85720C PDC Measurements Personality Including Digital Demodulation

User's Guide

Agilent Technologies

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Safety Notes

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

Caution The *caution* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could 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 **The *warning* sign 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* sign until the indicated conditions are fully understood and met.**

General Safety Considerations

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.

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.

What Is the PDC Communication System?

Personal Digital Cellular (PDC) is a wireless cellular telephone communication system.

The PDC communication system is defined in the Research and Development Center for Radio Systems document, RCR STD-27C, the Japan Digital Cellular Telecommunication System Standard.

The PDC system is a digital system that employs a combination of frequency division multiple access (FDMA) and time division multiple access (TDMA). A pair of frequencies (130 or 48 MHz apart) is used to provide full duplex operation with RF channel spacing of 25 kHz. The TDMA frame structure has 6 timeslots per frame (so each channel frequency can support up to 6 timeslots). Currently, two of the timeslots of the frame are used for each traffic channel because that is what is required for the full-rate speech codec. When half-rate speech codecs are incorporated into the system, each traffic channel will require just one timeslot per frame. A frame is 40 ms long and each timeslot is 6.667 ms long. Thus, the mobile stations have burst carriers that are turned on for two out of 6 timeslots (full-rate codec) or one out of 6 timeslots (half-rate codec). When an RF channel is in use by a digital base station, the base station carrier will be turned on for the entire frame. This is true even if only one traffic channel is in use on that RF channel. However, the carrier power can be different for each timeslot.

The digital modulation is $\pi/4$ differential quadrature phase shift keying ($\pi/4$ 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 140 symbol periods in each slot, and each symbol contains 2 bits of information. Thus, there are 280 bits per timeslot. Since there are 1,680 bits for all 6 timeslots in the frame, at 25 frames per second the transmission rate is 42,000 bits per second.

What Does the 85720C PDC Measurements Personality Do?

The 85720C PDC measurements personality can help determine if a PDC transmitter is working correctly. The 85720C adapts 8590 Series spectrum analyzer hardware for the testing of a PDC transmitter according to the Research and Development Center for Radio Systems (RCR) document, RCR STD-27C or RCR STD-27B. This document defines complex, multi-part measurements used to maintain an interference-free environment. For example, the documents include measuring the power of a carrier. The 85720C automatically makes these measurements using the measurement methods and limits that are defined in the RCR standards. In addition, the 85720C makes the base station carrier off leakage power, and spurious emissions measurements, using the measurement method and limits defined by the MKK. The detailed results displayed by the measurements allow you to analyze PDC system performance. You can alter the measurement parameters for specialized analysis.

The 85720C was primarily developed for making measurements on digital transmitter carriers. The 85720C is capable of making measurements on both the continuous carrier of a base station transmitter, and the burst carrier of mobile station transmitter. Many of the measurements may also be used on analog transmitter carriers.

The 85720C operates with the following options to make modulation accuracy measurements and to demodulate the transmitted bits of a PDC digital base or mobile station transmission:

Option 151 Fast ADC and Digital Demodulation Hardware

Option 160 PDC/PHS/CDMA/NADC-TDMA Firmware

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 deinterleaved. In addition, a constellation diagram of the phase and amplitude of baseband digital modulation is available.

The Option 151 and 160 digital demodulator also supplies a trigger with a period of 40 ms, the PDC frame rate. This trigger is called the frame trigger. The frame trigger may be positioned to select one timeslot for measurement. Digital demodulator based tests are usually triggered using the frame trigger. RF signal tests such as power verses time, and adjacent channel power may also be triggered using the frame trigger via the rear panel FRAME TRIG OUTPUT signal. Note that the PDC frame trigger frequency is locked to the spectrum analyzer reference, and may drift slowly relative to the PDC timeslots. Re-positioning, or re-acquiring, the frame trigger is automatic when using the 85720C personality.

How to Use This Guide

This guide provides all the information needed to install and operate the PDC measurements personality.

To use this guide:

1. Perform the procedures in Chapter 1, "Getting Started." These procedures explain how to prepare the spectrum analyzer for making a PDC measurement.
2. Once you have completed Chapter 1, proceed to either Chapter 2, "Mobile Station Measurements," or Chapter 4, "Base Station Measurements." These chapters contain procedures for making common measurements.

The rest of this user's guide contains information that you may want to refer to:

- Chapter 3, "Mobile Station Menu Map and Softkey Descriptions," and Chapter 5, "Base Station Menu Map and Softkey Descriptions," will help you navigate around the softkey structure. These chapters define and describe each softkey.
- Chapter 6, "Error Messages and Troubleshooting," describes the meanings of error messages and what to do to solve the problem.
- Chapter 7, "Programming Commands," is a list of the PDC personality programming commands, complete with syntax diagrams of each command. Examples of using each command is given, including alternate commands, related commands, and other information, when applicable. This chapter also contains a table of the limit and parameter variables.
- Chapter 8, "Programming Examples," consists mainly of measurement examples coded in BASIC. It also contains procedures for remotely accessing the 85720C PDC measurements personality, as well as some remote programming basics.
- Chapter 9, "Specifications," contains 85720C PDC measurements personality specifications and characteristics.
- Chapter 10, "Verifying Operation," contains test procedures that verify the electrical performance of the improved amplitude accuracy for the PDC option (Option 051), the time-gated spectrum analysis card (Option 105), and the digital demodulator option (Option 151 and 160). The verification tests should be performed at least once per year.

This guide uses the following conventions:

(Front-Panel Key)	This represents a key physically located on the instrument.
`Softkey`	This indicates a "softkey," a key whose label is determined by the instrument's firmware.
`Screen Text`	This indicates text displayed on the instrument's screen.

Spectrum Analyzer Operation

If you are not familiar with your spectrum analyzer, refer to the manuals for the spectrum analyzer. These manuals describe spectrum analyzer preparation and verification, and tell you what to do if something goes wrong. Also, they 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.

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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 Digital Cellular (PDC) transmission. This chapter contains the following information:

- descriptions of the equipment needed
- descriptions of the 8590 E-Series spectrum analyzer features that you will be using
- procedures for accessing the PDC analyzer mode
- procedures for accessing the spectrum analyzer functions
- information about the changes to the spectrum analyzer operation caused by the 85720C PDC measurements personality
- lists of the recommended accessories and spectrum analyzer options for use with the 85720C PDC 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 PDC personality.

Equipment Needed

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

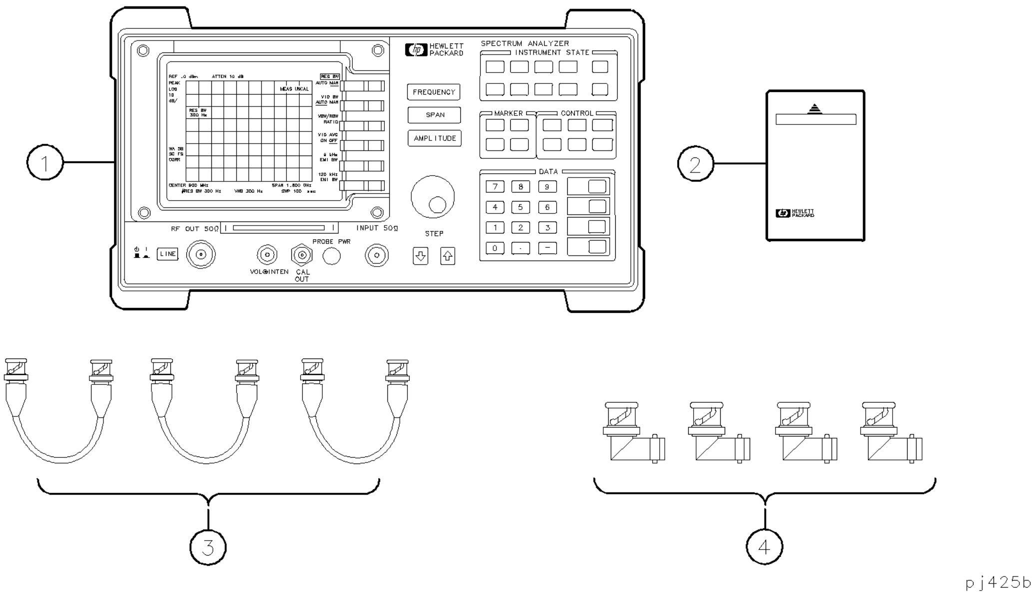


Figure 1-1. Required Equipment

1 An 8593E, 8594E, 8595E, or 8596E spectrum analyzer. The spectrum analyzer firmware must be dated 930506 or later. The options described in Table 1-1 are required or recommended, and should be installed in the spectrum analyzer.

2 The 85720C PDC measurements personality read-only memory (ROM) card. The PDC measurements personality is a program contained in this ROM card.

3 Three short BNC cables, each having 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 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 1-1. Required and Recommended 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 PDC measurement.
Option 041	The GPIB and parallel interface provides a general purpose interface bus (GPIB), an external keyboard interface, and a parallel printer interface. This option is recommended but not required.
Option 051	The improved amplitude accuracy is recommended for use with the 85720C, but not required. This option improves the spectrum analyzer amplitude accuracy specifications for PDC measurements made in the PDC frequency range. This option is available for the 8593E, 8594E, 8595E, or 8596E spectrum analyzer.
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 PDC mobile station measurements. Option 101 is not required if Option 151 is installed.
Option 105	The time-gated spectrum analyzer option card provides the time gating required in the gated adjacent channel power measurement and the trigger delay required in the power versus time measurements.
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). Options 151 and 160 are required for digital demodulator-based measurements. 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 Agilent Technologies 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 PDC Measurements Personality," later in this chapter for more information about these, and other options.	

List spectrum analyzer options and firmware revision

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 051 will not be shown. To confirm that Option 051 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 *8590 E-Series and L-Series Spectrum Analyzers User's Guide*.

Note The 85720C PDC measurements personality automatically displays an error message if you access a measurement that requires an option that is not installed.

The 8590 Series Spectrum Analyzer Front Panel Features

Familiarize yourself with the following features before using the PDC measurements personality.

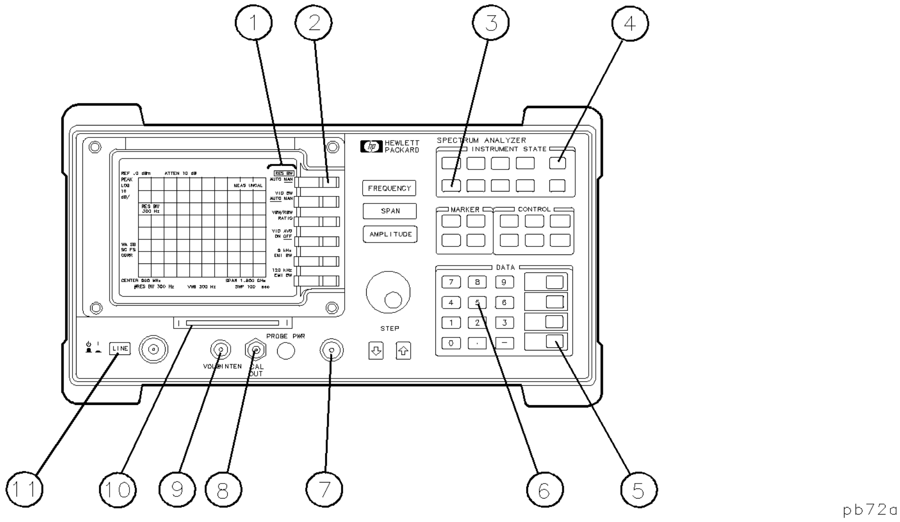


Figure 1-2. Front Panel Features

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, PDC 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 PDC 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

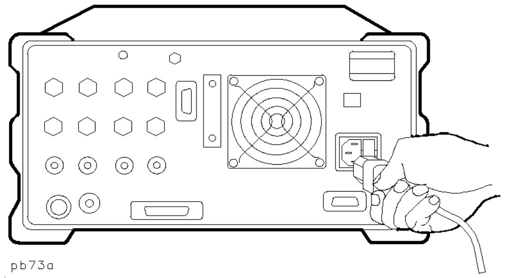
This section explains the steps that are necessary to prepare the spectrum analyzer for making PDC measurements. The steps are:

1. Load the PDC 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 sync word frame triggering.
5. Connect the external precision frequency reference (if Option 004 is *not* installed).
6. Access the PDC analyzer mode.

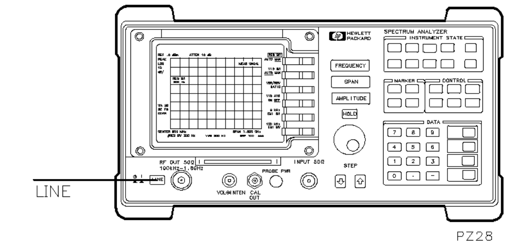
* Do not confuse this calibration with the *optional* EVM calibration explained in Chapter 2 "Mobile Station Measurements," and Chapter 4 "Base Station Measurements." The EVM calibration improves EVM measurement accuracy by calibrating to a high-quality external source, but is *not* necessary before making an EVM measurement.

Step 1. Load the PDC measurements personality

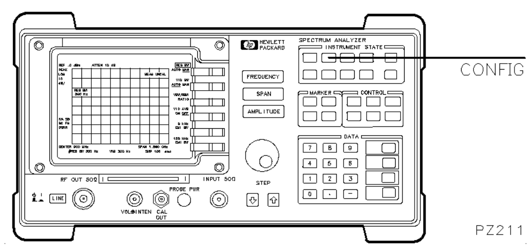
1. Plug the spectrum analyzer into an ac power supply.



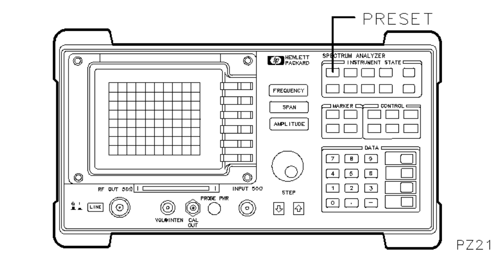
2. Press the (LINE) key and wait for the power-on routine to finish.



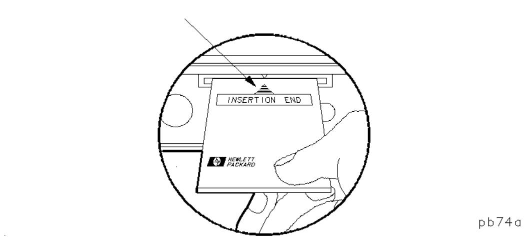
3. Press (CONFIG) `More 1 of 3` `Dispose User Mem` `ERASE DLP MEM` `ERASE DLP MEM` to erase any previously-installed program. Wait for the dispose routine to finish.



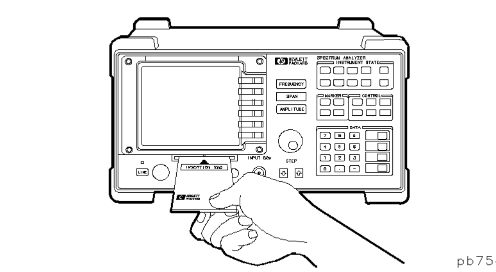
4. Press (PRESET).



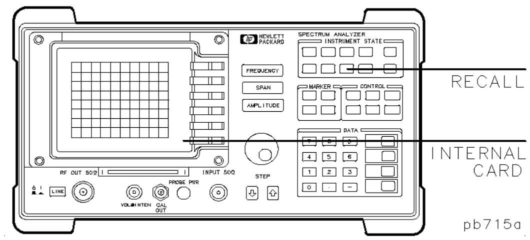
5. Locate the arrow printed on the PDC measurements personality card label.



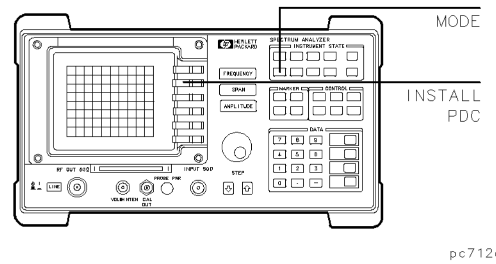
6. Insert the card into the spectrum analyzer with the card arrow matching the raised arrow on the bezel around the card-insertion slot.



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



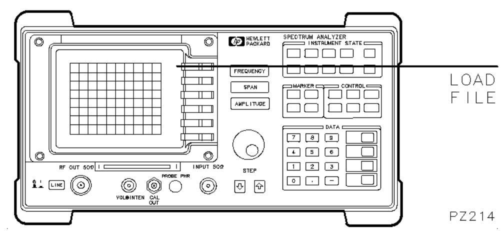
8. Press `Catalog Card` `CATALOG ALL`.



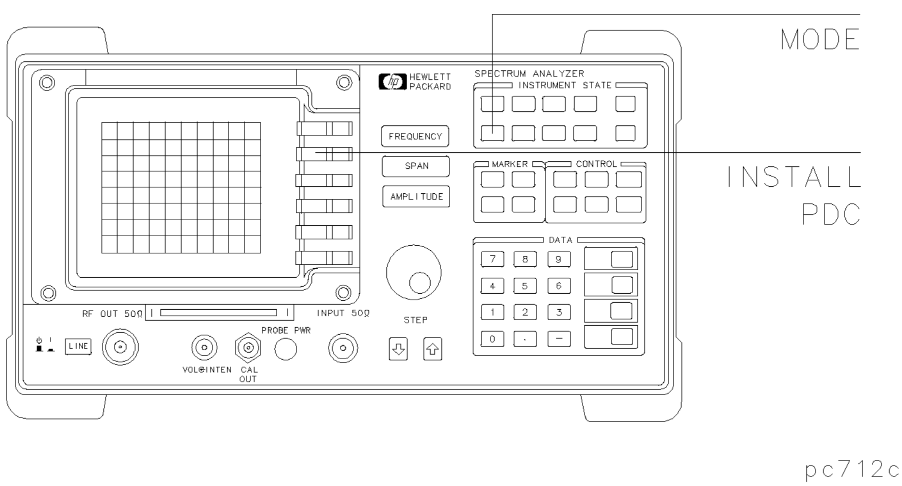
9. Make sure that dPDC is highlighted on the spectrum analyzer display. If necessary, use the large knob on the spectrum analyzer front panel so that dPDC is highlighted.

PDC	1024
<u>dPDC</u>	DLP
dC	DLP
dCID	DLP

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

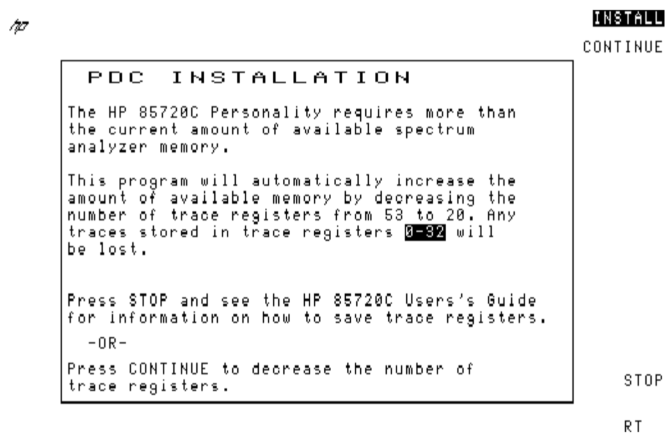


11. Press (MODE) `INSTALL PDC` to access the PDC installation mode.



12. The message `Please wait, Loading PDC ...` will appear on the screen if enough spectrum analyzer memory is available to load the PDC main file. It takes several minutes to load the PDC main file. `PDC 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 PDC 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 listed trace registers and make room in memory for the main PDC file.† The message `Please wait, Loading PDC ...` appears. It takes several minutes to load the main PDC file, at which time the message `PDC Loaded` appears. *Continue with the procedure "Step 2. Perform the spectrum analyzer self-calibration routines."

* Once the main PDC file has been loaded, the PDC 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 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 # and PREFIX= are displayed on the spectrum analyzer display.

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

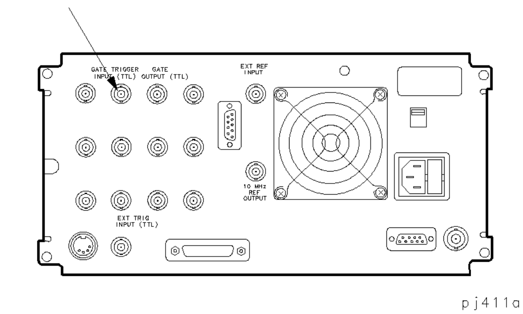
   The trace data is saved with a file name consisting of a "t," the current prefix, an underscore (_), and the register number. The "t" denotes that the file contains trace data. See "Save and recall data from the memory card" in Chapter 5, "Using Analyzer Features," of the *8590 E-Series and L-Series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

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

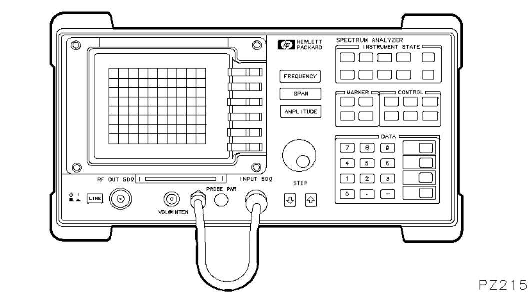
Step 2. Perform the spectrum analyzer self-calibration routines

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.)

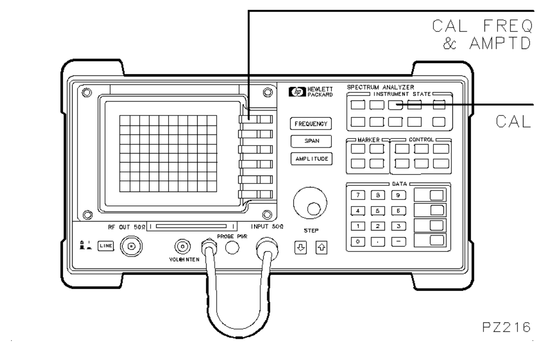
1. If the analyzer contains Option 105, then make sure nothing is connected to the GATE TRIGGER INPUT connector on the spectrum analyzer rear panel.



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

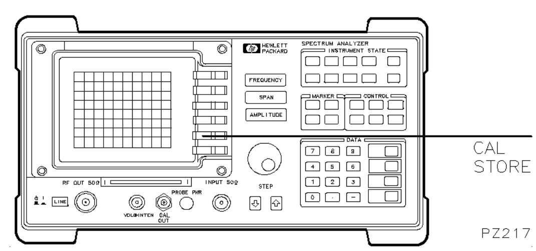


3. Press (CAL), then **CAL FREQ & AMPTD** .



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** .



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.

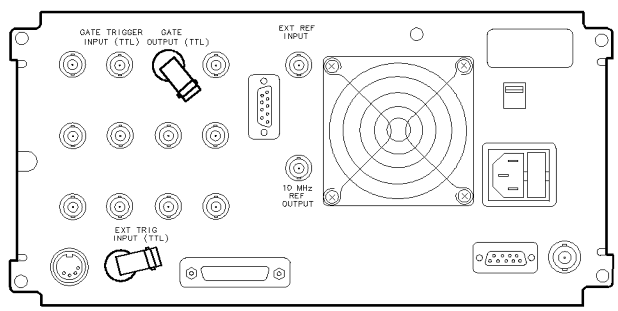
Step 3. Make the cable connections for triggering the spectrum analyzer

Perform this procedure if the following two things are true:

- Option 105 and either Option 101 or 151 is installed in your analyzer. See "List spectrum analyzer options and firmware revision" in the beginning part of this chapter to quickly determine the options installed in your analyzer.
- You want to perform a power versus time, gated adjacent channel power measurement, or *externally triggered* power or spurious emission measurement on a mobile station.

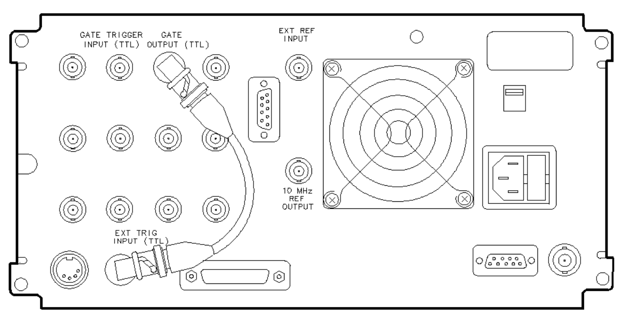
If these things are not true, then continue with the procedure "Step 5. Connect the external precision frequency reference."

1. 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.



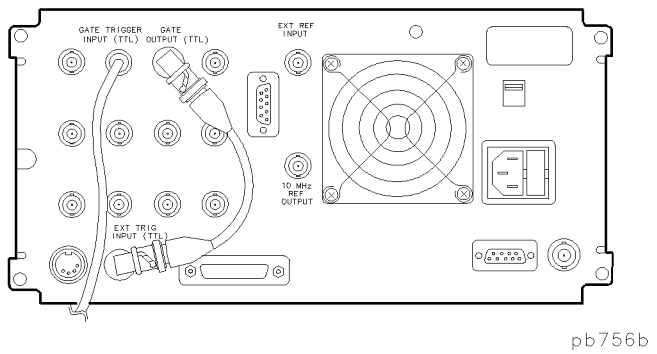
pb754b

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 PDC 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. If Options 151 (and 160) are installed and you want to use sync word frame triggering (using digital demodulation), proceed to the procedure “Step 4. Make the cable connections for sync word frame triggering.” Sync word frame trigger is sometimes referred to as off-the-air frame triggering.

To use an external trigger signal, continue with this procedure.

Connect a transistor-transistor logic (TTL) trigger signal to the GATE TRIGGER INPUT connector on the rear panel of the spectrum analyzer.

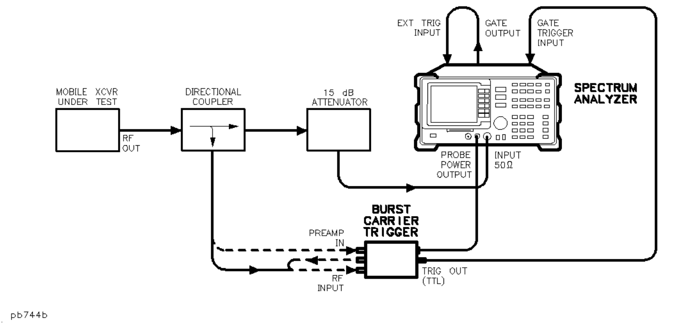


This TTL trigger signal provides an external trigger for the spectrum analyzer. The trigger signal should be a TTL pulse at least 1 μs wide that occurs once for every PDC frame (once per burst of the unit under test).

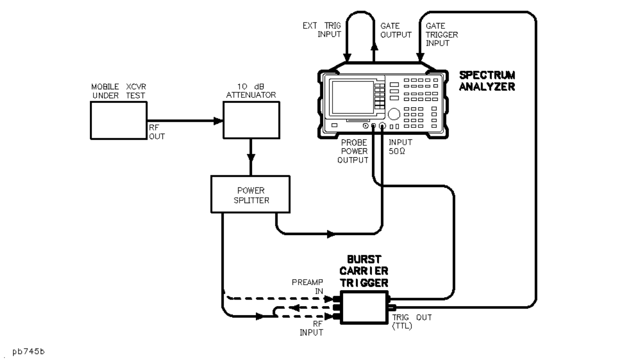
The TTL trigger signal can be supplied directly by the unit under test or by an associated piece of test equipment, or indirectly, by converting the RF carrier into a TTL signal. A burst carrier trigger device such as the 85902A Burst Carrier Trigger can be used for this conversion. (See example setups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

Example setups for using the 85902A Burst Carrier Trigger

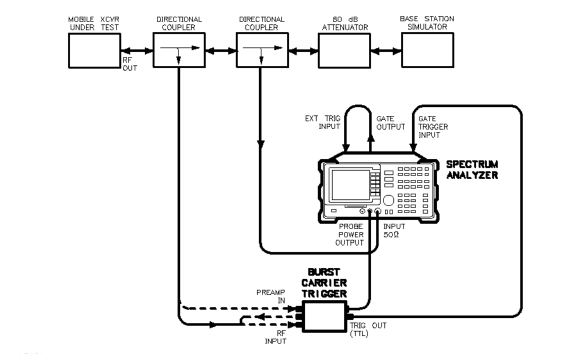
Here are some examples of connecting the 85902A Burst Carrier Trigger to a spectrum analyzer to use an external signal for triggering.



Mobile Station in Self-Test Mode, Using a Directional Coupler



Mobile Station in Self-Test Mode, Using a Power Splitter



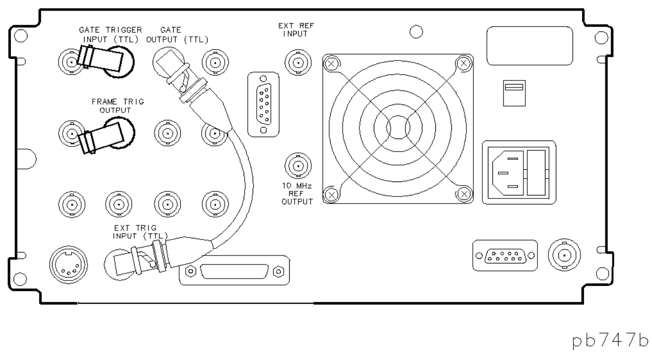
Mobile Station with a Base Station

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

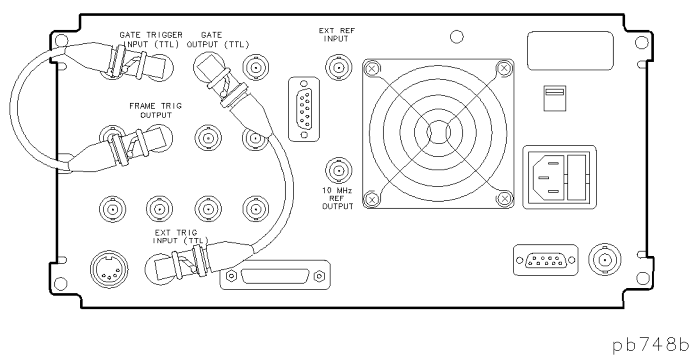
Perform this procedure if Options 151 and 160 are installed and you wish to trigger the spectrum analyzer using sync word frame trigger using digital demodulation for mobile station power versus time, gated adjacent channel power, or externally triggered power or spurious emission measurements.

See “List spectrum analyzer options and firmware revision” in the beginning part of this chapter to quickly determine the options installed in your analyzer.

1. 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.



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

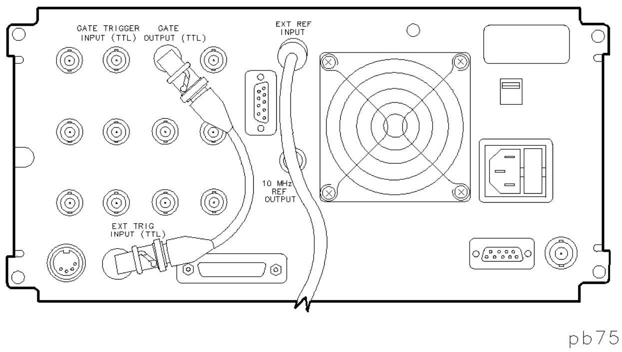


You do not need to remove the BNC cable after you have connected it to the right-angle adapters, unless you are executing self calibration (CAL AMPTD or CAL FREQ & AMPTD). This cable can remain attached to the spectrum analyzer for all the PDC measurements and all the conventional spectrum analyzer functions. 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.

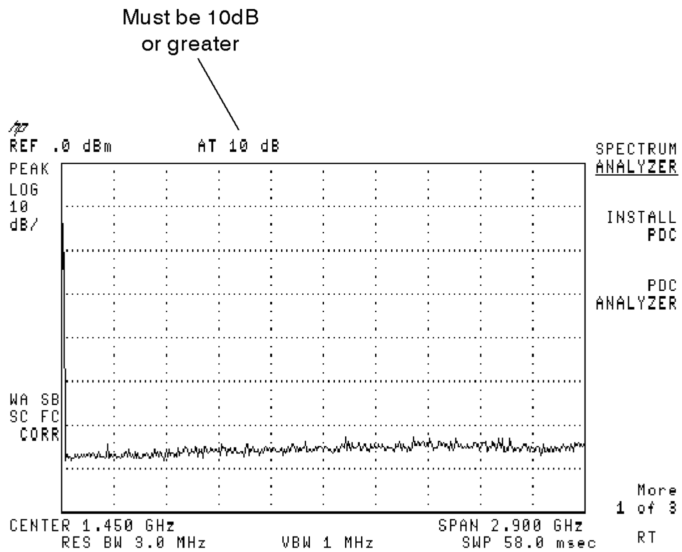


Step 6. Access the PDC analyzer mode

Caution

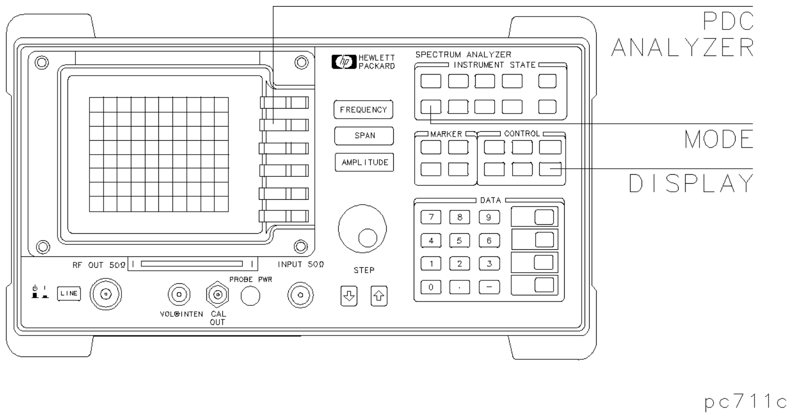
If you select 0 dB internal input attenuation manually while the instrument is in spectrum analyzer mode, then access the PDC mode, this attenuation value will be recalled automatically when you exit PDC mode and enter spectrum analyzer mode using the (MODE) key. Instrument damage may occur if total 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 PDC mode. Pressing (PRESET) will guarantee that at least 10 dB internal attenuation will be used.

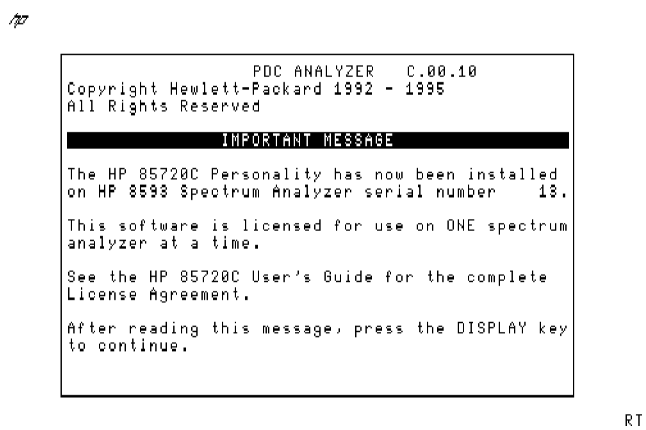


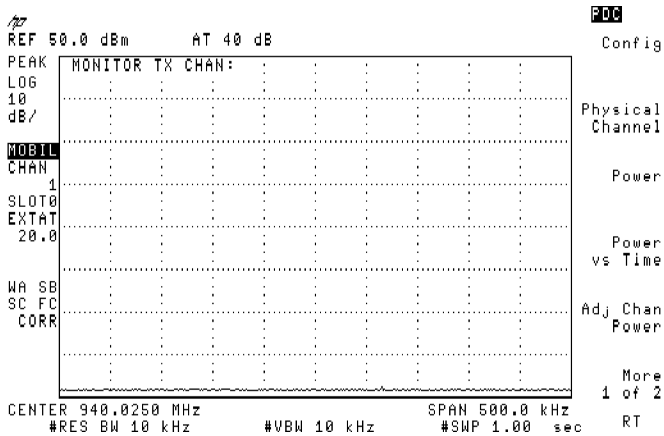
pc713c

1. Press (MODE) PDC ANALYZER to access the PDC analyzer mode. You will see the copyright message for the 85720C. This message is only displayed the first time you access the PDC analyzer mode.



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



3. When the spectrum analyzer is using the PDC analyzer mode, `PDC` appears in the upper right corner of the spectrum analyzer display.      **The PDC 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 PDC 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 6, "Error Messages and Troubleshooting."

PDC Measurements Personality Screen Annotations

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

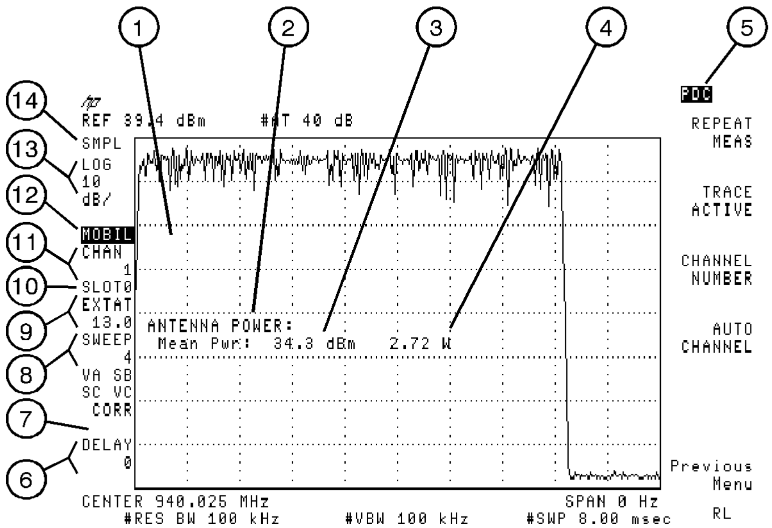


Figure 1-3. PDC Screen Annotations

Table 1-2. PDC 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 PDC measurement.
3	Pass/fail message	Indicates if the base or mobile station passed or failed the measurement (if PASSFAIL is set to ON).
4	Measurement results	The measurement results.
5	PDC	Indicates the spectrum analyzer is using the PDC measurements personality (also referred to as the PDC analyzer mode).
6	DELAY	Displays the trigger delay time in μs (mobile station testing only).
7	Total power	When TOTL PWR SGL MULT is set to multiple transmitters, the total power in dBm is displayed beneath CORR.
8	SWEEP	Displays the number of sweeps that were used for the measurement.
9	EXTAT	Displays the external attenuation in dB.
10	SLOT	Displays the slot number.
11	CHAN	Displays the channel number.
12	BASE or MOBIL	Indicates the current setting of TRANSMIT BS MS.
13	LOG	Displays the amplitude scale.
14	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

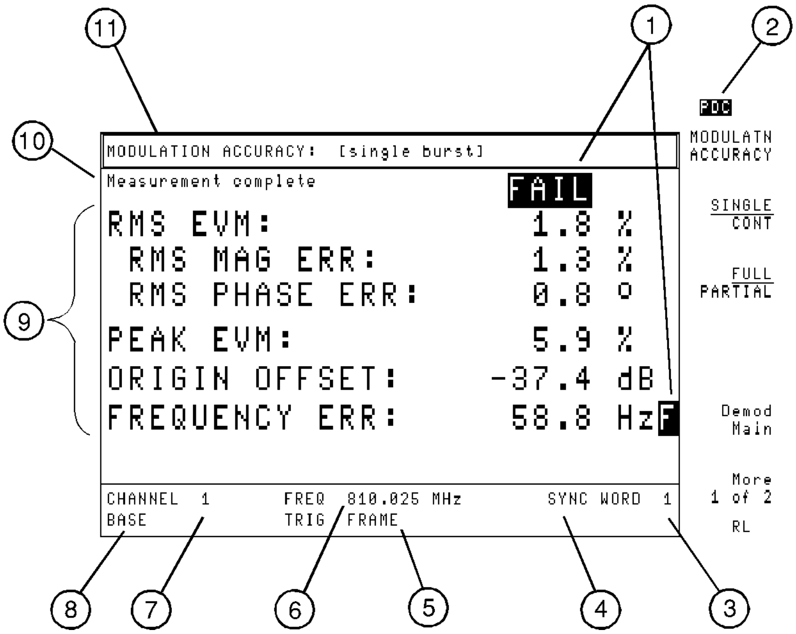


Figure 1-4. Digital Demodulation Screen Annotations 1

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 (PDC):	Indicates which mode the analyzer is operating in.
3	SYNC WORD:	If WRD SYNC ON OFF is set to ON, indicates current sync word of timeslot.
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	BASE or MOBILE:	Indicates current setting of TRANSMIT BS MS.
9	Measurement results:	The measurement results.
10	Messages:	Indicates progress of measurements or flags errors.
11	Measurement:	Indicates the current measurement being performed.

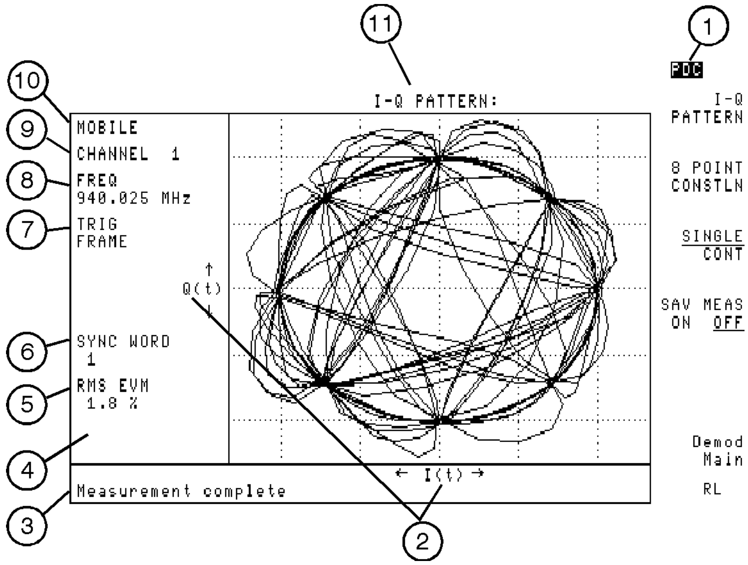


Figure 1-5. Digital Demodulation Screen Annotations 2

Table 1-4. Digital Demodulation Screen Annotations 2

Item	Display Annotations	Description
1	Mode indicator (PDC):	Indicates which mode the analyzer is operating in.
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	SYNC WORD:	If WRD SYNC ON OFF is set to ON, indicates current sync word of timeslot.
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	BASE or MOBILE:	Indicates current setting of TRANSMIT BS MS .
11	Measurement:	Indicates the current measurement being performed.

Accessing the Spectrum Analyzer Functions

The menus of the Personal Digital Cellular (PDC) measurements personality provide the softkeys that are normally needed for making PDC measurements. You may want to use some spectrum analyzer functions without leaving the PDC analyzer mode, or you may want to exit the PDC 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 PDC analyzer mode.
- Exit PDC analyzer mode and access the spectrum analyzer mode.

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

1. To use a spectrum analyzer function without leaving the PDC 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 PDC analyzer menu, do *either* of the following:
   - To return to the PDC 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 PDC measurements personality, press (MODE) PDC ANALYZER.

Some spectrum analyzer front panel keys can provide useful, supplemental functions for PDC measurements, and most spectrum analyzer functions can be used while using the PDC 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 PDC analyzer mode.

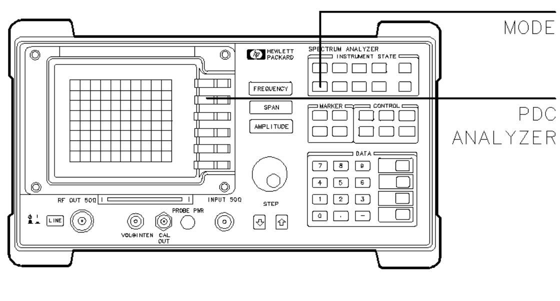


Figure 1-6. PDC Analyzer Mode Functions

To exit PDC mode and access the spectrum analyzer mode

There are two ways to access spectrum analyzer mode:

1. Press (PRESET). (PRESET) changes all of the PDC 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 PDC measurements personality softkey settings.

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

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

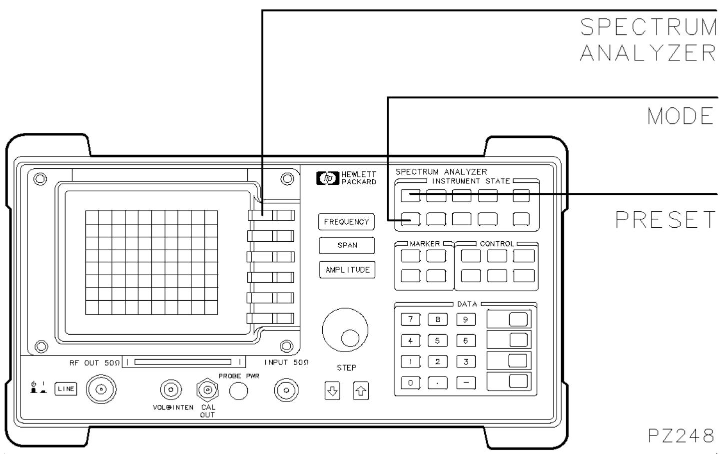


Figure 1-7. Accessing spectrum analyzer mode

Now that the spectrum analyzer is set up to make a measurement, refer to Chapter 2 “Mobile Station Measurements,” or Chapter 4 “Base Station 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 PDC analyzer mode or the spectrum analyzer mode. Some spectrum analyzer functions either are not available or are changed when using the PDC analyzer mode.

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

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

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

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

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

- Press (FREQUENCY) to access the physical channel menu softkeys if the current PDC 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 PDC measurement is monitor band or one of the spurious measurements.

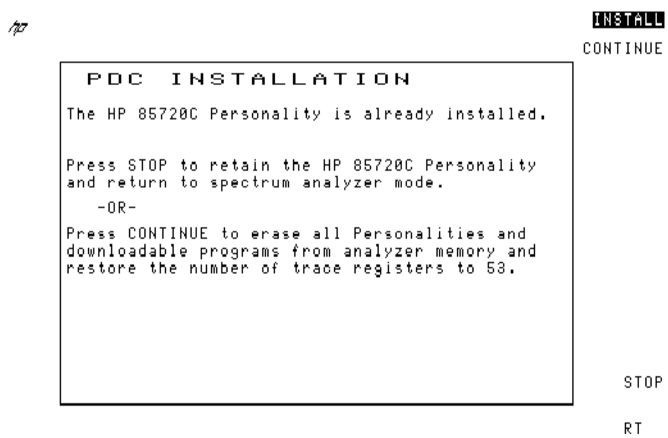
The number of trace registers in the spectrum analyzer may be changed

For spectrum analyzers with insufficient memory, the PDC installation mode decreases the number of spectrum analyzer trace registers to increase the amount of available memory so that the PDC 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 PDC mode as follows:

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

Press (MODE) INSTALL PDC to access the PDC 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 PDC 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 PDC measurements personality.

Option 004 is also available as a retrofit kit (Option R04) after the purchase of your spectrum analyzer, or as a kit 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, part number 5062-4805).

GPIB and parallel interface (Option 041)

Option 041 allows you to control your spectrum analyzer from a computer that uses a Hewlett-Packard interface bus (GPIB). Such computers include the HP 9000 Series 300, and the HP Vectra PC. Option 041 includes a connector for an external keyboard, an GPIB connector, a parallel interface connector for printers, and the *8590 E-Series, L-Series Spectrum Analyzers, and 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 part number 08590-60380.

Note Option 041 can be converted to an Option 043 by ordering the RS-232 and parallel interface connector assembly 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 *8590 E-Series, L-Series Spectrum Analyzers, and 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 part number 08590-60381.

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

Improved Amplitude Accuracy for PDC (Option 051)

Option 051 is an 8593E, 8594E, 8595E, or 8596E with improved amplitude accuracy specifications over the PDC high and low frequency bands. Refer to "Specifications for Option 051 (Available for 8593E, 8594E, 8595E, or 8596E spectrum analyzer)" in Chapter 9, "Specifications," for information about the specifications for Option 051.

Improved amplitude accuracy is available to retrofit spectrum analyzers without Option 051. Contact your Agilent Technologies sales and service office for more information about Option R51, the improved amplitude accuracy upgrade for PDC.

Fast 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 PDC measurements personality to perform time domain measurements. If Option 151 is installed, Option 101 is not required for the 85720C PDC 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 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 mobile station power versus time, and gated adjacent channel power measurements.

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 PDC digital modulator-based metric measurements for an 8593E, 8594E, 8595E and 8596E. You can measure error vector magnitude, carrier frequency error, and I-Q origin offset using the 85720C PDC measurements personality. I-Q pattern diagrams and demodulated bits are also available. All modulation measurements are automatically synchronized to the sync word.

In addition, the sync word frame trigger (off-the-air sync frame trigger) is available on the spectrum analyzer rear panel. This signal can be used as a trigger source for mobile station power versus time, and gated adjacent channel power 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 85720C PDC 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 8591E analyzer with Options 151 and 160 is offered and supported only for use with the 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 demodulator-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 85718B NADC-TDMA measurements personality provide a complete NADC-TDMA transmitter RF measurement solution, including modulation metrics.

Option 151 with Option 160 and the 85720C PDC measurements personality provide a complete PDC transmitter RF measurement solution, including modulation metrics.

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

Option 151 with Option 160 and the 85720C PDC measurements personality provide a complete PDC 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 PDC Measurements Personality

AC power source

The 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 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 MΩ 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 8593E analyzer; they may cause damage to the spectrum analyzer input circuit.

When using a dc-coupled probe with an 8594E, 8595E, or 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 10855A preamplifier provides a minimum of 22 dB gain from 2 MHz to 1300 MHz.
- The 8449B preamplifier provides a minimum of 30 dB gain from 1 GHz to 26.5 GHz.
- The 8447D preamplifier provides a minimum of 25 dB gain from 100 kHz to 1.3 GHz.
- The 8447E power amplifier provides a minimum of 22 dB gain from 0.1 GHz to 1.3 GHz.
- The 87405A preamplifier provides a minimum of 22 dB gain from 10 MHz to 3 GHz.

Burst carrier trigger/RF preamplifier

The 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 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 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 8590 Series.

Close field probes

The 11945A close field probe set contains the 11940A and 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 11941A operates from 9 kHz to 30 MHz. The 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 11945A Option E51 also includes the 8447F Option H64 preamplifier and a convenient carrying bag.

External keyboard

For use with Option 041 or 043. The 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 8591E, 8593E, 8594E, 8595E, and 8596E.

Table 1-5. Memory Card Model Numbers

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

Plotter

For use with Option 041 or 043. The ColorPro 7440A graphics plotter adds a color plot capability to the spectrum analyzer for permanent records of important measurements. The eight-pen 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 GPIB 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.

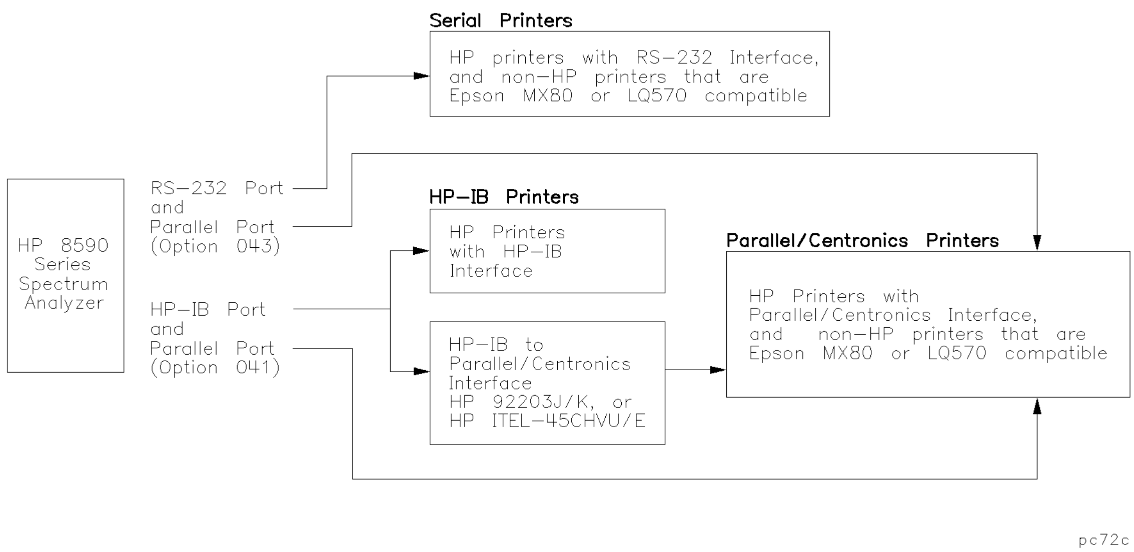


Figure 1-8. Connecting Printers Using Various Interface Options

Transit case

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

2

Mobile Station Measurements

This chapter demonstrates how to make measurements on a mobile station with the PDC measurements personality. It also contains procedures for performing the following measurements:

- Configuring the personality for your test setup.
- Measuring the antenna power, the carrier off power, the power steps, the occupied bandwidth, and monitoring the transmit channel.
- Measuring the time domain characteristics of a PDC burst.
- Measuring the adjacent channel power.
- Monitoring the PDC frequency bands, and measuring the spurious emissions.

If you have Options 151 and 160 you can also do the following:

Note See “List spectrum analyzer options and firmware revision” in the beginning part of Chapter 1, “Getting Started,” to quickly determine the options installed in your analyzer.

- Configure the personality for measurements using the digital demodulation capability.
- Measure the RMS error vector magnitude (EVM), RMS magnitude error, RMS phase error, peak EVM, carrier frequency error, and I-Q origin offset.
- Display the transmitted I-Q pattern graph or eight-point constellation graph.
- Display the transmitted demodulated bit sequence and highlight a selected portion of that sequence.

Note Before you begin any of the measurements in this chapter, perform the following steps:

1. Load the 85720C PDC measurements personality into the spectrum analyzer and perform the steps described in “Preparing to Make a Measurement” in Chapter 1, “Getting Started.”
2. Perform the procedures in the following section, “Configuring the Personality for Your Test Setup.”

A trigger signal is required for the gated adjacent channel power measurements and the power versus time measurements. See “Step 3. Make the cable connections for triggering the spectrum analyzer” in Chapter 1, “Getting Started,” for more information.

Configuring the Personality for Your Test Setup

Before you can begin to make a measurement, you must configure the personality according to the test setup that you are using. To configure the personality, use the functions that are in the `Config` and `Physical Channel` menus. This section contains 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). Agilent Technologies 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 051

- For specified amplitude accuracy with Option 051, use enough external attenuation so that the spectrum analyzer internal input attenuation is within the 10 to 40 dB range.
- For best amplitude accuracy with Option 051, use enough external attenuation so that the spectrum analyzer internal input attenuation is within the 10 to 30 dB range.

For the carrier off measurement, power versus time measurements, 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 internal 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:

$$external\ attenuation\ (dB) = mean\ carrier\ power\ (dBm) - input\ attenuation\ (dB) + 13\ dB$$

  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 PDC measurements personality by pressing (MODE) `PDC ANALYZER`.
2. Press `Config`.
3. If necessary, press `TRANSMIT BS MS` so that MS is underlined. Selecting MS selects a mobile station as the device to be tested.

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). Agilent Technologies 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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4. Because you need to use an external piece of equipment (for example, an attenuator, test fixture, or directional coupler) to connect the transmitter's 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:

Mobile Station Power	External Attenuation
+30 dBm (1 W) to +38 dBm (6 W)	13 dB
Up to +30 dBm (1 W)	15 dB

Note For the best absolute amplitude accuracy, the entered value for the 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 9, "Specifications," 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).

5. The mobile station is normally tested in a burst mode, so you should make sure that BURST is underlined in `BURST CONT`. If necessary, press `BURST CONT` so that BURST is underlined. If the mobile station under test is in a continuous carrier mode, press `BURST CONT` so that CONT is underlined.
6. Press `Trigger Config` to configure the measurement trigger.

7. Select a measurement trigger source. Press TRIG SRC DD EXT to underline DD to trigger Power versus Time gated ACP, and *externally triggered* Power and Spurious measurements using the digital demodulator off-the-air frame trigger from Options 151 and 160. If your input signal has transmitted synchronization words, the digital demodulator frame trigger will automatically align the measurement interval with the timeslot designated by the SLOT NUMBER softkey in the Physical Channel menu.

   This assumes the following:

   The trigger timeslot designated by the SLOT NUMBER softkey corresponds to the transmitted sync word of the signal

   DD TRIG FRAME in the Demod Config menu is set to FRAME

   WRD SYNC ON OFF is set to ON

   TIMESLOT SRCH NUM is set to NUM

   If the transmitted sync word is unknown, set TIMESLOT SRCH NUM to SRCH.

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

Note To use the Options 151 and 160 off-the-air frame trigger as a trigger source for measurements, you must connect a cable from the rear panel FRAME TRIG OUTPUT connector to the GATE TRIGGER INPUT connector.

   Set TRIG SRC DD EXT to EXT to trigger Power versus Time, gated ACP, and *externally triggered* Power and Spurious measurements using an external trigger to the GATE TRIGGER INPUT connector. An external trigger signal can be a TTL signal from a mobile station. If a TTL trigger signal is not available from the mobile station, a convenient way to obtain one is to use the 85902A Burst Carrier Trigger.

   See "Step 3. Make the cable connections for triggering the spectrum analyzer" in Chapter 1, "Getting Started," for more information.

8. If the frame structure for the transmission is for a full-rate codec, you should make sure that PERIOD 40ms 20ms is set to 20ms. If necessary, press PERIOD 40ms 20ms so that 20ms is underlined. If the frame structure is for a half-rate codec, press PERIOD 40ms 20ms so that 40ms is underlined.

Note The above settings assume that the trigger period is the same as the RF burst period. If the external trigger period is 40 ms, but the RF burst period is 20 ms, set PERIOD 40ms 20ms so that 40ms is underlined. In this case you must temporarily set PERIOD 40ms 20ms to 20ms for correct carrier off power measurements.

9. Select the trigger polarity for the trigger signal (the trigger signal is the TTL trigger signal that is connected to the GATE TRIGGER INPUT connector on the rear panel of the spectrum analyzer). If you want the spectrum analyzer to trigger on the positive edge of the trigger signal, make sure that POS is underlined in TRIG POL NEG POS. If necessary, press TRIG POL NEG POS so that POS is underlined. If you want the spectrum analyzer to trigger on the negative edge of the trigger signal, press TRIG POL NEG POS so that NEG is underlined.

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

10. Enter the trigger delay time value. If you selected positive edge triggering, this is the time from the positive edge of the trigger pulse to the start of point 0 (see Figure 2-2). If you selected negative edge triggering, this is 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 DD EXT is set to DD, use a value of 0. If TRIG SRC DD EXT is set to EXT, a positive value of trigger delay is usually required.

    If you do not know the trigger delay time of your test setup, you can use P vs T BURST to adjust the trigger delay time. Complete the rest of the procedures in this section and then see "To measure the burst" located later in this chapter.

11. Press Previous Menu.
12. Press More 1 of 2.
13. Many of the PDC measurements display either "PASS" or "FAIL" to indicate if the test passed the test limits. If you want a pass/fail message to be displayed, press PASSFAIL ON OFF so that ON is underlined. The test limits can be changed; see "Customizing the PDC Personality" in Chapter 8, "Programming Examples," for more information.
14. Because a mobile station has only a single carrier present, make sure that SGL is underlined for the TOTL PWR SGL MULT function. If necessary, press TOTL PWR SGL MULT so that SGL is underlined.
15. To tune by channel number, do the following:
    - Press Config More 1 of 2 Define Channels to access the define channels menu
    - Press DEFINE MS CHAN and enter the lowest channel number using the front panel knob, step keys, or number pad.
    - Press DEFINE MS FREQ and enter the frequency that corresponds to the lowest channel number.
    - Press Previous Menu.
16. Press More 2 of 2 Main Menu to return to the main menu.

Pressing Config accesses the configuration softkeys. Because the PDC 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 equipment. 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 2-1 shows the configuration menu and annotation.

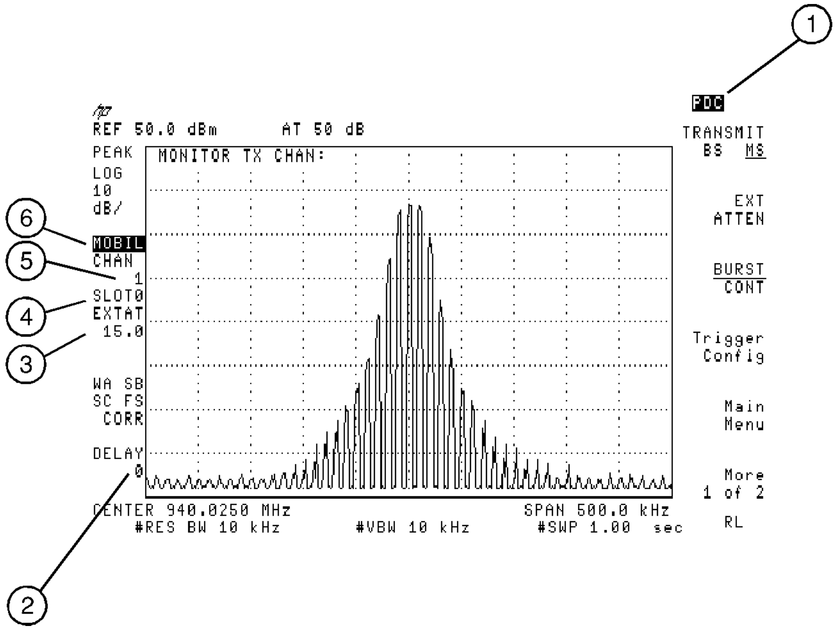

Figure 2-1. The Configuration Menu

Item	Description
1	Indicates the spectrum analyzer is using the PDC measurements personality (also referred to as the PDC 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 source (base station or mobile station).

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

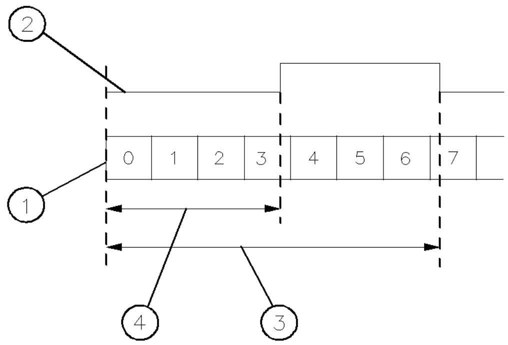

Figure 2-2. Timing Diagram

Item	Description
1	Indicates point 0 (the start of the first symbol).
2	The external trigger signal.
3	The trigger delay time if TRIG POL POS NEG is set to NEG.
4	The trigger delay time if TRIG POL POS NEG is set to POS.

To select a channel to test

Caution Make sure that the signal that is 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 PDC measurements personality by pressing (MODE) PDC ANALYZER.
3. Press Physical Channel. (You can also press (FREQUENCY). When the spectrum analyzer is in the PDC mode, (FREQUENCY) accesses the Physical Channel softkeys.)
4. Select the channel to test.
   - If you know the channel number, and the channels have been defined under the Config menu, press CHANNEL NUMBER, enter the channel number using the data keys, then press (ENTER).
   - If you want the spectrum analyzer to find and select the channel with the highest signal level in the current band, press AUTO CHANNEL. If there is no signal above the carrier minimum power threshold in the current band, the other band is searched. The carrier minimum power threshold default level is −15 dBm. In channel mode, the current band is the band that contains the currently selected 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. *If the external trigger signal is from a TTL signal from a mobile station or a burst carrier trigger connected to a mobile station RF output:* Set the slot number to 0 by pressing SLOT NUMBER, entering a "0" using the data keys, and then pressing (ENTER).
6. *If the external trigger signal is from the base station or a base station simulator:* Enter the number of the slot that you want to examine by pressing SLOT NUMBER, entering the number of the slot with the data keys, and then pressing (ENTER). If you do not enter a slot number, the slot number defaults to 0. The slot number selection applies only for a burst transmission.
7. 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 0) are shown on the left side of the spectrum analyzer display as in Figure 2-3.

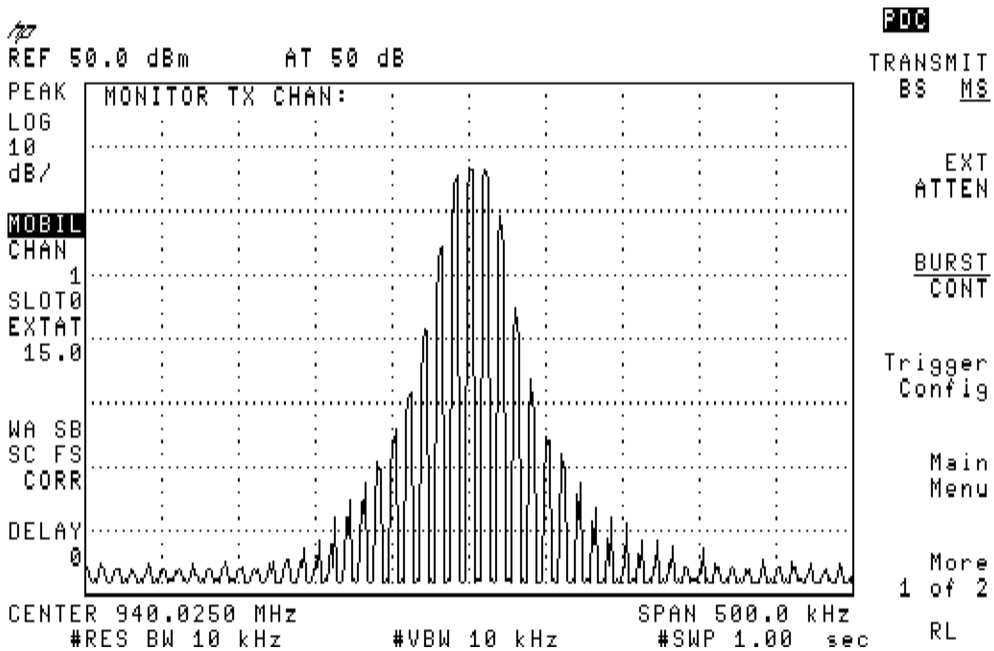

Figure 2-3. Selecting a Channel

To configure a digital demodulator-based test (For systems with Options 151 and 160)

See "List spectrum analyzer and firmware revision" 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, or demodulated data bits), you must configure the digital demodulator according to the test setup being used. After using the functions in the `Config` and `Physical Channel` menus to complete the main personality setup, use the `Demod Config` menu functions to configure the digital demodulator. This section contains the procedures for configuring 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.
- Defining the timeslot to be measured.
- 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) `PDC ANALYZER` `More 1 of 2` `Digital Demod`.
2. Press `Demod Config` to access the demodulation configuration menu.
3. Press `SLOT NUMBER`, enter the correct timeslot number using the data keys, then press (ENTER). This enters the timeslot number of the timeslot you want to measure. The default value is timeslot 0. This function is identical to the `SLOT NUMBER` in the `Physical Channel` menu. If the desired number was previously entered, it does not need to be entered here.

Note `SLOT NUMBER` is relevant for digital demodulator-based measurements only when the frame trigger is selected. (See step 7b.) The value of `SLOT NUMBER` is used by the frame trigger to automatically position the measurement at the timeslot of interest. Free run and external trigger do not use `SLOT NUMBER` for digital demodulator-based measurements.

4. Press `ERR MSG ON OFF` until ON is underlined. The `ERR MSG ON OFF` softkey enables all automatic error messages related to digital demodulator measurements, including triggering errors. See Chapter 6, "Error Messages and Troubleshooting," for an explanation of the error states. If you want to make a measurement without being interrupted or stopped by error messages, press `ERR MSG ON OFF` until OFF is underlined. 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.
5. Press `DD Trigger` to access the digital demodulator trigger menu.

6. 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 configured according to the characteristics of the PDC signal. If the signal contains any of the six possible 20-bit PDC timeslot synchronization words, the frame trigger is the best choice.

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

For a continuous signal without a sync word, any of the triggers can be selected; however, free run trigger and external trigger will permit the measurement to run more quickly than frame trigger. Frame trigger will cause the digital demodulator to search for a sync word that is missing, forcing the measurement to halt. Free run trigger, or external trigger do not search for the sync word.

External trigger requires that you supply a trigger signal to the rear panel of the instrument, and positioned such that the digital demodulator measurement interval is set to the desired time.

If Option 105 is installed, the signal should be connected to GATE INPUT, and GATE OUTPUT connected to EXT TRIG. In this case, TRIG DELAY in the Trigger Config menu can be used to correctly position an external trigger.

If Option 105 is not installed, the signal must be connected directly to EXT TRIG INPUT.

If no trigger is present, then the measurement will be held up indefinitely until a trigger occurs.

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

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

   a. Press WRD SYNC ON OFF until ON is underlined. The WRD SYNC ON OFF softkey enables and disables the frame trigger sync word search. 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. If you want to use the frame trigger without including automatic synchronization to a sync word, press WRD SYNC ON OFF until OFF is underlined.

      The default for WRD SYNC ON OFF is ON.

   b. Press TIMESLOT SRCH NUM until NUM is underlined. If NUM is underlined, frame trigger acquisition causes the digital demodulator to synchronize only with the timeslot defined by SLOT NUMBER. The input signal must contain the 20-bit PDC synchronization word for that timeslot. Only one of the six possible sync sequences is correlated with the demodulated bits. An exact bit match terminates the acquisition. If an exact bit match with the timeslot sync sequence defined by SLOT NUMBER is not found, the best bit match is used to synchronize the frame trigger. Frame trigger acquisition is successful if the best sync word match can be properly positioned in the data record. The default for TIMESLOT SRCH NUM is NUM.

      If SRCH is underlined, frame trigger acquisition causes the digital demodulator to search for an exact bit match with each of the six possible 20-bit PDC sync words, starting with sync word 1. The search successively correlates each of the six possible sync words with the demodulated bits. The first exact match found terminates the search, synchronizing the frame trigger to the first exact match. If no exact match is found for any of the six possible sync words, the sync word yielding the smallest number of bit errors is used to synchronize the frame trigger. Frame trigger acquisition is successful if the best sync word match can be properly positioned in the data record.

The sync word number that the frame trigger is synchronized to is reported on each measurement screen, and on the status screen. The number of bit errors for this sync word is shown on the status screen.

c. Press `FT ERR ON OFF` until ON is underlined to enable the frame trigger error messages.

The `FT ERR ON OFF` softkey enables the error messages associated with the process of acquiring the frame trigger. See Chapter 6, "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.

---

8. Press `Demod Main` to return to the digital demodulator main menu.

Measuring Power

To make a power measurement, you use the functions that are accessed by pressing `Power`. This section contains the procedures for performing the following measurements:

- Measure the antenna power.
- Measure the carrier off leakage power.
- View the "power steps" of a carrier.
- Measure the occupied bandwidth.
- Monitor the transmit channel.

The power measurements make measurements for both digital and analog carriers according to the RCR STD-27C standard. The power measurements routines were specifically designed for measurements on $\pi/4$ DQPSK burst carriers, but these measurements are also applicable to FM analog carriers by selecting continuous carrier (CONT) with `BURST CONT` in the `Config` menu. Note that test equipment designed for analog carriers would not give correct results for burst digital 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, "Mobile Station Menu Map and Softkey Descriptions."

To set up a power measurement

1. Press Power . If Power is not displayed, press (MODE) PDC ANALYZER .
2. Press Power Setup to access the power setup functions. Power Setup allows you to change how power measurements will be measured and displayed.
3. Enter the number of points per sweep to be used for the occupied bandwidth measurement. OBW PTS/SWP allows a range of 21 to 401 points. The measurement will be faster with less points, but somewhat less accurate. The default is 401.
4. Select a trigger for power measurements (carrier power, carrier off power, carrier power steps). If you want to trigger power measurements on the video envelope, set PWR TRIG EXT VID to VID. If triggering power measurements from an external trigger signal, set PWR TRIG EXT VID to EXT. VID is the default setting.
5. If TRIG SRC DD EXT in the Config menu is set to DD, FT ACQ ON OFF will be present. Setting FT ACQ ON OFF to ON will force the spectrum analyzer to locate the sync word within the frame and generate the trigger for *externally* triggered power measurements.
6. Press Previous Menu .

To measure the antenna power

1. Make sure that the channel number selection agrees with the transmitter's RF output. See "To select a channel to test" in this chapter for more information.
2. If external triggering is used (PWR TRIG EXT VID is set to EXT), and the mobile station is being tested in burst mode, make sure that the slot number (SLOT NUMBER) corresponds to the slot number of the burst signal. See the description for the PWR TRIG EXT VID softkey under "The Configuration Menu" in Chapter 3, "Mobile Station Menu Map and Softkey Descriptions," for more information about external triggering. Video triggering is normally used for this measurement, and the slot number selection has no effect.
3. If ANTENNA POWER is not displayed, press Power. (If Power is not displayed, press (MODE) PDC ANALYZER to access Power.)
4. Press ANTENNA POWER. The personality will measure the mean carrier power during the burst and then display the results.
5. Press Previous Menu if you are 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. 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 and lower limits for the antenna power. The limits can be entered remotely; see "Customizing the PDC Personality" in Chapter 8, "Programming Examples," for more information. See Figure 2-4 for an example of the antenna power measurement.

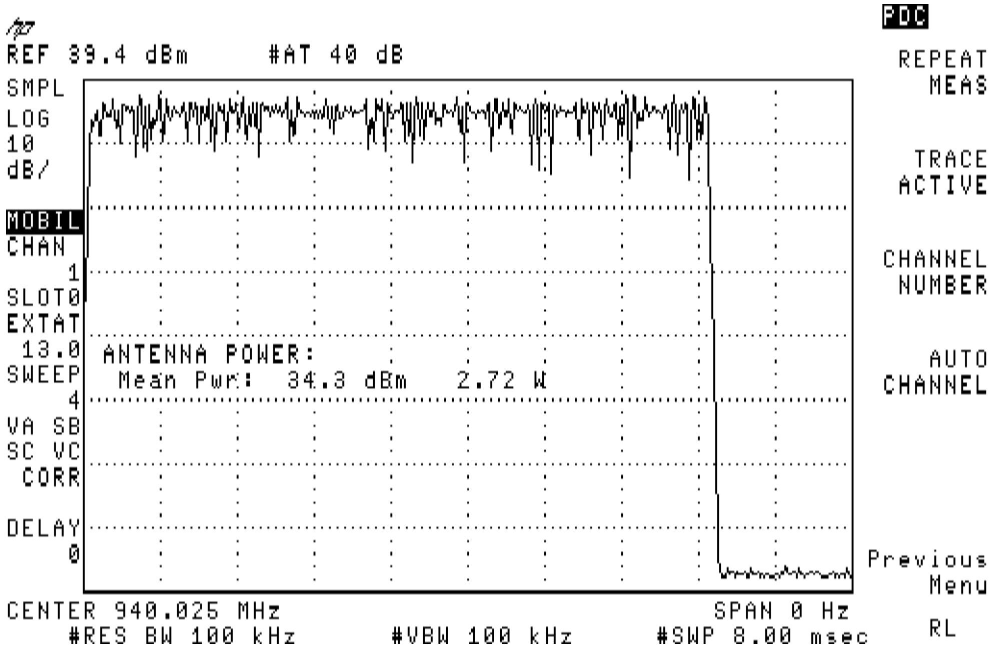

Figure 2-4. Antenna Power Measurement

RCR reference The antenna power measurement is based on RCR STD-27C 6.1.4.2, "Antenna Power Deviation (II)" and 3.4.2.1, "Transmission Output."

To measure the carrier off leakage power

1. Make sure that the channel number selection agrees with the transmitter's RF output. See "To select a channel to test" in this chapter for more information.
2. Perform the antenna power measurement before making the carrier off leakage power measurement. This is necessary because the carrier off leakage power determines a relative result with respect to the antenna power.
3. If external triggering is used (PWR TRIG EXT VID is set to EXT), and the mobile station is being tested in burst mode, make sure that the slot number (SLOT NUMBER) corresponds to the slot number of the burst signal. See the description for the PWR TRIG EXT VID softkey under "The Configuration Menu" in Chapter 3, "Mobile Station Menu Map and Softkey Descriptions," for more information about external triggering. Video triggering is normally used for this measurement, and the slot number selection has no effect.
4. If CARRIER OFF PWR is not displayed, press Power. (If Power is not displayed, press (MODE) PDC ANALYZER to access Power.)
5. Press CARRIER OFF PWR. The personality will make the measurement and display the results.
6. Press Previous Menu if you are done with the carrier off leakage power measurement, or use one of the post-measurement functions.

CARRIER OFF PWR measures the mean carrier power when the carrier is off (the carrier is off between burst transmissions). Two values are then determined. They are an absolute value (in dBm), and a ratio (in dB), with respect to the last measured antenna power. CARRIER OFF PWR sets the reference level to −20 dBm and the input attenuation to 10 dB. This causes the peak of the carrier waveform to go above the reference level, so that the carrier off level can be measured.

The mean carrier off power is measured by the RCR STD-27C method that computes the average power on a slot-by-slot basis, except for the carrier slot.

The mean carrier off power measurement can be made by the RCR STD-27B method that computes the average power over the complete off-part of the burst. The mean power is measured in the time region where the waveform is less than 10 dB above the peak value obtained at the center of the off region. To use this method set the remote command _RCRSTD to 2. See Chapter 7, "Programming Commands."

The mean carrier off leakage power is measured over several sweeps, and then the results are displayed. 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. Pass/ Fail checking gives a pass if *either* the absolute *or* relative result is less than the corresponding limit value. See Figure 2-5 for an example of a carrier off power measurement.

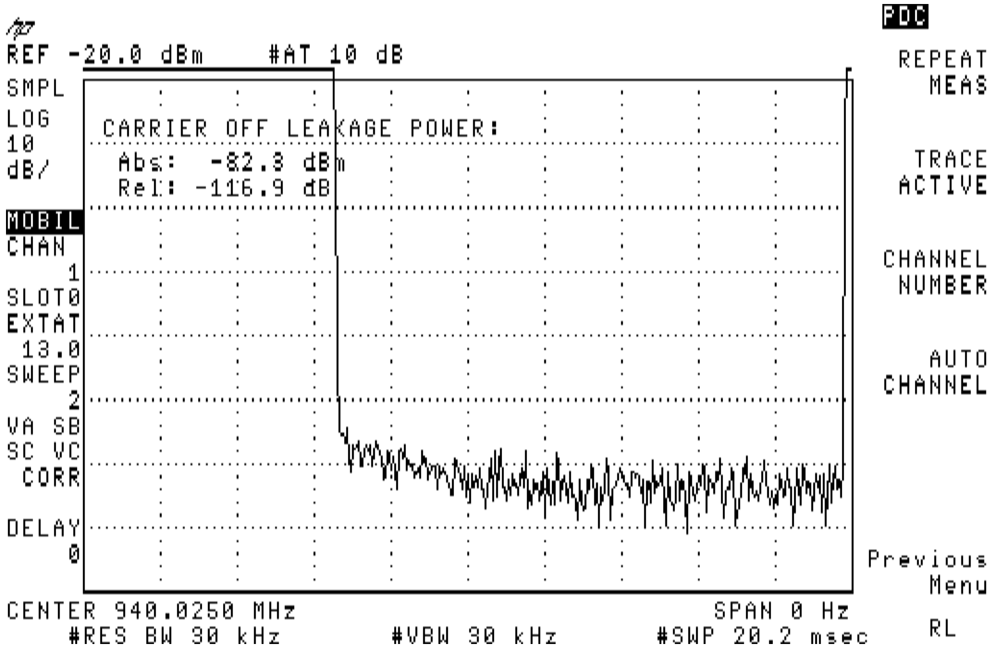

Figure 2-5. Carrier Off Leakage Power Measurement

RCR reference The carrier off leakage power is based on RCR STD-27C 6.1.5, “Leakage Power During Carrier Off” and 3.4.2.5, “Leakage Power During Carrier Off Time.”

The measurement can also be made based on RCR STD-27B. See the _RCRSTD command in Chapter 7, “Programming Commands.”

To measure the power steps of a carrier

1. Make sure that the channel number selection agrees with the transmitter's RF output. See "To select a channel to test" in this chapter for more information.
2. Perform the antenna power measurement with the transmitter set to the highest power level to be measured. See "To measure the antenna power" for more information about the antenna power measurement. Perform the antenna power measurement before the power step measurement because the power step measurement adjusts the reference level and input attenuator according to the peak power that was measured by the antenna power measurement. The power step measurement adjusts the reference level and attenuation so the peak power of the carrier is positioned 2 dB below the reference level.
3. If external triggering is used (PWR TRIG EXT VID is set to EXT), and the mobile station is being tested in burst mode, make sure that the slot number (SLOT NUMBER) corresponds to the slot number of the burst signal. See the description for the PWR TRIG EXT VID softkey under "The Configuration Menu" in Chapter 3, "Mobile Station Menu Map and Softkey Descriptions," for more information about external triggering. Video triggering is normally used for this measurement, and the slot number selection has no effect. If PWR TRIG EXT VID is set for external triggering, skip steps 4 and 7.
4. Turn off the transmitter.
5. If POWER STEP is not displayed, press Power More 1 of 2. (If Power is not displayed, press (MODE) PDC ANALYZER to access Power.)
6. Press POWER STEP. A message will appear; this message is a reminder that the power step measurement is normally triggered by turning on the transmitter after it has been turned off.
7. Turn on the transmitter.
8. When the spectrum analyzer begins to sweep, you can increase or decrease the output power of the carrier.
9. 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). Then press (MODE) twice to return to the previous PDC menu, turn off the transmitter, press REPEAT MEAS, and then turn on the transmitter.
10. You may want to use the spectrum analyzer marker functions to determine the amplitude of each step. To place a marker on the highest level, press (PEAK SEARCH). If you want to find the difference between the highest level and a lower level, press MARKER DELTA and then use the large knob on the spectrum analyzer front panel to move the marker. Press (MODE) (MODE) to return to the post-measurement menu.
11. Press Previous Menu if you are done with the power step measurement, or use one of the post-measurement functions.

The POWER STEP measurement takes one measurement sweep that lasts 8 seconds. During that time, you can increase or decrease the output power of the carrier and view the results. See Figure 2-6 for an example of the power step measurement.

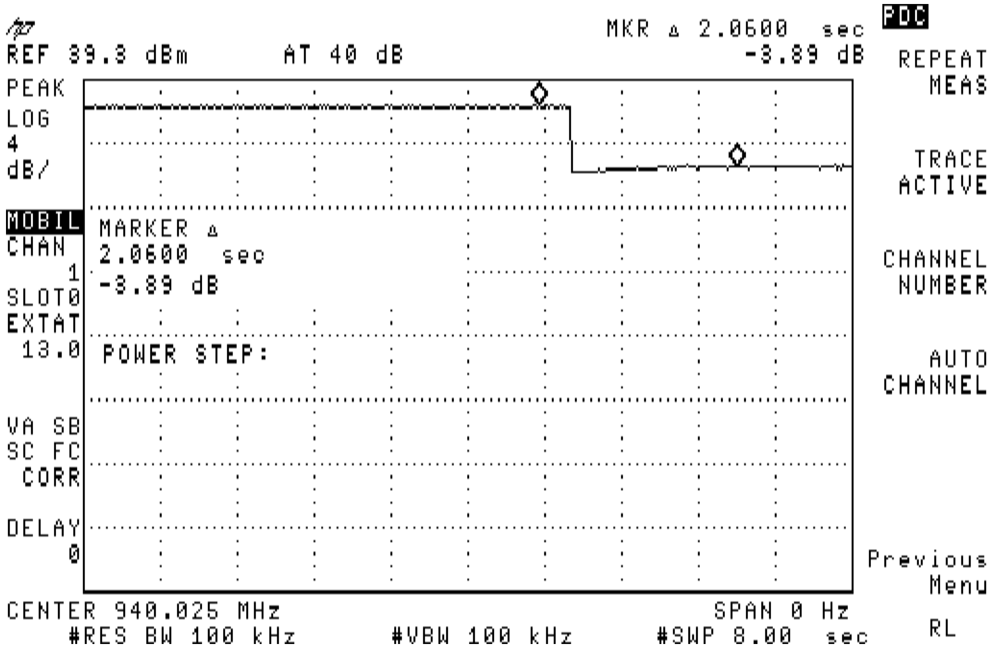

Figure 2-6. Power Step Measurement

To measure the occupied bandwidth

1. Make sure that the channel number selection agrees with the transmitter's RF output. See "To select a channel 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) PDC ANALYZER to access Power.)
3. Press OCCUPIED BANDWDTH. The PDC measurements personality automatically sets the reference level and input attenuation based upon the measured carrier, measures the 99 percent occupied power bandwidth and the approximate center frequency error of the transmitted signal, and then displays the results. (OCCUPIED BANDWDTH only approximates the center frequency error; it does not provide an accurate measurement).
4. Press Previous Menu if you are 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 approximate center frequency error 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 ON 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.

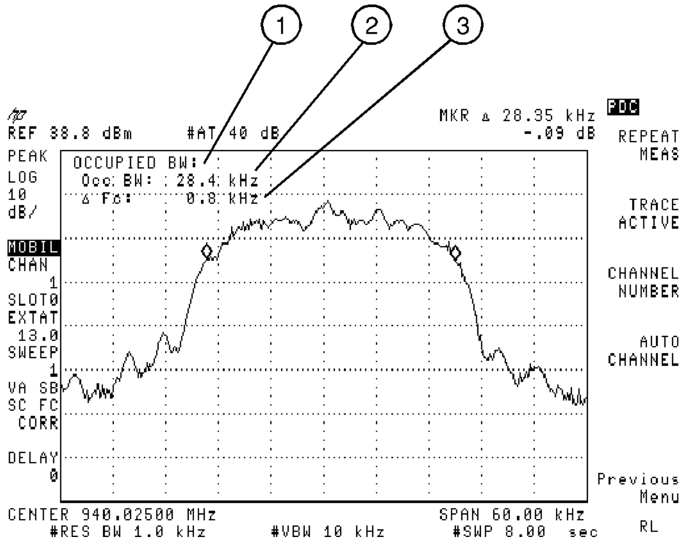

Figure 2-7. Occupied Bandwidth Measurement

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 approximate center frequency error.

RCR reference The occupied bandwidth measurement is based on RCR STD-27C 6.1.3, “Occupied Bandwidth” and 3.4.2.7, “Permissible Occupied Frequency Bandwidths.”

To monitor the transmit channel

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

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

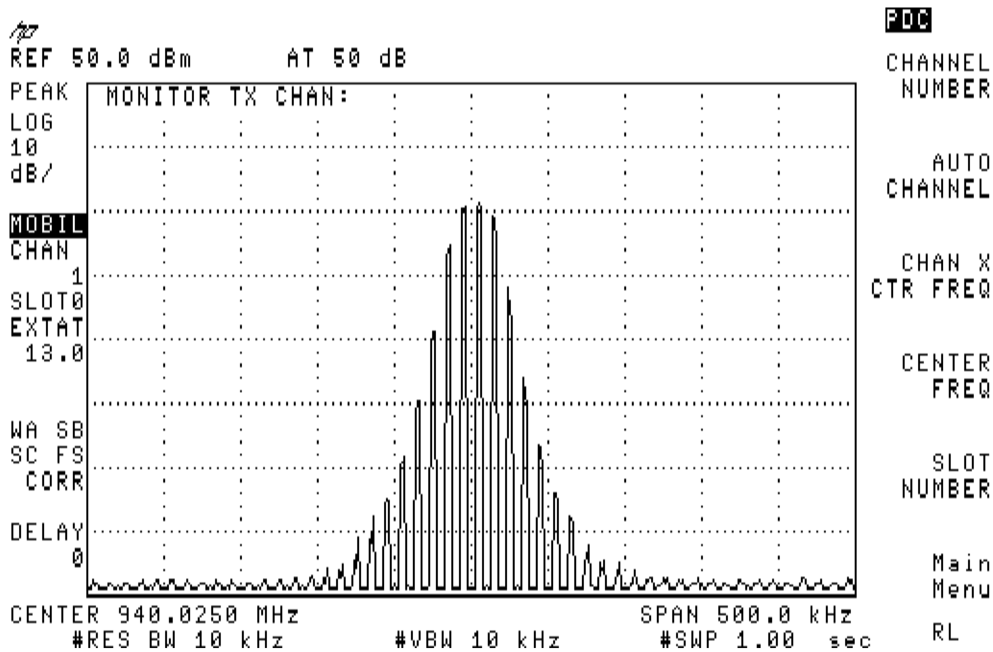

Figure 2-8. Viewing Channel 1

Measuring the Time Domain Characteristics of a PDC Burst

The power versus time measurements analyze the amplitude profile and timing of the burst of a mobile station transmission. The personality uses the setting of SLOT NUMBER to determine which burst period to examine.

This section contains the following procedures:

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

Note A trigger signal is required for all the power versus time measurements. If you have trouble performing any of the power versus time measurements, you should make sure that the selection for Period 40ms 20ms TRIG SRC DD EXT TRIG POL NEG POS, and TRIG DELAY are correct and that a TTL trigger signal is connected to the GATE TRIGGER INPUT on the analyzer rear panel. For more information, see step 3 in Chapter 1, "Getting Started," and "To configure the personality," earlier in this chapter.

RCR reference The power versus time measurements are based on RCR STD-27C 6.1.6, "Transmission Ramp-up and Ramp-down Power" and 3.4.2.4, "Mobile station burst transmission transient response characteristics." The measurement can also be made based on RCR STD-27B. See the _RCRSTD command in Chapter 7, "Programming Commands."

To set up a power versus time measurement

1. Make sure that the channel number selection agrees with the transmitter's RF output. See "To configure the personality" earlier in this chapter for more information.
2. Press Power vs Time. (If Power vs Time is not displayed, press (MODE) PDC ANALYZER to access that softkey.)
3. Press P vs T Setup to access the power versus time 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:

   - The number of sweeps
   - Either maximum and minimum peaks or averaged trace data
   - Either a 70 or a 110 dB amplitude range. (If you select the 110 dB amplitude range, 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.)
   - The number of bits
   - Synchronized trigger type
   - Frame trigger acquisition prior to measurements

4. If you want 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).
5. If you want 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 (see Figure 2-9). If you want 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 (see Figure 2-10). Averaging (MEASURE AVG PKS is set to AVG) applies only if the number of sweeps is set to more than 1. The default for this function is average (AVG).
6. If you want the power versus time measurements to display an amplitude range of 110 dB, press RANGE dB 70 110 so that 110 is underlined. Or, if you want an amplitude range of 70 dB, press RANGE dB 70 110 so that 70 is underlined. The default for this function is 110 dB.
7. The full power portion of the burst usually contains 270 bits (135 symbols), but may contain 258 bits (129 symbols). If the burst contains 270 bits, press BITS 258 270 so that 270 is underlined. If the burst contains 258 bits, press BITS 258 270 so that 258 is underlined. The default for this function is 270.

