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User's Guide

HP 85718B NADC-TDMA Measurements Personality Including Digital Demodulation

HEWLETT PACKARD

HP Part No. 85718-90013 Supersedes 85718-90004
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Safety Symbols

The following safety symbols are used throughout this guide. Familiarize yourself with each of the symbols and its 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

Warning

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

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

Caution

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

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

What is the NADC Communication System?

North American Dual Mode Cellular (NADC) is a wireless cellular telephone communication system. NADC is also called North American Digital Cellular, American Digital Cellular (ADC), or United States Digital Cellular (USDC). Occasionally it is also referred to as Digital Advanced Mobile Phone Service (D-AMPS) or NADC-TDMA.

The NADC communication system is defined in Electronics Industry Association (EIA) and Telecommunications Industry Association (TIA) standard documents. All relevant and applicable standard documents are listed in the specifications section of Chapter 9.

Each base station retains the analog control channels and analog traffic channels of the advanced mobile phone service (AMPS) system. In addition, a base station can have digital traffic channels. The mobile stations are dual mode and access the network via the analog control channel. They are capable of using either analog or digital traffic channels. Digital control channel and digital only mobile stations are also currently being produced.

The AMPS system and the analog part of the NADC IS-54 system employ frequency division multiple access (FDMA). FDMA means that each traffic channel is assigned to a separate RF frequency. A pair of frequencies 45 MHz apart (for 1900 MHz it is 80 MHz apart) is used to provide full duplex operation of the NADC system. The RF channel spacing is 30 kHz. The modulation for the analog portion is frequency modulation (FM).

The digital part of the NADC system employs a combination of FDMA and time division multiple access (TDMA). The NADC time division multiple access structure allows up to six users to share a single carrier frequency. The TDMA frame structure divides time on a carrier into a stream of frames. Each frame is 40 ms long. and has six timeslots; thus, timeslots are 6.67 ms long. A digital traffic channel is defined by a carrier frequency (or channel number), and a timeslot number. Each user must transmit data only on his carrier frequency, at a time defined by his timeslot number. Currently, two timeslots per frame for each user are required because more time is required to transmit voice using the full-rate speech codecs presently available. When half-rate speech codecs are incorporated into the system, each traffic channel will require just one timeslot per frame.

NADC digital mobile stations transmit a burst of data when their assigned timeslot occurs. This means a mobile station transmission is burst amplitude modulated, ramping transmit power on and off. An NADC digital base station transmits continuously, switching digital modulation on at the appropriate timeslot.

The digital modulation format used in the NADC system is $\pi/4$ shifted differentially encoded quadrature phase shift keying, or $\pi/4$ 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. Two bits make one NADC symbol. The digital modulation operates at 162 symbols, or 324 bits in each timeslot. Since there are 1944 bits for all 6 timeslots in the frame, the transmission bit rate is 48,600 bits per second at 25 frames per second.

What Does the HP 85718B NADC-TDMA Measurements Personality Do?

The HP 85718B NADC-TDMA measurements personality can help determine if an NADC-TDMA transmitter is working correctly. The HP 85718B adapts HP 8590E Series spectrum analyzer hardware for the testing of an NADC-TDMA transmitter according to the Electronics Industry Association (EIA) and Telecommunications Industry Association (TIA) standard documents. Refer to the special section of Chapter 9 for the complete list of applicable documents. These documents define complex, multi-part measurements used to maintain an interference-free environment and ensure voice quality. For example, the documents include measuring the power of a carrier. The HP 85718B automatically makes these measurements using the measurement methods and limits that are defined in the standards. The detailed results displayed by the measurements allow you to analyze NADC-TDMA system performance. You may alter the measurement parameters for specialized analysis.

The HP 85718B was primarily developed for making measurements on digital transmitter carriers. HP 85718B 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 HP 85718B operates with the Option 151 and 160 digital demodulator hardware to make modulation accuracy measurements, and demodulate the transmitted bits of an NADC digital base or mobile station transmission. 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, I-Q origin offset, and amplitude droop. 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 NADC 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 vs time, and adjacent channel power may also be triggered using the frame trigger via the rear panel FRAME TRIG OUTPUT signal. Note that the NADC frame trigger frequency is locked to the spectrum analyzer reference, and may drift slowly relative to the NADC timeslots. Re-positioning, or re-acquiring, the frame trigger is automatic when using the 85718B personality.

The E-TDMA Mode capabilities

The HP **85718B** personality includes a mode for measuring the E-TDMA system. This system uses all of the NADC-TDMA measurement methodologies, but is different in its slot structure.

- E-TDMA Mode:
  - Under the (MODE) **hardkey**, an additional **softkey** has been labeled **E-TDMA**. This **softkey** activates the HP **85718B** measurement personality to measure an E-TDMA transmission signal. Measurements under the E-TDMA mode operate identically to that of the NADC mode. Measurement algorithms and displayed results are identical to that of the NADC mode. The differences between modes are based on system differences between NADC and E-TDMA signals.
- E-TDMA system differences:
  - The E-TDMA system physical layer is identical to the NADC-TDMA **(IS-54, IS-136)** system in every way except:

    1. The time slot burst is 12 bits (6 symbols) shorter in duration.
    2. The base station transmission may optionally burst in the future.
    3. The time slot bit format is as follows:

Slot format Subscriber to Infrastructure								
Pretune	Ramp	Data	Synch	CFD	Data	Data	Guard	Freq Tune
6	6	16	28	12	122	122	6	6

Slot format Infrastructure to Subscriber								
Pretune	Ramp	Data	Synch	CFD	Data	Data	Guard	Freq Tune
6	6	16	28	12	122	122	6	6

Synchronization word: Synchronization word is located in exactly the same location as IS-54,-136.

Data bits: Data bits are located in different locations than that of IS-54.

CFD bits: Code Format Discriminator is same location and number of bits as the **IS-54** CDVCC.

SACCH: There is no SACCH in E-TDMA.

Accordingly, all measurements have been adjusted to compensate for the shorter burst of the mobile - including carrier power, adjacent channel power, power versus time and all modulation accuracy metrics and displays.

In This Guide

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

lb use this guide:

1. Perform the procedures in Chapter 1. These procedures explain how to prepare the spectrum analyzer for making a NADC measurement.
2. Once you have completed Chapter 1, proceed to Chapter 2 if you are testing a base station, or, if you are testing a mobile station, proceed to Chapter 3. Chapters 2 and 3 contain the procedures for making measurements with the NADC measurements personality.

The rest of the guide has information that you may want to refer to.

- Chapter 4 contains test procedures that verify the electrical performance of the improved amplitude accuracy for NADC option (Option 050), the time-gated spectrum analysis card (Option 105), and the digital demodulator Option 151/160. The verification tests should be performed at least once per year.
- Chapter 5 contains information about how to use a computer to operate the NADC measurements personality.
- Chapter 6 contains information about what to do if you have a problem with the NADC measurements personality.
- Chapter 7 contains reference information about the personality's base station measurement functions.
- Chapter 8 contains reference information about the personality's mobile station measurement functions.
- Chapter 9 contains general reference information about the NADC measurements personality, and the specifications and characteristics for the HP 85718B.
- Chapter 10 contains reference information about the NADC measurements personality's programming commands.

Key Conventions

The following key conventions are used in this guide:

Front-panel key	Text shown like this represents a key physically located on the spectrum analyzer.
Softkey or **SOFTKEY**	Text shown like this represents a softkey. (The softkeys are located next to the softkey labels, and the softkey labels are the annotation on the right side of the spectrum analyzer display.) If the softkey label contains upper and lowercase letters, pressing the softkey will access more softkeys. If the softkey label contains all uppercase letters, pressing the softkey will perform an immediate action.
`Screen Text`	Text printed in this typeface indicates text displayed on the spectrum analyzer.

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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8. Mobile Station Menu Map and Softkey Descriptions

9. Operating Reference

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1

Getting Started

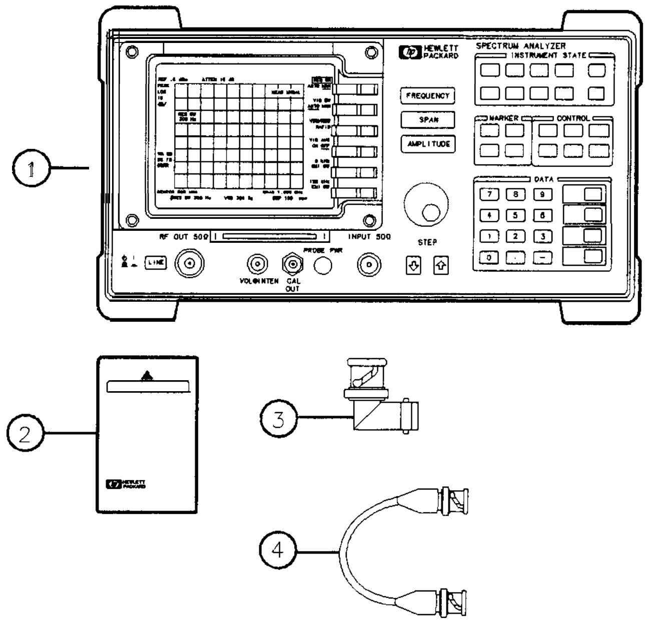
This chapter helps acquaint you with the spectrum analyzer features that you will be using, and also contains the procedures for preparing the spectrum analyzer to measure a NADC-TDMA or E-TDMA transmission. This chapter contains the following information:

- Descriptions of the equipment that you will need.
- Descriptions of the HP 8590 Series spectrum analyzer features that you will be using.
- Procedures for accessing the NADC analyzer mode.
- Procedures for accessing the spectrum analyzer functions (performing the procedures in this section is optional).

You should do all the procedures in "Preparing to Make a Measurement" (located in this chapter) before proceeding to Chapter 2 or Chapter 3.

The Equipment that You Will Need

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



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1 An HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E spectrum analyzer. The firmware in the spectrum analyzer must be dated 930506 or later. The options shown in Table l-l should be installed in the spectrum analyzer.

2 The HP 85718B NADC-TDMA measurements personality read-only memory (ROM) card. The NADC measurement personality is a program that resides on this ROM card.

3 Four BNC-male to BNC-female right-angle adapters. The HP part number for the adapters is 1250-0076.

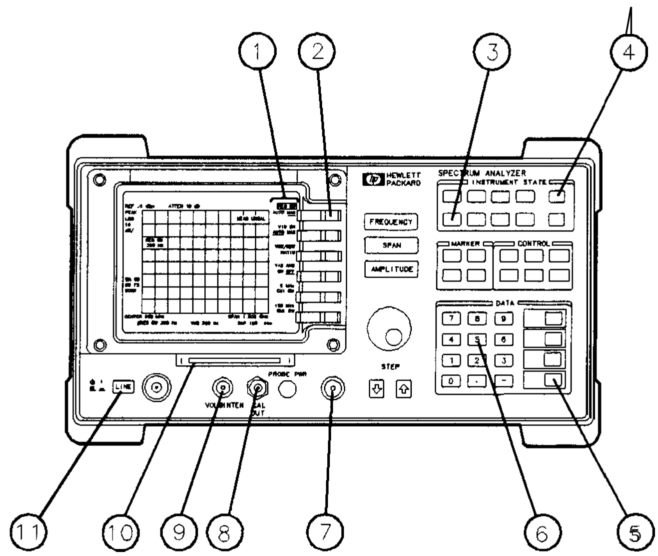
4 Two short BNC cables, HP part number 8120-2682.

Table 1-1. Required Options

Option	Use	Description
Option 004	Base and mobile station	The precision frequency reference provides increased frequency accuracy. If the spectrum analyzer does not have Option 004 installed in it, you must use an external 10 MHz precision frequency reference when performing a NADC measurement.
Option 101	Mobile station	The fast time-domain sweeps option card provides 20 ms to 20 μs sweep times in zero span. Option 101 is not required if Options 151/160 are installed.
Option 105	Mobile station	The time-gated spectrum analyzer option card provides the trigger delay and time gating needed in the power versus time and adjacent channel power measurements. (If you are retrofitting an older spectrum analyzer, the Option 105 card must have a serial number prefix of 3121K or higher.)
Options 151/160	Base and mobile station	The combination of the digital demodulator RF card, the digital demodulator digital signal processor (DSP) card, and the three digital signal processing (DSP) ROMs provided by Options 151/160 give the capability of digital demodulation measurements. Option 101 is not required if Options 151/160 are installed.
Option 050	Base and mobile station	The improved amplitude accuracy for the NADC/PDC option is recommended for use with the HP 85718B, but not required. Option 050 is a spectrum analyzer with improved amplitude accuracy specifications over the NADC and PDC frequency ranges. **Note:** Earlier versions of Improved Amplitude Options 050 (NADC) and 053 (CDMA) provided improved amplitude accuracy only in the 800 MHz cellular bands. In order to meet the improved amplitude accuracy specifications in the PCS bands, your HP 8590 E-Series spectrum analyzer must have Option 050 or Option 053 installed or calibrated after 21 February, 1997. The analyzer will meet the improved amplitude accuracy specifications if either: 1. These options were installed after 21 February, 1997 or 2. The analyzer was last calibrated after 21 February, 1997 If neither of these is true, then the verification procedure must be performed. If the instrument does not validate, you must have it serviced to guarantee the improved amplitude performance in all applicable frequency ranges.

The HP 8590 Series Spectrum Analyzer Front-Panel Features

To use the NADC measurements personality, you need to be familiar with the following features of an HP 8590 Series spectrum analyzer.



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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 within shaded boxes (for example, NADC ANALYZER).

2 The dark gray 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 NADC 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 memory card reader is where a random-access memory (RAM) or read-only memory (ROM) card is inserted.

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

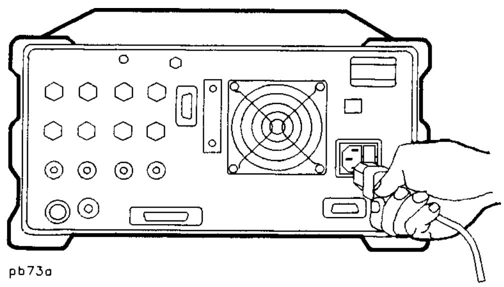
Preparing to Make a Measurement

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

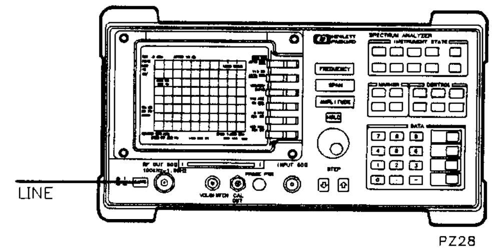
1. Load the NADC measurements personality into the spectrum analyzer memory.
2. Perform the spectrum analyzer self-calibration routines.
3. Make the cable connections for triggering the spectrum analyzer.
4. Connect the external precision frequency reference.
5. Access the NADC analyzer mode.

Step 1. Load the NADC measurements personality

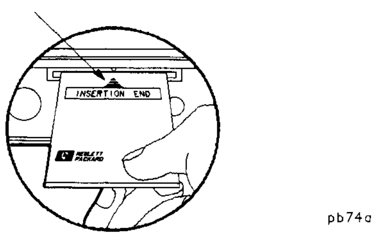
1 Plug the spectrum analyzer into an ac power supply.



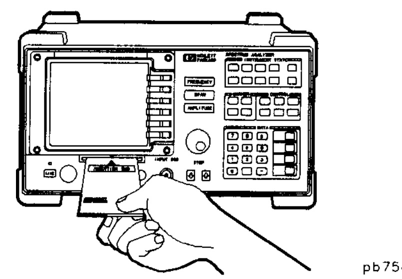
2 Press the (LINE) key.



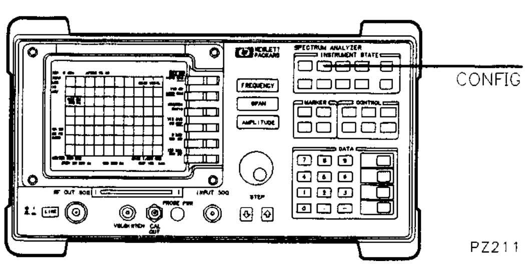
3 Locate the arrow printed on the NADC measurement personality's card label.



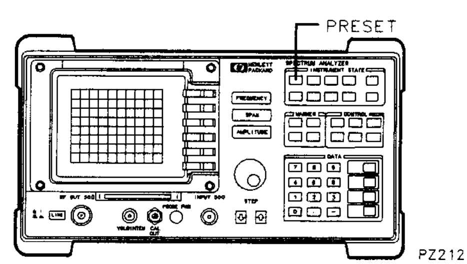
4 Insert the card into the spectrum analyzer with the card's arrow matching the raised arrow on the bezel around the card-insertion slot.

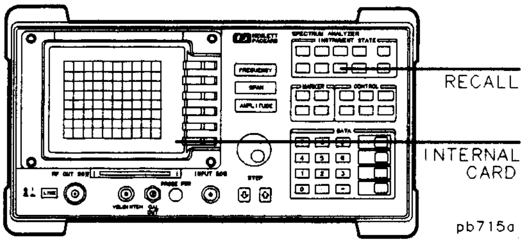
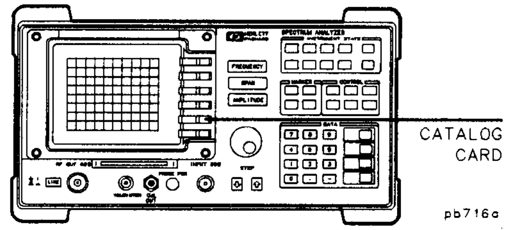
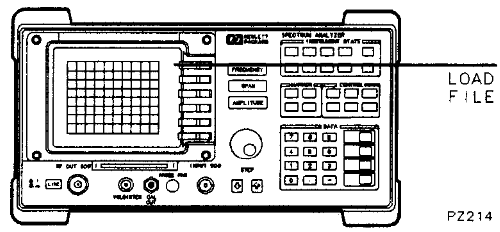


5 Press (CONFIG) **More 1 of 3** **Dispose User Mem** **ERASE DLP MEM** **ERASE DLP MEM**



6 Press (PRESET).

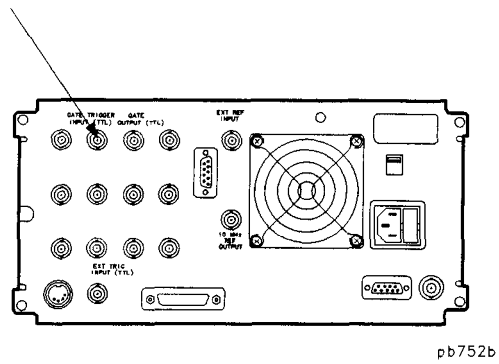


7 Press (RECALL). Press the **INTERNAL CARD** softkey so that CARD is underlined.	8 Press **Catalog Card** **CATALOG ALL**.
	
9 Ensure that **dNADC** is highlighted on the spectrum analyzer display. If necessary, use the large knob on the spectrum analyzer front panel so that **dNADC** is highlighted.	10 Press **LOAD FILE** . It takes about four minutes to load the NADC measurements personality.
NADC 512 → **dNADC** D L P	
When the spectrum analyzer has finished loading the NADC measurements personality, the catalog entries will be blanked from the spectrum analyzer display.	After completing this procedure, the NADC measurements personality will remain in the spectrum analyzer memory even if the line power is removed or the instrument is turned off. It will remain in memory until deleted with **ERASE DLP MEM** .

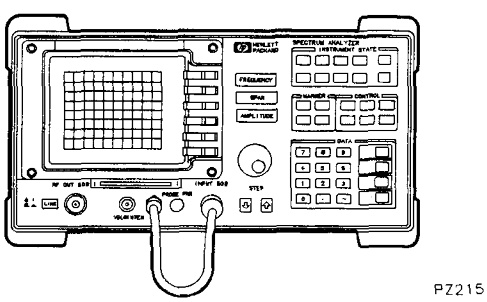
Step 2. Perform the spectrum analyzer self-calibration routines

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

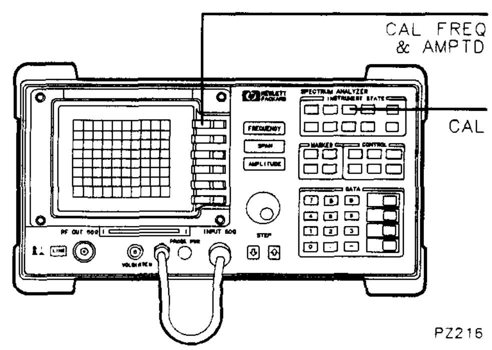
1 Ensure that there is nothing connected to the GATE TRIGGER INPUT connector on the spectrum analyzer rear panel.



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

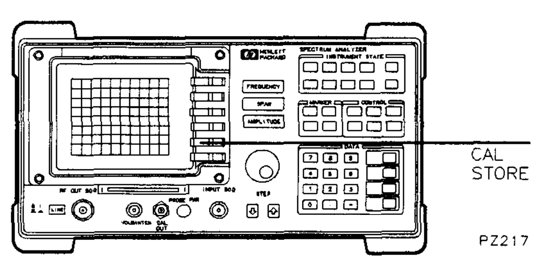


3 Press (CAL), then **CAL FREQ & AMPTD** .



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 Chapter 6, "If You Have a Problem."

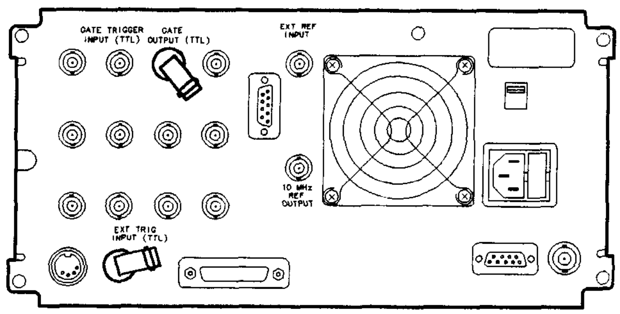
4 Press CAL **STORE** .



For the spectrum analyzer to meet its specifications and characteristics, 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, see "Improving Accuracy with Self-Calibration Routines" and "When is Self-Calibration Needed?" in the spectrum analyzer documentation.

Step 3. Make the cable connections for triggering

Perform this procedure if you have Options 101 (or Options 151/161) and 105 installed in your spectrum analyzer and you wish to trigger the spectrum analyzer as required by power vs time and adjacent channel power testing of mobile stations. Otherwise, proceed to the following 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.



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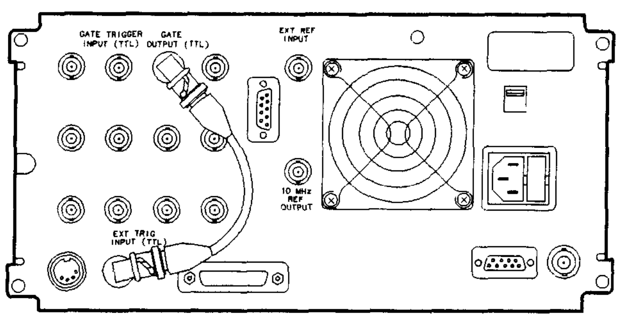
2 Connect a short BNC cable between the two adapters.



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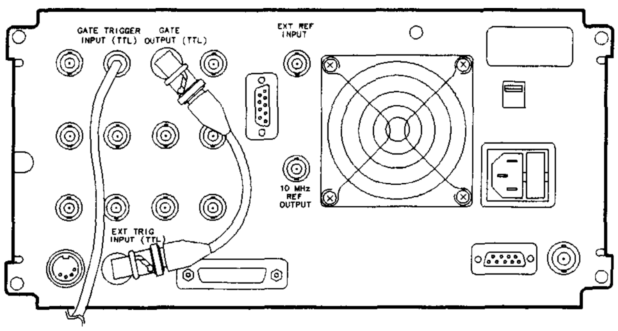
It is not necessary to remove the BNC cable after you have connected it to the right-angle adapters. This cable can remain attached to the spectrum analyzer for all the NADC measurements, all the self-calibration routines, and all the conventional spectrum analyzer functions. If you need to set the spectrum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

3 If you want to use an external trigger signal, continue with this procedure. If you have Options 151/161 installed and you want to use frame triggering, proceed to the following procedure "Step 4. Make the cable connections for frame triggering." Frame triggering is recommended if Options 151/161 are present.

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

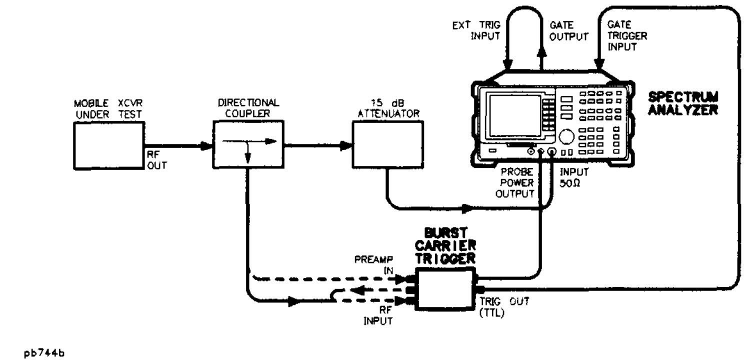


pb756b

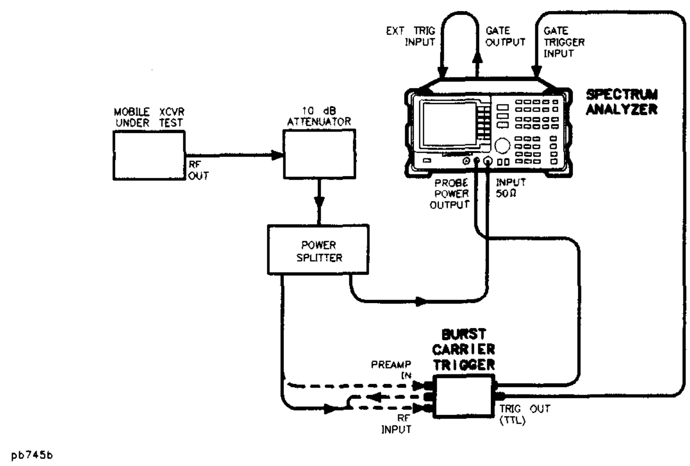
This TTL trigger signal provides an external trigger for the spectrum analyzer. The trigger signal should be a TTL pulse at least 1 μsec wide that occurs once for each NADC burst.

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

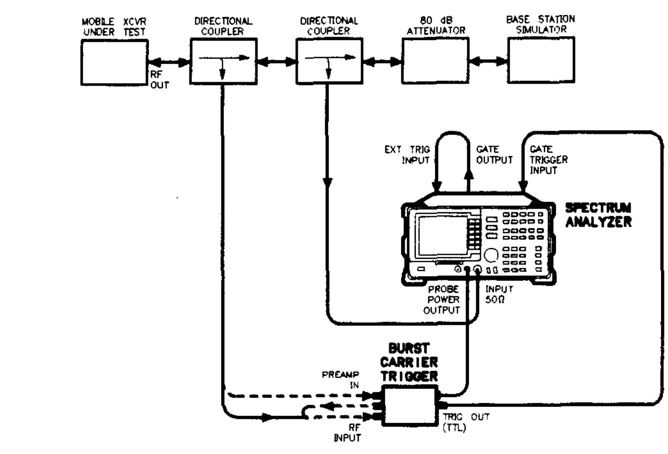
Some examples of using the HP 85902A Burst Carrier Trigger are shown below.



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



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

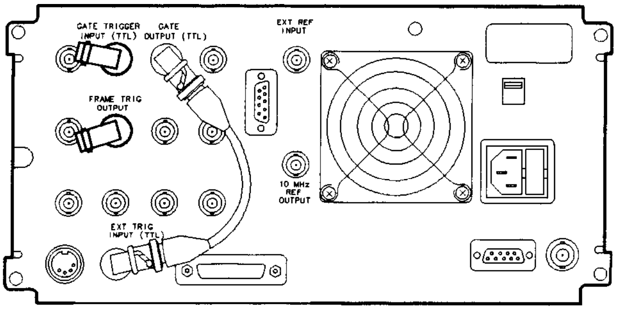


Mobile Station with a Base Station

Step 4. Make the cable connections for frame triggering

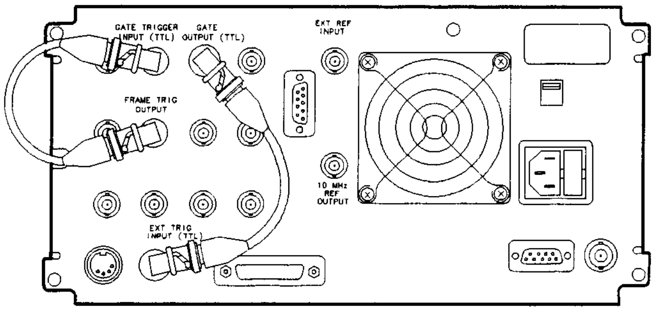
Perform this procedure if you have Options 151/161 and you wish to trigger the spectrum analyzer using the frame trigger for mobile station power vs time and adjacent channel power measurements.

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.



pb747b

2 Connect a short BNC cable between the two adapters.



pb748b

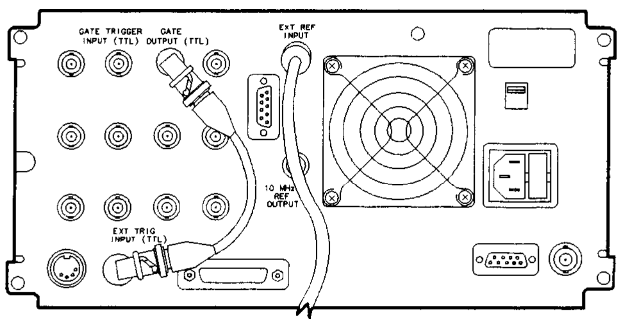
It is not necessary to remove the BNC cable after you have connected it to the right-angle adapters except when executing self calibration (CAL AMPTD or CAL FREQ & AMPTD). This cable can remain attached to the spectrum analyzer for all the NADC measurements and all the conventional spectrum analyzer 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 your spectrum analyzer does not have Option 004 installed in it.

1 Disconnect the connector from the 10 MHz REF OUTPUT and EXT REF IN connectors on the rear panel.

2 Connect the 10 MHz signal from a precision external frequency reference to the EXT REF IN connector.



pb757b

Step 6. Access the NADC analyzer or **E-TDMA** analyzer mode

1 Press (MODE) **NADC ANALYZER** to access the NADC analyzer mode or press (MODE) **E-TDMA ANALYZER** to access the E-TDMA analyzer. You will see the copyright message for the HP **85718B. This** message is only displayed the first time you access the NADC analyzer mode.

NADC-TDMA and E-TDMA ANALYZER B.02.00
Copyright Hewlett-Packard 1992 - 1996
All Rights Reserved

IMPORTANT MESSAGE
The HP 857188 Personality has now been installed
on HP 8591 Spectrum analyzer serial number 1064.

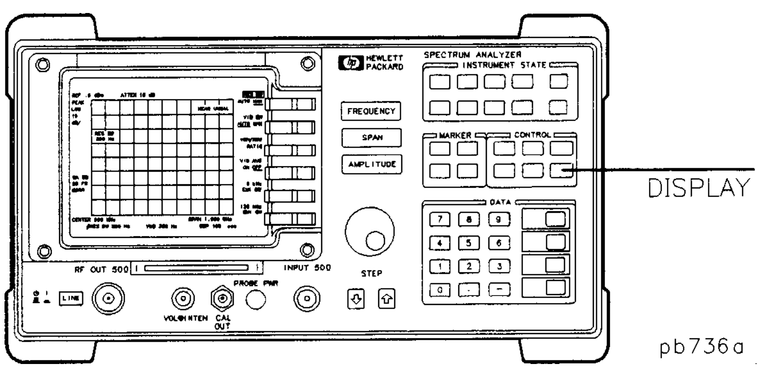
This software is licensed far use an ONE spectrum
analyzer at a time.

See the HP 857188 User's Guide for the complete
License Agreement.

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

RT

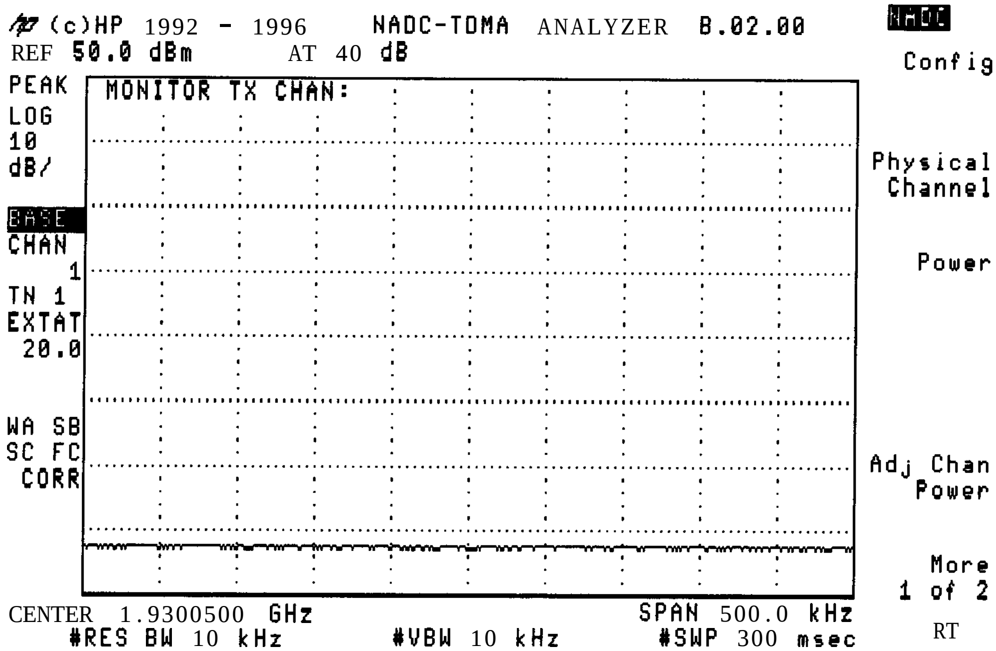
2 After reading the copyright message, press (DISPLAY) to erase the message.



pb736a

Usually, you will press (MODE) **NADC ANALYZER** to access the NADC analyzer mode. You need to press (DISPLAY) to access the NADC personality for the first time after you load the NADC measurements personality into spectrum analyzer memory.

When the spectrum analyzer is using the NADC or E-TDMA analyzer mode, **NADC** or **E-TDMA** will appear in the upper right corner of the spectrum analyzer display.



The NADC Measurements Personality Main Menu

f your spectrum analyzer does not have Option 004 installed in it, the message Ext precision treq reference required will be displayed. This message is a reminder that you must use an **xternal** frequency reference when using the NADC measurements personality. See the **revious** procedure, "Step 5. Connect the external precision frequency reference" for nformation about connecting an external frequency reference to the spectrum analyzer.

f any other messages are displayed, see Chapter 6, "If You Have a Problem."

Note Text and graphics throughout this manual assumes the **NADC ANALYZER** button has been pressed. All significant differences between NADC mode and E-TDMA mode will be noted.

Accessing the Spectrum Analyzer Functions

The menus of the NADC measurements personality provide the softkeys that are normally needed for making NADC measurements. You may want to use some spectrum analyzer functions without leaving the NADC analyzer mode, or you may want to exit the NADC 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 NADC analyzer mode.
- Access the spectrum analyzer mode.

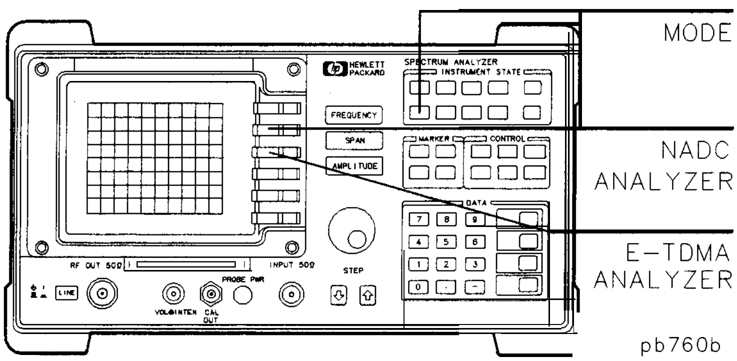
To access the spectrum analyzer functions while using the NADC analyzer mode

1 lb use a spectrum analyzer function without leaving the NADC 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; see the spectrum analyzer documentation for more information).

2 To return to a NADC analyzer menu, you can do either of the following:

- To return to the NADC 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 NADC measurements personality, press (MODE) **NADC ANALYZER** .

Some spectrum analyzer front-panel keys can provide useful, supplemental functions for NADC measurements, and most spectrum analyzer functions can be used while using the NADC analyzer mode. See "Changes to the Spectrum Analyzer Functions During NADC Operation" in Chapter 9 for the list of the functions that cannot be used while in the NADC analyzer mode.



To access the spectrum analyzer mode

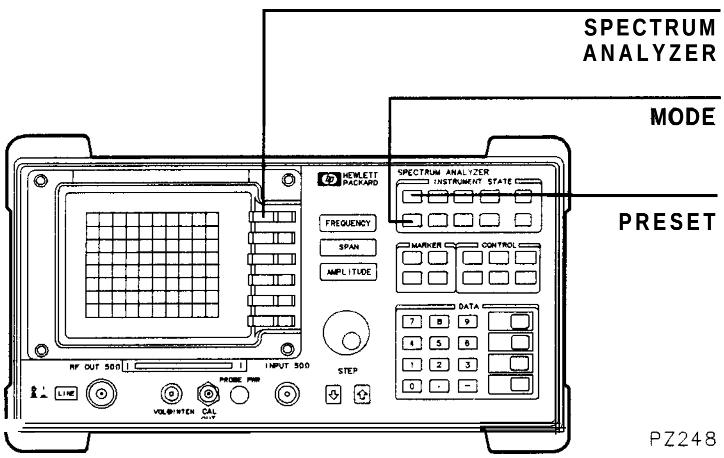
- The recommended method of accessing the spectrum analyzer mode is to press (MODE), then **SPECTRUM ANALYZER** . Unlike (ANALZET), **SPECTRUM YZER** does not change any of the NADC measurements personality's **softkey** settings.

or,

- Press (PRESET). (PRESET) changes all of the NADC measurements personality functions back to their default values, except for the functions in the configuration menus and the channel number. (The functions in the configuration menus and the channel number keep their previous value.)

When you press **SPECTRUM ANALYZER** or (PRESET), the spectrum analyzer will exit the NADC measurements personality and use the spectrum analyzer mode instead. When the spectrum analyzer is in the spectrum analyzer mode, NADC is no longer displayed in the upper right corner of the spectrum analyzer display.

The NADC analyzer mode can be reaccessed by pressing (MODE), then **NADC ANALYZER** .



Now that you have finished getting the spectrum analyzer ready to make a measurement, you can proceed to Chapter 2 (if you are testing a base station), or Chapter 3 (if you are testing a mobile station). As you perform the following measurements, keep in mind that, although the measurements for a base or mobile station are similar, the way the spectrum analyzer performs the measurements varies between a base and a mobile station.

2

Making a Measurement on a Base Station

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

- Configuring the personality for your test setup.
- Measuring the carrier 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 NADC frequency bands and measuring the intermodulation spurious emission products produced by multiple transmitters.

If you have Option 151 and 160 you can also:

- 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, amplitude droop, and I-Q origin offset.
- Display the transmitted I-Q pattern graph or 8 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 do the following:

1. Load the HP 85718B NADC measurements personality into the spectrum analyzer and perform the spectrum analyzer self-calibration routines as described in "Preparing to Make a Measurement" in Chapter 1.
2. Perform the procedures in 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 sufficient external attenuation so that the actual power at the spectrum analyzer input is less than the spectrum analyzer absolute maximum input power of + 30 dBm (1 watt). Hewlett-Packard recommends that you use enough external attenuation so that there is a “margin” of at least 3 dB attenuation, based on the highest possible input power.

For Option 050

- For specified amplitude accuracy with Option 050, use enough external attenuation so that the spectrum analyzer input attenuation is within the 10 to 40 dB range.
- For best amplitude accuracy with Option 050, use enough external attenuation so that the spectrum analyzer input attenuation is within the 10 to 30 dB range.

For the carrier off measurement or 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 maximum input power.

For spurious emissions measurements with a carrier present

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

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

  external attenuation (dB) = ***mean carrier power*** (dBm) − ***input attenuation*** (dB) + 13 *dB*

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

- For the best sensitivity for 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) + ***25*** *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 NADC measurements personality by pressing (MODE) **NADC 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 sufficient external attenuation so that the actual power at the spectrum analyzer input is less than the spectrum analyzer absolute maximum input power of +30 dBm (1 watt). Hewlett-Packard recommends that you use enough external attenuation so that there is a "margin" of at least 3 dB attenuation, based on the highest possible input power.

---

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:

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 9 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 NADC 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 "'Ib change the value of limit variables" in Chapter 5 for more information.)

7. If you are testing at a base station port that has a single carrier present, ensure that SGL is underlined for the TOTL PWR SGL MULT function. If necessary, press **TOTL PWR** SOL **MULT** so that SGL is underlined. Multiple is only used for special cases when several carriers are present at the spectrum analyzer input.

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

Pressing **Config** accesses the configuration softkeys. Because the NADC 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.

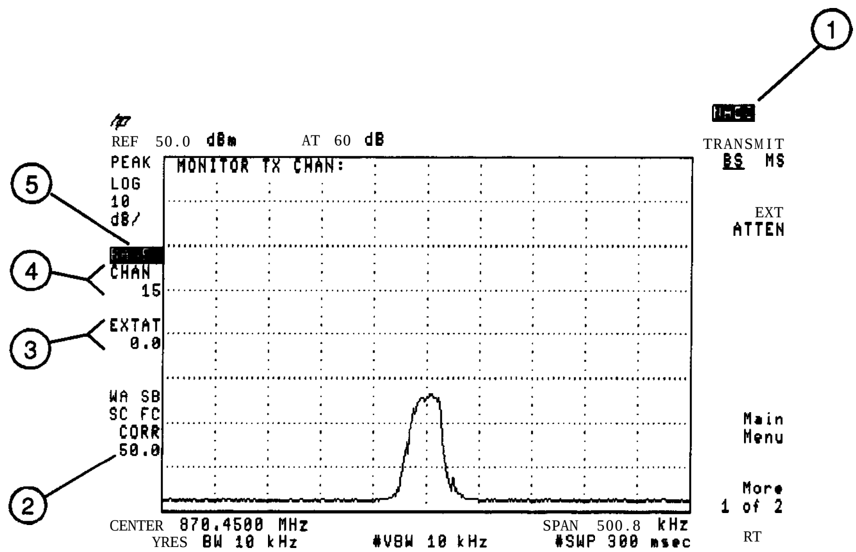


Figure 2-1. The Configuration Menu

Item	Description
1	Indicates the spectrum analyzer is using the NADC measurements personality (also referred to as the NADC 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 channel number.
5	The selected transmission source (base station or mobile station).

To Select a channel tuning plan to test

1. If **Config** is not displayed, you need to access the main menu of the NADC measurements personality by pressing (mode) **NADC ANALYZER** .

2. Press **Config**.

3. Press **Standard Band** .

4. Select the channel tuning plan to test

   a. **IS-54 800 MHz** follows EIA/TIA IS-54 Standard in the 800 MHz band.

   b. **IS-136 800 MHz** follows EIA/TIA IS-136 Standard in the 800 MHz band.

   c. **IS-136 1900 MHz** follows EIA/TIA IS-136 Standard in the 1900 MHz band.

5. Press **Main Menu**.

To select a channel to test

Caution Ensure 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 NADC measurements personality by pressing (MODE) **NADC ANALYZER** .
3. Press Physical Channel . (You can also press (FREQUENCY). When the spectrum analyzer is in the NADC mode, (FREQUENCY) accesses the **Physical Channel** softkeys.)
4. Select the channel to test.
   - If you know the channel number, 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, press AUTO **CHANNEL** .
   - If you know the frequency of the channel, or want to define a channel number for a channel that has 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. 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.

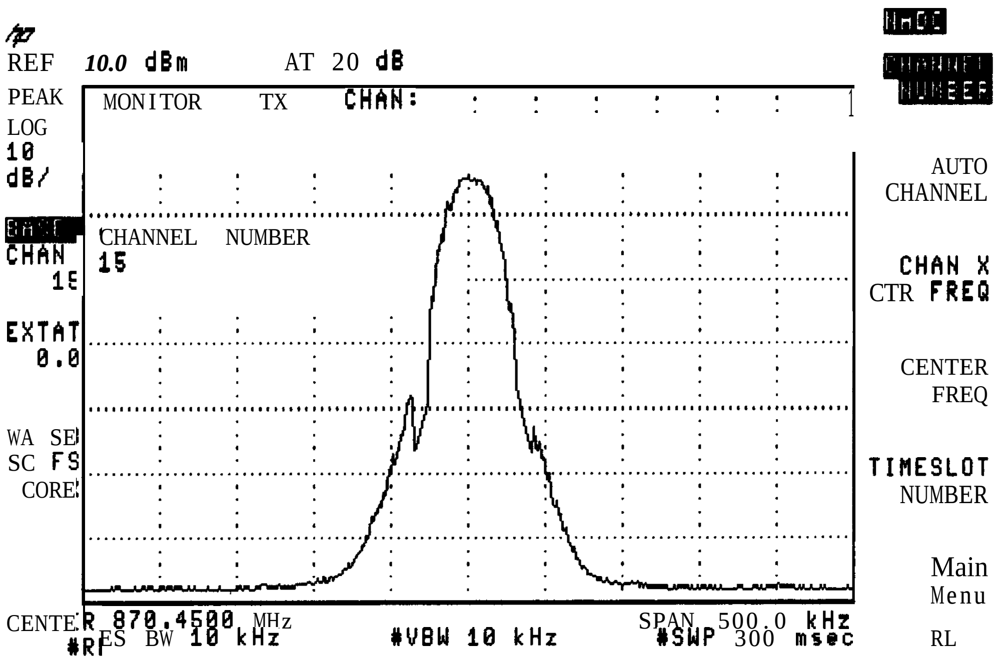


Figure 2-2. Selecting a Channel

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

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.
- Configuring digital demodulation resolution bandwidth.
- 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) **NADC ANALYZER** More **1** of 2 Digital **Demod** .
2. Press **Demod Config** to access the digital demodulator configuration menu.
3. Press **TIMESLOT 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 1. This function is identical to the **TIMESLOT NUMBER** in the physical channel menu. If the desired number was previously entered, it does not need to be entered here.

Note	**TIMESLOT NUMBER** is relevant for digital demodulator-based measurements only when the frame trigger is selected (see step 7.b below). The value of **TIMESLOT 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 **TIMESLOT 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, "If You Have a Problem" 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** to suppress all error messages. Note that making a measurement with an incorrect setup and with error messages off can yield incorrect measurement results. The default for ERR **MSG ON** OFF is ON.
5. Press **DEMOD** RESBW to set resolution bandwidth used in digital demodulation. Three available values are 300 kHz, 1 MHz, and 3 MHz. The default for DEMUR RESBW is 1 MHz.
6. Press DD Trigger to access the digital demodulator trigger menu.

7. 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 NADC signal. If the signal contains any of the six possible 28-bit NADC timeslot synchronization words, the frame trigger is the best choice.

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 you to supply a trigger signal to the rear panel EXT TRIG INPUT positioned such that the digital demodulator measurement interval is set to the desired time.

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

8. 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 **TIMESLOT NUMBER**. The input signal must contain the 28 bit NADC 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 **TIMESLOT 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 28 bit NADC 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, "If You Have a Problem" 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.

---

9. Press **Demod Main** to return to the digital demodulator main menu.

Measuring Power

lb 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 carrier power.
- Measure the carrier off 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 **EIA/TIA IS-56** standards. 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 7.

To measure the carrier power

1. Ensure 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 **CARRIER POWER** is not displayed, press Power . (If **Power** is not displayed, press (MODE) **NADC ANALYZER** to access Power .)
3. Press **CARRIER POWER** . The personality will measure the mean carrier power during the timeslot and then display the results.
4. Press **Previous Menu** if you are done with the carrier power measurement, or use one of the post-measurement functions.

CARRIER POWER automatically sets the reference level and input attenuation based upon the measured power level of the carrier. **CARRIER 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 of the mean carrier power are shown in dBm and in watts. Because the power levels of stations vary, a pass/fail message is not displayed for the carrier power measurement, even if **PASSFAIL ON OFF** is set to ON, unless you specify the upper and lower limits for the carrier power. The limits can be entered remotely; see "To change the value of limit variables" in Chapter 5 for more information. See Figure 2-3 for an example of the carrier power measurement.

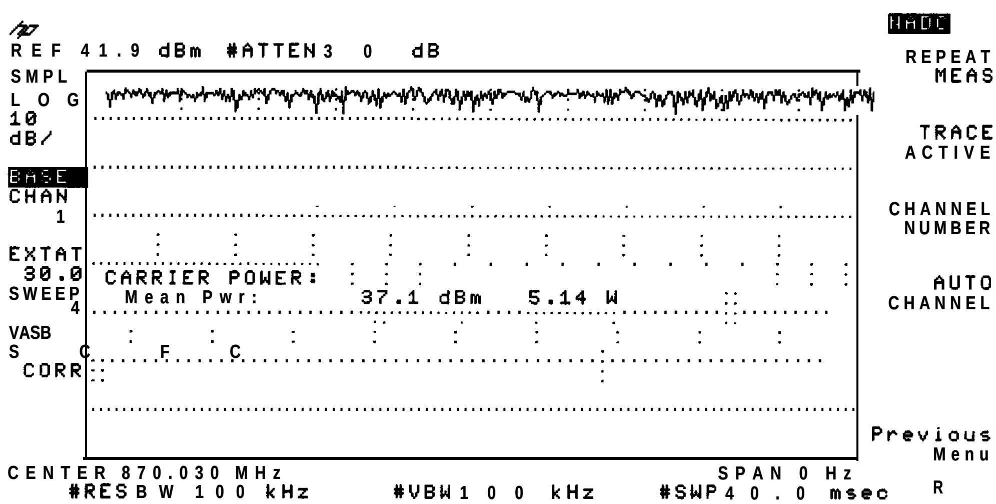


Figure 2-3. Carrier Power Measurement

To measure the carrier off power

1. Ensure that the channel number selection agrees with the transmitter's RF output. See "To select a channel to test" in earlier in this chapter for more information.
2. If **CARRIER OFF PWR** is not displayed, press Power . (If **Power** is not displayed, press (MODE) **NADC ANALYZER** to access **Power** .)
3. Turn off the transmitter's RF output power.
4. Press **CARRIER OFF PWR**. The personality will make the measurement and display the results.
5. Press **Previous Menu** if you are done with the carrier off power measurement, or use one of the post-measurement functions.

CARRIER OFF PWR measures the mean and peak carrier power when the carrier is off. **CARRIER OFF PWR** sets the reference level to -30 dBm and the input attenuation to 10 dB. The mean and peak carrier off 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. See Figure 2-4 for an example of a carrier off power measurement.

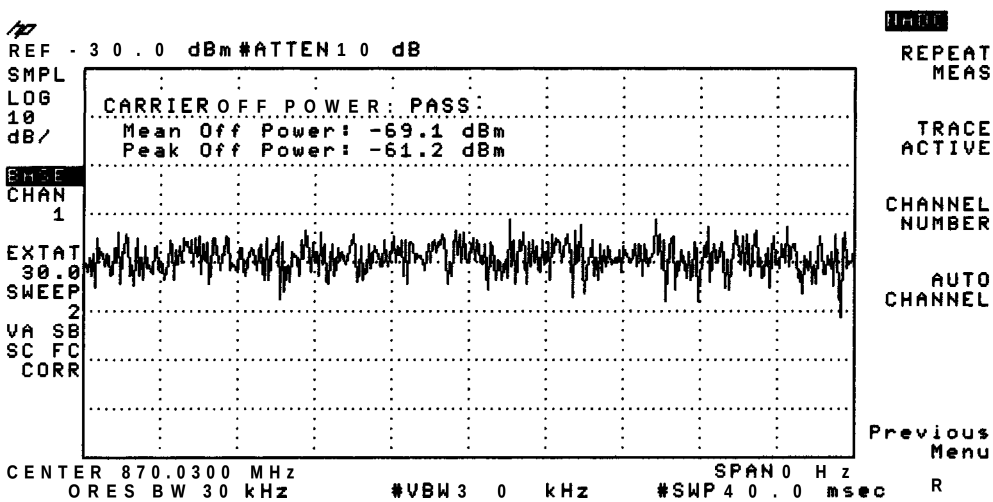


Figure 2-4. Carrier Off Power Measurement

For a base station, the carrier off measurement is useful for measuring the residual carrier power level when a transmitter is turned off.

To measure the power steps of a carrier

1. Ensure that the channel number selection agrees with the transmitter's RF output. See "'lb select a channel to test" in this chapter for more information.
2. Perform the carrier power measurement with the transmitter set to the highest power level to be measured. See "To measure the carrier power" for more information about the carrier power measurement. You need to perform the carrier power measurement before the power step measurement because the power step measurement adjusts the reference level and input attenuator according to the mean power that was measured by the carrier power measurement. The power step measurement adjusts the reference level and attenuation so the mean power of the carrier is positioned 5 dB below the reference level.
3. Turn off the transmitter.
4. If **POWER STEP** is not displayed, press **Power** . (If Power is not displayed, press (MODE) **NADC 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 NADC menu, turn off the transmitter, press REPEAT **MEAS** , and then turn on the transmitter.
9. 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.
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 2-5 for an example of the power step measurement.

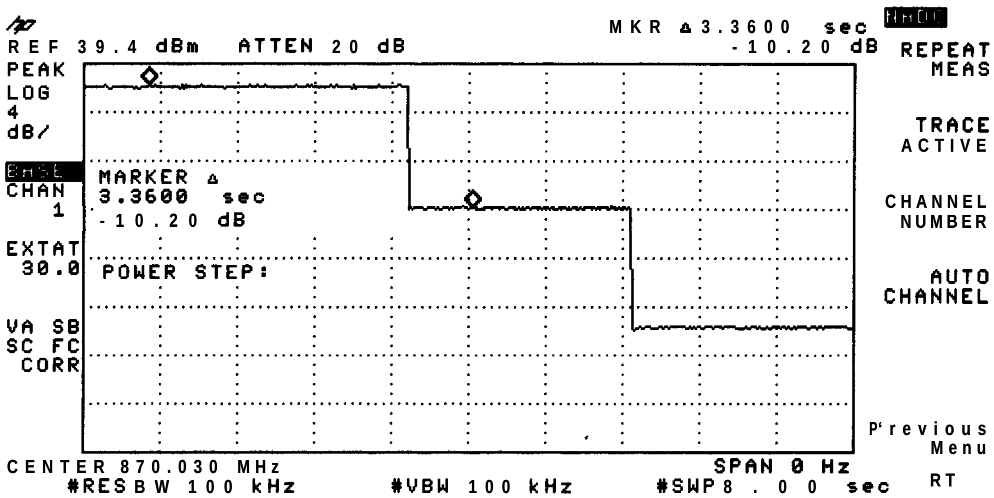


Figure 2-5. Power Step Measurement

‘lb measure the occupied bandwidth

1. Ensure 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) NADC ANALYZER to access **Power** .)
3. Press **OCCUPIED BANDWDTH** . The NADC 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 transmitted 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 2-6 for an example of an occupied bandwidth measurement.

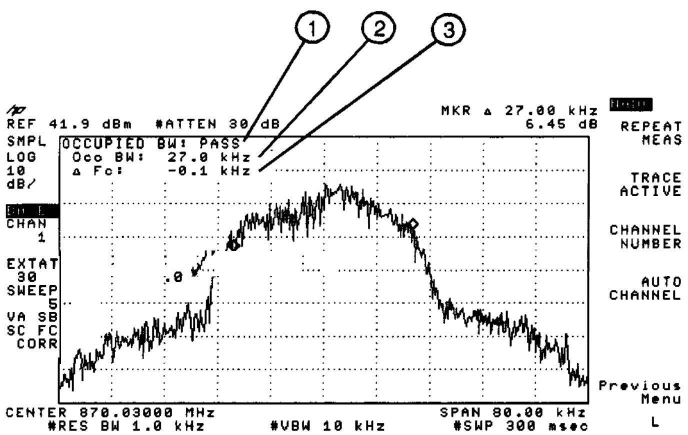


Figure 2-6. Occupied Bandwidth Measurement

Item	Description
1	Indicates whether the occupied bandwidth measurement passed or failed the test limit.
2	The bandwidth that 99 percent of the total transmitted power occupies.
3	The approximate center frequency error.

To monitor the transmit channel

1. Ensure that the channel number selection agrees with the transmitter's RF output. See "lb select a channel to test" earlier in this chapter for more information.
2. If **MONITOR TX CHAN** is not displayed, press **Power** . (If **Power** is not displayed, press (MODE) **NADC 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 2-7 for an example of viewing channel 1.

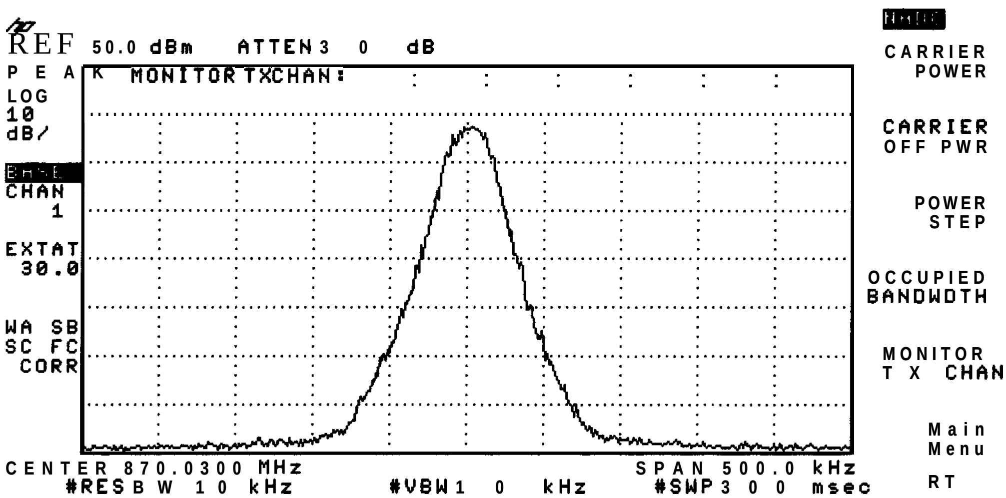


Figure 2-7. Viewing Channel 1

Measuring Adjacent Channel 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 power.
- Channel power.

Both the ACP and channel power measurements use the "spectrum analyzer integration" method for measuring the power. The ACP measurement makes the measurement for digital carriers according to the EIA/TIA standard. 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 7.

To measure the adjacent channel power

1. Ensure that the channel number selection agrees with the transmitter's RF output. See "lb 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) **NADC ANALYZER** to access **Adj Chan Power** .)
3. Make the ACP measurement with either **ACP** or **ACP CH/SWP** .

   For a fast measurement, press **ACP** . The personality measures the total transmitted power, as well as the power in the upper and lower adjacent, first alternate, and second alternate channels. The numerical results are displayed.

   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,

   For a slower but more accurate (and more repeatable) measurement, press **ACP CH/SWP** .

   ACP CH/SWP performs one measurement sweep for every channel, using a 1 kHz resolution bandwidth and 32.8 kHz span.
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 sample detector and a 32.8 kHz integration bandwidth to measure the power in the adjacent channels. The spectrum is filtered with a square root raised cosine filter before integration, providing a channel bandwidth of approximately 24 kHz at -3 dB.

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 2-8 for an example of the numerical results of an ACP measurement. See Figure 2-9 for an example of the trace results of an ACP measurement.

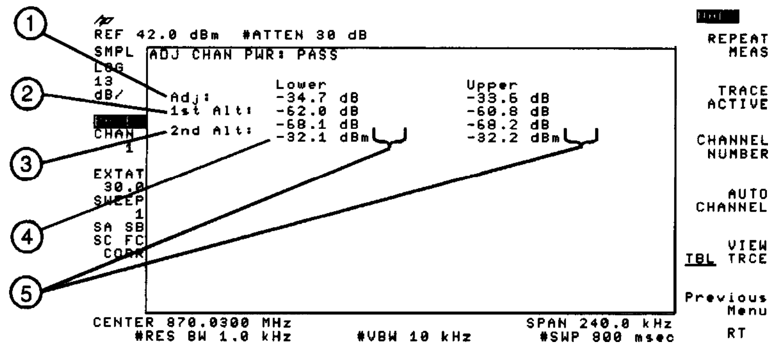


Figure 2-8. Table Results for the ACP Measurement

Item	Description
1	The power leakage (relative to the carrier power) into the upper and lower channels that are adjacent to the carrier.
2	The power leakage (relative to the carrier power) into the upper and lower first alternate channels. The first alternate channels spaced two channels from the carrier.
3	The power leakage (relative to the carrier power) into the upper and lower second alternate channels. The second alternate channels are spaced three channels from the carrier.
4	The absolute power leakage into the upper and lower second alternate channels.
5	An F next to any of the measured values indicates that the measured value failed the measurement limits.

Figure 2-9 shows the trace results of an ACP measurement.

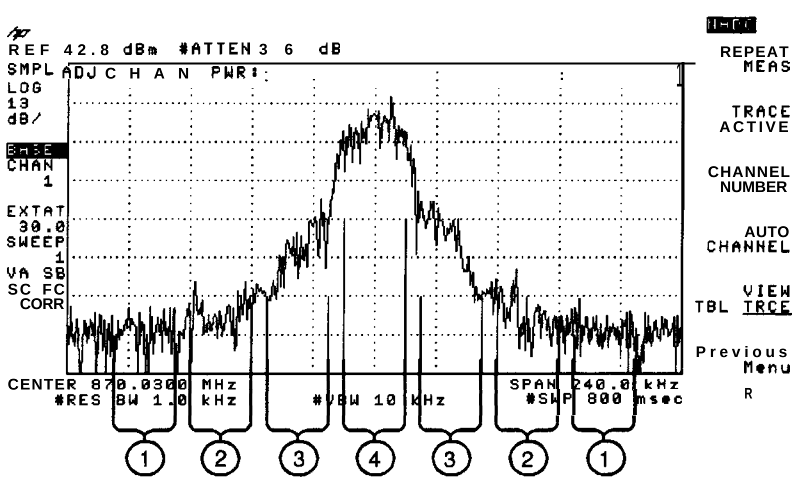


Figure 2-9. Spectrum Results of the ACP Measurement

Item	Description
1	Indicates the 3 dB bandwidth of the second alternate channel.
2	Indicates the 3 dB bandwidth of the first alternate channel.
3	Indicates the 3 dB bandwidth of the adjacent channel.
4	Indicates the 3 dB bandwidth of the carrier channel.

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

Differences	**ACP**	**ACP 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 CH/SWP**	More accurate than **ACP**
Allows you to view table and trace	Yes	No (table only)

To measure the channel power

1. Set the channel number to the desired channel.
2. ***If a carrier is not present:*** The spectrum analyzer reference level should be adjusted so that the noise is positioned above the second graticule from the bottom graticule on the spectrum analyzer display. To adjust the reference level, press (AMPLITUDE), and then use the large knob on the spectrum analyzer front panel to adjust the noise level so that it is above the second graticule from the bottom graticule. (If the post-measurement menu is displayed, you must first press **TRACE ACTIVE** before you press (AMPLITUDE).) Press (MODE) (MODE) after the reference level has be adjusted.
3. ***If a carrier is present:*** To avoid signal compression, you should perform the carrier power measurement on the carrier channel before the channel power measurement. You need to perform the carrier power measurement because the channel power measurement does not adjust the reference level and input attenuator. See "To measure the carrier power" for information about performing the carrier power measurement.
4. If **CHAN** POWER is not displayed, press **Adj Chan** Power. (If **Adj Chan** Power is not displayed, press (MODE) NADC 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 sample detector and an 32.8 kHz integration bandwidth to measure the power in the channel. The signal is filtered with a square root raised cosine filter before integration, providing a channel bandwidth of approximately 24 kHz at -3 dB.

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). If the channel power measurement is used to measure the power of the carrier channel, the channel power results will be slightly lower than the power measured by the carrier power measurement. Both the carrier power and channel power measurements measure the total carrier power, but the channel power measurement determines the power with the square root raised cosine filter bandwidth.

See Figure 2-10 for an example of a channel power measurement on an unoccupied channel.

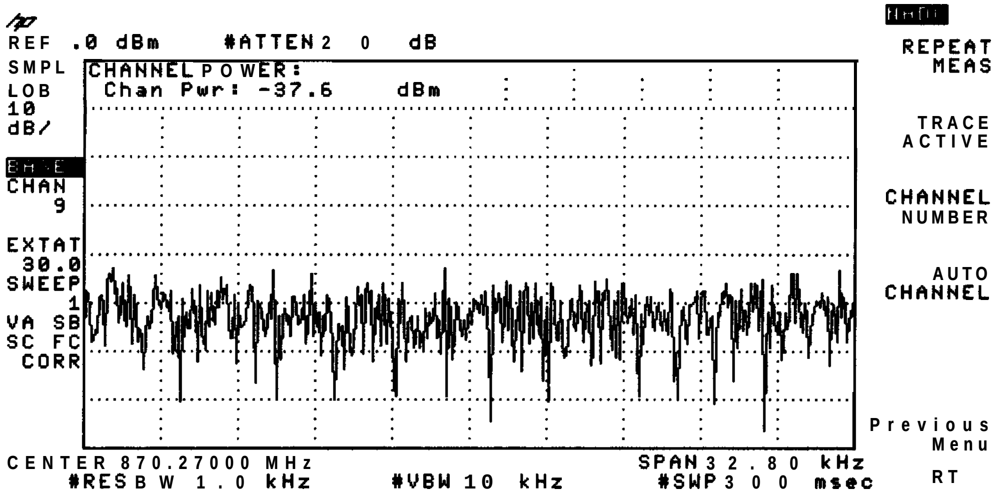


Figure 2-10. The Channel Power Measurement

Measuring Modulation Accuracy

lb 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.

This section contains the following procedures:

- Measure the modulation accuracy of an NADC 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, carrier frequency error, and amplitude droop of an NADC 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.

To perform a full modulation accuracy measurement

1. Ensure 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) **NADC 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, carrier frequency error, and amplitude droop. 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 "'lb 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, carrier frequency error, and amplitude droop.

    To stop a measurement in progress, press **STOP MEAS** . To repeat the measurement, press **MODULATN ACCURACY** .

    lb 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).

    To change the measurement to a different demodulation resolution bandwidth, you can use **DEMOD RESBW** key available by pressing **DEMOD MAIN DEMOD CONFIG MORE 1 of** 2 .

    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 the EIA/TIA standards. EVM is calculated after I-Q origin offset, carrier frequency error, and amplitude droop have been extracted from the measured data. For a base station, the measurement interval includes the full 162 transmitted symbols of a base station timeslot. Modulation metrics are calculated using measured data only at decision points.

