

**Agilent Technologies 89450A
Options H01, H02, and H03
User's Guide**



Agilent Technologies

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In This Book

This book describes the additional features provided by options H01, H02, and H03, to the Agilent 89450A M-16QAM Radio Test Personality application software. This book also contains the GP-IB commands for each option.

- Option H01 adds iDEN and DJ-SMRS capability to the Agilent 89450A M-16QAM Radio Test Personality. (see [Chapter 1, “Options H01 and H02.”](#))
- Option H02 adds iDEN M-4QAM and iDEN M-64QAM capability to the Agilent 89450A M-16QAM Radio Test Personality. (see [Chapter 1, “Options H01 and H02.”](#))
- Option H03 adds iDEN New 6:1 Interconnect, Enhanced 6:1 Dispatch, and WiDEN capabilities to the 89450A M-16QAM Radio Test Personality. (see [Chapter 2, “Option H03.”](#))

To Learn How to Install H01, H02, and H03 applications

See Firmware Install Note (89450-90006).

To Learn About the Agilent 89450A M-QAM Radio Test Personality

To learn how to use the Agilent 89450A M-16QAM Radio Test Personality, see the Agilent 89450A User's Guide shipped with the Agilent 89450A M-16QAM Radio Test Personality.

To Learn More About Agilent 89400-Series Analyzers

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

Hardware, Firmware, and Option Requirements

This section contains information about what hardware, firmware, and options are required to use options H01, H02, H03 and information about which versions of base firmware and application firmware are compatible.

Hardware and Options

To run the Agilent 89450A application software, your analyzer must have the options and hardware listed here.

- Option AYA (Vector Modulation Analysis)
- Option AY9 (Extended Time Capture)
- A50 Digital Filter assembly, Revision C or newer (part number 89410-69550).
- A42 Memory assembly, Revision B or newer (part number 89410-69542)

Note

If you upgrade the A42 Memory assembly, you must also upgrade the CPU.

To determine which options are installed on your analyzer includes,

Press [**System Utility**], [options setup]

To determine which board revisions your analyzer includes, display the test log.

Press [**System Utility**], [more], [diagnostics], [test log on].

```
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
```

Firmware compatibility

This table lists compatible base instrument firmware and application firmware versions

Press [**System Utility**], [more], [firmware version]

Analyzer	Base Instrument Firmware	Application Firmware
89450A standard	A.09.05/M09.06	A.02.00
89450A #H01	A.09.05/M09.06	A.02.00
89450A #H02	A.09.05/M09.06	A.02.00
89450A #H03	M09.06	A.04.00

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[SENSe:]DDEMod:MQAM:BERate:DSourCe	command/query 52
[SENSe:]DDEMod:MQAM:BERate:FRAMes	command/query 53
[SENS:]DDEM:MQAM:BER:SMOD:MULT[:STATe]	command/query 54
[SENSe:]DDEMod:MQAM:BERate:TMODE:SINGle[:STATe]	command/query 55
[SENSe:]DDEMod:MQAM:CCOD.....	command/query 56
[SENSe:]DDEMod:MQAM:FORMat	command/query 57
[SENSe:]DDEMod:MQAM:OCBandwidth:CTOCenter ..	command 58
[SENSe:]DDEMod:MQAM:OCBandwidth:CTOWiden...	command 59
[SENSe:]DDEM:MQAM:OCB:POW:PERC	command/query 60
[SENSe:]DDEMod:MQAM:OCBandwidth:WIDE ..	command/query 61
[SENSe:]DDEMod:MQAM:PTRack [:STATe]	command/query 62
[SENSe:]DDEMod:MQAM:SLOT:FORMat.....	command/query 63
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[SENSe:]DDEMod:MQAM:TEST:PRESet.....	command 66
SENSe:FREQuency:CENTer	command/query 67

1 Options H01 and H02

This chapter describes options H01 and H02.

For information on option H03, see [Chapter 2, "Option H03."](#)

About Option H01

Option H01 adds the following capabilities to the Agilent -89450A M-16QAM Radio Test Personality:

- Two new modulation formats (press [**Shift**], [**Instrument Mode**], [demod format]):
 - iDEN M-16QAM (Integrated Digital Enhanced Network Multiple 16 Quadrature Amplitude Modulated) modulation. iDEN is a trademark of the Motorola Company.
 - DJ-SMRS modulation.
- BER (Bit Error Rate) Test on iDEN or DJ-SMRS signals (press [**Shift**], [**Instrument Mode**], [select test], [BER]).
- Error Symbol Table: When BER test is selected, you can view the Error Symbol Table by pressing the [error symbol table] softkey from the MEAS DATA softkey menu list (press [**Measurement Data**], [more choices])

Option H01 does not change the operation of the Agilent 89450A M-16QAM Radio Test Personality. Therefore, use the *Agilent 89450A User's Guide* to learn how to use the Agilent 89450A M-16QAM Radio Test Personality application; use this manual to learn how to use the one new test added by option H01—the Bit Error Rate test.

Installing Option H01

You install option H01 the same way you install the *Agilent 89450A Radio Test Personality* application.

With option H01, you receive an Agilent 89400-Series Firmware Update kit and two 3.5" disks (an install disk and an application disk), just as you did when you received the Agilent 89450A M-16QAM Radio Test Personality. The install disk gives the analyzer permission to use option H01. The option H01 application disk contains the Agilent 89450A M-16QAM Radio Test Personality with option H01 enhancements.

Installation Procedure

The installation procedure for installing option H01 is the same process used to install the Agilent 89450A "M16-QAM Radio Test Personality" application. To install option H01, follow the instructions in Chapter 1 "Loading the Agilent 89450 Application" of the "Agilent 89450A User's Guide", using the Agilent 89400-Series "Firmware Update kit", "Install disk", and "Application disk" that you received with option H01, and these supplemental instructions:

- When you perform the "To determine if your analyzer can run the Application" in the Agilent 89450A "Users Guide", refer to the "[Hardware, Firmware, and Option Requirements](#)" on page 4, of this manual to determine if your analyzer has the correct options, hardware, and firmware compatibility to run the H01 application. The Agilent 89400-Series Firmware Update kit that you receive with option H01 contains the latest instrument firmware.

Note

To run the BER test on approximately 20 or more frames, you must have the following hardware option:

– **AY9 Extended Time Capture**

- After completing "To give your analyzer permission to use the application", verify that your analyzer has permission to use option H01 by looking for YES next to **0 and **1 in the OPTIONS CONFIGURATION table. To display the OPTIONS CONFIGURATION table, press [System Utility], [options setup].

About Option H02

Option H02 adds iDEN M-4QAM and iDEN M-64QAM modulation formats to option H01 (press [Shift], [Instrument Mode], [demod format]).

Note

Option H02 extends the capability of option H01, it does not effect the operation of option H01.

Installing Option H02

Option H02 requires option H01. If option H01 is not installed, install option H01 before installing option H02.

Like option H01, option H02 includes an Agilent 89400-Series Firmware Update kit and two 3.5" disks; an install disk and an application disk. The install disk gives the analyzer permission to use option H02. The option H02 application disk contains the Agilent 89450A M-16QAM Radio Test Personality with option H01 and option H02 enhancements.

Installation Procedure

The installation procedure for installing option H02 is the same process used to install the Agilent 89450A "M16-QAM Radio Test Personality" application. To install option H02, follow the instructions in Chapter 1 "Loading the Agilent 89450 Application" of the "Agilent 89450A User's Guide", using the Agilent 89400-Series "Firmware Update kit", "Install disk", and "Application disk" that you received with option H02, and these supplemental instructions:

- Additional instructions to the "To determine if your analyzer can run the Application" of the Agilent 89450A "Users Guide":
Refer to the "[Hardware, Firmware, and Option Requirements](#)" on page 4, of this manual to determine if your analyzer has the correct options, hardware, and firmware compatibility to run the this application. The Agilent 89400-Series Firmware Update kit that you receive with option H02 contains the latest instrument firmware.
- After completing "To give your analyzer permission to use the application", verify that your analyzer has permission to use option H02 by looking for YES next to **0, **1, and **3 in the OPTIONS CONFIGURATION table. To display the OPTIONS CONFIGURATION table, press [System Utility], [options setup].