8. If TRIG SRC DD EXT is set to DD (under the Trigger Config menu), the synchronization word (sync word) in the data stream is used as the trigger source, and the TRIG SRC FRM VID and FT ACQ ON OFF softkeys are displayed in the P vs T Setup menu.

   - Set TRIG SRC FRM VID to FRM (the default) when you want the measurement to trigger on the frame trigger signal routed to the EXT TRIG INPUT connector on the rear panel. This off-the-air frame trigger signal has a fixed period of 40 ms. If this does not match the mobile station frame period closely, the on-screen waveform may drift.
   - Setting TRIG SRC FRM VID to VID will cause the measurement to set up a *synchronized* video-triggered sweep such that the sync word position in the data stream is correctly aligned on the screen. Since this is a video trigger occurring on the burst signal, the screen waveform will not drift.
   - Set FT ACQ ON OFF to ON (frame trigger acquisition ON) to force the measurement to locate the sync word within the frame and appropriately delay the trigger. This frame trigger acquisition procedure is 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 frame trigger acquisition timing. This decreases the measurement time.

Note The carrier frequency must not be more than 3.5 kHz from the nominal channel center frequency for frame trigger acquisition to be successful.

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9. If TRIG SRC DD EXT is set to EXT, a trigger signal external to the spectrum analyzer is used as the trigger source, and the TRIG SRC FRM VID and FT ACQ ON OFF softkeys are not displayed. The external trigger may come from the PDC unit under test, from a PDC unit that has a link established with the PDC unit under test, or from a device such as the 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.

10. Press Previous Menu if you are done with the P vs T Setup functions.

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.

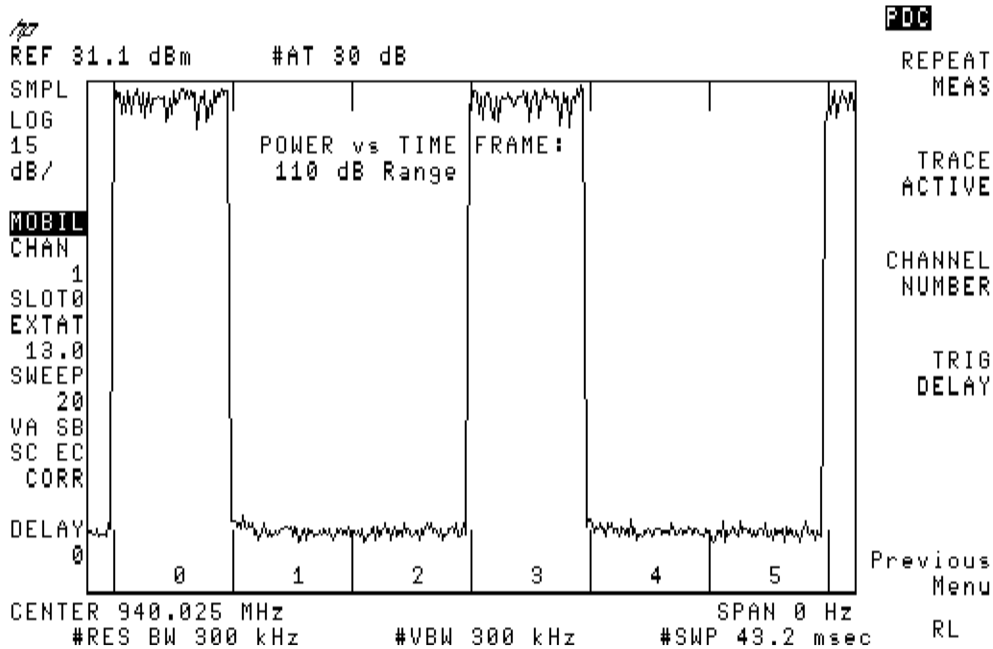


Figure 2-9. Measuring the Average of 20 Bursts

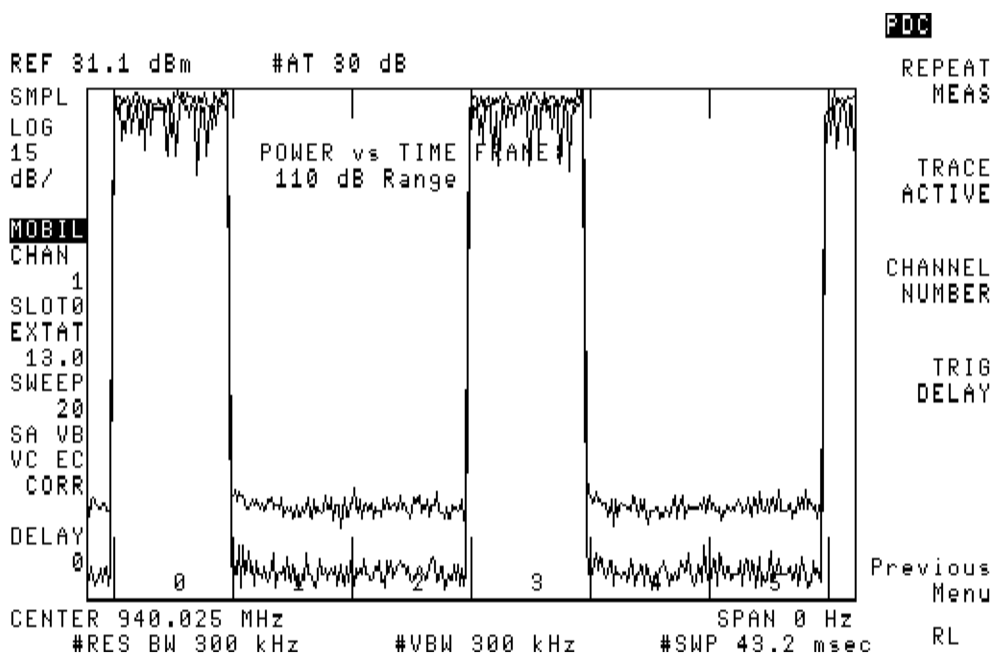


Figure 2-10. Measuring the Maximum and Minimum Peaks of 20 Bursts

To view the frame

1. Make sure that the channel number selection agrees with the transmitter's RF output. See "To select a channel 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) `PDC 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. If you are using an external trigger source (`TRIG SRC DD EXT` 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.)

   If you are using the digital demodulator off-the-air frame trigger as the gate trigger source (`TRIG SRC DD EXT` set to DD in the `Trigger Config` menu, and `FT ACQ ON OFF` set to ON in the `P vs T Setup` menu) the trigger delay can be set to zero. The frame trigger accurately positions the burst with respect to the limit lines by demodulated bit position, making trigger delay adjustment unnecessary. If `TRIG SRC FRM VID` is set to FRM in the `P vs T Setup` menu and the mobile station is in test mode (not locked to the base station), the burst may drift away from the limit line faster than the 1 bit per 15 minutes specified. In this case, trigger delay may be adjusted to keep the burst within the limit lines. No drift will occur if `TRIG SRC FRM VID` is set to VID, due to the *synchronized* video trigger used by the spectrum analyzer.
5. Press `Previous Menu` if you are 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 (TDMA) frame. Because one TDMA frame contains six slots, `P vs T FRAME` is a convenient way to determine which slots are off, and in which slots the bursts occur. 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.

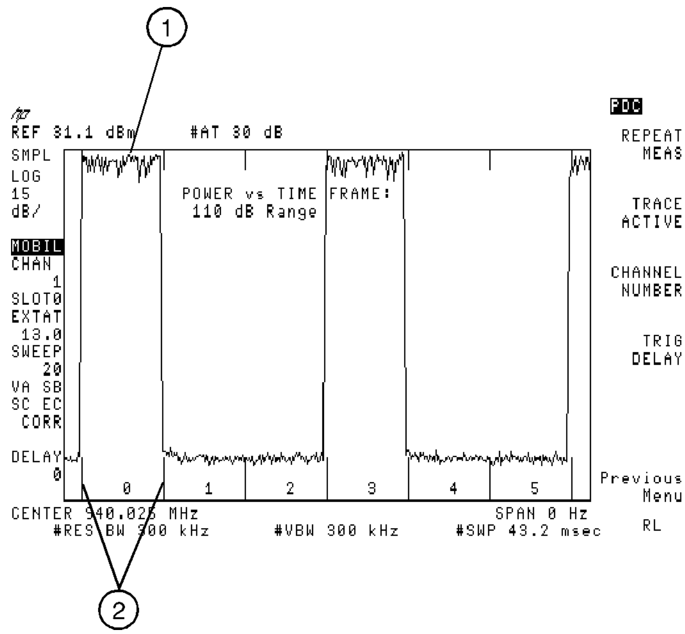


Figure 2-11. Viewing a Frame

Item	Description
1	The burst signal.
2	Indicates the starting and ending points for slot number 0.

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 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) `PDC ANALYZER` to access `Power vs Time`.)
3. Press `P vs T BURST` to display the transmission burst.
4. If you are using an external trigger source (`TRIG SRC DD EXT` 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 burst is symmetrical with respect to the limit lines. Or, if you know the actual trigger time delay, you can enter the time delay directly. In this case, press `TRIG DELAY`, enter the number with the data keys, and then press the appropriate units key ((sec), (ms), or (μs)).

   If you are using the digital demodulator off-the-air frame trigger as the gate trigger source (`TRIG SRC DD EXT` set to DD in the `Trigger Config` menu, and `FT ACQ ON OFF` set to ON in the `P vs T Setup` menu) the trigger delay can be set to zero. The frame trigger accurately positions the burst with respect to the limit lines by demodulated bit position, making trigger delay adjustment unnecessary. If `TRIG SRC FRM VID` is set to FRM in the `P vs T Setup` menu and the mobile station is in test mode (not locked to the base station), the burst may drift away from the limit line faster than the 1 bit per 15 minutes specified. In this case, trigger delay may be adjusted to keep the burst within the limit lines. No drift will occur if `TRIG SRC FRM VID` is set to VID, due to the *synchronized* video trigger used by the spectrum analyzer.
5. Press `Previous Menu` if you are 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. 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. The pass/fail message for the upper and lower limit lines is always displayed. The results from `P vs T BURST` can help you check your test setup, but for more 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.

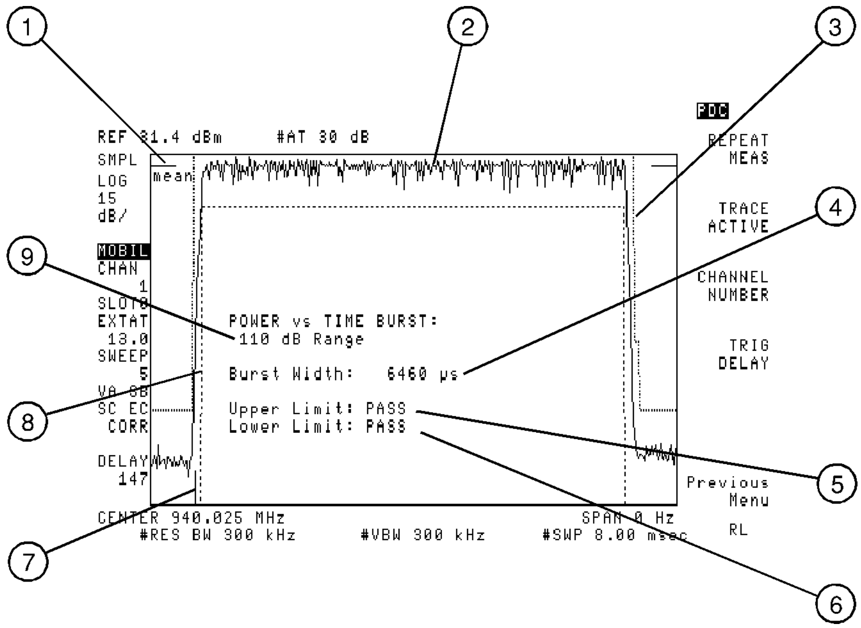


Figure 2-12. Measure a Burst

Item	Description
1	The mean value of the burst.
2	The burst signal.
3	The upper limit line. Because a portion of the upper limit line is specified at an absolute (dBm) level, the lower horizontal segments of the upper limit line can vary depending on the reference level.
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.
8	The lower limit line.
9	The selected display range (either 70 dB or 110 dB).

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 "To select a channel 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) PDC 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. If you are using an external trigger source (TRIG SRC DD EXT 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.

   If you are using the digital demodulator off-the-air frame trigger as the gate trigger source (TRIG SRC DD EXT set to DD in the Trigger Config menu, and FT ACQ ON OFF set to ON in the P vs T Setup menu) the trigger delay can be set to zero. The frame trigger accurately positions the burst with respect to the limit lines by demodulated bit position, making trigger delay adjustment unnecessary. If TRIG SRC FRM VID is set to FRM in the P vs T Setup menu and the mobile station is in test mode (not locked to the base station), the burst may drift away from the limit line faster than the 1 bit per 15 minutes specified. In this case, trigger delay may be adjusted to keep the burst within the limit lines. No drift will occur if TRIG SRC FRM VID is set to VID, due to the *synchronized* video trigger used by the spectrum analyzer.
5. Press Previous Menu if you are 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 measurement passed (PASS) or failed (FAIL) the numeric test limits. The pass/fail message for the upper and lower limit lines is always displayed.

P vs T RISING measures the attack time and allows you view the ramp up of a burst. The attack time is the time difference between the point 14 dB below the mean carrier level and the closest −56 dBm point (the markers are positioned at the −14 dB and −56 dBm points). See Figure 2-13 for an example of measuring the ramp up of a burst.

The width of the inner mask, from rising to falling, is 256 or 268 bits as specified in RCR STD-27C. By using the remote command _RCRSTD, the width of the inner mask can be changed to 258 or 270 bits, as specified in RCR STD-27B. For RCR STD-27C, the inner mask is shortened by 1 bit at both beginning and end of a burst as compared to RCR STD-27B.

The width of the outer mask, from rising to falling, is 268 or 280 bits for all revisions of the standard.

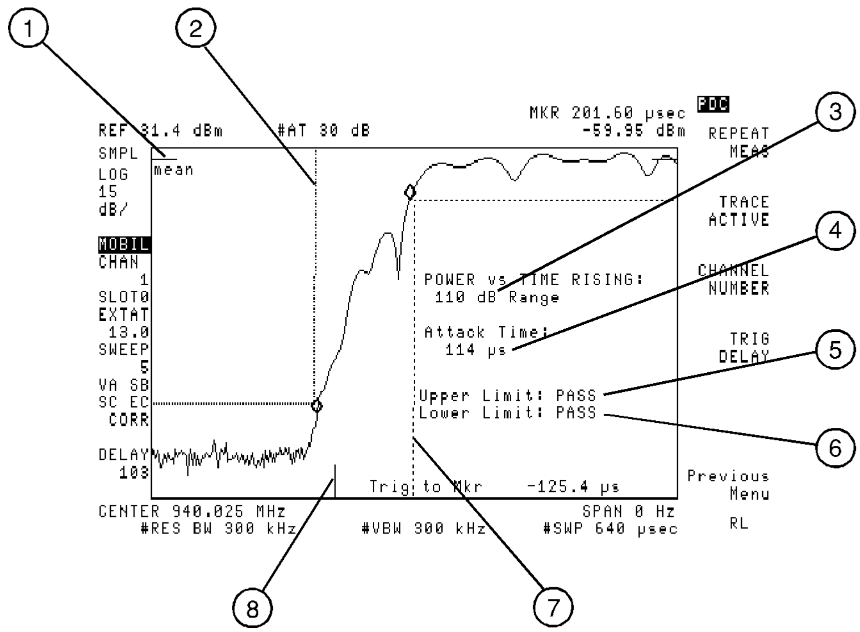


Figure 2-13. Measuring the Ramp Up of a Burst

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 attack time. The attack time is the time it takes the ramp up of the burst to transition from −56 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 for the burst.

P vs T FALLING measures the release time and allows you view the ramp down of a burst. The release time is the time difference between the point 14 dB below the mean carrier level and the closest −56 dBm point (the markers are positioned at the −14 dB and −56 dBm points). See Figure 2-14 for an example of measuring the ramp down of a burst.

The width of the inner mask, from rising to falling, is 256 or 268 bits as specified in RCR STD-27C. By using the remote command _RCRSTD, the width of the inner mask can be changed to 258 or 270 bits, as specified in RCR STD-27B. For RCR STD-27C, the inner mask is shortened by 1 bit at both beginning and end of a burst as compared to RCR STD-27B.

The width of the outer mask, from rising to falling, is 268 or 280 bits for all revisions of the standard.

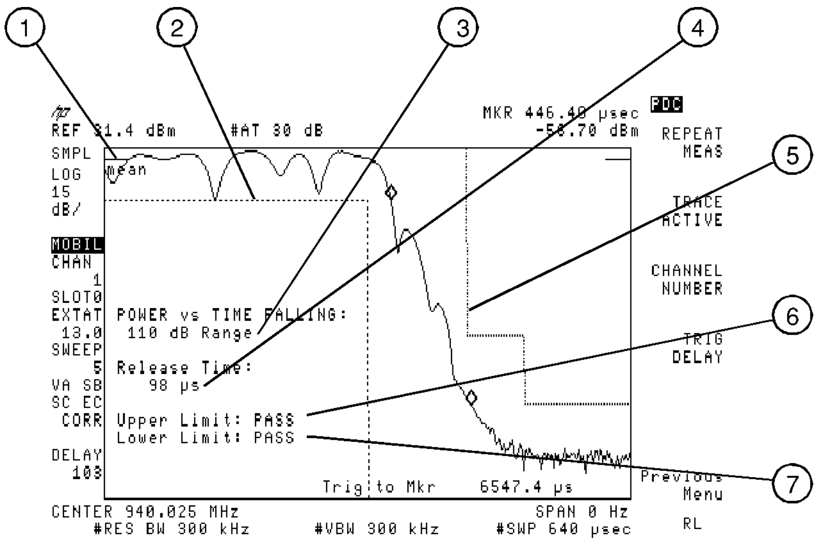


Figure 2-14. Measuring the Ramp Down of a Burst

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 −56 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 below the upper limit line. If the burst was below the upper limit line, PASS is displayed; otherwise, FAIL is displayed.
7	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.

Measuring Adjacent Channel Leakage Power

To make an adjacent channel power (ACP) measurement, use the functions that are accessed by pressing Adj Chan Power. This section contains the procedures for measuring the adjacent channel leakage power.

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, "Mobile Station Menu Map and Softkey Descriptions."

Three different ACP methods are provided for testing the burst carriers of mobile stations.

MKK ACP This method is the same as the ACP method used on continuous carriers (analog or digital), except that peak detection and a narrower video bandwidth (3 kHz) is used. It does not separate the modulation (random) and transient (impulsive) components of the spectrum. The random noise integration equation is applied to all components. Thus the transient components are under-reported in the displayed total result.

Time-Gated ACP This method uses time gating (gated video) to separate the modulation (random) and transient (impulsive) components. The correct equations are applied to the two components. The results are added together to obtain the total leakage power.

Two Bandwidth ACP This method uses measurements made in two resolution bandwidths to separate the modulation (random) and transient (impulsive) components. The correct equations are applied to the two components. The results are added together to obtain the total leakage power.

Note A trigger signal is required for gated adjacent channel power measurements. If you have trouble performing the gated adjacent channel power measurement, make sure that the selection for TRIG SRC DD EXT PERIOD 40ms 20ms TRIG POL NEG POS and TRIG DELAY are correct and that a TTL trigger signal is connected to the GATE TRIGGER INPUT on the analyzer rear-panel. For more information, see Step 3 in Chapter 1, "Getting Started," and "To configure the personality" earlier in this chapter.

To measure the adjacent channel leakage power (MKK method)

1. Make sure that the channel number selection agrees with the transmitter's RF output. See "To select a channel to test" earlier in this chapter for more information.
2. Press Adj Chan Power. (If Adj Chan Power is not displayed, press (MODE) PDC ANALYZER to access Adj Chan Power.)
3. Make the ACP measurement with ACP MKK.
   a. Press ACP MKK. The personality measures the total transmitted power, as well as the power in the upper and lower adjacent and alternate channels. One measurement sweep is taken, using peak detection.
   b. If you want to view the spectrum (trace) results of the 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.
4. Press Previous Menu if you are done with the ACP measurement, or use one of the post-measurement functions.

An ACP measurement measures the power that "leaks" from the transmit channel into adjacent and alternate channels. ACP MKK does 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. Thus, the transient components are under-reported in the displayed total result. Numeric ACP results are displayed for the leakage ratios. The personality uses the spectrum analyzer peak detector and a 21 kHz integration bandwidth to measure the power in the adjacent channels.

Figure 2-15 shows the table results for an ACP MKK measurement. Figure 2-16 shows the spectrum results for an ACP MKK measurement.

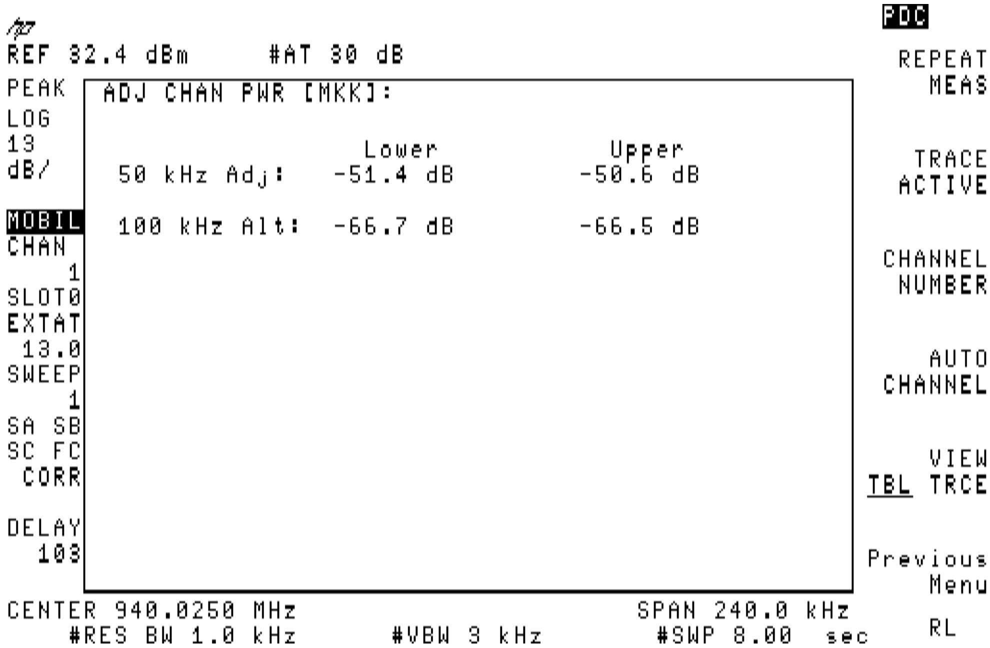


Figure 2-15. Table Results for the ACP MKK Measurement

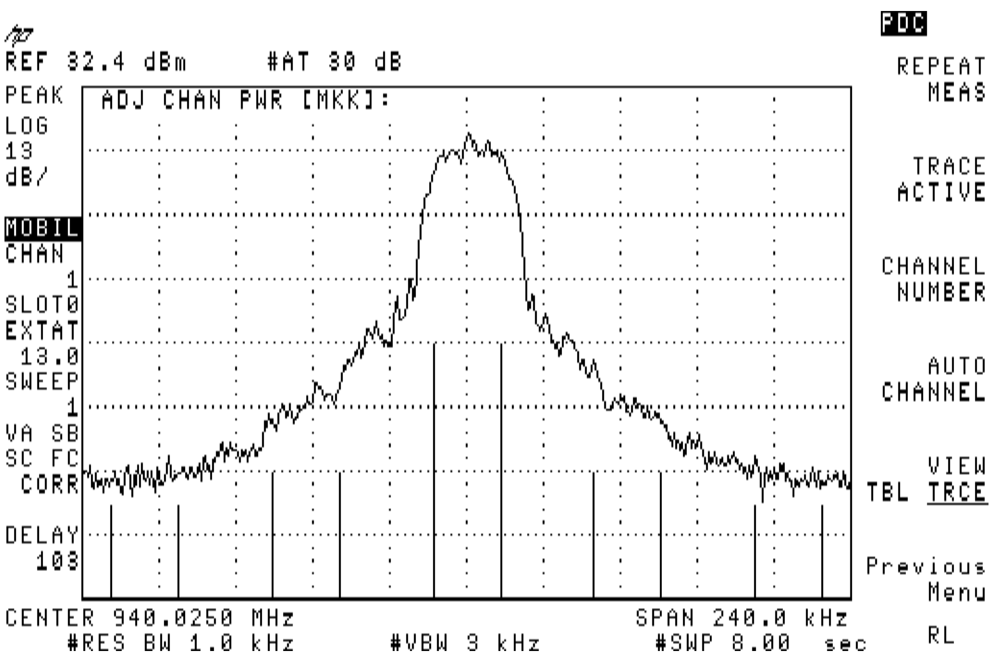


Figure 2-16. Spectrum Results for the ACP MKK Measurement

To measure the adjacent channel leakage power (time-gated method)

1. Make sure that the channel number selection agrees with the transmitter RF output. See "To select a channel to test" earlier in this chapter for more information.
2. Press `Adj Chan Power`. If `Adj Chan Power` is not displayed, press (MODE) `PDC ANALYZER` to access `Adj Chan Power`.
3. Press `ACP SETUP` to access the ACP setup menu.
4. If using the digital demodulator off-the-air frame trigger as the gate trigger source (`TRIG SRC DD EXT` set to DD), set `FT ACQ ON OFF` to ON. Setting `FT ACQ ON OFF` to ON will cause the measurement to acquire the digital demodulator frame trigger before every gated adjacent channel power measurement.

Note The carrier frequency must not be more than 3.5 kHz from the nominal channel center frequency for frame trigger acquisition to be successful.

Setting `FT ACQ ON OFF` to OFF will permit a gated adjacent channel power measurement without a frame trigger acquisition. This will decrease measurement time, but may allow the frame trigger to drift out of position.

5. Press `Previous Menu`.
6. Make the ACP measurement with either `ACP GTD` or `ACP GTD CH/SWP`.

   a. For a fast measurement, press `ACP GTD` (GTD means time-gated). The personality measures the total transmitted power, as well as the power in the upper and lower adjacent and alternate channels. The personality uses two measurement sweeps to do this. The first sweep uses time-gating to measure the ACP due to modulation (without transients). The second measurement sweep measures the ACP including transients. The numerical results are displayed for the total adjacent channel leakage power ratio. Results for the modulation (random) and transient (impulsive) components are also displayed.

   b. If you want to view the spectrum (trace) results of the 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,

a. For a slower but more accurate (and more repeatable) measurement, press ACP GTD CH/SWP. ACP GTD CH/SWP performs one measurement sweep for every channel, using a 1 kHz resolution bandwidth and 21 kHz span.

b. If desired, fewer data points can be specified for ACP GTD CH/SWP. To select the number of data points, press PTS/SWP in the ACP Setup menu, enter a number from 21 to 401 (the lower the number the faster the measurement) with the data keys, press (ENTER), and then press ACP GTD CH/SWP. Decreasing the number of data points makes ACP GTD CH/SWP faster, but less accurate. Decreasing the number of data points also truncates the displayed trace. The default number of data points is 401.

7. Press Previous Menu if you are done with the ACP measurement, or use one of the post-measurement functions.

An ACP measurement measures the power that "leaks" from the transmit channel into adjacent and alternate channels. ACP GTD and ACP GTD CH/SWP use time-gated (gated video) spectrum analysis to separate the spectrum due to modulation and the spectrum due to transients (ramping) from the full spectrum. The random power integration equation is applied to the modulation and noise components, and the impulsive power integration equation is applied to the transient component. The total is obtained by adding together the results of these two equations. Numeric ACP results are displayed for the leakage ratios due to modulation, due to transients and the total. The personality uses the spectrum analyzer peak detector and a 21 kHz integration bandwidth to measure the power in the adjacent channels. 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.

See Figure 2-17 for an example of the numerical results of an ACP time-gated measurement. See Figure 2-18 for an example of the trace results of an ACP time-gated measurement.

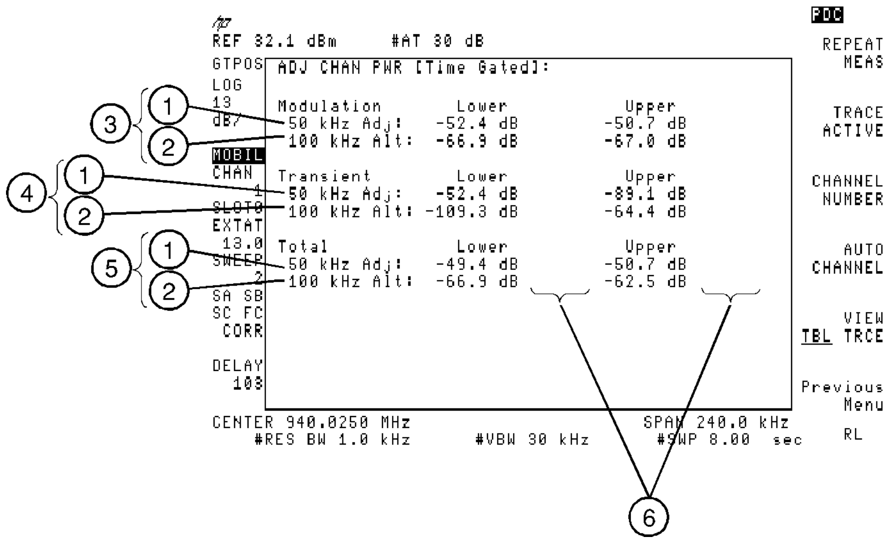


Figure 2-17. Table Results for the ACP Time-Gated Measurement

Item	Description
1	The power leakage (relative to the carrier power) into the upper and lower channels that are spaced 50 kHz from the carrier (adjacent channel).
2	The power leakage (relative to the carrier power) into the upper and lower channels that are spaced 100 kHz from the carrier (alternate channel).
3	The ACP leakage due to modulation.
4	The ACP leakage due to transients.
5	The ACP leakage due to transients and modulation (total).
6	An F next to any of the measured values indicates that the measured value failed the measurement limits.

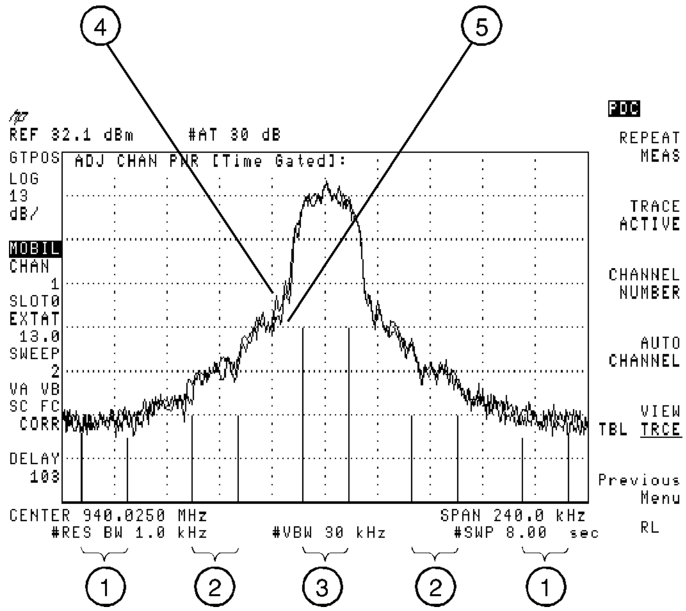


Figure 2-18. Spectrum Results of the ACP Time-Gated Measurement

Item	Description
1	Indicates the integration bandwidth of the alternate channel.
2	Indicates the integration bandwidth of the adjacent channel.
3	Indicates the integration bandwidth of the carrier channel.
4	This trace (trace A) is the full spectrum.*
5	This trace (trace B) is the spectrum due to modulation (time-gated).*
* Traces A and B may be viewed independently. Press TRACE to access the softkey menu that manipulates display trace math.	

You can use either ACP GTD CH/SWP or ACP GTD to perform an adjacent channel measurement, but there are some differences between the two functions. The following table compares the two functions.

Differences	ACP GTD	ACP GTD CH/SWP
Number of sweeps	Performs two measurement sweeps.	Performs a measurement sweep for each channel.
Measurement time	Faster	Slower*
Measurement accuracy	Not as accurate as ACP GTD CH/SWP	More accurate* than ACP GTD
Allows you to view table and trace	Yes	No (table only)
* You can use PTS/SWP to decrease the amount of time for an ACP GTD CH/SWP measurement, but the accuracy is decreased also. PTS/SWP allows you to specify the number of data points used for the ACP GTD CH/SWP measurement.		

To measure the adjacent channel leakage power (two bandwidth method)

1. Make sure that the channel number selection agrees with the transmitter's RF output. See "To select a channel to test" earlier in this chapter for more information.
2. Press `Adj Chan Power`. (If `Adj Chan Power` is not displayed, press (MODE) `PDC ANALYZER` to access `Adj Chan Power`.)
3. Make the ACP measurement with `ACP 2BW`.
   a. Press `ACP 2BW`. The personality measures the total transmitted power as well as the power in the upper and lower adjacent and alternate channels. The personality uses two measurement sweeps to do this. The first sweep uses a 1 kHz resolution bandwidth. The second measurement sweep uses a 3 kHz resolution bandwidth. The numerical results are displayed for the total adjacent channel leakage power ratio. Results for the modulation (random) and transient (impulsive) components are also displayed.
   b. If you want to view the spectrum (trace) results of the 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.
4. Press `Previous Menu` if you are done with the ACP measurement, or use one of the post-measurement functions.

An ACP measurement measures the power that "leaks" into adjacent and alternate channels. `ACP 2BW` uses measurements made with two different resolution bandwidths to separate the spectrum due to modulation from the spectrum due to transients (ramping).

The random power integration equation is applied to the modulation and noise components, and the impulsive power integration equation is applied to the transient component. The total is obtained by adding together the results of these two equations. Numeric ACP results are displayed for the leakage ratios due to modulation, due to transients and the total. The personality uses the spectrum analyzer peak detector and a 21 kHz integration bandwidth to measure the power in the adjacent channels. 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.

Figure 2-19 shows the table results of an ACP 2-bandwidth measurement. Figure 2-20 shows the spectrum results for an ACP 2-bandwidth measurement.

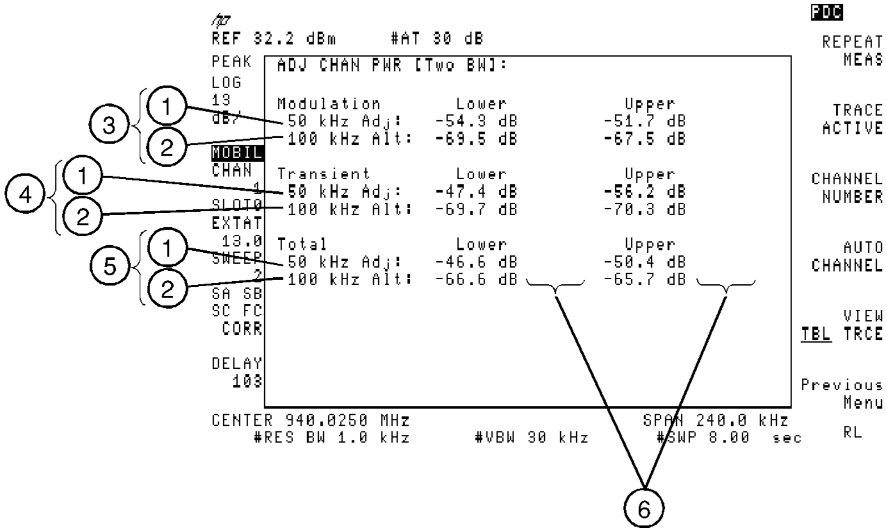


Figure 2-19. Table Results for the ACP 2BW Measurement

Item	Description
1	The power leakage (relative to the carrier power) into the upper and lower channels that are spaced 50 kHz from the carrier (adjacent channel).
2	The power leakage (relative to the carrier power) into the upper and lower channels that are spaced 100 kHz from the carrier (alternate channel).
3	The ACP leakage due to modulation.
4	The ACP leakage due to transients.
5	The ACP leakage due to transients and modulation (total).
6	An F next to any of the measured values indicates that the measured value failed the measurement limits.

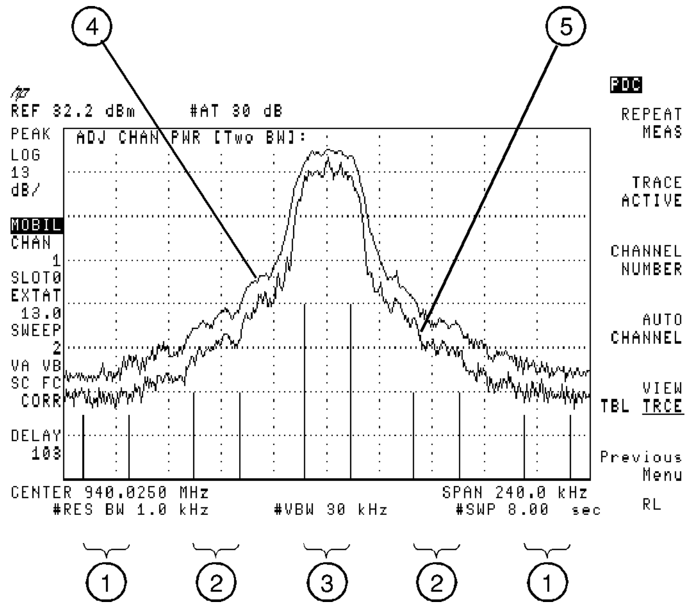


Figure 2-20. Spectrum Results for the ACP 2BW Measurement

Item	Description
1	Indicates the integration bandwidth of the alternate channel.
2	Indicates the integration bandwidth of the adjacent channel.
3	Indicates the integration bandwidth of the carrier channel.
4	This trace (trace B) is the spectrum using 3 kHz resolution bandwidth.
5	This trace (trace A) is the spectrum using 1 kHz resolution bandwidth.

RCR reference ACP measurements are based on RCR STD-27C 6.1.8, “Leakage Power of Adjacent Channel,” and 3.4.2.3, “Adjacent Channel Leakage.”

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 "List spectrum analyzer options and firmware revision" in the beginning part of Chapter 1, "Getting Started," to quickly determine the options installed in your analyzer.

This section contains the following procedures:

- Measure the modulation accuracy of a PDC digital mobile station. 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 of a PDC digital mobile station.
- Make a fast modulation accuracy measurement by choosing a partial modulation accuracy measurement.
- 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.
- Save the measurement data so that I-Q graphs and demodulated data bits for the same burst can be displayed.
- Calibrate the modulation accuracy measurement to correct for the inaccuracies of the spectrum analyzer hardware.

Note If the carrier frequency is more than 3.5 kHz away from the nominal channel center frequency, the measurement results may not be accurate.

To perform a full modulation accuracy measurement

1. Make sure that the channel number selection and timeslot number agree with the transmitter's RF output.
2. If the digital demodulator main menu is not displayed, press (MODE) PDC 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 for SINGLE CONT is SINGLE.
5. Press FULL PARTIAL until FULL is underlined to select a full set of modulation accuracy measurements. A full modulation 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. The default for FULL PARTIAL 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. If the SAV MEAS ON OFF softkey is present, press SAV MEAS ON OFF until OFF is underlined. See "To hold measurement data for viewing graphs and demodulated data bits" for details on how to use SAVE MEAS ON OFF. Note that after a successful modulation accuracy measurement, measured data for I-Q graphs and demodulated data bits are also available.

   Using SAV MEAS ON OFF permits I-Q graphs and data bits to be viewed without making a separate I-Q graph or data bits measurement.
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 Config, 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-27C. EVM is calculated after I-Q origin offset and carrier frequency error have been extracted from the measured data. For a mobile station, the measurement interval includes 135 of the transmitted symbol decision points of a mobile station burst. Modulation metrics are calculated using measured data only at symbol decision points.

By using the remote command _RCRSTD, the number of symbol decision points included in the measurement can be changed to 136 to comply with the procedures outlined in RCR STD-27B.

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 1 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 will be acquired at every SINGLE measurement and the first CONT 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 timeslot 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 2-21 for an example of the full modulation accuracy measurement screen.

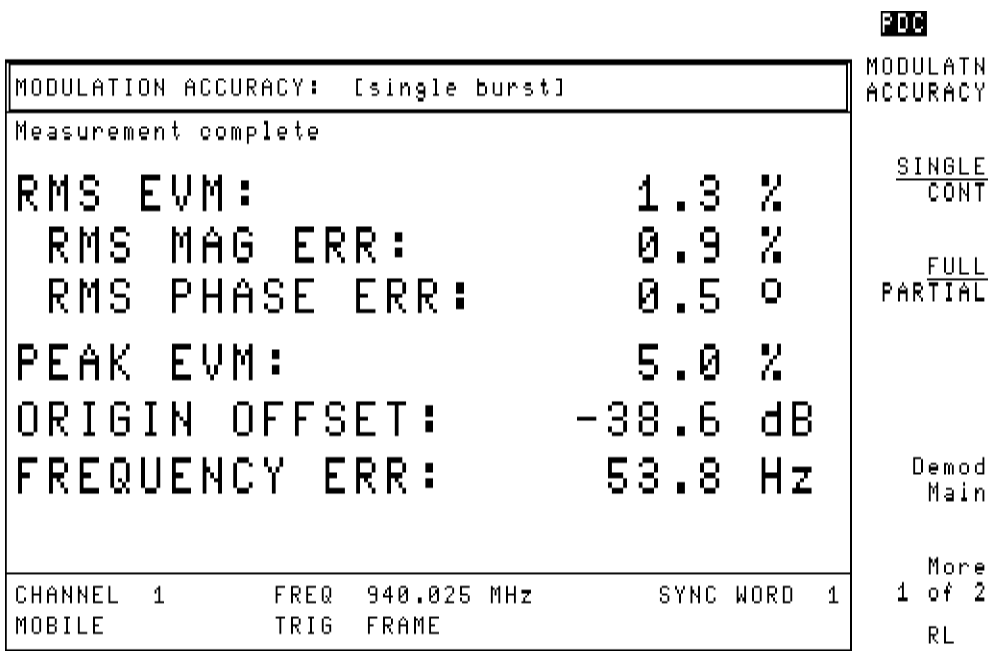


Figure 2-21. Full Modulation Accuracy Measurement

RCR reference Modulation accuracy measurements are based on RCR STD-27C "Modulation Accuracy," and 3.4.2.9 "Modulation Precision."

The measurement can also be made based on RCR STD-27B. See the _RCRSTD command in Chapter 7, "Programming Commands."

To perform a partial modulation accuracy measurement

1. Make sure that the channel number selection and timeslot number agree with the transmitter's RF output.
2. If the digital demodulator main menu is not displayed, press (MODE) PDC 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 for SINGLE CONT is SINGLE.
5. Press FULL PARTIAL until PARTIAL is underlined to select a partial set of modulation accuracy measurements. A partial modulation accuracy measurement includes the RMS error vector magnitude (EVM), RMS magnitude error, RMS phase error, peak EVM, and I-Q origin offset.

   Underlining PARTIAL excludes the carrier frequency error from the modulation accuracy tests performed. Carrier frequency error requires the spectrum analyzer center frequency to be tuned using 1 Hz resolution to optimize frequency accuracy of the measurement. Fine tuning the center frequency requires about one second, causing carrier frequency error measurement to slow the modulation accuracy measurement. A partial measurement of EVM is faster than a full measurement.

   The default for FULL PARTIAL 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. If the SAV MEAS ON OFF softkey is present, press SAV MEAS ON OFF until OFF is underlined. See "To hold measurement data for viewing" for details on how to use SAVE MEAS ON OFF.

   Note that after a successful modulation accuracy measurement, results for I-Q graphs, and demodulated data bits are also available.

   Using SAV MEAS ON OFF permits I-Q graphs and data bits to be viewed without making a separate I-Q graph or data bits measurement.
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, and I-Q origin offset.

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, you can use the CHANNEL NUMBER or CHAN X CTR FREQ keys available by pressing Demod Main Demod Config 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-27C. EVM is calculated after I-Q origin offset and carrier frequency error have been extracted from the measured data. For a mobile station, the measurement interval includes 135 of the transmitted symbol decision points of a mobile station burst. Modulation metrics are calculated using measured data only at symbol decision points. By using the remote command _RCRSTD, the number of symbol decision points included in the measurement can be changed to 136 to comply with the procedures outlined in RCR STD-27B.

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 1 Hz resolution to optimize the accuracy of the EVM measurement. For continuous measurements in partial mode, the spectrum analyzer is tuned once at the first measurement made, and is not relocked unless the MODULATN ACCURACY softkey is pressed again.

If the digital demodulator trigger is set to FRAME, frame trigger synchronization will be acquired at every SINGLE measurement and the first CONT 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 timeslot 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 2-22 for an example of the partial modulation accuracy measurement screen.

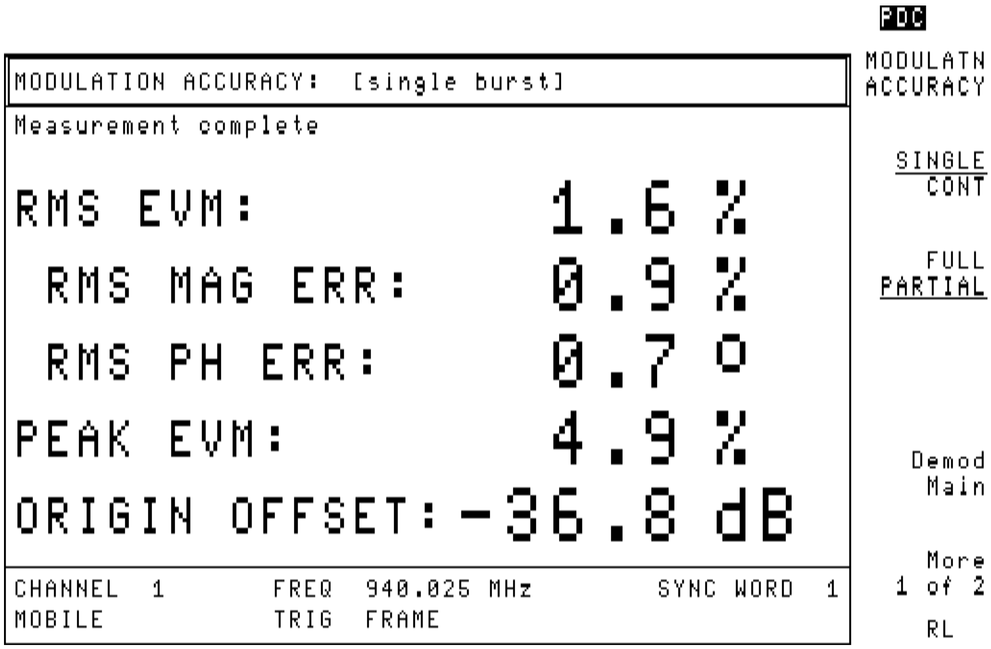


Figure 2-22. Partial Modulation Accuracy Measurement

To find the average error vector magnitude

1. Make sure that the channel number selection and timeslot number agree with the transmitter's RF output.
2. If the digital demodulator main menu is not displayed, press (MODE) PDC ANALYZER MORE 1 OF 2 Digital Demod.
3. Press Modulatn to access the modulation accuracy measurements menus.
4. Press FULL PARTIAL until FULL or PARTIAL is underlined to select either a full or a partial set of modulation accuracy measurements. A full 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.

   Selecting PARTIAL excludes carrier frequency error from the modulation accuracy tests performed. Carrier frequency error requires the spectrum analyzer center frequency to be tuned using 1 Hz resolution to optimize frequency accuracy of the measurement. Fine tuning the center frequency requires about one second, causing carrier frequency error measurement to slow the modulation accuracy measurement. A partial measurement of EVM is faster than a full measurement.

   The default for FULL PARTIAL is FULL.
5. Press More 1 of 2.
6. 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.
7. If the SAV MEAS ON OFF softkey is present, press SAV MEAS ON OFF until OFF is underlined.
8. Press More 2 of 2 to return to the previous menu.
9. 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, and I-Q origin offset. Carrier frequency error will appear if a full measurement was selected.

   To stop a measurement in progress, press STOP MEAS.

   To repeat the measurement, press MODULATN 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 an update of 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 bursts measured. This includes the mean, standard deviation, minimum and maximum values for RMS EVM, RMS magnitude error, and RMS phase error. Mean carrier frequency error and I-Q origin offset are also displayed. The accuracy of the statistical values depends on the number of bursts included in the calculations.

Uncertainty ranges for RMS EVM for room and full temperature measurement conditions are also displayed. The true RMS EVM of the averaged 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.

Note that the SAV MEAS ON OFF function is not available after executing an averaged measurement. Also, SINGLE CONT will be set to SINGLE 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 2-23 for an example of the statistics screen for a full measurement.

See Figure 2-24 for an example of the statistics screen for a partial measurement.

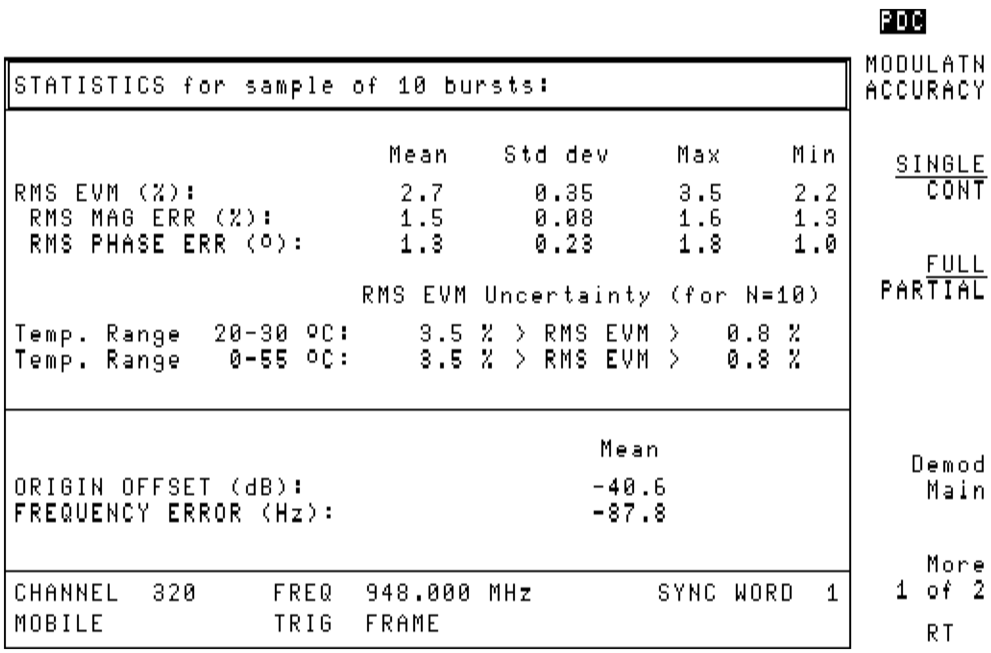


Figure 2-23. Averaged Full Modulation Accuracy Measurement

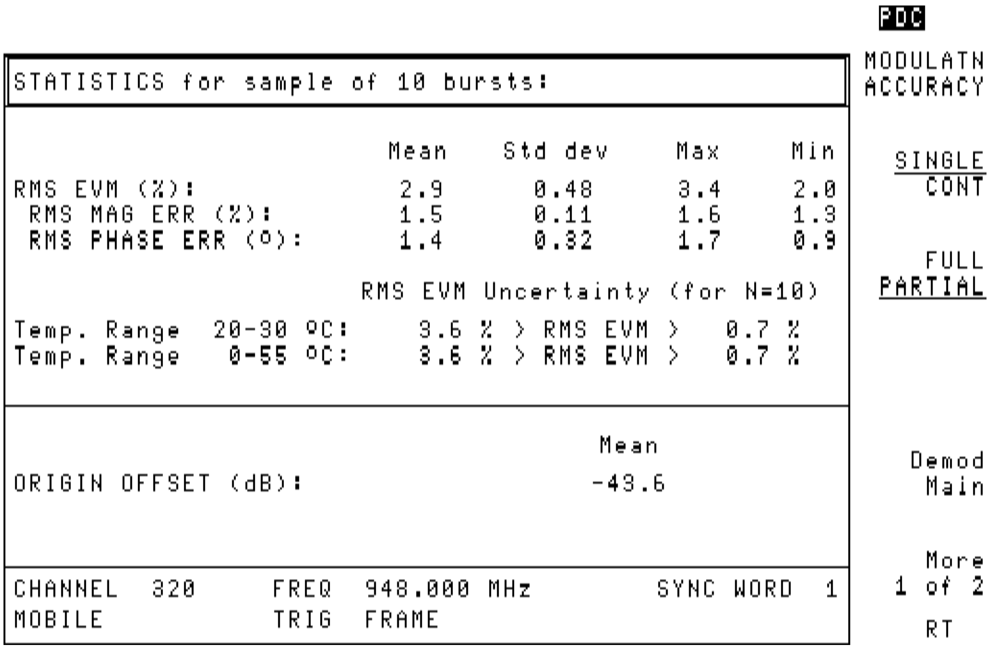


Figure 2-24. Averaged Partial Modulation Accuracy Measurement

To hold measurement data for viewing graphs and demodulated data bits

1. Perform a complete `Modulatn` measurement. See "To perform a full modulation accuracy measurement" and "To perform a partial modulation accuracy measurement" in this chapter for the procedure. Average modulation accuracy measurements or halted measurements cannot be held.

2. Press `SAV MEAS ON OFF` in the `Modulatn` menu 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. To view the I-Q pattern or the 8 point constellation for the current measurement, press `Demod Main` `Graphs` and either `I-Q PATTERN` or `8 POINT CONSTLN`. The I-Q diagram chosen will be plotted on screen.

4. Press `Demod Main` `Data` and `DATA BITS` to view the demodulated data for the current measurement. The demodulated data bits will be displayed on screen.

   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 new measurement. The `SAV MEAS ON OFF` softkey also appears in the `Graphs` and `Data` menus. The `SAVE MEAS ON OFF` softkey 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.

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) `PDC 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 2-25 for the EVM calibration instructions screen.

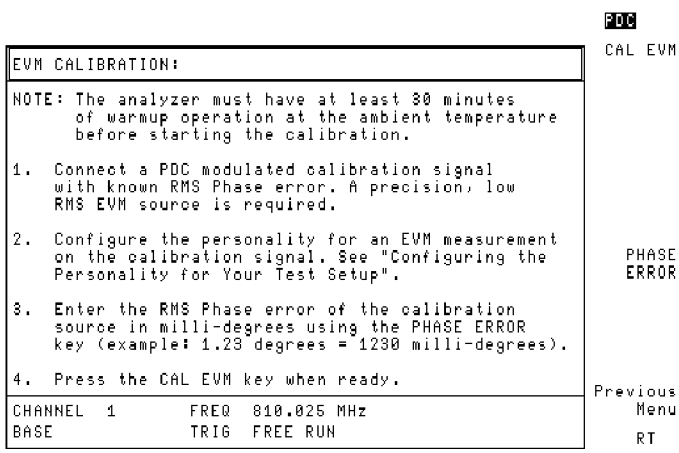


Figure 2-25. EVM Calibration Instructions

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 2-26 for an example of an EVM calibration results screen.

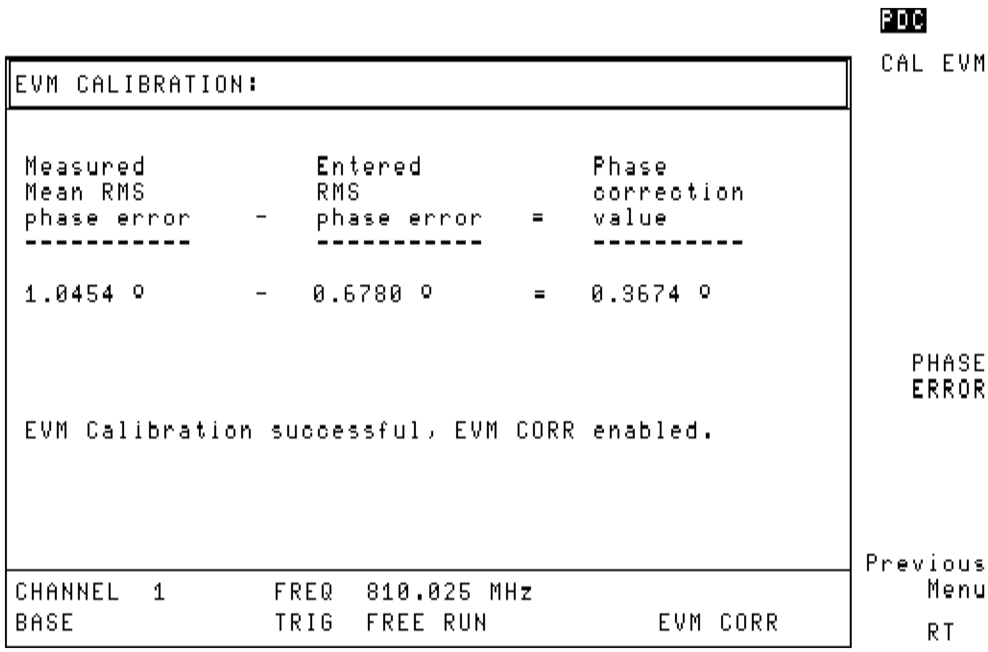


Figure 2-26. EVM Calibration Results

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 9, “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.

Displaying I-Q Diagrams

To display the I-Q pattern, or constellation diagrams, you use the functions that are accessed by pressing Graphs, in the digital demod main menu.

You must have Options 151 and 160 installed to perform this measurement. See “List spectrum analyzer options and firmware revision” in the beginning part of Chapter 1, “Getting Started,” to quickly determine the options installed in your analyzer.

This section contains the procedures for the following measurements:

- Plot the transmitted I-Q trajectory pattern of one timeslot.
- Plot the transmitted I-Q constellation of one timeslot.
- Save the measurement data so that modulation accuracy and demodulated data bits for the same burst can be displayed.

Note If the carrier frequency is more than 3.5 kHz away from the nominal channel center frequency, the measurement results may not be accurate.

To display the I-Q pattern graph

1. Make sure that the channel number selection and timeslot number agree with the transmitter's RF output.
2. If the digital demodulator main menu is not displayed, press (MODE) PDC ANALYZER MORE 1 OF 2 Digital Demod .
3. Press Graphs to access the functions that produce a graph of measurement results.
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 for SINGLE CONT is SINGLE.
5. If the SAV MEAS ON OFF softkey is present, press SAV MEAS ON OFF until OFF is underlined. See "To hold measurement data for viewing modulation accuracy and demodulated data bits" for details on how to use SAVE MEAS ON OFF .

   Note that after a successful I-Q pattern measurement, data for modulation accuracy and demodulated data bits are also available. Using SAV MEAS ON OFF permits modulation metrics and data bits to be viewed without making a separate modulation accuracy or data bits measurement.
6. Press I-Q PATTERN to start the measurement and graph plotting. The I-Q pattern screen will appear with the trajectory of the digital modulation plotted on I-Q axes.

   To stop a measurement in progress, press STOP MEAS .

   To repeat the measurement, press I-Q PATTERN .

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

The I-Q graphs are plotted at five samples per symbol resolution. The I-Q graphs are plotted after correction for I-Q origin offset and carrier frequency error. For mobile stations, 135 symbol decision points of the burst are plotted on the I-Q graphs. By using the remote command _RCRSTD, the number of symbol decision points included in the measurement can be changed to 136 to comply with the procedures outlined in RCR STD-27B. An I-Q graph measurement optimizes the spectrum analyzer for maximum measurement accuracy. Note that the spectrum 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 1 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 synchronization will be acquired at every SINGLE measurement and the first CONT 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 timeslot 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.

See Figure 2-27 for an example of the I-Q Pattern Graph Screen.

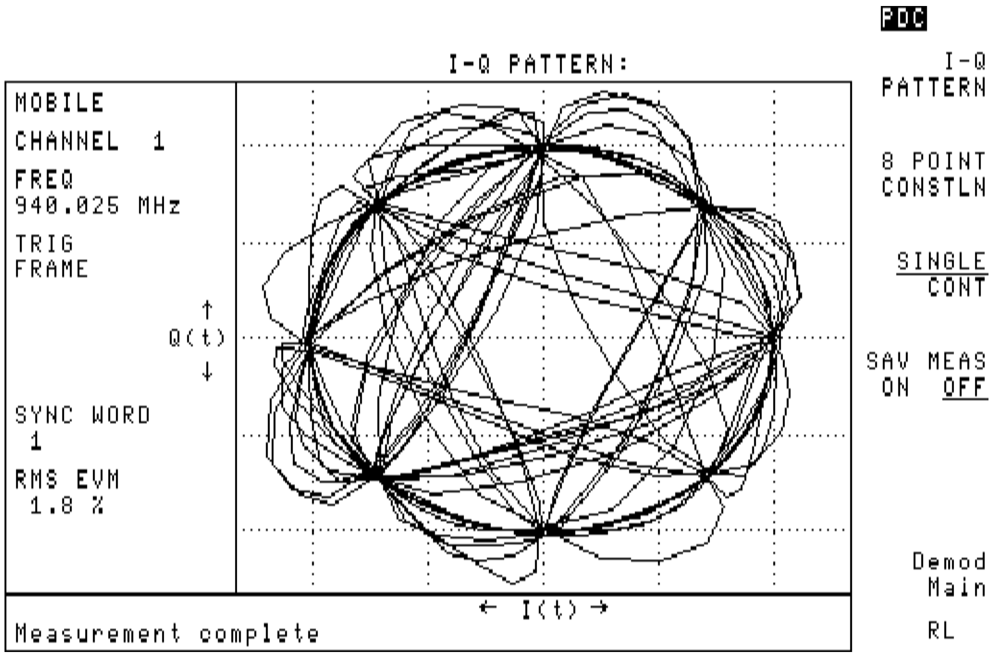


Figure 2-27. I-Q Pattern Graph Screen

To display the eight-point constellation graph

1. Make sure that the channel number selection and timeslot number agree with the transmitter RF output.
2. If the digital demodulator main menu is not displayed, press (MODE) PDC ANALYZER MORE 1 OF 2 Digital Demod .
3. Press Graphs to access the functions that produce a graph of measurement results.
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 for SINGLE CONT is SINGLE.
5. If the SAV MEAS ON OFF softkey is present, press SAV MEAS ON OFF until OFF is underlined. See "To hold measurement data for viewing" for details on how to use SAVE MEAS ON OFF .

   Note that after a successful eight-point constellation measurement, data for modulation accuracy and demodulated data bits are also available. Using SAV MEAS ON OFF permits modulation metrics and data bits to be viewed without making a separate modulation accuracy or data bits measurement.
6. Press 8 POINT CONSTLN to start the measurement and graph plotting. The eight decision states of the $\pi/4$ DQPSK modulation will be indicated by the " + " symbol. The magnitude and phase of 135 symbol decision points in a burst are plotted on the I-Q axes as pixel points.

   To stop a measurement in progress, press STOP MEAS .

   To repeat the measurement, press 8 POINT CONSTLN .

An eight-point constellation measurement displays the phase and amplitude of the baseband digital modulation only at the decision points of the timeslot. 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. The corresponding EVM is also displayed on screen. The eight-point constellation is plotted after correction for I-Q origin offset and carrier frequency error. For mobile stations, 135 symbol decision points of the burst are plotted on the eight-point constellation. By using the remote command _RCRSTD, the number of symbol decision points included in the measurement can be changed to 136 to comply with the procedures outlined in RCR STD-27B.

An eight-point constellation measurement optimizes the spectrum analyzer 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 1 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 synchronization will be acquired at every SINGLE measurement and the first CONT 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 timeslot 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.

See Figure 2-28 for an example of the eight-point constellation screen.

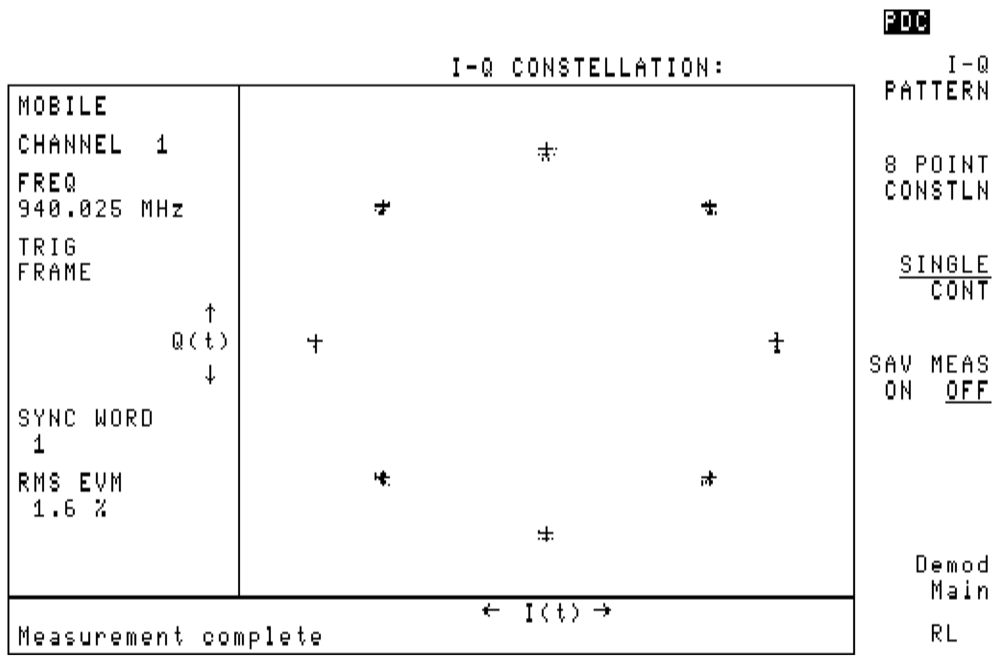


Figure 2-28. Eight-Point Constellation Graph Screen

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

1. Perform a complete Graphs measurement. Refer to "To display the I-Q pattern graph" and the "To display the eight-point constellation graph" sections for the procedure. Note that a halted measurement cannot be held.
2. Press SAV MEAS ON OFF in the Graphs menu 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. Press Demod Main Modulatn and MODULATN ACCURACY to view the modulation accuracy results for the current measurement. The modulation metrics of the current measurement will be displayed.
4. Press Demod Main Data and DATA BITS to view the demodulated data for the current measurement. The demodulated data bits will be displayed on screen.

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 new measurement.

The SAV MEAS ON OFF softkey also appears in the Modulatn and Data menus. 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.

Displaying the Demodulated Data Bits

To display the demodulated data bits, you use the functions that are accessed by pressing `Data` from the digital demodulator main menu.

You must have Options 151 and 160 installed to perform this measurement. See "List spectrum analyzer options and firmware revision" in the beginning part of Chapter 1, "Getting Started," to quickly determine the options installed in your analyzer.

This section contains the following procedures:

- View the demodulated bits from the timeslot measured. Highlight the sync word, data, color code, or control channel bits in the measured burst.
- Save the measurement data so that modulation accuracy and graphs for the same burst can be displayed.

Note If the carrier frequency is more than 3.5 kHz away from the nominal channel center frequency, the measurement results may not be accurate.

To display the demodulated data bits

1. Make sure that the channel number selection and timeslot number agree with the transmitter RF output.
2. If the digital demodulator main menu is not displayed, press (MODE) PDC ANALYZER MORE 1 OF 2 Digital Demod .
3. 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 for SINGLE CONT is SINGLE.
5. If the SAV MEAS ON OFF softkey is present, press SAV MEAS ON OFF until OFF is underlined. See "To hold measurement data for viewing modulation accuracy and graphs" for details on how to use SAVE MEAS ON OFF .

   Note that after a successful demodulated data measurement, data for modulation accuracy, and I-Q graphs are also available. Using SAV MEAS ON OFF permits modulation metrics and graphs to be viewed without making a separate modulation accuracy or graphs measurement.
6. Choose a portion of the demodulated data to highlight. Press Highlite to access the highlighting choices. Highlighting a part of the data in a timeslot makes it easy to read the bits of interest.
7. Press the appropriate softkey for the portion of the data bits you wish to highlight. If a data bits measurement has already been made, the screen will be redrawn with the newly selected portion highlighted.
   - Pressing HIGHLITE TCH will cause the data portion of the bit sequence to be highlighted. For PDC mobile stations this sequence consists of data bits 7 through 118, and data bits 163 through 274. Each of these two blocks is 112 bits long.
   - Pressing HIGHLITE SW will cause the sync word to be highlighted. For PDC mobile stations this sequence consists of data bits 119 through 138. This block is 20 bits long. HIGHLITE SW is the default setting.
   - Pressing HIGHLITE CC will cause the coded digital verification color code portion of the bit sequence to be highlighted. For PDC mobile stations, this sequence consists of data bits 139 through 146. This block is 8 bits long.
   - Pressing HIGHLITE SACCH will cause the slow associated control channel (SACCH) portion of the bit sequence to be highlighted. For PDC mobile stations this sequence consists of data bits 148 through 162. This block is 15 bits long.
8. Press Previous Menu to return to the Data menu.
9. Press DATA BITS to start the measurement and data bit display. Data bits will be displayed on screen with a bit number shown above every 10 bits.

   To stop a measurement in progress, press STOP MEAS .

   To repeat the measurement, press 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 20-bit synchronization word can be read to confirm that the correct timeslot has been measured. The CC and SACCH can also be read. The 280 bits for a full burst slot are displayed.

A data demodulation measurement optimizes the spectrum analyzer 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 data menu by pressing Data. 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 1 Hz resolution to optimize the accuracy of the measurement. The center frequency will be re-tuned at each data demodulation measurement.

If the digital demodulator trigger is set to FRAME, frame trigger synchronization will be acquired at every SINGLE measurement and the first CONT measurement. Since the frame trigger is based on an internal clock which may not be locked to the mobile station time base, the frame trigger may drift slowly away from the desired time slot 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. See Figure 2-29 for an example of the Data Bits Screen.

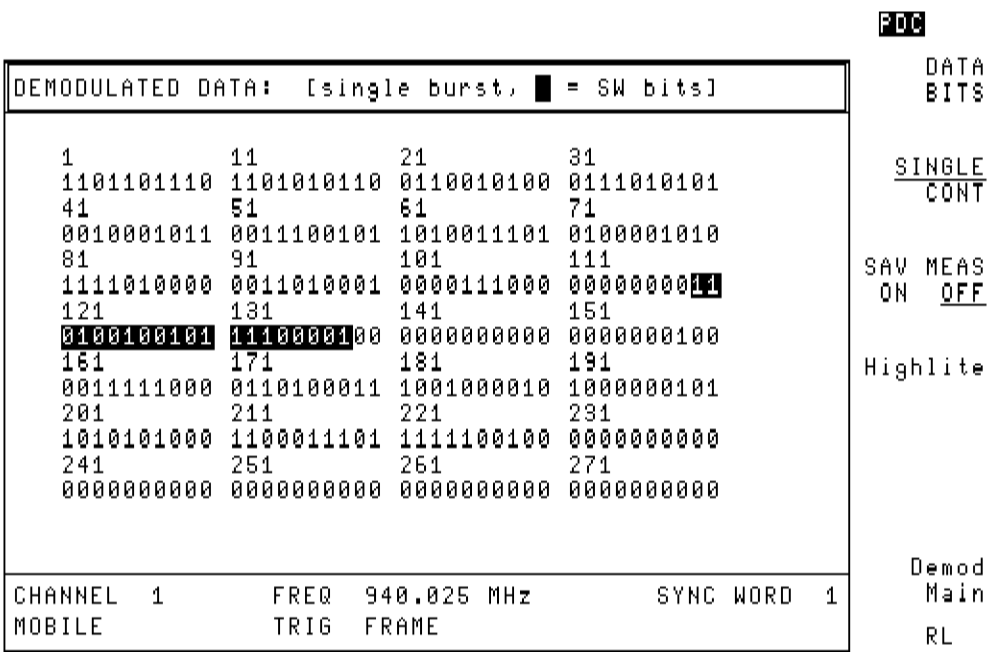


Figure 2-29. Data Bits Screen

To hold measurement data for viewing modulation accuracy and graphs

1. Perform a complete demodulated data bits measurement. See "To display the demodulated data bits" section for the procedure. Note that a halted measurement cannot be held.
2. Press `SAV MEAS ON OFF` in the `Data` menu 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. Press `Demod Main` `Modulatn` and `MODULATN ACCURACY` to view the modulation accuracy results for the current measurement. The modulation metrics of the current measurement will be displayed.
4. Press `Demod Main` `Graphs` and either `I-Q PATTERN` or `8 POINT CONSTLN` to view the I-Q pattern or the eight-point constellation for the current measurement. The I-Q diagram chosen will be displayed on the screen.

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 new measurement. The `SAV MEAS ON OFF` softkey appears in the `Modulatn` and `Graphs` menus. `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 and Measuring Spurious Emissions

This section demonstrates how you can use the `System` and `Spurious` functions. `System` accesses the functions that allow you to view the spectrum of the transmit or receive bands. `Spurious` accesses the function that allows you to measure spurious emissions.

This section contains the following procedures:

- View a transmit band spectrum
- View a receive band spectrum
- Measure spurious emissions over a specific frequency range
- Measure TX band and harmonic spurious emissions

These measurements are applicable for both analog and digital carriers.

To view the transmit band spectrum

1. If System is not displayed, press (MODE) PDC ANALYZER More 1 of 2.
2. Press System.
3. Press MONITOR TX BAND.
4. Select the band that you want to view by pressing 800 MHz BAND or 1500 MHz BAND.

   The personality will change the start and stop frequency of the spectrum analyzer so that the selected transmit band is displayed. The reference level is set to the total power value of TOTL PWR SGL MULT, regardless of whether TOTL PWR SGL MULT is set to single (SGL) or multiple (MULT) carriers.
5. The sweep time is set for fast trace updates, but 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 PDC menu.
6. Press Previous Menu when you are done.

MONITOR TX BAND displays the transmit band that you select. Your band selection is not changed by turning off the spectrum analyzer or pressing (PRESET). If you change the spectrum analyzer start and stop frequencies, the start and stop frequencies will be changed by pressing (PRESET). See Figure 2-30 for an example display of the mobile 800 MHz transmit band.

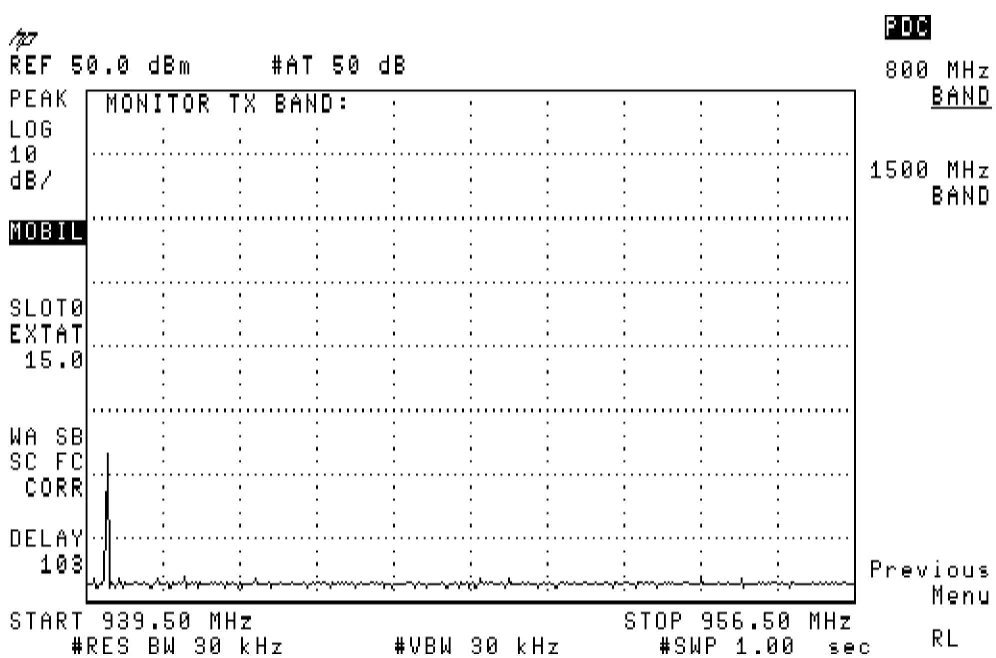


Figure 2-30. Mobile 800 MHz Transmit Band 1 Trace

To view the receive band spectrum

1. If MONITOR RX BAND is not displayed, press (MODE) PDC ANALYZER More 1 of 2 System.
2. Press MONITOR RX BAND.
3. Select the band that you want to view by pressing 800 MHz BAND or 1500 MHz BAND

   The personality will change the start and stop frequency of the spectrum analyzer so that the selected receive band is displayed.
4. Press Previous Menu when you are done.

MONITOR RX BAND displays the receive band that you select. Your band selection is not changed by turning off the spectrum analyzer or pressing (PRESET). If you change the spectrum analyzer start and stop frequencies, the start and stop frequencies will be changed by pressing (PRESET). Because MONITOR RX BAND assumes that there are no high level signals that are incident to the spectrum analyzer input, MONITOR RX BAND sets the reference level to −20 dBm, and the input attenuation to 10 dB. See Figure 2-31 for an example display of the mobile 800 MHz receive band.

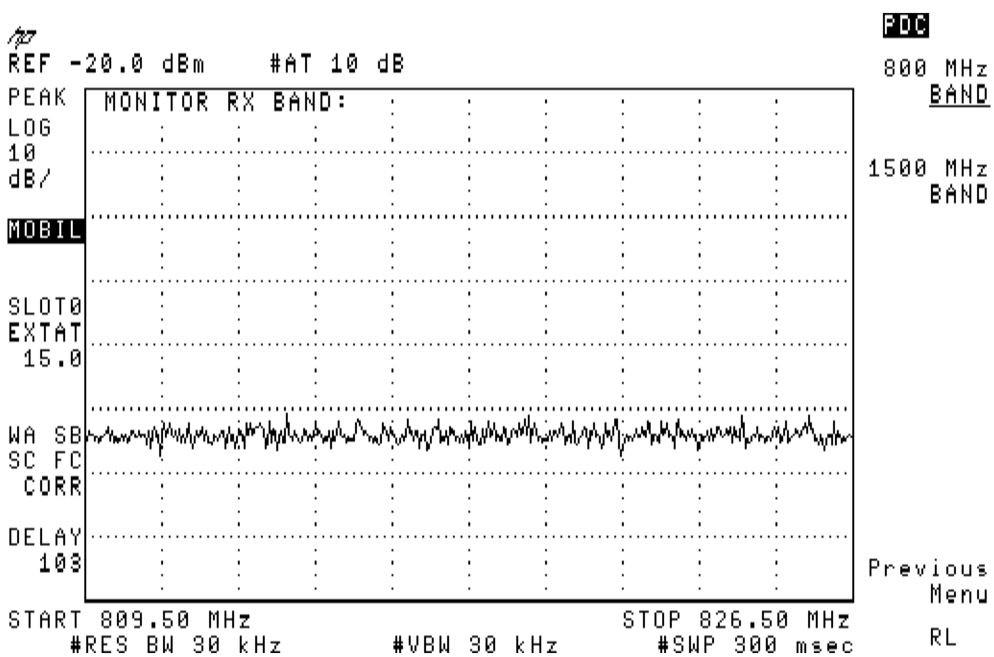


Figure 2-31. Mobile 800 MHz Receive Band 1

To measure spurious emissions over a specific frequency range

1. Measure the antenna power as previously described in this chapter under "Measuring Power."

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

2. If `SPURIOUS EMISSION` is not displayed, press (MODE) `PDC ANALYZER` `More 1 of 2` `Spurious`.

3. Press `SPURIOUS EMISSION`. The personality will set the start and stop frequencies for the band currently selected and set the input attenuator to a value determined by the antenna power. See Figure 2-32.

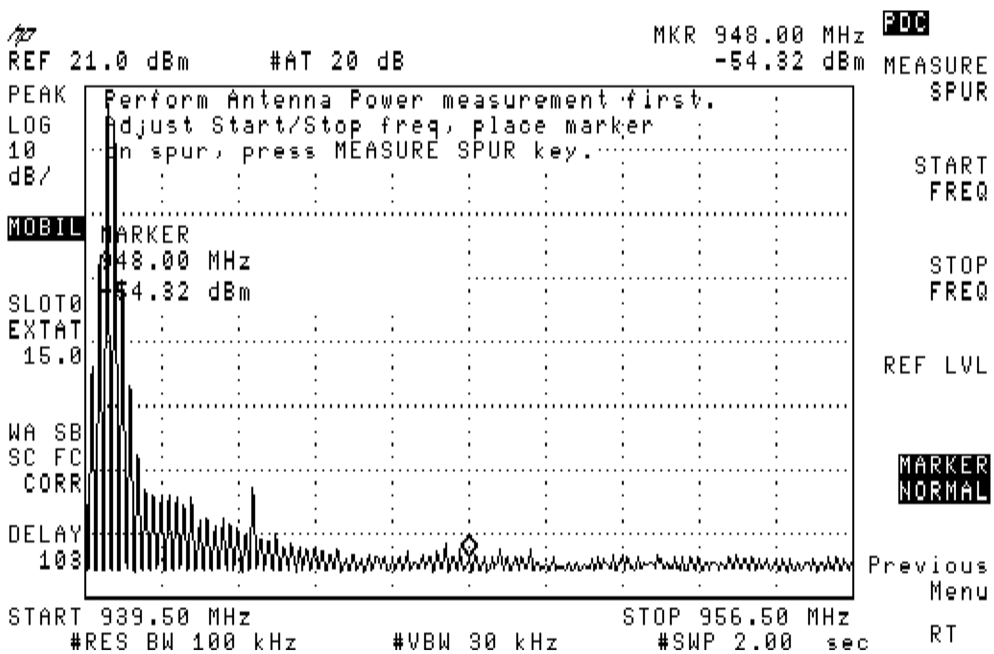


Figure 2-32. Spurious Emission Procedure

4. If necessary, use the `START FREQ` and `STOP FREQ` keys to adjust the frequency range. Press `MARKER NORMAL` to enable the marker and use the knob to place the marker on the spurious emission.

5. Press `MEASURE SPUR` to start the measurement. The spectrum analyzer will auto-zoom down onto the marker frequency. It will then make a zero-span measurement and compute the mean spurious power slot-by-slot as specified in RCR STD-27C.

The spurious emission measurement can be made by the RCR STD-27B method, which also causes the spectrum analyzer to auto-zoom down onto the marker frequency. It will then make a zero-span measurement and separately compute the mean power inside and outside the burst. To use this method set the remote command _RCRSTD to 2. See Chapter 7, “Programming Commands.” The spectrum analyzer auto-zoom method can be selected with the search mode key SRCH MOD FAST NOR. See “Spurious Setup Menu,” in Chapter 3, “Mobile Station Menu Map and Softkey Descriptions.”

The P/F AUTO ABS REL softkey in the Spurious Setup menu sets the criteria used for the pass/fail testing in this measurement. With P/F AUTO ABS REL set to the default setting of AUTO, PASS is displayed if *either* the absolute *or* the relative result is less than the corresponding limit value. Set P/F AUTO ABS REL to ABS for pass/fail checking to be done only on the *absolute* result. Set P/F AUTO ABS REL to REL for pass/fail checking to be done only on the *relative* result. A box appears around either the Abs or Rel label on the display to indicate the result actually used to determine pass or fail.

See Figure 2-33 for an example of a spurious emission measurement.

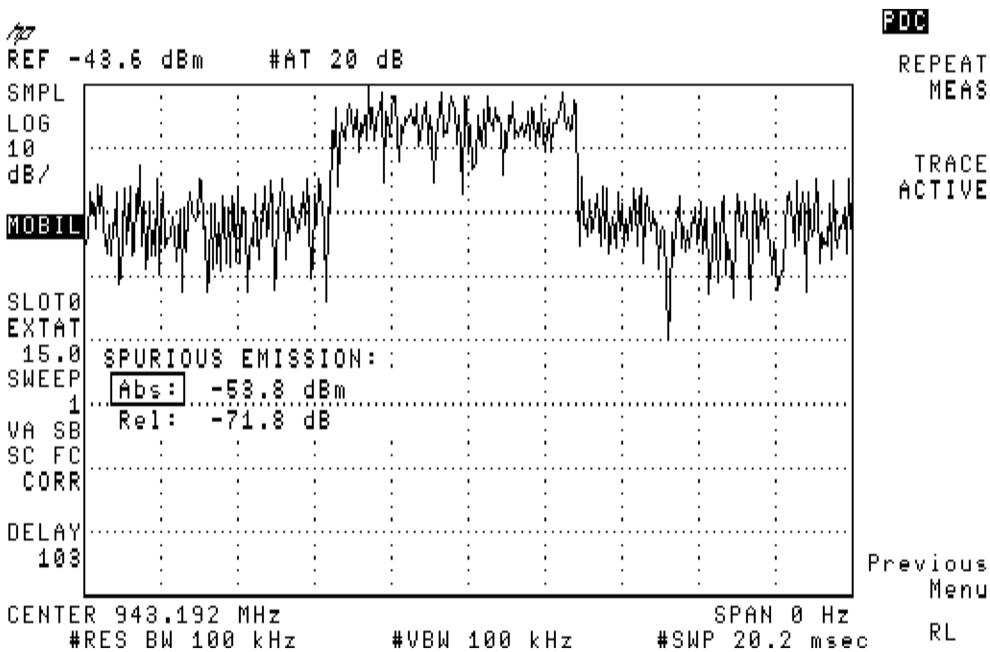


Figure 2-33. Spurious Emission Measurement

6. Press Previous Menu if you are done with the spurious emissions measurement, or use one of the post-measurement functions.

RCR reference The spurious emission measurement is based on RCR STD-27C 6.1.2, “Strength of Spurious Emission” and RCR STD-27C 3.4.2.6, “Transmission spurious.”

The measurement can also be made based on RCR STD-27B. See the _RCRSTD command in Chapter 7, “Programming Commands.”

To measure TX band spurious and harmonic emissions

1. Make sure the channel number selection agrees with the transmitter RF output by selecting the channel number, or by using the auto channel function. For more information, see "To select a channel to test" earlier in this chapter.
2. If SPUR & HARMONIC does not appear on the display, press (MODE) PDC ANALYZER More 1 of 2 Spurious .
3. Press SPUR & HARMONIC . The personality will perform a test sequence that measures the power at the fundamental, half sub- harmonic, 2nd harmonic, 3rd harmonic, the peak in the TX band more than 0.5 MHz above the fundamental. Both absolute amplitude and amplitude relative to the fundamental are displayed.

SPUR & HARMONIC automatically sets the reference level and the input attenuation based on the measured power level of the carrier.

The input attenuation then is locked for the rest of the test to prevent the input mixer from going into compression. If the carrier power is not above the minimum carrier power threshold value (default is −15dBm), an error message will appear and the measurement will stop. A true mean power measurement is made at the fundamental, sub-harmonic, and harmonic frequencies. The personality measures the time waveform of the RF envelope, converts the trace data from dB to power units, then averages the power trace data.

For mobile station measurements, the average power measurements compute the average of both the on and the off portions (in/out sections) of the bursts. This is different from the antenna power measurement that computes the average only of the ON portion of the burst. To provide a more accurate measurement of the fundamental power, the average of four sweeps is used. The absolute fundamental power is used as the reference for all the relative results.

Swept spectrum measurements are used to measure TX band spurious. The appropriate band (800 MHz or 1500 MHz) is chosen automatically, based upon the current channel setting. First a sweep is taken from the lower end of the TX band to 0.5 MHz below the carrier frequency, then a sweep is taken from 0.5 MHz above the carrier frequency to the upper end of the TX band.

The results are displayed in a table at the end of the measurement that includes absolute fundamental power, and absolute and relative amplitude levels for the following signals:

sub-harmonic

2nd harmonic

3rd harmonic

TX band below carrier

TX band above carrier

Absolute levels are expressed in dBm, while relative amplitude levels are expressed in dB.

If PASSFAIL ON OFF in the Configuration menu is set to ON, a global pass/fail message is displayed. In addition, an individual highlighted F is displayed next to any reading that fails the limit. The RCR standard gives both absolute and relative limits. In RCR STD-27C, these are given as −60 dBc *or* −36 dBm for mobile stations. With these limits relative values are used for determining pass/fail if the carrier power ≥+24 dBm. For carrier power less than these values, the absolute values are used to determine pass/fail. A box is drawn around either the `Absolute` or `Relative` label on the display to indicate the result that is actually used to determine pass or fail.

The P/F AUTO ABS REL softkey in the Spurious Setup menu sets the criteria used for the pass/fail testing in this measurement. With P/F AUTO ABS REL set to the default setting of AUTO, PASS is displayed if *either* the absolute *or* the relative result is less than the corresponding limit value. Set P/F AUTO ABS REL to ABS for pass/fail checking to be done only on the *absolute* result. Set P/F AUTO ABS REL to REL for pass/fail checking to be done only on the *relative* result. A box appears around either the `Abs` or `Rel` label on the display to indicate the result actually used to determine pass or fail.

See Figure 2-34 for an example of a TX band spurious and harmonic emission measurement.