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**. lb 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 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 2-11 for an example of the full modulation accuracy measurement screen.

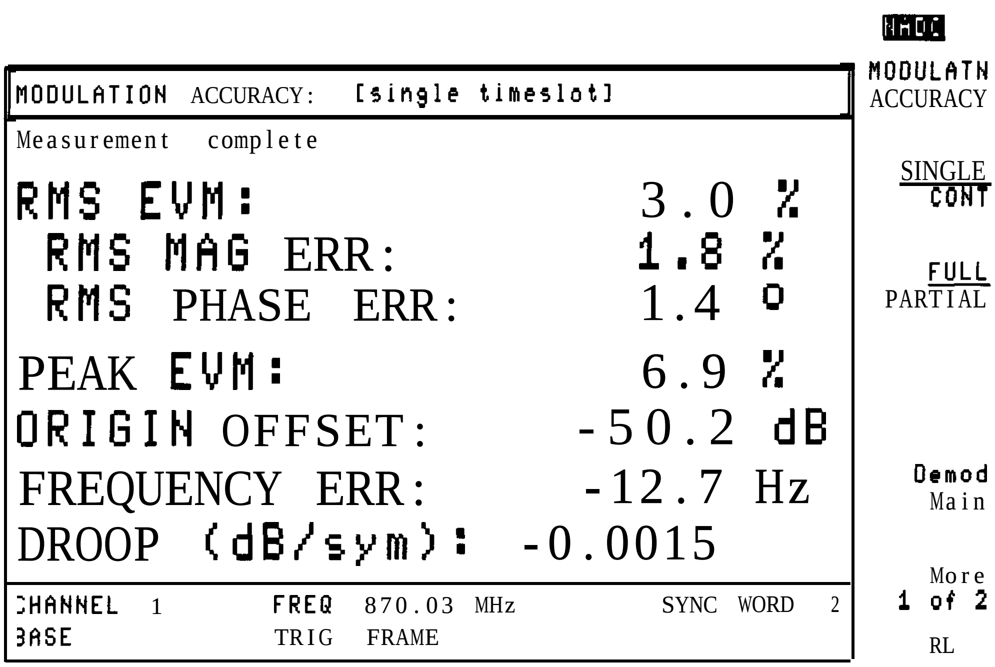


Figure 2-11. Full Modulation Accuracy Measurement

To make a partial modulation accuracy measurement

1. Ensure 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) **NADC 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 and amplitude droop 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 "lb 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** . 'lb 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 the EIA/TIA standards. EVM is calculated after I-Q origin offset, carrier frequency error, and amplitude droop have been extracted from the measured data. For a base station, the measurement interval includes the full 162 transmitted symbols of a base station timeslot. Modulation metrics are calculated using measured data only at decision points.

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.

For continuous measurements in partial mode, the spectrum analyzer center frequency is tuned once for 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 2-12 for an example of the partial modulation accuracy measurement screen.

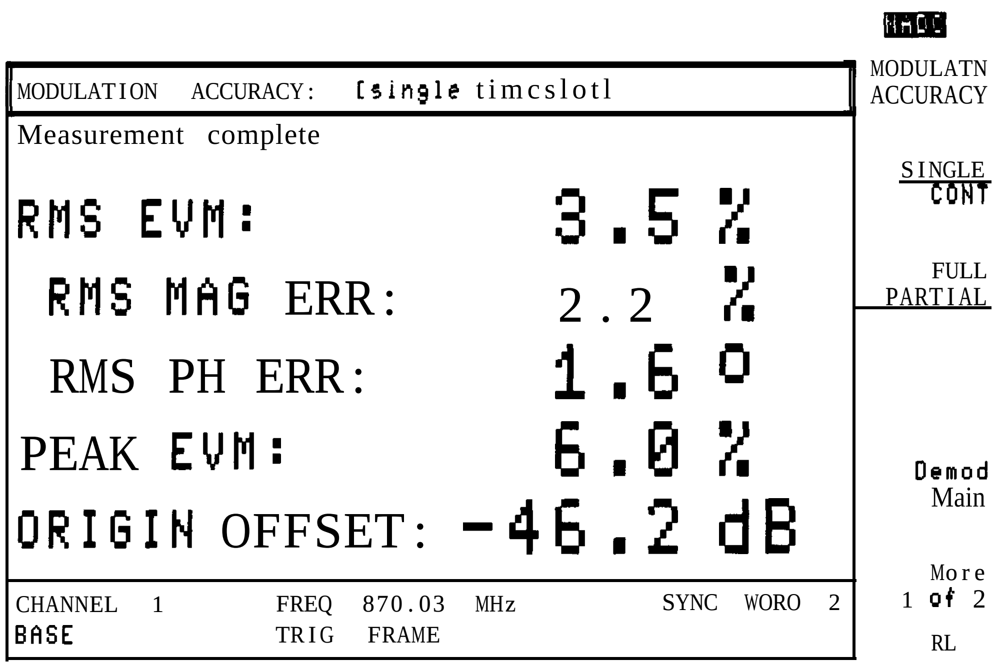


Figure 2-12. Partial Modulation Accuracy Measurement

To And the average error vector magnitude

1. Ensure 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) **NADC 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, carrier frequency error, and amplitude droop.

   Underlining PARTIAL excludes the carrier frequency error and amplitude droop 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 "lb hold measurement data for viewing" for details on how to use SAY **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 and amplitude droop 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, amplitude droop, and I-Q origin offset are also displayed. The accuracy of the statistical values 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 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 2-13 for an example of the full statistics screen. See Figure 2-14 for an example of the partial statistics screen.

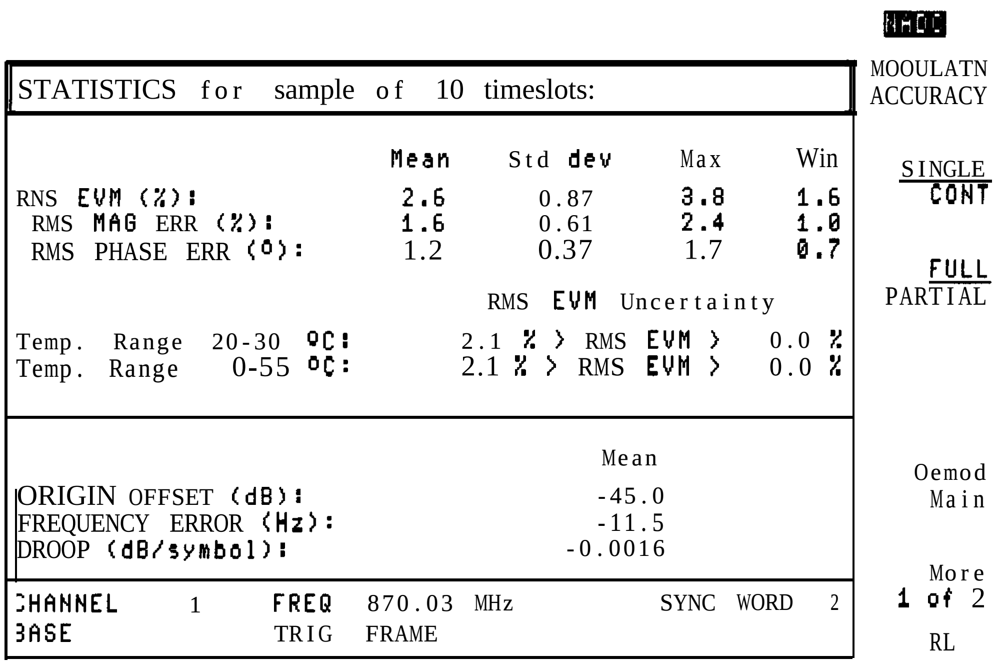


Figure 2-13. Averaged Full Modulation Accuracy Measurement

NADC

MODULATN ACCURACY

STATISTICS far sample of 18 timeslots:

	Mean	Std dev	Max	Min
RMS EVM (%):	2.6	0.69	3.5	1.9
RMS MAG ERR (%):	1.5	0.56	2.2	1.0
RMS PHASE ERR (o):	1.2	0.26	1.6	0.9

RMS EVM Uncertainty

Temp. Range 20-30 oC: 2.4 % > RMS EVM > 0.0 %
Temp. Range 0-55 oC: 2.4 % > RMS EVM > 0.0 %

Mean
ORIGIN OFFSET (dB): -45.3

CHANNEL *1* FRER 870.03 MHz SYNC WORD 2
BASE TRIG FRAME

SINGLE CONT

FULL PARTIAL

Demod Main

More 1 of 2

RL

Figure 2-14. 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 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. 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

1. If the digital demodulator main menu is not displayed, press (MODE) **NADC 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 2-15 for the EVM calibration instructions screen.

```
EVM CALIBRATION:

NOTE: The analyzer must have at least 30 minutes
      of warmup operation at the ambient temperature
      before starting the calibration.

1.  Connect an NAOC modulated calibration signal
    with known RMS Phase error. A precision, low
    RMS EVM source is recommended.

2.  Configure the personality for an EVM measurement
    on the calibration signal. See "Configuring the
    Personality far Your Test Setup".

3.  Enter the RMS Phase error of the calibration
    source in milli-degrees using the PHASE ERROR
    key (example: 1.29 degrees = 1230 milli-degrees).

4.  Press the CAL EVM key when ready.

CHANNEL 1        FREQ 870.03 MHz
BASE             TRIG FREE RUN
```

Softkeys: CAL EVM | PHASE ERROR | Previous Menu | RL

Figure 2-15. 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.

Note: The accuracy of this calibration depends on the accuracy and stability of the phase error of the calibration signal.

---

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 2-16 for an example of an EVM calibration results screen.

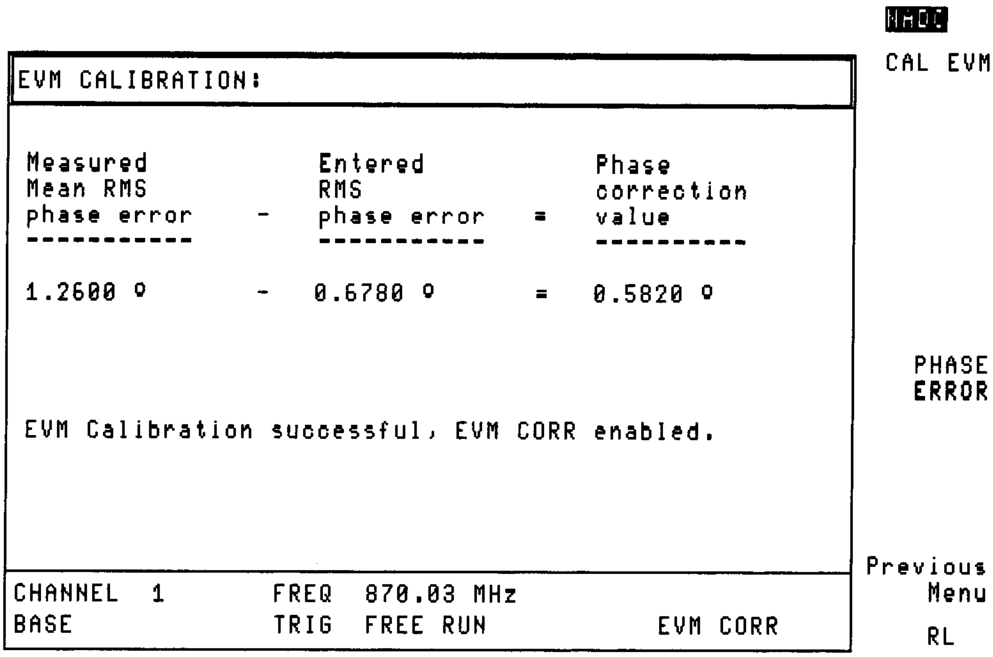


Figure 2-16. EVM Calibration Results

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 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, Operating Reference, 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 automatic correction, press EVM CORR ON OFF until OFF is underlined.

Displaying I-Q Diagrams

lb 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.

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.

To display the I-Q pattern graph

1. Ensure 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) **NADC 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 MEW 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 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 droop, I-Q origin offset, and carrier frequency error. A full 162 symbol timeslot is 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.

See Figure 2-17 for an example of the I-Q Pattern Graph Screen.

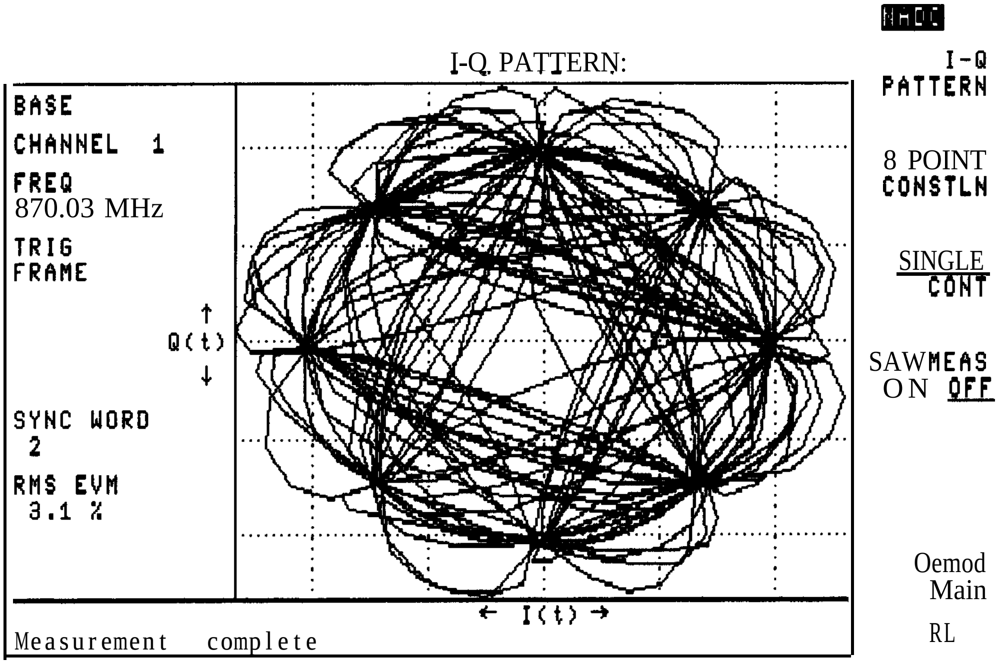


Figure 2-17. I-Q Pattern Graph Screen

To display the 8 point constellation graph

1. Ensure 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) **NADC 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 8 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 8 decision states of the $\pi/4$ DQPSK modulation will be indicated by the "+" symbol. The magnitude and phase of each of the 162 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 8 point constellation measurement displays the phase and amplitude of the baseband digital modulation only at the decision points of the timeslot. The 8 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 8 point constellation is plotted after correction for droop, I-Q origin offset, and carrier frequency error. A full 162 symbol timeslot is plotted on the 8 point constellation.

An 8 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 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 2-18 for an example of the 8 Point Constellation Screen.

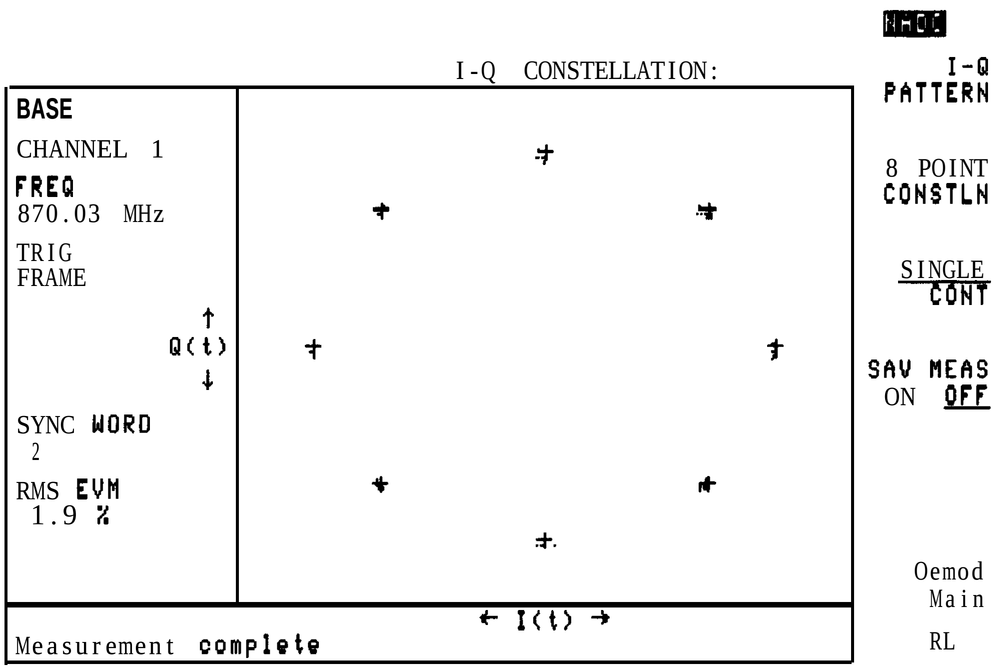


Figure 2-18. 8 Point Constellation Graph Screen

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 8 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

'lb 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.

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.

To display the demodulated data bits

1. Ensure 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) **NADC 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** DATA will cause the data portion of the bit sequence to be highlighted. For NADC base stations this is the 41st through the 170th bits, and the 183rd through the 312th bits. Each of these two blocks is 130 bits long.
   - Pressing **HIGHLITE SYNC** will cause the sync word to be highlighted. For NADC base stations this is the 1st through the 28th bits. This block is 28 bits long. **HIGHLITE** SYNC is the default setting.
   - Pressing **HIGHLITE CDVCC** will cause the Coded Digital Verification Color Code (CDVCC) portion of the bit sequence to be highlighted. For NADC base stations, these are the 171st through the 182nd bits. This block is 12 bits long.
   - Pressing **HIGHLITE SACCH** will cause the Slow Associated Control Channel (SACCH) portion of the bit sequence to be highlighted. For NADC base stations these are the 29th through the 40th bits. This block is 12 bits long.
   - Pressing **HIGHLITE CDL** will cause the Coded Digital Control Channel Locator (CDL) portion of the bit sequence to be highlighted. For NADC base stations, these are the 314th through the 324th bits. This block is 11 bits long. NOTE: **HIGHLITE** CDL is only available when IS-136 800 MHz or IS-136 1900 MHz is selected.

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 I-Q offset, carrier frequency error, and I-Q origin offset. The 28 bit synchronization word can be read to confirm that the correct timeslot has been measured. The CDVCC and SACCH can also be read. The 324 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**. 'Ib 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 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 2-19 for an example of the Data Bits Screen.

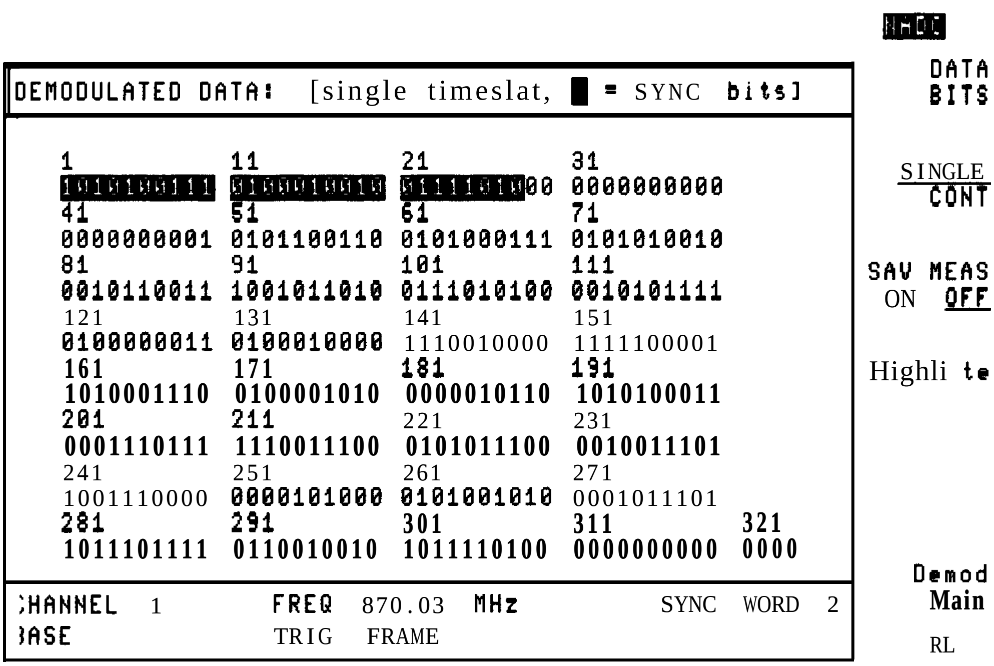


Figure 2-19. Data Bits Screen

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 8 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 the Intermodulation 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 the intermodulation spurious emissions of two or more transmitters. Intermodulation spurious emissions are caused by the interaction of carriers in the nonlinear elements of the transmitters.

This section contains the following procedures:

- View the transmit band or bands spectrum.
- View the receive band or bands spectrum.
- Use the combiner tuning function to adjust the outputs of a group of transmitters.
- Measure the intermodulation spurious emissions.

These measurements are applicable for both analog and digital carriers. **MONITOR TX BAND** and **MONITOR RX BAND** are useful for measuring the in-band spurious emissions. Even though **MONITOR TX BAND** and **MONITOR RX BAND** do not measure the spurious emissions automatically, they provide an excellent starting point for making spurious emission measurements because most of the spectrum analyzer settings are set automatically.

To view the transmit band spectrum

1. If **System** is not displayed, press (MODE) **NADC ANALYZER More 1 of 2** .
2. Press **System** .
3. Press **MONITOR** TX **BAND** .
4. Select the band that you want to view:
   a. For the 800 MHz tuning plan press **BANDS A'' + A** (selects bands A" and A), **BAND A'**, BAND **B** , or **BAND B'** .

   b. For the 1900 MHz tuning plan press **BAND A** , **BAND B** , **BAND C** , **BAND D** , **BAND E** , or BAND **F** .

   Refer to the description of **MONITOR** TX BAND, in Chapter 7 for a list of band frequencies.

   Select all the bands by pressing **FULLBAND** .

   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 or bands 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 2-20 for an example of viewing the A" and A bands.

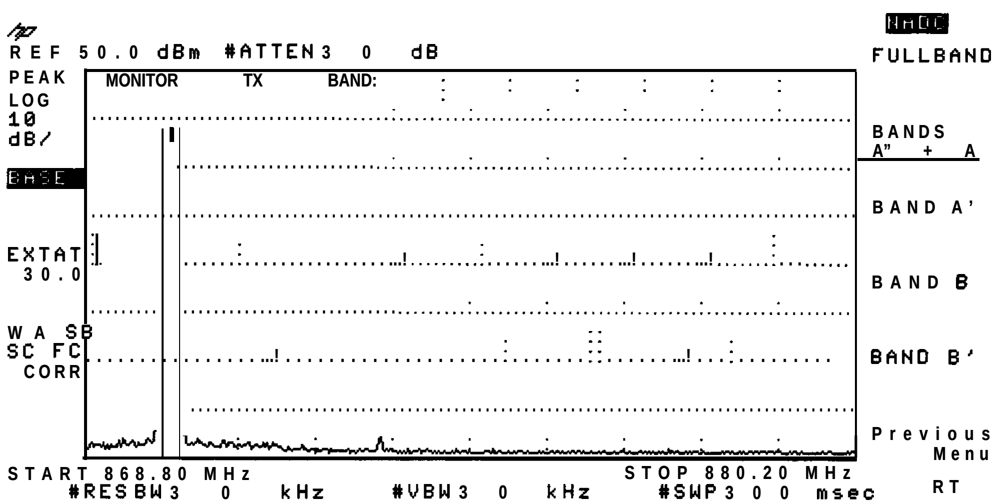


Figure 2-20. Viewing Bands A" and A of the 800 MHz tuning plan

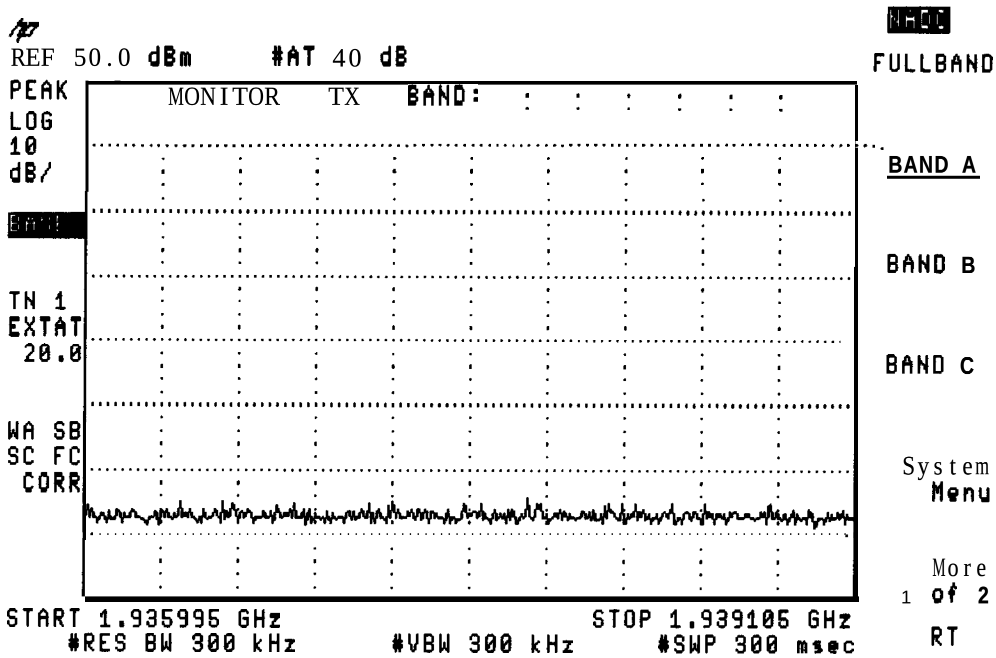


Figure 2-21. Viewing Bands A” and A of the 1900 MHz tuning plan

To view the receive band spectrum

1. If **MONITOR RX BAND** is not displayed, press (MODE) **NADC ANALYZER More 1 of 2 System**.
2. Press **MONITOR RX BAND**.
3. *Select the band that you want to view:

   a. For the 800 MHz tuning plan press **BANDS A'' + A** (selects bands A" and A), **BAND A'**, **BAND B**, or **BAND B'**.

   b. For the 1900 MHz tuning plan press BAND A, BAND **B**, **BAND** C, BAND **D**, **BAND E**, or **BAND** F.

   Refer to the description of **MONITOR TX** BAND in Chapter 7 for a list of band frequencies. Select all the bands by pressing FULLBAND.

   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 or bands 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 active carriers 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 2-22 for an example of viewing the A" and A bands.

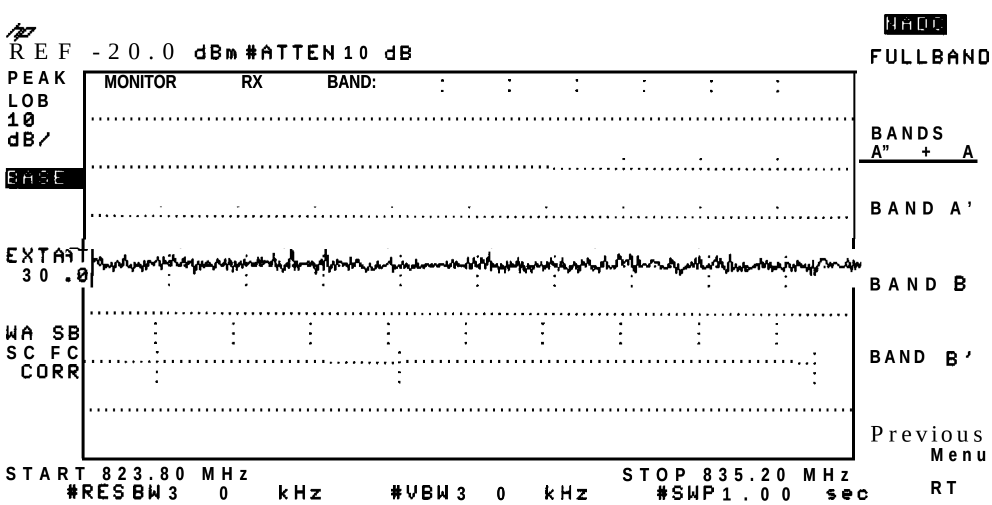


Figure 2-22. Viewing Bands A" and A of the 800 MHz tuning plan

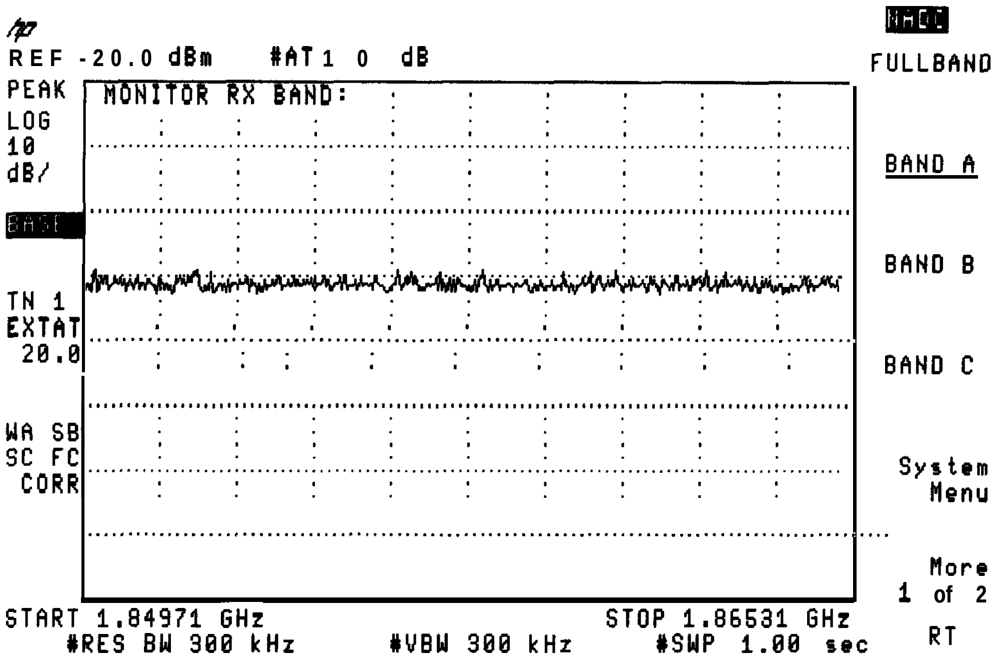


Figure 2-23. Viewing Band A of the 1900 MHz tuning plan

To use combiner tuning

1. If **Band** is not displayed, press (MODE) NADC **ANALYZER More 1** of 2 **System**.
2. Press **Band**.
3. Select the transmit band that you want to view:
   a. For the 800 MHz tuning plan press BANDS A'' + A (selects bands A" and A), **BAND A'**, BAND **B**, or **BAND B'**.
   b. For the 1900 MHz tuning plan press BAND A, **BAND B**, BAND **C**, BAND **D**, **BAND E**, or BAND F.
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. lb 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 (A 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. 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).

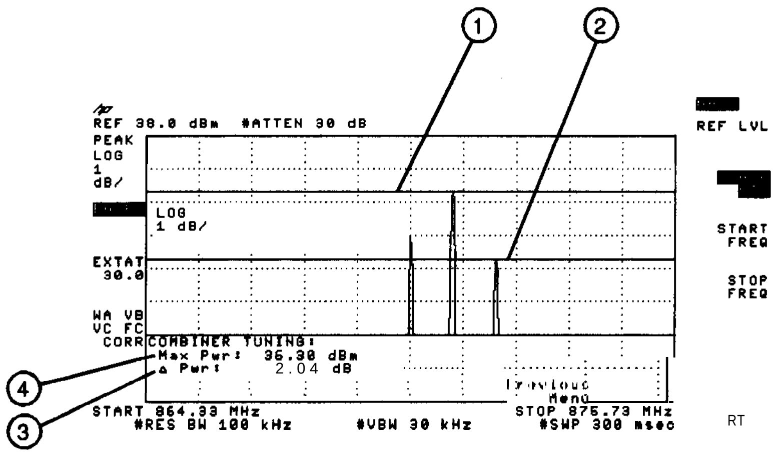


Figure 2-24. Combiner Tuning Results

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

To measure the intermodulation spurious emissions

1. Intermodulation spurious emissions measurement is meant to measure the intermodulation products caused by two carriers. You should ensure that there are two carriers of equal amplitude, spaced at least 600 kHz apart. Connect the equipment as shown in Figure 2-25. (See Figure 2-26 for an example of the spectrum analyzer display of two carriers.)

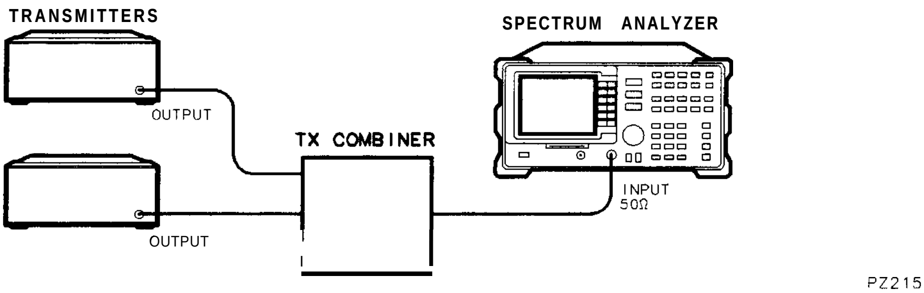


Figure 2-25. Equipment Setup for the Intermodulation Spurious Emissions Measurement

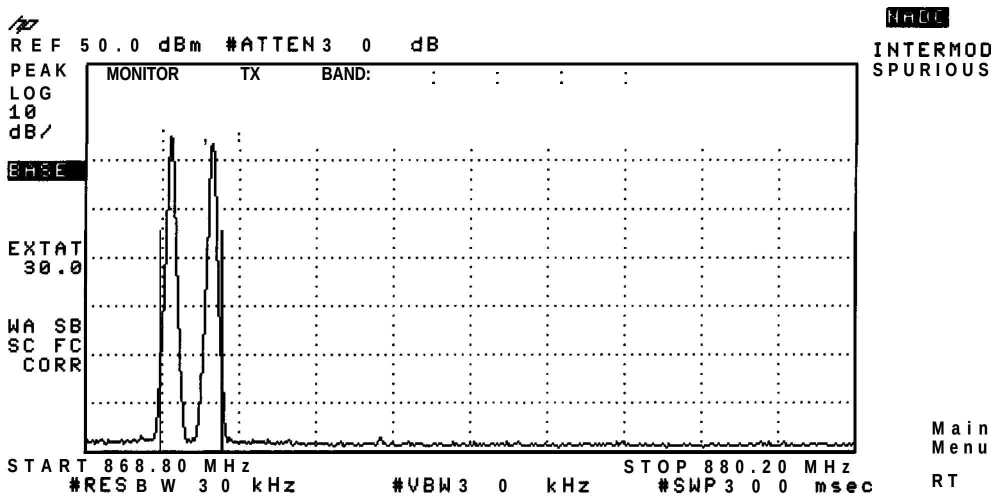


Figure 2-26. Screen Display of the Two Carriers

2. If **Spurious** is not displayed, press (MODE) **NADC ANALYZER More 1 of 2**.
3. Press **Spurious INTERMOD SPURIOUS** . The personality will measure the intermodulation products, and then display the result. The final trace display will be of the carriers and their intermodulation products. The delta marker will be placed on the intermodulation product with the highest amplitude.
4. If you want to repeat the measurement, press REPEAT **MEAS** .
5. If you want the analyzer to sweep, press **TRACE ACT VIEW** so that ACT is underlined. If you want to view the trace, press **TRACE** ACT **VIEW** so that VIEW is underlined. In the view mode, the trace data is not updated, and a delta marker is placed on the carrier with the highest amplitude.

6. If you want to change the position of the marker, press **MARKER DELTA** and use the large knob on the spectrum analyzer front panel to move the **marker.** If you want the marker to be placed on the highest displayed signal peak, press **MARKER PEAK** .

7. Press **Previous Menu** when you are done with the intermodulation spurious emissions measurement.

INTERMOD SPURIOUS searches for carriers, determines their spacing, and then adjusts the reference level and input attenuation based on the highest measured carrier level and the number of carriers. Once the carriers have been located, the personality measures the amplitude levels of the third-order intermodulation products, places the delta marker on the product **with** the highest amplitude, and then displays the result.

See Figure 2-27 for an example of measuring intermodulation spurious emissions.

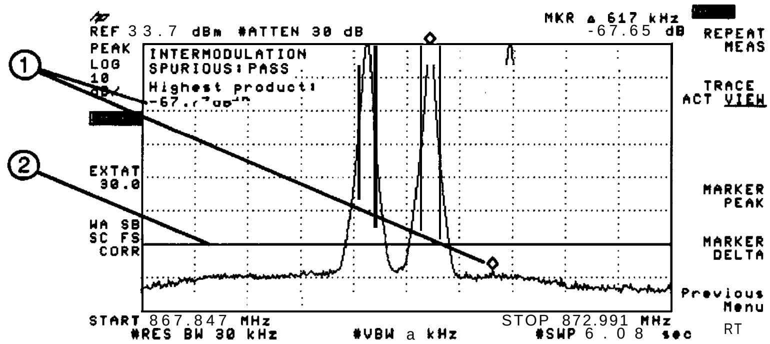


Figure 2-27. Measuring Intermodulation Spurious emissions

Item	Description
1	The power level of the intermodulation product with the highest amplitude level.
2	The specified test limit for the intermodulation spurious emissions.

3

Making a Measurement on a Mobile Station

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

- Configuring the personality for your test setup.
- Measuring the carrier power, the carrier off power, the power steps, the occupied bandwidth, and monitoring the transmit channel.
- Measuring the time domain characteristics of a TDMA burst.
- Measuring the **adjacent** channel power and channel power.
- Monitoring the NADC frequency bands

If you have Option 151 and 160 you can also:

- 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, amplitude droop, and I-Q origin offset.
- Display the transmitted I-Q pattern graph or 8 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 do the following:

1. Load the HP **85718B** NADC measurements personality into the spectrum analyzer and perform the spectrum analyzer self-calibration routines as described in "Preparing to Make a Measurement" in Chapter 1.
2. Perform the procedures in the following section, "**Configuring** the Personality for Your Test Setup."

A trigger signal is required for the adjacent channel power measurements and the power versus time measurements. See "Step 3. Make the cable connections for triggering" in Chapter 1 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, 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 sufficient external attenuation so that the actual power at the spectrum analyzer input is less than the spectrum analyzer absolute maximum input power of + 30 dBm (1 watt). Hewlett-Packard recommends that you use enough external attenuation so that there is a "margin" of at least 3 dB attenuation, based on the highest possible input power.

For Option 050

- For specified amplitude accuracy with Option 050, use enough external attenuation so that the spectrum analyzer input attenuation is within the 10 to 40 dB range.
- For best amplitude accuracy with Option 050, use enough external attenuation so that the spectrum analyzer 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 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:

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

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 NADC measurements personality by pressing (MODE) **NADC 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 sufficient external attenuation so that the actual power at the spectrum analyzer input is less than the spectrum analyzer absolute maximum input power of +30 dBm (1 watt). Hewlett-Packard recommends that you use enough external attenuation so that there is a "margin" of at least 3 dB attenuation, based on the highest possible input power.

---

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 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 ensure that BURST is underlined in **BURST CONT**. If necessary, press **BURST CONT** so that BURST is underlined.

   If you want to test the mobile station 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 vs Time, and ACP measurements using the Option 151/160 digital demodulator frame trigger. 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 **TIMESLOT NUMBER** softkey in the physical channel menu.

Note To use the Option 1511160 frame trigger as a trigger source for Power vs Time and ACP 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 vs Time and ACP 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 HP 85902A Burst Carrier Trigger.

See "Step 3. Make the cable connections for external triggering" in Chapter 1 for more information.

8. If the frame structure for the transmission is for a full-rate codec, you should ensure that **PERIOD 40ms20ms** is set to 20 ms. If necessary, press PERIOD **40ms20ms** so that 20ms is underlined. If the frame structure is for a half-rate codec, you should press **PERIOD 40ms20ms** so that 40 ms 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 40ms, but the RF burst period is 20ms, set **PERIOD 40ms20ms** so that 40ms is underlined. In this case you must temporarily set **PERIOD 40ms20ms** 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, ensure 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** PUS' **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 3-2). 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 3-2). 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. You should complete the rest of the procedures in this section and then see "To measure the burst" (located later in this chapter).

11. 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 a trigger signal, set **PWR** TRIG **EXT VID** to EXT. VID is the default setting.

12. Press Previous Menu.

13. Press **More 1 of 2**.

14. Many of the NADC 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 "To change the value of limit variables" in Chapter 5 for more information.)
15. Because a mobile station has only a single carrier present, ensure that SGL is underlined for the TOTL PWR SGL MULT function. If necessary, press **TOTL PWR SGL MULT** so that SGL is underlined. Multiple is used only for special cases when several carriers are present at the spectrum analyzer input.
16. Press **More 2 of 2** **Main Menu** to return to the main menu.

Pressing **Config** accesses the configuration softkeys. Because the NADC 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 3-1 shows the configuration menu and annotation.

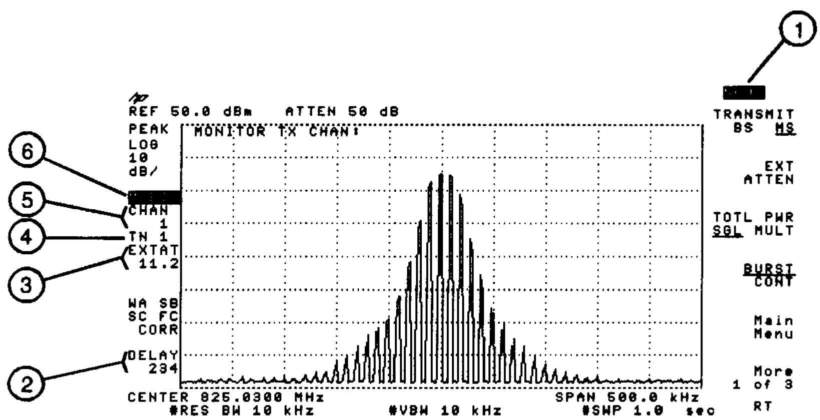


Figure 3-1. The Configuration Menu

Item	Description
1	Indicates the spectrum analyzer is using the NADC measurements personality (also referred to as the NADC mode).
2	The trigger delay time.
3	The current value for external attenuation.
4	The timeslot number.
5	The current channel number.
6	The selected transmission source (base station or mobile station).

Figure 3-2 shows the relationship between the trigger signal and the trigger delay time when TRIG **SRC DD EXT** is set to EXT.

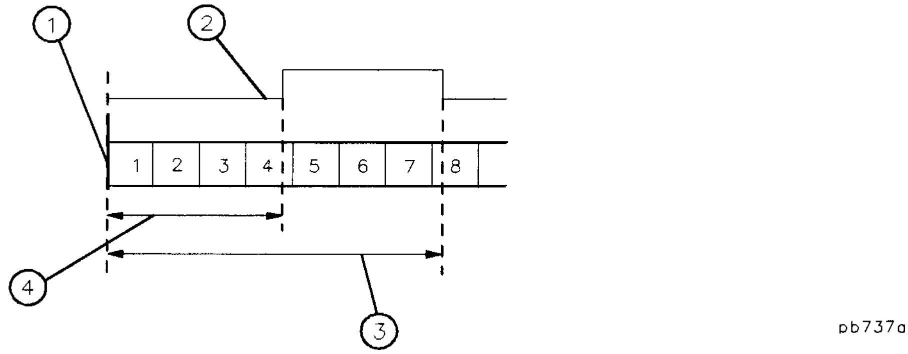


Figure 3-2. Timing Diagram

Item	Description
1	Indicates point 0 (the start of symbol 1).
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 tuning plan to test

1. If **Config** is not displayed, you need to access the main menu of the NADC measurements personality by pressing (mode) **NADC ANALYZER** .
2. Press **Config**.
3. Press **Standard Band** .
4. Select the channel tuning plan to test
   a. **IS-54 800 MHz** follows EIA/TIA IS-54 Standard in the 800 MHz band.
   b. **IS-136 800 MHz** follows EIA/TIA IS-136 Standard in the 800 MHz band.
   c. **IS-136 1900 MHz** follows EIA/TIA IS-136 Standard in the 1900 MHz band.
5. Press **Main Menu** .

To select a channel to test

Caution — Ensure 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 NADC measurements personality by pressing (MODE) **NADC ANALYZER**.
3. Press **Physical Channel**. (You can also press (FREQUENCY). When the spectrum analyzer is in the NADC mode, (FREQUENCY) accesses the **Physical Channel** softkeys.)
4. Select the channel to test.
   - If you know the channel number, 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, press **AUTO CHANNEL**.
   - If you know the frequency of the channel, or want to define a channel number for a channel that has 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 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 timeslot number to 1 by pressing **TIMESLOT NUMBER**, entering in a " 1" using the data keys, and then pressing (ENTER).

   If the trigger signal is from the base station, base station simulator, or Option 151/160 digital demodulator frame trigger output: Enter the number of the timeslot that you want to examine by pressing **TIMESLOT NUMBER**, entering the number of the timeslot with the data keys, and then pressing (ENTER). If you do not enter a timeslot number, the timeslot number defaults to 1.
6. Press **Main** Menu.

The functions accessed by **Physical Channel** allow you to select the channel that you want tested. Notice that the channel number (CHAN 1) and timeslot number (TN 1) are displayed on the left side of the spectrum analyzer display.

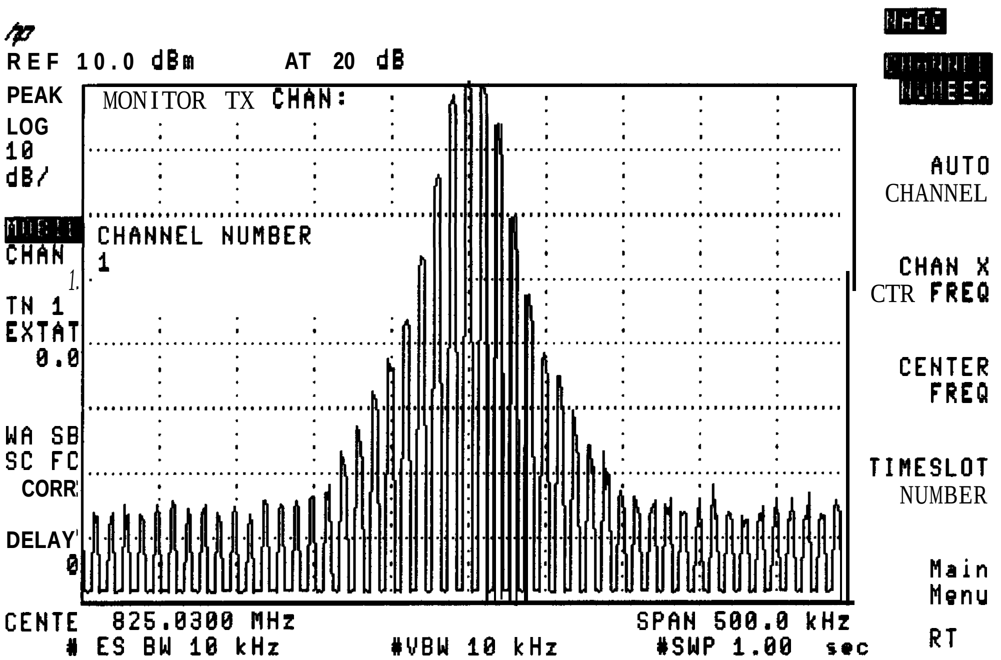


Figure 3-3. Selecting a Channel

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

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.
- Configuring digital demodulation resolution bandwidth.
- 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) **NADC ANALYZER** **More 1 of 2** **Digital Demod**.
2. Press **Demod Config** to access the demodulation configuration menu.
3. Press **TIMESLOT NUMBER**, enter the correct timeslot number using the data keys, then press (ENTER). This enters the time slot number of the timeslot you want to measure. The default value is timeslot 1. This function is identical to the **TIMESLOT NUMBER** in the physical channel menu. If the desired number was previously entered, it does not need to be entered here.

Note	**TIMESLOT NUMBER** is relevant for digital demodulator-based measurements only when the frame trigger is selected (see step 7.b below). The value of **TIMESLOT 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 **TIMESLOT 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, “If You Have a Problem” 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 to suppress all error messages. Note that making a measurement with an incorrect setup and with error messages off can yield incorrect measurement results. The default for **ERR MSG** ON OFF is ON.
5. Press **DEMOD RESBW** to set resolution bandwidth used in digital demodulation. Three available values are 300 kHz, 1 MHz, and 3 MHz. The default for **DEMOD RESBW** is 1 MHz.

6. Press **DD Trigger** to access the digital demodulator trigger menu,

7. Press **DD TRIG FRAME** **DD TRIG FREE RUN** or **DD TRIGEXTERNAL** 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 NADC signal. If the signal contains any of the six possible 28-bit NADC timeslot synchronization words, the frame trigger is the best choice.

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 you to supply a trigger signal to the rear panel EXT TRIG INPUT, positioned such that the digital demodulator measurement interval is set to the desired time.

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

8. 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** QFF 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 **TIMESLOT NUMBER**. The input signal must contain the 28 bit NADC 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 **TIMESLOT 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 28 bit NADC 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, "If You Have a Problem" 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.

---

9. 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 carrier power.
- Measure the carrier off 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 **EIA/TIA** standards documents The power measurements routines were specifically designed for measurements on **π/4** DQPSK burst carriers, but these measurements are also applicable to FM analog carriers by selecting continuous carrier (CONT) with **BURST CONT**. 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 8.

To measure the carrier power

1. Ensure 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, ensure that the timeslot number (TIRESLOT NUMBER) corresponds to the timeslot number of the burst signal. (See the description for PWR TRIG EXT VID in Chapter 8 for more information about external triggering.) Video triggering is normally used for this measurement, and the timeslot number selection has no effect.
3. If CARRIER POWER is not displayed, press Power . (If Power is not displayed, press (MODE) NADC ANALYZER to access Power .)
4. Press CARRIER 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 carrier power measurement, or use one of the post-measurement functions.

CARRIER POWER automatically sets the reference level and input attenuation based upon the measured power level of the carrier. CARRIER 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"). To measure the true mean carrier power, 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 of the mean carrier power are shown in dBm and in watts. Because the power levels of stations vary, a pass/fail message is not displayed for the carrier power measurement, even if PASSFAIL ON OFF is set to ON, unless you specify the upper and lower limits for the carrier power. The limits can be entered remotely; see "To change the value of limit variables" in Chapter 5 for more information. See Figure 3-4 for an example of the carrier power measurement.

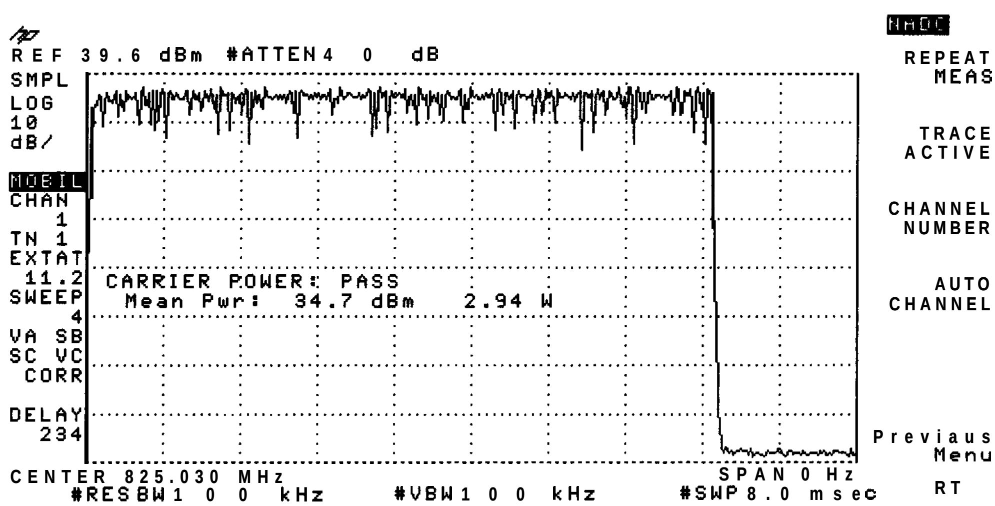


Figure 3-4. Carrier Power Measurement

To measure the carrier off power

1. Ensure that the channel number selection agrees with the transmitter's RF output. See "To select a channel to test" in earlier 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, ensure that the timeslot number (**TIMESLOT NUMBER**) corresponds to the timeslot number of the burst signal. (See the description' for **PWR TRIG EXT VID** in Chapter 8 for more information about external triggering.) Normally, video triggering is used for this measurement, and the timeslot number selection has no effect.
3. If **CARRIER OFF PWR** is not displayed, press **Power**. (If **Power** is not displayed, press (MODE) **NADC ANALYZER** to access **Power**.)
4. Press **CARRIER OFF PWR**. The personality will make the measurement and display the results.
5. Press **Previous Menu** if you are done with the carrier off power measurement, or use one of the post-measurement functions.

CARRIER OFF PWR measures the mean and peak carrier power when the carrier is off. (The carrier is off between burst transmissions.) **CARRIER OFF PWR** sets the reference level to -30 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 power is measured by determining the mean power in the region between the points that are + 10 dBc above the minimum carrier level. The peak power is measured by making the measurement in the region that is 25 μs inside the + 10 dB points of the burst. The mean and peak carrier off 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. See Figure 3-5 for an example of a carrier off power measurement.

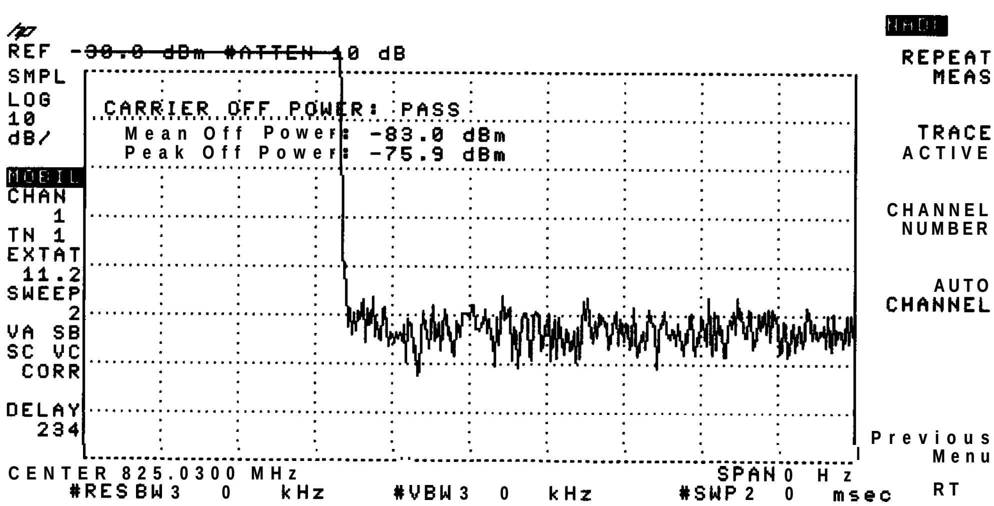


Figure 3-5. Carrier Off Power Measurement

To measure the power steps of a carrier

1. Ensure 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 carrier power measurement with the transmitter set to the highest power level to be measured. See "To measure the carrier power" for more information about the carrier power measurement. You need to perform the carrier power measurement before the power step measurement because the power step measurement adjusts the reference level and input attenuator according to the mean power that was measured by the carrier power measurement. The power step measurement adjusts the reference level and attenuation so the mean power of the carrier is positioned 5 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, ensure that the timeslot number (**TIMESLOT NUMBER**) corresponds to the timeslot number of the burst signal. (See the description for **PWR TRIG** EXT **VID** in Chapter 8 for more information about external triggering.) Video triggering is normally used for this measurement, and the timeslot 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**. (If **Power** is not displayed, press (MODE) **NADC 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 NADC 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 3-6 for an example of the power step measurement.

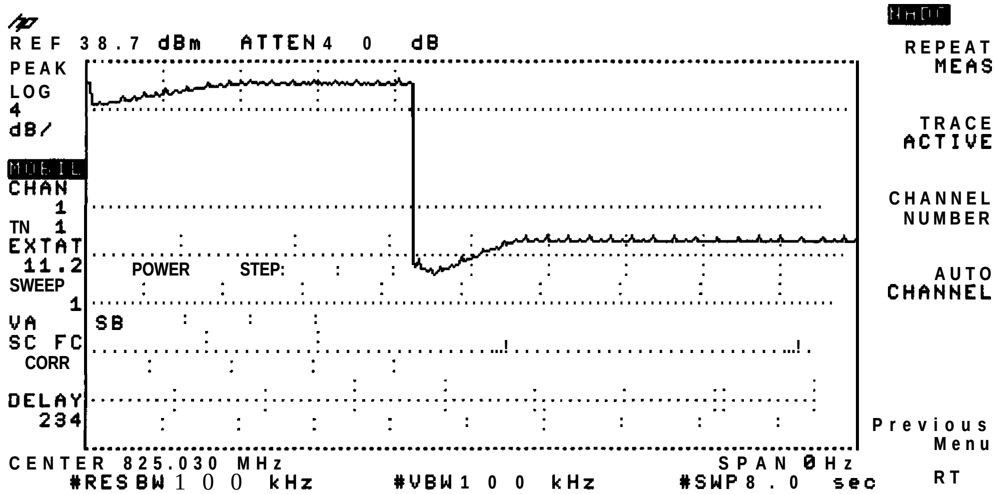


Figure 3-6. Power Step Measurement

To measure the occupied bandwidth

1. Ensure 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) **NADC ANALYZER** to access **Power** .)
3. Press **OCCUPIED BANDWDTH** . The NADC 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 transmitted 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 3-7 for an example of an occupied bandwidth measurement.

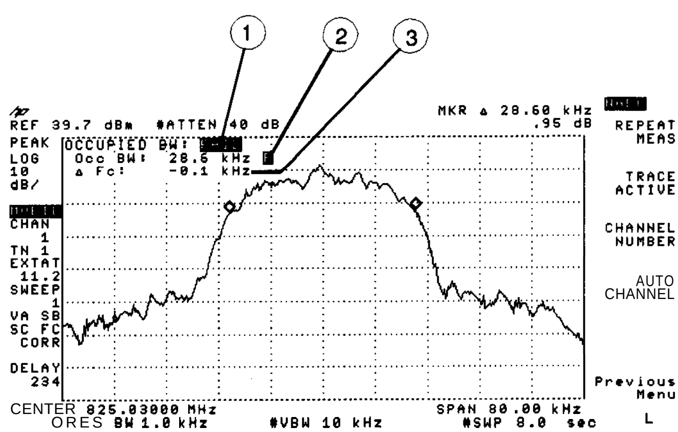


Figure 3-7. Occupied Bandwidth Measurement

Item	Description
1	Indicates whether the occupied bandwidth measurement passed or failed the test limit.
2	The bandwidth that 99 percent of the total transmitted power occupies.
3	The approximate center frequency error.

To monitor the transmit channel

1. Ensure 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** . (If **Power** is not displayed, press (MODE) **NADC 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 3-8 for an example of viewing channel 1. For burst carriers, the sweep time is faster than 1 trace element per burst period, which causes "gaps" in the spectrum.

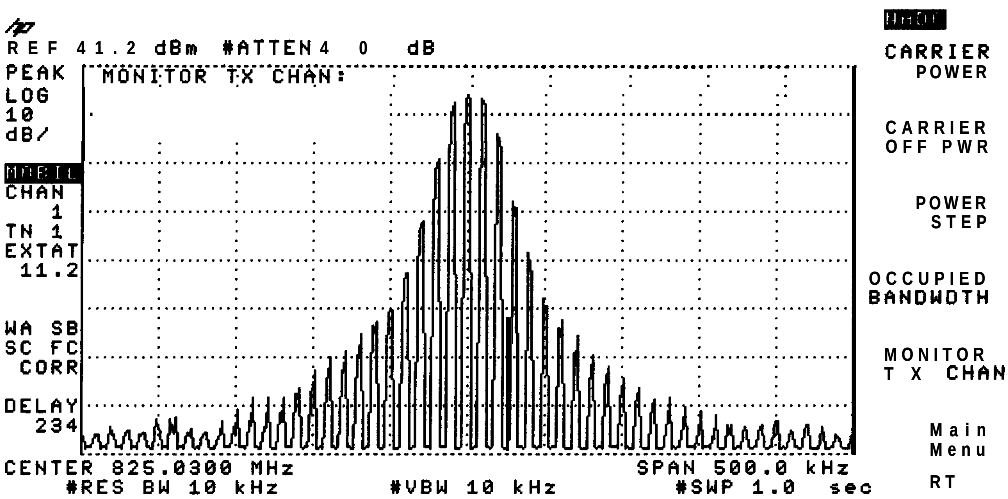


Figure 3-8. Viewing Channel 1

Measuring the Time Domain Characteristics of a TDMA 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 **TIMESLOT 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 rising or falling edge 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 ensure that the selection for **TRIG SRC DD EXT PERIOD 40ms20ms** **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, and "To configure the personality" earlier in this chapter.

To set up a power versus time measurement

1. Ensure 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) **NADC ANALYZER** to access **Power vs Time**.)
3. Press **P vs T Setup** to access the power versus time setup functions.
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. 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. 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. A burst usually contains 162 symbols, but may contain 140. If the burst contains 162 symbols, press **SYMBOLS 140 162** so that 162 is underlined. If the burst contains 140 symbols, press **SYMBOLS 140 162** symbols so that 140 is underlined. The default for this function is 162.
8. If using the digital demodulator frame trigger as the gate trigger source (**TRIG SRC DD EXT** set to DD), set **FT ACQ ON OFF** to ON. Setting ET **ACQ ON OFF** to ON will force the measurement to acquire the digital demodulator frame trigger before every Power vs Time measurement. This positions the frame trigger 3 ms before the first symbol of the selected timeslot. Setting **FT ACQ ON OFF** to OFF will allow a Power vs Time measurement without a frame trigger acquisition. This will decrease measurement time, but may allow the frame trigger to drift away from the desired timeslot, requiring compensation using **TRIG DELAY**.
9. Press **Previous Menu** if you are done with the P vs T Setup functions.

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

- Either maximum and minimum peaks or averaged trace data.
- The number of sweeps.
- Either a 70 or a 110 dB amplitude range. If 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 symbols.

- Frame trigger acquisition prior to measurements.

See Figure 3-9 for an example of the trace results of averaging 20 bursts. See Figure 3-10 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.

EIA/TIA reference The power versus time measurements are based on IS-55 3.1.2.3, "Carrier Switching Time."

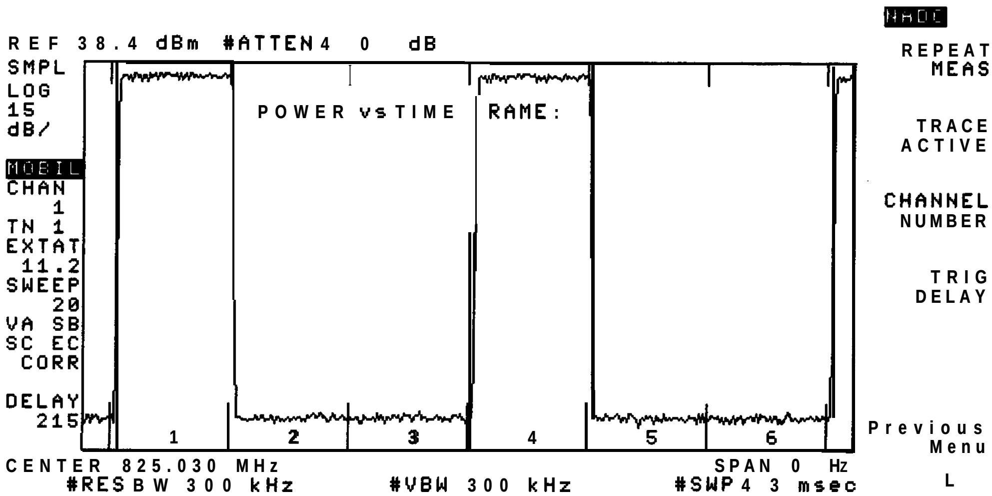


Figure 3-9. Measuring the Average of 20 Bursts

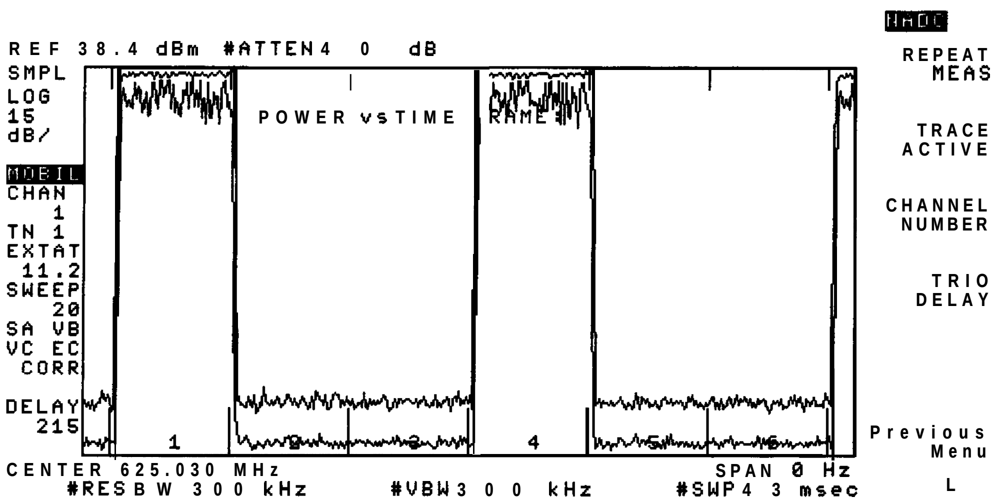


Figure 3-10. Measuring the Maximum and Minimum Peaks of 20 Bursts

To view the frame

1. Ensure 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) **NADC 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 "lb configure the personality" in this chapter for more information about setting the trigger time delay and trigger polarity.
4. If using an external trigger source (**TRIG SRC DD EXT** set to EXT in Trigger Config menu), and the edges of the bursts are not aligned with the lines for the timeslots, press **TRIG DELAY**. Use 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 symbol 1 of the timeslot.)

   If using the digital demodulator frame trigger as the gate trigger source (**TRIG SRC DD EXT** set to DD in Trigger Config menu) and **FT ACQ ON OFF** set to ON (in P vs T Setup menu), trigger delay should 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 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/15 minutes specified. In this case, trigger delay may be adjusted to keep the burst within the limit lines.
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 timeslots, **P vs T FRAME** is a convenient way to determine which timeslots are off, and in which timeslots 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 3-1 1 for an example of viewing a frame.

