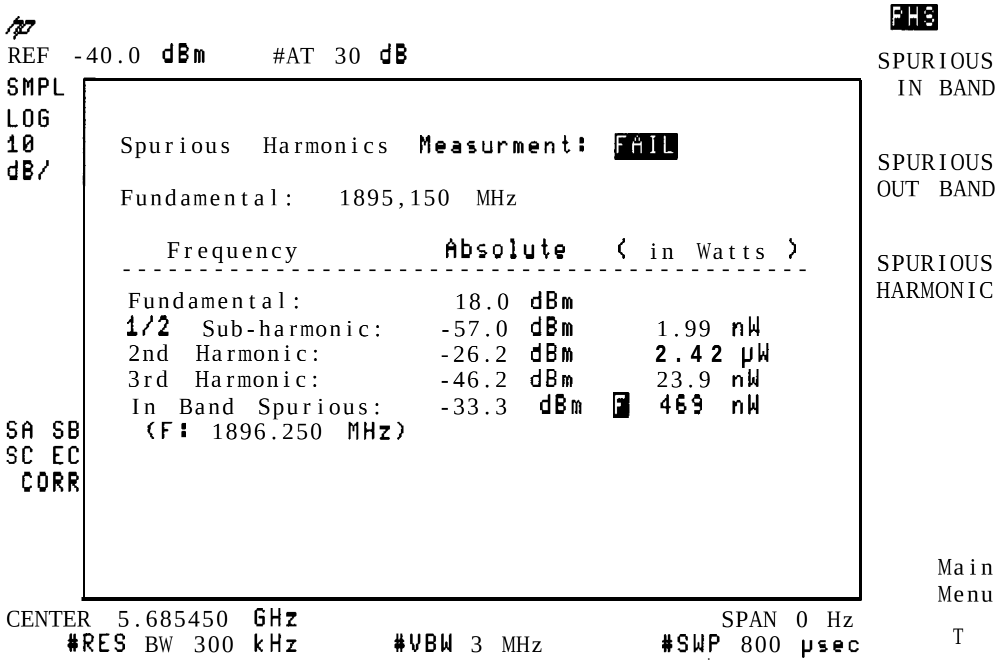


Figure 2-31. Spurious Harmonics Emission Measurement

3

Menu Map and Softkey Descriptions

This chapter contains menu map and definitions of the softkeys. The definitions for the softkeys are listed as they appear within a menu, and the PHS menus are presented as follows:

Configuration menu	Pressing Conf ig accesses the Configuration menu.
Physical Channel menu	Pressing Physical Channel access the Physical Channel menu.
Power menu	Pressing Power accesses the Power menu.
Power versus Time menu	Pressing Power vs Time accesses the Power versus Time menu.
Adjacent Channel Power menu	Pressing Adj Chan Power accesses the Adjacent Channel Power menu.
System menu	Pressing System accesses the System menu.
Spurious menu	Pressing Spurious accesses the Spurious Emissions menu.
Post-Measurement menu	Pressing a power measurement softkey, a power versus time measurement softkey, an adjacent channel power measurement softkey, or a spurious emission measurement softkey accesses the Post-Measurement menu.
Modulation Configuration menu	Pressing Demod Conf ig accesses the Modulation Configuration menu.

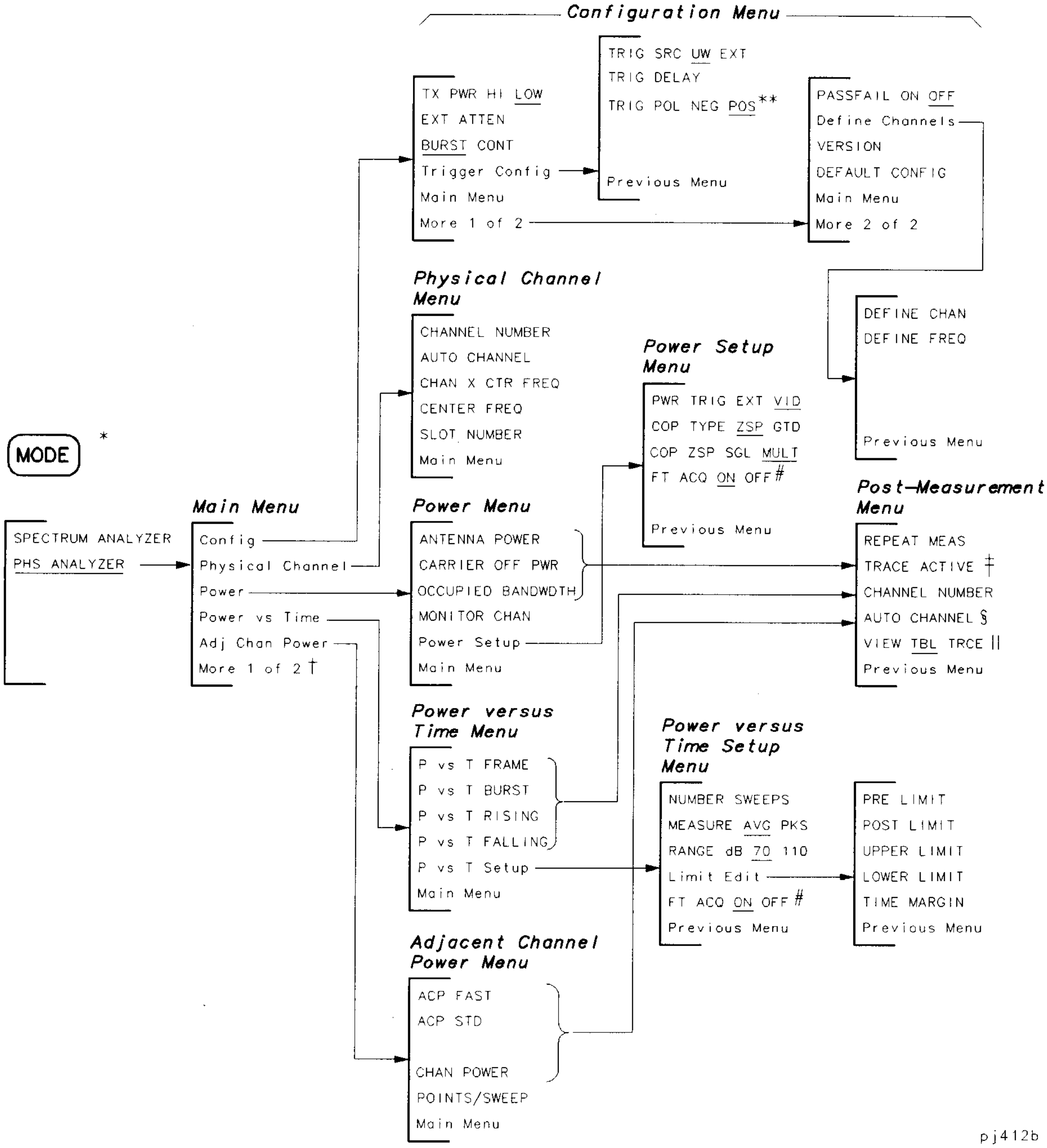


Figure 3-1. Menu Map

* The first time you press (MODE), you access the MODE menu. If you press (MODE) again, you will access the current PHS menu.

† See the following page for the digital demodulation, system and spurious menus.

‡ When you press TRACE ACTIVE, the softkey label changes to TRACE COMPARE. This remains until the measurement is repeated with REPEAT MEAS.

§ Becomes TRIG DELAY for a power versus time measurement.

|| VIEW TBL TRCE is available only with ACP FAST. For power versus time measurements, DISPLAY TOP BOT is displayed if the trace is active.

\# Present only if TRIG SRC UW EXT is set to UW.

** Appears only when Option 105 time-gated spectrum analyzer card is installed.

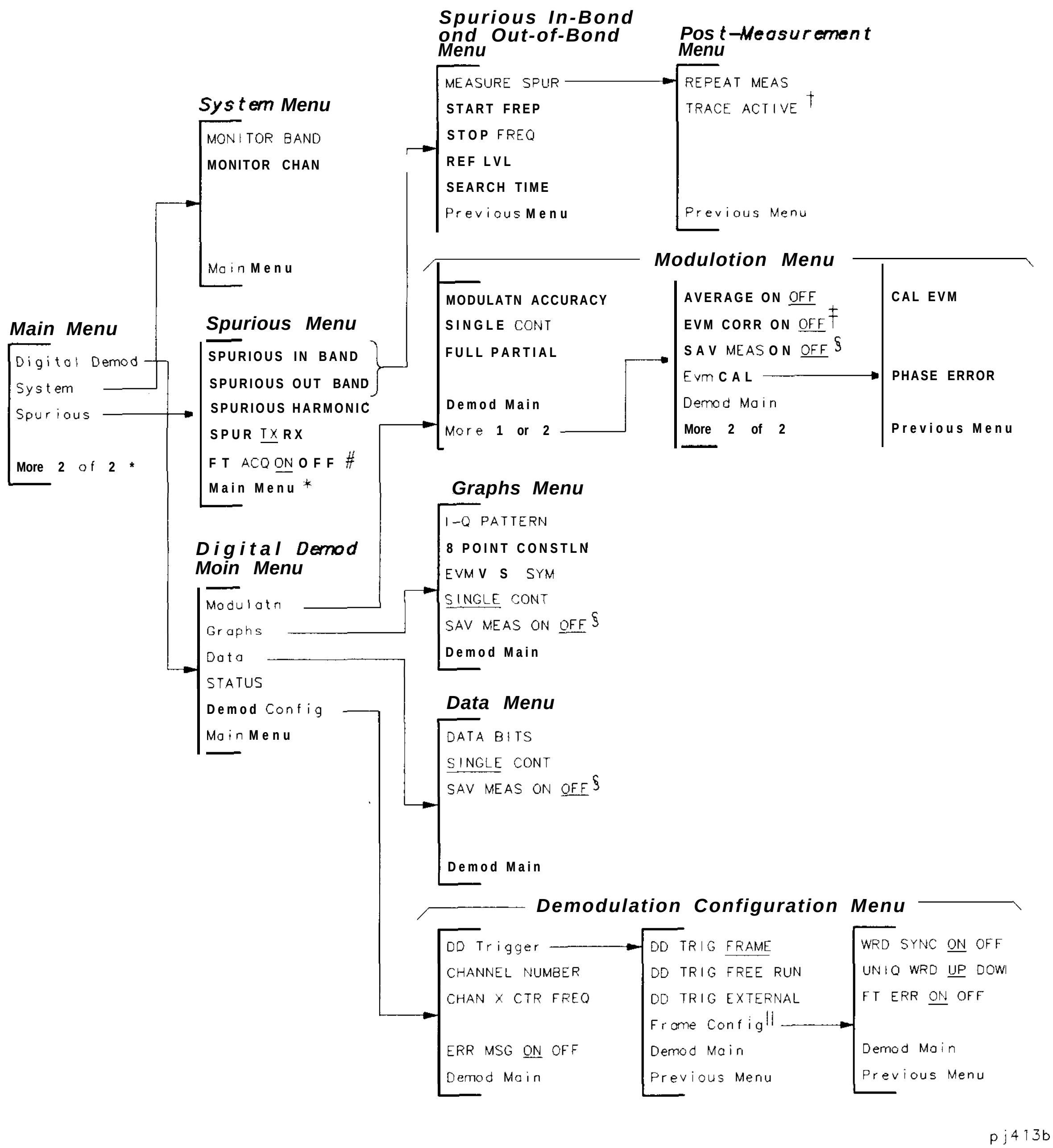


Figure 3-2. Menu Map (continued)

* See the previous page for the configuration, physical channel, power, power versus time, and adjacent channel power menus.

† When you press TRACE ACTIVE, the softkey label changes to TRACE COMPARE

‡ EVM CORR ON OFF is only available if CAL EVM was successful.

§ Refer to the SAV MEAS ON OFF softkey description.

|| Frame Config is only available when DD Trigger is set to FRAME.

\# Present only if TRIG SRC UW EXT is set to UW

The Configuration Menu

Pressing Config accesses the softkeys that allow you to configure the PHS measurements personality for your test setup.

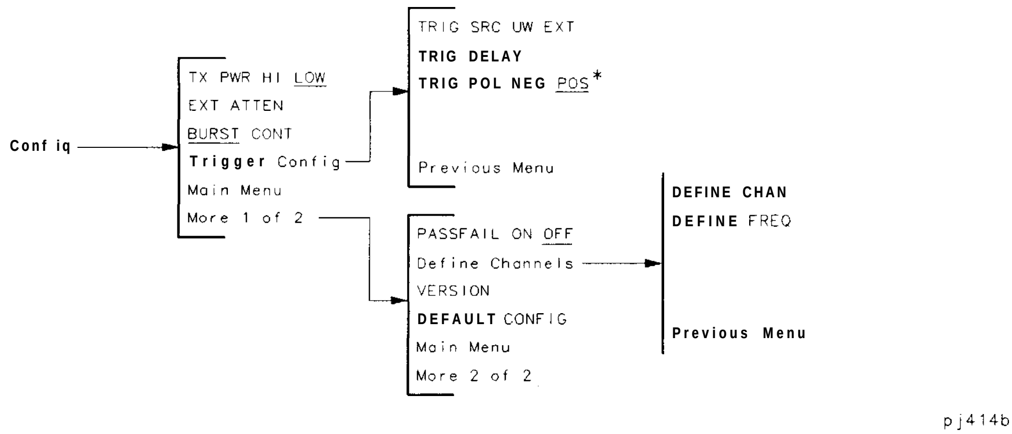


Figure 3-3. The Configuration Menu Map

* **Appears only when Option 105 time-gated spectrum analyzer card is installed.**

Most of the configuration functions allow you to enter a value into the function or to make a selection with the function. The values that you enter, or the selections that you make, are retained even if (PRESET) is pressed or the spectrum analyzer is turned off. If you want to reset all the configuration functions to their default values, you can use DEFAULT CONFIG . For example, if you previously entered 34 dB of external attenuation with EXT ATTEN , pressing DEFAULT CONFIG sets the external attenuation to its default value of 10 dB.

The Configuration Menu Softkeys

TX PWR HI LOW Allows you to select either high power stations (HI) or low power stations (LOW). Public cell stations are high power, other cell and personal stations are low power. If HI is underlined, the personality assumes that there is a public cell station (500 mW average output power) as the input to the spectrum analyzer. If LOW is underlined, the personality assumes that there is a personal station or other cell station (10 mW average output power) as the input to the spectrum analyzer.

The default for TX PWR HI LOW is LOW. The selection for TX PWR is retained even if (PRESET) is pressed or the spectrum analyzer is turned off. The selection of TX PWR is shown on the left side of the spectrum-analyzer display, above the annotation for the channel number. For example HIPWR is displayed if high power stations are selected.

EXT ATTEN Allows you to enter the attenuation of external equipment or cables that are used to connect the transmitter output to the spectrum analyzer input. The attenuation is used when calculating the amplitude readouts so that the readouts indicate the true power level at the transmitter output. You can enter the external attenuation from 0 to 90 dB in 0.01 dB increments. If the external attenuation is not entered, a default value of 10 dB is used.

BURST CONT Allows you to specify if the carrier is a burst or a continuous (non-burst) carrier. This selection affects the spectrum analyzer trigger mode and sweep time. The sweep time used in the measurements will be slower if BURST is selected, to ensure that the peak signal values are captured. The default for this function is BURST.

Trigger Config Allows you to access the softkey menu used for setting the trigger.

PASSFAIL ON OFF Allows you to select if "pass" or "fail" messages will be displayed during the measurements. If PASSFAIL ON OFF is set to ON, a message indicating if the measurement passed or failed the specified limits will be displayed along with the numerical results of the measurement. If PASSFAIL ON OFF is set to OFF, no pass or fail message will be displayed. The default for PASSFAIL ON OFF is OFF.

Define Channels The keys under this menu define a channel number and the corresponding frequency for stations.

The default channel spacing is 300 kHz. The center frequency for a given channel is given by:

$$\text{station center frequency} = ab + c$$

Where:

- a is (channel number − defined station channel number)
- b is channel spacing
- c is defined station frequency

DEFINE CHAN — Changes the channel number that corresponds to the "defined" station frequency; and is used for channel number tuning. The range is 0 to 9999. The default for this function is 0 (zero).

DEFINE FREQ — Changes the frequency that corresponds to the "defined" station channel number. The range is any frequency within range of the spectrum analyzer. The default for this function is 1894.85 MHz.

VERSION — Displays the version of the PHS measurements personality, and the version of the RCR standards documents that were used to derive the PHS measurement routines and test limits.

DEFAULT CONFIG — Replaces the entered values for the configuration functions with their default values on the second keypress.

The default values for the softkeys under the Configuration menu are as follows:

- TX PWR HI LOW is set to LOW.
- EXT ATTEN is set to 10 dB.
- BURST CONT is set to burst mode (BURST).
- TRIG SRC UW EXT is set to UW if Options 151 and 160 are present, otherwise EXT.
- TRIG DELAY is set to 0 μs.
- TRIG POL NEG POS is set to positive edge triggering (POS).
- PASSFAIL ON OFF is set to OFF.
- DEFINE CHAN is set to 0 (zero).
- DEFINE FREQ is set to 1894.85 MHz.

The default values for the softkeys under the Physical Channel menu are as follows:

- CHANNEL NUMBER is set to 1.
- CHANNEL X CTR FREQ is set to 300 MHz.
- SLOT NUMBER is set to 1.

The default values for the softkeys under the Power versus Time menu are as follows:

- RANGE dB 70 110 is set to 70.
- PRE LIMIT is set to -37 dBm.
- POST LIMIT is set to -37 dBm.
- UPPER LIMIT is set to 4 dB.
- LOWER LIMIT is set to – 14 dB.
- TIME MARGIN is set to 0 μs.
- FT ACQ ON OFF is set to ON.

The default values for the softkeys under the Demod Config menu are as follows:

- DD TRIG FRAME is enabled.
- WRD SYNC ON OFF is set to ON.
- UNIQ WRD UP DOWN is set to UP.
- FT ERR ON OFF is set to ON.

The default values for the softkeys under the Power Setup menu are as follows:

- PWR TRIG EXT VID is set to video (VID).
- COP TYPE ZSP GTD is set to ZSP.
- COP ZSP SGL MULT is set to MULT.
- FT ACQ ON OFF is set to ON.

The default value for the softkey under the Modulation menu is as follows:

- EVM CORR ON OFF is set to OFF.

The Trigger Configuration Menu Softkeys

TRIG SRC UW EXT Allows you to select the trigger source for power vs time and, carrier-off power, and spurious emission measurements. If TRIG SRC UW EXT is set to EXT, the personality expects the trigger source for the rear panel EXT TRIGGER INPUT to be from an external device. That is, a trigger signal from the equipment under test or from a burst carrier trigger circuit. If TRIG SRC UW EXT is set to UW (Unique Word), the personality expects the trigger source for the rear-panel EXT TRIGGER INPUT to be from the rear-panel frame trigger output of the Option 151 digital demodulator hardware. The personality sets internal delay parameters differently between the UW and EXT settings.

Setting TRIG SRC UW EXT to UW will automatically set the FT ACQ ON OFF softkeys, in the power versus time, carrier-off power, and spurious emission menus, to ON. Setting TRIG SRC UW EXT to UW will also automatically set the trigger polarity (TRIG POL MEG POS) to POS if option 105 is installed, and the trigger delay to 0.

See "Step 3. Make the cable connections for triggering the spectrum analyzer" in Chapter 1, "Getting Started," for more information. Refer to the following procedures in Chapter 2, "Making Measurements:"

"To set up triggering for MKK zero span carrier-off leakage power measurements"
"To set up triggering for MKK gated carrier-off leakage power measurements"
"To set up triggering for power vs time measurements"
"To set up triggering for spurious emission measurements"

The default for this function is UW if Options 151 and 160 are present; otherwise, EXT.

TRIG DELAY — Allows you to enter the delay time from the trigger signal to the reference point of the burst. If TRIG SRC UW EXT is set to UW, the reference point is point 0 (the start of symbol 1). With UW triggering, use a trig delay value of 0 for best results.

If TRIG SRC UW EXT is set to EXT, use a trig delay value that accurately positions the time record. See Chapter 2, "Making Measurements," for more information on setting trigger delay for externally-triggered measurements.

TRIG POL NEG POS — Allows you to select the edge trigger polarity for the external transistor-transistor logic (TTL) trigger signal applied to the GATE TRIGGER INPUT connector on the rear panel of the spectrum analyzer. If you select negative polarity, the spectrum analyzer will trigger on the negative (falling) edge of the trigger signal. Selecting positive polarity results in the spectrum analyzer triggering on the positive (rising) edge of the trigger signal. The default for this function is POS.

Setting TRIG SRC UW EXT to UW will automatically set TRIG POL POS MEG to POS.

The Physical Channel Menu

Pressing Physical Channel accesses the softkey functions that allow you to select the channel to be tested, and to change the center frequency of the spectrum analyzer.

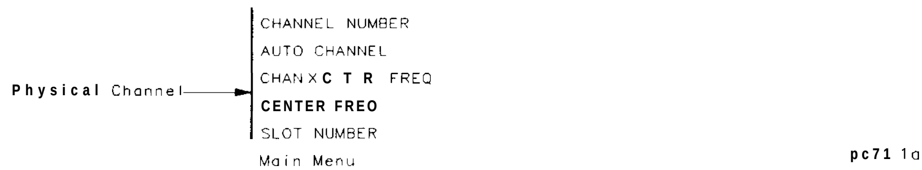


Figure 3-4. The Physical Channel Menu Map

The Physical Channel MenuSoftkeys

CHANNEL NUMBER
: Changes the center frequency of the spectrum analyzer to the frequency of the current channel, and then allows you to enter the channel number for the PHS channel you want to measure. The PHS measurements personality uses the channel number to set the center frequency to the correct value when one of the "channel" measurements is performed. The channel measurements are the measurements accessed by Power , Power vs Time and Adj Chan Power.

AUTO CHANNEL
: Automatically tunes to the channel having the highest carrier power level in the selected station transmit band..

CHAN X CTR FREQ
: Changes the center frequency of the spectrum analyzer to the frequency of the current channel "X," and then allows you to enter the frequency of any arbitrary channel that you want to measure. CHAN X CTR FREQ can be helpful if you know the channel frequency but not the channel number, or if you want to measure a frequency that does not correspond to a standard channel number. If you do not enter a frequency, the default frequency of 300 MHz will be used. Using CHAN X CTR FREQ automatically changes the channel number that is shown on the left side of the spectrum analyzer display to an "X. "

CENTER FREQ
: Allows you to change the center frequency of the spectrum analyzer temporarily.

SLOT NUMBER
: Allows you to select the slot number of the burst that you want to measure. The slot number is used in conjunction with *external* triggering for the antenna power, carrier-off leakage power, spurious emission, power versus time, and digital demodulator-based measurements. If the trigger is synchronous with the start of the RF burst or from the unique word trigger (TRIG SRC UW EXT set to UW), you should select slot number 1, regardless of the actual slot number being used by the station. A burst trigger may be obtained directly from a personal station or from an RF burst carrier trigger. If the trigger denotes the start of the PHS frame where the burst can be in one of eight slots within the frame, you can set the slot number from 1 to 8. This frame trigger may be obtained from a public cell, other cell, or personal station simulator, or from another piece of test equipment.

The Power Menu

Pressing Power accesses the softkeys that allow you to measure the transmitter antenna power, the carrier off power, the occupied bandwidth, and to view the channel. The Power menu functions not only make a measurement, but they also access additional softkeys. See "The Post-Measurement Menu" (located at the end of this chapter) for more information about the softkeys that the Power menu softkeys access.

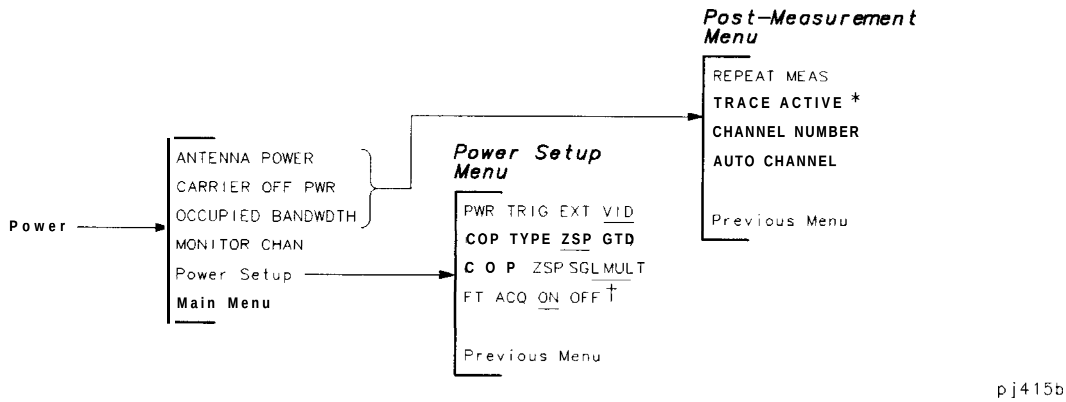


Figure 3-5. The Power Measurement Menu Map

* When you press TRACE ACTIVE, the softkey label changes to TRACE COMPARE

† Present only if TRIG SRC UW EXT is set to UW .

Table 3-1 shows the spectrum analyzer settings for each of the power measurements. The PHS measurements personality automatically sets the spectrum analyzer settings for each of the power measurements.

Table 3-1. Spectrum Analyzer Settings for Power Measurements

Spectrum Analyzer Setting	ANTENNA POWER	CARRIER OFF PWR	OCCUPIED HANDWDTH	MONITOR CHAN
Span	0 Hz	0 Hz	800 kHz	2 MHz
Resolution bandwidth	1 MHz	300 kHz	1 kHz	10 kHz
Video bandwidth	1 MHz	3 MHz	1 kHz	10 kHz
Sweep time	800 μs	800 μs	2.4 s	500 ms
Detector	Sample	Sample	Peak	Peak
Trigger mode	Video*	External†	Free run	Free run
* Video or external triggering can be selected with PWR TRIG EXT VID				
† Trigger source at rear panel can be either Frame Trigger Output, or an external signal.				

The limits and parameters for the power measurements can be changed remotely. See "Customizing the PHS Personality" in Chapter 6 for more information.

The Power Menu Softkeys

ANTENNA POWER — Measures the mean power of the carrier envelope. The average power of several sweeps is used in calculating the carrier power level. The default number of sweeps is 4. For a burst carrier, ANTENNA POWER measures the mean power of the transmitter carrier envelope during the burst transmission (when the burst is "on"). This measurement determines the mean carrier power of all trace data points that are greater than a threshold level set at 25 dB below the peak of the burst. The final value is averaged over the entire frame period.

For a continuous carrier, ANTENNA POWER measures the mean power of the carrier envelope.

CARRIER OFF PWR — If COP TYPE ZSP GTD is set to ZSP , then the spectrum analyzer searches for the "off" timeslot with the highest carrier power. It first measures at the carrier frequency, then at offsets of f300 kHz, ±600 kHz, and ±900 kHz. Finally, it measures at the frequency with the maximum leakage power in the PHS transmit band. Thus, to find the highest power "off" timeslot a total of 56 timeslots are measured. If COP ZSP SGL MULT (in the Power Setup menu) is set to SGL, only the carrier frequency is searched.

If COP TYPE ZSP GTD is set to GTD , then the time-selective spectrum analysis capability of Option 105 is used to make a frequency domain measurement of the maximum power in the PHS band when the carrier is off. The carrier power in the band is first measured, then the time-gate function is enabled and a second sweep is taken to measure the power when the carrier is off. A relative value, or ratio, is calculated from the two sweeps. Then, an absolute value for carrier-off power is computed from the ratio and the last measured antenna power. If the absolute value is under the limit, the absolute and relative test results are immediately displayed. If the absolute result is at or over the limit, a zero-span measurement at the frequency and timeslot of the maximum leakage will be performed to compute results having increased accuracy over the frequency-domain measurement results. The more accurate results are then displayed.

OCCUPIED BANDWDTH — Determines the bandwidth that contains 99 percent of the total carrier power. In addition, the center frequency error is displayed numerically. The center frequency error is the difference between the mid point of the upper and lower frequency values for the occupied bandwidth and the center frequency of the spectrum analyzer. The average data from several sweeps (the default number of sweeps is 1) is used in calculating the occupied bandwidth.

MONITOR CHAN — Allows you to view the channel. You can select the channel with CHANNEL NUMBER, AUTO CHANNEL , or CHAN X CTR FREQ .

Power Setup — Allows you to access the Power Setup Menu.

The Power Setup Menu Softkeys

PWR TRIG EXT VID
: Allows you to select if the trigger for the antenna power measurements is the video trigger or the external trigger. If you select the video trigger, the spectrum analyzer waits until the trace data rises across a level set by the display line to begin the next sweep. If you select the external trigger, the spectrum analyzer waits for the trigger from the signal that is connected to the EXT TRIGGER INPUT or GATE TRIGGER INPUT connector on the rear panel of the spectrum analyzer. The default for this function is VID.

COP TYPE ZSP GTD
: Allows you to specify if the carrier-off power measurement is performed in zero span or gated mode. ZSP is the default setting.

COP ZSP SGL MULT
: Allows you to specify if the carrier-off power, zero span measurement is performed at multiple frequencies (MULT) or only at the carrier frequency (SGL). MULT is the default setting.

FT ACQ ON OFF
: If FT ACQ ON OFF is set to ON, the personality will include a digital demodulator frame trigger acquisition (synchronized to the unique word timing) prior to making carrier-off power, zero span measurements. If FT ACQ ON OFF is set to OFF, the measurement will not include the frame trigger acquisition.

This softkey is only present when TRIG SRC UW EXT is set to UW.

Setting TRIG SRC UW EXT to UW automatically sets FT ACQ ON OFF to ON. Frame trigger acquisition prior to the measurement ensures that the Option 151 digital demodulator frame trigger output signal is accurate.

The Power versus Time Menu

Pressing Power vs Time accesses the softkeys that allow you to measure or to examine the PHS burst structure. The power versus time functions allow you to view the full PHS frame, the burst waveform, the rising edge (ramp up) of the burst, or the falling edge (ramp down) of the burst. All of the power versus time measurements automatically position the mean power of the on-part of the burst 4 dB below the reference level (the reference level is the top graticule). The maximum segment of the upper limit line is also placed at this position. The result of any of the power versus time measurements is both the graphical display of the PHS burst and numerical results.

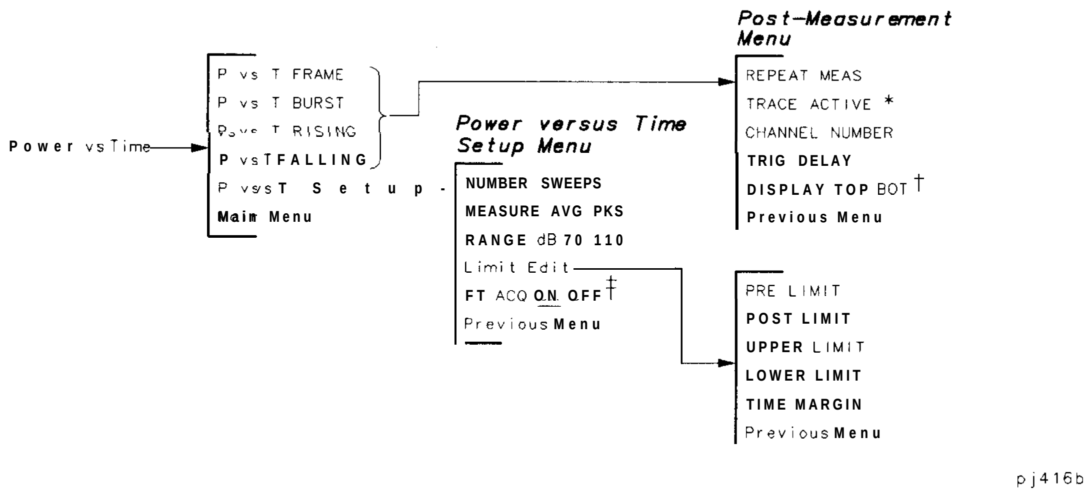


Figure 3-6. The Power versus Time Measurement Menu Map

* **When you press TRACE ACTIVE, the softkey label changes to TRACE COMPARE**

† **Appears only if the trace is** active.

‡ Present only if TRIG SRC *UW* EXT **is set to UW.**

Table 3-2 shows the spectrum analyzer settings for each of the power versus time measurements. The PHS measurements personality automatically sets the spectrum analyzer settings for each measurement. Notice that all power versus time measurements require a trigger signal at the rear panel EXT TRIG INPUT.

Table 3-2. Spectrum Analyzer Settings

Spectrum Analyzer Setting	P vs T FRAME	P vs T BURST	P vs T RISING	P vs T FALLING
Span	0 Hz	0 Hz	0 Hz	0 Hz
Resolution bandwidth	1 MHz	1 MHz	1 MHz	1 MHz
Video bandwidth	1 MHz	1 MHz	1 MHz	1 MHz
Sweep time	6.24 ms	800 μs	80 μs	80 μs
Detector	Sample	Sample	Sample	Sample
Trigger mode	External*	External*	External*	External*
*Trigger source at rear panel can be either Frame Trigger Output, or an external signal. With TRIG SRC UW EXT set to UW, trigger mode automatically switches to Video after successful frame trigger acquisition.				

The limits and parameters for the power versus time measurements can be changed remotely. See "Customizing the PHS Personality" in Chapter 6 for more information. Limit lines can also be changed by using the functions accessed by Limit Edit .

The Power versus Time Menu Softkeys

P vs T FRAME
: Displays the time domain waveform over a full frame. P vs T FRAME is useful for examining the bursts in a full frame, but for more accurate measurements you should use P vs T BURST, P vs T FALLING, or P vs T RISING.

P vs T BURST
: Displays the transmit burst waveform and measures the burst width of the waveform. The burst width is measured at -14 dB from the mean power of the burst. The burst waveform is compared to limit lines.

P vs T RISING
: Measures the ramp-up time of the rising edge of the burst. (The ramp-up time is the time it takes the rising edge of the burst to transition from -37 dBm to the mean power -14 dB.) The rising edge waveform is also compared to limit lines.

P vs T FALLING
: Measures the ramp-down time of the falling edge of the burst. (The ramp-down time is the time it takes the falling edge of the burst to transition from the mean power -14 dB to -37 dBm.) The falling edge waveform is also compared to limit lines.

P vs T Setup
: Accesses the menu that allows you to select the parameters used in a power versus time measurement. See "The Power versus Time Setup Menu Softkeys" below for the descriptions of the softkeys accessed by P vs T Setup .

The Power versus Time Setup Menu Softkeys

NUMBER SWEEPS
: Allows you to change the number of sweeps that are used in calculating the trace values. (The trace values can be calculated two different ways-see the description for MEASURE AVG PKS for more information.) You can change the number of sweeps from 1 to 99,999 with the data keys. After the measurement is performed, the number of sweeps used to make the measurement is shown on the left side of the spectrum analyzer screen. The default number of sweeps is five.

MEASURE AVG PKS
: Selects if the trace containing the averaged trace results is displayed, or if the traces containing the maximum and minimum trace results are displayed. If AVG is underlined, the displayed trace is an average of the trace values over multiple sweeps. If PKS is underlined, there are two displayed traces: one of the minimum trace peaks over multiple sweeps and one of the maximum trace peaks over multiple sweeps. Because the value of NUMBER SWEEPS determines the number of sweeps, the value of NUMBER SWEEPS must be greater than 1 to obtain averaged trace results (MEASURE AVG PKS set to AVG). The default for this function is AVG.

RANGE dB 70 110
: Allows you to select the total amplitude range that is displayed by a power versus time measurement. If you select 70, a useful range of 70 dB is displayed, and the amplitude scale is set to 10 dB per division. If you select 110, a useful range of 110 dB is displayed, and the amplitude scale is set to 15 dB per division. (The personality obtains a display range of 110 dB by combining measurements made at two different reference level and input attenuator settings.) 70 is the default setting for this function.

Limit Edit
: Allows you to adjust the limit lines and ramp-up or -down time limit for the power versus time -burst, -rising, and -falling measurements. See “To adjust the limits lines” in Chapter 2 for a description and default values for each of the keys in the Limit Edit menu.

FT ACQ ON OFF
: If FT ACQ ON OFF is set to ON, the personality will include a digital demodulator frame trigger acquisition (synchronized to the unique word timing) prior to making power versus time measurements. If FT ACQ ON OFF is set to OFF, the measurement will not include the frame trigger acquisition.

This softkey is only present when TRIG SRC UW EXT is set to UW.

Setting TRIG SRC UW EXT to UW automatically sets FT ACQ ON OFF to ON. Frame trigger acquisition prior to the measurement ensures that the Option 151 digital demodulator frame trigger output signal is accurate.

The Adjacent Channel Power Menu

Pressing Adj Chan Power accesses the softkeys that allow you to measure the adjacent channel power of the transmitter. (The adjacent channel power determines the leakage power in the adjacent and alternate channels to the carrier.) The Adjacent Channel Power menu functions not only make a measurement, but they also access additional softkeys. See "The Post-Measurement Menu" (located at the end of this chapter) for more information about the softkeys that the adjacent channel power menu softkeys access.

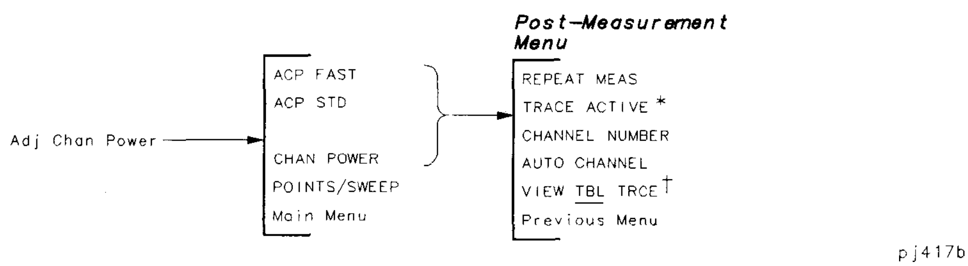


Figure 3-7. The Adjacent Channel Power Measurement Menu Map

* When you press TRACE ACTIVE, the softkey label changes to TRACE COMPARE

† VIEW TBL TRACE is only available with the ACP FAST measurement.

Table 3-3 shows the spectrum analyzer settings for each of the adjacent channel power measurements. The PHS measurements personality automatically sets the spectrum analyzer settings for each of the adjacent channel power measurements.

Table 3-3. Spectrum Analyzer Settings

Spectrum Analyzer Setting	ACP FAST	ACP STD	CHAN POWER
Span	2194 kHz	192 kHz	192 kHz
Resolution bandwidth	3 kHz	1 kHz	1 kHz
Video bandwidth	10 kHz	3 kHz	3 kHz
Sweep time	2 s	2 s	2 s
Detector	Peak	Peak	Peak
Trigger mode	Free Run	Free Run	Free Run

The limits and parameters for the power measurements can be changed remotely. See "Customizing the PHS Personality" in Chapter 6 for more information.

The Adjacent Channel Power Menu Softkeys

ACP FAST Measures the power in the transmitted channel, as well as the power in the upper and lower adjacent and alternate channels using the MKK method. ACP FAST does not separate the spectrum due to modulation from the full spectrum. The measurement performs one measurement sweep. The computation is done as if the full spectrum contained only random components from modulation and noise. If VIEW TBL TRCE is set to table (TBL), the numerical ratio results will be displayed. If VIEW TBL TRACE is set to trace (TRCE), the frequency spectrum results will be displayed. The personality uses the spectrum analyzer peak detector and a 192 kHz integration bandwidth to measure the power in the adjacent channels.

ACP STD Like ACP FAST, ACP STD measures the power in the transmitted channel, as well as the power in the upper and lower adjacent, and alternate channels using the MKK ACP method. Unlike ACP FAST, ACP STD uses separate measurement sweeps for each channel (one channel per sweep). This provides a slower but more accurate (and more repeatable) measurement than ACP FAST. To decrease the time required for ACP STD , you can use POINTS/SWEEP to specify the number of data points measured during each sweep.

GHAN POWER Measures the total power in the channel. The personality uses the spectrum analyzer sample detector and a 192 kHz integration bandwidth to measure the power in the channel.

POINTS /SWEEP Allows you to specify the number of measurement "points" to be used for the ACP STD and CHAN POWER measurements. Every time the spectrum analyzer takes a measurement sweep, the data from the measurement sweep is placed into a trace. Usually, 401 data points (also called trace elements) are stored in the trace. You can use POINTS/SWEEP to decrease the number data points stored in the trace (which truncates the displayed trace). The lower the number of points that you specify, the faster the measurement will be. However, reducing the number of points also reduces the accuracy and repeatability of the measurement. You can specify the number of data points from 120 to 401. The default number of data points is 401.

The System Menu

Pressing System accesses the softkeys that allow you to monitor the spectrum.

Figure 3-8. The System Menu Map

The System Menu Softkeys

MONITOR BAND — Allows you to view the spectrum of the PHS frequency band. The spectrum analyzer frequency range is set to 1894.55 to 1918.56 MHz.

MONITOR CHAN — Allows you to view the channel. You can select the channel with CHANNEL NUMBER, AUTO CHANNEL, or CHAN X CTR FREQ.

The Spurious Menu

Pressing Spurious accesses the spurious emission measurement softkeys.

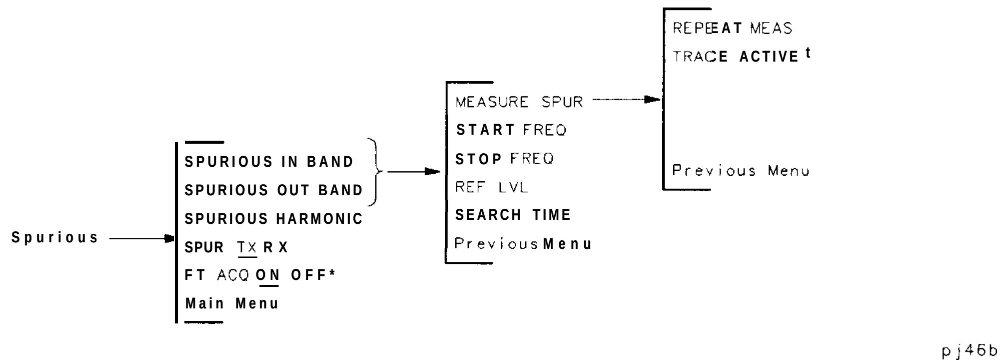


Figure 3-9. The Spurious Menu Map

* **Present only if TRIG SRC UW EXT is set to UW.**

† **When you press TRACE ACTIVE, the softkey label changes to TRACE COMPARE**

The Spurious Menu Softkeys

SPURIOUS IN BAND — Allows you to measure spurious emissions in the PHS frequency band. Pressing SPURIOUS IN BAND sets up the analyzer to monitor the band and accesses the following softkeys: MEASURE SPUR, START FREQ , STOP FREQ , REF LVL , SEARCH TIME , and Previous Menu. See the following descriptions for more information about the softkeys that SPURIOUS IN BAND accesses.

SPURIOUS OUT BAND — Allows you to measure spurious emissions in a band outside the PHS frequency band. Pressing SPURIOUS OUT BAND sets up the analyzer to monitor a band at twice the carrier frequency and accesses the following softkeys: MEASURE SPUR , START FREQ , STOP FREQ , REF LVL , SEARCH TIME, and Previous Menu. See the following descriptions for more information about the softkeys that SPURIOUS OUT BAND accesses.

SPURIOUS HARMONIC — Allows you to measure transmitter spurious harmonic emissions.

SPURIOUS TX RX — Allows you to specify out-of-band spurious emission measurement type. If you select TX, SPURIOUS OUT BAND measures the PHS unit under test in its transmission state. If you select RX, SPURIOUS OUT BAND measures the PHS unit under test in its receive state.

FT ACQ ON OFF	If FT ACQ ON OFF is set to ON, the personality will include a digital demodulator frame trigger acquisition prior to making spurious emission, zero span measurements. If FT ACQ ON OFF is set to OFF, the measurement will not include the frame trigger acquisition. This softkey is only present when TRIG SRC UW EXT is set to UW. Setting TRIG SRC UW EXT to UW automatically sets FT ACQ ON OFF to ON. Frame trigger acquisition prior to the measurement ensures that the Option 151 digital demodulator frame trigger output signal is accurate.

The Spurious In-Band and Out-of-Band Menu Softkeys

MEASURE SPUR	Allows you to start the spurious emission measurement on the spur indicated by the current position of the marker.
START FREQ	Allows you to adjust the start frequency of the spectrum analyzer.
STOP FREQ	Allows you to adjust the stop frequency of the spectrum analyzer.
REF LVL	Allows you to adjust the reference level of the spectrum analyzer.
SEARCH TIME	Allows you to adjust the sweep time used while the spectrum analyzer searches for a spur within the selected frequency band.

The Post-Measurement Menu

Once the measurement has been completed, many of the PHS measurements access the "post-measurement" menu. The post-measurement menu contains functions that allow you to repeat the previous measurement or change various testing parameters.

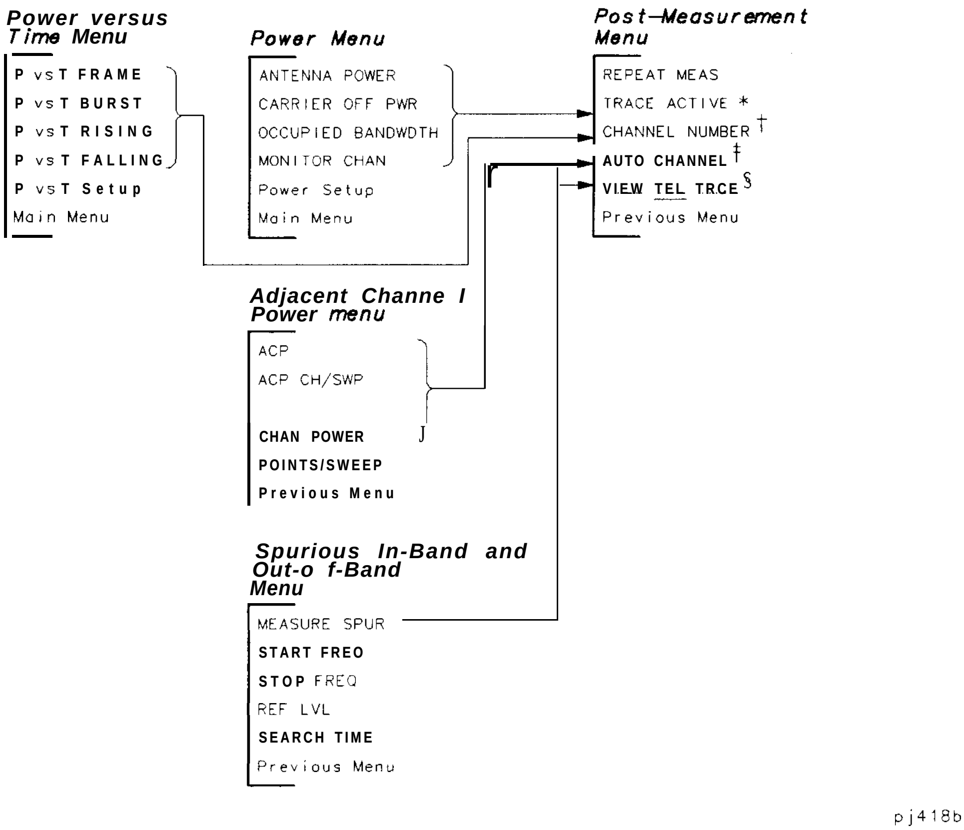


Figure 3-10. The Post-Measurement Menu Map

- * When you press TRACE ACTIVE, the softkey label changes to TRACE COMPARE
- † Not present for spurious measurements..
- ‡ This softkey changes to TRIG DELAY for a power versus time measurement.
- § VIEW TBL TRCE is only available with ACP FAST. For power versus time measurements, DISPLAY TOP BOT is displayed if the trace is active.

The Post-Measurement Menu Softkeys

REPEAT MEAS — Repeats the measurement. If desired, you can change parameters such as the channel number or resolution bandwidth before you press this key.

TRACE ACTIVE — Allows you to view the active trace. When you press TRACE ACTIVE , an active trace (a trace of the signal that is being continuously updated) is displayed and the softkey label changes to TRACE CDMPARE .

TRACE COMPARE — If you press TRACE COMPARE , the active trace data is copied from trace A into trace C, and trace C is placed in the view mode. The active trace (trace A) is displayed along with the trace in the view mode (trace C).

CHANNEL NUMBER — Allows you to change the channel number of the channel that is to be measured.

AUTO CHANNEL — Changes the channel by tuning to the channel with the highest carrier power, and then repeats the measurement.

TRIG DELAY — For a power versus time measurement, TRIG DELAY allows you to enter the delay time from the trigger signal to the reference point of the burst. The reference point is point 0 (point 0 is the start of symbol 1). You can enter a trigger delay from -6,000 μs to +6,000 μs in 1 μs increments. If you do not enter a trigger delay, a default value of 0 μs is used.

VIEW TBL TRCE — For the adjacent channel power measurement ACP FAST, VIEW TBL TRCE allows you to view either the numeric results in a table (TBL), or view the trace of the frequency spectrum (TRCE).

DISPLAY TOP BOT — Used for power versus time measurements, DISPLAY TOP BOT allows you to view the top (TOP) of the burst or the bottom (BOT) portion of the burst. If DISPLAY TOP BOT is set to TOP, the top 70 dB portion of the burst is measured and displayed. If DISPLAY TOP BOT is set to bottom (BOT), the bottom 70 dB portion of the burst is measured and displayed, and the limit lines are repositioned accordingly. The default setting for this function is TOP. DISPLAY TOP BOT appears only if the trace is active (TRACE ACTIVE is pressed).

Previous Menu — Returns to the previous menu.

The Modulation Menu

Pressing Modulatn accesses the softkeys that allow you to measure the transmitter RMS error vector magnitude (EVM), RMS magnitude error, RMS phase error, peak EVM, carrier frequency error, and I-Q origin offset.

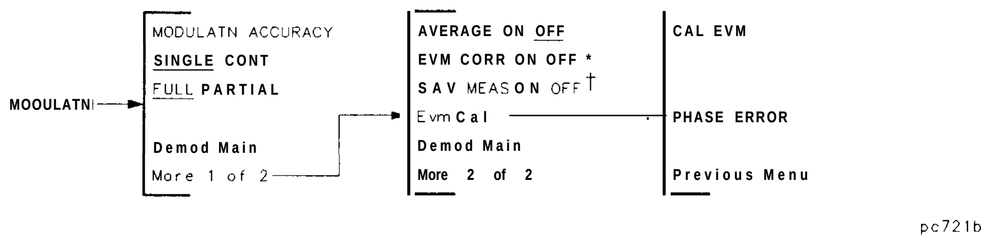


Figure 3-11. The Modulation Menu Map

*** EVM CORR ON OFF is only available if CAL EVM was successful.**

† Refer to the SAV MEAS ON OFF softkey description.

The Modulation Menu Softkeys

MODULATN ACCURACY — Measures the transmitter RMS error vector magnitude, RMS magnitude error, RMS phase error, peak EVM, carrier frequency error, and I-Q origin offset. First, the amplitude of the signal is checked and the analyzer reference level and attenuation are set appropriately. Next, if the demod trigger is set to FRAME, the frame trigger is acquired prior to the modulation accuracy measurements. If SAV MEAS ON OFF is set to ON, pressing MODULATN ACCURACY will display the last modulation accuracy measurement.

SINGLE CONT — If SINGLE CONT is set to SINGLE, pressing MODULATN ACCURACY will produce a single set of measurement values. If SINGLE CONT is set to CONT, then pressing MODULATN ACCURACY will cause the measurement to be made continuously.

FULL PARTIAL — If FULL PARTIAL is set to FULL, the analyzer will be count-locked to 10 Hz resolution prior to each measurement, and carrier frequency error will be displayed along with the other measurement results. If FULL PARTIAL is set to PARTIAL, the analyzer will not be count-locked for each measurement. In this case, only RMS EVM, RMS magnitude error, RMS phase error, peak EVM, and I-Q origin offset will be displayed. The PARTIAL setting makes measurements more quickly.

AVERAGE ON OFF — If AVERAGE ON OFF is set to OFF, then modulation accuracy measurements are displayed for one measurement only. If AVERAGE ON OFF is set to ON, the number of averages will become the active function. The user can then adjust it within the range of 1 to 999. The default is 10.

If AVERAGE ON OFF is set to ON, modulation accuracy measurements are made the selected number of times, and then the display changes to reflect the statistical results of the averaging. The statistical information displayed with averaging includes mean, standard deviation, maximum and minimum for RMS EVM, RMS magnitude error, and RMS phase error. RMS EVM uncertainty ranges are displayed for the averaged result at both room temperature, and over the full temperature range. The mean for I-Q origin offset, and carrier frequency error are displayed if FULL PARTIAL is set to FULL. If FULL PARTIAL is set to PARTIAL, the carrier frequency error will not be displayed.

EVM CORR ON OFF — Allows you to enable the EVM correction using the value generated by the EVM calibration measurement. This corrects the measured results of RMS EVM and RMS phase error. See "To calibrate and correct for spectrum analyzer EVM inaccuracies due to uncertainty in the phase error measurement" in Chapter 2, "Making Measurements," for details on when and how to use the EVM CORR ON OFF softkey.

SAV MEAS ON OFF — When the SAV MEAS ON OFF softkey is set to OFF, each press of a digital demodulation measurement softkey such as MODULATN ACCURACY, I-Q PATTERN, 8 POINT CONSTLN, or DATA HITS causes a new measurement to be made.

If SAV MEAS ON OFF is set to ON, then pressing a measurement softkey will not cause a new measurement. Instead, the requested results, for the last measurement made, will be displayed. This feature allows you to examine the modulation accuracy, graphs, and data bits from a single measurement. The default setting is OFF. SAV MEAS ON OFF is automatically set to OFF upon returning to the main PHS menu. This softkey is blanked if a measurement has not been made, is stopped, or is an averaged measurement. Only complete, non-averaged measurements may be saved.

Evm Cal — Pressing Evm Cal accesses the EVM calibration menu and also displays the EVM calibration instructions on screen. This calibration is *optional,* and can provide more accurate results when measuring EVM. See "To calibrate and correct for spectrum analyzer EVM inaccuracies due to uncertainty in the phase error measurement" in Chapter 2, "Making Measurements," for details on how to perform the EVM calibration procedure.

The EVM Calibration Menu Softkeys

CAL EVM — Starts the EVM calibration measurement. The measurement consists of a 20 average error vector magnitude measurement followed by an EVM results screen. The measurement is made with no corrections applied.

PHASE ERROR — Allows you to enter the RMS phase error of the precision calibration source. The EVM calibration subtracts this value from the measured mean RMS phase error to generate the phase correction value. The phase correction value is used to correct RMS phase error and RMS EVM when the EVM' CORR ON OFF softkey is set to ON.

The Graphs Menu

Pressing Graphs accesses the softkeys that allow you to display the transmitter I-Q pattern graph or eight-point constellation graph. RMS error vector magnitude corresponding to the graph is also displayed. Note that the data used to produce the graphs has had error contributions from I-Q origin offset, and carrier frequency error removed. Only the RMS EVM contribution remains.

Figure 3-12. The Graphs Menu Map

* **Refer to the SAV MEAS ON OFF softkey description.**

The Graphs Menu Softkeys

I-Q PATTERN Pressing the I-Q PATTERN softkey causes a measurement to be made (if SAV MEAS ON OFF is set to OFF) and the corresponding I-Q pattern to be displayed on the screen. The RMS EVM value is also displayed. First the amplitude of the signal is checked and the analyzer reference level and attenuation are set appropriately. If the demod trigger is set to FRAME, the frame trigger is acquired prior to the measurement. If SAV MEAS ON OFF is set to ON, pressing I-Q PATTERN will display the I-Q pattern for the currently saved measurement data.

8 POINT CONSTLN Pressing the 8 POINT CONSTLN softkey causes a measurement to be made (if SAV MEAS ON OFF is set to OFF) and the corresponding eight-point constellation I-Q pattern to be displayed on the screen. The RMS EVM value is also displayed. First the amplitude of the signal is checked and the analyzer reference level and attenuation are set appropriately. If the digital demodulator trigger is set to FRAME, the frame trigger is acquired prior to the measurement. If SAV MEAS ON OFF is set to ON, pressing 8 POINT CONSTLN will display the eight-point constellation for the currently saved measurement data.

EVM VS SYM Pressing the EVM vs SYM softkey causes a measurement to be made (if SAV MEAS ON OFF is set to OFF), and the corresponding EVM vs SYM graph to be displayed on the screen. The RMS EVM value is also displayed. First the amplitude of the signal is checked and the analyzer reference level and attenuation are set appropriately. If the digital demodulator trigger is set to FRAME, the frame trigger is acquired prior to the measurement.

If SAV MEAS ON OFF is set, to ON, pressing EVM vs SYM will display the EVM vs SYM graph for the currently saved measurement data.

SINGLE CONT If SINGLE CONT is set to SINGLE, then pressing I-Q PATTERN or 8 POINT CONSTLN will produce a single measurement and its corresponding graph. If SINGLE CONT is set to CONT, then pressing either measurement softkey will cause the measurement to be made and graphed continuously.

SAV MEAS ON OFF

When the SAV MEAS ON OFF softkey is set to OFF, each press of a digital demodulator-based measurement softkey such as MODULATN ACCURACY , I-Q PATTERN, 8 POINT CONSTLN , EVM vs SYM , or DATA BITS causes a new measurement to be made. If SAV MEAS ON OFF is set to ON then pressing a measurement softkey will not cause a new measurement. Instead, the requested results for the last measurement made will be displayed. This feature allows the user to examine the modulation accuracy, graphs, and data bits from a single measurement. The default setting is OFF. SAV MEAS ON OFF is automatically set to OFF upon returning to the main PHS menu.