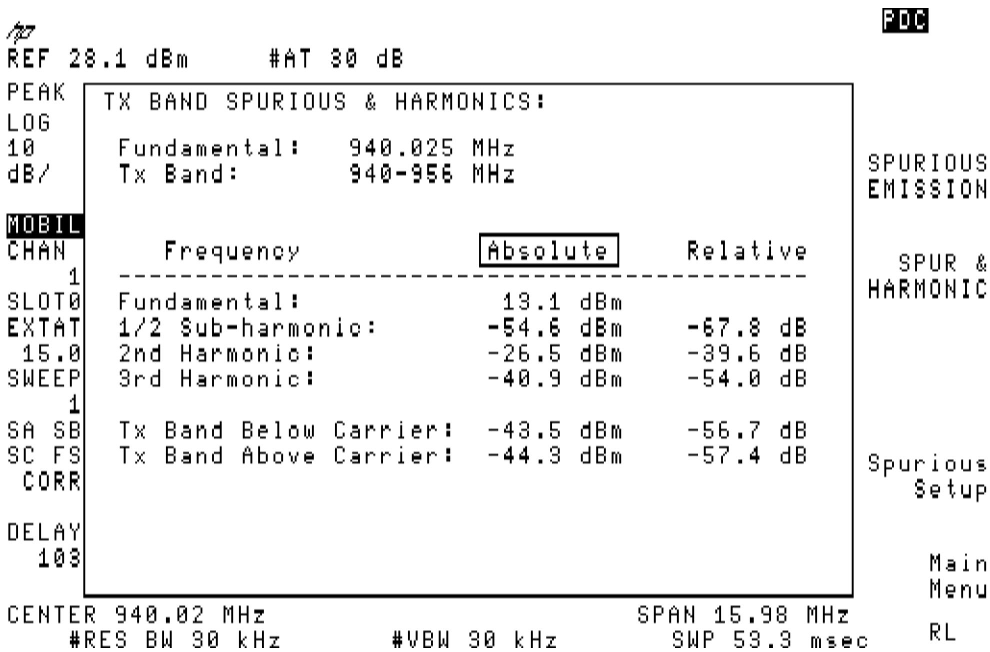


Figure 2-34. TX Band Spurious and Harmonic Measurement

3

Mobile Station Menu Map and Softkey Descriptions

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

Configuration menu
Pressing `Config` accesses the configuration menu.

Physical channel menu
Pressing `Physical Channel` accesses 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, or an adjacent channel power softkey accesses the post-measurement menu.

Pressing `Digital Demod` accesses the following four menus plus a status screen used for digital demodulator based measurements:

Modulation menu
Pressing `Modulatn` accesses the modulation menu.

Graphs menu
Pressing `Graphs` accesses the graphs menu.

Data menu
Pressing `Data` accesses the data menu.

Demod configuration menu
Pressing `Demod Config` accesses the digital demodulator configuration menu.

Status screen
Pressing `STATUS` allows you to examine the digital demodulator measurement status screen. The status screen is described in detail under “Status Screen Overview” in Chapter 6, “Error Messages and Troubleshooting.”

Mobile Station Menu Map

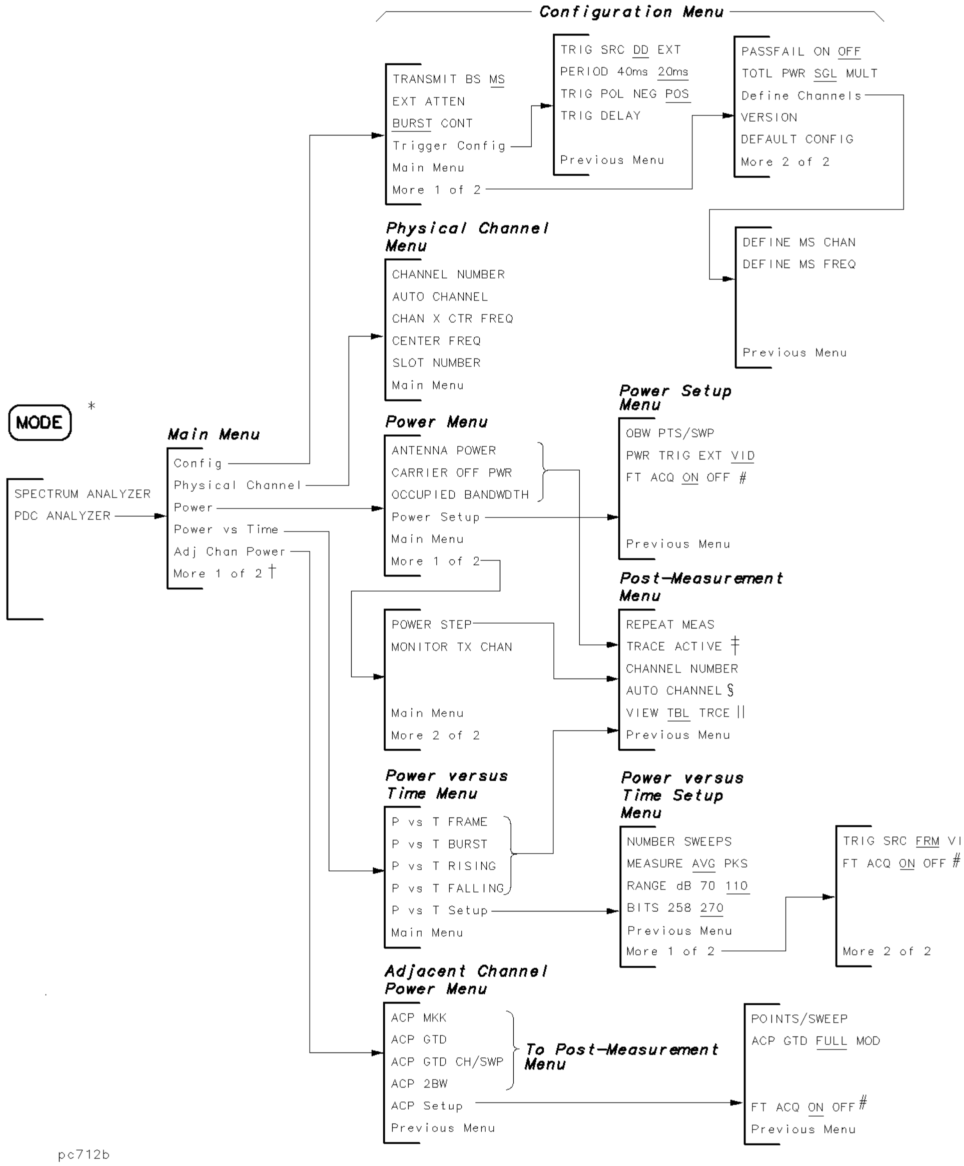


Figure 3-1. Mobile Station Menu Map

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

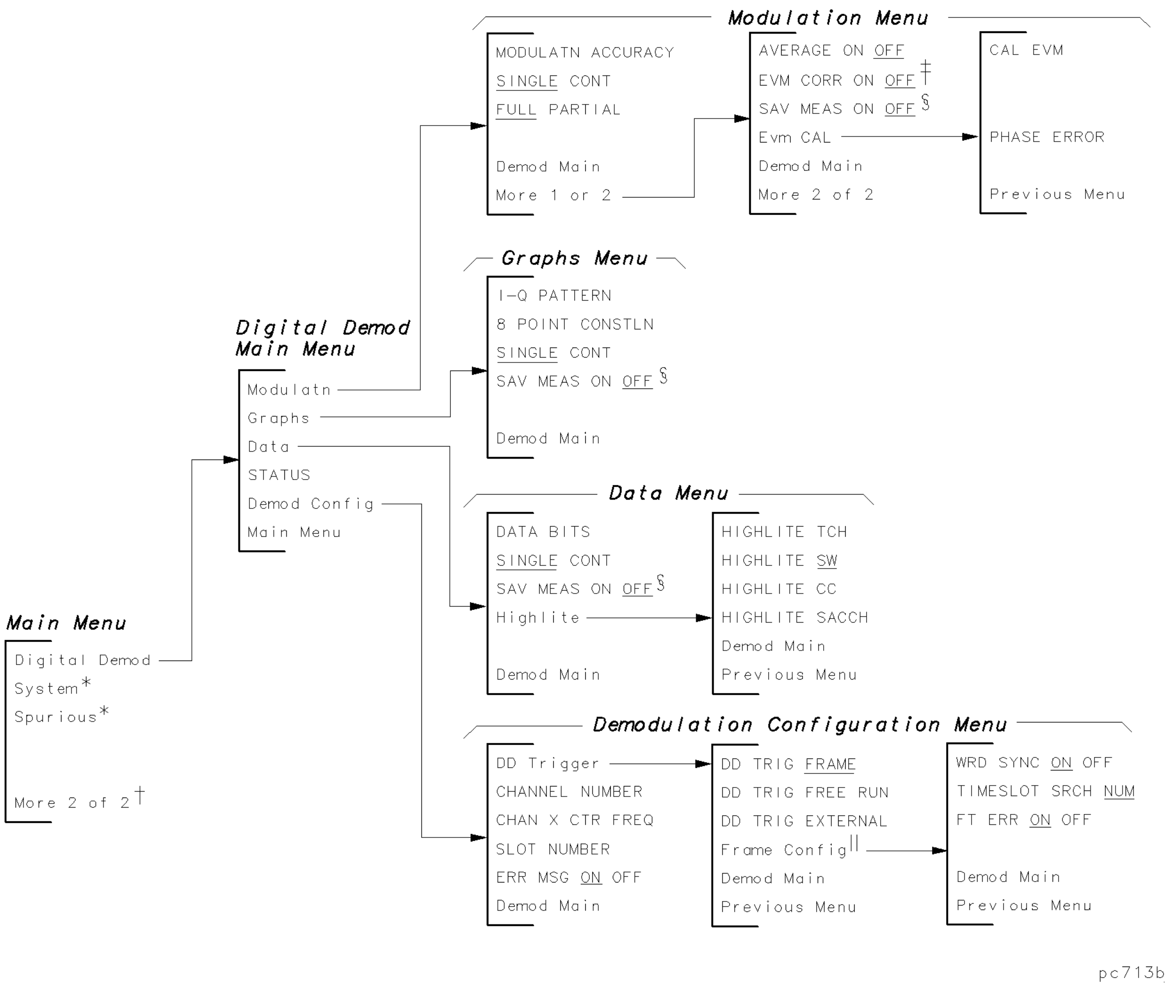
† See the following pages for the digital demod, system, and spurious menus.

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

§ Changes to TRIG DELAY for a power versus time measurement.

|| VIEW TBL TRCE is available with the adjacent channel power measurements except ACP GTD CH/SWP. VIEW TBL TRCE changes to GATE ON OFF when TRACE ACTIVE is pressed. For power versus time measurements, DISPLAY TOP BOT is displayed if the trace is active.

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



Mobile Station Menu Map (continued)

* See the following page for system and spurious menus.

† See the previous menu map for the configuration, physical channel, power, power versus time, and adjacent channel power menus.

‡ 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.

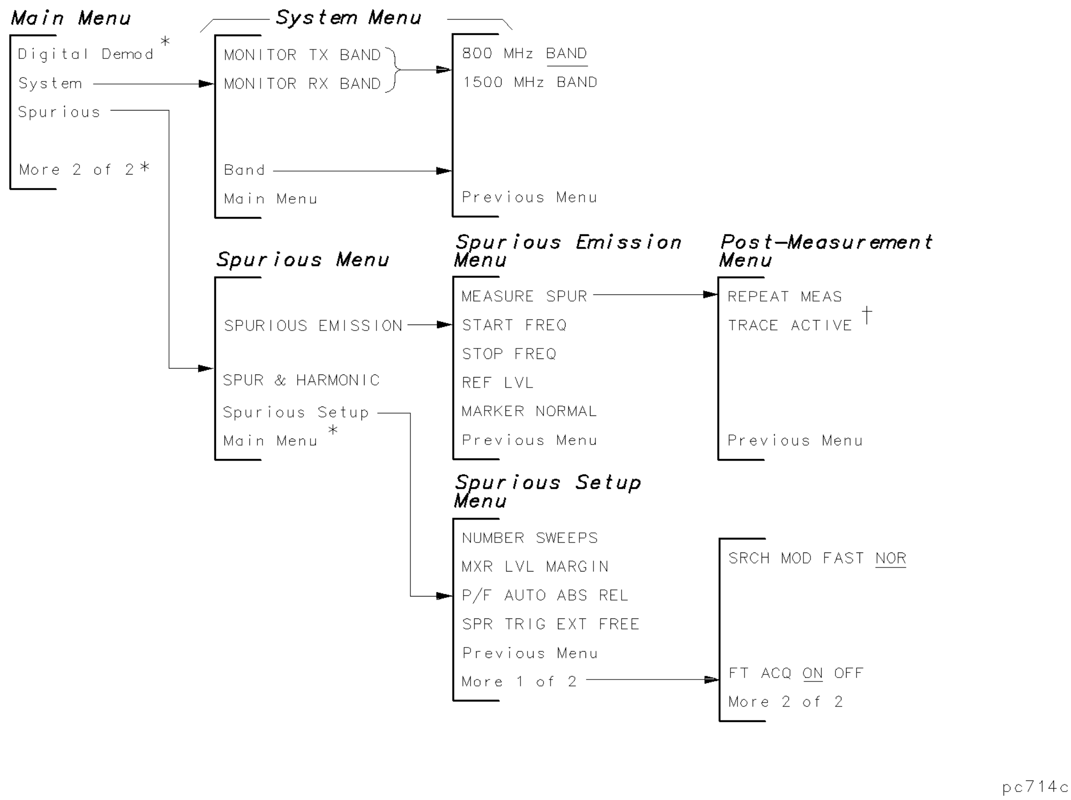


Figure 3-2. Mobile Station Menu Map (continued)

* See the previous page for the digital demod menu.

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

‡ Present only if TRIG SRC DD EXT is set to DD.

The Configuration Menu

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

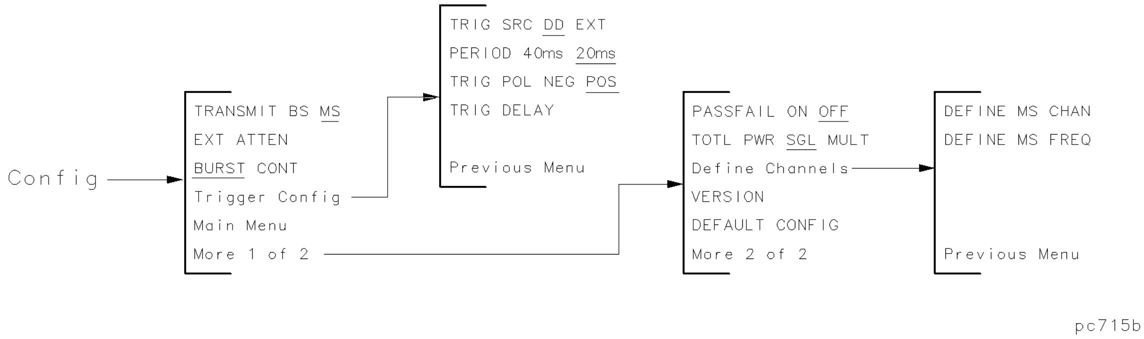


Figure 3-3. The Configuration Menu Map

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 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 20 dB.

The Configuration Menu Softkeys

TRANSMIT BS MS — Allows you to select either the base station (BS) or the mobile station (MS) as the transmitter under test. If BS is underlined, the personality assumes that there is a continuous, $\pi/4$-DQPSK, base-station carrier as the input to the spectrum analyzer. If MS is underlined, the personality assumes that there is a burst, $\pi/4$-DQPSK, mobile-station carrier as the input to the spectrum analyzer. The selection of base station or mobile station changes some of the PDC personality softkeys.

The default for TRANSMIT BS MS is base station (BS). The selection for base or mobile station is retained even if (PRESET) is pressed or the spectrum analyzer is turned off. The selection of base station or mobile station is shown on the left side of the spectrum analyzer, above the annotation for the channel number. If BS is selected, BASE is displayed on the left side of the spectrum analyzer display. If MS is selected, MOBIL is displayed.

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 20 dB is used.

BURST CONT Allows you to specify if the carrier is a burst or a continuous (nonburst) carrier. This selection affects the spectrum analyzer trigger mode and sweep time. The sweep time used in some 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.

Many of the PDC personality measurements display a pass/fail message if PASSFAIL ON OFF is set to ON. To determine if a measurement passed or failed, the PDC personality uses test limits. Table 3-1 lists the default values for the test limits that the PDC personality uses. If desired, you can change these default limits with a computer or with an external keyboard. See "Customizing the PDC Personality" in Chapter 8, "Programming Examples," for more information about how to change the default limits.

Table 3-1. Default Limits for the Pass/Fail Messages

Test	Limit
Antenna power (RCR STD-27C 3.4.2.1)	Maximum and minimum antenna power levels are set to 0 dBm to disable the pass/fail message
Carrier off leakage power (RCR STD-27C 3.4.2.5)	
Mean carrier off power - mobile	−60 dBm maximum
Mean carrier off power - base	−26 dBm maximum
Ratio with mean antenna power - base	−60 dB
Occupied bandwidth (RCR STD-27C 3.4.2.7)	
Bandwidth	32 kHz maximum
Frequency error	2 kHz maximum
Adjacent channel power (RCR STD-27C 3.4.2.3)	
Adjacent channel (50 kHz)	−45 dB maximum
Alternate channel (100 kHz)	−60 dB maximum
Power versus time (RCR STD-27C 3.4.2.4)	
258 bit burst width*	6143 μs minimum, 6357 μs maximum
270 bit burst width*	6429 μs minimum, 6643 μs maximum
Attack time (rising)*	24 μs minimum, 115 μs maximum
Release time (falling)*	24 μs minimum, 115 μs maximum
Limit line masks	Based on remote command _RCRSTD
Spurious emissions (RCR STD-27C 3.4.2.6 and 3.4.2.10)	
Mean spur power, mobile	−36 dBm maximum
Mean spur power, base	−26 dBm maximum
Ratio with mean antenna power	−60 dB
Modulation Accuracy	
Carrier Frequency Error	
Base	40 Hz maximum, Base 800 MHz Band
	74 Hz maximum, Base 1500 MHz Band
Mobile	2820 Hz maximum, Mobile 800 MHz Band
	2858 Hz maximum, Mobile 1500 MHz Band
Error Vector Magnitude	
RMS EVM	12.5%
EVM Magnitude Component	33%
EVM Phase Component	50 °
I-Q Origin Offset	−20 dB
* The pass or fail message is not displayed when these variables are set to 0.	

TOTL PWR SGL MULT Allows you to select if total RF output power of the transmitter is from a single (SGL) carrier, or from multiple (MULT) carriers. For a mobile station, you should set TOTAL PWR SGL MULT to single (SGL). The selection of either a single carrier or multiple carriers allows the personality to set the internal attenuator of the spectrum analyzer to an optimal value, and prevents possible gain compression.

If you select a single carrier, the spectrum analyzer input attenuation and reference level are automatically set according to the amplitude level of the measured carrier.

If you select multiple carriers, you can enter the total power from the carriers with the data keys. You can calculate the total power with the following equation:

$$P_{Total} = P + 10\log N$$

where:

P_{total} is the total power in dBm.
P is the power of one channel in dBm.
N is the number of channels transmitted by the base station.

The personality uses the total power value to set the spectrum analyzer input attenuator, and thus avoids signal compression for signals that are less than the entered value for total power. You can select a value from 0 to 60 dBm for the total power, referenced to the transmitter's output power.

The default value for TOTL PWR SGL MULT is single carrier and a power level of +50 dBm.

`Define Channels` The keys under this menu define a channel number and the corresponding frequency for mobile stations. The default channel spacing is 25 kHz. The center frequency for a given channel is given by:

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

Where:

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

`DEFINE MS CHAN` Changes the channel number that corresponds to the "defined" mobile station frequency; and is used for channel number tuning. The range is −9,999 to 32,000.

`DEFINE MS FREQ` Changes the frequency that corresponds to the "defined" mobile station channel number. The range is any frequency within the range of the spectrum analyzer.

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

`DEFAULT CONFIG` Replaces the entered values for the configuration functions with their default values. The default values are as follows:

- `EXT ATTEN` is set to 20 dB.
- `BURST CONT` is set to BURST.
- `TOTL PWR SGL MULT` is set to single carrier (SGL) and the power level is set to +50 dBm.
- `TRIG SRC DD EXT` is set to DD if Options 151 and 160 are present; otherwise, EXT.
- `PERIOD 40ms 20ms` is set to 20 ms.
- `TRIG DELAY` is set to 0 μs.
- `TRIG POL NEG POS` is set to positive edge triggering (POS).
- `PWR TRIG EXT VID` is set to video (VID).
- `PASSFAIL ON OFF` is set to OFF.

- CHANNEL NUMBER is set to 1.
- DD TRIG FRAME is enabled.
- TIMESLOT SRCH NUM is set to NUM.
- CHAN X CTR FREQ is set to 300 MHz.
- Band is set to 800 MHz.
- EVM CORR ON OFF is set to OFF.
- DEFINE MS CHAN is set to 0.
- DEFINE MS FREQ is set to 940.000 MHz.
- MXR LVL MARGIN is set to 15.
- P/F AUTO ABS REL is set to AUTO.

The Trigger Configuration Menu Softkeys

TRIG SRC DD EXT Allows you to select the trigger source for power vs time and gated adjacent channel power measurements. If TRIG SRC DD EXT is set to EXT, the personality expects the trigger source for the rear-panel GATE 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 DD EXT is set to DD, the personality expects the trigger source for the rear-panel GATE TRIGGER INPUT to be from the rear-panel off-the-air frame trigger output of the Options 151 and 160 digital demodulator hardware. The personality sets internal delay parameters differently between the DD and EXT settings.

Note For mobile station power vs time, and gated adjacent channel power measurements, the spectrum analyzer requires a trigger at the rear-panel GATE TRIGGER INPUT connector of the spectrum analyzer. For more details, see “Make the cable connections for triggering the spectrum analyzer” in Chapter 1, “Getting Started.”

Setting TRIG SRC DD EXT to DD will automatically set the FT ACQ ON OFF softkeys, in the power versus time and ACP setup menus, to ON. Setting TRIG SRC DD EXT to DD will also automatically set the trigger polarity (TRIG POL NEG POS) to POS and the trigger delay to 0.

The default for this function is DD if Options 151 and 162 are present; otherwise, EXT.

PERIOD 40ms 20ms Allows you to select a frame period of 40 ms or 20 ms. If the frame structure for the mobile station is for a full-rate codec, there is a burst every 20 ms and you should set PERIOD 40ms 20ms to 20 ms. If the frame structure for the mobile station is for a half-rate codec, there is a burst every 40 ms and you should set PERIOD 40ms 20ms to 40 ms. The default value is 20 ms.

Note The above settings assume that the trigger period is the same as the RF burst period. If the external trigger period is 40 ms, but the RF burst period is 20 ms, set PERIOD 40ms 20ms so that 40 ms is underlined. In this case, you must temporarily set PERIOD 40ms 20ms to 20 ms for correct carrier off power measurements.

TRIG POL NEG POS Allows you to select the edge trigger polarity for the TTL trigger signal. 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 DD EXT to DD will automatically set TRIG POL POS NEG to POS.

TRIG DELAY Allows you to enter the delay time from the trigger signal to the reference point of the burst. If TRIG SRC DD EXT is set to EXT, the reference point is point 0 (the start of symbol 1) and you can enter a trigger delay from −32,000 μs to +6,000 μs in 1 μs increments. If TRIG SRC DD EXT is set to DD, you can enter a trigger delay from −32,000 μs to +3,400 μs. If you do not enter a trigger delay, a default value of 0 μs is used. When TRIG SRC DD EXT is set to DD, use a value of 0. If TRIG SRC DD EXT is set to EXT, a positive value of trigger delay is usually required.

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.

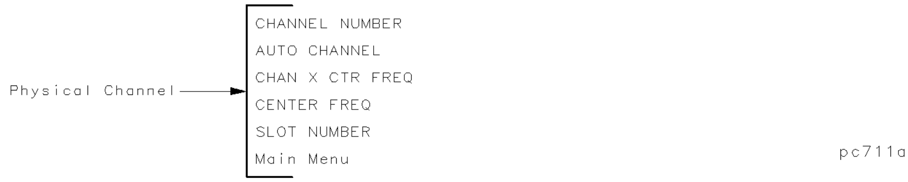


Figure 3-4. The Physical Channel Menu Map

The Physical Channel Menu Softkeys

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 PDC channel you want to measure. The PDC 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, Adj Chan Power, and Digital Demod. If you do not enter a channel number, the channel number defaults to the "defined" mobile station channel number. The channel numbers are defined under the configuration menu. If you press this softkey while in band mode, the personality will immediately recall the previous channel number and switch to channel mode.

AUTO CHANNEL This softkey automatically tunes the instrument to the channel having the highest carrier power in the current band. If in channel mode, the current band is the band containing the current channel frequency. If in band mode, the current band is selected by the band softkeys. If there is no signal above the carrier minimum power threshold (default is −15 dBm) in the current band, the other band is then searched.

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's 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." If you press this softkey while in band mode, the personality will immediately recall the previous channel "X" center frequency and switch to channel mode.

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 to select the burst for the antenna power, carrier off leakage power, gated adjacent channel power, power versus time, and digital demodulator-based measurements. For non-digital demodulator based measurements, if the trigger is obtained from the mobile station directly or from an RF burst carrier trigger, you should select slot number 0, regardless of the actual timeslot number being used by the mobile station. If the trigger is obtained from the rear-panel off-the-air frame trigger output, the base simulator, or another piece of test equipment, you can set the slot number from 0 to 5, inclusive. The default value for the slot number is 0.

The Power Menu

Pressing Power accesses the softkeys that allow you to measure the transmitter's antenna power, the carrier off power, the step power, the occupied bandwidth, and to view the transmit channel. The power menu functions not only make a measurement, but they also access additional softkeys. See "The Post-Measurement Menu" in this chapter for more information about the softkeys accessed by the power menu softkeys.

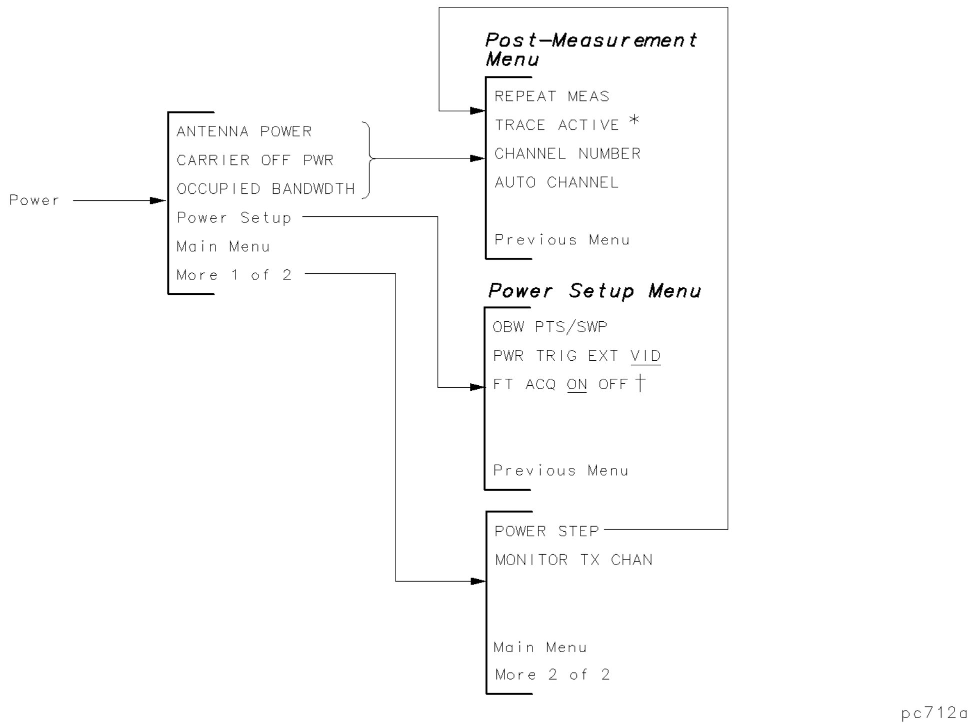


Figure 3-5. The Power Measurement Menu Map

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

Table 3-2 shows the spectrum analyzer settings for each of the power measurements. The PDC measurements personality automatically sets the spectrum analyzer settings for each of the power measurements.

Table 3-2.
Spectrum Analyzer Settings for the Mobile Station Power Measurements

Spectrum Analyzer Setting	ANTENNA POWER	CARRIER OFF PWR	POWER STEP	OCCUPIED BANDWDTH	MONITOR TX CHAN
Span	0 Hz	0 Hz	0 Hz	100 kHz	500 kHz
Resolution bandwidth	100 kHz	30 kHz	100 kHz	300 Hz	10 kHz
Video bandwidth	100 kHz	30 kHz	100 kHz	300 Hz	10 kHz
Sweep time	8 ms	20 ms or 40ms†	8 s or 16 s†	8 s or 16 s†	1 s
Detector	Sample	Sample	Peak	Peak	Peak
Trigger mode	Video*	Video*	Video*	Free run	Free run

* External triggering can also be selected. Video or external triggering can be selected with PWR TRIG EXT VID.

† The sweep time depends upon the current setting for PERIOD 40ms 20ms. If PERIOD 40ms 20ms is set to 20 ms, the shorter sweep time is used. If PERIOD 40ms 20ms is set to 40 ms, the longer sweep time is used.

The limits and parameters for the power measurements can be changed remotely. See "Customizing the PDC Personality" in Chapter 8, "Programming Examples," 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 four. 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 23 dB below the peak of the burst.

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

CARRIER OFF PWR Measures the mean power of the carrier when the carrier is off (the carrier is off between burst transmissions). The average data from several sweeps is used in calculating the carrier off leakage power levels. The default number of sweeps is 2. The mean carrier off power is measured by determining the mean power in a specific region between burst transmissions. That region is defined as being between the points that are +10 dB above the peak value at the center part of the off portion. A ratio value (in dB) relative to the last value measured in the antenna power measurement is determined. The absolute value (in dBm) is also determined.

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.

Power Setup Accesses the menu that allows you to select the parameters used in the power measurements.

POWER STEP Allows you to view the output power from a transmitter as you increase or decrease the power. If you press POWER STEP, and PWR TRIG EXT VID is set to the video trigger mode (VID), the spectrum analyzer will not sweep until the carrier is turned on or the carrier power level is increased. If you press POWER STEP and PWR TRIG EXT VID is set to the external trigger mode (EXT), the spectrum analyzer will not sweep until the external input signal trigger is received. After the spectrum analyzer begins to sweep, you can increase or decrease the output power from the transmitter to see the power "steps." The amplitude scale of the spectrum analyzer is set to 4 dB per division.

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

The Power Setup Menu Softkeys

OBW PTS/SWP Allows you to set the number of points used in the occupied bandwidth measurement. The number of points can range from 21 to 401; the default is 401.

PWR TRIG EXT VID Allows you to select if the trigger for the power measurements is the video trigger or the external trigger. The power measurements are the antenna power, carrier off power, and power step measurements. 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 applied to the rear panel GATE TRIGGER INPUT connector of the spectrum analyzer. VID is the default setting.

FT ACQ ON OFF If FT ACQ ON OFF is set to ON, the personality will include a digital demodulator sync word frame trigger (off-the-air) acquisition prior to making *externally triggered* power measurements. If FT ACQ ON OFF is set to OFF, the measurement will not include the frame trigger acquisition.

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

Setting TRIG SRC DD EXT to DD automatically sets FT ACQ ON OFF to ON. Frame trigger acquisition prior to the measurement ensures that the Options 151 and 160 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 PDC burst structure. The power versus time functions allow you to view the full PDC 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 PDC burst and numerical results.

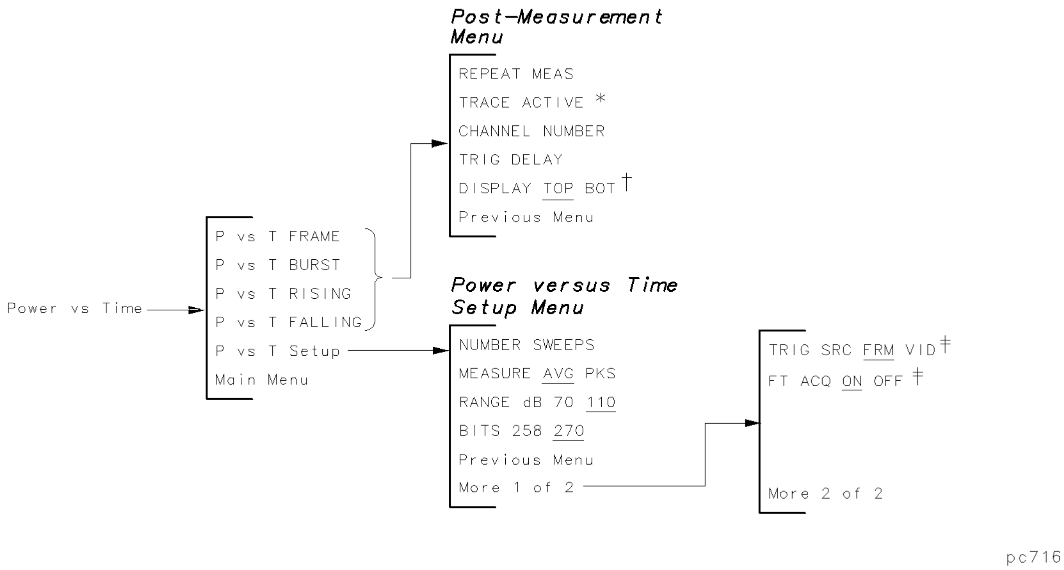


Figure 3-6. The Power versus Time Measurement Menu Map

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

† Appears only if the trace is active.

‡ Present only if TRIG SRC DD EXT is set to DD.

Table 3-3 shows the spectrum analyzer settings for each of the power versus time measurements. The PDC 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 GATE TRIGGER INPUT connector of the spectrum analyzer.

Table 3-3. 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	300 kHz	300 kHz	300 kHz	300 kHz
Video bandwidth	300 kHz	300 kHz	300 kHz	300 kHz
Sweep time	43 ms	8 ms	640 μs	640 μs
Detector	Sample	Sample	Sample	Sample
Trigger mode	External	External	External	External

The limits and parameters for the power versus time measurements can be changed remotely. See "Customizing the PDC Personality" in Chapter 8, "Programming Examples," for more information.

The Power versus Time Menu Softkeys

P vs T FRAME Displays the time domain waveform over a full TDMA 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 attack time of the rising edge (ramp up) of the burst. (The attack time is the time it takes the rising edge of the burst to transition from −56 dBm to the mean power −14 dB.) The rising edge waveform is also compared to limit lines.

P vs T FALLING Measures the release time of the falling edge (ramp down) of the burst. (The release time is the time it takes the falling edge of the burst to transition from the mean power −14 dB to −56 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.)

BITS 258 270 Allows you to enter the length of the burst to be measured, so that the limit lines and measurement limits for the power versus time measurements are sized accordingly. If BITS 258 270 is set to 258, the limit lines and measurement limits are set for a "short" burst of 258 bits per burst (129 symbols). If BITS 258 270 is set to 270, the limit lines and measurement limits are set for the normal 270 bits per burst (135 symbols). The default for this function is 270 bits per burst.

The inner limit lines for power versus time measurements are separated by 256 or 268 bit positions as specified in RCR STD-27C. The remote command _RCRSTD can be set so the RCR STD-27B limit line separation of 258 or 270 is used.

FT ACQ ON OFF If FT ACQ ON OFF is set to ON, the personality will include a digital demodulator sync word frame trigger (off-the-air) acquisition 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 present only when TRIG SRC DD EXT is set to DD.

Setting TRIG SRC DD EXT to DD automatically sets FT ACQ ON OFF to ON. Frame trigger acquisition prior to the measurement ensures that the Options 151 and 160 digital demodulator frame trigger output signal is accurate.

TRIG SRC FRM VID Allows you to select the digital demodulator trigger source. If TRIG SRC FRM VID is set to VID, a *synchronized* video trigger is set up such that the sync word position in the data stream is correctly aligned on the screen.

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

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" in this chapter for more information about the softkeys accessed by the adjacent channel power menu softkeys.

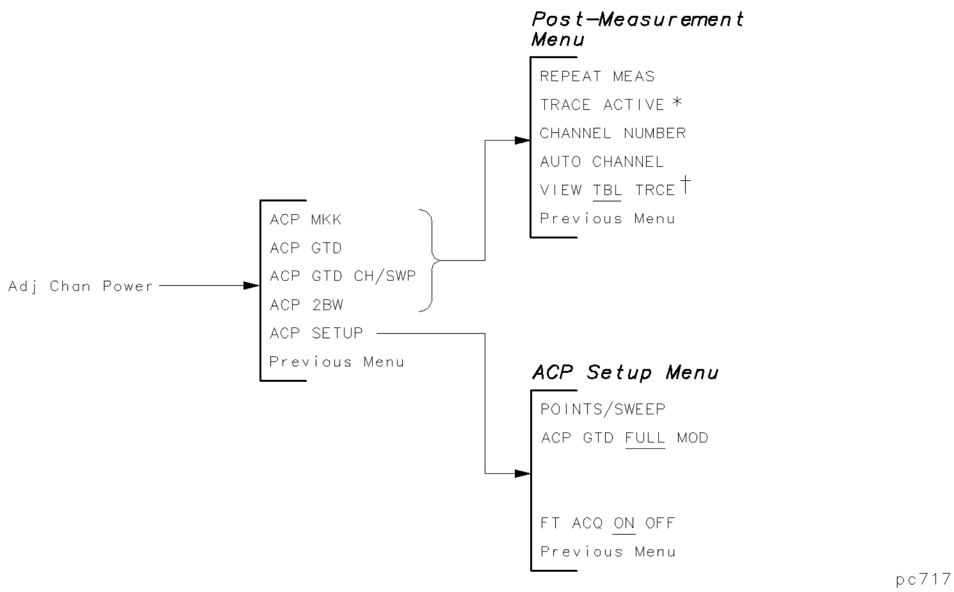


Figure 3-7. The Adjacent Channel Power Measurement Menu Map

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

† VIEW TBL TRCE is not available with the adjacent channel power (ACP GTD CH/SWP) measurement. It changes to GATE ON OFF if TRACE ACTIVE is pressed.

‡ Present only if TRIG SRC DD EXT is set to DD.

Table 3-4 shows the spectrum analyzer settings for each of the adjacent channel power measurements. The PDC measurements personality automatically sets the spectrum analyzer settings for each of the adjacent channel power measurements.

Note For valid measurements, the ACP GTD and ACP GTD CH/SWP measurements require a trigger signal at the rear panel GATE TRIGGER INPUT connector of the spectrum analyzer.

Table 3-4. Spectrum Analyzer Settings

Spectrum Analyzer Setting	ACP MKK	ACP GTD	ACP GTD CH/SWP	ACP 2BW
Span	240 kHz	240 kHz	21 kHz	240 kHz
Resolution bandwidth	1 kHz	1 kHz	1 kHz	1 kHz & 3 kHz
Video bandwidth	3 kHz	30 kHz	30 kHz	30 kHz
Sweep time	8 s or 16 s*	8 s or 16 s*	8 s or 16 s*	8 s or 16 s*
Detector	Peak	Gated positive	Gated Positive	Peak
Trigger mode	Free Run	Free Run	Free Run	Free Run
* The sweep time depends upon the current setting for PERIOD 40ms 20ms . If PERIOD 40ms 20ms is set to 20ms, the shorter sweep time is used. If PERIOD 40ms 20ms is set to 40ms, the longer sweep time is used.				

The limits and parameters for the power measurements can be changed remotely. See "Customizing the PDC Personality" in Chapter 8, "Programming Examples," for more information.

The Adjacent Channel Power Menu Softkeys

ACP MKK
: 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 MKK 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 21 kHz integration bandwidth to measure the power in the adjacent channels.

ACP GTD
: Measures the power in the transmitted channel, as well as the power in the upper and lower adjacent, and alternate channels using the gated video ACP method. ACP GTD uses time-gated spectrum analysis to separate out the spectrum due to modulation from the full spectrum due to modulation and ramping. The full spectrum due to modulation and ramping contains switching transients. The measurement performs two measurement sweeps; one sweep with gated video, and one without gated video. The personality uses the spectrum analyzer peak detector and a 21 kHz integration bandwidth to measure the power in the adjacent channels. If VIEW TBL TRCE is set to table (TBL), the numerical ratio results will be displayed. If VIEW TBL TRCE is set to trace (TRCE), the frequency spectrum results will be displayed.

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

`ACP 2BW` Measures the power in the transmitted channel, as well as the power in the upper and lower adjacent and alternate channels using the two bandwidth method. `ACP 2BW` uses a change in resolution bandwidth to separate out the spectrum due to modulation and the spectrum due to transients from the full spectrum. The measurement performs two measurement sweeps: one with a 1 kHz resolution bandwidth, and one with a 3 kHz resolution bandwidth. 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.

`ACP Setup` Allows you to access the ACP Setup Menu.

The ACP Setup Menu Softkeys

`POINTS/SWEEP` Allows you to specify the number of measurement "points" to be used for the `ACP GTD CH/SWP` measurement. 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 21 to 401. The default number of data points is 401.

`ACP GTD FULL MOD` If `ACP GTD FULL MOD` is set to FULL, gated adjacent channel power measurements will include modulation and transient components. If `ACP GTD FULL MOD` is set to MOD, only modulation components will be included in the measurement. The default is FULL.

`FT ACQ ON OFF` If `FT ACQ ON OFF` is set to ON, the personality will include a digital demodulator off-the-air frame trigger acquisition prior to making ACP GTD and ACP GTD CH/SWP measurements. If `FT ACQ ON OFF` is set to OFF, the measurement will not include the frame trigger acquisition. This softkey is present only when `TRIG SRC DD EXT` is set to DD. Setting `TRIG SRC DD EXT` to DD automatically sets `FT ACQ ON OFF` to ON. Frame trigger acquisition prior to the measurement ensures that the Options 151 and 162 digital demodulator frame trigger output signal is accurate.

The System Menu

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

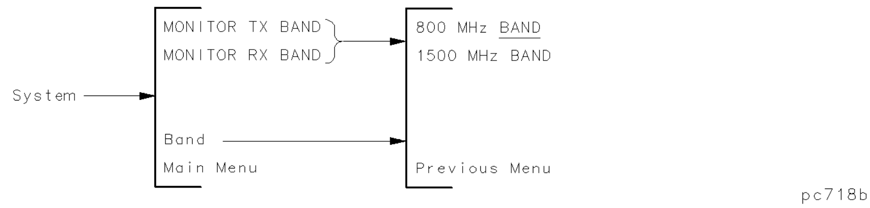


Figure 3-8. The System Menu Map

The System Menu Softkeys

MONITOR TX BAND — Allows you to view the spectrum of the mobile transmit bands. The softkeys accessed by MONITOR TX BAND corresponds to the frequencies shown in the following table.

Table 3-5. Transmit Bands, Mobile Station

Softkey Label	Analyzer Frequency Range (in MHz)
800 MHz BAND	939.5 to 956.5
1500 MHz BAND	1428.5 to 1453.5

MONITOR RX BAND — Allows you to view the spectrum of the mobile receive bands. The softkeys accessed by MONITOR RX BAND corresponds to the frequencies shown in the following table.

Table 3-6. Receive Bands, Mobile Station

Softkey Label	Analyzer Frequency Range (in MHz)
800 MHz BAND	809.5 to 826.5
1500 MHz BAND	1476.5 to 1501.5

Band — Allows you to select a particular band. After you have selected a band with the Band softkeys, you can press either MONITOR TX BAND (to view the transmit bands), or MONITOR RX BAND (to view the receive bands). Pressing Band accesses 800 MHz BAND, and 1500 MHz BAND. The band selection is not changed by turning off the spectrum analyzer or pressing PRESET. See Table 3-5 and Table 3-6 for a list of the frequencies for the bands.

The Spurious Menu

Pressing Spurious accesses the SPUR & HARMONIC and SPURIOUS EMISSION softkeys. SPURIOUS EMISSION allows you to measure spurious emissions over a specified frequency range. SPUR & HARMONIC allows you to measure TX band spurious and harmonic emissions.

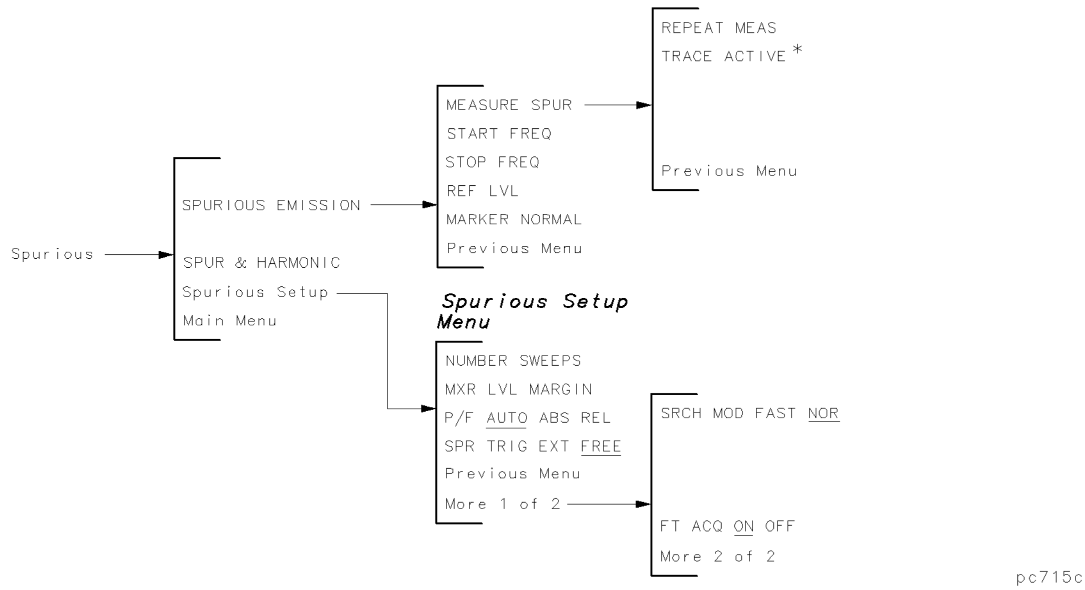


Figure 3-9. The Spurious Menu Map

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

The Spurious Menu Softkeys

SPURIOUS EMISSION Allows you to measure spurious emissions over a specific frequency range. Pressing SPURIOUS EMISSION sets up the analyzer to monitor the transmit band and accesses MEASURE SPUR, START FREQ, STOP FREQ, REF LVL, MARKER NORMAL, and Previous Menu. See "The Spurious Emission Menu Softkeys" for more information about the softkeys that SPURIOUS EMISSION accesses.

SPUR & HARMONIC Performs the TX band spurious and harmonic test sequence. This sequence measures the fundamental carrier level and the level of the half sub-harmonic, 2nd harmonic, 3rd harmonic, the peak in the TX band more than 0.5 MHz below the carrier frequency, and the peak in the TX band more than 0.5 MHz above the carrier frequency. The results are displayed in a table at the end of the test. Absolute power is shown for the fundamental carrier, and absolute and relative powers are shown for all the other measurements.

Spurious Setup Accesses the menu that lets you select the parameters used in a spurious measurement. See "Spurious Setup Menu Softkeys," later in this chapter.

The Spurious Emission 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.

MARKER NORMAL Allows you to enable the marker function.

The Spurious Setup Menu Softkeys

NUMBER SWEEPS Lets you change the number of sweeps used in time domain (zero span) measurements in the spurious and harmonic, spurious emission, and intermodulation spurious measurements. The range is 1 to 999, with a default of 1.

Note that the fundamental measurement in the spurious and harmonic test always uses at least four sweeps.

MXR LVL MARGIN Lets you change the minimum margin between the 1 dB gain compression level at the input mixer and the *mean* value of the measured carrier for the spurious and harmonic measurement. This will change the amount of amplitude margin used in setting the input attenuator automatically. Using a higher value will lower the harmonic distortion products generated in the analyzer, but also will raise the displayed noise level.

For measurements of carriers in the 1500 MHz band, internally generated harmonic distortion is not a problem, as the built-in YIG preselector is used when measuring the 2nd and 3rd harmonics. For measurement of carriers in the 800 MHz band, this function allows the harmonic distortion-free dynamic range to be optimized for the particular setup and specs. This function also controls the positioning of the trace on screen for zero span measurements. The range is 0 dB to 40 dB, with a default of 15 dB. This setting is saved even if you press [PRESET] or turn off the instrument.

P/F AUTO ABS REL Lets you select the criteria used for pass/fail in the spurious and harmonic, spurious emission and intermodulation spurious measurements. Auto pass/fail normally is used, which automatically selects *either* absolute *or* relative testing based on the measured carrier power and the limit values. Above a certain carrier level the relative limit is used; below that limit the absolute limit is used. This is equivalent to saying that the test is passed if either the absolute or the relative result is less than the corresponding limit value.

Set P/F AUTO ABS REL to ABS for pass/fail checking to be done only on the *absolute* result. Set P/F AUTO ABS REL to REL for pass/fail checking to be done only on the *relative* result. A box appears around either the Abs or Rel label on the display to indicate the result actually used to determine pass or fail. This setting is saved even if you press [PRESET] or turn off the instrument.

SPR TRIG EXT FREE

Allows you to select either free run or external trigger for the spurious emission measurement. In free run trigger mode, the analyzer does the following:

1. the burst is captured with full frame
2. the mean power is calculated
3. the threshold is set to the result of the first mean power calculation
4. the burst power above the threshold is then re-calculated

In external trigger mode, the analyzer does the following:

1. captures the full frame with proper slot position
2. calculates the mean power slot by slot
3. the mean power is displayed for the slot with the highest level spurious signal

In external trigger mode, the trigger delay must be set to correspond to the delay of the trigger signal.

SRCH MOD FAST NOR

Allows you to select the search mode for spurious emission measurements; either fast or normal.

Normal mode uses the marker track function of the spectrum analyzer for the spurious search.

Fast mode uses the peak search marker function of the spectrum analyzer for the spurious search.

FT ACQ ON OFF

If FT ACQ ON OFF is set to ON, the personality will include a sync word frame trigger (off-the-air) acquisition prior to making the *externally triggered* zero span portion of the spurious measurement.

The Post-Measurement Menu

Once the measurement has been completed, many of the PDC 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.

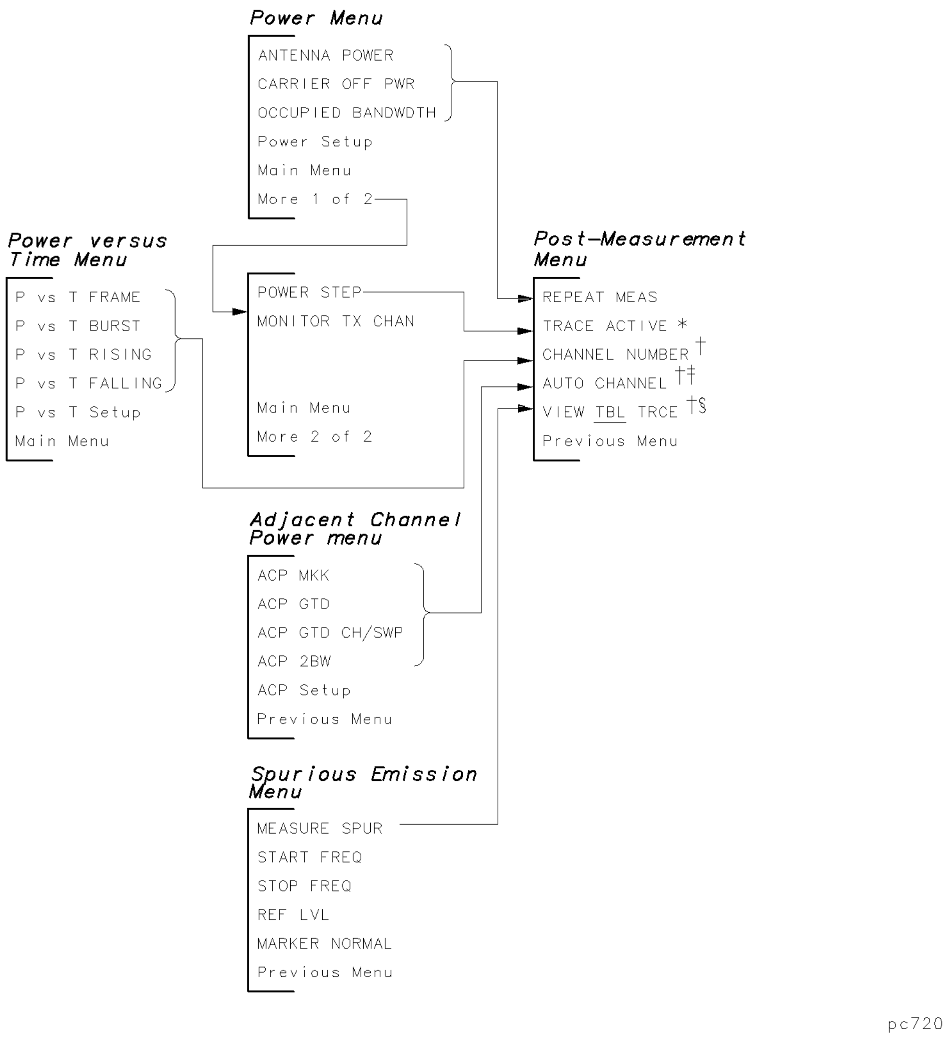


Figure 3-10. The Post-Measurement Menu Map

* 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 the adjacent channel power measurements (except ACP GTD CH/SWP). VIEW TBL TRCE changes to GATE ON OFF when TRACE ACTIVE is pressed. 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 COMPARE.
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.
VIEW TBL TRCE	For the adjacent channel power measurements (ACP MKK, ACP GTD, and ACP 2BW), VIEW TBL TRCE allows you to view either the numeric results in a table (TBL), or view the trace of the frequency spectrum (TRCE).
TRIG DELAY	For a power versus time measurement, TRIG DELAY allows you to enter the delay time from the external trigger signal to the reference point of the burst. The reference point is point 0 (point 0 is the start of the first symbol). If TRIG SRC DD EXT is set to EXT, you can enter a trigger delay from −32,000 μs to +6,000 μs in 1 μs increments. If TRIG SRC DD EXT is set to DD, you can enter a trigger delay from −32,000 μs to +3,400 μs. If you do not enter a trigger delay, a default value of 0 μs is used.
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).
GATE ON OFF	Used for the ACP gated measurement, GATE ON OFF allows you to select viewing the spectrum with the gate on (view the spectrum due to modulation only) or with the gate off (view the full spectrum due to modulation and switching transients). GATE ON OFF 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's RMS error vector magnitude (EVM), RMS magnitude error, RMS phase error, peak EVM, carrier frequency error, and I-Q origin offset.

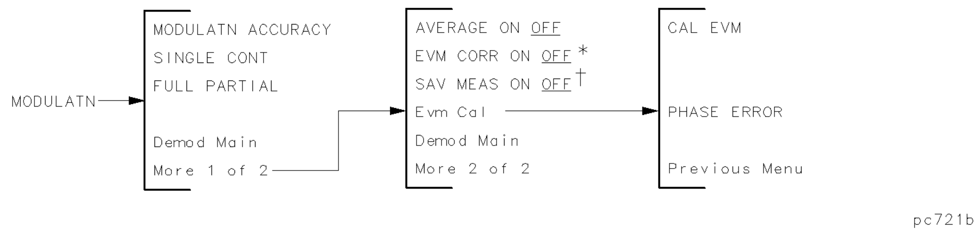


Figure 3-11. The Modulation Menu Map

* Refer to the SAV MEAS ON OFF softkey description.

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

The Modulation Menu Softkeys

MODULATN ACCURACY Measures the transmitter's 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 modulation accuracy results for the last 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 1 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, minimum, and maximum for RMS EVM, RMS magnitude error, and RMS phase error. RMS EVM uncertainty ranges for room and full temperature ranges are also displayed. 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 a correction value generated by the EVM calibration measurement. This correction value 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, "Mobile Station 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 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 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 PDC menu. This softkey is blanked if a measurement has not been made, is aborted, 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, "Mobile Station 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's 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 ON, pressing I-Q PATTERN will display the I-Q pattern for the currently stored measurement.

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 ON, pressing 8 POINT CONSTLN will display the eight-point constellation for the currently stored measurement.

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, 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 PDC menu.

Note that if a measurement is aborted, 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's demodulated bit sequence and to highlight a selected portion of that sequence.

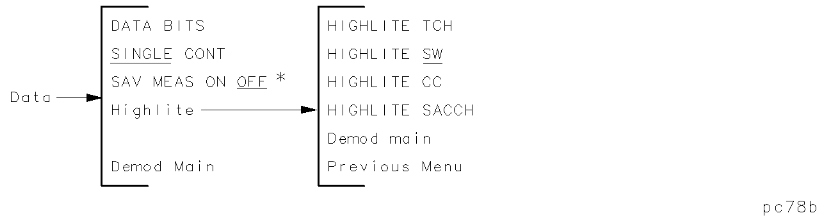


Figure 3-13. The Data Menu Map

* 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 ON, pressing DATA BITS will display the demodulated data bits for the last measurement. The default display will highlight the 20-bit sync word portion of the 280-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.

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

Highlite Pressing the Highlite softkey accesses the highlight menu softkeys which are described below. These softkeys allow the user to highlight selected portions of the bit sequence.

The Highlight Menu Softkeys

HIGHLITE TCH — Pressing the HIGHLITE DATA softkey will cause the data portion of the bit sequence (traffic channel) to be highlighted. For PDC mobile stations these are bits 7 through 118, and bits 163 through 274. Each of these two blocks is 112 bits long.

HIGHLITE SW — Pressing the HIGHLITE SW softkey will cause the sync portion of the bit sequence to be highlighted. For PDC mobile stations these are bits 119 through 138. This block is 20 bits long.

HIGHLITE CC — Pressing the HIGHLITE CC softkey will cause the CC (Coded Digital Verification Color Code) portion of the bit sequence to be highlighted. For PDC mobile stations these are bits 139 through 146. This block is 8 bits long.

HIGHLITE SACCH — Pressing the HIGHLITE SACCH softkey will cause the SACCH (Slow Associated Control CHannel) portion of the bit sequence to be highlighted. For PDC mobile stations these are bits 148 through 162. This block is 15 bits long.

The Demodulator 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 the timeslot number, triggering, and error messages.

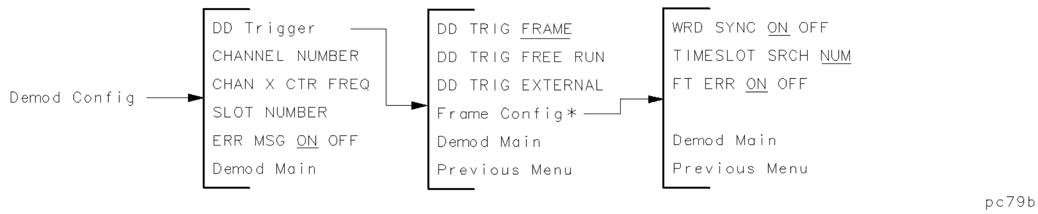


Figure 3-14. The Demodulator Configuration Menu Map

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

The Demodulator 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 PDC 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.

SLOT NUMBER Pressing the SLOT NUMBER softkey allows the user to select which of the six timeslots the measurement should be made on. The default value is timeslot number zero. If the digital demodulator trigger is set to FRAME, and frame trigger configuration is set so that WRD SYNC ON OFF is ON and TIMESLOT SRCH NUM is set to NUM, (these are the default settings) the frame trigger will attempt to lock to the selected timeslot number. See the Frame Config menu softkey descriptions for more detail. This softkey is identical to the SLOT NUMBER 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 6, "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 Digital Demodulator Trigger Menu Softkeys

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 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 wave (CW) 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 measurements that are made to be triggered by an external trigger that must be connected to the rear panel of the instrument.

If Option 105 is installed, the signal should be connected to GATE INPUT, and GATE OUTPUT connected to EXT TRIG. In this case, TRIG DELAY in the Trigger Config menu can be used to correctly position an external trigger.

If Option 105 is not installed, the signal must be connected directly to EXT TRIG INPUT.

If no trigger is present, then the measurement will be held up indefinitely until a trigger arrives. Selecting the external trigger will cause the Frame Config softkey to become unavailable.

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 TIMESLOT SRCH NUM softkey (see below) and the SLOT NUMBER softkey in the Demod Config menu. The frame trigger will be positioned relative to the timeslot to optimize making a measurement on that timeslot. If WRD SYNC ON OFF is set to OFF, no 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.

TIMESLOT SRCH NUM The TIMESLOT SRCH NUM softkey allows you to control how the frame trigger will be acquired if WRD SYNC ON OFF is set to ON. If WRD SYNC ON OFF is set to OFF, the setting of the TIMESLOT SRCH NUM has no effect. If WRD SYNC ON OFF is set to ON, and TIMESLOT SRCH NUM is set to NUM (which is the default), the frame trigger will attempt to synchronize to the timeslot selected by the SLOT NUMBER softkey in the Demod Config menu. The default timeslot number is zero. If WRD SYNC ON OFF is set to ON, and if TIMESLOT SRCH NUM is set to SRCH, the frame trigger will synchronize to whichever timeslot has the best match with a sync word. First, a search for a perfect match is attempted starting with timeslot zero and continuing through timeslot five. A perfect match will end the search. If no perfect matches are found, then the timeslot with the least amount of sync word bit errors will be used.

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 6, "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

Base Station Measurements

This chapter demonstrates how to make measurements on a base station with the PDC measurements personality. This chapter contains procedures for performing the following measurements:

- Configuring the personality for your test setup.
- Measuring the antenna power, the carrier off power, the power steps, the occupied bandwidth, and monitoring the transmit channel.
- Measuring the adjacent channel power and channel power.
- Monitoring the PDC frequency bands, measuring the transmitter intermodulation products, and measuring the spurious emissions.

If you have Options 151 and 160 you can also do the following:

Note See "List spectrum analyzer options and firmware revision" in the beginning part of Chapter 1, "Getting Started," to quickly determine the options installed in your analyzer.

- Configure the personality for measurements using the digital demodulation capability.
- Measure the RMS error vector magnitude (EVM), RMS magnitude error, RMS phase error, peak EVM, carrier frequency error, and I-Q origin offset.
- Display the transmitted I-Q pattern graph or eight-point constellation graph.
- Display the transmitted demodulated bit sequence and highlight a selected portion of that sequence.

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

1. Load the 85720C PDC measurements personality into the spectrum analyzer and perform the steps described in "Preparing to Make a Measurement" in Chapter 1, "Getting Started."
2. Perform the procedures in the following section, "Configuring the Personality for Your Test Setup."

An external trigger signal is not required for any of the measurements in this chapter.

Configuring the Personality for Your Test Setup

Before you can begin to make a measurement, you must configure the personality according to the test setup that you are using. To configure the personality, you use the functions that are in the `Config` and `Physical Channel` menus. This section contains 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). Agilent Technologies 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 051

- For specified amplitude accuracy with Option 051, use enough external attenuation so that the spectrum analyzer's internal input attenuation is within the 10 to 40 dB range.
- For best amplitude accuracy with Option 051, use enough external attenuation so that the spectrum analyzer's internal input attenuation is within the 10 to 30 dB range.

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

- For the best sensitivity, select the lowest possible value of external attenuation without exceeding the spectrum analyzer's 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 internal input attenuation. The spectrum analyzer's 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, and transmitter intermodulation spurious emissions, set the external attenuation at or slightly greater than the value given by the following equation:

  external attenuation (dB) = mean carrier power (dBm) − input attenuation (dB) + 13 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 PDC measurements personality by pressing (MODE) PDC ANALYZER.

2. Press Config.

3. If necessary, press TRANSMIT BS MS so that BS is underlined. Selecting BS selects a base station as the device to be tested.

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). Agilent Technologies 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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4. Because you need to use an external piece of equipment (for example, an attenuator, test fixture, or directional coupler) to connect the transmitter's output to the spectrum analyzer's 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:

Base Station Power	External Attenuation
+45 dBm (30 W) to +53 dBm (200 W)	40 dB
+35 dBm (3 W) to +45 dBm (30 W)	30 dB
+30 dBm (1 W) to +35 dBm (3 W)	20 dB

Note For the best absolute amplitude accuracy, the entered value for the 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 10, "Specifications," 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).

5. Press More 1 of 2.

6. Many of the PDC measurements display either "PASS" or "FAIL" to indicate if the test passed the test limits. If you want a pass/fail message to be displayed, press PASSFAIL ON OFF so that ON is underlined. The test limits can be changed; see "Customizing the PDC Personality" in Chapter 8, "Programming Examples," for more information.

7. If you are testing at a base station port that has a single carrier present, make sure that SGL is underlined for the TOTL PWR SGL MULT function. If necessary, press `TOTL PWR SGL MULT` so that SGL is underlined.

   If you are testing at a base station port that has multiple carriers present, press `TOTL PWR SGL MULT` so that MULT is underlined, enter the total transmit power using the data keys, and then press (+dBm).

8. To tune by channel number, do the following:

   - Press `Define Channels` to access the define channels menu
   - Press `DEFINE BS CHAN` and enter the lowest channel number using the front panel knob, step keys, or number pad.
   - Press `DEFINE BS FREQ` and enter the frequency that corresponds to the lowest channel number.
   - Press `Previous Menu`.

9. Press `More 2 of 2` `Main Menu` to return to the main menu.

Pressing `Config` accesses the configuration softkeys. Because the PDC 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 equipment. 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 4-1 shows the configuration menu and annotation.

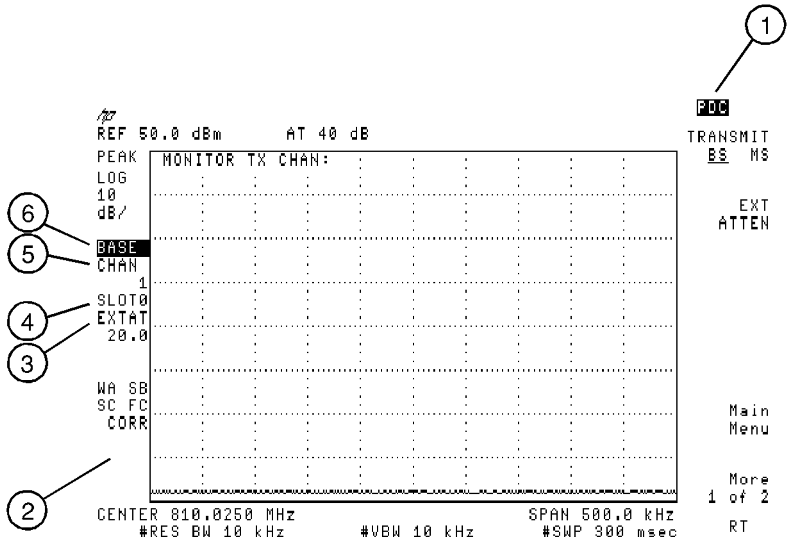

Figure 4-1. The Configuration Menu

Item	Description
1	Indicates the spectrum analyzer is using the PDC measurements personality (also referred to as the PDC mode).
2	If TOTL PWR SGL MULT is set to MULT, a number appears here. The number indicates the current value for the total power.
3	The current value for external attenuation.
4	The current value for slot number
5	The current channel number.
6	The selected transmission source (base station or mobile station).

To select a channel to test

Caution Make sure that the signal that is 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 PDC measurements personality by pressing (MODE) `PDC ANALYZER`.
3. Press `Physical Channel`. (You can also press (FREQUENCY). When the spectrum analyzer is in the PDC mode, (FREQUENCY) accesses the `Physical Channel` softkeys.)
4. Select the channel to test.
   - If you know the channel number, and the channels have been defined under the `Config` menu, press `CHANNEL NUMBER`, enter the channel number using the data keys, then press (ENTER).
   - If you want the spectrum analyzer to find and select the channel with the highest signal level in the current band, press `AUTO CHANNEL`. If there is no signal above the carrier minimum power threshold in the current band, the other band is searched. The carrier minimum power threshold default value is −15 dBm. The current band in channel mode is the band that contains the currently-selected 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's frequency range.
5. 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) is displayed on the left side of the spectrum analyzer display in Figure 4-2.

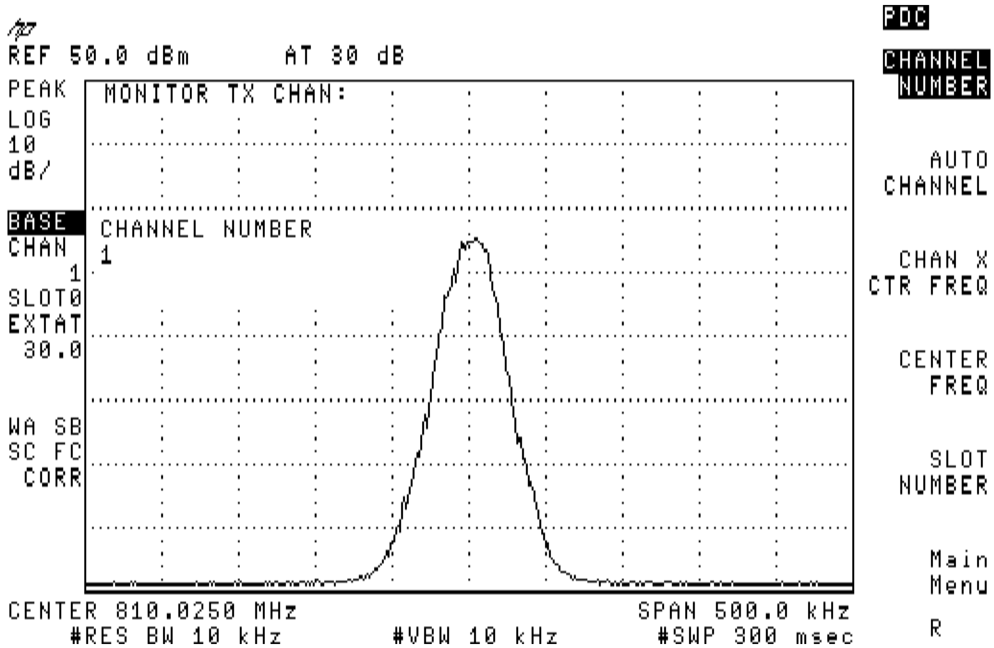

Figure 4-2. Selecting a Channel

To configure a digital demodulator-based test (For systems with Options 151 and 160)

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, or demodulated data bits), you must configure the digital demodulator according to the test setup being used. After using the functions in the Config and Physical Channel menus to complete the main personality setup, use the Demod Config menu functions to configure the digital demodulator. This section contains the procedures for configuring the digital demodulator.

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

The digital demodulator setup includes:

- Defining the timeslot to be measured.
- Turning measurement error messages on or off.
- Selecting frame, free run, or external triggering mode for the measurement.
- Configuring the frame trigger, if frame trigger is selected.

1. If the digital demodulator main menu is not displayed, press (MODE) PDC ANALYZER More 1 of 2 Digital Demod.
2. Press Demod Config to access the digital demodulator configuration menu.
3. Press SLOT NUMBER, enter the correct timeslot number using the data keys, then press (ENTER). This enters the timeslot number of the timeslot you want to measure. The default value is timeslot 0. This function is identical to SLOT NUMBER in the physical channel menu. If the desired number was entered previously, it does not need to be entered here.

Note SLOT NUMBER is relevant for digital demodulator-based measurements only when the frame trigger is selected. (See step 7b in this procedure.) The value of SLOT NUMBER is used by the frame trigger to automatically position the measurement at the timeslot of interest. Free run and external trigger do not use SLOT NUMBER for digital demodulator-based measurements.

4. Press ERR MSG ON OFF until ON is underlined. The ERR MSG ON OFF softkey enables all automatic error messages related to digital demodulator measurements, including triggering errors. See Chapter 6, "Error Messages and Troubleshooting," for an explanation of the error states. If you want to make a measurement without being interrupted or stopped by error messages, press ERR MSG ON OFF until OFF is underlined. 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.
5. Press DD Trigger to access the digital demodulator trigger menu.

6. 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 configured according to the characteristics of the PDC signal. If the signal contains any of the six possible non-superframe 20-bit PDC timeslot synchronization words, the frame trigger is the best choice.

Note Frame trigger synchronization only works with information channels. It will not sync to control channels.

For a continuous signal without a sync word, any of the triggers can be selected; however, free run trigger and external trigger will permit the measurement to run more quickly than frame trigger. Frame trigger will cause the digital demodulator to search for a sync word that is missing, forcing the measurement to halt. Free run trigger, or external trigger do not search for the sync word.

External trigger requires that you supply a trigger signal to the rear panel of the instrument, and positioned such that the digital demodulator measurement interval is set to the desired time.

If Option 105 is installed, the signal should be connected to GATE INPUT, and GATE OUTPUT connected to EXT TRIG. In this case, TRIG DELAY in the Trigger Config menu can be used to correctly position an external trigger.

If Option 105 is not installed, the signal must be connected directly to EXT TRIG INPUT.

If no trigger is present, then the measurement will be held up indefinitely until a trigger occurs.

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

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

   a. Press WRD SYNC ON OFF until ON is underlined. The WRD SYNC ON OFF softkey enables and disables the frame trigger sync word search. 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 OFF. If you want to use the frame trigger without including automatic synchronization to a sync word, press WRD SYNC ON OFF until OFF is underlined.

   The default for WRD SYNC ON OFF is ON.

   b. Press TIMESLOT SRCH NUM until NUM is underlined. If NUM is underlined, frame trigger acquisition causes the digital demodulator to synchronize only with the timeslot defined by SLOT NUMBER . The input signal must contain the 20-bit PDC synchronization word for that timeslot. Only one of the six possible sync sequences is correlated with the demodulated bits. An exact bit match terminates the acquisition. If an exact bit match with the timeslot sync sequence defined by SLOT NUMBER is not found, the best bit match is used to synchronize the frame trigger. Frame trigger acquisition is successful if the best sync word match can be properly positioned in the data record.

   The default for TIMESLOT SRCH NUM is NUM.

   If SRCH is underlined, frame trigger acquisition causes the digital demodulator to search for an exact bit match with each of the six possible non-superframe 20-bit PDC sync words, starting with sync word 1. The search successively correlates each of the six possible sync words with the demodulated bits. The first exact match found terminates the search, synchronizing the frame trigger to the first exact match. If no exact match is found for any of the six possible sync words, the sync word yielding the smallest number of bit errors is used to synchronize the frame trigger. Frame trigger acquisition is successful if the best sync word match can be properly positioned in the data record.

The sync word number that the frame trigger is synchronized to is reported on each measurement screen, and on the status screen. The number of bit errors for this sync word is shown on the status screen.

c. Press `FT ERR ON OFF` until ON is underlined to enable the frame trigger error messages.

The `FT ERR ON OFF` softkey enables the error messages associated with the process of acquiring the frame trigger. See Chapter 6, "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.

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8. Press `Demod Main` to return to the digital demodulator main menu.

Measuring Power

To make a power measurement, you use the functions that are accessed by pressing `Power`. This section contains the procedures for performing the following measurements:

- Measure the antenna power.
- Measure the carrier off leakage power.
- View the "power steps" of a carrier.
- Measure the occupied bandwidth.
- Monitor the transmit channel.

The power measurements make measurements for both digital and analog carriers according to the RCR STD-27C standard. The power measurements routines were specifically designed for measurements on $\pi/4$ DQPSK digital carriers, but these measurements are also applicable to FM analog carriers. Note that test equipment designed for analog carriers may not give correct results for digital 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 5, "Base Station Menu Map and Softkey Descriptions."

To set up a power measurement

1. Press Power . If Power is not displayed, press (MODE) PDC ANALYZER .
2. Press Power Setup to access the power setup functions. Power Setup allows you to change how power measurements will be measured and displayed.
3. Enter the number of points per sweep to be used for the occupied bandwidth measurement. OBW PTS/SWP allows a range of 21 to 401 points. The measurement will be faster with less points, but somewhat less accurate. The default is 401.
4. Select the measurement type for the carrier off leakage power measurement. If you want to make the measurement by the RCR (standard) method, set COPWR RCR MKK to RCR. The RCR method performs a zero-span measurement and averages the power in the whole frame. The carrier needs to be OFF when the measurement is initiated.

   If you want to make the measurement by the MKK method, set COPWR RCR MKK to MKK. The MKK method performs a frequency domain measurement. The carrier needs to be ON when the measurement is initiated. The carrier is then turned OFF, and the measurement senses the change and completes the measurement. The default is RCR.
5. Select the PDC band to be used by the carrier off leakage power measurement (MKK method only). Press Band to access 800 MHz and 1500 MHz softkeys, and choose the one that contains the carrier.
6. Press Previous Menu .

To measure the antenna power

1. Make sure that the channel number selection agrees with the transmitter's RF output. See "To select a channel to test" in this chapter for more information.
2. If ANTENNA POWER is not displayed, press Power . (If Power is not displayed, press (MODE) PDC ANALYZER to access Power .)
3. Press ANTENNA POWER . The personality will measure the mean carrier power and then display the results.
4. Press Previous Menu if you are 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, the personality measures the time waveform of the RF 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. 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 and lower limits for the antenna power. The limits can be entered remotely; see "Customizing the PDC Personality" in Chapter 8, "Programming Examples," for more information. See Figure 4-3 for an example of the antenna power measurement.

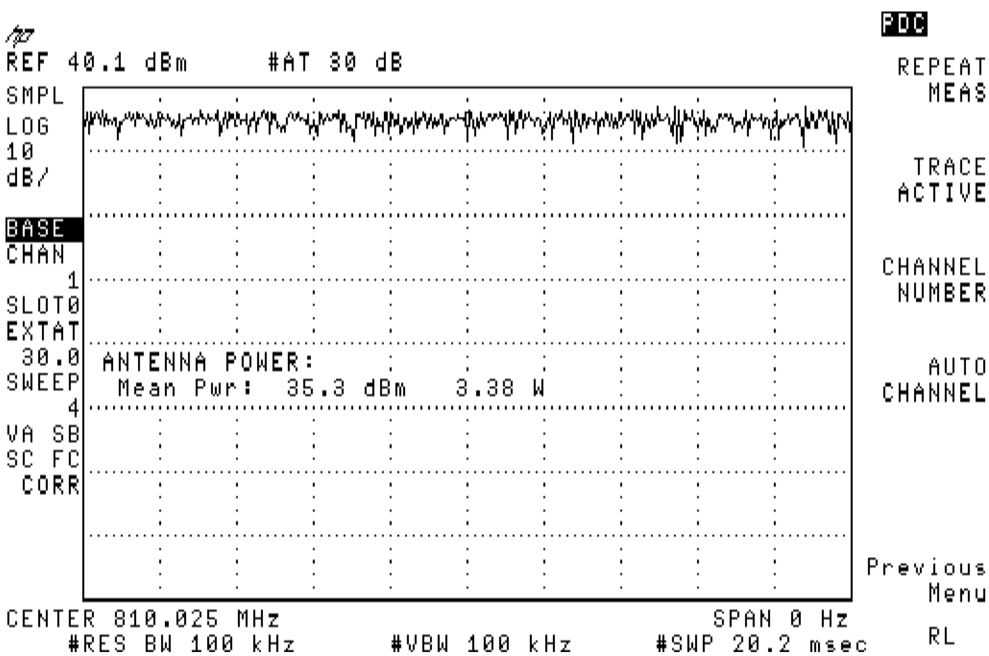


Figure 4-3. Antenna Power Measurement

RCR reference: The antenna power measurement is based on RCR STD-27C 6.1.4.2, "Antenna Power Deviation (II)" and 3.4.2.1, "Transmission Output."

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 to test" earlier in this chapter for more information.
2. Perform the antenna power measurement before making the carrier off leakage power measurement. This is necessary because the carrier off leakage power determines a relative result with respect to the antenna power.
3. If `CARRIER OFF PWR` is not displayed, press `Power`. (If `Power` is not displayed, press (MODE) `PDC ANALYZER` to access `Power`.)
4. Turn off the transmitter's RF output power.
5. Press `CARRIER OFF PWR`. The personality will make the measurement and display the results.
6. Press `Previous Menu` if you are done with the carrier off leakage power measurement, or use one of the post-measurement functions.

`CARRIER OFF PWR` measures the power when the carrier is off. Two values are then determined. They are an absolute value (in dBm), and a ratio (in dB), with respect to the last measured antenna power. `CARRIER OFF PWR` sets the reference level to −20 dBm and the input attenuation to 10 dB. The measurement method depends upon the setting of `COPWR RCR MKK` in the `Power Setup` menu.

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. Pass/fail checking gives a pass if *either* the absolute *or* relative result is less than the corresponding limit value. See Figure 4-4 for an example of a carrier off leakage power measurement. For a base station, the carrier off leakage measurement is useful for measuring the residual transmit power level when a transmitter is turned off.

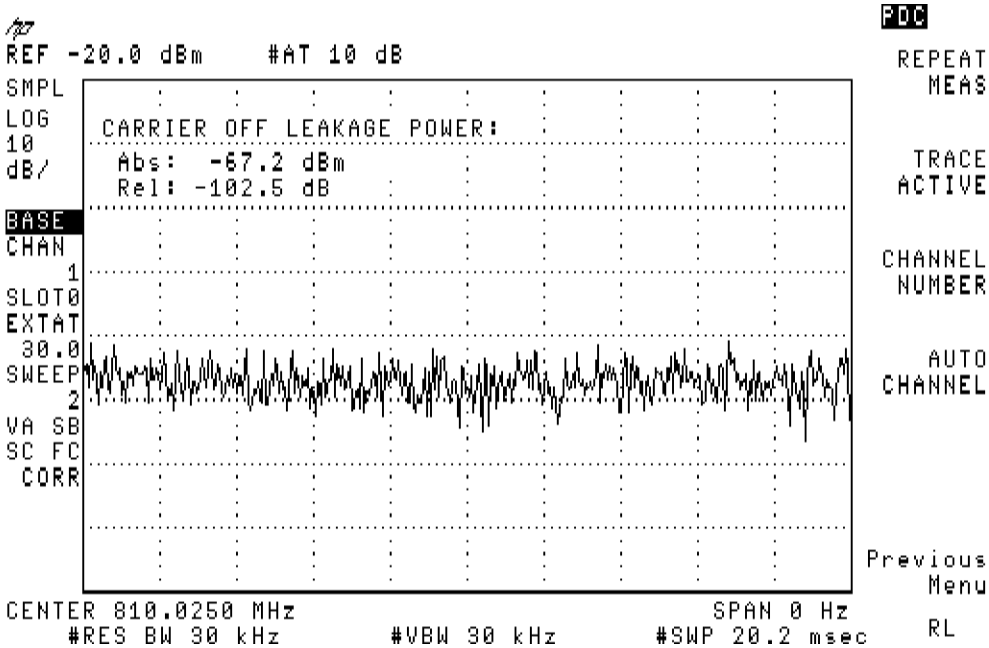


Figure 4-4. Carrier Off Leakage Power Measurement (RCR method)

RCR reference: The carrier off leakage power is based on RCR STD-27C 6.1.5, "Leakage Power During Carrier Off," and 3.4.2.5, "Leakage Power During Carrier Off Time."

To measure the power steps of a carrier

1. Make sure that the channel number selection agrees with the transmitter's RF output. See "To select a channel to test" in this chapter for more information.
2. Perform the antenna power measurement with the transmitter set to the highest power level to be measured. See "To measure the antenna power" for more information about the antenna power measurement. Perform the antenna power measurement before the power step measurement because the power step measurement adjusts the reference level and input attenuator according to the peak power that was measured by the antenna power measurement. The power step measurement adjusts the reference level and attenuation so the peak power of the carrier is positioned 2 dB below the reference level.
3. Turn off the transmitter.
4. If POWER STEP is not displayed, press Power More 1 of 2. (If Power is not displayed, press (MODE) PDC ANALYZER to access Power.)
5. Press POWER STEP. A message will appear; this message is a reminder that the power step measurement is triggered by turning on the transmitter after it has been turned off.
6. Turn on the transmitter.
7. When the spectrum analyzer begins to sweep, you can increase or decrease the output power of the carrier.
8. 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). Then press (MODE) twice to return to the previous PDC menu, turn off the transmitter, press REPEAT MEAS, and then turn on the transmitter.
9. You may want to use the spectrum analyzer's marker functions to determine the amplitude of each step. To place a marker on the highest level, press (PEAK SEARCH). If you want to find the difference between the highest level and a lower level, press MARKER DELTA and then use the large knob on the spectrum analyzer's front panel to move the marker. Press (MODE) twice to return to the post-measurement menu.
10. Press Previous Menu if you are done with the power step measurement, or use one of the post-measurement functions.

The POWER STEP measurement takes one measurement sweep that lasts 8 seconds. During that time, you can increase or decrease the output power of the carrier and view the results. See Figure 4-5 for an example of the power step measurement.

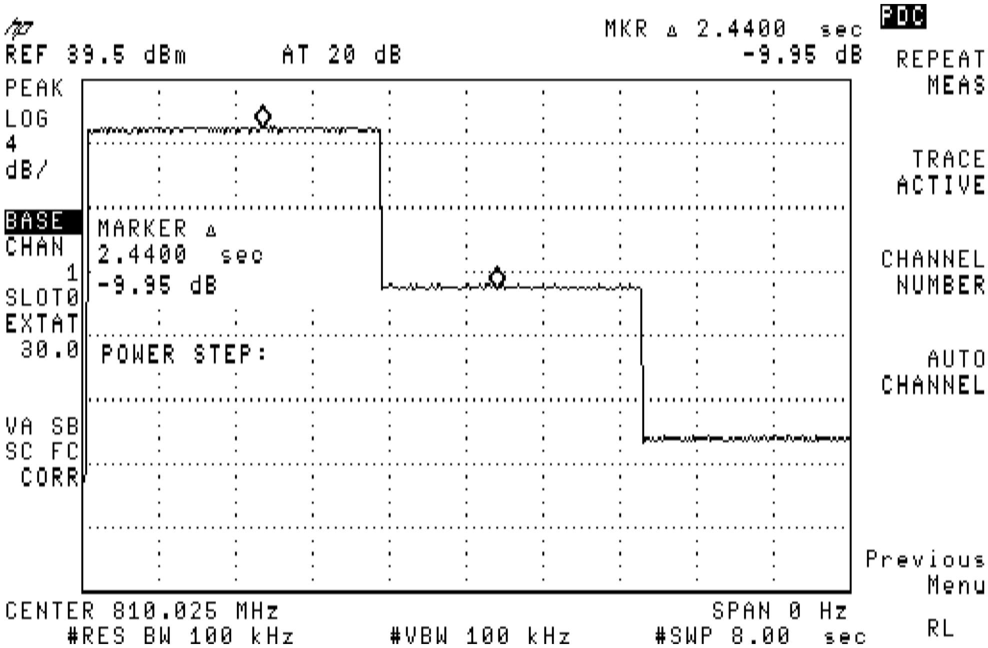


Figure 4-5. Power Step Measurement

To measure the occupied bandwidth

1. Make sure that the channel number selection agrees with the transmitter's RF output. See "To select a channel 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) PDC ANALYZER to access Power.)
3. Press OCCUPIED BANDWDTH. The PDC measurements personality automatically sets the reference level and input attenuation based upon the measured carrier, measures the 99 percent occupied power bandwidth and the approximate center frequency error of the transmitted signal, and then displays the results. (OCCUPIED BANDWDTH only approximates the center frequency error; it does not provide an accurate measurement.)
4. Press Previous Menu if you are 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 approximate center frequency error 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 ON OFF is set to ON, a message is displayed that indicates if the measurement passed (PASS) or failed (FAIL) the test limits. See Figure 4-6 for an example of an occupied bandwidth measurement.

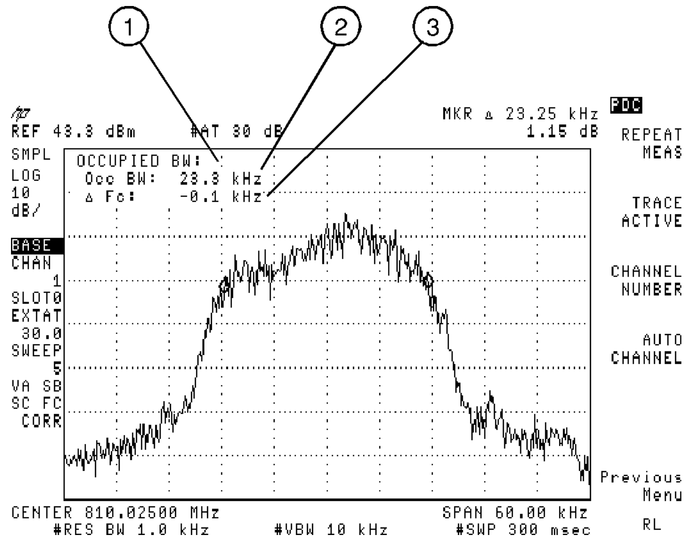


Figure 4-6. Occupied Bandwidth Measurement

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 approximate center frequency error.

RCR reference: The occupied bandwidth measurement is based on RCR STD-27C 6.1.3, “Occupied Bandwidth” and 3.4.2.7, “Permissible Occupied Frequency Bandwidths.”

To monitor the transmit channel

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

MONITOR TX CHAN displays the RF spectrum of the transmit channel that you select. See Figure 4-7 for an example of viewing channel 1.

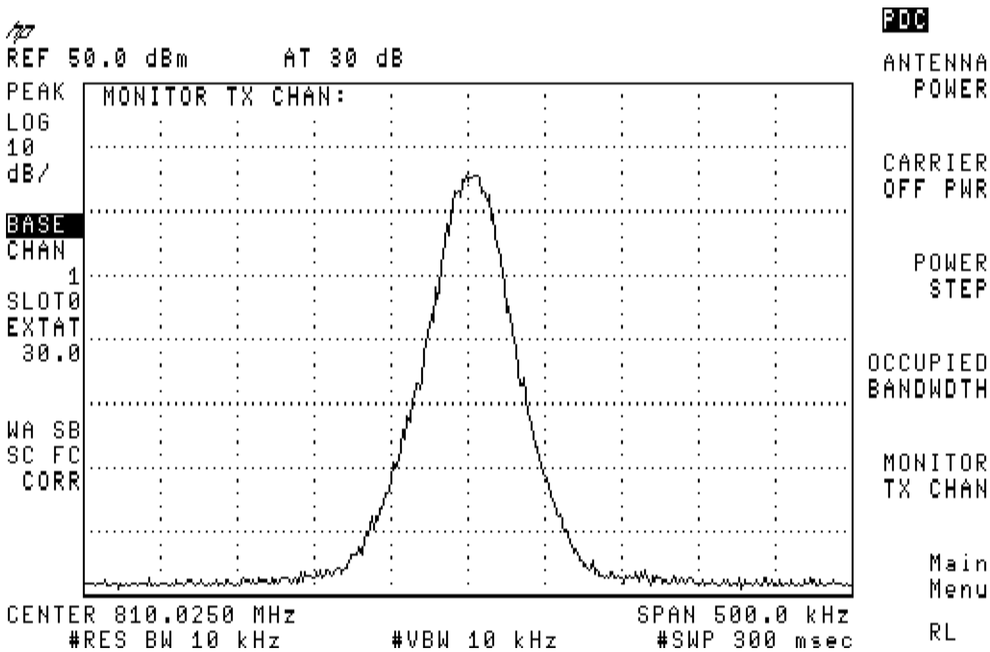


Figure 4-7. Viewing Channel 1

Measuring Adjacent Channel Leakage Power

To make an adjacent channel power (ACP) measurement, use the functions that are accessed by pressing `Adj Chan Power`. This section contains the procedures for performing the following measurements:

- Adjacent channel leakage power
- Channel power

Both the ACP and channel power measurements use the "spectrum analyzer integration" method for measuring the power. The ACP measurement routines were specifically designed for measurements on $\pi/4$ DQPSK digital carriers. The ACP measurements may also be used for FM analog carriers.