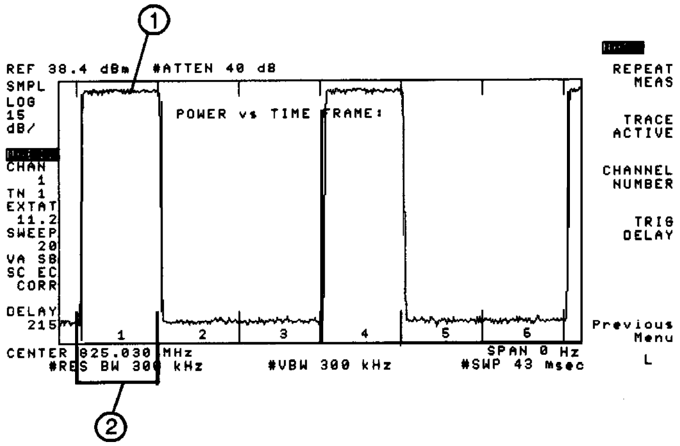


Figure 3-11. Viewing a Frame

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

To measure the burst

1. Ensure that the timeslot number corresponds to the timeslot number of the burst signal. See "To select a channel to test" earlier in this chapter for more information about selecting the timeslot.
2. If **P vs T BURST** is not displayed, press **Power vs Time**. (If **Power vs Time** is not displayed, press (MODE) **NADC ANALYZER** to access **Power vs Time**.)
3. Press **P vs T BURST** to display the transmission burst.
4. If using an external trigger source (**TRIG SRC DD EXT** set to EXT in Trigger Config menu), and the burst is not symmetrical with respect to the limit lines, press **TRIG DELAY**. Use 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 by pressing **TRIG DELAY**, entering the number with the data keys, and then pressing the appropriate units key ((sec), (ms), or (μs)).

   If using the digital demodulator frame trigger as the gate trigger source (**TRIG SRC DD EXT** set to DD in Trigger Config menu) and **FT ACQ ON OFF** set to ON (in P vs T Setup menu), trigger delay should 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 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/15 minutes specified. In this case, trigger delay may be adjusted to keep the burst within the limit lines.
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 -20 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 test limits.

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 3-12 for an example of measuring a burst.

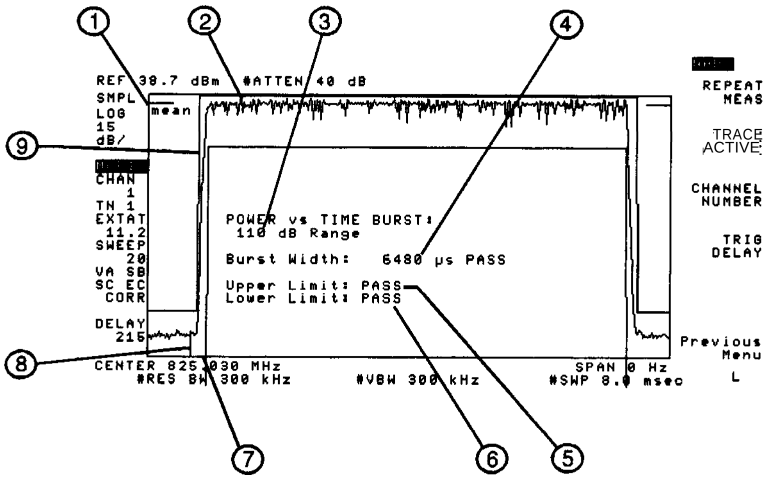


Figure 3-12. Measure a Burst

Item	Description
1	The mean value of the burst.
2	The burst signal.
3	The selected display range (either 70 dB or 110 dB).
4	The width of the burst waveform. The burst width is measured -20 dB from the peak of the burst. The pass/fail message indicates whether the burst width was within the burst width limits.
5	Indicates whether the burst was below the upper limit lime.
6	Indicates whether the burst was above the lower limit line.
7	The lower limit line.
8	The position of point 0. Point 0 is the start of symbol 1.
9	The upper limit line. Because a portion of the upper limit line is specified at an absolute (dBm) level, the lower horizontal edge of the upper limit line can vary depending on the reference level.

To measure the rising or falling edge of a burst

1. Ensure that the timeslot number corresponds to the timeslot number of the burst signal. See "To select a channel to test" earlier in this chapter for more information about selecting the timeslot.
2. Press **Power vs Time** . (If **Power vs Time** is not displayed, press (MODE) **NADC ANALYZER** to access **Power vs Time** .)
3. Measure the rising or falling edge of a burst. lb measure the rising edge, press **P vs T RISING** . 'lb measure the falling edge, 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 using an external trigger source (**TRIG SRC DD EXT** set to EXT in Trigger Config menu), and the edge of the burst is not within the displayed limit lines, press **TRIG DELAY** . Use the large knob on the spectrum analyzer front panel to adjust the trigger delay until the waveform edge is centered between the lines.

   If using the digital demodulator frame trigger as the gate trigger source (**TRIG SRC DD EXT** set to DD in Trigger Config menu) and **FT ACQ ON OFF** set to ON (in P vs T Setup menu), trigger delay should 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 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/15 minutes specified. In this case, trigger delay may be adjusted to keep the burst within the limit lines.
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 test limits.

P vs T RISING measures the attack time and allows you view the rising edge of a burst. The attack time is the time difference between the point 20 dB below the mean carrier level and the closest -60 dBm point (the markers are positioned at the -20 dBc and -60 dBm points). See Figure 3-13 for an example of measuring the rising edge of a burst.

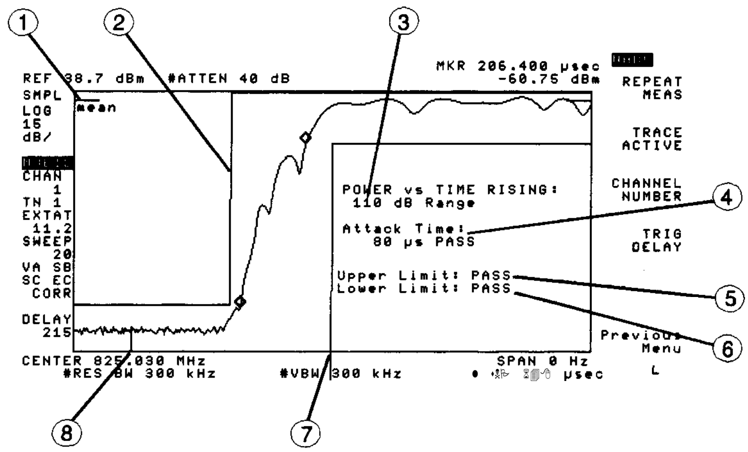


Figure 3-13. Measuring the Rising Edge of a Burst

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 rising edge 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 rising edge of the burst to transition from -60 dBm to -20 dBc.
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 rising edge for the burst.)
8	The position of point 0. Point 0 is the start of symbol 1 for the burst.

P vs T FALLING measures the release time and allows you view the falling edge of a burst. The release time is the time difference between the point 20 dB below the mean carrier level and the closest -60 dBm point (the markers are positioned at the -20 dBc and -60 dBm points). See Figure 3-14 for an example of measuring the falling edge of a burst.

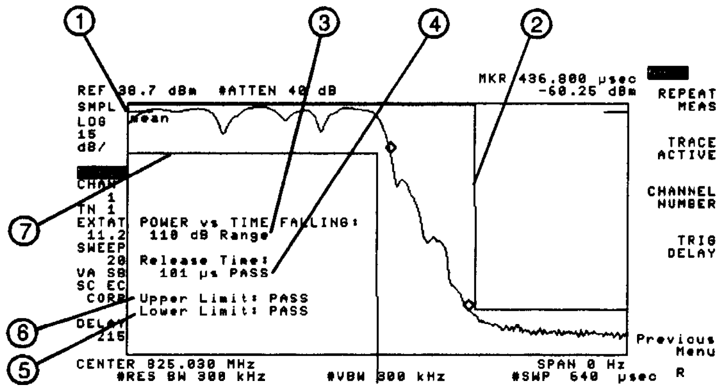


Figure 3-14. Measuring the Falling Edge of a Burst

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 falling edge 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 falling edge of the burst to transition from -20 dBc to -60 dBm.
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.
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	The lower limit line. (The lower limit line indicates the boundary for the minimum rising edge for the burst.)

Measuring Adjacent Channel 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 power.
- Channel power.

The ACP measurement uses the "time-gated spectrum analyzer integration" method for measuring the power. The ACP measurement makes the measurement for digital carriers according to the EIA/TIA IS-55 standards documents. 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 by selecting continuous carrier (CONT) with **BURST CONT**. While the results for analog carriers and digital carriers are equally valid, the method for testing the analog carriers differs from the method specified in IS-55. For analog carriers, IS-55 specifies a spectrum measurement instead of an ACP measurement.

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 8.

Note A trigger signal is required for adjacent channel power measurements. If you have trouble performing the adjacent channel power measurement, you should ensure 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, and "To configure the personality" earlier in this chapter.

To measure the adjacent channel power

1. Ensure 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) **NADC ANALYZER** to access **Adj Chan Power**.)

3. Press **ACP Setup** to access the ACP setup menu.

4. If using the digital demodulator 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 adjacent channel power measurement. Setting **FT ACQ ON OFF** to OFF will permit an 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, first alternate, and second alternate channels. The personality uses two measurement sweeps to do this: the first sweep uses time-gating to measure the ACP without transients, the second measurement sweep measures the ACP including transients. Transient results are actually the total leakage due to both modulation and transients. The 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 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 32.8 kHz span.

   b. If desired, fewer data points can be specified for **ACP GTD CH/SWP**. lb select the number of data points, press **POINTS/SWEEP** 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/SWPS**. 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 during the measurement. 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 spectrum analysis to separate the spectrum due to modulation and ramping (switching transients) from the full spectrum. Numeric ACP results are displayed for leakage ratio due to modulation and due to "transients." ("Transient" results are actually the total leakage due to both modulation and transients.) The personality uses the spectrum analyzer peak detector and a 32.8 kHz integration bandwidth to measure the power in the adjacent channels. The spectrum is filtered with a square root raised cosine filter before integration, providing a channel bandwidth of approximately 24 kHz at -3 dB. 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 3-15 for an example of the numerical results of an ACP measurement. See Figure 3-16 for an example of the trace results of an ACP measurement.

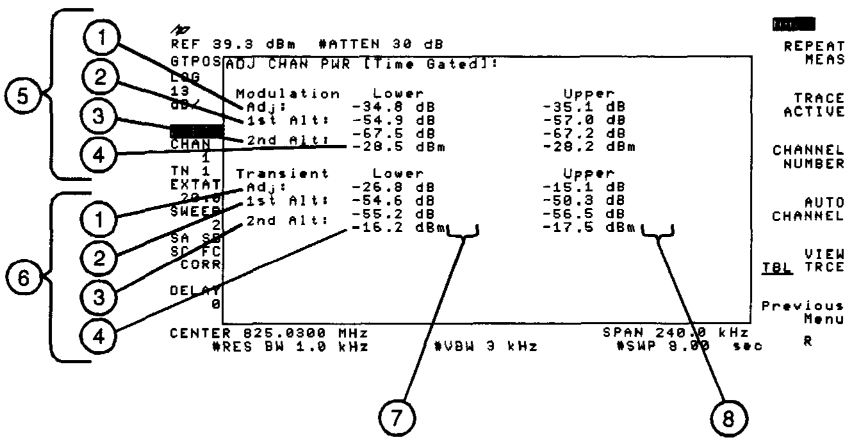


Figure 3-15. Table Results for the ACP Measurement

Item	Description
1	The power leakage (relative to the carrier power) into the upper and lower channels that are adjacent to the carrier.
2	The power leakage (relative to the carrier power) into the upper and lower first alternate channels. The first alternate channels spaced two channels from the carrier.
3	The power leakage (relative to the carrier power) into the upper and lower second alternate channels. The second alternate channels are spaced three channels from the carrier.
4	The absolute power leakage into the upper and lower second alternate channels.
5	The ACP leakage due to modulation.
6	The ACP leakage due to transients and modulation (total).
7 and 8	An F next to any of the measured values indicates that the measured value failed the measurement limits.

Figure 3-16 shows the trace results of an ACP measurement.

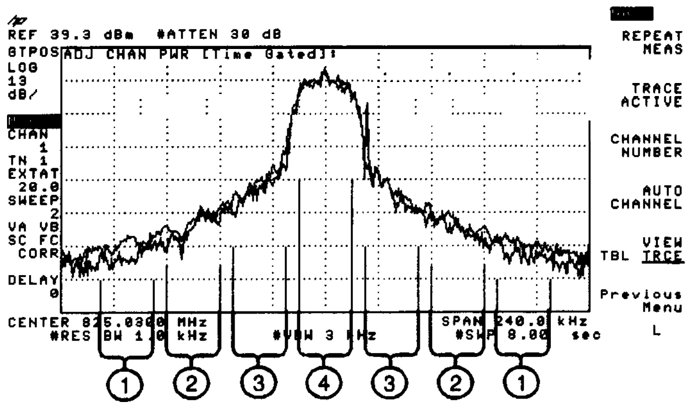


Figure 3-16. Spectrum Results of the ACP Measurement

Item	Description
1	Indicates the 3 dB bandwidth of the second alternate channel.
2	Indicates the 3 dB bandwidth of the first alternate channel.
3	Indicates the 3 dB bandwidth of the adjacent channel.
4	Indicates the 3 dB bandwidth of the carrier channel.

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 **POINTS/SWEEP** to decrease the amount of time for an ACP GTD CH/SWP measurement, but the accuracy is decreased also. **POINTS/SWEEP** allows you to specify the number of data points used for the ACP GTD CH/SWP measurement.

To measure the channel power

1. Set the channel number to the desired channel.
2. *If a carrier is not present:* The spectrum analyzer reference level should be adjusted so that the noise is positioned above the second graticule from the bottom graticule on the spectrum analyzer display. To adjust the reference level, press (AMPLITUDE), and then use the large knob on the spectrum analyzer front panel to adjust the noise level so that it is above the second graticule from the bottom graticule. (If the post-measurement menu is displayed, you must first press TRACE **ACTIVE** before you press (AMPLITUDE).) Press (MODE) (MODE) after the reference level has be adjusted.
3. *If* a carrier is *present:* To avoid signal compression, you should perform the carrier power measurement on the carrier channel before the channel power measurement. You need to perform the carrier power measurement because the channel power measurement does *not* adjust the reference level and input attenuator. See "To measure the carrier power" for information about performing the carrier power measurement.
4. If **CHAN POWER** is not displayed, press Adj **Chan Power** . (If **Adj Chan Power** is not displayed, press (MODE) **NADC ANALYZER** to access Ad j **Chan** Power .)
5. If desired, fewer data points can be specified by pressing **POINTS/SWEEP** , entering a number from 21 to 401 (the lower the number the faster the measurement) with the data keys, and then pressing (ENTER). **POINTS/SWEEP** allows you to specify the number of data points used for the channel power measurement. If you specify fewer than 401 data points, the displayed trace will be truncated.
6. Press **CHAN POWER** . The personality will measure the total power in any channel. The absolute channel power will be displayed.
7. Press **Previous Menu** if you are done with the channel power measurement, or use one of the post-measurement functions.

CHAN POWER uses the spectrum analyzer peak detector, so this measurement does not give a true power responding result. This measurement does not use time-gating, and the signal is measured as if the signal is all due to modulation and noise. The channel power measurement uses an 32.8 kHz integration bandwidth to measure the power in the channel. The signal is filtered with a square root raised cosine filter before integration, providing a channel bandwidth of approximately 24 kHz at -3 dB.

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 3-17 for an example of a channel power measurement on an unoccupied channel.

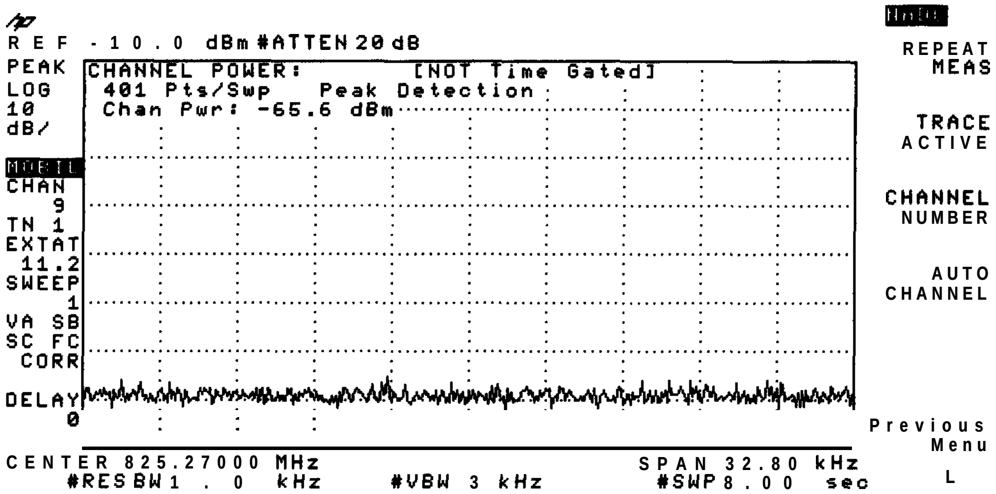


Figure 3-17. The Channel Power Measurement

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.

This section contains the following procedures:

- Measure the modulation accuracy of an NADC 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, carrier frequency error, and amplitude droop of an NADC digital mobile station.
- Make a fast modulation accuracy measurement by choosing a partial modulation accuracy measurement.
- Make a modulation accuracy measurement on the first ten symbols of ten bursts within one minute.
- 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.

To perform a full modulation accuracy measurement

1. Ensure 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). **NADC 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 **1 BURST 10 BURST** until 1 BURST is underlined to select measurements of the entire burst (all 157 symbols for 1 burst).
6. 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, carrier frequency error, and amplitude droop.

   The default for **FULL PARTIAL** is FULL.
7. Press **More 1 of 2**.
8. 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.
9. If the **SAV MEAS ON OFF** softkey is present, press SAY **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, 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.
10. Press **More** I' **of 2** to return to the previous menu.
11. 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, carrier frequency error, and amplitude droop.

    To stop a measurement in progress, press **STOP MEAS**. 'lb repeat the measurement, press **MODULATN ACCURACY**.

    'lb 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) To change the measurement to a different demodulation resolution bandwidth, you can use **DEMOD RESBW** key available by pressing **DEMOD MAIN** **DEMOD CONFIG MORE 1** of 3 . 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 **EIA/TIA** standards documents. EVM is calculated after I-Q origin offset, carrier frequency error, and amplitude droop have been extracted from the measured data. For a mobile station, the measurement interval includes the 157 transmitted symbols of a mobile station burst. Modulation metrics are calculated using measured data only at decision points.

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

The spectrum analyzer center frequency 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 3-18 for an example of the full modulation accuracy measurement screen.

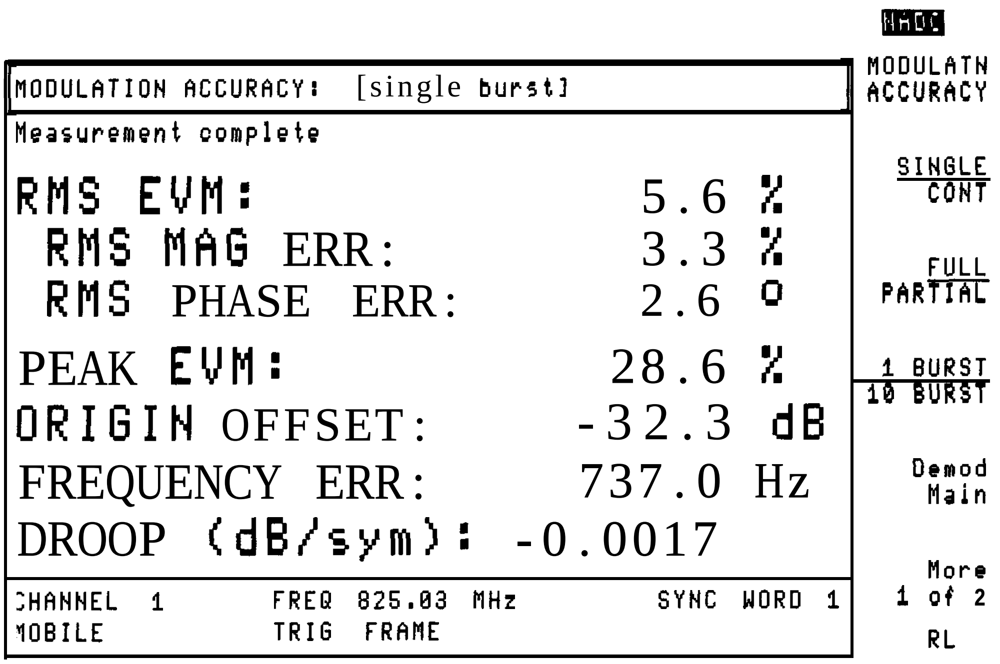


Figure 3-18. Full Modulation Accuracy Measurement

To make a partial modulation accuracy measurement

1. Ensure 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) **NADC 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 **1 BURST 10 BURST** until 1 BURST is underlined to select measurements on the entire burst (all 157 symbols for 1 burst).
6. 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 and amplitude droop 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.
7. Press **More 1 of 2**.
8. 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
9. 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.
10. Press **More 2 of 2** to return to the previous menu.
11. 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**. lb 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 EIA/TIA standards documents. EVM is calculated after I-Q origin offset, carrier frequency error, and amplitude droop have been extracted from the measured data. For a mobile station, the measurement interval includes the full 157 transmitted symbols of a mobile station burst. Modulation metrics are calculated using measured data only at decision points.

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

For continuous measurements in partial mode, the spectrum analyzer center frequency 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 3-19 for an example of the partial modulation accuracy measurement screen.

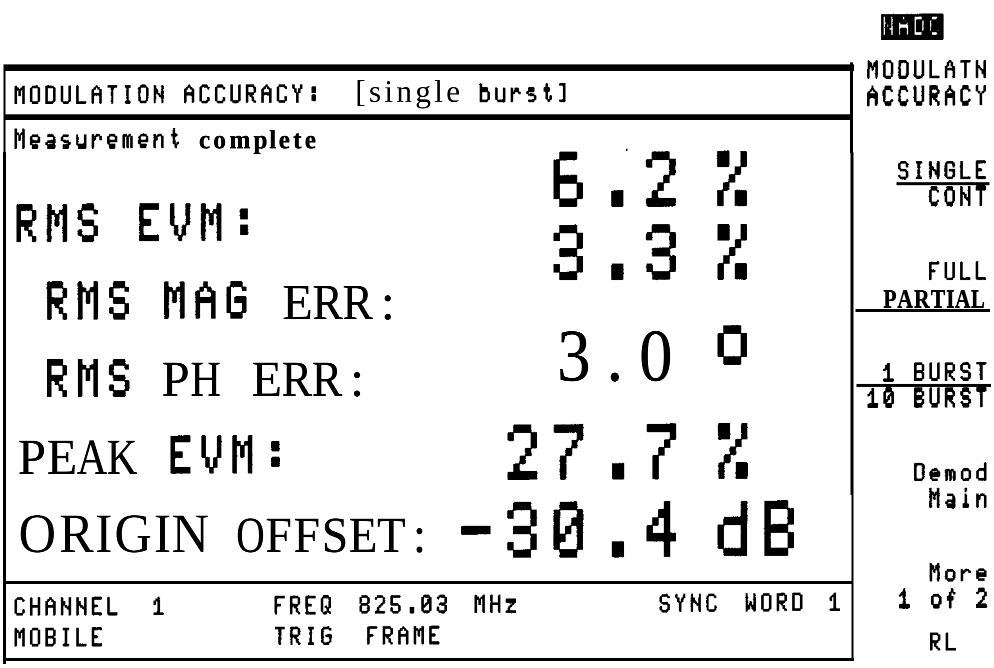


Figure 3-19. Partial Modulation Accuracy Measurement

To make a 10 symbol/10 burst modulation accuracy measurement

1. Ensure 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) **NADC ANALYZER MORE 1 OF 2 Digital Demod** .
3. Press **Modulatn** to access 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 **1BURST 10 BURST** until 10 BURST is underlined. A 10 symbol/10 burst modulation accuracy measurement includes the RMS error vector magnitude (EVM), RMS magnitude error, RMS phase error, I-Q origin offset, carrier frequency error, and amplitude droop. Selecting 10 BURST causes the modulation accuracy tests to be performed on the first 10 symbols of 10 bursts. For RMS EVM, RMS MAG ERR, and RMS PHASE ERR, the results for each of the 10 bursts are averaged and the average is the displayed value. Note that if 10 BURST is selected, partial measurements, averaging, and the ability to save measurement results are not available.

   The default setting is 1 BURST.
6. Press **MORE 1 of 2**
7. If the SAV **MEAS ON OFF** softkey is present and set to ON, 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 10 symbol, 10 burst modulation accuracy measurement. The modulation metrics screen will appear with values for RMS error vector magnitude (EVM), and RMS magnitude error, RMS phase error. I-Q origin offset, frequency error, and amplitude droop for a single full burst are also displayed.

   To stop a measurement in progress, press **STOP MEAS** . To repeat the measurement, press **MODULATN ACCURACY** .

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 EIA/TIA standards documents. EVM is calculated after I-Q origin offset, carrier frequency error, and amplitude droop have been extracted from the measured data. For a mobile station with 10 BURST selected, the measurement interval includes the first 10 transmitted symbols of a mobile station burst for 10 bursts. Modulation metrics for RMS EVM, RMS magnitude error, and RMS phase error are calculated using measured data only at decision points for each burst. The results for each burst are averaged, and the average value is displayed.

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.

If the digital demodulation 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 3-20 for an example of the 10 symbol/10 burst modulation accuracy measurement screen.

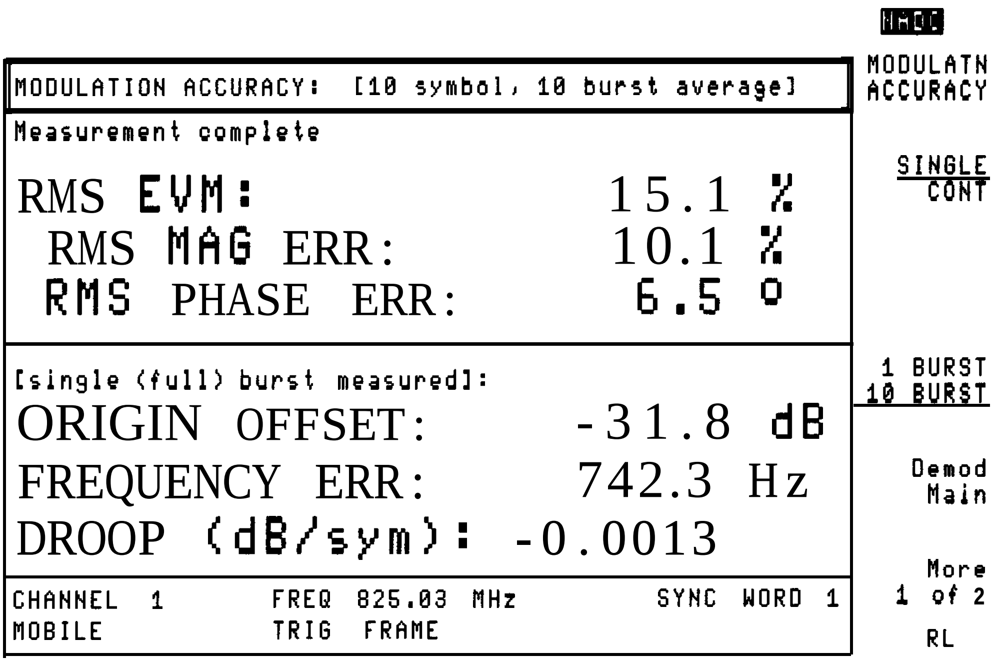


Figure 3-20. 10 Symbol/10 Burst Modulation Accuracy Measurement

To find the average error vector magnitude

1. Ensure 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) **NADC ANALYZER** MORE **1 OF 2 Digital Demod** .
3. Press **Modulatn** to access the modulation accuracy measurements menus.
4. Press **1 BURST 10 BURST** until 1 BURST is underlined. The average error vector magnitude measurement is not available with the 10 BURST selection.
5. 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, carrier frequency error, and amplitude droop.

   Selecting PARTIAL excludes carrier frequency error and amplitude droop 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** 2 of **2** .
7. 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.
8. If the **SAV MEAS ON OFF** softkey is present, press **SAV MEAS ON OFF** until OFF is underlined.
9. Press **More 2 of** 2 to return to the previous menu.
10. 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 and amplitude droop 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, amplitude droop, 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 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 make a full modulation accuracy measurement" for details on the automatic measurement process.

See Figure 3-21 for an example of the statistics screen for a full measurement.

See Figure 3-22 for an example of the statistics screen for a partial measurement.

STATISTICS for sample of 10 bursts:

	Mean	Std dev	Max	Min
RMS EVM (%):	5.8	0.26	6.2	5.4
RMS MAG ERR (%):	3.3	0.04	3.3	3.2
RMS PHASE ERR (°):	2.8	0.18	3.0	2.5

RMS EVM Uncertainty

Temp. Range 20-30 °C:	5.9 %	> RMS EVM >	3.2 %
Temp. Range 0-55 °C:	5.9 %	> RMS EVM >	2.9 %

	Mean
ORIGIN OFFSET (dB):	-31.5
FREQUENCY ERROR (Hz):	724.7
DROOP (dB/symbol):	-0.0015

CHANNEL 1 FREQ 825.03 MHz SYNC WORD 1
MOBILE TRIG FRAME

MODULATN ACCURACY
SINGLE CONT
FULL PARTIAL
1 BURST 10 BURST
Demod Main
More 1 of 2
RL

Figure 3-2 1. Averaged Full Modulation Accuracy Measurement

STATISTICS for sample of 10 bursts:

	Mean	Std dev	Max	Min
RMS EVM (%):	5.7	0.57	6.6	4.7
RMS MAG ERR (%):	3.3	0.04	3.3	3.2
RMS PHASE ERR (°):	2.6	0.40	3.3	2.0

RMS EVM Uncertainty

Temp. Range 20-30 °C: 5.2 % >RMS E'JM > 2.1 %

Temp. Range 0-55 °C: 5.2 % > RMS EVM > 1.7 %

	Mean
ORIGIN OFFSET (dB):	-32.1

CHANNEL 1 FREQ 825.03 MHz SYNC WORD 1

MOBILE TRIG FRAME

MODULATN ACCURACY

SINGLE CONT

FULL PARTIAL.

1 BURST 10 BURST

Demod Main

More 1 of 2

RL

Figure 3-22. Averaged Partial Modulation Accuracy Measurement

To hold measurement data for viewing graphs and demodulated data bits

1. Perform a complModulatn measurement. See "To perform a full modulation accuracy measurement" and "To perform a partial modulation accuracy measurement" sections for the procedure. Average modulation accuracy, 10 symbol/10 burst, or halted measurements cannot be held.
2. Press SAY **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

1. If the digital demodulator main menu is not displayed, press (MODE) **NADC 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 2 of 2**.

4. Press **Evm Cal** to access the EVM calibration menu. A screen containing instructions is also displayed. See Figure 3-23 for the EVM calibration instructions screen.

```
EVM CALIBRATION:                                          NADC
                                                          CAL EVM
NOTE: The analyzer must have at least 30 minutes
      of warmup operation at the ambient temperature
      before starting the calibration.

1.  Connect an NADC modulated calibration signal
    with known RMS Phase error. A precision, low
    RMS EVM source is recommended.

2.  Configure the personality for an EVM measurement
    on the calibration signal. See "Configuring the       PHASE
    Personality for Your Test Setup".                     ERROR

3.  Enter the RMS Phase error of the calibration
    source in milli-degrees using the PHASE ERROR
    key (example: 1.23 degrees = 1238 milli-degrees).

4.  Press the CAL EVM key when ready.                     Previous
                                                          Menu
CHANNEL 1          FREQ 870.03 MHz
BASE               TRIG FREE RUN                          RL
```

Figure 3-23. 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.

Note — The accuracy of this calibration depends on the accuracy and stability of the phase error of the calibration signal.

---

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 3-24 for an example of an EVM calibration results screen,

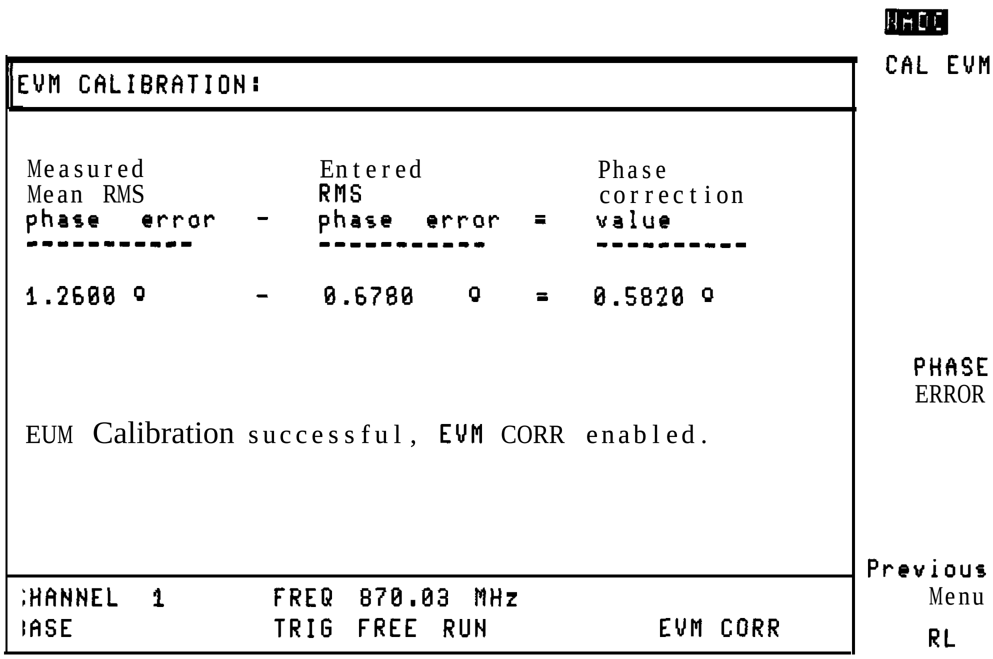


Figure 3-24. EVM Calibration Results

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** OH **OFF** is set to ON, the phase correction value generated by the EVM calibration is used to automatically correct all (except 10 symbol/10 burst) 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, Operating Reference, 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

lb 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.**

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.

To display the I-Q pattern graph

1. Ensure 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) **NADC 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 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 droop, I-Q origin offset, and carrier frequency error. A 157 symbol burst is 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 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 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 3-25 for an example of the I-Q Pattern Graph Screen.

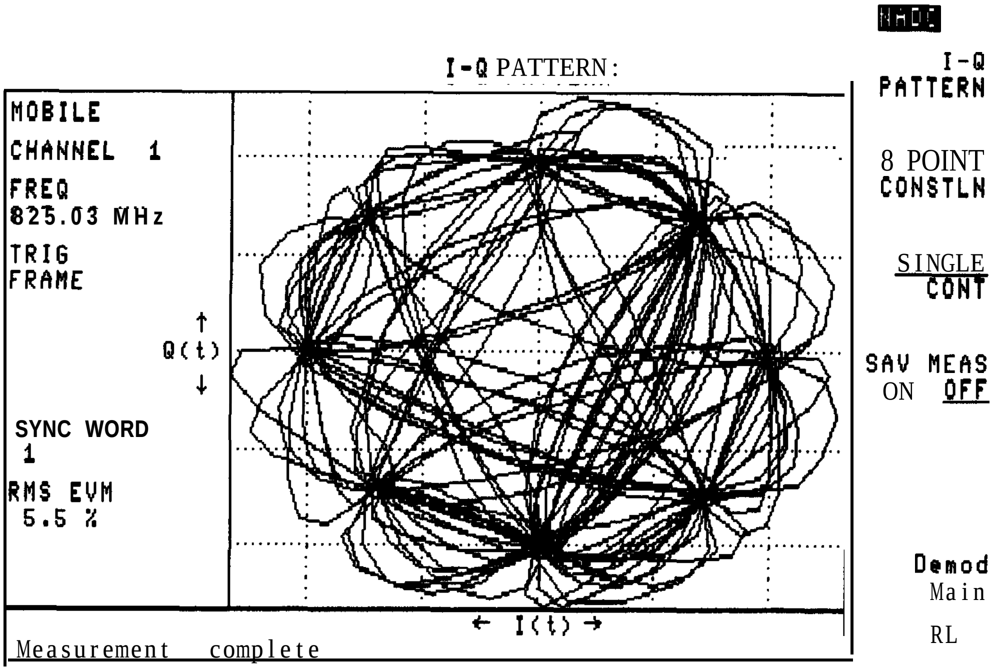


Figure 3-25. I-Q Pattern Graph Screen

To display the 8 point constellation graph

1. Ensure 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) **NADC 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 8 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 8 decision states of the $\pi/4$ DQPSK modulation will be indicated by the " + " symbol. The magnitude and phase of each of the 157 decision points in a burst 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 8 point constellation measurement displays the phase and amplitude of the baseband digital modulation only at the decision points of the timeslot. The 8 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 8 point constellation is plotted after correction for droop, I-Q origin offset, and carrier frequency error. A 157 symbol burst is plotted on the 8 point constellation.

An 8 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 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 3-26 for an example of the 8 Point Constellation Screen.

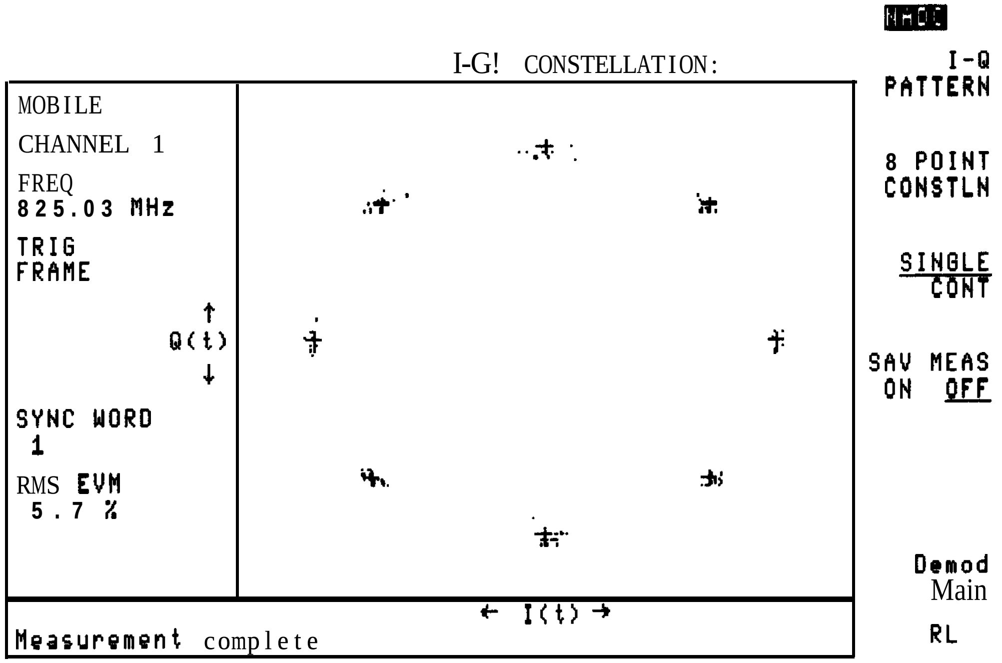


Figure 3-26. 8 Point Constellation Graph Screen

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 8 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 **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 to perform this measurement.

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.

To display the demodulated data bits

1. Ensure 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) **NADC 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** RATA will cause the data portion of the bit sequence to be highlighted. For NADC mobile stations this is the 57th through the 178th bits, and the 203rd through the 324th bits. Each of these two blocks is 122 bits long.
   - Pressing **HIGHLITE SYNC** will cause the sync word to be highlighted. For NADC mobile stations this is the 29th through the 56th bits. This block is 28 bits long. **HIGHLITE SYNC** is the default setting.
   - Pressing **HIGHLITE CDVCC** will cause the Coded Digital Verification Color Code (CDVCC) portion of the bit sequence to be highlighted. For NADC mobile stations, these are the 191st through the 202nd bits. This block is 12 bits long.
   - Pressing **HIGHLITE SACCH** will cause the Slow Associated Control Channel (SACCH) portion of the bit sequence to be highlighted. For NADC mobile stations these are the 179th through the 190th bits. This block is 12 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 time slot measured, after correction for I-Q offset, carrier frequency error, and I-Q origin offset. The 28 bit synchronization word can be read to confirm that the correct timeslot has been measured. The CDVCC and SACCH can also be read. The 324 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 Arst 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 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 3-27 for an example of the Data Bits Screen.

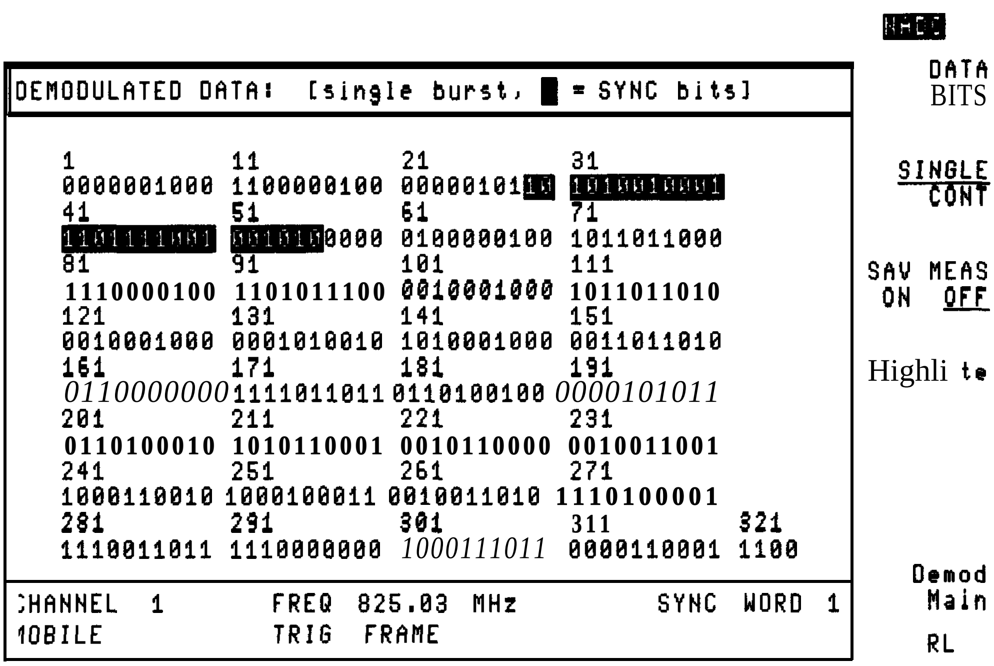


Figure 3-27. Data Bits Screen

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 8 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

System accesses the functions that allow you to view the spectrum of the transmit or receive bands.

This section contains the following procedures:

- View the transmit band or bands spectrum.
- View the receive band or bands spectrum.

These measurements are applicable for both analog and digital carriers. **MONITOR TX BAND** and **MONITOR RX BAND** are useful for measuring the in-band spurious emissions. Even though **MONITOR TX BAND** and **MONITOR RX BAND** do not measure the spurious emissions automatically, they provide an excellent starting point for making spurious emission measurements because most of the spectrum analyzer settings are set automatically.

To view the transmit band spectrum

1. If **System** is not displayed, press (MODE) **NADC ANALYZER** **More 1 of 2**.
2. Press **System**.
3. Press **MONITOR TX BAND**.
4. Select the transmit band that you want to view:

   a. For the 800 MHz tuning plan press **BANDS A'' + A** (selects bands A" and A), **BAND A'**, **BAND B**, or **BAND B'**.

   b. For the 1900 MHz tuning plan press **BAND A**, **BAND B**, **BAND C**, **BAND D**, **BAND E**, or **BAND F**.

   or,

   Select all the bands by pressing **FULLBAND**.

   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 NADC menu.
6. Press **Previous Menu** when you are done.

MONITOR TX BAND displays the transmit band or bands 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 3-28 for an example of viewing the A" and A bands.

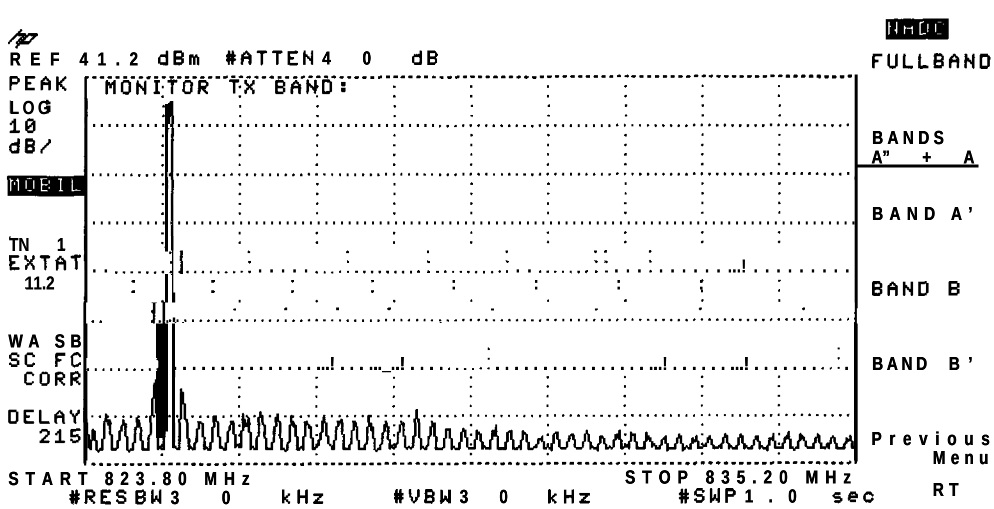


Figure 3-28. Viewing Bands A" and A

To view the receive band spectrum

1. If **MONITOR RX BAND** is not displayed, press (MODE) **NADC ANALYZER** **More 1 of 2** **System**.
2. Press **MONITOR RX BAND**.
3. Select the transmit band that you want to view:

   a. For the 800 MHz tuning plan press **BANDS A'' + A** (selects bands A" and A), **BAND A'**, **BAND B**, or **BAND B'**.

   b. For the 1900 MHz tuning plan press **BAND A**, **BAND B**, **BAND C**, **BAND D**, **BAND E**, or **BAND F**.

   or,

   Select all the bands by pressing **FULLBAND**.

   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 or bands 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 active carriers 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 3-29 for an example of viewing the A" and A bands.

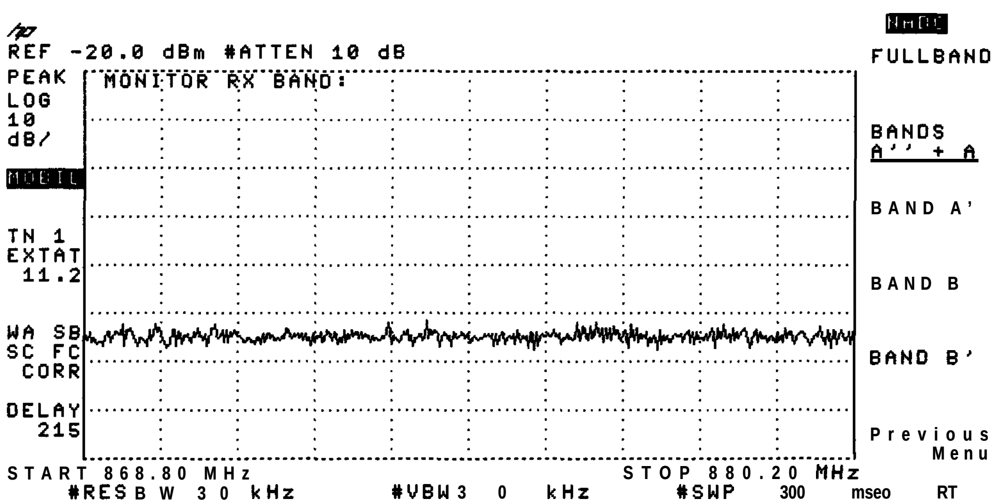


Figure 3-29. Viewing Bands A" and A

4

Verifying Operation

This chapter contains test procedures that verify the electrical performance of the improved amplitude accuracy for NADC (Option 050), and the time-gated spectrum analysis card (Option 105).

This chapter contains the following sections:

- Preparing for the verification tests.
- The following verification procedures:
  1. Absolute amplitude accuracy.
  2. Gate delay accuracy and gate length accuracy.
  3. Gate card insertion loss.
  4. IF frequency accuracy
  5. Error vector magnitude
- The performance verification test record.

Preparing for the **Verification Tests**

Do these four 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 HP 8590 Series spectrum analyzer operation.
3. Perform the spectrum analyzer self-calibration routines. Refer to the spectrum analyzer documentation for instructions. (Before performing the self-calibration routines, ensure that nothing is connected to the GATE TRIGGER INPUT connector. Otherwise, the self-calibration routine's results may not be valid.)
4. Read the rest of this section before you start any of the tests, and make a copy of the performance verification test record as described in "To record the test results."

The test equipment you will need

Table 4-1 list the recommended test equipment for the performance tests. Any equipment that meets the critical specifications given in the table can be substituted for the recommended model or models.

To record the test results

Within the verification procedure, there are places to enter the test results. In addition, the performance verification test record (Table 4-9) has been provided at the end of the chapter. We recommend that you make a copy of the test record, 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 ensure that the spectrum analyzer meets the specifications.

If the spectrum analyzer does not meet its specifications

1. Ensure that there is nothing connected to the spectrum analyzer GATE TRIGGER INPUT connector.
2. Rerun the spectrum analyzer frequency and amplitude self-calibration routines. See the spectrum analyzer documentation for more information.
3. Repeat the verification test.

If the spectrum analyzer continues to fail one or more of its specifications, complete any remaining tests and record the results on a copy of the performance verification test record, then return the spectrum analyzer with a copy of the completed test record to a Hewlett-Packard Sales and Service Office. Refer to the documentation for the spectrum analyzer for addresses and shipping instructions.

Recommended test equipment

Table 4-1 lists the recommended test equipment for performing the verification tests.

Table 4-1. Recommended Test Equipment

Instrument	Critical Specifications for Equipment Substitution	Recommended Model	Use *
Synthesized signal generator	Frequency range: 818 MHz to 2 GHz 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 to + 16 dBm	HP 8662A or HP 8663A	P
Synthesized sweeper	Frequency range: 818 MHz to 2 GHz Frequency accuracy (CW): ±0.02% Power level range: -35 to + 16 dBm	HP 8340A/B	P,A,T
Synthesizer/ level generator	Frequency range: 50 MHz Amplitude range: + 12 to -85 dBm Flatness: ±0.15 dB Attenuator accuracy: ±0.09 dB	HP 3335A	P,A,T
Spectrum analyzer	Phase noise: -80 dBc/Hz at 320 Hz offset -85 dBc/Hz at 1 kHz offset	HP 8566B	P
Measuring receiver	Compatible with power sensors Resolution: 0.01 dB Reference accuracy: ± 1.2 %	HP 8902A	P,A,T
Power sensor	Frequency range: 818 MHz to 2 GHz Maximum SWR: 1.1 (at stated range)	HP 8482A	P,A,T
Oscilloscope	No substitute	HP 54501A	P,T
Microwave frequency counter	Frequency range: 21.4 MHz Aging rate: 5 x 10^{-10} Hz/day	HP 5343A	P
Universal counter	Time interval: 100 ns to 100 ms	HP 5316A	P
Pulse/function generator	Frequency: 100 Hz Duty cycle: 50% Output: TTL square wave	HP 8116A	P
Power splitter	Frequency range: 818 MHz to 2 GHz Insertion loss: 6 dB (nominal) Output tracking: <0.25 dB Equivalent output SWR: < 1.22: 1	HP 11667A	P,A
Step attenuator	Range: 0 to 12 dB Step size: 1 dB steps Includes calibration data	HP 8494A Option 890	P
Step attenuator	Range: 0 to 120 dB Step size: 10 dB steps Includes calibration data	HP 8495A Option 890	P

* P = Performance Test, A = Adjustment, T = Troubleshooting

1. Absolute Amplitude Accuracy (Option 050 Only)

Specifications

Refer to Chapter 9 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 .... HP 8340A/B
Measurement receiver .... HP 8902A
Power splitter .... HP 11667A
Power sensor .... HP 8482A

Adapters
Type N (f) to APC 3.5 (m) 1250-1750
APC 3.5 (f) to APC 3.5 (f) 5061-5311
Type N (m) to Type N (m) 1250-0778

Cables
Type N, 183 cm (72 in) ...,.......,............................,,.,.,.,,... HP 11500A

To setup the equipment

1. Zero and calibrate the HP 8902A and the HP 8482A in log mode as described in the *HP 8902A 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 050 in Chapter 9 for more information about the temperature and the specification limits.

2. Connect the equipment as shown in Figure 4-1. Connect the power splitter to the spectrum analyzer using an adapter.

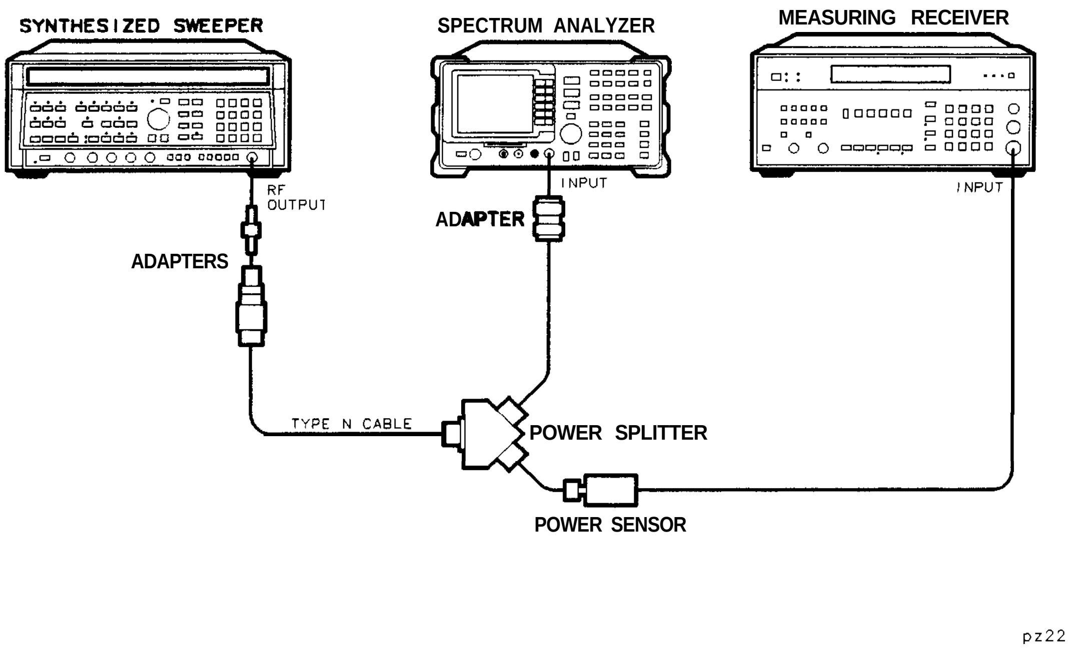


Figure 4-1. Absolute Amplitude Accuracy Verification

3. Press (INSTR PRESET) on the HP 8340A/B. Set the controls as follows:

   CW . . . . 818 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) 818 (MHz)
   (SPAN) 400 (kHz)
   (BW) 100 (kHz)
   VID BW AUTO MAN 30 (kHz)
   (AMPLITUDE) 4 (−dBm)
   ATTEN AUTO MAN 10 (dB)
   (PEAK SEARCH)

Log Fidelity

1. Set the power sensor cal factor for 829 MHz on the HP 8902A.
2. On the synthesized sweeper, press POWER LEVEL and adjust the output amplitude so that the spectrum analyzer marker amplitude reads -9 dBm ±0.05 dB.
3. Record the measuring receiver power reading in Table 4-2.
4. Adjust the output amplitude of the sweeper for spectrum analyzer marker amplitude readings of -14 dBm and -19 dBm.
5. Record the measuring receiver power readings in Table 4-2. The readings should be within the limits shown.

1. **Absolute Amplitude Accuracy (Option 050 Only)**

Table 4-2. Log Fidelity

Spectrum analyzer Marker Reading (dBm)	Measuring Receiver Min (dBm)	Reading (dBm)	Max (dBm)
-9	-9.6	______	-8.4
-14	−14.6	______	-13.4
-19	−19.6	______	-18.4

Frequency Response Input Attenuator 10 dB

1. Set the FREQUENCY of the spectrum analyzer to the first measurement frequency shown in Table 4-3.
2. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the spectrum analyzer is set in the previous step.
3. On the spectrum analyzer, press (PEAK SEARCH).
4. On the sweeper, press (POWER LEVEL) and adjust the output amplitude so the spectrum analyzer marker amplitude reads -9 dBm ±0.05 dB.
5. Set the power sensor cal factor (for frequency being measured) on the HP 8902A and record the measuring receiver power reading in Table 4-3.
6. Repeat steps 1 through 5 for the other frequencies listed. Record the results in Table 4-3. The results should be within the limits shown.

Table 4-3. Frequency Response Attenuator 10 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver Min (dBm)	Reading (dBm)	Max (dBm)
829	-9.6	______	-8.4
844	-9.6	______	-8.4
874	-9.6	______	-8.4
889	-9.6	______	-8.4
1850	-9.9	______	-8.1
1870	-9.9	______	-8.1
1890	-9.9	______	-8.1
1910	-9.9	______	-8.1
1930	-9.9	______	-8.1
1950	-9.9	______	-8.1
1970	-9.9	______	-8.1
1990	-9.9	______	-8.1

Frequency Response Input Attenuator 20 dB

1. On the spectrum analyzer, press the following keys:

   (AMPLITUDE) **ATTEN AUTO MAN** 20 dB
   (AMPLITUDE) 6 (+dBm)

2. Set the (FREQUENCY) of the spectrum analyzer to the measurement frequency shown in Table 4-4.
3. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the spectrum analyzer is set in the previous step.
4. On the spectrum analyzer, press (PEAK SEARCH).
5. On the sweeper press POWER LEVEL and adjust the amplitude so the spectrum analyzer marker amplitude reads +1 dBm ±0.05 dB.
6. Set the power sensor cal factor (for frequency being measured) on the HP 8902A and record the measuring receiver power reading in Table 4-4.
7. Repeat steps 1 through 6 for the other frequencies listed. Record the results in Table 4-4. The results should be within the limits shown.

Table 4-4. Frequency Response Attenuator 20 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver Min (dBm)	Reading (dBm)	Max (dBm)
1990	+0.1	______	+1.9
1970	+0.1	______	+1.9
1950	+0.1	______	+1.9
1930	+0.1	______	+1.9
1910	+0.1	______	+1.9
1890	+0.1	______	+1.9
1870	+0.1	______	+1.9
1850	+0.1	______	+1.9
889	+0.4	______	+1.6
874	+0.4	______	+1.6
844	+0.4	______	+1.6
829	+0.4	______	+1.6

Frequency Response Input Attenuator 30 dB

1. On the spectrum analyzer, press the following keys:

   (AMPLITUDE) **ATTEN AUTO MAN** 30 dB
   (AMPLITUDE) 10 (+dBm)

2. Set the FREQUENCY of the spectrum analyzer to the measurement frequency shown in Table 4-5.
3. On the spectrum analyzer, press (PEAK SEARCH).

4. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the spectrum analyzer is set in the previous step.
5. On the sweeper, press POWER LEVEL and adjust the amplitude so the spectrum analyzer marker amplitude reads +5 dBm ±0.05 dB.
6. Set the power sensor cal factor (for frequency being measured) on the HP 8902A and record the measuring receiver power reading in Table 4-5.
7. Repeat steps 1 through 6 for the other frequencies listed. Record the results in Table 4-5.

Table 4-5. Frequency Response Attenuator 30 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver Min (dBm)	Reading (dBm)	Max (dBm)
829	+ 4.4		+ 5.6
844	+ 4.4		+ 5.6
874	+4.4		+5.6
889	+4.4		+5.6
1850	+4.1		+5.9
1870	+4.1		+5.9
1890	+4.1		+ 5.9
1910	+4.1		+5.9
1930	+4.1		+5.9
1950	+4.1		+5.9
1970	+4.1		+ 5.9
1990	+4.1		+ 5.9

Frequency Response Input Attenuator 40 dB

1. On the spectrum analyzer, press the following keys:

   (AMPLITUDE) ATTEN AUTO MAN 40 dB
   (AMPLITUDE) 10 (+dBm)

2. Set the FREQUENCY of the spectrum analyzer to the measurement frequency shown in Table 4-6.
3. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the spectrum analyzer is set in the previous step.
4. On the spectrum analyzer, press (PEAK SEARCH).
5. On the sweeper, press POWER LEVEL and adjust the amplitude so the spectrum analyzer marker amplitude reads + 5 dBm ±0.05 dB.
6. Set the power sensor cal factor (for frequency being measured) on the HP 8902A and record the measuring receiver power reading in Table 4-6.
7. Repeat steps 1 through 6 for the other frequencies listed. Record the results in Table 4-6.

Table 4-6. Frequency Response Attenuator 40 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver Min (dBm)	Reading (dBm)	Max (dBm)
1990	+3.7		+6.3
1970	+3.7		+6.3
1950	+3.7		+6.3
1930	+3.7		+6.3
1910	+3.7		+6.3
1890	+3.7		+6.3
1870	+3.7		+6.3
1850	+3.7		+6.3
889	+4.0		+6.0
874	+4.0		+6.0
844	+4.0		+6.0
829	+4.0		+6.0

2. Verifying Gate Delay Accuracy and Gate Length Accuracy (Option 105 Only)

Specifications

Gate Delay Refer to Chapter 9 for specific values.

Gate Length Refer to Chapter 9 for specific values.

Description

The method used for measuring the gate length times is determined by the length of the gate. Shorter gate-length times are measured with an oscilloscope, and longer gate-length times are measured with a counter.

For shorter gate-length times, the output signal of a pulse generator is used to trigger the gate circuitry. To measure the gate delay, At markers are used. There is often up to 1 μs of jitter due to the 1 μs resolution of the gate delay clock. The "define measure" feature of the oscilloscope is used to measure and calculate the average length of the gate output automatically.

For longer gate-length times, a counter is used to measure the time period from the rising edge of the gate output to its falling edge. Because the gate-length time is equivalent to the clock accuracy of the spectrum spectrum analyzer, the gate-length time is compared to the specification for clock accuracy.

Equipment

Universalcounter .... HP 5316A
Pulse/function generator .... HP 8116A
Digitizing oscilloscope .... HP 54501A

Cables
BNC, 120 cm (48 in) (four required) .... HP 10503A

Adapters
BNC tee (m) (f) (f) (two required) ....,............................ 1250-0781

To determine small gate delay and gate length (jitter-term)

1. Connect the equipment as shown in Figure 4-2.

2. Verifying Gate Delay Accuracy and Gate Length Accuracy (Option 105 Only)

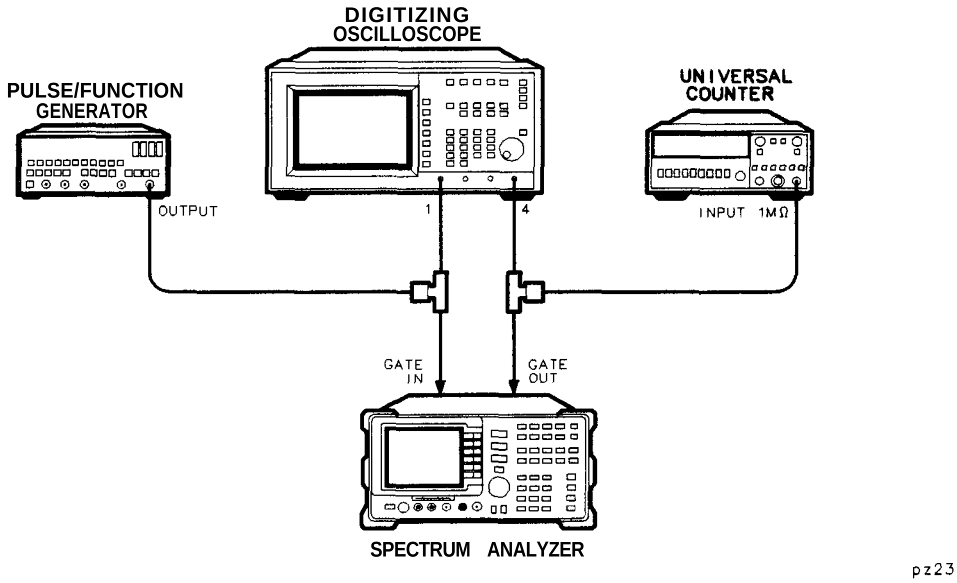


Figure 4-2. Gate Delay and Gate Length Test Setup

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 0.0V

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

2. **Verifying Gate Delay Accuracy and Gate Length Accuracy (Option 105 Only)**

(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 4-3.

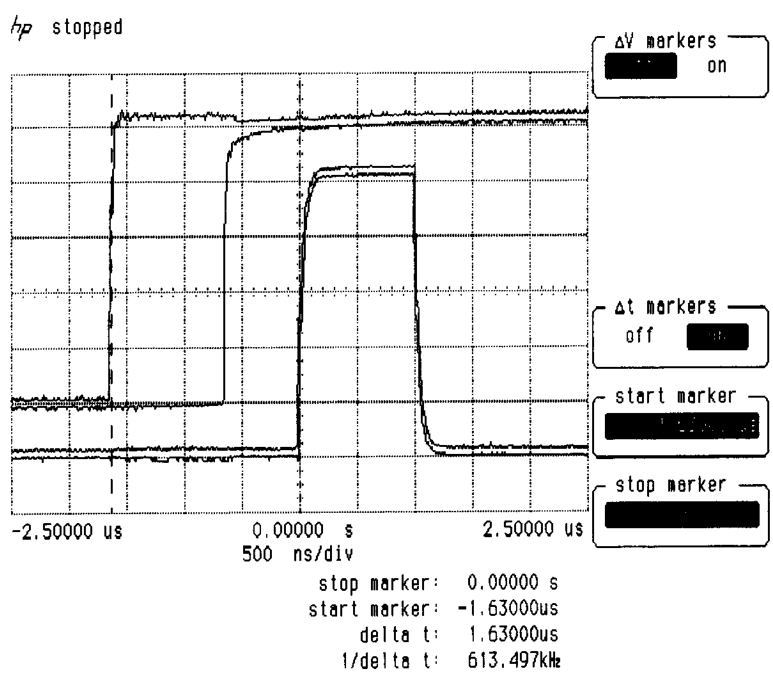


Figure 4-3. Oscilloscope Display of Minimum and Maximum Gate Delay Values

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 At 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 **1**μs 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 for specific values.