Note that if a measurement is stopped, this softkey is blanked. Only complete measurements may be saved.

The Data Menu

Pressing Data accesses the softkeys that allow you to display the transmitter demodulated bit sequence and to highlight a selected portion of that sequence.

Figure 3-13. The Data Menu Map

* **Refer to the SAV MEAS ON OFF softkey description.**

The Data Menu Softkeys

DATA BITS
: Pressing the DATA BITS softkey causes a measurement to be made (if SAV MEAS ON OFF is set to OFF) and the corresponding demodulated bit sequence to be displayed on the screen. First the amplitude of the signal is checked and the analyzer reference level and attenuation are set appropriately. Then if the digital demodulator trigger is set to FRAME, the frame trigger is acquired prior to the measurement. If SAV MEAS ON OFF is set to ON, pressing DATA BITS will display the demodulated data bits for the last measurement. The display will highlight the 16 bits of the unique word portion of the 240-bit timeslot.

SINGLE CONT
: If SINGLE CONT is set to SINGLE, then pressing DATA BITS will produce a single measurement and its corresponding display. If SINGLE CONT is set to CONT, then pressing the DATA BITS softkey will cause the measurement to be made and displayed continuously.

SAY MEAS ON OFF
: When the SAV MEAS ON OFF softkey is set to OFF, each press of a digital demodulator-based measurement softkey such as MODULATN ACCURACY , I-Q PATTERN, 8 POINT CONSTLN , or DATA BITS causes a new measurement to be made. If SAV MEAS ON OFF is set to ON then pressing a measurement softkey will not cause a new measurement. Instead, the requested results for the last measurement made will be displayed. This feature allows the user to examine the modulation accuracy, graphs, and data bits from a single measurement. SAV MEAS ON OFF is automatically set to OFF upon returning to the main PHS menu. Note that if a measurement is stopped, this softkey is blanked. Only complete measurements may be saved.

The Demodulation Configuration Menu

Pressing Demod Config accesses the softkeys that allow you to configure how the digital demodulator-based measurements will be made with respect to triggering, and error messages.

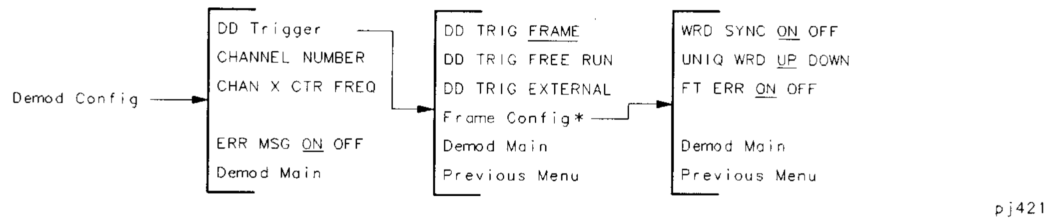


Figure 3-14. The Demodulation Configuration Menu Map

* **Frame Config is present only when DD TRIG FRAME is enabled.**

The Demodulation Configuration Menu Softkeys

DD Trigger Pressing the DD Trigger softkey accesses the digital demodulator trigger menu which allows the user to access the softkeys that control the triggering of the measurement.

CHANNEL NUMBER Changes the center frequency of the spectrum analyzer to the frequency of the current channel, and then allows you to enter the channel number for the PHS channel you want to measure. This softkey is identical to the CHANNEL NUMBER softkey in the physical channel menu.

CHAN X CTR FREQ Changes the center frequency of the spectrum analyzer to the frequency of the current channel "X," and then allows you to enter the frequency of any arbitrary channel that you want to measure. This softkey is identical to the CHAN X CTR FREQ softkey in the physical channel menu.

ERR MSG ON OFF If ERR MSG ON OFF is set to ON, then all of the error and warning messages mentioned in Chapter 4, "Error Messages and Troubleshooting," will be operational and will be displayed on screen. If ERR MSG ON OFF is set to OFF, then no error or warning messages will be displayed. The default setting for this softkey is ON. If ERR MSG ON OFF is set to ON, frame trigger error and warning messages may be turned on and off independently with the FT ERR ON OFF softkey in the Frame Configuration Menu.

The DD Trigger MenuSoftkeys

DD TRIG FRAME

Pressing the DD TRIG FRAME softkey will cause any subsequent digital demodulator-based measurements that are made to be triggered by the frame trigger. It will also cause the analyzer to acquire frame trigger synchronization prior to making a measurement. Additionally, the frame trigger will be automatically re-acquired if it drifts too far to make the measurement accurately. If the frame trigger is selected, the Frame Config softkey is available to access the frame trigger configuration menu.

DD TRIG FREE RUN

Pressing the DD TRIG FREE RUN softkey will cause any subsequent digital demodulator-based measurements that are made to be triggered by a free running trigger. This is used for measuring a pseudo-random bit sequence (that is, no sync word) on a continuous non-burst signal. Selecting the free run trigger will cause the Frame Config softkey to become unavailable.

DD TRIG EXTERNAL

Pressing the DD TRIG EXTERNAL softkey will cause any subsequent digital demodulator-based measurement to be triggered by a trigger signal at the rear panel EXT TRIG INPUT. If no trigger is present, then the measurement will be delayed indefinitely until a trigger arrives. Selecting the external trigger will cause the **Frame Config** softkey to become unavailable.

TRIG DELAY (and SLOT NUMBER) must be set correctly in order for valid externally triggered digital demodulator-based measurements to be made. The EVM versus Sym measurement may be used to verify and adjust the trigger delay setting.

Frame Config

If Frame Config is pressed, you can access to the Frame configuration menu softkeys that allow you to control how the frame trigger will be acquired and positioned relative to the frame. This softkey and its corresponding menu softkeys are accessible only when the trigger has been set to FRAME.

The Frame Configuration Menu Softkeys

WRD SYNC ON OFF

If WRD SYNC ON OFF is set to ON, the frame trigger acquisition algorithm will include searching for a sync word. Which sync word is searched for is controlled by the UNIQ WRD UP DOWN softkey (see below) in the Demod Config menu.

If WRD SYNC ON OFF is set to OFF, no unique (sync) word will be searched for. This is used for pseudo random bit sequences. The default setting for WRD SYNC ON OFF is automatically set by the trigger setting. When the trigger is set to FRAME, WRD SYNC ON OFF is set to ON. When the trigger is set to FREE RUN or EXTERNAL, WRD SYNC ON OFF is set to OFF'.

UNIQ WRD UP DOWN

The UNIQ WRD UP DOWN softkey allows you to control how the frame trigger will be acquired when WRD SYNC ON OFF is set to ON. UNIQ WRD UP DOWN has no effect when WRD SYNC ON OFF is set to OFF. If UNIQ WRD UP DOWN is set to UP , the frame trigger will attempt to synchronize to the uplink unique word. If UNIQ WRD UP DOWN is set to DOWN, the frame trigger will attempt to synchronize to the downlink unique word. If UNIQ WRD UP DOWN is set to UP DOWN, the frame trigger will attempt to synchronize to either the uplink or downlink unique word. If both uplink and downlink words are present, using UP DOWN is not recommended.

FT ERR ON OFF

If FT ERR ON OFF is set to ON, and ERR MSG ON OFF is set to ON, then all the error and warning messages associated with the frame trigger mentioned in Chapter 4, "Error Messages and Troubleshooting," will be operational and will be displayed on screen. If ERR MSG ON OFF is set to ON, and FT ERR ON OFF is set to OFF, then no error or warning messages associated with the frame trigger will be displayed, though other error and warning messages will continue to be displayed. The default setting for this softkey is ON.

Note that if ERR MSG ON OFF is set to off, this will supersede the setting of FT ERR ON OFF and therefore no error or warning messages will be displayed.

4

Error Messages and Troubleshooting

Use this chapter to troubleshoot problems indicated by error messages on the screen. All error messages are alphabetically listed in this chapter. All messages are explained in this chapter, including hints as to how to solve the problem. Error messages relating to digital demodulator test device troubleshooting are explained in “Test Device Troubleshooting” in this chapter.

This chapter begins with a list of the common problems that may or may not show an error message. Then, all error messages are listed alphabetically, along with troubleshooting information. If the problem is related to the spectrum analyzer, see the spectrum analyzer service guide.

How to Use This Chapter

1. Follow the procedure listed in “Before Troubleshooting.” Most issues involving setup and common errors not identified with an error message are discussed there.
2. If an error message is displayed, locate the message in “Error Messages” in this chapter and follow the directions given for that message.
3. If required, contact your nearest HP Sales and Service Office, listed at the end of this chapter.

Before Troubleshooting

If an error message appears, or if you suspect a problem, check the system setup first. Make sure the PHS measurements personality settings match the signal type under test. The system information part of the status screen gives a good overview of system parameters. For an explanation of this screen, see "Test Device Troubleshooting," later in this chapter.

Check the following common errors:

- Testing a continuous carrier when the personality is configured for a burst carrier, or vice-versa.
- Tuning to the wrong carrier or channel number.
- While using the digital demodulator frame trigger, designating the wrong unique word.
- Using the digital demodulator frame trigger with WRD SYNC set ON, on a signal that does not contain a unique (sync) word. If WRD SYNC is set ON, the frame trigger cannot synchronize to pseudo-random bit sequence (PRBS) data.
- Using the digital demodulator free run trigger on a burst carrier. The free run trigger is not synchronized to the bursts.

If the PHS measurements personality does not make a measurement

If you press one of the measurement functions and the personality does not make the measurement, it could be caused by one of the following:

- The channel number is not correct.

  Make sure that the channel number corresponds to the transmitted carrier frequency. AUTO CHANNEL in the Physical Channel menu can be used to automatically find the carrier in the transmit band with the highest signal level. For more information, see "To select a channel to test" in Chapter 3, "Making Measurements."
- Using the digital demodulator frame trigger on a signal with a large carrier frequency error.
- Excess carrier frequency error is interfering with the digital demodulator-based measurement.

  A radio may transmit a carrier frequency many kHz from the nominal channel frequency designated by the channel number. although the digital demodulator measurements are designed to automatically compensate for large carrier frequency offsets, check the actual carrier frequency being transmitted by using the occupied bandwidth measurement. If the carrier frequency error is larger than 10 kHz, the HP 85726B PHS measurements personality may have trouble compensating. You may manually compensate the carrier frequency offset using the CHAN X CTR FREQ softkey. Another alternative is to use the -ddFRQSRCH remote command to force a carrier frequency search at the beginning of all digital demodulator-based measurements.

- Burst carrier configuration is set incorrectly when measuring a PHS transmitter.

  Make sure that BURST in the configuration menu is underlined if a burst carrier is being tested. Likewise, make sure that CONT in the configuration menu is underlined if a continuous carrier is being tested. See "To configure the personality" in Chapter 2, "Making Measurements," for more information.

- The trigger signal is missing.

  Make sure that a trigger is input to the spectrum analyzer, when required. Triggering is used for carrier-off power measurements, power versus time measurements, and spurious emission measurements. See the end of "Step 3. Make the cable connections for triggering the spectrum analyzer" in Chapter 1, "Getting Started," for more information.

- The UNIQ WRD selection is wrong.

  Make sure that the UNIQ WORD selection corresponds to an uplink or a downlink. See "To select a channel to test" in Chapter 2, "Making Measurements," for more information.

If the test results are not what you expected

If the test results are incorrect or not what you expected, it could be caused by one of the following conditions:

- Be sure to perform the antenna power measurement before making carrier-off leakage power, adjacent channel power, or spurious emission measurements.

  After power on or instrument preset, carrier-off leakage power, adjacent channel power, or spurious emission measurements require that the antenna power measurement be performed first. Otherwise, you will get an absolute power measurement result which is about 20 dB too low.

  You should perform the antenna measurement *first* when you change the unit under test.

- Burst carrier configuration is set incorrectly.

  Make sure that BURST in the configuration menu is underlined if a burst carrier is being tested. Likewise, make sure that CONT in the configuration menu is underlined if a continuous carrier is being tested. See "To configure the personality" in Chapter 2, "Making Measurements," for more information.

- The external trigger settings are not correct.

  Make sure that the correct trigger source, period, delay, and polarity have been selected. See "To configure the personality" in Chapter 2, "Making Measurements," for more information about SLOT NUMBER, TRIG SRC UW EXT , TRIG DELAY , and TRIG POL NEG POS (if the gate card is installed).

- The external attenuation value is incorrect.

  Make sure that the EXT ATTEN has been set correctly; this function is in the configuration menu. A symptom of this problem is incorrect power measurement results. See "To configure the personality" For more information, see "To select a channel to test" in Chapter 2, "Making Measurements. "

- The self-calibration routines need to be performed as described under "Step 2. Perform the spectrum analyzer self-calibration routines" in Chapter 1, "Getting Started."

  Perform the self-calibration routines periodically to make accurate measurements. When you perform the spectrum analyzer self-calibration routines, make sure that nothing is connected to the GATE TRIGGER INPUT connector on the spectrum analyzer rear panel. If there is anything connected to the GATE TRIGGER INPUT connector during the self-calibration routines, it can cause incorrect calibration data. A symptom of this problem is that the time-gated carrier-off power measurement results are displayed too far up on the spectrum analyzer display (even above the top graticule).

  If the error message `CAL: DD DAC` Failed appears on the screen, then the analyzer attempted to run an amplitude self-calibration but failed. In this case, make sure the calibration reference signal is connected to the front panel input connector and run the calibration again. If it still fails, the Option 151 hardware is probably bad. Contact your nearest HP sales and service office.

- Excess frequency drift is interrupting the measurement.

  The spectrum analyzer center frequency has not yet stabilized to internal operating temperature. Wait a few minutes after turning on the spectrum analyzer before beginning digital demodulator-based measurements.

- Additional carriers are interfering with the digital demodulator based measurement.

  For digital demodulator-based measurements, make sure only one carrier is incident to the analyzer.

- Excess carrier frequency error is interfering with the digital demodulator-based measurement.

  A radio may transmit a carrier frequency many kHz from the nominal channel frequency designated by the channel number. Although the digital demodulator measurements are designed to automatically compensate for large carrier frequency offsets, check the actual carrier frequency being transmitted by using the occupied bandwidth measurement. If the carrier frequency error is larger than 10 kHz, the HP 85726B PHS measurements personality may have trouble compensating. You may manually compensate the carrier frequency offset using the `CHAN X CTR FREQ` softkey. Another alternative is to use the -ddFRQSRCH remote command to force a carrier frequency search at the beginning of all digital demodulator-based measurements.

- Check that `TX PWR HI LOW` is set correctly.

  Make sure that if you are testing a public cell station (high power), HI is underlined in the softkey label. If you are testing a personal or other cell station, make sure that LOW is underlined in the softkey label. See "To configure the personality" in Chapter 2.

Error Messages

All error messages are listed alphabetically by the first word in the message.

`Acquiring FT at new center frequency . . . offset = < >`

The personality has executed an automatic carrier frequency search during a digital demodulator-based measurement and is acquiring the frame trigger at the new center frequency. The offset value is the frequency difference (in Hz) from the old frequency to the new frequency).

To solve this problem:

- No action is necessary except to wait until the frame trigger acquisition is complete.

`Amplitude over range, resetting RL . . .`

`Amplitude under range, resetting RL . . .`

The personality is executing an automatic reference level adjustment to optimize the input signal level for accurate measurement using the digital demodulator. This message indicates that the signal level has changed since the last time the spectrum analyzer reference level was set.

To solve this problem:

- No action is necessary except to wait until the reference level adjustment is complete.

`CAL: DD DAC Failed`

This message appears on the screen when the analyzer attempted to run an amplitude self-calibration but failed.

To solve this problem:

- Make sure the calibration reference signal is connected to the front panel input connector.
- If the calibration reference signal is okay, then, the Option 151 hardware is probably bad. Contact your nearest HP sales and service office.

`CAL FREQ for best dynamic range`

Indicates that the CAL FREQ or CAL FREQ & AMPTD routines were not performed after the PHS personality was loaded into spectrum analyzer memory. This message appears during a power versus time measurement only. If you do not perform these self-calibration routines, the dynamic range on the falling edge of the burst can be degraded.

To solve this problem:

- Perform the self-calibration routines as described in “Step 2. Perform the spectrum analyzer self-calibration routines” in Chapter 1.

Carrier frequency error too high

This is a digital demodulator error message. Refer to "Test Device Troubleshooting" in this chapter for an explanation of this message.

Carrier not burst

Indicates that the carrier does not seem to have the characteristics of a burst carrier (the difference between the maximum and minimum points on the waveform is less than 35 dB), and the measurement has been stopped.

To solve this problem:

- Make sure the transmitter is in the burst mode.
- If the carrier to be measured is a continuous carrier, check that BURST CONT is set to CONT.

Carrier not cont

Indicates that the carrier does not seem to have the characteristics of a continuous carrier (the difference between the maximum and minimum points on the waveform is greater than 35 dB), and the measurement has been stopped.

To solve this problem:

- Make sure the transmitter is in the continuous mode.
- If the carrier to be measured is a burst carrier, check that BURST CONT is set to BURST.

Carrier power too low, Auto CH Stopped

Indicates that a carrier could not be found, and the AUTO CHANNEL function has been stopped. To be considered a carrier, the amplitude level of the carrier must be greater than -20 dBm.

To solve this problem:

- Check that the transmitter output is connected to the spectrum analyzer input correctly.
- Check that the EXT ATTEN function has been set correctly. For more information, see "To configure the personality" in Chapter 2.
- If you want the PHS measurements personality to use an amplitude'level other than -20 dBm when checking for carrier level, you can change the minimum amplitude level by using the remote variable _CMIN. See the description of _CMIN in Table 5-2 for more information.

Carrier power too low, Measurement Stopped

Indicates that the measured level of the carrier is too low to make a valid measurement and the measurement has been stopped. The carrier level must be greater than the minimum level of -20 dBm.

To solve this problem:

- Check that the transmitter output is connected to the spectrum analyzer input.
- Check that the EXT ATTEN function has been set correctly. For more information, see "To configure the personality" in Chapter 2.
- If you want the PHS measurements personality to use an amplitude level other than -20 dBm when checking for carrier level, you can change the minimum amplitude level by using the remote variable _CMIN. See the description of _CMIN in Table 5-2 for more information.

CF auto set failed

This is a digital demodulator error message. Refer to "Test Device Troubleshooting" in this chapter for an explanation of this message.

Clock signal too low, data may have to be randomized

This is a digital demodulator error message. Refer to "Test Device Troubleshooting" for an explanation of this message.

EVM Calibration failure, EVM CORR not enabled

The EVM calibration routine failed to complete the EVM calibration. A valid EVM correction value was not obtained.

To solve this problem:

- The phase correction value must be greater than zero. Examine the measured RMS phase error and compare it to the RMS phase error entered for the reference signal. The measured RMS phase error must be greater than the entered RMS phase error.

Ext precision freq reference required

Indicates that the spectrum analyzer does not have Option 004, the precision frequency reference, installed in it. If the spectrum analyzer does not have Option 004 installed in it, you must use an external precision frequency reference to make accurate measurements with the PHS measurements personality.

To use an external precision frequency reference:

- Disconnect the connector from the 10 MHz REF OUTPUT and EXT REF IN connectors on the rear panel. Connect the 10 MHz signal from a precision external frequency reference to the EXT REF IN connector.

Fast ADC required: (Opt 101 or Opt 151)

This indicates that neither Option 101 or 151 have been installed in the spectrum analyzer. Option 101 is the fast time domain sweep, and Option 151 is a digital demodulator which also contains the fast time domain capability. Your spectrum analyzer must have either Option 101 or 151 installed in it for most PHS measurements.

To solve this problem:

- ❑ If there is an Option 101 or Option 151 installed in the spectrum analyzer, it could be malfunctioning. See the documentation for your spectrum analyzer for more information about returning the spectrum analyzer for repair.
- ❑ If Option 101 or Option 151 is not installed in the spectrum analyzer, you can have either option installed in your spectrum analyzer. Contact your local HP Sales and Service Office for more information.

Finding carrier center frequency . . .

The personality is executing an automatic carrier frequency search to compensate for carrier frequency error during a digital demodulator-based measurement. This message indicates that the carrier frequency is out of range.

To solve this problem:

- No action is necessary except to wait until the search is complete.

Frame trigger acquisition failed, check status

This is a digital demodulator error message. Refer to "Test Device Troubleshooting" for an explanation of this message.

Frame trig. acquisition failed, check status in Digital Demod menu

This is a digital demodulator error message. Refer to "Test Device Troubleshooting" for an explanation of this message.

Frame trigger position invalid, re-acquiring FT . . .

The personality is executing an automatic frame trigger acquisition to re-acquire the frame trigger. This message indicates that the frame trigger has drifted out of range.

To solve this problem:

- No action is necessary, except to wait until the frame trigger acquisition is complete.

FT re-position failed, check status

This is a digital demodulator error message. Refer to "Test Device Troubleshooting" for an explanation of this message.

Gate card required: (Opt 105)

Indicates that the spectrum analyzer does not have Option 105, the time-gated spectrum analysis card, installed in it. You need to have Option 105 installed in the spectrum analyzer to perform the gated method of carrier-off leakage power measurement. To solve this problem:

- If Option 105 is not installed in your spectrum analyzer, you may perform the zero-span method of the carrier-off leakage power measurement. The zero-span method does not require the use of time-gating.
- If there is an Option 105 installed in the spectrum analyzer, it could be malfunctioning. See the documentation for your spectrum analyzer for more information about returning the spectrum analyzer for repair.
- If Option 105 is not installed in the spectrum analyzer, you can have an Option 105 installed in your spectrum analyzer. Contact your local HP Sales and Service Office for more information.

Hardware options 151/160 required for Digital Demod

This message indicates that the digital demodulator Option 151 and DSP firmware Option 160 are not installed in the analyzer. Option 151 and Option 160 are required to make digital demodulator-based measurements and to use the digital demodulator frame trigger.

To solve this problem:

- If Option 151 and Option 160 are installed in the spectrum analyzer, they may have failed. See the spectrum analyzer service guide for more information about returning the spectrum analyzer for repair.
- If Option 151 and Option 160 are not installed in the spectrum analyzer, they can be installed; contact your local HP sales and service office for more information.

INVALID SYMTAB ENTRY: SYMTAB OVERFLOW

This indicates that there was not enough available memory in the spectrum analyzer to hold the PHS measurements personality.

To solve this problem:

- Make sure that no other downloadable programs are resident in spectrum analyzer memory:
  1. Press (PRESET).
  2. Press (CONFIG) More 1 of 3 Dispose User Mem ERASE DLP MEM ERASE DLP MEM (PRESET).
  3. Reload the PHS measurements personality using the procedure under "Step 1. Load the PHS measurements personality," in Chapter 1, "Getting Started."

Locking at new center frequency . . . offset = < >

The personality has executed an automatic carrier frequency search during a digital demodulator-based measurement and is locking at the new center frequency. The offset value is the frequency difference (in Hz) from the old frequency to the new frequency.

To solve this problem:

- No action is necessary except to wait until the locking is complete.

Measurement failed, check status

This is a digital demodulator error message. Refer to "Test Device Troubleshooting" for an explanation of this message.

Newer firmware required: REV 940822 or later

This message indicates that the spectrum analyzer firmware must be updated before the PHS measurements personality can be used.

Press (CONFIG) More 1 of 3 SHOW OPTIONS to view the firmware version of your analyzer. Earlier firmware dates were given in a different format with the word REV preceding the day, month, and year separated by periods.

To solve this problem:

- Contact your local HP Sales and Service Office for more information about updating the firmware in your spectrum analyzer.

Opt 021 or 041 Required for SRQ measurement done indication

This indicates that the analyzer does not have an HP-IB/IEEE-488 interface option installed. Option 021 or 041 is required for SRQ measurement done indication.

PHS Digital Demod firmware required: (opt 160)

This message indicates that Option 160, the PHS/PDC/NADC/CDMA digital demodulator firmware ROMs, are not installed in the Option 151 digital demodulator boards.

To solve this problem:

- Contact your local HP sales and service office for information about obtaining Option 160.

Newer opt 160 firmware required: rev XXXXX or later

This message indicates that newer Option 160 firmware is required for the HP 85726B PHS measurements personality.

To solve this problem:

- Contact your local HP sales and service office for information about obtaining the latest Option 160 ROMs.

Ref level auto set failed, over range

Ref level auto set failed, under range

`Results may not be accurate, EVM corr too high`

`Results may not be accurate, EVM mag. exceeds limit`

`Results may not be accurate, FT acquisition failed`

`Results may not be accurate, Origin offset too high`

`Results may not be accurate, Pass 1&2 bit compare err`

`Results may not be accurate, Phase corr too high`

These are digital demodulator error messages. Refer to "Test Device Troubleshooting" for an explanation of these error messages.

`Sync word errors, check status`

This is a digital demodulator error message. Refer to "Test Device Troubleshooting" for an explanation of this message.

`Sync word errors present`

This is a digital demodulator error message. Refer to "Test Device Troubleshooting" for an explanation of this message.

`Time record invalid, check status`

This is a digital demodulator error message. Refer to "Test Device Troubleshooting" for an explanation of this message.

`Verify gate trigger input is disconnected before CAL& AMPTD`

This message appears whenever (CAL) is pressed. Nothing should be connected to the spectrum analyzer GATE TRIGGER INPUT connector when the spectrum analyzer amplitude self-calibration routine is performed.

Test Device Troubleshooting

This section is designed to help you troubleshoot problems with the device under test when using digital demodulator measurements. This section will not help with error messages not related to digital demodulator measurements. Refer to "Error Messages" for an error message not in the following list.

The following is a list of digital demodulator error messages explained in this section.

- Carrier frequency errortoohigh
- CF auto set failed
- Clock signaltoolow, **data may** havetobe randomized
- ☞❐♋❍♏ ♦❐♓♑📬 acquisition failed, check status **in Digital** Demodmenu
- Frame trigger acquisitionfailed, check status
- **FT re-position failed,** check status
- Measurement failed, check status
- Reflevelauto set failed, overrange
- Ref level auto set failed, underrange
- Resultsmaynotbe accurate,EVMcorr. **too high**
- Resultsmaynotbe accurate, **EVM mag.** exceeds limit
- Resultsmaynotbe accurate, **FT acquisition failed**
- Resultsmaynotbe accurate, Originoffsettoohigh
- Resultsmaynotbe accurate, Pass **1&2 bit** compare err
- Resultsmaynotbe accurate,Phase **corr. too high**
- Syncworderrors, check status
- Sync word errors present
- Timerecordinvalid, check status

How to use this section

1. During a digital demodulator-based measurement, note the error message on the screen.
2. Follow the procedure listed in "Check the Following Common Errors," in this chapter. Many issues involving setup and common errors not identified with an error message are discussed there.
3. Determine into which of the four categories the error message belongs:

   a. System information
   b. Frame trigger information
   c. Measurement status information
   d. Measurement results information

   These categories make up the status screen, a troubleshooting aid in the analyzer. These categories are explained in detail, beginning with "Status Screen Overview," and continuing with each category of the screen.

   Access the status screen by pressing STATUS in the digital demodulator main menu. To access the digital demodulator main menu, press (MODE) PHS ANALYZER More 1 of 2 Digital Demod.

4. Locate the part of this chapter that corresponds to troubleshooting the status screen category. Follow the instructions given under the error message listing.

Status screen overview

The HP 85726B supports extensive error checking of modulation accuracy, I-Q graphs, and data bits measurements. During a digital demodulator-based measurement, error messages appear on-screen to highlight invalid measurement conditions. Whenever any of these error messages appear, you can use the status screen to display the current state of various measurement operations for troubleshooting.

The status screen is very helpful because you can see many analyzer settings and measurement results in one place. Become familiar with this screen. Troubleshooting possible digital demodulator-based measurement problems and base station/mobile station problems is based heavily upon data supplied by this screen. To view the status screen, select `Digital Demod` `STATUS`. See Figure 4-1 to see the four main parts of the status screen.

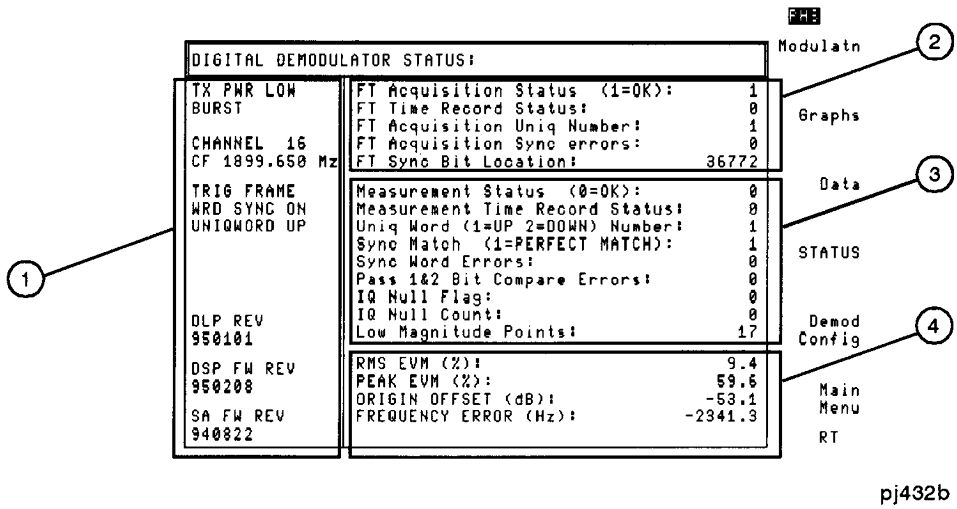


Figure 4-1. The PHS Digital Demodulator Status Screen

① **System information.** This area contains information such as the current configuration settings for the PHS personality and software revision numbers.

② **Frame trigger information.** This area shows the state of the off-the-air (frame) synchronization trigger.

③ **Measurement status information.** This area shows the condition of the current sampled data and metric calculations.

④ **Measurement results information.** This area shows the current measurement results.

Information is displayed only if valid values are available for the current measurement. For example, if no measurement has been run, only system information is displayed. If the system is not using the frame trigger, no frame trigger status is displayed.

System information part of the status screen

System information reflects the current settings of the PHS measurements personality. The parameters in this part of the status screen show overall system information. These data are useful to know when there is a problem related to configuration. Figure 4-2 shows this part of the status screen in detail. An explanation of each parameter in system information follows Figure 4-2.

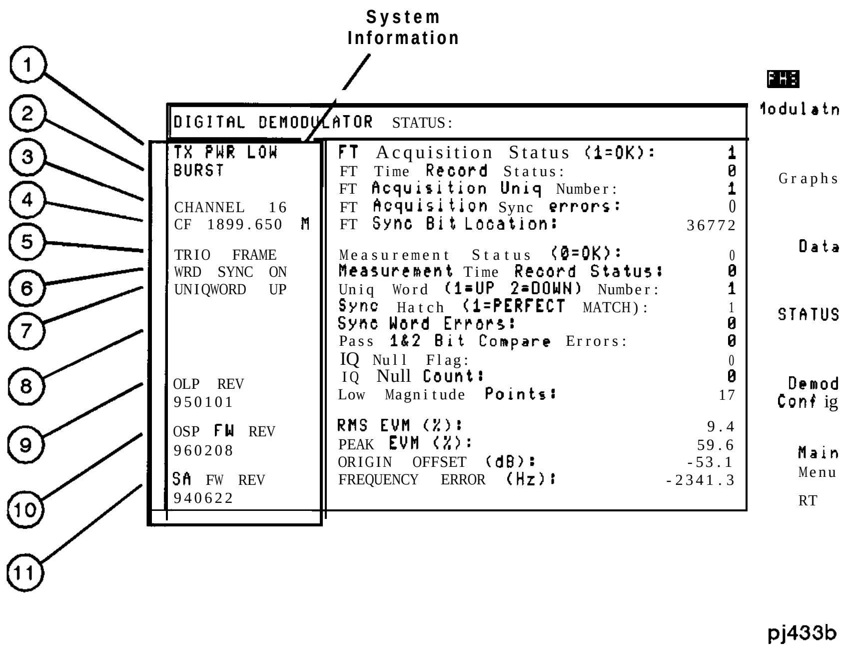


Figure 4-2. Detail of System Information

1 — TX PWR LOW **or** TX PWR HI. Indicates the selected transmission power.

2 — BURST **or** CONT. Indicates whether the test is set up for burst or continuous carrier.

3 — CHANNEL. Shows the setting of CHANNEL NUMBER.

4 — CF. Indicates the nominal center frequency of the current channel.

5 — TRIG. Shows the digital demodulator trigger setting; either FRAME, FREE RUN, or EXTERNAL.

6 — WRD SYNC. Shows the current setting of the WRD SYNC ON OFF softkey. WRD SYNC ON indicates that the frame trigger synchronizes to a transmitted unique (sync) word.

7 — UNIQWORD. Shows which unique word the measurement is synchronized to.

8 — CORRECTION. The two values here are the phase correction value being applied to the measured RMS phase error, and the EVM correction value being applied to the measured RMS EVM. These values only appear if the EVM calibration routine was completed and the EVM CORR ON OFF softkey is set to underline ON.

9 — DLP REV. Gives the code revision date of the PHS measurements personality.

10 — DSP FW REV. Shows the code revision date of the Option 160 PHS/PDC/NADC/CDMA DSP firmware.

11 — SA FW REV. Shows the code revision date of the spectrum analyzer firmware.

If you have a problem, check the system information first using the status screen. Common errors are explained in “Before Troubleshooting,” at the beginning of this chapter.

Correction Error Messages

Correction values

If an EVM calibration has been performed, and EVM correction is enabled, the system information includes the phase correction value being used to correct the RMS phase error and the EVM correction value used to correct the RMS EVM. These values are listed under CORRECTION in the system information. The phase correction value is obtained during the EVM calibration routine. The EVM correction value is derived from the phase correction value and the RMS magnitude and phase error for each measurement. The EVM correction value for the current measurement is displayed.

Error messages related to EVM correction

Results may not be accurate, EVM corr. too high

This error message appears only if an EVM calibration has been executed, and an EVM correction is in use. The EVM correction value that is derived from the current phase correction value is greater than the measured RMS EVM. The EVM correction value is too large for the current measurement.

To solve this problem:

1. Turn off EVM corrections, make a modulation accuracy measurement, and examine the RMS EVM value. If the value is less than 1.5%, the spectrum analyzer cannot measure the RMS EVM accurately. Do not use EVM corrections.
2. Repeat the EVM calibration on your EVM reference signal and then check the accuracy of the RMS phase error of your EVM reference signal.

Results may not be accurate, Phase corr. too high

This error message appears only if an EVM calibration has been executed, and an EVM correction is in use. The phase correction value currently in use is greater than the measured RMS phase error. The phase correction value is too large for the current measurement.

To solve this problem:

1. Turn off EVM corrections, make a modulation accuracy measurement, and examine the RMS EVM value. If the value is less than 1.5%, the spectrum analyzer cannot measure the RMS EVM accurately. Do not use EVM corrections.
2. Repeat the EVM calibration on your EVM reference signal and then check the accuracy of the RMS phase error of your EVM reference signal.

Measurement Status Error Messages

If the system settings are correct, use the following table to determine the status screen troubleshooting procedure that applies to the error message. Locate and follow the troubleshooting procedure later in this chapter for that part of the status screen. For instance, if the error message is `Sync word errors present,` the table shows "Measurement Status Troubleshooting" as the procedure to use. Find this procedure later in this chapter and follow it to troubleshoot the problem.

Table 4-1. Troubleshooting Map

Error Message	Troubleshooting Procedures For:		
	Frame Trigger status	Measurement status	Measurement Results
Carrier frequency error too high			√
CF auto set failed			√
Clock signal too low, data may have to be randomized		√	
Frame trig. acquisition failed, check status in Digital Demod menu	√		
Frame trigger acquisition failed, check status	√		
FT re-position failed, check status	√		
Measurement failed, check status		√	
Ref level auto set failed, over range			√
Ref level auto set failed, under range			√
Results may not be accurate, EVM mag. exceeds limit			√
Results may not be accurate, FT acquisition failed	√		
Results may not be accurate, Origin offset too high		√	
Results may not be accurate, Pass 162bit compare err		√	
Sync word errors, check status		√	
Sync word errors present		√	
Time record invalid, check status		√	

Frame Trigger Status Troubleshooting

If the frame trigger is used, frame trigger status information reflects the condition of the frame trigger in the current measurement. Frame trigger status information is displayed only if frame trigger is selected, and acquisition has been attempted.

Figure 4-3 shows an example of the frame trigger status part of the status screen. A short explanation of each entry follows. Refer to "Frame Trigger Troubleshooting Procedure" for more complete information about each entry.

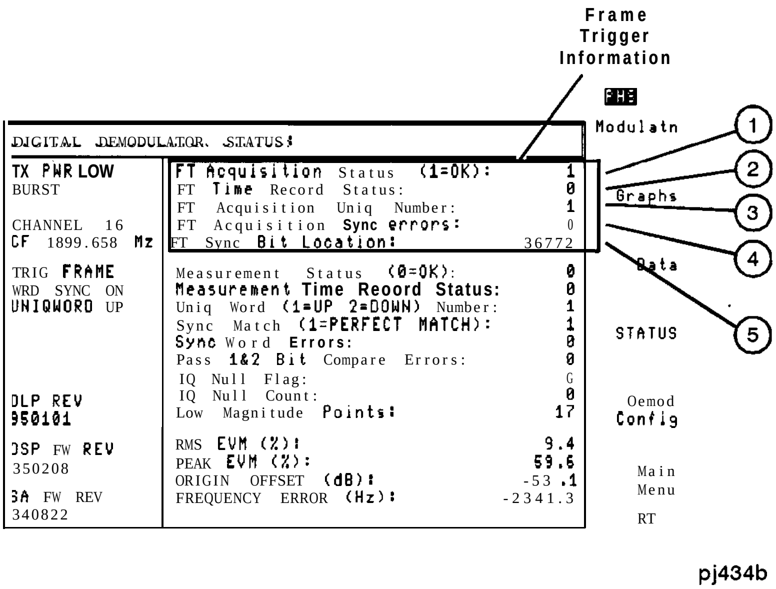


Figure 4-3. Detail of Frame Trigger Part of the Status Screen

① **FT Acquisition status.** Value is 1 if frame trigger acquisition is successful, and 2, 3, 4, 5, or 6, if frame trigger acquisition has failed.

② **FT Time Record status.** This indicates errors in the sampled data record. Valid values are 0 through 4.

③ **FT Acquisition Uniq Number.** This shows which UNIQ word to which the frame trigger has acquired synchronization (1 = UP, 2 = DOWN).

④ **FT Acquisition Sync errors.** This shows the number of bit errors in the unique (sync) word to which the frame trigger has synchronized.

⑤ **FT Sync Bit Location.** This is the data record position to which the measurement interval is targeted.

Error messages related to frame trigger status

Frame trig. acquisition failed, check status in Digital Demod menu

The initial acquisition of frame trigger failed.

To solve this problem:

- Perform the “Frame Trigger Troubleshooting Procedure” in this chapter.

Frame trigger acquisition failed, check status

The initial acquisition of frame trigger failed.

To solve this problem:

- Perform the “Frame Trigger Troubleshooting Procedure” in this chapter.

FT re-position failed, check status

The frame trigger cannot be repositioned within the target window. This state only occurs after the frame trigger has been acquired once, and is in use. When the digital demodulator sensed that the frame trigger was no longer synchronized to the input transmission, re-acquisition was attempted, and failed.

To solve this problem:

1. Ensure that the 10 MHz frequency reference is connected.
2. Check that the input signal is still at the defined channel frequency and timeslot.
3. Ensure that the input signal level is properly positioned, and its amplitude is stable during the timeslot.
4. Check that the desired sync sequence is still being transmitted.
5. Perform the “Frame Trigger Troubleshooting Procedure,” in this chapter.

Results may not be accurate, FT acquisition failed

The measurement was forced to continue with FT errors and the reporting of FT error messages was not disabled (FT ERR ON OFF set to OFF).

To solve this problem:

- Perform the “Frame Trigger Troubleshooting Procedure,” in this chapter.

Frame Trigger Troubleshooting Procedure

Examine the frame trigger status values in the STATUS menu to help diagnose the problem. The following is an explanation of each of these items in the frame trigger status menu.

FT Acquisition Status (1=OK):

FT acquisition status value is 1

If the status is 1, then frame trigger was acquired. This means that the closest match with a sync sequence was found and the frame trigger was able to adjust the measurement interval to the desired timeslot. In this case, measurement continues. Measured values are displayed when the measurement is finished.

FT acquisition status value is not 1

If the status is not 1, then the measurement stops and an error message appears. For digital-demodulator based measurements, a unique softkey menu is displayed, shown in Figure 4-4.

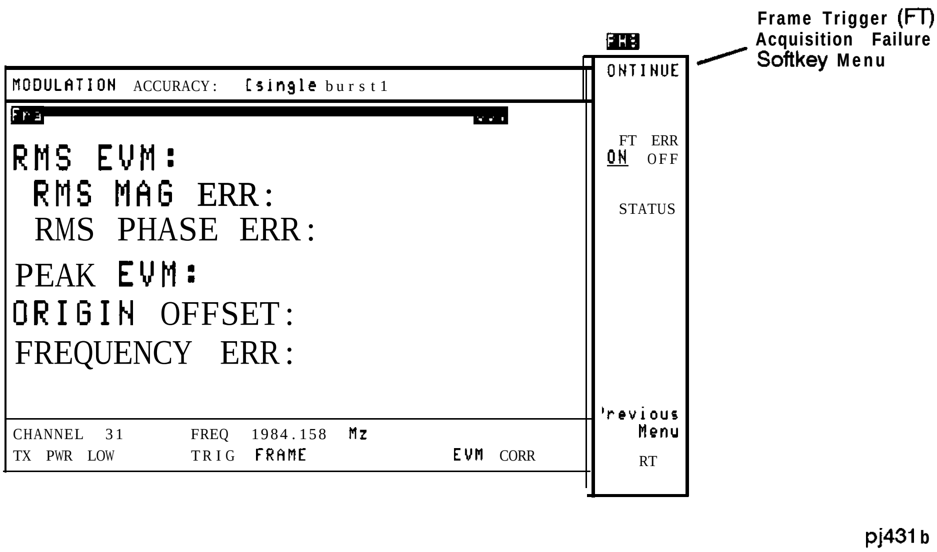


Figure 4-4. Frame Trigger Acquisition Failure Softkey Menu

If this occurs, HP recommends that you press STATUS to display the status screen and diagnose the problem before continuing. However, you can force the measurement to continue by pressing CONTINUE. This completes the measurement, but may give faulty data when the measurement is finished. Most of the time, you should press STATUS . For convenience, frame trigger error messages can be disabled by pressing FT ERR ON OFF until OFF is underlined before pressing CONTINUE . To re-enable frame trigger error message reporting after pressing CONTINUE, press Demod Config Frame Config , and then press FT ERR ON OFF until ON is underlined.

FT Acquisition status value is 0

Some possible problems indicated by an FT acquisition status value of 0 are:

- The 10 MHz reference signal is not present.
- Frame trigger time record may be invalid.
- The frame trigger adjustment was out of range for the frame trigger to capture the desired measurement interval. That is, the target address not acquired. Typically, this means a problem with the PHS digital demodulator hardware or PHS measurements personality.
- A pseudo-random bit sequence (PRBS) signal may be present with no sync information. For a continuous (non-bursted) carrier, use free run trigger by pressing Demod Config DD Trigger DD TRIG FREE RUN.
- The signal to noise ratio may be too small to reliably detect transmitted bits.
- The PHS measurements personality format may not be set to match the transmitting link. For example, the measurements personality is set to uplink format and the signal is downlink. Verify the setting of UNIQ WRD UP DOWN> .
- The center frequency drifts rapidly during a measurement sweep. This occurs if the analyzer is not fully warmed-up. If you have just turned the instrument on, the spectrum analyzer may not be internally temperature-stabilized. The frame trigger cannot be acquired when the carrier frequency is changing at a large rate. Wait for the analyzer to warm-up. This should take no more than five minutes. The first few times a measurement is attempted, frame trigger acquisition will fail. Then, as the center frequency stabilizes, a measurement will be made, probably displaying a large carrier frequency error. The carrier frequency error will decrease until the analyzer reaches a stable internal temperature when the center frequency has stopped drifting.
- The carrier frequency error was greater than 10 kHz. This is too large to be reliably detected by the automatic carrier frequency search. Use CHAN X CTR FREQ to adjust the analyzer center frequency closer to the carrier frequency. Another alternative is to use the _ddFRQSRCH remote command to force a carrier frequency search at the beginning of all digital demodulator-based measurements.

FT acquisition status value is 4 or 5

A possible problem indicated by an FT acquisition status value of 4 or 5 is:

- The carrier frequency error is greater than 99 kHz. The automatic carrier frequency search cannot compensate for this amount of frequency error. Decrease the carrier frequency error, or use CHAN X CTR FREQ to adjust the analyzer center frequency closer to the carrier frequency.

FT acquisition status value is 6

A possible problem indicated by an FT acquisition status value of 6 is:

- A problem was found in the burst during the unique word synchronization. Either the burst was too short, or there were insufficient points above a threshold for the algorithm to complete. Check the burst amplitude and shape.

With this possible solution in mind, examine these other frame trigger status parameters to diagnose the problem:

FT Time Record Status:

FT time record status value is 0

If the value of FT time record status is 0, then the data record is valid for frame trigger acquisition. If FT acquisition status is also 0, the error in frame trigger acquisition is not an error in the sampled data. See "FT Acquisition Sync Errors" and "FT Sync Bit Location" for further troubleshooting.

FT time record status value is 1

If the value of FT time record status is 1, then the digital signal processor is unable to lock its phase-locked loops. The 10 MHz reference may not be present. Check the signal at the external reference input. If the signal is good, then Option 151 has failed. Contact your nearest HP Sales and Service Office for assistance.

FT time record status value is 3

If the value of FT time record status is 3, then the digital signal processor has started but is unable to finish taking a time record. This occurs when there is no trigger present. For example, the PHS measurements personality is set to external trigger mode (DD TRIG EXTERNAL) and no trigger input is given.

FT time record status value is 4

If the value of FT time record status is 4, then the digital signal processor is in overrange. The signal level is too large for the automatic reference level routine in the personality.

FT Acquisition Uniq Number:

This is which sync word the frame trigger chose to synchronize to. If the PHS measurements personality is set to unique word search mode (UNIQ WRD UP DOWN), this is the best fit to either the uplink or downlink. If the measurements personality is set to fixed unique word (UNIQ WRD UP DOWN set to UP or DOWN), this is the specified unique word number (l=UP, 2=DOWN).

FT Acquisition Sync Errors:

FT acquisition sync errors value is 0 or 1

If the value of FT Acquisition Sync Errors is 0 or 1, a sync word was found with one or no bit errors. If the value of FT acquisition status is 0, the frame trigger was unable to capture the desired time interval. In this case, FT Sync Bit Location is out of range. See "FT Sync Bit Location" for more information.

FT acquisition sync errors value is 2 or greater

If the value of FT Acquisition Sync Errors is 2 or greater, no good match to a sync sequence was found and the frame trigger was set to the best match possible. The resulting frame trigger might be valid. Confirm frame trigger position by using an oscilloscope to compare the frame trigger output signal on the spectrum analyzer rear panel relative to the modulation. The frame trigger should be positioned just before the start of the desired unique word. If the position is correct, then disable frame trigger error messages by pressing FT ERR ON OFF to underline OFF, and then press CONTINUE to complete the measurement. If the frame trigger position is not correct, then the transmitter is at fault.

- If the PHS measurements personality was configured to search for the best unique word by setting UNIQ WRD UP DOWN to UP DOWN , then the frame trigger was set for the best match of the two possible unique word sequences. Try changing the setting to UP or DOWN to obtain the best match to a specific unique word.
- If the PHS measurements personality was configured to search for a specific unique word, then the frame trigger was set to best match the sequence designated by UNIQ WRD UP DOWN . If the input signal contains *only* uplink or downlink unique words, try changing the setting to search for the best match of the two possible sync sequences.

FT Sync Bit Location:

The value given for this parameter is the address of the sync bit in the array of detected bits for a frame trigger acquisition time record. It indicates whether frame trigger was able to acquire desired measurement interval at a target address. The range of valid target addresses are:

36660: Pwr vs. Time

36672: Demodulation Measurements

Only even addresses will allow successful measurement to be made. An odd (as opposed to even) FT sync bit address usually indicates a problem with the transmitter.

- Fix FT acquisition sync errors.
- If the target address was not acquired, and FT acquisition sync errors is 0, then Option 151 has failed. Contact your nearest HP Sales and Service Office for assistance.

Measurement Status Troubleshooting

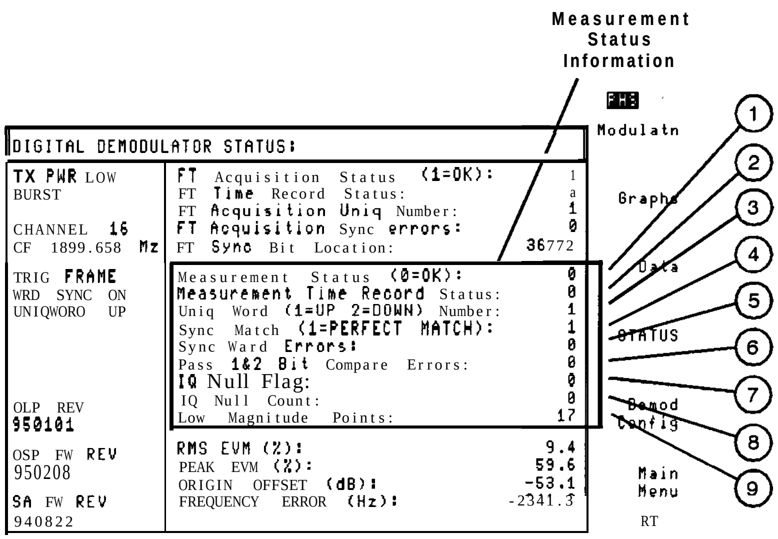
Measurement status information provides a report of the overall condition of the previous measurement. Results of measurement status, the first item in this group, gives the most information. Measurement status information is valid only after a measurement has been attempted. If using frame trigger, measurement status information is only valid if the frame trigger was successfully acquired.

Measurement status screen

Figure 4-5 highlights the measurement status portion of the status screen. When referred to this procedure for troubleshooting, follow the directions given for your particular error message. The error messages and directions to ‘troubleshoot them are listed alphabetically following Figure 4-5. A troubleshooting flow chart is included later in this chapter.

This flow chart indicates errors and actions to take with a given value of measurement status.

Use this flow chart when following the procedure in “Measurement Status Troubleshooting,” or when referred there from other locations in this chapter.



pj435b

Figure 4-5. Detail of the Measurement Status Part of the Status Screen

① Measurement `status (O=OK)` : Measurement status indicates whether or not the measurement was successfully completed. The allowable range of values for measurement status is 0 through 15. A measurement status value of 0 *can* indicate an EVM correction error, or a measurement results error. Figure 4-6, the “Measurement Status Troubleshooting Flow chart,” is included later in this chapter to help determine recommended actions to take for different values of measurement status.

② `Measurement Time Record status` : This indicates the condition of the sampled data. Valid values are 0 through 4.

③ `Uniq Word:` This gives the unique word of the signal. Valid values are 1 through 3. A value of 3 indicates a PRBS sync word, or no unique word synchronization.

④ Sync Match (1=PERFECT MATCH) : This value reports the occurrence of bit errors. A sync match value of 1 is shown if no bit errors were detected in the sync word. A value of 0 indicates the presence of bit errors.

⑤ Sync Word Errors: This shows the quantity of bit errors in the detected sync word. The maximum value is 20.

@Pass 1&2 Bit Compare Err: This indicates the number of bit discrepancies between bits detected from the sampled data in DSP pass 1 and DSP pass 2.

⑦ I-Q Null Flag: Value is 0 if no I-Q nulling was performed. A value of 1 indicates that I-Q nulling was done. A value of -1 occurs if an I-Q null was performed 5 times, and the I-Q null could not **be** accomplished well enough to make a measurement.

⑧ I-Q Null Count : This is the number of times I-Q nulling was performed on the sampled data. If it is performed 5 times without success, the I-Q null count is set to 6.

⑨ Low Magnitude Points: The number of sample points below the amplitude threshold. If low magnitude points is greater than 50, the automatic reference level setting routine is executed.

Error messages related to measurement status

Clock signal too low, data may have to be randomized

The symbol clock level is too small. The amplitude of the symbol clock that was recovered from the transmitted signal was not large enough to accurately synchronize the digital demodulation.

To solve this problem:

- Check the causes of the following possible errors, listed in order of most probable occurrence. The causes of these errors are explained at the end of this list of error messages.
  1. Confirm that digital modulation is present on the carrier. Transmitted data may need to be randomized to provide more symbol edges for the symbol clock recovery. Long strings of all zeros may not supply enough symbol edges.
  2. The measurement trigger position may place the measurement time interval over an inactive portion of a mobile burst or base station timeslot. Since no modulation energy is present in the inactive portion of a timeslot, the symbol clock level may be too small for recovery. Check that the trigger places the measurement over an active timeslot.
  3. The I-Q origin offset may be too large for the symbol clock recovery to operate properly. Check the input signal I-Q modulator.
  4. Confirm that the 10 MHz frequency reference is present at the spectrum analyzer.

Measurement failed, check status

The measurement status value is outside the allowable range.

To solve this problem:

- Examine the measurement status value and refer to the "Measurement Status Troubleshooting Flow Chart" located at the end of this section.

Results may not be accurate, Origin offset too high

The I-Q origin offset is too large to be removed by the I-Q nulling routine. Excess I-Q offset will add to the EVM values and degrade EVM accuracy. Maximum allowable origin offset is 1% of the average signal power at decision points after five passes of the I-Q nulling routine.

To solve this problem:

1. Adjust the transmitter I-Q modulator balance.
2. Check for in-channel spurious signals, particularly at the carrier frequency.
3. Ensure that the 10 MHz frequency reference is present at the spectrum analyzer.
4. Ensure that the carrier frequency error is less than 10 kHz.

Results may not be accurate, Pass 1&2 bit compare err

One or more bit comparison errors occurred between DSP pass 1 and DSP pass 2 of the DSP algorithm.

To solve this problem:

1. Check the signal to noise level of the input signal.
2. Confirm that the 10 MHz frequency reference is present.
3. Check the position of the trigger relative to the signal.

Sync word errors, check status

Bit errors are present in the demodulated'synchronization word.

To solve this problem:

1. Check that a correct 16-bit sync sequence is being transmitted.
2. Try to search for a single unique word. Change the personality to uplink or downlink (UNIQ WRD UP DOWN).

Sync word errors present

Bit errors are present in the demodulated synchronization word.

To solve this problem:

1. Check that a correct 16-bit unique word sequence is being transmitted.
2. Try to search for a single unique word. Change the personality to **uplink** or **downlink** (UNIQ WRD UP DOWN).

Time record invalid, check status

The sampled data record, or time record, is invalid due to errors during signal sampling. Check measurement time record status on the status screen. The value indicates the condition of the sampled data. A 0 indicates a good data record. A value of 1 through 4 indicates a problem in the data record.

To solve this problem:

- See "Measurement time record status," in "Measurement Status Troubleshooting."

Measurement status results

Measurement Status (O=OK):

The value of measurement status indicates the problems encountered while processing the data record for a digital demodulator measurement. Valid values are 0 through 15. A measurement status value of 0 can indicate an EVM correction error, or a measurement results error. Refer to Figure 4-6, "Measurement Status Troubleshooting Flow Chart," to help determine recommended actions to take for different values of measurement status.

The eight values listed beneath measurement status provide supplemental information about the status of the current measurement. They add information to the measurement status value.

Measurement Time Record Status:

- If measurement time record status is 0, then the sampled data record is valid for measurement.
- If measurement time record status is 1, the digital signal processor is unable to lock its phase-locked loops. Either the 10 MHz reference is missing, or Option 151 hardware has failed. Contact your nearest HP Sales and Service Office.
- If measurement time record status is 3, the digital signal processor has started but is unable to finish taking a time record. There is no trigger present. This might occur if the measurements personality was set in external trigger mode (DD TRIG EXTERNAL) and no trigger input is given.
- If measurement time record status is 4, then there is a DSP overrange. The signal level is too large for the automatic reference level routine of the personality.

Uniq Word (1=UP 2=DOWN) Number:

Valid values are 1 though 3, corresponding to uplink (1) and downlink (2) unique words. A PRBS data modulated signal returns a unique word number of 3.

Sync Match (1=PERFECT MATCH):

This flag is " 1" if a perfect match to a synchronization (unique) word was found. The flag is "0" if any bit errors were found in the best match to a sync word.

Examine Sync Word Errors and Measurement Status=2 in the "Measurement Status Troubleshooting Flow Chart, " for further information.

Sync Word Errors:

Sync Word Errors is the number of bit errors in the best match to a synchronization sequence (unique word) detected in the sampled data. The maximum value is 16, the length of an PHS sync sequence.

See "Measurement Status=2" in the "Measurement Status Troubleshooting Flow Chart," for further interpretation information.

Pass 1&2 Bit Compare Errors:

This value is the number of bit discrepancies between DSP signal processing pass 1 and DSP signal processing pass 2 on a data record. A value of 0 indicates no bit errors.

A failure of this parameter can be caused by the following:

- The 10 MHz frequency reference may not be present.
- The symbol detector cannot accurately interpret the phase at the decision points to demodulate the transmitted symbols. Check the input signal to noise, and supply a signal with less noise.

IQ Null Flag:

The I-Q Null Flag indicates whether I-Q nulling was performed on the data record.

- A value of 0 indicates that I-Q nulling did not occur.
- A value of 1 indicates that I-Q nulling was performed.
- A value of -1 indicates that I-Q nulling was unsuccessful after five tries.