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 5, "Base Station Menu Map and Softkey Descriptions."

To measure the adjacent channel leakage power

1. Make sure that the channel number selection agrees with the transmitter's RF output. See "To select a channel to test" earlier in this chapter for more information.
2. Press Adj Chan Power. (If Adj Chan Power is not displayed, press (MODE) PDC ANALYZER to access Adj Chan Power.)
3. Make the ACP measurement using the ACP softkey.
   a. Press ACP. The personality measures the total transmitted power, as well as the power in the upper adjacent channel, lower adjacent channel, and alternate channels. The leakage power ratio numerical results are displayed.
   b. If you want to view the spectrum (trace) results of the 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 with 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.
4. Press Previous Menu if you are done with the ACP measurement, or use one of the post-measurement functions.

An ACP measurement measures the power that "leaks" from the transmit channel into adjacent and alternate channels. Because the signal from a base station is continuous and not burst, the results from the ACP measurement are from modulation and noise effects. The personality uses the spectrum analyzer's sample detector and a 21 kHz integration bandwidth to measure the power in the adjacent channels. 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.

See Figure 4-8 for an example of the numerical table results of an ACP measurement. See Figure 4-9 for an example of the spectrum results of an ACP measurement.

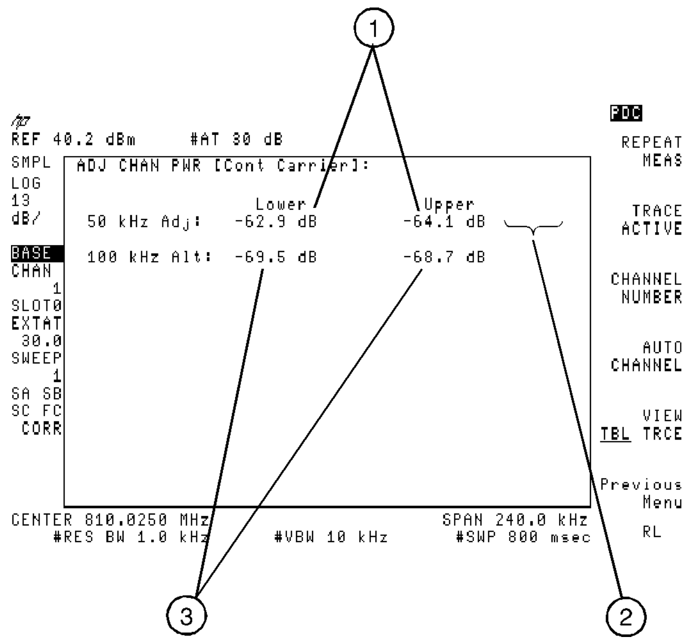


Figure 4-8. Table Results for the ACP Measurement

Item	Description
1	The power leakage (relative to the carrier power) into the upper and lower channels that are spaced 50 kHz from the carrier (adjacent channel).
2	An F next to any of the measured values indicates that the measured value failed the measurement limits.
3	The power leakage (relative to the carrier power) into the upper and lower channels that are spaced 100 kHz from the carrier (alternate channel).

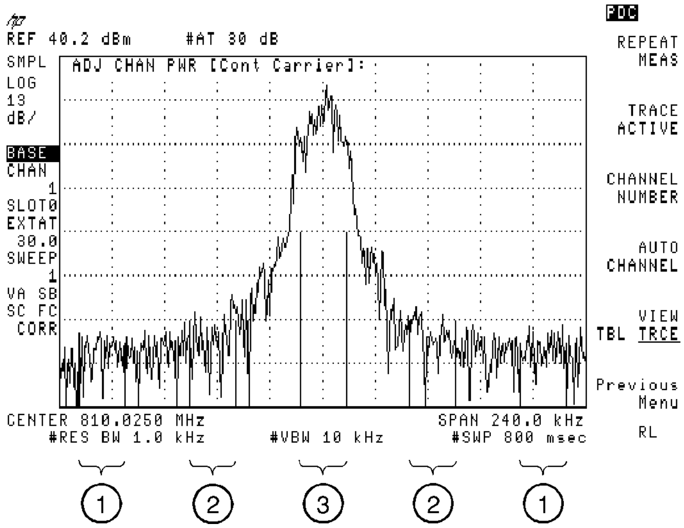


Figure 4-9. Spectrum Results of the ACP Measurement

Item	Description
1	Indicates the integration bandwidth of the alternate channel.
2	Indicates the integration bandwidth of the adjacent channel.
3	Indicates the integration bandwidth of the carrier channel.

RCR reference: ACP measurements are based on RCR STD-27C 6.1.8, “Leakage Power of Adjacent Channel,” and RCR STD-27C 3.4.2.3, “Adjacent Channel Leakage.”

To measure the channel power

1. Set the channel number to the desired channel.
2. *If a carrier is not present:* The spectrum analyzer's 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), and then use the large knob on the spectrum analyzer's 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 been 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) PDC ANALYZER to access Adj Chan Power .)
5. Press CHAN POWER . The personality will measure the total power in any channel. The absolute channel power will be displayed.
6. Press Previous Menu if you are 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's sample detector and a 21 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 4-10 for an example of a channel power measurement on an unoccupied channel.

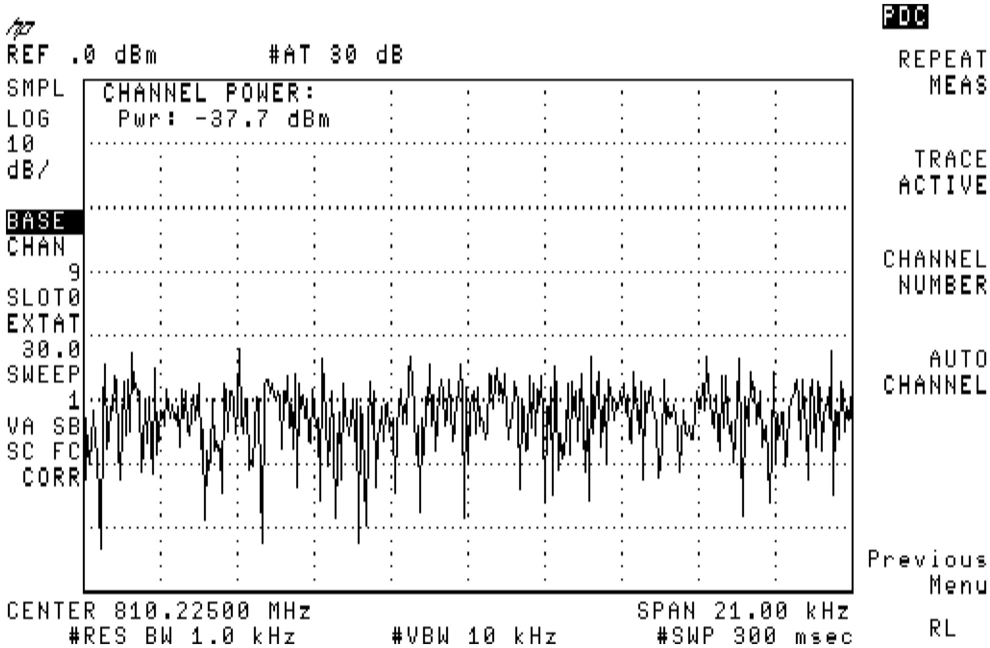


Figure 4-10. The Channel Power Measurement

Measuring Modulation Accuracy

To make modulation accuracy measurements, you use the functions that are accessed by pressing the `Modulatn` softkey in the digital demodulator main menu.

You must have Options 151 and 160 to perform these measurements. See "List spectrum analyzer options and firmware revision" in the beginning part of Chapter 1, "Getting Started," to quickly determine the options installed in your analyzer. This section contains the following procedures:

- Measure the modulation accuracy of an PDC digital base station. 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 of a PDC digital base station.
- Make a fast modulation accuracy measurement by choosing a partial modulation accuracy measurement.
- 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.
- Save the measurement data so that I-Q graphs and demodulated data bits for the same timeslot can be displayed.
- Calibrate the modulation accuracy measurement to correct for the inaccuracies of the spectrum analyzer hardware.

Note If the carrier frequency is more than 3.5 kHz away from the nominal channel center frequency, the measurement results may not be accurate.

To perform a full modulation accuracy measurement

1. Make sure that the channel number selection and timeslot number agree with the transmitter's RF output.
2. If the digital demodulator main menu is not displayed, press (MODE) PDC 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 for SINGLE CONT is SINGLE.
5. Press FULL PARTIAL until FULL is underlined to select a full set of modulation accuracy measurements. A full modulation 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. The default for FULL PARTIAL 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. If the SAV MEAS ON OFF softkey is present, press SAV MEAS ON OFF until OFF is underlined. See "To hold measurement data for viewing" for details on how to use SAVE MEAS ON OFF.

   Note that after a successful modulation accuracy measurement, results for I-Q graphs and demodulated data bits are also available. Using SAV MEAS ON OFF permits I-Q graphs and data bits to be viewed without making a separate I-Q graph or data bits measurement.
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, you can use the CHANNEL NUMBER or CHAN X CTR FREQ keys available by pressing Demod Main, Demod Config, 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-27C. EVM is calculated after I-Q origin offset and carrier frequency error have been extracted from the measured data. For a base station, the measurement interval includes 138 transmitted symbol decision points of a base station timeslot. Modulation metrics are calculated using measured data only at symbol decision points.

By using the remote command _RCRSTD, the number of symbol decision points included in the measurement can be changed to 139 to comply with the procedures outlined in RCR STD-27B.

Note that the analyzer will adjust reference level and attenuation to optimize measurement dynamic range automatically. This level setting is done at the first repetition of the measurement after entering the modulation accuracy menu by pressing Modulatn. To shorten measurement time, successive SINGLE or CONT repetitions do not repeat the level setting algorithm. It is also done automatically if the signal amplitude is detected outside the optimal range for the measurement.

The center frequency will be tuned using 1 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 will be acquired at every SINGLE measurement and the first CONT measurement. Since the frame trigger is based on an internal clock which is not locked to the base station time base, the frame trigger may drift slowly away from the desired timeslot 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 4-11 for an example of the full modulation accuracy measurement screen.

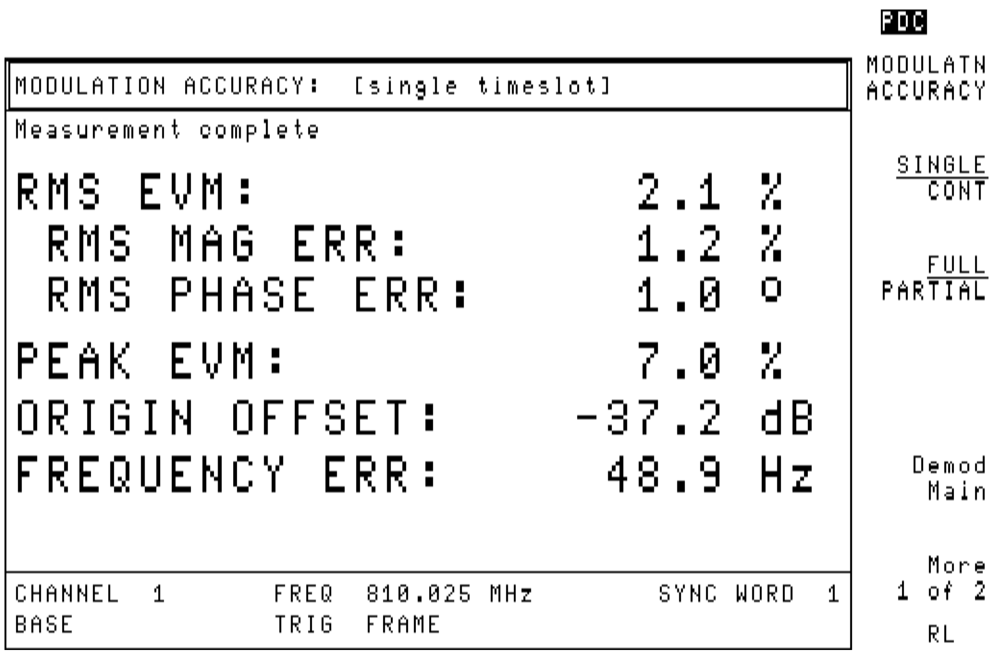


Figure 4-11. Full Modulation Accuracy Measurement

RCR reference: Modulation accuracy measurements are based on RCR STD-27C 6.1.7, "Modulation Accuracy," and RCR STD-27C 3.4.2.9, "Modulation Precision."

The measurement can also be made based on RCR STD-27B. See the _RCRSTD command in Chapter 7, "Programming Commands."

To make a partial modulation accuracy measurement

1. Make sure that the channel number selection and timeslot number agree with the transmitter's RF output.
2. If the digital demodulator main menu is not displayed, press (MODE) PDC 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 setting for SINGLE CONT is SINGLE.
5. Press FULL PARTIAL until PARTIAL is underlined to select a partial set of modulation accuracy measurements. A partial modulation accuracy measurement includes the RMS error vector magnitude (EVM), RMS magnitude error, RMS phase error, peak EVM, and I-Q origin offset. Underlining PARTIAL excludes the carrier frequency error from the modulation accuracy tests performed. Carrier frequency error requires the spectrum analyzer center frequency to be tuned using 1 Hz resolution to optimize frequency accuracy of the measurement. Fine tuning the center frequency requires about one second, causing carrier frequency error measurement to slow the modulation accuracy measurement. A partial measurement of EVM is faster than a full measurement.

   The default for FULL PARTIAL 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. If the SAV MEAS ON OFF softkey is present, press SAV MEAS ON OFF until OFF is underlined. See "To hold measurement data for viewing" for details on how to use SAVE MEAS ON OFF.

   Note that after a successful modulation accuracy measurement, results for I-Q graphs, and demodulated data bits are also available. Using SAV MEAS ON OFF permits I-Q graphs and data bits to be viewed without making a separate I-Q graph or data bits measurement.
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 error vector magnitude (EVM), RMS magnitude error, RMS phase error, peak EVM, and I-Q origin offset. 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, you can use the CHANNEL NUMBER or CHAN X CTR FREQ keys available by pressing Demod Main Demod Config 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-27C. EVM is calculated after I-Q origin offset, and carrier frequency error have been extracted from the measured data. For a base station, the measurement interval includes 138 transmitted symbol decision points of a base station timeslot. Modulation metrics are calculated using measured data only at symbol decision points.

By using the remote command _RCRSTD, the number of symbol decision points included in the measurement can be changed to 139 to comply with the procedures outlined in RCR STD-27B.

Note that the analyzer will adjust reference level and attenuation to optimize measurement dynamic range automatically. This level setting is done at the first repetition of the measurement after entering the modulation accuracy menu by pressing Modulatn. To shorten measurement time, successive SINGLE or CONT repetitions do not repeat the level setting algorithm. It is also done automatically if the signal amplitude is detected outside the optimal range for the measurement.

The center frequency will be tuned using 1 Hz resolution to optimize the accuracy of the EVM measurement. For continuous measurements in partial mode, the spectrum analyzer is tuned once at the first measurement made, and is not relocked unless the MODULATN ACCURACY softkey is pressed again.

If the digital demodulator trigger is set to FRAME, frame trigger synchronization will be acquired at every SINGLE measurement and the first CONT measurement. Since the frame trigger is based on an internal clock which is not locked to the base station time base, the frame trigger may drift slowly away from the desired timeslot 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 4-12 for an example of the partial modulation accuracy measurement screen.

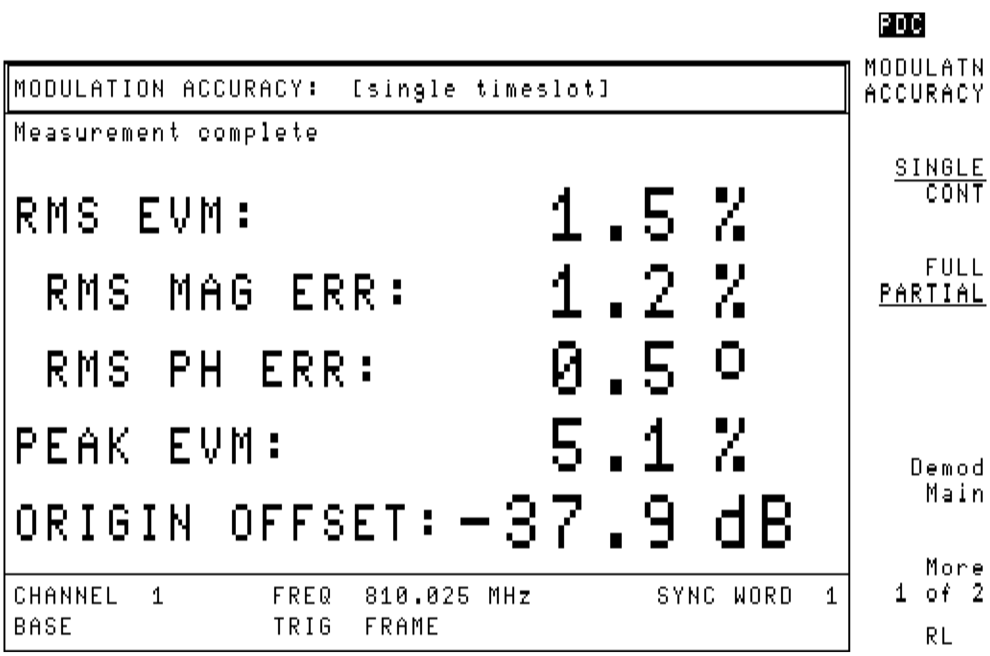


Figure 4-12. Partial Modulation Accuracy Measurement

To find the average error vector magnitude

1. Make sure that the channel number selection and timeslot number agree with the transmitter's RF output.
2. If the digital demodulator main menu is not displayed, press (MODE) PDC ANALYZER MORE 1 OF 2 Digital Demod.
3. Press Modulatn to access the modulation accuracy measurements menus.
4. Press FULL PARTIAL until FULL or PARTIAL is underlined to select either a full or a partial set of modulation accuracy measurements. A full 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.

   Underlining PARTIAL excludes the carrier frequency error from the modulation accuracy tests performed. Carrier frequency error requires the spectrum analyzer center frequency to be tuned using 1 Hz resolution to optimize frequency accuracy of the measurement. Fine tuning the center frequency requires about one second, causing carrier frequency error measurement to slow the modulation accuracy measurement. A partial measurement of EVM is faster than a full measurement.

   The default for FULL PARTIAL is FULL.
5. Press More 1 of 2.
6. Enable averaging by pressing AVERAGE ON OFF until ON is underlined. When averaging is turned ON, the number of time slots to average becomes an active function displayed on screen. Enter the number of timeslots 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 10.
7. If the SAV MEAS ON OFF softkey is present, press SAV MEAS ON OFF until OFF is underlined. See "To hold measurement data for viewing modulation accuracy and demodulated data bits" for details on how to use SAV MEAS ON OFF.
8. Press More 2 of 2 to return to the previous menu.
9. Press MODULATN ACCURACY to start the averaged modulation accuracy measurement. The modulation metrics screen will appear with values for error vector magnitude (EVM), RMS magnitude error, RMS phase error, peak EVM, and I-Q origin offset. Carrier frequency error will appear if a full measurement was selected. To stop a measurement in progress, press STOP MEAS.

   To repeat the measurement, press MODULATN ACCURACY.

The modulation metrics of a base station may fluctuate during transmission. The automatic averaging function of the personality allows you to find the mean 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 an update of the modulation accuracy screen, until the selected number of timeslots to average is reached. The display will then change to a screen with a summary of statistical information calculated from the set of timeslots measured. This includes the mean, standard deviation, and minimum and maximum values for RMS EVM, RMS magnitude error, and RMS phase error. Mean carrier frequency error and I-Q origin offset are also displayed. The accuracy of the statistical values (the repeatability) depends on the number of timeslots included in the calculations.

Uncertainty ranges for RMS EVM for room and full temperature measurement conditions are also displayed. The true RMS EVM of the averaged 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 timeslots averaged. If the number of timeslots 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 for room and full temperature measurement conditions. If the number of timeslots to average is greater than 1, uncertainty ranges are calculated from the measured standard deviation, which includes the variation of the measured source.

Note that the `SAV MEAS ON OFF` function is not available after executing an averaged measurement. Also, `SINGLE CONT` will be set to SINGLE after executing an averaged measurement.

See "To make a full modulation accuracy measurement" for details on the automatic measurement process.

See Figure 4-13 for an example of the full statistics screen. See Figure 4-14 for an example of the partial statistics screen.

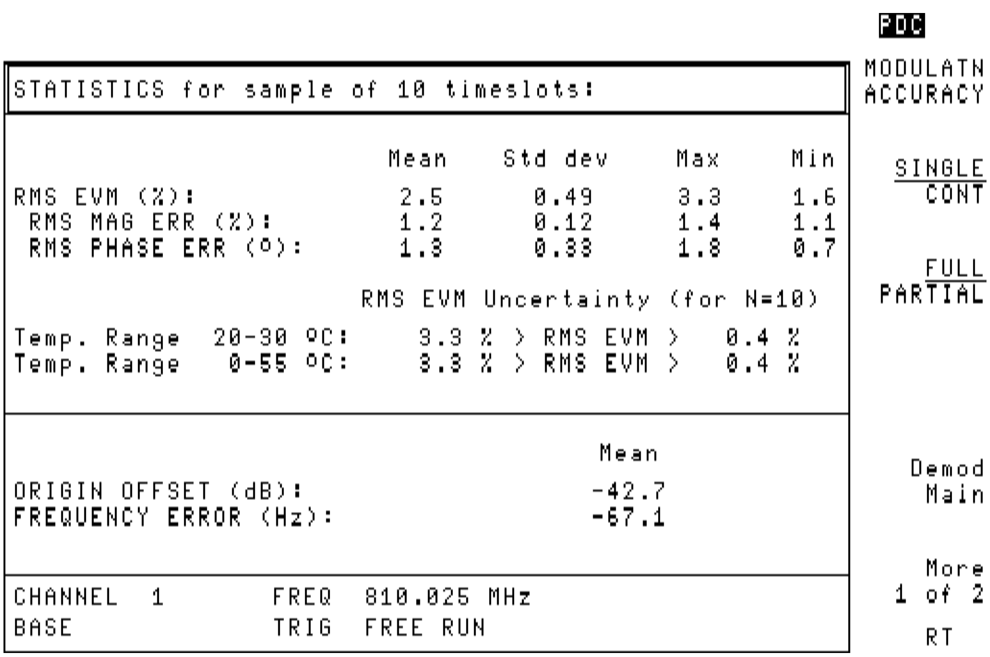


Figure 4-13. Averaged Full Modulation Accuracy Measurement

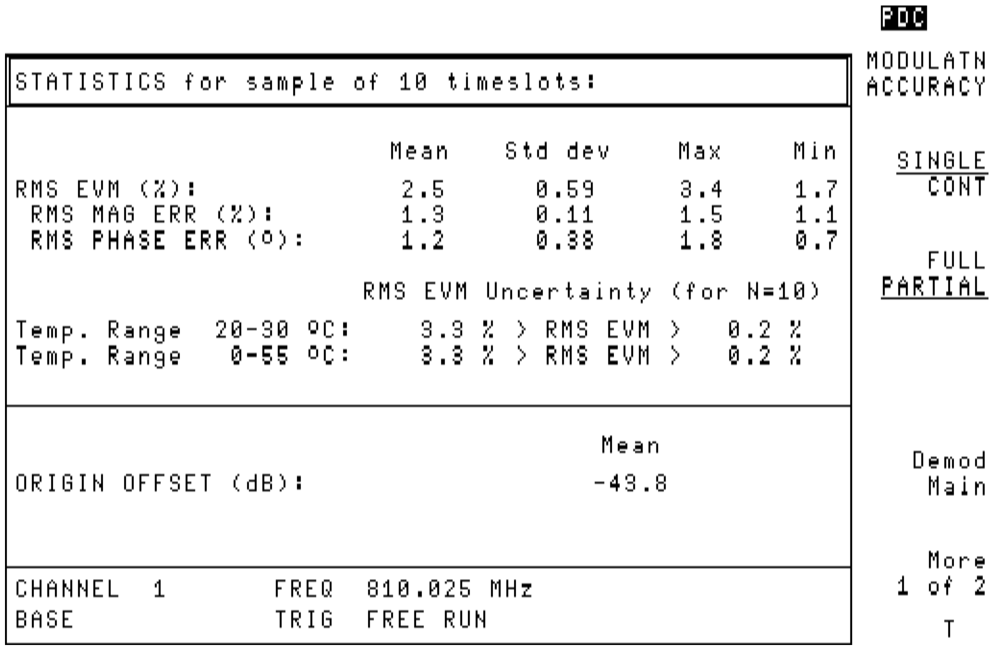


Figure 4-14. Averaged Partial Modulation Accuracy Measurement

To hold measurement data for viewing graphs and demodulated data bits

1. Perform a complete Modulatn measurement. See "To perform a full modulation accuracy measurement" and "To perform a partial modulation accuracy measurement" sections for the procedure. Average modulation accuracy results or halted measurements cannot be held.
2. Press SAV MEAS ON OFF in the Modulatn menu 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. To view the I-Q pattern or the eight-point constellation for the current measurement, press Demod Main Graphs and either I-Q PATTERN or 8 POINT CONSTLN. The I-Q diagram chosen will be plotted on screen.
4. Press Demod Main Data and DATA BITS to view the demodulated data for the current measurement. The demodulated data bits will be displayed on screen.

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 new measurement. The SAV MEAS ON OFF softkey also appears in the Graphs and Data menus. 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 measurements results will be lost.

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) PDC 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 4-15 for the EVM calibration instructions screen.

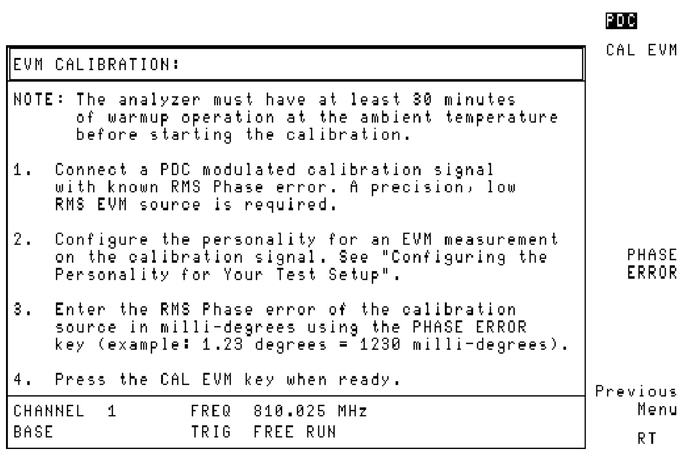


Figure 4-15. EVM Calibration Instructions

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 4-16 for an example of an EVM calibration results screen.

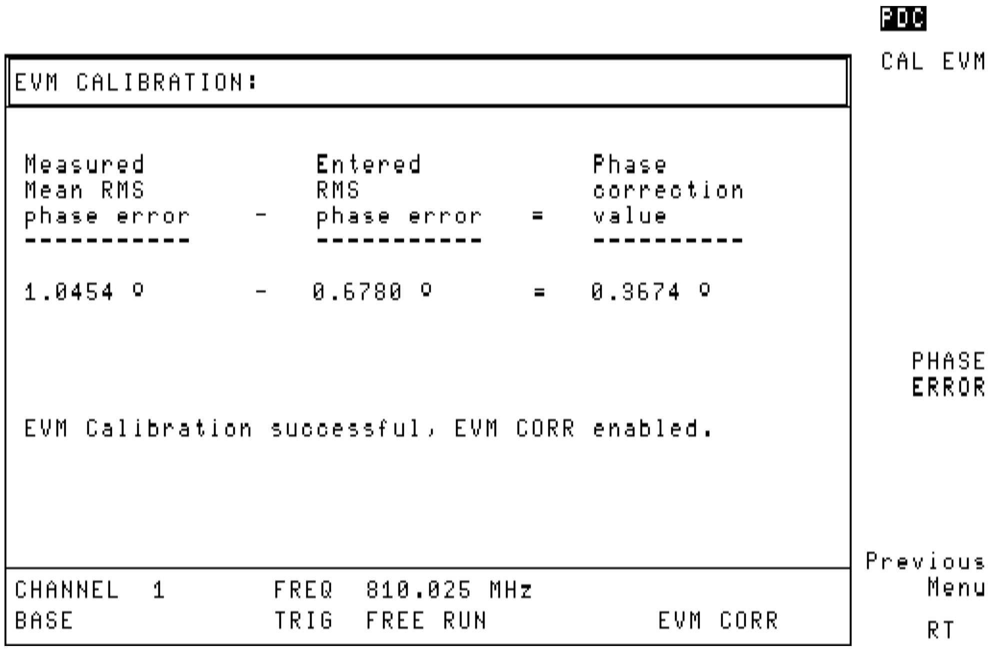


Figure 4-16. EVM Calibration Results

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 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 9, "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 ON.

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

Displaying I-Q Diagrams

To display the I-Q pattern, or constellation diagrams, you use the functions that are accessed by pressing `Graphs` in the digital demodulator main menu.

You must have Options 151 and 160 to perform this measurement. See “List spectrum analyzer options and firmware revision” in the beginning part of Chapter 1, “Getting Started,” to quickly determine the options installed in your analyzer.

This section contains the procedures for the following measurements:

- Plot the transmitted I-Q trajectory pattern of one timeslot.
- Plot the transmitted I-Q constellation of one timeslot.
- Save the measurement data so that modulation accuracy and demodulated data bits for the same timeslot can be displayed.

Note If the carrier frequency is more than 3.5 kHz away from the nominal channel center frequency, the measurement results may not be accurate.

To display the I-Q pattern graph

1. Make sure that the channel number selection and timeslot number agree with the transmitter's RF output.
2. If the digital demodulator main menu is not displayed, press (MODE) PDC ANALYZER MORE 1 OF 2 Digital Demod.
3. Press Graphs to access the functions that produce a graph of measurement results.
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 for SINGLE CONT is SINGLE.
5. If the SAV MEAS ON OFF softkey is present, press SAV MEAS ON OFF until OFF is underlined. See "To hold measurement data for viewing modulation accuracy and demodulated data bits" for details on how to use SAVE MEAS ON OFF.

   Note that after a successful I-Q pattern measurement, data for modulation accuracy and demodulated data bits are also available. Using SAV MEAS ON OFF permits modulation metrics and data bits to be viewed without making a separate modulation accuracy or data bits measurement.
6. Press I-Q PATTERN to start the measurement and graph plotting. The I-Q pattern screen will appear with the trajectory of the digital modulation plotted on I-Q axes.

   To stop a measurement in progress, press STOP MEAS.

   To repeat the measurement, press I-Q PATTERN.

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

The I-Q graphs are plotted at five samples per symbol resolution. The I-Q graphs are plotted after correction for I-Q origin offset and carrier frequency error. For base stations, 138 symbols of the timeslot are plotted on the I-Q graphs.

An I-Q graph measurement optimizes the spectrum analyzer for maximum measurement accuracy. Note that the analyzer will adjust reference level and attenuation to optimize measurement dynamic range automatically. This level setting is done at the first repetition of the measurement after entering the modulation accuracy menu by pressing Graphs. To shorten measurement time, successive SINGLE or CONT repetitions do not repeat the level setting algorithm. It is also done automatically if the signal amplitude is detected outside the optimal range for the measurement. The center frequency will be tuned using 1 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 synchronization will be acquired at every SINGLE measurement and the first CONT measurement. Since the frame trigger is based on an internal clock which is not locked to the base station time base, the frame trigger may drift slowly away from the desired timeslot 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 4-17 is an example of the I-Q Pattern Graph Screen.

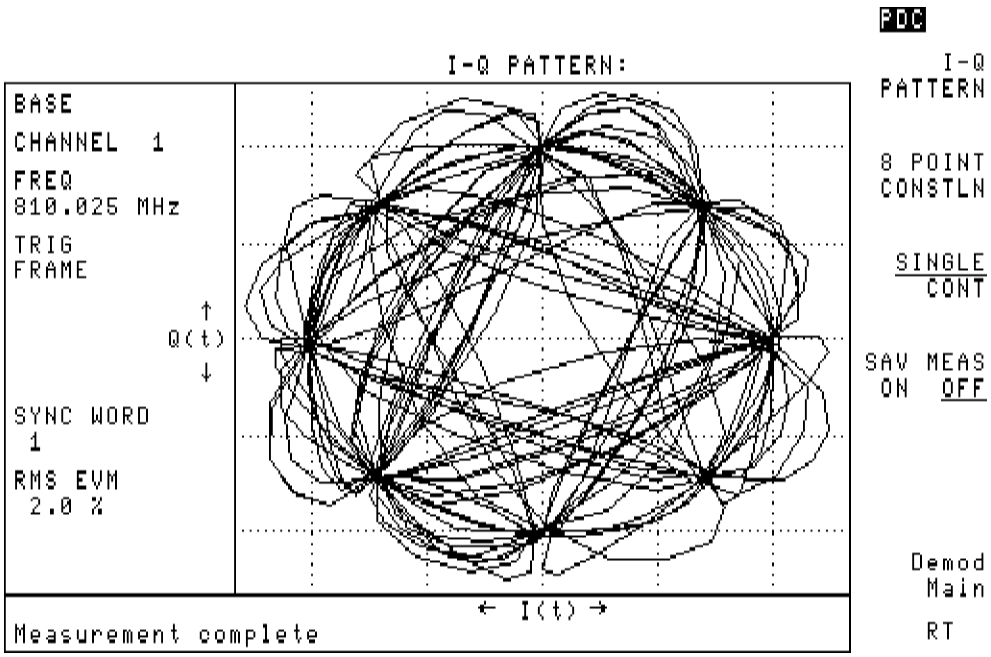


Figure 4-17. I-Q Pattern Graph Screen

To display the eight-point constellation graph

1. Make sure that the channel number selection and timeslot number agree with the transmitter's RF output.
2. If the digital demodulator main menu is not displayed, press (MODE) PDC ANALYZER MORE 1 OF 2 Digital Demod.
3. Press Graphs to access the functions that produce a graph of measurement results.
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 for SINGLE CONT is SINGLE.
5. If the SAV MEAS ON OFF softkey is present, press SAV MEAS ON OFF until OFF is underlined. See "To hold measurement data for viewing modulation accuracy and demodulated data bits" for details on how to use SAVE MEAS ON OFF.

   Note that after a successful eight-point constellation measurement, results for modulation accuracy and demodulated data bits are also available. Using SAV MEAS ON OFF permits modulation metrics and data bits to be viewed without making a separate modulation accuracy or data bits measurement.
6. Press 8 POINT CONSTLN to start the measurement and graph plotting. The eight decision states of the $\pi/4$ DQPSK modulation will be indicated by the "+" symbol. The magnitude and phase of 138 symbol decision points in a timeslot is plotted on the I-Q axes as pixel points.

   To stop a measurement in progress, press STOP MEAS.

   To repeat the measurement, press 8 POINT CONSTLN.

An eight-point constellation measurement displays the phase and amplitude of the baseband digital modulation only at the decision points of the timeslot. 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. The corresponding EVM is also displayed on screen.

The eight-point constellation is plotted after correction for I-Q origin offset and carrier frequency error. For base stations, 138 symbols of the timeslot are plotted on the eight-point constellation.

An eight-point constellation measurement optimizes the spectrum analyzer for maximum measurement accuracy. Note that the analyzer will adjust reference level and attenuation to optimize measurement dynamic range automatically. This level setting is done at the first repetition of the measurement after entering the modulation accuracy menu by pressing Graphs. To shorten measurement time, successive SINGLE or CONT repetitions do not repeat the level setting algorithm. It is also done automatically if the signal amplitude is detected outside the optimal range for the measurement.

The center frequency will be tuned using 1 Hz resolution to optimize the accuracy of the carrier frequency error measurement. The center frequency will be re-tuned at each graph measurement.

If the digital demodulator trigger is set to FRAME, frame trigger synchronization will be acquired at every SINGLE measurement and the first CONT measurement. Since the frame trigger is based on an internal clock which is not locked to the base station time base, the frame trigger may drift slowly away from the desired timeslot 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.

See Figure 4-18 for an example of the eight-point Constellation Screen.

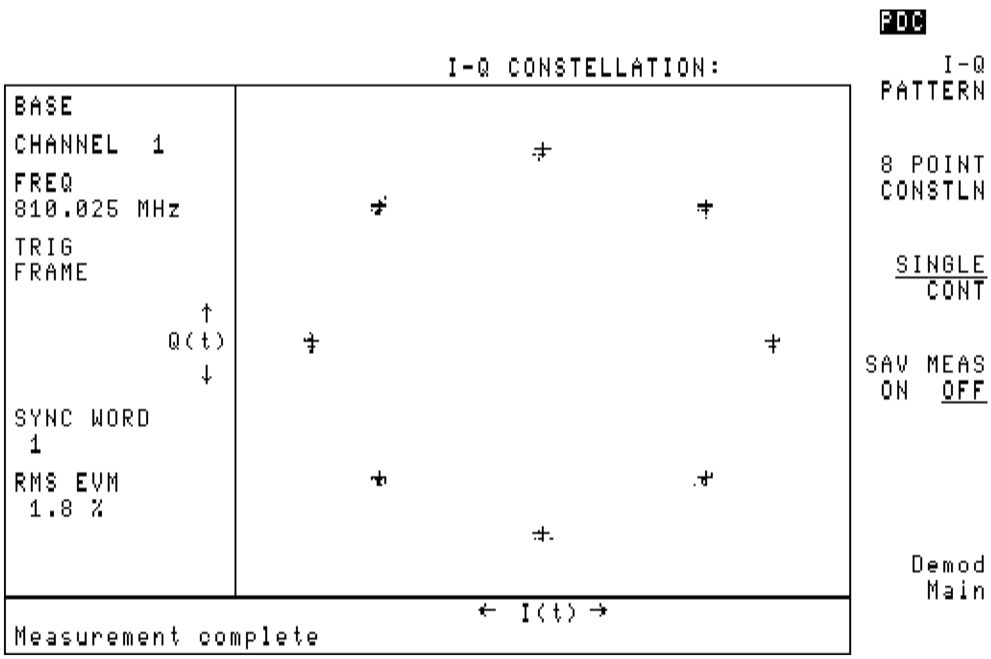


Figure 4-18. Eight-Point Constellation Graph Screen

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

1. Perform a complete Graphs measurement. Refer to "To display the I-Q pattern" and the "To display the eight-point constellation" sections for the procedure. Note that a halted measurement cannot be held.
2. Press SAV MEAS ON OFF in the Graphs menu 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. Press Demod Main Modulatn and MODULATN ACCURACY to view the modulation accuracy results for the current measurement. The modulation metrics of the current measurement will be displayed.
4. Press Demod Main Data and DATA BITS to view the demodulated data for the current measurement, The demodulated data bits will be displayed on screen.

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 new measurement. The SAV MEAS ON OFF softkey also appears in the Modulatn and Graphs menus. 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 measurements results will be lost.

Displaying the Demodulated Data Bits

To display the demodulated data bits, you use the functions that are accessed by pressing Data from the digital demodulator main menu.

You must have Options 151 and 160 to perform this measurement. 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.

This section contains the following procedures:

- View the demodulated bits from the timeslot measured. Highlight the sync word, data, color code, and control channel bits in the measured timeslot.
- Save the measurement data so that modulation accuracy and graphs for the same timeslot can be displayed.

Note If the carrier frequency is more than 3.5 kHz away from the nominal channel center frequency, the measurement results may not be accurate.

To display the demodulated data bits

1. Make sure that the channel number selection and timeslot number agree with the transmitter's RF output.
2. If the digital demodulator main menu is not displayed, press (MODE) PDC ANALYZER MORE 1 OF 2 Digital Demod.
3. 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 for SINGLE CONT is SINGLE.
5. If SAV MEAS ON OFF is present, press SAV MEAS ON OFF until OFF is underlined. See "To hold measurement data for viewing modulation accuracy and graphs" for details on how to use SAVE MEAS ON OFF.

   Note that after a successful demodulated data measurement, data for modulation accuracy, and I-Q graphs are also available. Using SAV MEAS ON OFF permits modulation metrics and graphs to be viewed without making a separate modulation accuracy or graphs measurement.
6. Choose a portion of the demodulated data to highlight. Press Highlite to access the highlighting choices. Highlighting a part of the data in a timeslot makes it easy to read the bits of interest.
7. Press the appropriate softkey for the portion of the data bits you wish to highlight. If a data bits measurement has already been made, the screen will be redrawn with the newly selected portion highlighted.
   - Pressing HIGHLITE TCH will cause the data portion of the bit sequence to be highlighted. For PDC base stations this sequence consists of data bits 7 through 118, and data bits 169 through 280. Each of these two blocks is 112 bits long.
   - Pressing HIGHLITE SW will cause the sync word to be highlighted. For PDC base stations this sequence consists of data bits 119 through 138. This block is 20 bits long. HIGHLITE SW is the default setting.
   - Pressing HIGHLITE CC will cause the coded digital verification color code portion of the bit sequence to be highlighted. For PDC base stations, this sequence consists of data bits 139 through 146. This block is 8 bits long.
   - Pressing HIGHLITE SACCH will cause the slow associated control channel (SACCH) portion of the bit sequence to be highlighted. For PDC base stations this sequence consists of data bits 148 through 168. This block is 21 bits long.
8. Press Previous Menu to return to the Data menu.
9. Press DATA BITS to start the measurement and data bit display. Data bits will be displayed on screen with a bit number shown above every 10 bits.

   To stop a measurement in progress, press STOP MEAS.

   To repeat the measurement, press 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 20-bit synchronization word can be read to confirm that the correct timeslot has been measured. CC and SACCH can also be read. The 280 bits for a full timeslot are displayed.

A data demodulation measurement optimizes the spectrum analyzer for maximum measurement accuracy. Note that the analyzer will adjust reference level and attenuation to optimize measurement dynamic range automatically. This level setting is done at the first repetition of the measurement after entering the modulation accuracy menu by pressing `Data`. To shorten measurement time, successive SINGLE or CONT repetitions do not repeat the level setting algorithm. It is also done automatically if the signal amplitude is detected outside the optimal range for the measurement.

The center frequency will be tuned using 1 Hz resolution to optimize the accuracy of the measurement. The center frequency will be re-tuned at each data demodulation measurement.

If the digital demodulator trigger is set to FRAME, frame trigger synchronization will be acquired at every SINGLE measurement and the first CONT measurement. Since the frame trigger is based on an internal clock which may not be locked to the base station time base, the frame trigger may drift slowly away from the desired timeslot 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. See Figure 4-19 for an example of the Data Bits Screen.

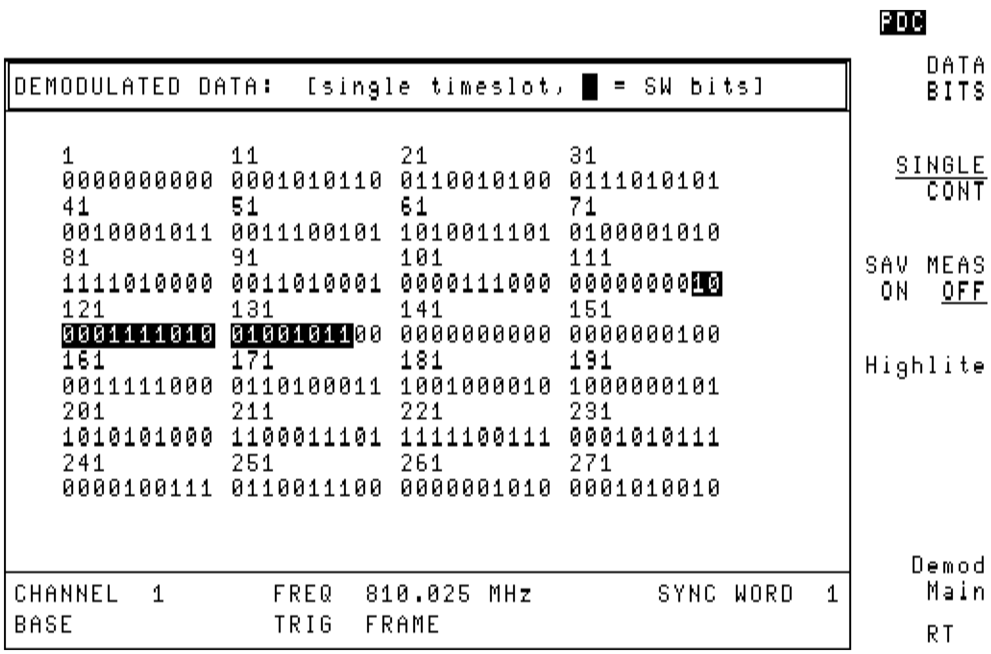


Figure 4-19. Data Bits Screen

To hold measurement data for viewing modulation accuracy and graphs

1. Perform a complete demodulated data bits measurement. See "To display the demodulated data bits" section for the procedure. Note that a halted measurement cannot be held.
2. Press SAV MEAS ON OFF in the Data menu 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. Press Demod Main Modulatn and MODULATN ACCURACY to view the modulation accuracy results for the current measurement. The modulation metrics of the current measurement will be displayed.
4. Press Demod Main Graphs and either I-Q PATTERN or 8 POINT CONSTLN to view the I-Q pattern or the eight-point constellation for the current measurement. The I-Q diagram chosen will be plotted on screen.

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 new measurement. The SAV MEAS ON OFF softkey also appears in the Modulatn and Data menus. 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 measurements results will be lost.

Performing the System Measurements and Measuring Spurious Emissions

This section demonstrates how you can use the `System` and `Spurious` functions.

`System` accesses the functions that allow you to view the spectrum of the transmit or receive bands, and adjust each transmitter for the optimum power level output.

`Spurious` accesses the function that allows you to measure transmitter intermodulation spurious emission products and spurious emissions.

This section contains the following procedures:

- View a transmit band spectrum.
- View a receive band spectrum.
- Use the combiner tuning function to adjust the outputs of a group of transmitters.
- Measure transmitter intermodulation spurious emission products.
- Measure spurious emissions within a specific frequency range.
- Measure TX band and harmonic spurious emissions

These measurements are applicable for both analog and digital carriers.

To view the transmit band spectrum

1. If System is not displayed, press (MODE) PDC ANALYZER More 1 of 2.
2. Press System.
3. Press MONITOR TX BAND.
4. Select the band that you want to view by pressing 800 MHz BAND or 1500 MHz BAND.

   The personality will change the start and stop frequency of the spectrum analyzer so that the selected transmit band is displayed. The reference level is set to the total power value of TOTL PWR SGL MULT, regardless of whether TOTL PWR SGL MULT is set to single (SGL) or multiple (MULT) carriers.
5. Press Previous Menu when you are done.

MONITOR TX BAND displays the transmit band that you select. Your band selection is not changed by turning off the spectrum analyzer or pressing (PRESET). If you change the spectrum analyzer's start and stop frequencies, the start and stop frequencies will be changed by pressing (PRESET). See Figure 4-20 for an example display of the base 800 MHz transmit band.

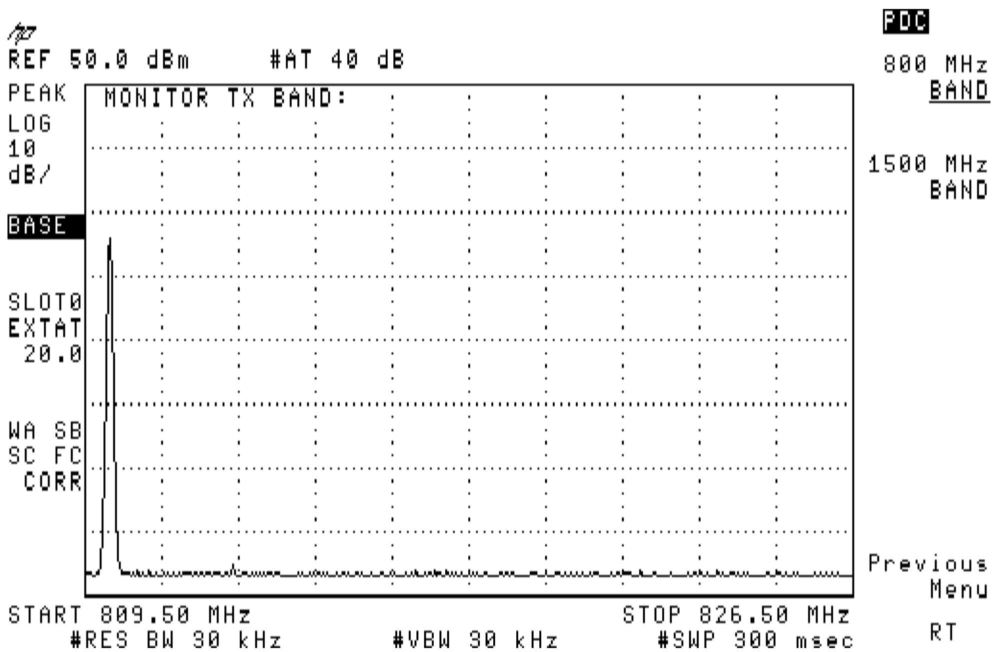


Figure 4-20. Base 800 MHz Transmit Band

To view the receive band spectrum

1. If MONITOR RX BAND is not displayed, press (MODE) PDC ANALYZER More 1 of 2 System.
2. Press MONITOR RX BAND.
3. Select the band that you want to view by pressing 800 MHz BAND or 1500 MHz BAND.

   The personality will change the start and stop frequency of the spectrum analyzer so that the selected receive band is displayed.
4. Press Previous Menu when you are done.

MONITOR RX BAND displays the receive band that you select. Your band selection is not changed by turning off the spectrum analyzer or pressing (PRESET). If you change the spectrum analyzer's start and stop frequencies, the start and stop frequencies will be changed by pressing (PRESET). Because MONITOR RX BAND assumes that there are no high level signals that are incident to the spectrum analyzer input, MONITOR RX BAND sets the reference level to −20 dBm, and the input attenuation to 10 dB. See Figure 4-21 for an example display of the base 800 MHz receive band.

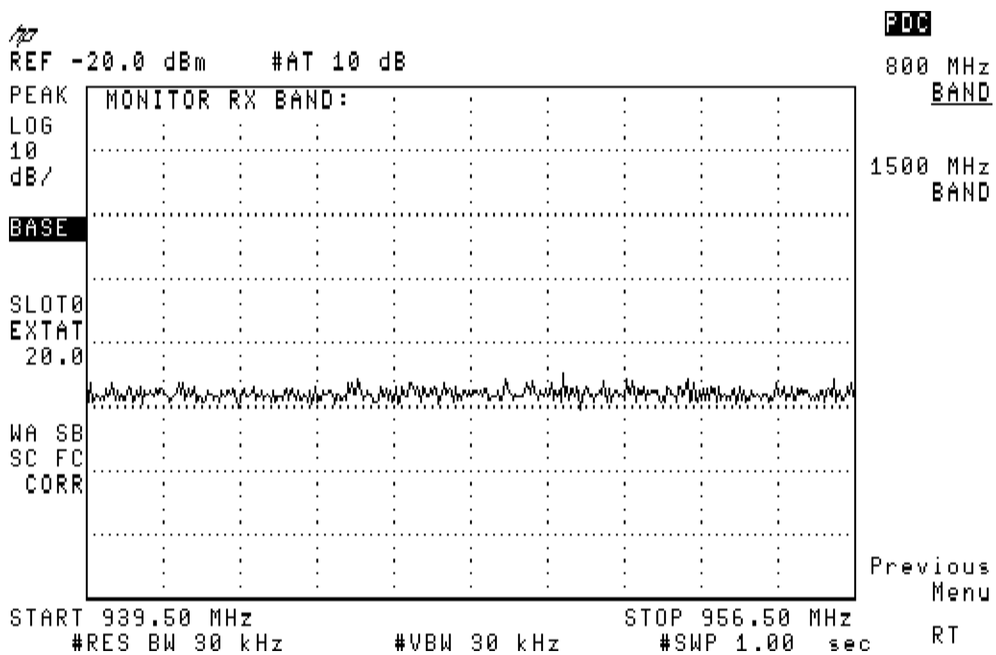


Figure 4-21. Base 800 MHz Receive Band

To use combiner tuning

1. If Band is not displayed, press (MODE) PDC ANALYZER More 1 of 2 System.
2. Press Band.
3. Select the transmit band that you want to view by pressing 800 MHz BAND or 1500 MHz BAND.
4. Press Previous Menu.
5. For best accuracy on digital transmitters, turn off the transmitter modulation.
6. Press COMBINER TUNING. The personality will change the start and stop frequency of the spectrum analyzer so that the selected transmit band is displayed. A horizontal marker line will be placed on the peak of the carrier with the highest amplitude, and another horizontal marker line will be placed on the peak of the carrier with the lowest amplitude. The numerical values of the maximum marker line and the difference between the two marker lines are also displayed.
7. If necessary, you can adjust the spectrum analyzer settings. You can adjust the reference level with REF LVL, the amplitude scale with SCALE LOG, the start frequency with START FREQ, and the stop frequency with STOP FREQ. To use one of these functions, press the softkey for the function, then use the step keys or knob to adjust the setting of the selected function.
8. Adjust the output from the transmitters. As you adjust the output from the transmitters so that the amplitude of the signals are equal, the distance between the upper and lower marker lines will decrease. The number representing the difference between the maximum and minimum marker lines (Δ Pwr) will also decrease.
9. Press Previous Menu when you are done.

COMBINER TUNING allows you to view the combined output spectrum of a group of base station transmitters and adjust the output power of each transmitter. See Figure 4-22. Your band selection is not changed by turning off the spectrum analyzer or pressing (PRESET). However, (PRESET) resets the start and stop frequencies to default values if they were changed prior to pressing (PRESET).

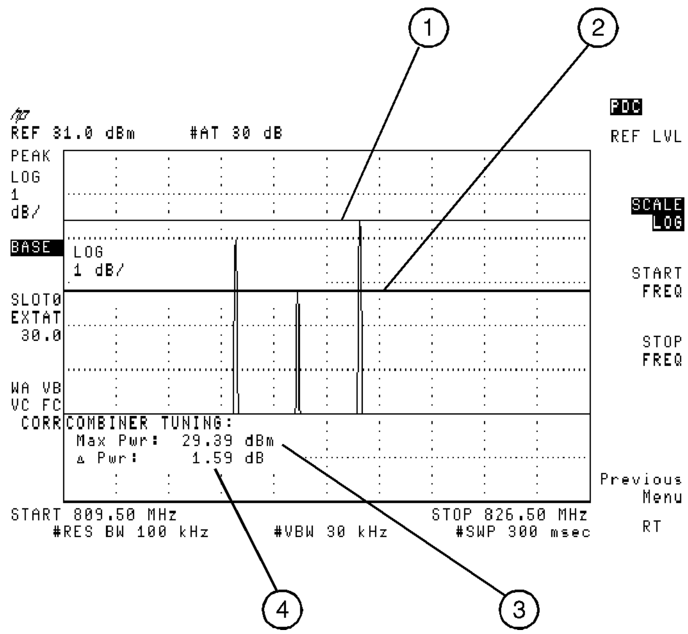


Figure 4-22. Combiner Tuning Results

Item	Description
1	Graphically indicates the carrier with the highest amplitude.
2	Graphically indicates the carrier with the lowest amplitude.
3	The carrier with the highest amplitude.
4	The difference between the highest and lowest amplitude carriers.

To measure transmitter intermodulation spurious emission products

1. Measure the antenna power as previously described in this chapter under "Measuring Power."

Note The last measured antenna power will be used in calculating the transmitter intermodulation ratio result (in dB). It is not necessary to repeat the antenna power measurement, provided that it was previously done for the current carrier frequency and power.

2. Transmitter intermodulation products are produced by injecting a CW signal from an external signal generator into the output of the transmitter. Intermodulation products are caused by the interaction of the transmitter's carrier and the CW signal in the nonlinear elements of the transmitter.

   Connect the equipment as shown in Figure 4-23. Set the signal generator frequency to 500 kHz above or below the transmitter carrier frequency. Using the spectrum analyzer or a power meter, set the signal generator power (measured at port 1 of the circulator) for 30 dB less than the transmitter carrier power.

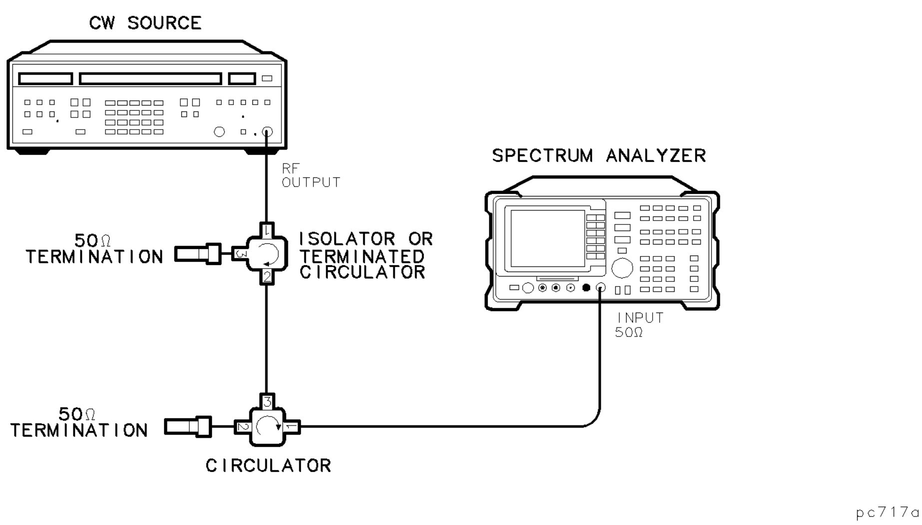


Figure 4-23. CW Signal Generator Setup

3. Connect the equipment as shown in Figure 4-24.

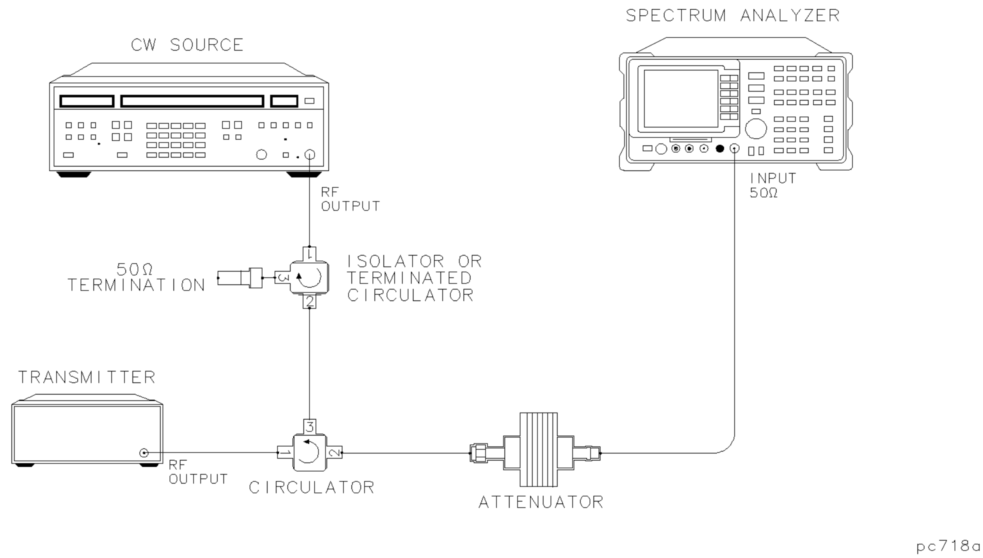


Figure 4-24. Equipment Setup for Transmitter Intermodulation Measurement

4. If `TRANS INTERMOD` is not displayed, press (MODE) `PDC ANALYZER` `More 1 of 2` `Spurious`.

5. Press `TRANS INTERMOD`. The personality will display a screen of instructions. See Figure 4-25.

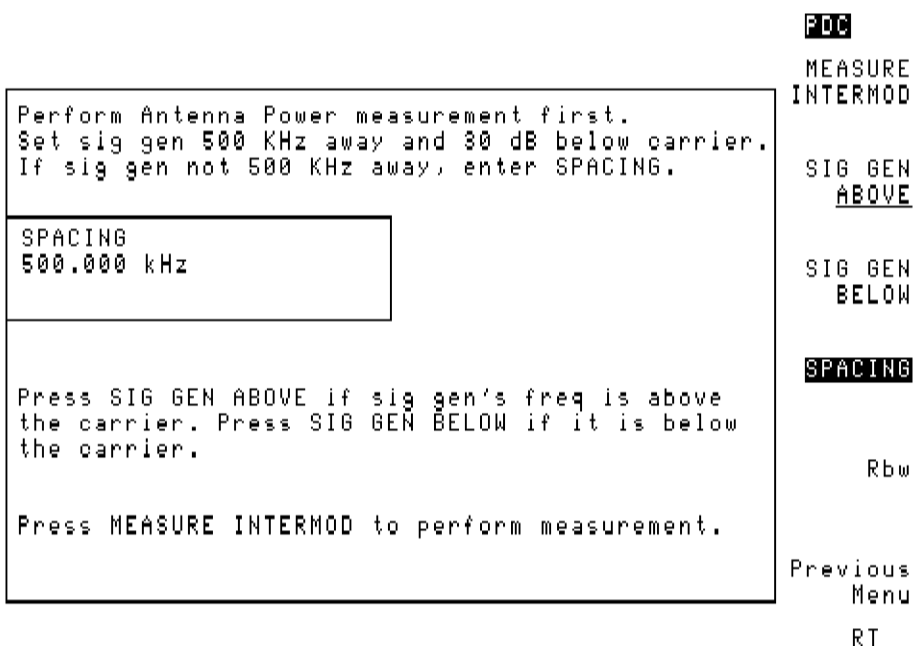


Figure 4-25. Transmitter Intermodulation Procedure

6. Press SIG GEN ABOVE if the signal generator frequency is above the carrier, or SIG GEN BELOW if the signal generator frequency is below the carrier. The active state (above or below) will be underlined.
7. If the signal generator frequency is not 500 kHz from the carrier, press SPACING and use the knob, step keys or data keys to enter the frequency difference.
8. An analyzer default resolution bandwidth of 30 kHz is used for transmitter intermodulation measurements. If another resolution bandwidth is desired, press Rbw and then select the desired bandwidth.
9. Press MEASURE INTERMOD to start the measurement. The spectrum analyzer will find the highest amplitude product from the 3rd to the 7th order. products. It will then use zero span to measure the product's mean power. Two values are then displayed: an absolute value (in dBm), and a ratio (in dB), with respect to 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 test limits.

   The P/F AUTO ABS REL softkey in the spurious setup menu sets the criteria used for the pass/fail testing in this measurement. With P/F AUTO ABS REL set to the default setting of AUTO, PASS is displayed if *either* the absolute *or* relative result is less than the corresponding limit value. Set P/F AUTO ABS REL to ABS for pass/fail checking to be done only on the *absolute* result. Set P/F AUTO ABS REL to REL for pass/fail checking to be done only on the *relative* result. A box appears around either the Abs or Rel label on the display to indicate the result actually used to determine pass or fail.

   See Figure 4-26 for an example of a transmitter intermodulation measurement.

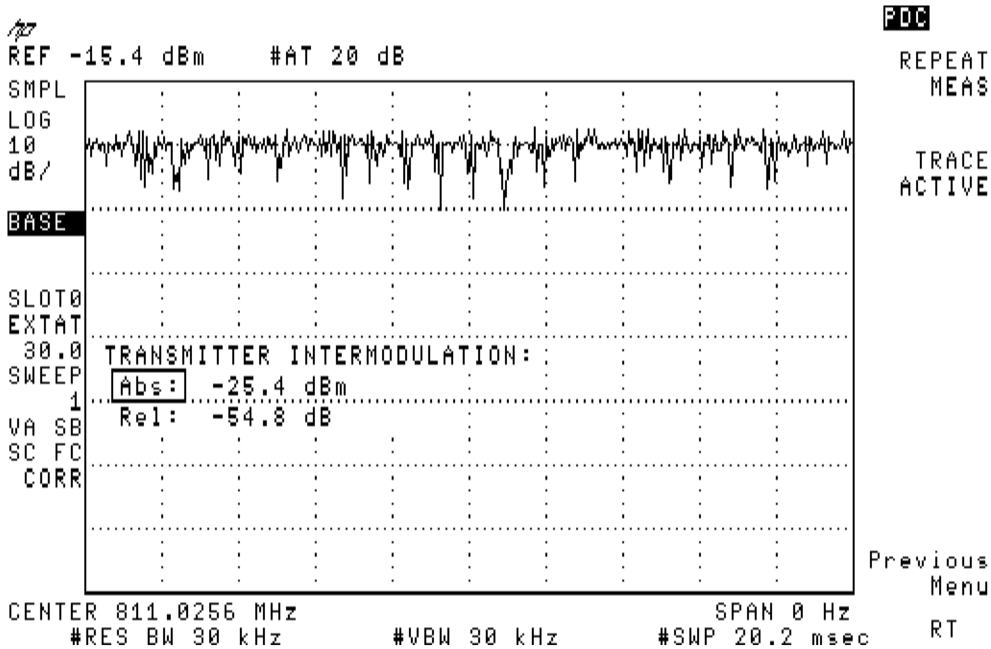


Figure 4-26. Transmitter Intermodulation Measurement

10. Press `Previous Menu` if you are done with the transmitter intermodulation measurement, or use one of the post-measurement functions.

RCR reference: The transmitter intermodulation measurement is based on RCR STD-27C 6.1.10, “Transmission Intermodulation” and 3.4.2.10, “Transmission IM.”

To measure spurious emissions within a specific frequency range

1. Measure the antenna power as previously described in this chapter under "Measuring Power."

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

2. If `SPURIOUS EMISSION` is not displayed, press (MODE) `PDC ANALYZER` `More 1 of 2` `Spurious`.
3. Press `SPURIOUS EMISSION`. The personality will set the start and stop frequencies and set the input attenuator to a value determined by the antenna power. See Figure 4-27.

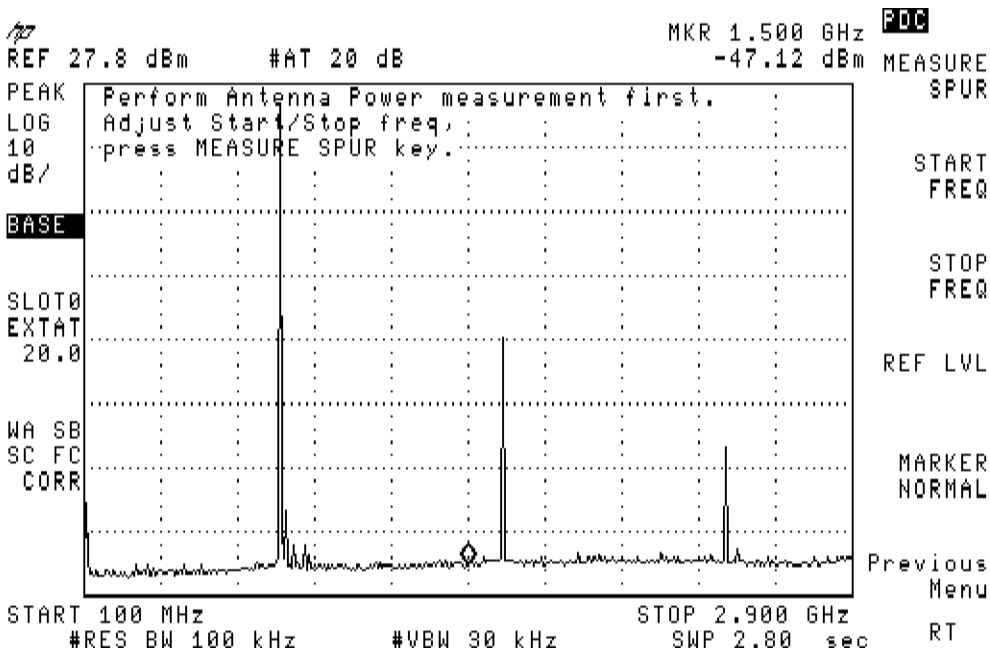


Figure 4-27. Spurious Emission Procedure

4. If necessary, use the `START FREQ` and `STOP FREQ` keys to adjust the frequency range. Press `MARKER NORMAL` to enable the marker and use the knob to place the marker on the spurious emission.
5. Press `MEASURE SPUR` to start the measurement. The spectrum analyzer will search for the highest spur level in the frequency domain and measure the power there using peak detection, as specified in RCR STD-27C. The frequency range is initially set at 100 MHz to 3 GHz if the carrier frequency is in the 800 MHz PDC band; and is set at 100 MHz to 5 GHz if the carrier frequency is in the 1500 MHz PDC band. You can change the range by using the procedure in step 4.

The spurious emission measurement can be made by the RCR STD-27B method, which causes the spectrum analyzer to auto-zoom down onto the marker frequency. The frequency range is initially set to the PDC band as selected by the `800 MHz` or `1500 MHz` keys in the `Band` menu. You can change the range by using the procedure in step 4. It will then make a zero-span measurement and compute the mean power over the full frame duration. To use this method, set the remote command _RCRSTD to 2. See Chapter 7, “Programming Commands.”

The spectrum analyzer auto-zoom method can be selected with the search mode key `SRCH MOD FAST NOR`. See “Spurious Setup Menu,” in Chapter 5, “Base Station Menu Map and Softkey Descriptions.”

The `P/F AUTO ABS REL` softkey in the spurious setup menu sets the criteria used for the pass/fail testing in this measurement. With `P/F AUTO ABS REL` set to the default setting of AUTO, PASS is displayed if *either* the absolute *or* relative result is less than the corresponding limit value. Set `P/F AUTO ABS REL` to ABS for pass/fail checking to be done only on the *absolute* result. Set `P/F AUTO ABS REL` to REL for pass/fail checking to be done only on the *relative* result. A box appears around either the `Abs` or `Rel` label on the display to indicate the result actually used to determine pass or fail.

See Figure 4-28 for an example of a spurious emission measurement.

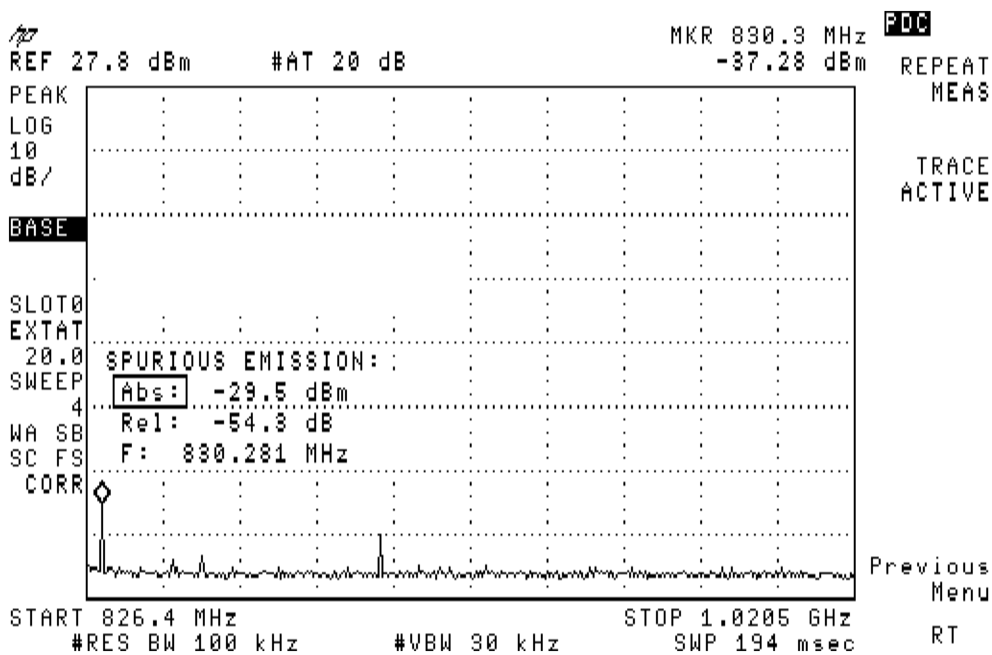


Figure 4-28. Spurious Emission Measurement

6. Press `Previous Menu` if you are done with the spurious emissions measurement, or use one of the post-measurement functions.

RCR reference: The spurious emission measurement is based on RCR STD-27C 6.1.2, “Strength of Spurious Emission” and RCR STD-27C 3.4.2.6, “Transmission Spurious.”

The measurement can also be made based on RCR STD-27B. See the _RCRSTD command in Chapter 7, “Programming Commands.”

To measure spurious adjacent emissions

1. Measure the antenna power as previously described in this chapter under "Measuring Power."

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

2. If `SPURIOUS ADJACENT` is not displayed, press (MODE) `PDC ANALYZER` `More 1 of 2` `Spurious`.

3. Press `SPURIOUS ADJACENT`. The personality will set the center frequency at the carrier frequency, set a span of 700 kHz, and set the input attenuator to a value determined by the antenna power. See Figure 4-29.

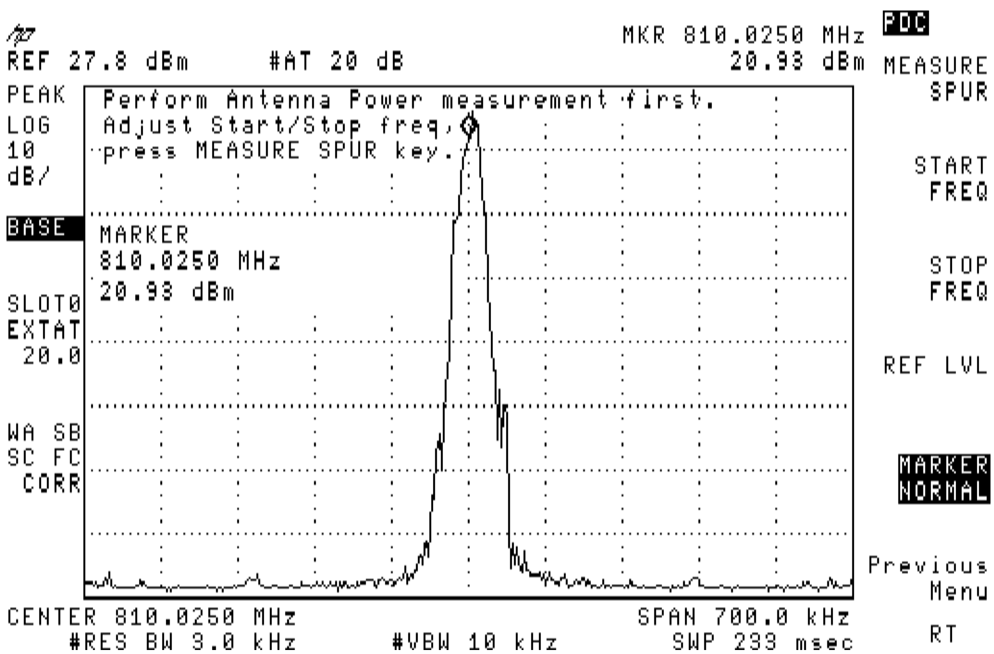


Figure 4-29. Spurious Emission Procedure

4. Press MEASURE SPUR to start the measurement. If CARRIERS ONE TWO is set to ONE, the spectrum analyzer will search for the highest level (spur) in the frequency domain (at frequencies greater than 112.5 kHz from the carrier) and measure the highest level using peak detection, as specified by MKK.

   If CARRIERS ONE TWO is set to TWO, the spectrum analyzer will measure the level in the frequency domain, using peak detection at the frequency where you positioned the marker, as specified by MKK.

   The P/F AUTO ABS REL softkey in the spurious setup menu sets the criteria used for the pass/fail testing in this measurement. With P/F AUTO ABS REL set to the default setting of AUTO, PASS is displayed if *either* the absolute *or* relative result is less than the corresponding limit value. Set P/F AUTO ABS REL to ABS for pass/fail checking to be done only on the *absolute* result. Set P/F AUTO ABS REL to REL for pass/fail checking to be done only on the *relative* result. A box appears around either the Abs or Rel label on the display to indicate the result actually used to determine pass or fail.

   See Figure 4-30 for an example of a spurious adjacent emission measurement.

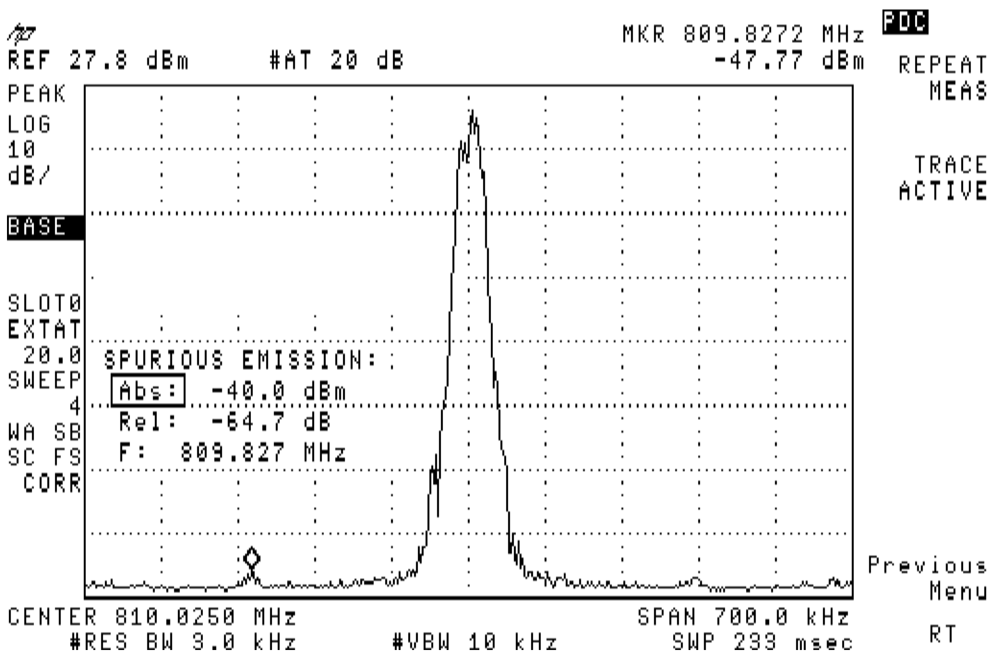


Figure 4-30. Spurious Adjacent Emission Measurement

5. Press Previous Menu if you are done with the spurious adjacent emissions measurement, or use one of the post-measurement functions.

RCR reference: The spurious adjacent emission measurement is based on MKK.

To measure TX band spurious and harmonic emissions

1. Make sure the channel number selection agrees with the RF output of the transmitter by selecting the channel number or by using the auto channel function. For more information, see "To select a channel to test" in this chapter.
2. If SPUR & HARMONIC does not appear on the display, press (MODE) PDC ANALYZER More 1 of 2 Spurious .
3. Press SPUR & HARMONIC . The personality will perform a test sequence that measures the power at:

   the fundamental
   half sub-harmonic
   2nd harmonic
   3rd harmonic

   In addition, the power is measured at the peak in the TX band less than 0.5 MHz below, and greater than 0.5 MHz above, the fundamental. Both absolute amplitude and amplitude relative to the fundamental are displayed.

SPUR & HARMONIC automatically sets the reference level and the input attenuation based on the measured power level of the carrier.

The input attenuation then is locked for the rest of the test to prevent the input mixer from compressing. If the carrier power is not above the minimum carrier power threshold value, an error message will appear and the measurement will stop. The default value for the minimum carrier power threshold is −15 dBm. A true mean power measurement is made at the fundamental, sub-harmonic, and harmonic frequencies. The personality measures the time waveform of the RF envelope, converts the trace data from dB to power units, then averages the power trace data.

Swept spectrum measurements are used to measure TX band spurious. The appropriate band (800 MHz or 1500 MHz) is chosen automatically, based upon the current channel setting. First a sweep is taken from the lower end of the TX band to 0.5 MHz below the carrier frequency, then a sweep is taken from 0.5 MHz above the carrier frequency to the upper end of the TX band.

The results are displayed in a table at the end of the measurement that includes absolute fundamental power, and absolute and relative amplitude levels for the following signals:

sub-harmonic
2nd harmonic
3rd harmonic
TX band below carrier
TX band above carrier

Absolute levels are expressed in dBm, while relative amplitude levels are expressed in dB.

If PASSFAIL ON OFF in the Config menu is set to ON, a global pass/fail message is displayed. In addition, an individual highlighted F is displayed next to any reading that fails the limit. The RCR standard gives both absolute and relative limits. In RCR STD-27C, these are given as −60 dBc *or* −26 dBm for base stations. With these limits, relative values are used for determining pass/fail if carrier power ≥ +34 dBm. For carrier powers less than these values, the absolute values are used to determine pass/fail. A box is drawn around either the Absolute or Relative level on the display to indicate the result that is actually used to determine pass or fail.

The P/F AUTO ABS REL softkey in the spurious setup menu sets the criteria used for the pass/fail testing in this measurement. With P/F AUTO ABS REL set to the default setting of AUTO, PASS is displayed if *either* the absolute *or* relative result is less than the corresponding limit value. Set P/F AUTO ABS REL to ABS for pass/fail checking to be done only on the *absolute* result. Set P/F AUTO ABS REL to REL for pass/fail checking to be done only on the *relative* result. A box appears around either the Abs or Rel label on the display to indicate the result actually used to determine pass or fail.

See Figure 4-31 for an example of a TX band spurious and harmonic emissions measurement.

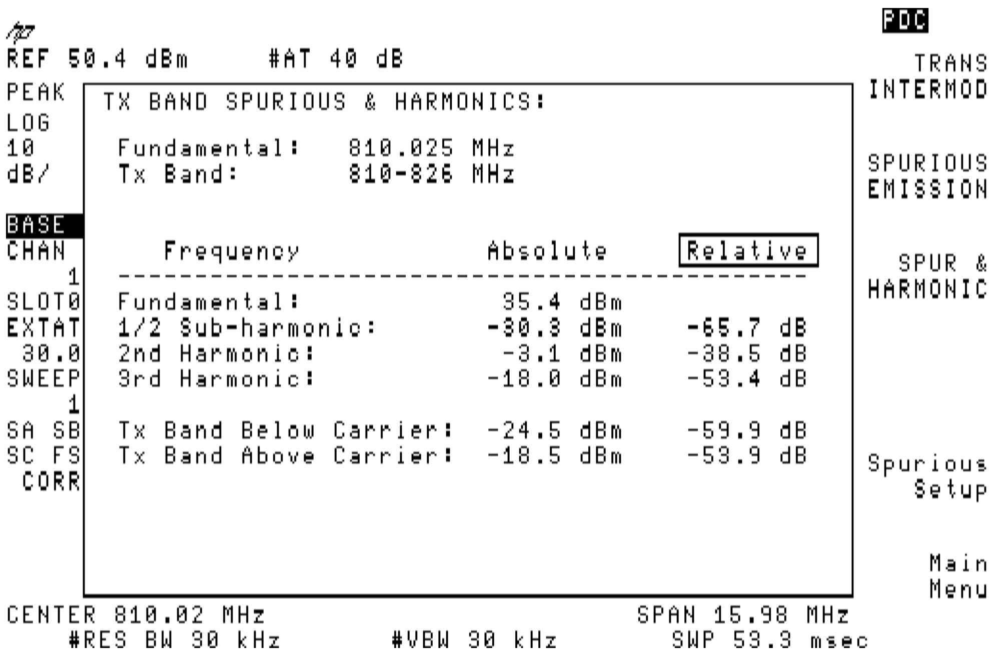


Figure 4-31. TX Band Spurious and Harmonic Emissions Measurement

5

Base Station Menu Map and Softkey Descriptions

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

Configuration menu
Pressing `Config` accesses the configuration menu.

Physical channel menu
Pressing `Physical Channel` accesses the physical channel menu.

Power menu
Pressing `Power` accesses the power 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, an adjacent channel power softkey, or a spurious emission softkey accesses the post-measurement menu.

Pressing `Digital Demod` accesses the following four menus and a status screen used for digital demodulator-based measurements:

Modulation menu
Pressing `Modulatn` accesses the modulation menu.

Graphs menu
Pressing `Graphs` accesses the graphs menu.

Data menu
Pressing `Data` accesses the data menu.

Demod configuration menu
Pressing `Demod Config` accesses the digital demodulator configuration menu.

Status screen
Pressing `STATUS` allows you to examine the digital demodulator measurement status screen. The status screen is described in detail under "Status Screen Overview" in Chapter 6, "Error Messages and Troubleshooting."

Base Station Menu Map

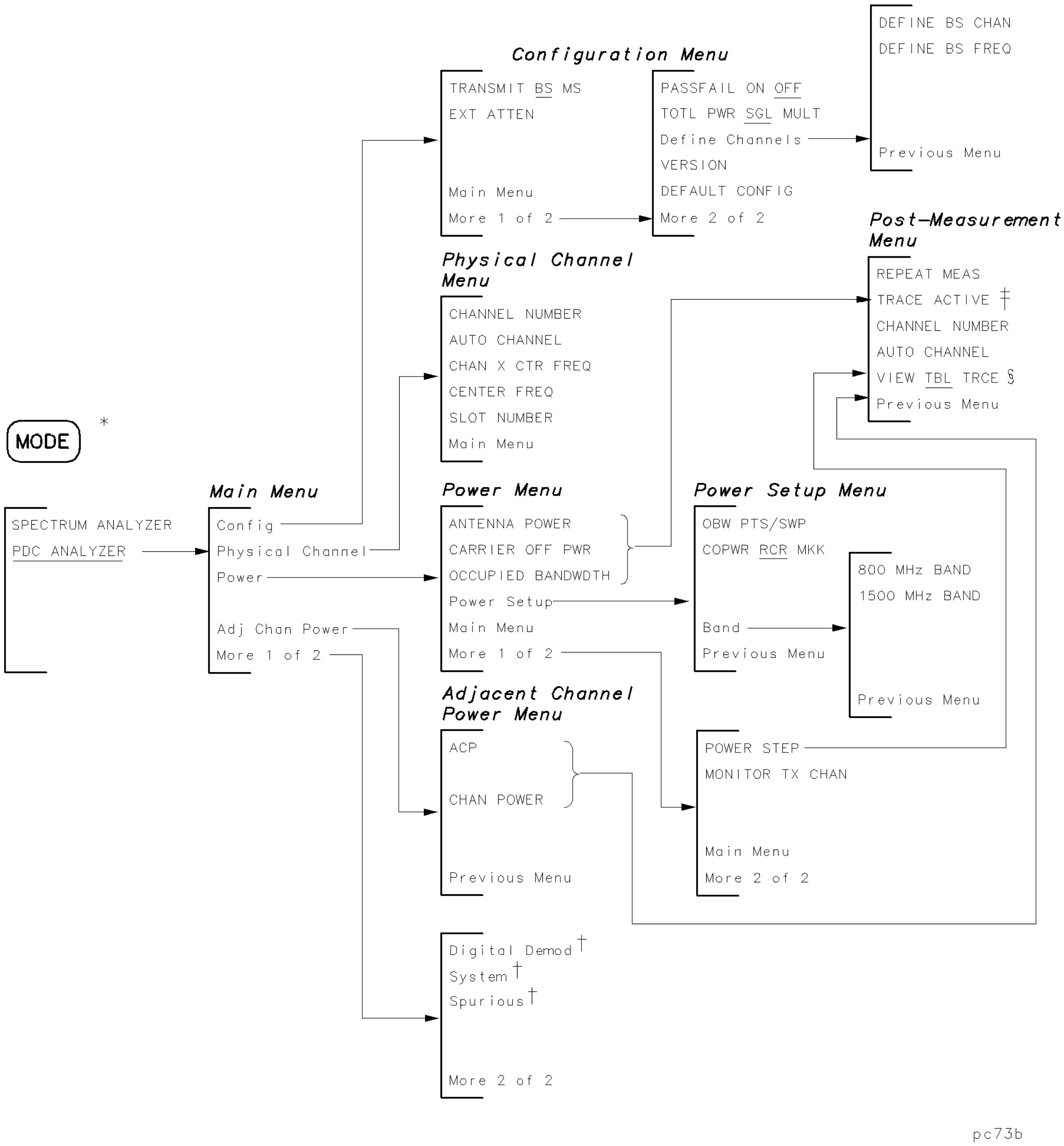


Figure 5-1. Base Station Menu Map

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

† See the following page for these menus.

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

§ VIEW TBL TRCE is available only with the adjacent channel power (ACP) measurement. VIEW TBL TRCE is blanked when TRACE ACTIVE is pressed.

