

# 89451A User's Guide



**Agilent Technologies**

**Manufacturing Part Number: 89451-90000**

**Printed in USA**

**October 1995**

© Copyright 1995, 2005 Agilent Technologies, Inc

This software and documentation is based in part on the Fourth Berkeley Software Distribution under license from The Regents of the University of California. We acknowledge the following individuals and institutions for their role in the development: The Regents of the University of California.

PORTIONS OF THE TCP/IP SOFTWARE ARE COPYRIGHT PHIL KARN, KA9Q.



# Notice

---

## Hewlett-Packard to Agilent Technologies Transition

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. To reduce potential confusion, the only change to product numbers and names has been in the company name prefix: where a product name/number was HP XXXX the current name/number is now Agilent XXXX. For example, model number HP8648 is now model number Agilent 8648.

## Contacting Agilent Sales and Service Offices

The sales and service contact information in this manual may be out of date. The latest service and contact information for your location can be found on the Web at:

<http://www.agilent.com/find/assist>

If you do not have access to the Internet, contact your field engineer or the nearest sales and service office listed below. In any correspondence or telephone conversation, refer to your instrument by its model number and full serial number.

### United States

(tel) 1 800 452 4844  
(fax) 1 800 829 4433

### Canada

(tel) +1 877 894 4414  
(fax) +1 888 900 8921

### Europe

(tel) (31 20) 547 2323  
(fax) (31 20) 547 2390

### Latin America

(tel) (305) 269 7500  
(fax) (305) 269 7599

### Japan

(tel) (81) 426 56 7832  
(fax) (81) 426 56 7840

### Australia

(tel) 1 800 629 485  
(fax) (61 3) 9210 5947

### New Zealand

(tel) 0 800 738 378  
(fax) 64 4 495 8950

### Asia Pacific

(tel) (852) 3197 7777  
(fax) (852) 2506 9284



**Agilent Technologies**



## Warranty

The information contained in this document is subject to change without notice.

**Hewlett-Packard makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties or merchantability and fitness for a particular purpose.**

Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

## Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument.

Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements. This is a Safety Class 1 instrument.

### Ground the Instrument

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

### Do Not Operate in an Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

### Keep Away from Live Circuits

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

### Do Not Service or Adjust Alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

### Do Not Substitute Parts or Modify Instrument

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure the safety features are maintained.

### Dangerous Procedure Warnings

Warnings accompany potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

### Cleaning

To prevent electrical shock, disconnect this product from mains before cleaning. Only use a dry cloth or one slightly dampened with water to clean external parts. DO NOT attempt to clean internally!

## Safety Symbols

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

### General Definitions of Safety Symbols Used on Equipment or in Manuals



Instruction manual symbol. The product is marked with this symbol when it is necessary for the user to refer to the instruction manual to protect against damage to the instrument.



Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked).



Protective ground (earth) terminal. Used to identify any terminal which is intended for connection to an external protective conductor for protection against electrical shock in case of a fault, or to the terminal of a protective ground (earth) electrode.



Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of a fault. A terminal marked with this symbol must be connected to ground in the manner described in the installation (operating) manual, and before operating the equipment.



Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.



Alternating current (power line).



Direct current (power line).



Alternating or direct current (power line).

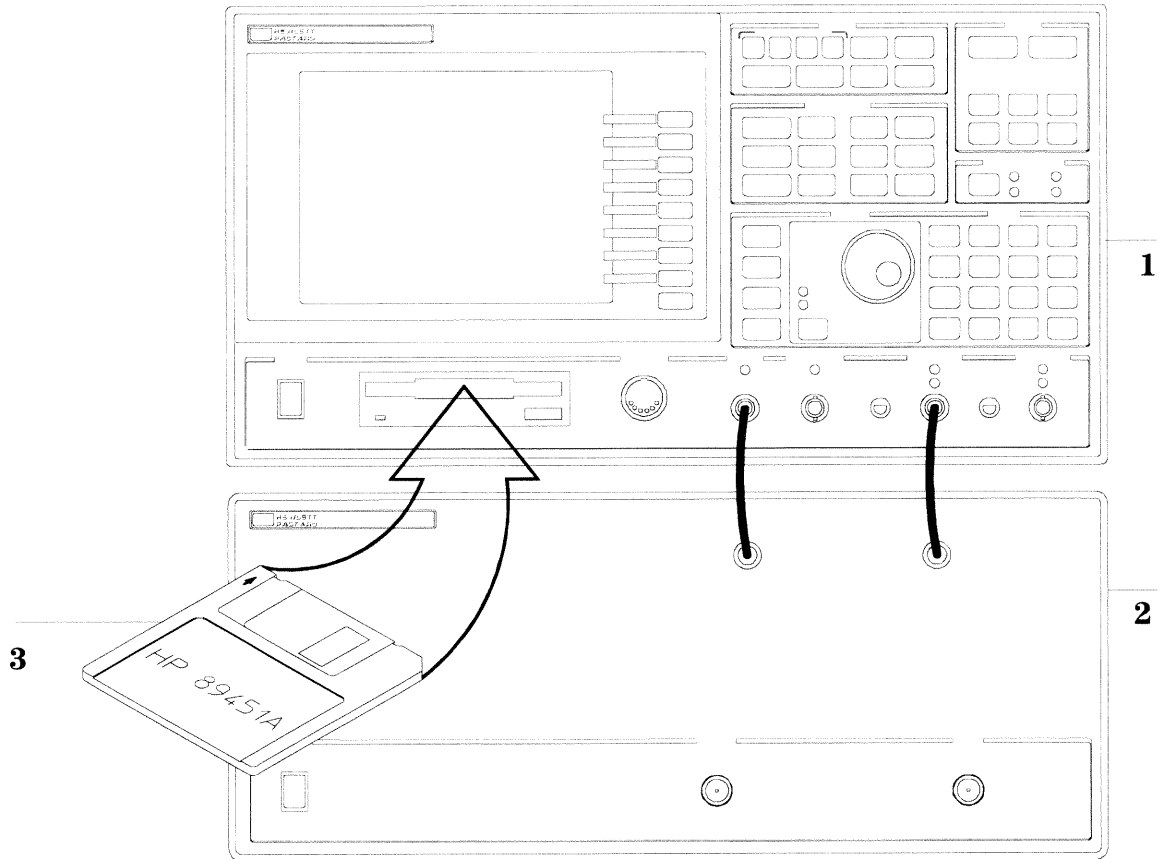
### Warning

The warning sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which if not correctly performed or adhered to, could result in injury or death to personnel.

### Caution

The caution sign denotes a hazard. It calls attention to an operating procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product or the user's data.

# The HP 89451A at a Glance



---

### **Front Panel**

**1**-This is the IF Section. The IF Section is the analyzer's measurement 'engine.' Use the IF Section to configure the analyzer and view measurement results.

**2**-This is the RF Section. The RF Section extends the frequency range of the IF Section and may contain an optional RF Source. The HP 89410A does not have an RF Section.

**3**-The HP 89451A consists of a diskette that adds one-button measurement capabilities for several industry standard cellular phone systems to your HP 89400-Series analyzer.

**This manual shows you how to install and use the HP 89451A in your HP 89400-Series analyzer. For details about your analyzer, see your analyzer's *Getting Started Guide* and *Operator's Guide*.**

---

## *Notation Conventions*

Before you use this book, it is important to understand the types of keys on the front panel of the analyzer and how they are denoted in this book.

**Hardkeys** Hardkeys are front-panel buttons whose functions are always the same. Hardkeys have a label printed directly on the key. In this book, they are printed like this: [**Hardkey**].

**Softkeys** Softkeys are keys whose functions change with the analyzer's current menu selection. A softkey's function is indicated by a video label to the left of the key (at the edge of the analyzer's screen). In this book, softkeys are printed like this: [softkey].

**Toggle Softkeys** Some softkeys toggle through multiple settings for a parameter. Toggle softkeys have a word highlighted (of a different color) in their label. Repeated presses of a toggle softkey changes which word is highlighted with each press of the softkey. In this book, toggle softkey presses are shown with the requested toggle state in bold type as follows:

"Press [key name **on**]" means "press the softkey [key name] until the selection on is active."

**Shift Functions** In addition to their normal labels, keys with blue lettering also have a shift function. This is similar to shift keys on a pocket calculator or the shift function on a typewriter or computer keyboard. Using a shift function is a two-step process. First, press the blue [**Shift**] key (at this point, the message "shift" appears on the display). Then press the key with the shift function you want to enable. Shift function are printed as two key presses, like this:

[**Shift**], [**Shift Function**]

**Numeric Entries** Numeric values may be entered by using the numeric keys in the lower right hand ENTRY area of the analyzer front panel. In this book, values that are to be entered from these keys are indicated only as numerals in the text, like this:  
Press 50, [enter]

**Ghosted Softkeys** A softkey label may be shown in the menu when it is inactive. This occurs when a softkey function is not appropriate for a particular measurement or not available with the current analyzer configuration. To show that a softkey function is not available, the analyzer "ghosts" the inactive softkey label. A ghosted softkey appears less bright than a normal softkey. Settings/values may be changed while they are inactive. If this occurs, the new settings are effective when the configuration changes such that the softkey function becomes active.



---

## *In This Book*

This guide shows you how to install and use the HP 89451A application software in an HP 89400-Series analyzer. This guide also contains all HP-IB information for the HP 89451A application software.

### **To Learn More About the HP 89400-Series Analyzers**

To learn more about HP 89400-Series analyzers, see the *Getting Started Guide* and *Operator's Guide* shipped with your HP 89400-Series analyzer.



---

# Table of Contents

## **1 Loading the HP 89451A Application**

- To determine if your analyzer can run the application 1-2
- To give your analyzer permission to use the application 1-3
- To allocate memory for the application 1-4
- To load the application 1-7

## **2 About the HP 89451A Application Software**

- About the HP 89451A Application Software 2-2
- Using the Application Software 2-3
  - Displaying Application Menus 2-4
  - Using Online Help 2-5
  - Measurement Tips 2-6
  - Running a Test 2-7
  - Parameters Set When You Run a Test 2-8
  - Saving Parameters to the USER System 2-10
  - Sync/Unique Words for the Modulation Accuracy Test 2-14
- About Adjacent-Channel Power 2-15

## **3 Making Measurements**

- Before you run a test 3-2
- To measure occupied bandwidth 3-4
- To measure adjacent-channel power 3-6
- To measure modulation accuracy 3-8
- To modify user defined occupied bandwidth 3-10
- To modify user defined adjacent-channel power 3-12
- To modify user defined modulation accuracy 3-14
- To define a sync/unique word pattern 3-15
- To save setup to the USER system 3-16
- To choose the best configuration 3-17

## **4 HP-IB Command Reference**

- HP-IB Commands 4-2

### **Index**

### **Need Assistance?**

### **About this edition**

### **Hewlett-Packard Sales and Service Offices**



---

**Installation**



---

# 1

---

## Loading the HP 89451A Application

This chapter shows how to load and run the HP 89451A application in an HP 89400-Series Vector Signal Analyzer.

---

## To determine if your analyzer can run the application

To run the HP 89451A application software, your analyzer must have the options and hardware shown below. The following steps show you how to determine if your analyzer has these options and hardware.

- Option AYA (Vector Modulation Analysis)
- A50 Digital Filter assembly, Revision C or newer (HP part number 89410-69550).

- 1** Display the `OPTIONS CONFIGURATION` table.  
Press [**System Utility**], [options setup].
- 2** Check that option AYA is installed in your analyzer. The analyzer displays `YES` under `INSTALLED` if the option is installed.
- 3** Check that your A50 Digital Filter assembly's revision is greater than Rev B.  
Set the power switch to to off (O).  
Set the power switch to on (I) to run the power-up tests.  
Press [**System Utility**], [more], [diagnostics], [test log on].

The test log contains the results of the power-up tests. The power-up tests report the revision of the A50 Digital Filter assembly. Make sure your analyzer has a revision greater than Rev B.

- 4** If your analyzer does not have all of the above options and hardware, you must purchase the options or hardware that you are missing. To do this, contact your Hewlett-Packard sales representative or your local Hewlett-Packard Sales and Service office (listed on the inside, rear cover of this guide).

The power-up tests report the revision of your A50 Digital Filter assembly. This analyzer does NOT need a new A50 Digital Filter Assembly because the revision (Rev) is greater than Rev B.

```
TEST LOG
-----
Mult fctn peripheral . . . . . PASS
NVRAM . . . . . PASS
Real time clock . . . . . PASS
DIN controller . . . . . PASS
Front panel . . . . . PASS
DSP/bus . . . . . PASS
Additional hardware . . . . . PASS
Additional hardware information:
  A50 Digital Filter assembly is greater than Rev B
  A42 Memory assembly is greater than Rev A
Sample RAM . . . . . PASS
DSP processor . . . . . PASS
Option UFG ROM . . . . . PASS

Power-up functional tests complete
```

### Test Log



---

## To give your analyzer permission to use the application

The HP 89451A application consists of an HP 89400-Series Firmware Update kit and two 3.5-inch disks: the *Install* disk and the *Application* disk. The firmware-update kit contains everything you need to install the latest firmware in your analyzer. The *Install* disk gives the analyzer permission to use the HP 89451A application. The *Application* disk contains the HP 89451A application software.

This procedure shows you how to give your analyzer permission to use the application.

- 1** Upgrade your instrument firmware.  
Follow the instructions in the HP 89400-Series Firmware Update kit.
- 2** Set the power switches to on (I).
- 3** Insert the Install disk into the analyzer's internal disk drive.
- 4** Give your analyzer permission to use the application software:  
Press [**System Utility**], [options setup], [install from option disk].
- 5** Remove the Install disk.
- 6** Cycle power (turn the power switch off (O), then on (I)).
- 7** Check that your analyzer has permission to use the HP 89451A application:  
Press [**System Utility**], [options setup].

Look for **\*\*2 Custom Application** in the OPTIONS CONFIGURATION table. This entry must exist for your analyzer to use the HP 89451A application. If this entry does not exist, repeat the above procedures.

## To allocate memory for the application

The analyzer loads the HP 89451A application into RAM. The following procedure shows you how to allocate memory for the HP 89451A application.

- 1** Display the MEMORY USAGE table.  
Press [**System Utility**], [memory usage].
- 2** Determine if sufficient memory is allocated for the HP 89451A application.  
The HP 89451A application requires approximately 200,000 bytes of RAM. If the number of bytes allocated for applications (*Applications* in the MEMORY USAGE table) is less than this, you must perform steps 3 through 7.

### HINT

You will need to allocate much more than 200,000 bytes if you have other applications loaded into the analyzer. In this case, allocate enough memory to load all applications.

### HINT

You can install option UFG (4 MByte Extended RAM and Additional I/O) to add an additional 4 megabytes of memory. To order this option, contact your local Hewlett-Packard Sales representative.

To run the application, you must have at least 200,000 bytes allocated for application memory.

MEMORY USAGE			
Purpose	Bytes Allocated	Bytes Used	Bytes Free
Measurement	970468	970468	0
LAN	400000	400000	0
Applications	200000	20	199980
IBASIC	0	0	0
RAM Disk	65536	65536	0
Data Regs	0	0	0
Trace Buffers	0	0	0
Unallocated	4354052	0	4354052
Meas Memory Configuration			
Max frequency points:		1601	
Num math temp:		4	

**Memory Usage Table**

- 3** If your analyzer has Option 1C2 (HP Instrument BASIC), perform steps 4 and 5. If your analyzer does not have Option 1C2, skip steps 4 and 5.

---

**CAUTION**


---

Steps 4 and 5 remove all IBASIC programs. If necessary, save all IBASIC programs before performing these steps. To allocate application memory in analyzers that have Option 1C2, you must first set IBASIC memory to zero. You can reallocate IBASIC memory after you allocate memory for applications.