See "IQ Null Count" for more information

IQ Null Count:

The I-Q Null Count Flag shows the number of times the I-Q offset was nulled in the sampled data record. The maximum number of I-Q nulls permitted is 5. If more than 5 I-Q nulls are necessary, the input signal may be faulty. If the I-Q nulling is unsuccessful after 5 tries, the I-Q null count is set to 6 and the I-Q null flag is set to -1. See “Measurement status=4” in the “Measurement Status Troubleshooting Flow Chart,” in this chapter.

Low Magnitude Points:

This quantity indicates the number of sample points below the amplitude threshold. The maximum number allowed before executing the automatic reference level setting routine is 50.

Measurement Status Troubleshooting Flow Chart

The following flow chart indicates errors and actions to take with a given value of measurement status. Use this flow chart when following the procedure in "Measurement Status Troubleshooting," or when referred here from other locations in this chapter.

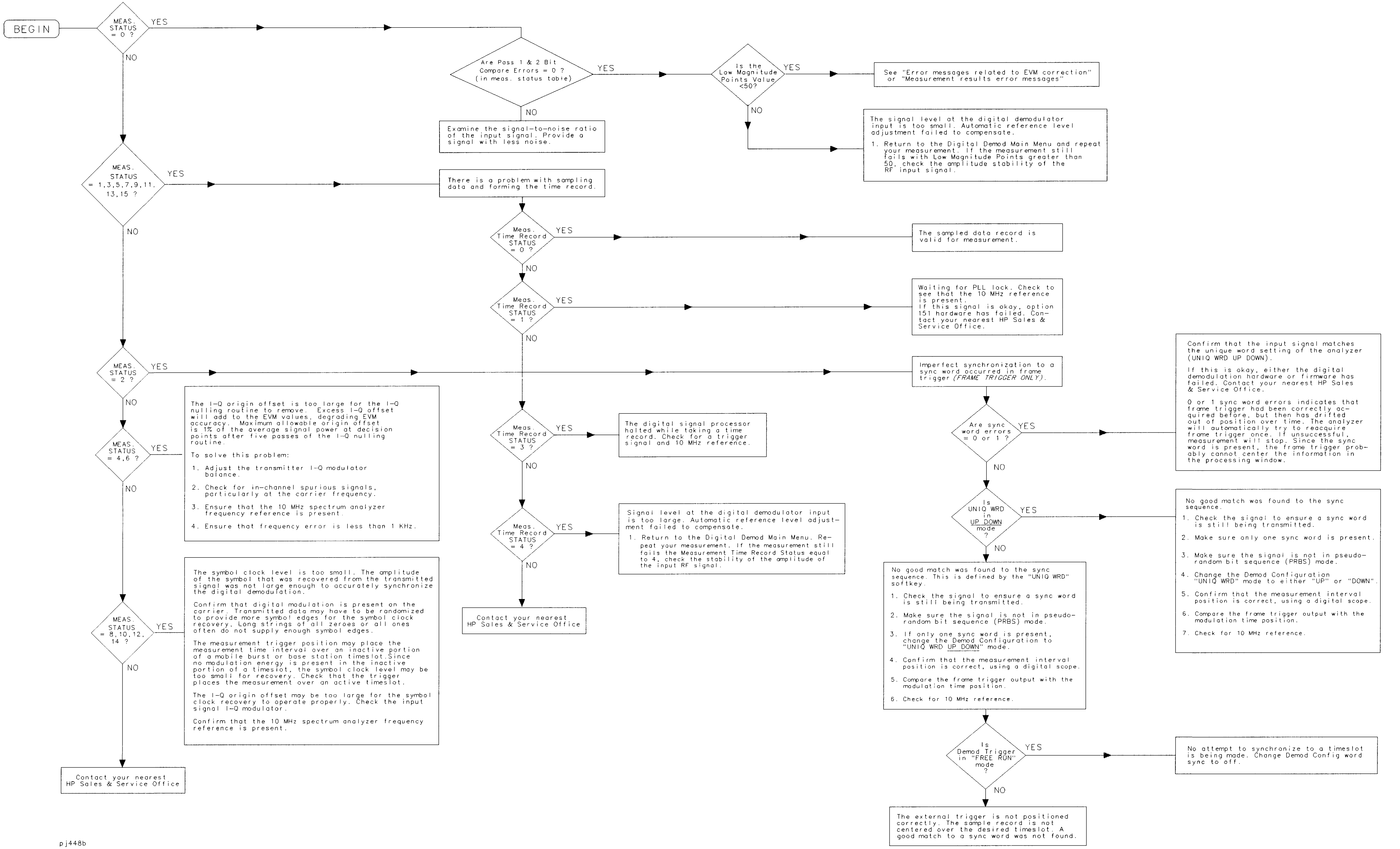


FIGURE 4-6. MEASUREMENT STATUS TROUBLESHOOTING FLOWCHART

Measurement Results Troubleshooting

Current measurement results are summarized on the status screen, as shown in Figure 4-7. Measurement results values are only displayed after a complete measurement. Any errors encountered during the measurement will be reflected in the measurement status.

Measurement status error messages take priority over measurement result error messages.

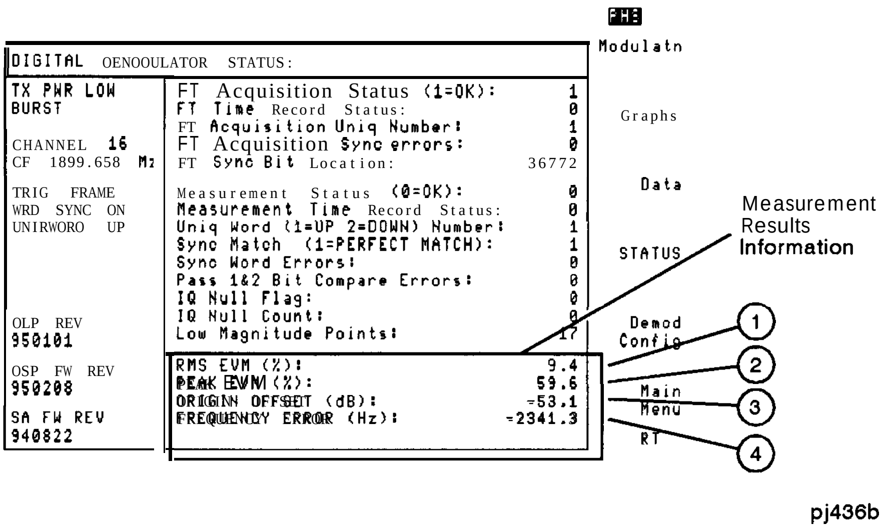


Figure 4-7. Measurement Results Fart of the Status Screen

① RMS EVM (%): This shows the current RMS EVM value

② PEAK EVM (%): This is the current peak EVM value

③ ORIGIN OFFSET (dB) : This shows the current I-Q origin offset

④ FREQUENCY ERROR (Hz): This shows the current frequency error

Measurement results error messages

Carrier frequency error too high

The personality has executed an automatic carrier frequency search, but the carrier frequency error is too large (greater than 99 kHz) to be compensated.

To solve this problem:

- Decrease the carrier frequency error.
- Use the CHAN X CTR FREQ softkey to manually set the analyzer center frequency to the carrier frequency.

CF auto set failed

The personality has executed an automatic carrier frequency search, but the carrier frequency is still out of range.

To solve this problem:

- Check the frequency stability of the RF input signal.
- If signal is bursted, make sure free run trigger is not selected.

Ref level auto set failed, over range

The personality attempted to set the automatic reference level, but failed because the amplitude of the RF signal input continued to increase.

To solve this problem:

- Check the amplitude stability of the RF input signal.

Ref level auto set failed, under range

The personality attempted to set the automatic reference level, but failed because the amplitude of the RF signal input continued to decrease.

To solve this problem:

- Check the amplitude stability of the RF input signal.

Results may not be accurate, EVM mag. exceeds limit

An EVM magnitude error component value at a decision point is greater than 33%. The fixed-point calculation algorithm is unable to handle a signal with greater than 33% magnitude error without overflowing the fixed point dynamic range. Large phase error are handled accurately. As a result, the displayed EVM values may be less than actual.

To solve this problem:

- Check the value of measurement status in the status menu. If measurement status is non-zero, fix the measurement status problem first.
- Look for and remove any in-channel spurious signals.
- Examine the eight-point constellation to determine if a large peak EVM is distorting the RMS EVM.
- Determine whether EVM is due primarily to magnitude errors or phase errors. Fix the signal magnitude errors.

How to Contact Hewlett-Packard

In the event something goes wrong with your spectrum analyzer, refer to the spectrum analyzer service guide about returning it for service. If you need to contact Hewlett-Packard about a problem with the PHS measurements personality, you can call your nearest Hewlett-Packard Sales and Service Office, listed in the table on the following page.

Table 4-2. Hewlett-Packard Sales and Service Offices

US FIELD OPERATIONS

Headquarters
Hewlett-Packard Co.
19320 Pruneridge Avenue
Cupertino, CA 95014
(800) 752-0900

California, Northern
Hewlett-Packard Co.
301 E. Evelyn
Mountain View, CA 94041
(415) 694-2000

California, Southern
Hewlett-Packard Co.
1421 South Manhattan Ave.
Fullerton, CA 92631
(714) 999-6700

Colorado
Hewlett-Packard Co.
24 Inverness Place, East
Englewood, CO 80112
(303) 649-5512

Georgia
Hewlett-Packard Co.
2000 South Park Place
Atlanta, GA 30339
(404) 955-1500

Illinois
Hewlett-Packard Co.
5201 Tollview Drive
Rolling Meadows, IL 60008
(708) 255-9800

New Jersey
Hewlett-Packard Co.
150 Green Pond Rd.
Rockaway, NJ 07866
(201) 586-5400

Texas
Hewlett-Packard Co.
930 E. Campbell Rd.
Richardson, TX 75081
(214) 231-6101

EUROPEAN FIELD OPERATIONS

Headquarters
Hewlett-Packard S.A.
150, Route du Nant-d'Avril
1217 Meyrln B/Geneva
Switzerland
(41 22) 780.8111

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

Germany
Hewlett-Packard GmbH
Hewlett-Packard Strasse
61352 Bad Homburg v.d.H
Germany
(49 6172) 16-O

Great Britain
Hewlett-Packard Ltd.
Eskdale Road, Winnersh Triangle
Wokingham, Berkshire RG41 5DZ
England
(44 734) 696622

INTERCON FIELD OPERATIONS

Headquarters
Hewlett-Packard Company
3495 Deer Creek Road
Palo Alto, California, USA
94304-1316
(415) 857-5027

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

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

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

Japan
Hewlett-Packard Japan, Ltd.
1-27-l 5 Yabe, Sagamihara
Kanagawa 229, Japan
(81 427) 59-1311

Singapore
Hewlett-Packard Singapore (Pte.) Ltd.
150 Beach Road
#29-00 Gateway West
Singapore 07 18
(65) 291-9088

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

5

Programming Commands

This chapter contains complete information for the programming commands available to operate the PHS measurements personality. The topics covered in this chapter are listed below.

- A table containing a cross reference of the PHS measurements personality softkeys to the corresponding programming command.
- A table containing a cross reference of the PHS measurements to the limit and parameter variables.
- A table containing a cross reference of PHS measurements and the corresponding limit line function names.
- The descriptions of all the PHS measurements personality programming commands.

This chapter contains reference information about the PHS programming commands. For more information about programming the PHS personality, refer to Chapter 6, "Programming Examples." For more information about programming the spectrum analyzer, see the programming documentation for the spectrum analyzer.

Functional Index

The following table lists each PHS measurements personality softkey and references the corresponding remote command sequence that performs the same operation remotely. The table contains only those remote commands that have corresponding softkeys.

Table 5-1. Functional Index

PHS Softkey	Corresponding Remote Command Sequence
PHS ANALYZER	MODE 10 (See "To select the PHS analyzer mode remotely" in Chapter 6 for more information.)
Configuration Menu	
BURST CONT	_CC
DEFAULT CONFIG	_DEFAULT
DEFINE CHAN	_CHDEF
DEFINE FREQ	_FDEF
EXT ATTEN	_EXTATN
PASSFAIL ON OFF	_DPF
TX PWR HI LOW	_TXPWR
TRIG DELAY	_TRIGD
TRIG POL NEG POS	_TRIGP
TRIG SRC UW EXT	_TRIGSRC
Physical Channel Menu	
AUTO CHANNEL	_ACH
CENTER FREQ	Use the spectrum analyzer CF command. See the programming documentation for the spectrum analyzer for more information about the CF command.
CHAN X CTR FREQ	_CFX
CHANNEL NUMBER	_CH
SLOT NUMBER	_TN
Power Menu	
ANTENNA POWER	_CPWR, or -CPS and -CPM
CARRIER OFF PWR	_COPMT, _COPWR, or _COPMT, -COS and _COM
MONITOR CHAN	_MCH, or _MCS and -MCM
OCCUPIED BANDWDTH	_OBW, or _OBWS and _OBWM
Power Setup Menu	
COP TYPE ZSP GTD	_COPMT
COP ZSP SGL MULT	_COPMKK
FT ACQ ON OFF	-FTACQ
PWR TRIG EXT VID	_TRIGM

Table 5-l. Functional Index (continued)

PHS Softkey	Corresponding Remote Command Sequence
Power versus Time Menu	
P vs T BURST	_PBURST
P vs T FALLING	_PFALL
P vs T FRAME	_PFRAME
P vs T RISING	_PRISE
Power versus Time Setup Menu	
FT ACQ ON OFF	_FTACQ
MEASURE AVG PKS	-AVG
NUHBER SWEEPS	_PNS
RANGE 70 110	_RNG
Power versus Time Limit Line Edit Menu	
PRE LIMIT	-PRX
POST LIMIT	-PFX
UPPER LIMIT	-PBRXU
LOWER LIMIT	-PBRXL
TIME MARGIN	-PTM
Adjacent Channel Power Menu	
ACP FAST, or ACP STD	Either _ACPMT and _ACP, or _ACPMT, _ACPS, and _ACPM
CHANNEL POWER	_CHPWR, or _CHPS and _CHPM
POINTS/SWEEP	_NP
System Menu	
MONITOR BAND	_MBND, or _MBS and -MBM
MONITOR CHAN	_MCH, or _MCS and _MCM
Spurious Menu	
UNIQ WRD UP DOWN	_ddUNIQWD
FT ACQ ON OFF	_FTACQ
MEASURE SPUR	_SPURZ
SPURIOUS IN BAND *or*	
SPURIOUS OUT BAND	_SPURMT, SPURSET
SPURIOUS HARMONIC	_SPURH
SPUR TX RX	_SPURM
SEARCH TIME	_SSST or _SSSTI

Table 5-l. Functional Index (continued)

PHS Softkey	Corresponding Remote Command Sequence
Post-Measurement Menu	
AUTO CHANNEL	_ACH
CHANNEL NUMBER	-CH
MEAS TOP BOT	_TOP
REPEAT MEAS	-RPT
TRACE ACTIVE	_TA
TRACE COMPARE	-TC
TRIG DELAY	_TRIGD
VIEW TBL TRCE	_TBL
Digital Demod Menu	
STATUS	_ddSTATUS
Digital Demod Modulation Accuracy Menu	
MODULATN ACCURACY	_MODACC
SINGLE CONT	_ddCONT
FULL PARTIAL	_ddPARTIAL
AVERAGE ON OFF	_ddAVG and _ddNAVG
EVM CORR ON OFF	_ddEVMCORR
SAVE MEAS ON OFF	_ddSAVMEAS
Digital Demod Evm Cal Menu	
CAL EVM	_CALEVM
PHASE ERROR	-ddPHASERR
Digital Demod Graphs Menu	
EVM vs SYM	_ddCONSTLN and _IQGRAPH
I-Q PATTERN	_ddCONSTLN and _IQGRAPH
8 POINT CONSTLN	_ddCONSTLN and _IQGRAPH
SINGLE CONT	_ddCONT
SAVE MEAS UN OFF	_ddSAVMEAS
Digital Demod Data Menu	
DATA BITS	_DATABITS
SINGLE CONT	_ddCONT
SAVE MEAS ON OFF	_ddSAVMEAS

Table 5-1. Functional Index (continued)

PHS Softkey	Corresponding Remote Command Sequence
Digital Demod Config Menu	
CHANNEL NUMBER	_CH
CHAN X CTR FREQ	_CFX
ERR MSG ON OFF	_ddERRM
DD TRIG	_ddTRIG
WRD SYNC ON OFF	_ddWSYNC
UNIQ WRD UP DOWN	_ddUNIQWD
FT ERR ON OFF	_ddFTERRM

Limit and Parameter Variables

The PHS measurements personality uses limit and parameter variables to perform the measurement tests. A limit variable is used to determine if a measurement results failed or passed (as displayed by the pass/fail message). A parameter variable is used to determine the spectrum analyzer settings for a measurement. Table 5-2 lists all the limit variables and parameter variables available for a PHS measurements personality command. For more information about using limit variables, see "To change the value of limit variables" in Chapter 6. For more information about using parameter variables, see "To change the value of parameter variables" in Chapter 6.

Table 5-2. Limit and Parameter Variables

Measurement	Variable Name	Description	Units	Default Value
		General		
	_CHSP	Channel spacing.	Hz	300000
	_CMIN	Minimum amplitude level for a signal to be detected as a carrier.	dBm	-20
	-DTC	A time offset that is added to the internal gate delay for time-gating. -DTC compensates for time delays caused by the spectrum analyzer hardware.	μs	0.5
	_FCF	Contains the frequency calibration factor for improving the dynamic range of the power versus time measurements. If -FCF is a 0, it indicates that the frequency self-calibration routine needs to be performed. If _FCF is a − 1 or a 1, it indicates that the frequency self-calibration routines were performed after the personality was loaded into spectrum analyzer memory.	None	0
	-VTM	Specifies the maximum difference between the reference level and the video trigger position.	dB	30
		Power Measurements		
Antenna power	_CPNS	Specifies the number of sweeps used for the antenna power measurement.	None	4
	_CPXL	The lower limit for the antenna power level.	dBm	0
	_CPXU	The upper limit for the antenna power level.	dBm	0*
Carrier off power	-CONS	Specifies the number of sweeps used for the carrier off power measurement.	None	2
	-COPVB	Specifies the video bandwidth used for carrier off power in-band search.	Hz	100,000
	_CORL	Specifies the reference level for the carrier off power measurement.	dBm	-10
	_COXA	The maximum limit mean carrier off power.	dBm	-40.97
Occupied bandwidth	_OBBWX	The maximum limit for the occupied bandwidth.	Hz	288000
	_OBFEX	The maximum limit for the frequency error.	Hz	6000
	_OBNS	Specifies the number of sweeps used for the occupied bandwidth measurement.	None	1
	_OBPCT	Specifies the percent of the occupied bandwidth.	Percent	99

The pass or fail message is not displayed when this variable is set to 0.

Table 5-2. Limit and Parameter Variables (continued)

Measurement	Variable Name	Description	Units	Default Value
Power versus Time Measurements				
Power versus time burst	_PBMP	Sets how far from the mean carrier the burst width is measured.	dBc	-14
	-PBXL	The lower limit for the width of a burst.	μs	572.9
	-PBXU	The upper limit for the width of a burst.	μs	598.9
Power versus time falling	_PRMPL	Sets where on the falling edge of the trace the measurement for the release time should end.	dBm	-37
	-PRMPU	Sets where on the falling edge of the trace the measurement for the release time should begin (referenced to the mean carrier power).	dBc	-14
	_PRXL	The lower limit for the release time for a burst.	μs	0
	_PRXU	The upper limit for the release time for a burst.	μs	13
Power versus time rising	-PAMPL	Sets where on the rising edge of the trace the measurement for the attack time should begin.	dB	-37
	-PAMPU	Sets where on the rising edge of the trace the measurement for the attack time should end (referenced to the mean carrier power).	dBc	-14
	_PAXL	The lower limit for the attack time for a burst.	μs	0
	_PAXU	The upper limit for the attack time for a burst.	μs	13
Adjacent Channel Power Measurements				
Adjacent channel power	ACPNS	Specifies the number of sweeps used for the adjacent channel power measurement.	None	1
	-ACPXA	The maximum limit for adjacent channel power (600 kHz separation).	dBm	-30.97
	-ACPXB	The maximum limit for alternate channel power (900 kHz separation).	dBm	-36.02

Table 5-2. Limit and Parameter Variables (continued)

Measurement	Variable Name	Description	Units	Default Value
Spurious Measurements				
spurious Emission	_SENS	Specifies the number of sweeps used for spurious emission measurements.	none	4
	_SEXA	The maximum limit for in-band spurious emission.	none	-36.02
	_SEXB	The maximum limit for transmitter out-of-band spurious emission.	dBm	-26.02
	_SEXC	The maximum limit for receiver out-of-band spurious emission.	dBm	-53.98
	_SSIVB	Specifies the video bandwidth used for spurious search in-band.	Hz	10,000
	_SSIZL	Specifies the zero span limit from carrier frequency. Set 2 MHz for MKK method. Set 1 MHz for RCR standard method.	Hz	2,000,000
Digital Demodulator Based Measurements				
dodulation accuracy	-EVMRMSXO	RMS EVM, 1 burst mode	Percent	12.5
	_MERRX	RMS magnitude error	Percent	33
	_PERRX	RMS phase error	Degrees	50
	-EVMPKX	Peak EVM	Percent	99
	_IQOFSX	I-Q origin offset	dB	-20
	_CFERRXP	Frequency error	Hz	5754
	-ddSDF	Standard deviation factor		3.13

Descriptions of the Programming Commands

This section contains the descriptions of the PHS measurements personality programming commands. The commands are listed alphabetically.

See the programming examples in Chapter 6 for more information about how to make a measurement remotely, and how to extract the measurement results from a variable, array, or trace.

_ACH
Auto Channel

Syntax

The _ACH command automatically tunes to the channel having the highest carrier power level. _ACH is similar to AUTO CHANNEL , but unlike AUTO CHANNEL -ACH does not repeat the last measurement.

Example

OUTPUT718;"_ACH;"

Measurement State: Whenever _ACH is executed, it returns a value when the auto channel function is completed.

Measurement State Results

Value	Description
1	The command was successfully completed.
2	The command was aborted. _ACH is aborted if a carrier could not be found. (To be considered a carrier, the amplitude level of the signal must be greater than _CMIN.)

See Also

"To select a channel with the auto channel command" in Chapter 6.

-ACP
Adjacent Channel Power

Syntax

xacp

Measures the adjacent channel power of the transmitter. Depending on the setting of _CC and, _ACPMT, _ACP is equivalent to AGP FAST, or AGP STD .

Example

```
OUTPUT 718;"MOV _ACPMT,1;"    Selects a normal, multichannel sweep.
OUTPUT 718;"_ACP;"            Performs the adjacent channel power measurement.
```

Executing _ACP does the following:

1. Performs the adjacent channel power measurement. How the adjacent channel power measurement is performed depends on the settings of _CC and _ACPMT. See Table 5-3 for more information.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in variables and a trace.

The following table describes how the settings of _CC and -ACPMT change how _ACP measures the adjacent channel power.

Table 5-3. Settings for the _ACP Measurement

_CC Setting	-ACPMT Setting	Result
0 (burst)	1 (multichannel sweep)	_ACP performs the adjacent channel measurement with one sweep. Equivalent softkey is ACP FAST.
0 (burst)	2 (single channel per sweep)	-ACP performs the adjacent channel measurement, one channel per measurement sweep. Equivalent softkey is ACP STD
1 (continuous carrier)	1 (multichannel sweep)	ACP performs the adjacent channel measurement with one sweep. With a faster sweep time than burst ACP measurement. Equivalent softkey is ACP FAST.
1 (continuous carrier)	2 (single channel per sweep)	_ACP performs the adjacent channel measurement, one channel per measurement sweep. With a faster sweep time than burst ACP measurement. Equivalent softkey is ACP FAST.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If _CC Is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If _CC Is set to continuous carrier, the carrier must be a nonburst carrier.)

Measurement Results: The results of the _ACP command are stored in traces and variables as described in the following two tables.

Measurement Results

Variable or Trace	Description	Units
TRA	**ACP and ACP CH/SWP** Trace **A** contains the swept RF spectrum that was used to calculate the adjacent and alternate channel powers.	Determined by the trace data format (TDF) command.
_NUMF	Indicates if the adjacent channel power was within the measurement limits. The measurement limits are determined by -ACPXA and -ACPXB. See Table 5-2 for more information about the measurement limits. ■ If _NUMF is 0, the numeric results were within the limits. ■ If _NUMF is 2, the numeric results were greater than the measurement limits.	None

Unlike the other measurement commands, -ACP uses arrays to store measurement results. (See the following table for a list of the arrays and the measurement results that are stored in each array.) Each array contains seven elements, and each element is used to store the measurement results for a specific channel. The seven elements corresponds to the following channels:

1 Lower adjacent
2 Upper adjacent
3 Lower alternate
4 Upper alternate
5 Unused
6 Unused
7 Carrier

For example, you would query the second element of _ACPR ("_ACPR[2]?;") to determine the transient power for the upper adjacent channel.

Table 5-4. Measurement Results (Array Information)

Array Name	Description	Units
-ACPR	The -ACPR array elements contain the ACP random ratio.	0.10 dBm
-ACPRC	The -ACPRC array elements contain the ACP random ratio.	0.10 dB

Related Commands: _ACPMT, and -CC.

Limit and Parameter Variables: _ACP uses -ACPXA, -ACPXB, and _ACPNS. See Table 5-2 for more information.

Alternate Commands: You can also use the _ACPS and -ACPM commands to measure adjacent channel power.

-ACPM
Adjacent Channel Power Measurement

Syntax

xacpm

Performs the adjacent channel power measurement.

Example

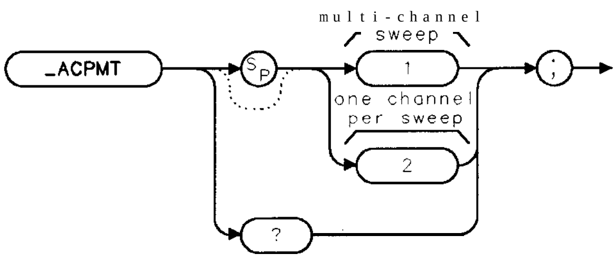
OUTPUT718;"_ACPS;"	*Sets up the adjacent channel power measurement.*
OUTPUT 718 ; “ST 4SC ;"	*Changes the sweep time to 4 seconds.*
OUTPUT 718; "_ACPM;"	***Performs** the adjacent channel power measurement.*

Before using _ACPM, you need to use the _ACPS command to perform the setup for the adjacent channel power measurement. The _ACPS and _ACPM commands are useful if you want to change the spectrum analyzer settings before making an adjacent channel power measurement. The combination of the _ACPS and -ACPM commands is equivalent to either ACP FAST, or ACP STD . (See Table 5-3 for more information.)

See the description for -ACP for information about the measurement state and measurement results from an adjacent channel measurement.

-ACPMT
Adjacent Channel Power Measurement Type

Syntax



xacpmt

Allows you to specify how the adjacent channel power measurement is performed. See Table 5-3. The default for -ACPMT is 1.

Example

`OUTPUT 718;"MOV _ACPMT,1;"`	*Specifies a multi-channel sweep for the adjacent channel measurement.*
`OUTPUT 718;"_ACP;"`	*Performs the adjacent channel measurement.*

Related Commands: _ACPMT is used by _ACP and -ACPM (the adjacent channel measurement commands).

Query Example

```
OUTPUT718;"_ACPMT?;"
```

The query response will be the current value of _ACPMT.

_ACPS
Adjacent Channel Power Setup

Syntax

xacps

Performs the setup for the adjacent channel power measurement.

Example

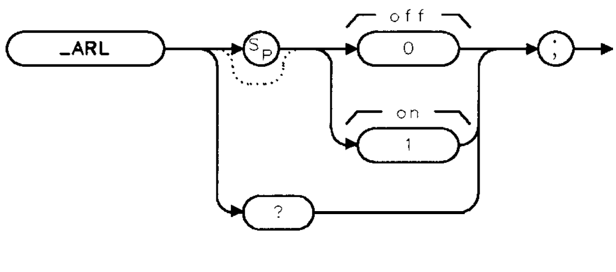
OUTPUT 718;"_ACPS;"	*Sets up the adjacent channel power measurement.*
OUTPUT 718;"ST 4SC;"	*Changes the sweep time to 4 seconds.*
OUTPUT 718;"_ACPM;"	***Performs** the adjacent channel power measurement.*

After using _ACPS, you need to use the -ACPM command to perform the adjacent channel power measurement. The _ACPS and -ACPM commands are useful if you want to change the spectrum analyzer settings before making an adjacent channel power measurement. The combination of the _ACPS and _ACPM commands is equivalent to ACP FAST, or ACP STD . (See Table 5-3 for more information.)

Related Commands: _ACPS must be executed before -ACPM.

-ARL
Automatic Reference Level

Syntax



Selects whether the personality automatically changes the reference level.

If _ARL is set to 0, the automatic reference level adjustment is turned off. If _ARL is set to 1, the automatic reference level adjustment is turned on. The default value for _ARL is 1.

Example

`OUTPUT 718;"MOV _ARL,0;"` *Turns off the automatic reference level adjustment.*

For most measurements, the personality automatically adjusts the reference level so that the signal is placed near the top graticule on the spectrum analyzer display. (The signal is placed near the top graticule for optimum amplitude accuracy and dynamic range.) By setting _ARL to 0, you can adjust the reference level, instead of allowing the personality to adjust the reference level automatically. Setting _ARL to 0 reduces the test time for a measurement. For example, you could use _ARL to reduce the test time of a measurement as follows:

1. Set _ARL to 1.
2. Perform the antenna power measurement. You need to perform the antenna power measurement because the antenna power measurement adjusts the reference level for the given transmitter setting.
3. Set _ARL to 0.
4. Perform the other measurements for a given transmitter setting. (If you change the transmitter setting, you must repeat steps 1 through 3 again.)

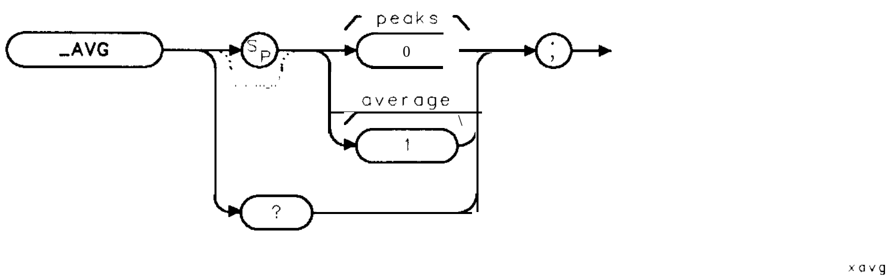
Query Example

`OUTPUT 718;"_ARL?;"`

The query response will be the current value of _ARL.

-AVG
Average or Peaks for Power versus Time

Syntax



Selects how the trace data for a power versus time measurement is taken: as a trace that contains an average of the trace data, or as a trace for minimum trace peaks and a trace for the maximum trace peaks. The -AVG command is equivalent to MEASURE AVG PKS .

If _AVG is set to 0, it is set to measure both the minimum and maximum peaks of the bursts. If _AVG is set to 1, it is set to measure the average of the bursts. The default value for -AVG is 1.

Example

OUTPUT 718;"MOV _AVG,0;" *Sets AVG to measure the minimum and maximum peaks **of** the burst.*

You should set _AVG prior to executing _PBURST, _PFRAME, _PRISE, or _PFALL. If you set _AVG to 1, then the averaged trace results will be placed in trace A. If you set -AVG to 0, the maximum trace peaks will be placed in trace B, and the minimum trace peaks will be placed in trace C. Because _PNS determines the number of sweeps, the value of _PNS must be greater than 1 to obtain averaged trace results.

Query Example

OUTPUT 718;"_AVG?;"

The query response will be the current value of -AVG.

_CALEVM
Calibrate EVM

Syntax

xcalevm

Performs a 20 average modulation accuracy measurement , calculates the phase correction value, and displays the results of the EVM calibration on screen. -CALEVM is equivalent to CAL EVM.

Example

`OUTPUT718;"_CALEVM;"` *Performs EVM calibration.*

Executing -CALEVM does the following:

1. Performs a 20 average modulation accuracy measurement and calculates the phase correction value.
2. Returns the measurement state. The measurement state indicates if the measurement was complete or aborted.
3. If the measurement was successfully completed, the measurement result is placed in a variable and -ddEVMCORR is set to 1. Both the value of the variable and the value of _ddEVMCORR retain their values through spectrum analyzer power cycles.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Note -CALEVM assumes a precision, low EVM calibration source is connected to the spectrum analyzer. It also assumes the RMS phase error of the precision source has been entered using the _ddPHASERR command and the digital demodulator configuration is correct for the calibration source signal. See “To calibrate and correct for spectrum analyzer EVM inaccuracies due to uncertainty in the phase error measurement” in Chapter 2, “Making Measurements.”

_CALEVM Calibrate EVM

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If -CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If _CC is set to continuous carrier, the carrier must be a non-burst carrier.)
6	Digital demodulator hardware not present or not correct (151) option.
7	Digital demodulator firmware not correct option.
8	Digital demodulator firmware revision date too old.
9	Carrier frequency error too high.
10	Frame trigger acquisition failed.
11	Time record invalid.
12	Frame trigger re-position failed.
13	Sync word errors present. *
14	Results may not be accurate: origin offset too high. *
15	Ref level auto set failed, over range.
16	Ref level auto set failed, under range.
17	Sync word errors.
18	Clock signal too low, data may have to be randomized.
19	Results may not be accurate: pass 1 and 2 bit compare error.*
23	EVM calibration failure, EVM CORR not enabled.
24	CF auto set failed.
26	Results may not be accurate: EVM exceeds system limit.*
30	Measurement failed, unspecified failure.
Measurement data present, all others abort the measurement and do not store measurement data.	

Measurement Results: The result of the -CALEVM command is stored in the following table.

Measurement Results

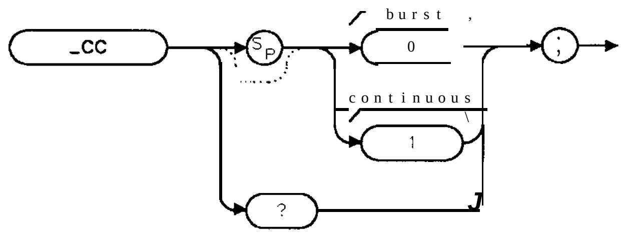
Variable	Description	Units
-ddPCVC	A variable that contains the calculated phase correction value.	degrees

If the calculated phase correction value (measured mean RMS phase error – entered calibration source RMS phase error) yields a negative number, _ddPCVC is fixed at 0 and the EVM calibration fails with a measurement state result of 23.

Related Commands: -ddEVMCORR, -ddPHASERR

_CC
Continuous Carrier or Burst Carrier

Syntax



XCC

Allows you to specify if the PHS carrier to be measured is continuous or burst. The -CC command is equivalent to BURST CONT.

If XC is set to 0, the personality is set to measure a burst carrier. If _CC is set to 1, the personality is set to measure a continuous carrier. The default value for CC is 0.

Example

OUTPUT 718;"MOV _CC,0;" *Sets _CC for a burst carrier.*

Related Commands: -DEFAULT sets -CC to 0.

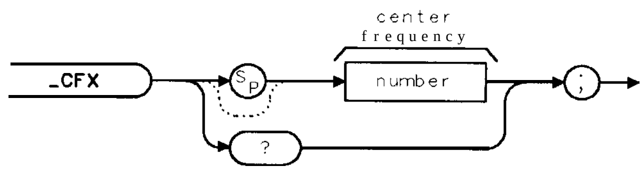
Query Example

OUTPUT 718;"-CC?;"

The query response will be the current value of -CC.

-CFX
Center Frequency for Channel X

Syntax



xcfx

Allows you to enter the frequency of the channel that you want to measure. The _CFX command is equivalent to CWAN X CTR FREQ .

-CFX can accept a real number. The measurement unit for _CFX is Hz. The default value for -CFX is 300 MHz.

Example 1

OUTPUT 718;"MOV _CFX,1895E6;" *Sets the channel number to channel X and the center frequency of the spectrum analyzer to 1895 MHz.*

Example 2

OUTPUT 718;"MOV _CFX,_CFX;" *Sets the channel number to channel X and the center frequency of the spectrum analyzer to the value for _CFX that was previously entered.*

Related Commands: -DEFAULT sets _CFX to 300 MHz.

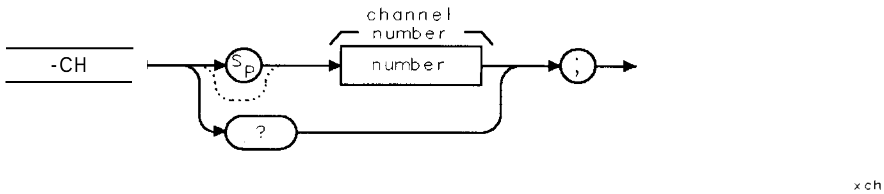
Query Example

OUTPUT 718;"_CFX?;"

The query response will be the current frequency for channel X.

_CH
Channel Number

Syntax



Allows you to enter the channel number for the RF channel you want to measure. The _CH command is equivalent to CHANNEL NUMBER .

_CH can accept an integer from -9999 to 9999. The default for -CH is 1.

Example

OUTPUT 718;"MOV _CH,2;" *Sets the channel number to 2.*

Related Commands: -DEFAULT sets _CH to 1.

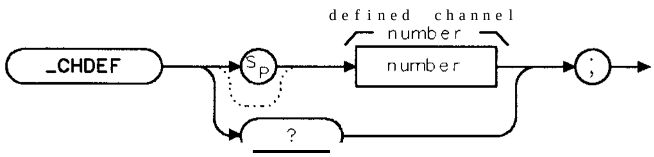
Query Example

OUTPUT 718;"_CH?;"

The query response will be the current channel number.

_CHDEF
Define Channel

Syntax



xchdef

Allows you to specify the channel number that corresponds to the frequency as defined in _FDEF. The XHDEF command is equivalent to DEFINE &HAN.

_CHDEF can accept an integer from -9999 to 9999.

Example

`OUTPUT 718;"MOV _CHDEF,3;"` *Sets defining channel to 3.*

Related Commands: _CHSP (Table 5-2), -DEFAULT sets _CHDEF to 0.

Query Example

`OUTPUT718;"_CHDEF?;"`

The query response will be the current defining channel.

_CHPM
Channel Power Measurement

Syntax

xchpm

Performs the channel power measurement.

Example

OUTPUT 718;"_CHPS;"	*Sets up the channel power measurement.*
OUTPUT 718;"RB 10KHZ;"	*Changes the resolution bandwidth to 10 kHz.*
OUTPUT 718;"_CHPM;"	*Performs the channel power measurement.*

Before using _CHPM, you need to use the _CHPS commands to perform the setup for the channel power measurement. The _CHPS and _CHPM commands are useful if you want to change the spectrum analyzer settings before making a channel power measurement. The combination of the _CHPS and _CHPM commands is equivalent to the CHPWR command and CHANNEL POWER.

See the description for CHPWR for information about the measurement state and measurement results from a channel power measurement.

Related Commands: _CH determines the channel that is measured.

_CHPS
Channel Power Setup

Syntax

Performs the setup for the transmitter channel power measurement.

Example

OUTPUT 718; "_CHPS;"	*Sets up the channel power measurement.*
OUTPUT 718;"RB10KHZ;"	*Changes the resolution bandwidth to 10 kHz.*
OUTPUT 718; "_CHPM;"	*Performs the channel power measurement.*

The _CHPS and _CHPM commands can be used if you want to change the spectrum analyzer settings before making a channel power measurement. The combination of the _CHPS and _CHPM commands is equivalent to the -CHPWR command and CHANNEL POWER.

_CHPWR
Channel Power

Syntax

xchpwr

Measures the channel power. The -CHPWR command is equivalent to CHANNEL POWER .

Example

OUTPUT 718;"_CHPWR;" *Performs the channel power measurement.*

Executing -CHPWR does the following:

1. Performs the channel power measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in variables and in a trace.

Measurement State: A “ 1” is returned to the external controller to indicate when the measurement is finished.

Measurement Results: The results of the channel power measurement are placed in the variables and trace shown in the following table.

Measurement Results

Variable or Trace	Description	Units
-CHPA	A variable that contains the channel power amplitude.	dBm
TRA	TRA is trace A. Trace A contains the power waveform that was used to test for channel power. TRA contains 1 through _NP data points.	Determined by the trace data format (TDF) command

Alternate Commands: The _CHPS and _CHPM commands can be used instead of _CHPWR if you want to change the spectrum analyzer settings before making a channel power measurement.

Related Commands: -CH determines the channel that is measured.

_COM
Carrier Off Power Measurement

Syntax

Performs the carrier off power measurement.

Example

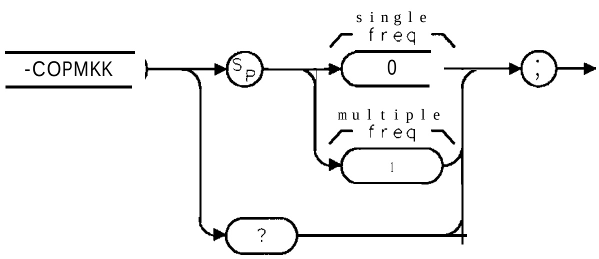
OUTPUT 718;"_COS;"	*Sets up the carrier off power measurement.*
OUTPUT 718;"VB 300KHZ;"	*Changes the video bandwidth to 300 kHz.*
OUTPUT 718;"_COM;"	*Performs the carrier off power measurement.*

Before using _COM, you need to use the -COS command to perform the setup for the carrier off power measurement. The _COS and -CPM commands are useful if you want to change the spectrum analyzer setting before making a carrier off power measurement. The combination of the _COS and _COM commands is equivalent to the _COPWR command and CARRIER OFF PWR .

See the description for _CPWR for information about the measurement state and measurement results from carrier off power measurement.

-COPMKK Carrier Off Power MKK Mode

Syntax



xcopmkk

Allows you to specify how the MKK zero span carrier off power measurement is performed. See Table 5-5. The default for -COPMKK is 1. The _COPMKK command is equivalent to COP ZSP SGL MULT .

Example

OUTPUT 718;"MOV _COPMT,1;"	*Specifies MKK Zero Span Method for the carrier off power.*
OUTPUT 718;"MOV _COPMKK,0;"	*Specifies single frequency measurement mode for MKK Zero Span Method.*
OUTPUT718;"_COPWR;"	*Performs the carrier off power measurement.*

Related Commands: -COPMKK is used by -COP, _COS, _COM (the carrier off power measurement commands).

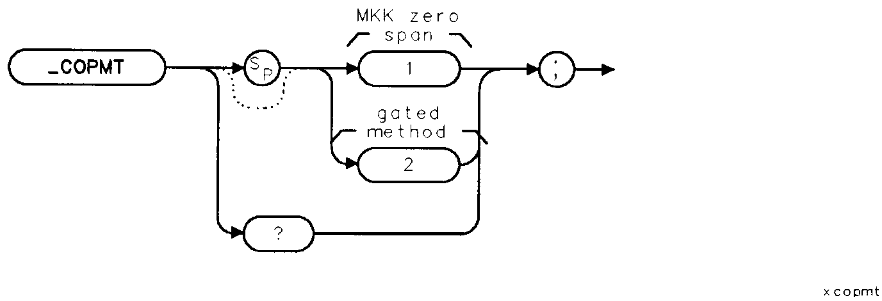
Query Example

OUTPUT718;"_COPMKK?;"

The query response will be the current value of _COPMKK.

-COPMT
Carrier Off Power Measurement Type

Syntax



Allows you to specify how the carrier off power measurement is performed. See Table 5-5. The default for _COPMT is 1. The XOPMT command is equivalent to COP TYPE ZSP GTD .

Example

`OUTPUT 718;"MOV _COPMT,1;"`	*Specifies MKK Zero Span Method for the carrier off power.*
`OUTPUT 718;"_COPWR;"`	*Performs the carrier off power measurement.*

Related Commands: XOPMT is used by _COP, _COS, _COM (The carrier off power measurement commands).

Query Example

```
OUTPUT718;"_COPMT?;"
```

The query response will be the current value of _COPMT.

_COPWR
Carrier Off Power Measurement

Syntax

xcopwr

Measures the transmitter carrier off power. The XOPWR command is equivalent to CARRIER OFF PWR .

Example

OUTPUT 718; "_COPWR;" *Performs the carrier off power measurement.*

Executing XOPWR does the following:

1. Performs the carrier off power measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in variables and in a trace.

Table 5-5. Setting for the -COPWR Measurement

_COPMT Setting	Result
1	_COPWR performs the carrier off power measurement with MKK zero span method. Equivalent softkey is CUP TYPE ZSP GTD. Refer to _COPMKK.
2	-COPWR performs the carrier off power measurement with MKK (and RCR) gated method. Equivalent softkey is CDP TYPE ZSP GTD
-COPMKK Setting*	
0	-COPWR performs the carrier off power measurement with MKK zero span method at the single (carrier) frequency. Equivalent softkey is COP ZSP SGL MULT
1	-COPWR performs the carrier off power measurement with MKK zero span method, with MKK recommended multi-frequency measurement. Equivalent softkey is COP ZSP SGL MULT .
* -COPMKK affects _COPMT, 1 only.	

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

_COPWR Carrier Off Power Measurement

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If -CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If -CC is set to continuous carrier, the carrier must be a nonburst carrier.)
The following are possible only if -FTACQ is set to 1.	
6	Digital demodulator hardware not present or not correct option (151).
7	Digital demodulator firmware not correct option.
8	Digital demodulator firmware revision date too old.
10	Frame trigger acquisition failed. (See Chapter 4, "Error Messages and Troubleshooting.")

Measurement Results: The results of the carrier off power measurement are placed in variables and trace shown in the following table.

Measurement Results

Variable or Trace	Description	Units
_NUMF	Indicates if the carrier off power was within the measurement limits. The measurement limits are determined by _COXU. Bee Table 5-2 for more information about measurement limits. ■ If _NUMF is 0, the numeric results were within the limits. ■ If _NUMF is 2, a numeric result was greater than the upper measurement limit.	None
_COA	A variable that contains the mean carrier off power.	dBm
_COAC	A variable that contains the ratio of the carrier off power to the mean power measured in the last antenna power measurement.	dB
TRA	TRA is trace A. Trace A contains the power waveform that was used to test for carrier off power.	Determined by the trace data format (TDF) command

Limit and Parameter Variables: -COPWR uses COXU, _CORL, COPVB, and -CONS. See Table 5-2 for more information.

Alternate Commands: The _COS and _COM commands can be used instead of _COPWR if you want to change the spectrum analyzer setting before making a carrier off power measurement.

_COS
Carrier Off Power Setup

Syntax

xcos

Performs the setup for the carrier off power measurement.

Example

`OUTPUT 718;"_COS;"`	*Sets up the carrier off power measurement.*
`OUTPUT 718;"VB 300KHZ;"`	*Changes the video bandwidth to 300 kHz.*
`OUTPUT 718;"_COM;"`	*Performs the carrier off power measurement.*

The _COS and _COM commands can be used if you want to change the spectrum analyzer setting before making a carrier off power measurement. The combination of the _COS and _COM commands is equivalent to the -COPWR command and CARRIER OFF PWR .

-CPM
Carrier Power Measurement

Syntax

xcpm

Performs the antenna (carrier) power measurement.

Example

```
OUTPUT 718;"_CPS;"        Sets up the antenna power measurement.
OUTPUT 718;"RB 10KHZ;"    Changes the resolution bandwidth to 10 kHz.
OUTPUT 718;"_CPM;"        Performs the antenna power measurement.
```

Before using -CPM, you need to use the _CPS command to perform the setup for the antenna power measurement. The _CPS and -CPM commands are useful if you want to change the spectrum analyzer settings before making an antenna power measurement. The combination of the _CPS and _CPM commands is equivalent to the -CPWR command and ANTENNA POWER.

See the description for -CPWR for information about the measurement state and measurement results from an antenna power measurement.

_CPS
Carrier Power Setup

Syntax

xcps

Performs the setup for the antenna (carrier) power measurement.

Example

`OUTPUT 718;"_CPS;"`	*Sets up the antenna power measurement.*
`OUTPUT 718;"RB 100KHZ;"`	*Changes the resolution bandwidth to 100 kHz.*
`OUTPUT 718;"_CPM;"`	*Performs the antenna power measurement.*

After using _CPS, you need to use the CPM command to perform the antenna power measurement. The _CPS and -CPM commands are useful if you want to change the spectrum analyzer settings before making an antenna power measurement. The combination of the _CPS and -CPM commands is equivalent to the -CPWR command and ANTENNA POWER.

_CPWR
Carrier Power

Syntax

xcpwr

Measures the antenna (carrier) power. The _CPWR command is equivalent to ANTENNA POWER .

Example

```
OUTPUT 718;"_CPWR;"
```

Executing _CPWR does the following:

1. Performs the antenna power measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in variables and a trace.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The antenna power was too low.
3	The antenna power was too high.
4	The carrier was not a burst carrier. (If _CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If -CC is set to continuous carrier, the carrier must be a nonburst carrier.)

Measurement Results: The results of _CPWR are stored in the variables and trace shown in the following table.

Measurement Results

Variable or Trace	Description	Units
_NUMF	Indicates if the antenna power was within the measurement limits. The measurement limits are determined by _CPXU and _CPXL. See Table 5-2 for more information about measurement limits. ■ If _NUMF is 0, the numeric result was within the limits. ■ If _NUMF is 1, the numeric result was less than the lower limit (_CPXL). ■ If _NUMF is 2, the numeric result was greater than the upper limit (_CPXU).	None
-CPA	A variable that contains the mean antenna power amplitude.	dBm
_CPW	A variable that contains the mean antenna power in watts.	W
TRA	TRA is trace A. Trace A contains the power waveform that was used to test for antenna power.	Determined by the trace data format (TDF) command

Limit and Parameter Variables: -CPWR uses _CPNS, _CPXL, and CPXU. See Table 5-2 for more information.

Alternate Commands: If you want to change the spectrum analyzer settings before making an antenna power measurement, use -CPS and -CPM instead of the -CPWR command.

See Also

"To measure the antenna power" in Chapter 5.

-DATABITS
Demodulated Data Bits

Syntax

xdatabits

Demodulates a single transmitter burst. The _DATABITS command is equivalent to DATA BITS .

Example

`OUTPUT718;"_DATABITS;"` *Performs the data bits measurement.*

Executing -DATABITS does the following:

1. Performs the demodulated data bits measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in an array.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If _CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If -CC is set to continuous carrier, the carrier must be a non-burst carrier.)
6	Digital demodulator hardware not present or not correct (151) option.
7	Digital demodulator firmware not correct option.
8	Digital demodulator firmware revision date too old.
9	Carrier frequency error too high.
10	Frame trigger acquisition failed.
11	Time record invalid.
12	Frame trigger re-position failed.
13	Sync word errors present. *
14	Results may not be accurate: origin offset too high.'
15	Ref level auto set failed, over range.
16	Ref level auto set failed, under range.
17	Sync word errors.
18	Clock signal too low, data may have to be randomized.
19	Results may not be accurate: pass 1 and 2 bit compare error.*
21	Results may not be accurate, phase corr. too high.
22	Results may not be accurate, EVM corr. too high.
24	CF auto set failed.
26	Results may not be accurate: EVM exceeds system limit. *
30	Measurement failed, unspecified failure.

* Measurement data present, all others abort the measurement and do not store measurement data.

Measurement Results: The results of the _DATABITS command are stored in an array of 240 elements.

Measurement Results

Array Name	Description	Units
-BITS	The -BITS array elements contain the demodulated data bits.	None

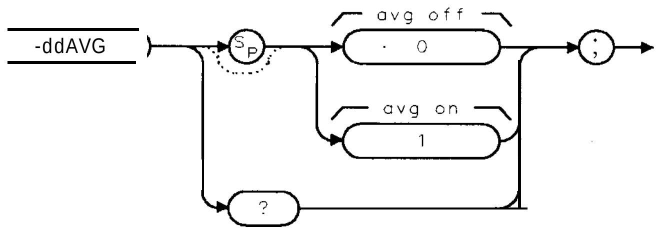
Related Commands: Use _ddNOPRT to specify if the data bits are to be displayed on the spectrum analyzer screen as part of the -DATABITS command.

See Also

"To measure the demodulated data bits" in Chapter 6, "Programming Examples."

-ddAVG
Digital Demod Average Mode

Syntax



xddavg

Allows you to specify averaging mode for the _MODACC command. The_ddAVG command is equivalent to AVERAGE ON OFF .

If _ddAVG is set to 1, _MODACC will average the number of measurements specified by _ddNAVG. If _ddAVG is set to 0, _MODACC will execute without averaging. The default value of _ddAVG is 0.

Note that if -ddAVG is set to 1, -ddCONT will automatically be set to 0 when _MODACC is executed.

Example

OUTPUT718;"MOV _ddAVG,1;" *Set for average mode.*

Related Commands: -MODACC and -ddNAVG.

Query Example

OUTPUT718;"_ddAVG?;"

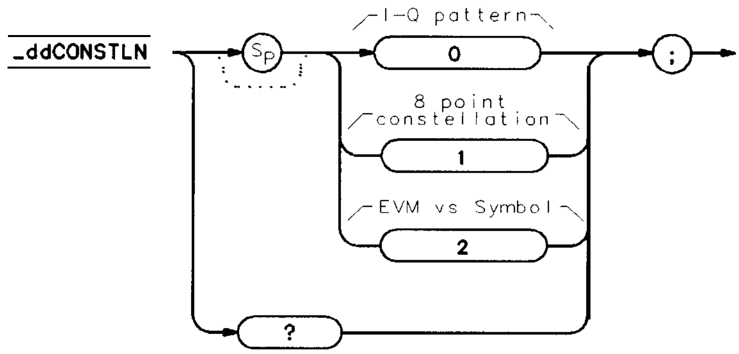
The query response will be the current value of -ddAVG.

See Also

"To measure the modulation accuracy using averaging" in Chapter 6, "Programming Examples."

_ddCONSTLN
Digital Demod Eight-Point Constellation Mode

Syntax



Allows you to specify which graph is displayed by the _IQGRAPH command.

If _ddCONSTLN is set to 0, _IQGRAPH will display the I-Q pattern diagram. If _ddCONSTLN is set to 1, _IQGRAPH will display the eight-point constellation diagram. If _ddCONSTLN is set to 2, _IQGRAPH will display the EVM vs Symbol graph. The default value of -ddCONSTLN is 0.

Example

`OUTPUT718;"MOV _ddCONSTLN,1;"` *Set for eight-point constellation.*

Related Commands: _IQGRAPH.

Query Example

`OUTPUT718;"_ddCONSTLN?"`

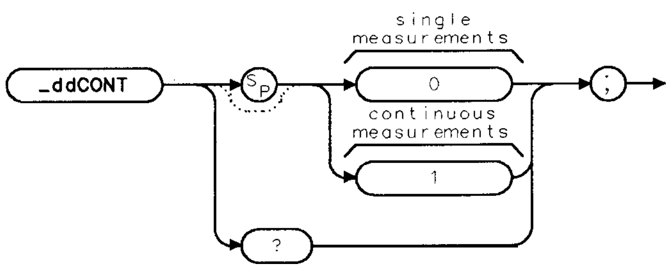
The query response will be the current value of _ddCONSTLN.

See Also

"To perform an I-Q pattern measurement" and "To make an eight-point constellation measurement" in Chapter 6, "Programming Examples."

_ddCONT
Digital Demod Continuous Measurement

Syntax



:ddcont

Allows you to specify if the digital demodulator based measurement is to be in a continuous mode. The _ddCONT command is equivalent to SINGLE CONT.

If -ddCONT is set to 0, single measurements will be made. If _ddCONT is set to 1, measurements will be continuous. The default value for _ddCONT is 0.

Note It is recommended that digital demodulator based measurements executed remotely be used in single measurement mode. That is, the value of -ddCONT should be 0. This allows the measurement to return a measurement state result when it is finished.

Example

`OUTPUT 718;"MOV _ddCONT,0;"` *Sets single measurement mode.*

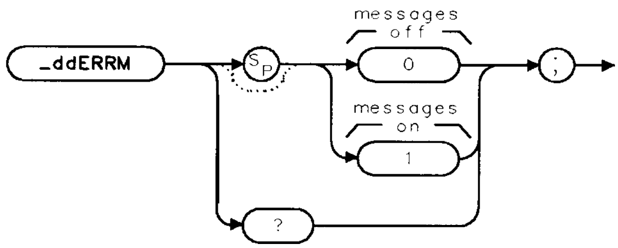
Query Example

`OUTPUT718;"_ddCONT?"`

The query response will be the current value of _ddCONT.

_ddERRM
Digital Demod Error Message

Syntax



xdderrm

Allows you to specify if digital demodulator based measurements will be made with all error messages and warnings enabled. The _ddERRM command is equivalent to ERR MSG ON OFF .

If -ddERRM is set to 1, digital demodulator based measurements will be made with all warnings enabled. If _ddERRM is set to 0, digital demodulator based measurements will be made regardless of **any** error conditions. The default value of _ddERRM is 1.

Note It is recommended that digital demodulator based measurements be made with error messages enabled.

Example

OUTPUT 718;"MOV _ddERRM,0;" *Disable error messages.*

Related Commands: -MODACC, -IQGRAPH, and -DATABITS.

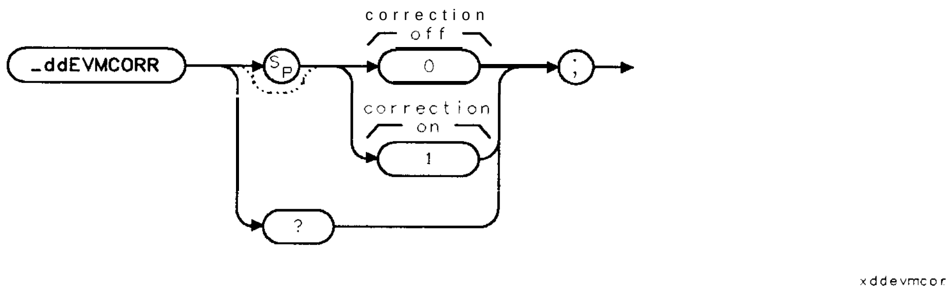
Query Example

OUTPUT718;"_ddERRM?;"

The query response will be the current value of _ddERRM.