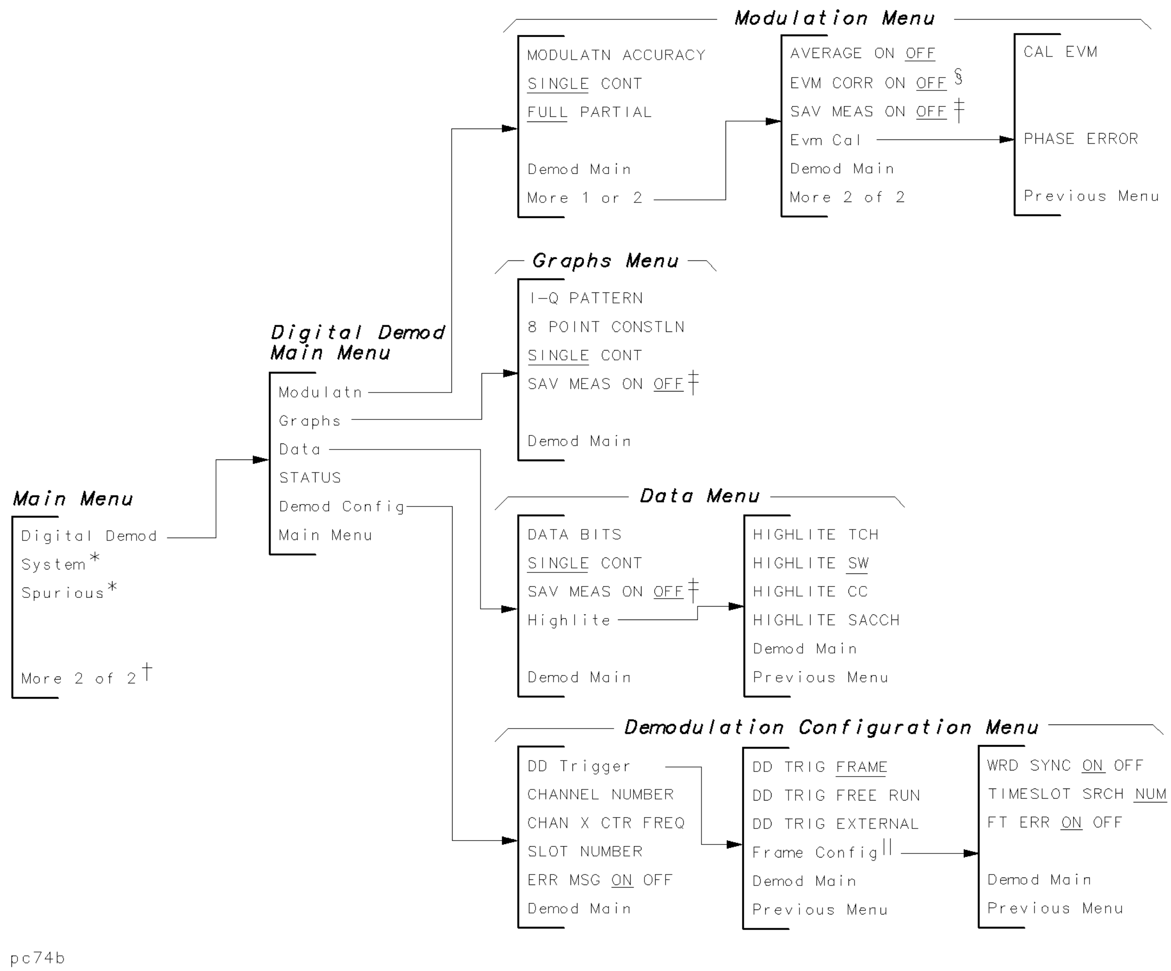


Figure 5-2. Base Station Menu Map (continued)

* See the following page for system and spurious menus.

† See the previous page for the configuration, physical channel, power, and adjacent channel power menus.

‡ Refer to the SAV MEAS ON OFF softkey description.

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

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

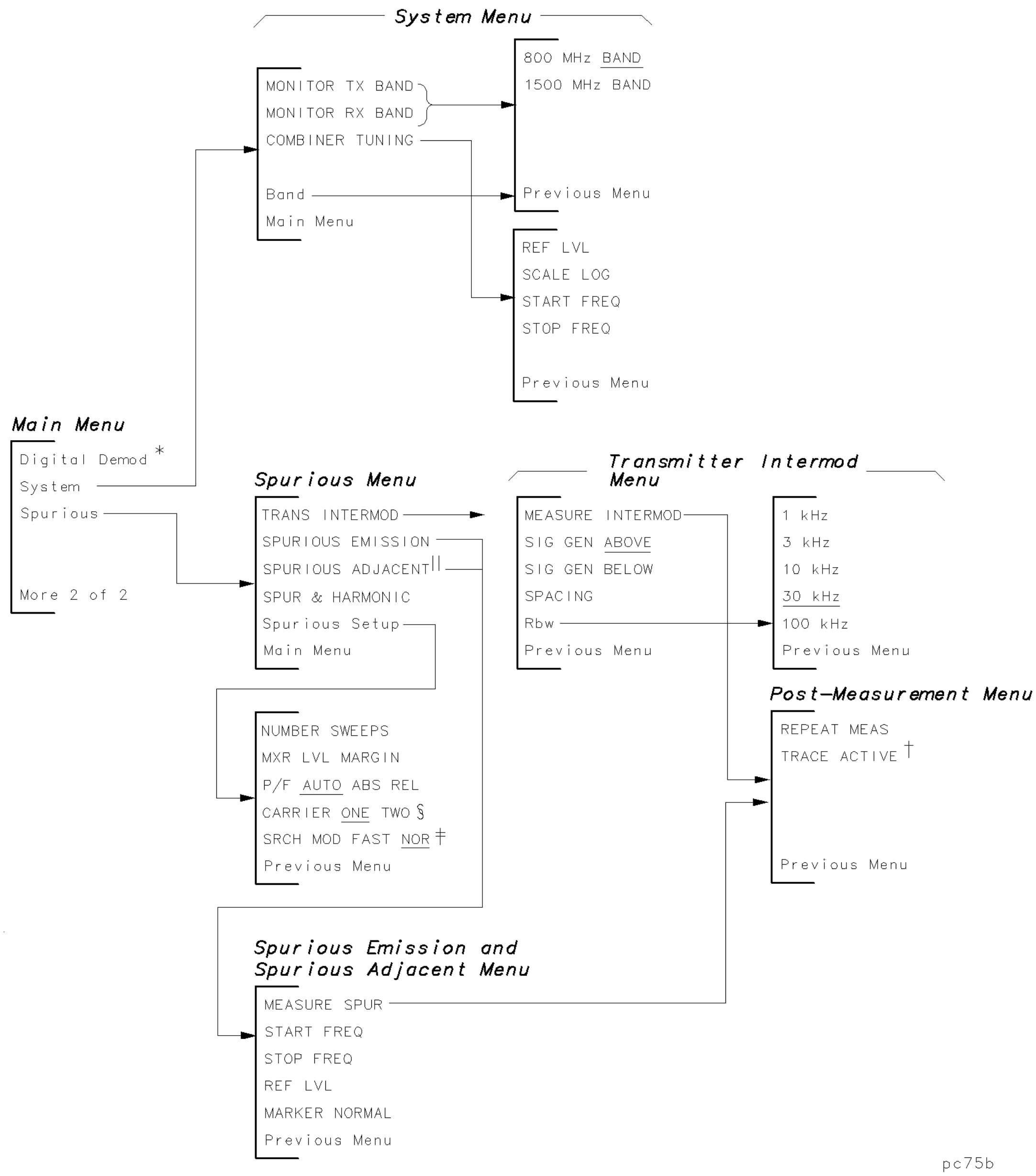


Figure 5-3. Base Station Menu Map (continued)

* See the previous page for the digital demod menus.

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

‡ Available only if remote command _RCRSTD is set to 2 (RCR-27B).

§ Replaced by SPR TRIG EXT FREE if remote command _RCRSTD is set to 2 (RCR-27B).

|| Blank if remote command _RCRSTD is set to 2 (RCR-27B).

The Configuration Menu

Pressing Config accesses the softkeys that let you configure the PDC measurements personality for your test setup.

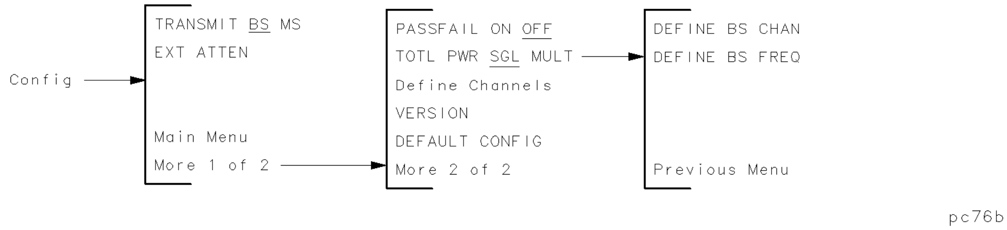


Figure 5-4. The Configuration Menu Map

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 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 20 dB.

The Configuration Menu Softkeys

TRANSMIT BS MS Allows you to select either the base station (BS) or the mobile station (MS) as the transmitter under test. If BS is underlined, the personality assumes that there is a continuous, $\pi/4$-DQPSK, base-station carrier as the input to the spectrum analyzer. If MS is underlined, the personality assumes that there is a burst, $\pi/4$-DQPSK, mobile station carrier as the input to the spectrum analyzer. The selection of base station or mobile station changes some of the PDC personality's softkeys.

The default for TRANSMIT BS MS is base station (BS). The selection for base or mobile station is retained even if (PRESET) is pressed or the spectrum analyzer is turned off. The selection of base station or mobile station is shown on the left side of the spectrum analyzer, above the annotation for the channel number. If BS is selected, BASE is displayed on the left side of the spectrum analyzer display. If MS is selected, MOBIL is displayed.

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 20 dB is used.

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.

Many of the PDC personality measurements display a pass/fail message if PASSFAIL ON OFF is set to ON. To determine if a measurement passed or failed, the PDC personality uses test limits. Table 5-1 lists the default values for the test limits that the PDC personality uses. If desired, you can change these default limits with a computer or with an external keyboard. See "Customizing the PDC Personality" in Chapter 8, "Programming Examples," for more information about how to change the default limits.

Table 5-1. Default Limits for the Pass/Fail Messages

Test	Limit
Antenna power (RCR STD-27C 3.4.2.1)	Maximum and minimum antenna power levels are set to 0 dBm to disable the pass/fail message
Carrier off leakage power (RCR STD-27C 3.4.2.5)	
Mean carrier off power - mobile	−60 dBm maximum
Mean carrier off power - base	−26 dBm maximum
Ratio with mean antenna power - base	−60 dB
Occupied bandwidth (RCR STD-27C 3.4.2.7)	
Bandwidth	32 kHz maximum
Frequency error	2 kHz maximum
Adjacent channel power (RCR STD-27C 3.4.2.3)	
Adjacent channel (50 kHz)	−45 dB maximum
Alternate channel (100 kHz)	−60 dB maximum
Power versus time (RCR STD-27C 3.4.2.4)	
258 bit burst width*	6143 μs minimum, 6357 μs maximum
270 bit burst width*	6429 μs minimum, 6643 μs maximum
Attack time (rising)*	24 μs minimum, 115 μs maximum
Release time (falling)*	24 μs minimum, 115 μs maximum
Limit line masks	Based on RCR STD-27C
Spurious emissions (RCR STD-27C 3.4.2.6 and 3.4.2.10)	
Mean spur power, mobile	−36 dBm maximum
Mean spur power, base	−26 dBm maximum
Ratio with mean antenna power	−60 dB
Modulation Accuracy	
Carrier Frequency Error	
Base	40 Hz maximum, Base 800 MHz Band
	74 Hz maximum, Base 1500 MHz Band
Mobile	2820 Hz maximum, Mobile 800 MHz Band
	2858 Hz maximum, Mobile 1500 MHz Band
Error Vector Magnitude	
RMS EVM	12.5%
EVM Magnitude Component	33%
EVM Phase Component	50 °
I-Q Origin Offset	−20 dB
* The pass or fail message is not displayed when these variables are set to 0.	

TOTL PWR SGL MULT Allows you to select if total RF output power of the transmitter is from a single (SGL) carrier, or from multiple (MULT) carriers. The selection of either a single carrier or multiple carriers allows the personality to set the internal attenuator of the spectrum analyzer to an optimal value, and prevents possible gain compression.

If you select a single carrier, the spectrum analyzer input attenuation and reference level are automatically set according to the amplitude level of the measured carrier.

If you select multiple carriers, you can enter the total power from the carriers with the data keys. You can calculate the total power with the following equation:

$$P_{Total} = P + 10\log N$$

where:

P_{total}	is the total power in dBm.
P	is the power of one channel in dBm.
N	is the number of channels transmitted by the base station.

The personality uses the total power value to set the spectrum analyzer input attenuator, and thus avoids signal compression for signals with a total power less than the entered value for total power. You can select a value from 0 to 60 dBm for the total power, referenced to the transmitter's output power.

The default value for TOTL PWR SGL MULT is single carrier and a power level of +50 dBm.

Define Channels The keys under this menu define a channel number and the corresponding frequency for base stations. The default channel spacing is 25 kHz. The center frequency for a given channel is given by:

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

Where:

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

DEFINE BS CHAN Changes the channel number that corresponds to the "defined" base station frequency; and is used for channel number tuning. The range is −9999 to 32000.

DEFINE BS FREQ Changes the frequency that corresponds to the "defined" base station channel number. The range is any frequency within the range of the spectrum analyzer.

VERSION Displays the version of the PDC measurements personality, and the version of the RCR standards documents that were used to derive the PDC 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 are as follows:

- EXT ATTEN is set to 20 dB.
- TOTL PWR SGL MULT is set to single carrier (SGL) and the power level is set to +50 dBm.
- PASSFAIL ON OFF is set to OFF.
- CHANNEL NUMBER is set to 1.
- DD TRIG FRAME is enabled.
- TIMESLOT SRCH NUM is set to NUM.
- CHAN X CTR FREQ is set to 300 MHz.
- Band is set to 800 MHz.
- EVM CORR ON OFF is set to OFF.
- DEFINE BS CHAN is set to 0.
- DEFINE BS FREQ is set to 810.000 MHz.
- MXR LVL MARGIN is set to 15.
- P/F AUTO ABS REL is set to AUTO.

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.

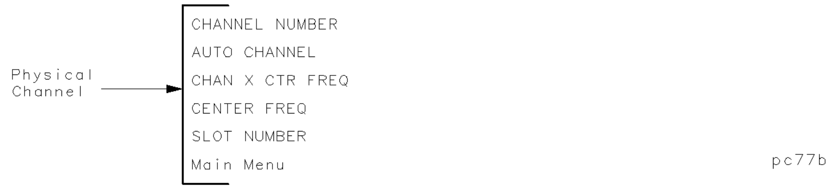


Figure 5-5. The Physical Channel Menu Map

The Physical Channel Menu Softkeys

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 PDC channel you want to measure. The PDC 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, Adj Chan Power, and Digital Demod. If you do not enter a channel number the channel number defaults to the "defined" base station channel number. The channel numbers are defined under the configuration menu. If you press this softkey while in band mode, the personality will immediately recall the previous channel number and switch to channel mode.

AUTO CHANNEL This softkey automatically tunes the instrument to the channel having the highest carrier power in the current band. If in channel mode, the current band is the band containing the current channel frequency. If in band mode, the current band is selected by the band softkeys. If there is no signal above the carrier minimum power threshold (default is −15 dBm) in the current band, the other band then is searched.

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's 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." If you press this softkey while in band mode, the personality will immediately recall the previous channel "X" center frequency and switch to channel mode.

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

SLOT NUMBER Allows you to select the timeslot number that you want to measure. The timeslot number is used by the digital demodulator based measurements, MODULATN ACCURACY, I-Q PATTERN graphs, and DATA BITS, when DD TRIG FRAME is enabled and TIMESLOT SRCH NUM is set to NUM. The default value for SLOT NUMBER is 0.

The Power Menu

Pressing Power accesses the softkeys that allow you to measure the transmitter's antenna power, the carrier off leakage power, the step power, the occupied bandwidth, and to view the transmit channel. The power menu functions not only make a measurement, but they also access additional softkeys. See "The Post-Measurement Menu" in this chapter for more information about the softkeys accessed by the power menu softkeys.

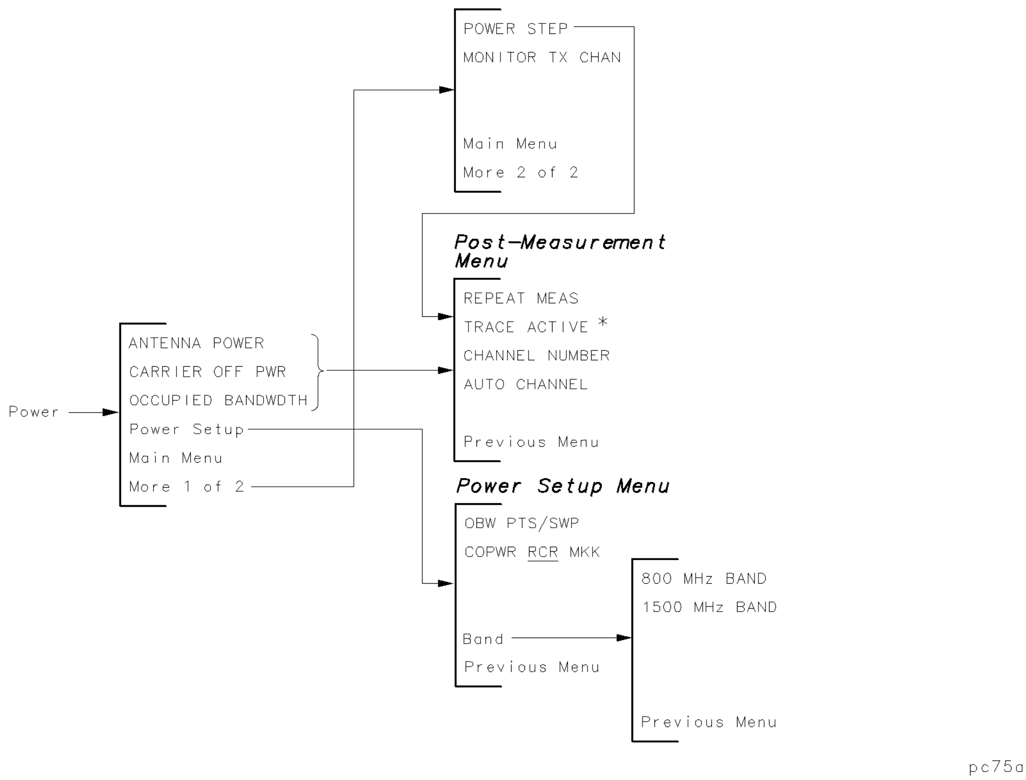


Figure 5-6. The Power Measurement Menu Map

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

Table 5-2 shows the spectrum analyzer settings for each of the power measurements. The PDC measurements personality automatically sets the spectrum analyzer settings for each of the power measurements.

Table 5-2.
Spectrum Analyzer Settings for the Base Station Power Measurements

Spectrum Analyzer Setting	ANTENNA POWER	CARRIER* OFF PWR	POWER STEP	OCCUPIED BANDWDTH	MONITOR TX CHAN
Span	0 Hz	0 Hz	0 Hz	100 kHz	500 kHz
Resolution bandwidth	100 kHz	30 kHz	100 kHz	300 Hz	10 kHz
Video bandwidth	100 kHz	30 kHz	100 kHz	300 Hz	10 kHz
Sweep time	20 ms	20 ms	8 s	3.4 s	300 ms
Detector	Sample	Sample	Peak	Sample	Peak
Trigger mode	Free Run	Free Run	Video	Free run	Free run
* For RCR method					

The limits and parameters for the power measurements can be changed remotely. See “Customizing the PDC Personality” in Chapter 8, “Programming Examples,” 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.

CARRIER OFF PWR
: Measures the mean power when the carrier is off. The average data from several sweeps is used in calculating the carrier off leakage power levels. The default number of sweeps is 2. A ratio value (in dB) relative to the last value measured in the antenna power measurement is determined. The absolute value (in dBm) is also determined.

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 center 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 5) is used in calculating the occupied bandwidth.

Power Setup
: Accesses the menu that allows you to select the parameters used in the power measurements.

POWER STEP
: Allows you to view the output power from a transmitter as you increase or decrease the power. When you press POWER STEP, the trigger mode is set to video, and the spectrum analyzer will not sweep until the carrier is turned on or the carrier power level is increased. After the spectrum analyzer begins to sweep, you can increase or decrease the output power from the transmitter to see the power “steps.” The amplitude scale of the spectrum analyzer is set to 4 dB per division.

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

The Power Setup Menu Softkeys

OBW PTS/SWP Allows you to set the number of points used in the occupied bandwidth measurement. The number of points can range from 21 to 401; the default is 401.

COPWR RCR MKK Allows you to select the method for making the carrier off leakage power measurement; either the RCR (standard), or MKK method. The RCR (standard) method performs a zero-span measurement and averages the power in the whole frame

The MKK method performs a frequency domain measurement. The carrier needs to be ON when the measurement is initiated. The carrier is then turned OFF; the measurement senses this change and completes the measurement.

Band Allows you to select a particular PDC band. Before making the carrier off power measurement by the MKK method, select the band that contains the carrier. Pressing Band accesses 800 MHz BAND, and 1500 MHz BAND. The band selection is not changed by turning off the spectrum analyzer or pressing (PRESET). See Table 5-4 and Table 5-5 for a list of the frequencies for the bands.

800 MHz Band This selects the 800 MHz band as the band that contains the carrier.

1500 MHz Band This selects the 1500 MHz band as the band that contains the carrier.

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 alternate and adjacent 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" in this chapter for more information about the softkeys accessed by the adjacent power menu softkeys.

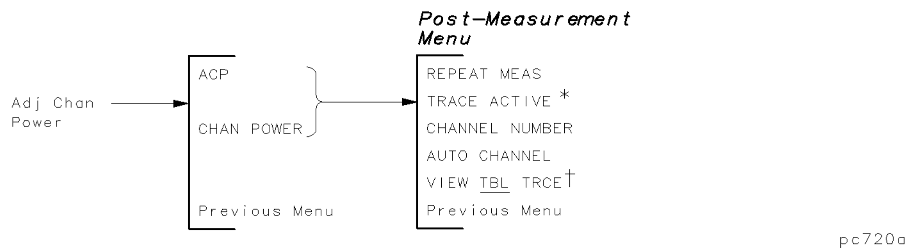


Figure 5-7. The Adjacent Channel Power Measurement Menu Map

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

† VIEW TBL TRCE is available only with the adjacent channel power (ACP) measurement. It is blanked if TRACE ACTIVE is pressed.

Table 5-3 shows the spectrum analyzer settings for each of the adjacent channel power and channel power measurements. The PDC measurements personality automatically sets the spectrum analyzer settings for each of these measurements.

Table 5-3. Spectrum Analyzer Settings

Spectrum Analyzer Setting	ACP	CHAN POWER
Span	240 kHz	21 kHz
Resolution bandwidth	1 kHz	1 kHz
Video bandwidth	10 kHz	10 kHz
Sweep time	800 ms	300 ms
Detector	Sample	Sample
Trigger mode	Free Run	Free Run

The limits and parameters for the power measurements can be changed remotely. See "Customizing the PDC Personality" in Chapter 8, "Programming Examples," for more information.

The Adjacent Channel Power Menu Softkeys

ACP Measures the power in the transmitted channel, as well as the power in the upper and lower adjacent, and alternate channels. Because the signal from a base station is continuous and not burst, the results from the adjacent channel power measurement are from modulation and noise effects. The personality uses the spectrum analyzer sample detector and a 21 kHz integration bandwidth to measure the power in the adjacent channels. The measurement performs one measurement sweep. If VIEW TBL TRCE is set to table (TBL), the numerical results will be displayed. If VIEW TBL TRCE is set to trace (TRCE), the frequency spectrum results will be displayed.

CHAN POWER Measures the total power in the channel. The personality uses the spectrum analyzer sample detector and an 21 kHz integration bandwidth to measure the power in the channel.

The System Menu

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

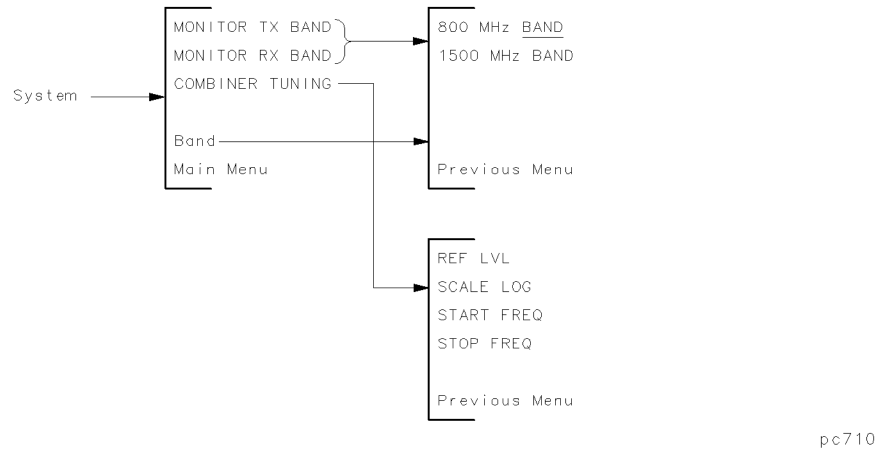


Figure 5-8. The System Menu Map

The System Menu Softkeys

MONITOR TX BAND — Allows you to view the spectrum of the base transmit bands. The softkeys accessed by MONITOR TX BAND corresponds to the frequencies shown in the following table.

Table 5-4. Transmit Bands, Base Station

Softkey Label	Analyzer Frequency Range (in MHz)
800 MHz BAND	809.5 to 826.5
1500 MHz BAND	1476.5 to 1501.5

MONITOR RX BAND — Allows you to view the spectrum of the base receive bands. The softkeys accessed by MONITOR RX BAND corresponds to the frequencies shown in the following table.

Table 5-5. Receive Bands, Base Station

Softkey Label	Analyzer Frequency Range (in MHz)
800 MHz BAND	939.5 to 956.5
1500 MHz BAND	1428.5 to 1453.5

COMBINER TUNING Allows you to view the output power from several transmitters so that you can adjust the output power from each transmitter. You can select the band that you want to view by using the softkeys that are accessed by Band. The PDC measurements personality places a marker line on the maximum carrier, and another marker line on the minimum carrier. The measurement also shows numerically the power of the maximum carrier detected, and the power difference between the maximum and minimum carriers. Pressing COMBINER TUNING accesses the following softkeys: REF LVL, SCALE LOG, START FREQ, STOP FREQ, and Previous Menu. See the descriptions below for more information about the softkeys that COMBINER TUNING accesses.

Band Allows you to select a particular band. After you have selected a band with the Band softkeys, you can press MONITOR TX BAND (to view the transmit bands), MONITOR RX BAND (to view the receive bands), or COMBINER TUNING. Pressing Band accesses 800 MHz BAND, and 1500 MHz BAND. The band selection is not changed by turning off the spectrum analyzer or pressing (PRESET). See Table 5-4 and Table 5-5 for a list of the frequencies for the bands.

The Combiner Tuning Menu Softkeys

REF LVL Allows you to adjust the reference level of the spectrum analyzer.

SCALE LOG Allows you to change the number of dB per division. COMBINER TUNING changes the scale to 2 dB per division, but you can press SCALE LOG, and then use the step keys or data keys to enter the desired dB per division.

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.

The Spurious Menu

Pressing Spurious accesses TRANS INTERMOD, SPURIOUS EMISSION, and SPUR & HARMONIC. TRANS INTERMOD allows you to measure transmitter intermodulation product spurious emissions. SPURIOUS EMISSION allows you to measure spurious emissions over a specified frequency range. SPUR & HARMONIC allows you to measure TX band and harmonic spurious emissions.

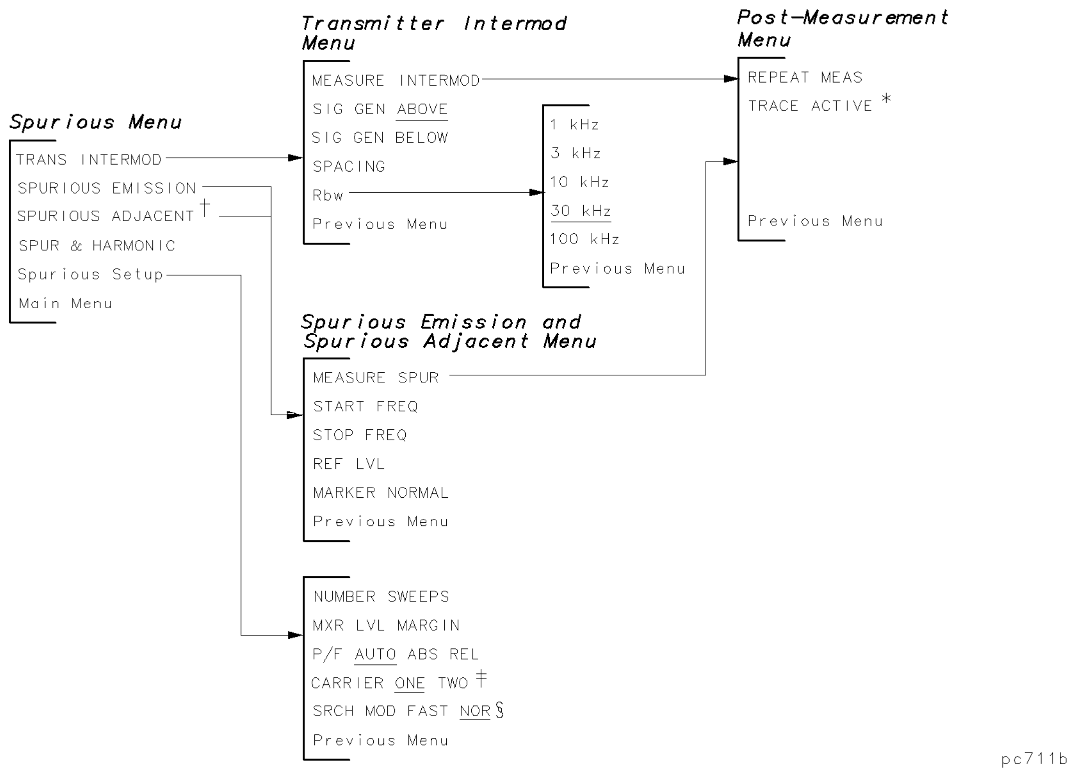


Figure 5-9. The Spurious Measurement Menu Map

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

† Blank if remote command _RCRSTD is set to 2 (RCR-27B).

‡ Replaced by SPR TRIG EXT FREE if remote command _RCRSTD is set to 2 (RCR-27B).

§ Available only if remote command _RCRSTD is set to 2 (RCR-27B).

The specified limits for the transmitter intermodulation product spurious emission and spurious emissions measurements can be changed remotely. See "Customizing the PDC Personality" in Chapter 8, "Programming Examples," for more information.

The Spurious Menu Softkeys

TRANS INTERMOD — Allows you to measure transmitter intermodulation spurious emissions. Pressing TRANS INTERMOD puts instructional text on the analyzer screen and accesses MEASURE INTERMOD, SIG GEN ABOVE, SIG GEN BELOW, SPACING, Rbw, and Previous Menu. See "The Transmitter Intermodulation Menu Softkeys" for more information about the softkeys that TRANS INTERMOD accesses.

SPURIOUS EMISSION — Allows you to measure spurious emissions over a specific frequency range. Pressing SPURIOUS EMISSION sets up the analyzer to monitor a wide frequency span (only PDC transmit band if remote command _RCRSTD is set to 2 (RCR-27B)) and accesses MEASURE SPUR, START FREQ, STOP FREQ, REF LVL, MARKER NORMAL, and Previous Menu. See "The Spurious Emission Menu Softkeys" for more information about the softkeys that SPURIOUS EMISSION accesses.

SPURIOUS ADJACENT — Allows you to measure spurious emissions by the MKK method, which uses a span of 700 kHz centered on the carrier frequency, and accesses MEASURE SPUR, START FREQ, STOP FREQ, REF LVL, MARKER NORMAL, and Previous Menu. See "The Spurious Emission Menu Softkeys" for more information about the softkeys that SPURIOUS EMISSION accesses.

SPUR & HARMONIC — Performs the TX band spurious and harmonic test sequence. This sequence measures the fundamental carrier level and the level of the half sub-harmonic, 2nd harmonic, 3rd harmonic, the peak in the TX band more than 0.5 MHz below the carrier frequency, and the peak in the TX band more than 0.5 MHz above the carrier frequency. The results are displayed in a table at the end of the test. Absolute power is shown for the fundamental carrier, and absolute and relative powers are shown for all the other measurements.

Spurious Setup — Accesses the menu that lets you select the parameters used in a spurious measurement. See "The Spurious Setup Menu Softkeys," later in this chapter.

The Transmitter Intermodulation Menu Softkeys

MEASURE INTERMOD — Allows you to start the measurement of transmitter intermodulation spurious emissions.

SIG GEN ABOVE — Allows you to specify if the signal generator used by the measurement is higher in frequency than the carrier frequency of the transmitter.

SIG GEN BELOW — Allows you to specify if the signal generator used by the measurement is lower in frequency than the carrier frequency of the transmitter.

SPACING — Allows you to specify the frequency difference between the signal generator used by the measurement and the carrier frequency of the transmitter. The default spacing is 500 kHz.

Rbw — Allows you to specify the analyzer resolution bandwidth used by the measurement. Pressing Rbw accesses 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, and Previous Menu. The default resolution bandwidth is 30 kHz.

The Spurious Emission and Spurious Adjacent 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.

MARKER NORMAL — Allows you to enable the marker function.

The Spurious Setup Menu Softkeys

NUMBER SWEEPS — Lets you change the number of sweeps used in time domain (zero span) measurements in the spurious and harmonic, spurious emission, and intermodulation spurious measurements. The range is 1 to 999, with a default of 1. Note that the fundamental measurement in the spurious and harmonic test always uses at least four sweeps.

MXR LVL MARGIN — Lets you change the minimum margin between the 1 dB gain compression level at the input mixer and the *mean* value of the measured carrier for the spurious and harmonic measurement. This will change the amount of amplitude margin used in setting the input attenuator automatically. Using a higher value will lower the harmonic distortion products generated in the analyzer, but also will raise the displayed noise level. For measurements of carriers in the 1500 MHz band, internally generated harmonic distortion is not a problem, as the built-in YIG preselector is used when measuring the 2nd and 3rd harmonics.

For measurement of carriers in the 800 MHz band, this function allows the harmonic distortion-free dynamic range to be optimized for the particular setup and specs. This function also controls the positioning of the trace on screen for zero span measurements. The range is 0 dB to 40 dB, with a default of 15 dB. This setting is saved even if you press (PRESET) or turn off the instrument.

P/F AUTO ABS REL — Lets you select the criteria used for pass/fail in the spurious and harmonic, spurious emission and intermodulation spurious measurements. Auto pass/fail normally is used, which automatically selects *either* absolute *or* relative testing based on the measured carrier power and the limit values.

Above a certain carrier level the relative limit is used; below that limit the absolute limit is used. This is equivalent to saying that the test is passed if either the absolute or the relative result is less than the corresponding limit value. Set P/F AUTO ABS REL to ABS for pass/fail checking to be done only on the *absolute* result. Set P/F AUTO ABS REL to REL for pass/fail checking to be done only on the *relative* result. A box appears around either the Abs or Rel label on the display to indicate the result actually used to determine pass or fail. This setting is saved even if you press (PRESET) or turn off the instrument.

CARRIER ONE TWO Allows you to select the number of carriers present within the span used by the adjacent spurious (MKK) measurement. If you have one carrier present, select ONE. The analyzer searches for spurious at frequencies greater than 112.5 kHz from the carrier, and the highest level will be measured as the spur. If you have two carriers present, select TWO. You must place the marker on the spur you want to measure, and its level will be measured. This key is available only if _RCRSTD is set to 3 (RCR-27C), which is the default.

SPR TRIG EXT FREE Allows you to select either free run or external trigger for the spurious emission measurement. In free run trigger mode, the analyzer does the following:

1. the burst is captured with full frame
2. the mean power is calculated
3. the threshold is set to the result of the first mean power calculation
4. the burst power above the threshold is then re-calculated

In external trigger mode, the analyzer does the following:

1. captures the full frame with proper slot position
2. calculates the mean power slot by slot
3. the mean power is displayed for the slot with the highest level spurious signal

In external trigger mode, the trigger delay must be set to correspond to the delay of the trigger signal.

This key is available only if the remote command _RCRSTD is set to 2 (RCR-27B).

SRCH MOD FAST NOR Allows you to select the search mode for spurious emission measurements; either fast or normal.

Normal mode uses the marker track function of the spectrum analyzer for the spurious search.

Fast mode uses the peak search marker function of the spectrum analyzer for the spurious search.

This key is available only if the remote command _RCRSTD is set to 2 (RCR-27B). If _RCRSTD is set to 3 (RCR-27C), only the frequency domain peak search method is used, as defined in the RCR STD-27C.

The Post-Measurement Menu

Once the measurement has been completed, many of the PDC 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.

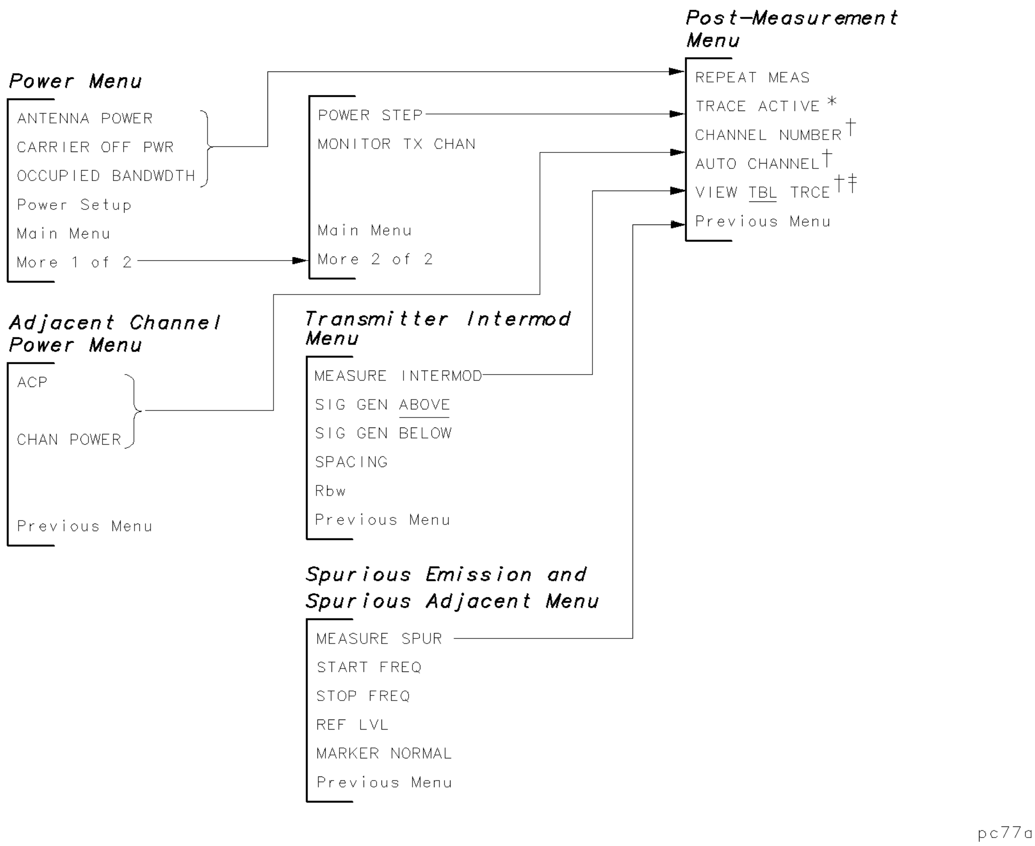


Figure 5-10. The Post-Measurement Menu Map

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

† Not present for spurious measurements.

‡ VIEW TBL TRCE is available only with the adjacent channel power (ACP) measurement. It is blanked if TRACE ACTIVE is pressed.

The Post-Measurement Menu Softkeys

REPEAT MEAS	Repeats the measurement. You may 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 COMPARE.
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.
VIEW TBL TRCE	For the adjacent channel power measurement (ACP), VIEW TBL TRCE allows you to view either the numeric results in a table (TBL), or view the trace of the frequency spectrum (TRCE).
Previous Menu	Returns to the previous menu.

The Modulation Menu

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

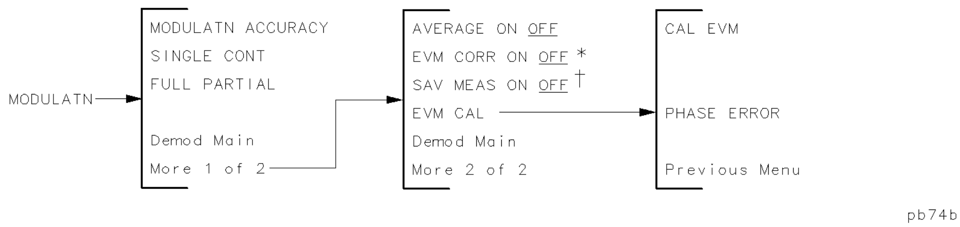


Figure 5-11. The Modulation Menu Map

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

† Refer to the SAV MEAS ON OFF softkey description.

The Modulation Menu Softkeys

MODULATN ACCURACY Measures the transmitter's 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 modulation accuracy results for the last 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 1 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 then the display changes to reflect the statistical results of the averaging. The statistical information displayed with averaging includes mean, standard deviation, minimum, and maximum for RMS EVM, RMS magnitude error, and RMS phase error. RMS EVM uncertainty ranges for room and full temperature ranges are also displayed. The mean values 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 a correction value generated by the EVM calibration measurement. This correction value corrects the measured results of RMS EVM and RMS Phase error. This softkey is available only if the EVM calibration was successful. See "To calibrate and correct for spectrum analyzer EVM inaccuracies due to uncertainty in the phase error measurement" in Chapter 4, "Base Station 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 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 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 PDC menu. This key is blanked if a measurement has not been made, is aborted, or is made with averaging ON. 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. See "To calibrate and correct for spectrum analyzer EVM inaccuracies due to uncertainty in the phase error measurement" in Chapter 4, "Base Station 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's 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 is free of errors from I-Q origin offset and carrier frequency error. Only the RMS EVM contribution remains.

Figure 5-12. 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 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 ON, pressing I-Q PATTERN will display the I-Q pattern from the last measurement.

8 POINT CONSTLN Pressing the 8 POINT CONSTLN softkey causes a measurement to be made (if SAV MEAS ON OFF is set OFF) and the corresponding eight-point constellation I-Q pattern to be displayed on the screen. First, the amplitude of the signal is checked and the analyzer reference level and attenuation are set appropriately. Next, 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 ON, pressing 8 POINT CONSTLN will display the eight-point constellation from the last measurement. The RMS EVM value is also displayed.

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, 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 PDC menu.

Note that if a measurement is aborted, 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's demodulated bit sequence and to highlight a selected portion of that sequence.

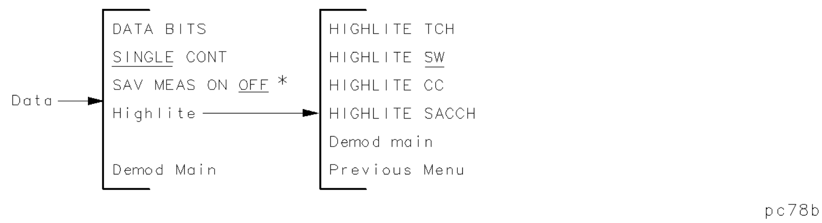


Figure 5-13. The Data Menu Map

* 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 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 ON, pressing DATA BITS will display the demodulated data from the last measurement. The default display will highlight the 20-bit sync word portion of the 280-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.

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

Highlite Pressing the Highlite softkey accesses the highlight menu softkeys which are described below. These softkeys allow the user to highlight selected portions of the bit sequence.

The Highlight Menu Softkeys

HIGHLITE TCH Pressing the HIGHLITE TCH softkey will cause the data (Traffic CHannel) portion of the bit sequence to be highlighted. For PDC base stations these are bits 7 through 118, and bits 169 through 280. Each of these two blocks is 112 bits long.

HIGHLITE SW Pressing the HIGHLITE SW softkey will cause the sync portion of the bit sequence to be highlighted. For PDC base stations these are bits 119 through 138. This block is 20 bits long.

HIGHLITE CC Pressing the HIGHLITE CC softkey will cause the coded digital verification color code portion of the bit sequence to be highlighted. For PDC base stations these are bits 139 through 146. This block is 8 bits long.

HIGHLITE SACCH Pressing the HIGHLITE SACCH softkey will cause the SACCH (Slow Associated Control CHannel) portion of the bit sequence to be highlighted. For PDC base stations these are bits 148 through 168. This block is 21 bits long.

The Demodulator 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 the timeslot number, triggering, and error messages.

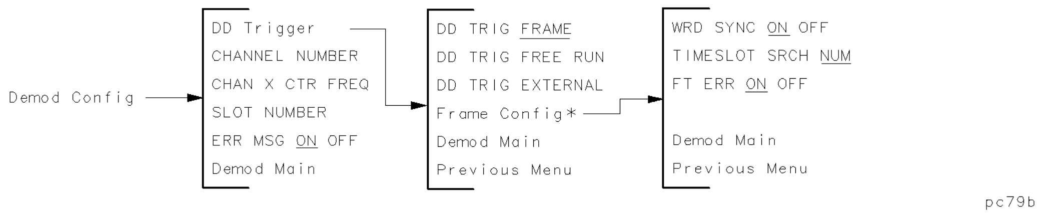


Figure 5-14. The Demodulator Configuration Menu Map

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

The Demodulator 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 PDC 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.

SLOT NUMBER Pressing the SLOT NUMBER softkey allows the user to select which of the six timeslots the measurement should be made on. The default value is timeslot number one. If the digital demodulator trigger is set to FRAME, and frame trigger configuration is set so that WRD SYNC ON OFF is ON and TIMESLOT SRCH NUM is set to NUM, (these are the default settings) the frame trigger will attempt to lock to the selected timeslot number. See the Frame Config menu softkey descriptions for more detail. This softkey is identical to the SLOT NUMBER 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 6, "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 Digital Demodulator Trigger Menu Softkeys

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 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 wave (CW) 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 measurements that are made to be triggered by an external trigger that must be connected to the rear panel of the instrument.

If Option 105 is installed, the signal should be connected to GATE INPUT, and GATE OUTPUT connected to EXT TRIG. In this case, TRIG DELAY in the Trigger Config menu can be used to correctly position an external trigger.

If Option 105 is not installed, the signal must be connected directly to EXT TRIG INPUT.

If no trigger is present, then the measurement will be held up indefinitely until a trigger arrives. Selecting the external trigger will cause the Frame Config softkey to become unavailable.

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. The TIMESLOT SRCH NUM softkey (see below) and the SLOT NUMBER softkey in the Demod Config menu determine which sync word is searched for. The frame trigger will be positioned relative to the timeslot to optimize making a measurement on that timeslot. If WRD SYNC ON OFF is set to OFF, no 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.

TIMESLOT SRCH NUM — The TIMESLOT SRCH NUM softkey allows you to control how the frame trigger will be acquired if WRD SYNC ON OFF is set to ON. If WRD SYNC ON OFF is set to OFF, the setting of the TIMESLOT SRCH NUM has no effect. If WRD SYNC ON OFF is set to ON, and TIMESLOT SRCH NUM is set to NUM (which is the default), the frame trigger will attempt to synchronize to the timeslot selected by the SLOT NUMBER softkey in the Demod Config menu. The default timeslot number is one. If WRD SYNC ON OFF is set to ON, and if TIMESLOT SRCH NUM is set to SRCH, the frame trigger will synchronize to whichever timeslot has the best match with a sync word. First, a search for a perfect match is attempted starting with timeslot one and continues to timeslot six. A perfect match will end the search. If no perfect matches are found, then the timeslot with the least amount of sync word bit errors will be used.

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 6, "Error Messages and Troubleshooting," 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 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.

6

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 Agilent Technologies 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 PDC 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 mobile station when the personality is configured for a base station, or vice versa.
- 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 a timeslot that is not being transmitted.
- Using the digital demodulator frame trigger with `WRD SYNC` set ON, on a signal that does not contain a 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.
- Configuring the digital demodulator to search for the best timeslot sync word (using `TIMESLOT SRCH`) when only timeslots with the user-designated sync word number are to be measured.

If the PDC 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 either Chapter 2, "Mobile Station Measurements," or Chapter 4, "Base Station 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 3.5 kHz, the 85720C PDC 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 mobile station.

  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, "Mobile Station 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 gated adjacent channel power measurements, and power versus time measurements, on a mobile station. See the end of "Step 3. Make the cable connections for triggering the spectrum analyzer" in Chapter 1, "Getting Started," for more information.

- The timeslot number is wrong when measuring a mobile station.

  Make sure that the timeslot number corresponds to a burst. See "To select a channel to test" in Chapter 2, "Mobile Station 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:

- Burst carrier configuration is set incorrectly when measuring a mobile station.

  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, "Mobile Station Measurements," for more information.

- The external trigger settings are not correct when testing a mobile station.

  Make sure that the correct trigger source, period, delay, and polarity have been selected. See "To configure the personality" in Chapter 2, "Mobile Station Measurements," for more information about TRIG SRC DD EXT, PERIOD 40ms 20ms, TRIG DELAY, and TRIG POL NEG POS.

- The personality is configured for the wrong transmitter format.

  Make sure that BS is underlined in the TRANSMIT BS MS softkey (in the configuration menu), if a base station is being tested. Likewise, make sure that MS is underlined in the TRANSMIT BS MS softkey, if a mobile station is being tested. For more information, see "To select a channel to test" in either Chapter 2, "Mobile Station Measurements," or Chapter 4, "Base Station Measurements."

- 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 either Chapter 2, "Mobile Station Measurements," or Chapter 4, "Base Station Measurements."

- The total power setting is not correct.

  Make sure that TOTL PWR SGL MULT has been set correctly. This function is in the configuration menu. If only one carrier is incident to the analyzer, make sure SGL is underlined. If multiple carriers are incident, make sure MULT is underlined and the value for the TOTL PWR active function is equal to the total power for all the carriers.

- 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 adjacent channel power measurement trace 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 Agilent Technologies 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 3.5 kHz, the 85720C PDC 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.

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 Agilent Technologies sales and service office.

CAL FREQ for best dynamic range

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

To solve this problem:

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

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

This 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 that the transmitter is in the burst mode.
- If the carrier to be measured is a continuous carrier, make sure that the PDC measurements personality is set to continuous mode (CONT) in the configuration menu.

Carrier not cont

This 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 that the transmitter is in the continuous mode.
- If the carrier to be measured is a burst carrier, make sure that the PDC measurements personality is set to burst mode (BURST) in the configuration menu.

Carrier power too high, Measurement Stopped

This indicates that the measured level of the carrier is too large to make a valid measurement and the measurement has been stopped. This message will only appear if the total power function in the configuration menu is set to multiple carriers (TOTL PWR MULT), and the amplitude of the measured carrier is greater than the value of the total power.

To solve this problem:

- Confirm that the transmitter output is correctly connected to the spectrum analyzer input.
- Confirm that the total PDC measurements personality total power function (TOTL PWR) has been set correctly. For more information, see "To configure the personality" in either Chapter 2, "Mobile Station Measurements," or Chapter 4, "Base Station Measurements."
- Confirm that the PDC measurements personality external attenuator function (EXT ATTEN) has been set correctly. For more information, see "To configure the personality" in either Chapter 2, "Mobile Station Measurements," or Chapter 4, "Base Station Measurements."

Carrier power too high, transmitter intermod stopped

This message indicates that the measured carrier level is too high to make a valid measurement. The carrier level must be within 5 dB of the last antenna power measurement.

To solve this problem:

- Perform the antenna power measurement.

Carrier power too low, Auto CH Stopped

This indicates that a carrier could not be found, and the automatic channel function (AUTO CHANNEL) in the post-measurement menu has been stopped. To be considered a carrier, the amplitude level of the carrier must be greater than −15 dBm.

To solve this problem:

- Make sure that the transmitter output is correctly connected to the spectrum analyzer input.
- Make sure that the PDC measurements personality external attenuation function (EXT ATTEN) has been set correctly. For more information, see "To configure the personality" in either Chapter 2, "Mobile Station Measurements," or Chapter 4, "Base Station Measurements."

  If you want the PDC measurements personality to use an amplitude level other than −15 dBm when checking for carrier level, change the minimum amplitude level by using the remote variable _CMIN. See the description of _CMIN in Table 10-2 for more information.

Carrier power too low, Measurement Stopped

This indicates that the measured carrier level is not large enough to make a valid measurement, and the measurement has been stopped. The carrier level must be greater than the minimum level of −15 dBm.

To solve this problem:

- Confirm that the transmitter output is connected to the spectrum analyzer input.
- Confirm that the PDC measurements personality external attenuator function (EXT ATTEN) has been set correctly. For more information, see "To configure the personality" in either Chapter 2, "Mobile Station Measurements," or Chapter 4, "Base Station Measurements."
- If you want the PDC measurements personality to use an amplitude level other than −15 dBm when checking for carrier level, change the minimum amplitude level by using the remote variable _CMIN. See the description of _CMIN in Table 10-2 for more information.

Carrier power too low, transmitter intermod stopped

This message indicates that the measured carrier level is too low to make a valid measurement. The carrier level must be within 5 dB of the last antenna power measurement.

To solve this problem:

- Perform the antenna power measurement.

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

This indicates that the spectrum analyzer does not have Option 004, the precision frequency reference, installed. If the spectrum analyzer does not have Option 004 installed, you must use an external precision frequency reference to make accurate measurements with the PDC 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. Note that the message will still be present when an external 10 MHz reference is correctly connected.

Fast ADC required: (opt 101 or opt 151)

This indicates that neither options 101 or 151 have been installed in the spectrum analyzer. Option 101 is the fast time domain sweep, and Option 151 is the PDC digital demodulator. Your spectrum analyzer must have fast ADC capability for the power versus time measurements on a mobile station when used with the 85720C PDC measurements personality.

The fast ADC function has been added to Option 151 PC boards, included with the 85720C PDC measurements personality. The Option 101 fast time domain sweep board is *not* recommended to be installed with Option 151 boards. Option 151 replaces Option 101 functions in the spectrum analyzer for PDC personality measurements.

To solve this problem:

- If Option 101 or Option 151 is installed in the spectrum analyzer, that option may have failed. See the spectrum analyzer service guide for more information about returning the spectrum analyzer for repair.
- If Option 101 or Option 151 is not installed in the spectrum analyzer, either option can be installed; contact your local Agilent Technologies 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)`

This indicates that the spectrum analyzer does not have Option 105, the time-gated spectrum analysis card, installed. Option 105 must be installed to make the adjacent channel power and power versus time measurements on a mobile station.

To solve this problem:

- If Option 105 is installed, it may have failed. See the spectrum analyzer service guide for more information about returning the spectrum analyzer for repair.
- If Option 105 is not installed in the spectrum analyzer, it can be installed; contact your local Agilent Technologies Sales and Service Office for more information.

Hardware options 151/16X required for Digital Demod

This message indicates that the digital demodulator Options 151 and 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 Agilent Technologies 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 PDC measurements personality.

To solve this problem:

- Press (CONFIG) More 1 of 3 SHOW OPTIONS and check the firmware version of your analyzer.

  If the version is earlier than 930506, then obtain the latest spectrum analyzer firmware from your nearest Agilent Technologies Customer Sales and Service Office. Earlier firmware dates were given in a different format with the word REV preceding the day, month, and year separated by periods.
- If your analyzer firmware is version 930506 or later, then there is insufficient available memory. You must delete the other programs in the spectrum analyzer memory as follows:
  1. Press (PRESET).
  2. Press (CONFIG) More 1 of 3 Dispose User Mem ERASE DLP MEM ERASE DLP MEM (PRESET).
  3. Reload the PDC measurements personality using the procedure under "Step 1. Load the PDC 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 930506 or later

This message indicates that the spectrum analyzer firmware must be updated before the PDC 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 Agilent Technologies Sales and Service Office for more information about updating the firmware in your spectrum analyzer.

PDC Digital Demod firmware required: (opt 160 or opt 162)

This message indicates that Option 160, the PDC/PHS/NADC/CDMA, or Option 162 PDC firmware ROMs are not installed in the Option 151 digital demodulator boards.

To solve this problem:

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

Newer opt 162 firmware required: rev 940317 or later

This message indicates that newer Option 162 firmware is required for the 85720C PDC measurements personality.

To solve this problem:

- Contact your local Agilent Technologies sales and service office for information about obtaining the latest Option 162 ROMs.

Newer opt 160 firmware required: rev 950515 or later

This message indicates that newer Option 160 firmware is required for the 85720C PDC measurements personality.

To solve this problem:

- Contact your local Agilent Technologies 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.

Single lower carrier assumed

This message indicates that the PDC measurements personality could locate only one carrier for the intermodulation spurious measurement. If you want the PDC measurements personality to use more than one carrier for the intermodulation spurious measurement:

- Make sure that there are at least two carriers, spaced at least 600 kHz apart and with the carrier amplitudes within 10 dB of each other.

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.

Turn carrier Off then On, to trigger sweep

This message appears when POWER STEP is pressed. It is a reminder that a significant increase in the carrier power level is required to trigger a measurement sweep with this function.

Sync word location search failed

This message appears when the frame trigger routine used by a power versus time measurement fails to correctly find the sync word location in relation to the rising edge. Check sync word, and burst width and shape.

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 Troubleshooting," 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 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 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`
- `Sync word errors, check STATUS`
- `Sync word errors present`
- `Time record invalid, 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) `PDC 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 85720C 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 6-1 to see the four main parts of the status screen.

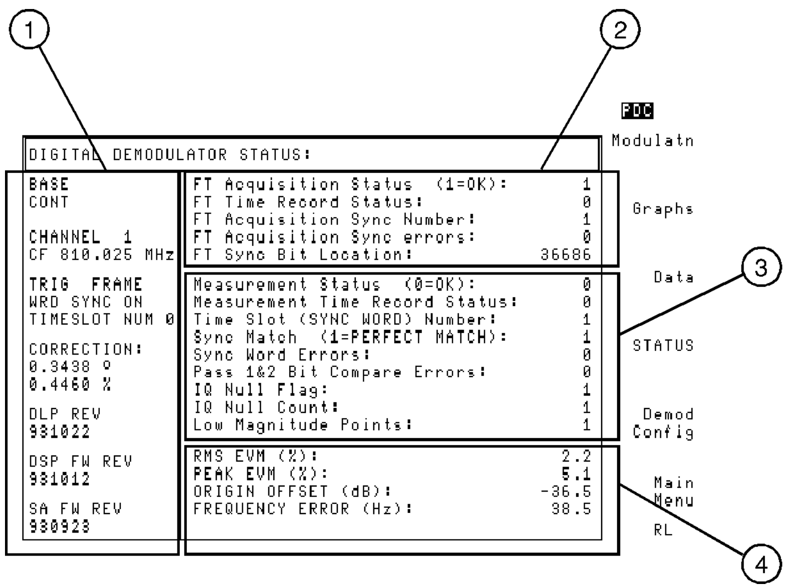


Figure 6-1. The PDC Digital Demodulator Status Screen

1. **System information.** This area contains information such as the current configuration settings for the PDC 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 PDC 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 6-2 shows this part of the status screen in detail. An explanation of each parameter in system information follows Figure 6-2.

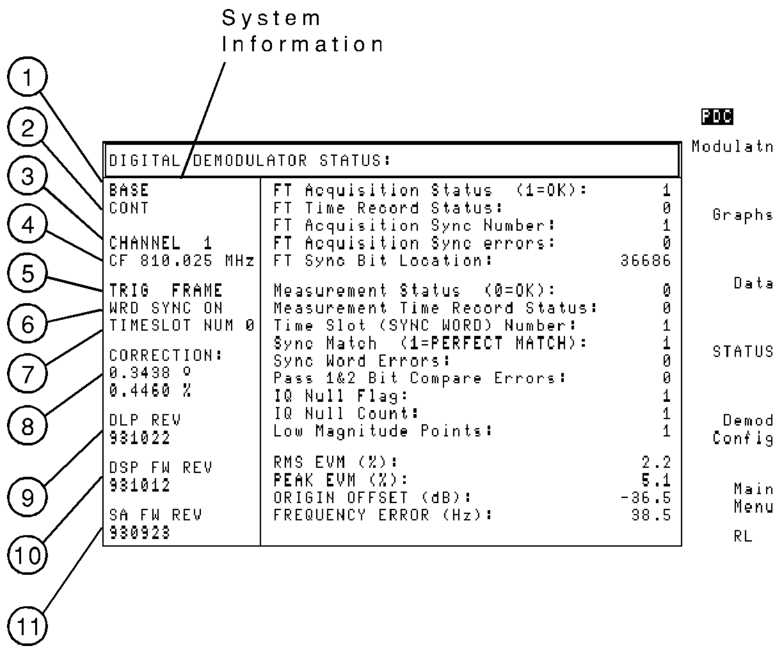


Figure 6-2. Detail of System Information

1. `BASE` **or** `MOBILE`. Indicates whether a mobile or base station is being tested and is the current setting of `TRANSMIT BS MS`.
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 sync word.
7. `TIMESLOT`. Shows the current setting of the `TIMESLOT SRCH NUM` softkey. It also shows the current setting of the `SLOT NUMBER` softkey if NUM is underlined in the `TIMESLOT SRCH NUM` softkey. The slot number is the user-designated timeslot to be measured.
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 PDC measurements personality.
10. `DSP FW REV`. Shows the code revision date of the Option 160 PDC 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 6-1. 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 1&2 bit 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 6-3 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.

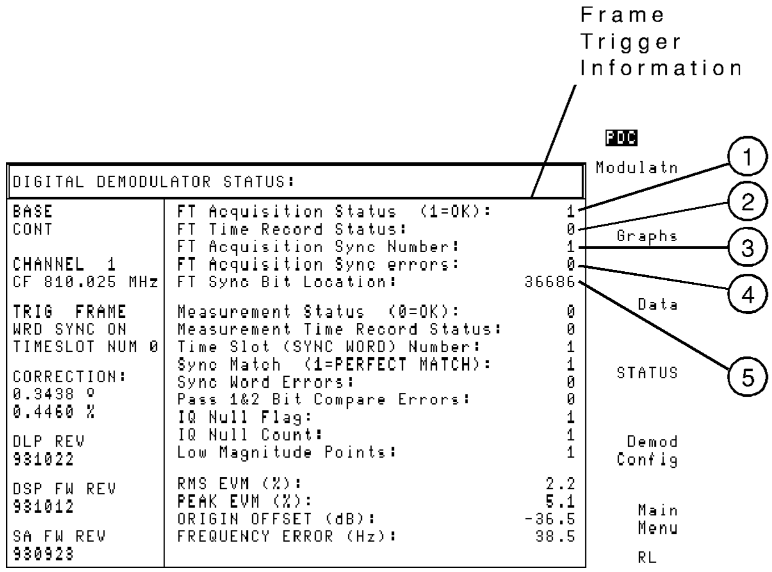


Figure 6-3. Detail of Frame Trigger Part of the Status Screen

1. **FT Acquisition Status.** Value is 1 if frame trigger acquisition is successful, and 2, 3, 4, or 5 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 Sync Number.** This shows the sync word number of the timeslot to which the frame trigger has acquired synchronization.
4. **FT Acquisition Sync Errors.** This shows the number of bit errors in the 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. An explanation of each of these items in the frame trigger status menu follows.

FT Acquisition Status (1 = OK)

If FT Acquisition 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.

If FT Acquisition 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 6-4.

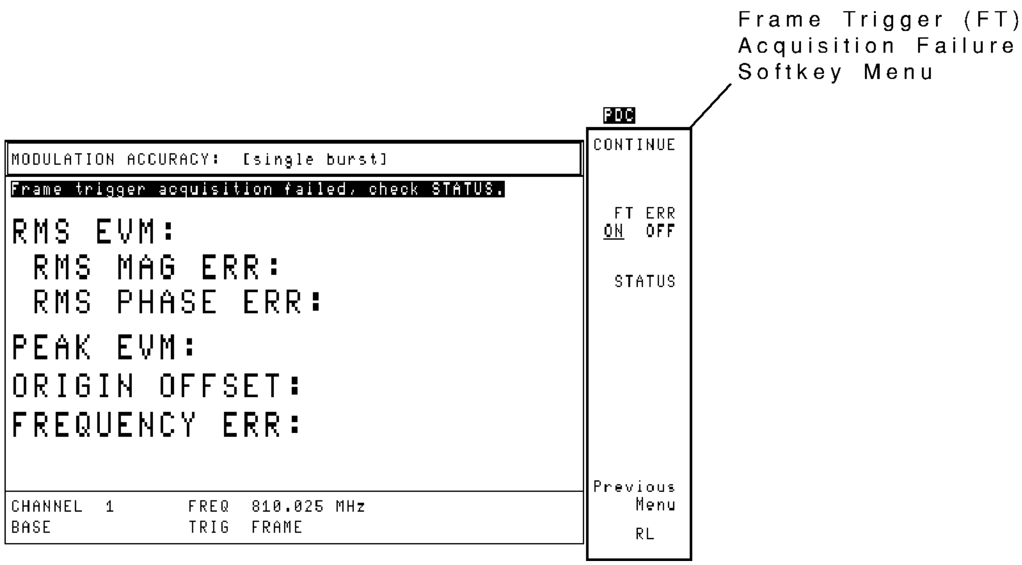


Figure 6-4. Frame Trigger Acquisition Failure Softkey Menu

If this occurs, Agilent Technologies 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.

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 PDC digital demodulator hardware or PDC 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`.
- A control channel is being measured, which does not contain information channel sync words.
- The transmitted timeslot may not match the timeslot designated by the personality. This can happen if `TIMESLOT SRCH NUM` is set to NUM and `SLOT NUMBER` is incorrect.
- The signal to noise ratio may be too small to reliably detect transmitted bits.
- The PDC measurements personality format may not be set to match the transmitting station format. For example, the PDC measurements personality is set to mobile station format and the signal is from a base station. Confirm that `TRANSMIT BS MS` is set correctly.
- 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 3.5 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.

A possible problem indicated by an FT Acquisition Status value of 2 or 3 is:

- The carrier frequency is not stable enough for the automatic carrier frequency search to be completed (this search compensates for carrier frequency error). Make sure the carrier frequency is stable.

A possible problem indicated by an FT acquisition status value of 4 or 5 is:

- The carrier frequency error is greater than 15 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.

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

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.

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 or Option 160 has failed. Contact your nearest Agilent Technologies Sales and Service Office for assistance.

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 PDC measurements personality is set to external trigger mode (DD TRIG EXTERNAL) and no trigger input is given. 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 Sync Number

This is the sync word that the frame trigger chose to synchronize to. If the PDC measurements personality is set to timeslot search mode (TIMESLOT SRCH NUM set to SRCH), this is the best fit to any of the six sync words. If the PDC measurements personality is set to timeslot number mode (TIMESLOT SRCH NUM set to NUM), this is the best fit to the sync word specified by SLOT NUMBER. If this number does not correspond to the desired timeslot, and timeslot number mode is active, access the desired timeslot by pressing Demod Config SLOT NUMBER, and enter the correct timeslot number.

FT Acquisition Sync Errors

- 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.
- 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 timeslot. 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 PDC measurements personality was configured to search for the best timeslot by setting TIMESLOT SRCH NUM to SRCH, then the frame trigger was set for the best match of the six possible sync sequences. Try changing the setting to NUM and test each timeslot number to obtain the best match to a designated timeslot.
- If the PDC measurements personality was configured to search for a specific timeslot, then the frame trigger was set to best match the sequence designated by SLOT NUMBER. Try changing the setting to search for the best match of the six possible sync sequences by setting TIMESLOT SRCH NUM to SRCH.

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:

Base station mode target address: 36686

Mobile station mode target address: 36686

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 or Option 160 has failed. Contact your nearest Agilent Technologies 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 6-5 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 6-5. A troubleshooting flowchart is included after "Measurement State Error Messages."

This flowchart indicates errors and actions to take with a given value of measurement status.

Use this flowchart when following the procedure in "Measurement Status Troubleshooting," or when referred there from other locations in this chapter.

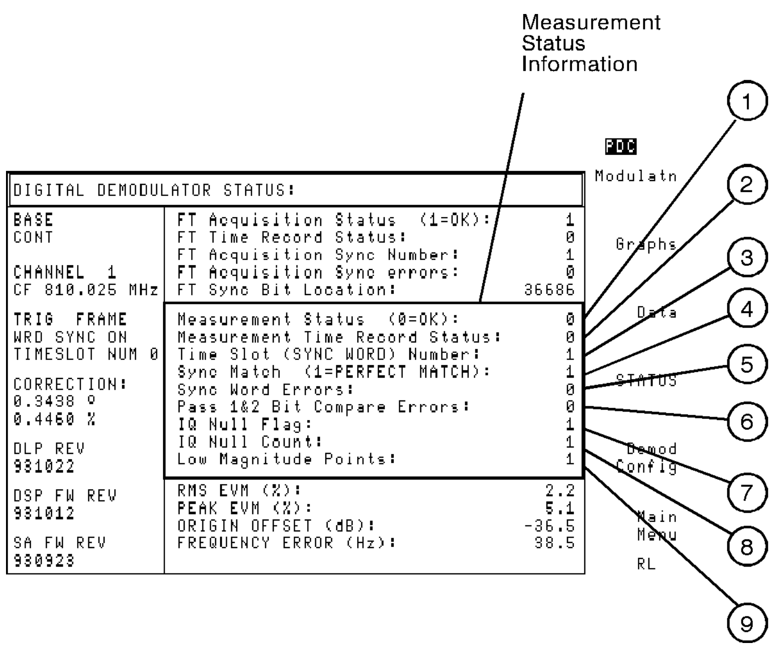


Figure 6-5. Detail of the Measurement Status Part of the Status Screen

1. `Measurement Status (0=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 6-6, the "Measurement Status Troubleshooting Flowchart," 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. `Time Slot (SYNC WORD) Number:` This gives the sync word number of the measured timeslot. Valid values are 1 through 7. A value of 7 indicates a PRBS sync word, or no sync 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.
6. `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 Flowchart" 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 3.5 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 20-bit sync sequence is being transmitted.
2. Try to search for a single sync word. Change the personality to timeslot number mode (TIMESLOT NUM).
3. Try to search for any valid sync word. Change the personality to timeslot search mode (TIMESLOT SRCH).

Sync word errors present

Bit errors are present in the demodulated synchronization word.

To solve this problem:

1. Check that a correct 20-bit sync sequence is being transmitted.
2. Try to search for a single sync word. Change the personality to timeslot number mode (TIMESLOT NUM).
3. Try to search for any valid sync word. Change the personality to timeslot search mode (TIMESLOT SRCH).

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 (0 = 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 6-6, "Measurement Status Troubleshooting Flowchart," 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 Agilent Technologies 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.

Time Slot (SYNC WORD) Number

Valid values are 1 though 7, corresponding to synchronization sequences 1 through 6. A PRBS data modulated signal returns a timeslot number of 7.

If the timeslot number does not match the timeslot number designated by SLOT NUMBER, change the timeslot mode (TIMESLOT SRCH NUM) to NUM.

Sync Match (1 = PERFECT MATCH)

This flag is "1" if a perfect match to a synchronization 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 Flowchart," for further information.

Sync Word Errors

Sync Word Errors is the number of bit errors in the best match to a synchronization sequence detected in the sampled data. The maximum value is 20, the length of an PDC sync sequence.

See Measurement Status=2 in the "Measurement Status Troubleshooting Flowchart," 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.

I-Q 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 "I-Q Null Count" for more information

I-Q Null Count

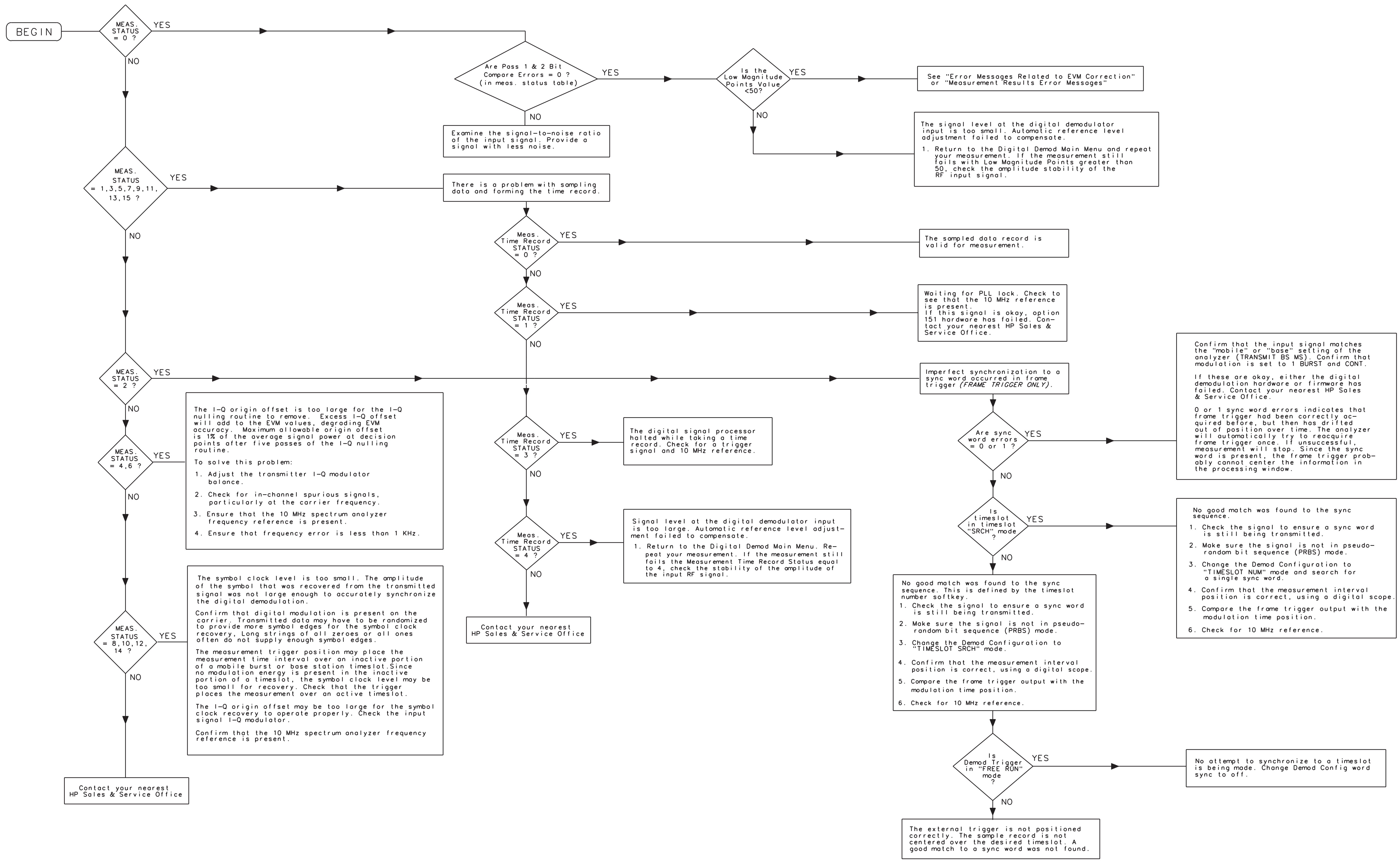
The I-Q Null Count Flag shows the number of times the I-Q offset was nulled in the sampled data record. The maximum number of I-Q nulls permitted is 5. If more than 5 I-Q nulls are necessary, the input signal may be faulty. If the I-Q nulling is unsuccessful after 5 tries, the I-Q null count is set to 6 and the I-Q null flag is set to −1. See "Measurement Status=4,6" in the "Measurement Status Troubleshooting Flowchart," 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 Flowchart

The following flowchart indicates errors and actions to take with a given value of Measurement Status. Use this flowchart when following the procedure in “Measurement Status Troubleshooting,” or when referred here from other locations in this chapter.



pc724b

FIGURE 6-6. MEASUREMENT STATUS TROUBLESHOOTING FLOWCHART

Measurement Results Troubleshooting

Current measurement results are summarized on the status screen, as shown in Figure 6-7. 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.

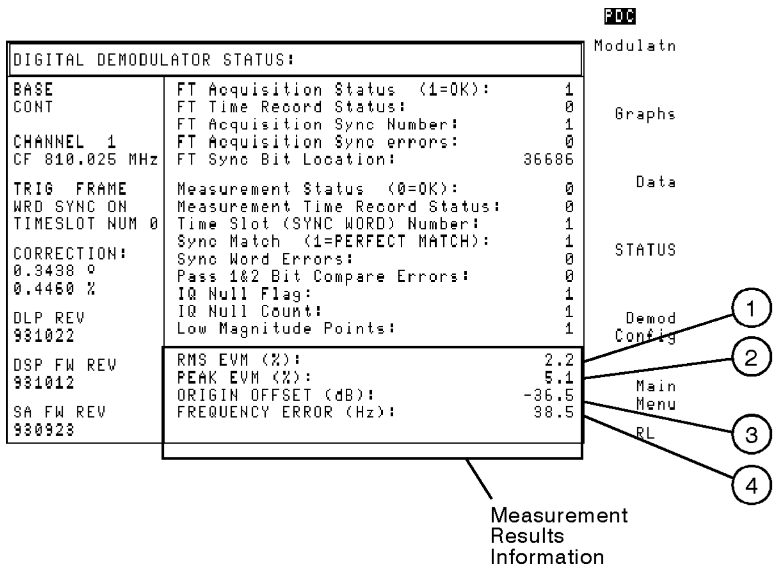


Figure 6-7. Measurement Results Part of the Status Screen

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 15 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 8-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 Agilent Technologies

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 Agilent Technologies about a problem with the PDC measurements personality, you can call your nearest Agilent Technologies Sales and Service Office, listed in the table on the following page.

By internet, phone, or fax, get assistance with all your test & measurement needs.

Table 6-2. Agilent Technologies Sales and Service Offices

Online Assistance: `www.agilent.com/find/assist`

United States	**Japan**	**New Zealand**
(tel) 1 800 452 4844	(tel) (81) 426 56 7832	(tel) 0 800 738 378
	(fax) (81) 426 56 7840	(fax) 64 4 495 8950
Canada	**Latin America**	**Asia Pacific**
(tel) 1 877 894 4414	(tel) (305) 269 7500	(tel) (852) 3197 7777
(fax) (905) 206 4120	(fax) (305) 269 7599	(fax) (852) 2506 9284
Europe	**Australia**	
(tel) (31 20) 547 2323	(tel) 1 800 629 485	
(fax) (31 20) 547 2390	(fax) (61 3) 9210 5947	

7

Programming Commands

This chapter contains complete information for the programming commands available to operate the PDC measurements personality. The topics covered in this chapter are:

- A table containing a cross reference of the PDC measurements personality softkeys to the corresponding programming command.
- A table containing a cross reference of the PDC measurements to the limit and parameter variables.
- A table containing a cross reference of PDC measurements and the corresponding limit-line function names.
- The descriptions of all the PDC measurements personality's programming commands.

This chapter contains reference information about the PDC programming commands. For more information about programming the PDC personality, refer to Chapter 8, "Programming Examples." For more information about programming the spectrum analyzer, see the spectrum analyzer programmer's guide.

Functional Index

Table 7-1 lists each PDC measurements personality softkey and references the corresponding remote command sequence that performs the same operation remotely.

Note Not all remote commands have corresponding softkeys. Remote commands which do not have corresponding softkeys do not appear in this index.

Table 7-1. Functional Index

PDC Softkey	Corresponding Remote Command Sequence
PDC ANALYZER	MODE 10 (See "To select the PDC analyzer mode remotely" in Chapter 8 for more information.)
Configuration Menu	
BURST CONT	_CC
DEFAULT CONFIG	_DEFAULT
DEFINE BS CHAN	_CHBS
DEFINE BS FREQ	_FBS
DEFINE MS CHAN	_CHMS
DEFINE MS FREQ	_FMS
EXT ATTEN	_EXTATN
PERIOD 40ms 20ms	_TRIGF
PASSFAIL ON OFF	_DPF
TOTL PWR SGL MULT	_TOTPM and _TOTPWR
TRANSMIT BS MS	_MS
TRIG DELAY	_TRIGD
TRIG POL NEG POS	_TRIGP
TRG SRC DD EXT	_TRIGSRC
Physical Channel Menu	
AUTO CHANNEL	_ACH
CENTER FREQ	Use the spectrum analyzer CF command. See the spectrum analyzer programmer's guide 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	_COPWR or _COS and _COM
MONITOR TX CHAN	_MCH or _MCS and _MCM
OCCUPIED BANDWDTH	_OBW or _OBWS and _OBWM
POWER STEP	_STEP or _SPS and _SPM
Power Setup Menu	
COPWR RCR MKK	_COPMT
OBW PTS/SWP	_OBNP
PWR TRIG EXT VID	_TRIGM
FT ACQ ON OFF	_FTACQ

Table 7-1. Functional Index (continued)

PDC 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
NUMBER SWEEPS	_PNS
RANGE 70 110	_RNG
BITS 258 270	_SYM
TRIG SRC FRM VID	_PTRIG
Adjacent Channel Power Menu	
ACP , ACP GTD , or ACP GTD CH/SWP	Either _ACPMT and _ACP, or _ACPMT, _ACPS, and _ACPM
ACP MKK or ACP 2BW	Either _ACPMT and _ACP, or _ACPMT, _ACPS, and _ACPM
CHANNEL POWER	_CHPWR or _CHPS and _CHPM
Adjacent Channel Power Setup Menu	
ACP GTD FULL MOD	_ACPGM
FT ACQ ON OFF	_FTACQ
POINTS/SWEEP	_NP
System Menu	
Band	_BAND
COMBINER TUNING	_CTUN or _CTS and _CTM
MONITOR RX BAND or MONITOR TX BAND	Either _MTX and _MBND, or _MTX, _MBS, and _MBM

Table 7-1. Functional Index (continued)

PDC Softkey	Corresponding Remote Command Sequence
Spurious Menu	
MEASURE INTERMOD	_IMDTRANS
SIG GEN ABOVE , SIG GEN BELOW	_ISGF
Rbw	_IRBW
SPACING	_ISPAC
SPURIOUS ADJACENT	_SPURSET
SPURIOUS EMISSION	_SPURSET
MEASURE SPUR	_SPURZ
SPUR & HARMONIC	_SPURH
Spurious Setup Menu	
NUMBER SWEEPS	_SENS
MXR LVL MARGIN	_SEMLM
P/F AUTO ABS REL	_SEPF
CARRIER ONE TWO	_BSCAR
SPR TRIG EXT FREE	_TRIGSPR
SRCH MOD FAST NOR	_SPURZT
Post-Measurement Menu	
AUTO CHANNEL	_ACH
CHANNEL NUMBER	_CH
GATE ON OFF	_ACPG
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

Table 7-1. Functional Index (continued)

PDC Softkey	Corresponding Remote Command Sequence
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	
I-Q PATTERN	_ddCONSTLN and _IQGRAPH
8 POINT CONSTLN	_ddCONSTLN and _IQGRAPH
SINGLE CONT	_ddCONT
SAVE MEAS ON OFF	_ddSAVMEAS
Digital Demod Data Menu	
DATA BITS	_DATABITS
SINGLE CONT	_ddCONT
SAVE MEAS ON OFF	_ddSAVMEAS
Digital Demod Config Menu	
CHANNEL NUMBER	_CH
CHAN X CTR FREQ	_CFX
TIMESLOT NUMBER	_TN
ERR MSG ON OFF	_ddERRM
DD TRIGGER	_ddTRIG
WRD SYNC ON OFF	_ddWSYNC
TIMESLOT SRCH NUM	_ddSRCH
FT ERR ON OFF	_ddFTERRM

Limit and Parameter Variables

The PDC 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 7-2 lists all the limit variables and parameter variables available for a PDC measurements personality command. For more information about using limit variables, see "To change the value of limit variables" in Chapter 8. For more information about using parameter variables, see "To change the value of parameter variables" in Chapter 8.

Table 7-2. Limit and Parameter Variables

Measurement	Variable Name	Description	Units	Default Value
General				
	_CHSP	Channel spacing.	Hz	25000
	_CMIN	Minimum amplitude level for a signal to be detected as a carrier.	dBm	−15
	_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	2
	_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 analyzer memory.	None	0
	_VTM	Specifies the maximum difference between the reference level and the video trigger position.	dB	60
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
	_CORL	Specifies the reference level for the carrier off power measurement.	dBm	−20
	_COXA	The maximum limit for the mobile station mean carrier off power.	dBm	−60
	_COXB	The maximum limit for the base station mean carrier off power	dBm	−26
	_COXC	The maximum limit for the base station carrier off power ratio with the antenna power.	dB	−60

* The pass or fail message is not displayed when these variables are set to 0.

Table 7-2. Limit and Parameter Variables (continued)

Measurement	Variable Name	Description	Units	Default Value
Power Measurements (continued)				
Occupied bandwidth	_OBBWX	The maximum limit for the occupied bandwidth.	Hz	32000
	_OBFEX	The maximum limit for the frequency error.	Hz	2000
	_OBNS	Specifies the number of sweeps used for the occupied bandwidth measurement.	None	5
	_OBPCT	Specifies the percent of the occupied bandwidth.	Percent	99
Power versus Time Measurements				
Power versus time burst	_PBMP	Sets how far from the mean carrier the burst width is measured.	dBc	−14
	_PBSXL	The lower limit for the width of a burst with 258 bits.	μs	6143
	_PBSXU	The upper limit for the width of a burst with 258 bits.	μs	6357
	_PBXL	The lower limit for the width of a burst with 270 bits.	μs	6429
	_PBXU	The upper limit for the width of a burst with 270 bits.	μs	6643*
Power versus time falling	_PFX	The lower segment of the upper limit line for the falling edge of the burst.	dBm	−56
	_PRMPL	Sets where on the falling edge of the trace the measurement for the release time should end.	dBm	−56
	_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	24
	_PRXU	The upper limit for the release time for a burst.	μs	115*
* The pass or fail message is not displayed when these variables are set to 0.				

Table 7-2. Limit and Parameter Variables (continued)

Measurement	Variable Name	Description	Units	Default Value
Power versus Time Measurements (continued)				
Power versus time rising	_PAMPL	Sets where on the rising edge of the trace the measurement for the attack time should begin.	dB	−56
	_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	24
	_PAXU	The upper limit for the attack time for a burst.	μs	115*
	_PRX	The lower segment of the upper limit line for the rising edge of the burst.	dBm	−56
Adjacent Channel Power Measurements				
Adjacent channel power	_ACPNS	Specifies the number of sweeps used for the adjacent channel power measurement.	None	1
	_ACPVB	Specifies the video bandwidth used for the MS ACP MKK measurement	Hz	3000
	_ACPXA	The maximum limit for adjacent channel power (50 kHz separation).	dB	−45
	_ACPXB	The maximum limit for alternate channel power (100 kHz separation).	dB	−60
Spurious Measurements				
Transmitter Intermodulation Spurious Emission, Spurious Emission, and Spur & Harmonic	_SEFM	The minimum frequency margin from the carrier for the spurious test in the TX band.	Hz	500 kHz
	_SEXA	The maximum absolute limit for the mobile station spurious emission.	dBm	−36
	_SEXB	The maximum absolute limit for the base station spurious emission.	dBm	−26
	_SEXC	The maximum relative limit for both mobile station and base station for the spurious emission ratio with the antenna power.	dB	−60
* The pass or fail message is not displayed when these variables are set to 0.				

Table 7-2. Limit and Parameter Variables (continued)

Measurement	Variable Name	Description	Units	Default Value
Digital Demodulator Based Measurements				
Modulation 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	33
	_IQOFSX	I-Q origin offset	dB	−20
	_CFERRXBL	Frequency error, base station, low band	Hz	40
	_CFERRXBU	Frequency error, base station, high band	Hz	74
	_CFERRXML	Frequency error, mobile station, low band	Hz	2820
	_CFERRXMU	Frequency error, mobile station, high band	Hz	2858
	_ddSDF	Standard deviation factor (the number of standard deviations to use in EVM uncertainty calculations)	None	3.13

Limit-line Functions

During the power versus time measurements that measure the burst width, rising edge, and falling edge of the burst, two limits line are displayed on the spectrum analyzer screen. You can change the limit lines by creating your own limit-line function. See "To create a limit-line function" in Chapter 8 for more information about creating your own limit-line function. Table 7-3 lists all the names of the limit-line functions.

Table 7-3. Limit-line Function Names

Measurement	Limit-line Name
Power versus time burst	_PBLIM
Power versus time rising edge	_PRLIM
Power versus time falling edge	_PFLIM

Descriptions of the Programming Commands

This section contains the descriptions of the PDC measurement personality programming commands. The commands are listed alphabetically.