Testing iDEN and DJ-SMRS Signals

With Options H01 and H02, you can perform all of the tests provided with the Agilent 89450A application on iDEN or DJ-SMRS signals including:

- Occupied Bandwidth
- Adjacent Channel Power
- Modulation Accuracy
- Burst Power (Power vs. Time)

For more information about performing these tests, see the “*Making Measurements*” chapter in the *Agilent 89450 Users Guide*.

- BER (Bit Error Rate) test

In addition to the default tests, option H01 adds the BER (Bit Error Rate) test. For more information about performing this test, see [Chapter 3, “BER test.”](#)

Configuring the test

Selecting iDEN or DJ-SMRS automatically configures a test to measure iDEN or DJ-SMRS signals. For example, selecting iDEN or DJ-SMRS sets the default adjacent-channel bandwidth (for the Adjacent-Channel Power test) to 10 kHz. The default for D-MCA is 18 kHz.

Before you run a test

To initialize a test, perform the “Before you run a test” instructions in the “*Making Measurement*” chapter of the *Agilent 89450A Users Guide*.

Running a Test

Follow these steps to run a test on an iDEN or DJ-SMRS signal:

- Step 1 Press **[Shift]**, **[Instrument Mode]**, [demod format] and select one of the iDEN modulation formats or select DJ-SMRS. The analyzer selects [iDEN M-16QAM] by default.
- Step 2. For test supported with Agilent 89450A application, follow the instructions in the “*Making Measurement*” chapter, of the *Agilent 89450A User’s Guide*, for your specific test.

For the BER test, follow the instructions in [Chapter 3, “BER test.”](#), of this manual.

Note

When running the Burst Power test on an iDEN or DJ-SMRS signal, you can still use the Burst Power template but remember—the template is defined by Standard RCR-32 for D-MCA signals.

Additional Details

When using option H01 or H02, note the following:

Save State

When you save the measurement state (using [**Save/Recall**] [save state]), the measurement state does not include 89450A application parameters.

2

Option H03

This chapter describes option H03.

For information about options H01 and H02, see [Chapter 1, "Options H01 and H02."](#)

About Option H03

Option H03 updates options H01/H02 and adds iDEN New 6:1 Interconnect, Enhanced 6:1 Dispatch, and WiDEN signal analysis capabilities to the 89450A M-16QAM Radio Test Personality. Option H03 requires the Agilent 89450A application and the option H01 and H02 upgrades.

Option H03 feature set and differences from options H01/H02:

- Option H03 does not support the options H01/H02 DMCA and D-JSMR signal analysis capability.
- Supports 4QAM, 16QAM and 64QAM modulation formats.
- Supports these Outbound slot types:
 - Full Outbound
 - New 6:1 Interconnect Outbound Slot
- Supports these Inbound slot types:
 - Full Reserve Access slot type
 - Full Reserved Enhanced 6:1
 - New 6:1 Interconnect Reserved Access
 - New 6:1 Interconnect Reserved Access with Training
- Supports these WiDEN Inbound slot types:
 - WiDEN 25 kHz
 - WiDEN 50 kHz
 - WiDEN 50kHz Outer
 - WiDEN 75 kHz
 - WiDEN 100 kHz

New 6:1 Reserved slot type

The New 6:1 Reserved slot type involves periodically sending training sequence slots within the continuous stream of non-training slots. The analyzer identifies the training sequence slots and applies them to the appropriate tests.

For example, the training sequence slots are ignored when the analyzer is performing a BER test. All data associated with the BER test is contained within the non-training slots.

Time Mask Measurement

For a given slot type, the mask timing limits are different between option H03 and options H01/H02. All other aspects of the measurement remain the same.

BER Measurement Information

The BER test selects the appropriate BER table for the specified slot type.

Occupied Bandwidth - Multi-carrier Features

The Occupied Bandwidth multi-carrier feature set, incorporating the [span wide|narrow], [centroid → center] and [centroid → align WiDEN carrier] softkeys, allow you to do the following operations:

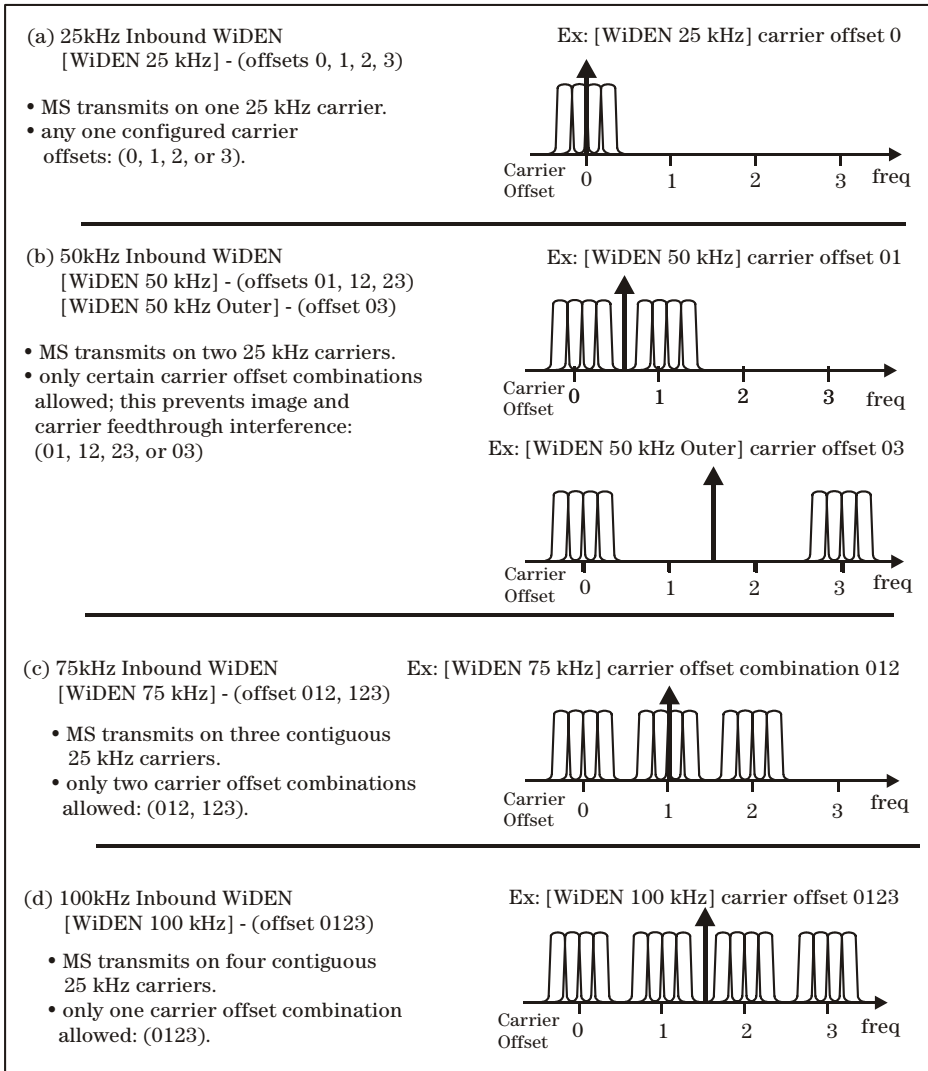
- Quickly switch between "wide" and "narrow" span views of the spectral data. "Wide" sets the span wide enough to view up to four WiDEN carriers at a time. You can then adjust the analyzer CF to center and show all carriers in the composite signal or center a single carrier for further analysis (this provides a rough estimate of the single carrier CF). "Narrow" decreases the span to show a single carrier that is intended for single carrier analysis.
- Set the analyzer CF to the centroid of the composite signal.
- Set the analyzer CF to the center of the lowest WiDEN carrier.
- Increment and decrement the analyzer's center frequency by the carrier offset to quickly select a specific carrier to analyze.