Linear scale Refer to Chapter 9 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 for the log and linear scale additional amplitude error due to gate-on enabled. The insertion loss is measured as follows:

1. HIGH SWEEP output on the spectrum analyzer is connected to GATE TRIGGER INPUT to provide a trigger signal for the gate circuitry.
2. The gate is turned off and a marker reading is taken.
3. The gate is then turned on and the synthesizer/level generator amplitude is adjusted to match the marker reading taken while the gate was off.

The difference between the two synthesizer/level generator readings is the measured insertion loss of the gate card.

Equipment

Synthesizer/level generator . . . . HP 3335A

Cables

BNC, 122 cm (48 in) (two required) . . . . HP 10503A

Additional Equipment for Option 001 Spectrum Analyzer

BNC cable, 750, 120 cm (48 in) . . . . HP part number 15525-80010

To determine the card insertion loss

1. Connect the equipment as shown in Figure 4-4. (For Option 001 spectrum analyzers, attach the 75Ω cable to the spectrum analyzer RF input connector rather than the 50Ω cable.)

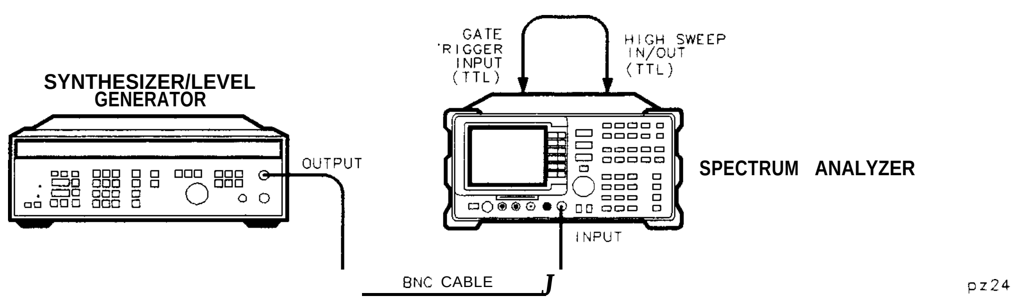


Figure 4-4. Gate Delay and Gate Length Test Setup

2. Set the synthesizer/level generator controls as follows:

   FREQUENCY .... 50 MHz
   AMPTDINCR .... 0.01 dB
   AMPLITUDE .... -5 dBm

3. On the spectrum analyzer, press (PRESET). Wait until preset is finished.
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 ±17 Hz or less for an HP 85913, or 21.4 MHz ±15 Hz or less for an HP 8593E through 8596E.

Description

Use this procedure to verify that the IF frequency accuracy of the spectrum analyzer with option 151 installed is within specification. The IF frequency accuracy is measured as follows:

1. A frequency and amplitude self-calibration is performed on the HP 8590-series spectrum analyzer to improve the accuracy of the spectrum analyzer.
2. 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 . . . . HP **8662A** or **8663A**
Microwave frequency counter . . . . HP **5343A**

Cables
BNC, 122 cm (48 in) (three required) . . . . HP **10503A**

Adapters
Type N (m) to BNC (f) (two required) . . . . HP part number 1250-0780

To determine the IF frequency accuracy

1. Connect the equipment as shown in Figure 4-5.

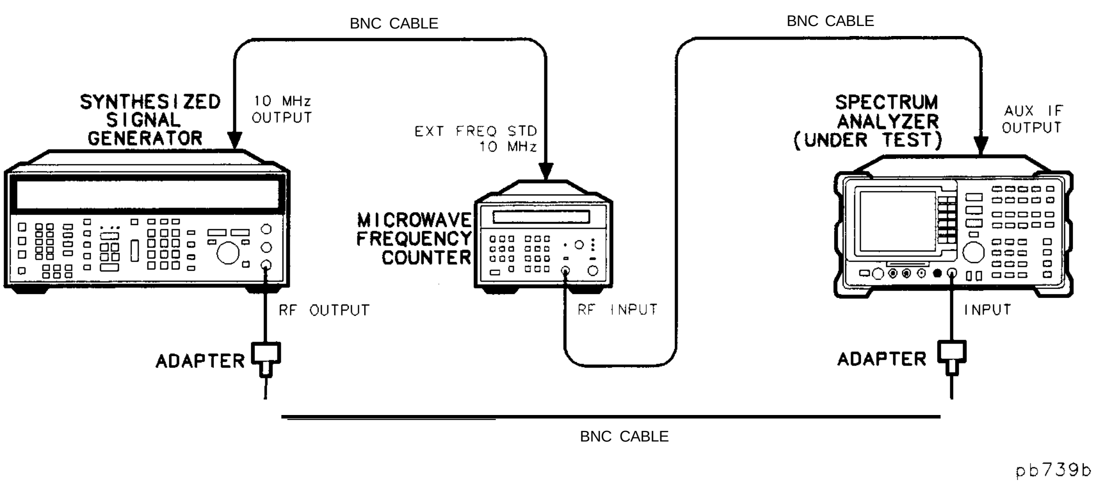


Figure 4-5. IF Frequency Accuracy Test Setup

2. Perform a frequency and amplitude self-calibration on the HP 8590-series spectrum analyzer. This improves the accuracy of the spectrum analyzer. If necessary, refer to the "Getting Started" chapter of the spectrum analyzer User's Guide for a complete explanation of this procedure.
3. Press the following synthesized signal generator keys:

   (FREQUENCY) (870.03) (MHz)
   (AMPLITUDE) (0) (+dBm)
   (MOD OFF)

4. Press the following HP 8590-series spectrum analyzer keys:

   (PRESET)
   (CAL) **More 1 of 2** **CORRECT OFF**
   (FREQUENCY) (870.03) (MHz)
   (BW) (1) (MHz)
   (SPAN) **ZERO SPAN**
   (MKR FCTN) **More 1 of 2**. Press **CNT RES MAN** until MAN is underlined. Press (1) (Hz).
   (PEAK SEARCH) (MKR →) **MARKER → REF LVL**
   (TRIG) **EXTERNAL**

5. Use the frequency counter to measure the IF frequency. Record this value in the performance verification test record at the end of this chapter.

5. Verifying Error Vector Magnitude (EVM)(Option 151 Only)

Specifications

The error vector magnitude (EVM) accuracy specification is based on the phase noise performance of the HP 8590-series spectrum analyzers. The frequency stability of the HP 85933 through 8596E spectrum analyzers contributes to an EVM uncertainty of +0.75% to -2.0% after an average of ten measurements. The close-in phase noise performance of the HP 8591E can support an EVM average specification of + 0.75% to -3.9% after an average of ten 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. After a 60-minute warmup, a frequency and amplitude self-calibration is performed to improve the accuracy of the spectrum analyzer.
2. A stable RF signal is input to the HP spectrum analyzer under test. The resulting IF signal is used to characterize single sideband phase noise of the spectrum analyzer under test at 100 Hz, 400 Hz, and 1 kHz bandwidths. Scale correction, log amplitude error, and detector response characteristics are taken into account using a worksheet table. 10 kHz and 100 kHz single sideband phase noise is measured using the RF signal itself and the spectrum analyzer under test. The measured phase noise values are then used to calculate the equivalent EVM.

Equipment

Synthesized signal generator .... HP 8662A or 8663A
Spectrum analyzer .... .HP 8566B
Step attenuator (1 dB) .... HP 8494A
Step attenuator (10 dB) .... HP 8495A

Cables

BNC, 122 cm (48 in) (five required) ....,.......................... HP 10503A

Adapters

Type N (m) to BNC (f) (three required) .... HP part number 1250-0780
Type N (m) to type N (m) (one required) .... HP part number 1250-0778

To determine phase noise

Perform a frequency and amplitude self-calibration on the HP 8590-series spectrum analyzer. This improves the accuracy of the spectrum analyzer and is intended to self test the digital demodulator PC boards in the spectrum analyzer. If necessary, refer to the "Getting Started" chapter of the spectrum analyzer User's Guide for a complete explanation of this procedure.

1. Connect the equipment as shown in Figure 4-6. Set the two step attenuators to 0 dB attenuation.

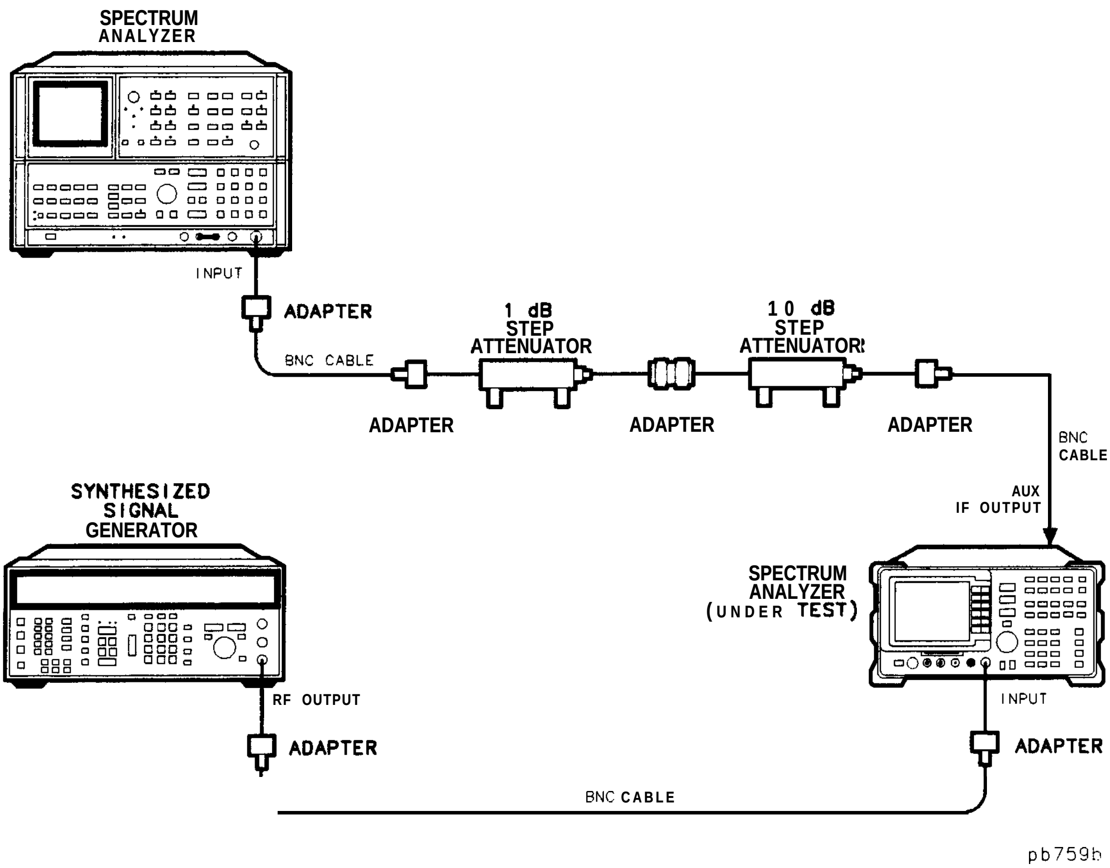


Figure 4-6. Error Vector Magnitude (EVM) Test Setup

2. Press the following synthesized signal generator keys:

   (FREQUENCY) (870.03) (MHz)
   (AMPLITUDE) (0) (+dBm)
   (MOD OFF) (press the blue key and then (FCTN OFF))

3. Press the following HP 8590-series spectrum analyzer keys:

   (PRESET)
   SPECTRUM ANALYZER
   (CAL) **More 1 of 4** **CORRECT OFF**
   (FREQUENCY) (870.03) (MHz)
   (BW) (1) (MHz)
   (SPAN) **ZERO SPAN**

4. Press the following HP 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 4-7 under column A. The far left-hand column in the table lists several bandwidths. Find the lines in column A that correspond with 100 Hz, 400 Hz, and 1 kHz bandwidths and record the marker amplitude value on those three lines.
   g. Press MARKER MODE (SIGNAL TRACK) (FREQUENCY SPAN) (5) (kHz)
   h. Press MARKER MODE (SIGNAL TRACK) to disable the signal track function
   i. Press (FREQUENCY SPAN) (0) (Hz) (RES BW) (10) (Hz)
   j. 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.
   k. Press (VIDEO BW) (1) (Hz) (CF STEP SIZE) (100) (Hz)
   l. Press (SWEEP TIME) (10) (sec) (CENTER FREQUENCY) (⇧). If the noise trace is below the eighth graticule line from the top, press (REFERENCE LEVEL), and then press (⇩) repeatedly until the noise trace is above the eighth graticule line.
   m. Press (SHIFT) (VIDEO BW) to turn on video averaging.
   n. Press (10) (Hz) SWEEP (SINGLE) to set the spectrum analyzer to take ten video averages Allow the spectrum analyzer to complete ten sweep averages (approximately two minutes). Monitor the number of averages on the left-hand side of the graticule.
   o. Press (SHIFT) (SWEEP TIME) to turn off video averaging.
   p. Press MARKER ENTRY (PEAK SEARCH) and in Table 4-7, record the marker amplitude value in column B on the line that corresponds to 100 Hz bandwidth in the first column.
   q. Press (RES BW AUTO) (VIDEO BW AUTO) (SWEEP TIME AUTO) SWEEP (CONT)
   r. Press (FREQUENCY SPAN) (5) (kHz). If the signal peak is not visible, press (REFERENCE LEVEL), and then press (⇧) repeatedly until the signal peak is on the top graticule line.
   s. Press MARKER ENTRY (PEAK SEARCH) (MKR → CF)
   t. Press (FREQUENCY SPAN) (0) (Hz) (RES BW) (10) (Hz)
   u. 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.
   v. Press (VIDEO BW) (1) (Hz) (CF STEP SIZE) (400) (Hz)
   w. Press (SWEEP TIME) (10) (sec) (CENTER FREQUENCY) (⇧). If the noise trace is below the eighth graticule line from the top, press (REFERENCE LEVEL), and then press (⇩) repeatedly until the noise trace is above the eighth graticule line.
   x. Press (SHIFT) (VIDEO BW) to turn on video averaging.
   y. Press (10) (Hz) SWEEP (SINGLE) to set the spectrum analyzer to take ten video averages.

      Allow the spectrum analyzer to complete ten sweep averages (approximately two minutes). Monitor the number of averages on the left-hand side of the graticule.
   z. Press (SHIFT) (SWEEP TIME) to turn off video averaging.
   aa. Press MARKER ENTRY (PEAK SEARCH) and in Table 4-7, record the marker amplitude value in column B on the line that corresponds to 400 Hz bandwidth in the first column.
   bb. Press (RES BW AUTO) (VIDEO BW AUTO) (SWEEP TIME AUTO) SWEEP (CONT)
   cc. Press (FREQUENCY SPAN) (5) (kHz). If the signal peak is not visible, press (REFERENCE LEVEL), and then press (⇧) repeatedly until the signal peak is on the top graticule line.
   dd. Press MARKER ENTRY (PEAK SEARCH) (MKR → CF)
   ee. Press (FREQUENCY) (0) (Hz) (RES BW) (10) (Hz)

ff. 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.
gg. Press (VIDEO BW) (1) (Hz) (CF STEP SIZE) (1) (kHz)
hh. Press (SWEEP TIME) (10) (sec) (CENTER FREQUENCY) (⇑) If the noise trace is below the eighth graticule line from the top, press (REFERENCE LEVEL), and then press (⇓) repeatedly until the noise trace is above the eighth graticule line.
ii. Press (SHIFT) (VIDEO BW) to turn on video averaging.
jj. Press (10) (Hz) SWEEP (SINGLE) to set the spectrum analyzer to take ten video averages

Allow the spectrum analyzer to complete ten sweep averages (approximately two minutes). Monitor the number of averages on the left-hand side of the graticule.
kk. Press (SHIFT) (SWEEP TIME) to turn off video averaging.
11. Press MARKER ENTRY (PEAK SEARCH) and in Table 4-7, record the marker amplitude value in column B on the line that corresponds to 1 kHz bandwidth in the first column.

Phase Noise/EVM Work Table 1

Table 4-7. Phase Noise/EVM Worktable 1

Bandwidth	**(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					

Phase Noise/EVM Work Table 2

Table 4-8. Phase Noise/EVM Worktable 2

Bandwidth	**(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 **(dB/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	

5. Press the following HP 8590-series spectrum analyzer keys:

   a. Press (FREQUENCY) **START FREQ** (870.025) (MHz) STOP **FREQ** (870.135) (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 4-7 for 10 kHz and 100 kHz bandwidths.

d. Press (AMPLITUDE) and then press STEP (⇓) repeatedly until the noise trace is above the 7th. graticule line.

e. Press (SGL SWP) (BW) **VID AVG ON** (10) (ENTER) to set the spectrum analyzer to take ten video averages

Allow the spectrum analyzer to complete ten sweep averages (approximately two minutes). Monitor the number of averages on the left-hand side of the graticule.

f. Press (PEAK SEARCH) (MKR) **MKR** A (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 4-7 for 10 kHz bandwidth.

g. Press **MKR Δ** (90) (kHz) **MARKER NORMAL**, and note the marker amplitude shown in the upper right-hand corner of the display. Enter that value in column B of Table 4-7 for 100 kHz bandwidth.

h. Press (FREQUENCY) **CENTER FREQ** (870.03) (MHz)

i. Press (BW) (1) (MHz) (SPAN) **ZERO SPAN**

6. Calculate the external attenuators setting in Table 4-7:

a. Refer to Table 4-7.

b. Subtract the value in column A from the value in column B for each bandwidth and enter each result in column C.

c. Calculate the value in column C for each bandwidth to the nearest dB and enter each result in column E. The values in column E will be used later in this procedure.

7. Press the following HP 8566B spectrum analyzer keys:

a. Press (INSTR PRESET) (CENTER FREQUENCY) (21.4) (MHz)

b. Press (ATTEN) (0) (dB)

c. Press (FREQUENCY SPAN) (10 MHz)

d. Press (PEAK SEARCH) MARKER MODE (SIGNAL TRACK) (FREQUENCY SPAN) (1) (kHz) and allow the spectrum analyzer to complete the tracking function.

e. When the displayed signal is stable, press MARKER MODE (SIGNAL TRACK) to disable the signal track function

f. Press (RES BW) (1) (kHz)

g. Press MARKER ENTRY (PEAK SEARCH) (MKR → CF) (MKR → REF LVL)

h. Press (FREQUENCY SPAN) (0) (Hz) (VIDEO BW) (1) (Hz)

i. Press MARKER MODE (Δ) and set the two external attenuators to the value in column E for 100 Hz bandwidth in Table 4-7.

j. Press SWEEP (SINGLE) and wait for one complete sweep. In Table 4-8, record the marker value in column F on the line that corresponds to 100 Hz bandwidth in the first column.

k. Set the two external attenuators to the value in column E for 400 Hz bandwidth in Table 4-7.

1. Press SWEEP (SINGLE) and wait for one complete sweep. In Table 4-8, record the marker value in column F on the line that corresponds to 400 Hz bandwidth in the first column.

m. Set the two external attenuators to the value in column E for 1 kHz bandwidth in Table 4-7.

n. Press SWEEP (SINGLE) and wait for one complete sweep. In Table 4-8, record the marker value in column F on the line that corresponds to 1 kHz bandwidth in the first column.

o. Set the two external attenuators to the value in column E for 10 kHz bandwidth in Table 4-7.

p. Press SWEEP (SINGLE) and wait for one complete sweep. In ‘lhble 4-8, record the marker value in column F on the line that corresponds to 10 kHz bandwidth in the first column.

q. Set the two external attenuators to the value in column E for 100 kHz bandwidth in Table 4-7.

r. Press SWEEP (SINGLE) and wait for one complete sweep. In Table 4-8, record the marker value in column F on the line that corresponds to 100 kHz bandwidth in the first column.

8. Calculate corrected phase noise value using Table 4-8

   a. Find the performance data provided with the two external attenuators. Determine the attenuator correction values for each bandwidth setting for column E in Table 4-7. Sum the two correction values and record the result in column D of Table 4-7.

   b. For each bandwidth, sum the values in columns D and E in Table 4-7, subtract the value in column F of Table 4-8, and record the value in column G of Table 4-8.

   c. For each bandwidth, sum column values C,G,H, and I in Table 4-7 and Table 4-8 and record the value in column J. The values in column J represent the corrected phase noise in dB/Hz for the five bandwidths.

9. Calculate %EVM using corrected phase noise values in Table 4-8

10. The EVM contribution of the HP 8590 E-Series spectrum analyzers is directly related to the spectrum analyzer phase noise. The phase noise of the spectrum analyzer is integrated over five offset regions to derive the RMS phase noise error contribution. The root sum square of these five regions is applied to the following equation:

$$\text{Percent EVM} = 100\sqrt{(.207936 \cdot 10^{-5}) + 4\left[1.004 * \sin\left(\frac{\text{Phase error}}{2}\right)^2\right]}$$

   a. First, solve for P_1 through P_5 using the values for phase noise listed in column J of Table 4-8. Column J phase noise values are represented with the variable J in the equations.

   For HP 8593/4/5/6E spectrum analyzers (Use J for 100 Hz bandwidth):

$$P_1 = 1.125.\ 10^6 \left(\frac{10^{\frac{J}{20}}}{100}\right)^2$$

   For HP 8593/4/5/6E spectrum analyzers (Use J for 400 Hz bandwidth):

$$P_2 = .005\left(\frac{10^{\frac{J}{20}}}{0.0025}\right)^2$$

   For HP 8593/4/5/6E spectrum analyzers (Use J for 1 kHz bandwidth):

$$P_3 = 2000(10^{\frac{J}{20}})^2$$

For HP 8593/4/5/6E spectrum analyzers (Use J for 10 kHz bandwidth):

$$P_4 = 7.383.\ 10^{-8}\left(\frac{10^{\frac{J}{20}}}{1\cdot 10^{-6}}\right)^2$$

For HP 8593/4/5/6E spectrum analyzers (Use J for 10 kHz bandwidth):

$$P_5 = 1\cdot 10^{-5}\left(\frac{10^{\frac{J}{20}}}{1\cdot 10^{-5}}\right)^2$$

For HP 85913 spectrum analyzers (Use J for 100 Hz bandwidth):

$$P_1 = 1.125\cdot 10^{6}\left(\frac{10^{\frac{J}{20}}}{100}\right)^2$$

For HP 85913 spectrum analyzers (Use J for 400 Hz bandwidth):

$$P_2 = 0.00567\left(\frac{10^{\frac{J}{20}}}{0.0025}\right)^2$$

For HP 85913 spectrum analyzers (Use J for 1 kHz bandwidth):

$$P_3 = 1000(10^{\frac{J}{20}})^2$$

For HP 85913 spectrum analyzers (Use J for 10 kHz bandwidth):

$$P_4 = 1.249.\ 10^{-7}\left(\frac{10^{\frac{J}{20}}}{1\cdot 10^{-6}}\right)^2$$

For HP 85913 spectrum analyzers (Use J for 10 kHz bandwidth):

$$P_5 = 1\cdot 10^{-5}\left(\frac{10^{\frac{J}{20}}}{1\cdot 10^{-5}}\right)^2$$

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:

$$\text{Percent EVM} = 100\sqrt{(.207936\cdot 10^{-5}) + 4\left[1.00456 * sin\left(\frac{\text{Phase error}}{2}\right)^2\right]}$$

e. Now 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. HP recommends 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 is helpful for tracking gradual changes in test results over long periods of time.

Table 4-9. Performance Verification Test Record (Page 1 of 3)

Hewlett-Packard Company

Address: ____________________ Report No. ____________________

____

____________________ Date ____________________

____________________ (e.g. 10 SEP 1989)

Model HP 8590 Series spectrum analyzer with HP 85718B

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			
LO dB Step attenuator			

Performance Verification Test Record (Page 2 of 3)

Hewlett-Packard Company
Model HP 8590 Series spectrum analyzer with HP 85718B 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 829 MHz	-9.6 dBm	______	-8.4 dBm	+0.24/−0.25 dB
	Amp accuracy at 844 kHz	-9.6 dBm	______	-8.4 dBm	+0.24/−0.25 dB
	Amp accuracy at 874 MHz	-9.6 dBm	______	-8.4 dBm	+0.24/−0.25 dB
	Amp accuracy at 889 MHz	-9.6 dBm	______	-8.4 dBm	+0.24/−0.25 dB
	Amp accuracy at 1850 MHz	-9.9 dBm	______	-8.1 dBm	+ 0.24/−0.25 dB
	Amp accuracy at 1870 MHz	-9.9 dBm	______	-8.1 dBm	+0.24/−0.25 dB
	Amp accuracy at 1890 MHz	-9.9 dBm	______	-8.1 dBm	+0.24/−0.25 dB
	Amp accuracy at 1910 MHz	-9.9 dBm	______	-8.1 dBm	+0.24/−0.25 dB
	Amp accuracy at 1930 MHz	-9.9 dBm	______	-8.1 dBm	+0.24/−0.25 dB
	Amp accuracy at 1950 MHz	-9.9 dBm	______	-8.1 dBm	+0.24/−0.25 dB
	Amp accuracy at 1970 MHz	-9.9 dBm	______	-8.1 dBm	+0.24/−0.25 dB
	Amp accuracy at 1990 MHz	-9.9 dBm	______	-8.1 dBm	+0.24/−0.25 dB
	20 dB attenuation				
	Amp accuracy at 1990 MHz	+0.1 dBm	______	+ 1.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 1970 MHz	+ 0.1 dBm	______	+ 1.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 1950 MHz	+0. 1 dBm	______	+ 1.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 1930 MHz	+0. 1 dBm	______	+ 1.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 1910 MHz	+ 0.1 dBm	______	+ 1.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 1890 MHz	+0. 1 dBm	______	+ 1.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 1870 MHz	+0.1 dBm	______	+ 1.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 1850 MHz	+0.1 dBm	______	+ 1.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 889 MHz	+0.4 dBm	______	+ 1.6 dBm	+0.24/−0.25 dB
	Amp accuracy at 874 MHz	+0.4 dBm	______	+ 1.6 dBm	+0.24/−0.25 dB
	Amp accuracy at 844 MHz	+0.4 dBm	______	+ 1.6 dBm	+0.24/−0.25 dB
	Amp accuracy at 829 MHz	+0.4 dBm	______	+ 1.6 dBm	+0.24/−0.25 dB

Test No.	Test Description	Results Min	Measured	Max	Measurement Uncertainty
	30 dB attenuation				
	Amp accuracy at 829 MHz	+4.4 dBm		+5.6 dBm	+0.24/−0.25 dB
	Amp accuracy at 844 MHz	+4.4 dBm		+5.6 dBm	+0.24/−0.25 dB
	Amp accuracy at 874 MHz	+4.4 dBm		+5.6 dBm	+0.24/−0.25 dB
	Amp accuracy at 889 MHz	+4.4 dBm		+5.6 dBm	+0.24/−0.25 dB
	Amp accuracy at 1850 MHz	+4.1 dBm		+5.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 1870 MHz	+4.1 dBm		+5.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 1890 MHz	+4.1 dBm		+5.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 1910 MHz	+4.1 dBm		+5.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 1930 MHz	+4.1 dBm		+5.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 1950 MHz	+4.1 dBm		+5.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 1970 MHz	+4.1 dBm		+5.9 dBm	+0.24/−0.25 dB
	Amp accuracy at 1990 MHz	+4.1 dBm		+5.9 dBm	+0.24/−0.25 dB
	40 dB attenuation				
	Amp accuracy at 1990 MHz	+3.7 dBm		+6.3 dBm	+0.24/−0.25 dB
	Amp accuracy at 1970 MHz	+3.7 dBm		+6.3 dBm	+0.24/−0.25
	Amp accuracy at 1950 MHz	+3.7 dBm		+6.3 dBm	+0.24/−0.25 dB
	Amp accuracy at 1930 MHz	+3.7 dBm		+6.3 dBm	+0.24/−0.25 dB
	Amp accuracy at 1910 MHz	+3.7 dBm		+6.3 dBm	+0.24/−0.25 dB
	Amp accuracy at 1890 MHz	+3.7 dBm		+6.3 dBm	+0.24/−0.25 dB
	Amp accuracy at 1870 MHz	+3.7 dBm		+6.3 dBm	+0.24/−0.25 dB
	Amp accuracy at 1850 MHz	+3.7 dBm		+6.3 dBm	+0.24/−0.25 dB
	Amp accuracy at 889 MHz	+4.0 dBm		+6.0 dBm	+0.24/−0.25 dB
	Amp accuracy at 874 MHz	+4.0 dBm		+6.0 dBm	+0.24/−0.25 dB
	Amp accuracy at 844 MHz	+4.0 dBm		+6.0 dBm	+0.24/−0.25 dB
	Amp accuracy at 829 MHz	+4.0 dBm		+6.0 dBm	+0.24/−0.25 dB
2.	Gate delay accuracy				
	Gate length accuracy				
	MIN gate delay	0.0 μs		2.0 μs	±0.011 μs
	MAX gate delay	0.0 μs		2.0 μs	±0.011 μs
	65 ms gate length	64.99 ms		65.01 ms	±0.434 μs
3.	Gate card insertion loss	−0.3 dB		+0.3 dB	±0.092 dB
4.	.F. frequency accuracy				
	HP 8593/4/5/6E	21.399985 MHz		21.400015 MHz	NA
	HP 8591E	21.399983 MHz		21.400017 MHz	NA

Performance Verification Test Record (Page 3 of 3)

Hewlett-Packard Company
Model HP 8590 Series spectrum analyzer with HP 85718B Report No. ______________

Serial No. ______________ Date ______________

Test No.	Test Description	Results Measured	Max	Measurement Uncertainty
5.	Error vector magnitude (EVM)			
	HP 8593/4/5/6E	______	1.5%	± 0.5%
	HP 8591E	______	1.7%	±0.5%

5

Programming the NADC Personality

This chapter explains how the NADC measurements personality's functions can be executed by using programming commands. When you use programming commands to operate the NADC measurements personality, you send instructions to the spectrum analyzer instead of pressing the softkeys. The instructions (also called programming commands) can be sent to the spectrum analyzer using either a computer or an external keyboard.

This chapter contains the following sections:

- Accessing the NADC measurements personality for remote operation.
- Programming basics for NADC remote operation.
- Customizing the NADC personality.
- Programming examples for NADC remote operation.

Before you can program the spectrum analyzer, you must connect the spectrum analyzer to the computer. See the programming documentation for the spectrum analyzer for more information.

All the programming examples in this chapter which use a computer (that is, contain line numbers or use "OUTPUT 718" or "OUTPUT @Sa") are written in HP BASIC.

Accessing the NADC Analyzer Mode for Remote Operation

To use the NADC programming commands, the NADC measurements personality must be loaded into spectrum analyzer memory, and NADC analyzer mode must be selected. This section contains the following procedures:

- Load the NADC measurements personality remotely.
- Select the NADC analyzer mode remotely.

To load the NADC measurements personality remotely

1. Insert the HP 85718B NADC-TDMA measurements personality memory card into the analyzer front-panel memory card reader.
2. Prepare the spectrum analyzer for the DONE command by doing an instrument preset and placing the spectrum analyzer into a single sweep mode.
3. Execute the take sweep (TS) command. You must execute the take sweep command before the DONE command.
4. Execute the DONE command.
5. Wait until the DONE command returns a "1."
6. Remove any personalities from the spectrum analyzer by executing the DISPOSE ALL command.
7. Wait until the DISPOSE ALL command has finished.
8. Use the spectrum analyzer LOAD command to load the file called "dNADC" into spectrum analyzer memory.
9. Execute the take sweep (TS) command. You must execute the take sweep command before the DONE command.
10. Execute the DONE command.
11. Wait until the DONE command returns a "1."

This procedure describes how to use programming commands to load the NADC measurement personality into spectrum analyzer memory. However, you may find it more convenient to use the spectrum analyzer front-panel keys to load the personality into memory.

Example

`OUTPUT 718;"IP;SNGLS;"`	*Does an instrument preset and places the spectrum analyzer in the single sweep mode.*
`OUTPUT 718;"TS;"`	*Performs a take sweep.*
`OUTPUT 718;"DONE?;"`	*Queries the spectrum analyzer to return a "1" when the take sweep (TS) command completes.*
`ENTER 718;Done`	*Waits until a "1" is returned.*
`OUTPUT 718;"DISPOSE ALL;"`	*Removes any personalities from spectrum analyzer memory.*
`WAIT 10`	*Wait for DISPOSE ALL to finish.*
`OUTPUT 718;"LOAD/dNADC/;"`	*Loads the NADC measurements personality into spectrum analyzer memory. "dNADC" is the jile name for the NADC measurements personality program.*
`OUTPUT 718;"TS;"`	*Performs a take sweep.*
`OUTPUT 718;"DONE?;"`	*DONE? returns a "1" when the LOAD and the TS commands are completed.*
`ENTER 718;Done`	*Waits until a "1" is returned.*

To select the NADC 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 NADC 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 NADC analyzer mode before you can send any NADC programming commands to the spectrum analyzer. You need to execute the DONE command to ensure that the spectrum analyzer has finished executing the MODE command.

Example

`OUTPUT718;"IP;SNGLS;"`	***Does an instrument preset and places the spectrum analyzer in the single sweep mode.***
`OUTPUT 718;"MODE IO;"`	***Changes to the NADC mode.***
`OUTPUT 718;"TS;"`	***Performs a take sweep.***
`OUTPUT 718;"DONE?;"`	***DONE? returns a "1" when the MODE and take sweep commands are completed.***
`ENTER 718;Done`	Waits ***until a "1" is returned.***

To select the E-TDMA 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 E-TDMA analyzer mode by setting the value of the MODE command to 11.
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 E-TDMA analyzer mode before you can send any E-TDMA 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 11;"`	*Changes to the E-TDMA mode.*
`OUTPUT 718;"TS;"`	*Performs a take sweep.*
`OUTPUT 718;"DONE?;"`	*DONE? returns a "1" when the MODE and take sweep commands are completed.*
`ENTER 718;Done`	*Waits until a "1" is returned.*

Programming Basics for NADC Remote Operation

This section contains information about how to use the NADC programming commands. For more information about a specific command, refer to the description for the command in Chapter 10.

This section contains the following procedures:

- Use the MOV command,
- Use the NADC setup and measurement commands.
- Use the repeat command.
- Determine when a measurement is done.
- Use an external keyboard to enter programming commands.

Note

The NADC programming commands and variables begin with an underscore (-), and spectrum analyzer programming commands do not. For example, -CH is a NADC programming command, and MOV is a spectrum analyzer programming command.

This guide contains information about the NADC programming commands. See the programming documentation for the spectrum analyzer for information about the spectrum analyzer programming commands.

To use the spectrum analyzer MOV command

- Use the MOV command to move a value into a NADC command that can accept a value.

You are encouraged to use the MOV command when you need to move a value into a NADC 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 NADC 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 NADC 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 carrier 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 carrier 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 carrier 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 carrier 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, intermodulation spurious measurement, digital demodulation measurement, or power versus time measurement. Some NADC 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

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 10 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 10 for more information about error conditions and measurement state values.

It is necessary to check the measurement state to ensure 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 low to make the measurement).

Example

OUTPUT 718;"_ACH;"	***Performs the auto channel routine.***
REPEAT	***Repeats the ENTER statement until a valid number for the measurement state is found.***
ENTER718;Meas_state	***Enters the values from the analyzer buffer.***
UNTIL Meas_state>0 AND Meas_state<3	***Ignores numbers that are not valid numbers for the ACH measurement state. For _ACH, the only valid measurement state values are 1 and 2.***

To use an external keyboard to enter commands

1. Turn off the spectrum analyzer.

Caution Do not connect the keyboard to the spectrum analyzer while the spectrum analyzer is turned on.

---

2. Connect an HP C1405 Option 2 cable from the spectrum analyzer rear panel connection (marked EXT KEYBOARD) to the HP C1405 Option ABA keyboard.
3. Press (LINE) to turn on the spectrum analyzer, then press (MODE) **NADC ANALYZER**.
4. Press (F8) on the external keyboard to enter the "keyboard to command" mode.
5. Type in the command syntax. The characters that you type are shown at the top of the spectrum analyzer display. You can enter more than one command per line by separating the commands with a semicolon (for example, IP ; SNGLS ;).
6. Press (ENTER).

You can enter the programming commands into the spectrum analyzer by using a keyboard that is connected to the spectrum analyzer external keyboard connector. The external keyboard connector is included with an Option 021 or Option 023 spectrum analyzer. Refer to the documentation for the spectrum analyzer for more information about the different external keyboard functions.

Because you are not using an external computer, the NADC 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:*

Customizing the NADC Personality

The NADC 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 NADC 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 NADC measurements personality uses a "limit" to decide if the measurement results failed or passed. For example, if a signal is above the intermodulation spurious limit, the unit under test will fall the intermodulation spurious measurement. You can change a limit by changing the value of the limit variable. See **Table 10-2** 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 _IMDX,-50;"`	***Changes the limit for intermodulation products 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 _IMDX,-50;"`	***Changes the limit for intermodulation products from its current value to -50 dB.***

The VARDEF command changes the NADC measurements personality that is currently in spectrum analyzer memory; the VARDEF command does not change the program on the HP 85718B memory card. If you reload the NADC measurements personality from the HP 85718B 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 NADC 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 10-2 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 VABDEF 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 NADC measurements personality that is currently in spectrum analyzer memory; the VARDEF command does not change the program on the HP 85718B memory card. If you reload the NADC measurements personality from the HP 85718B 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 10-3 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 NADC measurements personality.

2. Use the LIMIDEL command to delete any current limit lines. See the programming documentation for the spectrum analyzer 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 programming documentation for the spectrum analyzer 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 programming documentation for the spectrum analyzer for more information about the LIMILO command.

6. Turn on limit line testing with the LIMITEST command.

   See the programming documentation for the spectrum analyzer 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, your limit line function remains in use unless you reload the NADC 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.

```
8638    ! NADC Power vs Time Burst Limits
8640    !
8642    !  Notes:
8644    !  Horizontal: trace elements go from 1 thru 401.
8646    !  Vertical:   100 display units/dB, Ref Lvl = 8000, Bottom grat
8648    !              line for 10 dB/div = 0, for 15 dB/div = -4000.
8650    !  The mean of the burst is positioned 4dB below Ref Lvl =7600.
8652
8654    !  Swp Time = 8000 us, gives 20 us per trace element
8656    !  The right limit lines are based upon normal or short burst.
8658    !  For 162 symbol burst (_SYM=0) have shift of 0 trace elements.
```

```
8660    ! For 140 symbol burst (_SYM=1) have shift of 45 trace elements.
8662    !
8666    !
8668    OUTPUT @Sa;"FUNCDEF _PBLIM,@";      ! Limit line function name !
8670    !
8672    OUTPUT@Sa;"LIMIDEL;";           ! delete existing limit lines
8674    OUTPUT@Sa;"{_Y=45*_SYM};";      ! calculate shift of right limit line
8676    !
8678    !  upper limit line
8680    !  calc vert position for absolute limit line segment.
8682    ! (_PRX default= -60 dBm)
8684    OUTPUT @Sa;"IF(_TOP&&!_RNG);"; ! if TOP & 70 dB range
8686      OUTPUT @Sa;"_X1000;";         ! line at 7th graticule position
8688    OUTPUT @Sa;"ELSE ";             ! else 110 dB range or BOT 70 dB
8690      OUTPUT@Sa;"{_X=100*(80+_PRX-RL)};";   ! calculate dynamic position
8692    OUTPUT @Sa;"ENDIF;";
8694    !
8696    ! draw upper limit line in Trace A, then transfer to Limit Line Hi
8698    OUTPUT @Sa;"MOV TRA[1,39],_X;";          ! 1st horiz seg, calculated _X
8700    OUTPUT @Sa;"MOV TRA[40,(375-_Y)],8030;"; ! 2nd horiz seg, mean+4.3 dB
8702    OUTPUT @Sa;"MOV TRA[(376-_Y),401],_X;"; ! 3rd horiz seg, calculated _X
8704    OUTPUT @Sa;"LIMIHI TRA;";                ! transfer TRA to LIMIHI
8706    !
8708    !  lower limit line
8710    ! draw lower limit line in Trace A, then transfer to Limit Line Lo
8712    OUTPUT @Sa;"MOV TRA[1,46],-8000;";       ! 1st horiz seg, off screen
8714    OUTPUT @Sa;"MOV TRA[47,(367-_Y)],5600;"; ! 2nd horiz seg, mean-20 dB
8716    OUTPUT @Sa;"MOV TRA[(368-_Y),401],-8000;"; ! 3rd horiz seg, off screen
8718    OUTPUT @Sa;"LIMILO TRA;";                ! transfer TRA to LIMILO
8720    OUTPUT@Sa;"LIMITEST1;";                  ! turn on Limit Test
8722    OUTPUT @Sa;"@;";
```

Example 2

The following example shows you how you can create a limit line function for changing the limit lines that are usedinthe power versus time rising measurement.

```
8986    ! NADC Power vs Time Rising edge Limits
8988    !
8990    !  Notes:
8992    ! Horizontal: trace elements go from 1 thru 401.
8994    !  Vertical:  100 display units/dB, Ref Lvl = 8000, Bottom grat
8996    !             line for 10 dB/div = 0, for 15 dB/div = -4000.
8998    ! The mean of the burst is positioned 4dB below Ref Lvl =7600.
9000
9002    !  Swp Time = 640 us, gives 1.6 us per trace element
9004    !
9008
9010    OUTPUT @Sa;"FUNCDEF _PRLIM,@";      ! Limit line function name !
9012
9014    OUTPUT@Sa;"LIMIDEL;";               ! delete existing limit lines
9016
9018    !  upper limit line
9020    !  calc vert position for absolute limit line segment.
```

```
9022    ! (_PRX default= -60 dBm)
9024    OUTPUT @Sa;"IF(_TOP&&!_RNG);"; ! if TOP & 70 dB range
9026      OUTPUT@Sa;"_X1000;";          ! line at 7th graticule position
9028    OUTPUT @Sa;"ELSE ";             ! else 110 dB range or BOT 70 dB
9030      OUTPUT@Sa;"{_X=100*(80+_PRX-RL)};";   ! calculate dynamic position
9032    OUTPUT @Sa;"ENDIF;";
9034    !
9036    !  draw upper limit line in Trace A, then transfer to Limit Line Hi
9038    OUTPUT @Sa;"MOV TRA[1,122],_X;";        ! 1st horiz seg, calculated _X
9040    OUTPUT @Sa;"MOV TRA[123,401],8030;"; ! 2nd horiz seg, mean+4.3 dB
9042    OUTPUT @Sa;"LIMIHI TRA;";               ! transfer TRA to LIMIHI
9044    !
9046    ! lower limit line
9048    !  draw lower limit line in Trace A, then transfer to Limit Line Lo
9050    OUTPUT @Sa;"MOV TRA[1,200],-8000;";    ! 1st horiz seg, off screen
9052    OUTPUT @Sa;"MOVTRA[201,401],5600;";    ! 2nd horiz seg, mean-20 dB
9054    OUTPUT @Sa;"LIMILO TRA;";              ! transfer TRA to LIMILO
9056    OUTPUT@Sa;"LIMITEST1;";                ! turn on Limit Test
9058    OUTPUT @Sa;"@;";
```

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.

```
9264    ! NADC Power vs Time Falling Edge Limits
9266    !
9268    ! Notes:
9270    ! Horizontal: trace elements go from 1 thru 401.
9272    ! Vertical:  100 display units/dB, Ref Lvl = 8000, Bottom grat
9274    !            line for IO dB/div = 0, for 15 dB/div = -4000.
9276    ! The mean of the burst is positioned 4dB below Ref Lvl =7600.
9278    !
9280    !  SwpTime= 640 us, gives 1.6 us per trace element
9282    !
9286    !
9288    OUTPUT @Sa;"FUNCDEF _PFLIM,@";        ! Limit line function name !
9290    !
9292    OUTPUT @Sa;"LIMIDEL;";                ! delete existing limit lines
9294    !
9296    !  upper limit line
9298    !  calc vert position for absolute limit line segment.
9300    ! (_PRX default= -60 dBm)
9302    OUTPUT @Sa;"IF(_TOP&&!_RNG);"; ! if TOP & 70 dB range
9304      OUTPUT @Sa;"_X1000;";         ! line at 7th graticule position
9306    OUTPUT @Sa;"ELSE ";             ! else 110 dB range or BOT 70 dB
9308      OUTPUT@Sa;"{_X=100*(80+_PRX-RL)};";   ! calculate dynamic position
9310    OUTPUT @Sa;"ENDIF;";
9312    !
9314    ! draw upper limit line in Trace A, then transfer to Limit Line Hi
9316    OUTPUT @Sa;"MOV TRA[1,278],8030;";     ! 1st horiz segment, mean+4.3 dB
9318    OUTPUT @Sa;"MOVTRA[279,401],_X;";      ! 2nd horiz seg, calculated _X
9320    OUTPUT @Sa;"LIMIHI TRA;";              ! transfer TRA to LIMIHI
9322    !
```

```
9324    ! lower limit line
9326    ! draw lower limit line in Trace A, then transfer to Limit Line Lo
9328    OUTPUT @Sa;"MOV TRA[1,200],5600;";      ! 1st horiz segment, mean-20 dB
9330    OUTPUT @Sa;"MOV TRA[201,401],-8000;"; ! 2nd horiz segment, off screen
9332    OUTPUT @Sa;"LIMILO TRA;";              ! transfer TRA to LIMILO
9334    OUTPUT@Sa;"LIMITEST1;";                ! turn on Limit Test
9336    OUTPUT @Sa;"@;";
9338    !
```

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 NADC 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 10-2 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 NADC measurements personality" in Chapter 1 for more information).
7. Remove the NADC 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 Mare 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 NADC 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 carrier power high limit (_CPXU) to 27 dBm, change the carrier 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 NADC 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 10-2 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 (see "lb load the NADC measurements personality remotely" for more information).
6. Remove the NADC 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 REC **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 NADC 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 NADC DLP. This card file can then be loaded after
40   !loading NADC.
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 OSa;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 carrier pwr high limit to 27 dBm
140  OUTPUT @Sa;"VARDEF _CPXL,24;"  ! change carrier 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
```

Programming Examples

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 carrier power.
- Measure the carrier off 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 intermodulation spurious emissions.
- Monitor a band.
- Measure the demodulated data bits.
- Measure the I-Q pattern.
- Measure the 8 point constellation.
- Measure the modulation accuracy.
- Measure the 10 symbol, 10 burst modulation accuracy.
- Measure the modulation accuracy using averaging.
- Display digital demodulator status.

To select base or mobile station configuration

This example shows how you can use the NADC 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 NADC 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 NADC programming command -ACH for selecting a channel.

```
10   !re-store "ACH_EX"
20   !Shows how to use the _ACH command in the NADC 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 carrier power

This example shows how you can use the NADC programming commands to measure the carrier power and get the value for mean carrier power.

```
10   !re-store"CPWR_EX"
20   !Shows how to use the _CPWR command in the NADC 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-par-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 power

This example shows how you can use the NADC programming commands to measure the carrier off 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 NADC DLP
30  !
40  REAL Meas_state                  !measurement state variable
50  REAL Mean,off,pwr                !mean carrier off power variable
60  REAL Peak,off,pwr                !peak carrier off power variable
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;"_COP?;"            !query peak carrier off power value
210   ENTER @Sa;Peak_off_pwr         !enter value
220   PRINT
230   PRINT "Mean Off Power= ";Mean_off_pwr;" dBm"
240   PRINT "Peak Off Power= ";Peak_off_pwr;" dBm"
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 NADC programming commands to measure the occupied bandwidth.

```
10   !re-store"OBW_EX"
20   !Shows how to use the _OBW command in the NADC 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 NADC programming commands to measure the adjacent channel power of a base station, using instrument firmware later than (not including) version 930506.

```
10   !re-store"ACP_BS_EX"
20   !Shows how to use the _ACP command in the NADC 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 5 STEP 2
510         IF J=1 THEN Row$="Adjacent"
520         IF J=3 THEN Row$="1st Alternate"
530         IF J=5 THEN Row$="2nd Alternate"
540         IF I=1 THEN
550           PRINT USING Fmt_db;Row$,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 NADC programming commands to measure the adjacent channel power of a mobile station, using instrument firmware later than (not including) version 930506.

```
10   ! re-store "ACP_MS_EX"
20   !Shows how to use the _ACP command in the NADC 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,3D.D," dB",6X,3D.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 5 STEP 2
820         IF J=1 THEN Row$="Adjacent"
830         IF J=3 THEN Row$="1st Alternate"
840         IF J=5 THEN Row$="2nd Alternate"
850         SELECT I
860         CASE 1
870           PRINT USING Fmt_db;Row$,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 NADC 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 NADC 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 5 STEP 2
530         IF J=1 THEN Row$="Adjacent"
540         IF J=3 THEN Row$="1st Alternate"
550         IF J=5 THEN Row$="2nd Alternate"
560         IF I=1 THEN
570           PRINT USING Fmt_db;Row$,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 NADC 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 NADC 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 duw 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 5 STEP 2
880         IF J=1 THEN Row$="Adjacent"
890         IF J=3 THEN Row$="1st Alternate"
900         IF J=5 THEN Row$="2nd Alternate"
910         SELECT I
920         CASE 1
930           PRINT USING Fmt_db;Row$,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 NADC programming commandsto measure the channel power,

```
10   !re-store "CHPWR_EX"
20   !Shows how to use the _CHPWR command in the NADC 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 NADC 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 NADC 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 NADC 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 NADC 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 NADC 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 NADC 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 NADC 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 NADC 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 the intermodulation spurious emissions

This example shows how you can use the NADC programming commands to measure the intermodulation spurious emissions from a base station.

```
10   !re-store"IMDSPUR_EX"
20   !Shows how to use the _IMDSPUR command in the NADC DLP
30
40   REAL Meas_state                !measurement state variable
50   REAL Highest-prod              !highest IMD product variable
60   !
70   ASSIGN @Sa To 718              !i/o path to the spectrum analyzer
80   !
90   !
100  OUTPUT @Sa;"_IMDSPUR;"         !execute Intermod spurious measurement
110  REPEAT
120    ENTER @Sa;Meas_state         !enter measurement state
130  UNTIL Meas_state>0 AND Meas_state<3
140  !
150  IF Meas_state=1 THEN           !measurement completed
160    PRINT "INTERMODULATION SPURIOUS EMISSIONS:";
170    OUTPUT @Sa;"_IMD?;"          !query highest IMD product value
180    ENTER @Sa;Highest_prod       !enter value
190    PRINT
200    PRINT "Highest product=";Highest_prod;"dB"
210  ELSE
220    DISP "Measurement aborted"
230  END IF
240  !
250  END
```

To monitor a band

This example shows how you can use the NADC programming commands to monitor a band.

```
10    !re-store "MBND_EX"
20    !Shows how to use the _MBND command in the NADC 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 NADC programming commands to measure the demodulated data bits.

```
10   !re-store"DATABITS_EX"
20   !shows how to use the _DATABITS command in the NADC DLP
30   !
40   INTEGER I                        ! loop counter
50   INTEGER Bits_array(1:324)        ! 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 324
260        OUTPUT @Sa;"_BITS[";I;"]?;" ! query data bits
270        ENTER @Sa;Bits_array(I)    ! enter value
280     NEXT I
290     FOR I=1 TO 324
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 NADC 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 NADC DLP.
50   !
60   INTEGER I                        ! loop counter
70   INTEGER Ms                       ! flag for BS MS
80   INTEGER Cc                       ! flag for BURST CONT
90   INTEGER Start-i                  ! start index for plotting
100  !
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  OUTPUT @Sa;"_CC?;"               ! query _CC
190  ENTER @Sa;Cc                     ! enter value
200  IF Cc=1 THEN                     ! continuous carrier?
210     Start_i=6                     ! start plot at beginning of data
220  ELSE                             ! burst carrier
230     Start_i=36                    ! start plot at 7th decision point
240  END IF                           ! (avoids ramp up)
250  !
260  OUTPUT @Sa;"MOV _ddCONT,0;"      ! single measurement
270  OUTPUT @Sa;"MOV _ddNOPLT,1;"     ! turn off plotting graph on SA screen
280                                   ! (helps speed)
290  OUTPUT @Sa;"MOV _ddCONSTLN,0;"   ! I-Q Pattern mode
300  !
310  OUTPUT@Sa;"_IQGRAPH;"            ! execute I-Q Pattern measurement
320  REPEAT
330     ENTER @Sa;Meas_state          ! enter measurement state
340  UNTIL Meas_state>0 AND Meas_state<31
350  !
360  IF Meas_state=1 THEN                          ! measurement completed
370     DISP "Entering data..."
380     FOR I=1 TO 816
390        OUTPUT @Sa;"_IQX[";I;"]?;"              ! query X-coordinate
400        ENTER @Sa;Iqx_array(I)                  ! enter value
410        Iqx_array(I)=(Iqx_array(I)-240)/120     ! convert from SA screen units:
420                                                ! SA screen x=240 is 0
430                                                ! SA screen 120 x units is 1
440        oUTPUT @Sa;"_IQY[";I;"]?;"              ! query Y-coordinate
450        ENTER @Sa;Iqy_array(I)                  ! enter value
460        Iqy_array(I)=(Iqy_array(I)-100)/75      ! convert from SA screen units:
470                                                ! SA screen y=100 is 0
480                                                ! SA screen 75 y units is 1
490     NEXT I
500     DISP
510     GINIT
```

```
520       PLOTTER IS CRT,"INTERNAL"
530       GRAPHICS ON
540       VIEWPORT 20,(RATIO*100)-10,20,100
550       FRAME
560       WINDOW-1.5,1.5,-1.5,1.5
570       AXES .1,.1,0,0,10,10,2
580       FOR I=Start_i TO 816
590         PLOT Iqx_array(I),Iqy_array(I)
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 8 point constellation

This example shows how you can use the NADC programming commands to measure the 8 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 NADC DLP.
50   !
60   INTEGER I                            ! loop counter
70   INTEGER Ms                           ! flag for BS MS
80   INTEGER Cc                           ! flag for BURST CONT
90   INTEGER Start-i                      ! start index for plotting
100  !
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  OUTPUT @Sa;"_CC?;"                   ! query _CC
190  ENTER @Sa;Cc                         ! enter value
200  IF Cc=1 THEN                         ! continuous carrier?
210     Start_i=6                         ! start plot at beginning of data
220  ELSE                                 ! burst carrier
230     Start_i=36                        ! start plot at 7th decision point
240  END IF                               ! (avoids ramp up)
250  !
260  OUTPUT @Sa;"MOV _ddCONT,0;"          ! single measurement
270  OUTPUT @Sa;"MOV _ddNOPLT,1;"         ! turn off plotting graph on SA screen
280                                       ! (helps speed)
290  OUTPUT @Sa;"MOV _ddCONSTLN,1;"       ! 8 point constellation mode
300  !
310  OUTPUT@Sa;"_IQGRAPH;"                ! execute 8 point constln measurement
320  REPEAT
330     ENTER @Sa;Meas_state              ! enter measurement state
340  UNTIL Meas_state>0 AND Meas_state<31
350  !
360  IF Meas_state=1 THEN                              ! measurement completed
370     DISP 'Entering data..."
380     FOR I=1 TO 816
390        OUTPUT@Sa;"_IQX[";I;"]?;"                   ! query X-coordinate
400        ENTER@Sa;Iqx_array(I)                       ! enter value
410        Iqx_array(I)=(Iqx_array(I)-240)/120 ! convert from SA screen units
420        OUTPUT@Sa;"_IQY[";I;"]?;"                   ! query Y-coordinate
430        ENTER@Sa;Iqy_array(I)                       ! enter value
440        Iqy_array(I)=(Iqy_array(I)-100)/75          ! convert from SA screen units
450     NEXT I
460     DISP
470     GINIT
480     PLOTTER IS CRT,"INTERNAL"
490     GRAPHICS ON
500     VIEWPORT 20,(RATIO*100)-10,20,100
510     FRAME
```

```
520     WINDOW-1.5,1.5,-1.5,1.5
530     AXES .1,.1,0,0,10,10,2
540     FOR I=Start_i TO 816
550       IF (I MOD 5=1) THEN          ! use every 5th point
560         PENUP
570         PLOT Iqx_array(I),Iqy_array(I)
580       END IF
590     NEXT I
600   ELSE
610     DISP "Measurement aborted"
620   END IF
630   !
640   OUTPUT @Sa;"MOV _ddNOPLT,0;"       ! re-enable SA plotting
650
660   END
```

To measure the modulation accuracy

This example shows how you **can** use the NADC programming commands to measure the modulation accuracy.

```
10   !re-store"MODACC_EX1"
20   !shows how to use the _MODACC command in the NADC 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
120  REAL Droop                           ! amplitude droop
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
190  OUTPUT @Sa;"MOV _ddTENB,0;"          ! 'normal', 1 burst measurement
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
410     OUTPUT @Sa;"_DROOP?;"             ! query amplitude droop
420     ENTER @Sa;Droop                   ! enter value
430     PRINT "Modulation Accuracy results:  [single burst]"
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"
```

```
520      PRINT "AMPLITUDE DROOP:      ";Droop;" dB/symbol"
530   ELSE
540      DISP "Measurement aborted"
550   END IF
560   !
570   END
```

To measure the 10 symbol, 10 burst modulation accuracy

This example shows how you can use the NADC programming commands to measure the 10 symbol, 10 burst modulation accuracy.

```
10   !re-store"MODACC_EX2"
20   !shows how to use the _MODACC command with 10 symbol/ 10 burst averaging
30   !in the NADC DLP
40   !
50   !
60   REAL Meas_state                    ! measurement state variable
70   REAL Rms,evm                       ! rms error vector magnitude
80   REAL Mag,err                       ! rms magnitude error
90   REAL Phase-err                     ! rms phase error
100  REAL Iq,offset                     ! iq origin offset
110  REAL Cf,err                        ! carrier frequency error
120  REAL Droop                         ! amplitude droop
130  !
140  ASSIGN @Sa TO 718                  ! i/o path to spectrum analyzer
150  !
160  !
170  OUTPUT @Sa;"MOV _ddCONT,0;"        ! single measurement
190  OUTPUT @Sa;"MOV_ddTENB,1;"         ! enable IO symbol, 10 burst mode
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;"_IQOFS?;"            ! query iq origin offset
360     ENTER @Sa;Iq_offset             ! enter value
370     OUTPUT@Sa;"_CFERR?;"            ! query carrier frequency error
380     ENTER @Sa;Cf_err                ! enter value
390     OUTPUT@Sa;"_DROOP?;"            ! query amplitude droop
400     ENTER @Sa;Droop                 ! enter value
410     PRINT "Modulation Accuracy results:   [IO symbol, 10 burst avg]"
420     PRINT "-----------------------------------------------------------"
430     PRINT
440     PRINT "RMS EVM:                ";Rms_evm;" %"
450     PRINT " RMS MAC ERR:           ";Mag_err;" %"
460     PRINT " RMS PHASE ERROR:       ";Phase_err;"degrees"
470     PRINT
480     PRINT "[single full burst]:"
490     PRINT "IQ ORIGIN OFFSET:       ";Iq_offset;" dB"
500     PRINT "CARRIER FREQ ERROR: ";Cf_err;" Hz"
510     PRINT "AMPLITUDE DROOP:        ";Droop;" dB/symbol"
520  ELSE
530     DISP "Measurement aborted"
```

```
540   END IF
550  !
560   END
```

To measure the modulation accuracy using averaging

This example shows how you can use the NADC programming commands to measure the modulation accuracy with averaging.

```
10    !re-store"MODACC_EX3"
20    !shows how to use the _MODACC command with averaging in the NADC 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
110   REAL Droop-mean                  ! mean amplitude droop
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
330   OUTPUT @Sa;"MOV _ddTENB,0;"      ! 'normal', 1 burst measurement
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
540      OUTPUT @Sa;"_DROOP?;"         ! query mean amplitude droop
550      ENTER @Sa;Droop_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 MAC 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
950 Droop:     IMAGE "Mean DROOP (dB/symbol):    ",7X,2D.4D
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
1140      PRINT USING Droop;Droop_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 NADC programming commands to access the digital demodulator status.