- 4** Note the amount of memory allocated for IBASIC. If IBASIC memory is zero, skip step 5; if it is not zero, you must perform step 5.
- 5** Set IBASIC memory to zero (the [configure IBASIC memory] softkey exists only in analyzers that have Option 1C2).  
 Press [configure IBASIC memory], [IBASIC memory].  
 Press 0 (zero), [enter] to set IBASIC memory to zero.  
 Press [Return] (bottom softkey).
- 6** Allocate memory for the application.  
 Press [configure app memory], [APP memory].  
 Press 200000, [enter] to allocate 200,000 bytes for the HP 89451A application.  
 Press [Return] (bottom softkey).
- 7** Look at *Bytes Allocated for Applications* in the MEMORY USAGE table and verify that 200,000 bytes (or more) are allocated for applications.
- 8** If desired, reallocate IBASIC memory (if your analyzer has Option 1C2).  
 Press [configure IBASIC memory], [IBASIC memory].  
 Set IBASIC memory to the size noted in step 4.  
 Press [Return] (bottom softkey).
- 9** Determine if sufficient memory is allocated to maximum frequency points.  
 The application requires maximum frequency points to be set to 1601 or more. If maximum frequency points (*Max frequency points* in the MEMORY USAGE table) is less than 1601, you must perform step 10.
- 10** Set the maximum frequency points to 1601.  
 Press [config meas memory], [max freq pts].  
 Press 1601, [enter] to set time points to 1601.  
 Press [Return] (bottom softkey).
- 11** Determine if sufficient memory is allocated for the temporary math buffers.  
 The application requires 4 or more temporary math buffers. If the number of math buffers (*Num math temp* in the MEMORY USAGE table) is less than 4, you must perform step 12.

**12 Set the the number of temporary math buffers to 4.**

Press [configure meas memory], [num math temp].

Press 4, [enter] to set the number of tempory math buffers to 4.

Press [Return] (bottom softkey).

**13 Set the instrument mode to digital demodulation.**

Press [**Instrument Mode**], [Demodulation], [demod type], [Digital Demodulation].

**14 Display the MEMORY USAGE table.**

Press [**System Utility**], [memory usage].

**15 Determine if sufficient memory is allocated to maximum time points.**

The application requires maximum time points to be set to 2048 or more. If maximum time points (*max time points* in the MEMORY USAGE table) is less than 2048, you must perform step 16.

**16 Set the maximum time points to 2048.**

Press [config meas memory], [max time pts].

Press 2048, [enter] to set time points to 2048.

Press [Return] (bottom softkey).

---

## To load the application

Prior to loading the HP 89451A application software, you must complete the previous procedures. The previous procedures determine if your analyzer has the necessary options and hardware to load the application, give your analyzer permission to use the application, and allocate sufficient memory for the application.

**1** Insert the Application disk into the analyzer's internal disk drive.

**2** Make the internal disk drive the default disk:

Press [**Disk Utility**], [default disk], [internal disk].

**3** Load the application:

Press [**System Utility**], [applications], [load application], [enter].

When you press [load application], the analyzer finds the first application on the default disk. When you press [enter], the analyzer loads that application into the analyzer's volatile RAM. If you want, you can now remove the application disk from the internal disk drive.

If you created a disk that has multiple applications on it, insert the disk, display the disk catalog, then rotate the knob to select the desired application. In this case, the analyzer loads the selected application when you press [enter].

**4** After the application is successfully loaded, display the application's main menu:

Press [**Shift**], [**Instrument Mode**].

The analyzer loads the application into volatile RAM. Therefore, the application must be reloaded if you cycle power or remove power from the analyzer.

You can use the analyzer's auto-load feature to automatically load the application at power on. At power on, the analyzer searches its internal disk drive and NVRAM (non-volatile RAM) and automatically loads all files that end with .APP. The filename for the HP 89451A application is HP89451A.APP. Therefore, if you insert the Application disk in the analyzer's internal disk drive, the analyzer automatically loads the application (since it ends with .APP) at power on.

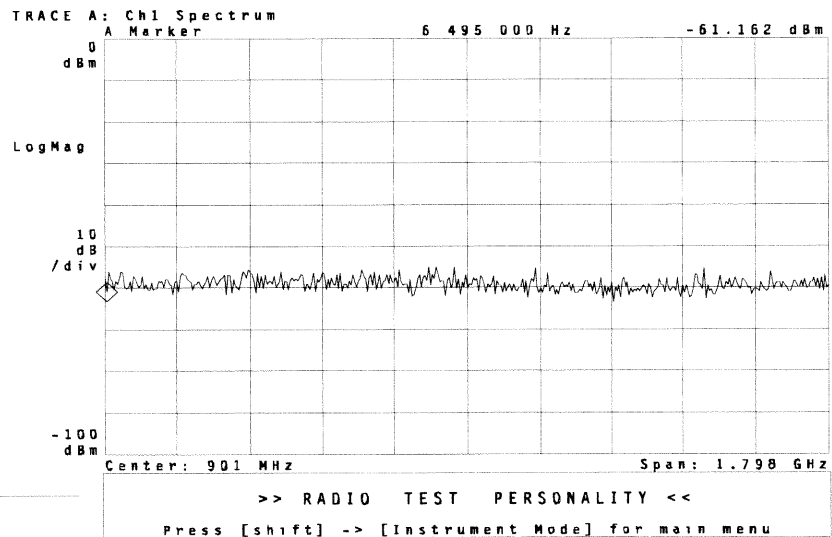
---

### Hint

To override the analyzer's *auto-load* feature, press and hold [**Preset**] while powering on the analyzer.

**Hint**

You may want to store the application in the analyzer's non-volatile RAM (NVRAM). That way, you don't have to keep the application disk near the analyzer. To store the application in NVRAM, insert the *Application* disk and press [**Disk Utility**], [copy file]. Then set [source file] to INT:HP89451A.APP and [destn file] to NVRAM:HP89451A.APP, and press [perform file copy]. Since the filename ends in .APP, the analyzer will load the application from NVRAM at power on unless you hold the [**Preset**] hardkey.



The analyzer displays a message after successfully loading the application.

**Application Loaded into Analyzer**

---

**Concepts**





---

# 2

---

## About the HP 89451A Application Software

This chapter describes the operation of the HP 89451A application software.

## *About the HP 89451A Application Software*

The HP 89451A Application software adds one-button measurement capabilities for the following industry standard cellular phone systems to your HP 89400-Series analyzer.

- North American Digital Cellular (NADC) — IS-54, 55, 56
- Personal Digital Cellular (PDC) — RCR-27C
- Personal Handy Phone System (PHS) — RCR-28

The application software:

- Automatically configures the analyzer to perform the following one-button tests:
  - Occupied Bandwidth
  - Adjacent-Channel Power
  - Modulation Accuracy
- Lets you use other powerful features in the analyzer to customize measurements for your specific application (such as advanced signal analysis, display features, averaging, and triggering).
- Lets you save your customized measurement setup creating a custom system.
- Measures continuous or burst modulated signals.

## *Using the Application Software*

The HP 89451A Application software works in any HP 89400-Series analyzer that has the following options and hardware installed (see “To determine if your analyzer can run the application” in chapter 1):

- Option AYA (Vector Modulation Analysis)
- A50 Digital Filter assembly greater than Rev. B

---

**NOTE**

The HP 89451A application software is designed for use with the Channel 1 input. The HP 89451A application software does not support the use of Channel 2.

---

### **Displaying Application Menus**

After loading the application, display the application's main menu by pressing **[Shift]**, **[Instrument Mode]**. The application contains several layers of menus. In other words, some softkeys display another menu, which in turn contain softkeys that display other menus.

If you are using one of the application's menus and you press any hardkey, the analyzer replaces that menu with the hardkey's menu. There are two ways to return to the application's menu:

- Press **[Shift]**, **[Instrument Mode]** to return to the application's main menu. Then press the softkeys that display the desired menu.
- Press **[Shift]** **[.]**. In other words, press the **[Shift]** hardkey, followed by the decimal point hardkey (located on the numeric keypad). This feature quickly returns you to the last (previously displayed) application menu. If you preset the analyzer or press the **[test preset]** softkey, you must display the application's main menu before you can use this feature.

## Using Online Help

The application software comes with its own online help. You access online help for the application the same way you access online help for the analyzer—by pressing the **[Help]** hardkey.

As with the analyzer, use online help to learn specifics about any key. These specific details, often called *reference* information, are only located in online help—they are not contained in this guide. Therefore, for in-depth details about any key, you must use online help.

Here are some additional details you should know when using online help with the application software.

- The online help index does not contain index entries for application topics.
- To display helptext for application softkeys, the current softkey menu must be an application menu. Within online help you cannot press **[Shift]**, **[Instrument Mode]** or **[Shift]**, **[.]** to display an application menu—pressing **[Shift]** displays online help for the **[Shift]** hardkey; pressing **[Instrument Mode]** displays online help for the **[Instrument Mode]** hardkey; pressing **[.]** displays online help for the decimal point hardkey. For example, if you display online help for the application's **[select test]** softkey, and then press **[Average]** to display online help for the Average hardkey, you cannot get back to the application's menu by pressing **[Shift]**, **[Instrument Mode]**. To return to the application's menus, you must exit online help (by pressing **[Help]** or **0**) and press **[Shift]**, **[Instrument Mode]**.

```

Topic: [select test] Softkey

Key Path: [Shift] -> [Instrument Mode]

Displays a softkey menu that lets you select or
deselect a test, save setup to the USER system, or
preset a test.

* [Occupied Bandwidth] measures the
  frequency bandwidth that contains 1% to 99%
  of the total power in the current span, as
  specified by the [% power] softkey.

* [Adjacent Chan Pwr] measures the amount
  of power that is leaking from the
  transmission channel into adjacent radio
  channels.

* [Modulation] measures the error vector
  magnitude (EVM) and other parameters of the
  modulated signal.

* [None] deselects (aborts) a test.

Prev Topic-7      Print-8      Prev Page-^      Index-1
Jump To Topic-4  Help On Help-5  Next Page-v      Quit-0

```

### Portion of Helptext for the **[select test]** Softkey

## Measurement Tips

The following lists some tips that you may find useful.

- Measurement parameters for each test can be changed. The changes for each test are remembered even if you run another test then rerun the original test. Most changes you make to a test will not, however, affect the other tests since each test reconfigures the analyzer. If you are unsure of a test's setup state and you are using one of the standard radio systems, press **[Shift]**, **[Instrument Mode]**, **[select test]**, **[test preset]** before running the test to restore the test to a known setup state. The USER system is not affected by pressing **[test preset]**.
- The preferred configuration is to set **[max time pts]** to 2048 and **[max freq pts]** to 1601. If these values are too low, the application displays a warning message. To change these values, see "To allocate memory for the application" in chapter 1.

---

### Caution

---

Setting external attenuation overwrites any external calibration gain values you may have set for channel 1 and 2.

- You can increase measurement speed in the Occupied Bandwidth test by selecting linear units for the y-axis and decreasing the frequency span. By default, the y-axis units are dBm. These units are non-linear. Non-linear units take longer to compute than linear units. Therefore, you can increase measurement speed by selecting linear units, such as watts. To change y-axis units, press **[Ref Lvl/Scale]**, **[X & Y units setup]**, **[Y units]**. For example, the frequency span is 156.25 kHz for NADC system measurements. To increase measurement speed, you may want to reduce the frequency span to 78.125 kHz. To do this, press **[Frequency]**, **[span]**, then press the down arrow key twice.

---

### Caution

---

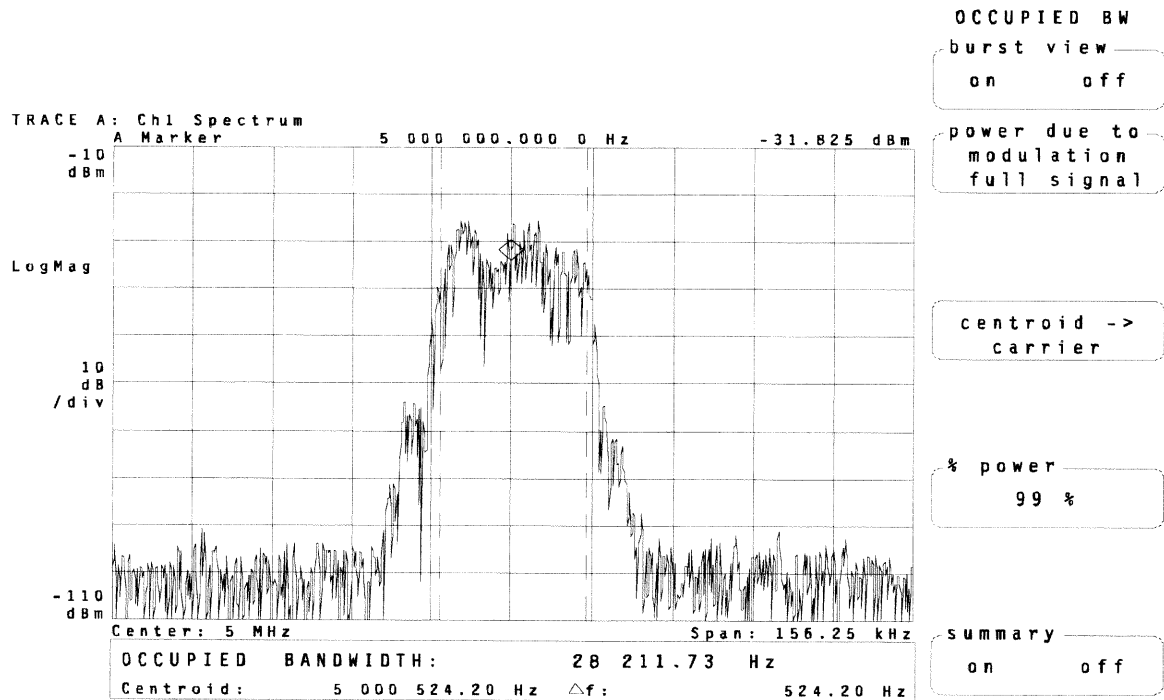
When channel filtering is set up for the Adjacent-Channel Power test, the F4, F5 and F6 math functions, K5 constant, and D6 data register are overwritten. If the test method is pseudo-swept, the F3 math function is also overwritten when channel filtering is set up. Save the data you want to keep to other locations before channel filtering is set up.

- The Modulation test automatically sets the analyzer's symbol rate. If your signal uses a different symbol rate than that set by the test, simply press **[Instrument Mode]**, **[demodulation setup]**, **[symbol rate]** and enter the symbol rate for your signal.

### Running a Test

To make measurements, run one of the application's one-button tests. Chapter 3 includes procedures that show you what to do before you run a test, how to choose the best configuration, and how to run a test.

Running a test displays another softkey menu that lets you modify parameters specific to the test. For example, pressing [Occupied Bandwidth] displays another softkey menu that, among other things, lets you select the percentage of power ([% power]) used in the measurement. You can change any selection in this menu and the analyzer will remember your changes until you press [test preset] or [Preset], or select a different radio standard.



### Parameters Set When You Run a Test

The table on the following page shows the parameters set when you first run a test. Once the test is running, you can change any of these parameters. Most changes will be remembered even if you run another test then rerun the original test. The changes you make in these parameters to one test will not, however, affect the other tests since each test reconfigures the analyzer.

Some of the parameters in the table are also updated whenever you change the signal or system format. For example, if you are running a test and you change the signal format from burst to continuous, the analyzer automatically resets all trigger parameters to measure the continuous signal format.

The tests also set the trigger level when the signal format is burst. The default trigger level is set 40 dB below the current range. The trigger level tracks the range setting. After you run a test, you can modify the trigger level and the new trigger level will track the range setting. For example, if you set the trigger level to 20 dB below the current range, then you change the range, the tests automatically set the trigger level 20 dB below the new range setting.

---

**HINT**

---

To see the value used for a parameter, run the test, then press the softkey that sets the parameter, or press [**View State**], [measurement state] or [input/source state].

---

**HINT**

---

If you modify test parameters and you are using one of the standard radio systems, the quickest way to return them to their default values is to press [**Shift**], [**Instrument Mode**], [select test], [test preset].