The [span wide|narrow], [centroid → center] and [centroid → align WiDEN carrier] functions support the WiDEN Inbound bandwidth and carrier combinations as shown in the following "Supported WiDEN Inbound Bandwidths" graphic. These operations can also be accomplished programmatically. For more information, see "Occupied Bandwidth Test" in this chapter.

Option H03
 About Option H03

Note

The proper operation of this capability requires the Occupied Bandwidth search power to be greater than 95 percent ([% power] > 95%)



Supported WiDEN Inbound Bandwidths

Installing Option H03

Option H03 requires option H02 to be installed, however, option H03 is not separately licensed. If option H02 is not installed, install option H02 before installing option H03.

Option H03 includes an Agilent 89400-Series Firmware Update kit and an application disk that contains the option H03 enhancements.

Installation Procedure

The installation procedure for installing option H03 is the same process used to install the Agilent 89450A “M16-QAM Radio Test Personality” application. To install option H03, follow the instructions in Chapter 1 “*Loading the Agilent 89450 Application*” of the “*Agilent 89450A User’s Guide*”, using the Agilent 89400-Series “Firmware Update kit” and the “Application disk” that you received with option H03, and these supplemental instructions:

- When performing the “*To determine is your analyzer can run the Application*” procedure, refer to the “[Hardware, Firmware, and Option Requirements](#)” on page 4 in this manual to determine if your analyzer has the correct options, hardware, and firmware compatibility to run the this application. The Agilent 89400-Series Firmware Update kit that you receive with option H03 contains the latest instrument firmware.
- After completing “*To give your analyzer permission to use the application*”, verify that your analyzer has permission to use option H02 by looking for YES next to **0, **1, and **3 in the OPTIONS CONFIGURATION table. To display the OPTIONS CONFIGURATION table, press [System Utility], [options setup].
- When performing the “*To load the Application*” procedure, in step 3, replace “Press [load application] “ with “Press [System Utility], [applications] [load application]” to load the application.

Measurement Memory Allocation

Verify that the size of the measurement memory allocation is set appropriately for this application.

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

Make sure that the minimum values specified for the {max time points} parameter is 1024 and the {max freq points} parameter is 3201. Change these values if necessary.

You may be able to use higher values, but the best measurement speed is achieved at these values; higher values reduce measurement speed.

Additional Details

When using option H03, note the following:

Save State

When you save the measurement state (using [**Save/Recall**] [save state]), the measurement state does not include 89450A application parameters.

Testing WiDEN, iDEN New 6:1, and Enhanced 6:1 Signals

Option H03 supports the Agilent 89450A application tests and the BER Test provided with the option H01 upgrade for iDEN New 6:1 Interconnect, Enhanced 6:1 Dispatch, and WiDEN signals. This chapter describes the Agilent 89450A application tests. The BER test procedures are described in [Chapter 3](#), “BER test.” of this manual.

The procedures in this chapter show you how to run tests for option H03 application signals. However, many of these procedures also reference instructions in the “*Making Measurement*” chapter of the *Agilent 89450A User’s Guide*. Therefore, you will also need a copy of the *Agilent 89450A User’s Guide* to complete these test procedures.

Option H03 supports all tests provided with the Agilent 89450A application for the 4QAM, 16QAM, and 64QAM modulation formats for the iDEN Enhanced 6:1 Full Slot Reserved Access and WiDEN inbound slot types among others. Option H03 supports the following Agilent 89450A application tests:

- Occupied Bandwidth (OBW) (supports Multi-carrier analysis for WiDEN).
- Adjacent Channel Power (ACPR) (supports Multi-carrier analysis for WiDEN)
- Modulation Accuracy
- Burst Power (Power vs. Time)

Option H03 also supports the BER test provided with the option H01 application upgrade. The BER test procedures are described in [chapter 4](#).

- Bit Error Rate (BER) (supports Single-carrier, multi-slot analysis)

Note

BER test procedures are described in [Chapter 3](#) , “BER test,” on [page 31](#) of this manual.

Configuring the test

Selecting an inbound or outbound slot type automatically configures the analyzer to test the specified modulated signal. For example, selecting a WiDEN slot type and the Adjacent Channel Power test will automatically set the measurement to the proper WiDEN default test frequency offsets and adjacent-channel bandwidths.

Before you run a test

This procedure shows you how to configure the analyzer to measure your test signal. If the test signal conditions and parameters do not change, you only need to configure the analyzer once before you run the first test; the same setup applies to all succeeding tests.

Note It is also recommended that you review the “*To choose the best configuration*” section in the “*Making Measurements*” chapter of the *Agilent 89450A User’s Guide*; this chapter provides information that will help you configure the analyzer for optimum performance.

1. Connect your test signal to the Analyzers RF input or Channel 1 input.
2. Verify that the input range is correct (see “*To choose the best configuration*” section of the “*Making Measurements*” chapter of the *Agilent 89450A User’s Guide*).

Note Set the measurement memory to the values specified in the “Measurement Allocation” step of section “[Installing Option H03](#)” on page 19.

3. Setup the test signal transmission parameters
 - a. Specify the signals M-QAM modulation format:
Press [**Shift**], [**Instrument Mode**], [demod format], and select one of the available M-QAM modulation formats (default = 16QAM).
 - b. Specify the Color Code (WiDEN or Enhanced 6:1 signals only)
If the test signal is a WiDEN or Enhanced 6:1signal, specify the color code (in Hexadecimal).
Press [**Shift**], [**Instrument Mode**], [color code], type the specific color code, press [enter].
 - c. Specify the test signals inbound or outbound slot type.

Inbound slot types: Press [**Shift**], [**Instrument Mode**], [inbound], select your signals modulation format, [iDEN] or [WiDEN], and then select the {slot type}.

Outbound slot types: Press [**Shift**], [**Instrument Mode**], [outbound], select your signals outbound slot type, [Full slot Outbound] **or** [New 6:1 Outbound]

4. Specify the carrier center frequency
 - a) If you know the center frequency within +/- 100 Hz:
Press [**Shift**], [**Instrument Mode**], [carrier], type the frequency, press [enter].
or
Press [**Frequency**], [center], type the frequency, press [enter].
 - b) If you know the approximate frequency (not within 100 Hz):
Use the OBW test and the [centroid → center] softkey to find the CF:
Press [**Shift**], [**Instrument Mode**], [select Test], [Occupied Bandwidth], [centroid → center], see “[Occupied Bandwidth Test Procedure](#)” on page 24.
5. Verify that the entire test signal is centered on the display:
Press [**Shift**], [**Instrument Mode**], [select Test], [Occupied Bandwidth].

Make sure that the entire spectrum of the test signal shows on the spectrum display and that it is centered. If it is not, adjust the CF so that it does; use the [centroid → center] softkey to center the signal.

6. Verify the Burst Signal Setup (Burst signals only)

If the test signal is a Burst, examine the Frequency-domain and Time-domain traces and make sure the entire signal is captured, centered, and stable. Set the analyzer to show the Spectrum trace in top grid and the Main-Time trace in the bottom grid.

Press [**Display**], [2 grids]

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 OBW and ACPR tests automatically set the trigger parameters to achieve this. View the signal in the Main-Time trace and make sure the entire burst is captured and centered.

If the burst signal is *not* stable, you may need to adjust the trigger level. Press [**Trigger**] to access the trigger parameters. In this case, adjust the trigger level to obtain a stable waveform. Changing the trigger level also changes the position of the waveform in the time record.