```
10   !re-store "STATUS,EX"
20   !shows how to use the _ddSTATUS command in the NADC 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   (O=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
```

6

If You Have a Problem

The purpose of this chapter is to help you troubleshoot problems when operating the NADC measurements personality, including any hardware or options installed with the personality to make it function. If the problem is related to the spectrum analyzer and not the NADC measurements personality, consult the spectrum analyzer documentation.

How to Use This Chapter

This chapter uses displayed error messages as the foundation for troubleshooting problems with the NADC measurements personality. It is likely that an error message is the first thing you see following a failure. However, a procedure is also provided for problems not reported by an error message. The messages are listed in alphabetical order, followed by a brief explanation of what each message means. If the solution is simple, it is explained there. If the solution is more involved, you are directed to a later part of this chapter to continue troubleshooting.

Order of Troubleshooting

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

Before Troubleshooting

If an error message appears, or if you suspect a problem, check the system setup Arst. Make sure the NADC 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 "NADC Digital Demodulator Measurements 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 NADC measurements personality does not make a measurement

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

- The channel number is not correct.

  Make sure that the channel number corresponds to the transmitted carrier frequency. **AUTO CHANNEL** in the Physical Channel menu can be used to automatically find the carrier in the transmit band with the highest signal level. For more information, see "To select a channel to test" in Chapter 2 for base station measurements, or Chapter 3 for mobile station 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 3 for more information.

- The external trigger signal is missing.

  Make sure that an external trigger is input to the spectrum analyzer, when required. External triggering is used for the adjacent channel power measurement on a mobile station, and the power versus time measurements. External triggering can also be selected for a carrier power measurement. If you have option 151/161, you may also choose frame triggering. See chapter 1 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 3 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 3 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 "lb configure the personality" in Chapter 3 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. See "To configure the personality" in Chapter 2 for measuring a base station, or Chapter 3 if a mobile station is being measured.

- The external attenuation value is incorrect.

  Make sure that the **EXT ATTEN** has been set correctly. This function is in the configuration menu. See "To configure the personality" in Chapter 2 for measuring a base station, or Chapter 3 if a mobile station is being measured. A symptom of this problem is incorrect power measurement results.

- The total power setting is 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 in chapter 1.

  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 HP sales and service office.

- Excess frequency drift is interrupting the measurement.

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

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

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

Error Messages

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

`Amplitude over range, resetting RL . . .`

`Amplitude under range, resetting RL . . .`

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

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

`CAL: DD DAC Failed`

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

To solve this problem:

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

`CAL FREQ for best dynamic range`

This indicates that the CAL FREQ or CAL FREQ & AMPTD routines were not performed after the NADC 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 in "Step 2. Perform the spectrum analyzer self-calibration routines" in Chapter 1.

`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 NADC 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 NADC 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 NADC measurements personality total power function (**TOTL PWR**) has been set correctly. For more information, see "To configure the personality" in Chapter 2 for base station measurements, or Chapter 3 for mobile station measurements.
- Confirm that the NADC measurements personality external attenuator function (**EXT ATTEN**) has been set correctly. For more information, see "To configure the personality" in Chapter 2 for base station measurements, or Chapter 3 for mobile station measurements.

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 -20 dBm.

To solve this problem:

- Make sure that the transmitter output is correctly connected to the spectrum analyzer input.
- Make sure that the NADC measurements personality external attenuation function (**EXT ATTEN**) has been set correctly. For more information, see "To configure the personality" in Chapter 2 for base station measurements, or Chapter 3 for mobile station measurements.

  If you want the NADC measurements personality to use an amplitude level other than -20 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 -20 dBm.

To solve this problem:

- Confirm that the transmitter output is connected to the spectrum analyzer input.
- Confirm that the NADC measurements personality external attenuator function (**EXT ATTEN**) has been set correctly. For more information, see "To configure the personality" in Chapter 2 for base station measurements, or Chapter 3 for mobile station measurements.
- If you want the NADC measurements personality to use an amplitude level other than -20 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.

Clock signal too low, data may have to be randomized

This is a digital demodulator error message. Refer to this error message under "NADC Digital Demodulator Measurements Troubleshooting," later in this chapter.

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 NADC 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 NADC digital demodulator. Your spectrum analyzer must have fast ADC capability for the power versus time measurements on a mobile station when used with the HP 85718B NADC-TDMA Measurements Personality.

The fast ADC function has been added to option 151 PC boards, included with the HP 85718B NADC-TDMA 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 NADC-TDMA personality measurements.

To solve this problem:

- If option 101 or 151 is installed in the spectrum analyzer, that option may have failed. See the documentation for your spectrum analyzer for more information about returning the spectrum analyzer for repair.
- If option 101 or 151 is not installed in the spectrum analyzer, either option can be installed; contact your local HP Sales and Service Office for more information.

Frame trigger acquisition failed, check STATUS

This is a digital demodulator error message. Refer to this error message under "NADC Digital Demodulator Measurements Troubleshooting," later in this chapter.

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

This is a digital demodulator error message. Refer to this error message under "NADC Digital Demodulator Measurements Troubleshooting," later in this chapter.

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 this error message under "NADC Digital Demodulator Measurements Troubleshooting," later in this chapter.

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 documentation for your spectrum analyzer for more information about returning the spectrum analyzer for repair.
- If Option 105 is not installed in the spectrum analyzer, it can be installed; contact your local HP Sales and Service Office for more information.

Hardware options 151/161 required for Digital Demod

This message indicates that the digital demodulator, option 151 and 161, is not installed in the analyzer. Options 151 and 161 are required to make digital demodulator-based measurements and to use the digital demodulator frame trigger.

To solve this problem:

- If option 151 and 161 are installed in the spectrum analy8zer, they may have failed. See the documentation for your spectrum analyzer for more information about returning the spectrum analyzer for repair.
- If option 151 and 161 are not installed in the spectrum analyzer, they can be installed; contact your local HP sales and service office for more information.

INVALID SYMTAB ENTRY: SYMTAB OVERFLOW

This indicates that there was not enough available memory in the spectrum analyzer to hold the NADC 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 HP 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 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 NADC measurements personality using the procedure "Step 1. Load the NADC measurements personality," in Chapter 1.

Measurement failed, check STATUS

This is a digital demodulator error message. Refer to this error message under "NADC Digital Demodulator Measurements Troubleshooting," later in this chapter.

NADC Digital Demod firmware required: (opt 161)

This message indicates that option 161, the NADC digital demodulator firmware ROMs, are not installed in the option 151 digital demodulator boards.

To solve this problem:

- Contact your local HP sales and service office for information about obtaining option 161.

Newer firmware required: REV 930506 or later

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

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

To solve this problem:

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

Newer opt 161 firmware required: rev 930625 or later

This message indicates that newer option 161 firmware is required for the HP 85718B NADC personality.

To solve this problem:

- Contact your local HP sales and service office for information about obtaining the latest option 161 ROMs.

Ref level auto set failed, over range

Ref level auto set failed, under range

Results may not be accurate, Droop exceeds corr. limit

Results may not be accurate, EVM corr too high

Results may not be accurate, EVM mag. exceeds limit

Results may not be accurate, Frequency error > 1 kHz

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 this error message under "NADC Digital Demodulator Measurements Troubleshooting," at the end of this section.

Single lower carrier assumed

This message indicates that the NADC measurements personality could locate only one carrier for the intermodulation spurious measurement. If you want the NADC 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 this error message under "NADC Digital Demodulator Measurements Troubleshooting," later in this chapter.

Sync word errors present

This is a digital demodulator error message. Refer to this error message under "NADC Digital Demodulator Measurements Troubleshooting," later in this chapter.

Time record invalid, check STATUS

This is a digital demodulator error message. Refer to this error message under "NADC Digital Demodulator Measurements Troubleshooting," later in this chapter.

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.

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.

NADC Digital Demodulator Measurements Troubleshooting

The HP 85718B supports extensive error checking of modulation accuracy, I-Q graphs, and data bits measurements. During a measurement, error messages appear on-screen to highlight invalid measurement conditions. Whenever any of the following error messages appear, you can use the status screen to display the current state of various measurement operations for troubleshooting. Access the status screen by pressing **STATUS** in the digital demodulator main menu. To access the digital demodulator main menu, press (MODE) **NADC ANALYZER** **More 1 of 2** **Digital Demod**.

- 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, overrange
- Ref level auto set failed, underrange
- Results may not be accurate, Droop exceeds corr. limit
- Results may not be accurate, EVM corr. too high
- Results may not be accurate, EVM mag. exceeds limit
- Results may not be accurate, Frequency error > 1 kHz
- 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

Status Screen Overview

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.

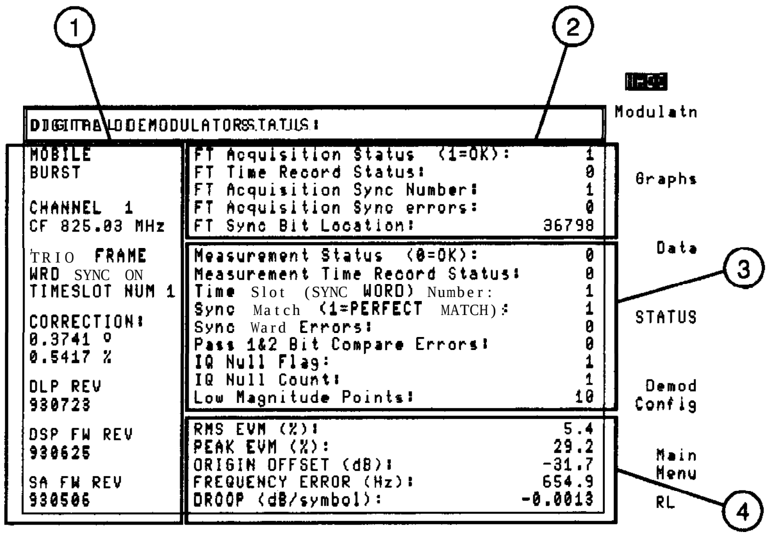


Figure 6-1. The NADC Digital Demodulator Status Screen

1. System information. This area contains information such as the current configuration settings for the NADC 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 only displayed 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 NADC 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.

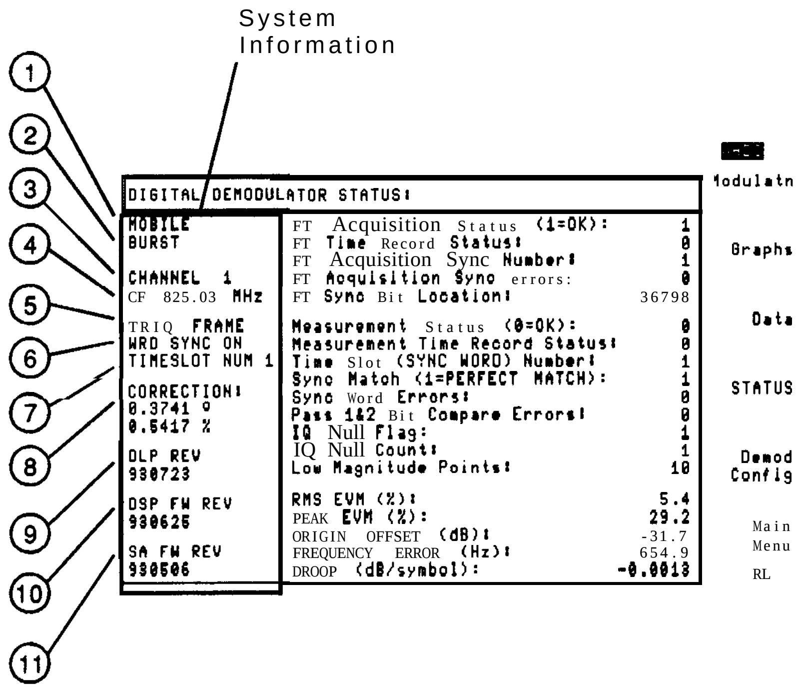


Figure 6-2. Detail of System Information

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 center frequency that the spectrum analyzer is set to.
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 **TIMESLOT NUMBER** softkey if NUM is underlined in the **TIMESLOT SRCH NUM** softkey. The timeslot 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.
9. DLP REV. Gives the code revision date of the NADC measurements personality.
10. DSP FW REV. Shows the code revision date of the Option 161 NADC 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 1.596, 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.

Troubleshooting Map

Error Message	Troubleshooting Procedure		
	Frame Trigger status Troubleshooting	Measurement status Troubleshooting	Measurement Results Troubleshooting
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, Droop exceeds corr. limit			√
Results may not be accurate, EVM mag. exceeds limit			√
Results may not be accurate, Frequency error > 1 kHz			√
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 vord 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.

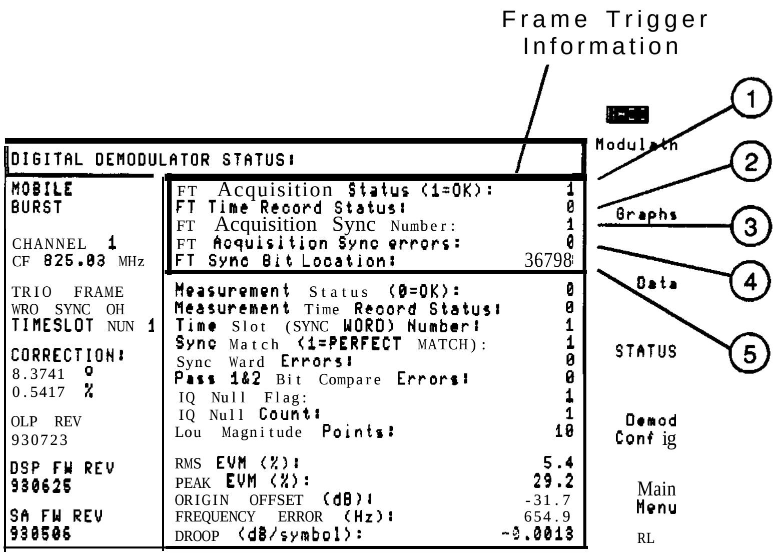


Figure 6-3. Detail of Frame Trigger Fart of the Status Screen

1. FT Acquisition Status. Value is 1 if frame trigger acquisition is successful, and 0 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 a 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 0, 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.

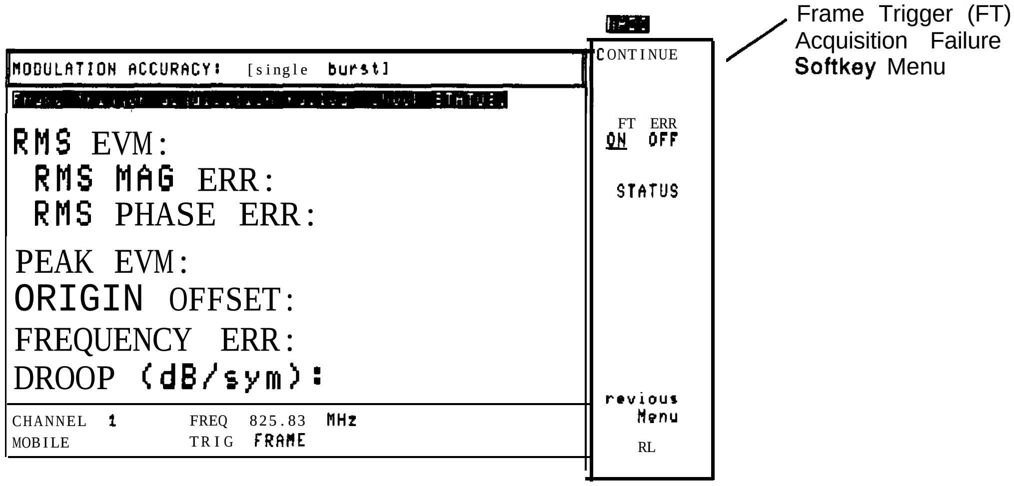


Figure 6-4. Frame Trigger Acquisition Failure **Softkey** Menu

If this occurs, HP recommends that you press **STATUS** to display the status screen and diagnose the problem before continuing. However, you can force the measurement to continue by pressing **CONTINUE**. This completes the measurement, but may give faulty data when the measurement is finished. Most of the time, you should press STATUS . For convenience, frame trigger error messages can be disabled by pressing FT ERR **ON** OFF until OFF is underlined before pressing **CONTINUE**. To re-enable frame trigger error message reporting after pressing **CONTINUE** , press **Demod Config** Frame **Conf ig** , 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 NADC digital demodulator hardware or NADC 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 Conf** ig RR Trigger **DD TRIG** FREE **RUN** .

- **The transmitted timeslot may n**ot match the **timeslot** designated by the personality. This can **happen if** **TIMESLOT SRCH NUM** is set to NUM and **TIMESLOT NUMBER** **is incorrect.**
- The signal to noise ratio may be too small to reliably detect transmitted bits.
- The NADC measurements personality format may not be set to match the transmitting station format. For example, the NADC 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 Arst 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.

With this list of possible solutions 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 161 has failed. Contact your nearest HP 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 NADC 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 NADC 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 NADC 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 **TIMESLOT 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** **TIMESLOT 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 NADC 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 NADC measurements personality was configured to search for a specific timeslot, then the frame trigger was set to best match the sequence designated by **TIMESLOT 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: 36824 through 36828

Mobile station mode target address: 36796 through 36800

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 161 has failed. Contact your nearest HP Sales and Service Office for assistance.

Measurement Status Troubleshooting

Measurement status information provides a report of the overall condition of the previous measurement. Results of measurement status, the first item in this group, gives the most information. Measurement status information is valid only after a measurement has been attempted. If using frame trigger, measurement status information is only valid if the frame trigger was successfully acquired.

Measurement Status Screen

Figure 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.

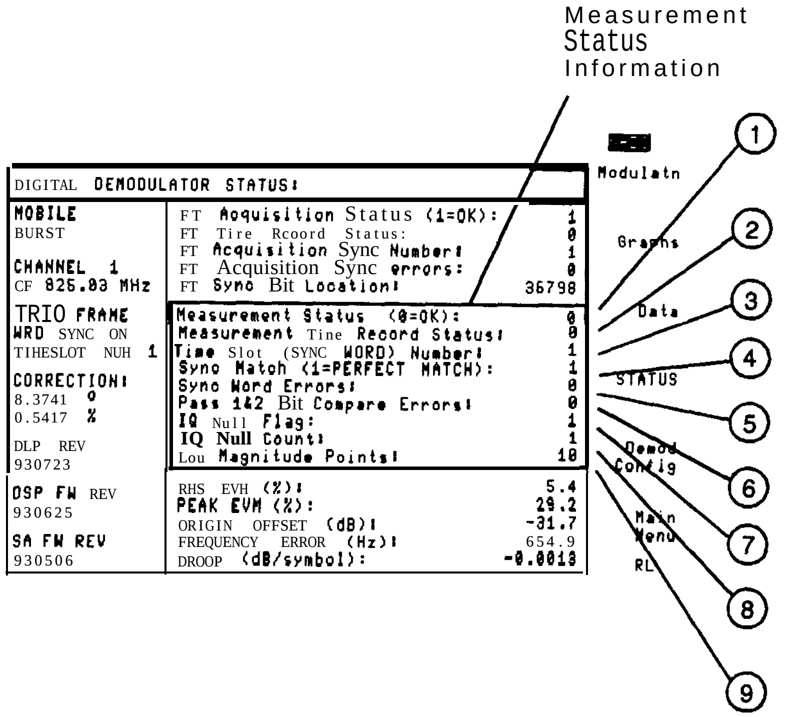


Figure 6-5. Detail of the Measurement Status Part of the Status Screen

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 28.
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.

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, 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 frequency error should be less than 1 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 28 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 28 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 HP Sales and Service Office.
- If Measurement Time Record Status is 3, the digital signal processor has started but is unable to Anish 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 **TIMESLOT NUMBER**, change the **timeslot** mode (**TIMESLUT 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 28, the length of an NADC 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 5 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" 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.

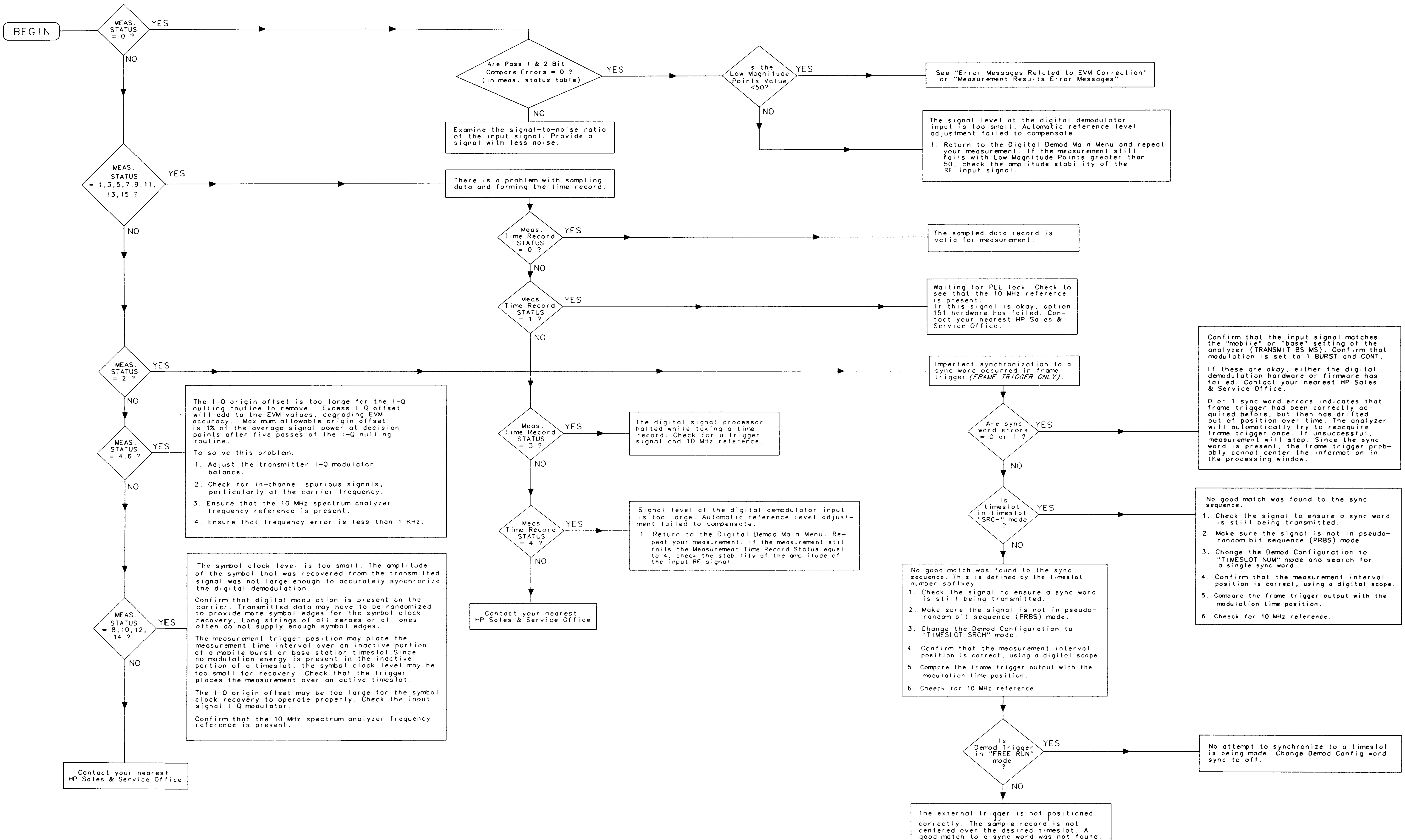


FIGURE 6–6. MEASUREMENT STATUS TROUBLESHOOTING FLOWCHART

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.

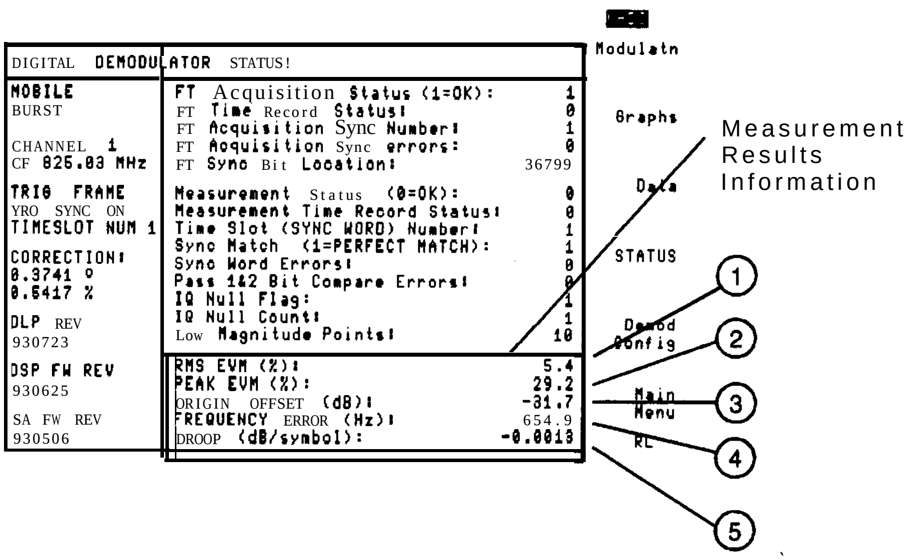


Figure 6-7. Measurement Results Part of the Status Screen

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
5. DROOP (dB/symbol):. This displays the current amplitude droop

Measurement Results Error Messages

`Results may not be accurate, Frequency Error > 1 kHz`

The carrier frequency error is greater than 1 kHz. This frequency error cannot be accurately compensated, so the measured phase portion of EVM may be greater than actual. To solve this problem:

- Check that a valid 10 MHz frequency reference is present
- Frequency lock the spectrum analyzer to the transmitter under test

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.

Results may not be accurate, Droop exceeds corr. limit

This means the amplitude droop is greater than 0.0185 dB per symbol across the burst (3 dB for 162 symbols). The correction algorithm is unable to accurately correct total timeslot droops greater than 0.0185 dB per symbol. The displayed EVM magnitude component may be greater than actual.

To solve this problem:

1. Examine the signal using the Power Vs. Time measurement feature. In particular, check the rolloff of the signal power over a timeslot. Fix the source of the excess droop.
2. Check the position of the measurement trigger relative to the transmitted timeslot.

How to Contact Hewlett-Packard

In the event something goes wrong with your spectrum analyzer, refer to the documentation for the spectrum analyzer about returning it for service. If you need to contact Hewlett-Packard about a problem with the NADC measurements personality, you can call your nearest Hewlett-Packard Sales and Service Office, listed in the table on the following page.

Table 6-1. Hewlett-Packard Sales and Service Offices

US FIELD OPERATIONS

Headquarters
Hewlett-Packard Co.
19320 Pruneridge Avenue
Cupertino, CA 95014
(800) 752-0900

California, Northern
Hewlett-Packard Co.
301 E. Evelyn
Mountain View, CA 94041
(415) 694-2000

California, Southern
Hewlett-Packard Co.
1421 South Manhattan Ave.
Fullerton, CA 92631
(714) 999-6700

Colorado
Hewlett-Packard Co.
24 Inverness Place, East
Englewood, CO 80112
(303) 649-5512

Atlanta Annex
Hewlett-Packard Co.
2124 Barrett Park Drive
Kennesaw, GA 30144
(404) 6480000

Illinois
Hewlett-Packard Co.
5201 lbllview Drive
Rolling Meadows, IL 60008
(708) 255-9800

New Jersey
Hewlett-Packard Co.
150 Green Pond Rd.
Rockaway, NJ 07866
(201) 586-5400

Texas
Hewlett-Packard Co.
930 E. Campbell Rd.
Richardson, TX 75081
(214) 231-6101

EUROPEAN FIELD OPERATIONS

Headquarters
Hewlett-Packard S.A.
150, Route du Nant-d'Avril
12 17 Meyrin 2/Geneva
Switzerland
(41 22) 780.8111

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

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

Great Britain
Hewlett-Packard Ltd.
Eskdale Road, Winnersh Triangle
Wokingham, Berkshire RG41 5DZ
England
(44 734) 696622

INTERCON FIELD OPERATIONS

Headquarters
Hewlett-Packard Company
3495 Deer Creek Road
Palo Alto, California, USA
94304-1316
(415) 857-5027

Australia
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackbum, Victoria 3130
(61 3) 895-2895

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

China
China Hewlett-Packard Company
38 Bei San Huan Xl Road
Shuang Yu Shu
Hai Dian District
Beijing, China
(86 1) 256-6888

Japan
Hewlett-Packard Japan, Ltd.
1-27-15 Yabe, Sagamihara
Kanagawa 229, Japan
(81 427) 59-1311

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

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

7

Base Station Menu Map and Softkey Descriptions

This chapter contains menu maps and definitions of the softkeys for base station testing. The definitions for the softkeys are listed as they appear within a menu, and the NADC 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** Ghan **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.

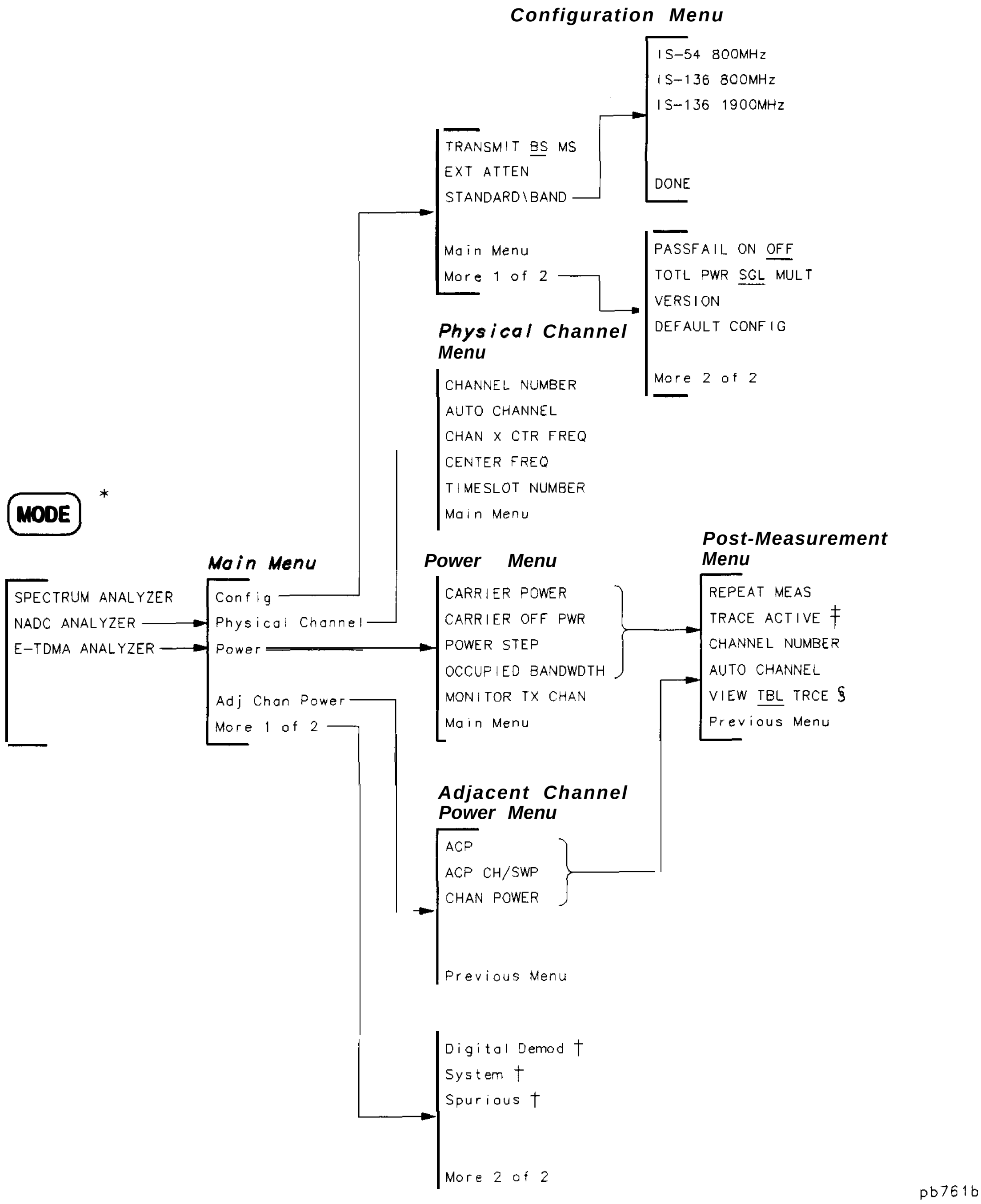
Graphs menu — Pressing **Graphs** accesses the graphs menu.

Data menu — Pressing Data accesses the data menu.

Demod config 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 in Chapter 6.

Base Station Menu Map



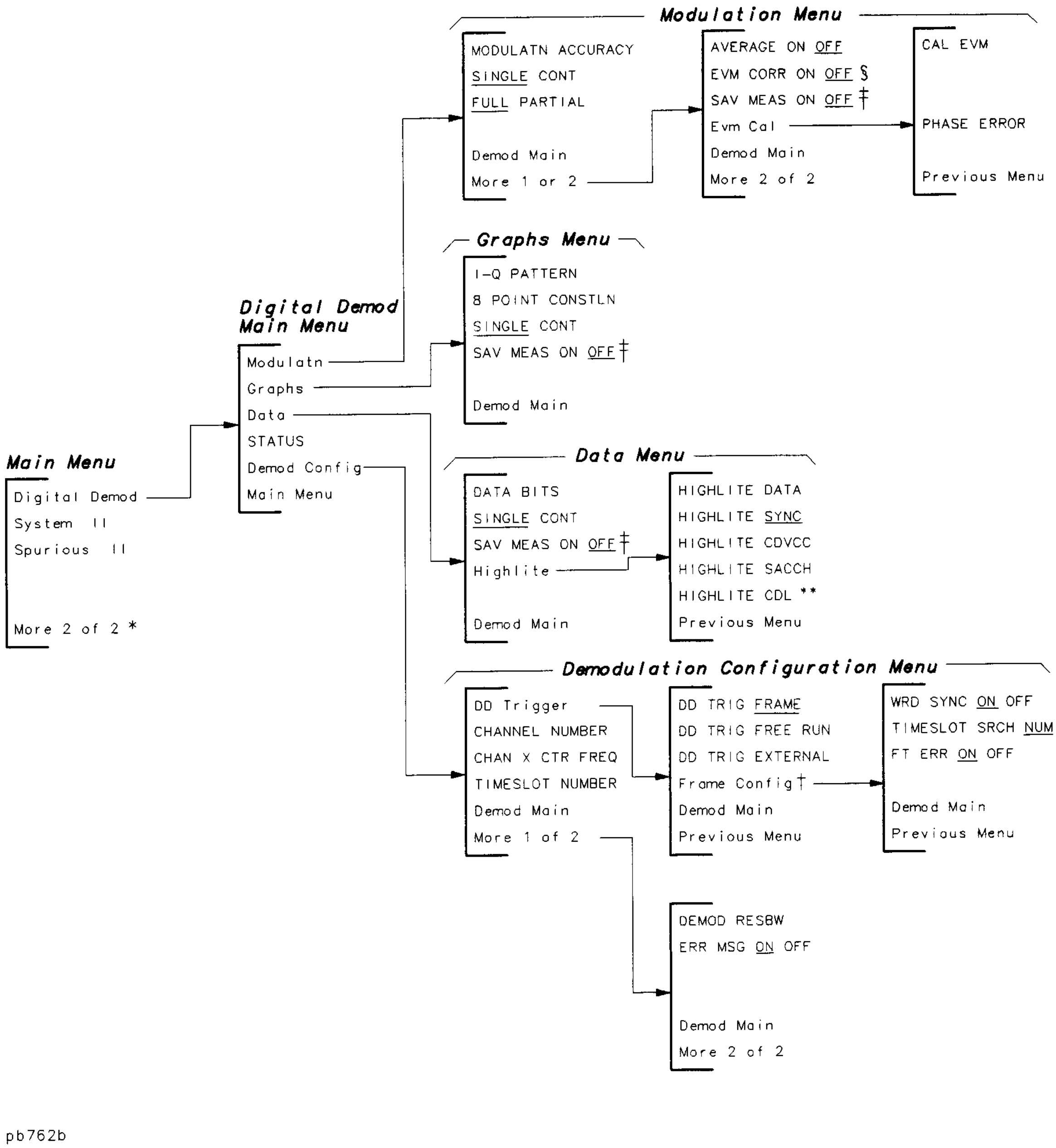
Base Station Menu Map

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

† gee the following two pages for these menus.

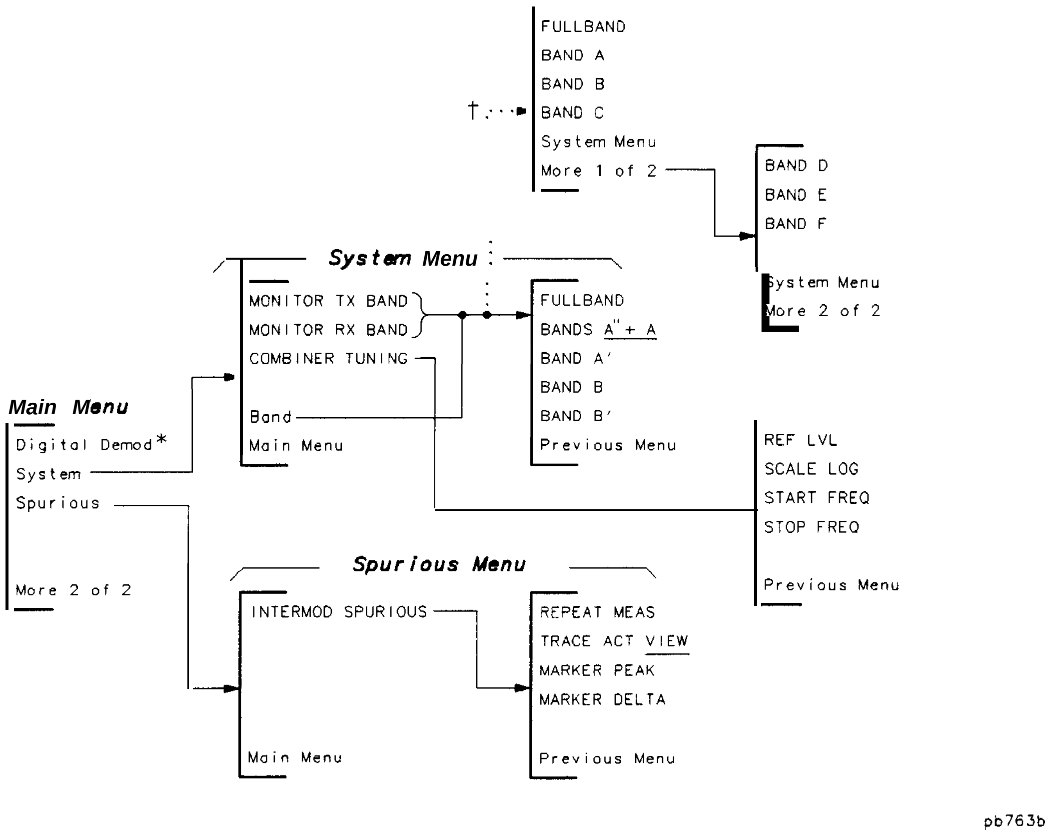
‡ When you press TRACE ACTIVE, the softkey label changes to TRACE COMPARE .

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



Base Station Menu Map (continued)

- * See the previous page for the configuration, physical channel, power, and adjacent channel power menus.
- † **Frame Config** is only available when **DD Trigger** is set to FRAME.
- ‡ Refer to the **SAV MEAS ON OFF** softkey description.
- § **EVM CORR ON OFF** is only available if **CAL EVM** was successful.
- || See the following page for system and spurious menus.
- ** Appears only when **TRANSMIT BS**, and **IS-136 1900 MHz** are selected.



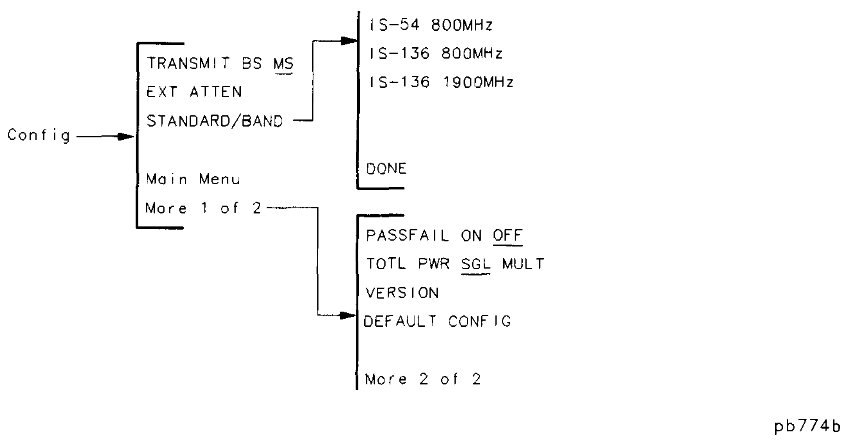
Base Station Menu Map (continued)

* See the previous page for the digital demod main menus.

† Appears only when IS-136 1900 MHz is selected.

The Configuration Menu

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



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 enter 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 NADC 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.

STANDARD BAND Allows you to select either IS-54 or IS-136 standard in the test. IS-136 is the newer standard that has the 1900 MHz tuning plan and the Digital Control Channel (CDL).

IS-54 800 MHz Selects IS-54 standard at 800 MHz band.

IS-136 800 MHz Selects IS-136 standard at 800 MHz band.

IS-136 1900 MHz Selects IS-136 standard at 1900 MHz band.

PASSFAIL ON OFF Allows you to display or blank "pass" and "fail" messages 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.

TOTL PWR SGL MULT Allows you to select whether 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 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.

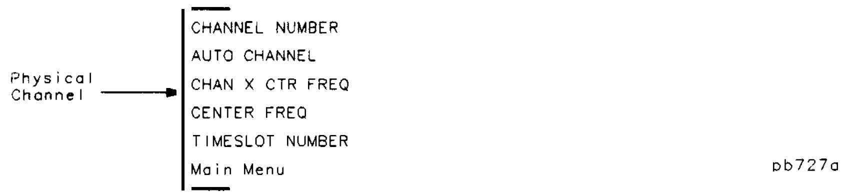
VERSION Displays the version of the NADC measurements personality, and the version of the Electronics Industry Association (EIA) and Telecommunications Industry Association (TIA) standard documents that were used to derive the NADC measurement routines and test limits.

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.
- **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** issetto 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 A" + A.
- **EVM CORR** UN **OFF** is set to OFF,

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.



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 NADC channel you want to measure. The NADC 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** . You can enter a channel number from 1 to 1023, inclusive. If you do not enter a channel number the channel number defaults to channel 1. You can determine the center frequency for a given channel with the following equation:

Transmitter	Channel Number	Center Frequency (MHz)
Base	$1 \leq N \leq 799$	$0.03N + 870.000$
	$990 \leq N \leq 1023$	$0.03(N - 1023) + 870.000$

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

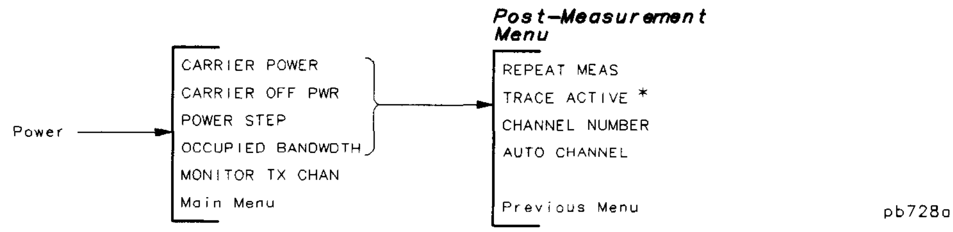
CHAN X CTR FREQ Changes the center frequency of the spectrum analyzer to the frequency of the current channel "X," and then allows you to enter the frequency of any arbitrary channel that you want to measure. **CHAN X CTR FREQ** can be helpful if you know the channel's frequency but not the channel number, 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."

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

TIMESLOT 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 the **TIMESLOT NUMBER** is 1.

The Power Menu

Pressing **Power** accesses the softkeys that allow you to measure the transmitter's carrier 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" (located at the end of this chapter) for more information about the softkeys that the power menu softkeys access.



The Power Measurement Menu Map

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

Table 7-1 shows the spectrum analyzer settings for each of the power measurements. The NADC measurements personality automatically sets the spectrum analyzer settings for each of the power measurements.

Table 7-1. Spectrum Analyzer Settings for the Base Station Power Measurement

Spectrum Analyzer setting	CARRIER POWER	CARRIER OFF PWR	POWER STEP	OCCUPIED BANDWDTH	MONITOR TX CHAN
Span	0 Hz	0 Hz	0 Hz	80 kHz	500 kHz
Resolution bandwidth	100 kHz	30 kHz	100 kHz	1 kHz	10 kHz
Video bandwidth	100 kHz	30 kHz	100 kHz	10 kHz	10 kHz
Sweep time	40 ms	40 ms	8 s	300 ms	300 ms
Detector	Sample	Sample	Peak	Sample	Peak
Trigger mode	Free Run	Free Run	Video	Free run	Free run

The limits and parameters for the power measurements can be changed remotely. See "Customizing the NADC Personality" in Chapter 5 for more information.

The Power Menu Softkeys

CARRIER 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. This measurement determines the mean carrier power between the -20 dBc points referenced from the peak of the burst.

CARRIER OFF PWR Measures the mean and peak power when the carrier is off. The average data from several sweeps is used in calculating the carrier off power levels. The default number of sweeps is 2.

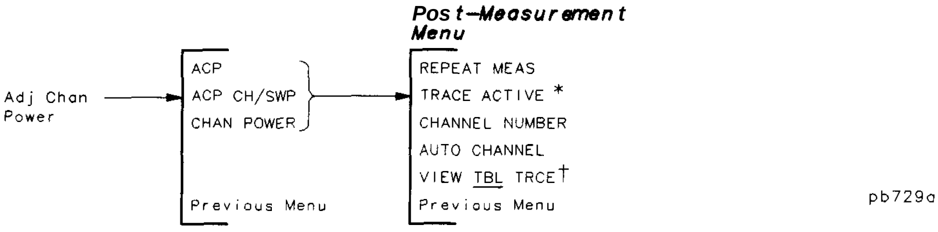
POWER STEP Allows you to view the output power from a transmitter as you increase or decrease the power. When you press **POWER STEP**, the trigger mode is set to video, and the spectrum analyzer will not sweep until the carrier is turned on or the carrier power level is increased. After the spectrum 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.

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

MONITOR 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 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" (located at the end of this chapter) for more information about the softkeys that the adjacent channel power menu softkeys access.



The Adjacent Channel Power Measurement Menu Map

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

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

Table 7-2 shows the spectrum analyzer settings for each of the adjacent channel power measurements. The NADC measurements personality automatically sets the spectrum analyzer settings for each of the adjacent channel power measurements.

Table 7-2. Spectrum Analyzer Settings

Spectrum Analyzer Setting	ACP	ACP CH/SWP	CHAN POWER
Span	240 kHz	32.8 kHz	32.8 kHz
Resolution bandwidth	1 kHz	1 kHz	1 kHz
Video bandwidth	30 kHz	30 kHz	30 kHz
Sweep time	800 ms	300 ms	300 ms
Detector	Sample	Sample	Sample
Trigger mode	Free Run	Free Run	Free Run

The limits and parameters for the power measurements can be changed remotely. See "Customizing the NADC Personality" in Chapter 5 for more information.

The Adjacent Channel Power Menu Softkeys

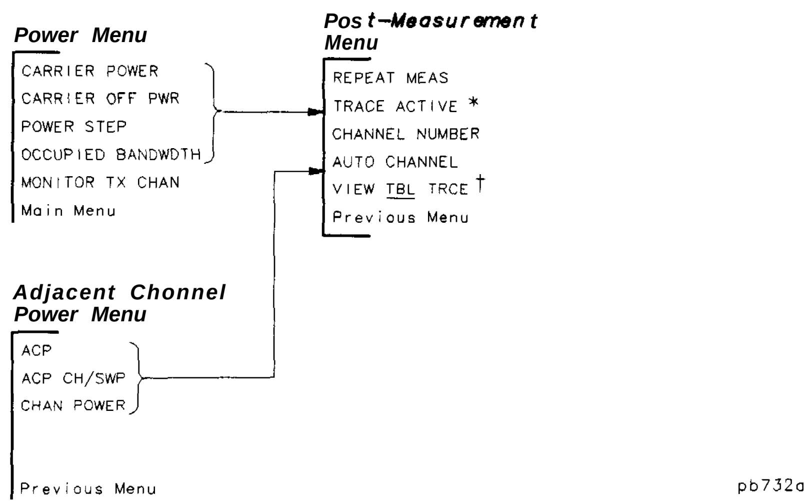
ACP Measures the power in the transmitted channel, as well as the power in the upper and lower adjacent, first alternate, and second alternate channels. Because the signal from a base station is continuous and not burst, the results from the adjacent channel power measurement are from modulation and noise effects. The personality uses the spectrum analyzer sample detector and a 32.8 kHz integration bandwidth to measure the power in the adjacent channels. The signal is filtered with a square root raised cosine filter prior to integration. The measurement performs two measurement sweeps. 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.

ACP CH/SWP Like **ACP**, **ACP CH/SWP** measures the power in the transmitted channel, as well as the power in the upper and lower adjacent, first alternate, and second alternate channels. Unlike **ACP** , **ACP 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** .

CHAN POWER Measures the total power in the channel. The personality uses the spectrum analyzer sample detector and an 32.8 kHz integration bandwidth to measure the power in the channel. The signal is filtered with a square root raised cosine filter prior to integration.

The Post-Measurement Menu

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



The Post-Measurement Menu Map

- * **When you press TRACE ACTIVE, the softkey label changes to TRACE COMPARE .**
- † **VIEW TBL TRCE is only available 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. If desired, you can change parameters such as the channel number or resolution bandwidth before you press this softkey.

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.

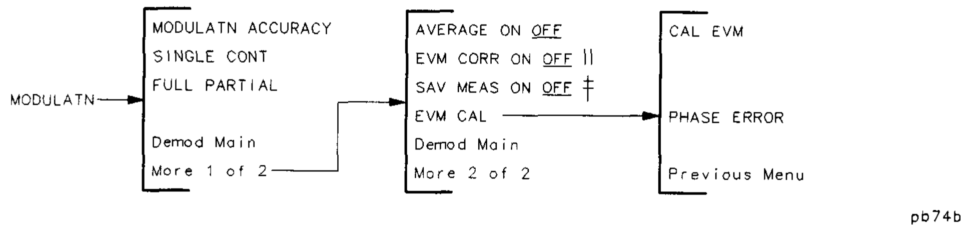
AUTO CHANNEL Changes the channel by tuning to the channel with the highest carrier power, and then repeats the measurement.

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, I-Q origin offset, and amplitude droop.



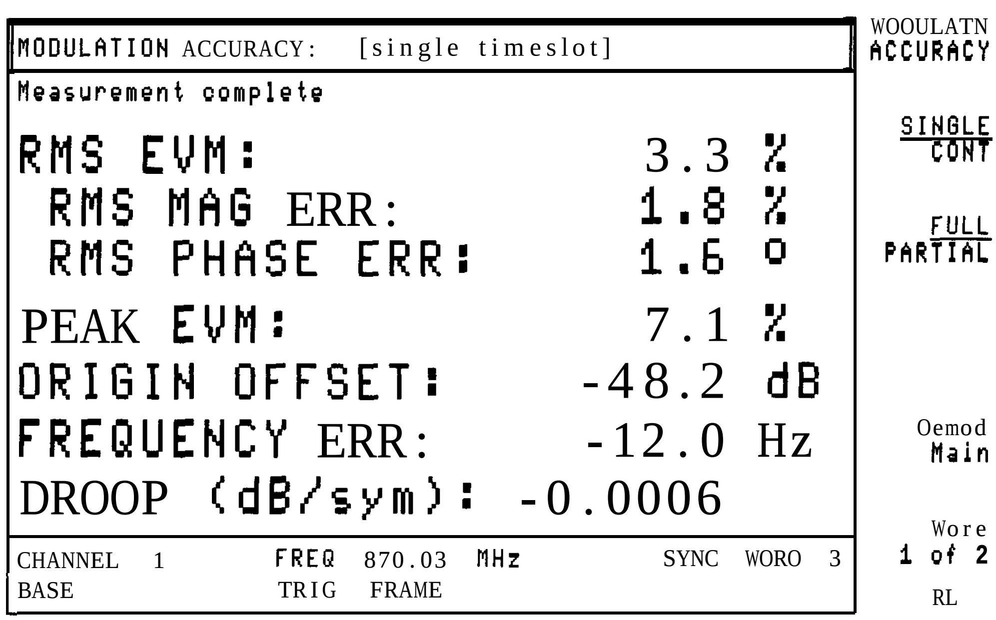
The Modulation Menu Map

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

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

The Modulation Menu Softkeys

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



The Normal Modulation Accuracy Screen

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. **SINGLE CONT** is automatically set to SINGLE when entering the modulation menu.

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 and amplitude droop 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 (see screen below). 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, carrier frequency error, and amplitude droop are displayed if **FULL PARTIAL** is set to FULL. If **FULL PARTIAL** is set to PARTIAL, the carrier frequency error and amplitude droop will not be displayed.

STATISTICS for sample of 10 timeslots:

	Mean	Std dev	Max	Min
RMS EVM (%):	2.8	0.58	3.6	1.9
RMS MAG ERR (%):	1.7	0.58	2.4	0.9
RMS PHASE ERR (o):	1.3	0.18	1.6	1.0

RMS EVM Uncertainty

Temp. Range 20-30 oC:	2.4 % > RMS EVM > 0.0 %
Temp. Range 0-55 oC:	2.4 % > RMS EVM > 0.0 %

	Mean
ORIGIN OFFSET (dB):	-46.1
FREQUENCY ERROR (Hz):	-8.6
DROOP (dB/symbol):	-0.0005

CHANNEL 1 FRER 870.03 MHz SYNC WORD 3
BASE TRIG FRAME

MODULATN ACCURACY | SINGLE CONT | FULL PARTIAL | Oemod Main | More 1 of 2 | AL

The Modulation Accuracy Statistics Screen

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 only available if the EVM calibration was successful. Refer to Chapter 2 for details on when and how to use the **EVM CORR** 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 NADC 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. Refer to Chapter 2 for details on how to do the EVM calibration measurement.

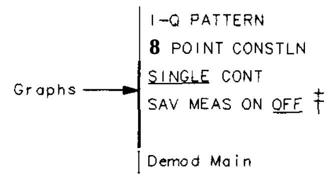
The EVM Calibration Menu Softkeys

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 8 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, amplitude droop, and carrier frequency error. Only the RMS EVM contribution remains.

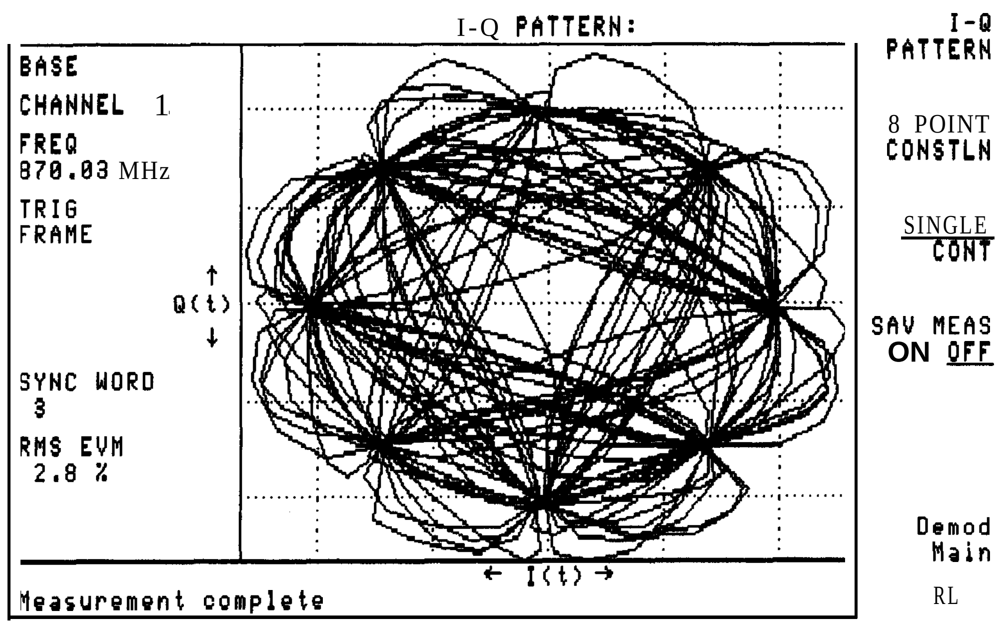


The Graphs Menu Map

‡ Refer to the SAV MEAS ON OFF softkey description.

The Graphs Menu Softkeys

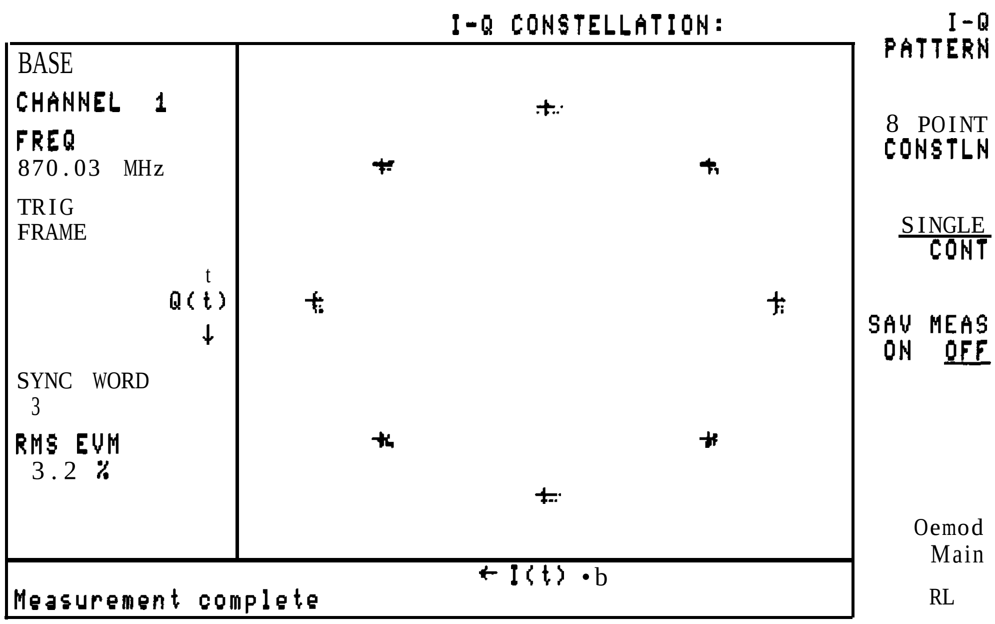
I-Q PATTERN Pressing the **I-Q PATTERN softkey** causes a measurement to be made (if **SAV MEAS ON OFF** is set OFF) and the corresponding I-Q pattern to be displayed on the screen (see screen below). The RMS EVM value is also displayed. First the amplitude of the signal is checked and the analyzer reference 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.



I-Q Pattern Screen Display

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 8 point constellation I-Q pattern to **be** displayed on the screen (see screen below). 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 8 point constellation from the last measurement. The RMS EVM value is also displayed.



8 Point Constellation Screen Display

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. **SINGLE CONT** is automatically set to SINGLE when entering the graphs menu.

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 NADC 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.

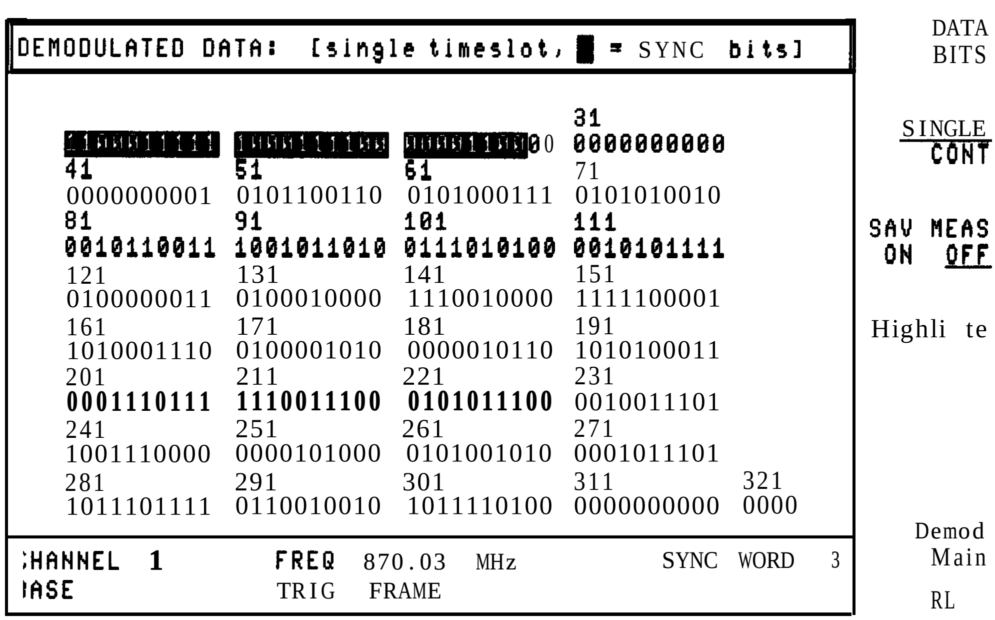
The Data Menu Map

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

† **Appears only when TRANSMIT BS, IS-136, and 1900 MHz are selected.**

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 (see screen below). 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 28 bit sync word portion of the 324 bit timeslot.



Data Bits Screen Display

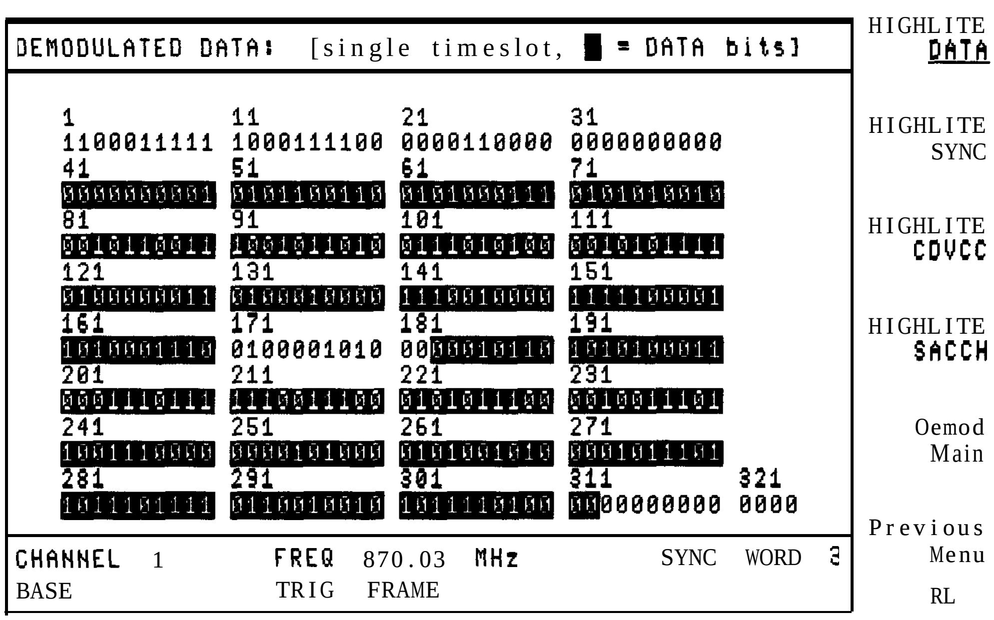
SINGLE CONT If **SINGLE CONT** is set to SINGLE, then pressing **DATA BITS** will produce a single measurement and its corresponding display. If **SINGLE CONT** is set to CONT, then pressing the **DATA** BITS softkey will cause the measurement to be made and displayed continuously. **SINGLE CONT** is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

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 NADC 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 DATA Pressing the **HIGHLITE DATA** softkey will cause the data portion of the bit sequence to be highlighted. For NADC base stations these would be the 41st to the 170th bits and the 183rd to the 312th bits. Each of these two blocks is 130 bits long (see screen below).



The Highlite Data Screen Display

HIGHLITE SYNC

Pressing the **HIGHLITE SYNC softkey** will cause the sync portion of the bit sequence to be highlighted. For NADC base stations these would be the **1st** to the **28th** bits. This block is 28 bits long (see screen below).

```
DEMODULATED DATA: [single timeslot, █ = SYNC bits]                DATA
                                                                  BITS
                                        31
 1100011111 1000111100 0000110000 0000000000                      SINGLE
 41         51         61         71                              CONT
 0000000001 0101100110 0101000111 0101010010
 81         91         101        111                             SAV MEAS
 0010110011 1001011010 0111010100 0010101111                      ON  OFF
 121        131        141        151
 0100000011 0100010000 1110010000 1111100001                      Highlite
 161        171        181        191
 1010001110 0100001010 0000010110 1010100011
 201        211        221        231
 0001110111 1110011100 0101011100 0010011101
 241        251        261        271
 1001110000 0000101000 0101001010 0001011101
 281        291        901        311         321
 1011101111 0110010010 1011110100 0000000000 eOOO                 Demod
                                                                  Main
CHANNEL 1        FREQ 870.03 MHz          SYNC WORD 3
BASE             TRIG FRAME                                       RL
```

The Highlite Sync Screen Display

HIGHLITE CDVCC

Pressing the **HIGHLITE CDVCC softkey** will cause the CDVCC (Coded Digital Verification Color Code) portion of the bit sequence to be highlighted. For NADC base stations these would be the **171st** to the **182nd** bits. This block is 12 bits long (see screen below).