**Parameters Set by Each Test**

<b>Parameters Set by All Tests</b>	<b>Modulation Test</b>	<b>Occupied Bandwidth and Adjacent-Channel Power Tests</b>
Averaging Trigger: type, level, delay, holdoff state, holdoff delay, slope <input type="checkbox"/> Measurement data Data format Summary views OFF Channel 1 input ON	Modulation format Symbol rate Measurement filter Reference filter Filter rolloff (alpha) Points/symbol Clock adjust Result length <input type="checkbox"/> Pulse search <input type="checkbox"/> Sync search <input type="checkbox"/> Sync word Sync word offset <input type="checkbox"/> Search length <input type="checkbox"/> Single grid 10 burst average	Instrument mode <input type="checkbox"/> Detector type <input type="checkbox"/> Main window <input type="checkbox"/> Main time length <input type="checkbox"/> Power due to full-signal or modulation <input type="checkbox"/> Time gate Gate window Gate length Gate delay Single grid Trace A active, spectrum Number of frequency points <input type="checkbox"/> Burst view OFF Resolution bandwidth <input type="checkbox"/> Frequency span <input type="checkbox"/>
<b>Additional Parameters Set by Occupied Bandwidth Test</b>  Power(%): 99%	<b>Additional Parameters Set by Adjacent-Channel Power Test</b>  Adjacent-channel frequency offsets Adjacent-channel bandwidth Reference channel bandwidth Channel filtering ☆ Channel filter bandwidth Channel filter rolloff Number of channel pairs Adjacent-channel power method	

A test sets these parameter the first time you run the test or when you change the signal format.

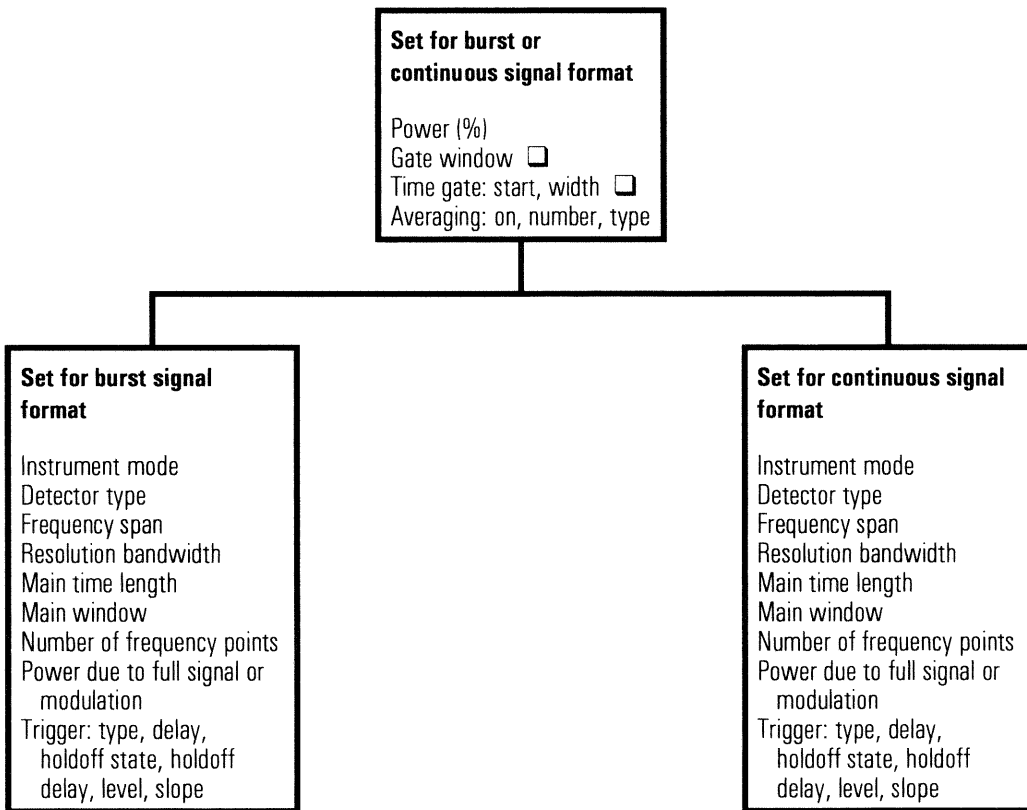
☆ Uses the math functions (F3 if the test method is pseudo-swept) F4, F5 and F6 , data register D6 , and math constant K5.

### Saving Parameters to the USER System

The application allows you to create a custom system by setting the parameters for one or more of the application's tests and saving the parameters to the USER system using the [save setup as USER system] softkey. Parameters saved to the USER system are remembered even if the instrument is preset and can be recalled using the [system], [USER] softkeys. Therefore, if you save your custom setup to the USER system, you only have to set up the parameters one time. For an example of saving parameters to the USER system, see "To save setup to the USER system" in chapter 3.

Setting parameters for one test does not set parameters for the other tests. In addition, certain parameters are dependent on the signal format (burst and continuous). Setting these parameters while in one signal format does not set these parameters for the other signal format. This allows you to set these parameters uniquely for each signal format. The following illustrations show the parameters you should consider setting when creating a custom system. The illustrations also show the parameters that can be set uniquely for burst and continuous signal format.

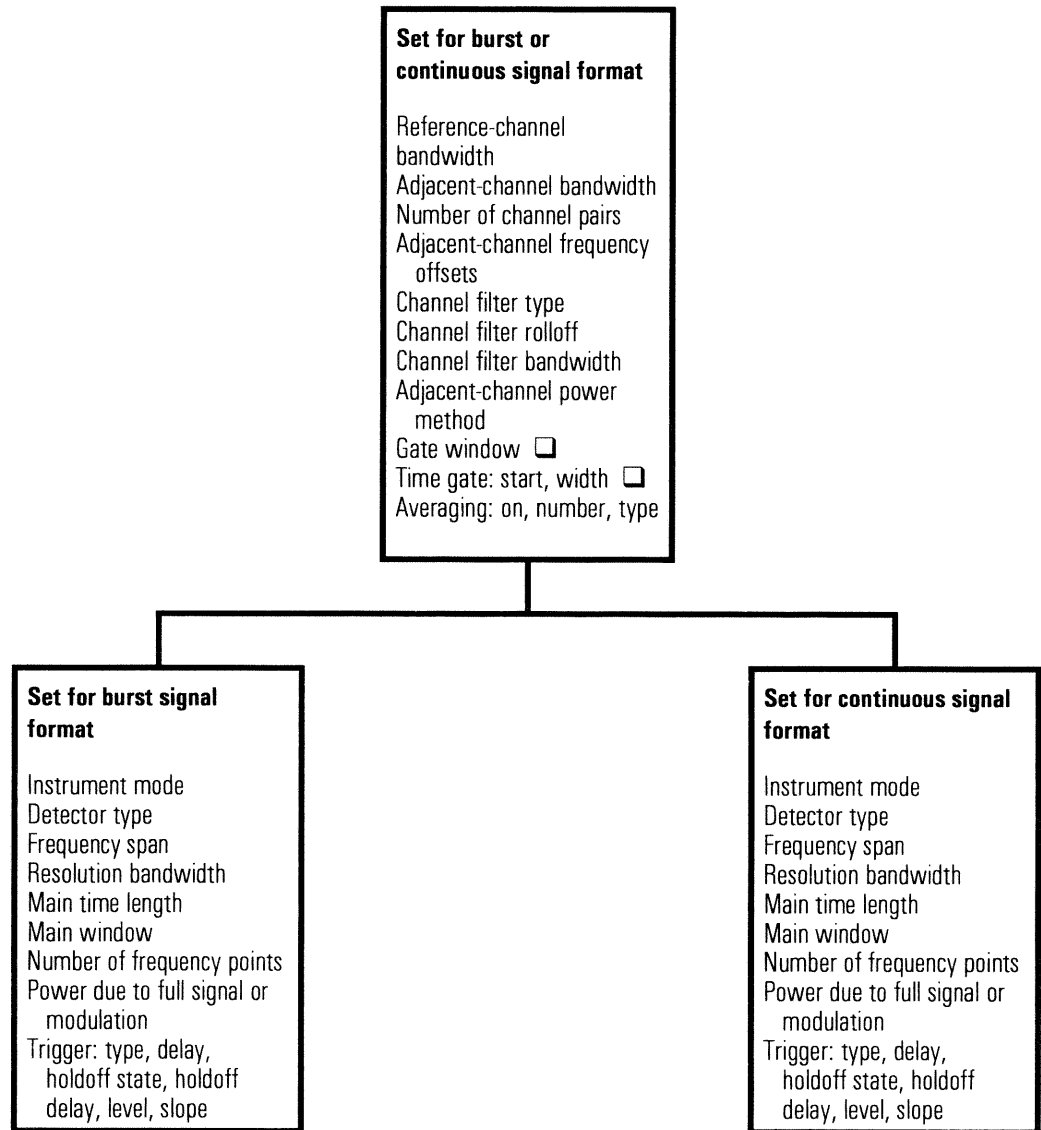
### User System Parameters for the Occupied Bandwidth test



Used in burst mode with power due to modulation selected.

In the Occupied Bandwidth and Adjacent-Channel Power test, you can select power due to full signal or power due to modulation. The absolute power observed in the power due to full signal mode depends on the percentage of the main time record occupied by the burst signal. For example, if the main time length is adjusted so that the burst signal only occupies 70% of the time record, then the absolute power due to full signal will be approximately 1.5 dB lower than the power due to modulation ( $1.5 \text{ dB} = 10 \log (0.7)$ ). If the main time length is adjusted so that the pulse occupies the entire record, then the difference between the absolute power due to modulation and due to full signal will be small.

**User System Parameters for the Adjacent-Channel Power test**



Used in burst mode with power due to modulation selected.

---

**Note**

If you do not set parameters for a particular test setup, default parameters will be used for that setup. For example, in the Modulation Accuracy test, if you set the result length while in burst signal format and later switch to continuous signal format, the result length will be set to its default settings. The default settings will depend on the radio system that was selected when you saved the setup to the USER system.

---

The Modulation Accuracy test has parameters that are not only dependent on the signal format but also on the sync word. You can set these parameters uniquely for each signal format with and without a sync word. In other words, you can set these parameters uniquely in 4 cases: burst signal format with no sync word, burst signal format with any sync word, continuous signal format with no sync word, and continuous signal format with any sync word.

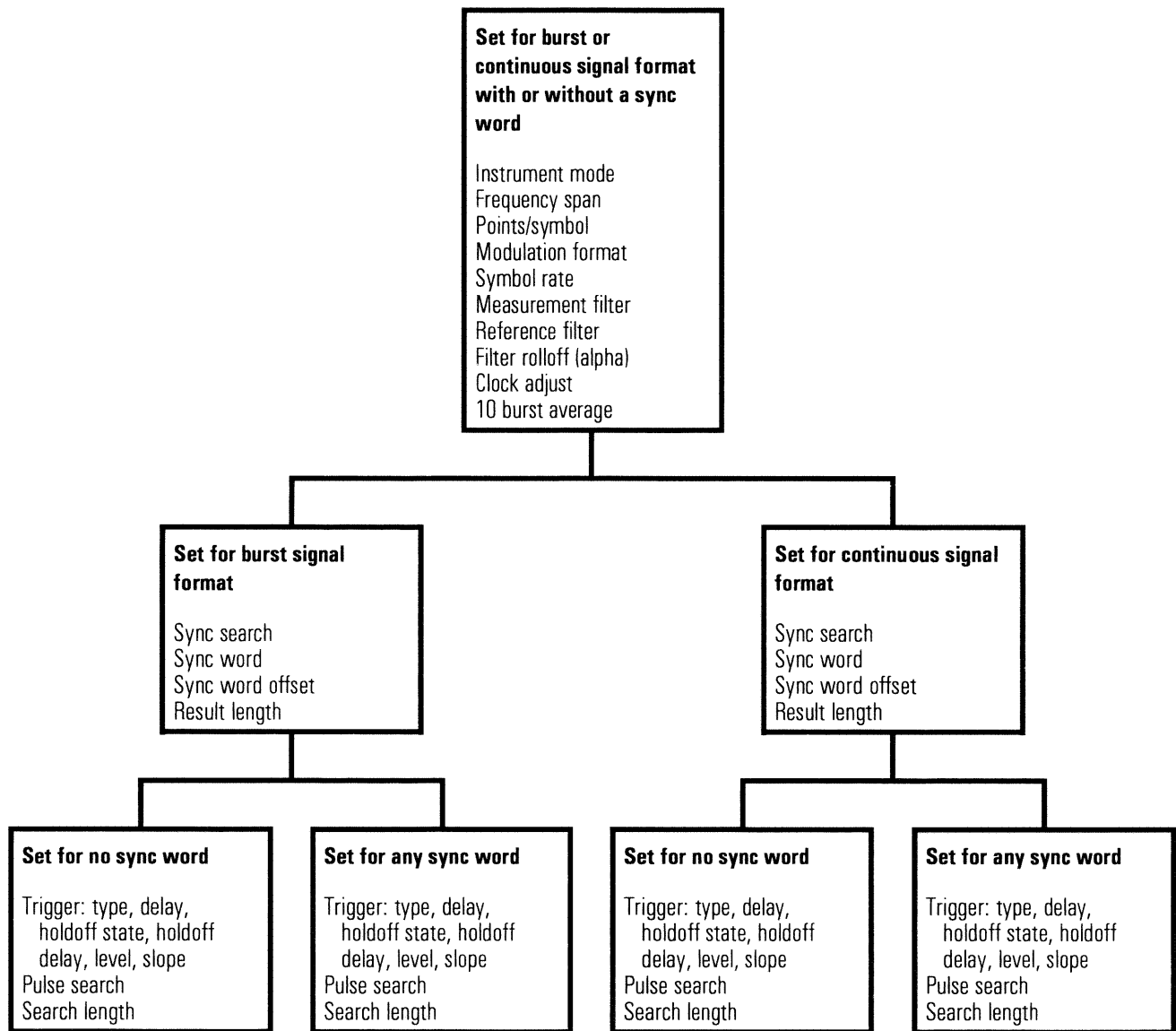
In the USER system, the Modulation Accuracy test only has two sync words (user and none) and the pattern for the user sync word is the same in burst and continuous signal formats. Therefore, you can not have different patterns for burst and continuous signal formats when in the USER system. When you create a custom system, you can select one of the standard radio systems (NADC, PDC, or PHS), modify the parameters you want to, then save it to the USER system. If you select a predefined sync/unique word from one of the standard radio systems, then save it to the USER system, the word pattern will be saved to the user sync word. For example, if you select the S1 (A91DE4A) sync word from the NADC radio system, save the setup to the USER system then select the USER system and the user sync word, the word pattern will be A91DE4A.

You can create a complete custom system that configures each test the way you want it to. To create a complete custom system, you must set up each test for all cases, then press the [save setup as USER system] softkey. For the Adjacent-Channel Power and Occupied Bandwidth tests, you need to set up all the parameters that are not dependent on the signal format and all the parameters that are dependent on the signal format in both burst and continuous signal formats. For the Modulation Accuracy test, you need to set up all the parameters that are not dependent on the signal format, all the parameters that are only dependent on the signal format in both burst and continuous signal formats, and all the parameters that are dependent on both the signal format and sync word in both burst and continuous signal formats with and without a sync word.

When parameters are saved to the USER system, the instrument state is also saved to a file on the default disk. You can create a library of custom systems by merely saving each custom system to a different file. To restore a custom system, recall the saved state. All measurement parameters previously saved to the USER system are overwritten when new measurement parameters are saved.

If you wish to modify measurement parameters previously saved to the USER system, select the USER system, modify the parameters, then resave the measurement parameters to the USER system.

**User System Parameters for the Modulation Accuracy Test**



### Sync/Unique Words for the Modulation Accuracy Test

The Modulation Accuracy test allows you to specify a sync/unique word. The analyzer uses the sync/unique word to determine which portion of the demodulated signal to display. The analyzer displays SYNC NOT FOUND if the selected sync/unique word is not found.

The following table shows the sync/unique words available for the various systems. Selecting [none] disables sync search and selecting any of the others enables sync search. Selecting [user] allows you to define the pattern of the sync/unique word. See "To define a sync/unique word pattern" on page 3-15.

<b>NADC System</b>		<b>PDC System – Burst Signal Format</b>		<b>PDC System – Continuous Signal Format</b>	
none		none		none	
S1	A91DE4A	S1	785B4	S1	87A4B
S2	A9D127A	S2	62DC9	S2	9D236
S3	C7E3C0C	S3	7E28A	S3	81D75
S4	342C3F3	S4	56B15	S4	A94EA
S5	13E23D1	S5	AE9B3	S5	5164C
S6	DC2EC1D	S6	B2621	S6	4D9DE
user		S7	CE450	S7	31BAF
		S8	E1A90	S8	1E56F
		S9	18ED3	S9	E712C
		S10	043E0	S10	FBC1F
		S11	7D861	S11	8279E
		S12	676F7	S12	98908
		user		user	
<b>PHS System</b>		<b>USER System</b>			
none		none			
PS_COM 16	E149	user			
PS_COM/CT 32	6B899AF0				
CS_COM 16	3D4C				
CS_COM/CT 32	50EF2993				
user					

## About Adjacent-Channel Power

There are many ways to define adjacent channel power measurements (ACP) for pulsed signals. Each method has its advantages and disadvantages, and each provides a different result. What follows is a brief tutorial on the different approaches commonly used. The last paragraphs in this chapter mention the methods used by the HP 89451A application.