See the programming examples in Chapter 5, "Programming Examples," for more information about how to make a remote measurement, 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

```
OUTPUT 718;"_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 8.

_ACP
Adjacent Channel Power

Syntax

xacp

Measures the adjacent channel power of the transmitter. Depending on the setting of the transmission source (_MS) and _ACPMT, _ACP is equivalent to ACP, ACP GTD, ACP GTD CH/SWP, ACP MKK, or ACP 2BW.

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 _MS, _CC, and _ACPMT. See Table 7-4 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, _MS and _ACPMT change how _ACP measures the adjacent channel power.

Table 7-4. Settings for the _ACP Measurement

_CC Setting	_MS Setting	_ACPMT Setting	Result
Not applicable	0 (base station)	1 (multichannel sweep)	_ACP performs the adjacent channel power measurement without time-gating, with one measurement sweep. Equivalent softkey is ACP.
0 (burst)	1 (mobile station)	1 (multichannel sweep, gated)	_ACP performs the adjacent channel power measurement, with time-gating and two measurement sweeps. Equivalent softkey is ACP GTD.
0 (burst)	1 (mobile station)	2 (single channel per sweep, gated)	_ACP performs the adjacent channel power measurement, with time-gating and one channel per measurement sweep. Equivalent softkey is ACP GTD CH/SWP.
0 (burst)	1 (mobile station)	3 (2BW)	_ACP performs the adjacent channel power measurement with the two bandwidth method and two measurement sweeps. Equivalent softkey is ACP 2BW.
0 (burst)	1 (mobile station)	5 (MKK)	_ACP performs the adjacent channel power measurement with the MKK method and one measurement sweep. Equivalent softkey is ACP MKK.
1 (continuous carrier)	1 (mobile station)	1 (multichannel sweep)	_ACP performs the adjacent channel power measurement without time-gating, with one measurement sweep. Equivalent softkey is ACP.

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 (151) option.
7	Digital demodulator firmware not correct (160) option.
8	Digital demodulator firmware revision date too old.
10	Frame trigger acquisition failed. (See Chapter 6, “Error Messages and Troubleshooting.”)

_ACP Adjacent Channel Power

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 MKK Trace A contains the swept RF spectrum that was used to calculate the adjacent and alternate channel powers. ACP GTD Trace A contains the swept RF modulation spectrum (without transients) that was used to calculate the adjacent and alternate channel powers. ACP 2BW Trace A contains the swept RF spectrum obtained with a 1 kHz resolution bandwidth that was used to calculate the adjacent and alternate channel powers.	Determined by the trace data format (TDF) command.
TRB	ACP GTD Trace B contains the swept RF full spectrum that was used to calculate the adjacent and alternate channel powers. ACP 2BW Trace B contains the swept RF spectrum obtained with a 3 kHz resolution bandwidth that was used to calculate the adjacent and alternate channel powers.	
_NUMF	Indicates if the adjacent channel power was within the measurement limits. The measurement limits are determined by _ACPXA through _ACPXB. See Table 7-2 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 Table 7-5 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 correspond 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 _ACPT (`"_ACPT[2]?;"`) to determine the transient power for the upper adjacent channel.

Table 7-5. ACP Measurement Results (Array Information)

Array Name	Description	Units
_ACPR	The _ACPR array elements contain the ACP random (modulation) for base or mobile, or result for MKK method.	0.1 dBm
_ACPI	The _ACPI array elements contain the ACP impulsive for mobile.	0.1 dBm
_ACPT	The _ACPT array elements contain the ACP total (transient) for mobile.	0.1 dBm
_ACPRC	The _ACPRC array elements contain the ACP random (modulation) ratio for base or mobile.	0.1 dB
_ACPIC	The _ACPIC array elements contain the ACP impulsive ratio for mobile.	0.1 dB
_ACPTC	The _ACPTC array elements contain the ACP total (transient) ratio for mobile.	0.1 dB

Related Commands: _MS, _ACPMT, and _CC.

Limit and Parameter Variables: _ACP uses _ACPXA, _ACPXB, and _ACPNS. See Table 7-2 for more information.

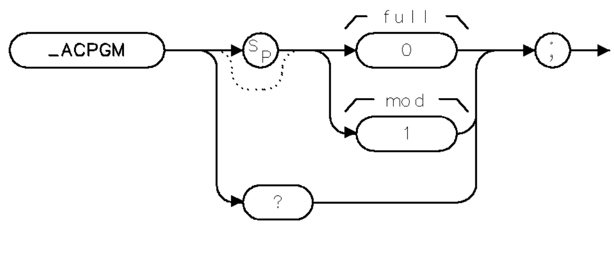
Alternate Commands: You can also use the _ACPS and _ACPM commands to measure adjacent channel power.

See Also

"To measure the adjacent channel power of a base station," and "To measure the adjacent channel power of a mobile station," both in Chapter 8, "Programming Examples."

_ACPGM
Adjacent Channel Power Gated Measurements Flag

Syntax



For gated adjacent channel power measurements, this command allows you to specify either modulation and transient measurements (full), or modulation only measurements, to be made. The _ACPGM command is equivalent to ACP GTD FULL MOD .

If _ACPGM is set to 0, full measurements (modulation and transient) will be made. If _ACPGM is set to 1, modulation only measurements will be made. The default value for _ACPGM is 0.

Example

`OUTPUT 718;"MOV _ACPGM,1;"` *Sets _ACPGM to modulation only gated ACP measurements.*

Set _ACPGM before executing _ACP. _ACPGM only affects mobile station gated ACP measurements.

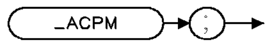
Query Example

```
Output 718; "_ACPGM?;"
```

The query response will be the current value of _ACPGM.

_ACPM
Adjacent Channel Power Measurement

Syntax



xacpm

Performs the adjacent channel power measurement.

Example

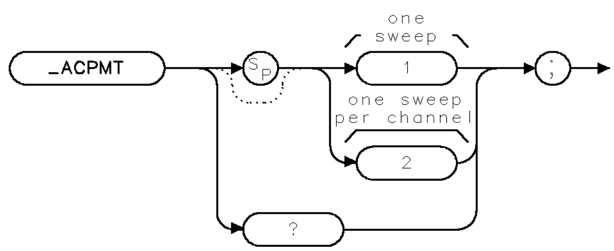
`OUTPUT 718;"_ACPS;"`	*Sets up the adjacent channel power measurement.*
`OUTPUT 718;"ST 4SC;"`	*Changes the sweep time to 4 seconds.*
`OUTPUT 718;"_ACPM;"`	*Performs the adjacent channel power measurement.*

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, ACP GTD, ACP GTD CH/SWP, ACP MKK, or ACP 2BW. See Table 7-4 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



Allows you to specify how the adjacent channel power measurement is performed. See Table 7-4. 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

```
OUTPUT 718;"_ACPMT?;"
```

The query response will be the current value of _ACPMT.

See Also

"To measure the adjacent channel power of a base station," and "To measure the adjacent channel power of a mobile station," both in Chapter 8, "Programming Examples."

_ACPS
Adjacent Channel Power Setup

Syntax

xacps

Performs the setup for the adjacent channel power measurement.

Example

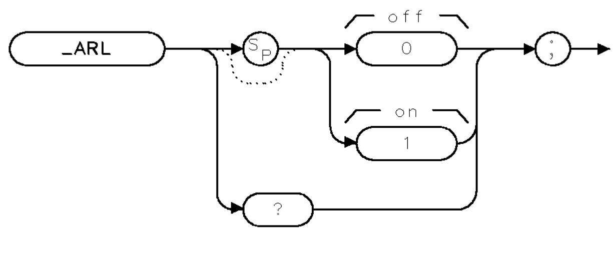
`OUTPUT 718;"_ACPS;"`	*Sets up the adjacent channel power measurement.*
`OUTPUT 718;"ST 4SC;"`	*Changes the sweep time to 4 seconds.*
`OUTPUT 718;"_ACPM;"`	*Performs the adjacent channel power measurement.*

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, ACP GTD, ACP GTD CH/SWP, ACP MKK, or ACP 2BW (see Table 7-4 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.)

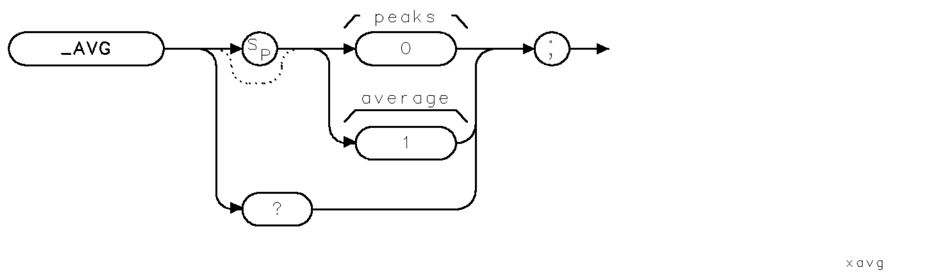
Query Example

`OUTPUT 718;"_ARL?;"`

The query response will be the current value of _ARL.

_AVG
Average or Peaks for Power vs 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.

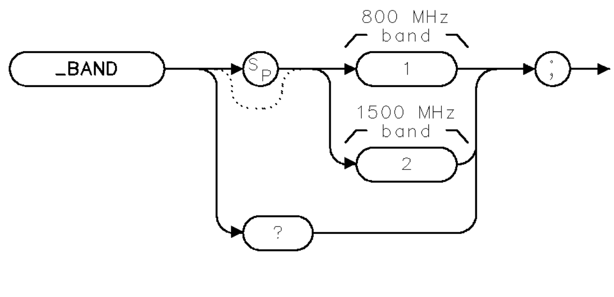
Query Example

```
OUTPUT 718;"_AVG?;"
```

The query response will be the current value of _AVG.

_BAND
Select Band

Syntax



Allows you to specify the band to be monitored or to be used for the combiner tuning measurement. The _BAND command is equivalent to selecting a band with either `800 MHz BAND` or `1500 MHz BAND`.

The frequency range selected by _BAND depends on whether _MS is set to a base station or a mobile station.

Example

`OUTPUT 718;"MOV _BAND,1;"`	*Selects 800 MHz band.*
`OUTPUT 718;"_MBND;"`	*Sets up the spectrum analyzer to monitor the PDC band.*

Related Commands: _MTX, _MS, _MBND, and _CTUN. _DEFAULT sets _BAND to 1.

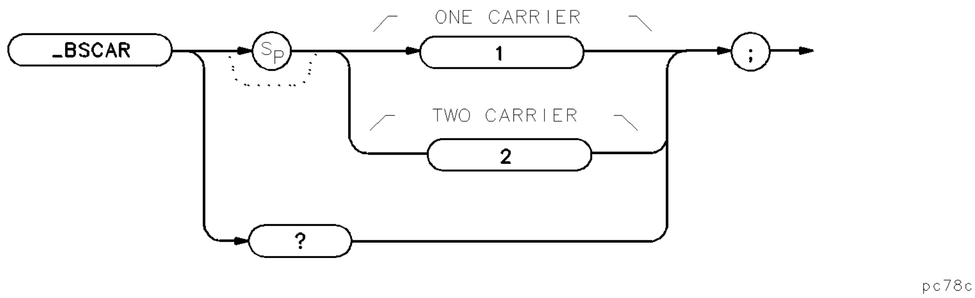
Query Example

```
OUTPUT 718;"_BAND?;"
```

The query response will be the current value of _BAND.

_BSCAR
Base Station Number of Carriers

Syntax



Allows you to select how many carriers are expected from the base station under test (within the span set on the spectrum analyzer for the adjacent spurious measurement). The _BSCAR command is equivalent to CARRIER ONE TWO. The default for _BSCAR is 1.

Example

```
OUTPUT 718;"MOV _SPURMT,2;"     Specify adjacent spurious measurement
OUTPUT 718;"MOV _BSCAR,2;"      Specify two carrier measurement
OUTPUT 718;"MOV _SPURSET;"      Set up spurious emission measurement
OUTPUT 718;"MOV _SPURZ;"        Perform spurious search measurement
```

Related Commands: _SPURSET, _SPURZ, _SPURMT

Query Example

```
OUTPUT 718;"_BSCAR?;"
```

The query response will be the current value of _BSCAR.

_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

`OUTPUT 718;"_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 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, “Mobile Station Measurements.”

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 (160) 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

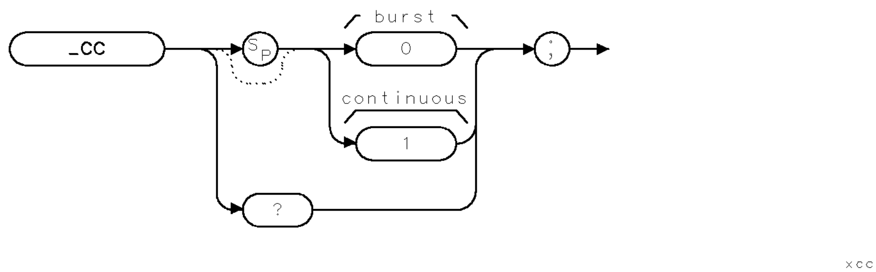
Variable	Description	Units
_ddPCVC	A variable that contains the calculated phase correction value.	degrees

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



Allows you to specify if the carrier to be measured is continuous or burst. The _CC command is equivalent to BURST CONT.

If _CC 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. _CC is set automatically by the _MS command. When _MS is set to 0 (base station) _CC is set to 1 (continuous). When _MS is set to 1 (mobile station) _CC is set to 0 (burst).

Example

`OUTPUT 718;"MOV _CC,0;"` *Sets _CC for a burst carrier.*

Related Commands: _MS, _DEFAULT sets _CC to 1 if _MS is set to 0, _CC to 0 if _ms is set to 1.

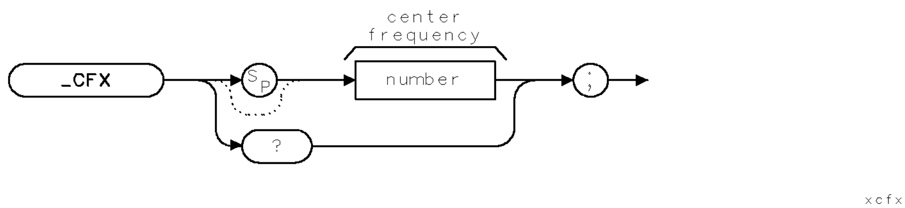
Query Example

`OUTPUT 718;"_CC?;"`

The query response will be the current value of _CC.

_CFX
Center Frequency for Channel X

Syntax



Allows you to enter the frequency of the channel that you want to measure. The _CFX command is equivalent to CHAN 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,840E6;"`	*Sets the channel number to channel X and the center frequency of the spectrum analyzer to 840 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.

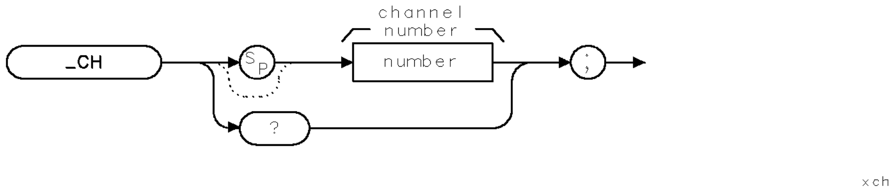
Query Example

```
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 32000. 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.

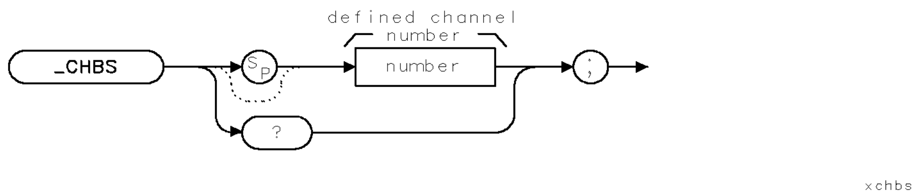
Query Example

`OUTPUT 718;"_CH?;"`

The query response will be a the current channel number.

_CHBS
Channel Base Station

Syntax



Allows you to specify the base station channel number that corresponds to the frequency as defined in _FBS. The _CHBS command is equivalent to `DEFINE BS CHAN`.

_CHBS can accept an integer from −9999 to 32000.

Example

`OUTPUT 718;"MOV _CHBS,3;"` *Sets base station defining channel to 3.*

Related Commands: _CHSP (Table 7-4), _DEFAULT sets _CHBS to 0.

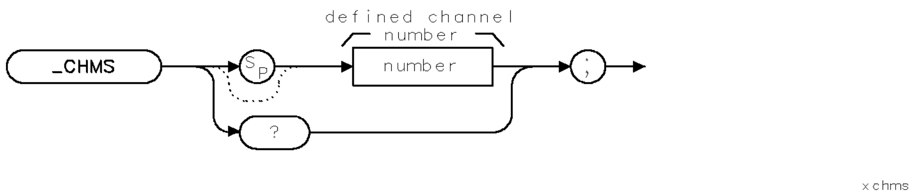
Query Example

`OUTPUT 718;"_CHBS?;"`

The query response will be the current base station defining channel.

_CHMS
Channel Mobile Station

Syntax



Allows you to specify the mobile station channel number that corresponds to the frequency as defined in _FMS. The _CHMS command is equivalent to DEFINE MS CHAN .

_CHMS can accept an integer from −9999 to 32000.

Example

OUTPUT 718;"MOV _CHMS,3;" *Sets mobile station defining channel to 3.*

Related Commands: _CHSP (Table 7-4), _DEFAULT sets _CHMS to 0.

Query Example

OUTPUT 718;"_CHMS?;"

The query response will be the current mobile station defining channel.

_CHPM
Channel Power Measurement

Syntax

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

xchps

Performs the setup for the transmitter 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.*

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. If _MS is set to base station, TRA contains 401 trace elements. If _MS is set to mobile station, 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.

See Also

"To measure the channel power" in Chapter 8.

_COM
Carrier Off Power Measurement

Syntax

xcom

Performs the carrier off leakage power measurement.

Example

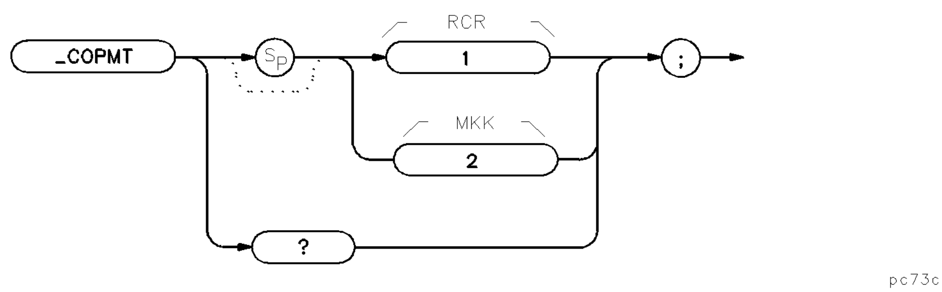
`OUTPUT 718;"_COS;"`	*Sets up the carrier off power measurement.*
`OUTPUT 718;"RB 10KHZ;"`	*Changes the resolution bandwidth to 10 kHz.*
`OUTPUT 718;"_COM;"`	*Performs the carrier off power measurement.*

Before using _COM, you need to use the _COS command to perform the setup for the carrier off power measurement. The _COS and _COM commands are useful if you want to change the spectrum analyzer settings 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 _COPWR for information about the measurement state and measurement results from a carrier off power measurement.

_COPMT
Carrier Off Power Measurement Type for BS

Syntax



Allows you to specify how the carrier off power measurement is performed for base station testing. See Table 7-6 in the documentation for the _COPWR command. The _COPMT command is equivalent to COPWR RCR MKK . The default for _COPMT is 1.

Example

`OUTPUT 718;"MOV _COPMT,2;"`	*Specifies a frequency domain carrier off power measurement.*
`OUTPUT 718;"_COPWR;"`	*Performs the carrier off power measurement.*

Related Command: _COPMT is used by _COS, _COM, and _COPWR

Query Example

```
OUTPUT 718;"_COPMT?;"
```

The query response will be the current value of _COPMT.

See Also

"To measure the carrier off power of a base station" in Chapter 8, "Programming Examples."

_COPWR
Carrier Off Power

Syntax

xcopwr

Measures the transmitter carrier off leakage power. The _COPWR command is equivalent to `CARRIER OFF PWR`.

Example

`OUTPUT 718;"_COPWR;"` *Performs the carrier off power measurement.*

Executing _COPWR does the following:

1. Performs the carrier off power measurement. The measurement method for carrier off power depends on the setting of _MS, _COPMT, and _RCRSTD. See Table 7-6 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 in a trace.

Table 7-6 describes how the setting of _MS, _COPMT, AND _RCRSTD changes the measurement method for carrier off leakage power.

Table 7-6. Settings for the _COPWR Measurement

_MS Setting	_RCRSTD Setting	_COPMT Setting	Results
0 (base)	Not applicable	1 (RCR standard)	_COPWR performs a zero span measurement, and averages the power over the whole frame.
0 (base)	Not applicable	2 (MKK)	_COPWR performs a frequency domain carrier off power measurement. (This requires the transmitter carrier power to be on, and then cycled off.)
1 (mobile)	2 (RCR STD-27B)	Not applicable	_COPWR performs a zero span measurement, and then averages the power in the off part of the burst.
1 (mobile)	3 (RCR STD-27C)	Not applicable	_COPWR performs a zero span measurement, and then averages the off power, slot by slot.

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 6, "Error Messages and Troubleshooting.")

_COPWR Carrier Off Power

Measurement Results: The results of the carrier off measurement are placed in the 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 _COXA, _COXB, and _COXC. See Table 7-2 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 COXA, _COXB, _COXC, _CORL, and _CONS. See Table 7-2 for more information.

Alternate Commands: The _COS and _COM commands can be used instead of _COPWR if you want to change the spectrum analyzer settings before making a carrier off power measurement.

See Also

"To measure the carrier off leakage power" in Chapter 8.

_COS
Carrier Off Power Setup

Syntax

xcos

Performs the setup for the transmitter carrier off leakage power measurement.

Example

`OUTPUT 718;"_COS;"`	*Sets up the carrier off power measurement.*
`OUTPUT 718;"RB 10KHZ;"`	*Changes the resolution bandwidth to 10 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 settings 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

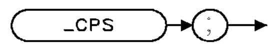
`OUTPUT 718;"_CPS;"`	*Sets up the antenna power measurement.*
`OUTPUT 718;"RB 10KHZ;"`	*Changes the resolution bandwidth to 10 kHz.*
`OUTPUT 718;"_CPM;"`	*Performs the antenna power measurement.*

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.

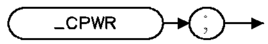
Example

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 7-2 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 7-2 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 8, "Programming Examples."

_CTM
Combiner Tuning Measurement

Syntax

xctm

Performs the combiner tuning measurement.

Example

`OUTPUT 718;"_CTS;"`	*Sets up the combiner tuning measurement.*
`OUTPUT 718;"RB 10KHZ;"`	*Changes the resolution bandwidth to 10 kHz.*
`OUTPUT 718;"_CTM;"`	*Performs the combiner tuning measurement.*

Before using _CTM, you need to use the _CTS command to perform the setup for the combiner tuning measurement. The _CTS and _CTM commands are useful if you want to change the spectrum analyzer settings before making a combiner tuning measurement. The combination of the _CTS and _CTM commands is equivalent to the _CTUN command and COMBINER TUNING.

See the description for _CTUN for information about the measurement state and measurement results from a combiner tuning measurement.

_CTS
Combiner Tuning Setup

Syntax

xcts

Performs the setup for the combiner tuning measurement.

Example

`OUTPUT 718;"_CTS;"`	*Sets up the combiner tuning measurement.*
`OUTPUT 718;"RB 10KHZ;"`	*Changes the resolution bandwidth to 10 kHz.*
`OUTPUT 718;"_CTM;"`	*Performs the combiner tuning measurement.*

After using _CTS, you need to use the _CTM command to perform the combiner tuning measurement. The _CTS and _CTM commands are useful if you want to change the spectrum analyzer settings before making a combiner tuning measurement. The combination of the _CTS and _CTM commands is equivalent to the _CTUN command and COMBINER TUNING.

_CTUN
Combiner Tuning

Syntax

xctun

Places a marker line at the signal peak with the maximum amplitude and another marker line at the signal peak with the minimum amplitude. The _CTUN command is equivalent to COMBINER TUNING.

Example

`OUTPUT 718;"MOV _BAND,2;"`	*Selects band 2.*
`OUTPUT 718;"_CTUN;"`	*Activates the combiner tuning measurement.*

_CTUN allows you to view the output power from several transmitters so that you can adjust the output power from each transmitter. You can select the band or bands that you want by using _BAND.

Executing _CTUN does the following:

1. Performs the combiner tuning 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 traces.

Measurement State: A "1" is returned to the external controller to indicate when the measurement is finished.

Measurement Results: The results of the combiner tuning measurement are placed in the traces shown in the following table.

Measurement Results

Variable or Trace	Description	Units
TRA	TRA is trace A. Trace A contains the swept RF spectrum.	Determined by the trace data format (TDF) command
TRB	TRB is trace B. Trace B acts as a marker line, and it is placed at the signal peak with the maximum amplitude.	Determined by the trace data format (TDF) command
TRC	TRC is trace C. Trace C acts as a marker line, and it is placed at the signal peak with the minimum amplitude.	Determined by the trace data format (TDF) command

Alternate Commands: The _CTS and _CTM commands can be used instead of _CTUN if you want to change the spectrum analyzer settings before making a combiner tuning measurement.

Related Commands: Use _BAND to select the band.

_DATABITS
Demodulated Data Bits

Syntax

Demodulates a single timeslot (or burst) of the transmitter. The _DATABITS command is equivalent to DATA BITS .

Example

`OUTPUT 718;"_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 (160) 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 280 elements.

Measurement Results

Array Name	Description	Units
_BITS	The _BITS array elements contain the demodulated data bits.	None

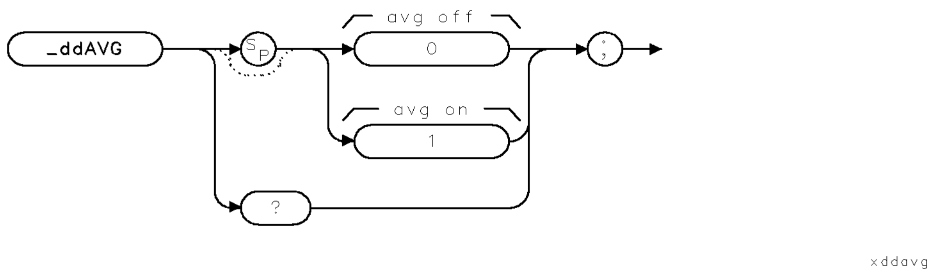
Related Commands: Use _ddNOPRT to specify if the data bits are to be displayed on the spectrum analyzer screen as part of the _DATABITS command.

See Also

"To measure the demodulated data bits" in Chapter 8, "Programming Examples."

_ddAVG
Digital Demod Average Mode

Syntax



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

`OUTPUT 718;"MOV _ddAVG,1;"` *Set for average mode.*

Related Commands: _MODACC and _ddNAVG.

Query Example

`OUTPUT 718;"_ddAVG?;"`

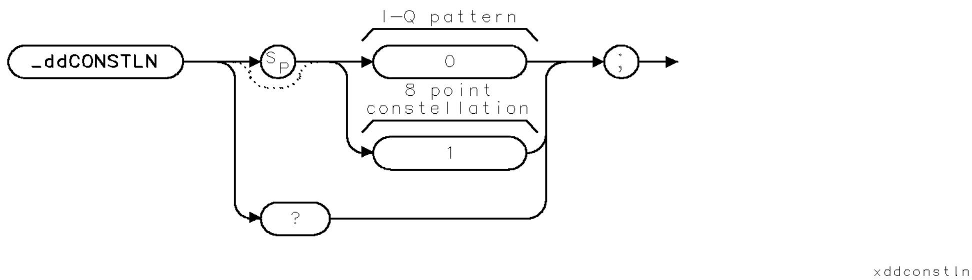
The query response will be the current value of _ddAVG.

See Also

"To measure the modulation accuracy using averaging" in Chapter 8, "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 1, _IQGRAPH will display the eight-point constellation diagram. If _ddCONSTLN is set to 0, _IQGRAPH will display the I-Q pattern diagram. The default value of _ddCONSTLN is 0.

Example

`OUTPUT 718;"MOV _ddCONSTLN,1;"` *Set for eight-point constellation.*

Related Commands: _IQGRAPH.

Query Example

`OUTPUT 718;"_ddCONSTLN?"`

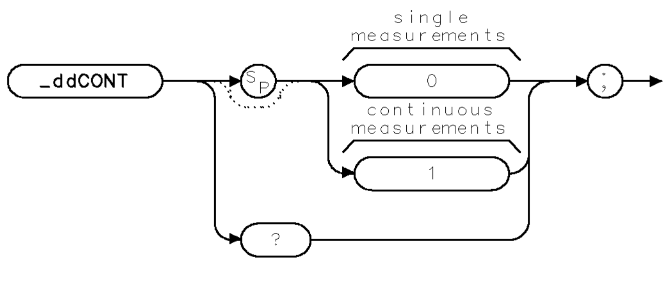
The query response will be the current value of _ddCONSTLN.

See Also

"To measure the I-Q pattern" and "To measure the eight-point constellation" in Chapter 8, "Programming Examples."

_ddCONT
Digital Demod Continuous Measurement

Syntax



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.*

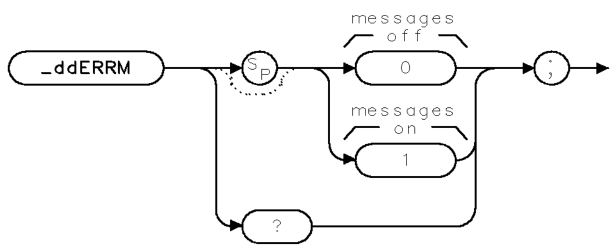
Query Example

`OUTPUT 718;"_ddCONT?"`

The query response will be the current value of _ddCONT.

_ddERRM
Digital Demod Error Message

Syntax



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.

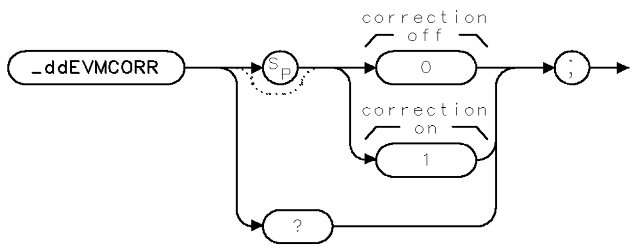
Query Example

`OUTPUT 718;"_ddERRM?;"`

The query response will be the current value of _ddERRM.

_ddEVMCORR
Digital Demod EVM Correction Mode

Syntax



xddevmcor

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 sets _ddEVMCORR to 0.

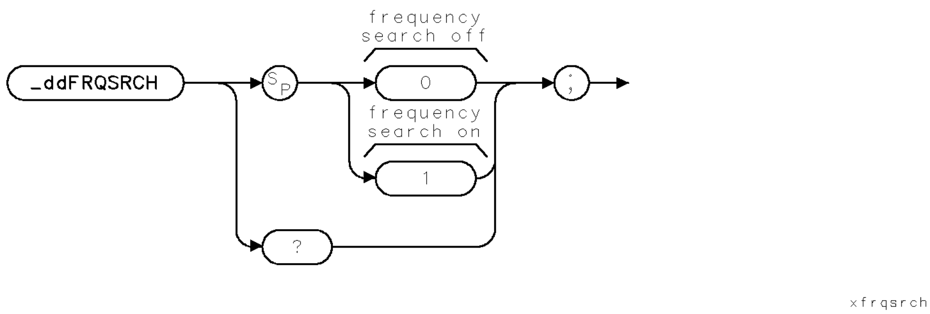
Query Example

`OUTPUT 718;"_ddEVMCORR?;"`

The query response will be the current value of _ddEVMCORR.

_ddFRQSRCH
Digital Demod Frequency Search

Syntax



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 vbalue of _ddFRQSRCH is 0.

Example

`OUTPUT 718;"MOV _ddFRQSRCH,1;"` *Enable carrier frequency search.*

Related Commands: _MODACC, _IQGRAPH, _DATABITS, _DEFAULT sets _ddFRQSRCH to 0.

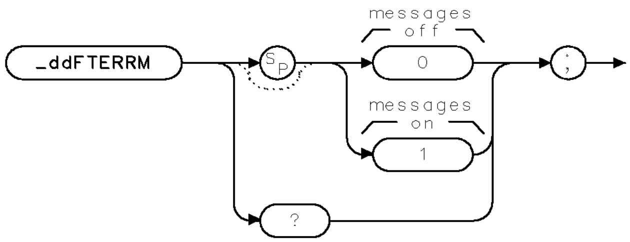
Query Example

`OUTPUT 718;"_ddFRQSRCH?;"`

The query response will be the current value of _ddFRQSRCH.

_ddFTERRM
Digital Demod Frame Trigger Error Message

Syntax



xddfterrm

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.

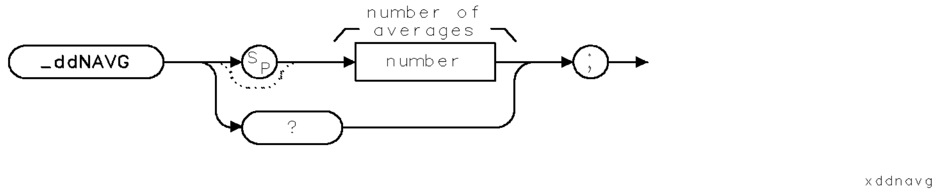
Query Example

`OUTPUT 718;"_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

`OUTPUT 718;"_ddNAVG?;"`

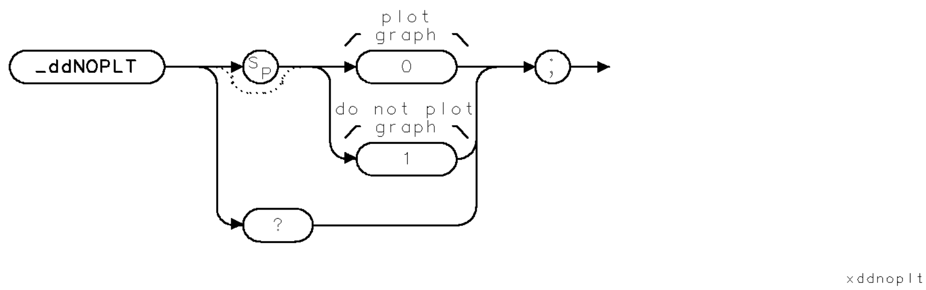
The query response will be the current value of _ddNAVG.

See Also

"To measure the modulation accuracy using averaging" in Chapter 8, "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

`OUTPUT 718;"_ddNOPLT?"`

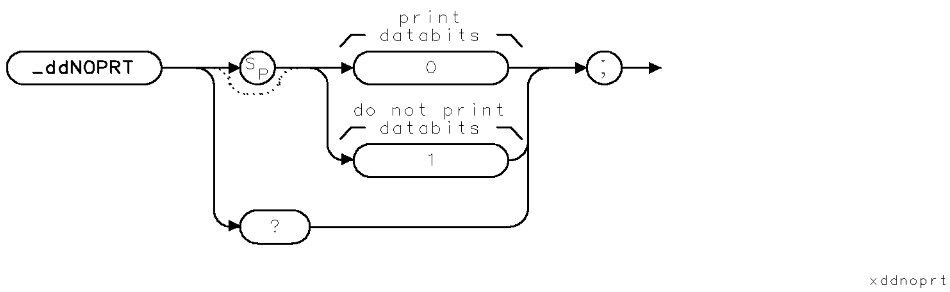
The query response will be the current value of _ddNOPLT.

See Also

"To measure the I-Q pattern" in Chapter 8, "Programming Examples."

_ddNOPRT
Digital Demod NO PRINT Data Bits

Syntax



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

`OUTPUT 718;"_ddNOPRT?"`

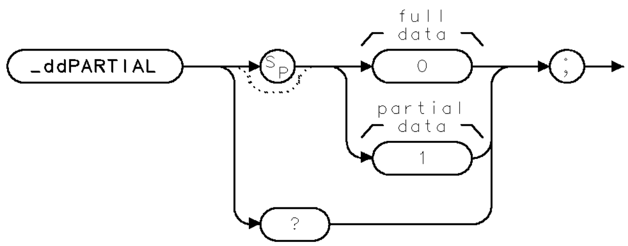
The query response will be the current value of _ddNOPRT.

See Also

"To measure the demodulated data bits" in Chapter 8, "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.

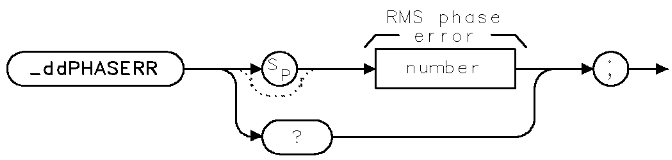
Query Example

`OUTPUT 718;"_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.

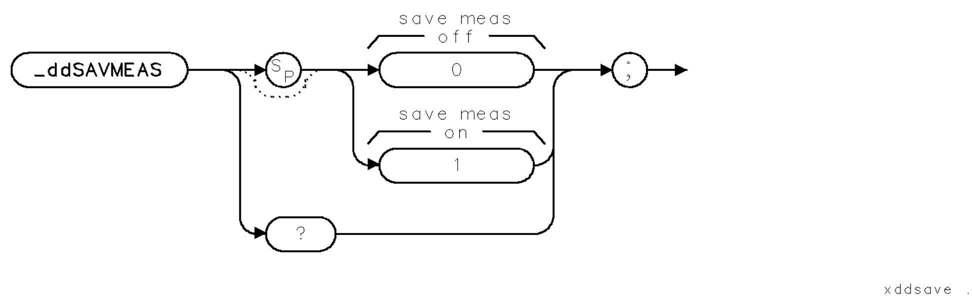
Query Example

`OUTPUT 718;"_ddPHASERR?;"`

The query response will be the current value of _ddPHASERR.

_ddSAVMEAS
Digital Demod Save Measurement

Syntax



Allows you to save the measurement data from the previous digital demodulator based measurements (that is, _MODACC, _IQGRAPH, 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, _IQGRAPH, 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 a 10 symbol, 10 burst measurement or an averaged measurement.

If _ddSAVMEAS is set to 0, further execution of _MODACC, _IQGRAPH, 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, _IQGRAPH, and _DATABITS.

Query Example

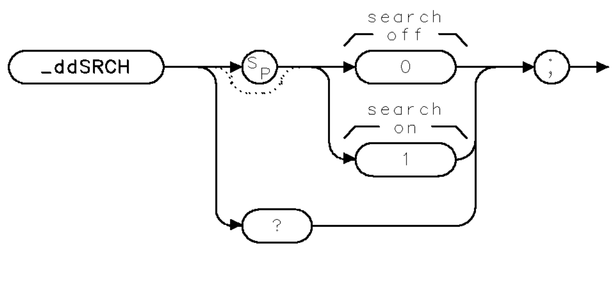
`OUTPUT 718;"_ddSAVMEAS?;"`

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.

_ddSRCH
Digital Demod Timeslot Search Mode

Syntax



Allows you to specify sync word searching over the entire frame if word sync (_ddWSYNC) is on. The _ddSRCH command is equivalent to TIMESLOT SRCH NUM.

If _ddSRCH is set to 1, digital demodulator based measurements will include a search for the best fit timeslot (least number of errors) over the entire frame (timeslots 0 through 5). If _ddSRCH is set to 0, digital demodulator based measurements will be made on the timeslot specified by the current value of _TN (timeslot number). The default value of _ddSRCH is 0.

Example

`OUTPUT 718;"MOV _ddSRCH,1;"` *Enable timeslot search mode.*

Related Commands: _MODACC, _IQGRAPH, _DATABITS, _ddWSYNC, _DEFAULT sets _ddSRCH to 0.

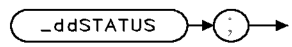
Query Example

`OUTPUT 718;"_ddSRCH?;"`

The query response will be the current value of _ddSRCH.

_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

`OUTPUT 718;"_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.

Measurement Results: The results of the _ddSTATUS command are stored in the variables shown in the following table.

Measurement Results

Value	Description	Units
_ddFTACQS	Frame trigger acquisition status.	None
_ddFTTRS	Frame trigger time record status.	
_ddFTSN	Frame trigger sync number.	
_ddFTSE	Frame trigger sync errors.	
_ddFTSBLOC	Frame trigger sync bit location.	
_ddSTAT	Measurement status result.	
_ddTRS	Measurement time record status.	
_ddSWN	Measurement time slot (sync 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.	

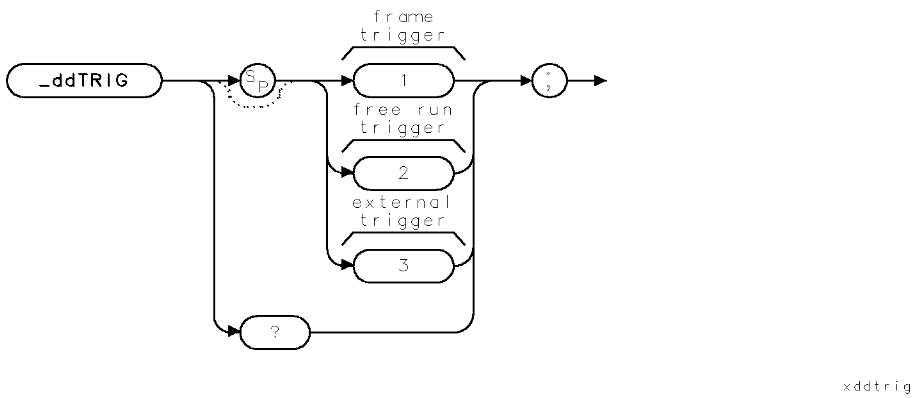
Related Commands: _MODACC, _IQGRAPH, and _DATABITS.

See Also

"To display the digital demodulator status" in Chapter 8, "Programming Examples," and Chapter 6, "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 sets _ddTRIG to 1.

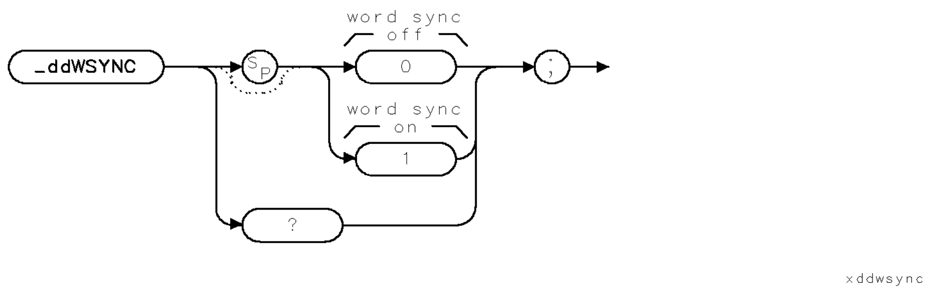
Query Example

`OUTPUT 718;"_ddTRIG?;"`

The query response will be the current value of _ddTRIG.

_ddWSYNC
Digital Demod Word Sync Mode

Syntax



Allows you to specify sync 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

`OUTPUT 718;"_ddWSYNC?;"`

The query response will be the current value of _ddWSYNC.

_DEFAULT
Default Configuration

Syntax

Replaces the values and selections for the configuration functions to their default values. The _DEFAULT command is equivalent to DEFAULT CONFIG .

Example

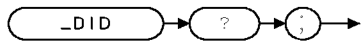
```
OUTPUT 718;"_DEFAULT;"
```

The default values are as follows:

_EXTATN	is set to 20 dB
_CC	is set to 0 if mobile, 1 if base
_CH	is set to channel number 1
_CHMS	is set to 0
_CHBS	is set to 0
_FMS	is set to 940 MHz
_FBS	is set to 810 MHz
_TOTPM	is set to 0 (single carrier)
_TOTPWR	is set to 50 dBm
_TRIGD	is set to 0 μs
_TRIGF	is set to 0 (triggering every 20 ms)
_TRIGP	is set to 1 (positive edge triggering)
_TRIGM	is set 0 (video triggering)
_DPF	is set to 0 (pass/fail display is set to off)
_CFX	is set to 300 MHz
_BAND	is set to 1 (800 MHz band)
_TRIGSRC	is set to 1 if Options 151 and 160 are present; otherwise, 0
_ddTRIG	is set to 1 (frame trigger)
_ddSRCH	is set to 0 (timeslot NUM)
_ddEVMCORR	is set to 0 (EVM correction OFF)
_ddFRQSRCH	is set to 0
_SELM	is set to 15 dB
_SEPF	is set to 0 (auto)

_DID
DLP Identification

Syntax



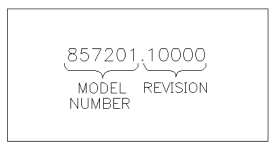
xdid

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



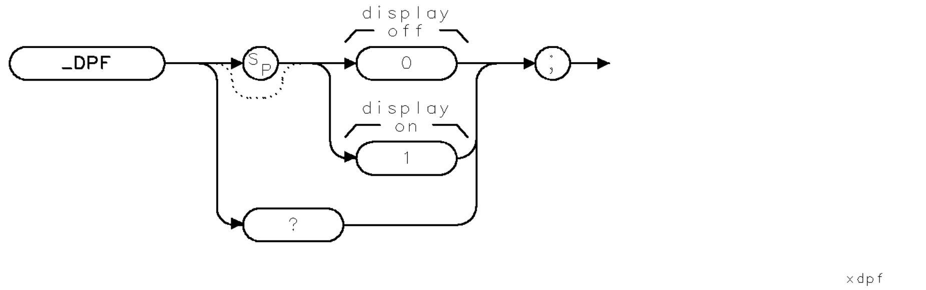
pc722b

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 85720B Rev. B.00.00.

_DPF
Display Pass/Fail Message

Syntax



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.

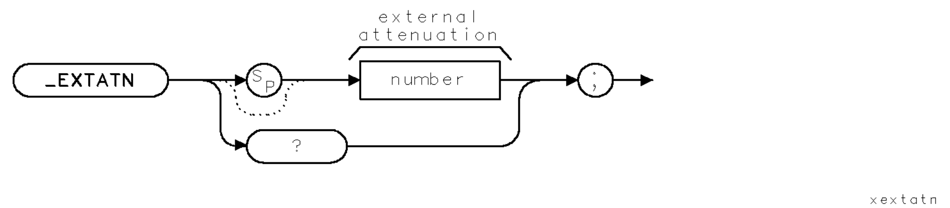
Query Example

`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 20.

Example

`OUTPUT 718;"MOV _EXTATN,13;"` *Sets the external attenuation to 13 dB.*

Related Commands: _DEFAULT sets _EXTATN to 20.

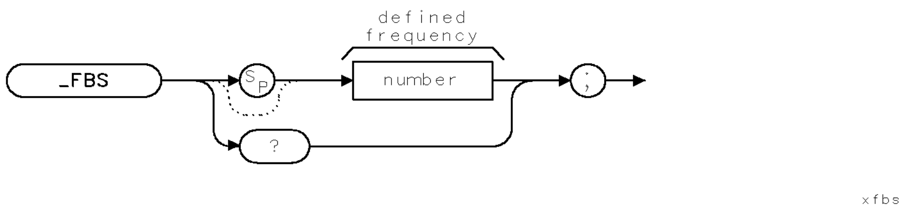
Query Example

`OUTPUT 718;"_EXTATN?;"`

The query response will be a the current setting for the external attenuation.

_FBS
Frequency Base Station

Syntax



Allows you to specify the base station frequency that corresponds to the channel number as defined in _CHBS. The _FBS command is equivalent to `DEFINE BS FREQ`.

The measurement unit for _FBS is Hz.

Example

`OUTPUT 718;"MOV _FBS,810.075E6;"` *Set base station defining frequency to 810.075 MHz.*

Related Commands: _CHSP (Table 7-4), _DEFAULT sets _FBS to 810 MHz.

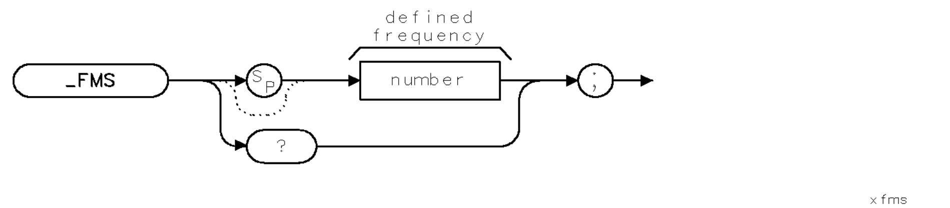
Query Example

`OUTPUT 718;"_FBS?;"`

The query response will be the current value of the base station defining frequency.

_FMS
Frequency Mobile Station

Syntax



Allows you to specify the mobile station frequency that corresponds to the channel number as defined in _CHMS. The _FMS command is equivalent to DEFINE MS FREQ .

The measurement unit for _FMS is Hz.

Example

OUTPUT 718;"MOV _FMS,940.075E6;" *Set mobile station defining frequency to 940.075 MHz.*

Related Commands: _CHSP (Table 7-4), _DEFAULT sets _FMS to 940 MHz.

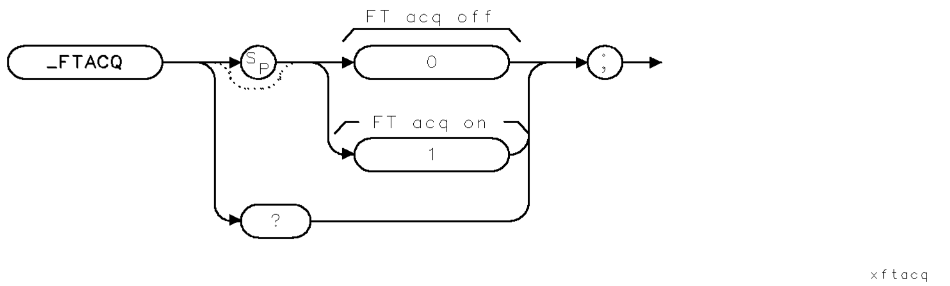
Query Example

OUTPUT 718;"_FMS?;"

The query response will be the current value of the mobile station defining frequency.

_FTACQ
Frame Trigger Acquisition

Syntax



Allows you to specify frame trigger acquisition prior to power versus time and gated ACP measurements. The _FTACQ is command equivalent to FT ACQ ON OFF.

If _FTACQ is set to 1, power versus time and gated ACP measurements will include a digital demodulator frame trigger acquisition prior to the measurement. If _FTACQ is set to 0, power versus time and ACP 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

`OUTPUT 718;"_FTACQ?;"`

The query response will be the current value of _FTACQ.

_IMDTRANS
Transmitter Intermodulation Emissions

Syntax

_IMDTRANS performs the base station transmitter intermodulation spurious emissions measurement. The _IMDTRANS command is equivalent to MEASURE INTERMOD .

Example

```
OUTPUT 718;"_IMDTRANS;"
```

Executing _IMDTRANS does the following:

1. Performs the transmitter intermodulation spurious 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 trace A.

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 amplitude was too low.
3	The carrier amplitude was too high.

Measurement Results: The results of the _IMDTRANS command are stored in the variables and trace shown in the following table.

Measurement Results

Value	Description	Units
_NUMF	Indicates if the intermodulation product was within the measurement limit. The measurement limit are determined by _SEXB and _SEXC. See Table 7-2 for more information about measurement limits. ■ If _NUMF is 0, the numeric result was within the limit. ■ If _NUMF is 2, the numeric result was greater than the upper measurement limit.	None
_SEA	A variable that contains the mean IMD product power.	dBm
_SEAC	A variable that contains the ratio of the mean IMD product 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 IMD product spurious emissions.	Determined by the trace data format (TDF) command

Limit and Parameter Variables: _IMDTRANS uses _SEXB and _SEXC.

See Table 7-2 for more information.

Related Commands: Use _IRBW to select resolution bandwidth. Use _ISGF to specify if the signal generator is above or below the carrier. Use _ISPAC to select the frequency difference of the carrier to the signal generator.

See Also

"To measure transmitter intermodulation spurious emissions" in Chapter 8.

_IQGRAPH
I-Q Pattern or Eight-Point Constellation

Syntax

xiqgraph

Demodulates a single timeslot (or burst) of the transmitter and plots an I-Q pattern or eight-point constellation. If the value of _ddCONSTLN is 1, it will plot an eight-point constellation. If the value of _ddCONSTLN is 0, it will plot an I-Q pattern. The _IQGRAPH command is equivalent to `I-Q PATTERN` or `8 POINT CONSTLN`.

Example

`OUTPUT 718;"MOV _ddCONSTLN,0"`	*Set for I-Q pattern.*
`OUTPUT 718;"_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 (160) 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 _IQGRAPH command are stored in two 816 element arrays.

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.	*
* 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.		

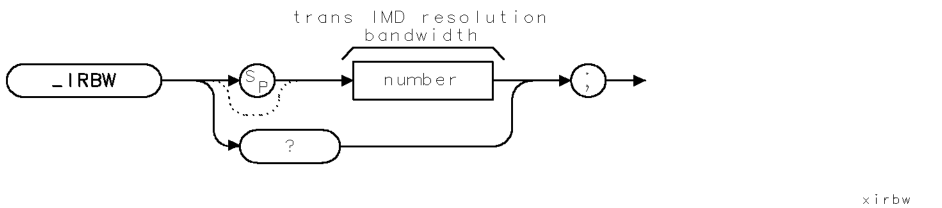
Related Commands: Use _ddCONSTLN to specify which graph is displayed. The _ddNOPLT specifies whether or not the graphs are to be displayed.

See Also

"To measure the I-Q pattern" and "To measure the eight-point constellation" in Chapter 8, "Programming Examples."

_IRBW
Transmitter Intermodulation Resolution Bandwidth

Syntax



Allows you to specify the resolution bandwidth used by the transmitter intermodulation spurious emissions measurement. The _IRBW command is equivalent to Rbw.

Values for _IRBW may range from 1000 to 100000 in a 1, 3, 10 sequence. The default value for _IRBW is 30000. The measurement unit for _IRBW is Hz.

Example

`OUTPUT 718;"MOV _IRBW,1E4;"` *Sets _IRBW to 10 kHz.*

Related Commands: _IMDTRANS

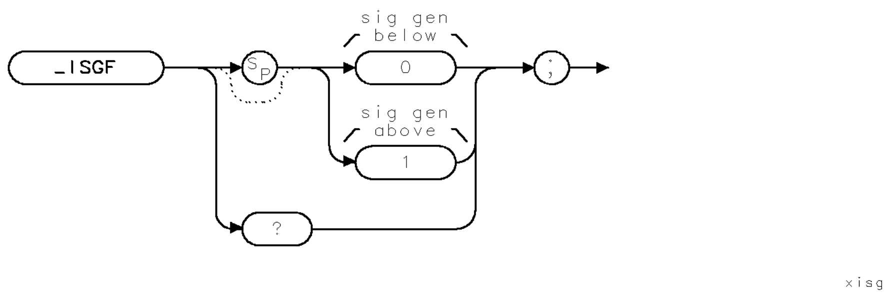
Query Example

`OUTPUT 718;"_IRBW?;"`

The query response will be the current value of _IRBW.

_ISGF
Transmitter Intermodulation Signal Generator Flag

Syntax



Allows you to specify if the frequency of the signal generator used by the transmitter intermodulation spurious emission smeasurement is above or below the transmitter carrier frequency. The _ISGF command is equivalent to `SIG GEN ABOVE` and `SIG GEN BELOW`.

If _ISGF is set to 0, the personality is set to measure transmitter intermodulation spurious emissions with the signal generator below the transmitter carrier frequency.

If _ISGF is set to 1, the personality is set to measure transmitter intermodulation spurious emissions with the signal generator above the transmitter carrier frequency.

The default value for _ISGF is 1.

Example

`OUTPUT 718;"MOV _ISGF,0;"` *Sets _ISGF for the signal generator below the transmitter carrier frequency.*

Related Commands: _IMDTRANS, _ISPAC.

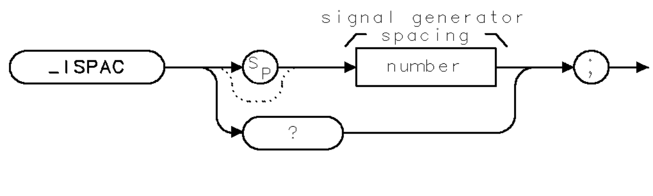
Query Example

```
OUTPUT 718;"_ISGF?;"
```

The query response will be the current value of _ISGF.

_ISPAC
Transmitter Intermodulation Signal Generator Spacing

Syntax



Allows you to specify the spacing (frequency difference) between the transmitter carrier frequency and the frequency of the signal generator used by the transmitter intermodulation spurious emissions measurement. The _ISPAC command is equivalent to `SPACING`.

_ISPAC can accept a real number. Values may range from 1E4 to 1E6. The default value for _ISPAC is 5E5 (500 kHz). The measurement unit for _ISPAC is Hz.

Example

`OUTPUT 718;"MOV _ISPAC,6E5;"` *Sets _ISPAC to 600 kHz.*

Related Commands: _IMDTRANS, _ISGF.

Query Example

`OUTPUT 718;"_ISPAC?;"`

The query response will be the current value of _ISPAC.

_MBM
Monitor Band Measurement

Syntax

xmbm

Performs the monitor band measurement.

Example

`OUTPUT 718;"MOV _MTX,1;"`	*Selects the transmit frequency bands.*
`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.*

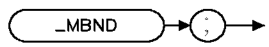
Before using _MBM, you need to use the _MBS command to perform the setup for the monitor band measurement. The _MBS and _MBM commands are useful if you want to change the spectrum analyzer settings before making a monitor band measurement. The combination of the _MBS and _MBM commands is equivalent to either MONITOR TX BAND or MONITOR RX BAND, depending on the setting of _MTX.

See the description for _MBND for information about the measurement state and measurement results from a monitor band measurement.

Related Commands: Use _MTX to select either the transmit or receive frequency band. Use _BAND to select the band.

_MBND
Monitor Band

Syntax



xmbnd

Displays either the transmit or receive frequency band. Depending on the setting of _MTX, _MBND is equivalent to MONITOR TX BAND or MONITOR RX BAND.

Example

```
OUTPUT 718;"MOV _MTX,1;"     Selects the transmit frequencies.
OUTPUT 718;"MOV _BAND,1;"    Selects 800 MHz band.
OUTPUT 718;"_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.

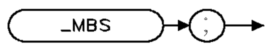
Related Commands: Use _MTX to select either the transmit or receive frequency band. Use _BAND to select the band.

See Also

"To monitor a band" in Chapter 8.

_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 either MONITOR TX BAND or MONITOR RX BAND, depending on the setting of _MTX.

_MCH
Monitor Channel

Syntax

Displays the spectrum for the channel that is specified by _CH. The _MCH command is equivalent to MONITOR TX CHAN.

Example

```
OUTPUT 718;"_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 TX 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

xmcs

Performs the setup for the monitor channel measurement.

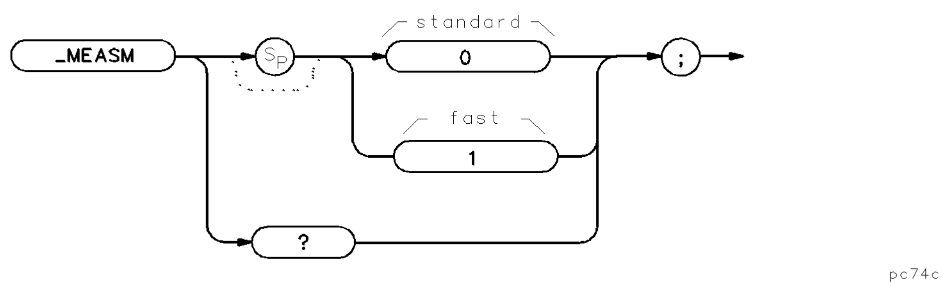
Example

`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 TX 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 carrier power measurement.*
`ENTER 718;Done`	*Wait until the measurement is done.*
`OUTPUT 718;"_MEASM 1;"`	*Set the measurement mode to fast.*
`OUTPUT 718;"_COPWR;"`	*Make the carrier off power measurement.*

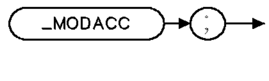
Query Example

```
OUTPUT 718;"_MEASM?;"
```

The query response will be the current value of _MEASM.

_MODACC
Modulation Accuracy

Syntax



Demodulates a single timeslot (or burst) of the transmitter and displays the modulation accuracy results. The _MODACC command is equivalent to MODULATN ACCURACY.

Example

`OUTPUT 718;"_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 (160) 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.	

_MODACC Modulation Accuracy

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.	Hz
* Valid only if _ddPARTIAL is 0 (off).		

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

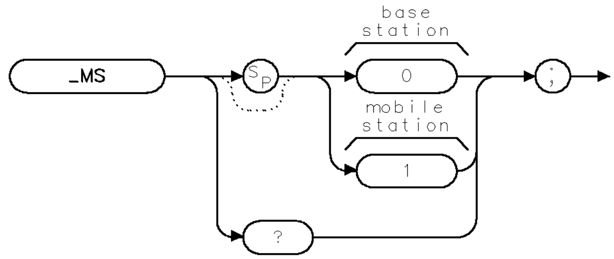
Related Commands: _ddPARTIAL, _ddTENB, _ddAVG, _ddNAVG, _ddEVMCORR, _RCRSTD.

See Also

"To measure the modulation accuracy," and "To measure the modulation accuracy using averaging" in Chapter 8, "Programming Examples."

_MS
Base Station or Mobile Station

Syntax



Allows you to select either the base station (BS) or mobile station (MS) as the transmitter under test. The _MS command is equivalent to TRANSMIT BS MS .

If _MS is set to 0, the transmission source is set to base station. If _MS is set to 1, the transmission source is set to mobile station. The default value for _MS is 0.

Example

`OUTPUT 718;"MOV _MS,0;"` *Sets the transmission source to base station.*

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.
3	No gate circuitry found (required for MS measurements).
4	No fast ADC found (required for MS measurements).

Query Example

`OUTPUT 718;"_MS?;"`

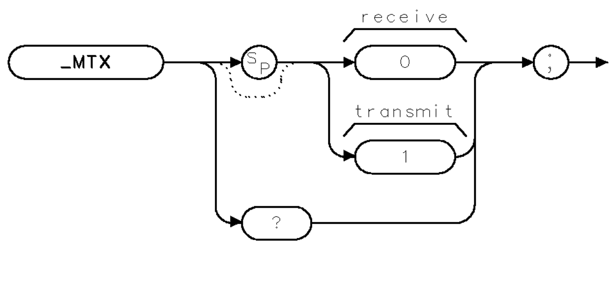
The query response will be the current value of _MS.

See Also

"To select base or mobile station configuration" in Chapter 8.

_MTX
Monitor Transmit or Receive Band

Syntax



Selects either the transmit or receive frequency bands for the monitor band measurements.

If _MTX is set to 0, the receive frequency bands will be selected. If _MTX is set to 1, the transmit frequency bands will be selected. The default value for _MTX is 1.

Example

`OUTPUT 718;"MOV _MTX,0;"` *Selects the receive frequency bands.*
`OUTPUT 718;"MOV _BAND,1;"` *Selects 800 MHz band.*
`OUTPUT 718;"_MBND;"` *Displays band.*

You should set _MTX prior to executing _MBND.

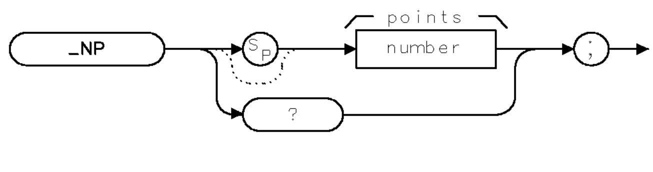
Query Example

`OUTPUT 718;"_MTX?;"`

The query response will be the current value of _MTX.

_NP
Number of Points per Sweep

Syntax



Allows you to specify the number of points per sweep used in the gated adjacent channel power (ACP GTD CH/SWP) and the channel power measurement (for testing mobile stations).

The _NP command is equivalent to POINTS/SWEEP .

_NP can accept an integer from 21 to 401. The default value for _NP is 401.

Example

OUTPUT 718;"MOV _NP,100;"	*Uses 100 points from every sweep to calculate the adjacent channel power.*

Related Commands: _NP is used by _ACP and _ACPM.

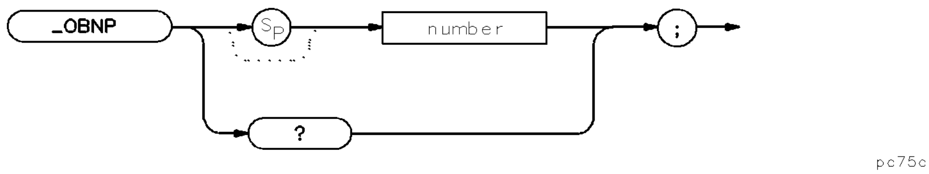
Query Example

```
OUTPUT 718;"_NP?;"
```

The query response will be the current value of _NP.

_OBNP
OBW Number of Points per Sweep

Syntax



Allows you to specify the number of points per sweep used in an Occupied Bandwidth measurement. The _OBNP command is equivalent to `OBW PTS/SWP`.

_OBNP can accept an integer from 21 to 401. The default value for _OBNP is 401.

Example

`OUTPUT 718;"MOV _OBNP,100;"` *Uses a 100-point sweep to calculate the occupied bandwidth.*

Related Commands: _OBW

Query Example

`OUTPUT 718;"_OBNP?;"`

The query response will be the current value of _OBNP.

_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 7-2 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 7-2 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.

Related Commands: _OBNP

See Also

"To measure the occupied bandwidth" in Chapter 8.

_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

xobws

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 BANDWDTH`.

_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 (151) option.
7	Digital demodulator firmware not correct (160) option.
8	Digital demodulator firmware revision date too old.
10	Frame trigger acquisition failed. (See Chapter 6, “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, _PBSXL, _PBXU and _PBXL. See Table 7-2 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 (_PBXL or _PBSXL). ■ 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.

_PBURST Power versus Time Burst

Limit and Parameter Variables: _PBURST uses _PBXL, _PBXU, _PBSXL, _PBSXU, and _PBMP. See Table 7-2 for more information.

Related Commands: _TN determines which slot is measured. _AVG should be set prior to executing _PBURST. _RCRSTD.

See Also

"To measure a burst" in Chapter 8.

_PFALL
Power versus Time Falling Edge

Syntax

xpfall

_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 (151) option.
7	Digital demodulator firmware not correct (160) option.
8	Digital demodulator firmware revision date too old.
10	Frame trigger acquisition failed. (See Chapter 6, “Error Messages and Troublehsooting.”)

_PFALL Power versus Time Falling Edge

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 _PRMPH and _PRMPL. See Table 7-2 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
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 line boundary. ■ If LIMIFAIL is equal to 2, the waveform failed the upper limit-line line boundary. ■ If LIMIFAIL is equal to 3, the waveform failed the both the upper and lower limit-line 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
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: _PFALL uses _PFX, _PRXU, _PRXL, PRMPU, and _PRMPL. See Table 7-2 for more information.

Related Commands: _TN determines the slot burst that is measured. _AVG should be set prior to executing _PFALL. _RCRSTD.

See Also

"To measure a falling edge" in Chapter 8.

_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

```
OUTPUT 718;"_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 (151) option.
7	Digital demodulator firmware not correct (160) option.
8	Digital demodulator firmware revision date too old.
10	Frame trigger acquisition failed. (See Chapter 6, "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 Result

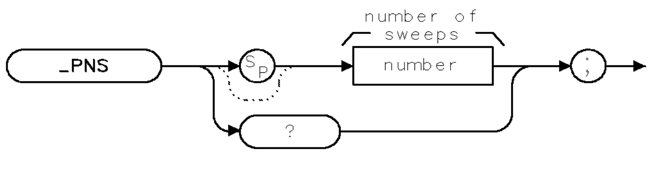
Variable or Trace	Description	Units
_PTMT	A variable that contains the time between the external trigger and the marker.	μs
TRA	TRA is trace A. Trace A contains the waveform of the average of the power versus time.	Determined by the trace data format (TDF) command*
TRB	TRB is trace B. Trace B contains 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.		

See Also

"To measure a frame" in Chapter 8.

_PNS
Power vs Time Number of Sweeps

Syntax



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 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 a the current setting for the number of sweeps.

See Also

"To change the value of parameter variables" in Chapter 8.

_PRISE
Power vs 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 (151) option.
7	Digital demodulator firmware not correct (160) option.
8	Digital demodulator firmware revision date too old.
10	Frame trigger acquisition failed. (See Chapter 6, “Error Messages and Troubleshooting.”)

_PRISE Power vs Time Rising Edge

Measurement Results: The results of the _PFRAME command are stored in the variables and traces shown in the following table.

Measurement Result

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 7-2 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 line boundaries. ■ If LIMIFAIL is equal to 1, the waveform failed the lower limit-line line boundary. ■ If LIMIFAIL is equal to 2, the waveform failed the upper limit-line line boundary. ■ If LIMIFAIL is equal to 3, the waveform failed the both the upper and lower limit-line 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, _PAMPH, _PRX, _PAXL, and _PAXH. See Table 7-2 for more information.

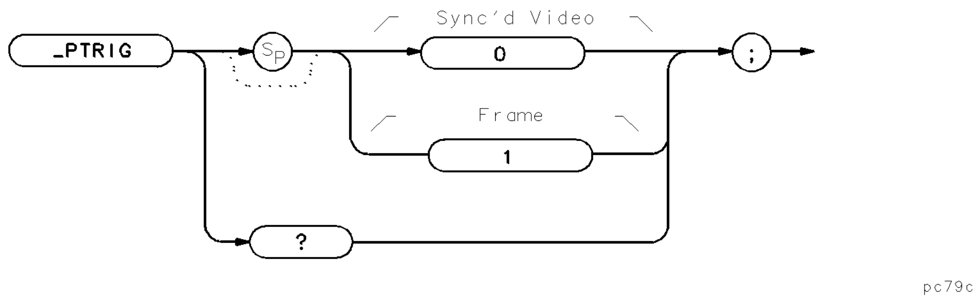
Related Commands: _TN determines the slot burst that is measured. _AVG should be set prior to executing _PFALL. _RCRSTD.

See Also

"To measure a rising edge" in Chapter 8.

_PTRIG
Power versus Time Trigger Source

Syntax



Allows you to select the trigger source for power versus time measurements when _TRIGSRC is set to 1 (digital demodulation). The _PTRIG command is equivalent to TRIG SRC FRM VID . The default for _PTRIG is 1.

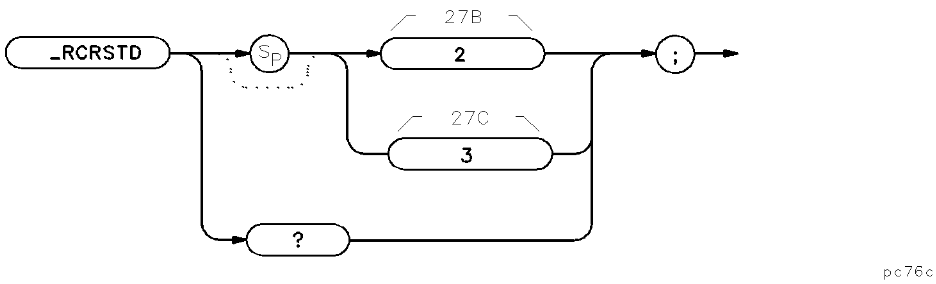
Example

`OUTPUT 718;"_MOV _PTRIG,0;"` *Select synchronized video trigger*

Related Commands: _TRIGSRC, _PBURST, _PRISE, _PFALL

_RCRSTD
RCR Standard Revision

Syntax



Allows you to select the measurement methods to agree with particular revisions of the RCR standard. If _RCRSTD is set to 2, the spectrum analyzer makes measurements according to RCR STD-27B. If _RCRSTD is set to 3, the spectrum analyzer makes measurements according to RCR STD-27C. The default value of _RCRSTD is 3.

This command affects the carrier-off leakage power, power versus time, spurious, and modulation accuracy measurements.

Example

`OUTPUT 718;"MOV _RCRSTD,2;"`	*Set the RCR STD-27B mode.*
`OUTPUT 718;"_COPWR;"`	*Perform a carrier-off power measurement.*

You should set _RCRSTD prior to executing _COPWR, _PBURST, _PRISE, _SPURSET, _SPURZ, or _MODACC.

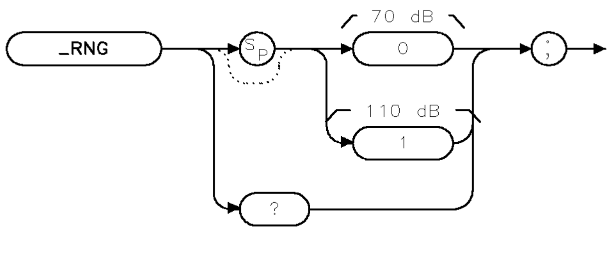
Query Example

```
OUTPUT 718;"_RCRSTD?;"
```

The query response will be the current value of _RCRSTD.

_RNG
Amplitude Range for Power vs Time

Syntax



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 1.

Example

OUTPUT 718;"MOV _RNG,0;" *Sets the amplitude range to 70 dB.*

You should set _RNG prior to executing _PFRAME, _PBURST, _PRISE, or _PFALL.

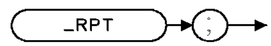
Query Example

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

```
OUTPUT 718;"_RPT;"
```

Related Commands: _RPT will repeat the following measurements: _CPWR, _COPWR, _OBW, _STEP, _ACP, _CHPWR, _PFRAME, _PBURST, _PRISE, _PFALL, _SPUR, _MODACC, _IQGRAPH, _DATABITS.

See Also

"To use the repeat command" in Chapter 8.

_SEM
Spurious Emission Power Measurement

Syntax

xsem

Performs the spurious emission power measurement.

Example

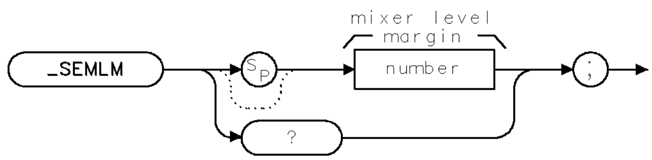
```
OUTPUT 718;"_SES;"        Sets up the spurious emission power measurement.
OUTPUT 718;"RB 30KHZ;"    Changes the resolution bandwidth to 30 kHz.
OUTPUT 718;"_SEM;"        Performs the spurious emission power measurement.
```

Before using _SEM, 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.

_SEMLM
Spurious Emission Mixer Level Margin

Syntax



xsemlm

Allows you to change the value used in automatically setting the input attenuator of the spectrum analyzer for the spur and harmonic measurement. It is the minimum margin between the 1 dB gain compression level at the input mixer and the mean value of the measured signal. The _SEMLM command is equivalent to MXR LVL MARGIN .

_SEMLM accepts a real number from 0 to 40. The measurement unit is dB. The default value for -SEMLM is 15.

Example

OUTPUT 718;"MOV _SEMLM,13;" *Sets the spurious emission mixer level margin to 13 dB.*

Related Commands: _SPURH, _DEFAULT sets _SEMLM to 15.

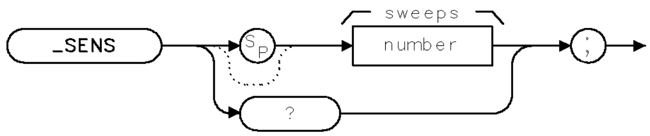
Query Example

OUTPUT 718;"_SEMLM?;"

The query response will be the current setting for the spur and harmonic measurement mixer level margin.

_SENS
Spurious Emission Number of Sweeps

Syntax



Allows you to change the number of sweeps used in the spurious and harmonic, spurious emission, and intermodulation spurious measurements. The _SENS command is equivalent to NUMBER SWEEPS in the spurious setup menu.

_SENS accepts an integer from 1 to 999. The default value for _SENS is 1.

Example

OUTPUT 718;"MOV _SENS,5;" *Sets the number of sweeps to 5.*

Related Commands: _SPUR, _SPURH, _IMDTRANS.

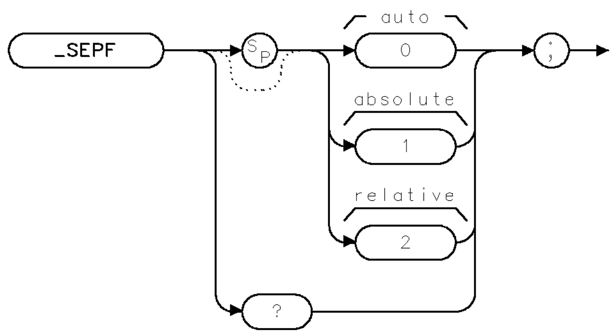
Query Example

OUTPUT 718;"_SENS?;"

The query response will be the current setting for the spurious emission number of sweeps.

_SEPF
Spurious Emission Pass/Fail

Syntax



Allows you to specify the pass/fail criteria for the spurious and harmonic, spurious emission, and intermodulation spurious measurements. The _SEMLM command is equivalent to P/F AUTO ABS REL . The default value for _SEPF is 0.

Example

`OUTPUT 718;"MOV _SEPF,1;"` *Use absolute limit for pass/fail.*

Related Commands: _SPUK, _SPURH, _IMDTRANS. _DEFAULT sets _SEPF to 0.

Query Example

`OUTPUT 718;"_SEPF?;"`

The query response will be the current setting for the spurious emission pass/fail criteria.

_SES
Spurious Emission Power Setup

Syntax

xses

Performs the setup for the spurious emission power measurement.

Example

`OUTPUT 718;"_SES;"`	*Sets up the spurious emission power measurement.*
`OUTPUT 718;"RB 30KHZ;"`	*Changes the resolution bandwidth to 30 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.

_SPM
Power Step Measurement

Syntax

xspm

Performs the power step measurement.

Example

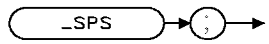
```
OUTPUT 718;"_SPS;"     Sets up the power step measurement.
OUTPUT 718;"ST 20;"    Changes the sweep time to 20 s.
OUTPUT 718;"_SPM;"     Performs the power step measurement.
```

Before using _SPM, you need to use the _SPS command to perform the setup for the measurement. The _SPS and _SPM commands are useful if you want to change the spectrum analyzer settings before making a power step measurement. The combination of the _SPS and _SPM commands is equivalent to the _STEP command and POWER STEP.

See the description for _STEP for information about the measurement state and measurement results from a power step measurement.

_SPS
Power Step Setup

Syntax



xsps

Performs the setup for the power step measurement.

Example

`OUTPUT 718;"_SPS;"`	*Sets up the power step measurement.*
`OUTPUT 718;"ST 20;"`	*Changes the sweep time to 20 s.*
`OUTPUT 718;"_SPM;"`	*Performs the power step measurement.*

The _SPS and _SPM commands can be used if you want to change the spectrum analyzer settings before making a power step measurement. The combination of the _SPS and _SPM commands is equivalent to the _STEP command and POWER STEP .

_SPUR
Spurious Emission Power Measurement

Syntax

xspur

Measures the spurious emission power level at the current analyzer center frequency.

Example

`OUTPUT 718;"_SPUR;"` *Performs spurious emission 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: A “1” is returned to the external controller to indicate when the measurement is finished.

_SPUR Spurious Emission Power 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

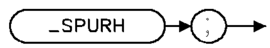
Variable or Trace	Description	Units
_NUMF	Indicates if the spurious emission power was within the measurement limits. The measurement limits are determined by _SEXA, _SEXB, and _SEXC. See Table 7-2 for more information about measurement limits. ■ If _NUMF is 0, the numeric results were within the limits. ■ 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 and _SEXC. See Table 7-2 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 and Harmonic Measurement

Syntax



xspurh

Performs the TX band spurious and harmonic test sequence. The _SPURH command is equivalent to SPUR & HARMONIC.

Example

`OUTPUT 718;"_SPURH;"` *Performs the spurious and harmonic measurement*

Executing _SPURH does the following:

1. Performs the spurious and harmonic 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 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 command was successfully completed.
2	The carrier power was too low.

_SPURH Spurious and Harmonic Measurement

Measurement Results: The results of the _SPURH command are stored in traces and variables as described in the following two tables.

Measurement Results

Variable or Trace	Description	Units
_SEFA	Fundamental (carrier) amplitude.	dBm
_NUMF	Indicates if the spurious emission power is within the measurement limits. The measurement limits are determined by _SEXA, _SEXB, and _SEXC. See Table 7-2 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

Unlike the other measurement commands, _SPURH 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 five elements. Each element is used to store the measurement results for a specific frequency or frequency range. The five elements correspond to the following frequencies:

1. Half Sub-harmonic
2. 2nd. Harmonic
3. 3rd. Harmonic
4. TX band below carrier
5. TX band above carrier

For example, you would query the second element of _SEAMP ("_SEAMP[2]?;") to determine the 2nd. harmonic power in absolute (dBm) power.

Measurement Results (Array Information)

Array Name	Description	Units
_SEAMP	The _SEAMP array elements contain the spurious emission power results absolute power.	dBm
_SEAMPC	The _SEAMPC array elements contain the spurious emission power results relative to the fundamental (carrier) power.	dB

Note If the carrier is outside the TX band, elements 4 and 5 will contain −999.9. If a harmonic is outside the specified frequency range of the analyzer, element 3 (or 2) will contain −999.9.

Related Commands: _SENS, _SEPF, _SEMLM.

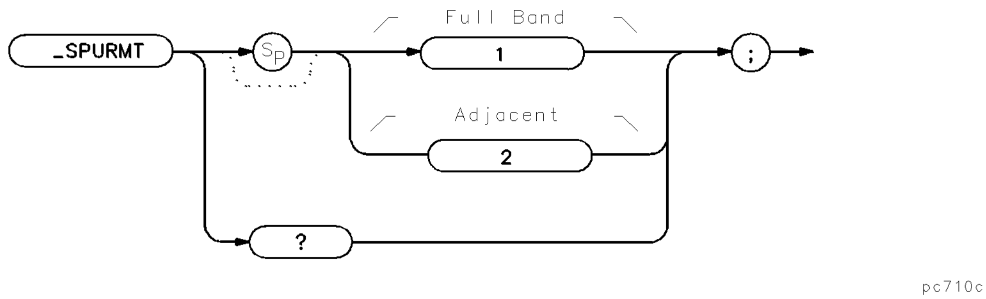
Limit and Parameter Variables: _SPURH uses _SEXA, _SEXB, _SEXC, AND _SEFM. See Table 7-2 for more information.

See Also

"To measure a spurious emission," in Chapter 8, "Programming Examples."

_SPURMT
Spurious Emission Measurement Type

Syntax



Allows you to select the base station spurious emission measurement to be either the full band or adjacent spurious. If _SPURMT is set to 1, the spectrum analyzer makes the measurement over the full PDC band. If _SPURMT is set to 2, the spectrum analyzer makes the measurement with a 700 kHz span. If _RCRSTD is set to 2 (RCR-27B), the setting of _SPURMT is ignored. The combination of _SPURMT and _SPURSET is equivalent to SPURIOUS EMISSION or SPURIOUS ADJACENT. The default value of _SPURMT is 1.

Example

`OUTPUT 718;"MOV _SPURMT,2;"`	*Specifies adjacent spurious measurement*
`OUTPUT 718;"MOV _SPURSET;"`	*Set up spurious emission measurement*
`OUTPUT 718;"MOV _SPURZ;"`	*Perform spurious search measurement*

Related Commands: _SPURSET, _RCRSTD, _BSCAR, _SPURZ.

See Also

Table 7-7 in the documentation of command _SPURZ.

Query Example

`OUTPUT 718;"_SPURMT?;"` *The query response will be the current value of _SPURMT.*

_SPURSET
Spurious Emission Search Setup

Syntax

xspurset

Sets up the analyzer for the spurious emission search measurement. The combination of _SPURMT and _SPURSET is equivalent to SPURIOUS EMISSION or SPURIOUS ADJACENT.

Example

OUTPUT 718;"_SPURSET;" *Perform the spurious emission search setup*

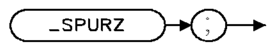
Related Commands: _SPURMT, _RCRSTD, _BSCAR, _SPURZ.

See Also

"To measure spurious emissions over a specific frequency range" in Chapter 8, and Table 7-7 in the documentation for command _SPURZ.

_SPURZ
Spurious Emission Search Measurement

Syntax



xspurz

For mobile stations, _SPURZ "auto-zooms" the analyzer span down. How this spurious zoom is performed depends on the setting of _SPURZT. If _SPURZT is set to 0, the spectrum analyzer uses the current marker and performs a marker-track to zoom-in. If _SPURZT is set to 1, the spectrum analyzer makes a peak search and zooms-in. It then performs the spurious emission measurement. The default value of _SPURZT is 0.

For base stations, setting _RCRSTD to 2 (RCR-27B) causes the same measurement methods as occurs with mobile station measurements. Setting _RCRSTD to 3 (RCR-27C) causes a frequency domain peak search measurement, as defined in RCR STD-27C.

The _SPURZ command is equivalent to MEASURE SPUR.

Example

```
OUTPUT 718;"_SPURZ;"
```

Measurement State: A "1" is returned to the external controller to indicate when the measurement is finished.

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, _SEXB, and _SEXC. See Table 7-2 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.

Table 7-7. Settings for the _SPURZ command

_MS Setting	_RCRSTD Setting	_SPURMT Setting	_SPURZT Setting	_BSCAR Setting	Results
0 (Base)	2 (RCR-27B)	NA	0 (Normal)	NA	_SPURSET sets the frequency range to the PDC band selected by _BAND. _SPURZ auto-zooms down onto the marker frequency using marker track, then takes a time domain sweep and computes the mean power over the full frame duration.
0 (Base)	2 (RCR-27B)	NA	1 (Fast)	NA	Same as above except uses the peak search marker instead of marker track.
0 (Base)	3 (RCR-27C)	1 (Fullband)	NA	NA	_SPURSET sets the frequency range to 100 MHz − 3 GHz if the carrier is in the 800 MHz band, or 100 MHz − 5 GHz if the carrier is in the 1500 MHz band. _SPURZ takes a frequency domain sweep that measures the level of carrier and the 2nd peak.*
0 (Base)	3 (RCR-27C)	2 (Adjacent)	NA	1 (1 carrier)	_SPURSET sets CF = carrier frequency and Span = 700 kHz, as MKK recommends. _SPURZ takes a frequency domain sweep that measures the level of the carrier and the 2nd peak.*
0 (Base)	3 (RCR-27C)	2 (Adjacent)	NA	2 (2 carrier)	Same as above except the 3rd peak is used instead of the 2nd peak.*
1 (Mobile)	2 (RCR-27B)	NA	0 (Normal)	NA	_SPURSET sets the frequency range to the PDC band selected by _BAND. _SPURZ auto-zooms down onto the marker frequency using marker track, then takes a time domain sweep and separately computes the mean power inside and outside the burst.
1 (Mobile)	2 (RCR-27B)	NA	1 (Fast)	NA	Same as above except uses peak search marker instead of marker track.
1 (Mobile)	3 (RCR-27C)	NA	0 (Normal)	NA	_SPURSET sets the frequency range to the PDC band selected by _BAND. _SPURZ auto-zooms down onto the marker frequency using marker track, then takes a time domain sweep and separately computes the mean spurious power on a slot-by-slot basis.
1 (Mobile)	3 (RCR-27C)	NA	1 (Fast)	NA	Same as above except uses peak search marker instead of marker track.

* The relative power is computed as: _SEAC = Carrier Level − Spurious Level
The absolute power is computed as: _SEA = Antenna Power + Relative Spur Power = _CPA + _SEAC.

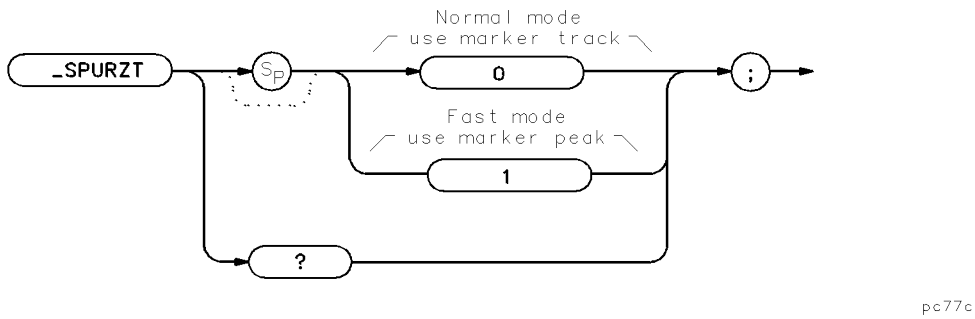
Related Commands: _SPURZT, _SPURSET, _SPURMT, _RCRSTD.

See Also

"To measure spurious emissions over a specific frequency range" in Chapter 8.

_SPURZT
Spurious Zoom Type

Syntax



Allows you to specify the spurious zoom type. If _SPURZT is set to 0, spurious zoom will be performed using the marker track capability of the spectrum analyzer. If _SPURZT is set to 1, spurious zoom will be performed using marker peak capability. Setting _SPURZT to 1 causes a fast zoom-in. The setting of _SPURZT is ignored if testing a base station and _RCRSTD is set to 3 (RCR-27C). The default value of _SPURZT is 0.

The _SPURZT command is equivalent to `SRCH MOD FAST NOR`.

Example

`OUTPUT 718;"_SPURZT 1;"`	*Set the spurious zoom type to fast marker peak mode.*
`OUTPUT 718;"_SPURZ;"`	*Make the spurious zoom measurement.*

You should set _SPURZT prior to _SPURZ.

Related Commands: _SPURZ, _SPURSET, _RCRSTD.

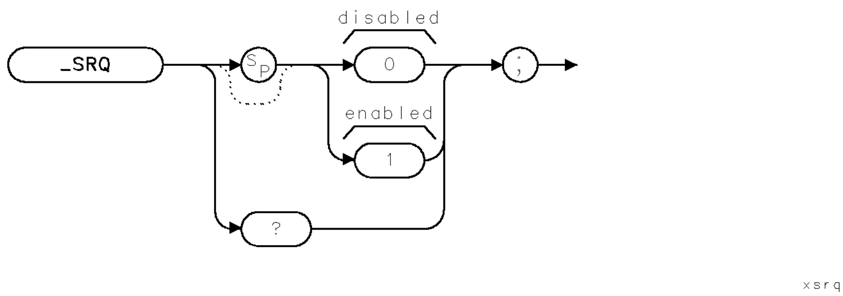
Query Example

```
OUTPUT 718;"_SPURZT?;"
```

The query response will be the current value of _SPURZT.

_SRQ
SRQ Measurement Done Indication

Syntax



Description

This command selects the mode for the synchronized completion of a PDC measurement. SRQ means "GPIB/IEEE 488 service request." If _SRQ is set to 1, all PDC 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 GPIB 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.

_STEP
Power Step

Syntax

xstep

Performs the power step measurement. The _STEP command is equivalent to POWER STEP.

Example

OUTPUT 718;"_STEP;" *Performs the power step measurement.*

Executing _STEP does the following:

1. Performs the power step 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 trace A.

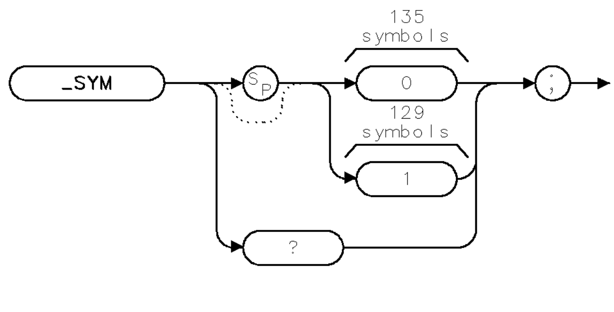
Measurement State: A "1" is returned to the external controller to indicate when the measurement is finished.

Measurement Results: The results of the power step measurement are stored in trace A. The measurement units for trace A are determined by the trace data format (TDF) command.

Alternate Commands: The _SPS and _SPM commands can be used instead of _STEP if you want to change the spectrum analyzer settings before making a power step measurement.

_SYM
Symbols per Burst for Power vs Time

Syntax



Selects the number of symbols per burst so that the limit lines and measurement limits for _PBURST, _PRISE, and _PFALL are sized accordingly. The _SYM command is equivalent to `BITS 258 270`.

If _SYM is set to 0, the number of symbols is set to 135 (270 bits). If _SYM is set to 1, the number of symbols is set to 129 (258 bits). The default value for _SYM is 0.

Example

`OUTPUT 718;"MOV _SYM,0;"` *Sets the number of symbols to 135 (270 bits).*

You should set _SYM prior to executing _PBURST, _PRISE, or _PFALL.

Query Example

`OUTPUT 718;"_SYM?;"`

The query response will be the current value of _SYM.

_TA
Trace Active

Syntax

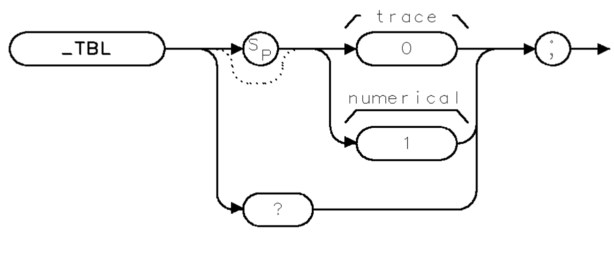
_TA allows you to view an active trace on the spectrum analyzer display after a measurement has been completed. The _TA command is equivalent to TRACE ACTIVE.

Example