_ddEVMCORR
Digital Demod EVM Correction Mode

Syntax



Allows you to specify if EVM correction is to be applied for the -MODACC command. The -ddEVMCORR command is equivalent to EVM CORR ON OFF .

If _ddEVMCORR is set to 1, _MODACC will use the phase correction value generated by the -CALEVM command to correct the measured RMS EVM and RMS phase error results. If _ddEVMCORR is set to 0, _MODACC will not apply correction. The default value of -ddEVMCORR is 0.

Note A successful EVM calibration must be done prior to enabling -ddEVMCORR.

Example

`OUTPUT 718;"MOV _ddEVMCORR,1;"` *Set for EVM correction.*

Related Commands: -MODACC, _CALEVM, -DEFAULT

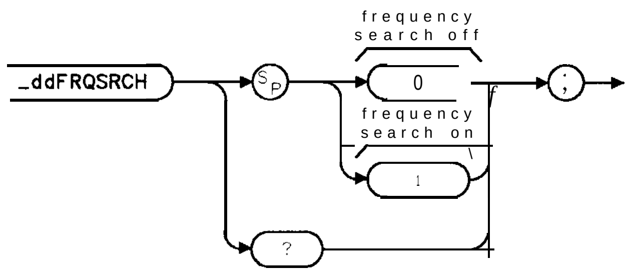
Query Example

`OUTPUT718;"_ddEVMCORR?;"`

The query response will be the current value of _ddEVMCORR.

-ddFRQSRCH
Digital Demod Frequency Search

Syntax



xfrqsrch

Allows you to enable a carrier frequency search at the start of a digital demodulator-based measurement. This search is done immediately after the carrier reference level is set.

If _ddFRQSRCH is set to 1, a carrier frequency search will be executed at the beginning of a digital demodulator-based measurement. If _ddFRQSRCH is set to 0, no search is done. The default value of _ddFRQSRCH is 0.

Example

OUTPUT 718;"MOV _ddFRQSRCH,1;" *Enable carrier frequency search.*

Related Commands: -MODACC, -IQGRAPH, -DATABITS, -DEFAULT

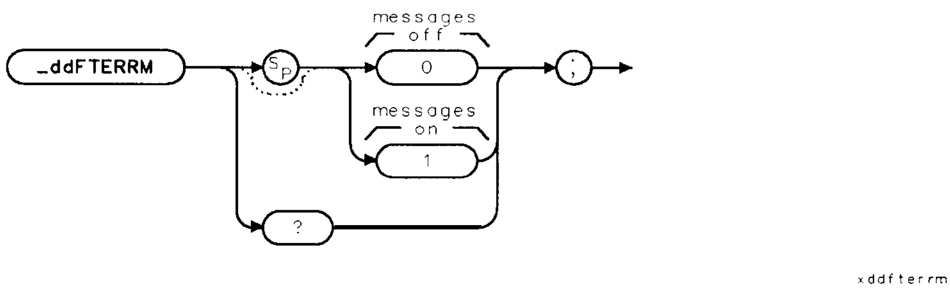
Query Example

OUTPUT718;"_ddFRQSRCH?;"

The query response will be the current value of _ddFRQSRCH.

_ddFTERRM
Digital Demod Frame Trigger Error Message

Syntax



Allows you to specify if digital demodulator based measurements will be made with frame trigger error messages and warnings enabled. The -ddFTERRM command is equivalent to FT ERR ON OFF.

If _ddFTERRM is set to 1, frame triggered digital demodulator based measurements will be made with all frame trigger warnings enabled. If -ddFTERRM is set to 0, frame triggered digital demodulator based measurements will be made regardless of any frame trigger error conditions. The default value of _ddFTERRM is 1. Note that -ddERRM has precedence over _ddFTERRM.

Note It is recommended that frame triggered digital demodulator based measurements be made with frame trigger error messages enabled.

Example

`OUTPUT 718;"MOV _ddFTERRM,0;"` *Disable FT error messages.*

Related Commands: -MODACC, -IQGRAPH, and -DATABITS.

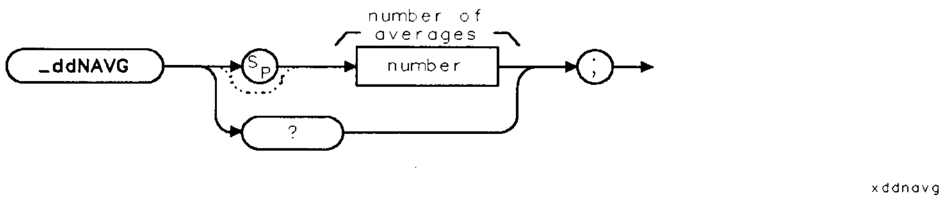
Query Example

`OUTPUT718;"_ddFTERRM?;"`

The query response will be the current value of _ddFTERRM.

_ddNAVG
Digital Demod Number of Averages

Syntax



Allows you to specify the number of measurements to average for the _MODACC command (if averaging has been enabled by the _ddAVG command). The _ddNAVG command is equivalent to AVERAGE **ON**.

_ddNAVG can accept an integer from 1 to 999. The default value for _ddNAVG is 10.

Example

`OUTPUT 718;"MOV _ddNAVG,20;"` *Average using 20 measurements.*

Related Commands: _MODACC, _ddAVG.

Query Example

`OUTPUT718;"_ddNAVG?;"`

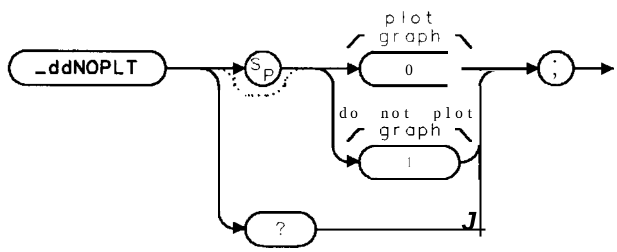
The query response will be the current value of _ddNAVG.

See Also

"To measure the modulation accuracy using averaging" in Chapter 6, "Programming Examples."

-ddNOPLT
Digital Demod NO PLOT Graphs

Syntax



Allows you to specify if the graphs are to be displayed on the spectrum analyzer screen as part of the _IQGRAPH command.

If _ddNOPLT is set to 1, the graphs are not displayed. If _ddNOPLT is set to 0, the graphs are displayed. The default value for _ddNOPLT is 0.

The -ddNOPLT command is used to speed up the _IQGRAPH command. If -ddNOPLT is set to 1, the time to execute the _IQGRAPH command will be decreased.

Example

`OUTPUT 718;"MOV _ddNOPLT,1;"` ***Do not plot graph.***

Related Commands: _IQGRAPH.

Query Example

`OUTPUT718;"_ddNOPLT?"`

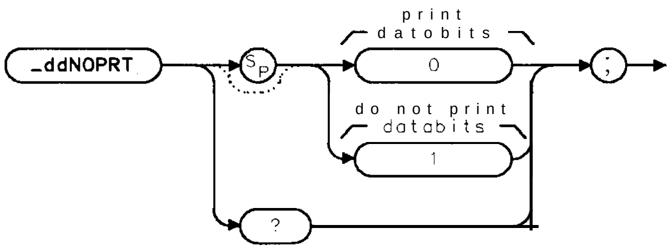
The query response will be the current value of _ddNOPLT.

See Also

"To measure the I-Q pattern" in Chapter 6, "Programming Examples."

_ddNOPRT
Digital Demod NO PRINT Data Bits

Syntax



xddnoprt

Allows you to specify if the data bits are to be displayed on the spectrum analyzer screen as part of the -DATABITS command.

If -ddNOPRT is set to 1, the data bits are not displayed. If -ddNOPRT is set to 0, the data bits are displayed. The default value for -ddNOPRT is 0.

The -ddNOPRT command is used to speed up the -DATABITS command. If _ddNOPRT is set to 1, the time to execute the -DATABITS command will be decreased.

Example

`OUTPUT 718;"MOV _ddNOPRT,1;"` *Do not print data bits.*

Related Commands: -DATABITS.

Query Example

`OUTPUT718;"_ddNOPRT?"`

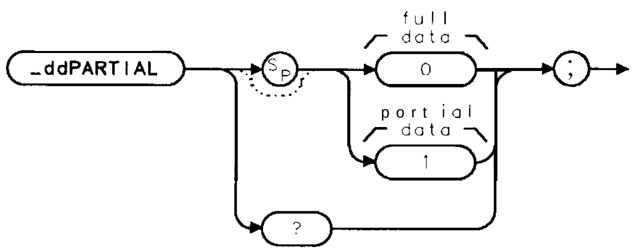
The query response will be the current value of -ddNOPRT.

See Also

"To measure the demodulated data bits" in Chapter 6, "Programming Examples."

-ddPARTIAL
Digital Demod Partial Data Mode

Syntax



xddpartial

Allows you to specify partial data mode for the -MODACC command. The -ddPARTIAL command is equivalent to FULL PARTIAL .

If _ddPARTIAL is set to 1, _MODACC will measure a partial set of the modulation accuracy data. If _ddPARTIAL is set to 0, _MODACC will measure the full set of modulation accuracy data. The default value of _ddPARTIAL is 0.

Example

OUTPUT 718;"MOV _ddPARTIAL,1;"   *Set for partial data mode.*

Related Commands: -MODACC.

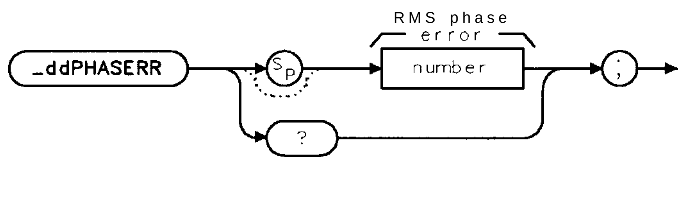
Query Example

OUTPUT718;"_ddPARTIAL?;"

The query response will be the current value of _ddPARTIAL.

_ddPHASERR
Digital Demod Calibration Source RMS Phase Error

Syntax



Allows you to specify the RMS phase error (in milli-degrees) of the calibration source used when the EVM calibration routine -CALEVM is executed. -ddPHASERR is equivalent to PHASE ERROR.

-ddPHASERR can accept an integer number from 0 to 9999. The default value for -ddPHASERR is 0.

Note The units for -ddPHASERR are milli-degrees. To enter 1.23 degrees of calibration source RMS phase error, enter 1230 into _ddPHASERR.

Example

`OUTPUT 718;"MOV_ddPHASERR,1230;"` *Enter 1.23" phase error:*

Related Commands: _CALEVM.

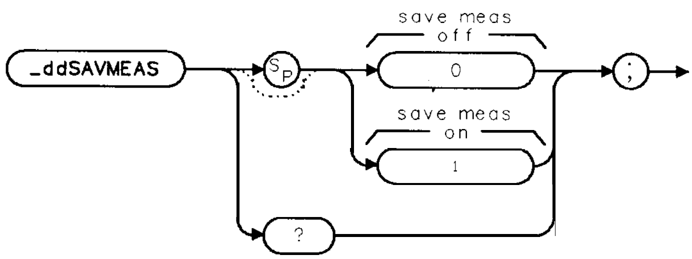
Query Example

`OUTPUT718;"_ddPHASERR?;"`

The query response will be the current value of _ddPHASERR.

_ddSAVMEAS
Digital Demod Save Measurement

Syntax



xddsave

Allows you to save the measurement data from the previous digital demodulator based measurements (that is, _MODACC, JQGRAPH, or _DATABITS). Further execution of any of these will simply display the data taken previously and not acquire new data. The -ddSAVMEAS command is equivalent to SAV MEAS ON OFF .

If _ddSAVMEAS is set to 1, further execution of _MODACC, JQGRAPH, or _DATABITS will only use the previous data and not acquire new data. Note that to set _ddSAVMEAS to a 1, a measurement must have been completed and it must not have been an averaged measurement.

If _ddSAVMEAS is set to 0, further execution of _MODACC, JQGRAPH, or _DATABITS will acquire new data each time. The default value of -ddSAVMEAS is 0.

Example

`OUTPUT 718;"MOV _ddSAVMEAS,1;"` *Set for save measurement.*

Related Commands: -MODACC, JQGRAPH, and -DATABITS.

Query Example

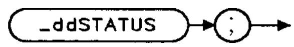
`OUTPUT718;"_ddSAVMEAS?;"`

The query response will be the current value of _ddSAVMEAS.

Note The measurement data is held in temporary storage. If the analyzer power is cycled, the measurement results will be lost.

_ddSTATUS
Digital Demod Status Display

Syntax



xddstat

Displays the status of various internal digital demodulator parameters for the previous digital demodulator based measurement (that is, -MODACC, -IQGRAPH, -DATABITS). The -ddSTATUS command is equivalent to STATUS . This command is typically used after a digital demodulator based measurement has halted.

Example

OUTPUT718;"_ddSTATUS;" *Display digital demod status.*

Executing _ddSTATUS does the following:

1. Displays the digital demodulator parameters.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in variables.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.

Note The measurement state result for _ddSTATUS is independent of the success or failure of the previous digital demodulator-based measurement. Also, other values can be returned. For example: 6 – Digital Demodulator hardware not present.

Measurement Results: The results of the -ddSTATUS command are stored in the variables shown in the following table.

_ddSTATUS Digital Demod Status Display

Measurement Results

Value	Description	Units
_ddFTACQS	Frame trigger acquisition status	None
-ddFTTRS	Frame trigger time record status	
_ddFTUW	Frame trigger unique word	
_ddFTSE	Frame trigger sync errors	
_ddFTSBLOC	Frame trigger sync bit location	
_ddSTAT	Measurement status result	
-ddTRS	Measurement time record status	
-ddAUW	Measurement actual (unique word) number	
-ddSM	Measurement sync match	
-ddSWE	Measurement sync word errors	
-ddBCE	Measurement pass 1 and 2 bit compare errors	
_ddIQNF	Measurement IQ null flag	
-ddIQNC	Measurement IQ null count	
-ddLOMAGPTS	Measurement low magnitude points	

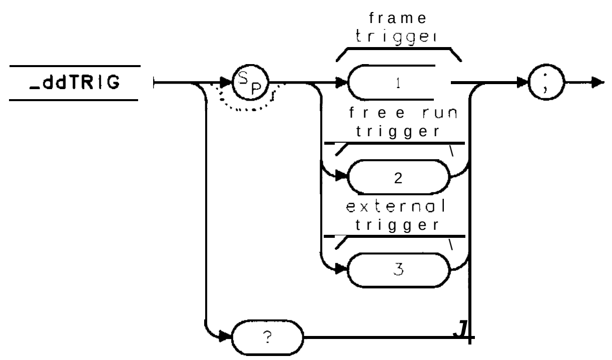
Related Commands: _MODACC, -IQGRAPH, and -DATABITS.

See Also

"To display the digital demodulator status" in Chapter 6, "Programming Examples," and Chapter 4, "Error Messages and Troubleshooting."

-ddTRIG
Digital Demod Trigger Mode

Syntax



Allows you to specify the trigger mode for digital demodulator based measurements. The -ddTRIG command is equivalent to DD TRIG FRAME , DD TRIG FREE RUN , and DD TRIG EXTERNAL.

If -ddTRIG is set to 1, digital demodulator based measurements will be made using the frame trigger (acquired from the signal under test). If -ddTRIG is set to 2, digital demodulator measurements will be made in a free run mode. If -ddTRIG is set to 3, digital demodulator measurements will be made using an external trigger. The default value of _ddTRIG is 1.

Example

OUTPUT 718;"MOV _ddTRIG,2;" *Enable* ***free run trigger:***

Related Commands: -MODACC, -IQGRAPH, -DATABITS, -ddWSYNC, -DEFAULT

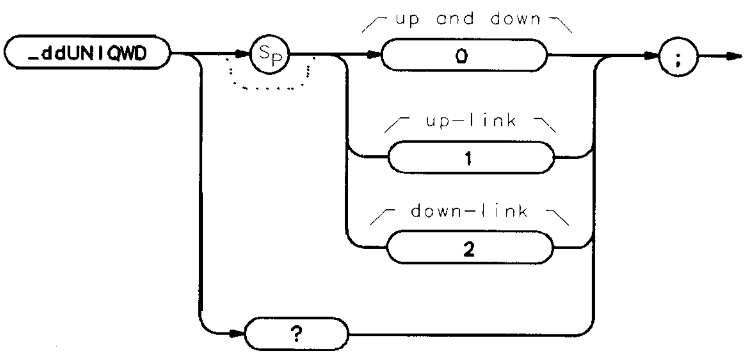
Query Example

OUTPUT718;"_ddTRIG?;"

The query response will be the current value of _ddTRIG.

_ddUNIQWD
Digital Demod Unique Word

Syntax



pj438b

Allows you to specify which unique word to search for. The -ddUNIQWD command is equivalent to UNIQ WRD UP DOWN . If -ddUNIQWD is set to 0, the best unique word match will be found using both uplink and downlink unique words. If -ddUNIQWD is set to 1, the uplink unique word will be used. If _ddUNIQWD is set to 2, the downlink unique word will be used. The default value of _ddUNIQWD is 1.

Example

`OUTPUT 718;"MOV _ddUNIQWD,1;"` *Select uplink unique word.*

Related Commands: -MODACC, -IQGRAPH, _DATABITS.

Query Example

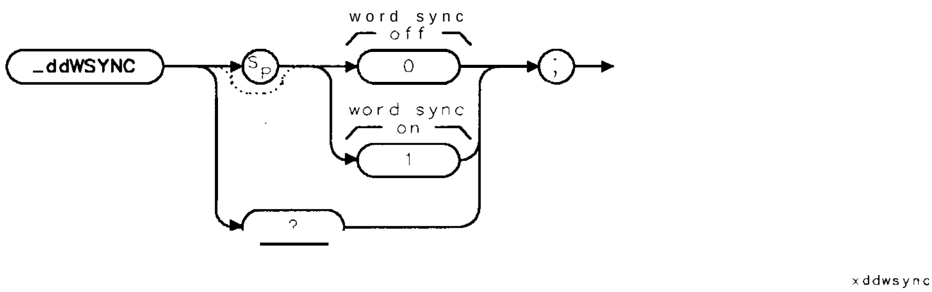
`OUTPUT718;"_ddUNIQWD?;"`

The query response will be the current value of -ddUNIQWD.

Note You cannot have both uplink and downlink words present in the input signal when _ddUNIQWD is set to 0.

-ddWSYNC
Digital Demod Word Sync Mode

Syntax



Allows you to specify sync (unique) word searching for frame trigger digital demodulator based measurements. The -ddWSYNC command is equivalent to WRD SYNC ON OFF .

If -ddWSYNC is set to 1, digital demodulator based measurements will include a sync word search. If -ddWSYNC is set to 0, digital demodulator measurements will not include a sync word search. _ddWSYNC is automatically set by -ddTRIG. If _ddTRIG is set to 1 (frame trigger), -ddWSYNC will be set to 1. If _ddTRIG is set to 2 or 3 (free run or external trigger), -ddWSYNC will be set to 0.

Note It is recommended that the values set by -ddTRIG for _ddWSYNC be used for typical measurements.

Example

`OUTPUT 718;"MOV _ddWSYNC,0;"` *Turn off word sync.*

Related Commands: -MODACC, _IQGRAPH, -DATABITS, and _ddTRIG.

Query Example

`OUTPUT718;"_ddWSYNC?;"`

The query response will be the current value of _ddWSYNC.

-DEFAULT
Default Configuration

Syntax

xdefault

Replaces the values and selections for the configuration functions to their default values. The -DEFAULT command is equivalent to DEFAULT CONFIG .

Example

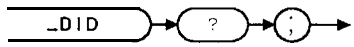
```
OUTPUT718;"_DEFAULT;"
```

The default values are as follows:

_CC	is set to 0 (burst mode).
-CFX	is set to 300 MHz.
_CHDEF	is set 0.
_CH	is set to channel number 1.
-COPMKK	is set to 1 (MULT).
-COPMT	is set to 0 (carrier off power zero span)
-ddEVMCORR	is set to 0 (EVM correction off).
-ddFRQSRCH	is set to 0.
-ddSDF	is set to 3.13.
-ddTRIG	is set to 1 (frame trigger).
-ddUNIQWD	is set to 1 (uplink unique word).
-ddWSYNC	is set to 1 (word sync on).
_DPF	is set to 0 (pass/fail display is set to off).
_EXTATN	is set to 10 dB if -TXPWR set to 0, or 30 dB otherwise.
_FDEF	is set to 1894.85 MHz.
-FTACQ	is set to 1 (frame trigger acquisition on).
-MEASM	is set to 0.
-PFX	is set to -37 dBm.
-PRX	is set to -37 dBm.
-PBRXU	is set to 4 dB.
_PBRXL	is set to – 14 dB.
_PTM	is set to 0 μs.
_SPURM	is set to 1 (TX).
_SRQ	is set to 0.
_TRIGD	is set to 0 μs.
_TRIGM	is set 0 (video triggering).
_TRIGP	is set to 1 (positive edge triggering).
-TRIGSRC	is set to 1 (Options 151 and 160 installed), or 0 otherwise.

-DID
DLP Identification

Syntax



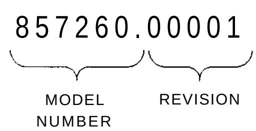
xdid

Allows you to query the downloadable program (DLP) personality model number and revision.

Query Example

OUTPUT 718; "-DID?; "

The query response will be of the form



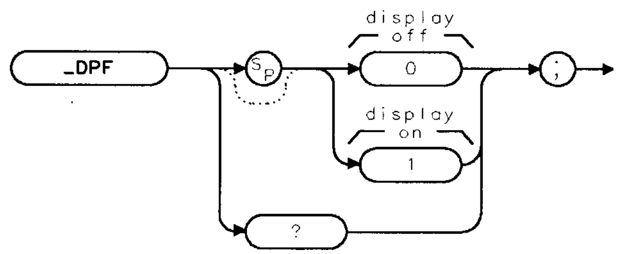
pj417c

The last digit in the model number sequence and the first digit in the revision sequence represent a letter where 0= A, 1 = B, and so forth.

The above example corresponds to HP 85726A Rev. A.OO.O1

-DPF
Display Pass/Fail Message

Syntax



xdpf

Allows you to specify if a pass/fail message is displayed after a measurement. The _DPF command is equivalent to PASSFAIL ON OFF .

If _DPF is set to 0, no message are displayed. If _DPF is set to 1, then a pass/fail message is displayed. The default value for -DPF is 0.

Example

OUTPUT 718;"MOV _DPF,1;" *Pass/fail messages will be displayed.*

Related Commands: -DEFAULT sets _DPF to 0.

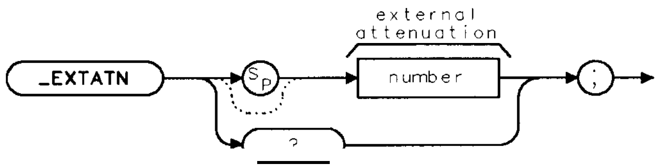
Query Example

OUTPUT 718;"_DPF?;"

The query response will be the current value of _DPF.

-EXTATN
External Attenuation

Syntax



Allows you to enter the attenuation of the external equipment that is used to connect the transmitter output to the spectrum analyzer input. The -EXTATN command is equivalent to EXT ATTEN.

_EXTATN accepts a real number from 0 to 90. The measurement unit is dB. The default value for -EXTATN is 10 if _TXPWR is 0, otherwise the value is 30.

Example

`OUTPUT 718;"MOV _EXTATN,13;"` *Sets the external attenuation to 13 dB.*

Related Commands: -DEFAULT sets -EXTATN to 10 if _TXPWR is 0, otherwise the value is 30.

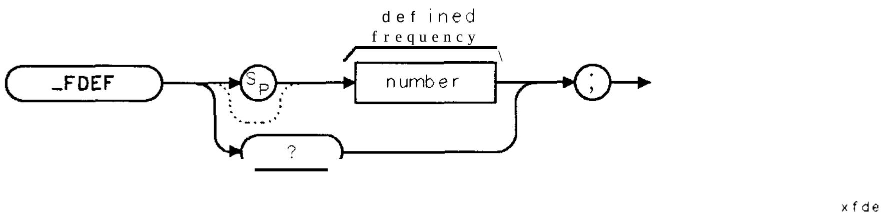
Query Example

`OUTPUT718;"_EXTATN?;"`

The query response will be at the current setting for the external attenuation.

_FDEF
Define Frequency

Syntax



Allows you to specify the frequency that corresponds to the channel number as defined in _CHDEF. The _FDEF command is equivalent to DEFINE FREQ .

The measurement unit for _FDEF is Hz.

Example

OUTPUT 718;"MOV _FDEF,1895.15E6;" *Set defining frequency to 1895.15 MHz.*

Related Commands: _CHSP (Table 5-2), -DEFAULT sets _FDEF to 1894.85 MHz.

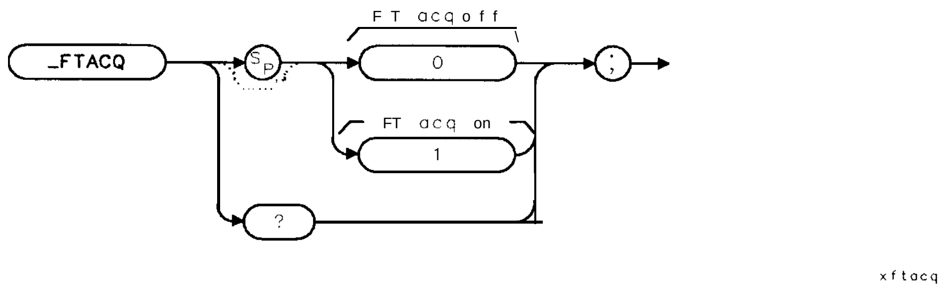
Query Example

OUTPUT 718;"_FDEF?;"

The query response will be the current value of the defining frequency.

_FTACQ
Frame Trigger Acquisition

Syntax



Allows you to specify frame trigger acquisition prior to power versus time, carrier-off power, and spurious measurements. The _FTACQ command is equivalent to FT ACQ ON OFF .

If _FTACQ is set to 1, power versus time, carrier off power, and spurious measurements will include a digital demodulator frame trigger acquisition prior to the measurement. If _FTACQ is set to 0, these measurements will not include a frame trigger acquisition prior to the measurement. The default value of _FTACQ is 0; however, note that setting _TRIGSRC to 1 will automatically set _FTACQ to 1. Setting _TRIGSRC to 0 will set _FTACQ to 0.

Example

`OUTPUT 718;"MOV _FTACQ,1;"` *Turn frame trigger acquisition on.*

Related Commands: -TRIGSRC.

Query Example

`OUTPUT718;"_FTACQ?;"`

The query response will be the current value of _FTACQ.

_IQGRAPH
I-Q Pattern, Eight-Point Constellation, or EVM versus Symbol

Syntax

xiqgraph

Demodulates a single burst of the transmitter and plots I-Q pattern, eight-point constellation, or EVM versus symbol. If the value of -ddCONSTLN is 0, an I-Q pattern will be plotted. If the value of _ddCONSTLN is 1, an eight-point constellation will be plotted. If the value of _ddCONSTLN is 2, an EVM versus symbol graph will be plotted. The _ddCONSTLN and _IQGRAPH commands are equivalent to I-Q PATTERN , 8 POINT CONSTLN , or EVM vs SYM .

Example

`OUTPUT 718;"MOV _ddCONSTLN,0"`	*Set for I-Q pattern.*
`OUTPUT718;"_IQGRAPH;"`	*Performs I-Q pattern measurement.*

Executing _IQGRAPH does the following:

1. Performs the I-Q pattern (or eight-point constellation) measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in two arrays.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If _CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If _CC is set to continuous carrier, the carrier must be a non-burst carrier.)
6	Digital demodulator hardware not present or not correct (151) option.
7	Digital demodulator firmware not correct option.
8	Digital demodulator firmware revision date too old.
9	Carrier frequency error too high.
10	Frame trigger acquisition failed.
11	Time record invalid.
12	Frame trigger re-position failed.
13	Sync word errors present. *
14	Results may not be accurate: origin offset too high.*
15	Ref level auto set failed, over range.
16	Ref level auto set failed, under range.
17	Sync word errors.
18	Clock signal too low, data may have to be randomized.
19	Results may not be accurate: pass 1 and 2 bit compare error.*
21	Results may not be accurate, phase corr. too high.
22	Results may not be accurate, EVM corr. too high.
24	CF auto set failed.
26	Results may not be accurate: EVM exceeds system limit.*
30	Measurement failed, unspecified failure.

* Measurement data present, all others abort the measurement and do not store measurement data.

_IQGRAPH I-Q Pattern, Eight-Point Constellation, or EVM versus Symbol

Measurement Results: If -ddCONSTLN is 0 or 1, the results of the _IQGRAPH command are stored in two 816 element arrays (-IQX and _IQY). If _ddCONSTLN is 2, the results are stored in a single 401-element array (-TREVS).

Measurement Results

Array Name	Description	Units
_IQX	The _IQX array elements contain the X-coordinates of the I-Q pattern or eight-point constellation.	*
_IQY	The _IQY array elements contain the Y-coordinates of the I-Q pattern or eight-point constellation.	*
_TREVS	The _TREVS array elements contain the result of EVM for each symbol.	**

* The values in these arrays are in spectrum analyzer "screen display" units. The array value of (240, 100) is displayed as (0,0). There are 120 "screen display" X-units for a vector in the X direction of length 1; 75 "screen display" Y-units for a vector in the Y direction of length 1.

**The value in this array are in spectrum analyzer "screen display" units. The value 1000 in "screen display" units is equivalent to an EVM of 10.00%. To read the EVM from this trace, use the following equation: Array Index = 3 x symbol number + 30. For example, to read the EVM of the first symbol, read _TREVS[33].

Related Commands: Use -ddCONSTLN to specify which graph is displayed. The _ddNOPLT specifies whether or not the graphs are to be displayed.

See Also

"To measure the I-Q pattern" and "To measure the eight-point constellation" in Chapter 6, "Programming Examples."

-MBM
Monitor Band Measurement

Syntax

Performs the monitor band measurement.

Example

`OUTPUT 718;"_MBS;"`	*Sets up the monitor band measurement.*
`OUTPUT 718;"RB 10KHZ;"`	*Changes the resolution bandwidth to 10 kHz.*
`OUTPUT 718;"_MBM;"`	*Performs the monitor band measurement.*

Before using _MBM, you need to use the -MBS command to perform the setup for the monitor band measurement. The _MBS and _MBM commands are useful if you want to change the spectrum analyzer settings before making a monitor band measurement. The combination of the _MBS and _MBM commands is equivalent to MONITOR BAMD .

See the description for _MBND for information about the measurement state and measurement results from a monitor band measurement.

_MBND
Monitor Band

Syntax

xmbnd

Displays either the transmit frequency band. Depending on the setting of _MTX, _MBND is equivalent to MONITOR BAND .

Example

OUTPUT718;"_MBND;" *Displays band*

Measurement Results: After executing _MBND, the spectrum of the band is stored in trace A. The measurement units for trace A are determined by the trace data format (TDF) command.

Alternate Commands: The _MBS and -MBM commands can be used instead of _MBND if you want to change the spectrum analyzer settings before monitoring a band.

-MBS
Monitor Band Setup

Syntax

xmbs

Performs the setup for the monitor band measurement.

Example

`OUTPUT 718;"_MBS;"`	*Sets up the monitor band measurement.*
`OUTPUT 718;"RB 10KHZ;"`	*Changes the resolution bandwidth to 10 kHz.*
`OUTPUT 718;"_MBM;"`	***Performs** the monitor band measurement.*

After using _MBS, you need to use the _MBM command to perform the monitor band measurement. The -MBS and -MBM commands are useful if you want to change the spectrum analyzer settings before making a monitor band measurement. The combination of the _MBS and -MBM commands is equivalent to MONITOR BAND .

_MCH
Monitor Channel

Syntax

Displays the spectrum for the channel that is specified by _CH. The _MCH command is equivalent to MONITOR CHAN .

Example

OUTPUT718;"_MCH;"

Measurement Results: After executing _MCH, the spectrum of the monitor band is stored in trace A. The measurement units for trace A are determined by the trace data format (TDF) command.

Alternate Commands: The _MCS and -MCM commands can be used instead of -MCH if you want to change the spectrum analyzer settings before monitoring a channel.

Related Commands: Use _CH to select the channel to be monitored.

-MCM
Monitor Channel Measurement

Syntax

Performs the monitor channel measurement,

Example

```
OUTPUT 718;"_MCS;"        Sets up the monitor channel measurement.
OUTPUT 718;"RB 10KHZ;"    Changes the resolution bandwidth to 10 kHz.
OUTPUT 718;"_MCM;"        Performs the monitor channel measurement.
```

Before using _MCM, you need to use the _MCS command to perform the setup for the monitor channel measurement. The _MCS and -MCM commands are useful if you want to change the spectrum analyzer settings before making a monitor channel measurement. The combination of the _MCS and _MCM commands is equivalent to MONITOR CHAN .

See the description for _MCH for information about the measurement state and measurement results from a monitor channel measurement.

_MCS
Monitor Channel Setup

Syntax

Performs the setup for the monitor channel measurement.

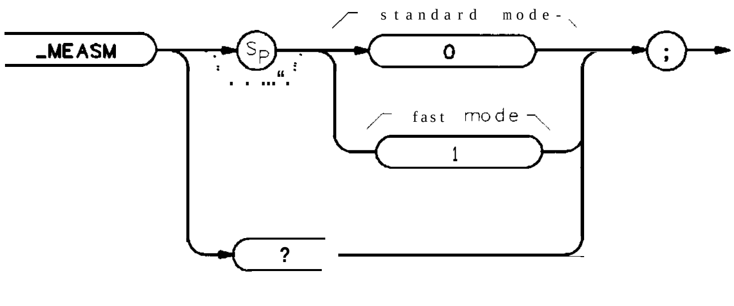
Example

`OUTPUT 718;"_MCS;"`	*Sets up the **monitor channel measurement.***
`OUTPUT 718;"RB 10KHZ;"`	*Changes **the** resolution bandwidth to 10 kHz.*
`OUTPUT 718;"_MCM;"`	*Performs the monitor channel measurement.*

After using _MCS, you need to use the _MCM command to perform the monitor channel measurement. The _MCS and -MCM commands are useful if you want to change the spectrum analyzer settings before making a monitor channel measurement. The combination of the -MBS and -MBM commands is equivalent to MONITOR CHAN .

_MEASM
Measurement Mode

Syntax



Allows you to specify the measurement mode. If _MEASM is set to 0, the measurement mode is set to standard. If _MEASM is set to 1, the measurement mode is set to fast. The display of measurement results and auto reference level setting are not performed in fast measurement mode. The default value for _MEASM is 0.

The carrier power measurement should be made first using the standard mode. This will check for the presence of a carrier signal and will set the analyzer reference level to the optimum value for making measurements at the measured power level. Then, fast mode may be selected for making other measurements on the same carrier at the same power level.

The measurement commands that provide fast mode capability are: _CPWR, _COPWR, _OBW, -ACP, _PBURST, _PRISE, _PFALL, _SPURSET, _SPURZ, and -SPUR.

Example

`OUTPUT 718;"_MEASM 0;"`	*Set the measurement mode to standard.*
`OUTPUT 718;"_CPWR;"`	*Make the measurement.*
`OUTPUT 718;"_MEASM 1;"`	*Set the measurement mode to fast.*
`OUTPUT 718;"_COPWR;"`	*Make the measurement.*

Query Example

`OUTPUT718;"_MEASM?;"`

The query response will be the current value of _MEASM.

_MODACC
Modulation Accuracy

Syntax

xmodacc

Demodulates a single burst of the transmitter and displays the modulation accuracy results. The -MODACC command is equivalent to MODULATN ACCLJRACY .

Example

OUTPUT718;"_MODACC;" *Performs modulation accuracy measurement.*

Executing _MODACC does the following:

1. Performs the modulation accuracy measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in variables.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If _CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If _CC is set to continuous carrier, the carrier must be a non-burst carrier.)
6	Digital demodulator hardware not present or not correct (151) option.
7	Digital demodulator firmware not correct option.
8	Digital demodulator firmware revision date too old.
9	Carrier frequency error too high.
10	Frame trigger acquisition failed.
11	Time record invalid.
12	Frame trigger re-position failed.
13	Sync word errors present. *
14	Results may not be accurate: origin offset too high.'
15	Ref level auto set failed, over range.
16	Ref level auto set failed, under range.
17	Sync word errors.
18	Clock signal too low, data may have to be randomized.
19	Results may not be accurate: pass 1 and 2 bit compare error.*
21	Results may not be accurate, phase corr. too high.
22	Results may not be accurate, EVM corr. too high.
24	CF auto set failed.
26	Results may not be accurate: EVM exceeds system limit. *
30	Measurement failed, unspecified failure.

' Measurement data present, all others abort the measurement and do not store measurement data.

Measurement Results: The results of the -MODACC command are stored in the variables shown in the following table.

Measurement Results

Variable	Description	Units
_NUMF	Indicates if the modulation accuracy results were within the measurement limits. The measurement limits are determined by -EVMRMSXO, _MERRX, _PERRX, -EVMPKX, _IQOFSX, -CFERRXB, and _CFERRXM. See Table 10-2 for more information about measurement limits. . If _NUMF is 0, the numeric results were within the limits. ■ If _NUMF is 2, a numeric result was greater than the upper measurement limit.	None
-EVMRMS	A variable that contains the RMS error vector magnitude.	Percent
_MERR	A variable that contains the RMS magnitude error.	Percent
_PERR	A variable that contains the RMS phase error.	Degrees
_EVMPK	A variable that contains the peak error vector magnitude.	Percent
_IQOFS	A variable that contains the I-Q origin offset.	dB
-CFERR *	A variable that contains the carrier frequency error.	

* Valid only if -ddPARTIAL is 0 (off.

-MODACC Modulation Accuracy

Limit and Parameter Variables: _MODACC uses _EVMRMSXO, _MERRX, _PERRX, -EVMPKX, -IQOFSX, -CFERRXB, and _CFERRXM. See Table 10-2 for more information.

If averaging is enabled using _ddAVG, the above measurement results, with the exception of -EVMPK, become mean values and additional information is available as described in the following table.

Additional Measurement Results When Averaging Enabled

Variable	Description	Units
-EVMSD	A variable that contains the RMS error vector magnitude standard deviation.	Percent
-EVMMAX	A variable that contains the RMS error vector magnitude maximum value	Percent
_EVMMIN	A variable that contains the RMS error vector magnitude minimum value.	Percent
-MERRSD	A variable that contains the RMS magnitude error standard deviation.	Percent
-MERRMAX	A variable that contains the RMS magnitude error maximum value.	Percent
-MERRMIN	A variable that contains the RMS magnitude error minimum value.	Percent
_PERRSD	A variable that contains the RMS phase error standard deviation.	Degrees
-PERRMAX	A variable that contains the RMS phase error maximum value.	Degrees
-PERRMIN	A variable that contains the RMS phase error minimum value.	Degrees
_EVMRUL	RMS EVM uncertainty upper limit (20° to 30° C).	Percent
_EVMRLL	RMS EVM uncertainty lower limit (20° to 30° C).	Percent
_EVMFUL	RMS EVM uncertainty upper limit (0° to 55° C).	Percent
_EVMFLL	RMS EVM uncertainty lower limit (0° to 55° C).	Percent

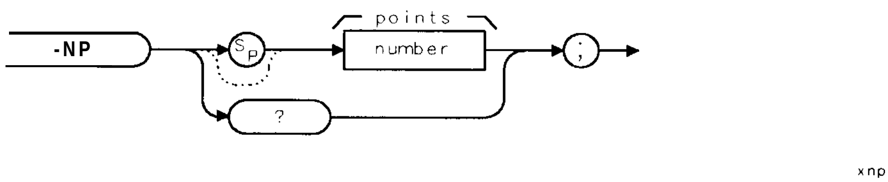
Related Commands: -ddPARTIAL, -ddTENB, -ddAVG, -ddNAVG, _ddEVMCORR.

See Also

"To measure the modulation accuracy," and "To measure the modulation accuracy using averaging" in Chapter 6, "Programming Examples."

-NP
Number of Points per Sweep

Syntax



Allows you to specify the number of points per sweep used in the adjacent channel power (ACP STD) and the channel power measurement. The -NP command is equivalent to POINTS/SWEEP.

_NP can accept an integer from 120 to 401. The default value for _NP is 401.

Example

OUTPUT 718;"MOV _NP,200;" *Uses 200 points from every sweep to calculate the adjacent channel power.*

Related Commands: -NP is used by _ACP and -ACPM.

Query Example

OUTPUT 718;"_NP?;"

The query response will be the current value of . NP.

_OBW
Occupied Bandwidth

Syntax

Performs the occupied bandwidth measurement. The _OBW command is equivalent to OCCUPIED BANDWDTH.

Example

```
OUTPUT 718;"_OBW;"
```

OBW measures the bandwidth that contains 99 percent of the total carrier power. (The percent can be changed with the variable _OBPCT.) _OBW also measures transmit frequency error (the difference between the center frequency and the midpoint between the upper and lower frequency values for the occupied bandwidth).

Executing _OBW does the following:

1. Performs the occupied bandwidth measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in variables and a trace.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If _CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If -CC is set to continuous carrier, the carrier must be a nonburst carrier.)

Measurement Results: The results of the OBW command are stored in the variables and trace in the following table.

Measurement Results

Variable or Trace	Description	Units
_NUMF	Indicates if the occupied bandwidth was within the measurement limits. The measurement limits are determined by _OBBWX and _OBFEX. See Table 5-2 for more information about measurement limits. ■ If _NUMF is 0, the numeric results were within the limits. . If _NUMF is 2, a numeric result was greater than the upper measurement limit.	None
_OBBW	A variable that contains the occupied bandwidth measured by _OBW.	HZ
_OBLLF	A variable that contains the relative lower frequency limit of the occupied bandwidth. The lower frequency limit is relative to the center frequency of the spectrum analyzer.	Hz
_OBULF	A variable that contains the relative upper frequency limit of the occupied bandwidth. The upper frequency limit is relative to the center frequency of the spectrum analyzer.	Hz
_OBFE	A variable that contains the occupied bandwidth transmit frequency error. This error is equal to the following: _OBFE = (_OBULF + _OBLLF)/2	Hz
TRA	TRA is trace **A.** Trace A contains the swept RF spectrum that was used to measure occupied bandwidth.	Determined by the trace data format (TDF) command.

Limit and Parameter Variables: _OBW uses _OBNS, _OBPCT, _OBBWX, and _OBFEX. See Table 5-2 for more information.

Alternate Commands: If you want to change the spectrum analyzer settings before making a occupied bandwidth measurement, use _OBWS and _OBWM instead of the _OBW command.

_OBWM
Occupied Bandwidth Measurement

Syntax

Performs the occupied bandwidth measurement.

Example

OUTPUT 718;"_OBWS;"	*Sets up the occupied bandwidth measurement.*
OUTPUT 718;"RB 10KHZ;"	*Changes the resolution bandwidth to 10 kHz.*
OUTPUT 718;"_OBWM;"	*Performs the occupied bandwidth measurement.*

Before using -OBWM, you need to use the _OBWS command to perform the setup for the occupied bandwidth measurement. The _OBWS and _OBWM commands are useful if you want to change the spectrum analyzer settings before making an occupied bandwidth measurement. The combination of the _OBWS and _OBWS commands is equivalent to the _OBW command and OCCUPIED BANDWDTH .

See the description for _OBW for information about the measurement state and measurement results from an occupied bandwidth measurement.

_OBWS
Occupied Bandwidth Setup

Syntax

Performs the setup for the occupied bandwidth measurement.

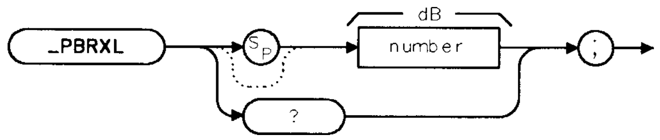
Example

OUTPUT 718; "_OBWS;"	*Sets up the occupied bandwidth measurement.*
OUTPUT 718:"RB 10KHZ;"	*Changes the resolution bandwidth to 10 kHz.*
OUTPUT 718; "_OBWM;"	*Performs the occupied bandwidth measurement.*

The _OBWS and _OBWM commands can be used if you want to change the spectrum analyzer settings before making a occupied bandwidth measurement. The combination of the _OBWS and _OBWM commands is equivalent to the _OBW command and OCCUPIED BAMDWDTH .

-PBRXL
Power versus Time Burst Lower Limit

Syntax



xpbrxl

Allows you to change the relative (dB) value for the difference between the burst lower (inner) limit and the mean power in the "on" part of the burst. The _PBRXL command is equivalent to LOWER LIMIT. You can enter a value from 0 to -30 dB. The default value for _PBRXL is -14 dB.

Example

`OUTPUT 718;"MOV _PBRXL,-12 dB;"` *Sets the burst lower limit to - 12 dB.*

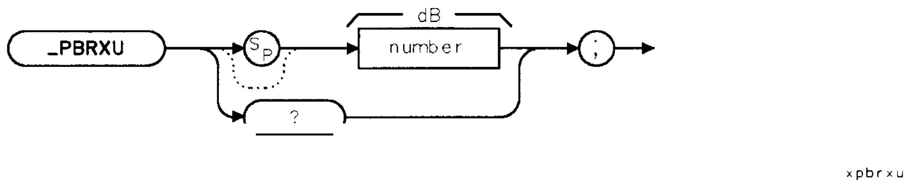
Query Example

`OUTPUT 718;"_PBRXL?;"`

The query response will be the current setting for the burst lower limit.

-PBRXU
Power versus Time Burst Upper Limit

Syntax



Allows you to change the relative (dB) value for the difference between the burst upper (outer) limit and the mean power in the "on" part of the burst. The _PBRXL command is equivalent to UPPER LIMIT . You can enter a value from 10 to 0 dB. The default value for -PBRXU is 4 dB.

Example

OUTPUT 718;"MOV _PBRXU,5;"   *Sets the burst upper limit to 5 dB.*

Query Example

OUTPUT 718;"_PBRXU?;"

The query response will be the current setting for the burst upper limit.

_PBURST
Power versus Time Burst

Syntax

xpburst

Performs the power versus time burst measurement. The _PBURST command is equivalent to P vs T BURST.

Example

```
OUTPUT 718; "_PBURST;"
```

Executing _PBURST does the following:

1. Performs the power versus time burst measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in variables and traces.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If -CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If -CC is set to continuous carrier, the carrier must be a nonburst carrier.)
The following are possible only if -FTACQ is set to 1.	
6	Digital demodulator hardware not present or not correct option (151).
7	Digital demodulator firmware not correct option.
8	Digital demodulator firmware revision date too old.
10	Frame trigger acquisition failed. (See Chapter 4, “Error Messages and Troubleshooting.“)

Measurement Results: The results of the _PBURST command are stored in the variables and traces shown in the following table.

Measurement Results

Variable or Trace	Description	Units
_NUMF	Indicates if the burst width was within the measurement limits. The measurement limits are determined by -PBSXU and _PBXL. See Table 5-2 for more information about measurement limits. ■ If _NUMF is 0, the numeric result was within the limits. ■ If _NUMF is 1, the numeric result was less than the lower limit ■ If _NUMF is 2, the numeric result was greater than the upper limit (_PBXU or _PBSXU).	None
LIMIFAIL	A spectrum analyzer command that contains the pass or fail results of the burst waveform compared to the upper and lower limit lines. ■ If LIMIFAIL is equal to 0, the waveform was within the limit line boundaries. ■ If LIMIFAIL is equal to 1, the waveform failed the lower limit line boundary. ■ If LIMIFAIL is equal to 2, the waveform failed the upper limit line boundary. ■ If LIMIFAIL is equal to 3, the waveform failed the both the upper and lower limit line boundaries.	None
-PBT	A variable that contains the measured width of the burst at − 14 dB (or the value of _PBMP) from the mean carrier power.	μs
-PTMT	A variable that contains the time between the external trigger and the marker.	μs
TRA	TRA is trace A. Trace A contains the waveform of the average of the power versus time.	Determined by the trace data format (TDF) command*
TRB	TRB is trace B. Trace B contains the waveform of the maximum peaks.	Determined by the trace data format (TDF) command*
TRC	TRC is trace C. Trace C contains the waveform of the minimum peaks.	Determined by the trace data format (TDF) command*

* If the trace data format of the spectrum analyzer is set to measurement units (TDF M), the measurement values for these traces range from 8000 to -4000. The measurement values for a trace are usually from 0 to 8000 measurement units, but because of the increased dynamic range (120 dB), the measurement values for trace **A,** trace B, and trace C can range from 8000 to -4000.

Limit and Parameter Variables: _PBURST uses _PBXL, _PBXU, and _PBMP. See Table 5-2 for more information.

Related Commands: _TN determines which slot is measured. _AVG should be set prior to executing _PBURST.

_PFALL
Power versus Time Falling Edge

Syntax

_PFALL performs the power versus time falling edge measurement. The _PFALL command is equivalent to P vs T FALLING.

Example

OUTPUT 718;"_PFALL;"

Executing _PFALL does the following:

1. Performs the power versus time falling edge measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in variables and traces.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If -CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If -CC is set to continuous carrier, the carrier must be a nonburst carrier.)
The following are possible only if _FTACQ is set to 1.	
6	Digital demodulator hardware not present or not correct option (151).
7	Digital demodulator firmware not correct option.
8	Digital demodulator firmware revision date too old.
10	Frame trigger acquisition failed. (See Chapter 4, "Error Messages and Troubleshooting.")

Measurement Results: The results of the _PFALL command are stored in the variables and traces shown in the following table.

Measurement Results

Variable or Trace	Description	Units
.NUMF	Indicates if the release time was within the measurement limits. The measurement limits are determined by _PRMPU and -PRMPL. See Table 5-2 for more information about measurement limits. ■ If _NUMF is 0, the numeric result was within the limits. ■ If _NUMF is 1, the numeric result was less than the lower limit (-PRMPL). ■ If _NUMF is 2, the numeric result was greater than the upper limit (-PRMPH).	None
.IMIFAIL	A spectrum analyzer command that contains the pass or fail results of the burst waveform compared to the upper and lower limit lines. ■ If LIMIFAIL is equal to 0, the waveform was within the limit line boundaries. ■ If LIMIFAIL is equal to 1, the waveform failed the lower limit line boundary. ■ If LIMIFAIL Is equal to 2, the waveform failed the upper limit line boundary. ■ If LIMIFAIL is equal to 3, the waveform failed the both the upper and lower limit line boundaries.	None
.PRET	A variable that contains the measured release time of the burst. A value of 0 for _PRET indicates an error has occurred.	μs
.PTMT	A variable that contains the time between the external trigger and the marker.	μs
[RA	TRA is trace A. Trace A contains the waveform of the average of the power versus time.	Determined by the trace data format (TDF) command*
[RB	TRB is trace B. Trace B contains the waveform of the maximum peaks.	Determined by the trace data format (TDF) command*
[RC	TRC is trace C. Trace C contains the waveform of the minimum peaks.	Determined by the trace data format (TDF) command*

' If the trace data format of the spectrum analyzer is set to measurement units (TDF M), the measurement values ‘or these traces range from 8000 to -4000. The measurement values for a trace are usually from 0 to 8000 neasurement units, but because of the increased dynamic range (120 dB), the measurement values for trace A, race B, and trace C can range from 8000 to -4000.

Limit and Parameter Variables: _PFALL uses _PRXU, _PRXL, PRMPU, and _PRMPL. See Table 5-2 for more information.

Related Commands: _TN determines the slot burst that is measured. _AVG should be set prior the executing _PFALL.

_PFRAME
Power versus Time Frame

Syntax

xpframe

_PFRAME performs the power versus time frame measurement. The _PFRAME command is equivalent to P vs T FRAME.

Example

```
OUTPUT718;"_PFRAME;"
```

Executing _PFRAME does the following:

1. Performs the power versus time frame measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, time between the external trigger and the spectrum analyzer marker is placed in the _PTMT variable and in traces A, B, and C.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If -CC is set to burst, the carrier must be a burst carrier,)
5	The carrier was not a continuous carrier. (If -CC is set to continuous carrier, the carrier must be a nonburst carrier.)
The following are possible only if -FTACQ is set to 1.	
6	Digital demodulator hardware not present or not correct option (151).
7	Digital demodulator firmware not correct option.
8	Digital demodulator firmware revision date too old.
10	Frame trigger acquisition failed. (See Chapter 4, “Error Messages and Troubleshooting. ”)

Measurement Results: The results of the _PFRAME command are stored in the variables and traces shown in the following table.

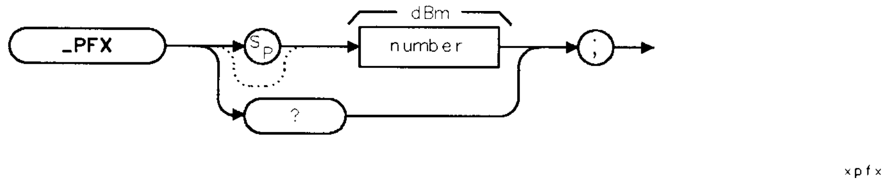
Measurement Results

Variable or Trace	Description	Units
-PTMT	A variable that contains the time between the external trigger and the marker.	μs
TRA	TRA is trace A. Trace A contains the waveform of the average of the power versus time.	Determined by the trace data format (TDF) command*
TRB	TRB is trace B. Trace B contains the waveform of the maximum peaks.	Determined by the trace data format (TDF) command*
TRC	TRC is trace C. Trace C contains the waveform of the minimum peaks.	Determined by the trace data format (TDF) command*

* If the trace data format of the spectrum analyzer is set to measurement units (TDF M), the measurement values for these traces range from 8000 to -4000. The measurement values for a trace are usually from 0 to 8000 measurement units, but because of the increased dynamic range (120 dB), the measurement values for trace A, trace B, and trace C can range from 8000 to -4000.

_PFX
Power versus Time Falling Edge Limit

Syntax



Allows you to change the absolute (dBm) value for the falling edge upper limit. The -PFX command is equivalent to POST LIMIT. You can enter a value from -80 to 0 dBm. The default value for -PFX is -37 dBm.

Example

OUTPUT 718;"MOV _PFX,-34.6;"   *Sets the falling edge upper limit to -34.6 dBm.*

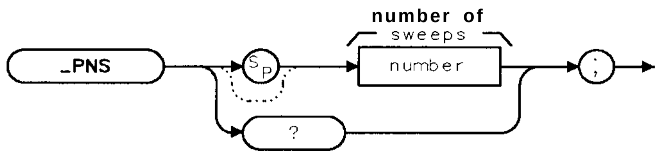
Query Example

OUTPUT 718; "_PFX?;"

The query response will be the current setting for the falling edge upper limit.

-PNS
Power versus Time Number of Sweeps

Syntax



xpns

Allows you to change the number of sweeps that are used in calculating the results for a power versus time measurement. The _PNS command is equivalent to NUMBER SWEEPS .

You can enter an integer from 1 to 99,999 into _PNS. The default value for _PNS is 5.

Example

OUTPUT 718;"MOV _PNS,10;" ***Sets the number of sweeps for the power versus time measurements to 10.***

Related Commands: The function performed by _AVG does not apply if _PNS is equal to 1.

Query Example

OUTPUT 718;"_PNS?;"

The query response will be the current setting for the number of sweeps.

See Also

"To change the value of parameter variables" in Chapter 6.

_PRISE
Power versus Time Rising Edge

Syntax

xprise

_PRISE performs the power versus time rising edge measurement. The _PRISE command is equivalent to P vs T RISING .

Example

```
OUTPUT 718;"_PRISE;"
```

Executing _PRISE does the following:

1. Performs the power versus time rising edge measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in variables and traces.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If _CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If _CC is set to continuous carrier, the carrier must be a nonburst carrier.)
The following are possible only if _FTACQ is set to 1.	
6	Digital demodulator hardware not present or not correct option (151).
7	Digital demodulator firmware not correct option.
8	Digital demodulator firmware revision date too old.
10	Frame trigger acquisition failed. (See Chapter 4, "Error Messages and Troubleshooting.")

Measurement Results: The results of the _PFRAME command are stored in the variables and traces shown in the following table.

Measurement Results

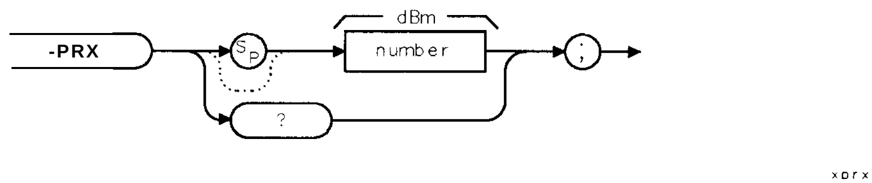
Variable or Trace	Description	Units
_NUMF	Indicates if the attack time was within the measurement limits. The measurement limits are determined by _PAMPU and _PAMPL. See Table 5-2 for more information about measurement limits. ■ If _NUMF is 0, the numeric result was within the limits. ■ If _NUMF is 1, the numeric result was less than the lower limit (-PAMPL). ■ If _NUMF is 2, the numeric result was greater than the upper limit (-PAMPU).	None
LIMIFAIL	A spectrum analyzer command that contains the pass or fail results of the burst waveform compared to the upper and lower limit lines. ■ If LIMIFAIL is equal to 0, the waveform was within the limit line boundaries. ■ If LIMIFAIL is equal to I, the waveform failed the lower limit line boundary. ■ If LIMIFAIL is equal to 2, the waveform failed the upper limit line boundary. ■ If LIMIFAIL is equal to 3, the waveform failed the both the upper and lower limit line boundaries.	None
_PATT	A variable that contains the measured attack time of the burst. A value of 0 for _PATT indicates an error has occurred.	μs
_PTMT	A variable that contains the time between the external trigger and the marker.	μs
TRA	TRA is trace A. Trace A contains the waveform of the average of the power versus time.	Determined by the trace data format (TDF) command*
TRB	TRB is trace B. Trace B contains the waveform of the maximum peaks.	Determined by the trace data format (TDF) command*
TRC	TRC is trace C. Trace C contains the waveform of the minimum peaks.	Determined by the trace data format (TDF) command*

* If the trace data format of the spectrum analyzer is set to measurement units (TDF M), the measurement values for these traces range from 8000 to -4000. The measurement values for a trace are usually from 0 to 8000 measurement units, but because of the increased dynamic range (120 dB), the measurement values for trace A, trace B, and trace C can range from 8000 to -4000.