As shown below, the power in a channel, or adjacent channel, can be determined from the power spectral density function (PSD) of a frequency waveform. In theory, it's necessary to observe the waveform over an infinite amount of time to compute PSD. However, since infinitely long observations aren't practical, the waveform is observed over shorter periods of time with a corresponding loss in frequency resolution.

The PSD function  $G_{xx}(f)$  is defined as:

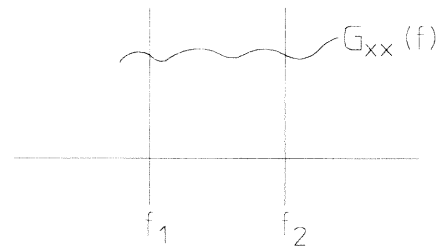
$$G_{xx}(f) = \lim_{T \rightarrow \infty} \frac{2}{T} E [ |X(f, T)|^2 ]$$

where:

$$X(f, T) = \int_{-\frac{T}{2}}^{\frac{T}{2}} x(t) e^{-j 2\pi f t} dt$$

The power in the channel defined by  $f_1$ ,  $f_2$  is:

$$P = \int_{f_1}^{f_2} G_{xx}(f) df$$



### Using PSD to Compute Channel Power

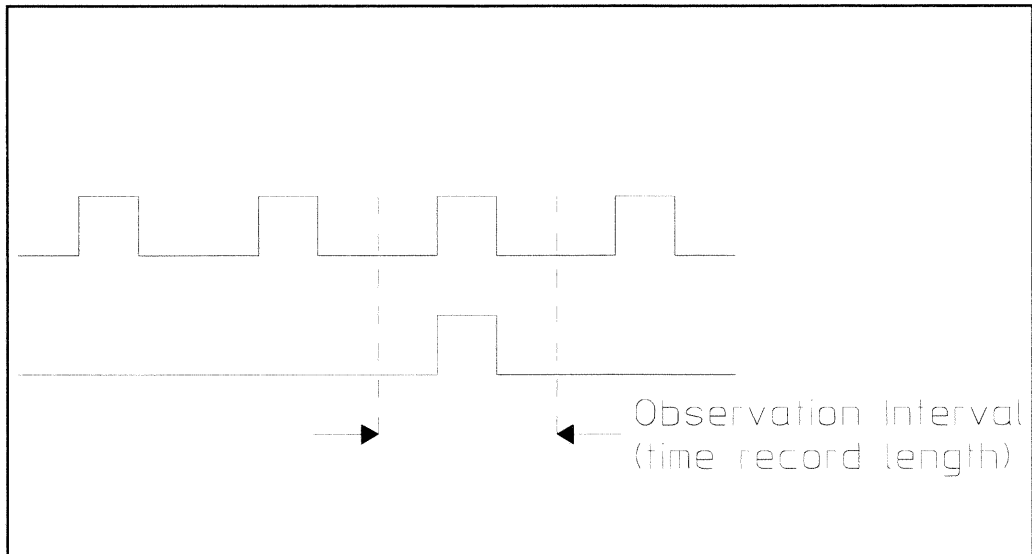
In general, shortening the observation interval does not degrade the estimate of PSD, provided that the signal appears to be stationary (in a statistical sense) within the period of observation. For pulsed signals, this would imply an observation interval that includes many pulses (in other words, many frames of a TDMA signal).

As the observation interval is decreased to the length of a pulse, or even shorter, the signal no longer appears stationary within the observation interval and the observed PSD becomes a function of time, length of observation, and also a function of the measurement method.

The adjacent channel power ratio (ACPR) is the ratio of the power of the transmitted signal in the assigned channel, to the power in an adjacent channel. It's intended to be a measure of a transmitters potential for interfering with a receiver on an adjacent (upper or lower) channel. Since receivers are sensitive to both the time and frequency distribution of the power, a measurement that observes a signal for a long period of time (several pulses) may not be a good indicator of a transmitter's potential for interference.

For example, a continuous carrier and a pulsed carrier can have the same average power. Yet, the peak power of the pulse modulated carrier is greater and is more likely to result in a bit error. For this reason, ACPR measurements, which by definition are frequency selective, are often designed to be time selective as well.

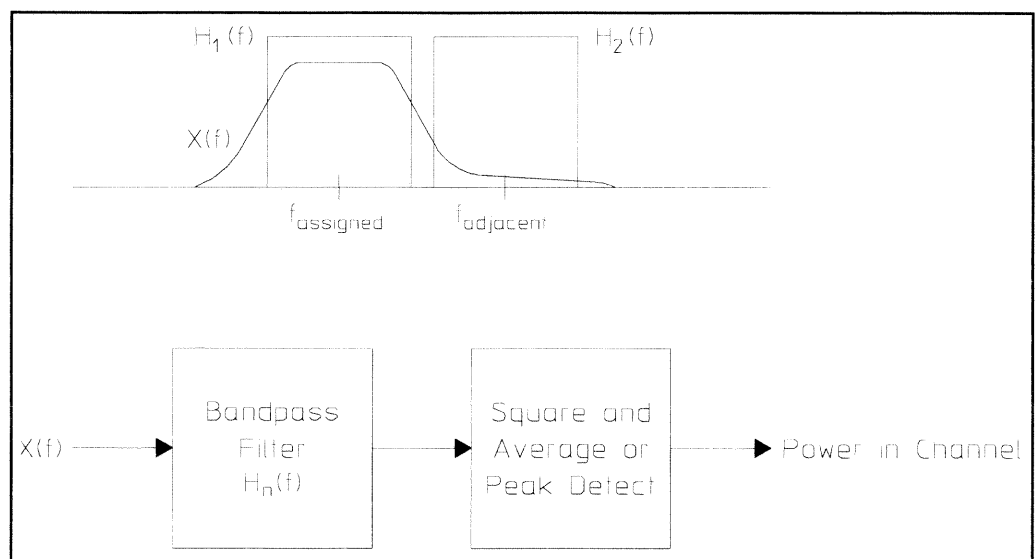
One method for determining the ACPR uses a PSD function that is defined as the theoretical PSD of a signal containing a single pulse. Using this definition, the minimum length of the observation interval is the pulse width, and maximum length of the interval is less than the pulse repetition rate. This method has two distinct advantages. First, measurements can be made very quickly using a vector signal analyzer. The analyzer digitizes the pulse and then uses an FFT to estimate PSD. Second, the result is not dependent on the settling characteristics of a measurement filter—a problem described later. It's worth noting that a window function is not used in the spectrum calculation, as the pulsed signal is self windowing.



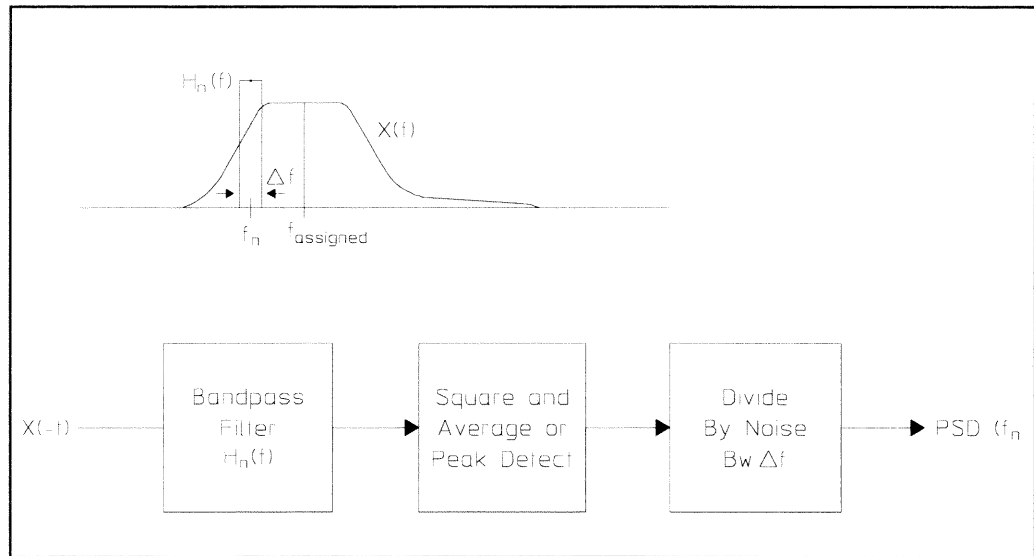
**Using a Single Pulse to Determine ACPR**



Another method for determining ACPR is to take the ratio between the detected powers at the output of two bandpass filters, each the width of the channel, as shown below. One filter is centered on the assigned channel, the other on an adjacent channel. The filters provide the necessary frequency selectivity in the power measurement. However, because the filters have a bandwidth that is wide enough to allow most of the signal to pass through it, the power at the output of each filter is a function of time, and in the case of the assigned channel filter, will closely follow the instantaneous power of the signal itself. As a result, the method used to determine the power at the output of the filter must be defined. For example, the power could be defined as: the average power over all time, the average power over the duration of the pulse, or the peak power.



**Using Two Bandpass Filters to Determine ACPR**



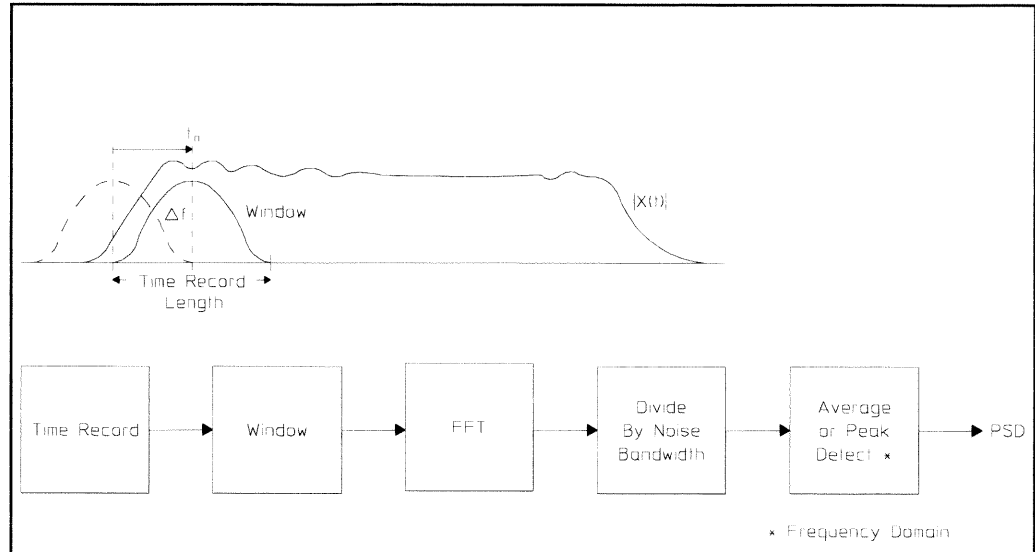
### Using Narrow Filters to Determine PSD

The ACPR can also be determined using filters that are much narrower than the channel to estimate the PSD function over the frequency range of the assigned channel and the adjacent channel, as shown above. The PSD at the center of each filter is the detected power at the output of the filter divided by the filter's noise bandwidth. The PSD function, which has units of dBm/Hz, can then be integrated over the channel bandwidth to determine the total power in the channel. Often, the PSD function is weighted before integration to produce a result equivalent to the channel-filter method (assuming the channel filter is not rectangular).

In general, a narrower filter has a longer impulse response. When the impulse response of the filter is long (that is, relative to the pulse repetition rate of a TDMA signal), then a reasonable estimate of the theoretical PSD is obtained. However, as was mentioned earlier, the theoretical PSD based on long observations may not be a good basis for a measurement intended to predict interference. For shorter impulse responses, the measurement becomes time selective and the problem of filter settling must again be addressed in the definition of ACPR.

This measurement method and the channel-filter method described previously are often implemented using analog swept-spectrum analyzers. With an analog spectrum analyzer there is only a single swept-tuned filter—the RBW filter. With a single filter, the measurement time is increased since the filter must be repositioned at each frequency to be measured. Also, the power measured in the assigned channel is measured at a different point in time than the power in the adjacent channel.

Using an FFT based approach, the vector signal analyzer can make a measurement similar to the swept spectrum analyzer except that the FFT is equivalent to a parallel bank of filters, which allows the power to be measured at all frequencies simultaneously. The problem of allowing the filters to settle still exists, but in a slightly different form. When the observation interval is shorter than a pulse, then the signal is no longer self windowing. In this case, a window function, which weights the time data, must be used.



**Using an FFT Based Approach to Determine ACPR**

As might be expected, PSD computed using an FFT will be a function of both the placement of the window (in time) and its shape. If the window is placed at the start of the pulse and then successively moved a fraction of its overall width towards the end of the pulse, the effect is that of a convolution. In fact, the window shape is the impulse response. As with the analog filters, the power must be defined. For example, the power could be defined as a function of the peak PSD observed as the window is moved across the signal.

To make this measurement using the vector signal analyzer, an entire pulse (plus a little) would be captured and stored in the time capture buffer. A measurement would then be set up using overlap processing and peak hold averaging. A high percent of overlap would be selected, for example 95%, and the main time-record length adjusted to control the length of the RBW filter's impulse response or to set a specific RBW.

The single pulse method for determining PSD and ACPR offers the best compromise between theory and practical time-selective measurements and is the HP 89451A application's true rms method. In addition to being a very fast measurement method, the true rms method provides repeatable measurements since it does not depend on the designs of the bandpass filter and power detector.

The HP 89451A application also provides a pseudo-swept method that can be used if the signal format is burst and power computations include the full signal. The pseudo-swept method provides some additional signal processing and the results are recalibrated to be very similar to the results you would find if you used a swept-tuned analyzer. Specifically, the pseudo-swept method yields results close to the results from measurements made per the MKK (Musensetsubi Kensa-kentei Kyokai — Radio Equipment Inspection and Certification Institute of Japan) specifications for ACPR on the PDC and PHS radio systems.

---

**Measurement**



---

# 3

---

## Making Measurements

This chapter shows how to make measurements using the HP 89451A application software.

## Before you run a test

This procedure shows you the initial steps to follow before running a test. Before you run your first test, read “To choose the best configuration” on page 3-17 to learn how to configure the analyzer for optimum performance.

- 1** Load the HP 89451A Application software as described in chapter 1.  
If the application was loaded earlier, press [**Preset**] to ensure that the instrument is set to its default states.
- 2** Connect your signal to the analyzer’s RF input or the Channel 1 input.
- 3** Verify that the input range is correct (for details, see “To choose the best configuration” on page 3-17).
- 4** Set the analyzer’s center frequency to the approximate carrier frequency.  
Press [**Shift**], [**Instrument Mode**], [carrier] and enter the approximate carrier frequency of your signal.
- 5** Run the Occupied Bandwidth test.  
Press [select test], [Occupied Bandwidth].
- 6** Set the analyzer’s center frequency.  
Press [centroid → carrier] to set the analyzer’s center frequency as close as possible to the detected carrier frequency. The analyzer’s center frequency must be correct for proper operation.
- 7** Select the signal format:  
Press [**Shift**], [**Instrument Mode**] or [Return], [Return], and the appropriate softkey.  
  
Press [signal **continuous**] if your signal is continuously modulated.  
  
Press [signal **burst**] if your signal is pulse (burst) modulated.



- 8** Select one of the application's standard radio systems:  
 Press [system] and the appropriate softkey.

Press [NADC] if your signal conforms to Standard IS-54 and related documents.

Press [PDC] if your signal conforms to Standard RCR-27C and related documents.

Press [PHS] if your signal conforms to Standard RCR-28 and related documents.