```
OUTPUT 718;"_TA;"
```

_TBL
Table or Trace

Syntax



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 TRCE.

If _TBL is set to 0, the trace result will be displayed. If _TBL is set to 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

xtc

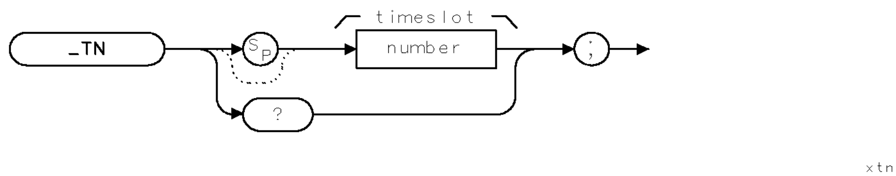
_TC copies the active trace from trace A into trace C. Trace A remains in the active mode, trace C is placed into the view mode (in the view mode, the trace is not updated). The _TC command is equivalent to TRACE COMPARE.

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 0 to 5. The default for _TN is 0.

Example

`OUTPUT 718;"MOV _TN,2;"` *Sets the slot number to 2.*

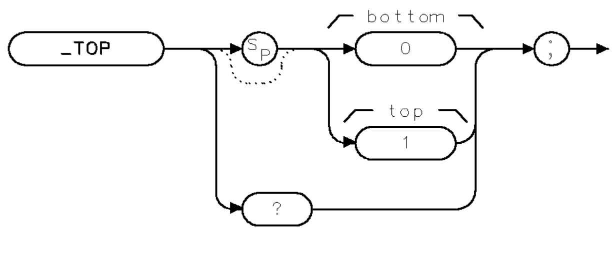
Query Example

`OUTPUT 718;"_TN?;"`

The query response will be a 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.

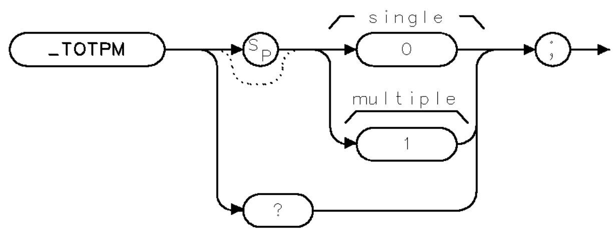
Query Example

OUTPUT 718;"_TOP?;"

The query response will be the current value of _TOP.

_TOTPM
Total Power Mode

Syntax



xtotpm

_TOTPM allows you to select the total power mode. The _TOTPM command is equivalent to selecting either SGL or MULT with TOTL PWR SGL MULT.

If _TOTPM is set to 0, the single carrier that is being measured determines the reference level setting. If _TOTPM is set to 1, the entered value for the total power (_TOTPWR) is used to set the reference level. The default value for _TOTPM is 0.

Example

`OUTPUT 718;"MOV _TOTPM,0;"` *Sets _TOTPM to a single carrier.*

Related Commands: _DEFAULT sets _TOTPM to 0.

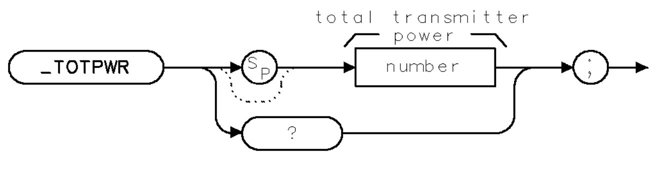
Query Example

`OUTPUT 718;"_TOTPM?;"`

The query response will be the current value of _TOTPM.

_TOTPWR
Total Power

Syntax



Allows you to enter the total RF power of the transmitters. The _TOTPWR command is equivalent to entering the power with TOTL PWR SGL MULT.

_TOTPWR can accept a real number from 0 to 60. The measurement unit is dBm. The default value for _TOTPWR is 50 dBm.

Example

`OUTPUT 718;"MOV _TOTPWR,30;"` *Sets the total power to +30 dBm.*

The entered value allows the spectrum analyzer to adjust the input attenuation automatically so that the spectrum analyzer is not driven into signal compression for signals with power levels less than the entered value.

Related Commands: _DEFAULT sets _TOTPWR to 50. _TOTPM selects the mode for the total power.

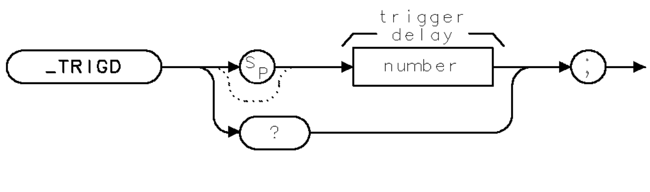
Query Example

`OUTPUT 718;"_TOTPWR?;"`

The query response will be the current setting for the total power.

_TRIGD
Trigger Delay

Syntax



Allows you to enter the delay time from the external trigger signal to the reference point of the burst. The _TRIGD variable is equivalent to TRIG DELAY.

If _FTACQ is set to 0, you can enter in an integer for trigger delay from −32,000 μs to 6,000 μs. If _FTACQ is set to 1, you can enter an integer for trigger delay from −32,000 μs to 3,400 μs. The measurement unit for _TRIGD is μs. If you do not enter a trigger delay, a default value of 0 μs is used. When TRIG SRC DD EXT is set to DD, use a value of 0. If TRIG SRC DD EXT is set to EXT, a positive value of trigger delay is usually required.

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: _TRIGSRC. _DEFAULT sets _TRIGD to 0.

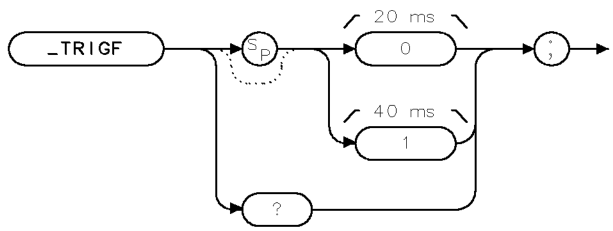
Query Example

`OUTPUT 718;"_TRIGD?;"`

The query response will be the current value of _TRIGD.

_TRIGF
Trigger Frame Period

Syntax



Allows you to specify if the mobile station uses a full-rate or half-rate speech codec.

The _TRIGF variable is equivalent to PERIOD 40ms 20ms. If the frame structure for the transmission is for a full-rate codec, you should ensure that _TRIGF is set to 0 (20 ms). If the frame structure is for a half-rate codec, you should ensure that _TRIGF is set to 1 (40 ms). The default value for _TRIGF is 0.

Note The above settings assume that the trigger period is the same as the RF burst period. If the external trigger period is 40 ms, but the RF burst period is 20 ms, set _TRIGF to 1. In this case, you must temporarily set _TRIGF to 0 for correct carrier off power measurements.

Example

`OUTPUT 718;"MOV _TRIGF,0;"` *Selects the 20 ms setting for _TRIGF.*

Related Commands: _TRIGSRC. _DEFAULT sets _TRIGF to 0.

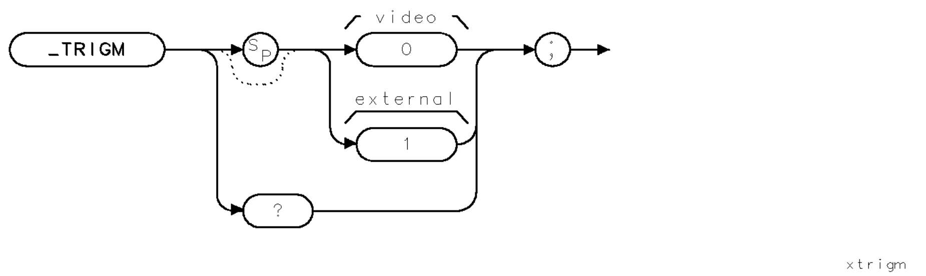
Query Example

`OUTPUT 718;"_TRIGF?;"`

The query response will be the current value of _TRIGF.

_TRIGM
Trigger Mode for Power Measurements

Syntax



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, _COPWR, or _STEP.

Related Commands: _DEFAULT sets _TRIGM to 0.

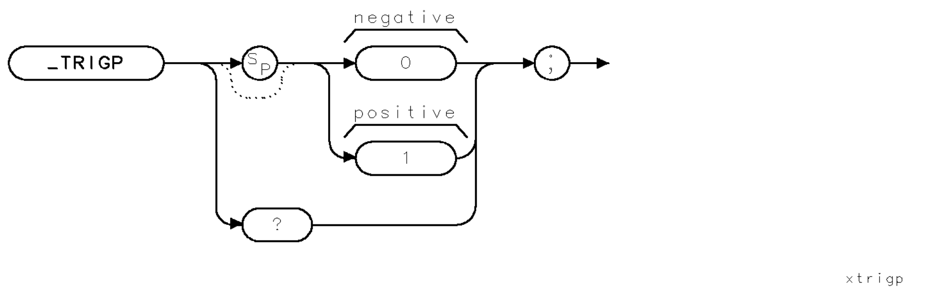
Query Example

`OUTPUT 718;"_TRIGM?;"`

The query response will be the current value of _TRIGM.

_TRIGP
Trigger Polarity

Syntax



Allows you to select the edge trigger polarity for the TTL trigger signal. The _TRIGP command is equivalent to TRIG POL NEG 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.

Example

`OUTPUT 718;"MOV _TRIGP,0;"` *Selects triggering on the negative edge of the external trigger signal.*

Related Commands: Setting _TRIGSRC to 1 sets _TRIGP to 1. _DEFAULT sets _TRIGP to 1.

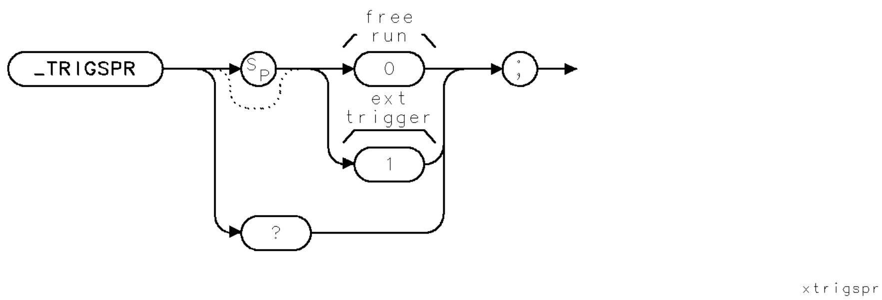
Query Example

```
OUTPUT 718;"_TRIGP?;"
```

The query response will be the current value of _TRIGP.

_TRIGSPR
Trigger Spurious

Syntax



Allows you to specify the source of trigger signals used for spurious emission measurements. The _TRIGSPR command is equivalent to `SPR TRIG EXT FREE`.

If _TRIGSPR is set to 1, the trigger mode is set to external mode. If _TRIGSPR is set to 0, the trigger mode is set to free run mode. The default value for _TRIGSPR is 0.

Example

`OUTPUT 718;"MOV _TRIGSPR,1;"`	*Set the trigger mode to external trigger. Set _TRIGSPR prior to executing _SPURZ, _SPUR.*

Related Commands: _SPUR, _SPURZ, _SPURZT.

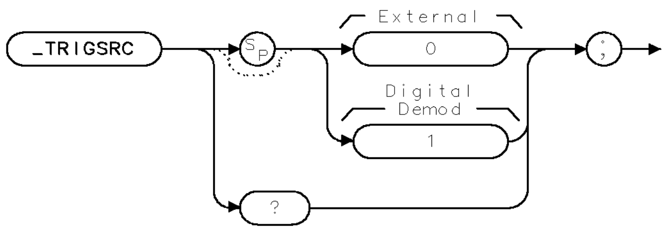
Query Example

```
OUTPUT 718;"_TRIGSPR?;"
```

The query response will be the current value of _TRIGSPR.

_TRIGSRC
Trigger Source

Syntax



Allows you to specify the source of trigger signals used for power versus time and gated ACP measurements. The _TRIGSRC command is equivalent to TRIG SRC DD 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 DD trigger source.*

Related Commands: _TRIGF, _TRIGP, _FTACQ. _DEFAULT sets _TRIGSRC to 1 if Options 151 and 160 are present, otherwise _TRIGSRC is set to 0.

Query Example

`OUTPUT 718;"_TRIGSRC?;"`

The query response will be the current value of _TRIGSRC.

Note With _TRIGSRC set to 1, you must connect a cable from the FRAME TRIG OUTPUT to the GATE TRIGGER INPUT on the analyzer rear panel.

8

Programming Examples

This chapter explains how the PDC measurements personality functions can be executed by using programming commands. When you use programming commands to operate the PDC measurements personality, you send instructions to the spectrum analyzer instead of pressing the softkeys. The instructions (also called programming commands) are usually sent to the spectrum analyzer with a computer. However, you can also execute instructions without a computer, as explained in this chapter.

Before you can program the spectrum analyzer, you must connect the spectrum analyzer to the computer. See the spectrum analyzer programmer's guide for more information.

All the examples in this chapter that use a computer (that is, contain line numbers or use `OUTPUT 718` or `OUTPUT @Sa`) are written in HP BASIC.

Accessing the PDC Analyzer Mode for Remote Operation

To use the PDC programming commands, the PDC measurements personality must be loaded into spectrum analyzer memory, and PDC analyzer mode must be selected.

To select the PDC 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 PDC 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 PDC analyzer mode before you can send any PDC 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

`OUTPUT 718;"IP;SNGLS;"`	*Does an instrument preset and places the spectrum analyzer in the single sweep mode.*
`OUTPUT 718;"MODE 10;"`	*Changes to the PDC mode.*
`OUTPUT 718;"TS;"`	*Performs a take sweep.*
`OUTPUT 718;"DONE?;"`	*DONE? returns a "1" when the MODE command and the take sweep command are completed.*
`ENTER 718;Done`	*Waits until a "1" is returned.*

Programming Basics for PDC Remote Operation

This section contains information about how to use the PDC programming commands. For more information about a specific command, refer to the description for the command in Chapter 7, “Programming Commands.”

This section contains the following procedures:

- Use the MOV command.
- Use the PDC setup and measurement commands.
- Use the _RPT command.
- Determine when a measurement is done.
- Use an external keyboard to enter programming commands.
- To use the EXECUTE TITLE softkey to enter commands.

Note The PDC programming commands and variables begin with an underscore (_), and spectrum analyzer programming commands do not. For example, _CH is a PDC programming command, and MOV is a spectrum analyzer programming command.

This guide contains information about the PDC programming commands. See the spectrum analyzer programmer’s guide 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 PDC command that can accept a value.

You are encouraged to use the MOV command when you need to move a value into a PDC 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 PDC setup and measurement commands

1. Execute the measurement's setup command.
2. Change the spectrum analyzer setting, as desired.
3. Execute the measurement's "measure" command.

Most of the PDC 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 PDC 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 7, "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 7, "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 GPIB/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 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 82335B GPIB Interface. 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 7, "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 (GPIB Interface), or Option 041 (GPIB and Parallel Interface), is installed.

Example

```
OUTPUT 718;"MOV _SRQ, 1;"            Enable SRQ measurement done indication
OUTPUT 718;"_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 C1405 Option 2 cable from the spectrum analyzer rear panel connection (marked EXT KEYBOARD) to the C1405 Option ABA keyboard.
3. Press (LINE) to turn on the spectrum analyzer, then press (MODE) `PDC 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 analyzers having Option 021, 023, or 024. Refer to the spectrum analyzer programmer's guide for more information about the different external keyboard functions.

Because you are not using an external computer, the PDC 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 85720C PDC measurements 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 PDC Personality

The PDC personality uses limits, parameters, and limit lines when performing the measurements. You can change the values of the limits, parameters, and limit lines so that the PDC 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.
- Create a limit-line function.
- Save the revised limit variables, parameter variables, or limit-line functions on a RAM card, using an external keyboard.
- Save the revised limit variables, parameter variables, or limit-line functions 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 PDC 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 7-2 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 _COXC,−50;"` *Changes the limit for carrier off power from its current value to −50 dB.*

If you use the VARDEF 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 _COXC,−50;"` *Changes the limit for carrier off power from its current value to −50 dB.*

The VARDEF command changes the PDC measurements personality that is currently in spectrum analyzer memory; the VARDEF command does not change the program on the 85720C memory card. If you reload the PDC measurements personality from the 85720C 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 PDC 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 7-2 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 PDC measurements personality that is currently in spectrum analyzer memory; the VARDEF command does not change the program on the 85720C memory card. If you reload the PDC measurements personality from the 85720C memory card, all the parameter variables are set to their default values.

To create a limit-line function

1. Use the FUNCDEF command to create a limit-line function.

   The power versus time burst, power versus time rising edge, and power versus time falling edge measurements each have a specific limit-line function definition (FUNCDEF) assigned to the measurement. (See Table 7-3 for a list of the limit-line function names.) When you use the FUNCDEF command to create a limit-line function, you are actually redefining the existing limit-line function that was created by the PDC measurements personality.

2. Use the LIMIDEL command to delete any current limit lines. See the spectrum analyzer programmer's guide for more information about the LIMIDEL command.

3. Enter the values for the new upper limit line into a trace.

   The values must be in display units. With an amplitude scale of 15 dB/div, there are −4000 to 8000 display units for the spectrum analyzer display, with −4000 representing the bottom graticule and 8000 representing the top graticule. A display unit is equal to 0.01 dB.

4. Move the contents of the trace into the upper limit line with the LIMIHI command.

   See the spectrum analyzer programmer's guide for more information about the LIMIHI command.

5. Repeat step 3, and then move the contents of the trace into the lower limit line with the LIMILO command.

   See the spectrum analyzer programmer's guide for more information about the LIMILO command.

6. Turn on limit-line testing with the LIMITEST command.

   See the spectrum analyzer programmer's guide for more information about the LIMITEST command.

7. End the FUNCDEF declaration.

The power versus time burst, power versus time rising edge, and power versus time falling edge measurements use and display an upper and a lower limit line as part of the measurement. You can change the position and shape of these limit lines by creating a limit-line function.

Once you have created a limit-line function, that function remains in use unless you reload the PDC measurements personality into spectrum analyzer memory.

Example 1

The following example shows you how you can create a limit-line function for changing the limit lines that are used in the power versus time burst measurement.

```
5810    ! PDC Power vs Time Burst Limits extended range
5811    !
5812    !  Notes:
5813    !  Horizontal: trace elements go from 1 thru 401.
5814    !  Vertical:  100 display units/dB, Ref Lvl = 8000, Bottom grat
5815    !             line for 10 dB/div = 0, for 15 dB/div = -4000.
5816    !  The mean of the burst is positioned 4dB below Ref Lvl =7600.
5817    !
5818    !  Swp Time = 8000 us, gives 20 us per trace element
5819    !  Sweep starts 20 us before start of 1st bit (with 0 trigger delay and
           opt 151)
5820    !
5821    !  The right limit lines are based upon normal or short burst.
5822    !  For 270 bit burst (_SYM=0) have shift of 0 trace elements.
5823    !  For 258 bit burst (_SYM=1) have shift of 14 trace elements.
5824    !
5825    !  Called by:  TOP
5826    !
5827    OUTPUT @Sa;"FUNCDEF _PBLIM,@";      ! limit line function name
5828    !
5829    OUTPUT @Sa;"LIMIDEL;";         ! delete existing limit lines
5830    OUTPUT @Sa;"{_Y=14*_SYM};";    ! calculate shift of right limit line
5831    !
5832    !  upper limit line
5833    !  calc vert position for absolute limit line segment.
5834    !  (_PRX default= -56 dBm)
5835    OUTPUT @Sa;"IF(_TOP&!_RNG);"; ! if TOP & 70 dB range
5836      OUTPUT @Sa;"_X1000;";        ! line at 7th graticule position
5837    OUTPUT @Sa;"ELSE ";            ! else 110 dB range or BOT 70 dB
5838      OUTPUT @Sa;"{_X=100*(80+_PRX-RL)};"; ! calc dynamic posn 1st & 5th seg
5839      OUTPUT @Sa;"{_Z=5600-4000*_TOP};";   ! calc posn 2nd & 4th  seg
5840    OUTPUT @Sa;"ENDIF;";
5841    !
5842    !  draw upper limit line in Trace A, then transfer to Limit Line Hi
5843    !  see calculation sheets for these:
5844    OUTPUT @Sa;"MOV TRA[1,29],_X;";          ! 1st horiz seg, calculated _X
5845    OUTPUT @Sa;"MOV TRA[30,33],_Z;";         ! 2nd seg, mean-60 dB
5846    OUTPUT @Sa;"MOV TRA[34,(369-_Y)],8020;"; ! 3rd seg, mean+4.2 dB
5847    OUTPUT @Sa;"MOV TRA[(370-_Y),(373-_Y)],_Z;"; ! 4th seg, mean-60 dB
5848    OUTPUT @Sa;"MOV TRA[(374-_Y),401],_X;";  ! 5th horiz seg, calculated _X
5849    OUTPUT @Sa;"LIMIHI TRA;";                ! transfer TRA to LIMIHI
5850    !
5851    !  lower limit line
5852    !  draw lower limit line in Trace A, then transfer to Limit Line Lo
5853    OUTPUT @Sa;"MOV TRA[1,40],-8000;";       ! 1st horiz seg, off screen
5854    OUTPUT @Sa;"MOV TRA[41,(360-_Y)],6200;"; ! 2nd horiz seg, mean-14 dB
5855    OUTPUT @Sa;"MOV TRA[(361-_Y),401],-8000;"; ! 3rd horiz seg, off screen
5856    OUTPUT @Sa;"LIMILO TRA;";                ! transfer  TRA to LIMILO
5857    OUTPUT @Sa;"LIMITEST1;";                 ! turn on Limit Test
5858    OUTPUT @Sa;"@;";
5859    !
```

Example 2

The following example shows you how you can create a limit-line function for changing the limit lines that are used in the power versus time rising measurement.

```
5991    ! PDC Power vs Time Rising edge Limits extended range
5992    !
5993    !  Notes:
5994    !  Horizontal: trace elements go from 1 thru 401.
5995    !  Vertical:  100 display units/dB, Ref Lvl = 8000, Bottom grat
5996    !             line for 10 dB/div = 0, for 15 dB/div = -4000.
5997    !  The mean of the burst is positioned 4dB below Ref Lvl =7600.
5998    !
5999    !  Swp Time = 640 us, gives 1.6 us per trace element
6000    !  Sweep starts 1.6 us before start of 1st bit (with 0 trigger delay and
           opt 151)
6001    !
6002    !  Called by: TOP
6003    !
6004    OUTPUT @Sa;"FUNCDEF _PRLIM,@";       ! limit line function name
6005    !
6006    OUTPUT @Sa;"LIMIDEL;";        ! delete existing limit lines
6007    !  upper limit line
6008    !  calc vert position for absolute limit line segment.
6009    !  (_PRX default = -56 dBm)
6010    OUTPUT @Sa;"IF(_TOP&!_RNG);";       ! if TOP & 70 dB range
6011      OUTPUT @Sa;"_X1000;";              ! line at 7th graticule position
6012    OUTPUT @Sa;"ELSE ";                  ! else 110 dB range or BOT 70 dB
6013      OUTPUT @Sa;"{_X=100*(80+_PRX-RL)};";  ! calc dynamic posn for 1st seg
6014      OUTPUT @Sa;"{_Z=5600-4000*_TOP};";    ! calc posn for 2nd seg
6015    OUTPUT @Sa;"ENDIF;";
6016    !
6017    !  draw upper limit line in Trace, then transfer to Limit Line Hi
6018    OUTPUT @Sa;"MOV TRA[1,81],_X;";      ! 1st horiz seg, calculated _X
6019    OUTPUT @Sa;"MOV TRA[82,126],_Z;";    ! 2nd horiz seg, calculated _Z
6020    OUTPUT @Sa;"MOV TRA[127,401],8020;"; ! 3rd horiz seg, mean+4.2 dB
6021    OUTPUT @Sa;"LIMIHI TRA;";            ! transfer TRA to LIMIHI
6022    !
6023    !  lower limit line
6024    !  draw lower limit line in Trace, then transfer to Limit Line Lo
6025    OUTPUT @Sa;"MOV TRA[1,215],-8000;";  ! 1st horiz segment, off screen
6026    OUTPUT @Sa;"MOV TRA[216,401],6200;"; ! 2nd horiz segment, mean-14 dB
6027    OUTPUT @Sa;"LIMILO TRA;";            ! transfer TRA to LIMILO
6028    OUTPUT @Sa;"LIMITEST1;";             ! turn on Limit Test
6029    OUTPUT @Sa;"@;";
6030    !
```

Example 3

The following example shows you how you can create a limit-line function for changing the limit lines that are used in the power versus time falling measurement.

```
6143    ! PDC Power vs Time Falling edge Limits extended range
6144    !
6145    !  Notes:
6146    !  Horizontal: trace elements go from 1 thru 401.
6147    !  Vertical:  100 display units/dB, Ref Lvl = 8000, Bottom grat
6148    !             line for 10 dB/div = 0, for 15 dB/div = -4000.
6149    !  The mean of the burst is positioned 4dB below Ref Lvl =7600.
6150    !
6151    !  Swp Time = 640 us, gives 1.6 us per trace element
6152    !
6153    !
6154    !  Called by: TOP
6155    !
6156    OUTPUT @Sa;"FUNCDEF _PFLIM,@";       ! USER DOCUMENTED !
6157    !
6158    OUTPUT @Sa;"LIMIDEL;";       ! delete existing limit lines
6159    !  upper limit line
6160    !  calc vert position for absolute limit line segment.
6161    !  (_PRX default + -56 dBm)
6162    OUTPUT @Sa;"IF(_TOP&!_RNG);";   ! if TOP & 70 dB range
6163      OUTPUT @Sa;"_X1000;";          ! line at 7th graticule position
6164    OUTPUT @Sa;"ELSE ";              ! else 110 dB range or BOT 70 dB
6165      OUTPUT @Sa;"{_X=100*(80+_PRX-RL)};"; ! calc dynamic posn for 3rd seg
6166      OUTPUT @Sa;"{_Z=5600-4000*_TOP};";   ! calc posn for 2nd seg
6167    OUTPUT @Sa;"ENDIF;";
6168    !
6169    !  draw upper limit line in Trace A, then transfer to Limit Line Hi
6170    OUTPUT @Sa;"MOV TRA[1,275],8020;";     ! 1st horiz segment, mean+4.2 dB
6171    OUTPUT @Sa;"MOV TRA[276,320],_Z;";     ! 2nd horiz seg, calc _Z
6172    OUTPUT @Sa;"MOV TRA[321,401],_X;";     ! 3rd horiz seg, calc _X
6173    !
6174    OUTPUT @Sa;"LIMIHI TRA;";              ! transfer TRA to LIMIHI
6175    !  lower limit line
6176    !  draw lower limit line in Trace A, then transfer to Limit Line Lo
6177    OUTPUT @Sa;"MOV TRA[1,186],6200;";     ! 1st horiz segment, mean-14 dB
6178    OUTPUT @Sa;"MOV TRA[187,401],-8000;";  ! 2nd horiz seg, off screen
6179    OUTPUT @Sa;"LIMILO TRA;";              ! transfer TRA to LIMILO
6180    OUTPUT @Sa;"LIMITEST1;";               ! turn on Limit Test
6181    OUTPUT @Sa;"@;";
6182    !
```

To save limit variables, parameter variables, and limit-line 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 PDC personality and any other downloadable programs from analyzer memory by pressing (CONFIG) More 1 of 3 DISPOSE USER MEM DISPOSE USER MEM.
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, parameter variable, or limit-line function.
   - For a limit or parameter variable, type in "VARDEF," the name of the variable (see Table 7-2 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.
   - For a limit-line function, create the limit-line function. (See "To create a limit-line function" for information about how to create a limit-line function, but do not use the OUTPUT or PRINT statements to send the commands to the spectrum analyzer.) Repeat this step for each limit-line function that you want to define.
5. Type in "STOR d,'dLIMITS',*;" to store all the newly defined limits, parameters, and limit-line functions on the memory card. The limits, parameters, and limit-line functions will be stored in a file called "dLIMITS."
6. Load the personality into spectrum analyzer memory. See "Step 1. Load the PDC measurements personality" in Chapter 1, "Getting Started," for more information.
7. Remove the PDC 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 PDC measurements personality, the measurements personality uses default values for the limits, parameters, and limit-line functions. If you then load the dLIMITS file into spectrum analyzer memory, the personality will use the revised limit values, variable value, or limit-line function. The revised values and limit-line functions 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,27;
VARDEF _CPXL,24;
VARDEF _PBXU,6650;
VARDEF _PBXL,6400;
STOR d,'dLIMITS',*;
```

The previous command lines will change the antenna power high limit (_CPXU) to 27 dBm, change the antenna power low limit (_CPXL) to 24 dBm, change the power versus time burst width high limit (_PBXU) to 6650 μs and change the power versus time burst width low limit (_PBXL) to 6400 μs. The last line stores these limits on a RAM card with the file name "dLIMITS."

To save limit variables, parameter variables, and limit-line 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 PDC personality and any other downloadable programs from analyzer memory with the DISPOSE ALL command.
3. Type in the programming statements that define the limit, parameter, or limit-line function.
   - 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 7-2 for a complete list of limits and parameter variables. Repeat this step for each variable you want to define.
   - For a limit-line function, create the limit-line function. (See "To create a limit-line function" for information about how to create a limit-line function.) Repeat this step for each limit-line function that 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 or limit-line functions on the memory card. The variables and limit-line function will be stored in a file called "dLIMITS."
5. Load the personality into spectrum analyzer memory.
6. Remove the PDC 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 PDC measurements personality, the measurements personality uses default values for the limit and parameter variables and the limit-line functions. If you then load the dLIMITS file into spectrum analyzer memory, the personality will use the revised limit or parameter values or limit-line functions. The revised values or limit-line functions 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 PDC DLP. This card file can then be loaded after
40    !loading PDC.
50    !
60    ASSIGN @Sa TO 718                !i/o path to spectrum analyzer
70    !
80    !
90    OUTPUT @Sa;"IP;SNGLS;"
100   OUTPUT @Sa;"TS;DONE?"
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,27;"  ! change antenna pwr high limit to 27 dBm
140   OUTPUT @Sa;"VARDEF _CPXL,24;"  ! change antenna pwr low limit to 24 dBm
150   !
160   OUTPUT @Sa;"VARDEF _PBXH,6650;"  ! change burst width hi limit to 6650 us
170   OUTPUT @Sa;"VARDEF _PBXL,6400;"  ! change burst width lo limit to 6400 us
180   !
190   OUTPUT @Sa;"STOR d,'dLIMITS',*;" ! store to RAM memory card
200   OUTPUT @Sa;"CONTS;"   ! continuous sweep
210   DISP "DONE"
220   !
230   END
```

Remote Measurements

This section contains programming examples that show you how to do the following measurements remotely:

- Select base or mobile station configuration
- Select a channel with the auto channel command
- Measure the antenna power
- Measure the carrier off leakage power
- Measure the occupied bandwidth
- Measure the adjacent channel power of a base station
- Measure the adjacent channel power of a mobile station
- Measure the channel power
- Measure a frame
- Measure a burst
- Measure a rising edge
- Measure a falling edge
- Measure the transmitter intermodulation spurious emissions
- Measure spurious emissions over a specific frequency range
- Measure transmit (TX) band spurious and harmonic emissions
- Monitor a band
- Measure the demodulated data bits
- Measure the I-Q pattern
- Measure the eight-point constellation
- Measure the modulation accuracy
- Measure the modulation accuracy using averaging
- Display digital demodulator status
- Run a test executive with multiple tests in fast mode

To select base or mobile station configuration

This example shows how you can use the PDC programming command _MS for selecting either a base or mobile station configuration.

```
10    !re-store "MS_EX"
20    !Shows how to use the _MS command in the PDC DLP
30    !
40    REAL Meas_state          !measurement state variable
50    !
60    ASSIGN @Sa TO 718        !i/o path to spectrum analyzer
70    !
80    OUTPUT @Sa;"MOV _MS,1;"  !set config for Mobile Station
90    REPEAT
100     ENTER @Sa;Meas_state   !enter measurement state
110   UNTIL Meas_state>0 AND Meas_state<5
120   !
121   IF Meas_state=1 THEN
122     DISP "Done"
123   ELSE
140     DISP "Options missing for MS tests"
150   END IF
160   !
170   END
```

To select a channel with the auto channel command

This example shows how you can use the PDC programming command _ACH for selecting a channel.

```
10    !re-store "ACH_EX"
20    !Shows how to use the _ACH command in the PDC 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 spectrum analyzer
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 PDC programming commands to measure the antenna power and get the value for mean carrier power.

```
10    !re-store "CPWR_EX"
20    !Shows how to use the _CPWR command in the PDC DLP
30    !
40    !
50    INTEGER Fail_flag                !measurement result fail flag
60    !
70    REAL Meas_state                  !measurement state variable
80    REAL Mean_pwr_dbm                !mean carrier power variable, dBm
90    REAL Mean_pwr_watts              !mean carrier power variable, watts
100   !
110   ASSIGN @Sa TO 718                !i/o path to spectrum analyzer
120   !
130   !
140   OUTPUT @Sa;"MOV _DPF,1;"         !turn on pass/fail reporting
150   !
160   OUTPUT @Sa;"_CPWR;"              !execute Carrier Power measurement
170   REPEAT
180     ENTER @Sa;Meas_state           !enter measurement state
190   UNTIL Meas_state>0 AND Meas_state<6
200   !
210   IF Meas_state=1 THEN             !measurement completed
220     PRINT "CARRIER POWER: ";
230     OUTPUT @Sa;"_NUMF?;"           !query measurement fail flag
240     ENTER @Sa;Fail_flag            !enter value
250     SELECT Fail_flag
260     CASE 0
270       PRINT "PASSED"
280     CASE 1
290       PRINT "FAILED LOWER LIMIT"
300     CASE 2
310       PRINT "FAILED UPPER LIMIT"
320     END SELECT
330     OUTPUT @Sa;"_CPA?;"            !query mean power value, dBm
340     ENTER @Sa;Mean_pwr_dbm         !enter value
350     OUTPUT @Sa;"_CPW?;"            !query mean power value, watts
360     ENTER @Sa;Mean_pwr_watts       !enter value
370     PRINT
380     PRINT "Mean On Power= ";Mean_pwr_dbm;"dBm, ";Mean_pwr_watts;"watts"
390   ELSE
400     DISP "Measurement aborted"
410   END IF
420   !
430   END
```

To measure the carrier off leakage power

This example shows how you can use the PDC programming commands to measure the antenna power and get the values for the mean and peak carrier off power.

```
10    !re-store "COPWR_EX"
20    !shows how to use the _COPWR command in the PDC DLP
30    !
40    REAL Meas_state                 !measurement state variable
50    REAL Mean_off_pwr               !mean carrier off power variable
60    REAL Off_pwr_rel                !carrier off power variable (relative
61                                    !to last antenna power measurement)
70    !
80    ASSIGN @Sa TO 718               !i/o path to spectrum analyzer
90    !
100   !
110   OUTPUT @Sa;"_COPWR;"            !execute Carrier OFF Power measurement
120   REPEAT
130     ENTER @Sa;Meas_state          !enter measurement state
140   UNTIL Meas_state>0 AND Meas_state<6
150   !
160   IF Meas_state=1 THEN            !measurement completed
170     PRINT "CARRIER OFF POWER: ";
180     OUTPUT @Sa;"_COA?;"           !query mean carrier off power value
190     ENTER @Sa;Mean_off_pwr        !enter value
200     OUTPUT @Sa;"_COAC?;"          !query carrier off power (relative)
210     ENTER @Sa;Off_pwr_rel         !enter value
220     PRINT
230     PRINT "Mean Off Power= ";Mean_off_pwr;" dBm"
240     PRINT "Off Power (relative)= ";Off_pwr_rel;" dB"
250   ELSE
260     DISP "Measurement aborted"
270   END IF
280   !
290   END
```

To measure the occupied bandwidth

This example shows how you can use the PDC programming commands to measure the occupied bandwidth.

```
10    !re-store "OBW_EX"
20    !Shows how to use the _OBW command in the PDC DLP
30    !
40    REAL Meas_state                  !measurement state variable
50    REAL Occ_bw                      !Occupied bandwidth variable
60    REAL Occ_bw_freq_err             !OBW frequency error variable
70    !
80    ASSIGN @Sa TO 718                !i/o path to spectrum analyzer
90    !
100   !
110   OUTPUT @Sa;"_OBW;"               !execute Occupied Bandwidth measurement
120   REPEAT
130     ENTER @Sa;Meas_state           !enter measurement state
140   UNTIL Meas_state>0 AND Meas_state<6
150   !
160   IF Meas_state=1 THEN
170     PRINT "OCCUPIED BANDWIDTH:";
180     OUTPUT @Sa;"_OBBW?;"           !query occupied bw value
190     ENTER @Sa;Occ_bw               !enter value
200     OUTPUT @Sa;"_OBFE?;"           !query occ. bw freq error value
210     ENTER @Sa;Occ_bw_freq_err      !enter value
220     PRINT
230     PRINT "Occupied Bandwidth= ";Occ_bw;"Hz"
240     PRINT "Occ. BW Freq Error= ";Occ_bw_freq_err;"Hz"
250   ELSE
260     DISP "Measurement aborted"
270   END IF
280   !
290   END
```

To measure the adjacent channel power of a base station (instrument firmware versions later than version 930506)

This example shows how you can use the PDC programming commands to measure the adjacent channel power of a base station, using instrument firmware later than (not including) version 930506. For firmware version 930506, see "To measure the adjacent channel power of a mobile station (instrument firmware version 930506)," later in this chapter.

```
10    !re-store "ACP_BS_EX"
20    !Shows how to use the _ACP command in the PDC DLP
30    !(for base stations)
40    !
50    INTEGER I,J             !loop counters
60    INTEGER Ch_num          !channel number variable
70    DIM Row$[20]            !row name
80    !
90    REAL Meas_state         !measurement state variable
100   REAL Acp_mod_abs(1:7)   !array to hold power due to modulation
110                           !(absolute, dBm)
120   REAL Acp_mod_ratio(1:7) !array to hold power due to modulation
130                           !(ratios, dB)
140   !
150   ASSIGN @Sa TO 718       !i/o path to spectrum analyzer
160   !
170   !
180   OUTPUT @Sa;"MOV _ACPMT,1;"  !set for normal ACP multi-channel sweep
190   !
200   OUTPUT @Sa;"_ACP;"          !execute Adjacent Ch. Power measurement
210   REPEAT
220     ENTER @Sa;Meas_state      !enter measurement state
230   UNTIL Meas_state>0 AND Meas_state<6
240   !
250   IF Meas_state=1 THEN         !measurement completed
260     PRINT "ADJACENT CHANNEL POWER: "
270     FOR I=1 TO 7
280       OUTPUT @Sa;"_ACPR[";I;"]?;"  !query power due to modulation
290       ENTER @Sa;Acp_mod_abs(I)     !enter value
300       Acp_mod_abs(I)=Acp_mod_abs(I)/10  !convert to dBm
310       OUTPUT @Sa;"_ACPRC[";I;"]?;"      !query power due to modulation
320       ENTER @Sa;Acp_mod_ratio(I)        !enter value
330       Acp_mod_ratio(I)=Acp_mod_ratio(I)/10  !convert to dB
340     NEXT I
350 Fmt_db:  IMAGE 16A,2X,3D.D," dB",6X,3D.D," dB"
360 Fmt_dbm: IMAGE 16A,2X,3D.D," dBm",5X,3D.D," dBm"
370     PRINT
380     OUTPUT @Sa;"_CH?;"             !query channel number
390     ENTER @Sa;Ch_num               !enter value
400     PRINT "(Base channel";Ch_num;", Carrier power= ";Acp_mod_abs(7);"dBm)"
410     FOR I=1 TO 2
420       PRINT
430       IF I=1 THEN
440         PRINT "Leakage power due to modulation, ratio:"
450       ELSE
460         PRINT "Leakage power due to modulation, absolute:"
470       END IF
480       PRINT "Channel:             Lower        Upper"
490       PRINT "----------------------------------------"
500       FOR J=1 TO 3 STEP 2
510         IF J=1 THEN Row$="Adjacent"
520         IF J=3 THEN Row$="Alternate"
530
540         IF I=1 THEN
550           PRINT USING Fmt_db;Row$,Acp_mod_ratio(J),Acp_mod_ratio(J+1)
560         ELSE
570           PRINT USING Fmt_dbm;Row$,Acp_mod_abs(J),Acp_mod_abs(J+1)
```

```
580        END IF
590      NEXT J
600    NEXT I
610  ELSE
620    DISP "Measurement aborted"
630  END IF
640  !
650  END
```

To measure the adjacent channel power of a mobile station (instrument firmware versions later than version 930506)

This example shows how you can use the PDC programming commands to measure the adjacent channel power of a mobile station, using instrument firmware later than (not including) version 930506. For firmware version 930506, see "To measure the adjacent channel power of a mobile station (instrument firmware version 930506)," later in this chapter.

```
10    !re-store "ACP_MS_EX"
20    !Shows how to use the _ACP command in the PDC DLP
30    !(for mobile stations)
40    !
50    INTEGER I,J                      !loop counters
60    INTEGER Ch_num                   !channel number variable
70    !
80    DIM Row$[20]                     !row name
90    !
100   REAL Meas_state           !measurement state variable
110   REAL Acp_mod_abs(1:7)     !array to hold power due to modulation
120                             !(absolute, dBm)
130   REAL Acp_imp_abs(1:7)     !array to hold power due to transients
140                             !(impulsive, absolute, dBm)
150   REAL Acp_tot_abs(1:7)     !array to hold power due to modulation
160                             !and transients (total, absolute, dBm)
170   REAL Acp_mod_ratio(1:7)   !array to hold power due to modulation
180                             !(ratios, dB)
190   REAL Acp_imp_ratio(1:7)   !array to hold power due to transients
200                             !(impulsive, ratios, dB)
210   REAL Acp_tot_ratio(1:7)   !array to hold power due to modulation
220                             !and transients (total, ratio, dB)
230   !
240   ASSIGN @Sa TO 718         !i/o path to spectrum analyzer
250   !
260   !
270   OUTPUT @Sa;"MOV _ACPMT,1;"  !set for normal ACP multi-channel sweep
280   !
290   OUTPUT @Sa;"_ACP;"          !execute Adjacent Ch. Power measurement
300   REPEAT
310     ENTER @Sa;Meas_state      !enter measurement state
320   UNTIL Meas_state>0 AND Meas_state<6
330   !
340   IF Meas_state=1 THEN        !measurement completed
350     PRINT "ADJACENT CHANNEL POWER: "
360     FOR I=1 TO 7
370       OUTPUT @Sa;"_ACPR[";I;"]?;"   !query power due to modulation,
380       ENTER @Sa;Acp_mod_abs(I)      !enter value
390       Acp_mod_abs(I)=Acp_mod_abs(I)/10   !convert to dBm
400       OUTPUT @Sa;"_ACPI[";I;"]?;"        !query pwr due to transients
410       ENTER @Sa;Acp_imp_abs(I)           !enter value
420       Acp_imp_abs(I)=Acp_imp_abs(I)/10   !convert to dBm
430       OUTPUT @Sa;"_ACPT[";I;"]?;"        !query power due to both
440       ENTER @Sa;Acp_tot_abs(I)           !enter value
450       Acp_tot_abs(I)=Acp_tot_abs(I)/10   !convert to dBm
460       OUTPUT @Sa;"_ACPRC[";I;"]?;"       !query pwr due to modulation
470       ENTER @Sa;Acp_mod_ratio(I)         !enter value
480       Acp_mod_ratio(I)=Acp_mod_ratio(I)/10  !convert to dB
490       OUTPUT @Sa;"_ACPIC[";I;"]?;"       !query pwr due to transients
500       ENTER @Sa;Acp_imp_ratio(I)         !enter value
510       Acp_imp_ratio(I)=Acp_imp_ratio(I)/10  !convert to dB
520       OUTPUT @Sa;"_ACPTC[";I;"]?;"       !query pwr due to both
530       ENTER @Sa;Acp_tot_ratio(I)         !enter value
540       Acp_tot_ratio(I)=Acp_tot_ratio(I)/10  !convert to dB
550     NEXT I
560 Fmt_db:  IMAGE 16A,2X,4D.D," dB",6X,4D.D," dB"
```

```
570 Fmt_dbm: IMAGE 16A,2X,3D.D," dBm",5X,3D.D," dBm"
580     PRINT
590     OUTPUT @Sa;"_CH?;"              !query channel number
600     ENTER @Sa;Ch_num                !enter value
610     PRINT "(Mobile channel";Ch_num;", Carrier power=
";Acp_mod_abs(7);"dBm)"
620     FOR I=1 TO 6
630       PRINT
640       SELECT I
650       CASE 1
660         PRINT "Leakage power due to modulation, ratio:"
670       CASE 2
680         PRINT "Leakage power due to transients, ratio:"
690       CASE 3
700         PRINT "Leakage power due to both mod. & trans., ratio:"
710       CASE 4
720         PRINT
730         PRINT "Leakage power due to modulation, absolute:"
740       CASE 5
750         PRINT "Leakage power due to transients, absolute:"
760       CASE 6
770         PRINT "Leakage power due to both mod. & trans., absolute:"
780       END SELECT
790       PRINT "Channel:             Lower        Upper"
800       PRINT "----------------------------------------"
810       FOR J=1 TO 3 STEP 2
820         IF J=1 THEN Row$="Adjacent"
830         IF J=3 THEN Row$="Alternate"
840
850         SELECT I
860         CASE 1
870           PRINT USING Fmt_db;Row$,Acp_mod_ratio(J),Acp_mod_ratio(J+1)
880         CASE 2
890           PRINT USING Fmt_db;Row$,Acp_imp_ratio(J),Acp_imp_ratio(J+1)
900         CASE 3
910           PRINT USING Fmt_db;Row$,Acp_tot_ratio(J),Acp_tot_ratio(J+1)
920         CASE 4
930           PRINT USING Fmt_dbm;Row$,Acp_mod_abs(J),Acp_mod_abs(J+1)
940         CASE 5
950           PRINT USING Fmt_dbm;Row$,Acp_imp_abs(J),Acp_imp_abs(J+1)
960         CASE 6
970           PRINT USING Fmt_dbm;Row$,Acp_tot_abs(J),Acp_tot_abs(J+1)
980         END SELECT
990       NEXT J
1000    NEXT I
1010  ELSE
1020    DISP "Measurement aborted"
1030  END IF
1040  !
1050  END
```

To measure the adjacent channel power of a base station (instrument firmware version 930506)

This example shows how you can use the PDC programming commands to measure the adjacent channel power of a base station, using instrument firmware version 930506.

```
10    !re-store "ACP_BS_EX_a"
20    !shows how to use the _ACP command in the JDC DLP
30    !(for base stations)
40    !
50    INTEGER I,J                     !loop counters
60    INTEGER Ch_num                  !channel number variable
70    DIM Row$[20]                    !row name
80    !
90    REAL Meas_state                 !measurement state variable
100   REAL Acp_mod_abs(1:7)           !array to hold power due to modulation
110                                   !(absolute, dBm)
120   REAL Acp_mod_ratio(1:7)         !array to hold power due to modulation
130                                   !(ratios, dB)
140   !
150   ASSIGN @Sa TO 718               !i/o path to spectrum analyzer
160   !
170   !
180   OUTPUT @Sa;"MOV _ACPMT,1;"      !set for normal ACP multi-channel sweep
190   !
200   OUTPUT @Sa;"_ACP;"              !execute Adjacent Ch. Power measurement
210   REPEAT
220     ENTER @Sa;Meas_state          !enter measurement state
230   UNTIL Meas_state>0 AND Meas_state<6
240   !
250   IF Meas_state=1 THEN            !measurement completed
260     PRINT "ADJACENT CHANNEL POWER: "
270     FOR I=1 TO 7
280       OUTPUT @Sa;"MOV _X,_ACPR[";I;"];"     !move into temp var _X
290       OUTPUT @Sa;"_X?;";                    !query power due to modulation
300       ENTER @Sa;Acp_mod_abs(I)              !enter value
310       Acp_mod_abs(I)=Acp_mod_abs(I)/10      !convert to dBm
320       OUTPUT @Sa;"MOV _X,_ACPRC[";I;"];"    !move into temp var _X
330       OUTPUT @Sa;"_X?;";                    !query power due to modulation
340       ENTER @Sa;Acp_mod_ratio(I)            !enter value
350       Acp_mod_ratio(I)=Acp_mod_ratio(I)/10  !convert to dB
360     NEXT I
370 Fmt_db:  IMAGE 16A,2X,4D.D," dB",6X,4D.D," dB"
380 Fmt_dbm: IMAGE 16A,2X,4D.D," dBm",5X,4D.D," dBm"
390     PRINT
400     OUTPUT @Sa;"_CH?;"            !query channel number
410     ENTER @Sa;Ch_num              !enter value
420     PRINT "(Base channel";Ch_num;", Carrier power= ";Acp_mod_abs(7);"dBm)"
430     FOR I=1 TO 2
440       PRINT
450       IF I=1 THEN
460         PRINT "Leakage power due to modulation, ratio:"
470       ELSE
480         PRINT "Leakage power due to modulation, absolute:"
490       END IF
```

```
500       PRINT "Channel:             Lower        Upper"
510       PRINT "----------------------------------------"
520       FOR J=1 TO 3 STEP 2
530         IF J=1 THEN Row$="Adjacent"
540         IF J=3 THEN Row$="Alternate"
560         IF I=1 THEN
570           PRINT USING Fmt_db;Row$,Acp_mod_ratio(J),Acp_mod_ratio(J+1)
580         ELSE
590           PRINT USING Fmt_dbm;Row$,Acp_mod_abs(J),Acp_mod_abs(J+1)
600         END IF
610       NEXT J
620     NEXT I
630   ELSE
640     DISP "Measurement aborted"
650   END IF
660   !
670   END
```

To measure the adjacent channel power of a mobile station (instrument firmware version 930506)

This example shows how you can use the PDC programming commands to measure the adjacent channel power of a mobile station, using instrument firmware version 930506.

```
10    !re-store "ACP_MS_EX_a"
20    !shows how to use the _ACP command in the JDC DLP
30    !(for mobile stations)
40    !
50    INTEGER I,J                     !loop counters
60    INTEGER Ch_num                  !channel number variable
70    !
80    DIM Row$[20]                    !row name
90    !
100   REAL Meas_state                 !measurement state variable
110   REAL Acp_mod_abs(1:7)           !array to hold power due to modulation
120                                   !(absolute, dBm)
130   REAL Acp_imp_abs(1:7)           !array to hold power due to transients
140                                   !(impulsive, absolute, dBm)
150   REAL Acp_tot_abs(1:7)           !array to hold power due to modulation
160                                   !and transients (total, absolute, dBm)
170   REAL Acp_mod_ratio(1:7)         !array to hold power due to modulation
180                                   !(ratios, dB)
190   REAL Acp_imp_ratio(1:7)         !array to hold power due to transients
200                                   !(impulsive, ratios, dB)
210   REAL Acp_tot_ratio(1:7)         !array to hold power due to modulation
220                                   !and transients (total, ratio, dB)
230   !
240   ASSIGN @Sa TO 718               !i/o path to spectrum analyzer
250   !
260   !
270   OUTPUT @Sa;"MOV _ACPMT,1;"      !set for normal ACP multi-channel sweep
280   !
290   OUTPUT @Sa;"_ACP;"              !execute Adjacent Ch. Power measurement
300   REPEAT
310     ENTER @Sa;Meas_state          !enter measurement state
320   UNTIL Meas_state>0 AND Meas_state<6
330   !
340   IF Meas_state=1 THEN            !measurement completed
350     PRINT "ADJACENT CHANNEL POWER: "
360     FOR I=1 TO 7
370       OUTPUT @Sa;"MOV _X,_ACPR[";I;"];"     !move into temp var _X
380       OUTPUT @Sa;"_X?;";                     !query power due to modulation,
390       ENTER @Sa;Acp_mod_abs(I)               !enter value
400       Acp_mod_abs(I)=Acp_mod_abs(I)/10       !convert to dBm
410       OUTPUT @Sa;"MOV _X,_ACPI[";I;"];"     !move into temp var _X
420       OUTPUT @Sa;"_X?;";                     !query pwr due to transients
430       ENTER @Sa;Acp_imp_abs(I)               !enter value
440       Acp_imp_abs(I)=Acp_imp_abs(I)/10       !convert to dBm
450       OUTPUT @Sa;"MOV _X,_ACPT[";I;"];"     !move into temp var _X
460       OUTPUT @Sa;"_X?;";                     !query power due to both
470       ENTER @Sa;Acp_tot_abs(I)               !enter value
480       Acp_tot_abs(I)=Acp_tot_abs(I)/10       !convert to dBm
490       OUTPUT @Sa;"MOV _X,_ACPRC[";I;"];"    !move into temp var _X
500       OUTPUT @Sa;"_X?;";                     !query pwr due to modulation
510       ENTER @Sa;Acp_mod_ratio(I)             !enter value
520       Acp_mod_ratio(I)=Acp_mod_ratio(I)/10   !convert to dB
530       OUTPUT @Sa;"MOV _X,_ACPIC[";I;"];"    !move into temp var _X
540       OUTPUT @Sa;"_X?;";                     !query pwr due to transients
550       ENTER @Sa;Acp_imp_ratio(I)             !enter value
560       Acp_imp_ratio(I)=Acp_imp_ratio(I)/10   !convert to dB
570       OUTPUT @Sa;"MOV _X,_ACPTC[";I;"];"    !move into temp var _X
580       OUTPUT @Sa;"_X?;";                     !query pwr due to both
590       ENTER @Sa;Acp_tot_ratio(I)             !enter value
```

```
600       Acp_tot_ratio(I)=Acp_tot_ratio(I)/10  !convert to dB
610     NEXT I
620 Fmt_db:  IMAGE 16A,2X,4D.D," dB",6X,4D.D," dB"
630 Fmt_dbm: IMAGE 16A,2X,4D.D," dBm",5X,4D.D," dBm"
640     PRINT
650     OUTPUT @Sa;"_CH?;"             !query channel number
660     ENTER @Sa;Ch_num               !enter value
670     PRINT "(Mobile channel";Ch_num;", Carrier power=
        ";Acp_mod_abs(7);"dBm)"
680     FOR I=1 TO 6
690       PRINT
700       SELECT I
710       CASE 1
720         PRINT "Leakage power due to modulation, ratio:"
730       CASE 2
740         PRINT "Leakage power due to transients, ratio:"
750       CASE 3
760         PRINT "Leakage power due to both mod. & trans., ratio:"
770       CASE 4
780         PRINT
790         PRINT "Leakage power due to modulation, absolute:"
800       CASE 5
810         PRINT "Leakage power due to transients, absolute:"
820       CASE 6
830         PRINT "Leakage power due to both mod. & trans., absolute:"
840       END SELECT
850       PRINT "Channel:             Lower        Upper"
860       PRINT "-----------------------------------------"
870       FOR J=1 TO 3 STEP 2
880         IF J=1 THEN Row$="Adjacent"
890         IF J=3 THEN Row$="Alternate"
910         SELECT I
920         CASE 1
930           PRINT USING Fmt_db;Row$,Acp_mod_ratio(J),Acp_mod_ratio(J+1)
940         CASE 2
950           PRINT USING Fmt_db;Row$,Acp_imp_ratio(J),Acp_imp_ratio(J+1)
960         CASE 3
970           PRINT USING Fmt_db;Row$,Acp_tot_ratio(J),Acp_tot_ratio(J+1)
980         CASE 4
990           PRINT USING Fmt_dbm;Row$,Acp_mod_abs(J),Acp_mod_abs(J+1)
1000        CASE 5
1010          PRINT USING Fmt_dbm;Row$,Acp_imp_abs(J),Acp_imp_abs(J+1)
1020        CASE 6
1030          PRINT USING Fmt_dbm;Row$,Acp_tot_abs(J),Acp_tot_abs(J+1)
1040        END SELECT
1050      NEXT J
1060    NEXT I
1070  ELSE
1080    DISP "Measurement aborted"
1090  END IF
1100  !
1110  END
```

To measure the channel power

This example shows how you can use the PDC programming commands to measure the channel power.

```
10    !re-store "CHPWR_EX"
20    !Shows how to use the _CHPWR command in the PDC DLP
30    !
40    !
50    REAL Meas_state                   !measurement state variable
60    REAL Ch_pwr                       !channel power variable
70    !
80    ASSIGN @Sa TO 718                 !i/o path to spectrum analyzer
90    !
100   !
110   OUTPUT @Sa;"MOV _CH,23;"          !set to un-occupied channel
120   !
130   !Before executing _CHPWR, must set RL & AT correctly:
140   OUTPUT @Sa;"MOV RL,-20;"          !set RL to low level
150   OUTPUT @Sa;"MOV AT,10;"           !assume no other carriers incident
160   !
170   OUTPUT @Sa;"_CHPWR;"              !execute channel power measurement
180   REPEAT
190     ENTER @Sa;Meas_state            !enter measurement state
200   UNTIL Meas_state>0 AND Meas_state<2
210   !
220   PRINT "CHANNEL POWER:";
230   OUTPUT @Sa;"_CHPA?;"              !query channel power value
240   ENTER @Sa;Ch_pwr                  !enter value
250   PRINT
260   PRINT "Channel power= ";Ch_pwr;"dBm"
270   !
280   END
```

To measure a frame

This example shows how you can use the PDC programming commands to measure a frame from a mobile station.

```
10    !re-store "PFRAME_EX"
20    !Shows how to use the _PFRAME command in the PDC DLP
30    !
40    REAL Meas_state                 !measurement state variable
50    REAL Trace_array(1:401)         !array to hold analyzer trace
60    !
70    ASSIGN @Sa TO 718               !i/o path to spectrum analyzer
80    !
90    !
100   OUTPUT @Sa;"TDF P;"             !set analyzer trace data format
110   !
120   OUTPUT @Sa;"_PFRAME;"           !execute P vs T Frame measurement
130   REPEAT
140     ENTER @Sa;Meas_state          !enter measurement state
150   UNTIL Meas_state>0 AND Meas_state<6
160   !
170   IF Meas_state=1 THEN
180     PRINT "POWER vs TIME"
190     OUTPUT @Sa;"TRA?;"            !query trace A
200     ENTER @Sa;Trace_array(*)      !enter trace
210     PRINT
220     PRINT "Amplitude value for 50th element of trace A=
        ";Trace_array(50);" dBm"
230   ELSE
240     DISP "Measurement aborted"
250   END IF
260   !
270   END
```

To measure a burst

This example shows how you can use the PDC programming commands to measure a burst from a mobile station.

```
10    !re-store "PBURST_EX"
20    !Shows how to use the _PBURST command in the PDC DLP
30    !
40    INTEGER Limi_fail_flag           !limit line fail flag
50    !
60    REAL Meas_state                  !measurement state variable
70    REAL Burst_width                 !carrier burst width variable
80    REAL Trace_array(1:401)          !array to hold analyzer trace
90    !
100   ASSIGN @Sa TO 718                !i/o path to spectrum analyzer
110   !
120   !
130   OUTPUT @Sa;"TDF P;"              !set analyzer trace data format
140   !
150   OUTPUT @Sa;"_PBURST;"            !execute Power vs Time Burst measurement
160   REPEAT
170     ENTER @Sa;Meas_state           !enter measurement state
180   UNTIL Meas_state>0 AND Meas_state<6
190   !
200   IF Meas_state=1 THEN
210     PRINT "POWER vs TIME"
220     OUTPUT @Sa;"LIMIFAIL?;"
230     ENTER @Sa;Limi_fail_flag
240     PRINT "LIMIT LINE: ";
250     SELECT Limi_fail_flag
260     CASE 0
270       PRINT "PASSED"
280     CASE 1
290       PRINT "FAILS LOWER LIMIT"
300     CASE 2
310       PRINT "FAILS UPPER LIMIT"
320     CASE 3
330       PRINT "FAILS UPPER & LOWER LIMITS"
340     END SELECT
350     PRINT "BURST WIDTH: ";
360     OUTPUT @Sa;"_PBT?;"            !query carrier burst width value
370     ENTER @Sa;Burst_width          !enter value
380     OUTPUT @Sa;"TRA?;"             !query trace A
390     ENTER @Sa;Trace_array(*)       !enter trace
400     PRINT
410     PRINT "Burst width= ";Burst_width;" usec"
420     PRINT "Amplitude value for 200th element of trace A=
        ";Trace_array(200);" dBm"
430   ELSE
440     DISP "Measurement aborted"
450   END IF
460   !
470   END
```

To measure a rising edge

This example shows how you can use the PDC programming commands to measure a rising edge from a mobile station.

```
10    !re-store "PRISE_EX"
20    !Shows how to use the _PRISE command in the PDC DLP
30    !
40    INTEGER Limi_fail_flag           !limit line fail flag
50    !
60    REAL Meas_state                  !measurement state variable
70    REAL Rise_time                   !burst rise time variable
80    REAL Trace_array(1:401)          !array to hold analyzer trace
90    !
100   ASSIGN @Sa TO 718                !i/o path to spectrum analyzer
110   !
120   !
130   OUTPUT @Sa;"TDF P;"              !set analyzer trace data format
140   !
150   OUTPUT @Sa;"_PRISE;"             !execute P vs T Rise time measurement
160   REPEAT
170     ENTER @Sa;Meas_state           !enter measurement state
180   UNTIL Meas_state>0 AND Meas_state<6
190   !
200   IF Meas_state=1 THEN
210     PRINT "POWER vs TIME"
220     OUTPUT @Sa;"LIMIFAIL?;"
230     ENTER @Sa;Limi_fail_flag
240     PRINT "LIMIT LINE: ";
250     SELECT Limi_fail_flag
260     CASE 0
270       PRINT "PASSED"
280     CASE 1
290       PRINT "FAILS LOWER LIMIT"
300     CASE 2
310       PRINT "FAILS UPPER LIMIT"
320     CASE 3
330       PRINT "FAILS UPPER & LOWER LIMIT"
340     END SELECT
350     PRINT "RISE TIME: ";
360     OUTPUT @Sa;"_PATT?;"           !query rise (attack) time value
370     ENTER @Sa;Rise_time            !enter value
380     OUTPUT @Sa;"TRA?;"             !query trace A
390     ENTER @Sa;Trace_array(*)       !enter trace
400     PRINT
410     PRINT "Rise time= ";Rise_time;" usec"
420     PRINT "Amplitude value for 300th element of trace A=
        ";Trace_array(300);" dBm"
430   ELSE
440     DISP "Measurement aborted"
450   END IF
460   !
470   END
```

To measure a falling edge

This example shows how you can use the PDC programming commands to measure a falling edge from a mobile station.

```
10    !re-store "PFALL_EX"
20    !Shows how to use the _PFALL command in the PDC DLP
30    !
40    INTEGER Limi_fail_flag           !limit line fail flag
50    !
60    REAL Meas_state                  !measurement state variable
70    REAL Fall_time                   !burst fall time variable
80    REAL Trace_array(1:401)          !array to hold analyzer trace
90    !
100   ASSIGN @Sa TO 718                !i/o path to spectrum analyzer
110   !
120   !
130   OUTPUT @Sa;"TDF P;"              !set analyzer trace data format
140   !
150   OUTPUT @Sa;"_PFALL;"             !execute P vs T Fall time measurement
160   REPEAT
170     ENTER @Sa;Meas_state           !enter measurement state
180   UNTIL Meas_state>0 AND Meas_state<6
190   !
200   IF Meas_state=1 THEN
210     PRINT "POWER vs TIME"
220     OUTPUT @Sa;"LIMIFAIL?;"
230     ENTER @Sa;Limi_fail_flag
240     PRINT "LIMIT LINE: ";
250     SELECT Limi_fail_flag
260     CASE 0
270       PRINT "PASSED"
280     CASE 1
290       PRINT "FAILS LOWER LIMIT"
300     CASE 2
310       PRINT "FAILS UPPER LIMIT"
320     CASE 3
330       PRINT "FAILS UPPER & LOWER LIMITS"
340     END SELECT
350     PRINT "FALL TIME: ";
360     OUTPUT @Sa;"_PRET?;"           !query fall (release) time value
370     ENTER @Sa;Fall_time            !enter value
380     OUTPUT @Sa;"TRA?;"             !query trace A
390     ENTER @Sa;Trace_array(*)       !enter trace
400     PRINT
410     PRINT "Fall time= ";Fall_time;" usec"
420     PRINT "Amplitude value for 300th element of trace A=
        ";Trace_array(300);" dBm"
430   ELSE
440     DISP "Measurement aborted"
450   END IF
460   !
470   END
```

To measure transmitter intermodulation spurious emissions

This example shows how you can use the PDC programming commands to measure the transmitter intermodulation spurious emissions from a base station.

```
10    !re-store "IMDTRANS_EX"
20    !shows how to use the _IMDTRANS command in the PDC DLP
30    !
40    REAL Meas_state                 !measurement state variable
50    REAL Prod_pwr_abs               !mean imd product power variable
60    REAL Prod_pwr_rel               !mean imd product power variable
70                                    !(relative to last antenna power
80                                    !measurement)
90    !
100   ASSIGN @Sa TO 718               !i/o path to spectrum analyzer
110   !
120   OUTPUT @Sa;"MOV _ISGF,1;"       !set for sig. gen. above carrier
130   OUTPUT @Sa;"MOV _ISPAC,600E3;"  !set spacing for 600 KHz
140   OUTPUT @Sa;"MOV _IRBW,30E3;"    !set measurement rbw to 30 KHz
150   !
160   OUTPUT @Sa;"_IMDTRANS;"         !execute Transmitter Intermod measurement
170   REPEAT
180     ENTER @Sa;Meas_state          !enter measurement state
190   UNTIL Meas_state>0 AND Meas_state<4
200   !
210   IF Meas_state=1 THEN            !measurement completed
220     PRINT "TRANSMITTER INTERMODULATION: ";
230     OUTPUT @Sa;"_SEA?;"           !query mean imd product power value
240     ENTER @Sa;Prod_pwr_abs        !enter value
250     OUTPUT @Sa;"_SEAC?;"          !query mean imd product power (relative)
260     ENTER @Sa;Prod_pwr_rel        !enter value
270     PRINT
280     PRINT "Mean Product Power= ";Prod_pwr_abs;" dBm"
290     PRINT "Mean Product Power (relative)= ";Prod_pwr_rel;" dB"
300   ELSE
310     DISP "Measurement aborted"
320   END IF
330   !
340   END
```

To measure spurious emissions over a specific frequency range

This example shows how you can use the PDC programming commands to measure spurious emissions over a specified frequency range.

```
10    !re-store "SPURZ_EX"
20    !shows how to use the _SPURZ command in the PDC DLP
40    !
50    INTEGER Cc                        !flag for continuous carrier
60    !
70    REAL Meas_state                   !measurement state variable
80    REAL Spur_pwr_abs                 !mean spur emission power variable
90    REAL Spur_pwr_rel                 !mean spur emission power variable
100                                     !(relative to last antenna power
110                                     !measurement)
120   !
130   ASSIGN @Sa TO 718                 !i/o path to spectrum analyzer
140   !
150   OUTPUT @Sa;"SNGLS;"               !control the sweep
160   OUTPUT @Sa;"_SPURSET;"            !setup for spurious emission search
170   OUTPUT @Sa;"TS;DONE?;"
180   ENTER @Sa;Done                    !wait 'til done
190   !
200   OUTPUT @Sa;"MOV RB,100E3;"        !use RBW for sufficient sensitivity
210   OUTPUT @Sa;"VB AUTO;"             !auto couple vid BW
220   OUTPUT @Sa;"ST AUTO;"             !auto couple sweep time
230   !
240   OUTPUT @Sa;"MOV FA,1870E6;"       !specify sweep range
250   OUTPUT @Sa;"MOV FB,1890E6;"
260   OUTPUT @Sa;"TS;DONE?;"
270   ENTER @Sa;Done
280   !
290   OUTPUT @Sa;"MKPK HI;"             !marker on highest signal
300   !
310   OUTPUT @Sa;"_CC?;"                !query cont carrier flag
320   ENTER @Sa;Cc                      !enter value
330   IF NOT Cc THEN                    !burst carrier
340     CALL Slow_sweep(@Sa)            !to guarantee spur capture
350     OUTPUT @Sa;"MOV ST,2;"          !use 2 sec for zoom to save time
360   END IF
370   !
380   OUTPUT @Sa;"_SPURZ;"              !execute spurious emission search
(zoom)
390                                     !measurement.
400   REPEAT
410     ENTER @Sa;Meas_state            !enter measurement state
420   UNTIL Meas_state>0 AND Meas_state<2
430   !
440   IF Meas_state=1 THEN              !measurement completed
450     OUTPUT @Sa;"CF?;"
460     ENTER @Sa;Cf
470     PRINT "SPURIOUS EMISSION: ";Cf/1.E+6;" MHz";
480     OUTPUT @Sa;"_SEA?;"             !query mean spur power value
490     ENTER @Sa;Spur_pwr_abs          !enter value
500     OUTPUT @Sa;"_SEAC?;"            !query mean spur power (relative)
510     ENTER @Sa;Spur_pwr_rel          !enter value
520     PRINT
530     PRINT "Spurious emission Power= ";Spur_pwr_abs;" dBm"
540     PRINT "Spurious emission Power (relative)= ";Spur_pwr_rel;" dB"
550   ELSE
560     DISP "Measurement aborted"
570   END IF
580   !
590   END
600   !
610   !
```

```
620 Slow_sweep:  SUB Slow_sweep(@Sa)
630   !
640   INTEGER Ms                        !flag for mobile
650   INTEGER Trigf                     !flag for carrier burst period value
660   REAL Span,Rbw,Trig_period
670   REAL Sweeptime,Marker,Limit
680   !
690   OUTPUT @Sa;"SP?;"                 !query span
700   ENTER @Sa;Span
710   OUTPUT @Sa;"RB?;"                 !query rbw
720   ENTER @Sa;Rbw
730   OUTPUT @Sa;"_TRIGF?;"             !query trigger period flag
740   ENTER @Sa;Trigf
750   IF Trigf=1 THEN
760     Trig_period=4.0E-2              !40 ms
770   ELSE
780     Trig_period=2.0E-2              !20 ms
790   END IF
800   Sweeptime=Trig_period*Span/Rbw
810   OUTPUT @Sa;"MOV ST,";Sweeptime;";"
820   OUTPUT @Sa;"TS;DONE?;"
830   ENTER @Sa;Done
840   OUTPUT @Sa;"MKPK HI;MKA?;"        !query marker
850   ENTER @Sa;Marker
860   OUTPUT @Sa;"_MS?;"                !query mobile flag
870   ENTER @Sa;Ms
880   IF Ms THEN
890     OUTPUT @Sa;"_SEXA?;"
900     ENTER @Sa;Limit                 !-36 dBm is default
910   ELSE
920     OUTPUT @Sa;"_SEXB?;"
930     ENTER @Sa;Limit                 !-26 dBm is default
940   END IF
950   IF Marker>Limit-5 THEN            !marker within 5dB of limit
960     IF Trigf THEN                   !40 ms burst period
970       OUTPUT @Sa;"MOV ST,16;"       !16 sec so 1 burst/bucket
980                                     !(.04 sec * 400 buckets)= 16 sec
990     ELSE
1000      OUTPUT @Sa;"MOV ST,8;"        !8 sec so 1 burst/bucket
1010    END IF
1020    OUTPUT @Sa;"TS;MKPK HI;DONE?;"
1030    ENTER @Sa;Done
1040  END IF
1050  !
1060  SUBEND
```

To measure TX band spurious and harmonic emissions

This example shows how you can use the PDC programming commands to measure spurious emissions at specific frequencies (1/2, 2nd., and 3rd. harmonics) and frequency ranges (transmit band).

```
10    !re-store "SPURH_EX"
20    !shows how to use the _SPURH command in the PDC DLP
30    !
40    INTEGER I                     ! loop counter
50    DIM Row$[30]                  ! row name
60    !
70    REAL Meas_state               ! measurement state variable
80    REAL Fund_pwr                 ! carrier, fundamental absolute power (dBm)
90    REAL Spur_pwr_abs(1:5)        ! array to hold absolute spur power (dBm)
100   REAL Spur_pwr_rel(1:5)        ! array to hold spur power relative to
110                                 ! fundamental power (dB)
120   !
130   ASSIGN @Sa TO 718             ! i/o path to spectrum analyzer
140   !
150   !
160   OUTPUT @Sa;"_SPURH;"          ! execute spur & harmonic measurement
170   REPEAT
180     ENTER @Sa;Meas_state        ! enter measurement state
190   UNTIL Meas_state>0 AND Meas_state<3
200   !
210   IF Meas_state=1 THEN            ! measurement completed
220     PRINT "Tx BAND SPURIOUS & HARMONICS:"
230     OUTPUT @Sa;"_SEFA?;"          ! query fundamental amplitude
240     ENTER @Sa;Fund_pwr            ! enter value
250     FOR I=1 TO 5
260       OUTPUT @Sa;"_SEAMP[";I;"]?;" ! query absolute spur power (dBm)
270       ENTER @Sa;Spur_pwr_abs(I)    ! enter value
280       Spur_pwr_abs(I)=Spur_pwr_abs(I)/10 ! convert to dBm
290       OUTPUT @Sa;"_SEAMPC[";I;"]?;"! query relative spur ppower (dB)
300       ENTER @Sa;Spur_pwr_rel(I)    ! enter value
310       Spur_pwr_rel(I)=Spur_pwr_rel(I)/10 ! convert to dB
320     NEXT I
330 Fmt_fund:  IMAGE 24A,2X,4D.D," dBm"
340 Fmt_spur:  IMAGE 24A,2X,4D.D," dBm",5X,4D.D," dB"
350     PRINT
360     PRINT "Frequency                  Absolute       Relative"
370     PRINT "--------------------------------------------------"
380     Row$="Fundamental:"
390     PRINT USING Fmt_fund;Row$,Fund_pwr
400     Row$="1/2 Sub-harmonic:"
410     PRINT USING Fmt_spur;Row$,Spur_pwr_abs(1),Spur_pwr_rel(1)
420     Row$="2nd Harmonic:"
430     PRINT USING Fmt_spur;Row$,Spur_pwr_abs(2),Spur_pwr_rel(2)
440     Row$="3rd Harmonic:"
450     PRINT USING Fmt_spur;Row$,Spur_pwr_abs(3),Spur_pwr_rel(3)
460     PRINT
470     Row$="Tx Band Below Carrier:"
480     PRINT USING Fmt_spur;Row$,Spur_pwr_abs(4),Spur_pwr_rel(4)
490     Row$="Tx Band Above Carrier:"
500     PRINT USING Fmt_spur;Row$,Spur_pwr_abs(5),Spur_pwr_rel(5)
510   ELSE
520     DISP "Measurement aborted"
530   END IF
540   !
550   END
```

To monitor a band

This example shows how you can use the PDC programming commands to monitor a band.

```
10    !re-store "MBND_EX"
20    !Shows how to use the _MBND command in the PDC DLP
30    !
40    REAL Meas_state                 !measurement state variable
50    !
60    REAL Trace_array(1:401)         !array to hold analyzer trace
70    !
80    ASSIGN @Sa TO 718               !i/o path to spectrum analyzer
90    !
100   !
110   OUTPUT @Sa;"TDF P;"             !set analyzer trace data format
120   !
130   OUTPUT @Sa;"_MBND;"             !execute Monitor Band command
140   REPEAT
150     ENTER @Sa;Meas_state          !enter measurement state
160   UNTIL Meas_state>0 AND Meas_state<2
170   !
180   OUTPUT @Sa;"TRA?;"              !query trace A
190   ENTER @Sa;Trace_array(*)        !enter trace
200   PRINT
210   PRINT "Maximum value of trace A= ";MAX(Trace_array(*));" dBm"
220   !
230   END
```

To measure the demodulated data bits

This example shows how you can use the PDC programming commands to measure the demodulated data bits.

```
10    !re-store "DATABITS_EX"
20    !shows how to use the _DATABITS command in the PDC DLP
30    !
40    INTEGER I                          ! loop counter
50    INTEGER Bits_array(1:280)          ! array to hold data bits
60    !
70    REAL Meas_state                    ! measurement state variable
80    !
90    ASSIGN @Sa TO 718                  ! i/o path to spectrum analyzer
100   !
110   !
120   OUTPUT @Sa;"MOV _ddCONT,0;"        ! single measurement
130   OUTPUT @Sa;"MOV _ddNOPRT,1;"       ! turn off printing bits on SA screen
140                                      ! (helps speed)
150   !
160   OUTPUT @Sa;"_DATABITS;"            ! execute Data Bits measurement
170   REPEAT
180      ENTER @Sa;Meas_state            ! enter measurement state
190   UNTIL Meas_state>0 AND Meas_state<31
200   !
210   IF Meas_state=1 THEN               ! measurement completed
220      PRINT "Demodulated Data:"
230      PRINT "-----------------"
240      PRINT
250      FOR I=1 TO 280
260         OUTPUT @Sa;"_BITS[";I;"]?;" ! query data bits
270         ENTER @Sa;Bits_array(I)      ! enter value
280      NEXT I
290      FOR I=1 TO 280
300         PRINT USING "#,D";Bits_array(I)  ! print each bit
310         IF (I MOD 10=0) THEN         ! 10th bit?
320            PRINT " ";                ! print a space
330         END IF
340         IF (I MOD 40=0) THEN         ! 40th bit?
350            PRINT                     ! new line
360         END IF
370      NEXT I
380   ELSE
390      DISP "Measurement aborted"
400   END IF
410   !
420   OUTPUT @Sa;"MOV _ddNOPRT,0;";      ! re-enable SA printing bits
430   !
440   END
```

To measure the I-Q pattern

This example shows how you can use the PDC programming commands to measure the I-Q pattern.

```
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 PDC DLP.
40    !
50    INTEGER I                         ! loop counter
60    INTEGER Ms                        ! flag for BS MS
70    INTEGER Cc                        ! flag for BURST CONT
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   OUTPUT @Sa;"_CC?;"                ! query _CC
200   ENTER @Sa;Cc                      ! enter value
210   IF Cc=1 THEN                      ! continuous carrier?
220      Stop_i=706                     ! (141*5)+1 = 706
230   ELSE                              ! burst carrier
240      Stop_i=691                     ! (138*5)+1 = 691
250   END IF                            ! (avoids ramp dn)
260   !
270   OUTPUT @Sa;"MOV _ddCONT,0;"       ! single measurement
280   OUTPUT @Sa;"MOV _ddNOPLT,1;"      ! turn off plotting graph on SA screen
290                                     ! (helps speed)
300   OUTPUT @Sa;"MOV _ddCONSTLN,0;"    ! I-Q Pattern mode
310   !
320   OUTPUT @Sa;"_IQGRAPH;"            ! execute I-Q Pattern measurement
330   REPEAT
340      ENTER @Sa;Meas_state           ! enter measurement state
350   UNTIL Meas_state>0 AND Meas_state<31
360   !
370   IF Meas_state=1 THEN                       ! measurement completed
380      DISP "Entering data..."
390      FOR I=1 TO 816
400         OUTPUT @Sa;"_IQX[";I;"]?;"           ! query X-coordinate
410         ENTER @Sa;Iqx_array(I)               ! enter value
420         Iqx_array(I)=(Iqx_array(I)-240)/120  ! convert from SA screen units:
430                                              ! SA screen x=240 is 0
440                                              ! SA screen 120 x units is 1
450         OUTPUT @Sa;"_IQY[";I;"]?;"           ! query Y-coordinate
460         ENTER @Sa;Iqy_array(I)               ! enter value
470         Iqy_array(I)=(Iqy_array(I)-100)/75   ! convert from SA screen units:
480                                              ! SA screen y=100 is 0
490                                              ! SA screen 75 y units is 1
```

```
500        NEXT I
510        DISP
520        GINIT
530        PLOTTER IS CRT,"INTERNAL"
540        GRAPHICS ON
550        VIEWPORT 20,(RATIO*100)-10,20,100
560        FRAME
570        WINDOW -1.5,1.5,-1.5,1.5
580        AXES .1,.1,0,0,10,10,2
590        FOR I=Start_i TO Stop_i
600           PLOT Iqx_array(I),Iqy_array(I)
610        NEXT I
620     ELSE
630        DISP "Measurement aborted"
640     END IF
650     !
660     OUTPUT @Sa;"MOV _ddNOPLT,0;"     ! re-enable SA plotting
670     !
680     END
```

To measure the eight-point constellation

This example shows how you can use the PDC programming commands to measure the eight-point constellation.

```
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 PDC DLP.
40   !
50   INTEGER I                         ! loop counter
60   INTEGER Ms                        ! flag for BS MS
70   INTEGER Cc                        ! flag for BURST CONT
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  OUTPUT @Sa;"_CC?;"                ! query _CC
200  ENTER @Sa;Cc                      ! enter value
210  IF Cc=1 THEN                      ! continuous carrier?
220     Stop_i=706                     ! (141*5)+1 = 706
230  ELSE                              ! burst carrier
240     Stop_i=691                     ! (138*5)+1 = 691
250  END IF                            ! (avoids ramp dn)
260  !
270  OUTPUT @Sa;"MOV _ddCONT,0;"       ! single measurement
280  OUTPUT @Sa;"MOV _ddNOPLT,1;"      ! turn off plotting graph on SA screen
290                                    ! (helps speed)
300  OUTPUT @Sa;"MOV _ddCONSTLN,1;"    ! 8 point constellation mode
310  !
320  OUTPUT @Sa;"_IQGRAPH;"            ! execute 8 point constln measurement
330  REPEAT
340     ENTER @Sa;Meas_state           ! enter measurement state
350  UNTIL Meas_state>0 AND Meas_state<31
360  !
370  IF Meas_state=1 THEN                       ! measurement completed
380     DISP "Entering data..."
390     FOR I=1 TO 816
400        OUTPUT @Sa;"_IQX[";I;"]?;"           ! query X-coordinate
410        ENTER @Sa;Iqx_array(I)               ! enter value
420        Iqx_array(I)=(Iqx_array(I)-240)/120  ! convert from SA screen units
430        OUTPUT @Sa;"_IQY[";I;"]?;"           ! query Y-coordinate
440        ENTER @Sa;Iqy_array(I)               ! enter value
450        Iqy_array(I)=(Iqy_array(I)-100)/75   ! convert from SA screen units
460     NEXT I
470     DISP
480     GINIT
490     PLOTTER IS CRT,"INTERNAL"
500     GRAPHICS ON
510     VIEWPORT 20,(RATIO*100)-10,20,100
520     FRAME
530     WINDOW -1.5,1.5,-1.5,1.5
540     AXES .1,.1,0,0,10,10,2
550     FOR I=Start_i TO Stop_i
560        IF (I MOD 5=1) THEN         ! use every 5th point
570           PENUP
580           PLOT Iqx_array(I),Iqy_array(I)
590        END IF
600     NEXT I
610  ELSE
```

```
620      DISP "Measurement aborted"
630   END IF
640   !
650   OUTPUT @Sa;"MOV _ddNOPLT,0;"       ! re-enable SA plotting
660   !
670   END
```

To measure the modulation accuracy

This example shows how you can use the PDC programming commands to measure the modulation accurracy.

```
10   !re-store "MODACC_EX1"
20   !shows how to use the _MODACC command in the PDC DLP
30   !
40   !
50   REAL Meas_state                  ! measurement state variable
60   REAL Rms_evm                     ! rms error vector magnitude
70   REAL Mag_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
130  !
140  ASSIGN @Sa TO 718                ! i/o path to spectrum analyzer
150  !
160  !
170  OUTPUT @Sa;"MOV _ddCONT,0;"      ! single measurement
180  OUTPUT @Sa;"MOV _ddPARTIAL,0;"   ! full data
200  OUTPUT @Sa;"MOV _ddAVG,0;"       ! averaging off
220  !
230  OUTPUT @Sa;"_MODACC;"            ! execute Modulation Accuracy meas.
240  REPEAT
250     ENTER @Sa;Meas_state          ! enter measurement state
260  UNTIL Meas_state>0 AND Meas_state<31
270  !
280  IF Meas_state=1 THEN             ! measurement completed
290     OUTPUT @Sa;"_EVMRMS?;"        ! query rms evm
300     ENTER @Sa;Rms_evm             ! enter value
310     OUTPUT @Sa;"_MERR?;"          ! query magnitude error
320     ENTER @Sa;Mag_err             ! enter value
330     OUTPUT @Sa;"_PERR?;"          ! query phase error
340     ENTER @Sa;Phase_err           ! enter value
350     OUTPUT @Sa;"_EVMPK?;"         ! query peak evm
360     ENTER @Sa;Peak_evm            ! enter value
370     OUTPUT @Sa;"_IQOFS?;"         ! query iq origin offset
380     ENTER @Sa;Iq_offset           ! enter value
390     OUTPUT @Sa;"_CFERR?;"         ! query carrier frequency error
400     ENTER @Sa;Cf_err              ! enter value
430     PRINT "Modulation Accuracy results:  "
440     PRINT "------------------------------"
450     PRINT
460     PRINT "RMS EVM:              ";Rms_evm;" %"
470     PRINT " RMS MAG ERR:         ";Mag_err;" %"
480     PRINT " RMS PHASE ERROR:     ";Phase_err;" degrees"
490     PRINT "PEAK EVM:             ";Peak_evm;" %"
500     PRINT "IQ ORIGIN OFFSET:     ";Iq_offset;" dB"
510     PRINT "CARRIER FREQ ERROR:   ";Cf_err;" Hz"
530  ELSE
540     DISP "Measurement aborted"
550  END IF
560  !
570  END
```

To measure the modulation accuracy using averaging

This example shows how you can use the PDC programming commands to measure the modulation accurracy with averaging.