Return the analyzer to show a single trace; Press [**Display**], [single grid]

Occupied Bandwidth Test Procedure

Occupied bandwidth test supports single-carrier and multi-carrier signal measurements. However, for inbound slot types, the OBW test only supports single-slot per frame measurements .

Note

OBW test only supports single-slot per frame measurements for WiDEN inbound slot types.

The OBW test is only supported for single slot per frame measurements for the WiDEN inbound slot types. The measurement process requires accurate triggering of the burst signal, which may be adversely affected by transmission of more than one slot per frame. If false triggering occurs, the measurement results will also be adversely effected and unreliable. Therefore, this test only supports single-slot per frame measurements for inbound slot types.

1. If you have not already done so, initialize the test by performing the “Before you run a test” procedure in this chapter.
2. Start the Occupied Bandwidth test:
Press **[Shift]**, **[Instrument Mode]**, [select test], [Occupied Bandwidth]

The analyzer starts the occupied bandwidth test and shows another softkey menu that allows you to change parameters specific to this test. For more information, see the “*To measure occupied bandwidth*” test procedure in the *Agilent 89450 Users Guide*.

Selecting a carrier to analyze (multi-carrier features)

Option H03 adds a new occupied bandwidth multi-carrier feature set, incorporating the [span wide | narrow], [centroid → center] and [centroid → align WiDEN carrier] softkeys, that allow you to do the following operations:

- [span wide | narrow] softkey - Quickly switch between "wide" and "narrow" span views of the spectral data. "Wide" sets the span wide enough to show up to four WiDEN carriers. You can use this view to adjust the analyzer CF to center all carriers in the composite signal or to center a single carrier for further analysis (this provides a rough estimate of the single carrier CF). "Narrow" decreases the span to show only a single carrier that will be used for further analysis.
- [centroid → center] softkey - Allows you to set the analyzer CF to the centroid of the composite signal; this is the frequency that is at the mid-point of the occupied bandwidth of the composite signal.
- [centroid → align WiDEN carrier] softkey - Allows you to set the analyzer CF to the center of the lowest WiDEN carrier.
- [UP/DOWN] arrow hardkeys - Increment and decrement the analyzer's center frequency by the carrier offset. This allows you to easily move between carrier offsets and select a specific carrier to analyze.

How to use the Multi-carrier features

These steps show you how use the multi-carrier features to view a WiDEN composite signal (all carriers) and then select a single WiDEN carrier to analyze

Set the span wide enough to capture the entire signal (toggle [span wide | narrow] to wide) and adjust the CF so that the entire composite signal is shown in the display. Then use the [centroid → center] softkey to locate the measured composite signals CF and to center the signal on the display. The trace display shows the calculated occupied bandwidth, centroid frequency, and difference frequency for the composite signal.

To select a single carrier to analyze, press the [centroid → align WiDEN carrier] softkey. This operation sets the analyzer CF to the lowest WiDEN carrier frequency. The trace display shows the calculated occupied bandwidth, centroid frequency, and difference frequency for shown single carrier.

To show and select a different carrier to analyze in the composite signal, make sure the [carrier] softkey is active and then press the front panel [UP] arrow hardkey. This shows the next higher available carrier by incrementing the analyzer CF an equivalent carrier offset frequency. You can use the [UP/DOWN] arrow hardkeys to move between higher and lower frequency carriers within the composite signal.

These operations can also be accomplished programmatically. These functions support the WiDEN Inbound bandwidth and carrier combinations as shown in the “Supported WiDEN Inbound Bandwidths” graphic.

Note

The proper operation of this capability requires the Occupied Bandwidth search power to be greater than 95 percent ([% power] > 95%).

Adjacent-channel Power Test Procedure

Adjacent-channel test supports multi-carrier signal measurements. However, for WiDEN Inbound slot types, the ACPR test only supports single-slot per frame measurements .

The analyzer will automatically configure the ACPR test parameters based on the specified inbound or outbound slot type, including the reference channel and adjacent channel bandwidths, and the high and low channel offset frequencies.

Note

ACPR test only supports single-slot per frame measurements for WiDEN inbound slot types.

The ACPR test is only supported for single slot per frame measurements for the WiDEN inbound slot types. The measurement process requires accurate triggering of the burst signal, which may be adversely affected by transmission of more than one slot per frame. If false triggering occurs, the measurement results will also be adversely effected and unreliable.

ACPR Measurements for WiDEN inbound slot types

There are two different ACPR measurement processes required for WiDEN inbound slot types. This is due to its various inbound slot types and carrier offset combinations. One procedure is for the WiDEN inbound slot types that have “Contiguous Carrier Offsets” and the second procedure is for the “Non-Contiguous Carrier Offsets” case.

- **Contiguous carrier offsets case**

The “Contiguous Carrier Offsets” case applies to WiDEN inbound slot types that have contiguous carrier offsets; no non-active carriers between active carrier-offsets. This includes all of the WiDEN inbound slot types and carrier offset combinations *except* the 50 kHz inbound WiDEN slot type - carrier offset combination 03, shown in the “Supported WiDEN Inbound Bandwidths” graphic.

For the *Contiguous Carrier Offset* case, the ACPR measurement is a one step process performed as any other typical ACPR test. For this test case, the ACPR reference bandwidth is set to include all carriers specified by the WiDEN inbound slot type. The adjacent channel High/Low offset frequencies are set to one carrier offset outside of the outer-carriers offset specified by the WiDEN inbound slot type, see “Supported WiDEN Inbound Bandwidths” graphic.

- **Non-Contiguous carrier offsets case**

The “Non-Contiguous Carrier Offsets” case applies to WiDEN inbound slot types that have non-contiguous carrier offsets; one or more non-active carrier(s) between a set of active carrier-offsets. The “50 kHz Inbound WiDEN - carrier offset combination 03” is an example of the non-contiguous case, see “Supported WiDEN Inbound Bandwidths” graphic. This is the analyzer [WiDEN 50 kHz Outer] WiDEN Inbound Slot type [Press **[Shift]**, **[Instrument Mode]**, [inbound], [WiDEN], [WiDEN 50 kHz Outer].

For the *Non-Contiguous Carrier Offset* case, the measurement is a two step process that requires you to perform the measurement twice; one measurement for each outer-carrier. For this test case, the measurement setup for the reference bandwidth and adjacent channel offsets is the same as the 25 kHz Inbound WiDEN slot type, see “Supported WiDEN Inbound Bandwidths” graphic.

Measurement Procedure

Follow the measurement procedure for your test signal. This procedure provides instructions for non-WiDEN signals, “WiDEN signal - contiguous carrier offsets” case, and “WiDEN signal - non-contiguous carrier offsets” case.

1. If you have not already done so, initialize the test by performing the “Before you run a test” procedure in this chapter.

Note

For more information about this test, see the “*To measure adjacent-channel power*” test procedure of the *Agilent 89450A User's Guide*.

2. **Non-WiDEN signals**

This procedure applies to all non-WiDEN signals.

Perform this test as described in the “*To measure adjacent-channel power*” test procedure of the *Agilent 89450A User's Guide*, with the following additional information.

Set the reference channel center frequency:

Use the occupied bandwidth test - [centroid → center] softkey function to set the analyzer CF to the center of the reference channel, see “[How to use the Multi-carrier features](#)” in [chapter 2](#) of this manual.

Start the ACPR test.

Press [**Shift**], [**Instrument Mode**], [select test], [Adjacent Chan Pwr]

3. **WiDEN signal - Contiguous carrier offsets case**

This procedure applies to all WiDEN signal inbound slot types that have “Contiguous Carrier Offsets” (previously described).