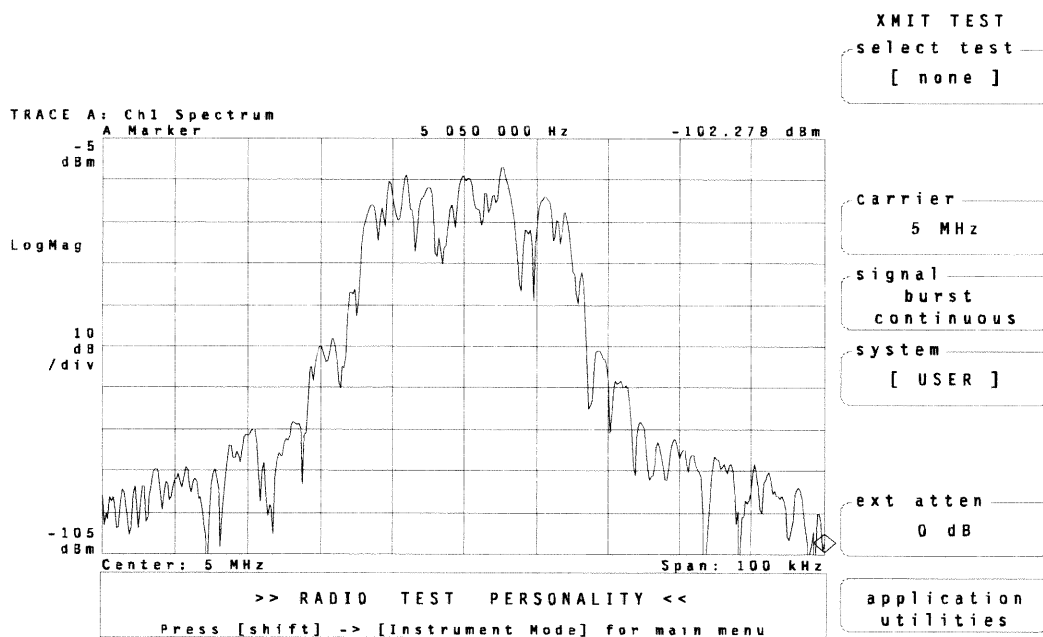
The [USER] radio system recalls the measurement parameters you saved with the [save setup as USER system] softkey (see "To save setup to the USER system" on page 3-16). Do not select the USER radio system to set up the exercises in this chapter.

- 9** If you placed external attenuation in the signal path, set the external attenuation value.

Press [Return], [ext atten], and the appropriate keys.

**Caution**

Setting external attenuation overwrites any external calibration gain values you may have set for channel 1 and 2.



**HP 89451A Main Menu**

## To measure occupied bandwidth

Occupied Bandwidth finds the band of frequencies that contains a specified percentage of the total power within the span.

- 1** If you haven't already done so, perform the steps in "Before you run a test."
- 2** Display the application's main menu.  
Press **[Shift]**, **[Instrument Mode]**.
- 3** Start the Occupied Bandwidth test.  
Press **[select test]**, **[Occupied Bandwidth]**.

At this point, the analyzer starts the Occupied Bandwidth test and displays another softkey menu that lets you change parameters specific to the test.

- Press **[burst view on]** to show the signal in the time domain.
- For burst signals, press **[power due to modulation]** to exclude the turn on and turn off portion of the burst from the occupied bandwidth computations. For details, see online help for the **[power due to]** softkey.
- Press **[centroid -> carrier]** to set the analyzer's center frequency to the centroid frequency.
- Press **[% power]** to set a target for the percentage of total power.
- Press **[summary on]** to display the summary of results. For details, see online help for the **[summary]** softkey.

Most changes you make will be remembered by the test even if you run another test then rerun the original test. Most changes you make to one test will not, however, affect the other tests since each test reconfigures the analyzer. If you are unsure of a test's setup state and you are using one of the standard radio systems (NADC, PDC, or PHS), press **[Return]**, **[test preset]** to restore the test to a known setup state.

---

### Note

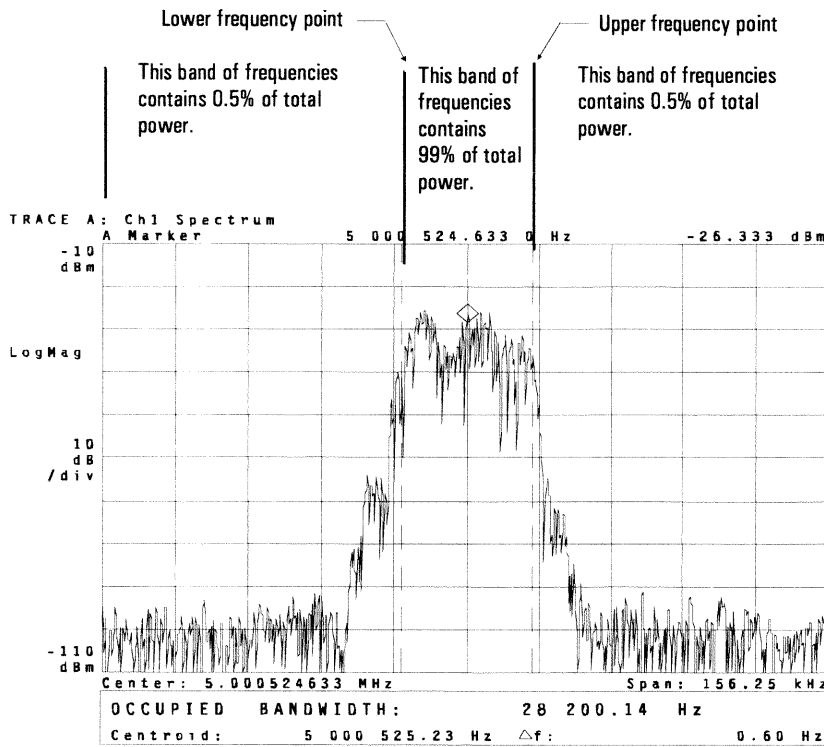
By default, the occupied bandwidth test sets the y-axis units to dBm. If desired, you can increase measurement speed by changing the units to Watts (logarithmic units, such as dBm, require additional computation time). Units are set with the **[Ref Lvl/Scale]**, **[Y ref level]** or **[Ref Lvl/Scale]**, **[X & Y units setup]**, **[Y units]** softkeys.

---

The test displays a window below the trace that shows the following:

- *OCCUPIED BANDWIDTH* is the bandwidth (in Hertz) that contains the target “% power” of all power in the displayed frequency span.
- *Centroid* shows the frequency that is at the mid-point of the occupied bandwidth.
- $\Delta f$  shows the difference between the Centroid and the analyzer’s center (or carrier) frequency.

The following illustration shows how the analyzer uses the value of [% power] to compute the occupied bandwidth. In this example, the analyzer searches forward from the start frequency until it finds 0.5% of the total power—this is the lower frequency point. It then searches back from the stop frequency until it finds 0.5% of the total power—this is the upper frequency point. The band of frequencies between these two points contains, in this case, 99% of the total power.



**Occupied Bandwidth Using a Target of 99%**

## To measure modulation accuracy

The Modulation Accuracy test measures modulation accuracy and displays the IQ measured signal in the IQ vector data format.

**1** If you haven't already done so, perform the steps in "Before you run a test."

**2** Display the application's main menu.

Press [Shift], [Instrument Mode].

**3** Start the Modulation Accuracy test.

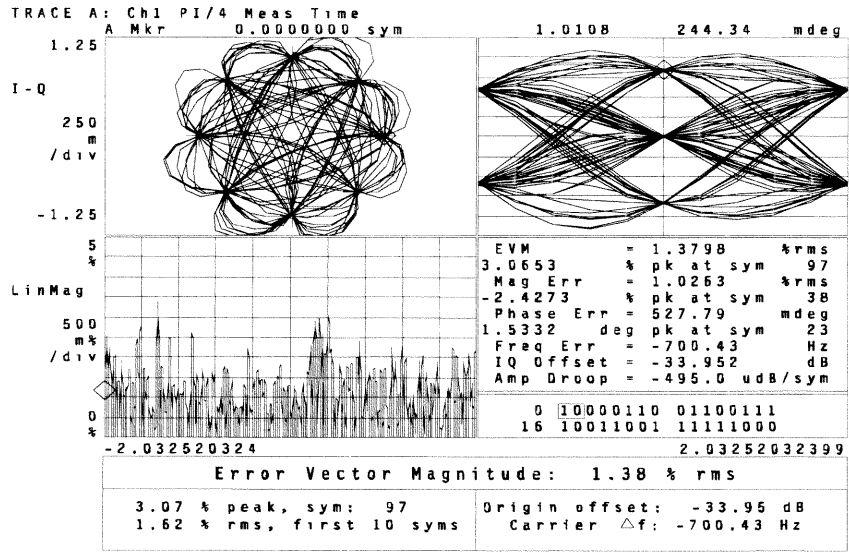
Press [select test], [Modulation].

At this point, the analyzer starts the Modulation Accuracy test and displays another softkey menu that lets you change parameters specific to the test.

- Press [ten burst avg on] to turn on trace averaging.
- Press [sync/unique word] to select a sync/unique word (see "To define the sync/unique word pattern" on page 3-15).
- Press [summary on] to display the four grids shown in the following illustration. For details, see online help for the [summary] softkey.

Most changes you make will be remembered by the test even if you run another test then rerun the original test. Most changes you make to one test will not, however, affect the other tests since each test reconfigures the analyzer. If you are unsure of a test's setup state and you are using one of the standard radio systems (NADC, PDC, or PHS), press [Return], [test preset] to restore the test to a known setup state.

The test also displays a window at the bottom of the screen that shows the rms Error Vector Magnitude (EVM), the symbol with the largest EVM (% peak, sym), the rms EVM of the demodulated signal calculated over the first ten symbol intervals (% rms, first 10 syms), the origin offset, and the difference ( $\Delta f$ ) between the analyzer's detected carrier frequency and the analyzer's center frequency.



**Modulation Accuracy Results Summary**

## To modify user defined occupied bandwidth

The Occupied Bandwidth test can be modified to measure radio systems other than NADC, PDC and PHS. The following example shows how to modify parameters to measure a burst signal in a GSM (Group Special Mobile) radio system. This is only an example, and as such, is not guaranteed to conform to applicable radio standards.

- 1** If you haven't already done so, perform the steps in "Before you run a test."
- 2** Display the application's main menu.  
Press [**Shift**], [**Instrument Mode**].
- 3** Set the signal format to burst.  
Press [signal **burst**].
- 4** Start the Occupied Bandwidth test.  
Press [select test], [Occupied Bandwidth].
- 5** Select power due to modulation.  
Press [power due to **modulation**].
- 6** Display the time domain signal.  
Press [burst view **on**].
- 7** Set the frequency span to 1 MHz.  
Press [**Frequency**], [span], 1, [MHz].
- 8** Set the main time length and main gate length.  
Press [**Time**], [main length], 577, [us].  
Press [gate **on**].  
Press [gate length], 530, [us].  
Press [ch1 gate dly], 20, [us].

**9 Set the trigger parameters.**

Press [**Trigger**], [ch1 delay], -6.25, [us].

Press [more], [holdoff delay], 600, [us].

**10 Turn averaging on.**

Press [**Average**], [average on].

**11 View the Results Summary.**

Press [**Shift**], [.] to return to the Occupied Bandwidth test.

Press [summary on].

## To modify user defined adjacent-channel power

The Adjacent-Channel Power test can be modified to measure radio systems other than NADC, PDC and PHS. The following example shows how to modify parameters to measure a burst signal in a GSM radio system. This is only an example, and as such, is not guaranteed to conform to applicable radio standards.

- 1** If you haven't already done so, perform the steps in "Before you run a test."
- 2** Display the application's main menu.  
Press [**Shift**], [**Instrument Mode**].
- 3** Set the signal format to burst.  
Press [signal **burst**].
- 4** Start the Adjacent-Channel Power test.  
Press [select test], [Adjacent Chan Pwr]
- 5** Select power due to modulation.  
Press [power due to **modulation**].
- 6** Display the signal in the time domain.  
Press [burst view **on**].
- 7** Set the frequency span to 1.25 MHz.  
Press [**Frequency**], [span], 1.25, [MHz].
- 8** Turn averaging on and set the average count.  
Press [**Average**], [average **on**].  
Press [num averages], 500, [enter].



**9 Set up the reference and adjacent channels.**

Press **[Shift]**, **[.]** to return to the Adjacent-Channel Power test.

Press **[chan setup]**,

Press **[chan filter]**, **[off]**.

Press **[Return]** (bottom softkey).

Press **[ref chan bw]**, **30**, **[kHz]**.

Press **[# chan pairs]**, **5**, **[enter]**.

Press **[adj chan bw]**, **30**, **[kHz]**.

Press **[select pair]**, **1**, **[enter]**, **[pair offset]**, **100**, **[kHz]**.

Press **[select pair]**, **2**, **[enter]**, **[pair offset]**, **200**, **[kHz]**.

Press **[select pair]**, **3**, **[enter]**, **[pair offset]**, **250**, **[kHz]**.

Press **[select pair]**, **4**, **[enter]**, **[pair offset]**, **400**, **[kHz]**.

Press **[select pair]**, **5**, **[enter]**, **[pair offset]**, **600**, **[kHz]**.

**10 Set the main time length and main gate length.**

Press **[Time]**, **[main length]**, **577**, **[us]**.

Press **[gate on]**.

Press **[gate length]**, **530**, **[us]**.

Press **[ch1 gate dly]**, **20**, **[us]**.

**11 Set the trigger parameters.**

Press **[Trigger]**, **[ch1 delay]**, **-6.25**, **[us]**.

Press **[trig holdoff on]**.

Press **[more]**, **[holdoff delay]**, **600**, **[us]**.

**12 View the Results Summary.**

Press **[Shift]**, **[.]** to return to the Adjacent-Channel Power test.

Press **[Return]** (bottom softkey).

Press **[summary on]**.

## To modify user defined modulation accuracy

The Modulation Accuracy test can be modified to measure radio systems other than NADC, PDC and PHS. The following example shows how to modify parameters to measure a burst signal in a GSM radio system. This is only an example, and as such, is not guaranteed to conform to applicable radio standards.

- 1** If you haven't already done so, perform the steps in "Before you run a test."
- 2** Display the application's main menu.  
Press [**Shift**], [**Instrument Mode**].
- 3** Set the signal format to burst.  
Press [signal **burst**].
- 4** Start the Modulation Accuracy test.  
Press [select test], [Modulation Accuracy].  
Press [Return] (bottom softkey).  
Press [test preset].
- 5** Select the GSM standard setup for demodulation.  
Press [**Instrument Mode**], [demodulation setup].  
Press [demod format], [standard setups], [GSM].
- 6** Turn sync search off.  
Press [**Time**], [sync search **off**].  
Press [search length], 1, [ms].
- 7** Set the trigger parameters.  
Press [**Trigger**], [trigger type], [IF channel 1].  
Press [Return] (bottom softkey).  
Press [ch1 delay], -100, [us].  
Press [trigger holdoff **on**].  
Press [more], [holdoff delay], 600, [us].
- 8** Turn averaging on.  
Press [**Average**], [average **on**].  
Press [average type], [continuous peak hold].
- 9** Display all traces.  
Press [**Display**], [four grids quad].

---

## To define a sync/unique word pattern

The word pattern for the sync/unique word in the Modulation Accuracy test can be defined. This allows, for example, exact alignment of the modulation accuracy results with respect to a specific symbol pattern. The following example shows how to define the word pattern of a burst signal in a GSM radio system. This is only an example, and as such, is not guaranteed to conform to applicable radio standards.

- 1** Set up the Modulation Accuracy test by performing the steps in “To modify user defined modulation accuracy.”
- 2** Return to the Modulation Accuracy test.  
Press [**Shift**], [**Instrument Mode**].  
Press [select test], [Modulation].
- 3** Select the user sync word.  
Press [sync word], [user].
- 4** Define the pattern for the user word.  
Press [**Time**], [sync setup].  
Press [pattern], 00100101110000100010010111 (TSC 0) or your desired training sequence, [enter].
- 5** Define the offset for the user word.  
Press [offset], 61, [sym].
- 6** Set the search length.  
Press [search length], 1, [ms].
- 7** Turn sync search on.  
Press [sync search **on**].

---

## To save setup to the USER system

Custom setup parameters for one or more of the application's tests can be saved to the USER system and to the default disk. For details, see "Saving parameters to the USER system" on page 2-10.