```
DEMODULATED DATA: [single timeslot, █ = CDVCC bits]               HIGHLITE
                                                                  DATA
                                   21         31
 2100011111 200111100  0000110000 0000000000                      HIGHLITE
 41         51         61         71                              SYNC
 0000000001 0101100110 0101000111 0101010010
 81         91         101        111                             HIGHLITE
 0010110011 1001011010 0111010100 0010101111                      CDVCC
 121        131        141        151
 0100000011 0100010000 1110010000 1111100001                      HIGHLITE
 161        171        181        191                             SACCH
 1010001110 0100001010 0000010110 1010100011
 201        211        221        231
 0001110111 1110011100 0101011100 0010011101                      Demod
 241        251        261        271                             Main
 1001110000 0000101000 0101001010 0001011101
 281        291        301        311         321
 1011101111 0110010010 1011110100 0000000000  0000                Previous
                                                                  Menu
CHANNEL 1        FREQ 870.03 MHz          SYNC WORO 3
BASE             TRIG FRAME                                       RL
```

The Highlite CDVCC Screen Display

HIGHLITE SACCH Pressing the **HIGHLITE SACCH** softkey will cause the SACCH (Slow Associated Control Channel) portion of the bit sequence to be highlighted. For NADC base stations these would be the 29th to the 40th bits. This block is 12 bits long. See the screen display below.

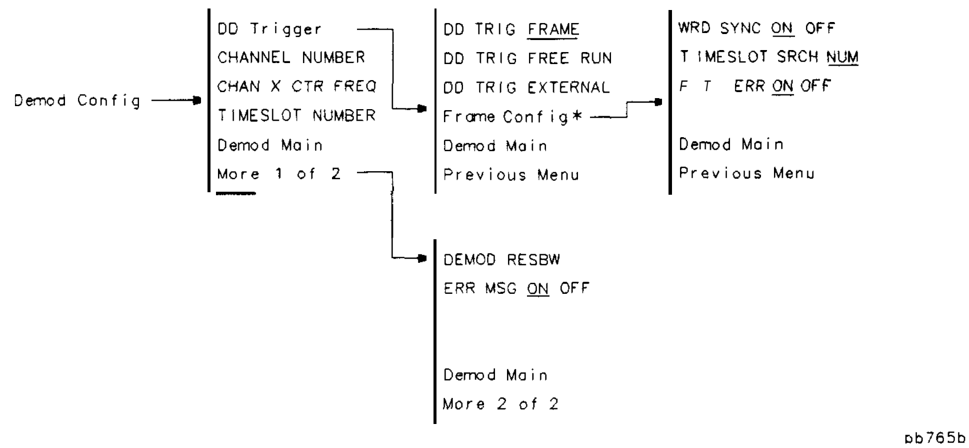
```
DEMODULATED DATA:  [single timeslot, █ = SACCH bits]            HIGHLITE
                                                                    DATA
 1           11          21          31
 1100011111  1000111100  0000110000  0000000000                 HIGHLITE
 41          51          61          71                             SYNC
 0000000001  0101100110  0101000111  0101010010
 81          91          101         111                        HIGHLITE
 0010110011  1001011010  0111010100  0010101111                    CDVCC
 121         131         141         151
 0100000011  0100010000  1110010000  1111100001                 HIGHLITE
 161         171         181         191                           SACCH
 1010001110  0100001010  0000010110  1010100011
 201         211         221         231
 0001110111  1110011100  0101011100  0010011101                    Oemod
 241         251         261         271                            Main
 1001110000  0000101000  0101001010  0001011101
 281         291         301         311         321
 1011101111  0110010010  1011110100  0000000000  0000           Previous
                                                                    Menu
CHANNEL  1        FREQ  870.03  MHz      SYNC WORD  3
BASE              TRIG  FRAME                                        RL
```

The Highlite SACCH Screen Display

HIGHLITE CDL Pressing **HIGHLITE CDL** will cause the Coded Digital Control (CDL) portion of the bit sequence to be highlighted. For NADC base stations, these are the 314th through the 324th bits. This block is 11 bits long. NOTE: **HIGHLITE CDL** is only available when IS-136 800 MHz or IS-136 1900 MHz is selected.

The Demodulation Configuration Menu

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



The Demodulation Configuration Menu Map

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

The Demodulation Configuration Menu Softkeys

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

CHANNEL NUMBER Changes the center frequency of the spectrum analyzer to the frequency of the current channel, and then allows you to enter the channel number for the NADC channel you want to measure. This softkey is identical to the **CHANNELNUMBER** 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.

TIMESLOT NUMBER Pressing the **TIMESLOT 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 **TIMESLOT NUMBER** softkey in the physical channel menu.

DEMOD RESBW Allows the end user to set the digital demod resolution bandwidth to 300 kHz, 1 MHz, and 3 MHz. This setting will be separate from the resolution bandwidth.

It will only be used during a digital demod function. Changes in the resolution bandwidth will not affect the digital demod resolution bandwidth.

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 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 Demodulation 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 psuedo 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 back panel of the instrument. 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 only accessible when the trigger has been set to FRAME.

The Frame Configuration Menu Softkeys

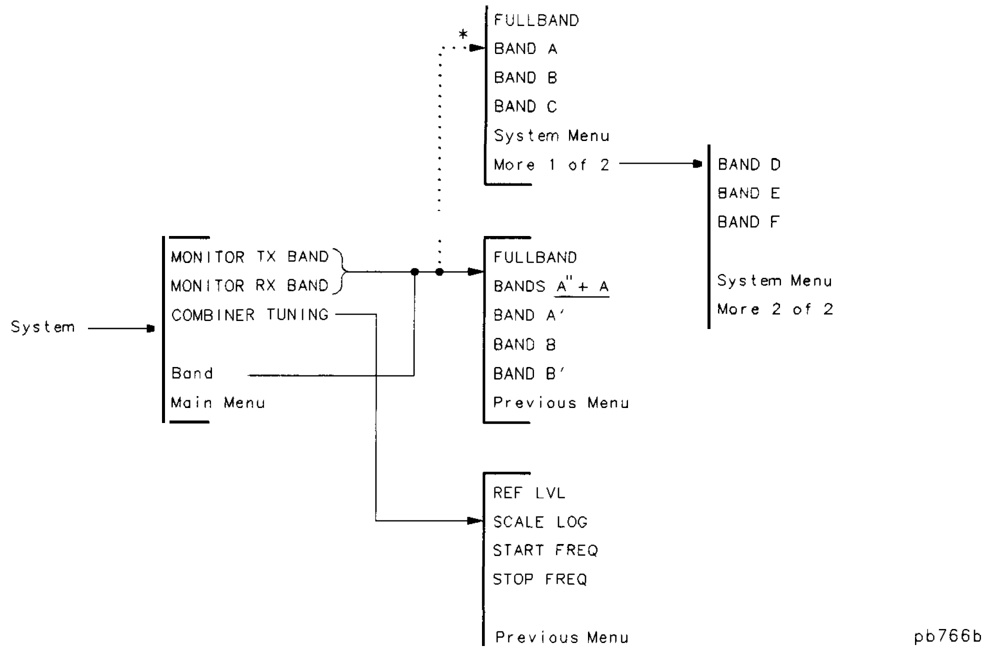
WRD SYNC ON OFF — If WRD SYNC ON OFF is set to ON, the frame trigger acquisition algorithm will include searching for a sync word. The TIMESLOT SRCH NUM softkey (see below) and the TIMESLOT NUMBER softkey in the Demod Config menu determine which sync word is searched for. The frame trigger will be positioned 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. If WRD SYNC ON OFF is set to OFF when trigger is set to FRAME, a frame trigger acquisition failure message will be reported unless you set the FT ERR ON OFF softkey to OFF. 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 **TIMESLOT 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 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.

The System Menu

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



The System Menu Map

* **Appears only when IS-136 1900 MHz is selected.**

Note The frequencies in the tables following are based upon IS-54 and IS-136. The actual band edge frequencies used give a wider span than the specification in order to detect carriers at the band edges.

The System Menu Softkeys

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

Table 7-3. Transmit Bands, Base Station (Cellular)

Softkey Label	Analyzer Frequency Range (in MHz)
FULLBAND	869.010 to 893.970
BANDS A'' + A	869.010 to 879.990
BAND A'	890.010 to 891.480
BAND B	880.020 to 889.980
BAND B'	891.510 to 893.970

Table 7-4. Transmit Bands, Base Station (PCS)

Softkey Label	Analyzer Frequency Range (in MHz)
FULLBANI	1930.050 to 1989.990
BAND A	1030.050 to 1945.050
BAND B	1950.000 to 1965.030
BAND C	1974.990 to 1989.990
BAND D	1944.990 to 1950.030
BAND E	1965.000 to 1970.040
BAND F	1970.010 to 1975.050

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

Table 7-5. Receive Bands, Base Station (Cellular)

Softkey Label	Analyzer Frequency Range (in MHz)
FULLBAND	824.010 to 848.970
BANDS A" + A	824.010 to 834.990
BAND A'	845.010 to 846.480
BAND B	835.020 to 844.980
BAND B'	846.510 to 848.970

Table 7-6. Receive Bands, Base Station (PCS)

Softkey Label	Analyzer Frequency Range (in MHz)
FULLBAND	1850.010 to 1909.960
BAND A	1850.010 to 1865.010
BAND B	1869.960 to 1884.990
BAND C	1894.950 to 1909.950
BAND D	1864.050 to 1869.990
BAND E	1884.960 to 1890.000
BAND F	1889.970 to 1895.010

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 or bands that you want to view by using the softkeys that are accessed by **Band**. The NADC 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 following descriptions for more information about the softkeys accessed by **COMBINER TUNING**.

Band Allows you to select all of the bands, or a particular band. After you have selected a band or bands with the **Band** softkeys, press **MONITOR TX BAND** to view the transmit bands, **MONITOR RX BAND** to view the receive bands, or **COMBINER TUNING**. Press **Band** to access **FULLBAND**, **BANDS A' ' + A**, **BAND A'**, **BAND B**, and **BAND B'**. Turning off the spectrum analyzer or pressing (PRESET) does not change the current band selection. See Table 7-3 and Table 7-5 for the 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.

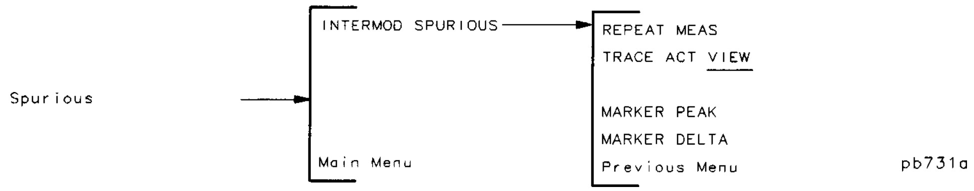
SCALE LOG Allows you to change the number of dB per division. **COMBINER TUNING** changes the scale to 2 dB per division, but you can press **SCALE LOG**, and then use the step keys or data keys to enter the desired dB per division.

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

Press **Spurious** to access' **INTERMOD SPURIOUS** . **INTERMOD SPURIOUS** allows you to measure the intermodulation products created by the transmitter.



The Spurious Measurement Menu Map

The specified limits for the intermodulation spurious measurement can be changed remotely. See "Customizing the NADC Personality" in Chapter 5 for more information.

The Spurious Menu Softkeys

INTERMOD SPURIOUS Measures the intermodulation products generated by two transmitters. lb measure the intermodulation products, there should be two carriers present, spaced at least 600 kHz apart. You must also ensure that the amplitude levels of the carriers are within 10 dB of each other. For the intermodulation spurious emissions measurement, the NADC measurements personality does the following:

1. Determines the carrier with the highest power level and the number of carriers present; this determines the optimal settings for the reference level and input attenuation. The carrier spacing is then determined.
2. Places the delta marker on the highest intermodulation product.

If only one carrier is found, the NADC personality assumes that the carrier is the lower carrier and that the spacing is 1 MHz. (Because one signal should not generate any intermodulation products, you can use one carrier to determine the measurement dynamic range as limited by spurious emissions or spectrum analyzer noise.)

Pressing **INTERMOD SPURIOUS** measures the intermodulation products and accesses the following softkeys.

The Intermodulation Spurious Post-Measurement Menu Softkeys

REPEAT MEAS Repeats the measurement.

TRACE ACT VIEW Allows you to select whether the trace is in the active mode or view mode. Upon completion of the intermodulation measurement, the trace is placed in view (VIEW) mode. In the view mode, the trace data is not updated. To view an active trace (a trace that is continuously updated) press TRACE ACT VIEW so that ACT is underlined.

MARKER PEAK Activates a marker that is placed on the peak amplitude signal. The amplitude and frequency of the marker is displayed on the spectrum analyzer display.

MARKER DELTA Activates a delta marker. A delta marker shows the difference in frequency and amplitude between the reference level and the marker that was placed on the intermodulation product.

8

Mobile Station Menu Map and Softkey Descriptions

This chapter contains menu maps and definitions of the softkeys for mobile station testing. The definitions for the softkeys are listed as they appear within a menu, and the NADC 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.

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.

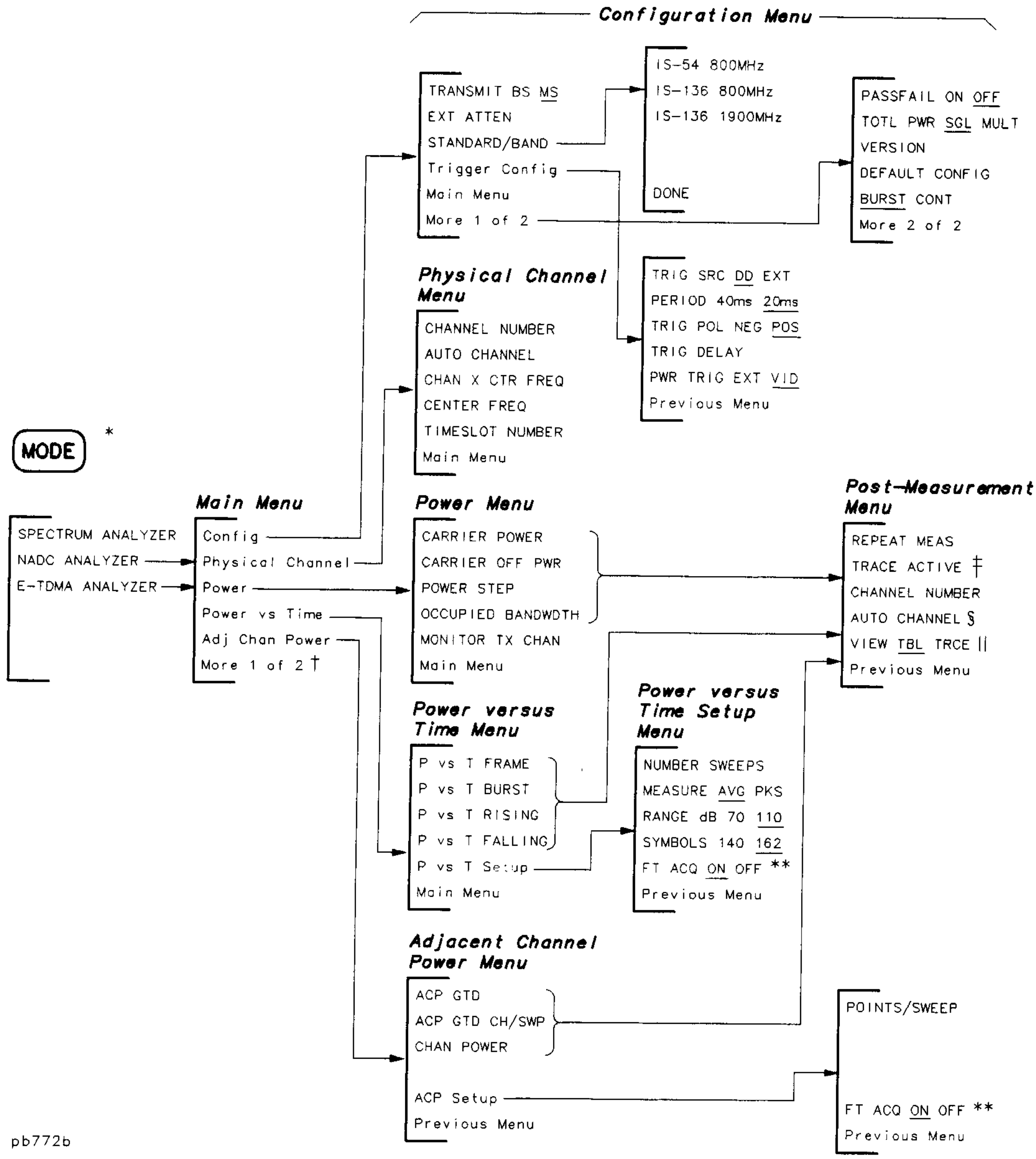
Graphs menu
Pressing **Graphs** accesses the graphs menu.

Data menu
Pressing **Data** accesses the data menu.

Demod config menu
Pressing **Demod Config** accesses the digital demodulator configuration menu.

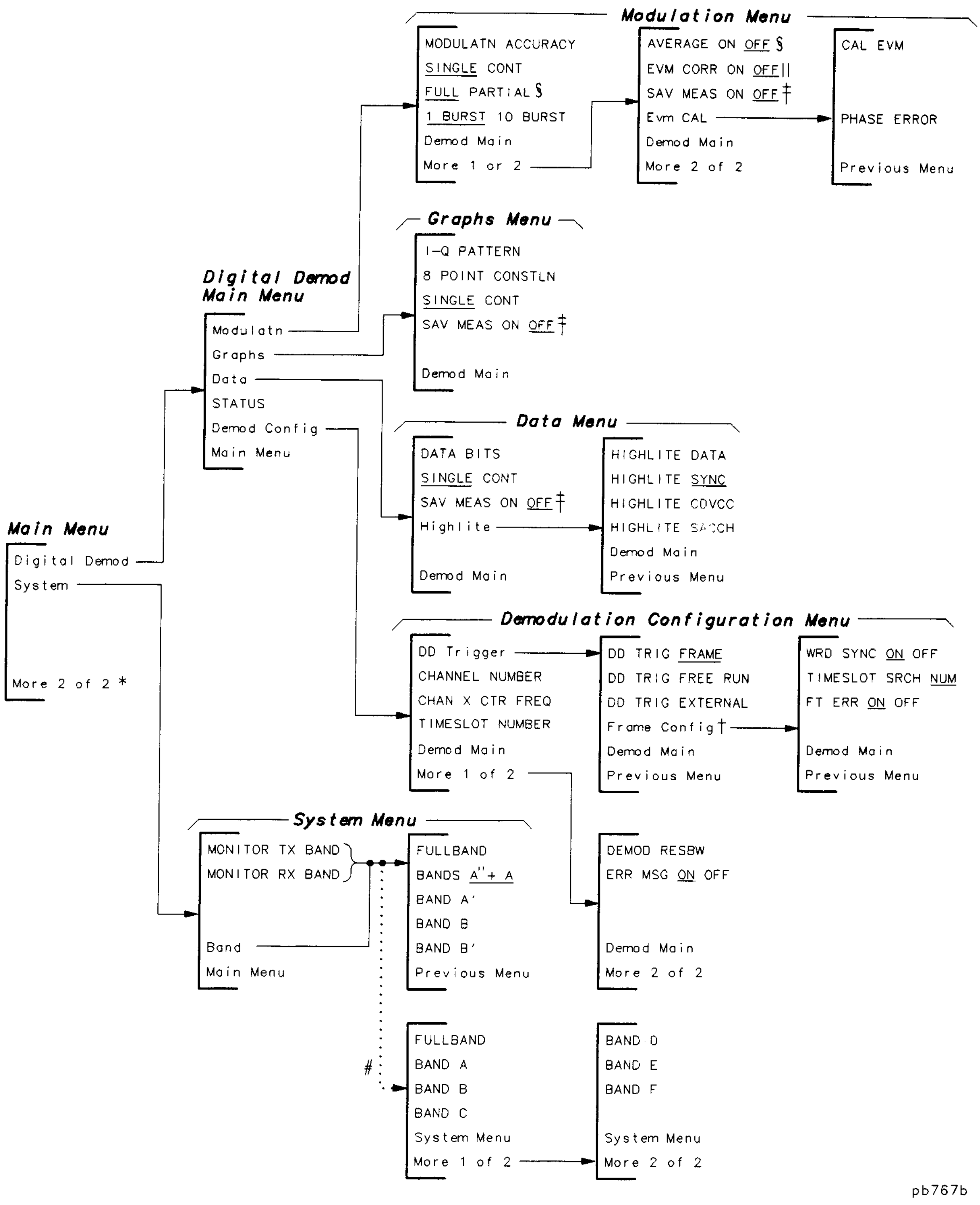
Status screen
Pressing **STATUS** allows you to examine the digital demodulator measurement status screen. The status screen is described in detail in Chapter 6.

Mobile Station Menu Map



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 NADC menu.
- † See the following page for the digital demod and system menus.
- ‡ When you press TRACE ACTIVE, the softkey label changes to TRACE COMPARE.
- § Becomes TRIG DELAY for a power versus time measurement.
- || VIEW TBL TRCE is only available with the adjacent channel power (ACP GTD) measurement. VIEW TBL TRCE changes to GATE ON OFF when TRACE ACTIVE is pressed. For a power versus time measurement, DISPLAY TOP BOT is displayed if the trace is active.
- ** Appears only when TRIG SRC DD EXT is set to DD.



Mobile Station Menu Map (continued)

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

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

‡ Refer to the SAV MEAS ON OFF softkey description.

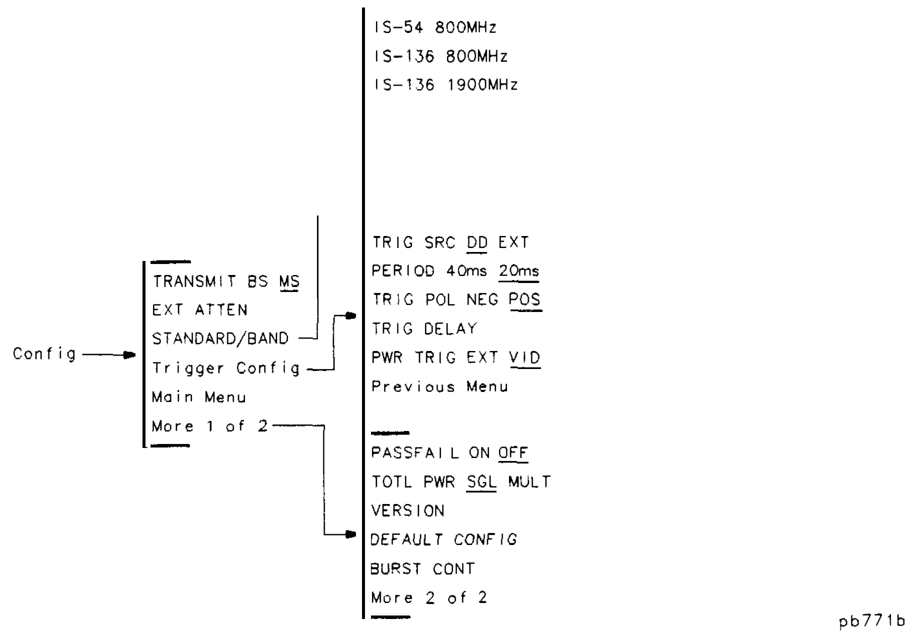
§ These softkeys are blanked when 1 BURST 10 BURST is set to 10 BURST.

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

Appears only when IS-136 1900 MHz is selected.

The Configuration Menu

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



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 enter 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, π/4-DQPSK, base-station carrier as the input to the spectrum analyzer. If MS is underlined, the personality assumes that there is a burst, π/4-DQPSK, mobile-station carrier as the input to the spectrum analyzer. The selection of base station or mobile station changes some of the NADC 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. Use attenuation to cause the the amplitude readouts to 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.

STANDARD BAND Allows you to select either IS-54 or IS-136 standard in the test. IS-136 is the newer standard that has the 1900 MHz tuning plan and the Digital Control Channel (CDL).

IS-54 800 MHz Selects IS-54 standard at 800 MHz band.

IS-136 800 MHz Selects IS-136 standard at 800 MHz band.

IS-136 1900 MHz Selects IS-136 standard at 1900 MHz band.

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

PASSFAIL ON OFF Allows you to choose "pass" and "fail" messages to be displayed or blanked 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.

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.

VERSION Displays the version of the NADC measurements personality, and the version of the Electronics Industry Association (EIA) and Telecommunications Industry Association (TIA) standard documents that were used to derive the NADC 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 151/161 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 (PCS).
- **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 A” + A.
- **EVM CORR ON OFF** is set to OFF

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.

The Trigger Configuration Menu Softkeys

TRIG SRC DD EXT Allows you to select the trigger source for power vs time and 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 frame 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 frame trigger output of the Option 151/161 digital demodulator hardware. The personality sets internal delay parameters differently between the DD and EXT settings.

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

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 151/161 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 PUS 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.

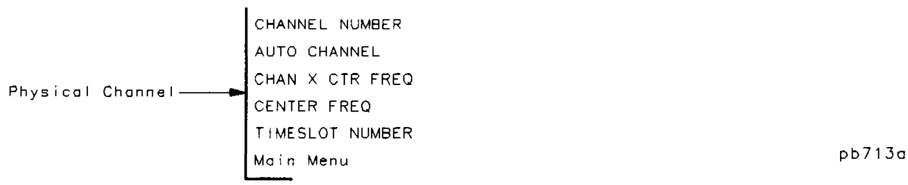
Setting TRIG **SRC DD** EXT to DD will automatically set **TRIG POL POS NEG** to POS.

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 + 3,000 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 +2,300 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.

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 carrier 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.

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.



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 NADC channel you want to measure. The NADC 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**. You can enter a channel number from 1 to 1023, inclusive. If you do not enter a channel number the channel number defaults to channel 1. You can determine the center frequency for a given channel with the following equation:

Transmitter	Channel Number	Center Frequency (MHz)
Mobile	$1 \le N \le 799$	0.03N + 825.00
	$990 \le N \le 1023$	0.03(N − 1023) + 825.000

AUTO CHANNEL Automatically tunes to the channel having the highest carrier power level.

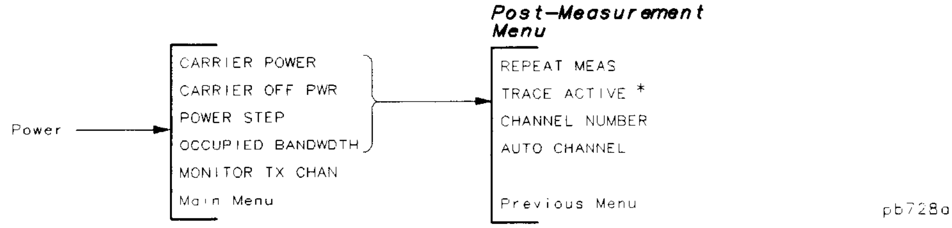
CHAN X CTR FREQ Changes the center frequency of the spectrum analyzer to the frequency of the current channel "X," and then allows you to enter the frequency of any arbitrary channel that you want to measure. **CHAN X CTR FREQ** can be helpful if you know the channel's frequency but not the channel number, 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."

CENTER FREQ Allows you to change the center frequency of the spectrum analyzer temporarily. NADC personality measurements will always use the channel setting defined by **CHANNEL NUMBER** or **CHAN X CTR FREQ**.

TIMESLOT NUMBER Allows you to select the timeslot number of the burst that you want to measure. The timeslot number is used to select the burst for the carrier power, carrier off power, adjacent channel power, power vs. time 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 timeslot number 1, regardless of the actual timeslot number being used by the mobile station. If the trigger is obtained from the rear-panel frame trigger output, the base simulator, or another piece of test equipment, you can set the timeslot number from 1 to 6, inclusive. The default value for the timeslot number is 1.

The Power Menu

Pressing Power accesses the softkeys that allow you to measure the transmitter's carrier 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" (located at the end of this chapter) for more information about the softkeys that the power menu softkeys access.



The Power Measurement Menu Map

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

Table 8-1 shows the spectrum analyzer settings for each of the power measurements. The NADC measurements personality automatically sets the spectrum analyzer settings for each of the power measurements.

Table 8-1. Spectrum Analyzer Settings for the Mobile Station Power Measurement

Spectrum Analyzer Setting	CARRIER POWER	CARRIER OFF PWR	POWER STEP	OCCUPIED BANDWDTH	MONITOR TX CHAN
Span	0 Hz	0 Hz	0 Hz	80 kHz	500 kHz
Resolution bandwidth	100 kHz	30 kHz	100 kHz	1 kHz	10 kHz
Video bandwidth	100 kHz	30 kHz	100 kHz	10 kHz	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 40ms20ms If PERIOD 40ms20ms is set to 20 ms, the shorter sweep time is used. If PERIOD 40ms20ms 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 NADC Personality" in Chapter 5 for more information.

The Power Menu Softkeys

CARRIER POWER Measures the mean power of the carrier envelope. The average power of several sweeps is used in calculating the carrier power level. The default number of sweeps is 4. For a burst transmission, **CARRIER POWER** measures the mean power of the transmitter carrier envelope during a burst transmission (when the burst is "on"). This measurement determines the mean carrier power between the -23 dBc points referenced from the peak of the burst.

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

CARRIER OFF PWR Measures the mean and peak power when the carrier is off. The average data from several sweeps is used in calculating the carrier off power levels. The default number of sweeps is 2. Measures the mean and peak power of the carrier when the carrier is off (the carrier is off between burst transmissions). The mean power is measured by determining the mean power in the region between the points that are + 10 dB above the minimum carrier level. The peak power is measured by making the measurement 25 μs inside these + 10 dB points. The average data from several bursts (the default number of bursts is 2) is used in calculating the mean carrier off power level and the peak carrier off power level.

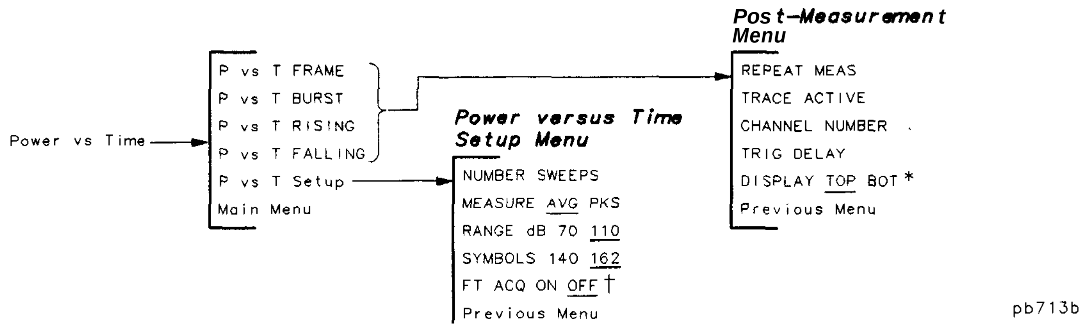
POWER STEP Allows you to view the output power from a transmitter as you increase or decrease the power. If you press **POWER STEP**, and **PWR TRIG EXT VID** is set to the video trigger mode (VID), the spectrum analyzer will not sweep until the carrier is turned on or the carrier power level is increased. 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.

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

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

The Power versus Time Menu

Pressing **Power vs Time** accesses the **softkeys** that allow you to measure or to examine the NADC burst structure. The power versus time functions allow you to view the full NADC frame, the burst waveform, the rising edge of the burst, or the falling edge 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 result of any of the power versus time measurements is both the graphical display of the NADC burst and numerical results.



The Power versus Time Measurement Menu Map

* Appears only if the trace is active.

† **Only present if TRIG SRC DD EXT is set to DD.**

Table 8-2 shows the spectrum analyzer settings for each of the power versus time measurements. The NADC 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 8-2. Spectrum Analyzer Settings

Spectrum Analyzer setting	P vs T FRAME	P vs T BURST	P vs T RISING	P vs T FALLING
Span	0 Hz	0 Hz	0 Hz	0 Hz
Resolution bandwidth	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 NADC Personality” in Chapter 5 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 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 -20 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 of the burst. (The attack time is the time it takes the rising edge of the burst to transition from -60 dBm to -20 dBc.) The rising edge waveform is also compared to limit lines.

P vs T FALLING — Measures the release time of the falling edge of the burst. (The release time is the time it takes the falling edge of the burst to transition from -20 dBc to -60 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 softkeys. 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 — This is selected 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 settings.)

SYMBOLS 140 162 — 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 **SYMBOLS 140 162** is set to 140, the limit lines and measurement limits are set for a "short" burst of 140 symbols per burst. If **SYMBOLS 140 162** is set to 162, the limit lines and measurement limits are set for the normal 162 symbols per burst. The default for this function is 162 symbols per burst.

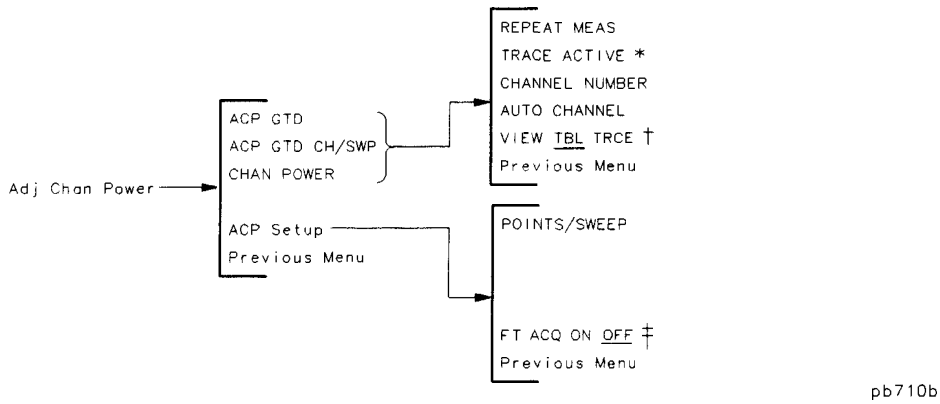
FT ACQ ON OFF

If **FT ACQ ON OFF** is set to ON, the personality will include a digital demodulator frame trigger acquisition prior to making power versus time measurements. If **FT ACQ ON OFF** is set to OFF, the measurement will not include the frame trigger acquisition.

This softkey is only present when **TRIG SRC 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 (Option 151/161) digital demodulator frame trigger output signal is accurate.

The Adjacent Channel Power Menu

Pressing **Adj Chan Power** accesses the softkeys that allow you to measure the adjacent channel power of the transmitter. (The adjacent channel power determines the leakage power in the 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" (located at the end of this chapter) for more information about the softkeys that the adjacent channel power menu softkeys access.



The Adjacent Channel Power Measurement Menu Map

- * **When you press TRACE ACTIVE, the softkey label changes to TRACE COMPARE.**
- † **VIEW TBL TRCE is only available with the adjacent channel power (ACP GTD) measurement. It changes to GATE ON OFF if TRACE ACTIVE is pressed.**
- ‡ **Only present if TRIG SRC DD EXT is set to DD.**

Table 8-3 shows the spectrum analyzer settings for each of the adjacent channel power measurements. The NADC measurements personality automatically sets the spectrum analyzer settings for each of the adjacent channel power measurements. Note that 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 8-3. Spectrum Analyzer Settings

Spectrum Analyzer Setting	ACP GTD	ACP GTD CH/SWP	CHAN POWER
Span	240 kHz	32.8 kHz	32.8 kHz
Resolution bandwidth	1 kHz	1 kHz	1 kHz
Video bandwidth	3 kHz	3 kHz	3 kHz
Sweep time	8 s or 16 s*	8 s or 16 s*	8 s or 16 s*
Detector	Gated positive	Gated Positive	Sample
Trigger mode	Free Run	Free Run	Free Run

* The sweep time depends upon the current setting for **PERIOD 40ms20ms**. If PERIOD **40ms20ms** is set to 20 ms, the shorter sweep time is used. If **PERIOD 40ms20ms** 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 NADC Personality" in Chapter 5 for more information.

The Adjacent Channel Power Menu Softkeys

ACP GTD Measures the power in the transmitted channel, as well as the power in the upper and lower adjacent, first alternate, and second alternate channels. **ACP GTD** uses time-gated spectrum analysis to separate out the spectrum due to modulation from the full spectrum due to modulation and ramping (contains switching transients). The personality uses the spectrum analyzer peak detector and a 32.8 kHz integration bandwidth to measure the power in the adjacent channels. The signal is filtered with a square root raised cosine filter prior to integration. The measurement performs two measurement sweeps. 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.

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, first alternate, and second alternate channels. 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.

CHAN POWER Measures the total power in the channel. The personality uses the spectrum analyzer peak detector and an 32.8 kHz integration bandwidth to measure the power in the channel. The signal is filtered with a square root raised cosine filter prior to integration. The number of data points used for the channel power measurement depend on the value of **POINTS/SWEEP**.

ACP Setup Allows you to set up the number of measurement points to be used for the **ACP GTD CH/SWP** and **CHAN POWER** measurements. Also, it allows you to include digital demodulator frame trigger acquisition prior to making gated ACP measurements.

The ACP Setup Menu Softkeys

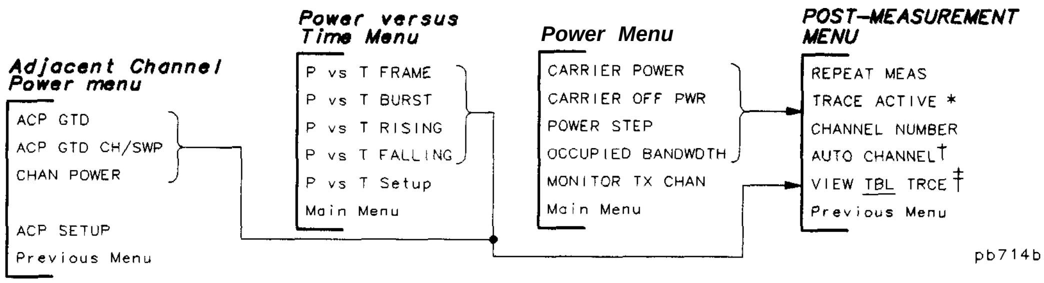
POINTS/ SWEEP Allows you to specify the number of measurement "points" to be used for the **ACP GTD CH/SWP** and **CHAN POWER** measurements. Every time the spectrum analyzer takes a measurement sweep, the data from the measurement sweep is placed into a trace. Usually, 401 data points (also called trace elements) are stored in the trace. You can use **POINTS/SWEEP** to decrease the number of 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.

FT ACQ ON OFF If **FT ACQ ON OFF** is set to ON, the personality will include a digital demodulator frame trigger acquisition prior to making **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 only present 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 (Option 151/161) digital demodulator frame trigger output signal is accurate.

The Post-Measurement Menu

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



The Post-Measurement Menu Map

- * When you press **TRACE ACTIVE**, the softkey label changes to **TRACE COMPARE**.
- † This softkey changes to **TRIG DELAY** for a power versus time measurement.
- ‡ **VIEW TBL TRCE** is only available with the adjacent channel power (**ACP GTD**) measurement. It is blanked if **TRACE ACTIVE** is pressed. For a power versus time measurement, **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 softkey.

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 GTD**), **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 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 +3,000 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 +2,300 μs. If you do not enter a trigger delay, a default value of 0 μs is used.

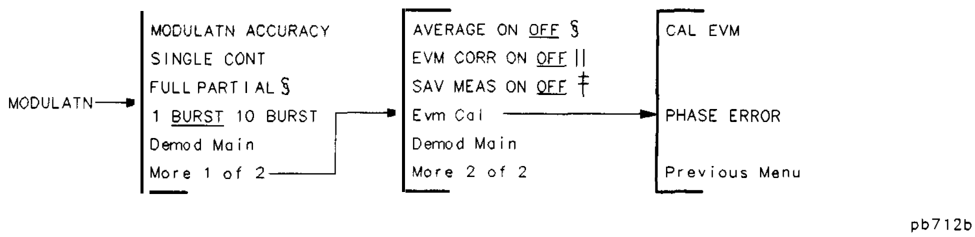
DISPLAY TOP BOT Allows you to view the top (TOP) of the burst or the bottom (BOT) portion of the burst. If **DISPLAY TOP BOT** is set to TOP, the top 70 dB portion of the burst is measured and displayed. If **DISPLAY TOP BOT** is set to bottom (BOT), the bottom 70 dB portion of the burst is measured 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 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).

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, I-Q origin offset, and amplitude droop.



The Modulation Menu Map

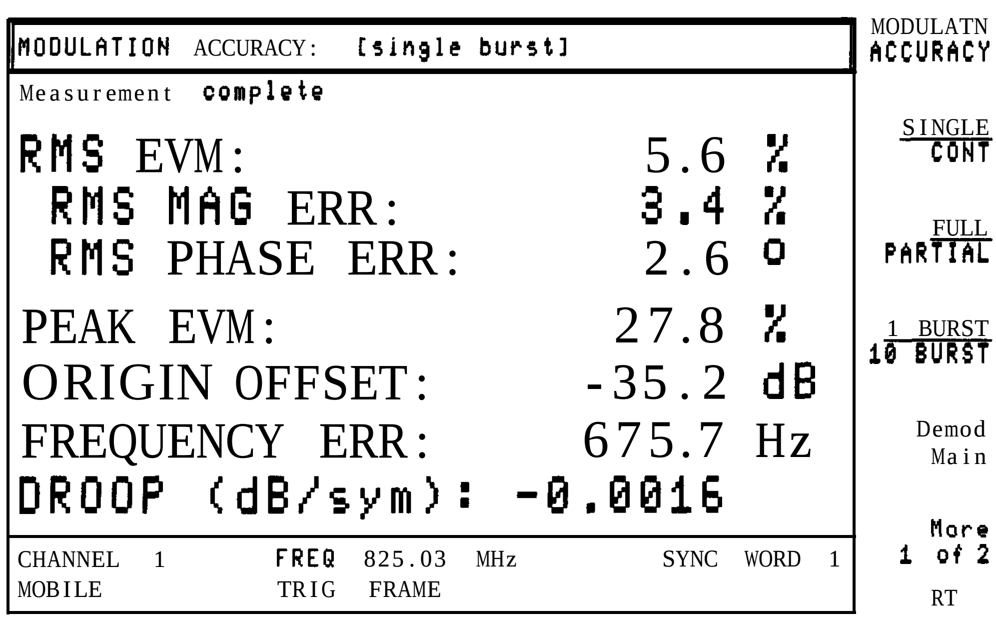
§ **These softkeys are blanked when 1 BURST 10 BURST is set to 10 BURST.**

‡ **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, amplitude droop, and I-Q origin offset. First, the amplitude of the signal is checked and the analyzer reference level and attenuation are set appropriately. Next, if the demod trigger is set to FRAME, the frame trigger is acquired prior to the modulation accuracy measurements. If **SAV MEAS ON** OFF is set to ON, pressing **MODULATN ACCURACY** will display the last mdulation accuracy measurement.



The Normal Modulation Accuracy Screen

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. **SINGLE CONT** is automatically set to SINGLE when entering the modulation menu.

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 and amplitude droop 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. Note that this softkey is present only if the 1 BURST **10 BURST** softkey is set to 1 BURST. 10 BURST measurements are always FULL.

1 BURST 10 BURST If 1 **BURST 10** BURST is set to 1 BURST, then when a measurement is made, it will be over the entire valid portion of the timeslot. If **1 BURST 10 BURST** is set to 10 BURST, then the measurement results will be over the first 10 valid symbols, averaged over 10 separate bursts within a 1 minute period.

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. Note that averaging can only be done if **1 BURST 10 BURST** is set to 1 BURST.

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 (see screen below). 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, carrier frequency error, and amplitude droop are displayed if **FULL PARTIAL** is set to FULL. If FULL **PARTIAL** is set to PARTIAL, the carrier frequency error and amplitude droop will not be displayed.

STATISTICS far sample of 10 bursts:					MODULATN ACCURACY
	Mean	Std dev	Max	Min	SINGLE CONT
RMS EVM (%):	6.1	0.56	6.9	5.3	
RMS HAG ERR (%):	3.3	0.05	3.4	3.2	
RMS PHASE ERR (°):	2.9	0.41	3.5	2.3	FULL PARTIAL
		RMS EVM Uncertainty			
Temp. Range 20-30 °C:	5.9 % > RMS EVM >			3.1 %	
Temp. Range 0-55 °C:	5.8 % > RMS EVM >			1.6 %	1 BURST 10 BURST
		Mean			Oemod Main
ORIGIN OFFSET (dB):		-34.4			
FREQUENCY ERROR (Hz):		675.2			
OROOP (dB/symbol):		-0.0015			More 1 of 2
CHANNEL 1	FREQ 825.03 MHz		SYNC WORD 1		
MOBILE	TRIG FRAME				RT

The Modulation Accuracy Statistics Screen

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. Refer to Chapter 3 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 NADC menu. This softkey is blanked if a measurement has not been made, is aborted, or is an averaged or 10 BURST measurement. Only complete, 1 BURST, non-averaged measurement may be saved.

Evm Cal Pressing **Evm Cal** accesses the EVM calibration menu and also displays the EVM calibration instructions on screen. Refer to Chapter 3 for details on how to do the EVM calibration measurement.

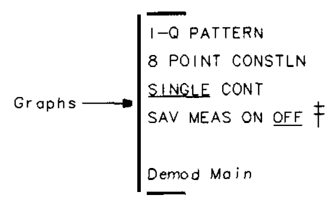
The EVM Calibration Menu Softkeys

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 8 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, amplitude droop, and carrier frequency error removed. Only the RMS EVM contribution remains.

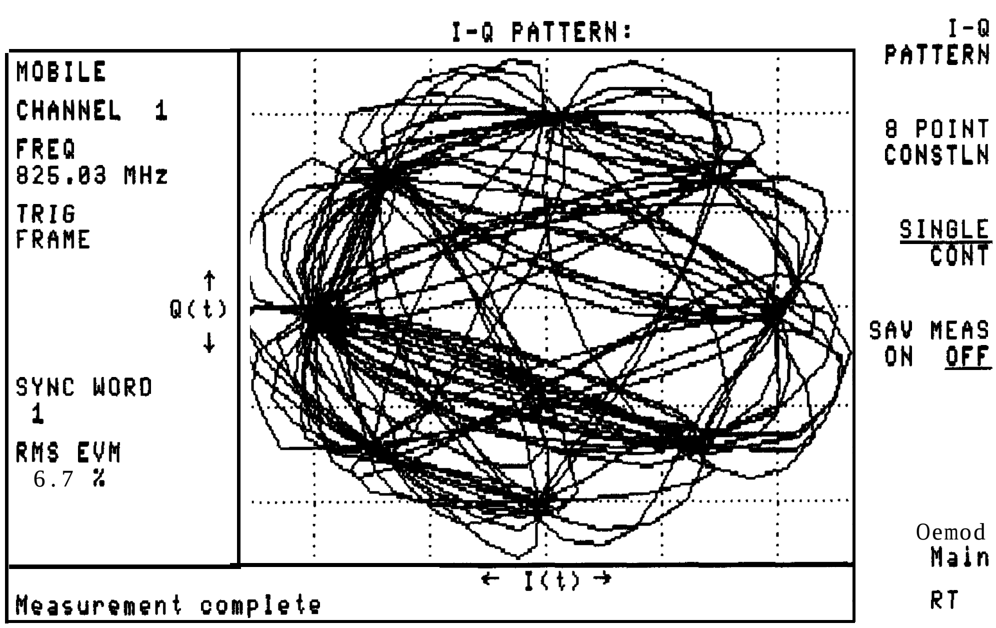


The Graphs Menu Map

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

The Graphs Menu Softkeys

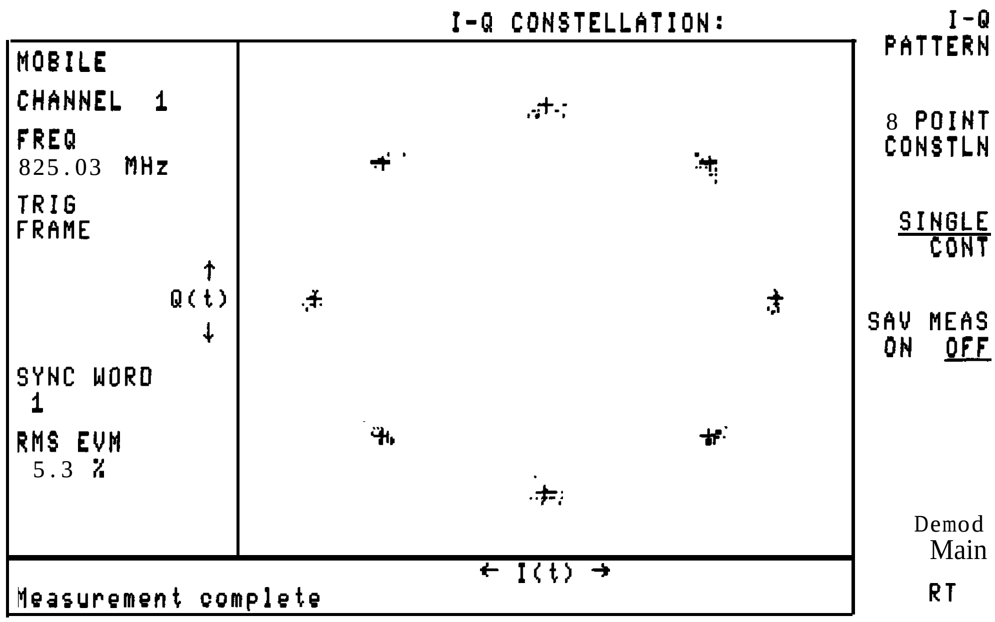
I-Q PATTERN Pressing the **I-Q PATTERN** softkey causes a measurement to be made (if **SAV MEAS ON OFF** is set to OFF) and the corresponding I-Q pattern to be displayed on the screen (see screen below). The RMS EVM value is also displayed. First the amplitude of the signal is checked and the analyzer 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.



I-Q Pattern Screen Display

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 8 point constellation I-Q pattern to be displayed on the screen (see screen below). 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 8 point constellation for the currently stored measurement.



8 Point Constellation Screen Display

SINGLE CONT

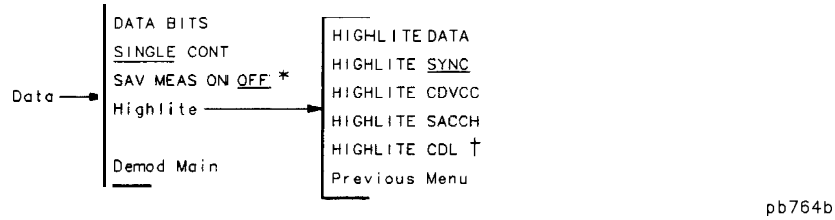
If **SINGLE CONT** is set to SINGLE, then pressing **I-Q PATTERN** or **8 POINT CONSTLN** will produce a single measurement and its corresponding graph. If **SINGLE CONT** is set to CONT, then pressing either measurement softkey will cause the measurement to be made and graphed continuously. **SINGLE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

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 NADC 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.

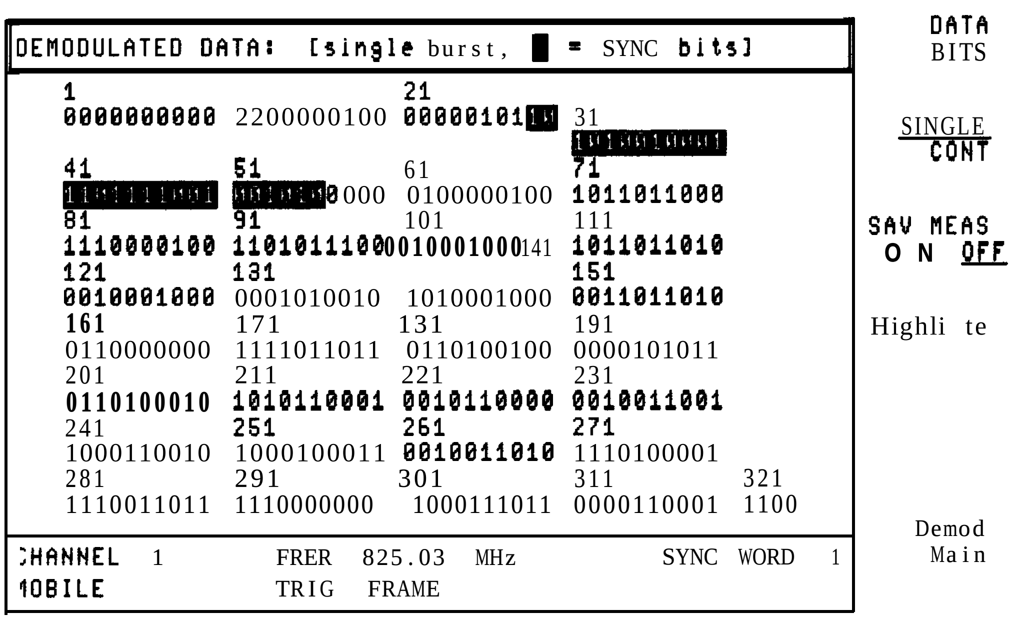


The Data Menu Map

‡ **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 (see screen below). 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 28 bit sync word portion of the 324 bit timeslot.



Data Bits Screen Display

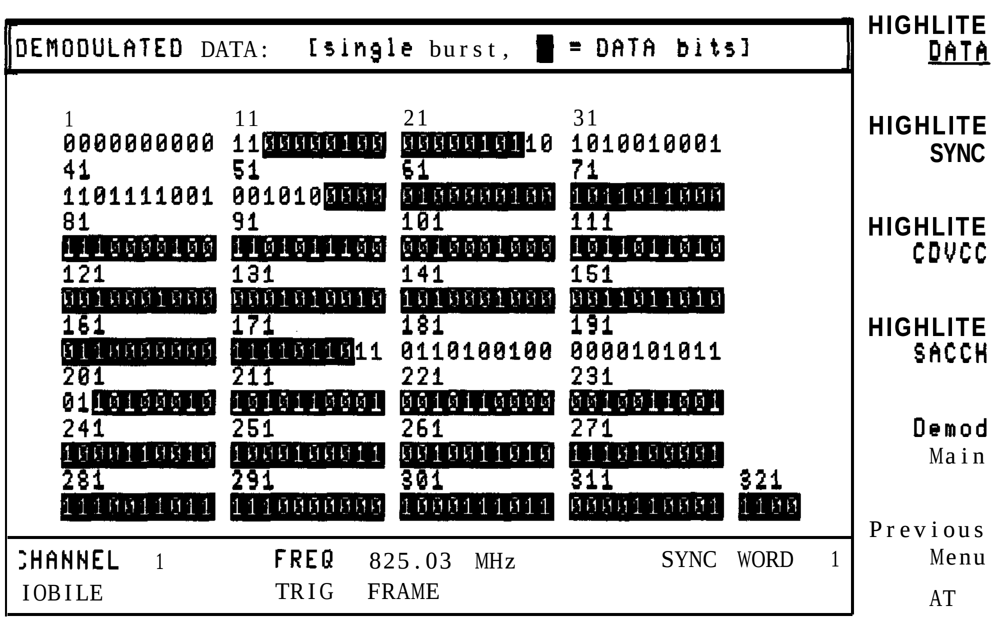
SINGLE CONT If **SINGLE CONT** is set to SINGLE, then pressing **DATA BITS** will produce a single measurement and its corresponding display. If **SINGLE CONT** is set to CONT, then pressing the **DATA BITS** softkey will cause the measurement to be made and displayed continuously. **SINGLE CONT** is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

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 NADC 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.

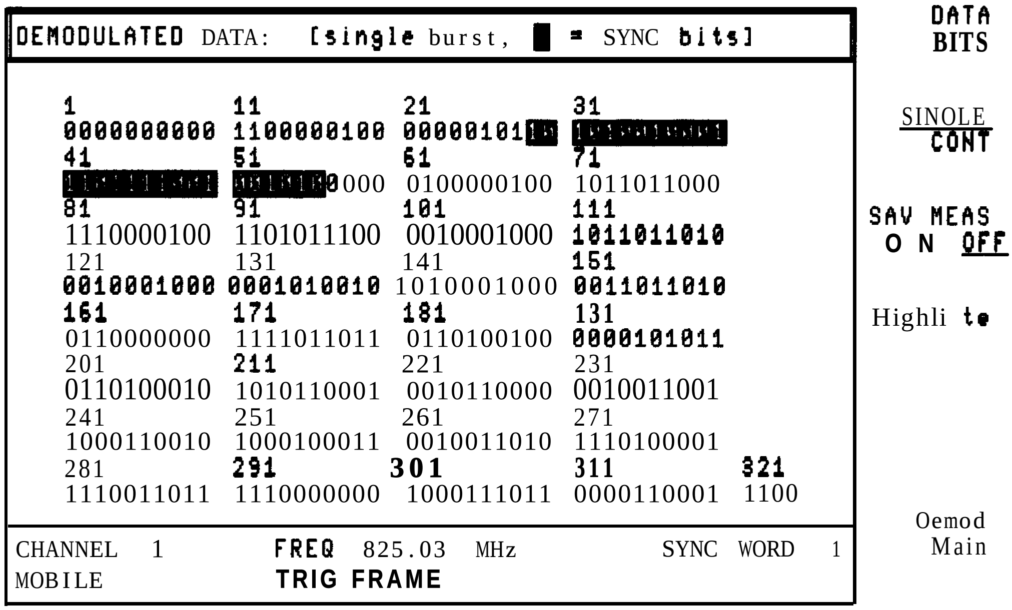
The Highlight Menu Softkeys

HIGHLITE DATA Pressing the **HIGHLITE DATA** softkey will cause the data portion of the bit sequence to be 'highlighted. For NADC mobile stations these would be the 57th to the 178th bits and the 203rd to the 324th bits. Each of these two blocks is 122 bits long (see screen below).



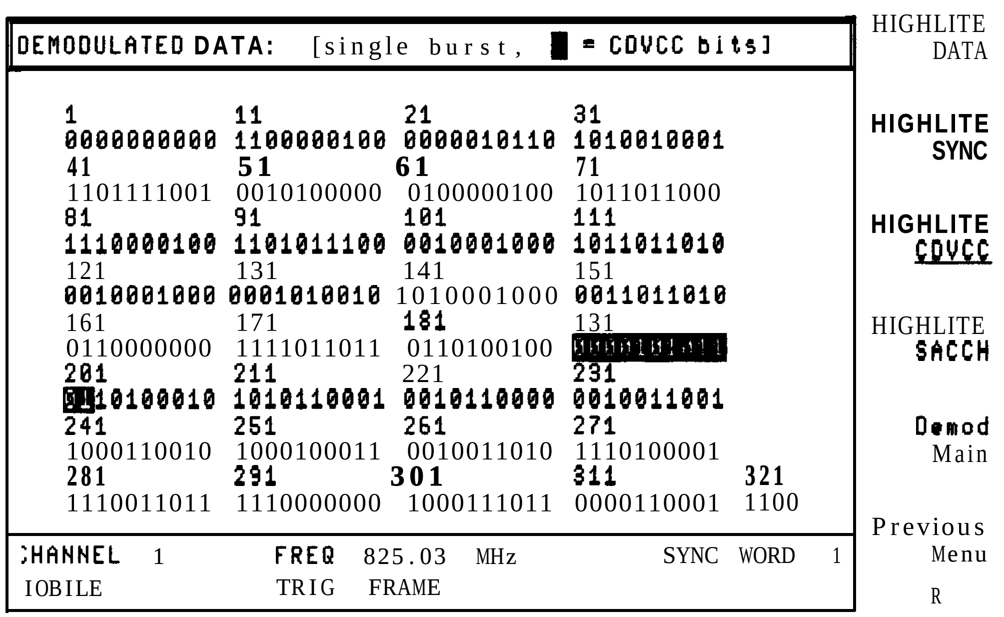
The Highlite Data Screen Display

HIGHLITE SYNC Pressing the **HIGHLITE SYNC softkey** will cause the sync portion of the bit sequence to be highlighted. For NADC mobile stations these would be the 29th to the 56th bits. This block is 28 bits long (see screen below).



The Highlite Sync Screen Display

HIGHLITE CDVCC Pressing the **HIGHLITE CDVCC softkey** will cause the CDVCC (Coded Digital verification Color Code) portion of the bit sequence to be highlighted. For NADC mobile stations these would be the 191st to the 202nd bits. This block is 12 bits long (see screen below).



The Highlite CDVCC Screen Display

HIGHLITE SACCH

Pressing the **HIGHLITE SACCH** softkey will cause the SACCH (Slow Associated Control Channel) portion of the bit sequence to be highlighted. For NADC mobile stations these would be the 179th to the 190th bits. This block is 12 bits long (see screen below).

```
DEMODULATED DATA:   [single burst, █ = SACCH bits]

1          11         21         31
0000000000 1100000100 0000010110 1010010001
41         51         61         71
1101111001 0010100000 0100000100 1011011000
81         91         101        111
1110000100 1101011100 0010001000 1011011010
121        131        141        151
0010001000 0001010010 1010001000 0011011010
161        171        181        191
                      0110100100
0110000000 1111011011 221        0000101011 231
0010100010 2010110001 0010110000 0010011001
241        251        261        271
1000110010 1000100011 0010011010 1110100001
281        231        301        311        321
1110011011 1110000000 1000111011 0000110001 1100