For the *Contiguous Carrier Offset* case, the ACPR measurement is a one step process performed as any other typical ACPR test. For this test case, the ACPR reference bandwidth is set to include all carriers specified by the WiDEN inbound slot type. The adjacent channel High/Low offset frequencies are set to one carrier offset outside of the outer-carriers offset (specified by the WiDEN inbound slot type), see “Supported WiDEN Inbound Bandwidths” graphic

a) Perform this test as described in the “*To measure adjacent-channel power*” test procedure of the *Agilent 89450A User's Guide*, with the following additional information.

b) Set the reference channel center frequency:

Use the occupied bandwidth test - [centroid → center] softkey function to set the analyzer CF to the center of the reference channel, see “[How to use the Multi-carrier features](#)” in [chapter 2](#).

c) Start the ACPR test:

Press [**Shift**], [**Instrument Mode**], [select test], [Adjacent Chan Pwr]

4. WiDEN signal - Non-Contiguous carrier offsets case

This procedure applies to WiDEN signal inbound slot types that have “*Contiguous Carrier Offsets*” (previously described). For example, the 50 kHz Inbound WiDEN, carrier offset combination 03, slot type (equivalent to the analyzer [WiDEN 50 kHz Outer] WiDEN Inbound slot type) is a contiguous offset case.

For the *Contiguous Carrier Offset* case, the measurement is a two step process that requires you to perform the measurement twice; one measurement for each outer-carrier. The measurement setup for the reference bandwidth and adjacent channel **High/Low offsets** is the same as the 25 kHz Inbound WiDEN slot type, see “Supported WiDEN Inbound Bandwidths” graphic.

a) Perform this test as described in the “*To measure adjacent-channel power*” test procedure of the *Agilent 89450A User’s Guide*, with the following additional information.

b) Perform the ACPR test for the lower outer-carrier offset.

Set the analyzers center frequency to the center of the lower outer-carrier offset (This is the reference channel center frequency for the measurement):

Use the occupied bandwidth test -[centroid → align WiDEN carrier] softkey function to set the analyzer CF to the center of the lowest WiDEN carrier. Follow the “[How to use the Multi-carrier features](#)” in [chapter 2](#), to perform this task.

c) Start the ACPR test.

Press [**Shift**], [**Instrument Mode**], [select test], [Adjacent Chan Pwr]

d) Perform the ACPR test for the upper outer-carrier offset.

Repeat this test for the upper outer-carrier offset. For this measurement, set the analyzer center frequency to the center of the upper outer-carrier offset.

Modulation Accuracy Test Procedure

Modulation Accuracy test only measures single-carrier measurements.

To run this test, follow the “*To measure modulation accuracy*” test procedure of the *Agilent 89450A User's Guide* in conjunction with the following additional information specific to the H03 WiDEN application capabilities and features.

1. If you have not already done so, initialize the test by performing the “Before you run a test” procedure in this chapter.

Select a single carrier to analyze within the composite signal, press the [centroid → align WiDEN carrier] softkey and then use the [UP/DOWN] arrow hardkeys to select a carrier, see “[How to use the Multi-carrier features](#)” on page 24.

2. Continue with the “*To measure modulation accuracy*” test procedure of the *Agilent 89450A User's Guide*.

Burst Power (Transient Response) Test Procedure

The Burst Power test is intended for use with iDEN signals. WiDEN signals can be tested with limitations. The signal may clip the mask at the point when the signal turns both on and off. This test can be reliably used to ensure that individual carriers of a multi-carrier signal meet the mask in the region of the SGC pulse.

Test Qualifications

The Burst Power Test results are based on the slot power envelope relative to a power mask. During the slot off time, the mask is the higher power of -54 dBm or -60 dBc. (Where dBc is power relative to the composite carrier power.) In the 89450 WiDEN application, the entire mask is always positioned relative to the composite power of the signal being measured. This means that when the composite power is greater than 6 dBm, the Burst Power Test provides accurate results for the entire mask. However, when the composite power is less than 6 dBm, the mask will not be positioned properly in the portions of the slot where power is off.

Run the Burst Power Test

To run this test, follow the “*To measure burst power (transient response)*” test procedure of the *Agilent 89450A User's Guide* in conjunction with the following additional information specific to the H03 WiDEN application capabilities and features.

1. If you have not already done so, initialize the test by performing the “Before you run a test” procedure in this chapter.

Select a single carrier to analyze within the composite signal, press the [centroid → align WiDEN carrier] softkey and the use the [UP/DOWN] arrow hardkeys to select a carrier, see “[How to use the Multi-carrier features](#)” on page 24.

Option H03

Burst Power (Transient Response) Test Procedure

2. Continue with the “*To measure burst power (transient response)*” test procedure of the *Agilent 89450A User’s Guide*.

3 **BER test**

Option H01 adds the BER (Bit Error Rate) test to the Agilent 89450A Radio Test Personality application for iDEN signals. Option H03 adds iDEN New 6:1 Interconnect, Enhanced 6:1 Dispatch, and WiDEN signals. This chapter shows you how make a BER measurement.

About Bit Error Rate (BER)

Option H01 adds one additional test to the Agilent 89450A Radio Test Personality: the BER (Bit Error Rate) test. Option H01 allows you to run the BER test for iDEN signals. Option H02 adds M-4QAM and M-16QAM modulation format measurement capability to the BER test.

Option H03 expands the option H01/H02 BER test to include iDEN New 6:1 Interconnect, Enhanced 6:1 Dispatch, and WiDEN signals. In-addition, option H03 adds single-carrier multi-slot BER test capability for WiDEN signals.

Before you run a test

1. BER Test Setup:

It is assumed that the analyzer has already been configured to run a test for your specific option and signal, including the test signals transmission parameters. If you have not already done so, perform the “Before you run a test” procedure for your specific option and test signal:

- Option H01/H02, iDEN signals, see [“Before you run a test” in chapter 1](#).
- Option H03, iDEN New 6:1 Interconnect, Enhanced 6:1 Dispatch, and WiDEN signals, see [“Before you run a test” in chapter 2](#).

The “Before you run a test” procedure will show you how to setup the analyzer to measure your specific signal including the following parameters:

- Input range,
- Span
- Center frequency
- Signal transmission parameters:
 - M-QAM modulation format
 - Color code (WiDEN signals)
 - Slot type (inbound or outbound)

Run the BER Test

1. Start the Bit Error Rate test.

Press **[Shift]**, **[Instrument Mode]**, [select test], [BER].

The analyzer starts the BER test and shows the BER test parameter softkey menu. These parameters allow you to configure the BER test for your specific test application and signal type:

- [data source] determines where the BER test acquires the source data. Select *input* [data source input] to acquire and analyze data from the RF input. Select *buffer* [data source buffer] to analyze data previously acquired in the analyzer's time-capture buffer.
- [test mode] determines how the BER test ends; *single* [test mode single] configures the BER test to end after one measurement; *loop* [test mode loop] configures the BER test to make repetitive measurements.
- [num frames] (Opt H01 and H02 only) Specifies the total number of frames used by each test. The default is 16. The BER algorithm requires one additional frame beyond the specified [num frames] value; for example, if [num frames] is 16, the BER test acquires 17 frames of data (n + 1). The analyzer searches the input for the first slot in the frame that it can demodulate and tests the WORD. The test advances to the next consecutive frame (consecutive 90 ms data-blocks), demodulates the slot and tests the WORD. This process is repeated until all frames specified by [num frames] have been analyzed. The size of time-capture memory determines the maximum number of frames that you can measure (default allows a maximum of 128). If you want to examine more frames than currently allowed, install option AY9 (Extended Time-Capture Memory).
- [words/frames multi/single] (Opt H03) This parameter determines if the BER test makes single word-per-frame or multiple word-per-frame measurements.
Single [words/frames single] configures the measurement to analyze one WORD per frame. The measurement is identical to the test process described above for the [num frames] softkey. The test repeats the measurement process until the [num words] value is reached.
Multiple [words/frames multi] configures the measurement to analyze multiple slots-per-frame. In this mode, the analyzer will consecutively test and analyze each slot in all frames until the [num words] value is reached.
- [num words] (Opt H03) Specifies the total number of words used by the BER Test. The default is 16.
- [pilot track on/off] (Default on) Enables (on) or Disables (off) pilot tracking. See "About Pilot Tracking" on page 39.
- [summary on/off] (Default off) *ON* shows the BER Summary table results. See "Bit Error Rate Summary Table" on page 38.