### 1 Modify the parameters for one or more of the application's tests.

Set up custom parameters by performing "To modify user defined occupied bandwidth," "To modify user defined adjacent-channel power," or "To modify user defined modulation accuracy."

### 2 Save the custom setup to the USER system.

Press [**Shift**], [**Instrument Mode**].

Press [select test], [save setup as USER system], [enter] to accept the default file name or type a different file name before pressing [enter].

---

#### Note

Setting up all three user defined tests in this chapter and saving them to the USER system will not create a complete custom system. The three examples in this chapter only set up the tests in burst signal format. To create a complete custom system, you must set up the Adjacent-Channel Power test and Occupied Bandwidth test in *both burst and continuous signal formats* and the Modulation Accuracy test in *both burst and continuous signal formats with and without a sync word*.

When parameters are saved to the USER system, the instrument state is also saved to a file on the default disk. You can create a library of custom systems by merely saving each custom system to a different file. To restore a custom system, recall the saved state.

Measurement parameters saved to the USER system are overwritten when new measurement parameters are saved. Parameters saved to the USER system are remembered even if you press [test preset] or [**Preset**]. To select the USER system, press [**Shift**], [**Instrument Mode**], [system], [USER]. If measurement parameters have not been saved to the USER system, the USER system's default measurement parameters are applied.

If you wish to modify measurement parameters previously saved to the USER system, select the USER system, modify the parameters, then resave the measurement parameters to the USER system. For example: You set up measurement parameters for the Occupied Bandwidth test and press [save setup as USER system]. Later you want to set up measurement parameters for the Adjacent-Channel Power test. To keep from losing the measurement parameters already saved to the USER system, select the USER system, modify the parameters for the Adjacent-Channel Power test, then press [save setup as USER system] again.

---

## To choose the best configuration

Measurement performance depends on analyzer configuration and the quality of your signal. This procedure shows you how to configure the analyzer for optimum performance.

**1** Load the HP 89451A Application software as described in chapter 1.

**2** Verify the size of measurement memory.

Press [**System Utility**], [memory usage], [configure meas memory].

The value of [max freq pts] must be equal to or greater than 1601; the value of [max time pts] must be equal to or greater than 2048. The preferred configuration is to set [max freq pts] equal to 1601 and [max time pts] equal to 2048. Change these values if necessary.

**3** Connect your signal to the analyzer's RF input or the Channel 1 input.

**4** Verify that the analyzer's input circuitry is configured properly.

Press [**Input**] and verify the input impedance and, if necessary, the input coupling.

**5** Verify that the input range is correct.

Press [**Range**], [ch1 range] and select the most sensitive range that does not overload the analyzer. The analyzer displays OV1 at the top of the display if the signal overloads the analyzer in the current range.

Since the analyzer only lets you set the range in 5 dB increments, you may want to fine-tune your signal level to optimize measurement accuracy. To do this, select the highest range that overloads the analyzer (for best accuracy when using the RF Section, keep the range above -30 dBm). Now, decrease your signal level in very small increments until the analyzer is no longer overloaded (OV1 disappears).

**6** If you placed external attenuation in the signal path, set the external attenuation value.

Press [**Shift**], [**Instrument Mode**], [ext atten], and the appropriate keys.

For example, if you placed 10 dB of external attenuation in the signal path, set external attenuation to 10 dB. The external attenuation value is reflected in all traces including marker data and calculations. This feature is active anytime the application is loaded. Therefore, if you set external attenuation and exit the application but do not remove the application, the external attenuation value will be applied to all traces. For signal paths with external gain, set external attenuation to the negative of the gain.

---

**Caution**

---

Setting external attenuation overwrites any external calibration gain values you may have set for channel 1 and 2. When the application is deleted, external calibration is turned off and the calibration gain values for channel 1 and 2 are set to 1.

**7** Enter the carrier frequency of your RF signal.

The HP 89451A provides a [carrier] softkey that lets you enter the carrier frequency of your RF signal. This softkey sets the analyzer's center frequency. There are three ways to set the analyzer's center frequency:

press [**Shift**], [**Instrument Mode**], [carrier],  
press [**Frequency**], [center],  
or run the Occupied Bandwidth test and press [centroid → carrier].

**8** Run the Occupied Bandwidth test.

Press [**Shift**], [**Instrument Mode**], [select test], [Occupied Bandwidth].

You should see the entire spectrum of your signal—if you don't, change the frequency span until you do.

**9** For burst signals, examine the frequency-domain and time-domain waveforms.

Press [burst view **on**] from the Occupied Bandwidth or Adjacent-Channel Power test menus.

The Occupied Bandwidth and Adjacent-Channel Power tests automatically display the spectrum of your signal in the top grid, and the time-domain waveform (log magnitude of input signal in analyzer's IF) in the bottom grid.

In the time-domain, the entire burst must be contained in the time record. In addition, the burst signal should be stable and approximately centered in the time record. The Occupied Bandwidth and Adjacent-Channel Power tests automatically set the trigger parameters to achieve this for signals that conform to one of the application's radio systems.

If your burst signal is *not* stable, you may need to adjust the trigger level, delay and holdoff. In this case, set the trigger level to obtain a stable waveform. Changing the trigger level also changes the position of the waveform in the time record.

---

**HP-IB Command**





# 4

---

## HP-IB Command Reference

This chapter describes the HP-IB commands for the HP 89451A Application Software.

## HP-IB Commands

This chapter describes the HP-IB commands for the HP 89451A Application software. These HP-IB commands let you control the application from an external controller.

The HP-IB commands are loaded into the analyzer with the application software. Therefore, you must load the application software to use these HP-IB commands.

The HP 89451A HP-IB commands operate the same way as the analyzer's HP-IB commands. Loading the HP 89451A Application software simply adds the HP 89451A HP-IB commands to the analyzer's HP-IB command set.

---

**Hint**

---

To learn how to program the analyzer with HP-IB commands, see the HP-IB documentation shipped with the analyzer.

This chapter contains the following information:

- HP-IB Cross Reference lists the HP 89451A softkeys and shows the equivalent HP-IB commands.
- HP-IB commands describe each HP-IB command for the HP 89451A application software.

## HP-IB Cross Reference

Softkey	Equivalent HP-IB Command
[# chan pairs]	[SENSe:]RTESt:ACPoweR:CHANnel[:COUNT]
[% power]	[SENSe:]RTESt:OBANdwidth:POWeR:PERCentage
[abort test]	[SENSe:]RTESt:ABORt
[adj chan bw]	[SENSe:]RTESt:ACPoweR:ACBandwidth
[Adjacent Chan Pwr]	[SENSe:]DDEMod:MQAM:TEST ACP
[burst view on/off]	DISPlay[:WINDow[1-4]]:RTESt:BURSt:VIEW[:STATe]
[carrier]	FREQ:CENT
[centroid → carrier]	[SENSe:]RTESt:OBANdwidth:CTOCenter
[CS_COM 16]	[SENSe:]RTESt:MODulation:SWORd CS16
[CS_COM/CT 32]	[SENSe:]RTESt:MODulation:SWORd CS32
[dB (relative)]	CALC:RTESt:ACP:RES:UNIT DB
[dBm]	CALC:RTESt:ACP:RES:UNIT DBM
[delete application]	[SENSe:]RTESt:APPLication:ABORt
[ext atten]	[SENSe:]RTESt:EXTernal:ATTenuation
[filt rolloff]	[SENSe:]RTESt:ACPoweR:CHANnel:FILTer:ROLLoff
[filter width]	[SENSe:]RTESt:ACPoweR:CHANnel:FILTer:WIDTh
[Modulation]	[SENSe:]DDEMod:MQAM:TEST MACC
[mW]	CALC:RTESt:ACP:RES:UNIT MW
[NADC]	RTESt:SYST NADC
[none]	[SENSe:]RTESt:MODulation:SWORd NONE

### HP-IB Cross Reference

<u>Softkey</u>	<u>Equivalent HP-IB Command</u>
[nW]	CALC:RTESt:ACP:RES:UNIT NW
[Occupied Bandwidth]	[SENSe:]DDEMod:MQAM:TEST OBAN
[off]	RTESt:ACP:CHAN:FILTer OFF
[pair offset]	[SENSe:]RTESt:ACP:Power:CHANnel:OFFSet
[PDC]	RTESt:SYST PDC
[PHS]	RTESt:SYST PHS
[power due to modulation/full signal]	[SENSe:]RTESt:PModulation[:STATe]
[pseudo-sweep (MKK)]	RTESt:ACP:METH PSW
[PS_COM 16]	[SENSe:]RTESt:MODulation:SWORd PS16
[PS_COM/CT 32]	[SENSe:]RTESt:MODulation:SWORd PS32
[pW]	CALC:RTESt:ACP:RES:UNIT PW
[raised cosine]	RTESt:ACP:CHAN:FILT RCOS
[ref chan bw]	[SENSe:]RTESt:ACP:Power:RCBandwidth
[result unit]	CALCulate4:RTESt:ACP:Power:RESult:UNIT DB   DBM   W   MW   UW   NW   PW
[root raised cosine]	RTESt:ACP:CHAN:FILTer RRC
[S10]	[SENSe:]RTESt:MODulation:SWORd S10
[S11]	[SENSe:]RTESt:MODulation:SWORd S11
[S12]	[SENSe:]RTESt:MODulation:SWORd S12
[S1]	[SENSe:]RTESt:MODulation:SWORd S1
[S2]	[SENSe:]RTESt:MODulation:SWORd S2

<b>HP-IB Cross Reference</b>	
<b>Softkey</b>	<b>Equivalent HP-IB Command</b>
[S3]	[SENSe:]RTESt:MODulation:SWORd S3
[S4]	[SENSe:]RTESt:MODulation:SWORd S4
[S5]	[SENSe:]RTESt:MODulation:SWORd S5
[S6]	[SENSe:]RTESt:MODulation:SWORd S6
[S7]	[SENSe:]RTESt:MODulation:SWORd S7
[S8]	[SENSe:]RTESt:MODulation:SWORd S8
[S9]	[SENSe:]RTESt:MODulation:SWORd S9
[select pair]	[SENSe:]RTESt:ACPpower:CHANnel:SElect
[signal burst/ continuous]	RTESt:SIGNal:BURSt[:STATe]
[summary on/off]	SCReen:CONTents:RTESt:SUMMary[:STATe]
[ten burst avg on/off]	[SENSe:]RTESt:MODulation:TBAverage[:STATe]
[test preset]	[SENSe:]RTESt:PRESet
[true rms]	RTESt:ACP:METH RMS
[USER]	RTESt:SYST USER
[user]	[SENSe:]RTESt:MODulation:SWORd USER
[uW]	CALC:RTESt:ACP:RES:UNIT UW
[W]	CALC:RTESt:ACP:RES:UNIT W

**CALCulate[1 | 2 | 3 | 4]:RTESt:ACPower:RESult:UNIT****command/query**

Selects the measurement results unit for the Adjacent-Channel Power test.

**Command Syntax:** CALCulate[1|2|3|4]:RTESt:ACPower:RESult:UNIT DB|DBM|W|MW|UW|NW|PW

**Example Statements:** OUTPUT 719;"CALCULATE1:RTES:ACP:RESULT:UNIT W"  
OUTPUT 719;"calculate1:rtes:acp:result:unit nW"

**Query Syntax:** CALCulate[1|2|3|4]:RTESt:ACPower:RESult:UNIT?

**Return Format:** CHAR

**Attribute Summary:** Synchronization Required: no  
Preset State: not affected by Preset  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Adjacent-Channel Power test is running. If the test is not running, sending this command does nothing. If the test is running, sending this command selects the measurement results unit. For example, to see adjacent-channel power results in units of nW, send CALC:RTES:ACP:RES:UNIT NW.

**Note** Reference channel power is always reported as an absolute power result. Therefore, if the selected result unit is dB, the result unit for reference channel power will be dBm.

---

**CALCulate[1 | 2 | 3 | 4]:RTESt:RESult?****query**

Queries all results for the current test.

**Query Syntax:** CALCulate[1|2|3|4]:RTESt:RESult?

**Example Statements:** OUTPUT 719;"CALCULATE1:RTES:RES?"  
OUTPUT 719;"calculatE1:rtes:result?"

**Return Format:** (see, text)

**Attribute Summary:** Option: AYA (vector modulation analysis)  
Synchronization Required: no  
Preset State: not affected by Preset  
SCPI Compliance: instrument-specific

**Description:**

This query command returns ALL test results for the current test. The results are returned in a single array. Each test determines the size of its array (see the following table).

Use CALCulate:RTESt:RESult:HEADer:POINts? to determine the number of elements (points) in the array.

**Test Results**

Selection you can use with: RTESSt:SPEC:RESult?	Array returned when using: CALC[1   2   3   4]; RTESSt:RESult?	Description
<b>Modulation Accuracy</b>		
MERMs	result[0]	EVM rms
MEPeak	result[1]	EVM peak
MEPSymbol	result[2]	EVM peak symbol
METRms	result[3]	EVM 10 symbols
MFEError	result[4]	Frequency error
MOOffset	result[5]	Origin offset
<b>Adjacent-Channel Power</b>		
ACRBandwidth	result[0]	Reference-channel bandwidth
ACBandwidth	result[1]	Adjacent-channel bandwidth
ACRP	result[2]	Power in reference channel (W)
ACOffset	result[3] – result[7]	Adjacent-channel offset ([3] is channel pair 1, [4] is channel pair 2, etc.)
ACHPower	result[8] – result[12]	Absolute power in high (upper) channel (W) ([8] is channel pair 1, [9] is channel pair 2, etc.)
ACLPower	result[13] – result[17]	Absolute power in low (lower) channel (W) ([13] is channel pair 1, [14] is channel pair 2, etc.)
<b>Occupied Bandwidth</b>		
OBPower	result[0]	Power in the occupied bandwidth (W) (occupied bandwidth is set with the [power %] softkey)
OBTPower	result[1]	Power in the measured span (W) (the measured span is set with the [carrier] softkey)
OBPRatio	result[2]	Ratio of power in occupied bandwidth to power in measured span (result[1] / result[0])
OBLFrequency	result[3]	Occupied bandwidth's lower frequency (Hz)
OBHFrequency	result[4]	Occupied bandwidth's upper frequency (Hz)
OBANdwidth	result[5]	Occupied bandwidth (result[4] – result[3]) (Hz)
OBCentroid	result[6]	Occupied bandwidth's centroid frequency (Hz)
OBDFrequency	result[7]	Occupied bandwidth's delta frequency (Hz)



---

**CALCulate[1 | 2 | 3 | 4]:RTESt:RESult:HEADer:POINts?****query**

Queries the number of test results for the current test.

**Query Syntax:** CALCulate[1|2|3|4]:RTESt:RESult:HEADer:POINts?

**Example Statements:** OUTPUT 719; "Calc1:Rtes:Result:Head:Points?"  
OUTPUT 719; "CALC:RTES:RESULT:HEAD:POINTS?"

**Return Format:** Integer

**Attribute Summary:** Option: AYA (vector modulation analysis)  
Synchronization Required: no  
Preset State: not affected by Preset  
SCPI Compliance: instrument-specific

**Description:**

This query command returns the number of test results available for the current test. The results for each test are stored in the analyzer's memory in separate arrays. Each test determines the size of its array.

To view test results, use the CALCulate:RTESt:RESult? command.

**CALCulate[1 | 2 | 3 | 4]:RTESt:SPECific:RESult?****query**

Queries a specified test result.

**Query Syntax:** CALCulate[1|2|3|4]:RTESt:SPECific:RESult? <selection>  
See CALCULATE:RTESt:RESult? for <selection>.

**Example Statements:** OUTPUT 719;":CALCULATE1:RTES:SPEC:RESULT? ACBANDWIDTH"  
OUTPUT 719;"calc1:rtest:spec:res? OBLFREQUENCY"

**Return Format:** Real

**Attribute Summary:** Option: AYA (vector modulation analysis)  
Synchronization Required: no  
Preset State: not affected by Preset  
SCPI Compliance: instrument-specific

**Description:**

This query command returns one result for any HP 89451A test. For a list of the test results that you can query, see the "Test Results" table for the CALCulate:RTESt:RESult? command.

**Note** If you query the ACOffset, ACHPower, or ACLPower test result, the result returned will be for the currently selected channel pair. To select a channel pair, use the RTESt:ACPower:CHANnel:SElect command.