CHANNEL  1       FREQ 825.03 MHz        SYNC WORD 1
MOBILE           TRIG  FRAME
```

HIGHLITE DATA

HIGHLITE SYNC

HIGHLITE CDVCC

HIGHLITE SACCH

Demod Main

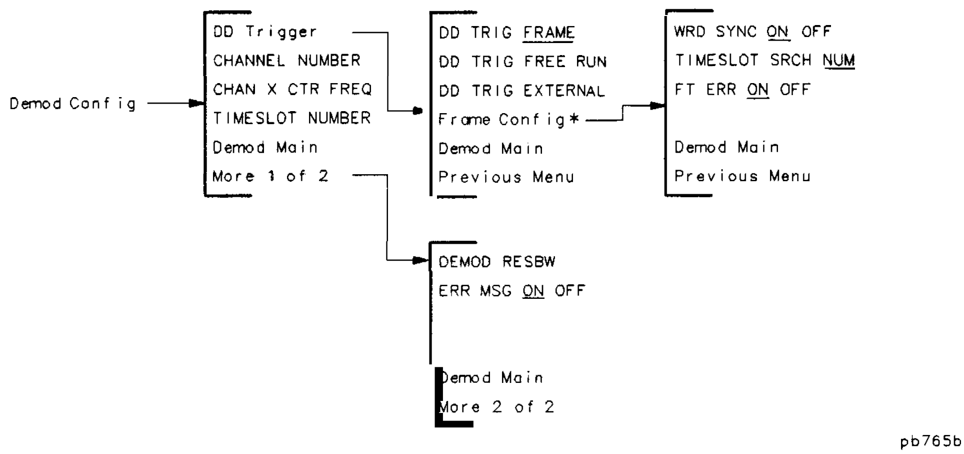
Previous Menu

RT

The Highlite SACCH Screen Display

The Demodulation Configuration Menu

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



The Demodulation Configuration Menu Map

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

The Demodulation Configuration Menu Softkeys

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

CHANNEL NUMBER Changes the center frequency of the spectrum analyzer to the frequency of the current channel, and then allows you to enter the channel number for the NADC 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.

TIMESLOT NUMBER Pressing the **TIMESLOT 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 **TIMESLOT NUMBER** softkey in the physical channel menu.

DEMOD RESBW Allows the end user to set the digital demod resolution bandwidth to 300 kHz, 1 MHz, and 3 MHz. This setting will be separate from the resolution bandwidth.

It will only be used during a digital demod function. Changes in the resolution bandwidth will not affect the digital demod resolution bandwidth.

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 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 Demodulation 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 psuedo 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 back panel of the instrument. If no trigger is present, then the measurement will be delayed indefinitely until a trigger arrives. Selecting the external trigger will cause the **Frame Config** softkey to become unavailable.

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 only accessible when the trigger has been set to FRAME.

The Frame Configuration Menu Softkeys

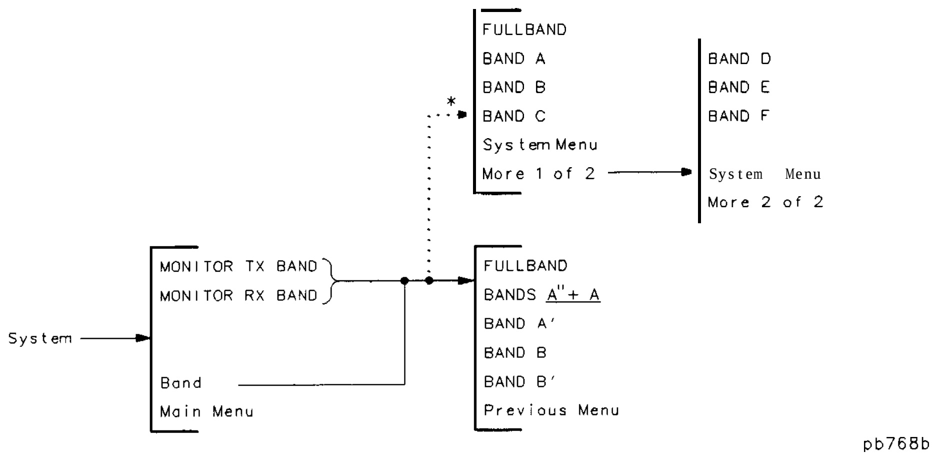
WRD SYNC ON **OFF** If **WRD SYNC ON** OFF is set to ON, the frame trigger acquisition algorithm will include searching for a sync word. Which sync word is searched for is controlled by the **TIMESLOT SRCH NUM** softkey (see below) and the **TIMESLOT NUMBER** softkey in the D**emod Config** menu. The 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. If **WRD SYNC ON OFF** is set to OFF when trigger is set to FRAME, a frame trigger acquisition failure message will be reported unless you set the FT ERR **ON** OFF softkey to OFF. 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 **TIMESLOT 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 going up to 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 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 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.

The System Menu

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



The System Menu Map

* Appears only when **IS-136 1900 MHz** is selected.

The System Menu Softkeys

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

Table 8-4. Transmit Bands, Mobile Station (Cellular)

Softkey Label	Analyzer Frequency Range (in MHz)
FULLBAND	869.010 to 893.970
BANDS A" + A	869.010 to 879.990
BAND A'	890.010 to 891.480
BAND B	880.020 to 889.980
BAND B'	891.510 to 893.970

Table 8-5. Transmit Bands, Base Station (PCS)

Softkey Label	Analyzer Frequency Range (in MHz)
FULLBAND	1930.050 to 1989.990
BAND A	1930.050 to 1945.050
BAND B	1950.000 to 1965.030
BAND C	1974.990 to 1989.990
BAND D	1944.990 to 1950.030
BAND E	1965.000 to 1970.040
BAND F	1970.010 to 1975.050

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

Table 8-6. Receive Bands, Mobile Station (Cellular)

Softkey Label	Analyzer Frequency Range (in MHz)
FULLBAND	824.010 to 848.970
BANDS A" + A	824.010 to 834.990
BAND A'	845.010 to 846.480
BAND B	835.020 to 844.980
BAND B'	846.510 to 848.970

Table 8-7. Receive Bands, Base Station (PCS)

Softkey Label	Analyzer Frequency Range (in MHz)
FULLBANI	1850.010 to 1909.950
BAND A	1860.010 to 1865.010
BAND B	1869.960 to 1884.990
BAND C	1894.950 to 1909.950
BAND D	1864.950 to 1869.990
BAND E	1884.960 to 1890.000
BAND F	1889.970 to 1895.010

Band Allows you to select all of the bands, or a particular a band. After you have selected a band or bands with the **Band** softkeys, you can press either **MONITOR TX BAND**(to view the transmit bands), **MONITOR RX BAND** (to view the receive bands). Pressing Band accesses **FULLBAND**, **BANDS A'' + A**, **BAND A'**, **BAND B**, and **BAND B'**. The band selection is not changed by turning off the spectrum analyzer or pressing (PRESET). See Table 8-4 and Table 8-6 for the a list of the frequencies for the bands.

9

Operating Reference

This chapter contains general information about the operation of the HP 85718B NADC measurements personality:

- Information about the changes to the spectrum analyzer operation caused by the HP 85718B NADC measurements personality.
- The specifications and characteristics for Option 050 and the NADC Cellular/PCS measurements personality.
- The specifications and characteristics for digital demodulation measurements with options 151 and 160 and the HP 85718B NADC measurements personality.
- A tutorial on understanding the EVM accuracy specification.
- Information about the default limit values that affect the pass/fail messages.
- Lists of the recommended accessories and spectrum analyzer options for use with the HP 85718B NADC measurements personality.

Spectrum Analyzer Functions and Annotation

This section contains information about how the NADC measurements personality changes the functions and screen annotation of an HP 8590 Series spectrum analyzer.

Changes to the Spectrum Analyzer Functions During NADC Operation

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

Note If you press SHOW OPTIONS and your spectrum analyzer has Option 050, SHOW OPTIONS does not display Option 050. If you need to check if your spectrum analyzer has an Option 050 installed in it, the "OPT" section of the serial number label on the spectrum analyzer rear panel lists the options that are installed in the spectrum analyzer. Also read the Option 050 information in Chapter 1 "Getting Started".

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

- **AMPTD UNITS** (The NADC measurements personality provides only dBm units.)
- **REF LVL OFFSET** (The NADC measurement personality offsets the reference level whenever a value is entered into the EXT ATTEN function.)
- **VID AVG ON** OFF (The NADC measurements personality uses its own averaging function.)

The following spectrum analyzer functions are changed by the NADC analyzer mode:

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

(FREQUENCY) Depending on the current NADC measurements personality measurement, (FREQUENCY) accesses either the spectrum analyzer frequency functions, or the NADC physical channel menu.

- Press (FREQUENCY) to access the softkeys in the physical channel menu, provided the current NADC measurement is for power, adjacent channel power, power versus time, digital demodulator-based, or monitoring transmit channel.
- Press (FREQUENCY) to access the spectrum analyzer frequency functions if the current NADC function is a system function, or the intermodulation spurious function.

NADC Measurements Personality Screen Annotation

When using the NADC measurements personality, you may have noticed an additional annotation displayed on the spectrum analyzer screen. This additional screen annotation supplies information that is related to the NADC measurements settings. Refer to Figures 9-1, 9-2, and 9-3 and Tables 9-1, 9-2, and 9-3 for an explanation of the screen annotation that is related to the NADC measurements personality.

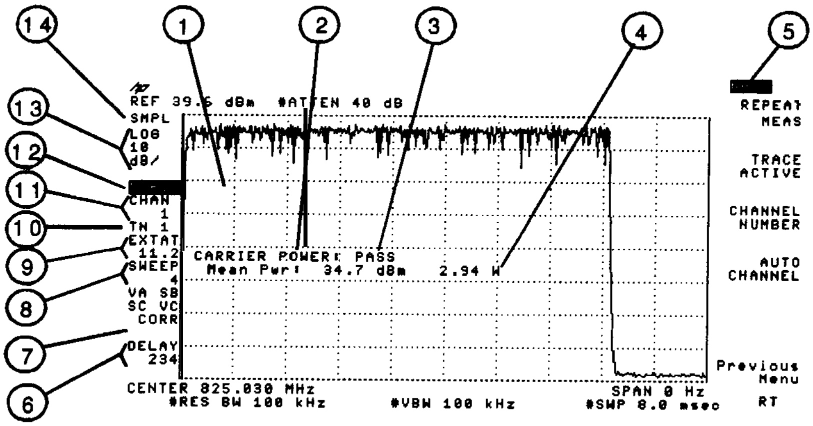


Figure 9-1. NADC Screen Annotation

Table 9-1. NADC Screen Annotation

Item	Display Annotation	Description
1	Active function or error message	Indicates either the active function that has been selected or an error message.
2	Measurement	The current NADC measurement.
3	Pass/fail message	Indicates if the base or mobile station passed or failed the measurement.
4	Measurement results	The measurement results.
5	NADC	Indicates the spectrum analyzer is using the NADC measurements personality (also referred to as the NADC 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	TN	Displays the timeslot 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).

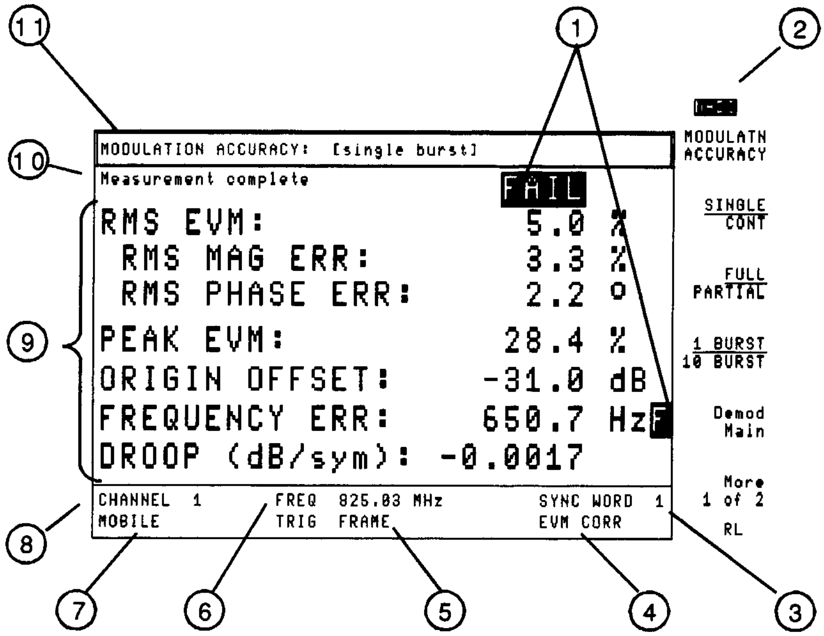


Figure 9-2. Digital Demodulation Screen Annotation 1

Table 9-2. Digital Demodulation Screen Annotation 1

Item	Display Annotation	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 (NADC):	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 center frequency.
7	BASE or MOBILE:	Indicates current setting of TRASMIT BS MS .
8	CHANNEL:	Indicates current channel number.
9	Measurement results:	The measurement results.
10	Messages:	Indicates progress of measurements or flags errors.
11	Measurement:	Indicates the current measurement being performed.

Digital Demodulation Screen Annotation

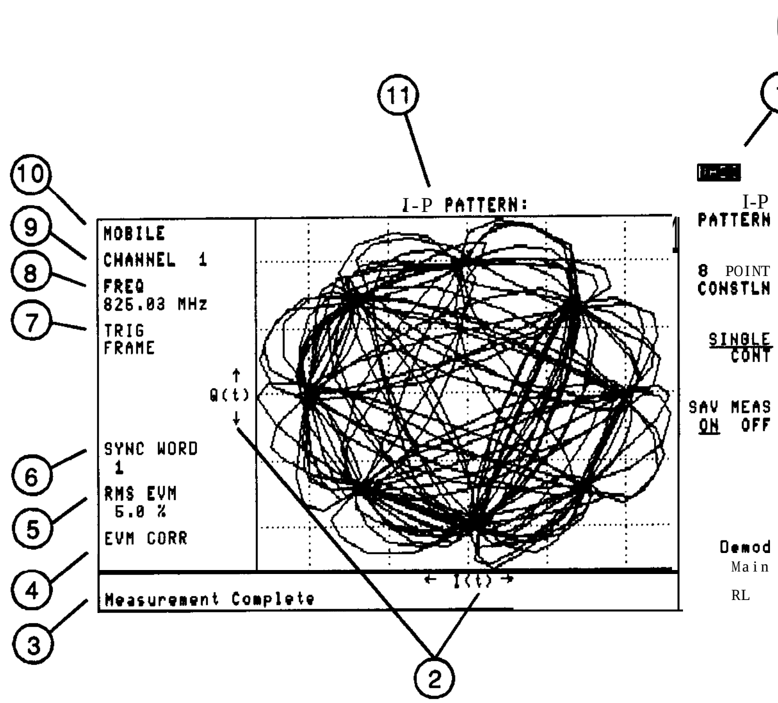


Figure 9-3. Digital Demodulation Screen Annotation 2

Table 9-3. Digital Demodulation Screen Annotation 2

Item	Display Annotation	Description
1	Mode indicator (NADC):	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 tlmeslot.
7	TRIG:	Indicates current digltal demodulator trigger mode FRAME, FREE RUN, or EXTERNAL.
8	FREQ:	Indicates current center frequency.
9	CHANNEL:	Indicates current channel number.
10	BASE or MOBILE:	Indicates current setting of **TRASMIT BS MS** .
11	Measurement:	Indicates the current measurement Being performed.

Specifications and Characteristics

This section contains information about the specifications and characteristics for Option 050 and the HP 85718B NADC-TDMA measurements personality.

Note For the HP 85718B or Option 050 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 050 (Available for HP 8591E, HP8593E, HP 8594E, HP8595E, or HP 8596E Spectrum Analyzer)

This section contains the specifications for Option 050, the improved amplitude accuracy for NADC spectrum analyzer. Specifications describe warranted performance. Option 050 is available only for an HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E spectrum analyzer.

The specifications for Option 050 apply only if the following conditions are met:

- The spectrum analyzer is operated within the temperature range of 0° to + 55° C (unless otherwise noted).
- The spectrum analyzer temperature has been stabilized. The instrument's 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 050 Specifications		
Frequency range	NADC Cellular bands, 824 to 849 MHz and 869 to 894 MHz NADC PCS bands, 1850 to 1910 MHz and 1930 to 1990 MHz	
Absolute amplitude accuracy: Cellular bands*		
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 correctiont)	fl.O dB	±0.6 dB
Input attenuation set to 40 dB (equivalent to a ref level	±1.3 dB	fl.O dB
of + 20 to + 30 dBm with no ext atten correctiont) blank>		
Absolute amplitude accuracy: PCS bands*		
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 correctiont)	±1.3 dB	±0.9 dB
Input attenuation set to 40 dB (equivalent to a ref level	±1.6 dB	±1.3 dB
of + 20 to + 30 dBm with no ext atten correctiont)		

* With RBW = 100 kHz, VBW = 30 kHz, signal level at 0 to -20 dB from ref level.
† With the input attenuation set to AUTO.

Specifications and Characteristics for the HP 85718B

This section contains the specifications and characteristics for the HP 85718B measurements personality. The specifications apply to both mobile and base station testing, unless otherwise indicated. The specifications and characteristics for HP 85718B apply only if the following conditions are met:

- The HP 85718B is used with an HP 8591E, HP 8593E, HP 8594E, or HP 8595E spectrum analyzer with firmware dated 930506 or later. The HP 85718B is not compatible with HP 8590A-series analyzers. Use the HP 85718A measurements personality with HP 8590A-series analyzers.
- The necessary options are installed in the spectrum analyzer (see "The Equipment that You Will Need" in Chapter 1 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's 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 NADC transmitter signals. The carrier frequencies must be within 824 MHz to 849 MHz, and 869 MHz to 894 MHz frequency bands.
- 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 Chapter 2 or Chapter 3 for more information.
- 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 HP 85718B:

Specifications — Describe warranted performance over the temperature range 0° C to + 55° C (unless otherwise noted).

Characteristics — Provide useful, but nonwarranted, 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).

Interim standard Many of the measurements refer to an Electronics Industry Association (EIA) and Telecommunications Industry Association (TIA) standard documents. The documents are:

EIA/TIA IS-54 Cellular System Dual Mode Mobile Station-Base Station Compatibility Standard

EIA/TIA IS-55 Recommended Minimum Performance Standards for 800 MHz Dual Mode Mobile Stations

EIA/TIA IS-56 Recommended Minimum Performance Standards for 800 MHz Base Stations Supporting Dual Mode Mobile Stations

EIA/TIA-627 800 MHz Cellular System, TDMA Radio Interface, Dual Mode Mobile Station - Base Station Compatibility Standard

EIA/TIA-628 800 MHz Cellular System, TDMA Radio Interface, Minimum Performance Standards for Dual Mode Mobile Stations

EIA/TIA-629 800 MHz Cellular System, TDMA Radio Interface, Minimum Performance Standards for Base Stations Supporting Dual Mode Mobile Stations

EIA/TIA IS-136.1 800 MHz TDMA Cellular - Radio Interface - Mobile Station - Base Station Compatibility - Digital Control Channel

EIA/TIA IS-136.2 800 MHz TDMA Cellular - Radio Interface - Mobile Station - Base Station Compatibility - Traffic Channels and FSK Control Channel

EIA/TIA IS-137A TDMA Cellular/PCS - Radio Interface - Minimum Performance Standards for Mobile Stations, Revision A

EIA/TIA IS-138A TDMA Cellular/PCS - Radio Interface - Minimum Performance Standards for Base Stations, Revision A

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	● 1×10^{-8}
External attenuation correction	0 to 90 dB in 0.01 dB steps
Channel number tuning	Channel 1 to 1023
Defined channel X frequency	Any frequency within the frequency range of the spectrum analyzer

Carrier Power Measurement*		
When testing a base station, the carrier power measurement measures the mean power of the RF carrier for the full frame duration. When testing a mobile station, the carrier 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 to a power trace and then averaging the trace data.		
Carrier power range	+ 53 dBm (200 W) to -20 dBm (0.01 mW)†	
achievable low limit	(-60 + ext atten) dBm	
Absolute carrier power accuracy, with carrier power of + 53 dBm to -20 dBm: Cellular Bands		
With Option 060, for mean carrier power range	0° c to 55° c	20° c to 30° c
(25 dBm + ext atten) to (15 dBm + ext atten)	±1.3 dB	fl.O dB
(15 dBm + ext atten) to (- 15 dBm + ext atten)	±1.0 dB	±0.6 dB
(-15 dBm + ext atten) to (-35 dBm + ext atten)	±1.2 dB	±0.9 dB
Without Option 050, for mean carrier power range	0° c to 55° c	
(25 dBm + ext atten) to (-35 dBm + ext atten)	±4.3 dB, 2.0 dB typical	
Absolute carrier power accuracy, with carrier power of + 53 dBm to -20 dBm: PCS Bands		
With Option 050, for mean carrier power range	0° c to 55° c	20° c to 30° c
(26 dBm + ext atten) to (15 dBm + ext atten)	±1.6 dB	±1.3 dB
(15 dBm + ext atten) to (-15 dBm + ext atten)	±1.3 dB	±0.9 dB
(- 15 dBm + ext atten) to (-35 dBm + ext atten)	±1.5 dB	±1.2 dB
Without Option 050, for mean carrier power range	0° c to 55° c	
(25 dBm + ext atten) to (-35 dBm + ext atten)	±4.3 dB, 2.0 dB typical	
Carrier power resolution	0.1 dB	

* Standards: IS-55 3.2.1 "RF Power Output "; IS-56 3.2.1, "RF Power Output "; IS-137A 3.2.1 "RF Power Output 800 MHz Equipment"; IS-137A 3.2.2 "RF Power Output 1900 MHz Equipment"; IS-138A 3.2.1 "RF Power Output"; EIA/TIA-629 3.2.1 "RF Power Output"; EIA/TIA-628 3.2.1 RF Power Output.

† 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 Power*		
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 -20 dBm	
Base (transmitter off)	<−35 dBm	
Carrier off power range	-36 dBm to (-85 + ext atten) dBm‡	
Absolute carrier off power accuracy: Cellular Bands		
For carrier off levels > 10 dB above the average noise level		
With Option 050	±2.7 dB	± 1.4 dB (typical)
Without Option 050	±3.6 dB	± 1.9 dB (typical)
Absolute carrier off power accuracy: PCS Bands		
For carrier off levels > 10 dB above the average noise level		
With Option 050	±3.0 dB	± 1.7 dB (typical)
Without Option 050	±3.6 dB	± 1.9 dB (typical)
Carrier off power resolution	0.1 dB	

* Standards: IS-55 3.2.3, "Carrier-on State"; IS-137A 3.2.4 "Carrier-on State"; EIA/TIA-628 3.2.3 "Carrier-on State".
† CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to an 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 -20 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% x the sweeptime

* Standards: IS-55 3.2.2, "RF Power Transition Time"; IS-56 3.1.1.3, "Carrier Switching Time"; IS-137A 3.2.3, "RF Power Transition Time"; EIA/TIA-628 3.2.2, "RF Power Transition Tie"; IS-137A 3.1.2.3, "Carrier Switching Time"; EIA/TIA-628 3.1.1.3, "Carrier Switching Time"
† CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to an absolute maximum of + 30 dBm (1 watt).

Occupied Bandwidth	
The occupied bandwidth measurement measures the 99 percent power bandwidth of the carrier. Two markers are positioned so that 0.5 percent of the total power is to the left and 0.5 percent is to the right of these limit frequencies. The carrier frequency error is also determined (defined as the difference between the analyzer center frequency and the mid point of the two limit frequencies).	
Carrier power range	+ 53 dBm to -20 dBm*
Frequency resolution of occupied bandwidth	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) x (carrier frequency) (characteristic)
* CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to an absolute maximum of + 30 dBm (1 watt).	

Adjacent Channel Power*		
When testing a base station, the ACP measurement is performed using the spectrum analyzer integration method with an integration bandwidth shaped by the root raised-cosine Nyquist filter specified in IS-54 2.1.3.3. The measurement is made using sample detection. The result is the ratio of the average power in adjacent/alternate channel to the mean output power of the carrier. When testing a mobile station, the ACP measurement is performed using the spectrum analyzer integration method with gated video, and with an integration bandwidth shaped by the root raised-cosine Nyquist filter specified in IS-54 2.1.3.3. The measurement is made using peak detection. The gated video separates out the ACP due to modulation from the ACP due to transients. For modulation, the result is equivalent to the ratio, with transients excluded, of the average power in adjacent/alternate channel to the mean output power of the carrier. For switching transients, the result is the ratio of the total peak power 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 multichannel per sweep measurement, but with increased test time for the ACP measurement.		
ACP Spectrum (Graphical)		
Carrier power range	+ 53 dBm (200 W) to -20 dBm (0.01 mW)†	
Spectrum display for a multichannel per sweep (seven channels) measurement	Small vertical lines near the bottom graticule of the spectrum analyzer display are used to indicate the 3 dB bandwidth edges for the adjacent, first and second alternate channels.	
Base station	800 ms sweeptime	
Mobile station	8 s sweeptime	
Display range of spectrum, log scale	0 to – 100 dB from ref level	
Relative amplitude accuracy for adjacent channels	±1.1 dB	±0.6 dB (typical)
Relative amplitude accuracy for first and second alternate channels	±1.6 dB	±0.8 dB (typical)
Absolute amplitude accuracy for second alternate channels: Cellular Bands		
With Option 050	±1.8 dB	± 1.2 dB (typical)
Without Option 050	±4.5 dB	± 1 .9 dB (typical)
Absolute amplitude accuracy for second alternate channels: PCS Bands		
With Option 050	H.1 dB	± 1.5 dB (typical)
Without Option 050	±4.5 dB	± 1 .9 dB (typical)
ACP lhble (Numerical)		
lhble entries		
Base and mobile	Power ratio for adjacent, first and second alternate channel. Absolute power for second alternate channels.	
Mobile	Results for both modulation (time-gated) and transient (total)	
ACP ratio minimum result for adjacent channels	-40 dB (characteristic)	
ACP ratio minimum result for first and second alternate channels	-60 dB (characteristic)	
ACP absolute minimum result for second alternate channels	– 17 dBm (characteristic)	
Achievable low limit	(carrier power – 70) dBm (characteristic)	

* Standards: IS-55 3.4.1.2 "Adjacent Channel Power"; IS-56 3.4.1.2 "Adjacent Channel Power"; IS-137A 3.4.1.2 'Adjacent Channel Power"; IS-138A 3.4.1.2 "Adjacent Channel Power"; EIA/TIA-628 3.4.1.2 "Adjacent Channel bwer"; EIA/TIA-629 3.4.1.2 "Adjacent Channel Power".

† CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to an absolute maximum of + 30 dBm (1 watt).

Adjacent Channel Power* (continued)	
ACP **Table** (Numerical)	
Power ratio accuracy for adjacent **channels**†	± 1.1 **dB** (characteristic)
Power ratio accuracy for Erst and second alternate channelst	± 1.6 **dB** (characteristic)
Absolute power accuracy for second alternate channels: Cellular **Bands**†	
With Option 050	± 1.8 **dB** (characteristic)
Without Option 050	**±4.5 dB** (characteristic)
Absolute power accuracy for second alternate channels: PCS **Bands**†	
With Option 050	**±2.1 dB** (characteristic)
Without Option 050	**±4.5 dB** (characteristic)
Integration bandwidth accuracy	• 3% (characteristic)
Frequency selectivity accuracy for **inner** edge of adjacent channels	
For multichannel per sweep (seven channels)	**±700** Hz (characteristic)
=	**±250** Hz (characteristic)

* Standards: **IS-55** 3.4.1.2 "**Adjacent** Channel Power"; **IS-56** 3.4.1.2 "Adjacent Channel Power"; **IS-137A** 3.4.1.2 "Adjacent Channel Power"; **IS-138A** 3.4.1.2 "Adjacent Channel Power"; **EIA/TIA-628** 3.4.1.2 "Adjacent Channel Power"; **EIA/TIA-629** 3.4.1.2 "Adjacent Channel Power". † The amplitude accuracy does not include the effects of:

- Misalignment between the actual transmitter carrier frequency and the actual spectrum analyzer center frequency.
- **Filter** rejection error of the analyzer square root-raised cosine **filter** approximation.

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 shaped by the root-raised cosine Nyqulst Alter. * The measurement is made using sample detection for continuous carriers and peak detection for burst 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: Cellular Bands		
With Option 050, input attenuation set to 10, 20, or 30 dB	±2.0 dB	± 1.2 dB (typical)
Without Option 050	±5.0 dB	±2.8 dB (typical)
Absolute amplitude accuracy of channel spectrum: PCS Bands		
With Option 050, input attenuation set to 10, 20, or 30 dB	±2.3 dB	± 1.5 dB (typical)
Without Option 050	±5.0 dB	±2.8 dB (typical)
Channel Numerical		
Absolute amplitude accuracy of channel power: Cellular Bands		
With Option 050, input attenuation set to 10, 20, or 30 dB	±2.0 dB (characteristic)	
Without Option 050	±5.0 dB (characteristic)	
Absolute amplitude accuracy of channel power: PCS Bands		
With Option 050, input attenuation set to 10, 20, or 30 dB	±2.3 dB (characteristic)	
Without Option 050	±5.0 dB (characteristic)	
Integration bandwidth accuracy	±3 % (characteristic)	
* Specified in IS-54 2.1.3.3., IS136 2.1.3.3, EIA/TIA-627 2.1.3.3. † CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to an absolute maximum of + 30 dBm (1 watt).		

Power versus Time, Mobile Station Only*		
The power versus time measurements analyze the amplitude profile of the burst. The time domain waveform is compared to limit lines. Pulse width, attack time, and release time are also displayed.		
Carrier power range	+ 38 dBm to -20 dBm†	
Display range of waveform, log scale	Select either 0 dB to -70 dB or 0 dB to – 110 dB	
Amplitude range	(Mean carrier power + 4 dB) to (-77 + ext atten) dBm‡	
Vertical scale per division	1 dB to 15 dB in 1 dB steps	
Relative amplitude accuracy:		
for 0 to -70 dB from ref level	1.0 dB	±0.7 dB (typical)
for 0 to -110 dB from ref level	±2.2 dB	± 1.2 dB (typical)
Sweep time accuracy (sweep times less than 20 ms)	±0.02% (characteristic)	
Time resolution:		
Frame	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 x delta time) + (2 x time resolution))μs (characteristic)	
Attack and release 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)	

* Standards: IS-55 3.1.2.3, "Carder-Switching Time"; IS-137A 3.1.2.3, "Carrier-Switching Time"; EIA/TIA-628 3.1.2.3, "Carrier-Switching Time";

† CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer Input to an 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 llne 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 an absolute maximum of + 30 dBm (1 watt).

Intermodulation Spurious, Base Station Only*	
Measures inter-modulation spurious emission products for base station carriers.	
Total carrier power range	+ 53 dBm† to 0 dBm
Analyzer third order distortion relative to carriers‡	<-67 dB (characteristic)
Relative amplitude accuracy	
For 0 to -60 dB from the reference level	-3.0 to +2.0 dB (characteristic)

* Standards: IS-56 3.4.4, "Intermodulation Spurious Base Station"; IS-138A 3.4.4, "Intermodulation Spurious Base Station"; EIA/TIA-629 3.4.4, "Intermodulation Spurious Base Station";

† CAUTION: Use sufficient external attenuation to limit power at spectrum analyzer input to an absolute maximum of + 30 dBm (1 watt).

‡ With two carriers with greater than or equal to 600 kHz separation, and external attenuation (dB) = mean carrier power (dBm) – input attenuation (dB) + 25 dB, where input attenuation is equal to 10, 20, 30 or 40 dB.

Digital Demodulation Specifications and Characteristics

HP 8593E, HP 8594E, HP 8595E, and HP 8596E NADC Spectrum Analyzers

The following specifications apply to HP 8593E, HP 8594E, HP 8595E and HP 8596E spectrum analyzers with option 151 and 160:

Minimum Input Power	
Minimum Input Power	-20 dBm

Carrier Frequency Error*	
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 x 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.	
* Standards: IS-55 3.1.1, "Frequency Stability"; IS-56 3.1.1, "Frequency Stability"; IS-137A 3.11, "Frequency Stability"; IS-138A 3.11, "Frequency Stability"; EIA/TIA-628 3.1.1, "Frequency Stability"; EIA/TIA-629 3.1.1, "Frequency Stability".	

I-Q Origin Offset*	
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
* Standards: IS-55 3.3.2 and IS-56 3.3.2 "Digital Modulation"; IS-137A 3.3.2, "Digital Modulation"; IS-138A 3.3.2, "Digital Modulation"; EIA/TIA-628 3.3.2, "Digital Modulation"; EIA/TIA-629 3.3.2, "Digital Modulation".	

Error Vector Magnitude*		
The error vector magnltude (EVM) measurement calculates the RMS error vector magnitude from a timeslot. In a base station, a full timeslot measurement includes 162 symbols. In a mobile station, a full tlmeslot measurement includes 157 symbols. EVM is minimized by removing amplitude droop, frequency error, phase offset, and IQ origin offset before calculating EVM for a given timeslot.		
Error Vector Magnitude Accuracy		
Full tlmeslot measurement without EVM correction	20 to 30° c	0 to 55° c
RMS EVM Floor§	1.5%	2.0%
RMS Magnitude Error Floor§	< 0.5%	< 0.5%
RMS Phase Error Floors	< 0.8 °	< 1.1 °
RMS EVM Repeatability, single measurement	±1.5%	±2.5%
RMS EVM Repeatability, average of 10	±0.5%	±1%
Average of first ten symbols of ten mobile station bursts, without EVM correction.	20 to 30° c	0 to 55° c
RMS EVM Floor	1.5%	2.0%
RMS EVM Repeatability, (a single average of ten symbols in ten timeslots)	±2%	±3%
Base station, RMS Magnitude Error = 1%, RMS EVM = 6% (display readings), full timeslot measurement without EVM correction.		
Measurement Condition	**EVM Uncertainty Range**	
	20 to 30° c	0 to 55° c
Single measurement+	+ 0.75% to -3.0%	+ 0.75% to -4.5%
Average of ten measurements‡	+0.75% to -2.0%	+ 0.75% to -3.0%
Mobile station, RMS Magnltude Error = 4%, RMS EVM = 6% (display readings), full tlmeslot measurement without EVM correction.		
Measurement Condition	**EVM Uncertainty Range**	
	20 to 30° c	0 to 55° c
Single measurement†	+0.75% to -2.5%	+0.75% to -3.8%
Average of ten measurements‡	+ 0.75% to -1.5%	+ 0.75% to -2.3%

* Standards: IS-55 3.3.2 and IS-56 3.3.2 "Digital Modulation"; IS-137A 3.3.2, "Digital Modulation"; IS-138A 3.3.2, "Digital Modulation"; EIA/TIA-628 3.3.2, "Digital Modulation"; EIA/TIA-629 3.3.2, "Digital Modulation".

§ 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 to 30° C

Displayed RMS EVM + 0.75% ≥ true RMS EVM ≥ Displayed RMS EVM -2.5%

‡ 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 to 30° C

Minimum RMS EVM + 0.75% ≥ true RMS EVM ≥ Average RMS EVM - 1.5%

Note See "Interpreting the EVM Specifications" for an explanation of the EVM accuracy tables.

The following characteristics apply to HP 8593E, HP 8594E, HP 8595E, and HP 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 to 30° C	0 to 55° C
RMS EVM Floor*	0.5%	0.5%
RMS EVM Repeatability, single measurement	±1.5%	±2.5%
RMS EVM Repeatability, average of 10	±0.5%	±1%
Full timeslot measurement with EVM correction (base and mobile station).		
Measurement Condition	**EVM Uncertainty Range**	
	20 to 30° C	0 to 55° C
Single measurement†	+ 1.5% to -2.0%	+2.5% to -3.0%
Average of ten measurements‡	+0.5% to -1.0%	+ 1.0% to -1.5%

* 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 to 30° C

Displayed RMS EVM + 1.5% ≥ true RMS EVM ≥ Displayed RMS EVM - 2.0%

‡ Apply positive EVM uncertainty to miniium detected RMS EVM. Apply negative EVM uncertainty to average RMS EVM.

Example: mobile station, average of ten measurements, 20 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

HP 8591E NADC Spectrum Analyzers

The following specifications apply to HP 8591E spectrum analyzers with options 151 and 160:

Minimum Input Power	
Minimum Input Power	-20 dBm

Carrier Frequency Error *	
The carrier frequency error measurement calculates the average carrier frequency error from the nominal channel frequency over a single timeslot.	
Frequency Error Accuracy	± [20 Hz + (frequency reference accuracy x carrier frequency)]
Frequency error accuracy with Option 004 high stability frequency reference is ±152 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.	
* Standards: IS-55 3.1.1, "Frequency Stability"; IS-56 3.1.1, "Frequency Stability"; IS-137A 3.11, "Frequency Stability"; IS-138A 3.11, "Frequency Stability"; EIA/TIA-628 3.1.1, "Frequency Stability"; EIA/TIA-629 3.1 .1, "Frequency Stability".	

I-Q Origin Offset*	
I-Q origin offset calculates the Axed 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
* Standards: IS-55 3.3.2 and IS-56 3.3.2 "Digital Modulation"; IS-137A 3.3.2, "Digital Modulation"; IS-138A 3.3.2, "Digital Modulation"; EIA/TIA-628 3.3.2, "Digital Modulation"; EIA/TIA-629 3.3.2, "Digital Modulation".	

Error Vector Magnitude*

The error vector magnitude (EVM) measurement calculates the RMS error vector magnitude from a tlmeslot. In a base station, a full **timeslot** measurement includes 162 symbols. In a mobile station, a full **timeslot** measurement includes 157 *symbols.* EVM is **minimized** by removing amplitude droop, frequency **error,** phase offset, and I-Q origin offset before calculating EVM for a given timeslot.

Error Vector Magnltude Accuracy

Full **timeslot** measurement without EVM calibration correction	20 to **30°** c	0 to **55°** c
RMS EVM **Floor**§	1.7%	2.0%
RMS Magnitude Error **Floor**§	< 0.5%	< 0.5%
RMS Phase Error **Floor**§	< 1.00	< **1.6 °**
RMS EVM Repeatability, single measurement	**±2.2%**	**±3.5%**
RMS EVM Repeatability, average of 10	● 2.2%	**±3.5%**

Average of **first** ten symbols of ten mobile station bursts, without EVM correction.	20 to **30°** c	0 to **55°** c
RMS EVM Floor	2.5%	3.5%
RMS EVM Repeatability, (a single average of ten symbols **in** ten tlmeslots)	**±2%**	**±3%**

Base station, RMS Magnitude Error = **1%,** RMS EVM ≈ 6% (display readings) full **timeslot** measurement without EVM correction.

Measurement Condition	**EVM Uncertainty Range**	
	20 **to 30°** c	0 **to 55°** c
Single measurementt	+ 0.75% to -3.0%	+ 0.75% to -6.4%
Average of ten **measurements**‡	+ 0.75% to -3.0%	+ 0.75% to -6.4%

Mobile station, full tlmeslot measurement without EVM correction. RMS Magnitude Error = **4%,** RMS EVM = 6% (display readings).

Measurement Condition	**EVM Uncertainty Range**	
	20 **to 30°** c	0 to **55°** c
Single measurementt	+ 0.75% to -3.4%	+ 0.75% to -5.3%
Average of ten **measurements**‡	+ 0.75% to -3.4%	+ 0.75% to -5.3%

* Standards: **IS-55** 3.3.2 and **IS-56** 3.3.2 "Digital Modulation"; **IS-137A** 3.3.2, "Digital Modulation"; **IS-138A** 3.3.2, "Digital Modulation"; **EIA/TIA-628** 3.3.2, "Digital Modulation"; **EIA/TIA-629** 3.3.2, "Digital Modulation".

§ RMS EVM, RMS magnitude error, and RMS phase error cannot be accurately measured below the floor value.

† Apply positive and negative EVM uncertainty **limits** to displayed RMS EVM.

Example: mobile station, 20 to **30°** C

Displayed RMS EVM + 0.75% $\geq$ **true** RMS EVM $\geq$ Displayed RMS EVM - 3.4%

‡ 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 to **30°** C

Minimum RMS EVM + 0.75% $\geq$ **true** RMS EVM $\geq$ Average RMS EVM -3.4%

Note — See "Interpreting the EVM Specifications" for an explanation of the EVM accuracy tables.

The following *characteristics* apply to HP 8591E 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 to 30° C	0 to 55° C
RMS EVM Floor*	0.5%	0.5%
RMS EVM Repeatability, single measurement	±2.2%	±3.5%
RMS EVM Repeatability, average of 10	±2.2%	±3.5%
Full timeslot measurement with EVM correction (base and mobile station).		
Measurement Condition	**EVM Uncertainty Range**	
	20 to 30° C	0 to 55° C
Single measurement†	+2.2% to -2.7%	+ 3.5% to -4.0%
Average of ten measurements‡	+2.2% to -2.7%	+ 3.5% to -4.0%

* 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 to 30° C

Displayed RMS EVM + 2.2% ≥ true RMS EVM ≥ Displayed RMS EVM - 2.7%

‡ 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 to 30° C

Miniium RMS EVM + 2.2% ≥ true RMS EVM ≥ Average RMS EVM - 2.7%

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 mode measurement	16 sec
Continuous mode 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 9-4. 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.

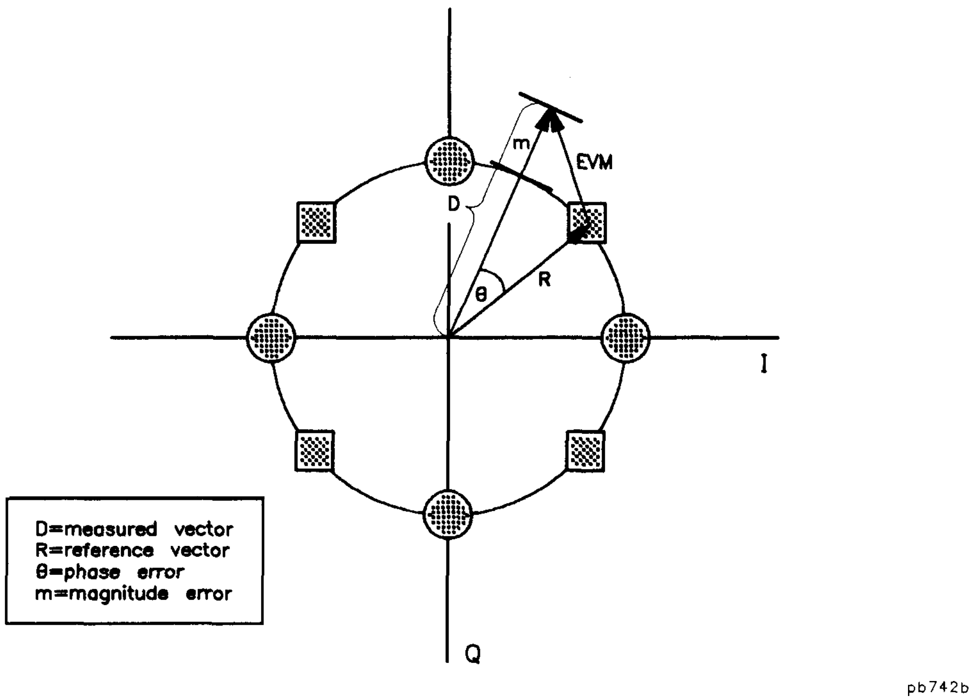


Figure 9-4. Vector Components of EVM

RMS EVM Floor

The EVM depends on two components, the phase error (θ), and the magnitude error (m). The accuracy of the RMS EVM measurement is defined by the accuracy with which the magnitude and phase error can be measured in the HP 8590 E-Series spectrum analyzers.

The accuracy of the magnitude error measurement is limited by the spectrum analyzer sampling resolution, and by the ripple of the filters in the signal processing path. In the HP 8590 E-Series spectrum analyzer, the total uncertainty in the magnitude error measurement is less than 0.5%.

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 HP 8593E, HP 8594E, HP 8595E, and HP 8596E produce a maximum RMS phase error uncertainty of0.8°. On a perfect NADC 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 + 1.0% from a typical RMS phase error uncertainty of 0.6".

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 1.5% between 20° to 30° C. Thus, a perfect NADC signal with 0% RMS EVM could be measured by a worst-case spectrum analyzer as 1.5% RMS EVM. Sources with RMS EVM below 1.5% cannot be measured accurately with the spectrum analyzer. The HP 8593E, HP 8594E, HP 8595E, and HP 8596E spectrum analyzers have a 1.5% 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 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 repeatability 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 repeatability. The following uncertainty table was created for an HP 8593E, HP 8594E, HP 8595E, or HP 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 NADC base stations usually do not burst amplitude modulate the carrier, but hold a fixed power level for a relatively long time.

HP 8593E, HP 8594E, HP 8595E, and HP 8596E RMS EVM Uncertainty

Error Vector Magnitude*		
Base station, RMS Magnitude Error = 1% , RMS EVM = 6% (display readings), full timeslot measurement without EVM correction.		
Measurement Condition	**EVM Uncertainty Range**	
	20 to 30° C	0 to 55° C
Single measurement	+0.75% to -3.0%	+ 0.75% to -4.5%
Average of ten measurements	+0.75% to -2.0%	+ 0.75% to -3.0%
* Standards: IS-55 3.3.2 and IS-56 3.3.2 “Digital Modulation”; IS-137A 3.3.2, “Digital Modulation”; IS-138A 3.3.2, “Digital Modulation”; EIA/TIA-628 3.3.2, “Digital Modulation”; EIA/TIA-629 3.3.2, “Digital Modulation”.		

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 HP 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) (Uncertainty)	=	(Maximum possible RMS EVM)

to

7.0%		-3.0%	=	4.0%
(Displayed RMS EVM)	+	(Negative EVM) (Uncertainty)	=	(Minimum possible RMS EVM)

The range of possible RMS EVM from a single 7.0% reading is:

7.75% > true EVM > 4.0%

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 HP 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) (RMS EVM)	+	(Positive EVM) (Uncertainty)	=	(Maximum possible RMS EVM)

to

7.2%		-2.0%	=	5.2%
(Displayed average) (RMS EVM)	+	(Negative EVM) (Uncertainty)	=	(Minimum possible RMS EVM)

The range of possible RMS EVM from a minimum 6.8% reading is:

7.55% > true EVM > 5.2%

Note For averaged modulation accuracy measurements, the HP 85718B 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 repeatability. The RMS EVM floor specifies the maximum positive offset added by the spectrum analyzer to the true RMS EVM of the source.

Example: A base station with an RMS EVM of 6 %, and an RMS magnitude error of 1% .

Measurement with an HP 8593E can have an average RMS EVM as high as 7.5% between 20° to 30" C.

6%		1.5%	=	7.5%
(RMS EVM of source)	+	(RMS EVM Floor)	=	(averaged)

In addition, individual RMS EVM readings will vary as defined by the RMS EVM repeatability. For example, an HP 85933 measuring a base station with 6% RMS EVM can have an average RMS EVM reading of 7.5% ±1.5%. Individual readings will be as low as 6.0% and as high as 9.0%. The spectrum analyzer adds a maximum 3.0% to the true RMS EVM of the base station.

9.0%		6%	=	3.0%
(highest analyzer reading)	–	(true RMS EVM)	=	(maximum 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 HP 85933 is 3.0%.

1.5%		1.5%	=	3.0%
(RMS EVM Floor)	+	(RMS EVM Repeatability)	=	(minimum RMS EVM uncertainty)

This example is shown graphically in Figure 9-5.

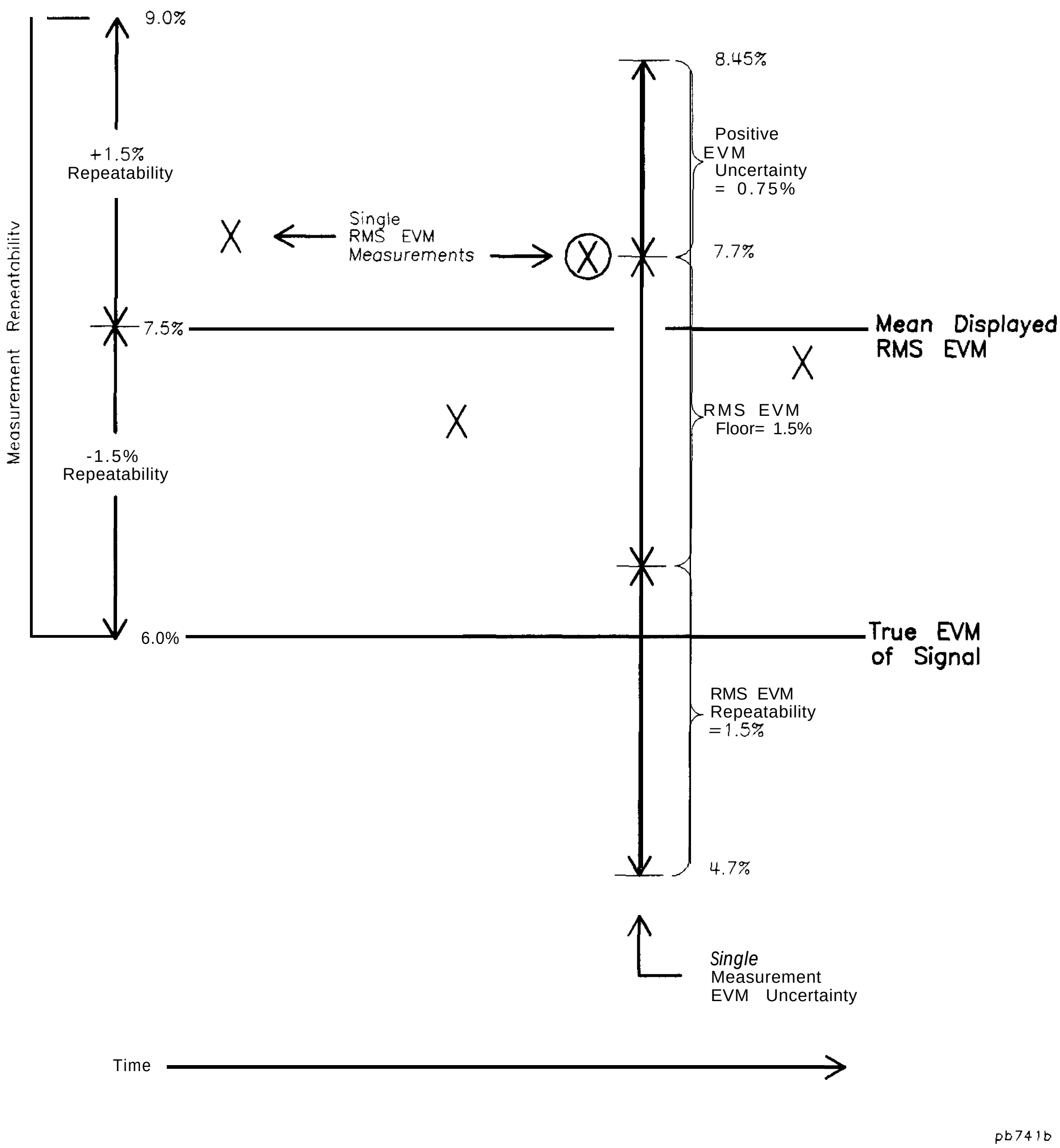


Figure 9-5. RMS EVM Uncertainty Example

The examples so far have assumed an NADC signal with low magnitude error, where RMS EVM is primarily from phase error. The worst case signals for measurement with the HP 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 has significant magnitude error. NADC 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.

The family of curves in Figure 9-6 through Figure 9-9 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.

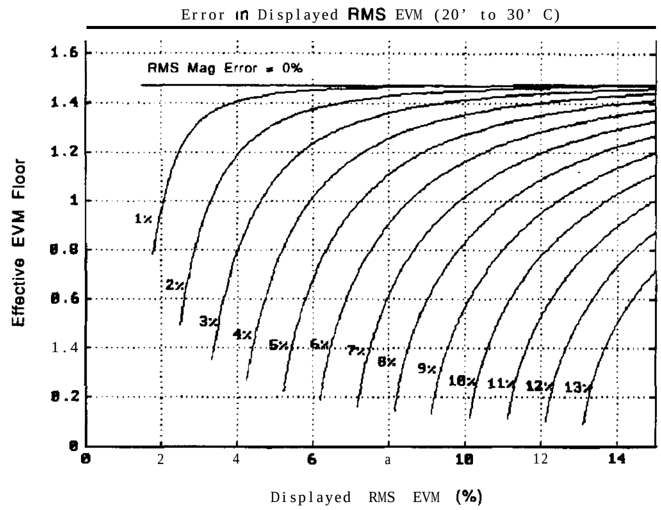


Figure 9-6. HP 8593/4/5/6E Analyzers Effective EVM Floor (20° to 30° C)

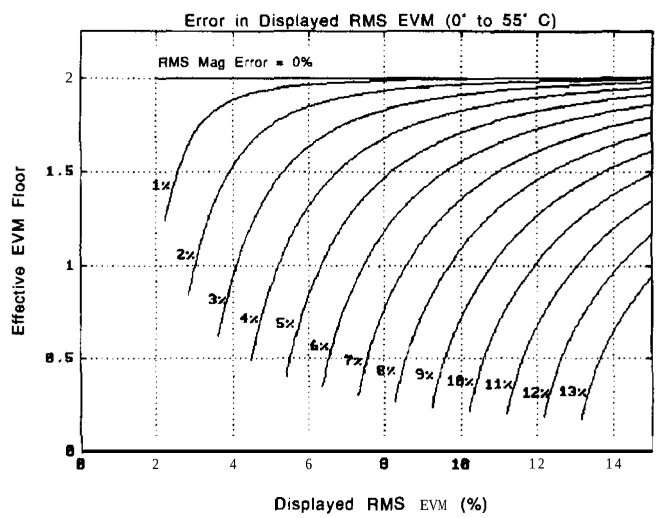


Figure 9-7. HP 8593/4/5/6E Analyzers Effective EVM Floor (0° to 55° C)

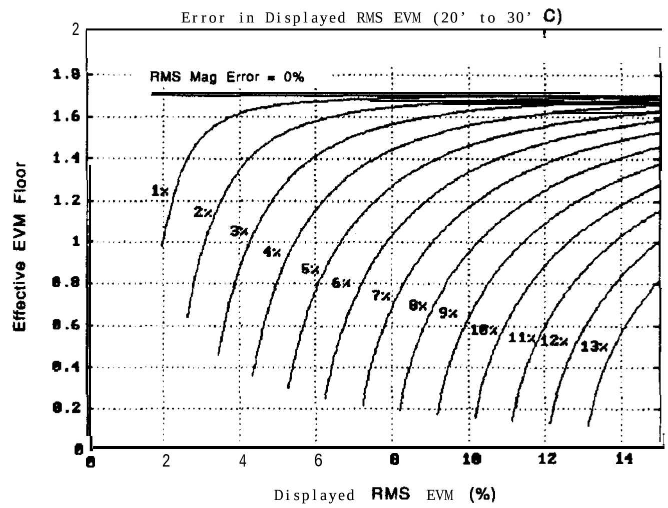


Figure 9-8. HP 8591E Analyzer Effective EVM Floor (20° to 30° C)

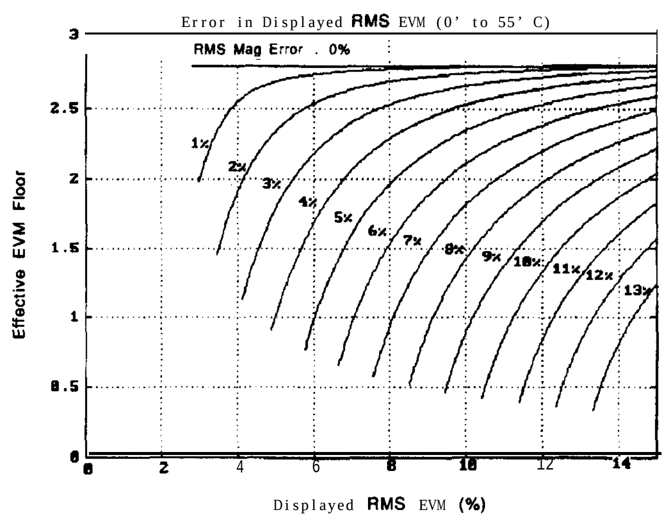


Figure 9-9. HP 8591E Analyzer Effective EVM Floor (0° to 55° C)

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 "Error in Displayed RMS EVM" axis to read the maximum positive offset in the current displayed RMS EVM

The "Error in Displayed EVM" 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 9-10. Obtain the "Error in Displayed RMS EVM" (or the effective RMS EVM floor) from the curve.

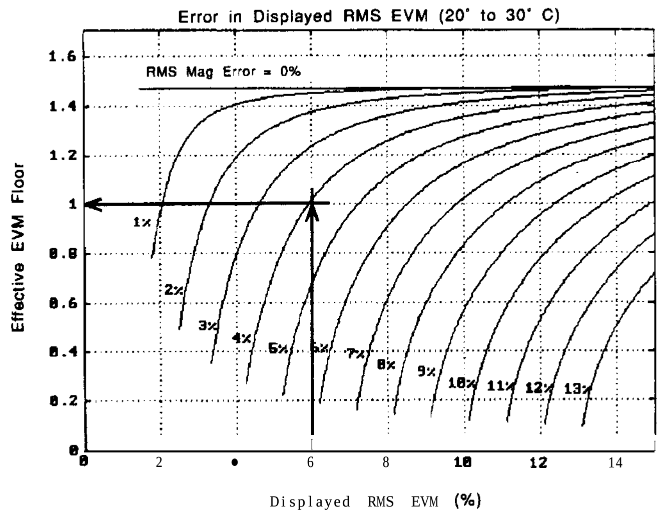


Figure 9-10. HP 8593/4/5/6E Analyzers Effective EVM Floor

For this case, the "error in displayed RMS EVM" is 1%, and is the effective RMS EVM floor for this measurement. 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 1.5%. The RMS EVM floor was improved by 0.5 % 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 HP 8593E, HP 8594E, HP 8595E, and HP 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.		
Meaaurement Condition	EVM Uncertainty Range	
	20 to 30° C	0 to 55° C
Single measurement	+0.75% to -2.5%	+0.75% to -3.8%
Average of ten measurements	+0.75% to -1.5%	+ 0.75% to -2.3%

The previous example showed that the effective RMS EVM floor is 1% between 20° 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 repeatability.

For a single measurement, between 20° and 30° C:

1%	+1.5%	=	2.5%
(Effective **EVM** Floor from curves)	+ (RMS **EVM Repeatability**)	=	(Negative EVM Uncertainty)

For an average of 10 measurements between 20° and 30° C:

1%	+0.5%	=	1.5%
(Effective **EVM** Floor from curves)	+ (RMS **EVM Repeatability**)	=	(Negative EVM Uncertainty)

Single Measurement Example: Using the previous table, a mobile station is measured with an HP 8593E spectrum analyzer between 20° 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% + .75% > true RMS EVM > 6.0% – 2.5%
6.75% > true RMS EVM > 3.5%

For averaged modulation accuracy measurements, the HP 85718B personality automatically calculates the RMS EVM uncertainty ranges from measured data and spectrum analyzer specifications. Figure 9-1 1 shows a summary screen that appears automatically when averaging is turned on.

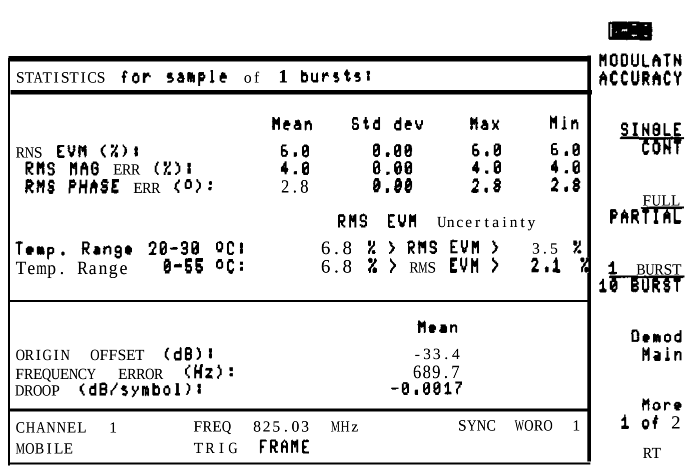


Figure 9-1 1. Averaged Modulation Accuracy Summary Screen

Default Limits for the Pass/Fail Message

Many of the NADC personality measurements display a pass/fail message if **PASSFAIL ON OFF** is set to ON. To determine if a measurement passed or failed, the NADC personality uses test limits. Table 9-4 lists default values for the test limits used by the NADC personality. If desired, you can change these default limits with a computer or with an external keyboard. See "Customizing the NADC Personality" in Chapter 5 for more information about how to change the default limits.

Table 9-4. Default Limits for the Pass/Fail Messages

Test	Limit	
Carrier power	Maximum and minimum carrier power levels are set to 0 dBm to disable the pass/fail message	
Carrier off power		
Mean carrier off power	– 60 dBm maximum	
Peak carrier off power	-40 dBm maximum	
Occupied bandwidth		
Bandwidth	28 kHz maximum	
Frequency error	2 kHz maximum	
Adjacent channel power	For Modulation	For Transient
Adjacent channel	-26 dB maximum	-26 dB maximum
First alternate channel	-45 dB maximum	-45 dB maximum
Second alternate channel	-45 dB maximum	-45 dB maximum
Second alternate channel absolute	– 13 dBm maximum	– 13 dBm maximum
'Power versus time		
140-symbol burst width*	5516 µs minimum, 5639 µs maximum	
162-symbol burst width*	6421 µs minimum, 6544 µs maximum	
Attack time (rising)*	40 µs minimum, 123 µs maximum	
Release time (falling)*	40 µs minimum, 123 µs maximum	
Limit line masks	Based on IS-55	
Intermodulation spurious	-60dB maximum	
Modulation Accuracy		
Carrier Frequency Error		
Base	217 Hz maximum	
Mobile	417 Hz maximum	
Error Vector Magnitude		
RMS EVM	12.5%	
RMS EVM 10 symbol/IO TS	25%	
EVM Magnitude Component	33%	
EVM Phase Component	50°	
I-Q Origin Offset	-20 dB	
Amplitude Droop	-0.01 dB/symbol	

The pass or fail message is not displayed when these variables are set to 0.

Recommended Spectrum Analyzer Options and Accessories for the NADC Measurements Personality

Additional equipment and spectrum analyzer options are described here. These can be used with the spectrum analyzer and with the NADC measurements personality.

Recommended and Required Spectrum Analyzer Options

The following is a description of the spectrum analyzer options that are required or recommended for use with the NADC measurements personality.

Precision Frequency Reference (Option 004)

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

You need either an Option 004 installed in your spectrum analyzer or an external 10 MHz precision frequency reference to use the NADC measurements personality.

Interface, HP-IB (Option 021)

Option 021 enables you to control your spectrum analyzer from a computer that uses an Hewlett-Packard Interface Bus (HP-IB). (The HP-IB Interface Bus is also called IEEE-488.) Such computers include HP 9000 Series 200 and Series 300, and HP Vectra PC. This option also enables the spectrum analyzer to control a printer, plotter, or another instrument with an HP-IB interface. Option 021 includes a connector for an external keyboard, an HP-IB connector, and the programming documentation.

Interface, RS-232 (Option 023)

Option 023 enables 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. This option also enables the spectrum analyzer to control a printer, plotter, or another instrument with an RS-232 interface. Option 023 includes a connector for an external keyboard, an RS-232 connector, and the programming documentation.

Impact Cover Assembly (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.

Soft Carrying Case (Option 042)

Option 042 is a soft carrying case with a pouch for accessories. Option 042 can be used to provide additional protection during travel.

Improved Amplitude Accuracy for NADC (Option 050)

Option 050 is an HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E with improved amplitude accuracy specifications over the NADC frequency ranges. Refer to "Specifications for Option 050 (Available for HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E Spectrum Analyzer)" for information about the specifications for Option 050.

Improved amplitude accuracy is available for spectrum analyzers without Option 050. Contact your HP sales and service office for more information about Option R50, the improved amplitude accuracy upgrade for NADC.

Fast Time Domain Sweeps (Option 101)

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 for an HP 8591E, HP 8593E, HP 8594E, HP 8595E, HP 8596E, or HP 8591A with firmware dated 17.7.91 or later. 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 you do not have Option 151 and 160 installed in your spectrum analyzer, you must have an Option 101 installed to use the NADC measurements personality to test a mobile station. If Options 151 and 160 are installed, Option 101 is not required for the NADC measurements personality and should *not* be installed. See the descriptions for Option 151 and 160 in Chapter 1, "Getting Started."

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 be separated in the time domain. By adjusting a time gate based on a 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 power versus time or adjacent channel power measurements on a mobile station. The Option 105 board assembly must have a number prefix of 3121K or higher.

Digital Demodulator and Fast Time Domain Sweeps (Option 151)

Option 151 supplies the hardware required for both fast time domain sweeps and digital demodulator measurements. Note that Option 151 provides a subset of Option 101 fast time domain functions. Option 101 allows zero span sweeptimes as low as 20μsec with a step resolution of 20 μsec (20 μsec, 40 μsec, 60 μsec, etc.) Option 151 allows zero span sweep times as short as 40 μsec with a sequence of 40 μsec, 80 μsec, 160 μsec, 320 μsec, and 160 μsec 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 and Option 151 both support negative peak detection for an HP 8591E, HP 8593E, HP 8594E, HP 8595E and HP 8596E. The negative peak detector capability is useful for video modulator balance adjustments and intermodulation distortion measurements. Option 101 allows negative peak detection with sweeptimes as high as 200 msec. Option 151 allows negative peak detection with sweeptimes as high as 800 msec.

Option 151 with Option 160 allows digital modulator-based metric measurements for the HP 8590E-series spectrum analyzers. You can measure error vector magnitude, carrier frequency error, amplitude droop, and I-Q origin offset using the NADC measurements personality. I-Q pattern diagrams, and demodulated bits are also available. All measurements can be automatically synchronized to the desired timeslot using the off-the-air frame trigger.

In addition, the off-the-air 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 adjacent channel power measurements. This eliminates the need for an external trigger signal.

You must have an Option 151 and 160 installed in your spectrum analyzer to use the HP 85718B NADC measurements personality to make digital demodulator-based measurements.

NADC Digital Demodulator Firmware (Option 160)

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

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

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

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

Option 151 with Option 160 and the NADC-TDMA Measurement Personality provide a complete NADC 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.

Recommended Accessories

This section lists accessories recommended for use with the NADC measurements personality.

Scalar 50 Ω Transmission/Reflection Test Set

The HP 85630A scalar transmission/reflection test set provides the capability to measure the impedance and transmission characteristics of devices simultaneously. It is effective over a frequency range of 300 kHz to 2.9 GHz and must be used with the HP 85714A scalar measurements personality.

RF Bridges

The HP 86205A 50 Ω RF bridge and HP 86207A 75 Ω RF bridge can be used to make reflection measurements with the spectrum analyzer. These external directional bridges offer high directivity and excellent port match. The HP 86205A operates over a frequency range of 300 kHz to 6 GHz. The HP 86207A operates over a frequency range of 300 kHz to 3 GHz.

AC Power Source

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

AC Probe

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

Broadband Preamplifiers and Power Amplifiers

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

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

Burst Carrier Trigger/RF Preamplifier

The HP 85902A Burst Carrier Trigger and RF Preamplifier unit samples a burst TDMA or TDD 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 and adjacent channel power gated measurements. Typical dynamic range is 60 dB without need for adjustment.

Separate from the triggering circuitry but included inside the HP 85902A is a 10 MHz to 2 GHz preamplifier. It provides a typical 10 to 18 dB gain for added triggering sensitivity, if required. DC power for the unit is supplied through the probe power connector located on the front panel of the HP 8590-series and 8560-series spectrum analyzers. The HP 8560-series spectrum analyzers are also well suited to use the HP 85902A.

Close Field Probes

The HP 11945A close field probe set contains the HP 11940A and HP 11941A close-field probes. These are small, hand-held, electromagnetic-field sensors that provide'repeatable, absolute, magnetic-field measurements over a wide frequency range. The HP 11941A operates from 9 kHz to 30 MHz. The HP 11940A from 30 MHz to 1 GHz. When attached to a source, the probes generate a localized magnetic field for electromagnetic interference (EMI) susceptibility testing. The HP 11945A Option E51 also includes the HP 8447F Option H64 preamplifier and a convenient carrying bag.

External Keyboard

For use with HP 8590 Series Option 021 or 023, Although there are many different IBM/AT non-auto switching keyboard models available, the HP C1405A Option ABA keyboard is recommended. The external keyboard can be connected to the external keyboard connector on the rear panel of the spectrum analyzer. Screen titles and remote programming commands can be entered easily with the external keyboard.

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

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

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 9-5. The memory card reader is standard for the HP 8591E, HP 8593E, HP 8594E, HP 8595E, and HP 8596E.

Table 9-5. Memory Card Model Numbers

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

Plotter

For use with Option 021 *or* 023. The HP ColorPro 7440A graphics plotter adds a color plot capability to the spectrum analyzer for permanent records of important measurements. The eight-pen HP ColorPro plotter produces color plots with 0.025 mm (0.001 inch) resolution on either 8.5 by 11 inch paper or transparency film. The plotter can be ordered with HP-IB or RS-232 interfaces to correspond to the interface option installed on the spectrum analyzer.

Printer

For use with an HP 8590 Series Option 021 or 023. The following printers can be ordered with HP-IB or RS-232 interfaces to correspond to the interface option installed on your spectrum analyzer. The display on the spectrum analyzer screen can be automatically copied to the printer for a permanent record of the display.

Printer	Interface	HP 8590-Series Option
HP C2614A Portable DeskJet	Centronics	Option 021 HP-IB and HP 92203J/K HP-IB to Centronics adapter
HP C2114A DeskJet 500C	RS232 Centronics	Option 023 Option 021 and HP 92203J/K
HP 3630A PaintJet	HP-IB RS232	Option 021 Option 023

Transit Case

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

10

Programming Reference

This chapter contains complete information for the programming commands available to operate the NADC measurements personality. The topics covered in this chapter are listed below.

- A table containing a cross reference of the NADC measurements personality **softkeys** to the corresponding programming command.
- A table containing a cross reference of the NADC measurements to the limit and parameter variables.
- A table containing a cross reference of NADC measurements and the corresponding limit line function names.
- The descriptions of all the NADC measurements personality's programming commands.

This chapter contains reference information about the NADC programming commands. For more information about programming the NADC personality, refer to Chapter 5. For more information about programming the spectrum analyzer, see the programming documentation for the spectrum analyzer.

Functional Index

The following table lists each NADC measurements personality softkey and references the corresponding remote command sequence that performs the same operation remotely.

Table 10-1. Functional Index

NADC Softkey	Corresponding Remote Command Sequence
NADC ANALYZER	MODE 10 (See "To select the NADC analyzer mode remotely" in Chapter 5 for more information.)
E-TDMA ANALYZER	MODE 11 (See "To select the E-TDMA analyzer mode remotely" in Chapter 5 for more information.)
Configuration Menu	
BURST CONT	-CC
DEFAULT CONFIG	-DEFAULT
STANDARD BAND	-STANDARD
EXT ATTEN	_EXTATN
PERIOD 40ms20ms	_TRIGF
PASSFAIL ON OFF	-DPF
TOTL PWR SGL MULT	_TOTPM and -TOTPWR
TRANSMIT BS MS	-MS
TRIG DELAY	_TRIGD
PWR TRIG EXT OLD	_TRIGM
TRIG POL NEG POS	_TRIGP
TRIG SRC DD EXT	-TRIGSRC
Physical Channel Menu	
AUTO CHANNEL	-ACH
CENTER FREQ	Use the spectrum analyzer CF command. See the programming documentation for the spectrum analyzer for more information about the CF command.
CHAR X CTR FREQ	_CFX
CHANNEL NUMBER	-CH
TIMESLOT NUMBER	-TN
Power Menu	
CARRIER OFF PWR	_COPWR or _COS and -COM
CARRIER POWER	_CPWR or _CPS and -CPM
MONITOR TX CHAN	-MCH or -MCS and -MCM
OCCUPIED BANDWDTH	_OBW or _OBWS and _OBWM
POWER STEP	_STEP or _SPS and _SPM
Power versus Time Menu	
P vs T BURST	_PBURST
P vs T FALLING	_PFALL
P vs T FRAME	_PFRAME
F vs T RISING	_PRISE

Table 10-1. Functional Index (continued)

NADC Softkey	Corresponding Remote Command Sequence
Power versus Time Setup Menu	
FT ACQ ON OFF	_FTACQ
MEASURE AVG PKS	_AVG
NUMBER SWEEPS	_PNS
RANGE 70 110	_RNG
SYMBOLS 140 162	-SYM
Adjacent Channel Power Menu	
ACP or ACP GTD	Either -ACPMT and _ACP, or _ACPMT, _ACPS, and _ACPM
ACP CH/SWP or ACP GTD CH/SWP	Either -ACPMT and _ACP, or _ACPMT, _ACPS, and _ACPM
CHAN POWER	-CHPWR or _CHPS and _CHPM
Adjacent Channel Power Setup Menu	
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
Spurious Menu	
INTERMOD SPURIOUS	_IMDSPUR
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

Table 10-1. Functional Index (continued)

NADC Softkey	Corresponding Remote Command Sequence
Digital Demod Menu	
STATUS	-ddSTATUS
Digital Demod Modulation Accuracy Menu	
MODULATN ACCURACY	-MODACC
SINGLE CONT	-ddCONT
FULL PARTIAL	_ddPARTIAL
1 BURST 10 BURST	-ddTENB
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
DEMOD RESBW	-ddRESBW
ERR MSG ON OFF	-ddERRM
DD TRIG	-ddTRIG
WRD SYNC ON OFF	-ddWSYNC
TIMESLOT SRCH NUM	-ddSRCH
FT ERR ON OFF	-ddFTERRM

Limit and Parameter Variables

The NADC 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 10-2 lists all the limit variables and parameter variables available for a NADC measurements personality command. For more information about using limit variables, see "To change the value of limit variables" in Chapter 5. For more information about using parameter variables, see "To change the value of parameter variables" in Chapter 5.

Table 10-2. Limit and Parameter Variables

Measurement	Variable Name	Description	units	Default Value
	General			
	_CMIN	Miniium amplitude level for a signal to be detected as a carrier.	dBm	-20
	_DTC	A time offset that is added to the internal gate delay for time-gating. _DTC compensates for time delays caused by the spectrum analyzer hardware.	μs	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			
Carrier power	_CPNS	Specifies the number of sweeps used for the carrier power measurement.	None	4
	_CPXL	The lower limit for the mean carrier power level.	dBm	0
	_CPXU	The upper limit for the mean carrier 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	-30
	_COXA	The maximum limit for the mean carrier off power.	dBm	−60*
	_COXP	The maximum limit for the peak carrier off power	dBm	-45
Occupied bandwidth	_OBBWX	The maximum limit for the occupied bandwidth.	Hz	28000
	_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

The pass or fail message is not displayed when these variables are set to 0.

Table 10-2. Limit and Parameter Variables (continued)

Measurement	Variable Name	Description	units	Default Value
Power versus Time Measurements				
Power versus time burst	_PBMP	Sets how far from the mean carrier the burst width is measured.	dBc	-20
	-PBSXL	The lower limit for the width of a burst with 140 symbols.	μs	5516
	-PBSXU	The upper limit for the width of a burst with 140 symbols.	μs	5639*
	_PBXL	The lower limit for the width of a burst with 162 symbols.	μs	6421
	-PBXU	The upper limit for the width of a burst with 162 symbols.	μs	6544*
Power versus time falling	_PFX	The lower segment of the upper limit line for the falling edge of the burst.	dBm	-60
	_PRMPL	Sets where on the falling edge of the trace the measurement for the release time should end.	dBm	-60
	-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	-20
	_PRXL	The lower limit for the release time for a burst.	μs	40
	_PRXU	The upper limit for the release time for a burst.	μs	123*
Power versus time rising	-PAMPL	Sets where on the rising edge of the trace the measurement for the attack time should begin.	dB	-60
	-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	-20
	_PAXL	The lower limit for the attack time for a burst.	μs	40
	_PAXU	The upper limit for the attack time for a burst.	μs	123”
	_PRX	The lower segment of the upper liiit line for the rising edge of the burst.	dBm	-60
Adjacent Channel Power Measurements				
Adjacent channel power	_ACPNS	Specifies the number of sweeps used for the adjacent channel power measurement.	None	1
	_ACPXA	The maximum limit for adjacent channel power due to modulation.	dB	-26
	_ACPXB	The maximum limit for first alternate channel power due to modulation.	dB	-45
	_ACPXC	The maximum limit for second alternate channel power due to modulation.	dB	-45
	_ACPXD	The maximum limit for second alternate channel absolute power due to modulation.	dBm	-13
	_ACPXE	The maximum limit for adjacent channel power due to transients (total).	dB	-26
	_ACPXF	The maximum liiit for first alternate channel power due to transients (total).	dB	-45

The pass or fail message is not displayed when these variables are set to 0.

Table 10-2. Limit and Parameter Variables (continued)

Measurement	Variable Name	Description	Units	Default Value
Adjacent Channel Power Measurements				
	_ACPXG	The maximum limit for second alternate channel power due to transients (total).	dB	-45
	_ACPXH	The maximum limit for second alternate channel absolute power due to transients (total).	dBm	-13
Intermodulation Spurious Measurements				
Intermodulation	_IMDX	Intermodulation spurious limit	dB	-60
Digital Demodulator baaed Measurements				
Modulation accuracy	_EVMRMSXO	RMS EVM, 1 burst mode	Percent	12.5
	_EVMRMSXT	RMS EVM, 10/10 mode	Percent	25
	_MERRX	RMS magnitude error	Percent	33
	_PERRX	RMS phase error	Degrees	50
	_EVMPKX	Peak EVM	Percent	33
	_IQOFSX	I-Q origin offset	dB	-20
	-CFERRXB	Frequency error, base station	Hz	217
	_CFERRXM	Frequency error, mobile station	Hz	417
	_DROOPX	Amplitude droop	dB/symbol	-0.01

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 5 for more information about creating your own limit line function. Table 10-3 lists all the names of the limit line functions.

Table 10-3. 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 NADC measurement personality's programming commands. The commands are listed alphabetically.

See the programming examples in Chapter 5 for more information about how to make a measurement remotely, and how to extract the measurement results from a variable, array, or trace.

_ACH
Auto Channel

Syntax

The _ACH command automatically tunes to the channel having the highest carrier power level. -ACH is similar to **AUTO CHANNEL** , but unlike **AUTO CHANNEL** -ACH does not repeat the last measurement.

Example

```
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. (lb 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 5.

_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**, or **ACP CH/SWP**.

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 10-4 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 10-4. 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**.
Not applicable	0 (base station)	2 (single channel per sweep)	_ACP performs the adjacent channel power measurement without time-gating, with one channel per measurement sweep. Equivalent softkey is **ACP CH/SWPS**.
0 (burst)	1 (mobile station)	1 (multichannel sweep)	-ACP performs the adjacent channel power measurement, with time-gating and one measurement sweep. Equivalent softkey is **ACP GTD**.
0 (burst)	1 (mobile station)	2 (single channel per sweep)	_ACP performs the adjacent channel power measurement, with time-gating and one channel per measurement sweep. Equivalent softkey is **ACP GTD CH/SWP**.
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**.
1 (continuous carrier)	1 (mobile station)	2 (single channel per sweep)	_ACP performs the adjacent channel power measurement without time-gating, with one channel per measurement sweep. Equivalent softkey is **ACP CH/SWP**.

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 XC 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).