Limit and Parameter Variables: _PRISE uses _PAMPL, _PAMPU, _PAXL, and _PAXH. See Table 5-2 for more information.

_PRX
Power versus Time Rising Edge Limit

Syntax



Allows you to change the absolute (dBm) value for the rising edge upper limit. The _PRX command is equivalent to PRE LIMIT . You can enter a value from -80 to 0 dBm. The default value for _PRX is -37 dBm.

Example

OUTPUT 718;"MOV _PRX,-35.2;" *Sets the rising edge upper limit to -35.2 dBm.*

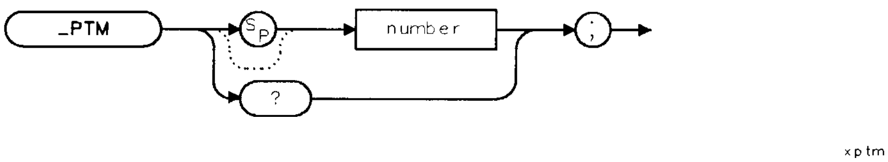
Query Example

OUTPUT 718;"_PRX?;"

The query response will be the current setting for the rising edge upper limit.

-PTM
Power versus Time Margin

Syntax



Allows you to adjust the 13 μs time between the rising and falling edge boundaries. The value in _PTM is added to both sides of the 13 μs time as an offset. The _PTM command is equivalent to TIME MARGIN . You can enter a value from -7 to 26 μs. The default value for -PTM is 0 μs.

Example

`OUTPUT 718;"MOV _PTM,3;"`	***Sets the rising and falling edge time margin to 3 μs. (3 + 13 + 3 = 19 μs between rising and falling edge boundaries).***

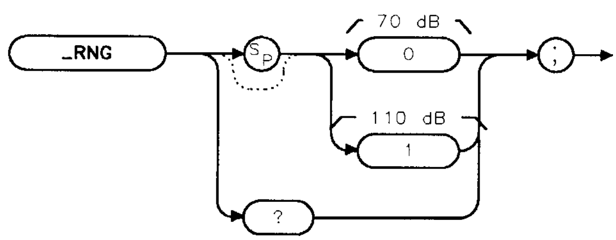
Query Example

```
OUTPUT 718;"_PTM?;"
```

The query response will be the current setting for the rising and falling edge time margin.

_RNG
Amplitude Range for Power versus Time

Syntax



xrng

Selects the amplitude range that is displayed for a power versus time measurement; either 70 dB or 110 dB. The _RNG command is equivalent to RANGE dB 70 110 .

If _RNG is set to 0, the amplitude range is set to 70 dB. If _RNG is set to 1, the amplitude range is set to 110 dB. The default value for _RNG is 0.

Example

OUTPUT 718;"MOV _RNG,1;" *Sets the amplitude range to 110 dB.*

You should set _RNG prior to executing _PFRAME, _PBURST, _PRISE, or _PFALL.

Query Example

OUTPUT 718;"_RNG?;"

The query response will be the current value of -RNG.

-RPT
Repeat

Syntax

xrpt

Repeats a power measurement, adjacent channel power measurement, power versus time measurement, or spurious measurement. The _RPT command is equivalent to REPEAT MEAS .

Example

```
OUTPUT718;"_RPT;"
```

Related Commands: _RPT will repeat the following measurements: _CPWR, _COPWR, -OBW, -ACP, -CHPWR, _PFRAME, _PBURST, _PRISE, _PFALL, -SPUR, -MODACC, -IQGRAPH, -DATABITS.

See Also

"To use the repeat command" in Chapter 6.

-SEM
Spurious Emission Power Measurement

Syntax

xsem

Performs the spurious emission power measurement.

Example

OUTPUT 718;"_SES;"	***Sets up the spurious emission power measurement.***
OUTPUT 718;"VB 300KHZ;"	***Changes the resolution bandwidth to 300 kHz.***
OUTPUT 718;"_SEM;"	***Performs the spurious emission power measurement.***

Before using _SEM, you need to use the -SES command to perform the setup for the spurious emission power measurement. The -SES and -SEM commands are useful if you want to change the spectrum analyzer settings before making a spurious emission power measurement. The combination of the -SES and -SEM commands is equivalent to the -SPUR command.

See the description for -SPUR for information about the measurement state and measurement results from a spurious emission power measurement.

-SES
Spurious Emission Power Setup

Syntax

Performs the setup for the spurious emission power measurement.

Example

OUTPUT 718; "_SES;"	***Sets up the spurious emission power measurement.***
OUTPUT 7 18 ; "VB 300KHZ ;"	***Changes the resolution bandwidth to 300 kHz.***
OUTPUT 718; "_SEM;"	***Performs the spurious emission power measurement.***

The -SES and -SEM commands can be used if you want to change the spectrum analyzer settings before making a spurious emission power measurement. The combination of the _SES and -SEM commands is equivalent to the -SPUR command.

SPUR
Spurious Emission Power Measurement

Syntax

xspur

Measures the spurious emission power at the current spectrum analyzer center frequency. If in-band spurious measurement, measure only one slot at the same slot with carrier. If out-of-band measurement, measure all slots and find maximum slot of the full burst. See Table 5-6, below.

Example

OUTPUT 718; “-SPUR; "   *Performs* ***spurious mission power measurement.***

Executing SPUR does the following:

1. Performs the spurious emission power measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in variables and in a trace.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If -CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If -CC is set to continuous carrier, the carrier must be a nonburst carrier.)
The following are possible only if -FTACQ is set to 1.	
6	Digital demodulator hardware not present or not correct option (151)
7	Digital demodulator firmware not correct option.
8	Digital demodulator firmware revision date too old.
10	Frame trigger acquisition failed. (See Chapter 4, “Error Messages and Troubleshooting.“)

Table 5-6. Setting for the _SPUR Measurement

_SPURMT Setting	Result
1	-SPUR performs the spurious emission power measurement for out-of-band measurement.
2	-SPUR performs the spurious emission power measurement for in-band measurement.

Measurement Results: The results of the spurious emission power measurement are placed in the variables and trace shown in the following table.

Measurement Results

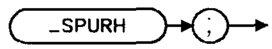
Variable or Trace	Description	Units
_NUMF	Indicates if the spurious emission power was within the measurement limits. The measurement limits are determined by _SEXA, and _SEXB. See Table 5-2 for more information about measurement limits. ■ If _NUMF is 0, the numeric results were within the limits. ■ If _NUMF is 2, a numeric result was greater than the upper measurement limit.	None
_SEA	A variable that contains the mean spurious emission power.	dBm
_SEAC	A variable that contains the ratio of the mean spurious emission power to the mean power measured in the last antenna power measurement	dB
TRA	TRA is trace A. Trace A contains the power waveform that was used to test for spurious emission power.	Determined by the trace data format (TDF) command.

Limit and Parameter Variables: SPUR uses _SEXA, _SEXB, -SSIVB, and _SENS. See Table 5-2 for more information.

Alternate Commands: The _SES and _SEM commands can be used instead of SPUR if you want to change the spectrum analyzer setting before making a spurious emission power measurement.

_SPURH
Spurious Harmonics Measurement

Syntax



xspurh

Performs in-band spurious measurement first, and measures out-of-band spurious at x1/2, x2, and x3 of carrier frequency. The _SPURH command is equivalent to SPURIOUS HARMONIC .

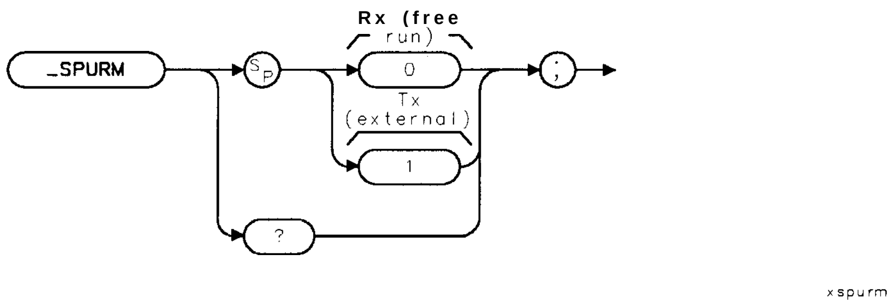
Example

OUTPUT 718;"_SPURH;"

See the description for the _SPUR for information about measurement state and measurement results.

_SPURM
Spurious Emission Measurement Mode

Syntax



Selects the trigger source for spurious emission measurement. The SPURM command is equivalent to SPUR TX RX .

_SPURM allows you to make measurements of conducted spurious components, refer to RCR STD-28 3.4.3.7 and 7.2.5.

If _SPURM is set to 0, the trigger mode is set to free run mode. If SPURM is set to 1, the trigger mode is set to external trigger mode. The default value for SPURM is 1.

Note If you set SPURM to 0, _SENS will be ignored, and the measurement will be made using a single sweep.

Example

OUTPUT 718;"MOV _SPURM,0;"	***Sets trigger mode to free run.***
OUTPUT718;"_SPURSET;"	***Performs the spurious emission set up.***
OUTPUT718;"_SPURZ;"	***Performs the spurious emission measurement.***

You should set _SPURM prior to executing -SPURSET, _SPURZ, SPUR, _SEM

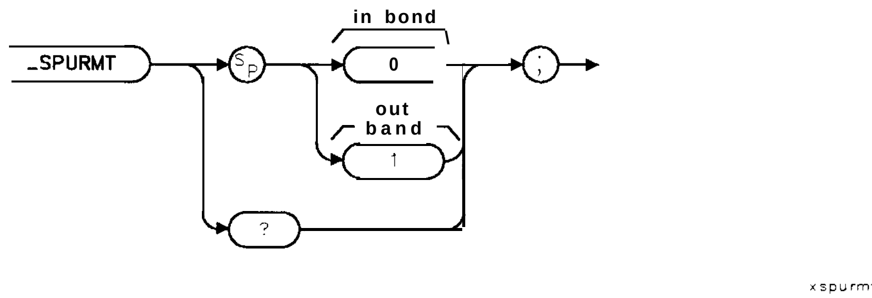
Query Example

```
OUTPUT718;"_SPURM?;"
```

The query response will be the current value of SPURM.

_SPURMT
Spurious Emission Power Measurement Type

Syntax



Allows you to specify how the spurious emission power measurement is performed. See Table 5-6. The default for _SPURMT is 1.

Example

`OUTPUT 718;"MOV _SPURMT,1;"`	*Specifies out-of-band spurious emission measurement.*
`OUTPUT718;"_SPURSET;"`	*Sets up spurious mission measurement.*
`OUTPUT718;"_SPURZ;"`	*Performs spurious search measurement.*

Related Commands: _SPURMT is used by _SPURSET, _SPURZ, SPUR, and _SEM.

Query Example

```
OUTPUT718;"_SPURMT?;"
```

The query response will be the current value of _SPURMT.

_SPURSET
Spurious Emission Search Setup

Syntax

xspurset

Sets up the spectrum analyzer for the spurious emission search measurement. The _SPURMT and _SPURSET commands are equivalent to SPURIOUS IN BAND , SPURIOUS OUT BAND .

Example

```
OUTPUT 718;"MOV _SPURMT,1;"     Set spurious measurement type to out of band.
OUTPUT718;"_SPURSET;"
```

_SPURZ
Spurious Emission Search Measurement

Syntax

xspurz

Using current span and marker peak search, the spectrum analyzer spans down and then performs the spurious emission power measurement. The _SPURZ command is equivalent to MEASURE SPUR .

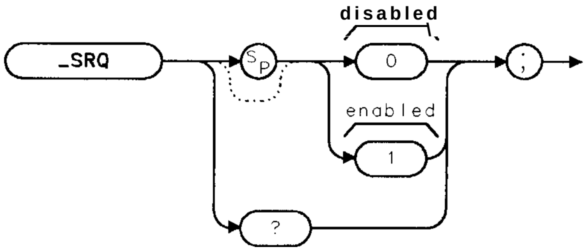
Example

```
OUTPUT718;"_SPURZ;"
```

See the description for _SPUR for information about measurement state and measurement results.

_SRQ
SRQ Measurement Done Indication

Syntax



Description

This command selects the mode for the synchronized completion of a PHS measurement. SRQ means "HP-IB/IEEE 488 service request." If -SRQ is set to 1, all PHS measurements will generate an SRQ to tell an external controller that the measurement command is complete. If _SRQ is set to 0, all measurements return a measurement state value in the spectrum analyzer output buffer to tell an external controller that the command is complete.

If _SRQ is set to 1, the measurement state must be returned by querying the value of _DF. The SRQ measurement done indication is valid only with an HP-IB interface (Option 021 or 041). At the completion of a measurement command with _SRQ enabled, bits 6 and 4 of the status byte are set. The decimal value of the status byte is then 80. $80_{10} = 64_{10}$ (binary bit location 6) + 16_{10} (binary bit location 4).

Softkey Equivalent: none

Example: -SRQ 1;

Valid Values: 0 = SRQ measurement done indication disabled
1 = SRQ measurement done indication enabled

Units: none

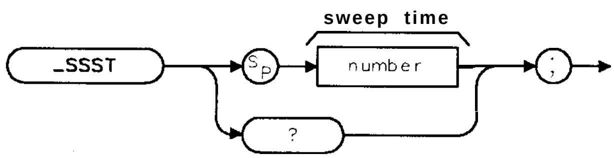
Default Value: 0

Preset State: last value

Note If _SRQ is enabled, subsequent front panel operation of the personality will generate service request (SRQ) messages on the spectrum analyzer screen. These messages can only be disabled by disabling _SRQ.

SSST
Spurious Emission Search Sweep Time for Out-of-band Measurement

Syntax



xssst

Specify the sweep time for spurious emission search. The _SSST command is equivalent to SEARCH TIME in SPURIOUS OUT BAND .

Recommended sweep value is 0.5, for 100 MHz span. If you specify a spurious zoom time less than 0.5 s, you might miss the spurious emission. The default is 2 s.

Example

OUTPUT 718; "_SSST 0.5; "	***Set spurious search sweep time.***
OUTPUT 718;"_SPURMT 1;"	***Set the out-of-band spurious measurement mode.***
OUTPUT 718;"_SPURSET;"	***Performs the spurious emission set up.***
OUTPUT 718; "_SPURZ;"	***Performs the spurious emission measurement.***

You should set _SSST prior to executing -SPURSET, _SPURZ.

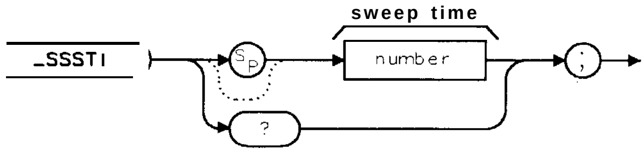
Query Example

OUTPUT 718;"_SSST?;"

The query response will be the current value of _SSST.

_SSSTI
Spurious emission Search Sweep Time for In-band Measurement

Syntax



xsssti

Specify the sweep time for spurious emission search. The _SSSTI command is equivalent to SEARCH TIME in SPURIOUS IN BAND .

The default value for -SSSTI is 2.

Example

OUTPUT 718;"_SSSTI 1;"	***Set spurious search sweep time.***
OUTPUT 718; "_SPURMT 2;"	***Set the in-band spurious measurement mode.***
OUTPUT 718; "_SPURSET;"	***Performs the spurious emission set up.***
OUTPUT718;"_SPURZ;"	***Performs the spurious emission measurement.***

You should set -SSSTI prior to executing _SPURSET, _SPURZ.

Query Example

OUTPUT 718; "_SSSTI?;"

The query response will be the current value of _SSST.

-TA
Trace Active

Syntax

xta

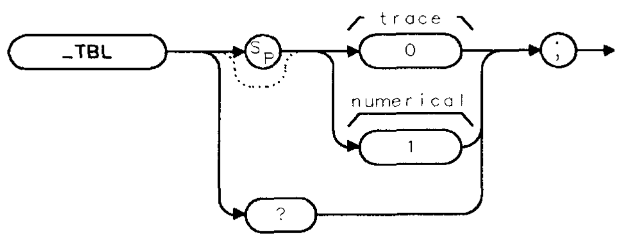
-TA allows you to view an active trace on the spectrum analyzer display after a measurement has been completed. The -TA command is equivalent to TRACE ACTIVE .

Example

```
OUTPUT 7 18 ;"_TA;"
```

-TBL
Table or Trace

Syntax



xtbl

Allows you to specify if the numerical or trace results of the adjacent channel power measurements are displayed on the spectrum analyzer screen. The -TBL command is equivalent to VIEW TBL TACE .

If -TBL is set to a "0," the trace result will be displayed. If -TBL is set to a " 1, " the numerical results, in a tabular format, will be displayed. The default for -TBL is 1.

Example

`OUTPUT 718;"MOV _TBL,0;"` *The trace result will be displayed.*

Related Commands: _ACP, _ACPM, and -ACPMT.

Query Example

`OUTPUT 718;"_TBL?;"`

The query response will be the current value of _TBL.

_TC
Trace Compare

Syntax

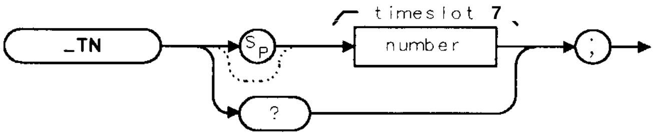
_TC copies the active trace from trace A into trace C. Trace A remains in the active mode, trace C is placed into the view mode (in the view mode, the trace is not updated). The -TC command is equivalent to TRACE COMPARE.

Example

```
OUTPUT 718;"_TC;"
```

-TN
Timeslot Number

Syntax



Allows you to enter the slot number for the burst that you want to measure. The -TN command is equivalent to SLOT NUMBER.

_TN can accept an integer from 1 to 8. The default for **_TN** is 1.

Example

`OUTPUT 718;"MOV _TN,2;"` ***Sets the slot number to 2.***

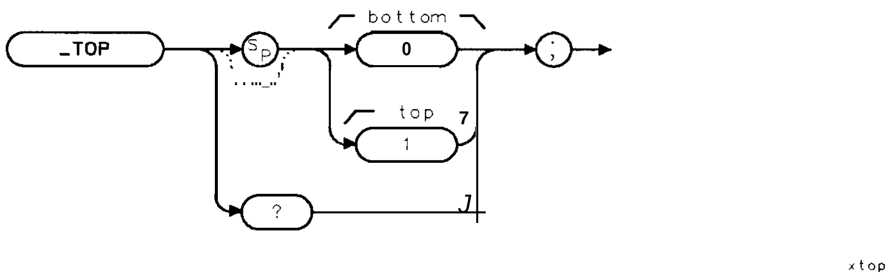
Query Example

`OUTPUT 718;"-TN?;"`

The query response will be the current slot number.

-TOP
Display Top or Bottom

Syntax



For a power versus time measurement, -TOP selects the section of the burst that is measured and displayed: the top section or the bottom section. The -TOP command is equivalent to DISPLAY TOP BOT.

If -TOP is set to 0, it is set to display the bottom section of the burst. If -TOP is set to 1, it is set to display the top section of the burst. The default value for -TOP is 1.

Example

OUTPUT 718;"MOV _TOP,0;" *Sets -TOP to display the bottom section of the burst.*

You should set -TOP prior to executing _PBURST, _PRISE, or . PFALL.

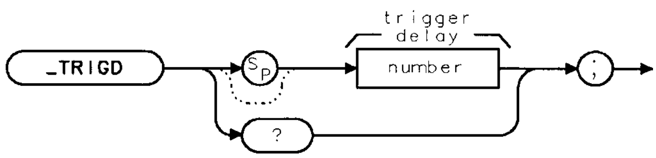
Query Example

OUTPUT 718;"_TOP?;"

The query response will be the current value of _TOP.

_TRIGD
Trigger Delay

Syntax



xtrigd

Allows you to enter the delay time from the external trigger signal to the reference point of the burst. The _TRIGD command is equivalent to TRIG DELAY.

You can enter an integer for trigger delay from -6,000 μs to 6,000 μs. The measurement unit for _TRIGD is μs. If you do not enter a trigger delay, a default value of 0 μs is used.

Example

`OUTPUT 718;"MOV _TRIGD,40;"` *Sets the trigger delay to 40 μs.*

The reference point for the trigger delay is point 0 of the burst.

Related Commands: -DEFAULT sets _TRIGD to 0. Use _TRIGP to set the trigger polarity, _TRIGM to set the trigger mode, and _TRIGF to set the trigger frame.

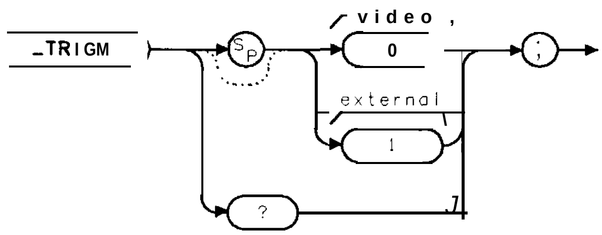
Query Example

`OUTPUT718;"_TRIGD?;"`

The query response will be the current value of _TRIGD.

_TRIGM
Trigger Mode for Power Measurements

Syntax



xtrigm

Selects the trigger source for antenna power, carrier off power, and power step measurements. The _TRIGM command is equivalent to PWR TRIG EXT VID .

If _TRIGM is set to 0, the trigger mode is set to video. If _TRIGM is set to 1, the trigger mode is set to external. The default value for _TRIGM is 0.

Example

OUTPUT 718;"MOV _TRIGM,0;" *Sets the trigger mode to video.*

You should set _TRIGM prior to executing _CPWR, or _COPWR.

Related Commands: _TRIGD, _TRIGP, _TRIGF, and -DEFAULT.

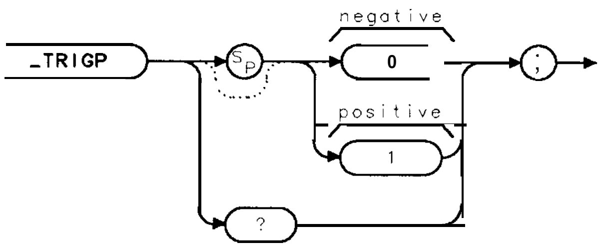
Query Example

OUTPUT 718;"_TRIGM?;"

The query response will be the current value of _TRIGM.

_TRIGP
Trigger Polarity

Syntax



xtrigp

Allows you to select the edge trigger polarity for the external transistor-transistor logic (TTL) frame trigger signal. The _TRIGP command is equivalent to TRIG POL MEG POS .

If _TRIGP is set to 0, the spectrum analyzer will trigger on the negative edge of the trigger signal. If _TRIGP is set to 1, the spectrum analyzer will trigger on the positive edge of the trigger signal. The default value for _TRIGP is 1.

Note that _TRIGP will only have an effect if the external trigger is connected to the GATE INPUT connector.

Example

OUTPUT 718;"MOV _TRIGP,0;" *Selects triggering on the negative edge of the external trigger signal.*

Related Commands: _TRIGM, _TRIGF, _TRIGD, and -DEFAULT.

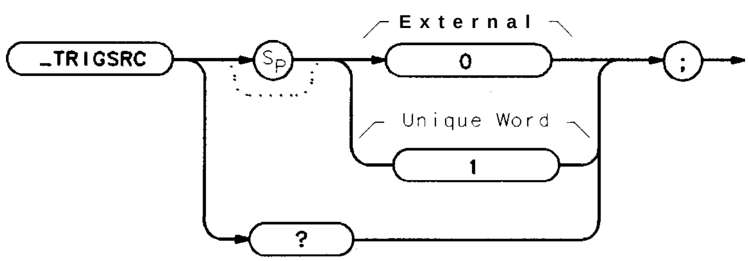
Query Example

OUTPUT 718;"_TRIGP?;"

The query response will be the current value of _TRIGP.

_TRIGSRC
Trigger Source

Syntax



pj447b

Allows you to specify the source of trigger signal used for carrier-off power, power versus time, and spurious emission measurements. The -TRIGSRC command is equivalent to TRIG SRC UW EXT.

If **the** trigger signal is from an external source, (that is, burst carrier trigger circuit or transmitter frame trigger output), you should ensure that _TRIGSRC is set to 0. If the trigger signal is from the frame trigger output of the Option 151 and 160 digital demodulator, you should ensure that -TRIGSRC is set to 1. The default value of -TRIGSRC is 1 if Options 151 and 160 are present; 0 otherwise.

Setting -TRIGSRC to 1 will set _TRIGP to 1, _TRIGD to 0, and _FTACQ to 1. Setting _TRIGSRC to 0 will set _FTACQ to 0.

Example

OUTPUT 718;"MOV _TRIGSRC,1;" *Select UW **trigger source.***

Related Commands: _TRIGF, _TRIGP, -FTACQ, -DEFAULT.

Query Example

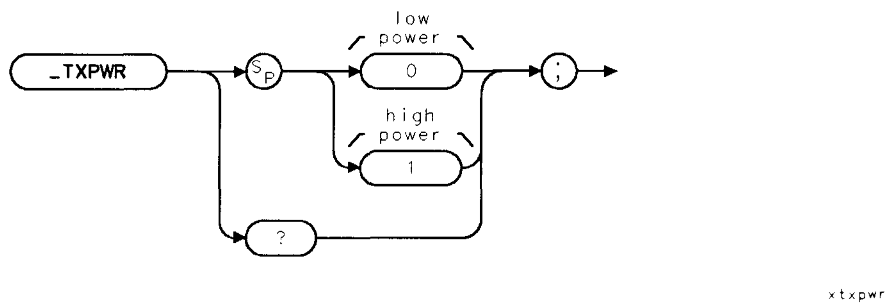
OUTPUT 718;"_TRIGSRC?;"

The query response will be the current value of _TRIGSRC.

Note With -TRIGSRC set to 1 (Unique Word), the rear panel Frame Trigger Output must be routed to the rear panel External Trigger Input. Connect FRAME TRIGGER OUTPUT directly to EXT TRIG INPUT. If Option 105 (Time-gated spectrum analysis) is installed, an alternate setup is to connect FRAME TRIGGER OUTPUT to GATE TRIGGER INPUT, and connect GATE OUTPUT to EXT TRIG INPUT.

-TXPWR
Transmitter Power Level

Syntax



Allows you to specify the PHS station-under-test's power output. The -TXPWR command is equivalent to TXPWR HI LOW.

If -TXPWR is set to 0, the personality assumes the PHS unit under test has 10 mW output power. If -TXPWR is set to 1, the personality assumes the unit under test has 500 mW output power.

Example

OUTPUT 718;"MOV _TXPWR,1;" ***Sets _TXPWR for*** *high power* ***measurement.***

Related Commands: -DEFAULT, _EXTATN.

Query Example

OUTPUT718;"_TXPWR?;"

The query response will be the current value of -TXPWR.

6

Programming Examples

This chapter explains how the PHS measurement personality functions can be executed by using programming commands. When you use programming commands to operate the PHS measurements personality, you send instructions to the spectrum analyzer instead of pressing the softkeys. The instructions (also called programming commands) are sent to the spectrum analyzer with a computer.

This chapter contains the following sections:

- Accessing the PHS measurements personality for remote operation
- Programming basics for PHS remote operation
- Customizing the PHS personality
- Programming examples for PHS remote operation

Before you can program the spectrum analyzer, you must connect the spectrum analyzer to the computer. See the programming documentation for the spectrum analyzer for more information.

All the examples in this chapter are written in HP BASIC.

Accessing the PHS Analyzer Mode for Remote Operation

To use the PHS programming commands, the PHS measurements personality must be loaded into spectrum analyzer memory, and the PHS analyzer mode must be selected. This section contains the following procedure:

- Select the PHS analyzer mode remotely.

To select the PHS analyzer mode remotely

1. Prepare the spectrum analyzer for the DONE command by doing an instrument preset and placing the spectrum analyzer into a single sweep mode.
2. Change to the PHS analyzer mode by setting the value of the MODE command to 10.
3. Perform a take sweep. You must do a take sweep before executing the DONE command.
4. Execute the DONE command.
5. Wait until the DONE command returns a " 1. "

The spectrum analyzer must be using the PHS analyzer mode before you can send any PHS programming commands to the spectrum analyzer. You need to execute the DONE command to ensure that the spectrum analyzer has finished executing the MODE command.

Example

`OUTPUT718;"IP;SNGLS;"`	***Does an instrument preset and places the spectrum** analyzer **in the single sweep mode.***
`OUTPUT 718;"MODE 10;"`	***Changes to the PHS mode.***
`OUTPUT 718;"TS;"`	***Performs a take sweep.***
`OUTPUT 718;"DONE?;"`	***DONE? returns a "1" when the MODE** com-**mand and the take sweep command are completed.***
`ENTER 718;Done`	***Waits until a "1" is returned.***

Programming Basics for PHS Remote Operation

This section contains information about how to use the PHS programming commands. For more information about a specific command, refer to the description for the command in Chapter 10.

This section contains the following procedures:

- Use the MOV command.
- Use the PHS setup and measurement commands.
- Use the repeat command.
- Determine when a measurement is done.
- Use the execute title to enter commands.
- Use an external keyboard to enter programming commands.

Note

The PHS programming commands and variables begin with an underscore (_), and spectrum analyzer programming commands do not. For example, -CH is a PHS programming command, and MOV is a spectrum analyzer programming command.

This guide contains information about the PHS programming commands. See the programming documentation for the spectrum analyzer for information about the spectrum analyzer programming commands.

To use the spectrum analyzer MOV command

- Use the MOV command to move a value into a PHS command that can accept a value.

You are encouraged to use the MOV command when you need to move a value into a PHS programming command. Using MOV allows the spectrum analyzer to process the command faster because no text is displayed in the active function area during command execution.

Example

This example shows how to move a number into the _CH command. The _CH command allows you to enter the channel number to be measured.

`OUTPUT 718;"MOV _CH,4;"`	***Changes the channel number to 4.***

To use the PHS setup and measurement commands

1. Execute the measurement setup command.
2. Change the spectrum analyzer setting, as desired.
3. Execute the measurement "measure" command.

Most of the PHS measurements can be done two ways:

Method 1: By executing the command that automatically performs both the setup and measurement. For example, _CPWR sets up the measurement and also performs the antenna power measurement.

or,

Method 2: By executing the command that sets up the measurement, a command that changes a spectrum analyzer setting, and then the command that actually performs the measurement. This method allows you to change parameters (for example, resolution bandwidth) for a measurement. For example, the two commands needed to perform the antenna power measurement are -CPS (sets up the measurement) and -CPM (actually performs the measurement).

This procedure demonstrates how you can perform a measurement by the second method.

Example

`OUTPUT 718;"_CPS;"`	***Sets up the spectrum analyzer settings for the antenna power measurement. After _CPS is executed, the resolution bandwidth is set to 100 kHz.***
`OUTPUT 718;"RB 300KHZ;"`	***Changes the resolution bandwidth to 300 kHz.***
`OUTPUT 718;"-CPM;"`	***Performs the antenna power measurement.***

To use the repeat command

- Execute the _RPT command to repeat a measurement.

You can use the _RPT command if you want to repeat a power measurement, adjacent channel power measurement, spurious emission, intermodulation spurious measurement, or power versus time measurement. Some PHS measurements personality parameters such as channel number and trace status can be changed prior to executing _RPT.

Example

```
OUTPUT 718;"MOV _CH,1;"    Changes the channel number to channel 1.
                           _CH is the command for the channel number
OUTPUT 718;"_RPT;"         Repeats the previous measurement.
```

To determine when a measurement is done

Two methods are available to determine when a measurement is done. The command _SRQ controls which of the two is used.

Method 1, _SRQ disabled

If _SRQ is disabled (the default), the analyzer automatically returns the measurement state value in the output buffer when the command is completed. This method is detailed below.

1. Execute the desired measurement command. When the measurement is finished, the command will return a number. This number is called the measurement state.
2. Use a REPEAT UNTIL loop to enter the numbers from the spectrum analyzer output buffer into the computer.

   Because there may be other numbers in the spectrum analyzer output buffer, you need to use a loop to determine if the measurement state has been received. See the description for the command in Chapter 5, "Programming Commands," to determine what numbers are valid measurement state values.
3. Examine the value of the measurement state.

   If the number is 1, the spectrum analyzer has successfully completed the command. If the number is greater than 1, an error has occurred. See the description for the measurement command in Chapter 5, "Programming Commands," for more information about error conditions and measurement state values.

You must check the measurement state to make sure that the results of a measurement are not queried before the measurement is completed. The measurement state is also useful for checking for error conditions. (For example, if the carrier level is too high to make the measurement.)

Example

```
OUTPUT 718;"_CHPWR;"                  Performs the channel power routine.
REPEAT                                Repeats the ENTER statement until a valid
                                      number for the measurement state is found.
  ENTER 718;Meas_state                Enters the values from the analyzer buffer.
UNTIL Meas_state>0 AND Meas_state<6   Ignores numbers that are not valid numbers
                                      for the _CHPWR measurement state. For
                                      _CHPWR, the only valid measurement state
                                      values are 1, 3, 4, and 5.
```

Method 2, _SRQ enabled

If _SRQ is enabled, the analyzer generates an HPIB/IEEE488 service request (SRQ), and sets a value in its status byte. Many different ways of using the SRQ and status byte exist. One way (using HP BASIC) is shown below.

For other examples that use HP BASIC, see Chapter 16, "How an Instrument Summons Service" in the HP 82302A, ***Using HP BASIC for Instrument Control, A Self-Study Course.*** For examples using the Quickbasic or C programming languages, see the file "HP_RMBCNV.TXT," on the disk included with the HP 82335B HP-IB Interface. HP VEE users can use the WAIT SPOLL direct I/O transaction.

1. Enable SRQ measurement done indication. This need only be done once; all subsequent measurements will be made with SRQ measurement done indication.
2. Execute the desired measurement command. When the measurement is finished, the command will issue an SRQ and set the instrument status byte to the decimal value 80.
3. Use a REPEAT/UNTIL loop to enter values from the spectrum analyzer status byte into the computer using the HP BASIC SPOLL command.
4. Note the status byte value. If the number is greater than zero, the measurement has completed.
5. Test the status byte value. If the value is 80, the measurement has completed normally with bits 6 and 4 set. $80_{10} = 64_{10}$ (binary bit location 6) + 16_{10} (binary bit location 4). Other values indicate other bits are set. For example, bit 5, which is an illegal command.
6. If the command completed normally, query and note the measurement state value.

   If the number is 1, the spectrum analyzer has successfully completed the command. If the number is greater than 1, an error has occurred. See the description for the measurement command in Chapter 5, "Programming Commands," for more information about error conditions and measurement state values.

   The measurement results can be queried only after the measurement is complete. The measurement state value is useful for checking error conditions. For example, it can detect that the carrier level is too low for a measurement to be made.

Note This method requires that Option 021 (HP-IB Interface), or Option 041 (HP-IB and Parallel Interface), is installed.

Example

```
OUTPUT 718;"MOV _SRQ,1;"            Enable SRQ measurement done indication
OUTPUT718;"_CHPWR;"                 Perform the channel power routine
REPEAT                              Repeats the SPOLL command until the
  Status-byte = SPOLL (718)         status byte is greater than 0
UNTIL Status_byte>0
If Status-byte = 80 THEN            Command completed normally
  Output 718; "_DF?;"               Query measurement state using _DF
  ENTER 718; Meas_state             Enter value
ELSE                                Other bits also set
  DISP "Abnormal command complete"
ENDIF
```

To use an external keyboard to enter commands

1. Turn off the spectrum analyzer.

Caution Do not connect the keyboard to the spectrum analyzer while the spectrum analyzer is turned on.

---

2. Connect an HP C1405B cable to the spectrum analyzer rear-panel connection (marked EXT KEYBOARD) using the C1405-60015 adapter.
3. Press (LINE) to turn on the spectrum analyzer, then press (MODE) PHS ANALYZER .
4. Press (F8) on the external keyboard to enter the "keyboard to command" mode.
5. Type in the command syntax. The characters that you type are shown at the top of the spectrum analyzer display. You can enter more than one command per line by separating the commands with a semicolon (for example, IP ; SNGLS ;).
6. Press (ENTER).

You can enter the programming commands into the spectrum analyzer by using a keyboard that is connected to the spectrum analyzer external keyboard connector. The external keyboard connector is included with an Option 021, Option 023, or Option 024 spectrum analyzer. Refer to the documentation for the spectrum analyzer for more information about the different external keyboard functions.

Because you are not using an external computer, the PHS personality and spectrum analyzer commands are entered without an OUTPUT or PRINT statement preceding them.

Example

Type in following programming line. Press (ENTER) after the programming line has been entered.

MOV_CH,2; ***Changes the channel number to 2. _CH is the command for the channel number***

To use the EXECUTE TITLE softkey to enter commands

If an external keyboard is not available or your analyzer does not have Option 021, 023, or 024 installed, you can enter commands using the analyzer EXECUTE TITLE softkey.

1. Press DISPLAY, Change Title. Use the softkeys to select characters for the command to be entered. You can also use the RPG TITLE softkey to select characters from a list on the screen. When using the RPG TITLE softkey, use the knob or arrow keys to place the cursor under the desired character. Press ENTER to select the character for the title. Press Windows (NEXT) to exit the RPG title mode.
2. Press (CAL), More 1 of 4 , ***More*** 2 of 4, Service Cal, EXECUTE TITLE to execute the commands entered into the title area.

The PHS personality and spectrum analyzer commands are entered without an OUTPUT or PRINT statement preceding them because you are not using an external computer.

Example

Enter the following programming line into the title area:

`MOV _CH,3;` ***Changes the channel number to 3.***

Execute the title using the EXECUTE TITLE softkey.

Customizing the PHS Personality

The PHS personality uses limits, and parameters when performing the measurements. You can change the values of the limits, parameters, and limit lines so that the PHS personality performs the measurements according to your particular test situation. For your convenience, you can store the limits and parameters that you have changed on a RAM memory card so the values can be easily loaded into the spectrum analyzer memory, whenever needed. This section contains the following procedures:

- Change the value of limit variables.
- Change the value of parameter variables.
- Save the revised limit variables, or parameter variables on a RAM card, using an external keyboard.
- Save the revised limit variables, or parameter variables on a RAM card, using a computer.

To change the value of limit variables

- Use the MOV command to move the new value for a limit into the variable for the limit.

or,

- Use the VARDEF command to move the new value for a limit into the variable for the limit. Using VARDEF to move the value for a limit redefines the instrument preset (IP) value of that limit.

The PHS measurements personality uses a "limit" to decide if the measurement results failed or passed. For example, if a signal is above the carrier off leakage power limit, the unit under test will fail the carrier off leakage power measurement. You can change a limit by changing the value of the limit variable. See Table 5-2 for a list of all the limit variables.

If you use the MOV command:

The limit variable will be reset to the default value for the limit variable if an instrument preset (IP) is executed or the spectrum analyzer is turned off.

Example of the MOV command

`OUTPUT 718;"MOV _COXA,-50;"` *Changes the limit for carrier off power from its current value to -50 dBm.*

If you use the VABDEF command:

The value for the limit variable is retained by the limit variable even if an instrument preset (IP) is executed or the spectrum analyzer is turned off.

Example for the VARDEF command

`OUTPUT 718;"VARDEF _COXA,-50;"` *Changes the limit for carrier off power from its current value to -50 dBm.*

The VARDEF command changes the PHS measurements personality that is currently in spectrum analyzer memory; the VARDEF command does not change the program on the HP 85726B memory card. If you reload the PHS measurements personality from the HP 85726B memory card, all the limit variables are set to their default values.

To change the value of parameter variables

- Use the MOV command to move the new value for a parameter into the variable for the parameter.

  or,

- Use the VARDEF command to move the new value for a parameter into the variable for the parameter. Using VARDEF to move the value for a parameter redefines the instrument preset (IP) value of that parameter.

Many of the PHS programming commands use one or more parameters when making a measurement. A parameter is a variable that specifies a spectrum analyzer setting. For example, the occupied bandwidth measurement uses the parameter _OBPCT to determine the percent used for the occupied bandwidth measurement. You can change the parameter for a measurement by moving the new value into the parameter variable. See Table 5-2 for a list of all the parameters variables.

If you use the MOV command:

The parameter variable will be reset to the default value for the parameter variable if an instrument preset (IP) is executed or the spectrum analyzer is turned off.

Example of the MOV command

`OUTPUT 718;"MOV _OBPCT,95;"`	***Sets the percent of the occupied bandwidth to 95 percent.***

If you use the VARDEF command:

The value for the parameter variable is retained by the parameter variable even if an instrument preset (IP) is executed or the spectrum analyzer is turned off.

Example for the VARDEF command

`OUTPUT 718;"VARDEF _OBPCT,95;"`	***Sets the percent of the occupied bandwidth to 95 percent.***

The VARDEF command changes the PHS measurements personality that is currently in spectrum analyzer memory; the VARDEF command does not change the program on the HP 85726B memory card. If you reload the PHS measurements personality from the HP 85726B memory card, all the parameter variables are set to their default values.

To save limit variables, and parameter variables functions on a RAM card, using an external keyboard

1. Refer to "To use an external keyboard to enter commands" (located earlier in this chapter) for information about connecting an external keyboard to the spectrum analyzer.
2. Delete the current version of the PHS personality and any other downloadable programs from analyzer memory by pressing (CONFIG) More 1 of 3 Dispose User Mem ERASE DLP MEM ERASE DLP MEM . Press (PRESET).
3. If necessary, insert a RAM card into the analyzer front-panel memory card reader. Ensure that the RAM card is not write-protected (the switch on the RAM card should be set to the read/write (↔) position).
4. Type in the programming statements that define the limit variable, or parameter variable.
   - For a limit or parameter variable, type in "VARDEF," the name of the variable (see Table 5-2 for a complete list of limit and parameter variables), a comma, and the value you want for the limit or parameter. Repeat this step for each variable or limit you want to define.
5. Type in "STOR d,'dLIMITS', *;" to store all the newly defined limits, or parameters on the memory card. The limits and parameters will be stored in a file called "dLIMITS."
6. Load the personality into spectrum analyzer memory (see "Step 1. Load the PHS measurements personality" in Chapter 1 for more information).
7. Remove the PHS memory card from the memory card reader and insert the RAM card (with the dLIMITS file on it) into the memory card reader.
8. Load the dLIMITS file into spectrum analyzer memory by pressing [RECALL) Catalog Card More 1 of 2 CATALOG DLP . If necessary, turn the large knob on the spectrum analyzer front panel until "dLIMITS" is highlighted. Press LOAD FILE .

When you load. the PHS measurements personality, the measurements personality uses default values for the limits and parameters. If you then load the dLIMITS file into spectrum analyzer memory, the personality will use the revised limit values, or variable value . The revised values will remain in spectrum analyzer memory until the analyzer memory . is erased, or the personality is reloaded from the memory card.

Example

Use an external keyboard to enter in the following command example lines. Press ENTER after each line:

```
VARDEF_CPXU,4;
VARDEF_CPXL,-2;
VARDEF_PBXU,560;
VARDEF_PBXL,600;
STOR d,'dLIMITS',*;
```

The previous command lines will change the antenna power high limit (-CPXU) to 4 dBm, change the antenna power low limit (-CPXL) to -2 dBm, change the power versus time burst width high limit (_PBXU) to 560 μs and change the power versus time burst width low limit (_PBXL) to 600 μs. The last line stores these limits on a RAM card with the file name "dLIMITS."

To save limit variables and parameter variables functions on a RAM card, using a computer

1. Insert a RAM card into the analyzer front-panel memory card reader. Ensure that the RAM card is not write-protected (the switch on the RAM card should be set to the read/write (↔) position).
2. Delete the current version of the PHS personality and any other downloadable programs from analyzer memory with the DISPOSE ALL command.
3. Type in the programming statements that define the limit or parameter.
   - For a limit or parameter variable, use an OUTPUT or PRINT command to send the spectrum analyzer command VARDEF (defines the limit or parameter variable) and the limit or parameter variable name. See Table 5-2 for a complete list of limits and parameter variables. Repeat this step for each variable you want to define.
4. Use an OUTPUT or PRINT command to send the STOR spectrum analyzer command. Use "STOR d,'dLIMITS', *;" to store the newly defined variables on the memory card. The variables will be stored in a file called "dLIMITS."
5. Load the personality into spectrum analyzer memory.
6. Remove the PHS memory card from the memory card reader and insert the RAM card (with the dLIMITS file on it) into the memory card reader.
7. Load the dLIMITS file into spectrum analyzer memory. You can load the dLIMITS file by pressing (RECALL) Catalog Card More 1 of 2 CATALOG DLP . If necessary, turn the large knob on the spectrum analyzer front panel until "dLIMITS" is highlighted. Press LOAD FILE.

   or,

   Use the LOAD command to load the dLIMITS file. For example, execute OUTPUT 718; "LOAD %dLIMITS%;".

When you load the PHS measurements personality, the measurements personality uses default values for the limit and parameter variables . If you then load the dLIMITS file into spectrum analyzer memory, the personality will use the revised limit or parameter values . The revised values will remain in spectrum analyzer memory until the analyzer memory is erased, or the personality is reloaded from the memory card.

Any number of custom limit files may be created and stored on a memory card as long as each file has a unique file name, and there is enough space on the RAM card to store the files.

Example

```
10    !re-store "LIMITS-EX"
20    !Shows how to save custom measurement limits to a card
30    !for the PHS DLP. This card file can then be loaded after
40    !loading PHS.
50
60    ASSIGN @Sa TO 718             !i/o path to spectrum analyzer
70
80
90    OUTPUT @Sa;"IP;SNGLS;"
100   OUTPUT @Sa;"TS;DONE?"            ! make sure all DLPs erased
110   ENTER @Sa;Done
120   OUTPUT @Sa;"DISPOSE ALL;"        ! make sure all DLPs erased
125   WAIT 10                      ! wait for dispose all to finish
130   OUTPUT @Sa;"VARDEF _CPXH,4;" !  change antenna par high limit to 4 dBm
140   OUTPUT @Sa;"VARDEF _CPXL,-2;"    ! change antenna pwr low limit to -2 dBm
150   !
160   OUTPUT @Sa;"VARDEF _PBXH,560;"  ! change burst width hi limit to 560 us
170   OUTPUT @Sa;"VARDEF _PBXL,600;"  ! change burst width lo limit to 600 us
180
190   OUTPUT @Sa;"STOR d,'dLIMITS',*;" ! store to RAM memory card
200   OUTPUT @Sa;"CONTS;"   ! continuous sneep
210   DISP "DONE"
220
230   END
```

Programming Examples

This section contains programming examples that show you how to do the following measurements remotely:

- Select a channel with the auto channel command.
- Measure the antenna power.
- Run a test executive with multiple tests in fast mode.
- Run a test executive with multiple tests.
- Make an eight-point constellation measurement
- Perform a data bits measurement
- Perform an I-Q pattern measurement
- Perform a modulation accuracy measurement
- Perform a modulation accuracy measurement with averaging
- See the status of a digital demodulation measurement

To select a channel with the auto channel command

This example shows how you can use the PHS programming command -ACH for selecting a channel.

```
10    !re-store "ACH_EX"
20    !Shows how to use the _ACH command in the PHS DLP
30
40    INTEGER Ch_num              !channel number variable
50
60    REAL Meas_state             !measurement state variable
70
80    ASSIGN @Sa TO 718           !i/o path to sa
90
100
110   OUTPUT @Sa;"_ACH;"          !execute Auto Channel command
120   REPEAT
130     ENTER @Sa;Meas_state      !enter measurement state
140   UNTIL Meas_state>0 AND Meas_state<3
150
160   IF Meas_state=1 THEN
170     OUTPUT @Sa;"_CH?;"        !query channel number
180     ENTER @Sa;Ch_num          !enter value
190     PRINT
200     PRINT "Channel number=";Ch_num
210   ELSE
220     DISP "Measurement aborted"
230   END IF
240
250   END
```

To measure the antenna power

This example shows how you can use the PHS programming commands to measure the antenna power.

```
10   !re-store "CPWR_EX"
20   !
30   ! Show how to use the _CPWR command in the PHS DLP
40   !
60   !
70   INTEGER Fail-flag         ! measuring result flag
80   INTEGER I                 ! loop counter
90   !
100  REAL Meas_stat            ! measurment state variable
110  REAL Mean-pwr-dbm         ! mean carrier power variable, dBm
120  REAL Mean-pwr-watts       ! mean carrier power variable, watts
130  !
140  !
150  ASSIGN @Sa TO 718         ! i/o path to spectrum analyzer
160  !
170  !
180  OUTPUT @Sa;"MOV _DPF,1;"  ! turned on pass/fail reporting
190  !
200  OUTPUT @Sa;"_CPWR;";      ! execute carrier power setting
210  !
220  REPEAT
230    ENTER @Sa;Meas_stat     ! enter measurment state
240  UNTIL Meas_stat>0 AND Meas_stat<6
250  !
260  IF Meas_stat=1 THEN       ! measurment completed
270    PRINT "Antenna Power       : "·
280    OUTPUT @Sa;"_NUMF?;"    ! query'measurment fail flag
290    ENTER @Sa;Fail_flag     ! enter value
300    SELECT Fail-flag
310    CASE 0
320      PRINT "PASSED . . .";
330    CASE 1
340      PRINT "FAILED LOWER LIMIT . . . ";
350    CASE 2
360      PRINT "FAILED UPPER LIMIT . . . ";
370    END SELECT
380    OUTPUT @Sa;"_CPA?;"     ! query mean power value, dBm
390    ENTER @Sa;Mean_pwr_dbm ! enter value
400    OUTPUT @Sa;"_CPW?;"     ! query meas power value, watts
410    ENTER @Sa;Mean_pwr_watts ! enter value
420    PRINT "Mean power = ";Mean_pwr_dbm;"(dBm), ";Mean_pwr_watts;"(W)"
430  ELSE
440    DISP "Antenna Power Measurment Aborted . . . Error stat:";Meas_stat
450  END IF
460  !
470  END
```