The analyzer's memory contains separate arrays for each test. The size of the array depends on the test. An array is updated each time the test is run.

Use this command to return one result from an array. For example, sending CALC:RTES:SPEC:RES? OBPOWER returns the power in the occupied bandwidth obtained the last time you ran the Occupied Bandwidth test.

**DISPlay[:WINDow[1 | 2 | 3 | 4]]:RTESt:BURSt:VIEW[:STATe]****command/query**

Displays the signal in the time domain.

**Command Syntax:** DISPlay[:WINDow[1|2|3|4]]:RTESt:BURSt:VIEW[:STATe] OFF|0|ON|1

**Example Statements:** OUTPUT 719;":DISPLAY:RTES:BURS:VIEW OFF"  
OUTPUT 719;"disp>window4:rtes:burs:view:stat ON"

**Query Syntax:** DISPlay[:WINDow[1|2|3|4]]:RTESt:BURSt:VIEW[:STATe]?

**Return Format:** Integer

**Attribute Summary:** Synchronization Required: no  
Preset State: 0 (OFF)  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Adjacent-Channel Power test or Occupied Bandwidth test is running. If neither test is running, sending this command does nothing. If either test is running, sending this command displays the signal in the time domain. The signal is displayed in trace B, the lower grid. Any result you previously put into trace B is overwritten when this command is sent.

**SCReen:CONTents:RTESt:SUMMary[:STATe]****command/query**

Displays a summary of the test results for the current test.

**Command Syntax:** [SENSE:]RTESt:SUMMARY ON|1|OFF|0

**Example Statements:** OUTPUT 719;"Screen:Cont:Rtes:Summary:Stat OFF"  
OUTPUT 719;"SCREEN:CONT:RTES:SUMMARY OFF"

**Query Syntax:** SCReen:CONTents:RTESt:SUMMary[:STATe]?

**Return Format:** Integer

**Attribute Summary:** Synchronization Required: no  
Preset State: 0 (OFF)  
SCPI Compliance: instrument-specific

**Description:**

This command displays a summary of the test results for the current test on the analyzer's CRT. The summary provides additional information for each test. Use this command to turn on, or off, the summary for the current test.

This command only affects the current test. If you change tests, you must send this command again to turn on the summary for the new test.

**[SENSe:]RTESt****command/query**

Selects one of the HP 89451A application's tests.

**Command Syntax:** [SENSe:]RTESt <selection>  
  
<selection> ::= MACCuracy|ACPower|OBandwidth|NONE

**Example Statements:** OUTPUT 719; ":rtes ACPOWER"  
OUTPUT 719; "Sense:Rtes NONE"

**Query Syntax:** [SENSe:]RTESt?

**Return Format:** CHAR

**Attribute Summary:** Synchronization Required: no  
Preset State: NONE  
SCPI Compliance: instrument-specific

**Description:**

This command selects a test. You can select the:

- Occupied Bandwidth test (OBAN)
- Adjacent-Channel Power test (ACP)
- Modulation Accuracy test (MACC)

Sending this command configures the analyzer for the selected test. See chapter 2 for a table listing the parameters set by each test.

**Caution** If the Adjacent-Channel Power test's setup includes channel filtering, the F4, F5 and F6 math functions, K5 constant, and D6 data register are overwritten when you select the test. If the Adjacent-Channel Power test's method is pseudo-swept, the F3 math function is also overwritten when channel filtering is set up.

To deselect a test (abort the current test), send this command and select NONE.

Synchronization is required with this command. Therefore, use \*WAI when using this command. For example, to select the Occupied Bandwidth test, send RTESt OBAN;\*WAI.

## **[SENSe:]RTESt:ABORt**

**command**

Aborts the current test.

**Command Syntax:** [SENSe:]RTESt:ABORt

**Example Statements:** OUTPUT 719;"SENS:RTEST:ABOR"  
OUTPUT 719;"rtest:abor"

**Attribute Summary:** Synchronization Required: no  
Preset State: not applicable  
SCPI Compliance: instrument-specific

### **Description:**

This command aborts the current test. This command does not change any configurations in the analyzer—it only aborts (terminates) the current test.

**[SENSe:]RTESt:ACPower:ACBandwidth****command/query**

Sets the bandwidth of the adjacent channels for the Adjacent-Channel Power test.

**Command Syntax:** [SENSe:]RTESt:ACPower:ACBandwidth {<number>  
[<unit>]}|<step>|<bound>

<number> ::= a real number (NRF data)  
                  limits determined by current configuration

<unit> ::= [Hz]

<step> ::= UP|DOWN

<bound> ::= MAX|MIN

**Example Statements:** OUTPUT 719; "SENSe:RTESt:ACPower:ACB 10e3"  
OUTPUT 719; "rtes:acp:acbandwidth 15000"

**Query Syntax:** [SENSe:]RTESt:ACPower:ACBandwidth?

**Return Format:** Real

**Attribute Summary:** Synchronization Required: no  
Preset State: (See text)  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Adjacent-Channel Power test is running. If the test is not running, sending this command does nothing. If the test is running, sending this command sets the power integration bandwidth of the high (upper) and low (lower) channels. For example, sending RTESt:ACP:ACB 10000 sets the power integration bandwidth of these channels to 10 kHz.

To change the number of adjacent channel pairs, use the RTESt:ACPower:CHANnel command.

The preset state is 30 kHz for the NADC system, 21 kHz for the PDC system, and 192 kHz for the PHS system.

**[SENSe:]RTESt:ACPower:CHANnel[:COUNT]****command/query**

Sets the number of adjacent channel pairs for the Adjacent-Channel Power test.

**Command Syntax:** [SENSe:]RTESt:ACPower:CHANnel[:COUNT] <number>|<step>|<bound>

<number> ::= a real number (Nrf data)  
          limits: 1:5  
<step> ::= UP|DOWN  
<bound> ::= MAX|MIN

**Example Statements:** OUTPUT 719;":Rtes:Acpower:Chan 1"  
OUTPUT 719;"SENSe:RTESt:ACPower:CHANnel:COUN 3"

**Query Syntax:** [SENSe:]RTESt:ACPower:CHANnel[:COUNT]?

**Return Format:** Integer

**Attribute Summary:** Synchronization Required: no  
Preset State: (See text)  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Adjacent-Channel Power test is running. If the test is not running, sending this command does nothing. If the test is running, sending this command sets the number of channel pairs.

When the number of channel pairs is 1, the Adjacent-Channel Power test measures the power in the reference channel and in the adjacent channel above and below the center (carrier) frequency. When the number of channel pairs is 2, the Adjacent-Channel Power test measures the power in the reference channel and in the adjacent and alternate channels above and below the center frequency.

The preset state is 3 for the NADC system and 2 for the PDC and PHS systems.



**[SENSe:]RTESt:ACPower:CHANnel:FILTer****command/query**

Selects channel filtering for the Adjacent-Channel Power test.

**Command Syntax:** [SENSe:]RTESt:ACPower:CHANnel:FILTer NONE|RRCosine|RCOSine

**Example Statements:** OUTPUT 719;"sense:rtes:acp:channel:filt NONE"  
OUTPUT 719;"Rtest:Acp:Chan:Filter RRCOSINE"

**Query Syntax:** [SENSe:]RTESt:ACPower:CHANnel:FILTer?

**Return Format:** CHAR

**Attribute Summary:** Synchronization Required: no  
Preset State: (See text)  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Adjacent-Channel Power test is running. If the test is not running, sending this command does nothing. If the test is running, sending this command selects channel filtering. Channel filtering applies spectral weighting to the input signal before power integrations.

Select OFF to select no channel filtering. Select RRCosine to select the Nyquist, root raised-cosine filter. Select RCOSine to select the Nyquist, raised-cosine filter.

**Caution** When the analyzer is configured for RRCosine or RCosine channel filtering, the F4, F5 and F6 math functions, K5 constant, and D6 data register are overwritten. If the test method is pseudo-swept, the F3 math function is also overwritten when channel filtering is set up.

The preset state is RRCosine for the NADC system and OFF for the PDC and PHS systems.

**[SENSe:]RTESt:ACPower:CHANnel:FILTer:ROLloff****command/query**

Sets the channel filter's rolloff in the transition region for the Adjacent-Channel Power test.

**Command Syntax:** [SENSe:]RTESt:ACPower:CHANnel:FILTer:ROLloff  
<number>|<step>|<bound>

<number> ::= a real number (Nrf data)  
          limits: 0.01:1.0  
  
<step> ::= UP|DOWN  
  
<bound> ::= MAX|MIN

**Example Statements:** OUTPUT 719;":RTESt:ACPOWER:CHAN:FILT:ROLLOFF 0.7"  
OUTPUT 719;"sens:rtest:acp:chan:filter:roll 0.07"

**Query Syntax:** [SENSe:]RTESt:ACPower:CHANnel:FILTer:ROLloff?

**Return Format:** Real

**Attribute Summary:** Synchronization Required: no  
Preset State: (See text)  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Adjacent-Channel Power test is running. If the test is not running, sending this command does nothing. If the test is running, sending this command sets the channel filter's rolloff in the transition region.

To select channel filtering, use the RTESt:ACPower:CHANnel:FILTer command.

**Caution** If channel filtering is selected when this command is sent, the F4, F5 and F6 math functions, K5 constant, and D6 data register are overwritten. If the test method is pseudo-swept, the F3 math function is also overwritten when channel filtering is set up.

The preset state is 0.35 for the NADC system and 0.5 for the PDC and PHS systems.

**[SENSe:]RTESt:ACPower:CHANnel:FILTer:WIDTh****command/query**

Sets the channel filter's width for the Adjacent-Channel Power test.

**Command Syntax:** [SENSe:]RTESt:ACPower:CHANnel:FILTer:WIDTh  
 {<number>[<unit>]}|<step>|<bound>

<number> ::= a real number (NRF data)  
 limits: 1.0 Hz to 100 MHz

<unit> ::= [Hz]

<step> ::= UP|DOWN

<bound> ::= MAX|MIN

**Example Statements:** OUTPUT 719; "Sense:Rtes:Acp:Channel:Filt:Width 50kHz"  
 OUTPUT 719; "RTES:ACP:CHANNEL:FILT:WIDTH 30e+3"

**Query Syntax:** [SENSe:]RTESt:ACPower:CHANnel:FILTer:WIDTh?

**Return Format:** Real

**Attribute Summary:** Synchronization Required: no  
 Preset State: (See text)  
 SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Adjacent-Channel Power test is running. If the test is not running, sending this command does nothing. If the test is running, sending this command sets the channel filter's passband width.

To select channel filtering, use the RTESt:ACPower:CHANnel:FILTer command.

**Caution** If channel filtering is selected when this command is sent, the F4, F5 and F6 math functions, K5 constant, and D6 data register are overwritten. If the test method is pseudo-swept, the F3 math function is also overwritten when channel filtering is set up.

The preset state is 24.3 kHz for the NADC system, 21 kHz for the PDC system, and 192 kHz for the PHS system.

**[SENSe:]RTESt:ACPower:CHANnel:OFFSet****command/query**

Sets the offset (from carrier) of the currently selected channel pair for the Adjacent-Channel Power test.

**Command Syntax:** [SENSe:]RTESt:ACPower:CHANnel:OFFSet  
{<number>[<unit>]}|<step>|<bound>

<number> ::= a real number (NRf data)  
          limits: span/2

<unit> ::= [Hz]

<step> ::= UP|DOWN

<bound> ::= MAX|MIN

**Example Statements:** OUTPUT 719;":rtes:acp:channel:offs 300KHZ"  
OUTPUT 719;"Sense:Rtes:Acp:Channel:Offs 300e+3"

**Query Syntax:** [SENSe:]RTESt:ACPower:CHANnel:OFFSet?

**Return Format:** Real

**Attribute Summary:** Synchronization Required: no  
Preset State: (See text)  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Adjacent-Channel Power test is running. If the test is not running, sending this command does nothing. If the test is running, sending this command sets the frequency offset (from the carrier) of the currently selected channel pair.

To select a channel pair, use the RTESt:ACPower:CHANnel:SElect command.

The preset state for the NADC system is 30 kHz for the 1st channel pair, 60 kHz for the 2nd channel pair, and 90 kHz for the 3rd channel pair. The preset state for the PDC system is 50 kHz for the 1st channel pair and 100 kHz for the 2nd channel pair. The preset state for the PHS system is 600 kHz for the 1st channel pair and 900 kHz for the 2nd channel pair.

**[SENSe:]RTESt:ACPower:CHANnel:SElect****command/query**

Selects the channel pair for the Adjacent-Channel Power test.

**Command Syntax:** [SENSe:]RTESt:ACPower:CHANnel:SElect <number>|<step>|<bound>

<number> ::= a real number (NRf data)  
          limits: 1:5  
<step> ::= UP|DOWN  
<bound> ::= MAX|MIN

**Example Statements:** OUTPUT 719;":RTESt:ACPOWER:CHAN:SEL 3"  
OUTPUT 719;"sense:rtes:acpower:chan:sel 1"

**Query Syntax:** [SENSe:]RTESt:ACPower:CHANnel:SElect?

**Return Format:** Integer

**Attribute Summary:** Synchronization Required: no  
Preset State: 1  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Adjacent-Channel Power test is running. If the test is not running, sending this command does nothing. If the test is running, sending this command selects the channel pair. The selected channel pair's frequency offset can then be changed using the RTESt:ACPower:CHANnel:OFFset command.

To change the number of channel pairs, use the RTESt:ACPower:CHANnel command.

**[SENSe:]RTESt:ACPower:MEtHod****command/query**

Selects the measurement method for the Adjacent-Channel Power test.

**Command Syntax:** [SENSe:]RTESt:ACPower:MEtHod RMS|PSwept

**Example Statements:** OUTPUT 719;"Sense:Rtes:Acpower:Meth PSWEPT"  
OUTPUT 719;"RTES:ACPOWER:METH RMS"

**Query Syntax:** [SENSe:]RTESt:ACPower:MEtHod?

**Return Format:** CHAR

**Attribute Summary:** Option: AYA (vector modulation analysis)  
Synchronization Required: no  
Preset State: true RMS  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Adjacent-Channel Power test is running, the signal format is burst, and power computations include the full signal. If any of these conditions are not met, sending this command does nothing. If the conditions are met, sending this command selects the true rms or pseudo-sweep (MKK-like) measurement method.

The true rms measurement method uses a pure DSP approach. The spectrum displayed is the FFT of the input time record. The input signal's power as a function of frequency is detected in an unbiased manner and all at once. The measurement results are fast and highly accurate. For details see "About Adjacent-Channel Power" in chapter 2.

In the pseudo-sweep measurement method, the signal undergoes some additional processing and the results are recalibrated to be very similar to the results you would get using a swept-tuned analyzer for the same measurement. Specifically, the pseudo-sweep method yields results close to the results from measurements made per the MKK (Musensetsubi Kensa-kentei Kyokai — Radio Equipment Inspection and Certification Institute of Japan) specifications for adjacent-channel power on the PDC and PHS radio systems.

The results using the pseudo-sweep measurement method are only valid using the application's standard radio systems (NADC, PDC, PHS) in their default states (preset states). In other words, the results are not valid using the USER system or any of the standard radio systems if any parameters were changed. To ensure that the Adjacent-Channel Power test is in its default state, send the RTESt:PRESet command. The preset state for power computations in the NADC system is modulation. After sending the RTESt:PRESet command in a NADC system, you must set power computations to include full signal.

To set the signal format to burst, send the RTESt:SIGNAL:BURSt ON command. To set power computations to include the full signal, send the RTESt:PMOD OFF command.

**[SENSe:]RTESt:ACPower:RCBandwidth****command/query**

Sets the bandwidth of the reference channel for the Adjacent-Channel Power test.

**Command Syntax:** [SENSe:]RTESt:ACPower:RCBandwidth {<number>  
[<unit>]}|<step>|<bound>

<number> ::= a real number (NRf data)  
                  limits determined by current configuration

<unit> ::= [Hz]

<step> ::= UP|DOWN

<bound> ::= MAX|MIN

**Example Statements:** OUTPUT 719;"SENSE:RTESt:ACPOWER:RCB 30e3"  
OUTPUT 719;"rtes:acp:rcbandwidth 30000"

**Query Syntax:** [SENSe:]RTESt:ACPower:RCBandwidth?

**Return Format:** Real

**Attribute Summary:** Synchronization Required: no  
Preset State: (See text)  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Adjacent-Channel Power test is running. If the test is not running, sending this command does nothing. If the test is running, sending this command sets the power integration bandwidth of the reference channel.