```
10    !re-store "MODACC_EX3"
20    !shows how to use the _MODACC command with averaging in the PDC DLP
30    !
40    !
50    REAL Meas_state                ! measurement state variable
60    REAL Rms_evm_mean              ! mean rms error vector magnitude
70    REAL Mag_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
120   !
130   REAL Rms_evm_sd                ! rms evm standard deviation
140   REAL Rms_evm_max               ! rms evm maximum value
150   REAL Rms_evm_min               ! rms evm minimum value
160   REAL Mag_err_sd                ! rms magnitude error std dev.
170   REAL Mag_err_max               ! rms magnitude error max. value
180   REAL Mag_err_min               ! rms magnitude error min. value
190   REAL Ph_err_sd                 ! rms phase error std dev.
200   REAL Ph_err_max                ! rms phase error max. value
210   REAL Ph_err_min                ! rms phase error min. value
220   !
230   REAL Evm_rt_ul                 ! rms evm uncertainty (20-30C) upper
                                     limit
240   REAL Evm_rt_ll                 ! lower limit
250   REAL Evm_ft_ul                 ! (0-55C)  upper limit
260   REAL Evm_ft_ll                 ! lower limit
270   !
280   ASSIGN @Sa TO 718              ! i/o path to spectrum analyzer
290   !
300   !
310   OUTPUT @Sa;"MOV _ddCONT,0;"    ! single measurement
320   OUTPUT @Sa;"MOV _ddPARTIAL,0;" ! full data
340   OUTPUT @Sa;"MOV _ddAVG,1;"     ! averaging on
350   OUTPUT @Sa;"MOV _ddNAVG,15;"   ! set for 15 measurement average
370   !
380   OUTPUT @Sa;"_MODACC;"          ! execute Modulation Accuracy meas.
390   REPEAT
400      ENTER @Sa;Meas_state        ! enter measurement state
410   UNTIL Meas_state>0 AND Meas_state<31
420   !
430   IF Meas_state=1 THEN           ! measurement completed
440      OUTPUT @Sa;"_EVMRMS?;"      ! query mean rms evm
450      ENTER @Sa;Rms_evm_mean      ! enter value
460      OUTPUT @Sa;"_MERR?;"        ! query mean magnitude error
470      ENTER @Sa;Mag_err_mean      ! enter value
480      OUTPUT @Sa;"_PERR?;"        ! query mean phase error
490      ENTER @Sa;Ph_err_mean       ! enter value
500      OUTPUT @Sa;"_IQOFS?;"       ! query mean iq origin offset
510      ENTER @Sa;Iq_offset_mean    ! enter value
520      OUTPUT @Sa;"_CFERR?;"       ! query mean carrier frequency error
530      ENTER @Sa;Cf_err_mean       ! enter value
560      !
570      OUTPUT @Sa;"_EVMSD?;"       ! query rms evm std dev
580      ENTER @Sa;Rms_evm_sd        ! enter value
590      OUTPUT @Sa;"_EVMMAX?;"      ! query rms evm max value
600      ENTER @Sa;Rms_evm_max       ! enter value
610      OUTPUT @Sa;"_EVMMIN?;"      ! query rms evm min value
620      ENTER @Sa;Rms_evm_min       ! enter value
630      OUTPUT @Sa;"_MERRSD?;"      ! query rms mag err std dev
640      ENTER @Sa;Mag_err_sd        ! enter value
650      OUTPUT @Sa;"_MERRMAX?;"     ! query rms mag err max value
```

```
660      ENTER @Sa;Mag_err_max        ! enter value
670      OUTPUT @Sa;"_MERRMIN?;"      ! query rms mag err min value
680      ENTER @Sa;Mag_err_min        ! enter value
690      OUTPUT @Sa;"_PERRSD?;"       ! query rms phase err std dev
700      ENTER @Sa;Ph_err_sd          ! enter value
710      OUTPUT @Sa;"_PERRMAX?;"      ! query rms phase err max value
720      ENTER @Sa;Ph_err_max         ! enter value
730      OUTPUT @Sa;"_PERRMIN?;"      ! query rms phase err min value
740      ENTER @Sa;Ph_err_min         ! enter value
750      !
760      OUTPUT @Sa;"_EVMRUL?;"       ! query (20-30C) rms evm uncert low
                                      limit
770      ENTER @Sa;Evm_rt_ul          ! enter value
780      OUTPUT @Sa;"_EVMRLL?;"       ! query (20-30C) rms evm uncert upper
                                      limit
790      ENTER @Sa;Evm_rt_ll          ! enter value
800      OUTPUT @Sa;"_EVMFUL?;"       ! query (0-55C) rms evm uncert low
                                      limit
810      ENTER @Sa;Evm_ft_ul          ! enter value
820      OUTPUT @Sa;"_EVMFLL?;"       ! query (0-55C) rms evm uncert upper
                                      limit
830      ENTER @Sa;Evm_ft_ll          ! enter value
840      !
850 Title:   IMAGE "                  ",6X,"Mean",6X,"Std
                                      dev",6X,"Max",6X,"Min"
860 Evm:     IMAGE "RMS EVM (%):      ",6X,2D.D,9X,D.DD,6X,D.D,6X,D.D
870 Mag_err: IMAGE " RMS MAG ERR (%):",6X,2D.D,9X,D.DD,6X,D.D,6X,D.D
880 Ph_err:  IMAGE " RMS PHASE ERR (deg):",2X,2D.D,9X,D.DD,6X,D.D,6X,D.D
890      !
900 Room_temp: IMAGE "Temp. Range 20-30 C",9X,DD.D," % > RMS EVM >
",DD.D,"
    %"
910 Full_temp: IMAGE "Temp. Range  0-55 C",9X,DD.D," % > RMS EVM >
",DD.D,"
    %"
920      !
930 Iq_offset: IMAGE "Mean IQ ORIGIN OFFSET (dB):",9X,3D.D
940 Cf_error:  IMAGE "Mean CARRIER FREQ ERR (Hz):",8X,4D.D
960      !
970      PRINT "Modulation Accuracy results: [for sample of 15 bursts]"
980      PRINT
"-----------------------------------------------------------------"
990      PRINT
1000     PRINT USING Title
1010     PRINT
1020     PRINT USING Evm;Rms_evm_mean,Rms_evm_sd,Rms_evm_max,Rms_evm_min
1030     PRINT USING
         Mag_err;Mag_err_mean,Mag_err_sd,Mag_err_max,Mag_err_min
1040     PRINT USING Ph_err;Ph_err_mean,Ph_err_sd,Ph_err_max,Ph_err_min
1050     PRINT
1060     PRINT "                                 RMS EVM Uncertainty"
1070     PRINT
1080     PRINT USING Room_temp;Evm_rt_ul,Evm_rt_ll
1090     PRINT USING Full_temp;Evm_ft_ul,Evm_ft_ll
1100     PRINT
1110     PRINT
1120     PRINT USING Iq_offset;Iq_offset_mean
1130     PRINT USING Cf_error;Cf_err_mean
1150  ELSE
1160     DISP "Measurement aborted"
1170  END IF
1180  !
1190  END
```

To display the digital demodulator status

This example shows how you can use the PDC programming commands to access the digital demodulator status.

```
10    !re-store "STATUS_EX"
20    !shows how to use the _ddSTATUS command in the PDC DLP
30    !
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_sync_num              ! Frame trigger sync (word) number
100   INTEGER Ft_sync_errs             ! Frame trigger sync errors
110   REAL Ft_sbloc                    ! Frame trigger sync bit location
120   !
130   INTEGER Meas_stat                ! Measurement status result
140   INTEGER Meas_tr_stat             ! Measurement time record status
150   INTEGER Meas_sync_num            ! Measurement sync (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
205   INTEGER Meas_lomag_pts       ! Measurement low magnitude points
210   !
220   !
230   ASSIGN @Sa TO 718                ! i/o path to spectrum analyzer
240   !
250   !
260   OUTPUT @Sa;"_ddSTATUS;"          ! display digital demod. status
270   REPEAT
280      ENTER @Sa;Meas_state          ! enter measurement state
290   UNTIL Meas_state>0 AND Meas_state<2
300   !
310   IF Meas_state=1 THEN             ! measurement completed
320      OUTPUT @Sa;"_ddFTACQS?;"      ! query FT acqusition status
330      ENTER @Sa;Ft_acq_stat         ! enter value
340      OUTPUT @Sa;"_ddFTTRS?;"       ! query FT time record status
350      ENTER @Sa;Ft_tr_stat          ! enter value
360      OUTPUT @Sa;"_ddFTSN?;"        ! query FT sync number
370      ENTER @Sa;Ft_sync_num         ! enter value
380      OUTPUT @Sa;"_ddFTSE?;"        ! query FT sync word errors
390      ENTER @Sa;Ft_sync_errs        ! enter value
400      OUTPUT @Sa;"_ddFTSBLOC?;"     ! query FT sync bit location
410      ENTER @Sa;Ft_sbloc            ! enter value
420      OUTPUT @Sa;"_ddSTAT?;"        ! query meas status result
430      ENTER @Sa;Meas_stat           ! enter value
440      OUTPUT @Sa;"_ddTRS?;"         ! query meas time record status
450      ENTER @Sa;Meas_tr_stat        ! enter value
460      OUTPUT @Sa;"_ddSWN?;"         ! query meas sync (word) number
470      ENTER @Sa;Meas_sync_num       ! enter value
480      OUTPUT @Sa;"_ddSM?;"          ! query meas sync match
490      ENTER @Sa;Meas_sync_match     ! enter value
500      OUTPUT @Sa;"_ddSWE?;"         ! query meas sync errors
510      ENTER @Sa;Meas_sync_err       ! enter value
520      OUTPUT @Sa;"_ddBCE?;"         ! query meas bit compare errors
530      ENTER @Sa;Meas_bce            ! enter bvalue
540      OUTPUT @Sa;"_ddIQNF?;"        ! query meas iq null flag
550      ENTER @Sa;Meas_iqnf           ! enter value
560      OUTPUT @Sa;"_ddIQNC?;"        ! query meas iq null count
570      ENTER @Sa;Meas_iqnc           ! enter value
575      OUTPUT @Sa;"_ddLOMAGPTS?;"    ! query meas low mag points
577      ENTER @Sa;Meas_lomag_pts    ! enter value
```

```
580      !
590      PRINT "Digital Demodulator status:"
600      PRINT "--------------------------------------------"
610      PRINT
620      PRINT "FT Acquisition Status   (1=OK):       ";Ft_acq_stat
630      PRINT "FT Time Record Status:               ";Ft_tr_stat
640      PRINT "FT Acquisition Sync Number:          ";Ft_sync_num
650      PRINT "FT Acquisition Sync errors:          ";Ft_sync_errs
660      PRINT "FT Sync Bit Location:                ";Ft_sbloc
670      PRINT
680      PRINT "Measurement Status   (0=OK):          ";Meas_stat
690      PRINT "Measurement Time Record Status:       ";Meas_tr_stat
700      PRINT "Time Slot (SYNC WORD) Number:         ";Meas_sync_num
710      PRINT "Sync Match  (1=PERFECT MATCH):        ";Meas_sync_match
720      PRINT "Sync Word Errors:                     ";Meas_sync_err
730      PRINT "Pass 1&2 Bit Compare Errors:          ";Meas_bce
740      PRINT "IQ Null Flag:                         ";Meas_iqnf
750      PRINT "IQ Null Count:                        ";Meas_iqnc
755      PRINT "Low magnitude points:          ";Meas_lomag_pts
760   ELSE
770      DISP "Measurement aborted"
780   END IF
790   !
800   END
```

To run a test executive with multiple tests in fast mode

This example shows how you can use the PDC programming commands to run a test executive with multiple tests in *fast mode*.

```
10    !re-store "FAST_EX"
20    !Show how to use the measurement command in the fast mode
30    !
40    !
50    INTEGER Meas_mode           ! measurement mode
60    REAL Meas_state             ! measurement state variable
70    !
80    ASSIGN @Sa TO 718           ! i/o path to spectrum analyzer
90    !
100   !
110   OUTPUT @Sa;"MOV _MEASM,0;"  ! set measurement mode to standard
120   !
130   ! Make carrier power measurement
140   !
150   OUTPUT @Sa;"_CPWR;"         ! execute carrier power measurement
160   REPEAT
170     ENTER @Sa;Meas_state      ! enter measurement state
180   UNTIL 0<Meas_state AND Meas_state<6
190   IF Meas_state=1 THEN
200     ! query results. See "CPWR_EX" for more information
210   ELSE
220     ! measurement aborted.
230   END IF
240   !
250   OUTPUT @Sa;"MOV _MEASM,1;"  ! set measurement mode to fast
260   !
270   ! Make carrier off power measurement
280   !
290   OUTPUT @Sa;"MOV _CONS,1;"   ! set # of avg for _COPWR to 1
300   !
310   OUTPUT @Sa;"_COPWR;"        ! execute carrier off power measurement
320   REPEAT
330     ENTER @Sa;Meas_state      ! enter measurement state
340   UNTIL 0<Meas_state AND Meas_state<6
350   IF Meas_state=1 THEN
360     ! query results. See "COPWR_EX" for more information
370   ELSE
380     ! measurement aborted.
390   END IF
400   !
410   ! Make occupied bandwidth measurement
420   !
430   OUTPUT @Sa;"MOV _OBNS,201;" ! set number of points to 201
440   !
450   OUTPUT @Sa;"_OBW;"          ! execute occupied bandwidth measurement
460   REPEAT
470     ENTER @Sa;Meas_state      ! enter measurement state
480   UNTIL 0<Meas_state AND Meas_state<6
490   IF Meas_state=1 THEN
500     ! query results. See "OBW_EX" for more information
510   ELSE
520     ! measurement aborted.
530   END IF
540   !
550   ! Make spurious emission measurement
560   !
570   OUTPUT @Sa;"MOV _SPURZT,1;" ! set spurious search mode to fast
580   !
590   OUTPUT @Sa;"SNGLS;"         ! control the sweep
600   OUTPUT @Sa;"_SPURSET;"      ! setup for spurious emission measurement
610   OUTPUT @Sa;"TS;DONE?"
```

```
620   ENTER @Sa;Done
630   !
640   OUTPUT @Sa;"MOV RB,100E3;"  ! use RBW for sufficient sensitibity
650   OUTPUT @Sa;"VB AUTO;"       ! auto couple
660   OUTPUT @Sa;"ST AUTO;"       ! auto couple
670   !
680   OUTPUT @Sa;"MOV FA,1870E6;" ! specify sweep range
690   OUTPUT @Sa;"MOV FB,1890E6;"
700   OUTPUT @Sa;"TS;DONE?"
710   ENTER @Sa;Done
720   !
730   OUTPUT @Sa;"_SPURZ;";
740   REPEAT
750     ENTER @Sa;Meas_state
760   UNTIL 0<Meas_state AND Meas_state<6
770   !
780   IF Meas_state=1 THEN
790     ! query results. See "SPURZ_EX" for more information
800   ELSE
810     ! measurement aborted
820   END IF
830   !
840   ! ... Keep going
850   !
860   END
```

9

Specifications

This chapter contains the following:

- The specifications and characteristics for Option 051 and the PDC measurements personality.
- The specifications and characteristics for digital demodulation measurements with Option 151 and Option 160 and the 85720C PDC measurements personality.
- A tutorial on understanding the EVM accuracy specification.

Specifications and Characteristics

This chapter contains information about the specifications and characteristics for Option 051 and the 85720C PDC measurements personality.

Note For the 85720C or Option 051 to meet the specifications and characteristics, 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 documentation.

Specifications for Option 051 (Available for 8593E, 8594E, 8595E, or 8596E Spectrum Analyzer)

This section contains the specifications for Option 051, the improved amplitude accuracy for the PDC spectrum analyzer. Specifications describe warranted performance. Option 051 is available only for an 8593E, 8594E, 8595E, or 8596E spectrum analyzer.

The specifications for Option 051 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 watt).

Option 051 Specifications		
Frequency range	PDC bands, 810 to 826 MHz, 940 to 956 MHz, 1429 to 1453 MHz, and 1477 to 1501 MHz	
Absolute amplitude accuracy*		
Input attenuation set to 10, 20, or 30 dB (equivalent to a	0 °C to 55 °C	20 °C to 30 °C
ref level of −10 to +20 dBm with no ext atten correction†)	±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	±1.0 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 85720C

This section contains the specifications and characteristics for the 85720C PDC measurements personality. The specifications apply to both mobile and base station testing, unless otherwise indicated. The specifications and characteristics for 85720C apply only if the following conditions are met:

- The 85720C is used with an 8593E, 8594E, or 8595E spectrum analyzer with firmware dated 930506 or later. The 85720C is not compatible with 8590A-series analyzers. Use the 85720A measurements personality with 8590A-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 PDC transmitter signals. The carrier frequencies must be within the following band limits:
  810 to 826 MHz
  940 to 956 MHz
  1429 to 1453 MHz
  1477 to 1501 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 watt).
- The optimum amount of external attenuation is used for the specific carrier power level. See "Configuring the Personality for Your Test Setup" in either Chapter 2, "Mobile Station Measurements," or Chapter 4, "Base Station Measurements."
- The TOTL PWR SGL MULT function is set to SGL (single carrier).

Table Notation

The following terms and abbreviations are used in the table of specifications and characteristics for the 85720C:

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-27C Japan Digital Cellular Telecommunication System standard. The user can also choose to have these measurements based upon the RCR STD-27B standard. RCR is the Research and Development Center for Radio Systems.

Several measurements using the MKK methods are also provided. MKK is Musen Setsubi Kensa Mentei-Kyoukai (Radio Equipment Inspection and Certification Institute).

General Specifications	
Maximum safe input level	Total power must not exceed +30 dBm (1 watt)
Precision 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	−9999 to 32000 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-27C 6.1.4.2 and 3.4.2.1)

When testing a base station, the antenna power measurement measures the mean power of the RF carrier for the full frame duration. When testing a mobile station, the antenna power measurement measures the mean power of the RF carrier during the "on" part of the burst. 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.

Antenna power range	+53 dBm (200 W) to −15 dBm (0.03 mW)*	
achievable low limit	(−60 + ext atten) dBm	
Absolute antenna power accuracy, with carrier power of +53 dBm to −20 dBm		
With Option 051, for mean antenna 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 051, for mean antenna power range	0 °C to 55 °C	
(25 dBm + ext atten) to (−35 dBm + ext atten)	±4.3 dB, 2.0 dB typical	
Antenna power resolution	0.1 dB	

* CAUTION: You must use sufficient external attenuation to limit power at spectrum analyzer input to an absolute maximum of +30 dBm (1 watt). The low limit applies for external attenuation of 40 dB or less.

Carrier Off Leakage Power (RCR STD-27C 6.1.5 and 3.4.2.5 and MKK method for base stations)		
When testing a base station, the carrier off power measurement measures the average residual power when the transmitter is turned off. When testing a mobile station, the carrier off power measurement measures the average power during the off part of the burst.		
Carrier power range		
Mobile	+38 dBm* to −15 dBm	
Base (transmitter off)	<−35 dBm	
Carrier off leakage power range	−35 dBm to (−85 + ext atten) dBm†	
Absolute carrier off leakage power accuracy		
For carrier off levels > 10 dB above the average noise level		
With Option 051	±2.7 dB	±1.4 dB (typical)
Without Option 051	±3.6 dB	±1.9 dB (typical)
Relative carrier off leakage power accuracy		
For carrier off levels > 10 dB above the average noise level		
With Option 051	±2.5 dB	±1.1 dB (typical)
Without Option 051	±2.9 dB	±1.2 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 watt). † The lower limit is equivalent to the displayed average noise level of the spectrum analyzer.		

Power Step	
The power step measurement displays the power transition characteristics of the transmitter as the carrier power level is switched between different levels. Peak detection is used for this measurement.	
Carrier power range	+53 dBm* to −15 dBm
Vertical scale per division	0.1 to 1.0 dB in 0.1 dB steps 1 to 10 dB in 1 dB steps
Relative carrier power amplitude accuracy	
For 0 to −50 dB from Ref level	±0.4 dB/4 dB with maximum of ±0.8 dB
Time resolution	0.25% × the sweep time
* CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to absolute maximum of +30 dBm (1 watt).	

Occupied Bandwidth (RCR STD-27C 6.1.3 and 3.4.2.7)	
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 −15 dBm*
Frequency resolution of occupied bandwidth	200 Hz†
Frequency accuracy of occupied bandwidth	±300 Hz (characteristic)†
Frequency resolution of delta frequency	100 Hz†
Frequency accuracy of delta frequency	±[700 Hz + (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 watt). † With OBW number of points per sweep=401	

Adjacent Channel Power (RCR STD-27C 6.1.8 and 3.4.2.3)	
When testing a base station, the ACP measurement is performed using the spectrum analyzer integration method with an integration bandwidth of 21 kHz. The measurement is made using sample detection. The result is the ratio of the average power in adjacent/alternate channel to the mean power of the carrier. When testing a mobile station, the ACP measurement is performed using the spectrum analyzer integration method with an integration bandwidth of 21 kHz. The measurement is made using peak detection. For mobile stations, three different methods may be selected: 1. The MKK ACP method uses a single integration equation and treats all spectral components as if due to modulation and random noise. 2. The time-gated ACP method separates out the ACP due to modulation from the ACP due to transients. Separate integration equations are used for the modulation (random) and transient (impulsive) components. The modulation ACP is equivalent to the ratio, with transients excluded, of the average power in adjacent/alternate channel to the mean output power of the carrier. The total ACP result is the ratio of the total peak power (modulation plus transient) in the adjacent/alternate channel to the peak power of the carrier. 3. The Two Bandwidth method (the defined method in RCR STD-27C) separates out the ACP due to modulation from the ACP due to transients. Separate integration equations are used for the modulation (random) and transient (impulsive) components. The total ACP result is the ratio of the total peak power (modulation plus transient) in the adjacent/alternate channel to the peak power of the carrier. Because of the noise-like nature of the $\pi/4$ DQPSK modulation, there is some measurement-to-measurement variation in the results. This is especially noticeable in the ACP due to transients results for mobile stations. The repeatability of the measurement can be improved by using the ACP single channel per sweep measurement; this measurement takes more data points per channel than does the multi channel per sweep measurement, but with increased test time for the ACP measurement.	
ACP Spectrum (Graphical)	
Carrier power range	+53 dBm (200 W) to −15 dBm (0.03 mW)*
Spectrum display for a multi channel per sweep (seven 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.
Base station	800 ms sweep time
Mobile station	8 s sweep time
Display range of spectrum, log scale	0 to −100 dB from ref level
Relative amplitude accuracy for adjacent channels (50 kHz) and alternate channels (100 kHz)	±1.6 dB ±0.8 dB (typical)
ACP Table (Numerical)	
Table entries	
Base and mobile	Power ratio for adjacent and alternate channels.
Mobile	
Time-gated, Two bandwidth	Results for modulation, transients, and total (modulation + transients).
MKK	Results for total.
ACP ratio minimum result for adjacent channels (50 kHz)	−60 dB (characteristic)
ACP ratio minimum result for alternate channels (100 kHz)	−65 dB (characteristic)
* CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to absolute maximum of +30 dBm (1 watt).	

Adjacent Channel Power (continued)	
ACP Table (Numerical)	
Power ratio accuracy for adjacent channels (50 kHz) and alternate channels (100 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)	±700 Hz (characteristic)
For single channel per sweep	±250 Hz (characteristic)

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 21 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 051, input attenuation set to 10, 20, or 30 dB	±2.0 dB	±1.2 dB (typical)
Without Option 051	±5.0 dB	±2.8 dB (typical)
Channel Numerical		
Absolute amplitude accuracy of channel power		
With Option 051, input attenuation set to 10, 20, or 30 dB	±2.0 dB (characteristic)	
Without Option 051	±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 watt).		

Power versus Time, Mobile Station Only (RCR STD-27C 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, ramp-up (attack time), and ramp-down (release time) are also displayed.		
Carrier power range	+38 dBm to −15 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	100 μs	
Burst	20 μs	
Rising edge	1.6 μs	
Falling edge	1.6 μs	
Jitter	1.3 μs (characteristic)	
Relative time between any two points	±(1.3 + (0.0001 × delta time) + (2 × time resolution))μs (characteristic)	
Ramp-up and Ramp-down time accuracy	±4.5 μs (characteristic)	
Burst width time accuracy	±45 μs (characteristic)	
Absolute time error, with respect to external trigger:		
Frame display	±110 μs (characteristic)	
Burst display	±25 μs (characteristic)	
Rising edge display	±6 μs (characteristic)	
Falling edge display	±6 μs (characteristic)	
* CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to absolute maximum of +30 dBm (1 watt). † The lower limit is equivalent to the displayed average noise level of the spectrum analyzer.		

Combiner Tuning (Base Station Only)	
The combiner tuning test places horizontal line markers on the carriers with the maximum and minimum power level. The test also displays the delta value between the minimum and maximum markers and the absolute value of the maximum marker for reference. The position of the markers and the numerical results are updated at the end of every sweep.	
Carrier power range	+53 dBm* to 0 dBm
Vertical scale per division	1 dB to 10 dB in 1 dB steps
	0.1 dB to 1 dB in 0.1 dB steps
Relative amplitude accuracy of delta value	±(0.2 dB + 0.1 dB/dB) (characteristic)
* CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to absolute maximum of +30 dBm (1 watt).	

Transmitter Intermodulation, Base Station Only (RCR STD-27C 6.1.10 and 3.4.2.10)		
Measures intermodulation spurious emission products using an external signal generator.		
Carrier power range	+53 dBm* to −15 dBm	
Minimum spurious emission power sensitivity with RBW = 30 kHz, and carrier to CW signal frequency difference (spacing) > 100 kHz.	(−72 + ext atten) dBm †	
Absolute transmitter intermodulation product spurious emission power accuracy.		
For product power levels >10 dB above the average noise level:		
With Option 051	±2.7 dB	±1.4 dB (typical)
Without Option 051	±3.6 dB	±1.9 dB (typical)
Relative transmitter intermodulation product spurious emission power accuracy		
For product power levels >10 dB above the average noise level		
With Option 051	±3.0 dB	±1.2 dB (typical)
Without Option 051	±4.9 dB	±2.4 dB (typical)
* CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to absolute maximum of +30 dBm (1 watt). † The minimum spurious emission is equivalent to the displayed average noise level of the spectrum analyzer.		

Spurious Emissions (RCR STD-27C 6.1.2 and 3.4.2.6 and MKK method for base stations)		
Measures the spurious emission level. The mean power for mobile station tests is computed by converting the log power obtained in zero span to a power trace and then averaging the trace data. The peak power for base station tests is determined by taking a frequency domain sweep and finding the peak.		
Carrier power range	+53 dBm* to −15 dBm	
Minimum spurious emission power for spur ≥1 MHz from carrier and 1 MHz ≤ spur frequency ≤ 2.9 GHz.	(−69 + ext atten) dBm †	
Absolute spurious emission power accuracy (within PDC bands)		
For spurious levels >10 dB above the average noise level:		
With Option 051	±2.7 dB	±1.4 dB (typical)
Without Option 051	±3.6 dB	±1.9 dB (typical)
Relative spurious emission power accuracy (within PDC bands)		
For spurious levels >10 dB above the average noise level:		
With Option 051	±2.2 dB	±1.1 dB (typical)
Without Option 051	±4.1 dB	±2.3 dB (typical)
* CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to absolute maximum of +30 dBm (1 watt). † 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

8593E, 8594E, 8595E, and 8596E PDC Spectrum Analyzers

The following specifications apply to 8593E, 8594E, 8595E and 8596E spectrum analyzers with Options 151 and 160:

Minimum Input Power	
Minimum Input Power	−15 dBm

Minimum Input Carrier Frequency	
Minimum Input Carrier Frequency	10 MHz

Carrier Frequency Error (RCR STD-27C 6.1.1 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 + (frequency reference accuracy × carrier frequency)]
Frequency error accuracy with Option 004 high stability frequency reference is ±150 Hz (based on 0.132 ppm frequency reference accuracy, 1 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-27C 6.1.7 “Modulation Accuracy,” and 3.4.2.9 “Modulation Precision”)	
I-Q origin offset calculates the fixed offset of the in-phase and quadrature components of the digital modulation.	
I-Q origin offset accuracy	±0.5 dB for origin offset values greater than -40 dB

Error Vector Magnitude (RCR STD-27C 6.1.7 “Modulation Accuracy,” and 3.4.2.9 “Modulation Precision”)		
The error vector magnitude (EVM) measurement calculates the RMS error vector magnitude from a timeslot. In a base station, a full timeslot measurement includes 138 symbols. In a mobile station, a full timeslot measurement includes 135 symbols. EVM is minimized by removing frequency error, phase offset, and I-Q origin offset before calculating EVM for a given timeslot.		
Error Vector Magnitude Accuracy		
Full timeslot measurement without EVM correction	**20 °C to 30 °C**	**0 °C to 55 °C**
RMS EVM Floor*	1.4%	1.7%
RMS Magnitude Error Floor*	< 0.5%	< 0.5%
RMS Phase Error Floor*	< 0.8 °	< 1.0 °
RMS EVM max standard deviation of all single measurements	0.5%	0.6%
RMS EVM max standard deviation of all measurements, average of 10	0.16%	0.17%
Base station, RMS Magnitude Error = 1%, RMS EVM = 6% (display readings), full timeslot measurement without EVM correction.		
Measurement Condition	**EVM Uncertainty Range**	
	20 °C to 30 °C	**0 °C to 55 °C**
Single measurement†	+0.75% to -2.9%	+0.75% to -3.5%
Average of ten measurements‡	+0.75% to -1.9%	+0.75% to -2.3%
Mobile station, RMS Magnitude Error = 4%, RMS EVM = 6% (display readings), full timeslot measurement without EVM correction.		
Measurement Condition	**EVM Uncertainty Range**	
	20 °C to 30 °C	**0 °C to 55 °C**
Single measurement†	+0.75% to -2.6%	+0.75% to -3.1%
Average of ten measurements‡	+0.75% to -1.6%	+0.75% to -1.9%

* RMS EVM, RMS magnitude error, and RMS phase error can not be accurately measured below the floor value.

†Apply positive and negative EVM uncertainty limits to displayed RMS EVM.

Example: mobile station, 20 °C to 30 °C

Displayed RMS EVM + 0.75% ≥true RMS EVM ≥ Displayed RMS EVM -2.6%

‡ Apply positive EVM uncertainty to minimum detected RMS EVM. Apply negative EVM uncertainty to average RMS EVM.

Example: mobile station, average of ten measurements, 20 °C to 30 °C

Minimum RMS EVM + 0.75% ≥true RMS EVM ≥ Average RMS EVM -1.6%

Note See “Interpreting the EVM Specifications” for an explanation of the EVM accuracy tables.

The following *characteristics* apply to 8593E, 8594E, 8595E, and 8596E spectrum analyzers with Options 151 and 160:

Corrected Error Vector Magnitude Accuracy (characteristic)		
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*	0.5%	0.5%
RMS EVM max standard deviation of all single measurements	±0.5%	±0.6%
RMS EVM max standard deviation of all measurements, average of 10	±0.16%	±0.17%
Full timeslot measurement with EVM correction (base and mobile station).		
Measurement Condition	**EVM Uncertainty Range**	
	20 °C to 30 °C	**0 to 55 °C**
Single measurement†	+1.5% to -2.0%	+1.8% to -2.3%
Average of ten measurements‡	+0.5% to -1.0%	+0.6% to -1.1%

* RMS EVM cannot be accurately measured below the floor value.

† Apply positive and negative EVM uncertainty limits to displayed RMS EVM.

Example: mobile station, 20 °C to 30 °C

Displayed RMS EVM + 1.5% ≥true RMS EVM ≥ Displayed RMS EVM - 2.0%

‡ Apply positive EVM uncertainty to minimum detected RMS EVM. Apply negative EVM uncertainty to average RMS EVM.

Example: mobile station, average of ten measurements, 20 °C to 30 °C

Minimum RMS EVM + 0.5% ≥true RMS EVM ≥ Average RMS EVM - 1.0%

Note See "Interpreting the EVM Specifications" for an explanation of the EVM accuracy tables.

Measurement Time (characteristic)	
(Full timeslot measurement with frame synchronization)	
Initial setup and first measurement	20 sec
Repeat a single measurement	16 sec
Continuous measurement update interval	1.5 sec

Frame Trigger Stability (characteristic)	
Frame trigger stability	1 bit in 15 min after 1 hour warm-up

Interpreting the EVM Specifications

Refer to Figure 9-1. 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.

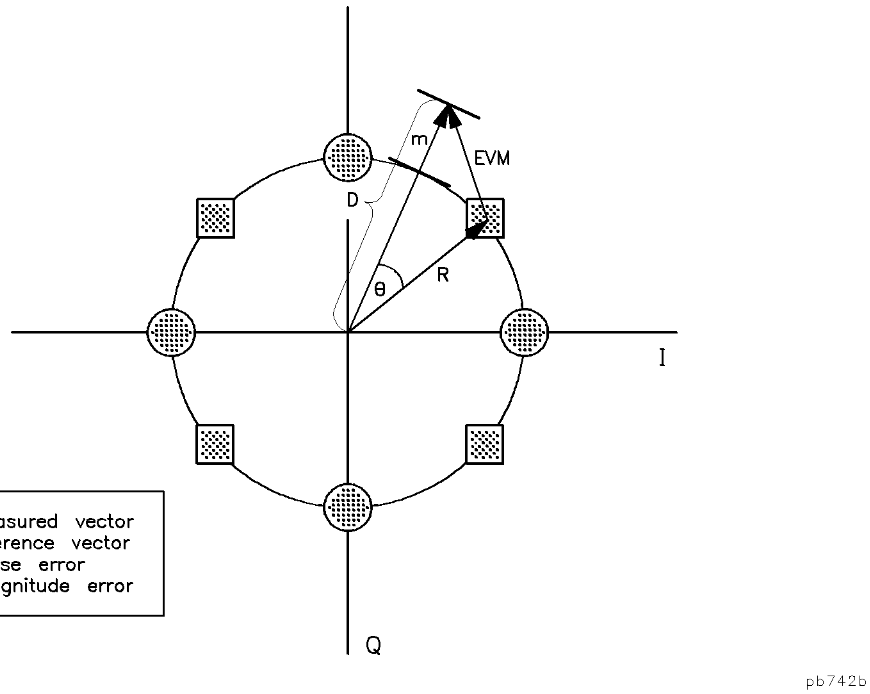


Figure 9-1. Vector Components of EVM

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 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 8590 E-Series spectrum analyzer, the total uncertainty in the magnitude error measurement is less than 0.5%.

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° to 30 °C, the phase noise of the 8593E, 8594E, 8595E, and 8596E produce a maximum RMS phase error uncertainty of 0.8°. On a perfect PDC modulated source, the phase error uncertainty will produce a positive error in the RMS EVM reading of up to +1.4%. Typically, the error in the RMS EVM reading will be about +0.9% from a typical RMS phase error uncertainty of 0.4°.

The phase error uncertainty and the magnitude error uncertainty combine in an RMS sum, yielding a maximum positive error in the RMS EVM reading of 1.4% between 20° to 30 °C. Thus, a perfect PDC signal with 0% RMS EVM could be measured by a worst-case spectrum analyzer as 1.4% RMS EVM. Sources with RMS EVM below 1.4% cannot be measured accurately with the spectrum analyzer. The 8593E, 8594E, 8595E, and 8596E spectrum analyzers have a 1.4% RMS EVM measurement floor between 20° to 30 °C.

This EVM measurement floor is analogous to the noise floor in a signal amplitude measurement. The RMS EVM floor is specified between 20° to 30 °C (common room temperature), *and* over a temperature range of 0° to 55 °C.

The dominant contributor to the RMS EVM floor is the phase error uncertainty due to phase noise. The measured RMS EVM is the sum of the spectrum analyzer RMS EVM and the true RMS EVM of the signal. The spectrum analyzer 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 on a source with fixed RMS EVM. This variation of RMS EVM is defined by the RMS EVM maximum standard deviation specification. Averaging reduces the variation of repeated measurements.

RMS EVM Uncertainty Tables

Typical RMS EVM uncertainty tables can be produced by combining values of RMS EVM Floor and RMS EVM maximum standard deviation. The following uncertainty table was created for an 8593E, 8594E, 8595E, or 8596E spectrum analyzer testing a base station signal having low RMS magnitude error and an RMS EVM of 6%. Power control in base station signals is usually good, producing a low RMS magnitude error. This is because PDC base stations usually do not burst amplitude modulate the carrier, but hold a fixed power level for a relatively long time.

8593E, 8594E, 8595E, and 8596E RMS EVM Uncertainty

Error Vector Magnitude (RCR STD-27C 6.1.7 "Modulation Accuracy," and 3.4.2.9 "Modulation Precision")		
Base station, RMS Magnitude Error = 1%, RMS EVM = 6% (display readings), full timeslot measurement without EVM correction.		
Measurement Condition	**EVM Uncertainty Range**	
	20 °C to 30 °C	**0 to 55 °C**
Single measurement	+0.75% to -2.9%	+0.75% to -3.5%
Average of ten measurements	+0.75% to -1.9%	+0.75% to -2.3%

How to use the EVM uncertainty tables:

EVM uncertainty tables define the range of uncertainty of a spectrum analyzer RMS EVM reading.

Example: A single RMS EVM measurement on a base station at room temperature on an 8593E with a displayed reading of 7.0%.

The true RMS EVM of the source is in the range:

7.0%		0.75%	=	7.75%
(Displayed RMS EVM)	+	(Positive EVM)	=	(Maximum possible RMS EVM)
		(Uncertainty)		

to

7.0%		−2.9%	=	4.1%
(Displayed RMS EVM)	+	(Negative EVM)	=	(Minimum possible RMS EVM)
		(Uncertainty)		

The range of possible RMS EVM from a single 7.0% reading is:

7.75% > true EVM > 4.1%

Narrow the range of uncertainty by taking an average of ten individual single measurements.

For an averaged measurements, apply the positive RMS EVM uncertainty range to the lowest individual reading in the averaged set of measurements. This can be done since the measured reading is greater than the true RMS EVM due to spectrum analyzer errors. The negative RMS EVM uncertainty range must be applied to the average reading.

Example: An average of 10 measurements on a base station between 20° to 30 °C using an 8593E. Minimum RMS EVM of the set of 10 measurements was 6.8%. The average of ten measurements was 7.2 %. The true RMS EVM of the source is in the range:

6.8%		0.75%	=	7.55%
(Displayed minimum)	+	(Positive EVM)	=	(Maximum possible RMS EVM)
(RMS EVM)		(Uncertainty)		

to

7.2%		−1.9%	=	5.3%
(Displayed average)	+	(Negative EVM)	=	(Minimum possible RMS EVM)
(RMS EVM)		(Uncertainty)		

The range of possible RMS EVM from a minimum reading of 6.8% in 10 measurements is:

7.55% > true EVM > 5.3%

Note For averaged modulation accuracy measurements, the 85720C PDC measurements personality automatically calculates the RMS EVM uncertainty ranges from measured data and spectrum analyzer specifications.

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 remain constant at +0.75%.

The negative RMS EVM uncertainty limit is derived from the effect of the RMS EVM floor and the RMS EVM measurement repeatability. The RMS EVM floor specifies the maximum positive offset added by the spectrum analyzer to the true RMS EVM of the source. The maximum standard deviation of RMS EVM measurements describes the repeatability of EVM results.

Example: A base station with an RMS EVM of 6%, and an RMS magnitude error of 1%.

Measurement with an 8593E can have an average RMS EVM as high as 7.5% between 20° to 30 °C.

6%		1.4%	=	7.4%
(true RMS EVM of source)	+	(RMS EVM Floor)	=	(averaged)

In addition, individual RMS EVM readings will vary as defined by the RMS EVM standard deviation. For example, an 8593E measuring a base station with 6% RMS EVM can have an RMS EVM reading of 7.4% ±1.5%. The ±1.5% range is 3 standard deviations 1.5% (3 X 0.5%) of the distribution of single (non-averaged) RMS EVM values. 99.7% of the RMS EVM values should fall within this range. Individual readings will be as low as 5.9% and as high as 8.9%. The spectrum analyzer adds a maximum 2.9% to the true RMS EVM of the base station.

8.9%		6%	=	2.9%
(highest analyzer reading)	−	(true RMS EVM of source)	=	(negative RMS EVM uncertainty)

For low RMS magnitude error signals, the total negative RMS EVM uncertainty equals the sum of the RMS EVM floor and the RMS EVM repeatability. For example, negative RMS EVM uncertainty between 20° to 30 °C for an 8593E is 2.9%.

1.4%		(3 X 0.5%)	=	2.9%
(RMS EVM Floor)	+	(RMS EVM repeatability)	=	(negative RMS EVM uncertainty)

The true RMS EVM of the source is at most 2.9% below the displayed reading, so the EVM uncertainty range value is −2.9%. This example is shown graphically in Figure 9-2.

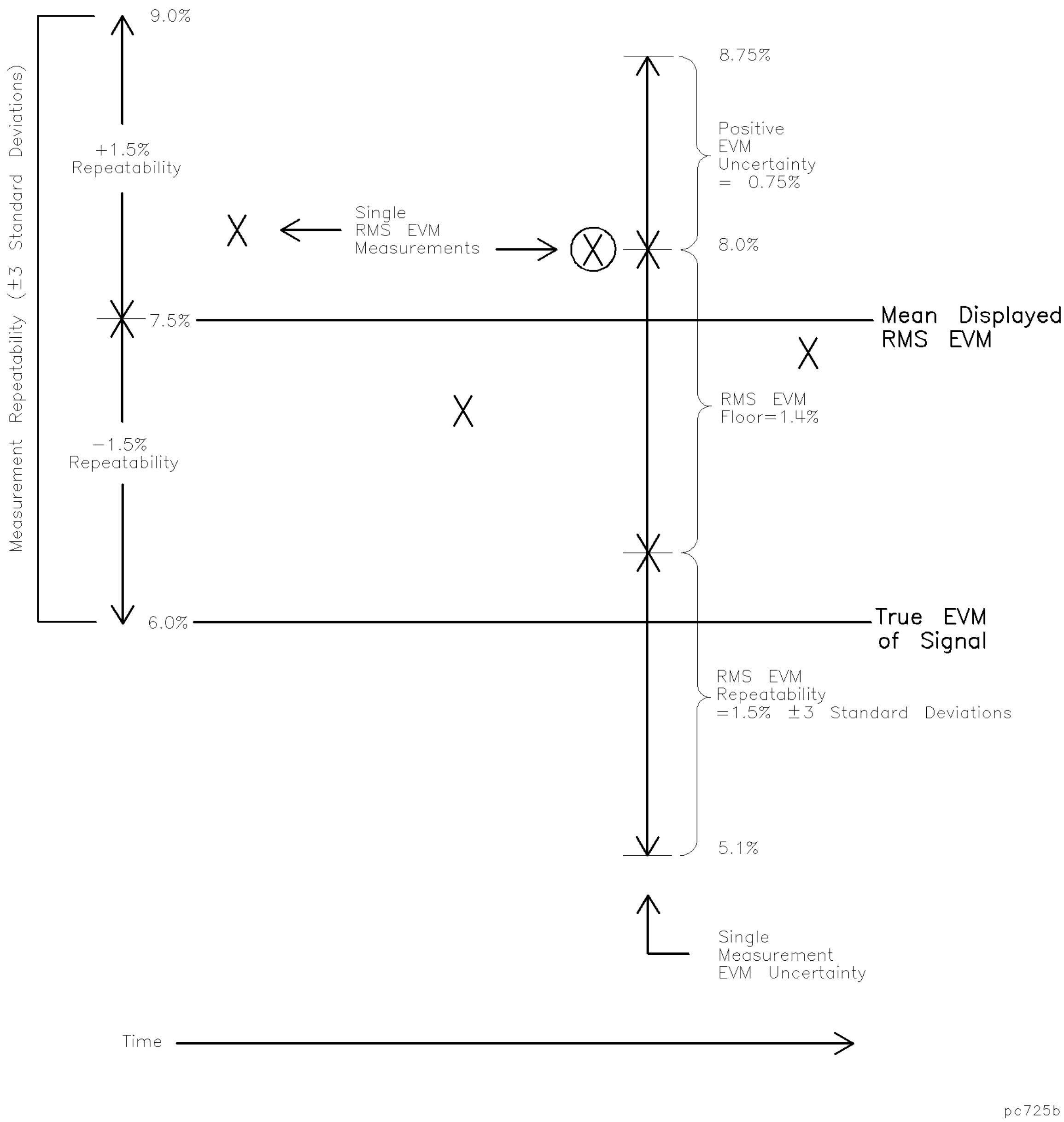


Figure 9-2. RMS EVM Uncertainty Example

The examples so far have assumed an PDC signal with low magnitude error, where RMS EVM is primarily from phase error. The worst case signals for measurement with the 8590 E-series spectrum analyzer are those signals having a low magnitude error component of RMS EVM. This is because the spectrum analyzer phase error uncertainty is much greater than the magnitude error uncertainty of the signal (see the discussion on RMS EVM floor). The RMS EVM reading can be very accurate if a signal primarily has magnitude error. PDC mobile stations often have high magnitude errors due to the burst amplitude modulation of the carrier.

Error in the displayed RMS EVM is a function of the size of the RMS EVM magnitude error compared to 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 RMS magnitude error more accurately than RMS phase error.

Curves Figure 9-3 and Figure 9-4 show the error in the displayed RMS EVM reading as a function of displayed RMS EVM for 1% steps in displayed RMS magnitude error. Note that EVM error is positive. In other words, the EVM error always makes the displayed EVM larger than the true signal EVM. This is an effective EVM floor.

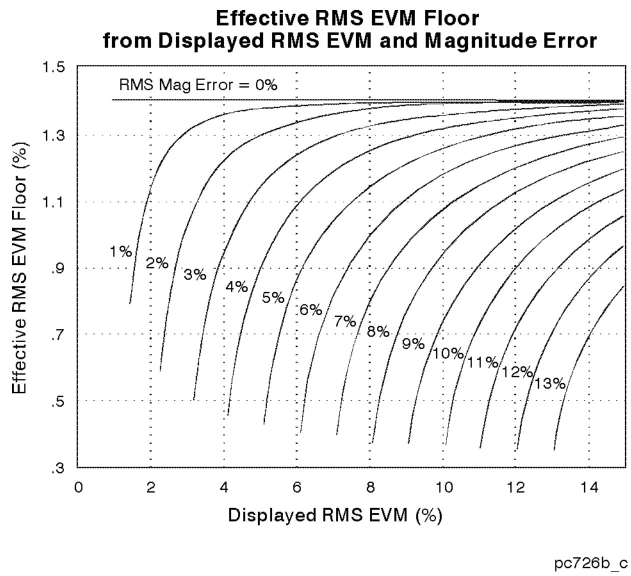


Figure 9-3. 8593/4/5/6E Analyzers Effective EVM Floor (20 °C to 30 °C)

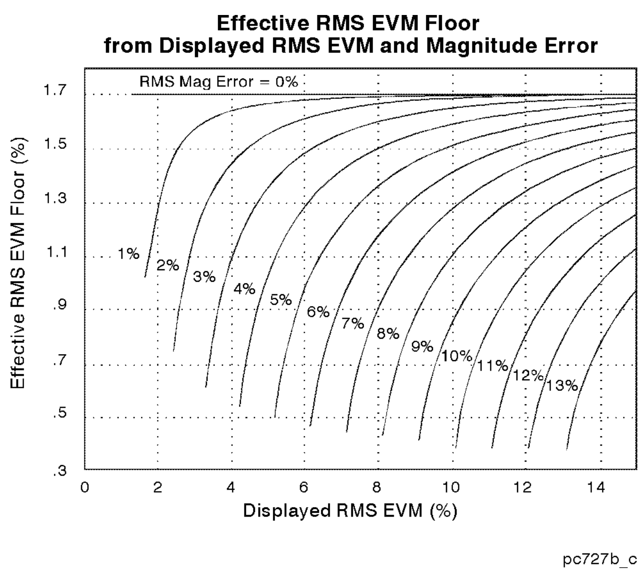


Figure 9-4. 8593/4/5/6E Analyzers Effective EVM Floor (0 °C to 55 °C)

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.

Example: A mobile station with an RMS EVM of 6%, and RMS magnitude error of 4%, measured between 20° to 30 °C.

Refer to Figure 9-5. Obtain the "Effective EVM Floor" from the curve.

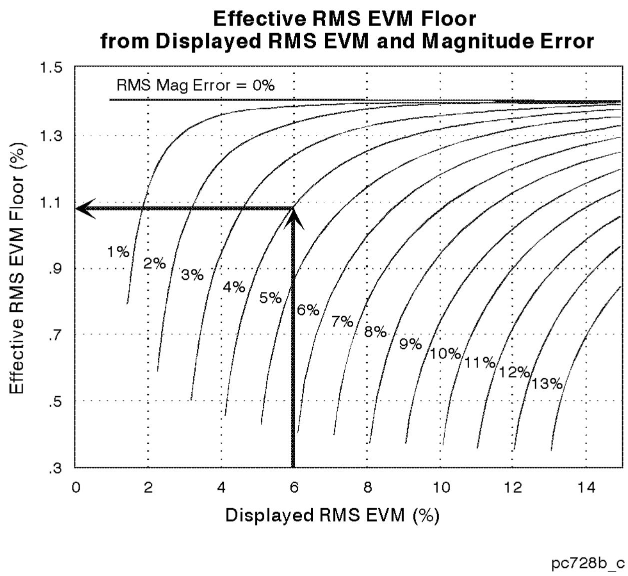


Figure 9-5. 8593/4/5/6E Analyzers Effective EVM Floor

For this case, the "effective RMS EVM floor" is 1.08%. Compare this to the base station example used earlier, where RMS magnitude error was 1% for an RMS EVM of 6%. The RMS EVM floor for the base station is about 1.4%. 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 can be used to produce EVM uncertainty tables.

Example: The following EVM uncertainty table is for the 8593E, 8594E, 8595E, and 8596E spectrum analyzers. This represents a full timeslot measurement without EVM correction on a mobile station. The measured RMS magnitude error is 4% and the RMS EVM is 6%.

Mobile station, RMS Magnitude Error = 4%, RMS EVM = 6% (display readings)full timeslot measurement without EVM correction.		
Measurement Condition	**EVM Uncertainty Range**	
	20 °C to 30 °C	**0 to 55 °C**
Single measurement	+0.75% to -2.6%	+0.75% to -3.1%
Average of ten measurements	+0.75% to -1.6%	+0.75% to -1.9%

The previous example showed that the effective RMS EVM floor is 1.08% between 20 °C and 30 °C. The positive EVM uncertainty remains fixed at 0.75%. The negative EVM uncertainty is calculated using the effective RMS EVM floor and the RMS EVM maximum standard deviation.

For a single measurement, between 20 °C and 30 °C:

1.08%		+1.5% (3 X 0.5%)	=	2.6%
(Effective EVM Floor from curves)	+	(RMS EVM Repeatability, 3 X standard deviation)	=	(Negative EVM Uncertainty)

For an average of 10 measurements between 20 °C and 30 °C:

1.08%		+0.5% (3 X 0.16%)	=	1.6%
(Effective EVM Floor from curves)	+	(RMS EVM Repeatability, 3 X standard deviation)	=	(Negative EVM Uncertainty)

Single Measurement Example:

Using the previous table, a mobile station is measured with an 8593E spectrum analyzer between 20 °C and 30 °C. The displayed spectrum analyzer reading is 6.0 % RMS EVM. The displayed RMS magnitude error is 4% and averaging is not used. The RMS EVM range is:

6.0% + 0.75%	> true RMS EVM >	6.0% − 2.6%
6.75%	> true RMS EVM >	3.4%

For averaged modulation accuracy measurements, the PDC measurements personality automatically calculates the RMS EVM uncertainty ranges from measured data and spectrum analyzer specifications. Figure 9-6 shows a summary screen that appears automatically when averaging is turned on.

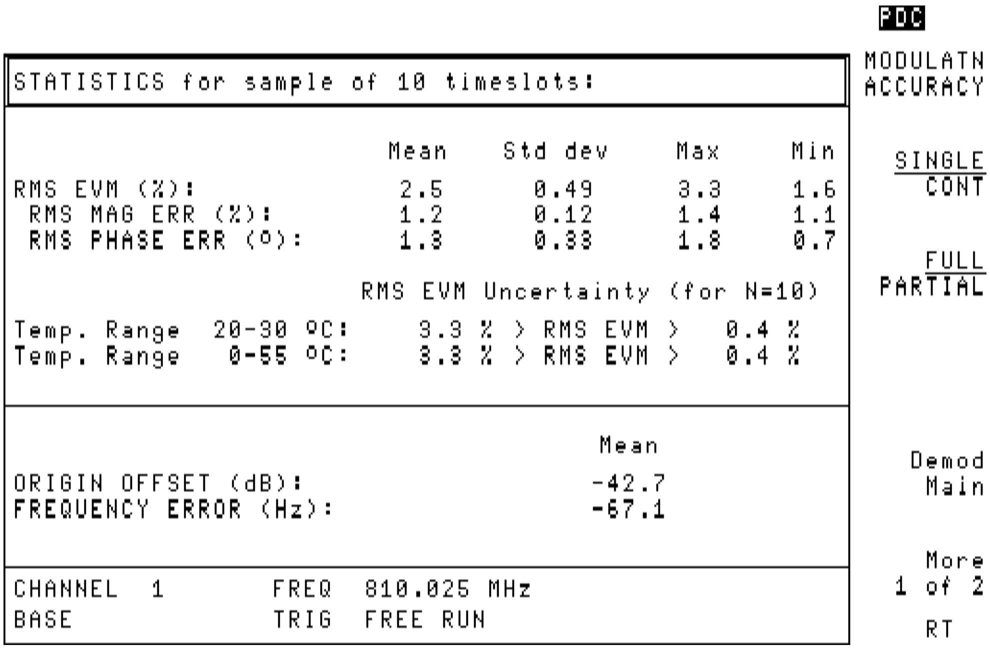


Figure 9-6. Averaged Full Modulation Accuracy Summary Screen

10

Verifying Operation

This chapter contains test procedures that verify the electrical performance of the improved amplitude accuracy for the PDC option (Option 051), and the time-gated spectrum analysis card (Option 105).

This chapter contains the following sections:

- Preparing for the verification tests.
- The following verification procedures:
    - Absolute amplitude accuracy
    - Gate delay accuracy and gate length accuracy
    - Gate card insertion loss
    - IF frequency accuracy
    - Error vector magnitude
- The performance verification test record.

Preparing for the Verification Tests

Do these four things 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 8590 Series spectrum analyzer operation.
3. Perform the spectrum analyzer's self-calibration routines. Refer to the spectrum analyzer user's guide for instructions. (Before performing the self-calibration routines, make sure 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 10-1 lists 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 10-9) 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.

Periodically verifying operation

The spectrum analyzer requires periodic verification of operation. Under most conditions of use, you should perform these verification tests once a year to make sure that the spectrum analyzer meets the specifications.

If the spectrum analyzer does not meet its specifications

1. Make sure that there is nothing connected to the spectrum analyzer's GATE TRIGGER INPUT connector.
2. Rerun the spectrum analyzer's frequency and amplitude self-calibration routines. See the spectrum analyzer user's guide 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 an Agilent Technologies Sales and Service Office. Refer the spectrum analyzer service guide for addresses and shipping instructions.

Recommended test equipment

Table 10-1.
Recommended Test Equipment for Performing Verification Tests

Instrument	Critical Specifications for Equipment Substitution		Recommended Model	Use*
Synthesized signal generator	Frequency range:	810 MHz to 1.501 GHz	8662A or 8663A	P
	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		
Synthesized sweeper	Frequency range:	810 MHz to 1.501 GHz	8340A/B	P,A,T
	Frequency accy. (CW):	±0.02%		
	Power level range:	−35 dBm to +16 dBm		
Synthesized/ level generator	Frequency range:	50 MHz	3335A	P,A,T
	Amplitude range:	+12 dBm to −85 dBm		
	Flatness:	±0.15 dB		
	Attenuator accuracy:	±0.09 dB		
Spectrum analyzer	Phase noise:	−80 dBc/Hz at 320 Hz offset −85 dBc/Hz at 1 kHz offset	8566B	P
Measuring receiver	Compatible with power sensors		8902A	P,A,T
	Resolution:	0.01 dB		
	Reference accuracy:	±1.2%		
Power sensor	Frequency range:	810 MHz to 1.501 GHz	8482A	P,A,T
	Maximum SWR:	1.1 (at stated range)		
Oscilloscope	No substitute		54501A	P,T
Microwave frequency counter	Frequency range:	21.4 MHz	5343A	P
	Aging rate:	5×10^{-10} Hz/day		
Universal counter	Time interval:	100 ns to 100 ms	5316A	P
Pulse/function generator	Frequency:	100 Hz	8116A	P
	Duty cycle:	50%		
	Output:	TTL square wave		
Power splitter	Frequency range:	810 MHz to 1.501 GHz	11667A	P,A
	Insertion loss:	7 dB (nominal)		
	Output tracking:	<0.25 dB		
	Equivalent output SWR:	<1.22:1		
Step attenuator	Range:	0 dB to 12 dB	8494A Option 890	P
	Step size:	1 dB steps		
	Includes calibration data			
Step attenuator	Range:	0 dB to 120 dB	8495A Option 890	P
	Step size:	10 dB steps		
	Includes calibration data			
* P = Performance Test, A = Adjustment, T = Troubleshooting				

1. Absolute Amplitude Accuracy (Option 051 Only)

Specifications

Refer to Chapter 9, "Specifications," for specific values.

Related Adjustments

Frequency Response

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. To determine the absolute amplitude accuracy:

1. The amplitude of the sweeper's signal is adjusted until the spectrum analyzer marker reads out a known amplitude.
2. The amplitude of the sweeper's signal is measured by the measuring receiver. (The measurement receiver is used as a power meter.)
3. The difference between the marker readout and the measuring receiver's measurement is determined. This difference is the absolute amplitude accuracy.

Equipment

Synthesized sweeper 8340A/B
Measurement receiver 8902A
Power splitter 11667A
Power sensor 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) 11500A

To set up the equipment

1. Zero and calibrate the 8902A and the 8482A in log mode as described in the *8902A Measuring Receiver Operation Manual*.

Note The absolute amplitude accuracy test should only be performed if the ambient temperature is between 20° and 30° C. Refer to the specifications for Option 051 in Chapter 9, "Specifications," for more information about the temperature and the specification limits.

2. Connect the equipment as shown in Figure 10-1. Connect the power splitter to the spectrum analyzer using an adapter.

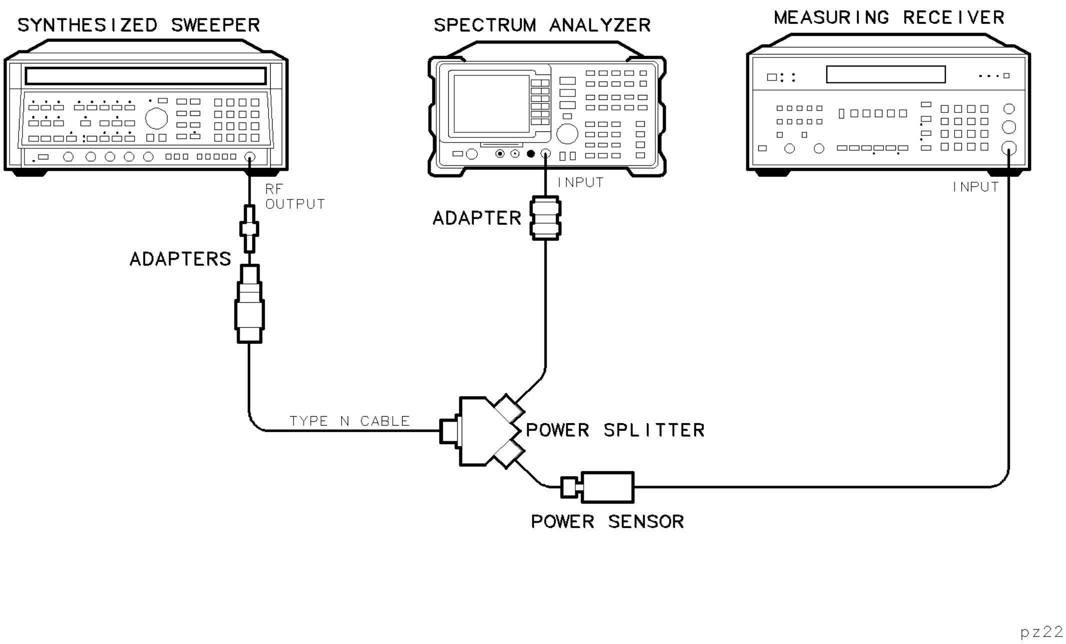


Figure 10-1. Absolute Amplitude Accuracy Verification

3. Press (INSTR PRESET) on the 8340A/B. Set the controls as follows:

   CW .... 810 MHz
   POWER LEVEL .... −2 dBm

4. Press (PRESET) on the spectrum analyzer and wait for the preset to finish, then press the following spectrum analyzer keys:

   (FREQUENCY) 810 (MHz)
   (SPAN) 400 (kHz)
   (BW) 100 (kHz)
   VID BW AUTO MAN 30 (kHz)
   (AMPLITUDE) 4 (−dBm)
   ATTEN AUTO MAN 10 (dB)
   (PEAK SEARCH)

1. **Absolute Amplitude Accuracy (Option 051 Only)**

Log Fidelity

1. Set the power sensor cal factor for 810 MHz on the 8902A.
2. On the synthesized sweeper, press POWER LEVEL and adjust the output amplitude so that the analyzer marker amplitude reads −9 dBm ±0.05 dB.
3. Record the measuring receiver power reading in Table 10-2.
4. Adjust the output amplitude of the sweeper for analyzer marker amplitude readings of −14 dBm and −19 dBm.
5. Record the measuring receiver power readings in Table 10-2. The readings should be within the limits shown.

Table 10-2. Log Fidelity

Analyzer Marker Reading (dBm)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
−9	−9.7	__________	−8.3
−14	−14.7	__________	−13.3
−19	−19.7	__________	−21.3

Frequency Response Input Attenuator 10 dB

1. Set the FREQUENCY of the analyzer to the first measurement frequency shown in Table 10-3.
2. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the analyzer is set in the previous step.
3. On the analyzer, press (PEAK SEARCH).
4. On the sweeper, press (POWER LEVEL) and adjust the output amplitude so the analyzer marker amplitude reads −9 dBm ±0.05 dB.
5. Set the power sensor cal factor (for frequency being measured) on the 8902A and record the measuring receiver power reading in Table 10-3.
6. Repeat steps 1 through 5 for frequencies of 826 MHz, 940 MHz, 956 MHz, 1429 MHz, 1453 MHz, 1477 MHz, and 1501 MHz. Record the results in Table 10-3. The results should be within the limits shown.

Table 10-3. Frequency Response Attenuator 10 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
810	−9.6	__________	−8.4
826	−9.6	__________	−8.4
940	−9.6	__________	−8.4
956	−9.6	__________	−8.4
1429	−9.6	__________	−8.4
1453	−9.6	__________	−8.4
1477	−9.6	__________	−8.4
1501	−9.6	__________	−8.4

Frequency Response Input Attenuator 20 dB

1. On the analyzer, press the following keys:

   (AMPLITUDE) ATTEN AUTO MAN 20 dB
   (AMPLITUDE) 6 (+dBm)

2. Set the (FREQUENCY) of the analyzer to the measurement frequency shown in Table 10-4.
3. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the analyzer is set in the previous step.
4. On the analyzer, press (PEAK SEARCH).
5. On the sweeper press POWER LEVEL and adjust the amplitude so the analyzer marker amplitude reads +1 dBm ±0.05 dB.
6. Set the power sensor cal factor (for frequency being measured) on the 8902A and record the measuring receiver power reading in Table 10-4.
7. Repeat steps 1 through 6 for frequencies of 826 MHz, 940 MHz, 956 MHz, 1429 MHz, 1453 MHz, 1477 MHz, and 1501 MHz. Record the results in Table 10-4. The results should be within the limits shown.

Table 10-4. Frequency Response Attenuator 20 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
810	+0.4	______	+1.6
826	+0.4	______	+1.6
940	+0.4	______	+1.6
956	+0.4	______	+1.6
1429	+0.4	______	+1.6
1453	+0.4	______	+1.6
1477	+0.4	______	+1.6
1501	+0.4	______	+1.6

Frequency Response Input Attenuator 30 dB

1. On the analyzer, press the following keys:

   (AMPLITUDE) ATTEN AUTO MAN 30 dB
   (AMPLITUDE) 10 (+dBm)

2. Set the FREQUENCY of the analyzer to the measurement frequency shown in Table 10-5.
3. On the analyzer, press (PEAK SEARCH).
4. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the analyzer is set in the previous step.
5. On the sweeper, press POWER LEVEL and adjust the amplitude so the analyzer marker amplitude reads +5 dBm ±0.05 dB.
6. Set the power sensor cal factor (for frequency being measured) on the 8902A and record the measuring receiver power reading in Table 10-5.
7. Repeat steps 1 through 6 for frequencies of 826 MHz, 940 MHz, 956 MHz, 1429 MHz, 1453 MHz, 1477 MHz, and 1501 MHz. Record the results in Table 10-5. The results should be within the limits shown.

Table 10-5. Frequency Response Attenuator 30 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
810	+4.4	________	+5.6
826	+4.4	________	+5.6
940	+4.4	________	+5.6
956	+4.4	________	+5.6
1429	+4.4	________	+5.6
1453	+4.4	________	+5.6
1477	+4.4	________	+5.6
1501	+4.4	________	+5.6

Frequency Response Input Attenuator 40 dB

1. On the analyzer, press the following keys:

   (AMPLITUDE) ATTEN AUTO MAN 40 dB
   (AMPLITUDE) 10 (+dBm)

2. Set the FREQUENCY of the analyzer to the measurement frequency shown in Table 10-6.
3. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the analyzer is set in the previous step.
4. On the analyzer, press (PEAK SEARCH).
5. On the sweeper, press POWER LEVEL and adjust the amplitude so the analyzer marker amplitude reads +5 dBm ±0.05 dB.
6. Set the power sensor cal factor (for frequency being measured) on the 8902A and record the measuring receiver power reading in Table 10-6.
7. Repeat steps 1 through 6 for frequencies of 826 MHz, 940 MHz, 956 MHz, 1429 MHz, 1453 MHz, 1477 MHz, and 1501 MHz. Record the results in Table 10-6. The results should be within the limits shown.

Table 10-6. Frequency Response Attenuator 40 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
810	+4.0	________	+6.0
826	+4.0	________	+6.0
940	+4.0	________	+6.0
956	+4.0	________	+6.0
1429	+4.0	________	+6.0
1453	+4.0	________	+6.0
1477	+4.0	________	+6.0
1501	+4.0	________	+6.0

2. Verifying Gate Delay Accuracy and Gate Length Accuracy (Option 105 Only)

Specifications

Gate Delay Refer to Chapter 9, "Specifications," for specific values.

Gate Length Refer to Chapter 9, "Specifications," 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, Δt 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 5316A
Pulse/function generator 8116A
Digitizing oscilloscope 54501A

Cables
BNC, 120 cm (48 in) (four required) 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 10-2.

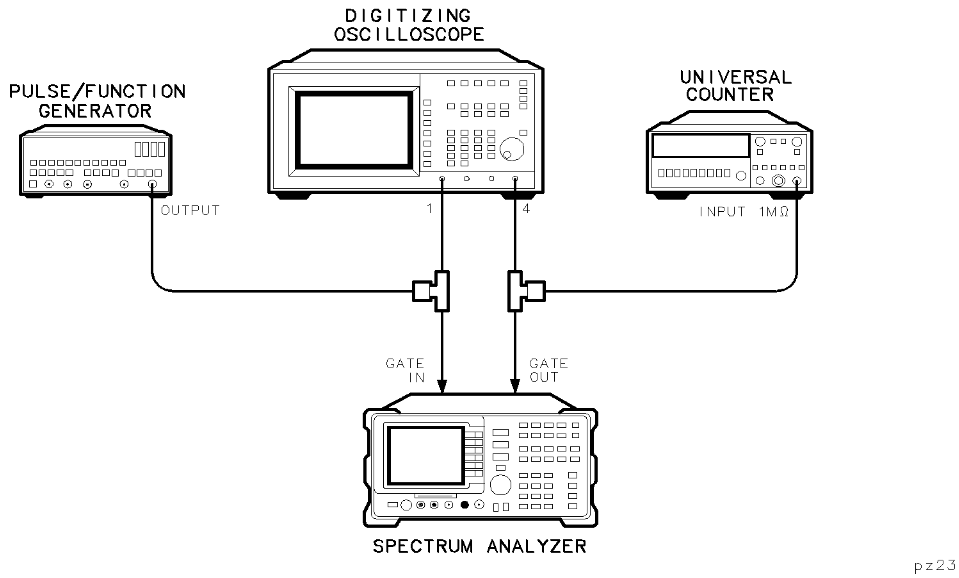


Figure 10-2. Gate Delay and Gate Length Test Setup

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 MENU 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 . . . . 0.0 V

5. Press the following keys on the oscilloscope:

   (RECALL)
   (CLEAR)
   (DISPLAY)
   off frame axes grid . . . . highlight grid
   connect dots off on . . . . highlight on
   (TRIG)
   source 1 2 3 4 . . . . highlight 4
   level . . . . 2 V
   (TIMEBASE) . . . . 500 ηs/div

(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

(DISPLAY)

DISPLAY norm avg env .... highlight env

6. Press (CLEAR DISPLAY) on the oscilloscope. Wait for the trace to fill in, then press the following keys:

(Δt ΔV)

Δt markers off on .... highlight on

stop marker .... 0 μs

To record the minimum and maximum gate delay values

7. On the oscilloscope, press `start marker`. Use the knob to position the start marker on the upper trace on the right side of the oscilloscope display. See Figure 10-3.

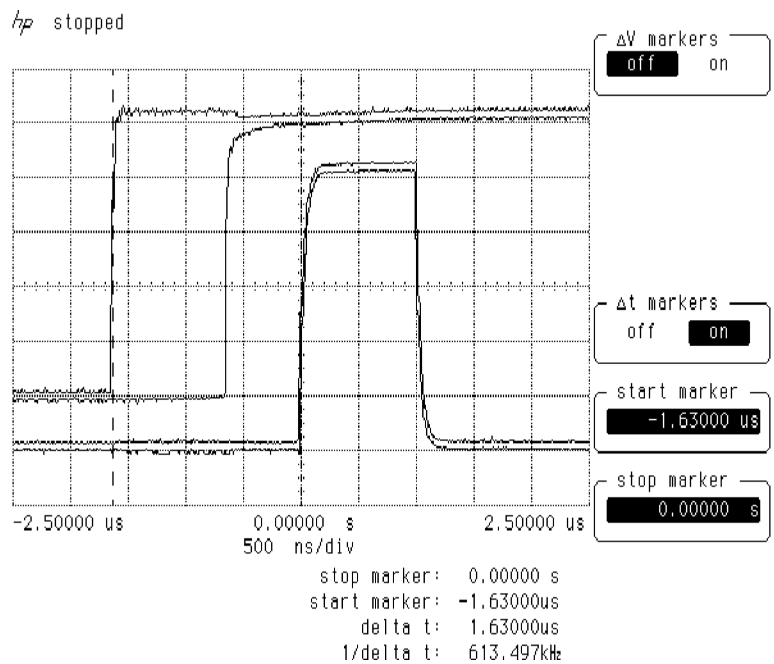


Figure 10-3. Oscilloscope Display of Minimum and Maximum Gate Delay Values

8. Record the Δt value of the start marker reading as the MIN gate delay.

   MIN gate delay ____________________

   (the expected value is greater than 0.0 μs, but less than 2.0 μs)

9. Use the oscilloscope knob to position the start marker on the edge of the left side of the upper trace.

10. Record the Δt value of the start 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

11. Press the following keys on the oscilloscope:

    (BLUE) (+WIDTH) 4

    (DEFINE MEAS)

    statistics off on .... highlight ON

12. Read the average +width (4) displayed on the oscilloscope in the bottom right-hand annotation area.
13. 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)

14. Press the following spectrum analyzer keys:

    (SWEEP) 150 (ms) GATE MENU GATE DELAY 10 (ms) GATE LENGTH 65 (ms)

15. Set the universal counter controls as follows:

    TI .... A → B
    GATE TIME delay .... mid-range
    CHANNEL A .... rising edge, dc couple, SENSITIVITY mode
    CHANNEL B .... falling edge, dc couple, SENSITIVITY mode
    COM A

16. Adjust LEVEL/SENS on the universal counter for best triggering.
17. 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 9, "Specifications," for specific values.

Linear scale Refer to Chapter 9, "Specifications," 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 9, "Specifications," 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 3335A

Cables
BNC, 122 cm (48 in) (two required) 10503A

Additional Equipment for Option 001 Spectrum Analyzer
BNC cable, 75Ω, 120 cm (48 in) . . . . part number 15525-80010

To determine the card insertion loss

1. Connect the equipment as shown in Figure 10-4. (For Option 001 spectrum analyzers, attach the 75Ω cable to the spectrum analyzer RF input connector rather than the 50Ω cable.)

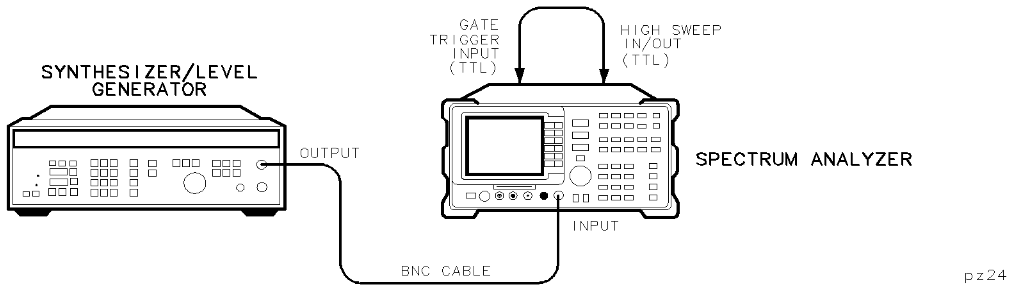


Figure 10-4. Gate Card Insertion Loss Test Setup

2. Set the synthesizer/level generator controls as follows:

   FREQUENCY . . . . 50 MHz
   AMPTD INCR . . . . 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) 50 (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 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 8590 Series spectrum analyzer to improve the accuracy of the spectrum analyzer.
2. A stable RF signal from a synthesized source is input to the spectrum analyzer. The signal is at 870 MHz, the worst-case frequency for spectrum analyzer errors in the radiotelephone band.
3. 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.
4. The frequency measured is compared with the specified IF output frequency of the spectrum analyzer.

Equipment

Synthesized signal generator . . . . 8662A or 8663A
Microwave frequency counter 5343A

Cables
BNC, 122 cm (48 in) (three required) 10503A

Adapters
Type N (m) to BNC (f) (two required) . . . . part number 1250-0780

To determine the IF frequency accuracy

1. Connect the equipment as shown in Figure 10-5.

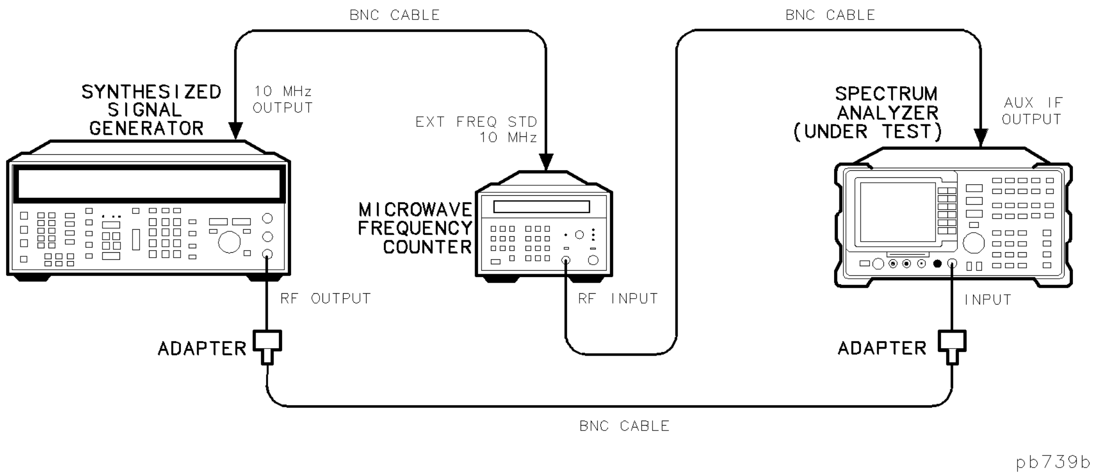


Figure 10-5. IF Frequency Accuracy Test Setup

2. Perform a frequency and amplitude self-calibration on the 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) (810.025) (MHz)
   (AMPLITUDE) (0) (+dBm)
   (MOD OFF)

4. Press the following 8590 Series spectrum analyzer keys:

   (PRESET)
   (CAL) More 1 of 2 CORRECT OFF
   (FREQUENCY) (810.025) (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 8590 E-Series spectrum analyzers. The frequency stability of the 8593E through 8596E spectrum analyzers contributes to an EVM uncertainty of +0.75% to −2.0% 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 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 ....8662A or 8663A
Spectrum analyzer 8566B
Step attenuator (1 dB) 8494A
Step attenuator (10 dB) 8495A
Calibration data for the above attenuators

Cables
BNC, 122 cm (48 in) (five required) 10503A

Adapters
Type N (m) to BNC (f) (three required) .... part number 1250-0780
Type N (m) to type N (m) (one required) .... part number 1250-0778

To Determine the Error Vector Magnitude

1. Connect the equipment as shown in Figure 10-6. 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 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 8590 Series analyzer to view close-in (100 Hz) phase noise at 810 MHz.

---

2. Perform a frequency and amplitude self-calibration on the 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.

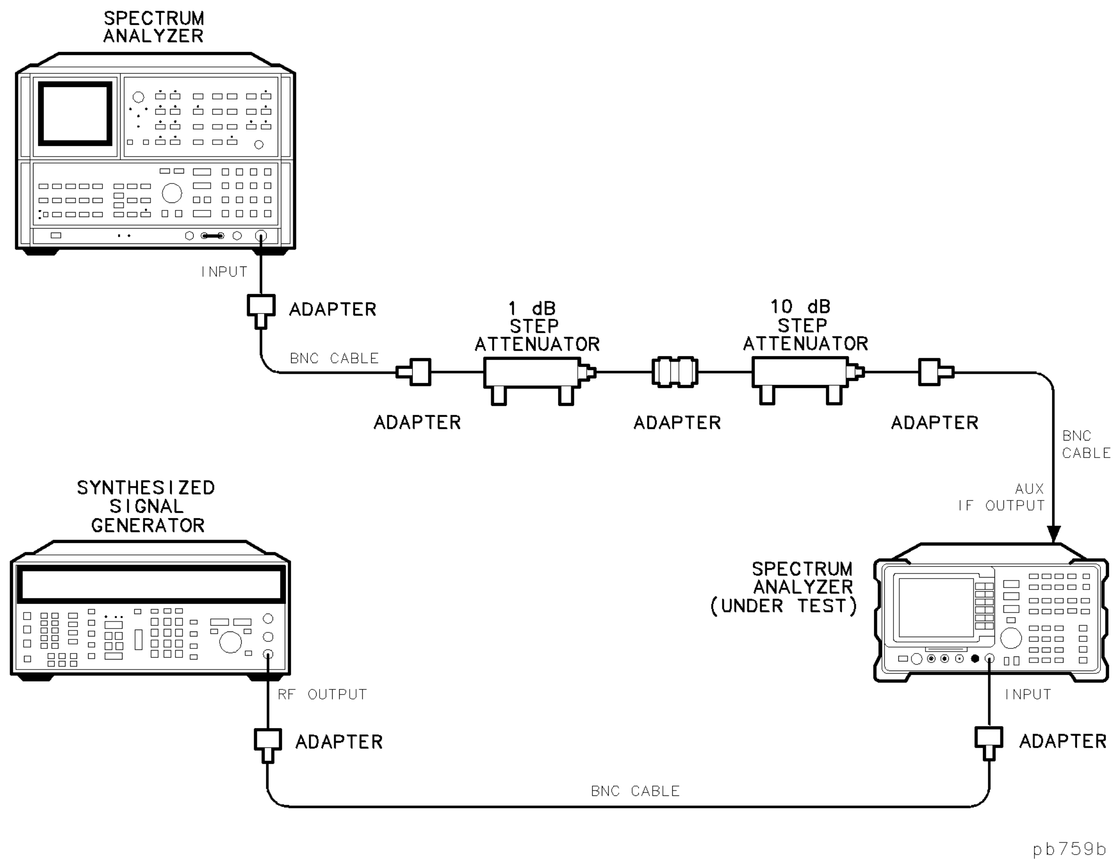


Figure 10-6. Error Vector Magnitude (EVM) Test Setup

3. Press the following synthesized signal generator keys:

   (FREQUENCY) (810.025) (MHz)
   (AMPLITUDE) (0) (+dBm)
   (MOD OFF) (press the blue key and then (FCTN OFF))

4. Press the following 8590 Series spectrum analyzer keys:

   (PRESET)
   SPECTRUM ANALYZER
   (CAL) More 1 of 4 CORRECT OFF
   (FREQUENCY) (810.025) (MHz)
   (BW) (1) (MHz)
   (SPAN) ZERO SPAN

5. Wait 30 minutes for the equipment to stabilize at 810 MHz. This time is necessary to stabilize the YIG oscillator in the 8590 Series analyzer to view close-in (100 Hz) phase noise at 810 MHz.

Measure the carrier (reference) amplitude

6. Press the following 8566B spectrum analyzer keys:
   a. Press (INSTR PRESET) (CENTER FREQUENCY) (21.4) (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 10-7 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 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 10-7, 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 8566B spectrum analyzer keys:
   a. Press (RES BW AUTO) (VIDEO BW AUTO) (SWEEP TIME 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 10-7, 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 8566B spectrum analyzer keys:
   a. Press (RES BW AUTO) (VIDEO BW AUTO) (SWEEP TIME 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) (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.
   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 10-7, record the marker amplitude value in column B on the line that corresponds to 1 kHz offset in the first column.

5. **Verifying Error Vector Magnitude (EVM) (Option 151 Only)**

Table 10-7. 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 10-8. Phase Noise/EVM Worktable 2

Offset	(F) Marker Δ 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 8590 Series spectrum analyzer keys:
    a. Press (FREQUENCY) START FREQ (810.02) (MHz) STOP FREQ (810.13) (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 10-7 for 10 kHz and 100 kHz offsets.

Measure average noise at 10 kHz and 100 kHz offsets

11. Press the following 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 △ (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 10-7 for 10 kHz offset.
    d. Press MKR △ (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 10-7 for 100 kHz offset.
    e. Press (FREQUENCY) CENTER FREQ (810.025) (MHz).
    f. Press (BW) (1) (MHz) (SPAN) ZERO SPAN .

Calculate attenuator settings

12. Calculate the external attenuators setting in Table 10-7:
    a. Refer to Table 10-7.
    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. Calculate 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 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 8566B spectrum analyzer keys:

a. Press MARKER MODE (△) and set the two external attenuators to the value in column E for 100 Hz offset in Table 10-7.

b. Press SWEEP (SINGLE) and wait for one complete sweep. In Table 10-8, 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 10-7.

d. Press SWEEP (SINGLE) and wait for one complete sweep. In Table 10-8, 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 10-7.

f. Press SWEEP (SINGLE) and wait for one complete sweep. In Table 10-8, 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 10-7.

h. Press SWEEP (SINGLE) and wait for one complete sweep. In Table 10-8, 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 10-7.

j. Press SWEEP (SINGLE) and wait for one complete sweep. In Table 10-8, 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 10-8.

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 10-7. Sum the two correction values and record the result in column D of Table 10-7.

b. For each frequency offset, sum the values in columns D and E in Table 10-7, subtract the value in column F of Table 10-8, and record the value in column G of Table 10-8.

c. For each offset, sum the value under column C in Table 10-7 with the values under columns G and I in Table 10-8. Subtract from this sum the value under column H, and record the result in column J of Table 10-8.

Calculate %EVM

16. Calculate %EVM using corrected phase noise values in Table 10-8.

The EVM contribution of the 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:

$$\text{Percent EVM} = 100\sqrt{(2.07936 * 10^{-5}) + 4\left[1.00456 * sin^2\left(\frac{\text{Phase error}}{2}\right)\right]}$$

a. First, solve for P_1 through P_5 using the values for phase noise listed in column J of Table 10-8. Column J phase noise values are represented with the variable *J* in the equations.

Use the value of **J** in Table 10-8 for 100 Hz offset:

$$J = J - (log 1.5 * 40)$$

$$P_1 = 1.125 * 10^6 \left(\frac{10^{\frac{J}{20}}}{100}\right)^2$$

Use the value of **J** in Table 10-8 for 400 Hz offset:

$$P_2 = .005 \left(\frac{10^{\frac{J}{20}}}{0.0025}\right)^2$$

Use the value of **J** in Table 10-8 for 1 kHz offset:

$$P_3 = 2000(10^{\frac{J}{20}})^2$$

Use the value of **J** in Table 10-8 for 10 kHz offset:

$$P_4 = 7.383 * 10^{-8} \left(\frac{10^{\frac{J}{20}}}{1 * 10^{-6}}\right)^2$$

Use the value of **J** in Table 10-8 for 10 kHz offset:

$$P_5 = 1 * 10^{-5} \left(\frac{10^{\frac{J}{20}}}{1 * 10^{-5}}\right)^2$$

b. Next, solve for P_t:

$$P_t = 2\sqrt{(P_1 + P_2 + P_3 + P_4 + P_5)}$$

c. Now solve for phase error:

$$\text{Phase Error} = 57.296\left(\frac{P_t}{\sqrt{2}}\right)$$

d. Finally, solve for percent EVM:

$$\text{Percent EVM} = 100\sqrt{(2.07936 * 10^{-5}) + 4\left[1.00456 * sin^2\left(\frac{\text{Phase error}}{2}\right)\right]}$$

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 10-9. Performance Verification Test Record (Page 1 of 3)

Agilent Technologies

Address: ____________________ Report No. ____________________

____

____________________ Date ____________________

____________________ (e.g. 10 SEP 1989)

Model 8590 Series spectrum analyzer with 85720C

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
Synthesized signal generator			
Synthesized sweeper			
Synthesizer/level generator			
Spectrum analyzer			
Measuring receiver			
Power sensor			
Oscilloscope			
Microwave frequency counter			
Universal counter			
Pulse/function generator			
Power splitter			
1 dB Step attenuator			
10 dB Step attenuator			

Performance Verification Test Record (Page 2 of 3)

Agilent Technologies Model 8590 Series spectrum analyzer with 85720C	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 810 MHz	−9.5 dBm	______	−8.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 826 MHz	−9.5 dBm	______	−8.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 940 MHz	−9.5 dBm	______	−8.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 956 MHz	−9.5 dBm	______	−8.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 1429 MHz	−9.5 dBm	______	−8.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 1453 MHz	−9.5 dBm	______	−8.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 1477 MHz	−9.5 dBm	______	−8.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 1501 MHz	−9.5 dBm	______	−8.5 dBm	+0.24/−0.25 dB
	20 dB attenuation				
	Amp accuracy at 810 MHz	+0.5 dBm	______	+1.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 826 MHz	+0.5 dBm	______	+1.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 940 MHz	+0.5 dBm	______	+1.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 956 MHz	+0.5 dBm	______	+1.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 1429 MHz	+0.5 dBm	______	+1.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 1453 MHz	+0.5 dBm	______	+1.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 1477 MHz	+0.5 dBm	______	+1.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 1501 MHz	+0.5 dBm	______	+1.5 dBm	+0.24/−0.25 dB
	30 dB attenuation				
	Amp accuracy at 810 MHz	+4.5 dBm	______	+5.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 826 MHz	+4.5 dBm	______	+5.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 940 MHz	+4.5 dBm	______	+5.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 956 MHz	+4.5 dBm	______	+5.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 1429 MHz	+4.5 dBm	______	+5.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 1453 MHz	+4.5 dBm	______	+5.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 1477 MHz	+4.5 dBm	______	+5.5 dBm	+0.24/−0.25 dB
	Amp accuracy at 1501 MHz	+4.5 dBm	______	+5.5 dBm	+0.24/−0.25 dB
	40 dB attenuation				
	Amp accuracy at 810 MHz	+4.0 dBm	______	+6.0 dBm	+0.24/−0.25 dB
	Amp accuracy at 826 MHz	+4.0 dBm	______	+6.0 dBm	+0.24/−0.25 dB
	Amp accuracy at 940 MHz	+4.0 dBm	______	+6.0 dBm	+0.24/−0.25 dB
	Amp accuracy at 956 MHz	+4.0 dBm	______	+6.0 dBm	+0.24/−0.25 dB
	Amp accuracy at 1429 MHz	+4.0 dBm	______	+6.0 dBm	+0.24/−0.25 dB
	Amp accuracy at 1453 MHz	+4.0 dBm	______	+6.0 dBm	+0.24/−0.25 dB
	Amp accuracy at 1477 MHz	+4.0 dBm	______	+6.0 dBm	+0.24/−0.25 dB
	Amp accuracy at 1501 MHz	+4.0 dBm	______	+6.0 dBm	+0.24/−0.25 dB

Performance Verification Test Record (Page 3 of 3)

Agilent Technologies Model 8590 Series spectrum analyzer with 85720C	Report No. ______
Serial No. ______	Date ______

Test No.	Test Description	Results			Measurement Uncertainty
		Min	Measured	Max	
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**				
	8593/4/5/6E	21.399985 MHz	______	21.400015 MHz	NA
5.	**Error vector magnitude (EVM)**				
	8593/4/5/6E		______	1.5%	±0.5%

Glossary

π/4 DQPSK
π/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.

amplitude droop
The amplitude slope of an NADC burst signal measured at the decision points over one timeslot. The units typically are dB/symbol.

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 spectrum analyzer ability 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.

base station (BS)
A controlling transceiver that provides service to cellular mobile stations. Also called a cell site.

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 PDC signal this refers to the 280 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 PDC signal, using the slope of the signal phase at the decision points after subtraction of the IF.

CC
This acronym stands for the color code and is an eight-bit segment of the 280-bit PDC timeslot bit sequence. For PDC these are bits 139 through 146.

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 codec performs analog to digital and digital to analog conversions on voice signals. It is also 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 PDC signal where magnitude and phase information are measured to obtain the bit sequence and signal modulation accuracy. A PDC timeslot consists of 141 decision points, which create 140 symbols and 280 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 technique of extracting the information used to modulate a 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 PDC 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 PDC 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. Refer to chapter 9, "Operating Reference/Specifications," for a further discussion of EVM.

external trigger signal

For the PDC 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 PDC signal, a frame consists of six timeslots. Each frame is equivalent to 840 symbol periods (1680 bits) and is 40 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 8590E-series analyzers called FRAME TRIG OUTPUT. For PDC signals, this rear panel frame trigger is a TTL level positive pulse of 1.4 microsecond duration with a period of 40 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.

GPIB
The abbreviation for General Purpose 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.

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 Agilent Technologies 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 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 162, the I-Q trajectory pattern of an PDC 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 spectrum analyzer measurement range. 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 Agilent Technologies 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. Spectrum analyzers not based upon microprocessors 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 PDC 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 PDC 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 Agilent Technologies 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 memory device shaped like a credit card 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.

mobile station (MS)
A transceiver unit operating as part of a cellular system. Also called the subscriber unit. This includes vehicle-mounted handheld units.

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 PDC 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**.

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 EMI measurements usually call for peak detection.

personality
Applications available on a memory card or other electronic media that extends the capability of an instrument for specific uses. Examples include the 85720C PDC 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 PDC signal has an ideal phase and a measured phase. Phase error is the difference between the ideal and measured phase expressed in degrees.

For PDC 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 PDC frame structure, point 0 refers to the start of the first symbol 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.

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.

RX (receive) band
The frequency range over which a PDC base station or mobile station can receive carrier signals.

SACCH
This acronym stands for the *slow associated control channel*, and is a 15 or 21-bit segment of the 280-bit PDC timeslot bit sequence. For PDC base stations, these are bits 148 through 168. For PDC mobile stations, these are bits 148 through 162.

scale factor
The display vertical axis calibration in terms of single division units.

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. Agilent Technologies 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.

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.

symbol
For the PDC modulation scheme, a symbol consists of 2 bits of data.

synchronization word
The synchronization (sync) word is a segment of the bit sequence used to identify the timeslot that contains it. For PDC signals there are six different sync words; one for each timeslot in a frame. The sync words are each 20-bits long. For PDC information channels the sync word consists of bits 119 through 138.

syntax
The grammar rules that specify how commands must be structured for an operating system, programming language, or applications.

TCH
This acronym stands for Traffic Channel and is the portion of a PDC timeslot bit sequence which contains the voice (traffic) data. For PDC mobile stations, this consists of bits 7 through 118, and bits 163 through 274. For PDC base stations, this consists of bits 7 through 118, and bits 169 through 280. These TCH bit sequences are all 112 bits long.

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 duplex (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 PDC system, there are six timeslots per frame. Each timeslot is 140 symbol periods (280 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 the spectrum analyzer displays. The number of traces is specific to the instrument.

transmission 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.

TX (transmit) band
The frequency range over which a PDC base station or mobile station can transmit carrier signals.

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 dissipated in the nominal input impedance of the spectrum analyzer), dBmV (dB relative to 1 mV), dBμV (dB relative to 1 μV), V (volts), and, in some spectrum analyzers, W (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 cutoff 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.

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