BER test

Run the BER Test

The BER test is a time-capture measurement and uses data stored in the analyzer's time-capture buffer:

- If you select [data source **input**], the BER test first puts the measured RF input data into time-capture buffer and then performs bit error data analysis using the time-capture buffer data.
- If you select [data source **buffer**], the BER test assumes data is already in the time-capture buffer and uses the existing data to perform bit error data analysis.

To view the time-capture data, select the [Measurement Data] hardkey, [more choices], [capture buffer]. By default, the measurement data for Trace D is capture-buffer data.

Default BER Test Results

BER Test Default Display

The default BER Test display shows three sets of data results; Trace A - Composite Symbol Table, Trace B - Error Symbol Table, and, at the bottom of the display, the BER Test results.

Hint

Trace information, such as that shown in the composite and error symbol tables, only shows results from the current slot. If your analyzer has option AYW (Waterfall and Spectrogram Displays), you can turn on the waterfall display to see results from previous frames. For details, see online help for the [waterfall on/off] softkey.

Default BER Test Display - Trace A and Trace B

BER WORD shows the number of the current BER test word. A "WORD NOT FOUND" message will show if the measured data does not match the BER test word.

Trace A:

The default trace A is the *Composite Symbol Table*, which contains information interleaved from all sub-channels, including:

- (S) SYNC symbols
- (P) PILOT symbols

TRACE A: Ch1 M64QAM Composit
A Marker 13.00000 syn 77.374 k

Line	Hex	Hex	Hex	Hex	Hex	Hex	BER WORD:
0	SSSSSSSS	SSSSSSSS	SSSSSSSS	370F0430	2939310F	PPO321PP	15
6	17042404	3B171715	0D31250D	0BPPPP1A	04113B24	32090211	
12	28391328	PPPP2EPP	2A00043D	2B151C34	15121A1D	18PPPP27	
18	20040A04	1D3A0F04	211B1928	PP1218PP	19042410	1F30280D	
24	202B2F25	1CPPPP06	042B3204	213B122D	04273905	PP2F15PP	
30	0404040F	21183F19	27131A05	1BPPPP33	001C3F24	06341338	
36	3C13273D	PP0D04PP	37040015	110C1717	2A310833	32PPPP17	
42	042B2A20	3A082430	2604332B	PP2C20PP	0A040431	243A2B3D	
48	3E233034	06PPPP13	11273734	2E2F012F	2117212C	PP1839PP	
54	1B061E14	311F2F19	SSSSSSSS	SSSSSSSS	SSSSSSSS	183B1E3F	

Trace B:

The default trace B is the *Error Symbol Table*, which shows:

- bit errors (default: Hex format),
- (S) SYNC symbols,
- (P) Pilot symbols,
- (-) Dashes) indicate no bit errors.

For additional details, see *Error Symbol Table* online help, Press [Help], [Measurement Data] hardkeys, [more choices], [err sym tbl] softkeys.

TRACE B: Ch1 M64QAM Error Sy
B Marker 13.00000 syn 0. dB

Line	Hex	Hex	Hex	Hex	Hex	Hex	BER WORD:
0	SSSSSSSS	SSSSSSSS	SSSSSSSS	---	---	PP---	15
6	---	---	---	---	---	PP---	
12	---	PP---	---	---	---	PP---	
18	---	---	---	---	---	PP---	
24	---	---	---	---	---	PP---	
30	---	---	---	---	---	PP---	
36	---	PP---	---	---	---	PP---	
42	---	---	---	---	---	PP---	
48	---	---	---	---	---	PP---	
54	---	---	SSSSSSSS	SSSSSSSS	SSSSSSSS	---	

BER Test Results

	Total	Peak	Current
BIT ERROR RATE:	0.034 %	0.051 %	0.051 %
Bits Failed:	2	1	1
Bits Tested:	5832	1944	1944
Found:	3/ 3 words	Word: 13	Word: 15

The BER Test results are determined by comparing data in the current slot with BER Test WORD..

BER Test Default Display: Trace A "Composite Symbol Table" and Trace B "Error Symbol Table"

Default BER Test Display - BER Test Results

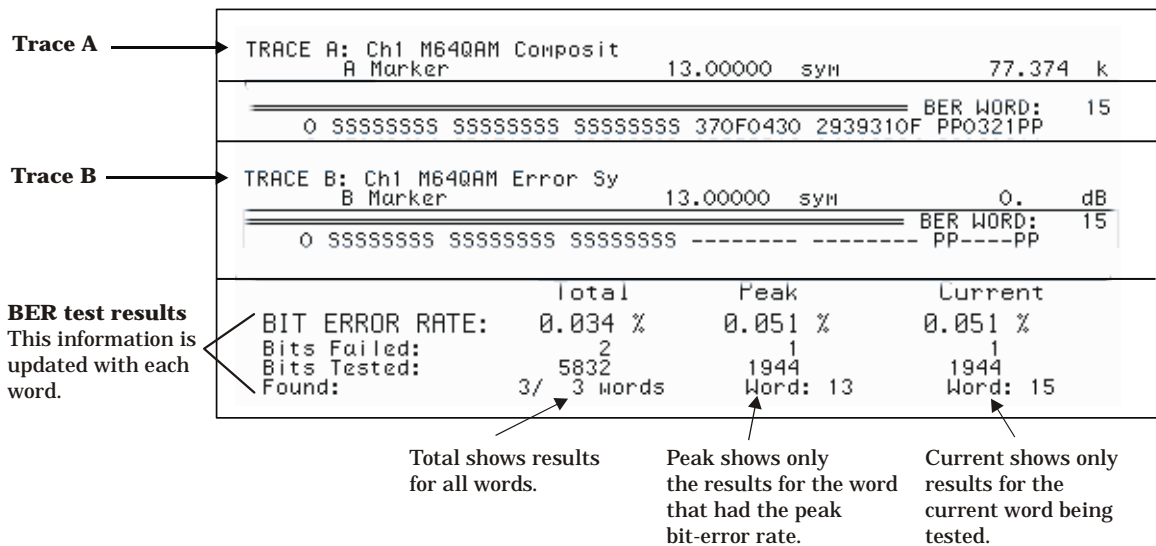
As mentioned previously, the default display also shows a table of BER test results at the bottom of the display. Each test result provides values for 1) the Total measurement, 2) the Peak measurement, and 3) the Current measurement.

- **BIT ERROR RATE:** Shows 1) the *Total* BER result for the entire measurement, 2) the *WORD* with the *Peak* BER, and 3) the BER for the *Current* *WORD*.

BER is computed as a percentage as shown in the following formula::

$$BER (\%) = \frac{\text{Number of bits failed}}{\text{Number of bits tested}} \times 100 \%$$

- **Bits failed:** Shows 1) the *Total* number of bits that failed, 2) the number of bits that failed in the *WORD* that has the *Peak* BER, and 3) the number of bits that failed in the *Current* *WORD*.
- **Bits Tested:** Shows 1) the *Total* number of bits tested, 2) the number of bits tested in the *WORD* that has the *Peak* BER, and 3) the number of bits tested in the *Current* *WORD*.
- **Found:** Shows 1) the *Total* *WORDS* found (slots successfully analyzer for BER) versus the *Total* words tested, 2) the number of the *WORD* that has the *Peak* BER, and 3) the number of the *Current* *WORD*.



BER Test Default Display: BER Test Results

How BER results are affected by non-analyzed slots

This topic describes how slots that cannot be analyzed effect BER test results.