The preset state is 30 kHz for the NADC system, 225 kHz for the PDC system, and 192 kHz for the PHS system.

**[SENSe:]RTESt:APPLication:ABORt****command**

Aborts the current test and exits, then removes the application.

**Command Syntax:** [SENSe:]RTESt:APPLication:ABORt

**Example Statements:** OUTPUT 719; ":rtest:appl:abor"  
OUTPUT 719; "Sense:Rtes:Application:Abor"

**Attribute Summary:** Synchronization Required: no  
Preset State: not applicable  
SCPI Compliance: instrument-specific

**Description:**

This command aborts the current test, exits the application, and then removes the application from the analyzer's application memory. After removing the application, this command presets the analyzer to return all parameters to their default settings.

If you want to abort a test without removing the application, use RTESt:ABORT.



**[SENSe:]RTEST:EXTernal:ATTenuation****command/query**

Sets the external attenuation value.

**Command Syntax:** [SENSe:]RTEST:EXTernal:ATTenuation  
{<number>[<unit>]}|<step>|<bound>

<number> ::= a real number (NRf data)  
limits: -120.0:120.0

<unit> ::= [DB]

<step> ::= UP|DOWN

<bound> ::= MAX|MIN

**Example Statements:** OUTPUT 719;"SENS:RTEST:EXT:ATTENUATION -81.8228"  
OUTPUT 719;"rtes:ext:attenuation 7.93553"

**Query Syntax:** [SENSe:]RTEST:EXTernal:ATTenuation?

**Return Format:** Real

**Attribute Summary:** Synchronization Required: no  
Preset State: 0  
SCPI Compliance: instrument-specific

**Description:**

This command sets the external attenuation value for channel 1 and 2. For example, if you placed 10 dB of external attenuation in the signal path, set external attenuation to 10 dB. The external attenuation value is reflected in all traces including marker data and calculations. This feature is active anytime the application is loaded. Therefore, if you set external attenuation and exit the application but do not remove the application, the external attenuation value will be applied to all traces.

**Caution** Setting external attenuation overwrites any external calibration gain value you may have set for channel 1 and 2. When the application is deleted, external calibration is turned off and the calibration gain values for channel 1 and 2 are set to 1.

**[SENSe:]RTESt:MODulation:SWORd[:SElect]****command/query**

Selects the sync/unique word for the Modulation Accuracy test.

**Command Syntax:** [SENSe:]RTESt:MODulation:SWORd[:SElect]  
NONE|USER|S1|S2|S3|S4|S5|S6|S7|S8|S9|S10|S11|S12|PS16|PS32|CS16|CS32

**Example Statements:** OUTPUT 719;":Rtes:Modulation:Swor S9"  
OUTPUT 719;"SENS:RTEST:MOD:SWORD:SEL S9"

**Query Syntax:** [SENSe:]RTESt:MODulation:SWORd[:SElect]?

**Return Format:** CHAR

**Attribute Summary:** Synchronization Required: no  
Preset State: NONE  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Modulation Accuracy test is running. If the test is not running, sending this command does nothing. If the test is running, sending this command enables sync search and selects the sync/unique word. The sync/unique word determines which portion of the signal to display. For a list of all the sync/unique words, see "Sync/Unique Words for the Modulation Accuracy Test" in chapter 2.

To disable sync search, send this command and select NONE. To define your own sync/unique word, send this command and select USER, then define the word using the DDEM:SEAR:SYNC:PATT command.

**[SENSe:]RTESt:MODulation:TBAverage[:STATe]****command/query**

Selects exponential rms (video) averaging and sets the number of averages to ten for the Modulation Accuracy test.

**Command Syntax:** [SENSe:]RTESt:MODulation:TBAverage[:STATe] OFF|0|ON|1

**Example Statements:** OUTPUT 719;"sens:rtest:mod:tbaverage:stat OFF"  
OUTPUT 719;"Rtes:Modulation:Tbav OFF"

**Query Syntax:** [SENSe:]RTESt:MODulation:TBAverage[:STATe]?

**Return Format:** Integer

**Attribute Summary:** Synchronization Required: no  
Preset State: 0 (OFF)  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Modulation Accuracy test is running. If the test is not running, sending this command does nothing. If the test is running, sending this command selects exponential rms (video) averaging and sets the number of averages to ten.

Exponential averaging weights new data more than old data. This is useful for tracking data that changes over time. Exponential averaging does not stop after averaging 10 traces but continues indefinitely. The results from only the past 10 traces are included in the average.

When averaging is on, the number of averages is displayed at the bottom of the display. When the number reaches 10, the analyzer no longer increments the number even though it continues to average from trace to trace.

**[SENSe:]RTESt:OBANdwidth:CTOCenter****command**

Sets the analyzer's center frequency to match the current centroid frequency for the Occupied Bandwidth test.

**Command Syntax:** [SENSe:]RTESt:OBANdwidth:CTOCenter

**Example Statements:** OUTPUT 719;":RTESt:OBAN:CTOC"  
OUTPUT 719;"sense:rtes:obandwidth:ctoc"

**Attribute Summary:** Synchronization Required: no  
Preset State: not applicable  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Occupied Bandwidth test is running. If the test is not running, sending this command does nothing. If the test is running, sending this command sets the analyzer's center frequency to match the current centroid frequency.

If the current centroid frequency is invalid (indicated by "\*\*\*\*" on the display), sending this command does nothing.

The "centroid" frequency is the center point of the occupied bandwidth.

**[SENSe:]RTESt:OBANdwidth:POWer:PERCentage****command/query**

Sets the percentage of power used for the Occupied Bandwidth test.

**Command Syntax:** [SENSe:]RTESt:OBANdwidth:POWer:PERCentage  
{<number>[<unit>]}|<step>|<bound>

<number> ::= a real number (NRf data)  
          limits: 1:100  
  
<unit> ::= [PCT]  
  
<step> ::= UP|DOWN  
  
<bound> ::= MAX|MIN

**Example Statements:** OUTPUT 719;"SENSe:RTESt:OBAN:POW:PERC 99"  
OUTPUT 719;"rtes:oban:power:percentage 50"

**Query Syntax:** [SENSe:]RTESt:OBANdwidth:POWer:PERCentage?

**Return Format:** Real

**Attribute Summary:** Synchronization Required: no  
Preset State: 99%  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Occupied Bandwidth test is running. If the test is not running, sending this command does nothing. If the test is running, sending this command sets the percentage of power for the Occupied Bandwidth test.

The test uses the percentage of power to compute the occupied bandwidth. For example, if you send RTESt:OBandwidth:POWer:PERCentage 50, the Occupied Bandwidth test finds the region of the spectrum that contains 50% of the total power in the frequency span. For additional details, see online help for the [Occupied Bandwidth] test.

**[SENSe:]RTESt:PMODulation[:STATe]****command/query**

Selects time gating for power computations for the Adjacent-Channel Power test and Occupied Bandwidth test.

**Command Syntax:** [SENSe:]RTESt:PMODulation[:STATe] OFF|0|ON|1

**Example Statements:** OUTPUT 719; "Sens:Rtest:Pmod:State OFF"  
OUTPUT 719; "RTES:PMOD ON"

**Query Syntax:** [SENSe:]RTESt:PMODulation[:STATe]?

**Return Format:** Integer

**Attribute Summary:** Synchronization Required: no  
Preset State: 0 (off)  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when the Adjacent-Channel Power test or Occupied Bandwidth test is running. If neither test is running, sending this command does nothing. If either test is running, sending this command selects time gating and positions the gate-time record to exclude the turn on and turn off portions of the burst. Thus, power computations include only the modulated portion of the burst.

For burst signals, you can select either ON or OFF. For continuous signals, you can only select OFF. For details, see online help for the [power due to] softkey.

**[SENSe:]RTESt:PRESet****command**

Presets the analyzer settings for the currently selected test.

**Command Syntax:** [SENSe:]RTESt:PRESet

**Example Statements:** OUTPUT 719; ":rtest:pres"  
OUTPUT 719; "Sense:Rtes:Pres"

**Attribute Summary:** Synchronization Required: no  
Preset State: not applicable  
SCPI Compliance: instrument-specific

**Description:**

This command applies only when a test is selected and the NADC, PDC, or PHS radio system is selected. If a test is not currently selected or the USER radio system is selected, sending this command does nothing. If a test is selected and the NADC, PDC, or PHS radio system is selected, sending this command preserves the signal transmission format, center (carrier) frequency, radio system, external attenuation, and input range. It then presets the analyzer, restores the parameters saved before the preset, and then reruns the currently selected test.

If you change certain measurement parameters while running a test, the settings are remembered even when you change tests. Send this command to ensure that the measurement parameters for a test are in a known state.

**[SENSe:]RTESt:SIGNal:BURSt[:STATe]****command/query**

Selects the signal format.

**Command Syntax:** [SENSe:]RTESt:SIGNal:BURSt[:STATe] OFF|0|ON|1

**Example Statements:** OUTPUT 719;"SENSe:RTES:SIGNal:BURSt:STAT OFF"  
OUTPUT 719;"rtest:sign:burst OFF"

**Query Syntax:** [SENSe:]RTESt:SIGNal:BURSt[:STATe]?

**Return Format:** Integer

**Attribute Summary:** Synchronization Required: no  
Preset State: 0 (OFF)  
SCPI Compliance: instrument-specific

**Description:**

This command configures the application to measure burst or continuous signals. Trigger parameters as well as many other measurement parameters are changed by this command.

Select ON to configure the application to measure pulse (burst) modulated signals. Select OFF to configure the application to measure continuously modulated signals.



**[SENSe:]RTEST:SYSTem****command/query**

Selects a standard radio system or user defined parameters. `ystem;selecting`

**Command Syntax:** `[SENSe:]RTEST:SYSTem NADC|PDC|PHS|USER`

**Example Statements:** `OUTPUT 719; ":Rtes:Syst PDC"`  
`OUTPUT 719; "SENSE:RTES:SYSTEM USER"`

**Query Syntax:** `[SENSe:]RTEST:SYSTem?`

**Return Format:** CHAR

**Attribute Summary:** Synchronization Required: no  
Preset State: (See text)  
SCPI Compliance: instrument-specific

**Description:**

This command configures the application to make custom measurements and use default settings appropriate for the selected radio system. You can select one of three standard radio systems or user defined measurement parameters.

Select NADC to configure the application to measure signals that conform to Standard IS-54 and related documents.

Select PDC to configure the application to measure signals that conform to Japanese Standard RCR-27C and related documents.

Select PHS to configure the application to measure signals that conform to Japanese Standard RCR-28 and related documents.

Select USER to configure the application to measure signals using the measurement parameters saved with the the `MMEM:STOR:STAT` command or the [save setup as USER system] softkey. For more information, see "Saving Parameters to the USER System" in chapter 2. For an example of saving parameters to the USER system, see "To save setup to the USER system" in chapter 3. The USER system contains default measurement parameters that are used if measurement parameters were not saved to the USER system prior to selecting the USER system.



---

# Index

---

**!**  
% power 3-5, 4-29

**A**  
abort test 4-14  
adjacent channel  
    bandwidth 4-15  
    number of pairs 4-16  
adjacent-channel power test  
    measurement methods 2-15  
    modifying parameters 3-12  
    running 3-6  
    selecting 4-13  
application  
    displaying menus 2-4  
    hardware required 1-2  
    loading 1-7  
    options required 1-2  
    storing in NVRAM 1-8  
    utilities 2-6, 4-14, 4-24  
attenuation, external 3-18, 4-25  
averaging 3-8, 4-27

**B**  
bandwidth  
    adjacent channel 4-15  
    reference channel 4-23  
burst signal format  
    parameters dependent on 2-10  
    selecting 3-2, 4-32  
burst view 3-4, 4-11

**C**  
calibration, external 3-18  
centroid to carrier 3-4, 4-28  
channel filter  
    rolloff 4-18  
    selecting 4-17  
    width 4-19

channel pair  
    number of 4-16  
    offset 4-20  
    selecting 4-21  
configuration 3-17  
constant K5 3-6  
continuous signal format  
    parameters dependent on 2-10  
    selecting 3-2, 4-32

**D**  
data register D6 3-6  
default parameters, USER system 2-12  
delete application 4-24  
displaying  
    application menus 2-4  
    online help 2-5  
    results summary 3-4

**E**  
external attenuation 3-18, 4-25

**F**  
firmware, upgrading 1-3  
frequency, setting center 3-2, 4-28  
full signal, power due to 2-11, 4-30

**G**  
gain, setting external 3-18  
GSM system  
    adjacent-channel power test 3-12  
    modulation accuracy test 3-14  
    occupied bandwidth test 3-10

**H**  
hardware, required 1-2  
help, displaying online 2-5

**I**  
IBASIC memory 1-5  
instrument firmware, upgrading 1-3

## **L**

loading application 1-7

## **M**

math functions F3 to F6 3-6

measurement method

description 2-20

selecting 3-6, 4-22

measurement parameters

dependent on signal format 2-10

dependent on sync word 2-12

set by each test 2-8

measurement result unit 3-6, 4-6

memory, allocating 1-4

MKK method

description 2-20

selecting 3-6, 4-22

modulation accuracy test

modifying parameters 3-14

running 3-8

selecting 4-13

modulation, power due to 3-4, 4-30

## **N**

NADC system 3-3, 4-33

## **O**

occupied bandwidth test

modifying parameters 3-10

running 3-4

selecting 4-13

offset, channel pair 3-7, 4-20

online help 2-5

options, required 1-2

## **P**

parameters

dependent on signal format 2-10

dependent on sync word 2-12

set by each test 2-8

pattern, sync word 3-15

PDC system 3-3, 4-33

PHS system 3-3, 4-33

power due to

selecting 3-4, 4-30

USER system 2-11

power percentage 3-5, 4-29

preset 2-6, 3-2, 4-31

pseudo-swept method

description 2-20

selecting 3-6, 4-22

## **R**

radio system

creating custom 2-10, 3-16

selecting 3-3, 4-33

reference channel bandwidth 3-7, 4-23

result unit 3-6, 4-6

results summary 3-4, 4-12

rolloff, channel filter 4-18

## **S**

save setup as USER system 3-16

select test 4-13

adjacent-channel power 3-6

modulation accuracy 3-8

occupied bandwidth 3-4

signal format

effect on parameters 2-8

parameters dependent on 2-10

selecting 3-2, 4-32

summary 3-4, 4-12

symbol rate 2-6

SYNC NOT FOUND 2-14

sync word

list 2-14

parameters dependent on 2-12

pattern 3-15

selecting 4-26

system

creating custom 2-10, 3-16

selecting 3-3, 4-33

## **T**

ten burst average 3-8, 4-27

test

preset 2-6, 4-31

selecting 4-13

test results

query current 4-7

query number of 4-9

query specific 4-10

time domain 3-4, 4-11

trace B 3-4, 4-11

true rms method

description 2-20

selecting 3-6, 4-22

## **U**

unique word

list 2-14

parameters dependent on 2-12

pattern 3-15

selecting 4-26

user sync word pattern 2-12

USER system

  saving 3-16

  selecting 3-3, 4-33

  setting up complete 2-12

## **W**

word pattern

  defining 3-15

  USER system 2-12

---

## *Need Assistance?*

If you need assistance, contact your nearest Hewlett-Packard Sales and Service Office listed in the HP Catalog, or contact your nearest regional office listed at the back of this guide. If you are contacting Hewlett-Packard about a problem with your analyzer, please provide the following information:

- Model number:
- Firmware version: †
- Serial number: ‡
- Options: ††
- Date the problem was first encountered:
- Circumstances in which the problem was encountered:
- Can you reproduce the problem?
- What effect does this problem have on you?

† To display the firmware version, press [**System Utility**], [more], [firmware version].

‡ To display the serial number, press [**System Utility**], [more], [serial number].

†† To display the options, press [**System Utility**], [options setup].

---

## *About this edition*

July 1995: First Edition. This edition documents the use of the HP 89451A Application personality software with HP 89400-Series analyzers that have software revision A.04.10 or later.