To run a test executive with multiple tests in fast mode

This example shows how you can use the PHS programming commands to run a test executive with multiple tests in *fast mode.*

```
10  !RE-STORE "PHS_TST"
20   !
30   !   PHS Measurement Personality
40   !   Example: Test Executive With Multiple Test
50   !            Fast Mode Test
60   !
70   ! Caution:
80   !
90   !   When you choose "fast mode" only, you must make a carrier power
100  !   measurement in STANDARD mode, or the measurement result may be incorrect.
110  !
120  !   This program assumes use of a Burst Carrier Trigger (BCT).
130  !
140  ! Contents:
150  !
160  !    1. Carrier Power Measurement
170  !    2. Carrier Off Power Measurement
180  !    3. Occupied Bandwidth Measurement
190  !    4. Adjacent Channel Power Measurement
200  !    5. Power vs. Time Measurement
210  !    6. Spurious Measurement
220  !
230  !                                  !
240  GINIT                              ! Init screen
250  GCLEAR                             !
260  CLEAR SCREEN                       !
270  !                                  !
280  REAL Freq                          ! Carrier frequency
290  INTEGER Meas_mode                  ! Measurement Mode
300  !                                  ! 0 = Standard
310  !                                  ! 1 = Fast
320  INTEGER Standard,Fast
330  DATA 0,1
340  READ Standard,Fast
350  !
360  ASSIGN @Sa TO 718                  ! Assign S/A path
370 !ON TIMEOUT 7.32 GOTO Fatal-error    ! Error handling
380  !                                  !
390  FOR Meas_mode=Standard TO Fast
400    !
410    PRINT                            ! Annotation message
420    PRINT "   Begin PHS Measurement."!
430    PRINT                            !
440    !                                !
450    Sa_init(@Sa,Meas_mode,Freq)      ! Enter PHS Personality mode
460    Sa_cpwr(@Sa)                     ! Carrier power measurment
470    Sa_copwr(@Sa)                    ! Carrier off power measurment
480    Sa_obw(@Sa)                      ! OBW measurment
490    Sa_acp(@Sa)                      ! ACP measurment
500    Sa_pvst(@Sa)                     ! Power vs Time measurment
510    Sa_spur(@Sa,Freq)                ! Spurious emission measurment
520    Sa_finished(@Sa)                 ! Monitor channel
530    !
540    PRINT                            !
550    PRINT "   Finished PHS Measurement."!
560    PRINT                            !
570    !                                !
580  NEXT Meas_mode
590  !
600  STOP
610  !
```

```
620 Fatal-error:   !
630   DISP "Fatal error occured.(TIME OUT)."
640   END
650   !
660   !
670   !
680 Sa_init:SUB Sa_init(@Sa,INTEGER Meas_mode,REAL Freq)
690     !
700     ! Initilize PHS DLP
710
720     !    Parameter passed in: @Sa . . . i/o path to spectrum analyzer
725     !    Parameter passed in: Meas_mode . . . measurement mode.
730     !    Parameter passed out: Freq . . . Center frequency to meas.
740
750     ! Change MODE to the PHS Personality
760
770     OUTPUT @Sa;"_MODE;"
780     OUTPUT @Sa;"TS;"
790     OUTPUT @Sa;"DONE?;"
800     ENTER @Sa;Done
810
820     ! Auto channel
830
840     OUTPUT @Sa;"_ACH;"
850     OUTPUT @Sa;"TS;"
860     OUTPUT @Sa;"DONE?;"
870     ENTER @Sa;Done
880
890     OUTPUT @Sa;"_CF?;"
900     ENTER @Sa;Freq
910
920     OUTPUT @Sa;"_TRIGSRC0;"        ! Use with BCT
930     OUTPUT @Sa;"_TRIGD20;"         ! Set trigger delay to 20(uS)
940
950     OUTPUT @Sa;"_TXPWR0;"          ! Set TX power to normal
960     OUTPUT @Sa;"_EXTATN8.5;"       ! Set ext loss to 8.5(dB)
970
980     ! Set the measurement parameters
990
1000    IF Meas_mode=0 THEN
1010      OUTPUT @Sa;"_MEASM0;"        ! Set measurement mode to standard
1020
1030      ! Set number of sweep to default values
1040
1050      OUTPUT @Sa;"{_CPNS=4;_CONS=2;_PNS=5;_SENS=4};"
1060
1070      OUTPUT @Sa;"_ACPMT2;"        ! Set ACP measurement type to multi swp
1080      OUTPUT @Sa;"_COPMT2;"        ! Set COPWR measurement type to GATED
1090      OUTPUT @Sa;"_SSST2;"         ! Set spurious search time to 2(sec)
1100      OUTPUT @Sa;"_DPF1;"          ! display pass/fail on
1110    ELSE
1120      OUTPUT @Sa;"_MEASM1;"        ! Set measurement mode to fast
1130
1140      ! Set number of sweep to 1
1150
1160      OUTPUT @Sa;"{_CPNS=1;_CONS=1;_PNS=1;_SENS=1};"
1170
1180      OUTPUT @Sa;"_ACPMT1;"        ! Set ACP measurement type to single
1190      OUTPUT @Sa;"_COPMT1;"        ! Set COPWR measurement type to ZERO SPAN
1200      OUTPUT @Sa;"_COPMKK0;"       ! Set to single frequency mode
1210      OUTPUT @Sa;"_SSST0.5;"       ! Set spurious search time to 0.5(sec)
1220      OUTPUT @Sa;"_DPF0;"          ! display pass/fail off
1230    END IF
1240    !
1250  SUBEND
1260    !
```

```
1270 Sa_cpwr:SUB Sa_cpwr(@Sa)
1280    !
1290    ! Show how to use the _CPWR, _CPS, _CPM command in the PHS DLP
1300
1310    !    Prameter passed in: @Sa . . . i/o path to spectrum analyzer
1320    !
1330    INTEGER Fail-flag                   ! measuring result flag
1340    INTEGER I                           ! loop counter
1350
1360    REAL Meas_stat                      ! measurment state variable
1370    REAL Mean_pwr_dbm                   ! mean carrier power variable, dBm
1380    REAL Mean-pwr-watts                 ! mean carrier power variable, wattes
1390    !
1400    OUTPUT @Sa;"_CPWR;"                 ! execute carrier power measurment
1410    REPEAT
1420      ENTER @Sa;Meas_stat               ! enter measurment state
1430    UNTIL Meas_stat>0 AND Meas_stat<6
1440
1450    IF Meas_stat=1 THEN                 ! measurment completed
1460      PRINT "Carrir Power       : ";
1470      OUTPUT @Sa;"_NUMF?;"              ! query measurment fail flag
1480      ENTER @Sa;Fail_flag               ! enter value
1490      SELECT Fail-flag
1500      CASE 0
1510        PRINT "PASSED . . .";
1520      CASE 1
1530        PRINT "FAILED LOWER LIMIT . . . ";
1540      CASE 2
1550        PRINT "FAILED UPPER LIMIT . . . ";
1560      END SELECT
1570      OUTPUT @Sa;"_CPA?;"               ! query mean power value, dBm
1580      ENTER @Sa;Mean_pwr_dbm            ! enter value
1590      OUTPUT @Sa;"_CPW?;"               ! query meas power value, watts
1600      ENTER @Sa;Mean_pwr_watts          ! enter value
1610      PRINT "Mean power = ";Mean_pwr_dbm;"(dBm), ";Mean_pwr_watts;"(W)"
1620    ELSE
1630      DISP "Carrier Power Measurement Aborted . . . Error stat:";Meas_stat
1640    END IF
1650
1660  SUBEND
1670
1680 Sa_copwr:SUB Sa_copwr(@Sa)
1690    !
1700    ! Show how to use the _COPWR, _COS, _COM commands int PHS DLP
1710    !
1720    !    Parameters passed in: @Sa . . . i/o path to spectrum analyzer
1730    !
1740    INTEGER Fail-flag                   ! measurment result flag
1750    INTEGER I                           ! loop counter
1760    !
1770    REAL Meas_stat                      ! measurment state variable
1780    REAL Mean-par-watts                 ! mean carrier off power variable
1790    REAL Rel_pwr                        ! carrier off power variable
1800    !                          (relative to last antenna power measurment)
1810    !
1820    ! Measurement
1830    !
1840    OUTPUT @Sa;"_COPWR;";               ! execute carrier off power
1850    !
1860    REPEAT
1870      ENTER @Sa;Meas_stat               ! enter measurment state
1880    UNTIL Meas_stat>0 AND Meas_stat<6
1890      !
1900    IF Meas_stat=1 THEN                 ! measurment completed
1910      PRINT "Carrir Off Power   : ";
1920      OUTPUT @Sa;"_NUMF?;"              ! query measurment fail flag
```

```
1930      ENTER @Sa;Fail_flag               ! enter value
1940      SELECT  Fail-flag
1950      CASE 0
1960        PRINT  "PASSED . . .";
1970      CASE 2
1980        PRINT "FAILED UPPER LIMIT . . . ";
1990      END  SELECT
2000      OUTPUT @Sa;"_COA?;"               ! query mean carrier off power value
2010      ENTER @Sa;Mean_pwr_dbm            ! enter value
2020      OUTPUT @Sa;"_COAC?;"              ! query carrier off power (relative)
2030      ENTER @Sa;Rel_pwr                 ! enter value
2040      PRINT "Pwr = ";Mean_pwr_dbm;"(dBm), ";Rel_pwr;"(dBc)"
2050    ELSE
2060      DISP "Carrier Off Power Measurement Aborted . . . Error stat:";Meas_stat
2070    END IF
2080    !
2090  SUBEND
2100 !
2110 Sa_obw:SUB Sa_obw(@Sa)
2120    !
2130    ! Shows how to use the _OBW, _OBWS, _OBWM commands in the PHS DLP
2140
2150    !    Parameter passed in: @Sa . . .  i/o path to spectrum anaplzer
2160
2170    INTEGER  Fail-flag                  ! measuring result flag
2180    INTEGER I                           ! loop counter
2190
2200    REAL Meas_status                    ! measurment state variable
2210    REAL Occ_bw                         ! occupied bandwidth variable
2220    REAL Occ_bw_f_err                   ! OBW frequency error variable
2230
2240    OUTPUT @Sa;"_OBW;"                  ! execute OBW
2250
2260    REPEAT
2270      ENTER @Sa;Meas_stat               ! enter measurment state
2280    UNTIL Meas_stat>0 AND Meas_stat<6
2290
2300    IF Meas_stat=1 THEN                 ! measurment completed
2310      PRINT "Occupies Bandwidth : ";
2320      OUTPUT @Sa;"_NUMF?;"              ! query measurment fail flag
2330      ENTER @Sa;Fail_flag
2340      SELECT  Fail-flag
2350      CASE 0
2360        PRINT  "PASSED . . .";
2370      CASE 2
2380        PRINT "FAILED UPPER LIMIT . . . ";
2390      END  SELECT
2400      OUTPUT @Sa;"_OBBW?;"              ! query occupied bw value
2410      ENTER @Sa;Occ_bw                  ! enter value
2420      OUTPUT @Sa;"_OBFE?;"              ! query occ. bw freq error value
2430      ENTER @Sa;Occ_bw_f_err            ! enter value
2440      PRINT "Obw = ";Occ_bw;"(Hz), ";Occ_bw_f_err;"(Hz)"
2450    ELSE
2460      DISP "Occupied Bandwidth Measurement Aborted . . . Error stat:";Meas_stat
2470    END IF
2480
2490  SUBEND
2500 !
2510 Sa_acp:SUB Sa_acp(@Sa)
2520   !
2530    ! Show how to use the _ACP, _ACPS, _ACPM commands in the PHS DLP
2540   !
2550   !    Parameter passed in: @Sa . . .  i/o path to spectrum analyzer
2560   !
2570    INTEGER  Fail-flag                  ! measuring result flag
2580    INTEGER I                           ! loop counter
```

```
2590   !
2600   REAL Meas_status                   ! masurment stat variable
2610   REAL Acpr(4)                       ! arrey to hold adjacent channel power
2620   !
2630   OUTPUT @Sa;"_ACP;";                ! execute ACP setting
2640
2650   REPEAT
2660     ENTER @Sa;Meas_stat              ! enter measurment state
2670   UNTIL Meas_stat>0 AND Meas_stat<6
2680
2690   IF Meas_stat=1 THEN                ! measurment completed
2700     PRINT "Adjacent Cannel Power: ";
2710     OUTPUT @Sa;"_NUMF?;"             ! query pass/fail flag
2720     ENTER @Sa;Fail_flag
2730     SELECT Fail-flag
2740     CASE 0
2750       PRINT "PASSED ... "
2760     CASE 2
2770       PRINT "FAILED UPPER LIMIT . . . "
2780     END SELECT
2790
2800     OUTPUT @Sa;"_ACPR[1]?;"          ! query loner adjacent power
2810     ENTER @Sa;Acpr(1)                ! enter value
2820     OUTPUT @Sa;"_ACPR[2]?;"          ! query upper adjacent power
2830     ENTER @Sa;Acpr(2)                ! enter value
2840     OUTPUT @Sa;"_ACPR[3]?;"          ! query lower adjacent power
2850     ENTER @Sa;Acpr(3)                ! enter value
2860     OUTPUT @Sa;"_ACPR[4]?;"          ! query upper adjacent power
2870     ENTER @Sa;Acpr(4)                ! enter value
2880
2890     PRINT "   ACP: Lower adj =";Acpr(1)/10.;"(dBm)"
2900     PRINT "   ACP: Upper adj =";Acpr(2)/10.;"(dBm)"
2910     PRINT "   ACP: Lower alt =";Acpr(3)/10.;"(dBm)"
2920     PRINT "   ACP: Upper alt =";Acpr(4)/10.;"(dBm)"
2930
2940   ELSE
2950     DISP "Adjacent Cannel Power Measurement Aborted . . . Error stat:";Meas_stat
2960   END IF
2970
2980 SUBEND
2990 !
3000 Sa_pvst:SUB Sa_pvst(@Sa)
3010   !
3020   ! Show how to use the _PBURST, _PRISE, _PFALL commands in the PHS DLP
3030   !
3040   !    Parameter passed in: @Sa . . . i/o path to spectrum analyzer
3050   !
3060   INTEGER Fail-flag                  ! measuring result flag
3070   INTEGER I                          ! loop counter
3080   !
3090   REAL Meas_status                   ! measurment state variable
3100   REAL Burst-time                    ! burst width time
3110   REAL Rise-time                     ! attack time
3120   REAL Fall-time                     ! release time
3130   !
3140   FOR I=1 TO 3
3150     SELECT I
3160     CASE 1
3170       OUTPUT @Sa;"_PBURST;"          ! execute P vs T burst measurment
3180     CASE 2
3190       OUTPUT @Sa;"_PRISE;"           ! execute P vs T riseing measurment
3200     CASE 3
3210       OUTPUT @Sa;"_PFALL;"           ! execute P vs T falling measurment
3220     END SELECT
3230     !
3240     REPEAT
```

```
3250        ENTER @Sa;Meas_stat             ! enter measurment state
3260      UNTIL Meas_stat>0 AND Meas_stat<6
3270      !
3280      IF Meas_stat=1 THEN               ! measurment completed
3290        PRINT "Power vs. Time: ";
3300        OUTPUT @Sa;"LIMIFAIL?;"         ! query the result of limit test
3310        ENTER @Sa;Fail_flag
3320        SELECT Fail-flag
3330        CASE 0
3340          PRINT "PASSED . . .";
3350        CASE ELSE
3360          PRINT "FAILED . . .";
3370        END SELECT
3380        !
3390        SELECT I
3400        CASE 1
3410          OUTPUT @Sa;"_PBT?;"           ! query burst time
3420          ENTER @Sa;Burst_time          ! enter burst time
3430          PRINT "Burst time = ";Burst_time;"(uS)"
3440        CASE 2
3450          OUTPUT @Sa;"_PATT?;"          ! query attack time
3460          ENTER @Sa;Rise_time           ! enter attack time
3470          PRINT "Rise time = ";Rise_time;"(uS)"
3480        CASE 3
3490          OUTPUT @Sa;"_PRET?;"          ! query release time
3500          ENTER @Sa;Fall_time           ! enter release time
3510          PRINT "Fall time = ";Fall_time;"(uS)"
3520        END SELECT
3530        !
3540      ELSE
3550        DISP "Power vs Time Measurement Aborted . . . Error stat:";Meas_stat
3560      END IF
3570    NEXT I
3580  !
3590  SUBEND
3600  !
3610 Sa_spur:SUB Sa_spur(@Sa,REAL Freq)
3620    !
3630    ! Shows how to use _SPURSET, _SPURZ, -SPUR commands in the PHS DLP
3640
3650    !    Parameter passed in: @Sa . . . i/o path to spectrum analyzer
3660    !                         Freq . . . carrier frequency
3670
3680    INTEGER Fail-flag                   ! measuring result flag
3690    INTEGER I                           ! loop counter
3700    INTEGER Fast-zoom-on                ! fast zoom in flag
3710
3720    REAL Meas_status                    ! measurment state variable
3730    REAL Spur-pwr                       ! mean spur emission power variable
3740    REAL Spur_pwr_rel                   ! mean spur emission power variable
3750    REAL Spur_f(1:3)                    ! spur frequency to measurment
3760    REAL Span                           ! spurious search span
3770    REAL Fa                             ! start frequensy for span
3780    REAL Fb                             ! stop frequency for span
3790
3800    ! Set spurious frequency to meas, and span
3810
3820    Spur_f(1)=Freq/2.
3830    Spur_f(2)=Freq*2.
3840    Spur_f(3)=Freq*3.
3850    Span=3.0E+6
3860
3870    OUTPUT @Sa;"MOV _SPURMT,1;"         ! set in band spurious emission
3880    !                       2 for in band meas
3890   !OUTPUT @Sa;"_CPPKA-100;"            ! Force ATT to 10
3900
```

```
3910   OUTPUT @Sa;"_SPURSET;"               ! setup for spurious emission search
3920   OUTPUT @Sa;"TS;"
3930   OUTPUT @Sa;"DONE?;"                  ! wait until done
3940   ENTER @Sa;Done
3950   !
3960   FOR I=1 TO 3                         ! I=0 For in band meas
3970     IF I>0 THEN
3980       IF I=1 THEN
3990         OUTPUT @Sa;"MOV _SPURMT,1;"
4000       END IF
4010       Fa=Spur_f(I)-Span/2.
4020       Fb=Spur_f(I)+Span/2.
4030       OUTPUT @Sa;"FA ";Fa;              specify start frequency for search
4040       OUTPUT @Sa;"FB ";Fb;              specify stop frequency for search
4050     END IF
4060     !
4070     Fast_zoom_on=0                     0 ... standard zoom in
4080     IF Fast-zoom-on THEN               1 ... fast zoom in
4090       Spur_zoom(@Sa,Span*1.E-6)        if you choose fast zoom in
4100       OUTPUT @Sa;"_SPUR;"              execute spurious emission measurment
4110     ELSE
4120       OUTPUT @Sa;"_SPURZ;";            if you choose standard zoom in
4130     END IF
4140     !
4150     REPEAT
4160       ENTER @Sa;Meas_stat              enter measurment state
4170     UNTIL Meas_stat=1
4180     !
4190     IF Meas_stat=1 THEN                measurment completed
4200       PRINT "Spurios: ";
4210       OUTPUT @Sa;"_NUMF?;"
4220       ENTER @Sa;Fail_flag
4230       SELECT Fail-flag
4240       CASE 0
4250         PRINT "PASSED . . .";
4260       CASE 2
4270         PRINT "FAILED . . .";
4280       END SELECT
4290       !
4300       OUTPUT @Sa;"_SEA?;"              query mean spur power value
4310       ENTER @Sa;Spur_pwr               enter value
4320       OUTPUT @Sa;"_SEAC?;"             query mean spur power (relative)
4330       ENTER @Sa;Spur_pwr_rel           enter value
4340       PRINT "Spur =";Spur_pwr;"(dBm), ";Spur_pwr_rel;"(dBc), ";
4350       IF I=0 THEN
4360         PRINT
4370       ELSE
4380         PRINT "Freq =";Spur_f(I);"(Hz)"
4390       END IF
4400
4410     ELSE
4420       DISP "Spurious Measurement Aborted . . . Error stat:";Meas_stat
4430     END IF
4440
4450     ! some controls for loop measurment
4460
4470     OUTPUT @Sa;"{RL=_CPA+_CPAJB+3;ST=_SSST};";
4480     OUTPUT @Sa;"DET POS;";
4490     OUTPUT @Sa;"A1;";
4500
4510   NEXT I
4520
4530 SUBEND
4540 !
4550 Sa_finished:SUB Sa_finished(@Sa)
4560   OUTPUT @Sa;"_MCH;";                  ! monitor channel
```

```
4570    DISP ""
4580 SUBEND
4590 !
```

To run a test executive with multiple tests

This example shows how you can use the PHS programming commands to run a test executive with multiple tests in *normal* mode where the reference level is automatically set by each measurement and all results are displayed on the screen.

```
10   !RE-STORE "PHS_DEMO_BAS"
20   !RE-SAVE  "PHS_DEMO_ASC"
30   !
40   ! SA_PHS_XXX:
50   !
60   !   PHS Measurement Personality
70   !   Example: Test Executive With Multiple Tests
80   ! Contents:
90   !
100  !    1. Antenna Power Measurement
110  !    2. Carrier Off Power Measurement
120  !    3. Occupied Bandwidth Measurement
130  !    4. Adjacent Channel Power Measurement
140  ! 5. Power vs. Time Measurement
150  ! 6. Spurious Measurement
160  !
270  !
280  !
290  !                                !
300  GINIT                            ! Init screen
310  GCLEAR
320  CLEAR SCREEN
330  !
340  REAL Freq                        ! Carrier frequency
350  INTEGER Flag                     ! Pause flag
360  !
370  INTEGER True,False               ! Define True, False set
380 Flag-data:
390  DATA 1,0
400  READ True,False
410  !
420  !
430  Freq=3.00E+8                     ! Define Carrier Frequency, use _CFX mode
440  Flag=False                       ! Define PAUSE flag, "True" or "False"
450  !
460  !
470  ASSIGN @Sa TO 718                ! Assign S/A path
480 !ON TIMEOUT 7,32 GOTO Fatal-error  ! Error handling
490  !
500  !
510  LOOP
520    PRINT                          ! Annotation message
530    PRINT "   Begin PHS Measurement." !
540    PRINT                          !
550    !                              !
560    Sa_init(@Sa,Freq)              ! Enter PHS Pers mode
570    Sa_cpwr(@Sa)                   ! Carrier power meas.
580    Sa_pause(@Sa,Flag,"Carrier off power")!
590    Sa_copwr(@Sa)                  ! Carrier off power meas
600    Sa_pause(@Sa,Flag,"OBW")       !
610    Sa_obw(@Sa)                    ! OBW measurement
620    Sa_pause(@Sa,Flag,"ACP")       !
630    Sa_acp(@Sa)                    ! ACP measurement
640    Sa_pause(@Sa,Flag,"PvsT")      !
650    Sa_pvst(@Sa)                   ! Power vs Time meas
660    Sa_pause(@Sa,Flag,"Spurious emission")!
670    Sa_spur(@Sa,Freq)              ! Spurious emission meas
680    Sa_finished(@Sa)               ! Monitor channel
690    !                              !
```

```
700     PRINT                          !
710     PRINT "   Finished PHS Measurement."!
720     PRINT                          !
730     !                              !
740     Wait-loop
750   END LOOP
760   STOP
770   !
780 Fatal-error: !
790   DISP "Fatal error occured. (TIME OUT)."
800   END
810   !
820   !
830   !
840 Sa_init:SUB Sa_init(@Sa,REAL Freq)
850     !
860     !    Initialize PHS DLP
870     !
880     I Parameters passed in: @Sa  . . . i/o path to sa
890     ! Freq . . . Center frequency to meas.
900     !
910     !    Change MODE to the PHS Personality
920     !
930     OUTPUT @Sa;"_MODE;"
940     OUTPUT @Sa;"TS;"
950     OUTPUT @Sa;"DONE?;"
960     ENTER @Sa;Done
970     !
980     ! Set _CFX mode and frequency
990     !
1000    OUTPUT @Sa;"_CFX";Freq;
1010    OUTPUT @Sa;"TS;"
1020    OUTPUT @Sa;"DONE?;"
1030    ENTER @Sa;Done
1040    !
1050  SUBEND
1060    !
1070 Sa_cpwr:SUB Sa_cpwr(@Sa)
1080    !
1090    ! Show how to use _CPWR, _CPS, _CPM command in DLP
1100
1110    !    Parameter passed in: @Sa . . . i/o path to sa
1120
1130    INTEGER Fail-flag            ! meas result flag
1140    INTEGER I                    ! loop counter
1150
1160    REAL Meas_stat               ! measurement state variable
1170    REAL Mean_pwr_dbm          ! mean carrier pwr variable, dBm
1180    REAL Mean_pwr_watts        ! mean carrier par variable, watts
1190
1200    OUTPUT @Sa;"MOV _DPF,1;"     ! turn on pass/fail flag
1210    OUTPUT @Sa;"_CPS;"           ! execute carrier par setting
1220
1230    ! you may use _CPWR instead of _CPS, -CPM,
1240    ! if you do not change measurement parameters
1250    !
1260    FOR I=1 TO 2
1270      OUTPUT @Sa;"_CPM;"         ! execute car pwr meas
1280      REPEAT
1290        ENTER @Sa;Meas_stat      ! enter meas state
1300      UNTIL Meas_stat>0 AND Meas_stat<6
1310
1320      IF Meas_stat=1 THEN        ! measurement completed
1330        PRINT "Antenna Power       : ";
1340        OUTPUT @Sa;"_NUMF?;"     ! query meas fail flag
1350        ENTER @Sa;Fail_flag      ! enter value
```

```
1360        SELECT Fail-flag
1370        CASE 0
1380          PRINT "PASSED . . .";
1390        CASE 1
1400          PRINT "FAILED LOWER LIMIT . . . ";
1410        CASE 2
1420          PRINT "FAILED UPPER LIMIT . . . ";
1430        END SELECT
1440        OUTPUT @Sa;"_CPA?;"       ! query mean pwr value, dBm
1450        ENTER @Sa;Mean_pwr_dbm    ! enter value
1460        OUTPUT @Sa;"_CPW?;"       ! query meas pwr value, watts
1470        ENTER @Sa;Mean_pwr_watts        ! enter value
1480        PRINT "Mean power = ";Mean_pwr_dbm;"(dBm), ";Mean_pwr_watts;"(W)"
1490      ELSE
1500        DISP "Antenna Power Measurement Aborted . . . Error stat:";Meas_stat
1510      END IF
1520      OUTPUT @Sa;"VB 3MHZ;";      ! user other VBW for loop 2
1530    NEXT I
1540 !
1550 SUBEND
1560 !
1570 Sa_copwr:SUB Sa_copwr(@Sa)
1580    !
1590    ! Show how to use _COPWR, _COS, _COM commands in DLP
1600    !
1610    !    Parameters passed in: @Sa . . . i/o path to sa
1620    !
1630    INTEGER Fail-flag            ! meas result flag
1640    INTEGER I                    ! loop counter
1650    !
1660    REAL Meas_stat               ! meas state variable
1670    REAL Mean-par-watts          ! mean carrier off par variable
1680    REAL Rel_pwr                 ! carrier off power variable
1690    !                 (relative to last antenna power meas)
1700    !
1710    ! Measurement
1720    !
1730    OUTPUT @Sa;"MOV _DPF,1;"     ! turne on pass/fail flag
1740    OUTPUT @Sa;"MOV _COPMT,1;"; ! set for MKK zero span method
1750    OUTPUT @Sa;"_COS;"           ! execute car-off-pwr setting
1760    !
1770    ! You may use _COPWR instead of _COS, _COM,
1780    ! if you do not change measurement parameters
1790    !
1800    FOR I=1 TO 2
1810      OUTPUT @Sa;"_COM;"         ! execute car-off-pwr meas
1820      REPEAT
1830        ENTER @Sa;Meas_stat      ! enter meas state
1840      UNTIL Meas_stat>0 AND Meas_stat<6
1850      !
1860      IF Meas_stat=1 THEN        ! measurement completed
1870        PRINT "Carrier Off Power   : ";
1880        OUTPUT @Sa;"_NUMF?;"     ! query meas fail flag
1890        ENTER @Sa;Fail_flag      ! enter value
1900        SELECT Fail-flag
1910        CASE 0
1920          PRINT "PASSED . . .";
1930        CASE 2
1940          PRINT "FAILED UPPER LIMIT . . . ";
1950        END SELECT
1960        OUTPUT @Sa;"_COA?;"      ! query mean car-off-par value
1970        ENTER @Sa;Mean_pwr_dbm ! enter value
1980        OUTPUT @Sa;"_COAC?;"     ! query carrier off power (rel)
1990        ENTER @Sa;Rel_pwr        ! enter value
2000        PRINT "Pwr = ";Mean_pwr_dbm;"(dBm), ";Rel_pwr;"(dBc)"
2010      ELSE
```

```
2020        DISP "Carrier Off Power Measurement Aborted . . . Error stat:";Meas_stat
2030      END IF
2040      OUTPUT @Sa;"VB 300KHZ;";  ! use other VBW for loop 2
2050    NEXT I
2060    !
2070 SDBEND
2080 !
2090 Sa_obw:SUB Sa_obw(@Sa)
2100    '
2110    ! Shows how to use _OBW, _OBWS, _OBWM commands in DLP
2120
2130    '    Parameter passed in: @Sa . . . i/o path to sa
2140    !
2150    INTEGER  Fail-flag               ! measuring result flag
2160    INTEGER I                        ! loop counter
2170    !
2180    REAL Meas_status                 ! meas state variable
2190    REAL Occ_bw                      ! OBW variable
2200    REAL Occ_bw_f_err                ! OBW freq err variable
2210    !
2220    OUTPUT @Sa;"MOV _DPF,1;"         ! turn on pass/fail flag
2230    OUTPUT @Sa;"_OBWS;"              ! execute OBW setting
2240    !
2250    ! You may use _OBW instead of _OBWS, _OBWM
2260    ! if you do not change measurement parameters
2270    !
2280    FOR I=1 TO 2
2290      OUTPUT @Sa;"_OBWM;"            ! execute OBW meas
2300      REPEAT
2310        ENTER @Sa;Meas_stat          ! enter meas state
2320      UNTIL Meas_stat>0 AND Meas_stat<6
2330
2340      IF Meas_stat=1 THEN            ! measurement completed
2350        PRINT "Occupied Bandwidth : ";
2360        OUTPUT @Sa;"_NUMF?;"         ! query meas fail flag
2370        ENTER @Sa;Fail_flag
2380        SELECT  Fail-flag
2390        CASE 0
2400          PRINT "PASSED . . .";
2410        CASE 2
2420          PRINT "FAILED UPPER LIMIT . . . ";
2430        END SELECT
2440        OUTPUT @Sa;"_OBBW?;"         ! query OBW value
2450        ENTER @Sa;Occ_bw             ! enter value
2460        OUTPUT @Sa;"_OBFE?;"         ! query OBW freq err value
2470        ENTER @Sa;Occ_bw_f_err       ! enter value
2480        PRINT "Obw = ";Occ_bw;"(Hz), ";Occ_bw_f_err;"(Hz)"
2490      ELSE
2500        DISP "Occupied Bandwidth Measurement Aborted . . . Error stat:";Meas_stat
2510      END IF
2520      OUTPUT @Sa;"VB 3KHZ;";         ! use other VBW for loop2
2530    NEXT I
2540
2550  SDBEND
2560
2570 Sa_acp:SUB Sa_acp(@Sa)
2580    !
2590    ! Show how to use _ACP, _ACPS, _ACPM commands in DLP
2600    !
2610    !    Parameter passed in: @Sa . . . i/o path to sa
2620    !
2630    INTEGER  Fail-flag             ! measuring result flag
2640    INTEGER I                      ! loop counter
2650    !
2660    REAL Meas_status               ! meas state variable
2670    REAL Acpr(4)                   ! array to hold ACP
```

```
2680   !
2690   OUTPUT @Sa;"MOV _DPF,1;"      ! turn on pass/fail flag
2700   OUTPUT @Sa;"MOV _ACPMT,1;"  ! set for MKK ACP multi ch swp
2710   OUTPUT @Sa;"_ACPS;";          ! execute ACP setting
2720
2730   ! You may use _ACP instead of _ACPS, _ACPM
2740   ! if you do not change measurement parameters
2750   !
2760   FOR I=1 TO 2
2770     OUTPUT @Sa;"_ACPM;"          ! execute ACP meas
2780    REPEAT
2790       ENTER @Sa;Meas_stat        ! enter meas state
2800     UNTIL Meas_stat>0 AND Meas_stat<6
2810     !
2820     IF Meas_stat=1 THEN          ! measurement completed
2830       PRINT "Adjacent Cannel Power: ";
2840       OUTPUT @Sa;"_NUMF?;"       ! query pass/fail flag
2850       ENTER @Sa;Fail_flag
2860       SELECT Fail-flag
2870       CASE 0
2880         PRINT "PASSED ... "
2890       CASE 2
2900         PRINT "FAILED UPPER LIMIT . . . "
2910       END SELECT
2920
2930       OUTPUT @Sa;"_ACPR[1]?;"    ! query lower adj power
2940       ENTER @Sa;Acpr(1)          ! enter value
2950       OUTPUT @Sa;"_ACPR[2]?;"    ! query upper adj power
2960       ENTER @Sa;Acpr(2)          ! enter value
2970       OUTPUT @Sa;"_ACPR[3]?;"    ! query lower adj power
2980       ENTER @Sa;Acpr(3)          ! enter value
2990       OUTPUT @Sa;"_ACPR[4]?;"    ! query upper adj power
3000       ENTER @Sa;Acpr(4)          ! enter value
3010
3020       PRINT "   ACP: Lower adj =";Acpr(1)/10.;"(dBm)"
3030       PRINT "   ACP: Upper adj =";Acpr(2)/10.;"(dBm)"
3040       PRINT "   ACP: Lower alt =";Acpr(3)/10.;"(dBm)"
3050       PRINT "   ACP: Upper alt =";Acpr(4)/10.;"(dBm)"
3060
3070     ELSE
3080       DISP "Adjacent Channel Power Measurement Aborted . . . Error stat:";Meas_stat
3090     END IF
3100     OUTPUT @Sa;"RB 3KHZ;";      ! use other RBW for loop 2
3110     OUTPUT @Sa;"VB 10KHZ;";     ! use other VBW for loop 2
3120   NEXT I
3130
3140 SUBEND
3150
3160 Sa_pvst:SUB Sa_pvst(@Sa)
3170   !
3180   ! Show how to use _PBURST, _PRISE, _PFALL commands in DLP
3190   !
3200   !    Parameter passed in: @Sa . . . i/o path to sa
3210   !
3220   INTEGER Fail-flag               ! measuring result flag
3230   INTEGER I                       ! loop counter
3240   !
3250   REAL Meas_status                ! meas state variable
3260   REAL Burst-time                 ! burst width time
3270   REAL Rise-time                  ! attack time
3280   REAL Fall-time                  ! release time
3290   !
3300   REAL Trace_array(1:401)         ! array to hold sa trace
3310   !
3320   OUTPUT @Sa;"MOV _DPF,1;"        ! turn on pass/fail flag
3330   OUTPUT @Sa;"_TN 1;";            ! set slot number to 1
```

```
3340    OUTPUT @Sa;"TDF P;";              ! set sa trace data format
3350    !
3360    FOR I=1 TO 3
3370      SELECT I
3380      CASE 1
3390        OUTPUT @Sa;"_PBURST;"         ! execute P vs T burst meas
3400      CASE 2
3410        OUTPUT @Sa;"_PRISE;"          ! execute P vs T rise meas
3420      CASE 3
3430        OUTPUT @Sa;"_PFALL;"          ! execute P vs T fall meas
3440      END SELECT
3450      !
3460      REPEAT
3470        ENTER @Sa;Meas_stat           ! enter meas state
3480      UNTIL Meas_stat>0 AND Meas_stat<6
3490      !
3500      IF Meas_stat=1 THEN                ! measurement completed
3510        PRINT "Power vs. Time: ";
3520        OUTPUT @Sa;"_NUMF?;"             ! query meas fail flag
3530        ENTER @Sa;Fail_flag
3540        SELECT Fail-flag
3550        CASE 0
3560          PRINT "PASSED . . .";
3570        CASE 1
3580          PRINT "FAILED . . .";
3590        CASE 2
3600          PRINT "FAILED . . .";
3610        END SELECT
3620        !
3630        SELECT I
3640        CASE 1
3650          OUTPUT @Sa;"_PBT?;"            ! query burst time
3660          ENTER @Sa;Burst_time           ! enter burst time
3670          PRINT "Burst time = ";Burst_time;"(uS)"
3680        CASE 2
3690          OUTPUT @Sa;"_PATT?;"           ! query attack time
3700          ENTER @Sa;Rise_time            ! enter attack time
3710          PRINT "Rise time = ";Rise_time;"(uS)"
3720        CASE 3
3730          OUTPUT @Sa;"_PRET?;"           ! query release time
3740          ENTER @Sa;Fall_time            ! enter release time
3750          PRINT "Fall time = ";Fall_time;"(uS)"
3760        END SELECT
3770        !
3780        OUTPUT @Sa;"TRA?;";              ! query trace A
3790        ENTER @Sa;Trace_array(*)         ! enter trace A
3800        PRINT "Amplitude value for 100th element of trace A = ";Trace_array(100);"(dBm)"
3810        !
3820      ELSE
3830        DISP "Power vs Time Measurement Aborted . . . Error stat:";Meas_stat
3840      END IF
3850    NEXT I
3860  !
3870  SUBEND
3880  !
3890 Sa_spur:SUB Sa_spur(@Sa,REAL Freq)
3900    !
3910    ! Shows how to use _SPURSET, _SPURZ, -SPUR commands in DLP
3920    !
3930    !    Parameter passed in: @Sa . . . i/o path to sa
3940    !                         Freq . . . carrier frequency
3950    !
3960    INTEGER Fail-flag               ! measuring result flag
3970    INTEGER I                       ! loop counter
3980    INTEGER Fast-zoom-on            ! fast zoom in flag
3990    !
```

```
4000   REAL Meas_status              ! measurement state variable
4010   REAL Spur-pwr                 ! mean spur emiss pwr var
4020   REAL Spur_pwr_rel             ! mean spur emiss pwr var
4030   REAL Spur_f(1:3)              ! spur frequency for meas
4040   REAL Span                     ! spurious search span
4050   REAL Fa                       ! start frequency for span
4060   REAL Fb                       ! stop frequency for span
4070   !
4080   ! Set spurious frequency to meas, and span
4090   !
4100   Spur_f(1)=Freq/2.
4110   Spur_f(2)=Freq*2.
4120   Spur_f(3)=Freq*3.
4130   Span=5.0E+7
4140   !
4150   OUTPUT @Sa;"MOV _DPF,1;"      ! turn on pass/fail flag
4160   OUTPUT @Sa;"MOV _SPURMT,1;";  ! set out of band spur emiss
4170   !
4180   OUTPUT @Sa;"SNGLS;";          ! control the sweep
4190   OUTPUT @Sa;"_SPURSET;"        ! setup/spur emiss search
4200   OUTPUT @Sa;"TS;"
4210   OUTPUT @Sa;"DONE?;"           ! wait until done
4220   ENTER @Sa;Done
4230   !
4240   FOR I=1 TO 3
4250     Fa=Spur_f(I)-Span/2.
4260     Fb=Spur_f(I)+Span/2.
4270     !
4280     OUTPUT @Sa;"FA ";Fa;       ! specify start freq for search
4290     OUTPUT @Sa;"FB ";Fb;       ! specify stop freq for search
4300     !
4310     Fast_zoom_on=0             ! 0 . . . standard zoom in
4320   IF Fast-zoom-on THEN         ! 1 . . . fast zoom in
4330    Spur_zoom(@Sa,Span*1.E-6)   ! if fast zoom in chosen
4340       OUTPUT @Sa;"_SPUR;"      ! execute spur emiss meas
4350     ELSE
4360       OUTPUT @Sa;"_SPURZ;";    ! if standard zoom in chosen
4370     END IF
4380     !
4390     REPEAT
4400       ENTER @Sa;Meas_stat      ! enter meas state
4410     UNTIL Meas_stat=1
4420     !
4430     IF Meas_stat=1 THEN        ! measurement completed
4440       PRINT "Spurious Emissions: ";
4450       OUTPUT @Sa;"_NUMF?;"
4460       ENTER @Sa;Fail_flag
4470       SELECT Fail-flag
4480       CASE 0
4490         PRINT "PASSED . . .";
4500       CASE 2
4510         PRINT "FAILED . . .";
4520       END SELECT
4530       !
4540       OUTPUT @Sa;"_SEA?;"       ! query mean spur power value
4550       ENTER @Sa;Spur_pwr        ! enter value
4560       OUTPUT @Sa;"_SEAC?;"      ! query mean spur power (rel)
4570       ENTER @Sa;Spur_pwr_rel    ! enter value
4580     PRINT "Spur =";Spur_pwr;"(dBm), ";Spur_pwr_rel;"(dBc),";
4590       PRINT "Freq =";Spur_f(I);"(Hz)"
4600       !
4610     ELSE
4620       DISP "Spurious Measurement Aborted . . . Error stat:";Meas_stat
4630     END IF
4640     !
4650     ! some controls for loop measurement
```

```
4660      !
4670      OUTPUT @Sa;"MOV RL, (-CPA+3);";
4680      OUTPUT @Sa;"DET POS;";
4690      OUTPUT @Sa;"MOV ST, 2;"
4700      OUTPUT @Sa;"CLRW TRA;";
4710      !
4720    NEXT I
4730    !
4740  SUBEND
4750  !
4760 Sa_finished:SUB Sa_finished(@Sa)
4770    OUTPUT @Sa;"_MCH;";                   ! monitor channel
4780    DISP ""
4790  SUBEND
4800  !
4810 SUB Spur_zoom(@Sa,REAL Span_in)
4820    !
4830    !    Fast spurions zoom
4840    !
4850    ! @Sa . . . SA address path
4860    ! Span-in . . . Specified span in (MHz)
4870    !
4910    !
4920    INTEGER I,N
4930    REAL Done,Span_work
4940    REAL Span(1:5),Rbw(1:5),Vbw(1:5),Sweeptime(1:5)
4950    !
5030    !
5040 Phs_data:   !
5050    DATA 3
5060    DATA  100E6,  5E6,  1E6,  0  ,0    ! SPAN DATA
5070    DATA   1E6,300E3,100E3,  0  ,0    !  RBW DATA
5080    DATA   3E3,  3E3,  3E3,  0  ,0    ! VBW DATA
5090    DATA  0.5,  0.2,  0.5,  0  ,0    ! ST   DATA
5100    ! Error             10kHz
5110    !
5120    RESTORE Phs_data                  ! Pdc, Phs switch
5130    READ N
5140    READ Span(*),Rbw(*),Vbw(*),Sweeptime(*)
5150    !
5160    Span_work=Span_in*1.E+6
5170    IF Span_work>Span(1) THEN Span_work=Span(1)
5180    !
5190    FOR I=1 TO N
5200      !
5210      IF Span_work>Span(I+1) THEN
5220        OUTPUT @Sa;"SP";Span_work;";{RB=";Rbw(I);";VB=";Vbw(I);";ST=";Sweeptime(I);"};"
5230        OUTPUT @Sa;"TS;"
5240        OUTPUT @Sa;"DONE?;"
5250        ENTER @Sa;Done
5260        Span_work=Span(I+1)
5270        OUTPUT @Sa;"E1;E2;"
5280      END IF
5290      !
5300    NEXT I
5310    !
5320  SUBEND
5330  !
5340 SUB Sa_pause(@Sa,INTEGER Flag,Meas$)
5350   IF Flag THEN
5360     OUTPUT @Sa;"HD;";
5370     DISP "Press ""Cont"" to continue. Next measurement is ";Meas$;"."
5380     PAUSE
5390     DISP "Measuring ";Meas$;"."
5400   END IF
5410 SUBEND
```

```
5420  !
5430  SUB Wait-loop
5440    INTEGER I
5450    FOR I=1 TO 300
5460      DISP "Waiting . . . ";I
5470      WAIT 1.
5480    NEXT I
5490    DISP ""
5500  SUBEND
5510
5520  SUB Take_sweep(@Sa)
5530    REAL Done
5540    OUTPUT @Sa;"TS;";
5550    OUTPUT @Sa;"DONE?;"
5560    ENTER @Sa;Done
5570  SUBEND
```

To make an eight-point constellation measurement

This example shows how to make an eight-point constellation measurement.

```
10   !re-store "8PTCONSTLN_EX"
20   !shows how to use the _IQGRAPH command in conjunction with the _ddCONSTLN
30   !command to make the 8 POINT CONSTLN measurement in the PHS DLP.
40   !06/05/95
50
60   INTEGER I                           ! loop counter
70   INTEGER Ms                          ! flag for BS MS
80   INTEGER Cc                          ! flag for BURST CONT
90   INTEGER Start-i                     ! start index for plotting
100  INTEGER Stop-i                      ! stop index for plotting
110
120  REAL Meas_state                     ! measurement state variable
130  REAL Iqx_array(1:816)               ! array to hold x-coordinate values
140  REAL Iqy_array(1:816)               !        "      Y     "
150
160  ASSIGN @Sa TO 718                   ! i/o path to spectrum analyzer
170
180
190  Start-i=16                          ! start at beginning of data
200  Stop-i=566                          ! stop at end of data
210
220  OUTPUT @Sa;"MOV _ddCONT,0;"         ! single measurement
230  OUTPUT @Sa;"MOV _ddNOPLT,1;"        ! turn off plotting graph on SA screen
240                                      ! (helps speed)
250  OUTPUT @Sa;"MOV _ddCONSTLN,1;"      ! 8 point constellation mode
260
270  OUTPUT @Sa;"_IQGRAPH;"              ! execute 8 point constln measurement
280  REPEAT
290    ENTER @Sa;Meas_state              ! enter measurement state
300  UNTIL Meas_state>0 AND Meas_state<31
310
320  IF Meas_state=1 THEN                          ! measurement completed
330    DISP "Entering data..."
340    FOR I=1 TO 816
350      OUTPUT @Sa;"_IQX[";I;"]?;"                ! query X-coordinate
360      ENTER @Sa;Iqx_array(I)                    ! enter value
370      Iqx_array(I)=(Iqx_array(I)-240)/120       ! convert from SA screen units
380      OUTPUT @Sa;"_IQY[";I;"]?;"                ! query Y-coordinate
390      ENTER @Sa;Iqy_array(I)                    ! enter value
400      Iqy_array(I)=(Iqy_array(I)-100)/75        ! convert from SA screen units
410    NEXT I
420    DISP
430    GINIT
440    PLOTTER IS CRT,"INTERNAL"
450    GRAPHICS ON
460    VIEWPORT 20,(RATIO*100)-10,20,100
470    FRAME
480    WINDOW -1.5,1.5,-1.5,1.5
490    AXES .1,.1,0,0,10,10,2
500    FOR I=Start_i TO Stop-i
510      IF (I MOD 5=1) THEN             ! use every 5th point
520        PENUP
530        PLOT Iqx_array(I),Iqy_array(I)
540      END IF
550    NEXT I
560  ELSE
570    DISP "Measurement aborted"
580  END IF
590
600  OUTPUT @Sa;"MOV _ddNOPLT,0;"         ! re-enable SA plotting
610
620  END
```

To perform a data bits measurement

This example shows how to run the -DATABITS command.

```
10   !re-store "DATABITS_EX"
20   !shows how to use the _DATABITS command in the PHS DLP
30   !06/05/95
40   !
50   INTEGER I                        ! loop counter
60   INTEGER Bits_array(1:240)        ! array to hold data bits
70   !
80   REAL Meas_state                  ! measurement state variable
90   !
100  ASSIGN @Sa TO 718                ! i/o path to spectrum analyzer
110  !
120  !
130  OUTPUT @Sa;"MOV _ddCONT,0;"      ! single measurement
140  OUTPUT @Sa;"MOV _ddNOPRT,1;"     ! turn off printing bits on SA screen
150                                   ! (helps speed)
160  !
170  OUTPUT @Sa;"_DATABITS;"          ! execute Data Bits measurement
180  REPEAT
190    ENTER @Sa;Meas_state           ! enter measurement state
200  UNTIL Meas_state>0 AND Meas_state<31
210  !
220  IF Meas_state=1 THEN             ! measurement completed
230    PRINT "Demodulated Data:"
240    PRINT "-----------------"
250    PRINT
260    FOR I=1 TO 240
270      OUTPUT @Sa;"_BITS[";I;"]?;"  ! query data bits
280      ENTER @Sa;Bits_array(I)      ! enter value
290    NEXT I
300    FOR I=1 TO 240
310      PRINT USING "#,D";Bits_array(I)    ! print each bit
320      IF (I MOD 10=0) THEN         ! 10th bit?
330        PRINT " ";                 ! print a space
340      END IF
350      IF (I MOD 40=0) THEN         ! 40th bit?
360        PRINT                      ! new line
370      END IF
380    NEXT I
390  ELSE
400    DISP "Measurement aborted"
410  END IF
420  !
430  OUTPUT @Sa;"MOV _ddNOPRT,0;";    ! re-enable SA printing bits
440  !
450  END
```

To perform an I-Q pattern measurement

This example shows how to make an I-Q pattern measurement.

```
10   !re-store "IQPATTERN_EX"
20   !shows how to use the _IQGRAPH command in conjunction with the _ddCONSTLN
30   !command to make the I-Q PATTERN measurement in the PHS DLP.
40   !06/05/95
50   !
60   INTEGER I                         ! loop counter
70   INTEGER Ms                        ! flag for BS MS
80   INTEGER Start-i                   ! start index for plotting
90   INTEGER Stop-i                    ! stop index for plotting
100  !
110  REAL Meas_state                   ! measurement state variable
120  REAL Iqx_array(1:816)             ! array to hold x-coordinate values
130  REAL Iqy_array(1:816)             !        "      Y     "
140  !
150  ASSIGN @Sa TO 718                 ! i/o path to spectrum analyzer
160  !
170  !
180  Start-i=16                        ! start at beginning of data
190  Stop-i=566                        ! stop at the end of data
200  !
210  OUTPUT @Sa;"MOV _ddCONT,0;"       ! single measurement
220  OUTPUT @Sa;"MOV _ddNOPLT,1;"      ! turn off plotting graph on SA screen
230                                    ! (helps speed)
240  OUTPUT @Sa;"MOV _ddCONSTLN,0;"    ! I-Q Pattern mode
250  !
260  OUTPUT @Sa;"_IQGRAPH;"            ! execute I-Q Pattern measurement
270  REPEAT
280    ENTER @Sa;Meas_state            ! enter measurement state
290  UNTIL Meas_state>0 AND Meas_state<31
300  !
310  IF Meas_state=1 THEN                          ! measurement completed
320    DISP "Entering data..."
330    FOR I=1 TO 816
340      OUTPUT @Sa;"_IQX[";I;"]?;"                ! query X-coordinate
350      ENTER @Sa;Iqx_array(I)                    ! enter value
360      Iqx_array(I)=(Iqx_array(I)-240)/120       ! convert from SA screen units:
370                                                ! SA screen x=240 is 0
380                                                ! SA screen 120 x units is 1
390      OUTPUT @Sa;"_IQY[";I;"]?;"                ! query Y-coordinate
400      ENTER @Sa;Iqy_array(I)                    ! enter value
410      Iqy_array(I)=(Iqy_array(I)-100)/75        ! convert from SA screen units:
420                                                ! SA screen y=100 is 0
430                                                ! SA screen 75 y units is 1
440    NEXT I
450    DISP
460    GINIT
470    PLOTTER IS CRT,"INTERNAL"
480    GRAPHICS ON
490    VIEWPORT 20,(RATIO*100)-10,20,100
500    FRAME
510    WINDOW -1.5,1.5,-1.5,1.5
520    AXES .1,.1,0,0,10,10,2
530    FOR I=Start_i TO Stop-i
540      PLOT Iqx_array(I),Iqy_array(I)
550    NEXT I
560  ELSE
570    DISP "Measurement aborted"
580  END IF
590  !
600  OUTPUT @Sa;"MOV _ddNOPLT,0;"     ! re-enable SA plotting
610  !
620  END
```

To perform a modulation accuracy measurement

This example shows how to use the _MODACC command to perform a modulation accuracy measurement.

```
10    !re-store "MODACC_EX1"
20    !shows how to use the _MODACC command in the PHS DLP
30    !06/05/95
40    !
50    REAL Fleas-state                    ! measurement state variable
60    REAL Rms_evm                        ! rms error vector magnitude
70    REAL Hag-err                        ! rms magnitude error
80    REAL Phase-err                      ! rms phase error
90    REAL Peak-evm                       ! peak error vector magnitude
100   REAL Iq_offset                      ! iq origin offset
110   REAL Cf_err                         ! carrier frequency error
120   !
130   ASSIGN @Sa TO 718                   ! i/o path to spectrum analyzer
140   !
150   !
160   OUTPUT @Sa;"MOV _ddCONT,0;"         ! single measurement
170   OUTPUT @Sa;"MOV _ddPARTIAL,0;"      ! full data
180   OUTPUT @Sa;"MOV _ddAVG,0;"          ! averaging off
190   !
200   OUTPUT @Sa;"_MODACC;"               ! execute Modulation Accuracy meas.
210   REPEAT
220     ENTER @Sa;Meas_state              ! enter measurement state
230   UNTIL Meas_state>0 AND Meas_state<31
240   !
250   IF Meas_state=1 THEN                ! measurement completed
260     OUTPUT @Sa;"_EVMRMS?;"            ! query rms evm
270     ENTER @Sa;Rms_evm                 ! enter value
280     OUTPUT @Sa;"_MERR?;"              ! query magnitude error
290     ENTER @Sa;Mag_err                 ! enter value
300     OUTPUT @Sa;"_PERR?;"              ! query phase error
310     ENTER @Sa;Phase_err               ! enter value
320     OUTPUT @Sa;"_EVMPK?;"             ! query peak evm
330     ENTER @Sa;Peak_evm                ! enter value
340     OUTPUT @Sa;"_IQOFS?;"             ! query iq origin offset
350     ENTER @Sa;Iq_offset               ! enter value
360     OUTPUT @Sa;"_CFERR?;"             ! query carrier frequency error
370     ENTER @Sa;Cf_err                  ! enter value
380     PRINT "Modulation Accuracy results: "
390     PRINT II----------------------------S?
400     PRINT
410     PRINT "RMS EVM:               ";Rms_evm;" %"
420     PRINT " RMS HAG ERR:          ";Mag_err;" %"
430     PRINT " RMS PHASE ERROR:      ";Phase_err;" degrees"
440     PRINT "PEAK EVM:              ";Peak_evm;" %"
450     PRINT "IQ ORIGIN OFFSET:      ";Iq_offset;" dB"
460     PRINT "CARRIER FREQ ERROR: ";Cf_err;" Hz"
470   ELSE
480     DISP "Measurement aborted"
490   END IF
500   !
510   END
```

To perform a modulation accuracy measurement with averaging

This example shows how to use the -MODACC command to perform a modulation accuracy measurement with averaging.

```
10   !re-store "MODACC_EX3"
20   !shows how to use the _MODACC command with averaging in the PHS DLP
30   !06/05/95
40   !
50   REAL Meas_state                   ! measurement state variable
60   REAL Rms_evm_mean                 ! mean rms error vector magnitude
70   REAL Hag-err-mean                 ! mean rms magnitude error
80   REAL Ph_err_mean                  ! mean rms phase error
90   REAL Iq_offset_mean               ! mean iq origin offset
100  REAL Cf_err_mean                  ! mean carrier frequency error
110  !
120  REAL Rms_evm_sd                   ! rms evm standard deviation
130  REAL Rms_evm_max                  ! rms evm maximum value
140  REAL Rms_evm_min                  ! rms evm minimum value
150  REAL Mag_err_sd                   ! rms magnitude error std dev.
160  REAL Mag_err_max                  ! rms magnitude error max. value
170  REAL Mag_err_min                  ! rms magintude error min. value
180  REAL Ph_err_sd                    ! rms phase error std dev.
190  REAL Ph_err_max                   ! rms phase error max. value
200  REAL Ph_err_min                   ! rms phase error min. value
210  !
220  REAL Evm_rt_ul                    ! rms evm uncertainty (20-30C) upper lim
230  REAL Evm_rt_ll                    !         "            "       lower lim
240  REAL Evm_ft_ul                    !         "         (0-55C) upper lim
250  REAL Evm_ft_ll                    !         "            "       lower lim
260  !
270  ASSIGN @Sa TO 718                 ! i/o path to spectrum analyzer
280  !
290  !
300  OUTPUT @Sa;"MOV _ddCONT,0;"       ! single measurement
310  OUTPUT @Sa;"MOV _ddPARTIAL,0;     ! full data
320  OUTPUT @Sa;"MOV _ddAVG,1;"        ! averaging on
330  OUTPUT @Sa;"MOV _ddNAVG,15;"      ! set for 15 measurement average
340  !
350  OUTPUT @Sa;"_MODACC;"             ! execute Modulation Accuracy meas.
360  REPEAT
370    ENTER @Sa;Meas_state            ! enter measurement state
380  UNTIL Meas_state>0 AND Meas_state<31
390
400  IF Meas_state=1 THEN              ! measurement completed
410    OUTPUT @Sa;"_EVMRMS?;"          ! query mean rms evm
420    ENTER @Sa;Rms_evm_mean          ! enter value
430    OUTPUT @Sa;"_MERR?;"            ! query mean magnitude error
440    ENTER @Sa;Mag_err_mean          ! enter value
450    OUTPUT @Sa;"_PERR?;"            ! query mean phase error
460    ENTER @Sa;Ph_err_mean           ! enter value
470    OUTPUT @Sa;"_IQOFS?;"           ! query mean iq origin offset
480    ENTER @Sa;Iq_offset_mean        ! enter value
490    OUTPUT @Sa;"_CFERR?;"           ! query mean carrier frequency error
500    ENTER @Sa;Cf_err_mean           ! enter value
510
520    OUTPUT @Sa;"_EVMSD?;"           ! query rms evm std dev
530    ENTER @Sa;Rms_evm_sd            ! enter value
540    OUTPUT @Sa;"_EVMMAX?;"          ! query rms evm max value
550    ENTER @Sa;Rms_evm_max           ! enter value
560    OUTPUT @Sa;"_EVMMIN?;"          ! query rms evm min value
570    ENTER @Sa;Rms_evm_min           ! enter value
580    OUTPUT @Sa;"_MERRSD?;"          ! query rms mag err std dev
590    ENTER @Sa;Mag_err_sd            ! enter value
600    OUTPUT @Sa;"_MERRMAX?;"         ! query rms mag err max value
610    ENTER @Sa;Mag_err_max           ! enter value
```

```
620     OUTPUT @Sa;"_MERRMIN?;"         ! query rms mag err min value
630     ENTER @Sa;Mag_err_min           ! enter value
640     OUTPUT @Sa;"_PERRSD?;"          ! query rms phase err std dev
650     ENTER @Sa;Ph_err_sd             ! enter value
660     OUTPUT @Sa;"_PERRMAX?;"         ! query rms phase err max value
670     ENTER @Sa;Ph_err_max            ! enter value
680     OUTPUT @Sa;"_PERRMIN?;"         ! query rms pahse err min value
690     ENTER @Sa;Ph_err_min            ! enter value
700       !
710     OUTPUT @Sa;"_EVMRUL?;"          ! query (20-30C) rms evm uncert low lim
720     ENTER @Sa;Evm_rt_ul             ! enter value
730     OUTPUT @Sa;"_EVMRLL?;"          ! query (20-30C) rms evm uncert upp lim
740     ENTER @Sa;Evm_rt_ll             ! enter value
750     OUTPUT @Sa;"_EVMFUL?;"          ! query (0-55C) rms evm uncert low lim
760     ENTER @Sa;Evm_ft_ul             ! enter value
770     OUTPUT @Sa;"_EVMFLL?;"          ! query (0_55C) rms evm uncert upp lim
780     ENTER @Sa;Evm_ft_ll             ! enter value
790       !
800 Title:IMAGE "                  ",6X,"Mean",6X,"Std dev",6X,"Max",6X,"Min"
810 Evm:IMAGE "RMS EVM (%):     ",5X,3D.D,8X,2D.DD,5X,2D.D,5X,2D.D
820 Mag_err:IMAGE " RMS HAG ERR (%):",6X,2D.D,9X,D.DD,6X,D.D,6X,D.D
830 Ph_err:IMAGE " RMS PHASE ERR (deg):",2X,2D.D,9X,D.DD,6X,D.D,6X,D.D
840       !
850 Room-temp:IMAGE "Temp. Range 20-30 C",9X,DD.D," % > RMS EVA > ",DD.D," %"
860 Full-temp:IMAGE "Temp. Range 0-55 C",9X,DD.D," % > RMS EVM > ",DD.D," %"
870       !
880 Iq_offset:IMAGE "Mean IQ ORIGIN OFFSET (dB):",9X,3D.D
890 Cf_error:IMAGE "Mean CARRIER FREQ ERR (Hz):",8X,5D.D
900       !
910     PRINT "Modulation Accuracy results: [for sample of 15 bursts]"
920     PRINT "-----------------------------------------------------------"
930     PRINT
940     PRINT USING Title
950     PRINT
960     PRINT USING Evm;Rms_evm_mean,Rms_evm_sd,Rms_evm_max,Rms_evm_min
970     PRINT USING Mag_err;Mag_err_mean,Mag_err_sd,Mag_err_max,Mag_err_min
980     PRINT USING Ph_err;Ph_err_mean,Ph_err_sd,Ph_err_max,Ph_err_min
990     PRINT
1000    PRINT "                                  RMS EVM Uncertainty"
1010    PRINT
1020    PRINT USING Room_temp;Evm_rt_ul,Evm_rt_ll
1030    PRINT USING Full_temp;Evm_ft_ul,Evm_ft_ll
1040    PRINT
1050    PRINT
1060    PRINT USING Iq_offset;Iq_offset_mean
1070    PRINT USING Cf_error;Cf_err_mean
1080  ELSE
1090    DISP "Measurement aborted"
1100  END IF
1110
1120  END
```

To see the status of a digital demodulation measurement

This example shows how to see the status of a digital demodulation measurement using the -ddSTATUS command.

```
10    !re-store "STATUS-EX"
20    !shows how to use the _ddSTATUS command in the PHS DLP
30    !06/05/95
40
50    REAL Meas_state                   ! measurement state variable
60
70    INTEGER Ft_acq_stat               ! Frame trigger acquisition status
80    INTEGER Ft_tr_stat                ! Frame trigger time record status
90    INTEGER Ft_uniq_word              ! Frame trigger uniq word number
100   INTEGER Ft_sync_errs              ! Frame trigger sync errors
110   REAL Ft_sbloc                     ! Frame trigger sunc bit location
120
130   INTEGER Meas_stat                 ! Measurement status result
140   INTEGER Meas_tr_stat              ! Measurement time record status
150   INTEGER Meas_uniq_num             ! Measurement uniq (word) number
160   INTEGER Meas_sync_match           ! Measurement sync match
170   INTEGER Meas_sync_err             ! Measurement sync errors
180   INTEGER Meas_bce                  ! Measurement bit compare errors
190   INTEGER Meas_iqnf                 ! Measurement iq null flag
200   INTEGER Meas_iqnc                 ! Measurement iq null count
210   INTEGER Meas_lomag_pts            ! Measurement low magnitude points
220
230
240   ASSIGN @Sa TO 718                 ! i/o path to spectrum analyzer
250
260
270   OUTPUT @Sa;"_ddSTATUS;"           ! display digital demod. status
280   REPEAT
290     ENTER @Sa;Meas_state            ! enter measurement state
300   UNTIL Meas_state>0 AND Meas_state<2
310   !
320   IF Meas_state=1 THEN              ! measurement completed
330     OUTPUT @Sa;"_ddFTACQS?;"        ! query FT acqusition status
340     ENTER @Sa;Ft_acq_stat           ! enter value
350     OUTPUT @Sa;"_ddFTTRS?;"         ! query FT time record status
360     ENTER @Sa;Ft_tr_stat            ! enter value
370     OUTPUT @Sa;"_ddFTUW?;"          ! query FT uniq word number
380     ENTER @Sa;Ft_uniq_word          ! enter value
390     OUTPUT @Sa;"_ddFTSE?;"          ! query FT sync word errors
400     ENTER @Sa;Ft_sync_errs          ! enter value
410     OUTPUT @Sa;"_ddFTSBLOC?;"       ! query FT sync bit location
420     ENTER @Sa;Ft_sbloc              ! enter value
430     OUTPUT @Sa;"_ddSTAT?;"          ! query meas status result
440     ENTER @Sa;Meas_stat             ! enter value
450     OUTPUT @Sa;"_ddTRS?;"           ! query meas time record status
460     ENTER @Sa;Meas_tr_stat          ! enter value
470     OUTPUT @Sa;"_ddAUW?;"           ! query meas actual uniq word number
480     ENTER @Sa;Meas_uniq_num         ! enter value
490     OUTPUT @Sa;"_ddSM?;"            ! query meas sync match
500     ENTER @Sa;Meas_sync_match       ! enter value
510     OUTPUT @Sa;"_ddSWE?;"           ! query meas sync errors
520     ENTER @Sa;Meas_sync_err         ! enter value
530     OUTPUT @Sa;"_ddBCE?;"           ! query meas bit compare errors
540     ENTER @Sa;Meas_bce              ! enter bvalue
550     OUTPUT @Sa;"_ddIQNF?;"          ! query meas iq null flag
560     ENTER @Sa;Meas_iqnf             ! enter value
570     OUTPUT @Sa;"_ddIQNC?;"          ! query meas iq null count
580     ENTER @Sa;Meas_iqnc             ! enter value
590     OUTPUT @Sa;"_ddLOMAGPTS?;"      ! query meas low mag points
600     ENTER @Sa;Meas_lomag_pts        ! enter value
610
```

```
620    PRINT "Digital Demodulator status:"
630    PRINT "--------------------------------------------"
640    PRINT
650    PRINT "FT Acquisition Status   (1=OK):       ";Ft_acq_stat
660    PRINT "FT Time Record Status:                 ";Ft_tr_stat
670    PRINT "FT Acquisition Uniq Number:            ";Ft_uniq_num
680    PRINT "FT Acquisition Sync errors:            ";Ft_sync_errs
690    PRINT "FT Sync Bit Location:                  ";Ft_sbloc
700    PRINT
710    PRINT "Measurement Status   (0=OK):           ";Meas_stat
720    PRINT "Measurement Time Record Status:        ";Meas_tr_stat
730    PRINT "Uniq Word (1=UP 2=DOWN):               ";Meas_uniq_num
740    PRINT "Sync Match  (1=PERFECT MATCH):         ";Meas_sync_match
750    PRINT "Sync Word Errors:                      ";Meas_sync_err
760    PRINT "Pass 1&2 Bit Compare Errors:           ";Meas_bce
770    PRINT "IQ Null Flag:                          ";Meas_iqnf
780    PRINT "IQ Null Count:                         ";Meas_iqnc
790    PRINT "Low magnitude points:                  ";Meas_lomag_pts
800  ELSE
810    DISP "Measurement aborted"
820  END IF
830  !
840  END
```

7

Specifications

This chapter contains the following:

- The specifications and characteristics for Option 052 and the HP 85726B PHS measurements personality.
- The specifications and characteristics for digital demodulation measurements with Option 151 and Option 160 and the HP 85726B PHS measurements personality.
- A tutorial on understanding the EVM accuracy specification.