- Total BER test results:
 - Total Bits Failed: The Total Bits Failed is not changed.
 - Total Bits Tested: The Total Bits Tested is not changed.
 - Total Found: *Total Found* provides the total WORDS found (slots successfully analyzer for BER) versus the total WORDS tested. For example, the “*Total Found: 4/15 words*” result means 15 slots were tested—of these, only 4 slots were successfully demodulated and analyzed; the other 11 slots could not be analyzed for any one of these reasons: “SYNC NOT FOUND”, “WORD NOT FOUND”, or “PULSE NOT FOUND”.
- Peak test results:

In general, the *Peak* test results are replaced with their respective *Current* test results when they are higher than the existing values, except for multi-slot BER measurements when the demodulation fails due to “PULSE NOT FOUND”. This is because multi-slot BER tests may intentionally have some non-active slots; slots not transmitting bursts.
- Current test results:
 - Current Bits Failed: Shows half the number of bits in the test WORD.
 - Current Bits Tested: Shows all bits in the current test WORD.
 - Current WORD: The Current WORD is incremented by one or set to zero if it is the first word in the test.

Error Messages

If the BER test cannot analyze a slot, the analyzer will identify the cause and show one of the following error messages:

- *SYNC NOT FOUND*—the test did not find a valid SYNC pattern in the current slot. The analyzer also displays SYNC NOT FOUND if your carrier frequency drifts more than 100 Hz between measurements. For example, if the BER test is processing a long time capture and the carrier frequency drifts more than 100 Hz before the next time capture, the analyzer loses sync and displays SYNC NOT FOUND. For additional details, see “Tracking Carrier-Frequency Drift” in chapter 2 of the *Agilent 89450A User's Guide*.
- *WORD NOT FOUND*—the test did not find a valid BER test word in the current slot.
- *PULSE NOT FOUND*—you are measuring an inbound signal and the test did not detect a pulse in the current slot.

Hint

For additional details about SYNC NOT FOUND or PULSE NOT FOUND, see online help for the [pulse search on/off] softkey (under [Time] when digital demodulation is selected)

Bit Error Rate Summary Table

The BER test also provides a “Bit Error Rate Summary” table. This table shows a repeat of the BER test results from the “BER test default display” and a “Symbols table” that contains a list of the symbols that contained the most bit errors (20 symbols maximum). To show this data, press the [summary on] softkey from the BER test menu.

The symbol with the most bit errors is shown first. Slots that cannot be found (slots that cannot be analyzed) do not affect this table.

- *WORD* is the BER Test Word that contains the symbol with the bit errors.
- *Symbol* is the composite symbol that contained the bit errors.
- *Total* is the total number of bit errors in the composite symbol. This is the sum of all sub-channel bit errors for that symbol.
- *Sub_n* is the number of bit errors in the *n*th sub-channel for the composite symbol.

BER Summary Table

BER Test Results →

Symbol Table →

The BER test updates the results with each slot tested. A new measurement clears the results. If [test mode loop] is selected, the start of the next loop (next measurement) clears the results.

BIT ERROR RATE RESULTS SUMMARY						
	Total	Peak	Current			
BIT ERROR RATE:	0.766 %	1.625 %	0.750 %			
Bits Failed:	98	13	6			
Bits Tested:	12800	800	800			
Found:	16/16 frames	Word 2	Word 8			
SYMBOLS WITH MOST BIT ERRORS (20 max)						
Word	Symbol	Total	Sub_1	Sub_2	Sub_3	Sub_4
11	59	3	1	1	0	1
10	56	2	0	0	1	1
10	59	2	0	1	0	1
11	46	2	0	0	1	1
1	59	2	1	1	0	0
2	58	2	1	0	1	0
3	57	2	1	0	0	1
7	48	2	1	0	1	0
10	23	1	1	0	0	0
11	5	1	0	0	1	0
11	14	1	0	0	0	1
11	15	1	0	0	0	1
11	16	1	0	1	0	0
11	18	1	0	0	1	0
11	33	1	1	0	0	0
11	57	1	1	0	0	0
12	35	1	0	1	0	0
12	38	1	0	1	0	0
13	10	1	0	0	0	1
13	12	1	0	0	0	1

About Pilot Tracking

The BER test allows you to enable or disable Pilot Tracking. By default, the BER test uses pilot tracking to closely simulate the reception characteristics of an actual M-QAM receiver.

[pilot track **on**]: (Default) Enables Pilot Tracking

[pilot track **off**]: Disable Pilot Tracking

Pilot tracking removes magnitude and phase deviations within a slot by using the sync and pilot symbols as magnitude and phase reference-points.

You may want to turn pilot tracking off to:

- Observe the BER in the system with pilot tracking removed.
- Examine the drift/pull characteristics of an LO (Local Oscillator) across a slot.

BER test
About Pilot Tracking

For a list of the Agilent 89450A Application GP-IB commands, see the *GP-IB Command Reference* chapter of the *Agilent 89450A User's Guide*.

About GP-IB Command Reference

Note

The *Agilent 89450A User's Guide* describes the Agilent 89450A GP-IB/HP-IB commands except those changed or added by Options H01, H02, or H03.

This chapter contains the following information:

- *Questionable Modulation Status Register* describes how Option H01 affects this status register.
- *GP-IB Cross Reference* table lists the softkeys added or changed to the Agilent 89450A application by Options H01, H02, or H03 and shows the equivalent GP-IB commands.
- *GP-IB commands* describes each GP-IB command for Options H01, H02, and H03.

Questionable Modulation Status Register Set

The *HP-IB/GP-IB Command Reference* that you received with your analyzer describes the analyzer's GP-IB status registers. Option H01 adds the following bit to the Questionable Modulation Status Register:

Word Not Found (bit 2) is set to 1 when the BER test cannot locate a known test word in the current frame. In other words, this bit is set if the current frame does not contain one of the 16 words defined by the iDEN or DJ-SMRS BER test sequence.

For further details about the Questionable Modulation Status Register, see chapter 1 in your analyzer's *HP-IB/GP-IB Command Reference*.

Softkey GP-IB/HP-IB Command Cross Reference

The *Agilent 89450A User's Guide, GP-IB Command Reference* chapter, provides the softkey to GP-IB cross references for the Agilent 89450A application. This table lists the additional and/or changed softkey GP-IB command cross references for options H01, H02, and H03.

The “Applies To” column identifies the option specific softkeys.

GP-IB/HP-IB Cross References Options H01, H02, and H03		
Softkey	Equivalent GP-IB Command	Applies To
[align WiDEN carrier]	[SENS:]DDEM:MQAM:OCB:CTOW	H03
[BER]	[SENS:]DDEM:MQAM:TEST BER	H01/H02/H03
[carrier]	[SENS:]FREQ:CENT:	H01/H02/H03
[centroid → center]	[SENS:]DDEM:MQAM:OCB:CTOC	H01/H02/H03
[color code]	[SENSE:]DDEM:MQAM:CCOD	H03
[data source input/buffer]	[SENS:]DDEM:MQAM:BER:DSO INP BUFF	H01/H02/H03
[D-MCA]	[SENSE:]DDEM:MQAM:FORM DMCA	H01/H02
[DJ-SMRS]	[SENSE:]DDEM:MQAM:FORM JSMR	H01/H02
[error symbol table]	CALC:FEED 'XTIM:DDEM:SYMB:ERR'	H01/H02/H03
[Full Slot Enhanced 6:1] (Inbound)	[SENS:]DDEM:MQAM:SLOT:FORM TCH6	H03
[Full Slot RAP] + [time mask phs1] (Inbound)	[SENS:]DDEM:MQAM:SLOT:FORM RAP1	H03
[Full Slot RAP] + [time mask phs2] (Inbound)	[SENS:]DDEM:MQAM:SLOT:FORM RAP2	H03
[Full Slot Reserved] + [time mask phs1] (Inbound)	[SENS:]DDEM:MQAM:SLOT:FORM TCH1	H01/H02/H03
[Full Slot Reserved] + [time mask phs2] (Inbound)	[SENS:]DDEM:MQAM:SLOT:FORM TCH2	H03
[Full Slot Outbound] (Outbound)	[SENS:]DDEM:MQAM:SLOT:FORM OUTB	H01/H02/H03
[iDEN M-4QAM]	[SENS:]DDEM:MQAM:FORM IDEN4	H02/H03
[iDEN M-16QAM]	[SENS:]DDEM:MQAM:FORM IDEN16	H01/H02/H03
[iDEN M-64QAM]	[SENS:]DDEM:MQAM:FORM IDEN64	H02/H03
[New 6:1 RAP] (Inbound)	[SENS:]DDEM:MQAM:SLOT:FORM RAP3	H03
[New 6:1 Outbound] (Outbound)	[SENS:]DDEM:MQAM:SLOT:FORM OB31	H03
[New 6:1 Rsv pseudo] (Inbound)	[SENS:]DDEM:MQAM:SLOT:FORM TCH3	H03