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	TRA contains the swept RF modulation spectrum (without the transients) that was used to calculate adjacent channel power. TRA contains 1 through -NP data points for a mobile station test, 401 points for a base station test.	Determined by the trace data format (TDF) command.
TRB (for mobile station testing only)	Contains the swept RF full spectrum that was used to measure adjacent channel power. TRB contains 1 through _NP data points.	Determined by the trace data format (TDF) command.
_NUMF	Indicates if the adjacent channel power was within the measurement limits. The measurement limits are determined by _ACPXA through -ACPXH. See Table 10-2 for more information about the measurement limits. ■ If _NUMF is 0, the numeric results were within the limits. ■ If _NUMF is 2, the numeric results were greater than the measurement limits.	None

Unlike the other measurement commands, -ACP uses arrays to store measurement results. (See the following table for a list of the arrays and the measurement results that are stored in each array.) Each array contains seven elements, and each element is used to store the measurement results for a specific channel. The seven elements corresponds to the following channels:

1 Lower adjacent
2 Upper adjacent
3 Lower first alternate
4 Upper first alternate
5 Lower second alternate
6 Upper second alternate
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 10-5. Measurement Results (Array Information)

Array Name	Description	units
_ACPR	The _ACPR array elements contain the ACP random (modulation) for base or mobile.	dBm
_ACPI	The -ACPl array elements contain the ACP impulsive for mobile.	dBm
_ACPT	The _ACPT array elements contain the ACP total (transient) for mobile.	dBm
-ACPRC	The _ACPRC array elements contain the ACP random (modulation) ratio for base or mobile.	dB
_ACPIC	The _ACPI array elements contain the ACP impulsive ratio for mobile.	dB
-ACPTC	The _ACPT array elements contain the ACP total (transient) ratio for mobile.	dB

Related Commands: -MS, _ACPMT, _FTACQ, and -CC.

Limit and Parameter Variables: _ACP uses _ACPXA through _ACPXH, and -ACPNS. See Table 10-2 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" in Chapter 5 and "To measure the adjacent channel power of a mobile station" in Chapter 5.

-ACPM
Adjacent Channel Power Measurement

Syntax

xacpm

Performs the adjacent channel power measurement.

Example

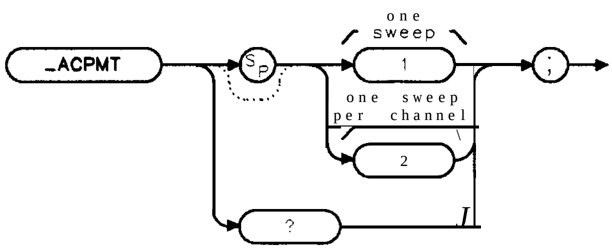
OUTPUT 718;"_ACPS;"	*Sets up the adjacent channel power measurement.*
OUTPUT 718;"ST 4SC;"	*Changes the sweep time to 4 seconds.*
OUTPUT 718;"_ACPM;"	*Performs the adjacent channel power measurement.*

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 CH/SWP**, **ACP GTD**, or **ACP GTD CH/SWP** (see **Table 10-4** 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



xacpmt

Allows you to specify how the adjacent channel power measurement is performed. If _ACPMT is set to a " 1, " the measurement will be performed using one, multichannel sweep. If -ACPMT is set to a "2," the measurement will be performed by measuring one channel at a time. The default for -ACPMT is 1.

Example

`OUTPUT 718;"MOV _ACPMT,2;"`	*Specifies a multi-channel sweep for the adjacent channel measurement.*
`OUTPUT 718;"_ACP;"`	**Performs** *the adjacent channel measurement.*

Related Commands: -ACPMT is used by -ACP and -ACPM (the adjacent channel measurement commands).

Query Example

```
OUTPUT718;"_ACPMT?;"
```

The query response will be the current value of _ACPMT.

See Also

"To measure the **adjacent** channel power of a base station" in Chapter 5 and "To measure the **adjacent** channel power of a mobile station" in Chapter 5.

_ACPS
Adjacent Channel Power Setup

Syntax

xacps

Performs the setup for the adjacent channel power measurement.

Example

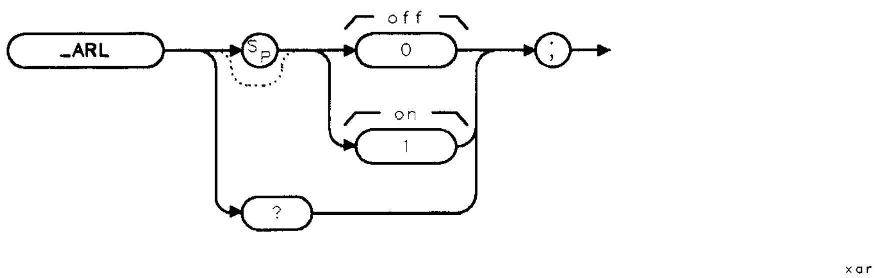
OUTPUT 718;"_ACPS;"	*Sets up the adjacent channel power measurement.*
OUTPUT 718;"ST 4SC;"	*Changes the sweep time to 4 seconds.*
OUTPUT 718;"_ACPM;"	*Performs the adjacent channel power measurement.*

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 either **ACP**, **ACP CH/SWP**, **ACP GTD**, or **ACP GTD CH/SWP** (see Table 10-4 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 carrier power measurement. You need to perform the carrier power measurement because the carrier 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.)

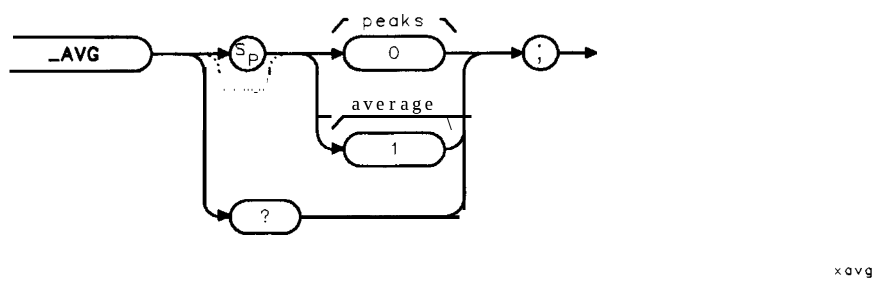
Query Example

`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.

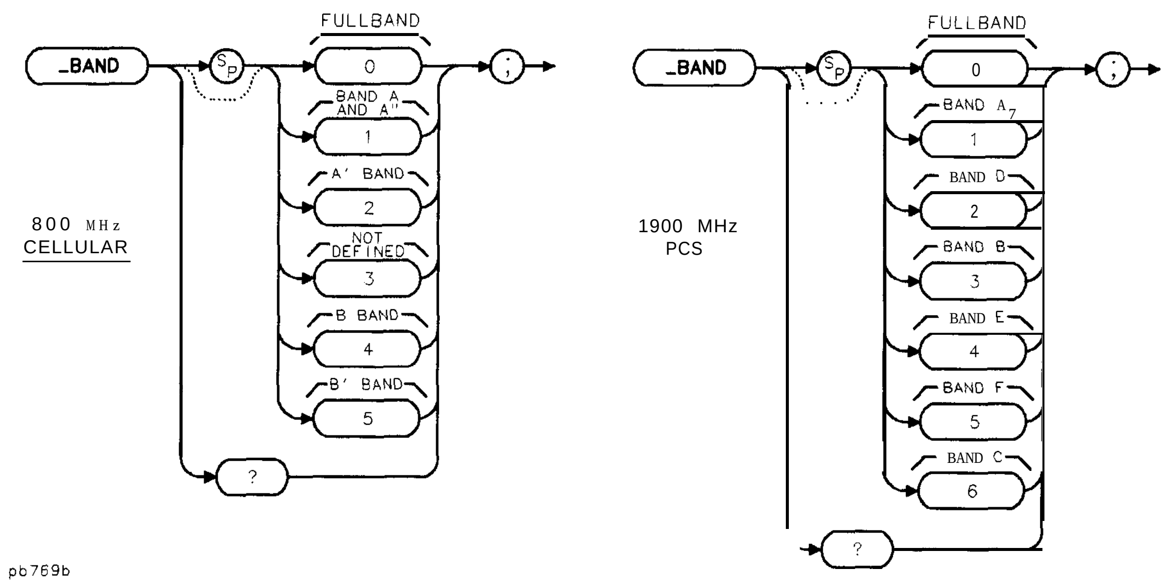
Query Example

`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. If the svstem is in IS-54 800 MHz or IS-136 800 MHz mode, -BAND allows choices of **FULLBAND**, **BANDS A '' +** A , **BAND** A' , **BAND B** , or **BAND B'** . If the system is in IS-136 1960 MHz mode, -BAND allows choices of **FULLBAND** , **BAND A** , **BAND B** , **BAND C** , **BAND D** , **BAND E** or **BAND F** . **BAND** B ' .

The frequency range selected by -BAND depends on two things:

- Whether -MS is set to a base station or a mobile station
- Whether -STANDARD is set to IS-54 800 MHz, IS-136 800 MHz, or IS-136 1900 MHz mode.

Example

`OUTPUT 718;"MOV _BAND,0;"`	Sets *the monitor band to fullband.*
`OUTPUT 718;"_MBND;"`	*Sets up the spectrum analyzer to monitor the NADC band.*

Related Commands: -MTX, -MS, _MBND, _CTUN and STANDARD. -DEFAULT sets -BAND to 1.

Query Example

```
OUTPUT 718;"_BAND?;"
```

The query response will be the current value of -BAND.

_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 Chapter 2 "To calibrate and correct for spectrum analyzer EVM inaccuracies due to uncertainty in the phase error measurement."

_CALEVM Calibrate EVM

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If -CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If -CC is set to continuous carrier, the carrier must be a non-burst carrier.)
6	Digital demodulator hardware not present or not correct (151) option.
7	Digital demodulator firmware not correct (160) option.
8	Digital demodulator firmware revision date too old.
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.
25	Results may not be accurate: frequency error >1 kHz.*
26	Results may not be accurate: EVM exceeds system limit.*
27	Results may not be accurate: droop exceeds correction 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

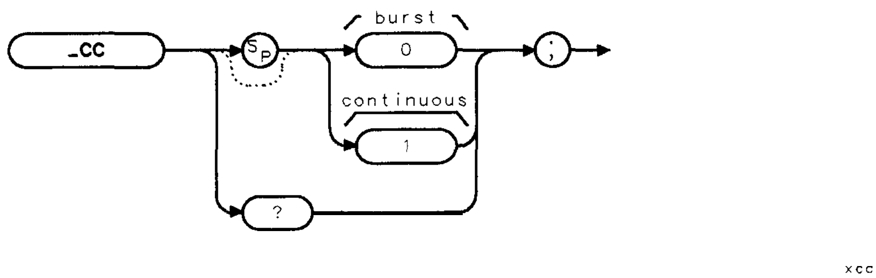
Variable	Description	units
_ddPCVC	A variable that contains the calculated phase correction value.	degrees

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 (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

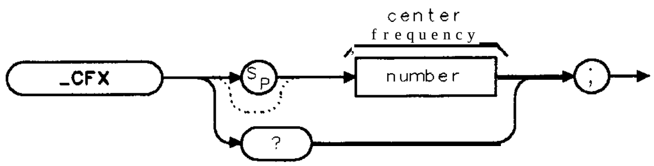
Query Example

`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 variable 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.

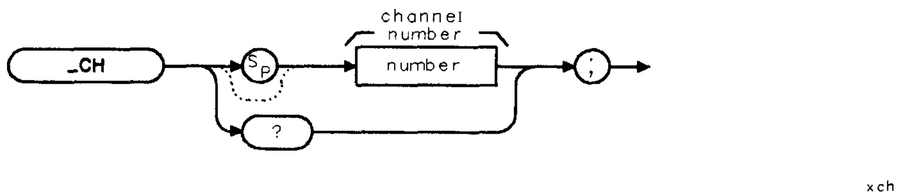
Query Example

`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 1 to 1023. 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.

_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 **CHAN 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 **CHAN POWER**.

_CHPWR
Channel Power

Syntax

xchpwr

Measures the channel power. The _CHPWR command is equivalent to **CHAN 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 5.

_COM
Carrier Off Power Measurement

Syntax

xcom

Performs the carrier off power measurement.

Example

OUTPUT 718;"_COS;"	*Sets up the carrier off power measurement.*
OUTPUT 718;"RB10KHZ;"	*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.

-COPWR
Carrier Off Power

Syntax

xcopwr

Measures the transmitter carrier off power. The -COPWR command is equivalent to **CARRIEROFF** PWR.

Example

`OUTPUT 718;"_COPWR;"` *Performs the carrier off power measurement.*

Executing -COPWR does the following:

1. Performs the carrier off power measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in variables and in a trace.

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 XC is set to continuous carrier, the carrier must be a nonburst carrier.)

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 and _COXP. 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
-COA	A variable that contains the mean carrier off power.	dBm
_COP	A variable that contains the peak carrier off power.	dBm
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, _COXP, _CORL, and -CONS. See Table 10-2 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 power" in Chapter 5.

_COS
Carrier Off Power Setup

Syntax

Performs the setup for the transmitter carrier off power measurement.

Example

OUTPUT 718;"_COS;"	*Sets up the carrier off power measurement.*
OUTPUT 718;"RB10KHZ;"	*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

Performs the carrier power measurement.

Example

OUTPUT 718;"_CPS;"	Sets *up the carrier power measurement.*
OUTPUT 718 ;"RB 10KHZ ;"	*Changes the resolution bandwidth to 10 kHz.*
OUTPUT 718;"_CPM;"	*Performs the carrier powermeasurement.*

Before using -CPM, you need to use the -CPS command to perform the setup for the carrier power measurement. The -CPS and -CPM commands are useful if you want to change the spectrum analyzer settings before making a carrier power measurement. The combination of the _CPS and -CPM commands is equivalent to the -CPWR command and **CARRIER POWER** .

See the description for -CPWR for information about the measurement state and measurement results from a carrier power measurement.

_CPS
Carrier Power Setup

Syntax

xcps

Performs the setup for the carrier power measurement.

Example

OUTPUT 7 18;"_CPS;"	*Sets up the carrier power measurement.*
OUTPUT 718 ; "RB 100KHZ ; "	*Changes the resolution bandwidth to 100 kHz.*
OUTPUT 718;"_CPM;"	*Performs the carrier power measurement.*

After using _CPS, you need to use the -CPM command to perform the carrier power measurement. The _CPS and -CPM commands are useful if you want to change the spectrum analyzer settings before making a carrier power measurement. The combination of the -CPS and -CPM commands is equivalent to the -CPWR command and **CARRIER POWER** .

_CPWR
Carrier Power

Syntax

xcpwr

Measures the transmitter carrier power. The _CPWR command is equivalent to **CARRIER POWER**.

Example

```
OUTPUT 718;"_CPWR;"
```

Executing -CPWR does the following:

1. Performs the carrier 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 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.)

-CPWR Carrier Power

Measurement Results: The results of the _CPWR are stored in the variables and trace shown in the following table.

Measurement Results

Variable or Trace	Description	Units
_NUMF	Indicates if the carrier power was within the measurement limits. The measurement limits are determined by -CPXU and -CPXL. See Table 10-2 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 carrier power amplitude.	dBm
_CPW	A variable that contains the mean carrier power in watts.	W
TRA	TRA is trace A. Trace A contains the power waveform that was used to test for carrier power.	Determined by the trace data format (TDF) command

Limit and Parameter Variables: -CPWR uses _CPNS, _CPXL, and CPXU. See Table 10-2 for more information.

Alternate Commands: If you want to change the spectrum analyzer settings before making a carrier power measurement, use _CPS and -CPM instead of the _CPWR command.

See Also

"To measure the carrier power" in Chapter 5.

-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 carrier power 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 A.*
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

xdatabits

Demodulates a single timeslot (or burst) of the transmitter. The -DATABITS command is equivalent to **DATA BITS**.

Example

`OUTPUT718;"_DATABITS;"` *Performs the data bits measurement.*

Executing -DATABITS does the following:

1. Performs the demodulated data bits measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in an array.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If _CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If -CC is set to continuous carrier, the carrier must be a non-burst carrier.)
6	Digital demodulator hardware not present or not correct (151) option.
7	Digital demodulator firmware not correct (160) option.
8	Digital demodulator firmware revision date too old.
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 con too high.
25	Results may not be accurate: frequency error >1 kHz.*
26	Results may not be accurate: EVM exceeds system limit.*
27	Results may not be accurate: droop exceeds correction 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 324 elements.

Measurement Results

Array Name	Description	units
-BITS	The -BITS array elements contain the demodulated data bits.	None

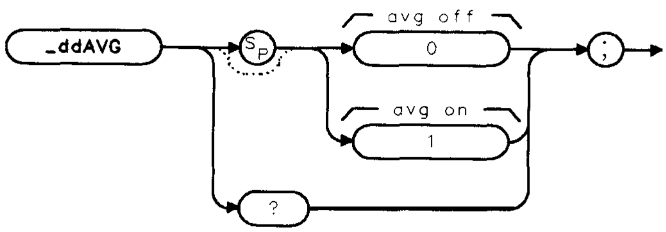
Related Commands: Use -ddNOPRT to specify if the data bits are to be displayed on the spectrum analyzer screen as part of the -DATABITS command.

See Also

"To measure the demodulated data bits" in Chapter 5.

-ddAVG
Digital Demod Average Mode

Syntax



xddavg

Allows you to specify averaging mode for the _MODACC command. The_ddAVG command is equivalent to **AVERAGE ON OFF** .

If -ddAVG is set to 1, _MODACC will average the number of measurements specified by -ddNAVG. If -ddAVG is set to 0, _MODACC will execute without averaging. The default value of -ddAVG is 0.

Note that if _ddAVG is set to 1, _ddCONT will automatically be set to 0 when -MODACC is executed.

Example

OUTPUT 718;"MOV _ddAVG,1;" *Set for average mode.*

Related Commands: _MODACC and _ddNAVG.

Query Example

OUTPUT 718 ; "_ddAVG? ; "

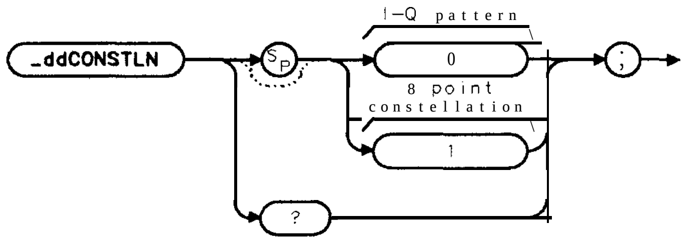
The query response will be the current value of _ddAVG.

See Also

"To measure the modulation accuracy using averaging" in Chapter 5.

_ddCONSTLN
Digital Demod 8 Point Constellation Mode

Syntax



xddconstln

Allows you to specify which graph is displayed by the _IQGRAPH command.

If -ddCONSTLN is set to 1, **_IQGRAPH** will display the 8 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 8 point constellation.*

Related Commands: _IQGRAPH.

Query Example

`OUTPUT718;"_ddCONSTLN?"`

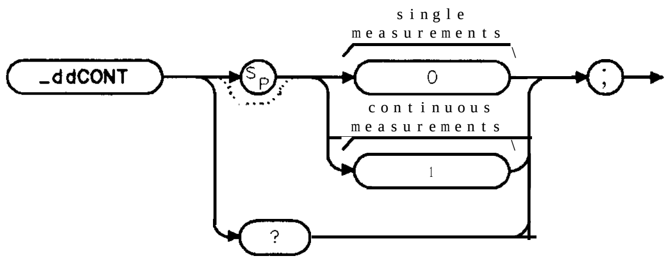
The query response will be the current value of -ddCONSTLN.

See Also

"To measure the I-Q pattern" and "To measure the 8 point constellation" in chapter 5.

_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.*

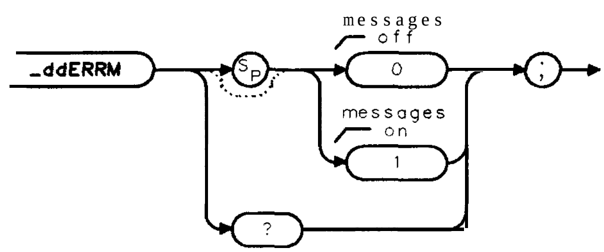
Query Example

`OUTPUT718;"_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.

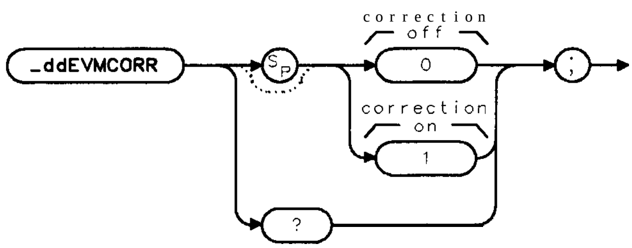
Query Example

`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.

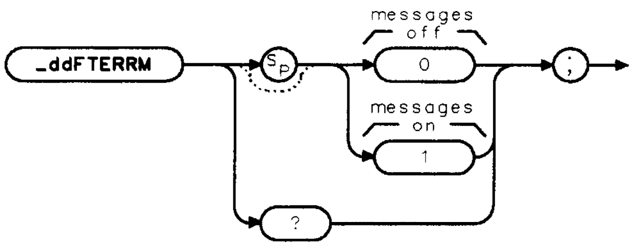
Query Example

`OUTPUT718;"_ddEVMCORR?;"`

The query response will be the current value of -ddEVMCORR.

-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.

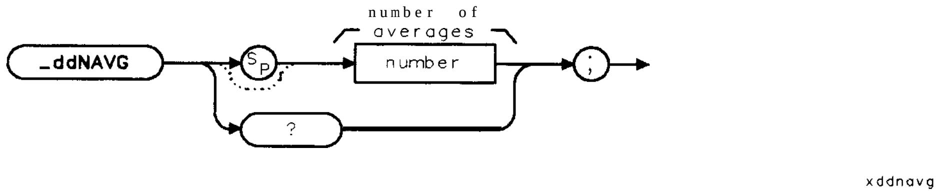
Query Example

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?;"

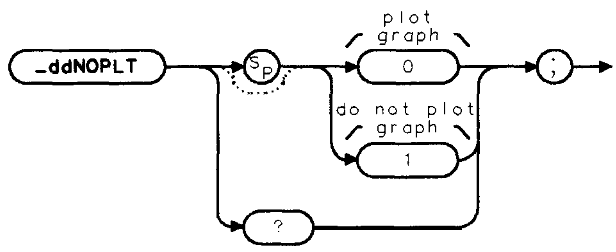
The query response will be the current value of _ddNAVG.

See Also

"To measure the modulation accuracy using averaging" in Chapter 5.

-ddNOPLT
Digital Demod NO PLOT Graphs

Syntax



Allows you to specify if the graphs are to be displayed on the spectrum analyzer screen as part of the _IQGRAPH command.

If _ddNOPLT is set to 1, the graphs are not displayed. If -ddNOPLT is set to 0, the graphs are displayed. The default value for -ddNOPLT is 0.

The _ddNOPLT command is used to speed up the _IQGRAPH command. If -ddNOPLT is set to 1, the time to execute the _IQGRAPH command will be decreased.

Example

`OUTPUT 718;"MOV _ddNOPLT,1;"` *Do not plot graph.*

Related Commands: _IQGRAPH.

Query Example

`OUTPUT718;"_ddNOPLT?"`

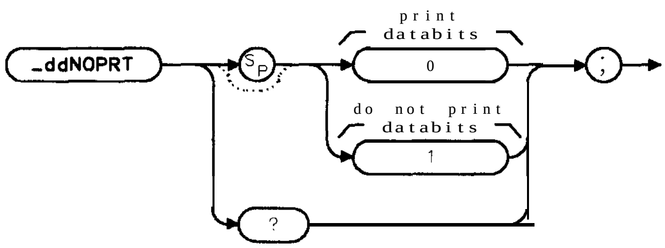
The query response will be the current value of _ddNOPLT.

See Also

"To measure the I-Q pattern" in Chapter 5.

-ddNOPRT
Digital Demod NO PRINT Data Bits

Syntax



xddnoprt

Allows you to specify if the data bits are to be displayed on the spectrum analyzer screen as part of the _DATABITS command.

If -ddNOPRT is set to 1, the data bits are not displayed. If -ddNOPRT is set to 0, the data bits are displayed. The default value for -ddNOPRT is 0.

The _ddNOPRT command is used to speed up the _DATABITS command. If -ddNOPRT is set to 1, the time to execute the _DATABITS command will be decreased.

Example

`OUTPUT 718;"MOV _ddNOPRT,1;"` *Do not print data bits.*

Related Commands: _DATABITS.

Query Example

`OUTPUT718;"_ddNOPRT?"`

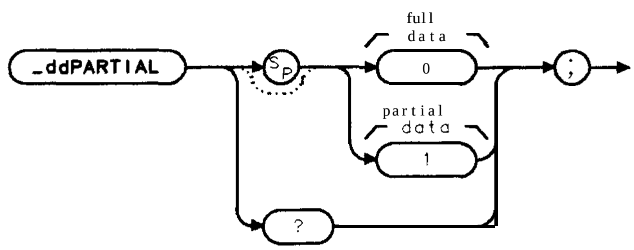
The query response will be the current value of _ddNOPRT.

See Also

"To measure the demodulated data bits" in Chapter 5.

_ddPARTIAL
Digital Demod Partial Data Mode

Syntax



xddpartial

Allows you to specify partial data mode for the -MODACC command. The -ddPARTIAL command is equivalent to **FULL PARTIAL** .

If _ddPARTIAL is set to 1, _MODACC will measure a partial set of the modulation accuracy data. If _ddPARTIAL is set to 0, _MODACC will measure the full set of modulation accuracy data. The default value of -ddPARTIAL is 0.

Example

`OUTPUT 718;"MOV _ddPARTIAL,1;"` *Set for partial data mode.*

Related Commands: _MODACC.

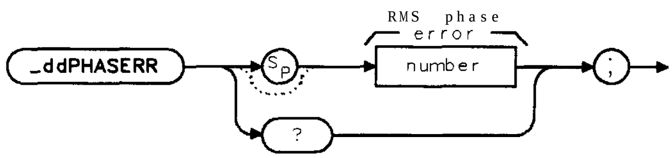
Query Example

`OUTPUT718;"_ddPARTIAL?;"`

The query response will be the current value of -ddPARTIAL.

_ddPHASERR
Digital Demod Calibration Source RMS Phase Error

Syntax



Allows you to specify the RMS phase error (in milli-degrees) of the calibration source used when the EVM calibration routine -CALEVM is executed. -ddPHASERR is equivalent to **PHASE ERROR**.

-ddPHASERR can accept an integer number from 0 to 9999. The default value for -ddPHASERR is 0.

Note	The units for _ddPHASERR are milli-degrees. To enter 1.23 degrees of calibration source RMS phase error, enter 1230 into -ddPHASERR.

Example

`OUTPUT 718;"MOV _ddPHASERR,1230;"` *Enter 1.23 degrees phase error:*

Related Commands: -CALEVM.

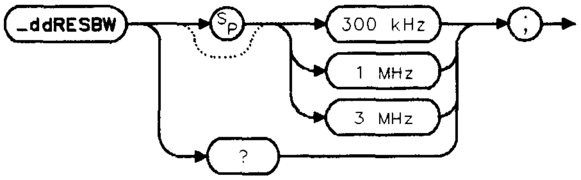
Query Example

`OUTPUT718;"_ddPHASERR?;"`

The query response will be the current value of -ddPHASERR.

_ddRESBW
Digital Demod Resolution Bandwidth

Syntax



pb770b

Allows you to specify the digital demod resolution bandwidth to be 300 kHz, 1 MHz, or 3 MHz. Frequencies are rounded to the nearest value in the 1, 3, 10 sequence if the frequency is other than the 1, 3, 10 sequence.

Example

`OUTPUT 718;"MOV _ddRESBW, 1E6;"`	*Set the digital demod resolution bandwidth to 1 MHz.*

Related Commands: -DEFAULT sets -ddRESBW to 1 MHz.

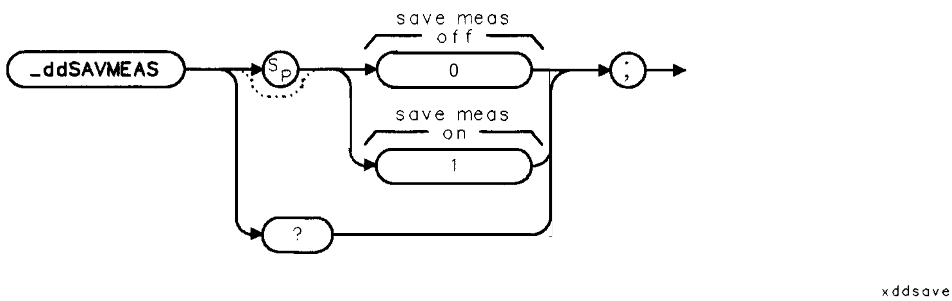
Query Example

```
OUTPUT.718;"_ddRESBW?;"
```

The query response will be the current value of -ddRESBW

-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

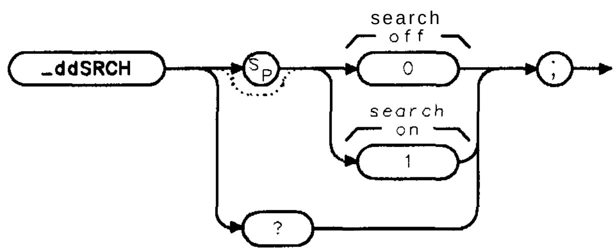
OUTPUT718;"_ddSAVMEAS?;"

The query response will be the current value of -ddSAVMEAS.

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

-ddSRCH Digital Demod Timeslot Search Mode

Syntax



xddsrch

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 1 through 6). 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

`OUTPUT718;"_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	

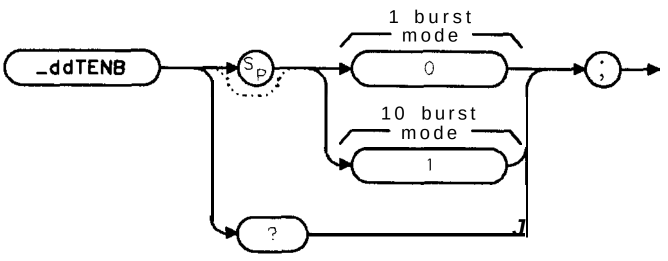
Related Commands: -MODACC, _IQGRAPH, and _DATABITS.

See Also

" To display the digital demodulator status" in Chapter 5 and "NADC Digital Demodulator Measurements Troubleshooting" in Chapter 6.

_ddTENB
Digital Demod 10 Symbol, 10 Burst Mode

Syntax



Allows you to specify 10 symbol, 10 burst average mode for the _MODACC command. The _ddTENB command is equivalent to **1** BURST 10 **BURST**.

If _ddTENB is set to 1, -MODACC will execute the 10 symbol, 10 burst average measurement. If -ddTENB is set to 0, -MODACC will execute the normal, 1 burst measurement. The default value of -ddTENB is 0.

Note that the 10 symbol, 10 burst mode is only valid for mobile stations (-MS must be 1). If _ddTENB is set to 1, -ddPARTIAL and _ddAVG have no effect, 10/10 measurements are always full, non-averaged measurements.

Example

`OUTPUT 718;"MOV _ddTENB,1;"` *Set for 10/10 mode.*

Related Commands: -MODACC.

Query Example

`OUTPUT718;"_ddTENB?;"`

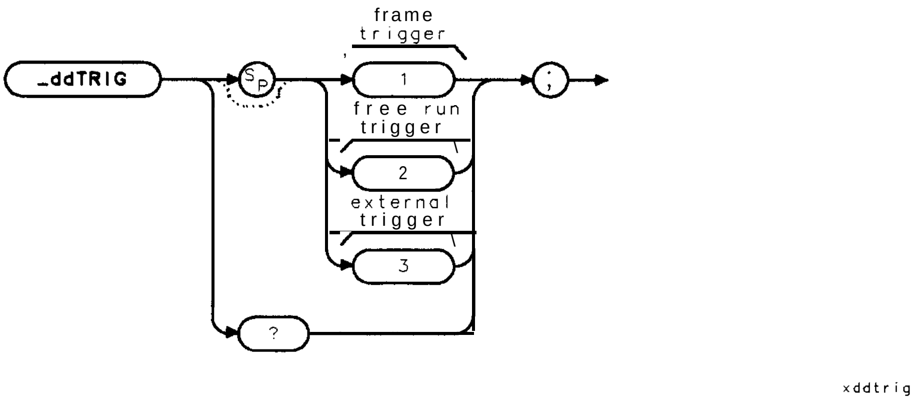
The query response will be the current value of -ddTENB.

See Also

"To measure the 10 symbol, 10 burst modulation accuracy" in Chapter 5.

-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.

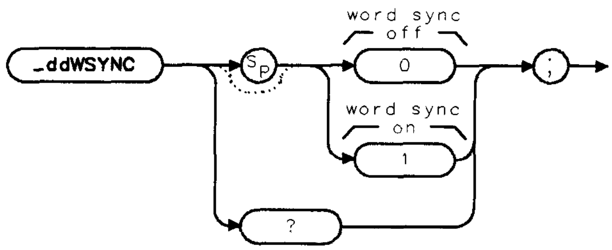
Query Example

`OUTPUT718;"_ddTRIG?;"`

The query response will be the current value of -ddTRIG.

-ddWSYNC
Digital Demod Word Sync Mode

Syntax



xddwsync

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

`OUTPUT718;"_ddWSYNC?;"`

The query response will be the current value of -ddWSYNC.

-DEFAULT
Default Configuration

Syntax

xdefault

Replaces the values and selections for the configuration functions to their default values. The -DEFAULT command is equivalent to **DEFAULT CONFIG** .

Example

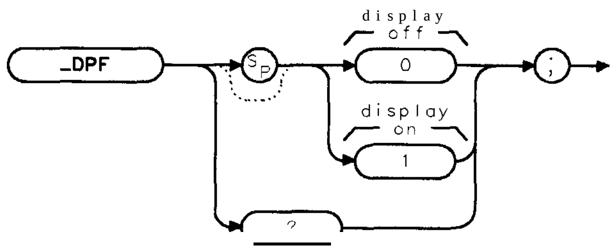
```
OUTPUT718;"_DEFAULT;"
```

The default values are as follows:

_ EXTATN	is set to 20 dB.
_CC	is set to 0 if mobile, 1 if base.
_CH	is set to channel number 1.
_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 (bands A" and A).
-TRIGSRC	is set to 1 if Options 151/160 present; otherwise, 0.
_FTACQ	is set to 0 (frame trigger acquire OFF).
_ddTRIG	is set to 1 (frame trigger).
_ddSRCH	is set to 0 (timeslot NUM).
-ddEVMCORR	is set to 0 (EVM correction OFF).
_ddRESBW	is set to 1 MHz.
-STANDARD	is set to 0 (IS-54/800 MHz.)

_DPF
Display Pass/Fail Message

Syntax



xdpf

Allows you to specify if a pass/fail message is displayed after a measurement. The -DPF command is equivalent to **PASSFAIL ON** OFF .

If _DPF is set to 0, no messages 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.

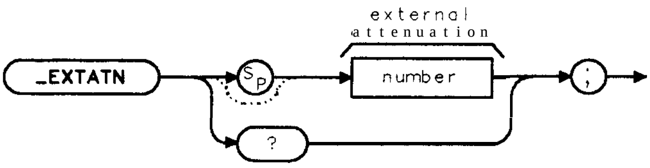
Query Example

`OUTPUT 718;"_DPF?;"`

The query response will be the current value of _DPF.

-EXTATN
External Attenuation

Syntax



xextatn

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 variable 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.

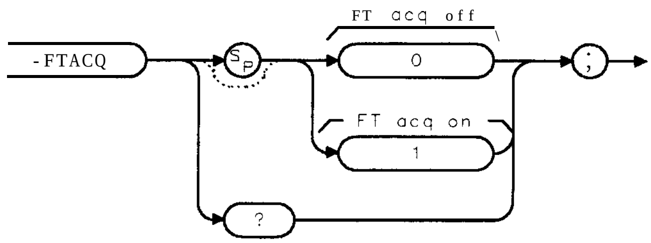
Query Example

`OUTPUT718;"_EXTATN?;"`

The query response will be a the current setting for the external attenuation.

-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, -DEFAULT sets _FTACQ to 0.

Query Example

OUTPUT 718;"_FTACQ?;"

The query response will be the current value of -FTACQ.

_IMDSPUR
Intermodulation Spurious Emissions

Syntax

ximdspur

_IMDSPUR performs the intermodulation spurious emissions measurement. The _IMDSPUR command is equivalent to **INTERMOD SPURIOUS**.

Example

```
OUTPUT718;"_IMDSPUR;"
```

Executing _IMDSPUR does the following:

1. Performs the 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.

Measurement Results: The results of the _IMDSPUR 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 _IMDX. See Table 10-2 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
_IMD	A variable that contains the amplitude value of the highest intermodulation product.	dB
IRA	TRA is trace A. Trace A contains the swept RF spectrum.	Determined by the trace data format (TDF) command

Limit and Parameter Variables: _IMDSPUR uses _IMDX. See Table 10-2 for more information.

See Also

"To measure the intermodulation spurious emissions" in Chapter 5.

_IQGRAPH
I-Q Pattern or 8 Point Constellation

Syntax

xiqgraph

Demodulates a single timeslot (or burst) of the transmitter and plots an I-Q pattern or 8 point constellation. If the value of -ddCONSTLN is 1, it will plot an 8 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 8 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.

_IQGRAPH I-Q Pattern or 8 Point Constellation

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 flrmware revision date too old.
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.
25	Results may not be accurate: frequency error > 1 kHz. *
26	Results may not be accurate: EVM exceeds system limit. *
27	Results may not be accurate: droop exceeds correction 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 8 point constellation.	*
_IQY	The _IQY array elements contain the Y-coordinates of the I-Q pattern or 8 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 8 point constellation" in Chapter 5.

_MBM
Monitor Band Measurement

Syntax

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 ;"RBIOKHZ;"	*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 bands A and A''.
OUTPUT 718;"_MBND;"          Displays the A and A'' transmission bands.
```

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 5.

_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;"RB10KHZ;"	*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

xmcm

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

OUTPUT718;"_MCS;"	*Sets up the monitor channel measurement.*
OUTPUT 7 18·"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**.

_MODACC
Modulation Accuracy

Syntax

xmodacc

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 ilrmware not correct (160) option.
8	Digital demodulator ilrmware revision date too old.
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.
25	Results may not be accurate: frequency error > 1 kHz. *
26	Results may not be accurate: EVM exceeds system limit. *
27	Results may not be accurate: droop exceeds correction limit. *
30	Measurement failed, unspecified failure.

' Measurement data present, all others abort the measurement and do not store measurement data.

Measurement Results: The results of the -MODACC command are stored in the variables shown in the following table.

Measurement Results

Variable	Description	Units
_NUMF	Indicates if the modulation accuracy results were within the measurement limits. The measurement limits are determined by _EVMRMSXO, _EVMRMSXT, _MERRX, _PERAX, _EVMPKX, _IQOFSX, _CFERRXB, _CFERRXM, and _DROOPX. 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
_DROOP†	A variable that contains the amplitude droop.	dB/symbol

* Valid only if -ddTENB is 0 (off).
† Valid only if -ddPARTIAL is 0 (off).

Limit and Parameter Variables: _MODACC uses -EVMRMSXO, _EVMRMSXT, _MERRX, _PERRX, -EVMPKX, _IQOFSX, -CFERRXB, _CFERRXM, and _DROOPX. 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 magnltude 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 magnltude error maximum value.	Percent
_MERRMIN	A variable that contains the RMS magnitude error minimum value.	Percent
_PERRSD	A variable that contains the RMS phase error standard deviation.	Degrees
-PERRMAX	A variable that contains the RMS phase error maximum value.	Degrees
-PERRMIN	A variable that contains the RMS phase error minimum value.	Degrees
_EVMRUL	RMS EVM uncertainty upper limit (20° to 30° C).	Percent
-EVMRLL	RMS EVM uncertainty lower limit (20° to 30° C).	Percent
_EVMFUL	RMS EVM uncertainty upper limit (0° to 55° C).	Percent
_EVMFLL	RMS EVM uncertainty lower limit (0° to 55° C).	Percent

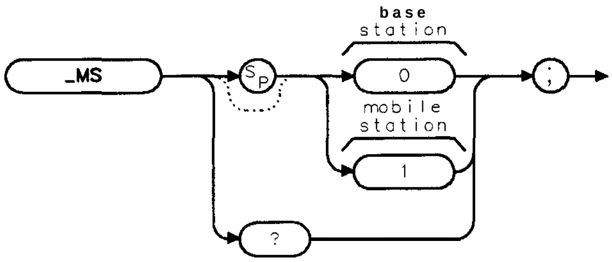
Related Commands: -ddPARTIAL, _ddTENB, -ddAVG, -ddNAVG, -ddEVMCORR.

See Also

"To measure the modulation accuracy," "To measure the 10 symbol, 10 burst modulation accuracy," and "To measure the modulation accuracy using averaging" in Chapter 5.

_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

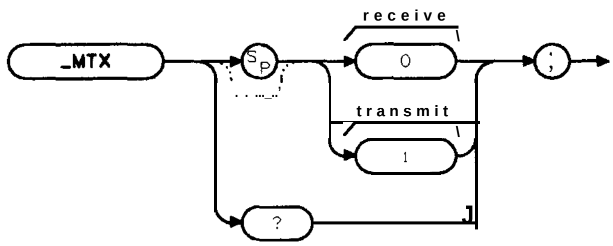
Related Commands: _CC. _Ms sets the value of -CC to the opposite of the current value of -MS.

See Also

"To select base or mobile station configuration" in Chapter 5.

_MTX
Monitor Transmit or Receive Band

Syntax



xmtx

Selects the 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 bands A and A ''.*
OUTPUT 718;"_MBND;"	*Displays the A and A" receive bands.*

You should set -MTX prior to executing _MBND.

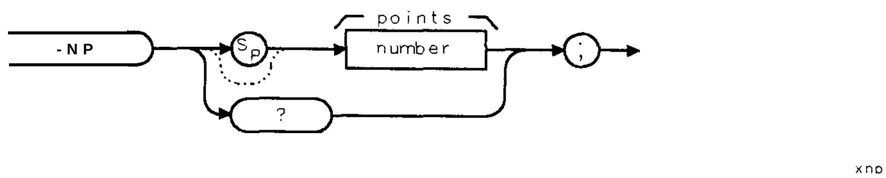
Query Example

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 channel power.*
OUTPUT 718;"_CHPWR;"	*Performs the channel power measurement.*

Related Commands: _NP is used by _ACP, _ACPM, -CHPWR, and _CHPM commands.

Query Example

OUTPUT 718;"_NP?;"

The query response will be the current value of _NP.

_OBW
Occupied Bandwidth

Syntax

xobw

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 XC 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.

_OBW Occupied Bandwidth

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. gee 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
_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 10-2 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.

See Also

"To measure the occupied bandwidth" in Chapter 5.

_OBWM
Occupied Bandwidth Measurement

Syntax

xobwm

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;"RB10KHZ;"	***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 .

_PBURST 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 XC 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 flrmware not correct (160) option.
8	Digital demodulator firmware revision date too old.
10	Frame trigger acquisition failed (see Chapter 6).

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 10-2 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 fall 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 -20 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 minlmum peaks.	Determined by the trace data format (TDF) command*

* If the trace data format of the spectrum analyzer is set to measurement units (TDF M), the measurement values for these traces range from 8000 to -4000. The measurement values for a trace are usually from 0 to 8000 measurement units, but because of the increased dynamic range (120 dB), the measurement values for trace A, trace B, and trace C can range from 8000 to -4000.

Limit and Parameter Variables: _PBURST uses _PBXL, _PBXU, _PBSXL, -PBSXU, and _PBMP. See Table 10-2 for more information.

Related Commands: -TN determines which timeslot is measured. -AVG should be set prior the executing _PBURST.

See Also

"To measure a burst" in Chapter 5.

_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).

Measurement Results: The results of the _PFALL command are stored in the variables and traces shown in the following table.

_PFALL Power versus Time Falling Edge

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 10-2 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 boundary. ■ If LIMIFAIL is equal to 2, the waveform failed the upper limit line boundary. ■ If LIMIFAIL is equal to 3, the waveform failed the both the upper and lower limit line boundaries.	None
_PRET	A variable that contains the measured release time of the burst. A value of 0 for _PRET indicates an error has occurred.	μs
_PTMT	A variable that contains the time between the external trigger and the marker.	μs
IRA	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 10-2 for more information. **Related Commands:** _TN determines the timeslot burst that is measured. -AVG should be set prior the executing _PFALL.

See Also

“To measure the falling edge” in Chapter 5.

_PFRAME

Power versus **Time Frame**

Syntax

xpframe

_PFRAME performs the power versus time frame measurement. The **_PFRAME** command is **equivalent to P vs T FRAME**.

Example

```
OUTPUT718;"_PFRAME;"
```

Executing **_PFRAME** does the following:

1. Performs the power versus time frame measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, time between the external trigger and the spectrum analyzer marker is placed in the *_PTMT* variable and in traces A, B, and C.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If _CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If _CC is set to continuous carrier, the carrier must be a **nonburst** carrier.)
The following are possible only if **_FTACQ** is set to **1**.	
6	Digital demodulator hardware not present or not correct (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).

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*

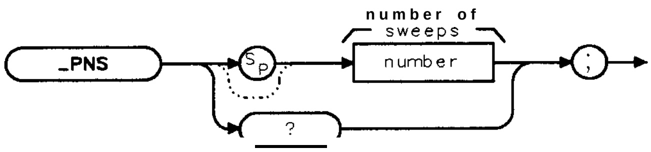
* If the trace data format of the spectrum analyzer is set to measurement units (TDF M), the measurement values for these traces range from 8000 to -4000. The measurement values for a trace are usually from 0 to 8000 measurement units, but because of the increased dynamic range (120 dB), the measurement values for trace A, trace B, and trace C can range from 8000 to -4000.

See Also

"To measure a frame" in Chapter 5.

_PNS
Power versus Time Number of Sweeps

Syntax



xpns

Allows you to change the number of sweeps that are used in calculating the results for a power versus time measurement. The **_PNS** variable 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 functions 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 5.

_PRISE
Power versus Time Rising Edge

Syntax

xprise

_PRISE performs the power versus time rising edge measurement. The _PRISE command is equivalent to P vs T RISING.

Example

```
OUTPUT 718;"_PRISE;"
```

Executing _PRISE does the following:

1. Performs the power versus time rising edge measurement.
2. Returns the measurement state. The measurement state indicates if the measurement was completed or aborted.
3. If the measurement was completed, the measurement results are placed in variables and traces.

Measurement State: The measurement state value is returned to the external controller to indicate when the measurement is finished.

Measurement State Results

Value	Description
1	The measurement was successfully completed.
2	The carrier power was too low.
3	The carrier power was too high.
4	The carrier was not a burst carrier. (If _CC is set to burst, the carrier must be a burst carrier.)
5	The carrier was not a continuous carrier. (If _CC is set to continuous carrier, the carrier must be a nonburst carrier.)
The following are possible only if _FTACQ is set to 1.	
6	Digital demodulator hardware not present or not correct (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).

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 10-2 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 liiit 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
_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.

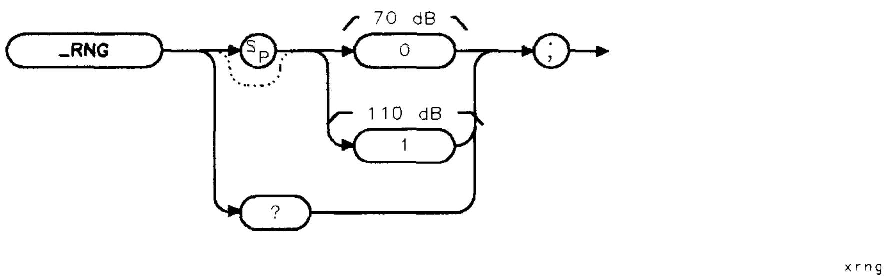
Limit and Parameter Variables: _PRISE uses _PAMPL, _PAMPH, _PRX, _PAXL, and _PAXH. See Table 10-2 for more information.

See Also

"To measure a rising edge" in Chapter 5.

_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 1 10 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

Repeats a power measurement, adjacent channel power measurement, power versus time measurement, digital demodulation measurement, or intermodulation 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, _MODACC, _IQGRAPH, _DATABITS, and _IMDSPUR.

See Also

"To use the repeat command" in Chapter 5.

_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

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**.

_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.

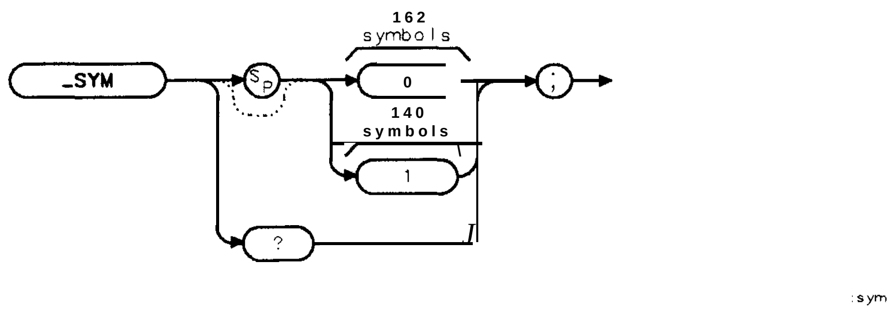
Measurement State: A "1" is returned to the external controller to indicate when the measurement is finished.

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 **SYMBOLS 140 162**.

If _SYM is set to 0, the number of symbols is set to 162. If -SYM is set to 1, the number of symbols is set to 140. The default value for _SYM is 0.

Example

`OUTPUT 718;"MOV _SYM,0;"` *Sets the number of symbols to 162.*

You should set -SYM prior to executing _PBURST, _PRISE, or _PFALL.

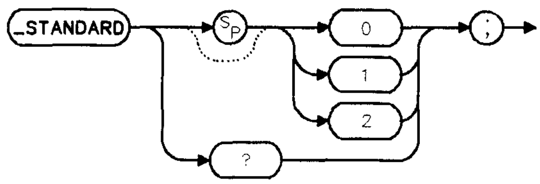
Query Example

`OUTPUT 718;"_SYM?;"`

The query response will be the current value of -SYM.

_STANDARD
Standard Band Mode

Syntax



pb773b

Allows you to specify which tuning mode the system is in; IS-54/800MHz mode, IS-136/800MHz mode, or IS-136/1900MHz mode. If IS-54/800MHz or IS136/800MHz is selected, the 800 MHz tuning plan will be used throughout all the measurements. If IS-136/1900 MHz is selected, 1900 MHz tuning plan will be used throughout all the measurements. The 800 MHz frequency band is from 824 MHz to 894 MHz and has frequency blocks A", A, B, A', and B'. The 1900 MHz bands is from 1.850 GHz to 1.990 GHz and has frequency blocks A, D, B, E, F, and C. IS-136 also has the digital control channel. The -STANDARD command is equivalent to the menu key **Standard/Band**.

If STANDARD is set to 0, the system is in IS-54/800 MHz mode. If -STANDARD is set to 1, the system is in IS-136/800 MHz mode. If STANDARD is set to 2, the system is in IS-136/1900 MHz mode.

Example

`OUTPUT 718;"MOV _STANDARD,1;"` *Sets system to IS-136/800 MHz mode.*

Query Example

`OUTPUT718;"_STANDARD?;"`

The query response will be the current value of STANDARD.

_TA
Trace Active

Syntax

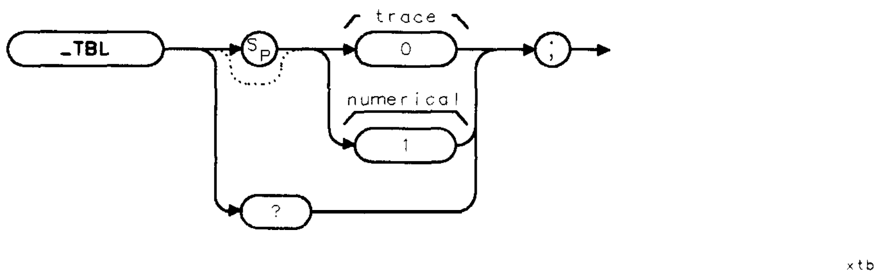
-TA allows you to view an active trace on the spectrum analyzer display after a measurement has been completed. The -TA command is equivalent to **TRACE ACTIVE**.

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 a "0," the trace result will be displayed. If _TBL is set to a " 1," the numerical results, in a tabular format, will be displayed. The default for -TBL is 1.

Example

`OUTPUT 718;"MOV _TBL,0;"` *The trace result will be displayed.*

Related Commands: _ACP, _ACPM, and _ACPMT.

Query Example

`OUTPUT 718;"_TBL?;"`

The query response will be the current value of -TBL.

_TC
Trace Compare

Syntax

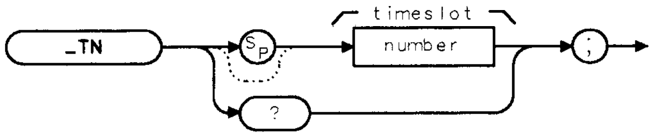
_TC copies the active trace from trace A into trace C. Trace A remains in the active mode, trace C is placed into the view mode (in the view mode, the trace is not updated). The -TC command is equivalent to **TRACE COMPARE**.

Example

OUTPUT 718;"_TC;"

_TN
Timeslot Number

Syntax



xtn

Allows you to enter the timeslot number for the burst that you want to measure. The _TN command is equivalent to **TIMESLOT NUMBER** .

-TN can accept an integer from 1 to 6. The default for -TN is 1.

Example

`OUTPUT 718;"MOV _TN,2;"` *Sets the timeslot number to 2.*

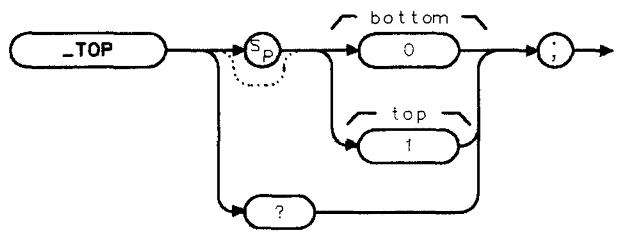
Query Example

`OUTPUT 718;"_TN?;"`

The query response will be a the current timeslot number.

_TOP
Display Top or Bottom

Syntax



xtop

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.

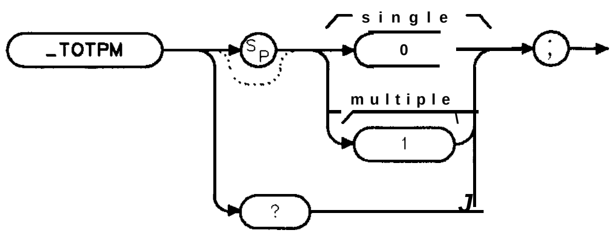
Query Example

`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.

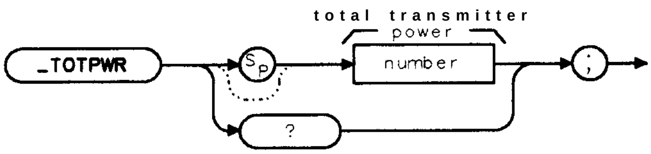
Query Example

`OUTPUT 718;"_TOTPM?;"`

The query response will be the current value of _TOTPM.

_TOTPWR Total Power

Syntax



xtotpwr

Allows you to enter the total RF power of the transmitters. The -TOTPWR variable 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.

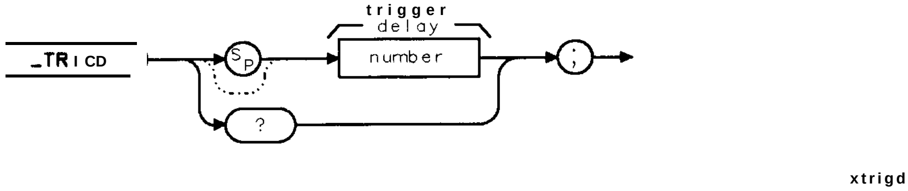
Query Example

`OUTPUT718;"_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 2,300 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.

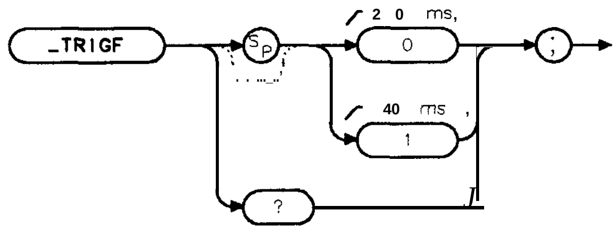
Query Example

`OUTPUT718;"_TRIGD?;"`

The query response will be the current value of _TRIGD.

_TRIGF
Trigger Frame Period

Syntax



xtrigf

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.

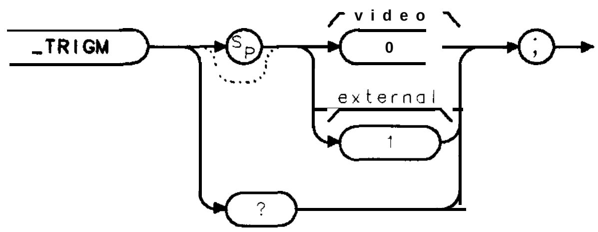
Query Example

`OUTPUT 718;"_TRIGF?;"`

The query response will be the current value of _TRIGF.

_TRIGM
Trigger Mode for Power Measurements

Syntax



xtrigm

Selects the trigger source for carrier 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.

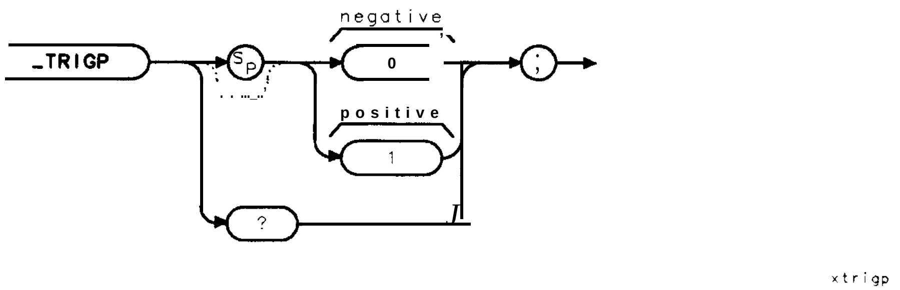
Query Example

`OUTPUT718;"_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** variable 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.

Setting -TRIGSRC to 1 will automatically set **_TRIGP** to 1.

Example

`OUTPUT 718;"MOV _TRIGP,0;"` *Selects triggering on the negative edge of the trigger signal.*

Related Commands: _TRIGSRC. -DEFAULT sets _TRIGP to 1.

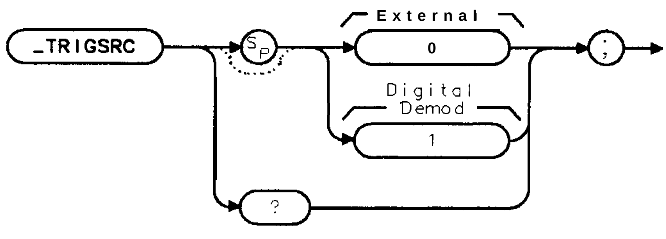
Query Example

`OUTPUT718;"_TRIGP?;"`

The query response will be the current value of _TRIGP.

_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 151/160 digital demodulator, you should ensure that -TRIGSRC is set to 1. The default value of _TRIGSRC is 1 if Options 151/160 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 0.

Query Example

`OUTPUT718;"_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.

Glossary

$\pi/4$ DQPSK

$\pi/4$ 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's 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 an NADC signal this refers to the 324 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 NADC signal, using the slope of the signal phase at the decision points after subtraction of the I.F.

CDL bits

The difference between IS-54 and IS-136 is in how the base station represents the bits in one transmission time slot. The last eleven bits of the time slot represent the CDL bits in IS-136. Under Digital Demod, end users can demod the bits in the time slot and highlight them on the screen. **IS-54/IS-136** under **BAND STANDARD** toggles the availability of this function.

CDVCC

This acronym stands for the ***coded digital verification*** color code, and is a twelve bit segment of the 324 bit NADC timeslot bit sequence. For NADC base stations, these are bit numbers 171 through 182. For NADC mobile stations, these are bit numbers 191 through ***202*** **.**

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 NADC signal where magnitude and phase information are measured to obtain the bit sequence and signal modulation accuracy. An NADC timeslot consists of 163 decision points, which create 162 symbols and 324 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 NADC 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 NADC signals, EVM is calculated after I-Q origin offset, carrier frequency error, and amplitude droop 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 NADC measurements personality, the external trigger signal is a TTL signal that is input to the spectrum analyzer's 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 NADC-TDMA signal, a frame consists of six timeslots. Each frame is equivalent to 972 symbol periods (1944 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 HP 8590E-series analyzers called FRAME TRIG OUTPUT. For NADC 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

HP-IB
The abbreviation for Hewlett-Packard Interface Bus. It is a parallel interface that allows you to “daisy-chain” more than one device to a port on a computer or instrument. Interface protocol is defined in IEEE 488.2. It is equivalent to the industry standard GPIB.

input attenuator
An attenuator between the input connector and the first mixer of a spectrum analyzer (also called an RF attenuator). The input attenuator is used to adjust the signal level incident to the first mixer, and to prevent gain compression due to high-level or broadband signals. It is also used to set the dynamic range by controlling the degree of internally-generated distortion. For some spectrum analyzers, changing the input attenuator settings changes the vertical position of the signal on the display, which then changes the reference level accordingly. In Hewlett-Packard microprocessor-controlled spectrum analyzers, the IF gain

is changed to compensate for changes in input attenuator settings. Because of this, the signals remain stationary on the display, and the reference level is not changed.

intermodulation spurious

A measure of the capability of the transmitter to inhibit the generation of intermodulation distortion products. Intermodulation spurious is sometimes called intermodulation attenuation.

intermodulation distortion

Undesired frequency components resulting from the interaction of two or more spectral components passing through a device having nonlinear behavior, such as a mixer or an amplifier. The undesired components are related to the fundamental components by sums and differences of the fundamentals and various harmonics. The algorithm is:

$$f_1 \pm f_2, 2 \times f_1 \pm f_2, 2 \times f_2 \pm f_1, 3 \times f_1 \pm 2 \times f_2, \text{ and so on}$$

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 161, the I-Q trajectory pattern of an NADC 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's 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 Ale

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's CRT when the first local oscillator frequency is equal to the first IF. The LO feedthrough is a 0 Hz marker with no error, so it can be used to improve the frequency accuracy of spectrum analyzers with nonsynthesized LO systems.

log display

The display mode in which vertical deflection is a logarithmic function of the input-signal voltage. Log display is also called logarithmic display. The display calibration is set by selecting the value of the top graticule line (reference level), and scale factor in volts per division. On Hewlett-Packard spectrum analyzers, the bottom graticule line represents zero volts for scale factors of 10 dB/division or more. The bottom division, therefore, is not calibrated for those spectrum analyzers. Spectrum analyzers with microprocessors allow reference level and marker values to be indicated in dBm, dBmV, dBμV, volts, and occasionally in watts. Nonmicroprocessor-based spectrum analyzers usually offer only one kind of unit, typically dBm.

magnitude error

Magnitude error refers to the magnitude component of an EVM measurement. Each decision point in an NADC 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 NADC 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 calulated as the root mean square of the individual decision point magnitude errors.

marker

A visual indicator we can place anywhere along the displayed trace. A marker readout indicates the absolute value of the trace frequency and amplitude at the marked point. The amplitude value is displayed with the currently selected units.

maximum input level

The maximum signal power that may be safely applied to the input of a spectrum analyzer. The maximum input level is typically 1 W (-30 dBm) for Hewlett-Packard spectrum analyzers.

memory

A storage medium, device, or recording medium into which data can be stored and held until some later time, and from which the entire original data may be retrieved.

memory card

A small, credit-card-shaped memory device that can store data or programs. The programs are sometimes called personalities and give additional capabilities to your instrument. Typically, there is only one personality per memory card. Refer also to **personality.**

menu
The spectrum analyzer functions that appear on the display and are selected by pressing front-panel keys. These selections may evoke a series of other related functions that establish groups called menus.

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 NADC signals, modulation accuracy is expressed in terms of EVM, magnitude error, phase error, carrier frequency error, I-Q origin offset, and amplitude droop.

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 HP 85718B NADC-TDMA 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 an NADC signal has an ideal phase and a measured phase. Phase error is the difference between the ideal and measured phase expressed in degrees.

For NADC signals, phase error is calculated after I-Q origin offset, carrier frequency error, and amplitude droop have been mathematically eliminated from the signal. The RMS phase error is calulated as the root mean square of the individual decision point phase errors.

point 0
For the NADC-TDMA frame structure, point 0 refers to the start of symbol 1 of a timeslot.

positive peak
The maximum, instantaneous value of an incoming signal. On digital displays, each displayed point of the signal indicates the maximum value of the signal for that part of the frequency span or time interval represented by the point.

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's 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 Alter 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 NADC-TDMA base station or mobile station can receive carrier signals.

SACCH
This acronym stands for the ***slow associated*** *control channel,* and is a twelve bit segment of the 324 bit NADC timeslot bit sequence. For NADC base stations, these are bits 29 through 40. For NADC mobile stations, these are bits 179 through 190.

scale factor
The per-division calibration of the vertical axis of the display.

sensitivity
The level of the smallest sinusoid that can be observed on a spectrum analyzer, usually under optimized conditions of minimum resolution bandwidth, 0 dB input attenuation, and minimum video bandwidth. Hewlett-Packard defines sensitivity as the displayed average noise level. A sinusoid at that level appears to be about 2 dB above the noise.

serial prefix
Serial numbers that identify an instrument begin with a five-character prefix. The prefix in this case represents the version of firmware that particular instrument was shipped with.

single-sweep mode
The spectrum analyzer sweeps once when trigger conditions are met. Each sweep is initiated by pressing an appropriate front-panel key, or by sending a programming command.

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 NADC-TDMA 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 NADC signals there are six different sync words; one for each timeslot in a frame. The sync words are each 28 bits long. For NADC base stations the sync word consists of bits 1 through 28. For NADC mobile stations the sync word consists of bits 29 through 56.

syntax
The grammar rules that specify how commands must be structured for an operating system, programming language, or applications.

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 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 NADC system, there are six timeslots per frame. Each timeslot is 162 symbol periods (324 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.

TX (transmit) band
The frequency range over which a NADC-TDMA 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 (milliwatt) dissipated in the nominal input impedance of the spectrum analyzer), dBmV (dB relative to 1 mV (millivolt)), dBμV (dB relative to 1 μV), volts, and, in some spectrum analyzers, watts.

update
To make existing information current; to bring information up to date.

video
A term describing the output of a spectrum analyzer's envelope detector. The frequency range extends from 0 Hz to a frequency that is typically well beyond the widest resolution bandwidth available in the spectrum analyzer. However, the ultimate bandwidth of the video chain is determined by the setting of the video filter.

video bandwidth
The cut-off frequency (3 dB point) of an adjustable low-pass filter in the video circuit. When the video bandwidth is equal to or less than the resolution bandwidth, the video circuit cannot fully respond to the more rapid fluctuations of the output of the envelope detector. The result is a smoothing of the trace, or a reduction in the peak-to-peak excursion, of broadband signals such as noise and pulsed RF when viewed in broadband mode. The degree of averaging or smoothing is a function of the ratio of the video bandwidth to the resolution bandwidth.

video Alter
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's 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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