Specifications and Characteristics

This chapter contains information about the specifications and characteristics for Option 052 and the HP 85726B PHS measurements personality.

Note For the HP 85726B PHS measurements personality or Option 052 to meet the specifications, the spectrum analyzer self-calibration routines must be performed periodically. For practical advice on when and how often the self-calibration routines should be performed, see "Improving Accuracy with Self-Calibration Routines" and "When is Self-Calibration Needed" in the spectrum analyzer User's Guide, Chapter 2, "Getting Started."

Specifications for Option 052 (Available for HP 8593E, HP 8594E, HP 8595E, or HP 8596E Spectrum Analyzer)

This section contains the specifications for Option 052, the improved amplitude accuracy for the PHS spectrum analyzer. Specifications describe warranted performance. Option 052 is available only for an HP 8593E, HP 8594E, HP 8595E, or HP 8596E spectrum analyzer.

The specifications for Option 052 apply only if the following conditions are met:

- The spectrum analyzer is operated within the temperature range of 0 °C to +55 °C (unless otherwise noted).
- The spectrum analyzer temperature has been stabilized. The instrument temperature is considered to be stabilized if the spectrum analyzer has been stored at a constant temperature between 0 °C and +55 °C for 2 hours, *and* after the spectrum analyzer has been turned on for at least 30 minutes.
- The amplitude (CAL AMPTD) and frequency (CAL FREQ) self-calibration routines have been performed after the instrument temperature is stabilized.
- The maximum safe input level is not exceeded. Total input power to the spectrum analyzer must not exceed +30 dBm (1 W).

Option 052 Specifications		
Frequency range	PHS band, 1895 to 1918 MHz	
Absolute amplitude accuracy*		
Input attenuation set to 10, 20, or 30 dB (equivalent to a ref level of −10 to +20 dBm with no ext atten correction†)	0 °C to 55 °C	20 °C to 30 °C
	±1.0 dB	±0.5 dB
Input attenuation set to 40 dB (equivalent to a ref level of +20 to +30 dBm with no ext atten correction†)	±1.3 dB	±0.5 dB

* With RBW = 100 kHz, VBW = 30 kHz, signal level at 0 to −20 dB from ref level.
† With the input attenuation set to AUTO.

Specifications and Characteristics for the HP 85726B

This section contains the specifications and characteristics for the HP 85726B PHS measurements personality. The specifications apply to both personal and cell station testing, unless otherwise indicated. The specifications and characteristics for HP 85726B apply only if the following conditions are met:

- The HP 85726B PHS measurements personality is used with an HP 8593E, 8594E, 8595E, or 8596E spectrum analyzer with firmware dated 940822 or later. The HP 85726B is not compatible with HP 8590 A-Series analyzers.
- The necessary options are installed in the spectrum analyzer. See "The Equipment You Will Need" in Chapter 1, "Getting Started," for a list of the necessary options and acceptable option substitutions.
- The spectrum analyzer is operated within the temperature range of 0 °C to +55 °C, except where a restricted temperature range is noted.
- The spectrum analyzer temperature has been stabilized. The instrument temperature is considered to be stabilized if the spectrum analyzer has been stored at a constant temperature between 0 °C and +55 °C for 2 hours, ***and*** after the spectrum analyzer has been turned on for at least 30 minutes.
- The instrument temperature is stabilized, and the amplitude (CAL AMPTD) and frequency (CAL FREQ) self-calibration routines have been performed.
- The measurements are performed on PHS transmitter signals. The carrier frequencies must be within the band limit of 1895 to 1918 MHz.
- The spectrum analyzer settings have been set automatically by each measurement routine in the personality.
- The maximum safe input level is not exceeded. Total input power to the spectrum analyzer must not exceed +30 dBm (1 W).
- The optimum amount of external attenuation is used for the specific carrier power level. See "Configuring the Personality for Your Test Setup" in Chapter 2, "Station Measurements."

Table Notation

The following terms and abbreviations are used in the table of specifications and characteristics for the HP 85726B:

Specifications Describe warranted performance over the temperature range 0 °C to +55 °C (unless otherwise noted).

Characteristics Provide useful, but non-warranted, information about the functions and performance of the instrument. Characteristics are identified by the label "(characteristic)."

Typical Many of the specifications have more than one value associated with them. The first value gives the specification as the sum of the measurement uncertainties. The second value gives you an idea of the typical value for the specification. Typical performance, where listed, is not warranted, but indicates performance that most spectrum analyzers will exhibit. Typical values are shown with "typical" next to them.

Abbreviations The following abbreviations have been used: RBW (resolution bandwidth), VBW (video bandwidth), ref level (reference level), and ext atten (external attenuation).

Standards Many of the measurements are based upon the RCR STD-28 Japan Digital Cellular Telecommunication System standard. RCR is the Research and Development Center for Radio Systems.

General Specifications	
Maximum safe input level	Total power must not exceed + 30 dBm (1 W)
‘recision Frequency Reference (Option 004)	
Aging	$\pm 1 \times 10^{-7}$/year
Temperature stability	$\pm 1 \times 10^{-8}$
External attenuation correction	0 to 90 dB in 0.01 dB steps
Channel number tuning	0 to 9999 with respect to user defined frequency
Defined channel X frequency	Any frequency within the frequency range of the spectrum analyzer

Antenna Power (carrier power) (RCR STD-28 7.1.4.2 and 3.4.2.1)		
The antenna power measurement measures the mean power of the RF carrier during the "on" part of the burst, and then displays a value which is the calculated average power over the entire frame. The mean power is obtained by converting the log power trace obtained in zero span to a power trace and then averaging the trace data.		
Carrier power range	+53 dBm (200 W) to −20 dBm (0.01 mW)*	
achievable low limit	(−60 + ext atten) dBm	
Absolute carrier power accuracy, with carrier power of +53 dBm to −20 dBm		
With Option 052, for mean carrier power range	0 °C to 55 °C	20 °C to 30 °C
(25 dBm + ext atten) to (15 dBm + ext atten)	±1.3 dB	±1.0 dB
(15 dBm + ext atten) to (−15 dBm + ext atten)	±1.0 dB	±0.5 dB
(−15 dBm + ext atten) to (−35 dBm + ext atten)	±1.2 dB	±0.9 dB
Without Option 052, for mean carrier power range	0 °C to 55 °C	
(25 dBm + ext atten) to (−35 dBm + ext atten)	±4.1 dB	*±1.9 dB (typical)*
Carrier power resolution	0.1 dB	
* CAUTION: You must use sufficient external attenuation to limit power at spectrum analyzer input to absolute maximum of +30 dBm (1 W). The low limit applies for external attenuation of 40 dB or less.		

Carrier Off Leakage Power (RCR STD-28 7.1.5 and 3.4.2.5) (MKK test item 3)		
The carrier off power measurement measures the average power during the off part of the burst.		
Carrier power range	+38 dBm* to −20 dBm	
Carrier off leakage power range	−30 dBm to (−75 + ext atten) dBm†	
Absolute carrier off leakage power accuracy		
For carrier off levels > 10 dB above the average noise level		
With Option 052	±2.8 dB	*±1.5 dB (typical)*
Without Option 052	±4.2 dB	*±1.9 dB (typical)*
Relative carrier off leakage power accuracy		
For carrier off levels > 10 dB above the average noise level	±1.8 dB	*±1.1 dB (typical)*
Carrier off power resolution	0.1 dB	
* CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to absolute maximum of +30 dBm (1 W). † The lower limit is equivalent to the displayed average noise level of the spectrum analyzer.		

Occupied Bandwidth (RCR STD-28 7.1.3 and 3.4.2.7) (MKK test item 6)	
The occupied bandwidth measurement measures the 99 percent power bandwidth of the carrier. Two markers are positioned so that 0.5 percent of the total power is to the left and 0.5 percent is to the right of these limit frequencies. The carrier frequency error is also determined (defined as the difference between the analyzer center frequency and the mid point of the two limit frequencies).	
Carrier power range	+53 dBm to −20 dBm*
Frequency resolution of occupied bandwidth	2 kHz
Frequency accuracy of occupied bandwidth	*±3 kHz (characteristic)*
Frequency resolution of delta frequency	1 kHz
Frequency accuracy of delta frequency	*±8 kHz + (frequency reference error) × (carrier frequency) (characteristic)*
* CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to absolute maximum of +30 dBm (1 W).	

Adjacent Channel Power (RCR STD-28 7.1.8, 3.4.2.3) (MKK test item 4)		
The ACP measurement is performed using the spectrum analyzer integration method with an integration bandwidth of 192 kHz. The measurement is made using peak detection. The ACP measurement uses a single integration equation and treats all spectral components as if due to modulation and random noise. Because of the noise-like nature of the $\pi/4$ DQPSK modulation, there is some measurement-to-measurement variation in the results of the ACP FAST measurement. The repeatability of the measurement can be improved by using the ACP single channel per sweep measurement (ACP STD); this measurement takes more data points per channel than does the multichannel per sweep measurement (ACP FAST), but with increased test time for the ACP measurement.		
ACP Spectrum (Graphical)		
Carrier power range	+53 dBm (200 W) to −20 dBm (0.01 mW)*	
Spectrum display for a multichannel per sweep (five channels) measurement	Small vertical lines near the bottom graticule of the spectrum analyzer display are used to indicate the integration bandwidth edges for the adjacent and alternate channels.	
Sweep time	2 s	
Display range of spectrum, log scale	0 to −100 dB from ref level	
Absolute amplitude accuracy for adjacent channels.		
With Option 052	±2.6 dB	*±1.4 dB (typical)*
Without Option 052	±4.1 dB	*±1.9 dB (typical)*
Relative amplitude accuracy	±1.6 dB	*±1.0 dB (typical)*
ACP Table (Numerical)		
Table entries	Absolute power for adjacent and alternate channels. Power ratio for adjacent and alternate channels.	
ACP minimum result for adjacent channels	−45 dBm *−50 dBm (characteristic)*	
Power ratio accuracy for adjacent channels (600 kHz) and alternate channels (900 kHz)	*±1.6 dB (characteristic)*	
Integration bandwidth accuracy	*±3% (characteristic)*	
Frequency selectivity accuracy for inner edge of adjacent channels		
For multichannel per sweep (five channels)	*5.5 kHz (characteristic)*	
For single channel per sweep	*720 Hz (characteristic)*	
* CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to absolute maximum of +30 dBm (1 W).		

Channel Power		
Measures the absolute power in a channel with or without a carrier present in another channel. Makes the measurement using the spectrum analyzer integration method with an integration bandwidth of 192 kHz. The measurement is made using sample detection for continuous carriers.		
Channel Spectrum (Graphical)		
Channel power range, with optimum total attenuation		
Maximum	+53 dBm*	
Minimum	*total carrier power −80 dB but not less than −85 dBm (characteristic)*	
Absolute amplitude accuracy of channel spectrum		
With Option 052, input attenuation set to 10, 20, or 30 dB	±2.0 dB	*±1.2 dB (typical)*
Without Option 052	±5.0 dB	*±2.8 dB (typical)*
Channel Power (Numerical)		
Absolute amplitude accuracy of channel power		
With Option *052, input attenuation set to 10, 20, or 30 dB*	*±2.0 dB (characteristic)*	
Without Option 052	*±5.0 dB (characteristic)*	
Integration bandwidth accuracy	*±3% (characteristic)*	

* CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to absolute maximum of +30 dBm (1 W).

Power versus Time (RCR STD-28 6.1.6 and 3.4.2.4)		
The power versus time measurements analyze the amplitude profile of the burst. The time domain waveform is compared to limit lines. Pulse width, attack time, and release time are also displayed.		
Carrier power range	+38 dBm to −20 dBm*	
Display range of waveform, log scale	Select either 0 dB to −70 dB or 0 dB to −110 dB	
Amplitude range	(Mean carrier power +4 dB) to (−77 + ext atten) dBm†	
Vertical scale per division	1 dB to 15 dB in 1 dB steps	
Relative amplitude accuracy:		
for 0 to −70 dB from ref level	±1.0 dB	*±0.7 dB (typical)*
for 0 to −110 dB from ref level	±2.2 dB	*±1.2 dB (typical)*
Sweep time accuracy (sweep times less than 20 ms)	*±0.02% (characteristic)*	
Time resolution:		
Frame	15.625 μs	
Burst	2 μs	
Rising edge	0.2 μs	
Falling edge	0.2 μs	
Jitter	*0.1 μs (characteristic)*	
Relative time between any two points	*±(0.1 + (0.0001 x delta time) + (time resolution) μs (characteristic)*	
Attack and release time accuracy	*±0.6 μs (characteristic)*	
Burst width time accuracy	*±6 μs (characteristic)*	
Absolute time error, with respect to external trigger:		
Frame display	*±17 μs (characteristic)*	
Burst display	*±2.5 μs (characteristic)*	
Rising edge display	*±0.7 μs (characteristic)*	
Falling edge display	*±0.7 μs (characteristic)*	
* CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to absolute maximum of +30 dBm (1 W). † The lower limit is equivalent to the displayed average noise level of the spectrum analyzer.		

Spurious Emissions (RCR STD-28 7.1.2, 3.4.2.6) (MKK test item 7)		
Measures the mean power of a spurious emission over the full frame duration. The mean power is obtained by converting the log power obtained in zero span to a power trace and then averaging the trace data.		
Carrier power range	+53 dBm* to −20 dBm	
Minimum spurious emission power for spur ≥1 MHz from carrier and 1 MHz ≤ spur frequency ≤ 2.9 GHz	(−57 + ext atten) dBm †	
Absolute spurious emission power accuracy (within PHS bands)		
For spurious levels >10 dB above the average noise level		
With Option 052	±2.8 dB	*±1.5 dB (typical)*
Without Option 052	±4.2 dB	*±1.9 dB (typical)*
Relative spurious emission power accuracy (within PHS Bands)		
For spurious levels >10 dB above the average noise level		
With Option 052	±1.8 dB	*±1.0 dB (typical)*
* CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to absolute maximum of +30 dBm (1 W). † The minimum spurious emission power is equivalent to the displayed average noise level of the spectrum analyzer and does not include the effect of 2nd order distortion caused by the spectrum analyzer.		

Digital Demodulation Specifications and Characteristics

HP 8593E, HP 8594E, HP 8595E, and HP 8596E PHS Spectrum Analyzers With Options 151 and 160

Specifkations

Minimum Input Power	
Minimum Input Power	-15 dBm

Minimum Input Carrier Frequency	
Minimum Input Carrier Frequency	10 MHz

Carrier Frequency Error (RCR STD-28 7.1.1.2, "Frequency error" and 3.4.2.8, "Frequency stability")	
The carrier frequency error measurement calculates the average carrier frequency error from the nominal channel frequency over a single timeslot.	
Frequency Error Accuracy	± [18 Hz t (frequency reference accuracy x carrier frequency)]
Frequency error accuracy with Option 004 high stability frequency reference is f270 Hz (based on 0.132 ppm frequency reference accuracy, 1 .9 GHz carrier frequency, 0 to 55 °C, within one year of calibration). See the precision frequency reference specification in the spectrum analyzer calibration guide.	

I-Q Origin Offset (RCR STD-28 7.1.7 "Modulation accuracy," and 3.4.2.9 "Modulation accuracy")	
I-Q origin offset calculates the fixed offset of the in-phase and quadrature components of the digital modulation.	
I-Q origin offset accuracy	f0.5 dB for origin offset values greater than -40 dB

Error Vector Magnitude (RCR STD-28 7.1.7 "Modulation accuracy," and 3.4.2.9 "Modulation accuracy")		
The error vector magnitude (EVM) measurement calculates the RMS error vector magnitude over a timeslot. A full timeslot measurement includes 111 symbols. EVM is minimized by removing frequency error, phase offset, and I-Q origin offset before calculating EVM for a given timeslot.		
Error Vector Mag	**itude Accuracy**	
Full timeslot measurement without EVM correction	**20 °C to 30 °C**	**0 °C to 55 °C**
RMS EVM Floor*†	1.0%	1.3%
RMS Magnitude Error Floor†	< 0.8%	< 0.8%
RMS Phase Error Floor†	< 0.58 °	< 0.75 °
RMS EVM max standard deviation of all single measurements	0.4%	0.5%
RMS EVM max standard deviation of all measurements, average of 10	0.12%	0.16%
Note: For a detailed description of the EVM specifications, see "Interpreting the EVM Specifications," later in this chapter.		
* Represents the maximum mean RMS EVM due to internal limitations. † RMS EVM, RMS magnitude error, and RMS phase error can not be accurately measured below the floor value.		

Characteristics

Corrected Error Vector Magnitude Accuracy		
Full timeslot measurement with EVM correction enabled	**20 °C to 30 °C**	**0 °C to 55 °C**
*RMS EVM Floor**	0.4%	0.5%
RMS EVM max standard deviation of all single *measurements*	● 0.4%	±0.5%
RMS EVM max standard deviation of all measurements, average of 10	±0.12%	±0.16%
Note: For a detailed *description of the EVM specifications,* see "Interpreting the *EVM Specifications," later* in this *chapter.*		
** RMS EVM cannot be accurately measured below the floor value. Represents the maximum mean RMS EVM due to internal limitations.*		

Measurement Time	
Full timeslot measurement with frame synchronization	
Initial setup and first measurement	*12.5 s*
Repeat a single measurement	*6.0 s*
Continuous measurement update interval	*1.6 s*

Frame Trigger Stability	
Frame trigger stability	*1 bit* in *15 min after 1 hour warm-up*

Interpreting the EVM Specifications

Refer to Figure 7-l. Error vector magnitude, or EVM, is the magnitude of the vector difference between the perfect baseband modulation (vector R) and the modulation vector actually sent (vector D). The EVM depends on the difference between the magnitude (vector m) and phase (angle θ) of the perfect vector and the actual measured vector.

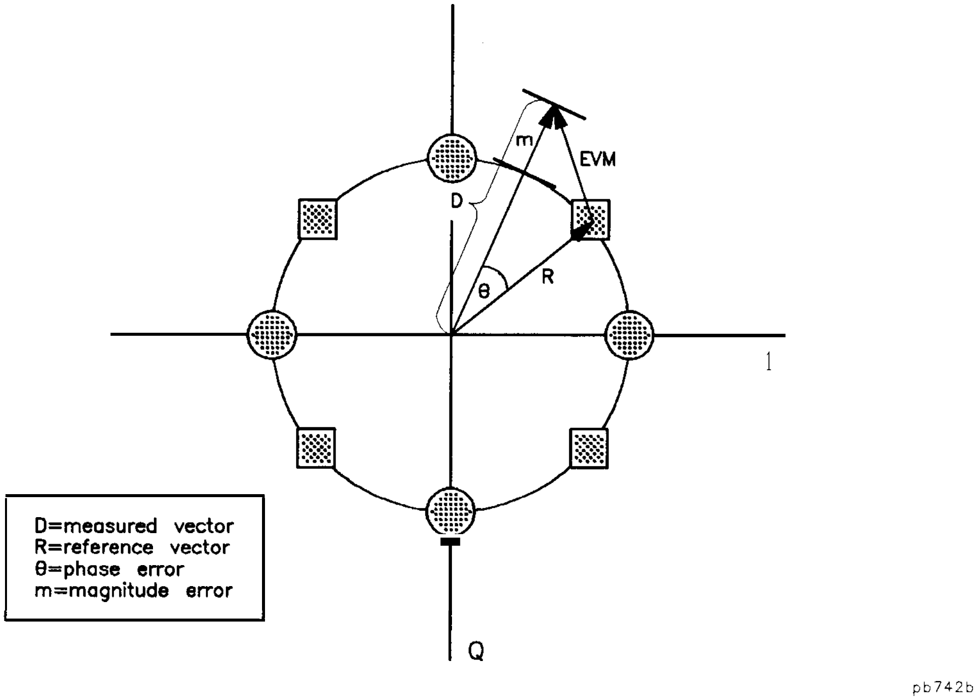


Figure 7-1. Vector Components of EVM

RMS EVM Floor

The EVM depends on two components, the phase error (θ), and the magnitude error (m). The accuracy of the RMS EVM measurement is defined by the accuracy with which the magnitude and phase error can be measured in the HP 8590 E-Series spectrum analyzers.

The accuracy of the magnitude error measurement is limited by the spectrum analyzer sampling resolution, and by the ripple of the filters in the signal processing path. In the HP 8590 E-Series spectrum analyzer, the total uncertainty in the magnitude error measurement is less than 0.8%.

The accuracy of the phase error measurement is limited by the spectrum analyzer phase noise. Phase noise adds jitter to the modulated carrier phase, producing uncertainty in the measured phase error. For example, between 20 °C to 30 "C, the phase noise of the HP 8593E, HP 8594E, HP 8595E, and HP 8596E produce a maximum RMS phase error uncertainty of 0.58".

The phase and magnitude error uncertainties combine in an RMS sum, yielding a maximum positive error in the RMS EVM reading of 1.0% between 20 °C to 30 "C. Thus, a perfect PHS signal with 0% RMS EVM could be measured by a worst-case spectrum analyzer as 1.0% RMS EVM. Typically, the error in the RMS EVM reading will be about +0.7% from a typical RMS phase error uncertainty of 0.35". Also, sources with RMS EVM below 1.0% cannot be measured accurately unless the spectrum analyzer EVM is calibrated using a known precision modulated source.

This EVM measurement floor is analogous to the noise floor in a signal amplitude measurement and represents an averaged value.

The RMS EVM floor is specified between 20 °C to 30 °C (common room temperature), *and* over a temperature range of 0 °C to 55 °C.

The dominant contributor to the RMS EVM floor is the phase error uncertainty due to spectrum analyzer phase noise. The measured RMS EVM is the sum of the spectrum analyzer RMS EVM and the true RMS EVM of the signal. The RMS EVM reading will usually be higher than the true RMS EVM.

RMS EVM Measurement Repeatability

Variations due to filter ripple and phase noise between measurements produce variations in the measurement results. Also, PHS devices under test can output widely-varying EVM from measurement to measurement. Throughout the rest of this discussion, we assume the source to have *fixed* RMS EVM. The variation of RMS EVM, which is caused by the instrument, is specified as the RMS EVM Maximum Standard Deviation. Averaging will reduce the variation of repeated measurements and follows the relation from Gaussian probability distributions. That is:

(eq. 7-1)

$$Sdev\_avg = \frac{1}{\sqrt{N}} \times Sdev\_single$$

where N is the number of averages, $Sdev\_single$ is the RMS EVM Maximum standard deviation for single measurements, and $Sdev\_avg$ is the standard deviation of repeated trials of N averages.

This example uses the Max Standard Deviation specification to calculate the maximum standard deviation between repeated trials of 20 average measurements.

Use the Max Standard Deviation specification for Single Measurements and also the above equation:

$$Sdev\text{-}avg = \frac{1}{\sqrt{20}} \times 0.4\%$$

$$= 0.089\% \ maximum$$

This result gives the maximum repeatability error that is due solely to the spectrum analyzer.

When averaged EVM measurements are made by the HP 85726B PHS measurements personality, the mean and standard deviation of the N intermediate data points is calculated and displayed.

Uncertainty in EVM Measurements

All EVM measurements contain uncertainty in the measurement result. Uncertainty is caused by addition of RMS EVM due to the Max EVM Floor of the spectrum analyzer, and also from the spectrum analyzer EVM repeatability. When calculating the uncertainty, different limits are used in the positive and negative directions. For more information on calculating positive and negative uncertainties, refer to Appendix A, located at the end of this chapter.

When averaging is done, the HP 85726B PHS measurements personality calculates and displays the uncertainties for the measurement using the equations defined in Appendix A for both temperature ranges. User-specified parameters for this uncertainty calculation are number of averages and the standard deviation factor.

Corrected or Calibrated EVM Measurements

Chapter 2, "Making Measurements" contains details on how to perform the EVM calibration procedure. The process of calibrating the instrument for EVM effectively minimizes the RMS EVM floor of the analyzer but does not remove it altogether. Rather than the worst case RMS EVM floor specification, the actual measured floor is used for subsequent averaged measurements. For single measurements, the specified maximum RMS EVM floor value of 0.4% is used when calculating uncertainties. For corrected averaged measurements, uncertainties are calculated by the HP 85726B PHS measurements personality.

Appendix A
Uncertainty in EVM Measurements

The Cause of EVM Uncertainties

All EVM measurements contain uncertainty in the measurement result. Uncertainty is caused by addition of RMS EVM due to the Max EVM Floor of the spectrum analyzer, and also from the spectrum analyzer EVM repeatability. When calculating the uncertainty, different limits are used in the positive and negative directions.

How to Derive Positive and Negative EVM Uncertainties

The ***positive RMS EVM uncertainty limit*** is derived from the magnitude error due to the digital FIR filter ripple in the signal processing path, and an internal spectrum analyzer correction for the minimum RMS EVM floor. The FIR filter ripple and the minimum floor correction are not affected by temperature or averaging. This causes the positive RMS EVM uncertainty to be a maximum of 0.75% for single measurements. If averaging is done, the positive uncertainty can be modified slightly. The standard deviation of the RMS EVM is calculated for the number of averages and multiplied by a factor. This factor is the number of standard deviations to be used in the uncertainty calculations; 3σ or 4σ, for example. This factor (_ddSDF) is remotely-settable by the user, and defaults to 3.13. Positive uncertainty is then calculated as the lesser of 0.75%, or:

$$\left(Factor \times \frac{stddev}{\sqrt{N}}\right)\%$$

(eq. *A-l)*

$$Positive\ uncertainty\ limit = MINIMUM\left(0.75,\ Factor\ x\ \frac{stddev}{\sqrt{N}}\right)$$

The RMS EVM reading will usually be higher than the true RMS EVM because the spectrum analyzer adds error to the EVM measurement.

The ***negative RMS EVM uncertainty limit*** is derived from the RMS EVM standard deviation and the Effective RMS EVM Floor. For single measurements the RMS EVM maximum standard deviation is used. For averaged measurements, a calculated RMS EVM standard deviation is derived from gaussian probability theory, as in equation 7-1. The standard deviation is multiplied by a factor, as described above.

The second contributor, the Effective RMS EVM Floor, can differ from the RMS EVM Floor specification because spectrum analyzer phase error uncertainty is much greater than the magnitude uncertainty. Error in the displayed RMS EVM is a function of the size of the RMS EVM magnitude error and the RMS EVM phase error, for values above the RMS EVM Floor. An RMS EVM value with a large magnitude component has less error than an RMS EVM value with a small magnitude component.

This is because the spectrum analyzer measures EVM magnitude error more accurately than RMS phase error.

The Effective Floor for a measurement is calculated from the phase error contribution from the spectrum analyzer and the displayed RMS Magnitude, Phase and EVM numbers. The equations for the calculation are as follows:

(eq. A-2)

$$Effective\ EVM\ Floor = Displayed\ RMS\ EVM - Signal\ RMS\ EVM$$

Breaking these terms down,

(eq. A-3)

Effective EVM Floor =

$$DRE - 100 \times \left[\left(\frac{DRME}{100}\right)^2 + 4 \times \left(1 + \frac{DRME}{100}\right) \times \sin^2\left(\frac{(DRPE - Ephsa)}{2}\right)\right]^{\frac{1}{2}}$$

where:

- ***DRE*** is Displayed RMS EVM
- ***DRME*** is Displayed RMS Magnitude Error
- ***DRPE*** is Displayed RMS Phase Error
- ***Ephsa*** is Spectrum Analyzer Phase Error Floor
- ***Phase*** is in degrees, Magnitude is in %.
- For the temperature range 20 °C to ***30*** °C, use ***Ephsa = 0.573*** degrees
- For the temperature range ***0*** °C to 55 ***"C,*** use ***Ephsa = 0.745*** degrees

The negative uncertainty limit is then:

$$Negative\ uncertainty\ limit = Factor \times \frac{stddev}{\sqrt{N}} + Effective\ EVM\ Floor$$

When averaging is done, the HP 85726B PHS measurements personality calculates and displays the uncertainties for the measurement using the equations defined above for both temperature ranges. When single EVM measurements are made ($N = 1$), the uncertainties can be calculated by hand. A family of curves has been created using equation A-3, that specifies Effective RMS EVM Floor versus Displayed RMS EVM versus Displayed Magnitude Error. These curves are shown in Figure 7-2 and Figure 7-3 for the 20 °C to 30 °C, and 0 °C to 55 °C temperature ranges.

To use these curves:

1. Find the displayed RMS EVM on the horizontal axis
2. Trace a vertical line to the intersection with the curve that represents the displayed RMS magnitude error
3. Look across to the effective EVM floor axis to read the maximum positive offset in the current displayed RMS EVM

The effective EVM floor represents the effective RMS EVM floor for the current displayed RMS EVM and displayed RMS magnitude error.

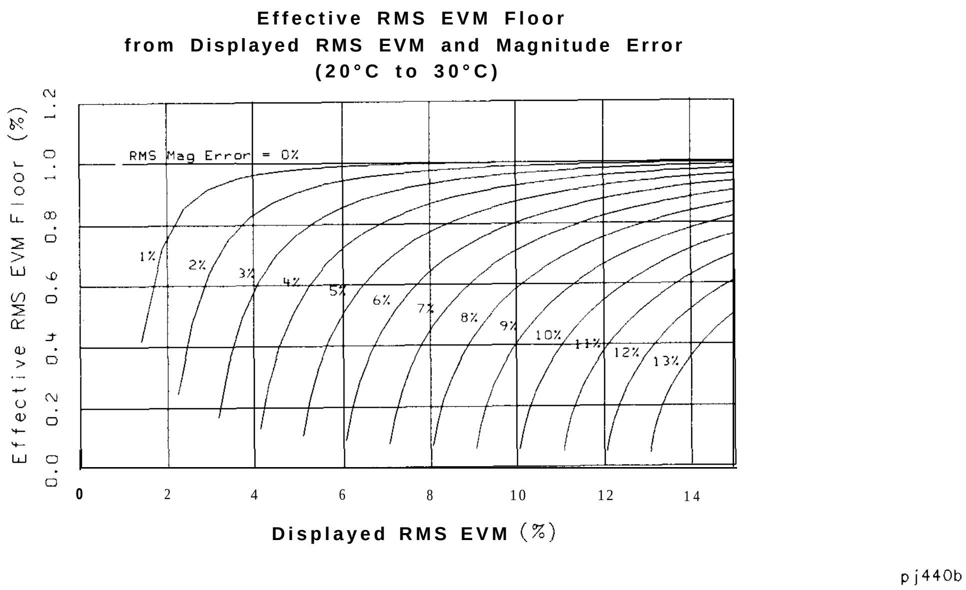


Figure 7-2. HP 8593/4/5/6E Analyzers Effective EVM Floor, 20 °C to 30 °C

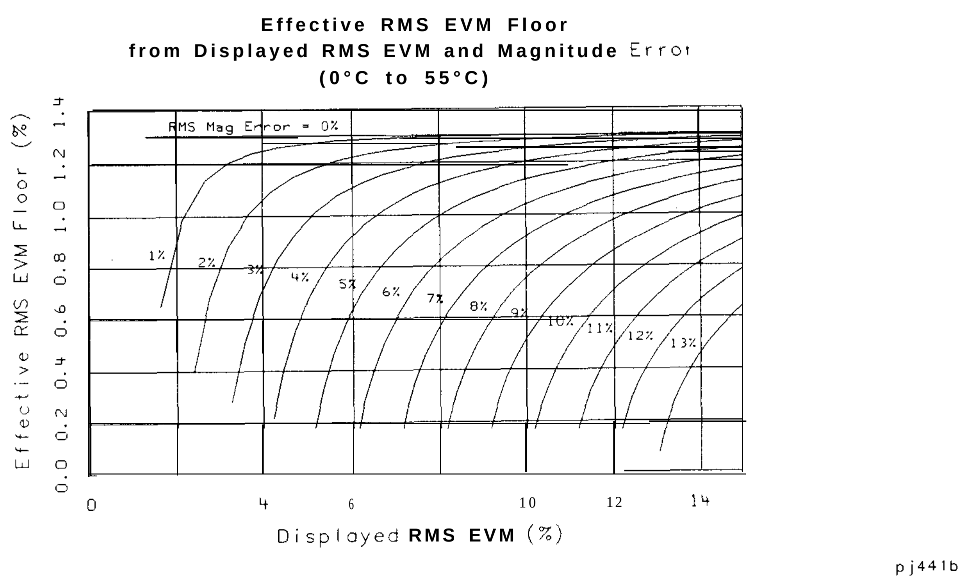


Figure 7-3. HP 8593/4/5/6E Analyzers Effective EVM Floor, 0 °C to 55 °C.

Example: A PHS station with an RMS EVM of 6 % , and RMS magnitude error of 4%, measured between 20 °C to 30 °C.

Refer to Figure 7-4. Obtain the effective EVM floor from the curve.

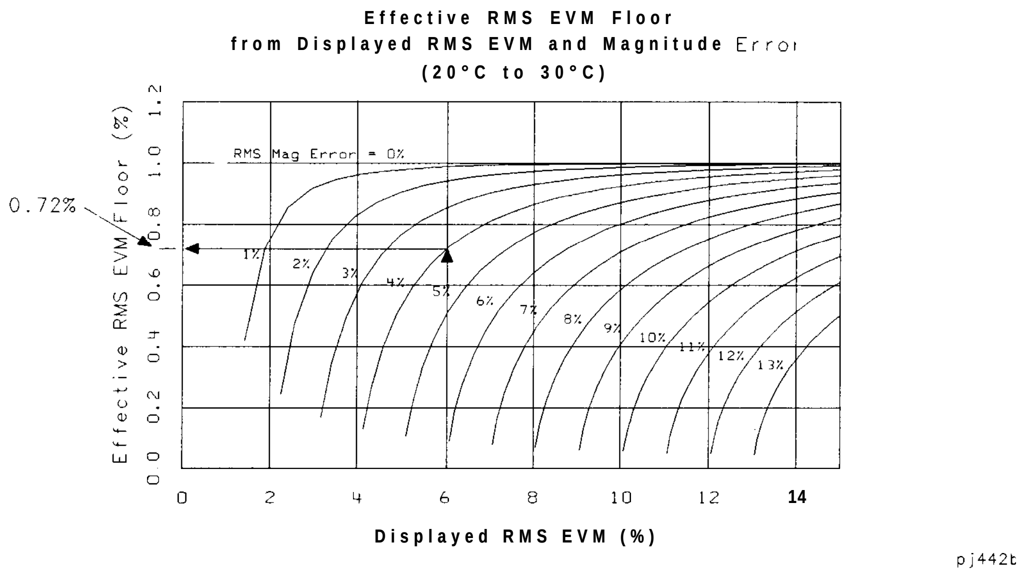


Figure 7-4. HP 8593/4/5/6E Analyzers effective EVM floor, 20 °C to 30 °C

For this case, the effective RMS EVM floor is 0.72%. Compare this to another PHS station example, which has better amplitude control. For example, the station results might be an RMS magnitude error of 1% and an RMS EVM of 6%.

The effective RMS EVM floor for this station is about 1.0%. The RMS EVM floor was improved by 0.3% by understanding the measurement strengths of the spectrum analyzer.

Note The effective EVM floor curves are based on specified spectrum analyzer performance. Typical analyzers may have better accuracy. The effective RMS EVM floor generated from the curves is used to derive negative EVM uncertainty.

Applying Uncertainty Limits to Measurement Data

Describing how uncertainty limits are applied in different situations is best done by example. So, here are several examples which will clarify the methods.

For single measurements, the uncertainties are calculated from the RMS EVM standard deviation specification.

Example: A PHS station with a Displayed RMS EVM of 6 % , and Displayed RMS Magnitude error of 4%. Standard deviation factor = 3.0. Find the worst case uncertainty for a single measurement, over 20 °C to 30 °C.

Positive Uncertainty:

6% (Displayed RMS EVM)	+	0.75% (worst case positive error)	=	6.75% (Maximum True Value)

Negative Uncertainty:

% (Displayed6 RMS EVM)	–	1.2% (3 x RMS EVM Max Std Dev)	–	0.72% (Effective RMS EVM Floor)
			=	4.08% (Minimum True Value)

The limits on the True RMS EVM are: 4.08% ≤ RMS EVM ≤ 6.75%

Example: A PHS station with a Displayed RMS EVM of 10%, and Displayed RMS Magnitude error of 8%. Use 3 standard deviations for the calculation. Find the worst case uncertainty for a single measurement, over 0 °C to 55 °C.

Positive Uncertainty:

10% (Displayed RMS EVM)	+	0.75% (worst case positive error)	=	10.75% (Maximum True Value)

Negative Uncertainty:

10% (Displayed RMS EVM)	–	1.2% (3 x RMS EVM Max Std Dev)	–	0.76% (Effective RMS EVM Floor)
			=	8.04% (Minimum True Value)

The limits on the True RMS EVM are: 8.04% ≤ RMS EVM ≤ 10.75%

Using Averaging to Reduce Measurement Uncertainty

Averaging can narrow the uncertainty range for a measurement. For averaged measurements, the HP 85726B PHS measurements personality calculates and displays the uncertainty limits.

This can be illustrated by way of example.

A PHS station has mean EVM of 8.0, mean magnitude error of 3%, and standard deviation of 0.4%. What is the uncertainty in a 40 reading EVM measurement using 4 standard deviations and the 0 °C to + 55 °C temperature range?

From equation 7-1, the standard deviation contribution from the spectrum analyzer will be:

$$\frac{1}{\sqrt{40}} \times 0.4\% = 0.063\%$$

Positive Uncertainty:

6% (Displayed RMS EVM)	+	MINIMUM (0.75%, 4 x 0.063) (worst case positive error)	=	6.25% (Maximum True Value)

Negative Uncertainty:

6% (Displayed RMS EVM)	–	4 x 0.063% (4 x RMS EVM Max Std Dev)	–	1.2% (Effective RMS EVM Floor)
			=	4.55% (Minimum True Value)

The limits on the True RMS EVM are: 4.55% $\leq$ RMS EVM $\leq$ 6.25%

8

Verifying Operation

This chapter contains test procedures that verify the electrical performance of the improved amplitude accuracy for PHS (Option 052), the time-gated spectrum analysis card (Option 105), and the digital demodulator (Options 151 and 160).

This chapter contains the following sections:

- preparing for the verification tests
- the following verification procedures:

  1. absolute amplitude accuracy
  2. gate delay accuracy and gate length accuracy
  3. gate card insertion loss
  4. IF frequency accuracy
  5. error vector magnitude

- the performance verification test record

Preparing for the Verification Tests

Do these four steps before beginning a verification test:

1. Turn on the spectrum analyzer and allow it to warm up for at least 30 minutes.
2. Familiarize yourself with basic HP 8590 Series spectrum analyzer operation.
3. Perform the spectrum analyzer self-calibration routines. Refer to the spectrum analyzer documentation for instructions. (Before performing the self-calibration routines, ensure that nothing is connected to the GATE TRIGGER INPUT connector. Otherwise, the self-calibration routine's results may not be valid.)
4. Read the rest of this section before you start any of the tests, and make a copy of the performance verification test record as described in "To record the test results."

The test equipment you will need

Table 8-l list the recommended test equipment for the performance tests. Any equipment that meets the critical specifications given in the table can be substituted for the recommended model or models.

To record the test results

Within the verification procedure, there are places to enter the test results. In addition, the performance verification test record (Table 8-9) has been provided at the end of the chapter. We recommend that you make a copy of the table, record the test results on the copy, and keep the copy for your calibration test records. This record could prove valuable in tracking gradual changes in test results over long periods of time.

To periodically verify operation

The spectrum analyzer requires periodic verification of operation. Under most conditions of use, you should perform these verification tests once a year to ensure that the spectrum analyzer meets the specifications.

If the spectrum analyzer does not meet its specifications

1. Ensure that there is nothing connected to the spectrum analyzer GATE TRIGGER INPUT connector.
2. Rerun the spectrum analyzer frequency and amplitude self-calibration routines. See the spectrum analyzer documentation for more information.
3. Repeat the verification test.

If the spectrum analyzer continues to fail one or more of its specifications, complete any remaining tests and record the results on a copy of the performance verification test record, then return the spectrum analyzer with a copy of the completed test record to a Hewlett-Packard Sales and Service Office. Refer the documentation for the spectrum analyzer for addresses and shipping instructions.

Recommended test equipment

Table 8-1 lists the recommended test equipment for performing the verification tests.

Table 8-1.
Recommended Test Equipment for Performing Verification Tests

Instrument	Critical Specifications for Equipment Substitution	Recommended Model	Use*
Synthesized signal generator	Frequency range: 1895 MHz to 1918 MHz Phase noise: −108 dBc/Hz at 100 Hz offset −119 dBc/Hz at 1 kHz offset −130 dBc/Hz at 10 kHz offset Power level range: −35 dBm to +16 dBm	HP 8662A or HP 8663A	P
Synthesized sweeper	Frequency range: 1895 MHz to 1918 MHz Frequency accuracy (CW): ±0.02% Power level range: −35 dBm to +16 dBm	HP 8340A/B	P,A,T
Synthesized/ level generator	Frequency range: 50 MHz Amplitude range: +12 dBm to −85 dBm Flatness: ±0.15 dB Attenutor accuracy: ±0.09 dB	HP 3335A	P,A,T
Spectrum analyzer	Phase noise: −80 dBc/Hz at 320 Hz offset −85 dBc/Hz at 1 kHz offset	HP 8566B	P
Measuring receiver	Compatible with power sensors Resolution: 0.01 dB Reference accuracy: ±1.2%	HP 8902A	P,A,T
Power sensor	Frequency range: 1895 MHz to 1918 MHz Maximum SWR: 1.1 (at stated range)	HP 8482A	P,A,T
Oscilloscope	No substitute	HP 54501A	P,T
Microwave frequency counter	Frequency range: 21.4 MHz Aging rate: 5 x 10^{-10} Hz/day	HP 5343A	P
Universal counter	Time interval: 100 ns to 100 ms	HP 5316A	P
Pulse/function generator	Frequency: 100 Hz Duty cycle: 50% Output: TTL square wave	HP 8116A	P
Power splitter	Frequency range: 1895 MHz to 1918 MHz Insertion loss: 7 dB (nominal) Output tracking: <0.25 dB Equivalent output SWR: <1.22:1	HP 11667A	P,A
Step attenuator	Range: 0 dB to 12 dB Step size: 1 dB steps Includes calibration data	HP 8494A Option 890	P
Step attenuator	Range: 0 dB to 120 dB Step size: 10 dB steps Includes calibration data	HP 8495A Option 890	P

* P = Performance Test, A = Adjustment, T = Troubleshooting

1. Absolute Amplitude Accuracy (Option 052 Only)

Description

To measure the absolute amplitude accuracy of the spectrum analyzer, a signal from a synthesized sweeper is output to both the spectrum analyzer and a measurement receiver. The sweeper signal amplitude is adjusted until the spectrum analyzer marker displays a known amplitude. The amplitude of this signal is measured by the measuring receiver. The difference between the marker readout and the value measured by the measuring receiver is the absolute amplitude accuracy.

Equipment

Synthesized sweeper .... HP 8340A/B
Measurement receiver .... HP 8902A
Power splitter .... HP 11667A
Power sensor .... HP 8482A

Adapters
Type N (f) to APC 3.5 (m) 1250-1750
APC 3.5 (f) to APC 3.5 (f) 5061-5311
Type N (m) to Type N (m) 1250-0778

Cables
Type N, 183 cm (72 in) .... HP 11500A

To set up the equipment

1. Zero and calibrate the measuring receiver and the power sensor in log mode as described in the measuring receiver operating manual.

Note The absolute amplitude accuracy test should only be performed if the ambient temperature is between 20 °C and 30 °C.

2. Connect the equipment as shown in Figure 8-l. Connect the power splitter to the spectrum analyzer using an adapter.

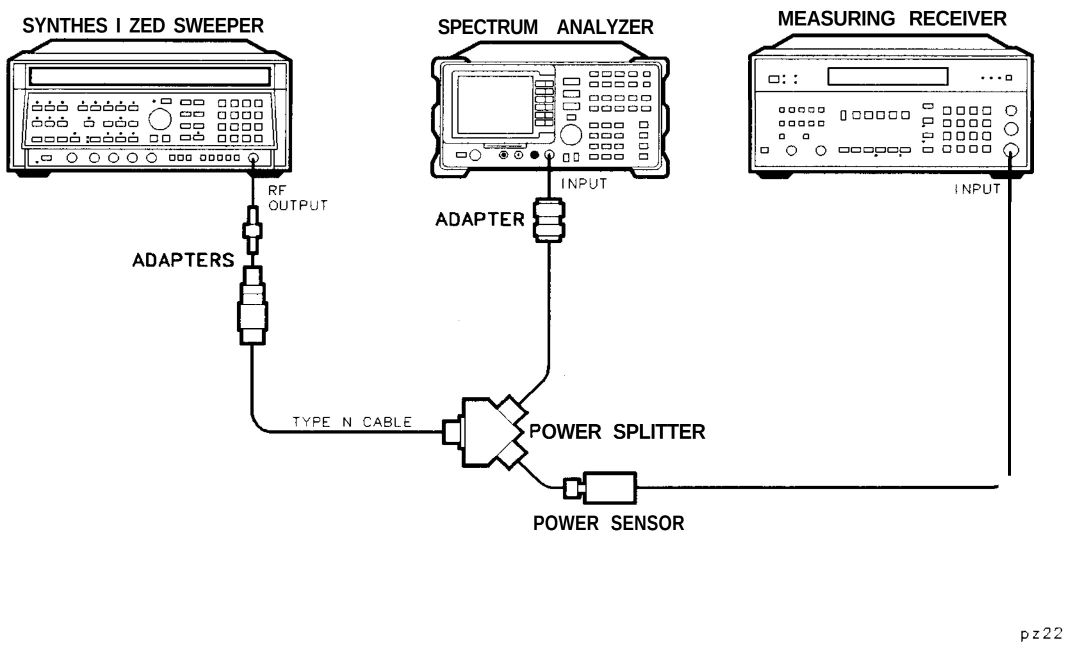


Figure 8-1. Absolute Amplitude Accuracy Verification

3. Press (INSTR PRESET) on the synthesized sweeper. Set the controls as follows:

CW .... 1895 MHz
POWERLEVEL .... -2 dBm

4. Press (PRESET) on the spectrum analyzer and wait for the preset to finish, then press the following spectrum analyzer keys:

(FREQUENCY) 1895 (MHz)
(SPAN) 400 (kHz)
(BW) 100 (kHz)
VID BW AUTO MAN 30 (kHz)
(AMPLITUDE) 4 (−dBm)
ATTEN AUTO MAN 10 (dB)
(PEAK SEARCH)

Log fidelity

5. Set the power sensor cal factor for 1895 MHz on the measuring receiver.
6. On the synthesized sweeper, press (POWER LEVEL) and adjust the output amplitude so that the analyzer marker amplitude reads −9 dBm ±0.05 dB.
7. Record the measuring receiver power reading in Table 8-2.
8. Adjust the output amplitude of the sweeper for spectrum analyzer marker amplitude readings of −14 dBm and −19 dBm ±0.05 dB.
9. Record the measuring receiver power readings in Table 8-2. The readings should be within the limits shown.

Table 8-2. Log Fidelity

Analyzer Marker Reading (dBm)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
−9	−8.3	____________	−9.7
−14	−13.3	____________	−14.7
−19	−21.3	____________	−19.7

Frequency response (input attenuator 10 dB)

10. Set the frequency of the spectrum analyzer to the first measurement frequency shown in Table 8-3.
11. On the synthesized sweeper, press (CW) and set the frequency to the same measurement frequency as the spectrum analyzer is set in the previous step.
12. On the spectrum analyzer, press (PEAK SEARCH).
13. On the synthesized sweeper, press (POWER LEVEL) and adjust the output amplitude so the spectrum analyzer marker amplitude reads −9 dBm ±0.05 dB.
14. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in Table 8-3.
15. Repeat steps 10 through 14 for a frequency of 1918 MHz. Record the results in Table 8-3. The results should be within the limits shown.

Table 8-3. Frequency Response (Input Attenuator 10 dB)

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
1895	−9.5	____________	−8.5
1918	−9.5	____________	−8.5

Frequency response (input attenuator 20 dB)

16. On the spectrum analyzer, press the following keys:

    (AMPLITUDE) ATTEN AUTO MAN 20 dB

    (AMPLITUDE) 6 (+dBm) REF LVL

17. Set the frequency of the spectrum analyzer to the measurement frequency shown in Table 8-4.
18. On the synthesized sweeper, press (CW) and set the frequency to the same measurement frequency as the spectrum analyzer is set in the previous step.
19. On the spectrum analyzer, press (PEAK SEARCH).
20. On the sweeper, press (POWER LEVEL) and adjust the amplitude so the spectrum analyzer marker amplitude reads +1 dBm ±0.05 dB.
21. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in Table 8-4.
22. Repeat steps 17 through 21 for a frequency of 1918 MHz. Record the results in Table 8-4. The results should be within the limits shown.

Table 8-4. Frequency Response (Input Attenuator 20 dB)

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
1895	+0.5	________	+1.5
1918	+0.5	________	+1.5

Frequency response (input attenuator 30 dB)

23. On the spectrum analyzer, press the following keys:

    (AMPLITUDE) ATTEN AUTO MAN 30 dB

    (AMPLITUDE) 10 (+dBm) REF LVL

24. Set the frequency of the spectrum analyzer to the measurement frequency shown in Table 8-5.
25. On the spectrum analyzer, press (PEAK SEARCH).
26. On the synthesized sweeper, press (CW) and set the frequency to the same measurement frequency as the spectrum analyzer is set in the previous step.
27. On the synthesized sweeper, press (POWER LEVEL) and adjust the amplitude so the spectrum analyzer marker amplitude reads +5 dBm ±0.05 dB.
28. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in Table 8-5.
29. Repeat steps 24 through 28 for a frequency of 1918 MHz. Record the results in Table 8-5.

1. **Absolute Amplitude Accuracy (Option 052 Only)**

Table 8-5. Frequency Response (Input Attenuator 30 dB)

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
1895	+4.5	____________	+5.5
1918	t4.5	____________	+5.5

Frequency response (input attenuator 40 dB)

30. On the spectrum analyzer, press the following keys:

(AMPLITUDE) ATTEN AUTO MAN 40 dB
(AMPLITUDE) 10 (+dBm)

31. Set the frequency of the spectrum analyzer to the measurement frequency shown in Table 8-6.
32. On the synthesized sweeper, press (CW) and set the frequency to the same measurement frequency as the spectrum analyzer is set in the previous step.
33. On the analyzer, press (PEAK SEARCH).
34. On the synthesized sweeper, press [POWER LEVEL] and adjust the amplitude so the spectrum analyzer marker amplitude reads + 5 dBm f0.05 dB.
35. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in Table 8-6.
36. Repeat steps 31 through 35 for a frequency of 1918 MHz. Record the results in Table 8-6.

Table 8-6. Frequency Response (Input Attenuator 40 dB)

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
1895	14.0	____________	+6.0
1918	+4.0	____________	+6.0

2. Verifying Gate Delay Accuracy and Gate Length Accuracy (Option 105 Only)

Specifications

Gate Delay Refer to Chapter 7 for specific values.

Gate Length Refer to Chapter 7 for specific values.

Description

The method used for measuring the gate length times is determined by the length of the gate. Shorter gate-length times are measured with an oscilloscope, and longer gate-length times are measured with a counter.

For shorter gate-length times, the output signal of a pulse generator is used to trigger the gate circuitry. To measure the gate delay, At markers are used. There is often up to 1 μs of jitter due to the 1 μs resolution of the gate delay clock. The "define measure" feature of the oscilloscope is used to measure and calculate the average length of the gate output automatically.

For longer gate-length times, a counter is used to measure the time period from the rising edge of the gate output to its falling edge. Because the gate-length time is equivalent to the clock accuracy of the spectrum analyzer, the gate-length time is compared to the specification for clock accuracy.

Equipment

Universal counter .... HP 5316A
Pulse/function generator .... HP 8116A
Digitizing oscilloscope .... HP 54501A

Cables
BNC, 120 cm (48 in) (four required) .... HP 10503A

Adapters
BNC tee (m) (f) (f) (two required) 1250-0781

To determine small gate delay and gate length (jitter-term)

1. Connect the equipment as shown in Figure 8-2.

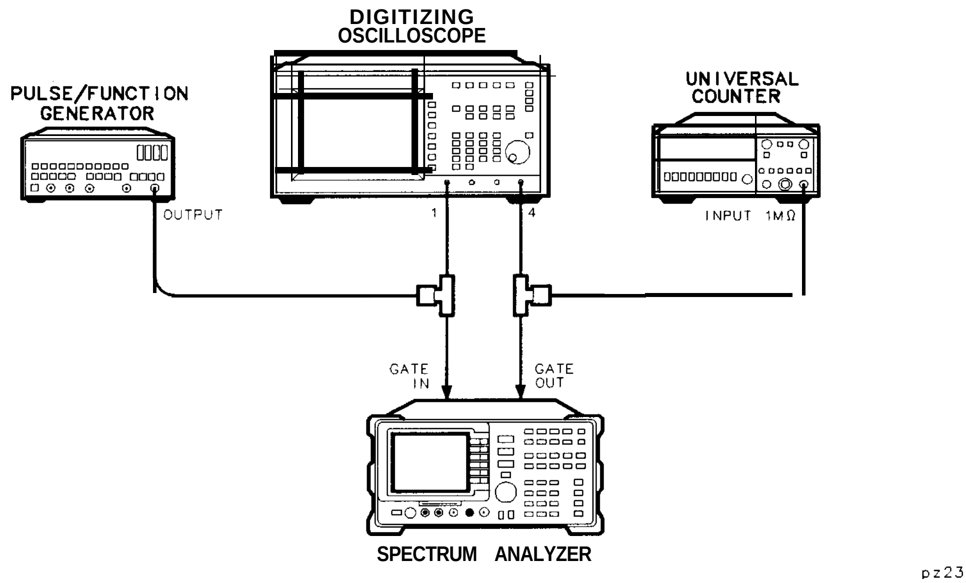


Figure 8-2. Gate Delay and Gate Length Test Setup

2. Press the following spectrum analyzer keys:

   (PRESET) (wait for the completion of the preset routine)
   (SPAN) ZERO SPAN
   (SWEEP) 20 (ms) GATE ON OFF (underline ON) Gate Control GATE DELAY 1 (μs)
   GATE LENGTH 1 (μs)

3. Activate the square wave output on the function generator.
4. Set the pulse/function generator controls as follows:

   MODE ....NORM
   FRQ .... 100 Hz
   DTY 50%
   HIL .... 2.5 V
   LOL 0.0V

5. Press the following keys on the oscilloscope:

   SETUP (RECALL)
   ENTRY (CLEAR)
   MENUS (DISPLAY)
   off frame axes grid .... highlight grid
   connect dots off on .... highlight on
   MENUS (TRIG)
   source 1 2 3 4 .... highlight 4
   level .... 2 V
   MENUS (TIMEBASE) .... 500 ηs/div
   MENUS (CHAN)
   CHANNEL 1 2 3 4 off on
   highlight CHANNEL 1 on
   set V/div to 1 V and offset to 2 V
   highlight CHANNEL 4 on
   set V/div to 1 V and offset to 3 V
   MENUS (DISPLAY)
   DISPLAY norm avg env .... highlight env

6. Press SYSTEM CONTROL (CLEAR DISPLAY) on the oscilloscope. Wait for the trace to fill in, then press the following keys:

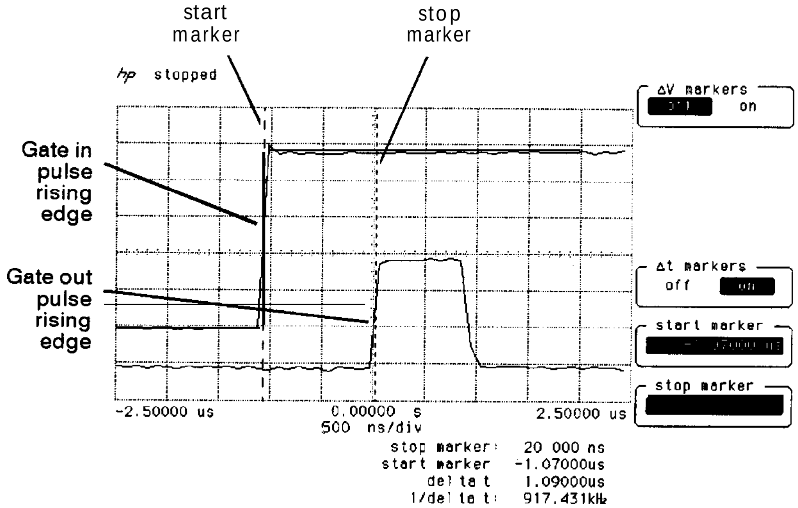
   MENUS (Δt ΔV)
   Δt markers off on .... highlight on
   stop marker .... 0 μs

7. Press (RUN/STOP) (CLEAR DISPLAY) (SINGLE) to obtain a better view of the displayed traces.

Note It is normal to see pulses on the spectrum analyzer display.

To record the minimum and maximum gate delay values

8. On the oscilloscope, press start marker . Use the knob to position the start marker at the mid-point of the rising edge of the gate in pulse. See Figure 8-3.



pj444b

Figure 8-3. Oscilloscope Display of Minimum and Maximum Gate Delay Values

9. Record the value of the start marker reading as the MIN gate delay.

   MIN gate delay ____________________

   (the expected value is greater than -2.0 μs, but less than 0.0 μs)

10. Press stop marker and use the oscilloscope knob to position the stop marker at the mid-point of the rising edge of the gate out pulse.

11. Record the value of the stop marker reading as the MAX gate delay.

    MAX gate delay ____________________

    (the expected value is greater than 0.0 μs, but less than 2.0 μs)

To determine small gate length

12. Press the following keys on the oscilloscope:

    (BLUE) (+WIDTH) 4

    MENUS (DEFINE MEAS)

    statistics off on .... highlight on

13. Read the average + width (4) displayed on the oscilloscope in the bottom right-hand annotation area.
14. Record this value as the 1 μs gate length value.

    1 μs gate length ________________

    (the 1μs gate length minimum width should be greater than 800 ηs and maximum width should be less than 1200 ηs.

To determine large gate length (clock accuracy term)

15. Press the following spectrum analyzer keys:

    (SWEEP) 150 (ms) GATE Gate Con rol GATE DELAY 10 (ms) GATE LENGTH 65 (ms)

16. Set the universal counter controls as follows:

    TI .... A → B
    GATE TIME delay .... mid-range
    CHANNEL A .... rising edge, dc couple, SENSITIVITY mode
    CHANNELB .... falling edge, dc couple, SENSITIVITY mode
    COM A

17. Adjust LEVEL/SENS on the universal counter for best triggering.
18. Record the universal counter readout value as the 65 ms gate length.

    65 ms gate length ________________

    (minimum gate length width should be greater than 64.99 ms)

    (maximum width should be less than 65.01 ms)

3. Verifying Gate Card Insertion Loss (Option 105 Only)

Specifications

- Additional amplitude error due to gate-on enabled

Log scale	Refer to Chapter 7 for specific values.
Linear scale	Refer to Chapter 7 for specific values.

Description

Use this procedure to verify that the insertion loss for the Option 105 card is within the specifications. See the specifications in Chapter 7 for the log and linear scale additional amplitude error due to gate-on enabled. The insertion loss is measured as follows:

1. HIGH SWEEP output on the spectrum analyzer is connected to GATE TRIGGER INPUT to provide a trigger signal for the gate circuitry.
2. The gate is turned off and a marker reading is taken.
3. The gate is then turned on and the synthesizer/level generator amplitude is adjusted to match the marker reading taken while the gate was off.

The difference between the two synthesizer/level generator readings is the measured insertion loss of the gate card.

Equipment

Synthesizer/level generator . . . . HP 3335A

Cables
BNC, 122 cm (48 in) (two required) . . . . HP 10503A

Additional Equipment for Option 001 Spectrum Analyzer
BNC cable, 75ohm, 120 cm (48 in) . . . . HP part number 15525-80010

To determine the card insertion loss

1. Connect the equipment as shown in Figure 8-4. (For Option 001 spectrum analyzers, attach the 750 cable to the spectrum analyzer RF input connector rather than the 50Ω cable.)

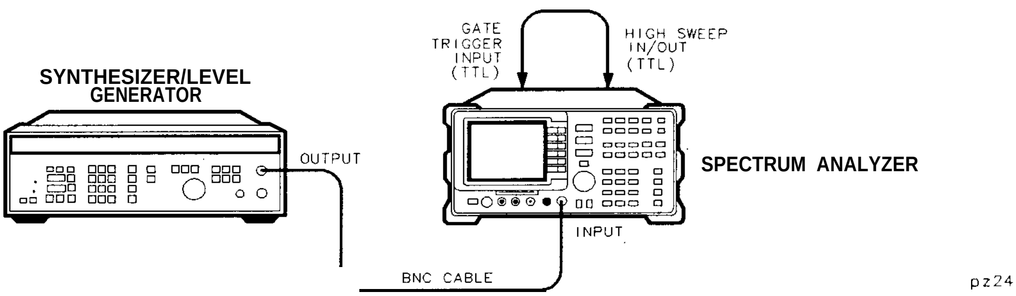


Figure S-4. Gate Delay and Gate Length Test Setup

2. Set the synthesizer/level generator controls as follows:

FREQUENCY . . . . 50 MHz
AMPTDINCR . . . .0.01 dB
AMPLITUDE . . . . -5 dBm

3. On the spectrum analyzer, press (PRESET). Wait for preset to complete.
4. Press the following spectrum analyzer keys:

(FREQUENCY) 5 (MHz)
(SPAN) 1 (MHz)
(BW) 100 (kHz)
(SWEEP) 100 (ms) GATE ON OFF (underline OFF) GATE MENU GATE DELAY 20 (ms)
GATE LENGTH 65 (ms)
(PEAK SEARCH) MARKER DELTA
(SWEEP) GATE ON OFF (underline ON)
(PEAK SEARCH)

5. Use the step INCR (▲) or (▼) key on the synthesizer/level generator to adjust the output amplitude for a spectrum analyzer MKR Δ reading of 0.0 ±0.05 dB.
6. Record the amplitude displayed on the synthesizer/level generator as the synthesizer/level generator reading.

synthesizer/level generator reading ________________

7. Subtract the synthesizer/level generator reading you just recorded from -5.0 dBm. Record the result as the gate card insertion loss.

For example, if the synthesizer/level generator reading is -4.96 dBm, then the result is -0.04 dBm as shown below:

-5.0 dB minus the synthesizer reading is equal to the gate card insertion loss

(-5.0) − (-4.96) = -0.04 dBm

gate card insertion loss ________________

(the insertion loss should be between -0.3 dB and +0.3 dB)

4. Verifying IF Frequency Accuracy (Option 151 Only)

Specifications

The IF frequency accuracy should be 21.4 MHz ±15 Hz or less for an HP 8593E through 8596E.

Description

Use this procedure to verify that the IF frequency accuracy of the spectrum analyzer with Option 151 installed is within specification. The IF frequency accuracy is measured as follows:

1. A frequency and amplitude self-calibration is performed on the HP 8590 Series spectrum analyzer to improve the accuracy of the spectrum analyzer.
2. The spectrum analyzer IF output frequency is then measured with a frequency counter that is externally triggered by a 10 MHz output from the synthesizer.
3. The frequency measured is compared with the specified IF output frequency of the spectrum analyzer.

Equipment

Synthesized signal generator . . . . HP 8662A or 8663A
Microwave frequency counter . . . . HP 5343A

Cables
BNC, 122 cm (48 in) (three required) . . . . HP 10503A

Adapters
Type N (m) to BNC (f) (two required) . . . . HP part number 1250-0780

To determine the IF frequency accuracy

1. Connect the equipment as shown in Figure 8-5.

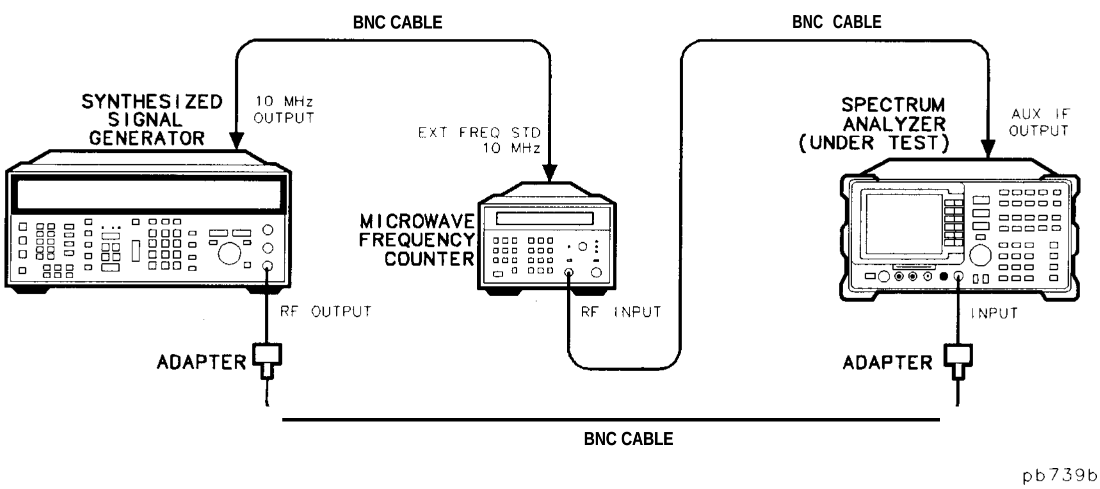


Figure 8-5. IF Frequency Accuracy Test Setup

2. Perform a frequency and amplitude self-calibration on the HP 8590 Series spectrum analyzer. This improves the accuracy of the spectrum analyzer. If necessary, refer to "Getting Started" in the spectrum analyzer user's guide for a complete explanation of this procedure.
3. Press the following synthesized signal generator keys:

   (FREQUENCY) (1895.30) (MHz)
   (AMPLITUDE) (0) (+dBm)
   (MOD OFF)

4. Press the following HP 8590 Series spectrum analyzer keys:

   (PRESET)

   (CAL) More 1 of 2 CORRECT OFF

   (FREQUENCY) (1895.30) (MHz)
   (BW) (1) (MHz)
   (SPAN) ZERO SPAN

   (MKR FCTN) More 1 of 2 . Press CNT RES MAN until MAN is underlined. Press (1) (Hz).

   (PEAK SEARCH) (MKR →) MARKER → REF LVL

   (TRIG) EXTERNAL

5. Use the frequency counter to measure the IF frequency. Record this value in the performance verification test record at the end of this chapter.

5. Verifying Error Vector Magnitude (EVM) (Option 151 Only)

Specifications

The error vector magnitude (EVM) accuracy specification is based on the phase noise performance of the HP 8590 E-Series spectrum analyzers. The frequency stability of the HP 8593E through 8596E spectrum analyzers contributes to an EVM uncertainty of+ 0.4% to – 1.4% after an average of 10 measurements.. This performance test procedure characterizes the spectrum analyzer single sideband phase noise at frequency offsets close to and far from the carrier frequency. Frequency offsets tested are 100 Hz, 400 Hz, 1 kHz, 10 kHz, and 100 kHz away from the carrier.

Description

Use this procedure to measure phase noise in order to verify that the calculated error vector magnitude (EVM) is within specification. This procedure measures phase noise at offsets of 100 Hz, 400 Hz, 10 kHz, 100 kHz from the carrier, after which the equivalent EVM is calculated. The phase noise level at each of these five offsets represent the phase noise behavior over a region of the phase noise curve. The total phase noise level of the spectrum analyzer can be judged by making a measurement in each region. The five phase noise measurements have been broken into two ranges; close-in phase noise (100 Hz, 400 Hz, and 1 kHz), and wide offset phase noise (10 kHz and 100 kHz). Different methods for measuring phase noise are used for each range.

1. A frequency and amplitude self-calibration is performed to improve the accuracy of the spectrum analyzer. A warmup of 60 minutes total is required before making measurements.
2. A stable RF signal is input to the HP spectrum analyzer under test. The resulting IF signal is used to characterize single sideband phase noise of the spectrum analyzer under test at 100 Hz, 400 Hz, and 1 kHz offsets from the carrier. Scale correction, log amplitude error, and detector response characteristics are taken into account using a worksheet table. 10 kHz and 100 kHz single sideband phase noise is measured using the RF signal itself and the spectrum analyzer under test. The measured phase noise values are then used to calculate the equivalent EVM.

Equipment

Synthesized signal generator . . . . HP 8662A or 8663A
Spectrum analyzer . . . . .HP 8566B
Step attenuator (1 dB) . . . . HP 8494A
Step attenuator (10 dB) . . . . HP 8495A
Calibration data for the above attenuators

Cables
BNC, 122 cm (48 in) (five required) . . . . HP 10503A

Adapters
Type N (m) to BNC (f) (three required) . . . . HP part number 1250-0780
Type N (m) to type N (m) (one required) . . . . HP part number 1250-0778

To determine the error vector magnitude

1. Connect the equipment as shown in Figure 8-6. Set the two step attenuators to 0 dB attenuation. Turn on all equipment and allow it to warm up for 30 minutes before proceeding.

Note Later after the HP 8590 Series analyzer frequency has been set, you will be instructed to wait another 30 minutes before proceeding. These warmup times are *important* to stabilize the YIG oscillator in the HP 8590 Series analyzer to view close-in (100 Hz) phase noise at 1895 MHz.

2. Perform a frequency and amplitude self-calibration on the HP 8590 Series spectrum analyzer. This improves the accuracy of the spectrum analyzer and is intended to self test the digital demodulator PC boards in the spectrum analyzer. If necessary, refer to "Getting Started" in the spectrum analyzer user's guide for a complete explanation of this procedure.

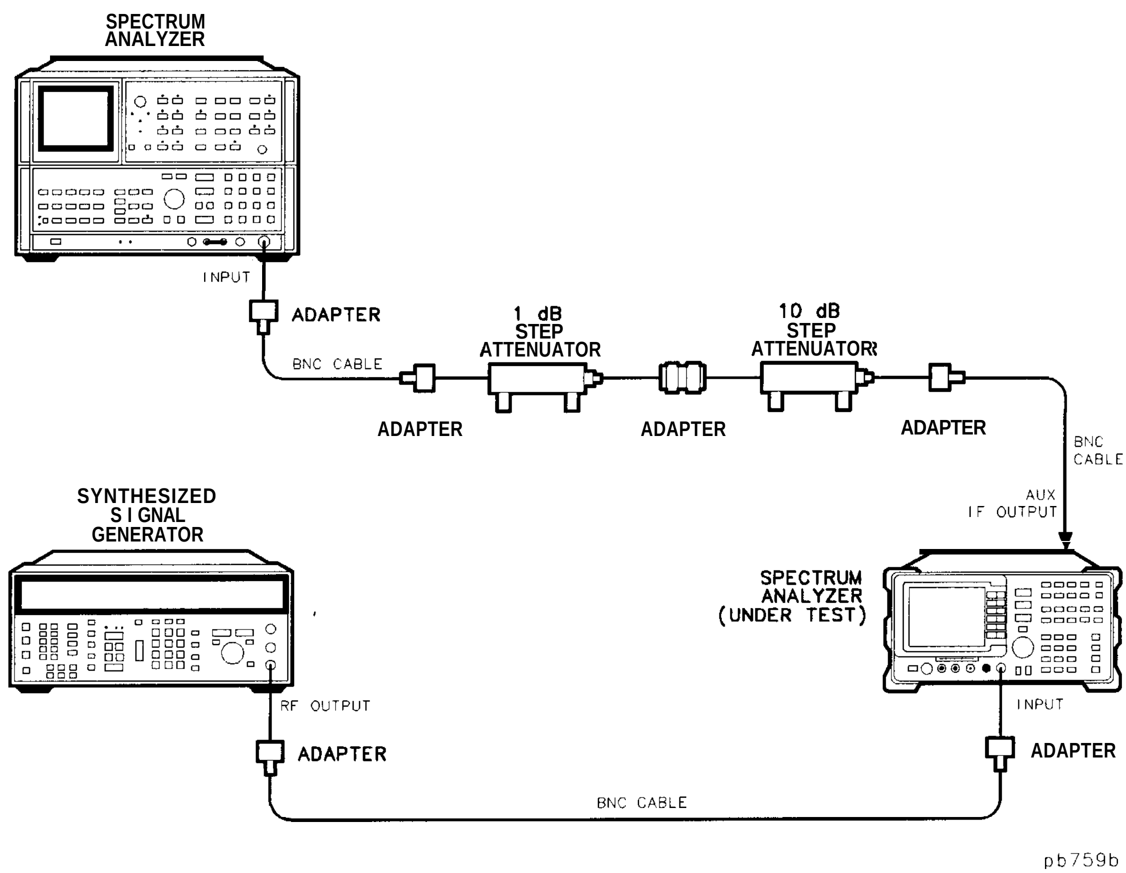


Figure 8-6. Error Vector Magnitude (EVM) Test Setup

3. Press the following synthesized signal generator keys:

(FREQUENCY) (1895.30) (MHz)
(AMPLITUDE) (0) (+dBm)
(MOD OFF) (press the blue key and then (FCTN OFF))

4. Press the following HP 8590 Series spectrum analyzer keys:

   (PRESET)
   SPECTRUM ANALYZER
   (CAL) More 1 of 4 CORRECT OFF
   (FREQUENCY) (1895.30) (MHz)
   (BW) (1) (MHz)
   (SPAN) ZERO SPAM

5. Wait 30 minutes for the equipment to stabilize at 1895.30 MHz. This time is necessary to stabilize the YIG oscillator in the HP 8590 Series analyzer to view close-in (100 Hz) phase noise at 1895.30 MHz.

Measure the carrier (reference) amplitude

6. Press the following HP 8566B spectrum analyzer keys:
   a. Press (INSTR PRESET) (CENTER FREQUENCY) 121.4) (MHz).
   b. Press (FREQUENCY SPAN) (20) (MHz).
   c. Press MARKER ENTRY (PEAK SEARCH) (MKR → CF).
   d. Press (FREQUENCY SPAN) (1) (MHz_).
   e. Press MARKER ENTRY (PEAK SEARCH) (MKR → CF) (MKR → REF LVL).
   f. Record this one marker amplitude value on three different lines in Table 8-7 under column A. The far left-hand column in the table lists several offsets from the carrier. Find the lines in column A that correspond with 100 Hz, 400 Hz, and 1 kHz offsets and record the marker amplitude value on those three lines.

Measure average noise at 100 Hz offset

7. Press the following HP 8566B spectrum analyzer keys:
   a. Press MARKER MODE (SIGNAL TRACK) (FREQUENCY SPAN) (5) (kHz).
   b. Press MARKER MODE (SIGNAL TRACK) to disable the signal track function.
   c. Press (FREQUENCY SPAN) (0) (Hz) (RES BW) (10) (Hz).
   d. Press (SWEEP TIME) (20) (msec) (CENTER FREQUENCY) and then turn the knob either direction to adjust the line for a "peak" near the top graticule.
   e. Press (VIDEO BW) (1) (Hz) (CF STEP SIZE) (100) (Hz).
   f. Press (SWEEP TIME) (10) (sec) (CENTER FREQUENCY) (⇧). If the noise trace is below the eighth graticule line from the top, press (REFERENCE LEVEL), then press (⇩) repeatedly until the noise trace is above the eighth graticule line.
   g. Press (SHIFT) (VIDEO BW) to turn on video averaging.
   h. Press (10) (Hz) SWEEP (SINGLE) to set the spectrum analyzer to take 10 video averages Allow the spectrum analyzer to complete 10 sweep averages (approximately two minutes). Monitor the number of averages on the left-hand side of the graticule.
   i. Press (SHIFT) (SWEEP TIME) to turn off video averaging.
   j. Press MARKER ENTRY (PEAK SEARCH) and in Table 8-7, record the marker amplitude value in column B on the line that corresponds to 100 Hz offset in the first column.

Measure average noise at 400 Hz offset

8. Press the following HP 8566B spectrum analyzer keys:
   a. Press (RES BW AUTO) (VIDEO BW AUTO) (SWEEP TIME AUTO) (CF STEP SIZE) (AUTO) SWEEP (CONT).
   b. Press (FREQUENCY SPAN) (5) (kHz). If the signal peak is not visible, press (REFERENCE LEVEL), then press (⇧) repeatedly until the signal peak is on the top graticule line.
   c. Press MARKER ENTRY (PEAK SEARCH) (MKR → CF).
   d. Press (FREQUENCY SPAN) (0) (Hz) (RES BW) (10) (Hz).
   e. Press (SWEEP TIME) (20) (msec) (CENTER FREQUENCY) and then turn the knob both directions to adjust the line for a "peak" near the top graticule.
   f. Press (VIDEO BW) (1) (Hz) (CF STEP SIZE) (400) (Hz).
   g. Press (SWEEP TIME) (10) (sec) (CENTER FREQUENCY) (⇧). If the noise trace is below the eighth graticule line from the top, press (REFERENCE LEVEL), then press (⇩) repeatedly until the noise trace is above the eighth graticule line.
   h. Press (SHIFT) (VIDEO BW) to turn on video averaging.
   i. Press (10) (Hz) SWEEP (SINGLE) to set the spectrum analyzer to take 10 video averages.

      Allow the spectrum analyzer to complete 10 sweep averages (approximately two minutes). Monitor the number of averages on the left-hand side of the graticule.
   j. Press (SHIFT) (SWEEP TIME) to turn off video averaging.
   k. Press MARKER ENTRY (PEAK SEARCH) and in Table 8-7, record the marker amplitude value in column B on the line that corresponds to 400 Hz offset in the first column.

Measure average noise at 1 kHz offset

9. Press the following HP 8566B spectrum analyzer keys:
   a. Press (RES BW AUTO) (VIDEO BW AUTO) (SWEEP TIME AUTO) (CF STEP SIZE) (AUTO) SWEEP (CONT).
   b. Press (FREQUENCY SPAN) (5) (kHz). If the signal peak is not visible, press (REFERENCE LEVEL), then press (⇧) repeatedly until the signal peak is on the top graticule line.
   c. Press MARKER ENTRY (PEAK SEARCH) (MKR → CF).
   d. Press (FREQUENCY SPAN) (0) (Hz) (RES BW) (10) [Hz).
   e. Press (SWEEP TIME) (20) (msec) (CENTER FREQUENCY) and then turn the knob both directions to adjust the line for a "peak" near the top graticule.
   f. Press (VIDEO (1) (Hz) (CF STEP SIZE) (1) (kHz).
   g. Press (SWEEP TIME) (10) (sec) (CENTER FREQUENCY) (⇧) If the noise trace is below the eighth graticule line from the top, press (REFERENCE LEVEL), and press (⇩) repeatedly until the noise trace is above the eighth graticule line.
   h. Press (SHIFT) (VIDEO BW) to turn on video averaging.

5. Verifying Error Vector Magnitude (EVM) (Option 151 Only)

i. Press (10) (Hz) SWEEP (SINGLE) to set the spectrum analyzer to take 10 video averages.

Allow the spectrum analyzer to complete 10 sweep averages (approximately two minutes). Monitor the number of averages on the left-hand side of the graticule.

j. Press (SHIFT) (SWEEP TIME) to turn off video averaging.

k. Press MARKER ENTRY (PEAK SEARCH) and in Table 8-7, record the marker amplitude value in column B on the line that corresponds to 1 kHz offset in the first column.

Table 8-7. Phase Noise/EVM Worktable 1

Offset	(A) Signal Level (dB)	(B) Worst-case Average Noise Level (dB)	(C) Signal Level dBc at Noise Level (B-A)	(D) Attenuator Correction Value (dB)	(E) External Attenuators Setting (dB)
100 Hz					
400 Hz					
1 kHz					
10 kHz					
100 kHz					

Table 8-8. Phase Noise/EVM Worktable 2

Offset	(F) Marker A Reading (dB)	(G) Log Scale Correction (dB) (D + E)-F	(H) Bandwidth Correction dB (10 $\log_{10}$ BW)	(I) Detector and Log Amp Correction	(J) Corrected Phase Noise (dBc/Hz) (C + G-H + I)
100 Hz			10	2.5	
400 Hz			10	2.5	
1 kHz			10	2.5	
10 kHz			24.77	2.5	
100 kHz			24.77	2.5	

Measure the carrier (reference) amplitude

10. Press the following HP 8590 Series spectrum analyzer keys:

a. Press (FREQUENCY) START FREQ (1895.30) (MHz) STOP FREQ (1895.410) (MHz).

b. Press (BW) (300) (Hz) VID BW (100) (Hz).

c. Press MARKER (PEAK SEARCH) and note the marker amplitude shown in the upper right-hand corner of the display. Enter that value in column A of Table 8-7 for 10 kHz and 100 kHz offsets.

Measure average noise at 10 kHz and 100 kHz offsets

11. Press the following HP 8590 Series spectrum analyzer keys:
    a. Press (AMPLITUDE) and then press STEP (⇩) repeatedly until the noise trace is above the 7th. graticule line.
    b. Press (SGL SWP) (BW) VID AVG ON (10) (ENTER) to set the spectrum analyzer to take 10 video averages.

       Allow the spectrum analyzer to complete 10 sweep averages (approximately two minutes). Monitor the number of averages on the left-hand side of the graticule.
    c. Press (PEAK SEARCH) (MKR) MKR Δ (10) (kHz) MARKER NORMAL, and note the marker amplitude shown in the upper right-hand corner of the display. Enter that value in column B of Table 8-7 for 10 kHz offset.
    d. Press MKR Δ (90) (kHz) MARKER NORMAL , and note the marker amplitude shown in the upper right-hand corner of the display. Enter that value in column B of Table 8-7 for 100 kHz offset.
    e. Press (FREQUENCY) CENTER FREQ (1895.30) (MHz).
    f. Press (BW) (1) (MHz) (SPAN) ZERO SPAN.

Calculate attenuator settings

12. Calculate the external attenuators setting in Table 8-7:
    a. Refer to Table 8-7.
    b. Subtract the value in column A from the value in column B for each frequency offset and enter each result in column C.
    c. Round off (up or down) the value in column C for each frequency offset to the nearest dB and enter each result in column E. The values in column E will be used later in this procedure.

Set up the analyzer to make log amplitude correction measurements

13. Press the following HP 8566B spectrum analyzer keys:
    a. Press (INSTR PRESET) (CENTER FREQUENCY) (21.4) (MHz).
    b. Press (ATTEN) (0) (dB).
    c. Press (FREQUENCY SPAN) (10 MHz).
    d. Press (PEAK SEARCH) MARKER MODE (SIGNAL TRACK) (FREQUENCY SPAN) (1) (kHz) and allow the spectrum analyzer to complete the tracking function.
    e. When the displayed signal is stable, press MARKER MODE (SIGNAL TRACK) to disable the signal track function.
    f. Press (RES BW) (1) (kHz).
    g. Press MARKER ENTRY (PEAK SEARCH) (MKR → CF) (MKR → REF LVL).
    h. Press (FREQUENCY SPAN) (0) (Hz) (VIDEO BW) (1) (Hz).

Measure log amplitude correction values

14. Press the following HP 8566B spectrum analyzer keys:

5. **Verifying Error Vector Magnitude (EVM) (Option 151 Only)**

a. Press MARKER MODE (Δ) and set the two external attenuators to the value in column E for 100 Hz offset in Table 8-7.

b. Press SWEEP (SINGLE) and wait for one complete sweep. In Table 8-8, record the marker value in column F on the line that corresponds to 100 Hz offset in the first column.

c. Set the two external attenuators to the value in column E for 400 Hz offset in Table 8-7.

d. Press SWEEP (SINGLE) and wait for one complete sweep. In Table 8-8, record the marker value in column F on the line that corresponds to 400 Hz offset in the first column.

e. Set the two external attenuators to the value in column E for 1 kHz offset in Table 8-7.

f. Press SWEEP (SINGLE) and wait for one complete sweep. In Table 8-8, record the marker value in column F on the line that corresponds to 1 kHz offset in the first column.

g. Set the two external attenuators to the value in column E for 10 kHz offset in Table 8-7.

h. Press SWEEP (SINGLE) and wait for one complete sweep. In Table 8-8, record the marker value in column F on the line that corresponds to 10 kHz offset in the first column.

i. Set the two external attenuators to the value in column E for 100 kHz offset in Table 8-7.

j. Press SWEEP (SINGLE) and wait for one complete sweep. In Table 8-8, record the marker value in column F on the line that corresponds to 100 kHz offset in the first column.

Calculate corrected phase noise

15. Calculate corrected phase noise value using Table 8-8

a. Find the performance data provided with the two external attenuators. Determine the attenuator correction values for each frequency offset setting for column E in Table 8-7. Sum the two correction values and record the result in column D of Table 8-7.

b. For each frequency offset, sum the values in columns D and E in Table 8-7, subtract the value in column F of Table 8-8, and record the value in column G of Table 8-8.

c. For each offset, sum the value under column C in Table 8-7 with the values under columns G and I in Table 8-8. Subtract from this sum the value under column H, and record the result in column J of Table 8-8.

Calculate %EVM

16. Calculate %EVM using corrected phase noise values in Table 8-8

The EVM contribution of the HP 8590 E-Series spectrum analyzers is directly related to the spectrum analyzer phase noise. The phase noise of the spectrum analyzer is integrated over five offset regions to derive the RMS phase noise error contribution. The root sum square of these five regions is applied to the following equation:

$$\text{Percent EVM} = 100\sqrt{(5.655 \times 10^{-5}) + 4\left[1.00752 \times sin^2\left(\frac{\text{Phase error}}{2}\right)\right]}$$

a. First, solve for P_1 through P_5 using the values for phase noise listed in column J of Table 8-8. Column J phase noise values are represented with the variable Jin the equations.

Note J_1 (phase noise at 100 Hz) is not used in the following equations.

Use the value of **J** in Table 8-8 for 400 Hz offset:

$$P_1 = 8.531 \times 10^3 \times 10^{\frac{(J_2-20)}{10}}$$

Use the value of **J** in Table 8-8 for 1 kHz offset:

$$P_2 = 2400 \times 10^{\frac{J_3}{10}}$$

Use the value of **J** in Table 8-8 for 10 kHz offset:

$$P_3 = 5.181 \times 10^4 \times 10^{\frac{J_4}{10}}$$

Use the value of **J** in Table 8-8 for 100 kHz offset:

$$P_4 = 8.95 \times 10^5 \times 10^{\frac{J_5}{10}}$$

Use the value of **J** in Table 8-8 for 100 kHz offset:

$$P_5 = 1.609 \times 10^5 \times 10^{\frac{J_5}{10}}$$

b. Next, solve for P_t Peak Radians:

$$P_t = 2\sqrt{(P_1 + P_2 + P3 + P4 + P_5)}$$

c. Now solve for phase error (RMS Degrees):

$$\text{Phase Error} = 57.296\left(\frac{P_t}{\sqrt{2}}\right)$$

d. Finally, solve for percent EVM:

$$\text{Percent EVM} = 100\sqrt{(5.655 \times 10^{-5}) + 4\left[1.00752 \times sin^2\left(\frac{\text{Phase error}}{2}\right)\right]}$$

e. Record the percent EVM in the "Performance Verification Test Record" at the end of this chapter.

Performance Verification Test Record

The Performance Verification Test Record lists test specifications and acceptable limits. We recommend that you make a copy of this table, record the complete test results on the copy of the performance verification test record, and keep the copy for your calibration test records. You may find that keeping a record of the calibration test records helpful for tracking gradual changes in test results over long periods of time.

Table 8-9. Performance Verification Test Record

Hewlett-Packard Company

Address: ______________________ Report No. ______________________

____

______________________ Date ______________________

______________________ (e.g. 10 SEP 1989)

Model HP 8590 Series spectrum analyzer with HP 85726B

Serial No. ______________________

Options ______________________

Firmware revision ______________________

Customer ______________________ Tested by ______________________

Ambient temperature ____________ °C Relative humidity ____________ %

Power mains line frequency ____________ Hz (nominal)

Test Equipment Used:

Description	**Model No.**	**Trace No.**	**Cal Due Date**
Counter			
Oscilloscope			
Synthesizer/function generator			
Synthesizer/level generator			
Synthesized sweeper			
Measurement receiver			
Power splitter			
Power sensor			

Table 8-9. Performance Verification Test Record (Page 2 of 2)

Hewlett-Packard Company Model HP 8590 Series spectrum analyzer with HP 85726B	Report No. ______
Serial No. ______	Date ______

Test No.	Test Description	Results Min	Measured	Max	Measurement Uncertainty
1.	**Absolute amplitude accuracy**				
	10 dB attenuation				
	Amp accuracy at 1895 MHz	−9.7 dBm	______	−8.3 dBm	+0.24/−0.25 dB
	Amp accuracy at 1918 MHz	−9.7 dBm	______	−8.3 dBm	+0.24/−0.25 dB
	20 dB attenuation				
	Amp accuracy at 1895 MHz	+0.5 dBm	______	+1.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 1918 MHz	+0.5 dBm	______	+1.5 dBm	+0.24/−0.25 dB
	30 dB attenuation				
	Amp accuracy at 1895 MHz	+4.5 dBm	______	+5.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 1918 MHz	+4.5 dBm	______	+5.5 dBm	+0.24/−0.25 dB
	40 dB attenuation				
	Amp accuracy at 1895 MHz	+4.0 dBm	______	+6.0 dBm	+0.24/−0.25 dB
	Amp accuracy at 1918 MHz	+4.0 dBm	______	+6.0 dBm	+0.24/−0.25 dB
2.	**Gate delay accuracy**				
	Gate length accuracy				
	MIN gate delay	0.0 μs	______	2.0 μs	±0.011 μs
	MAX gate delay	0.0 μs	______	2.0 μs	±0.011 μs
	65 ms gate length	64.99 ms	______	65.01 ms	±0.434 μs
3.	**Gate card insertion loss**	−0.3 dB	______	+0.3 dB	±0.092 dB
4.	**IF frequency accuracy**				
	HP 8593/4/5/6E	21.399985 MHz	______	21.400015 MHz	NA
5.	**Error vector magnitude (EVM)**				
	HP 8593/4/5/6E		______	1.5%	±0.5%

Glossary

π/4 DQPSK
a/4 shifted, differential quadrature phase shift keying. This is a type of digital modulation.

absolute amplitude accuracy
The degree of correctness or uncertainty (expressed either in volts or dB power). It includes relative uncertainties plus calibrator uncertainty. For improved accuracy, some spectrum analyzers specify frequency response relative to the calibrator as well as relative to the midpoint between peak-to-peak extremes. Refer also to **relative amplitude accuracy.**

active function readout
The area of a display screen where the active function and its state are displayed. The active function is the one that was completed by the last key selection or remote-programming command.

active marker
The marker on a trace that can be repositioned either by front-panel controls or by programming commands.

active trace
The trace (commonly A, B, or C) that is being swept (updated) with incoming signal information.

amplitude accuracy
The general uncertainty of a spectrum analyzer amplitude measurement, whether relative or absolute.

attenuation
A general term used to denote a decrease of signal magnitude in transmission from one point to another. Attenuation may be expressed as a scalar ratio of the input to the output magnitude in decibels.

bandwidth selectivity
This is a measure of the ability of the spectrum analyzer to resolve signals unequal in amplitude. It is the ratio of the 60 dB bandwidth to the 3 dB bandwidth for a given resolution filter (IF). Bandwidth selectivity tells us how steep the filter skirts are. Bandwidth selectivity is sometimes called shape factor.

battery-backed RAM
Random access memory (RAM) data retained by a battery. RAM memory cards can contain data that is maintained with a battery. Refer also to **nonvolatile memory.**

bit sequence
The sequence of ones and zeros detected when demodulating the signal for a given digital modulation format. For a PHS signal this refers to the 240 bits detected from the signal measured over one timeslot.

burst carrier
A carrier that is periodically turned off and on. A burst carrier may or may not be modulated.

carrier
A signal used to convey information through modulation of signal characteristics. The amplitude of a carrier signal is usually higher than other types of signals.

carrier frequency error
This is the difference between the expected carrier frequency and the measured carrier frequency. The units are Hz. Carrier frequency error is calculated from a digitally demodulated PHS signal, using the slope of the signal phase at the decision points after subtraction of the IF.

channel number
A number assigned to a carrier frequency.

clear-write mode
This is a spectrum analyzer function that clears the specified trace (A, B, or C) from the display, then sweeps (updates) the trace each time trigger conditions are met. When trigger conditions are met, the new input-signal data is displayed, then cleared, and the process begins again.

codec
Refers to a coder and decoder. A coder and decoder are used to compress and expand data for more efficient transmission.

command
A set of instructions that are translated into instrument actions. The actions are usually made up of individual steps that together can execute an operation. Generally, for spectrum analyzers it is a sequence of code that controls some operation of a spectrum analyzer. These codes can be keyed in via a controller, or computer. Refer also to **function.**

continuous carrier
A carrier that is always on. A continuous carrier may or may not be modulated.

continuous sweep mode
The spectrum analyzer condition where traces are automatically updated each time trigger conditions are met.

decision points
These are discrete points on the demodulated PHS signal where magnitude and phase information are measured to obtain the bit sequence and signal modulation characteristics. A PHS timeslot consists of 121 decision points, which create 120 symbols and 240 bits.

default
The factory-defined conditions, options, or parameters of an instrument. The default state may be changed by choosing key selections or writing programming commands to use other conditions.

digital demodulation
This describes a process of extracting the information from a modulated carrier signal. Digital signal processing algorithms are used on the signal after it has been converted from an analog to a digital form (digitized).

display detector mode
The manner in which analog, video information is processed prior to being digitized and stored in memory.

DLP
The abbreviation for downloadable program. A single programming command or a sequence of programming commands used to perform specific operations. DLPs can be made up of several functions, variables, and traces defined by the program creator. The DLP can be downloaded from one electronic storage medium into another and executed without a controller.

drift
The slow (relative to sweep time) change of signal position on the display as a result of a change in local oscillator frequency versus sweep voltage. While spectrum analyzer drift may require periodic retuning, it does not impair frequency resolution.

dynamic range
The power ratio (dB) between the smallest and largest signals simultaneously present at the input of a spectrum analyzer that can be measured with some degree of accuracy. Dynamic range generally refers to measurement of distortion or intermodulation products.

envelope detector
A detector circuit whose output follows the envelope, but not the instantaneous variation of its input signal. This detector is sometimes called a peak detector. In superheterodyne spectrum analyzers, the input to the envelope detector comes from the final IF, and the output is a video signal. When the spectrum analyzer is in zero span, the envelope detector demodulates the input signal, and you can observe the modulating signal as a function of time on the display.

error message
A message on the spectrum analyzer display that indicates an error condition. An error condition can be caused by missing or failed hardware, improper user operation, or other conditions that require additional attention. Generally, the requested action or operation cannot be completed until the condition is resolved.

EVM
This acronym stands for error vector magnitude, and is a measure of the modulation accuracy for a digitally modulated carrier. Each decision point in a demodulated PHS signal has an ideal magnitude and phase, and a measured magnitude and phase. The error vector is the difference between the vectors formed by the ideal and measured magnitude and phase at the decision points. EVM is the ratio of the magnitude of the error vector to the magnitude of the ideal vector, expressed in percent.

For PHS signals, EVM is calculated after I-Q origin offset and carrier frequency error have been mathematically eliminated from the signal. The RMS EVM is calculated as the root mean square of the individual decision point EVMs within a transmission burst (timeslot period). Refer to chapter 7, “Specifications,” for a further discussion of EVM.

external trigger signal
For the PHS measurements personality, the external trigger signal is a TTL signal that is input to the spectrum analyzer GATE INPUT connector. The external trigger signal initiates a sweep of the spectrum analyzer, thus the external trigger signal makes the measurements synchronous with the frame rate of the burst RF input signal.

firmware

An assembly made up of hardware and instruction code. The hardware and instruction code is integrated and forms a functional set that cannot be altered during normal operation. The instruction code, permanently installed in the circuitry of the instrument, is classified as ROM (read-only memory). The firmware determines the operating characteristics of the instrument or equipment. Each firmware version is identified by a revision code number, or date code.

frame

For a PHS signal, a frame consists of eight timeslots. Each frame is equivalent to 960 symbol periods (1920 bits) and is 5 ms in length. See also **timeslot.**

frame trigger

This is a trigger signal that provides one pulse per frame; it can be used to synchronize the measurement interval with a selected timeslot. Option 151 makes a frame trigger available at the rear panel of the HP 8590 E-Series analyzers called FRAME TRIG OUTPUT. For PHS signals, this rear panel frame trigger is a TTL level positive pulse of 1.4 microsecond duration with a period of 5 milliseconds.

frame trigger acquisition

The act of positioning the frame trigger to a specific point in the frame just prior to the timeslot to be measured. Once the frame trigger has been successfully acquired, the timeslot of interest can be digitized with a time record not much longer than the timeslot.

frequency accuracy

The uncertainty with which the frequency of a signal or spectral component is indicated, either in an absolute sense or relative to another signal or spectral component. Absolute and relative frequency accuracies are specified independently.

frequency range

The range of frequencies over which the spectrum analyzer performance is specified. The maximum frequency range of many microwave spectrum analyzers can be extended with the application of external mixers.

frequency resolution

The ability of a spectrum analyzer to separate closely spaced spectral components and display them individually. Resolution of equal amplitude components is determined by resolution bandwidth. Resolution of unequal amplitude signals is determined by resolution bandwidth and bandwidth selectivity.

frequency response

The peak-to-peak variation in the displayed signal amplitude over a specified center frequency range. Frequency response is typically specified in terms of ±dB relative to the value midway between the extremes. It also may be specified relative to the calibrator signal.

frequency span

The magnitude of the displayed frequency component. Span is represented by the horizontal axis of the display. Generally, frequency span is given as the total span across the full display. Some spectrum analyzers represent frequency span (scan width) as a per-division value.

frequency stability

The ability of a frequency component to remain unchanged in frequency or amplitude over short- and long-term periods of time. Stability refers to the local oscillator's ability to remain fixed at a particular frequency over time. The sweep ramp that tunes the local oscillator influences where a signal appears on the display. Any long-term variation in local oscillator frequency (drift) with respect to the sweep ramp causes a signal to shift its horizontal position on the display slowly. Shorter-term local oscillator instability can appear as random FM or phase noise on an otherwise stable signal.

front-panel key

Keys that are located on the front panel of an instrument. The key labels identify the function the key activities. Numeric keys and step keys are two examples of front-panel keys.

function

The action or purpose that a specific item is intended to perform or serve. The spectrum analyzer contains functions that can be executed via front-panel key selections, or through programming commands. The characteristics of these functions are determined by the firmware in the instrument. In some cases, a DLP (downloadable program) execution of a function allows you to execute the function from front-panel key selections.

harmonic distortion

Undesired frequency components added to signals because of nonlinear behavior of the device (for example, a mixer or an amplifier) through which signals pass. These unwanted components are harmonically related to the original signal.

HP-IB

The abbreviation for Hewlett-Packard Interface Bus. It is a parallel interface that allows you to "daisy-chain" more than one device to a port on a computer or instrument. Interface protocol is defined in IEEE 488.2. It is equivalent to the industry standard GPIB.

input attenuator

An attenuator between the input connector and the first mixer of a spectrum analyzer (also called an RF attenuator). The input attenuator is used to adjust the signal level incident to the first mixer, and to prevent gain compression due to high-level or broadband signals. It is also used to set the dynamic range by controlling the degree of internally-generated distortion. For some spectrum analyzers, changing the input attenuator settings changes the vertical position of the signal on the display, which then changes the reference level accordingly. In Hewlett-Packard microprocessor-controlled spectrum analyzers, the IF gain is changed to compensate for changes in input attenuator settings. Because of this, the signals remain stationary on the display, and the reference level is not changed.

intermodulation spurious

A measure of the capability of the transmitter to inhibit the generation of intermodulation distortion products. Intermodulation spurious is sometimes called intermodulation attenuation.

intermodulation distortion

Undesired frequency components resulting from the interaction of two or more spectral components passing through a device having nonlinear behavior, such as a mixer or an amplifier. The undesired components are related to the fundamental components by sums and differences of the fundamentals and various harmonics. The algorithm is:

$$f_1 \pm f_2, 2 \times f_1 \pm f_2, 2 \times f_2 \pm f_1, 3 \times f_1 \pm 2 \times f_2, \textit{ and so on}$$

I-Q constellation pattern

The pattern formed when the magnitude and phase of a signal's decision points are plotted in the I-Q (in-phase quadrature) domain. For $\pi/4$ DQPSK signals the ideal pattern has eight evenly spaced points that are $\pi/4$ radians apart with a magnitude of one.

I-Q domain

The I-Q (in-phase quadrature) domain is a way of expressing a signal in terms of an in-phase component (0 degree phase shift) and a quadrature component (90 degree phase shift). The magnitude of the signal is given by:

$$\sqrt{I^2 + Q^2}$$

The phase of the signal is given by:

$$arctan(Q/I)$$

I-Q origin offset

The ratio of the offset of the measured origin from the ideal origin of a signal in the I-Q (in-phase quadrature) domain to the ideal magnitude at the decision points. This ratio is expressed in units of dB.

I-Q trajectory pattern

The pattern formed when the magnitude and phase of a signal are plotted in the I-Q (in-phase quadrature) domain. With options 151 and 160, the I-Q trajectory pattern of a PHS signal can be plotted with a resolution of five points per symbol. The measured points are plotted sequentially, connected to one another.

limit line

A test limit made up of a series of line segments, positioned according to frequency or time, and amplitude, within the measurement range of the spectrum analyzer. Two defined limit lines may be displayed simultaneously. One sets an upper test limit, the other sets a lower test limit. Trace data can be compared with the limit lines as the spectrum analyzer sweeps. If the trace data exceeds either the upper or lower limits, the spectrum analyzer displays a message or sounds a warning, indicating that the trace failed the test limits.

limit-line file

The user-memory file that contains the limit-line table entries. Limit lines are composed of frequency and amplitude components that make up a trace array and this data is stored in the file. The limit-line file feature is available on spectrum analyzers that are capable of limit-line operation. Refer also to **limit line.**

limit-line table

The line segments of a limit line are stored in the limit-line table. The table can be recalled to edit the line segments, then restored in the limit-line file. Refer also to **limit line.**

LO

The abbreviation for local oscillator. The local oscillator output in a superheterodyne system is mixed with the received signal to produce a sum or difference equal to the intermediate frequency (IF) of the receiver.

LO feedthrough

The response that occurs on a spectrum analyzer CRT when the first local oscillator frequency is equal to the first IF. The LO feedthrough is a 0 Hz marker with no error, so it can be used to improve the frequency accuracy of spectrum analyzers with nonsynthesized LO systems.

log display

The display mode in which vertical deflection is a logarithmic function of the input-signal voltage. Log display is also called logarithmic display. The display calibration is set by selecting the value of the top graticule line (reference level), and scale factor in volts per division. On Hewlett-Packard spectrum analyzers, the bottom graticule line represents zero volts for scale factors of 10 dB/division or more. The bottom division, therefore, is not calibrated for those spectrum analyzers. Spectrum analyzers with microprocessors allow reference level and marker values to be indicated in dBm, dBmV, dBμV, volts, and occasionally in watts. Nonmicroprocessor-based spectrum analyzers usually offer only one kind of unit, typically dBm.

magnitude error

Magnitude error refers to the magnitude component of an EVM measurement. Each decision point in a PHS signal has an ideal magnitude and a measured magnitude. Magnitude error is the ratio of the difference between the ideal and measured magnitude to the ideal magnitude, expressed in percent.

For PHS signals, magnitude error is calculated after I-Q origin offset, carrier frequency error, and amplitude droop have been mathematically eliminated from the signal. The RMS magnitude error is calculated as the root mean square of the individual decision point magnitude errors.

marker

A visual indicator we can place anywhere along the displayed trace. A marker readout indicates the absolute value of the trace frequency and amplitude at the marked point. The amplitude value is displayed with the currently selected units.

maximum input level

The maximum signal power that may be safely applied to the input of a spectrum analyzer. The maximum input level is typically 1 W (-30 dBm) for Hewlett-Packard spectrum analyzers.

memory

A storage medium, device, or recording medium into which data can be stored and held until some later time, and from which the entire original data may be retrieved.

memory card

A small, credit-card-shaped memory device that can store data or programs. The programs are sometimes called personalities and give additional capabilities to your instrument. Typically, there is only one personality per memory card. Refer also to **personality.**

menu

The spectrum analyzer functions that appear on the display and are selected by pressing front-panel keys. These selections may evoke a series of other related functions that establish groups called menus.

MKK

Musen setsubi Kensa Mentei-kyoukai (Radio equipment Inspection and Certification Institute.)

modulation accuracy

Modulation accuracy is a measure of the difference between the modulation characteristic of a real transmitter and that of an ideal transmitter. For PHS signals, modulation accuracy is expressed in terms of EVM, magnitude error, phase error, carrier frequency error and I-Q origin offset.

nonvolatile memory
Memory data that is retained in the absence of an ac power source. This memory is typically retained with a battery. Refer also to **battery-backed RAM.**

other cell station
A low-power PHS transceiver unit for residential and office use.

parameter units
Standard units of measure, which include the following:

Measured Parameter	Unit Name	Unit Abbreviation
frequency	hertz	Hz
power level	decibel relative to milliwatts	dBm
power ratio	decibel	dB
voltage	volt	V
time	second	s
electrical current	ampere	A
impedance (resistance)	ohm	Ω

peak detection mode
The spectrum analyzer state where circuits calculate the peak value of a displayed signal. This value is determined by evaluating a series of measured values from an active trace.

peak detector
A detector that follows the peak or envelope of the signal applied to it. The standard detector in a spectrum analyzer is typically a peak detector. MIL-STD EM1 measurements usually call for peak detection.

personal handy phone system (PHS)
A digital cordless telephone communication system that employs a combination of frequency division multiple access (FDMA), time division multiple access (TDMA), and time division duplex (TDD).

personal stations
A hand-held PHS transceiver unit.

personality
Applications available on a memory card or other electronic media that extends the capability of an instrument for specific uses. Examples include the HP 85726B PHS measurements personality, the digital radio personality, and the cable TV personality.

phase error
Phase error refers to the phase component an EVM measurement. Each decision point in a PHS signal has an ideal phase and a measured phase. Phase error is the difference between the ideal and measured phase expressed in degrees.

For PHS signals, phase error is calculated after I-Q origin offset and carrier frequency error have been mathematically eliminated from the signal. The RMS phase error is calculated as the root mean square of the individual decision point phase errors.

point 0
For the PHS frame structure, point 0 refers to the start of symbol 1 of a timeslot.

positive peak
The maximum, instantaneous value of an incoming signal. On digital displays, each displayed point of the signal indicates the maximum value of the signal for that part of the frequency span or time interval represented by the point.

public cell station
A high-power public accessible PHS transceiver unit.

query
Any spectrum analyzer programming command having the distinct function of returning a response. These commands may end with a question mark (?). Queried commands return information to the computer.

random-access memory
RAM (random-access memory) or read-write memory, is a storage area allowing access to any of its storage locations. Data can be written to or retrieved from RAM, but data storage is only temporary. When the power is removed, the information disappears. User-generated information appearing on a display is RAM data.

read-only memory
ROM (read-only memory) that is encoded into the spectrum analyzer firmware. The data can be read only; it cannot be written to or altered by the user.

reference level
The calibrated vertical position on the display used as a reference for amplitude measurement in which the amplitude of one signal is compared with the amplitude of another regardless of the absolute amplitude of either.

relative amplitude accuracy
The uncertainty of an amplitude measurement in which the amplitude of one signal is compared with the amplitude of another, regardless of the absolute amplitude of either. Distortion measurements are relative measurements. Contributors to uncertainty include frequency response and display fidelity and changes of input attenuation, IF gain, scale factor, and resolution bandwidth.

resolution bandwidth
The ability of a spectrum analyzer to display adjacent responses discretely (hertz, hertz decibel down). This term is used to identify the width of the resolution bandwidth filter of a spectrum analyzer at some level below the minimum insertion-loss point (maximum deflection point on the display). Typically, it is the 3 dB resolution bandwidth that is specified, but in some cases the 6 dB resolution bandwidth is specified.

scale factor
The per-division calibration of the vertical axis of the display.

sensitivity
The level of the smallest sinusoid that can be observed on a spectrum analyzer, usually under optimized conditions of minimum resolution bandwidth, 0 dB input attenuation, and minimum video bandwidth. Hewlett-Packard defines sensitivity as the displayed average noise level. A sinusoid at that level appears to be about 2 dB above the noise.

serial prefix
Serial numbers that identify an instrument begin with a five-character prefix. The prefix in this case represents the version of firmware that particular instrument was shipped with.

single-sweep mode
The spectrum analyzer sweeps once when trigger conditions are met. Each sweep is initiated by pressing an appropriate front-panel key, or by sending a programming command.

slot
A specific time period within the digital frame. For a PHS system, there are eight timeslots per frame. Each timeslot is 120 symbol periods (240 bits) long. Refer also to **frame.**

softkey
Key labels displayed on a screen or monitor that are activated by mechanical keys surrounding the display, or located on a keyboard. Softkey selections usually evoke menus that are written into the program software. Front-panel key selections determine the menu (set of softkeys) appears on the display.

span
Span equals the stop frequency minus the start frequency. The span setting determines the horizontal-axis scale of the spectrum analyzer display.

span accuracy
The uncertainty of the indicated frequency separation of any two signals on the display.

spectral component
One of the sine waves comprising a spectrum.

spectrum
An array of sine waves differing in frequency and amplitude. They are properly related with respect to phase and, taken as a whole, form a particular time-domain signal.

spectrum analyzer
A device that effectively performs a Fourier transform and displays the individual spectral components (sine waves) that form a time-domain signal.

step
The increment of change that results when you press the front-panel step keys, (▲) and (▼), or by program commands.

stop/start frequency
Terms used in association with the stop and start points of the frequency measurement range. Together they determine the span of the measurement range.

syntax
The grammar rules that specify how commands must be structured for an operating system, programming language, or applications.

symbol
For the PHS modulation scheme, a symbol consists of 2 bits of data.

test limit
The acceptable results levels for any given measurement. The levels vary from country to country, and depend on the equipment being tested.

time-division duplexing (TDD)
Time-division duplexing (TDD) is the transferring of data by simultaneous transmission and reception from two sources over the same frequency. The signal transmission from each source occurs at a different time interval.

time-division multiple access (TDMA)
A process of sharing a cellular channel by sharing time between users. Each user is assigned a specific time position.

timeslot
A specific time period within the digital frame. For a PHS system, there are eight timeslots per frame. Each timeslot is 120 symbol periods (240 bits) long. Refer also to **frame.**

trace
A trace is made up of a series of data points containing frequency and amplitude information. The series of data points is often called an array. Traces A, B, and C are the typical names of traces that spectrum analyzer displays. The number of traces is specific to the instrument.

unique word
The unique word is a segment of the bit sequence used to identify a synchronization position in the transmission burst that contains it. For PHS signals there are two different unique words; one for uplink transmission timeslots, and one for downlink transmission timeslots. The unique words are 16-bits long each. For PHS traffic channels, the unique word consists of bits 12 through 27.

units
Dimensions on the measured quantities. Units usually refer to amplitude quantities because they can be changed. In spectrum analyzers with microprocessors, available units are dBm (dB relative to 1 mW (milliwatt) dissipated in the nominal input impedance of the spectrum analyzer), dBmV (dB relative to 1 mV (millivolt)), dBμV (dB relative to 1 μV), volts, and, in some spectrum analyzers, watts.

update
To make existing information current; to bring information up to date.

video
A term describing the output of a spectrum analyzer envelope detector. The frequency range extends from 0 Hz to a frequency that is typically well beyond the widest resolution bandwidth available in the spectrum analyzer. However, the ultimate bandwidth of the video chain is determined by the setting of the video filter.

video bandwidth
The cut-off frequency (3 dB point) of an adjustable low-pass filter in the video circuit. When the video bandwidth is equal to or less than the resolution bandwidth, the video circuit cannot fully respond to the more rapid fluctuations of the output of the envelope detector. The result is a smoothing of the trace, or a reduction in the peak-to-peak excursion, of broadband signals such as noise and pulsed RF when viewed in broadband mode. The degree of averaging or smoothing is a function of the ratio of the video bandwidth to the resolution bandwidth.

video filter
A post-detection, low-pass filter that determines the bandwidth of the video amplifier. It is used to average or smooth a trace. Refer also to **video bandwidth.**

zero span
The case in which a spectrum analyzer local oscillator remains fixed at a given frequency so that the spectrum analyzer becomes a fixed-tuned receiver. In this state, the bandwidth is equal to the resolution bandwidth. Signal amplitude variations are displayed as a function of time. To avoid loss of signal information, the resolution bandwidth must be as wide as the signal bandwidth. To avoid any smoothing, the video bandwidth must be set wider than the resolution bandwidth.

Index

B

C

P