[New 6:1 Rsv Training] (Inbound)	[SENS:]DDEM:MQAM:SLOT:FORM TCHT]	H03
[num frames]	[SENS:]DDEM:MQAM:BER:FRAMES]	H01/H02
[num words]	[SENS:]DDEM:MQAM:BER:FRAMES]	H03
[pilot track on/off]	[SENS:]DDEM:MQAM:PTR[:STAT]	H01/H02/H03
[span wide/narrow]	[SENS:]DDEM:MQAM:OCB:WIDE	H03
summary	SCReen:CONTents:MQAM:SUMMary [:STATe] ON 1 OFF 0	H01/H02/H03
[words/frame]	[SENS:]DDEM:MQAM:BER:SMOD:MULT]	H03
[test mode loop/single]	[SENS:]DDEM:MQAM:BER:TMOD:SING ON OFF]	H01/H02/H03
[WiDEN 25 kHz]	[SENS:]DDEM:MQAM:SLOT:FORM I25	H03
[WiDEN 50 kHz]	[SENS:]DDEM:MQAM:SLOT:FORM I50	H03
[WiDEN 50 kHz (outer)]	[SENS:]DDEM:MQAM:SLOT:FORM O50	H03
[WiDEN 75 kHz]	[SENS:]DDEM:MQAM:SLOT:FORM I75	H03
[WiDEN 100 kHz]	[SENS:]DDEM:MQAM:SLOT:FORM I100	H03
[words/frame multi single]	[SENS:]DDEM:MQAM:BER:SMOD:MULT ON OFF]	H03

GP-IB Commands

The *Agilent 89450A User's Guide, GP-IB Command Reference* chapter, provides the GP-IB command descriptions for the Agilent 89450A application. This section describes the additional and/or changed GP-IB commands for options H01, H02, and H03.

CALCulate[1|2|3|4]:DATA?

command/query

This GP-IB command operates as described in the Agilent 89400-Series *HP-IB/GP-IB Command Reference*, with the following exception:

When the composite or error symbol table is displayed in hexadecimal format and the demodulation format is M-4QAM or M-64QAM, the data returned by this command contains interleaved zeros. For example, each composite symbol in M-4QAM represents four subcarriers, and each subcarrier has two bits-per-symbol. If the composite symbol is 01 10 11 00, the analyzer returns 0001 0010 0011 0000, or 1230 Hex.

CALCulate[1|2|3|4]:FEED

command/query

Selects the measurement data to be displayed.

Command Syntax: CALCulate[1|2|3|4]:FEED <string>
 <string> :=(see below)

Example Statements: OUTPUT 719;"calc2:feed 'XTIM:DDEM:SYMB:ERR'"

Query Syntax: CALCulate[1|2|3|4]:FEED?

Return Format: STRING

Attribute Summary: Synchronization Required: no
 Preset State: dependent on options installed
 SCPI Compliance: confirmed

Description:

Option H01 adds one additional measurement result, which is:

error symbol table (send CALC:FEED 'XTIM:DDEM:SYMB:ERR')

This command is the same command as documented in the *Agilent 89450A User's Guide* and the *GP-IB/HP-IB Command Reference* shipped with your analyzer. See those manuals for additional details about this command.

CALCulate[1|2|3|4]:MARKer:Y?

command/query

This GP-IB command operates as described in the Agilent 89400-Series *HP-IB/GP-IB Command Reference*, with the following exception:

When the composite or error symbol table is displayed in hexadecimal format and the demodulation format is M-4QAM or M-64QAM, the data returned by this command contains interleaved zeros. For example, each composite symbol in M-4QAM represents four subcarriers, and each subcarrier has two bits-per-symbol. If the composite symbol is 01 10 11 00, the analyzer returns 0001 0010 0011 0000, or 1230 Hex.

CALCulate[1|2|3|4]:MQAM:TEST:RESult?

query

Queries all results for the current test.

Query Syntax: CALC[1|2|3|4]:MQAM:TEST:RES?
Example Statements: OUTPUT 719;"Calc3:Mqam:Test:Res?"
 OUTPUT 719;"CALCULATE:MQAM:TEST:RESULT?"
Query Syntax: CALC[1|2|3|4]:MQAM:TEST:RES?
Return Format: see Description
Attribute Summary: Option: AYA (vector modulation analysis)
 Synchronization Required: no
 Preset State: not affected by Preset
 SCPI Compliance: instrument-specific

Description:

This command is documented in the *Agilent 89450A User's Guide*. The following table shows information specific to Option H01.

Selection you can use with:	Array returned when using:	Description
CALC[1 2 3 4]:MQAM:RESult?	CALC[1 2 3 4]:MQAM:TEST:RESult?	
ERTotal	result[0]	Total Bit Error Rate.
ERTFbits	result[1]	Total number of bits that failed.
ERTTbits	result[2]	Total number of bits tested.
ERFrames	result[3]	Total number of frames tested *.
ERPeak	result[4]	BER in worst frame *.
ERPFbits	result[5]	Number of bits that failed in worst frame *.
ERPTbits	result[6]	Number of bits tested in worst frame *.
ERPWord	result[7]	WORD found in worst frame *.
ERFFrame	result[8]	Total number of frames not found *.
Note: * When multiple slots per frame are enabled then "Frame" should be interpreted as "slot".		

SCReen:CONTents:MQAM:SUMMary [:STATe]

command/query

Displays summary table for the current test.

Command Syntax: SCReen:CONTents:MQAM:SUMMary [:STATe] ON | 1 | OFF | 0

Example Statements: OUTPUT 719;"Screen:Contents:Mqam:Summary ON"
OUTPUT 719;"SCR:CONT:MQAM:SUMM:STATE OFF"

Query Syntax: [SENSe:] DDEMod:MQAM:PTRack [:STATe]?

Return Format: Char

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

Description:

You can display a summary table for each test that shows additional results for the test. Use this command to show, or not show, the summary table for the current test.

This command only affects the current test. For example, sending this command to the analyzer shows the summary table for the current test. If you change tests, you must send this command again to show the summary table for the new test.

[SENSe:]DDEMod:MQAM:BERate:DSOurce **command/query**

Determines the source of data for the BER test.

Command Syntax: [SENSe:]DDEMod:MQAM:BERate:DSOurce INPut | BUFFer

Example Statements: OUTPUT 719;"SENSe:DDEMod:MQAM:BERate:DSO BUFFER"
OUTPUT 719;"ddemod:mqam:ber:dsourcE INPUT"

Query Syntax: [SENSe:]DDEMod:MQAM:BERate:DSOurce?

Return Format: CHAR

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

Description:

This command determines where the BER test obtains data. Input obtains data from the RF input. Buffer obtains data from the time-capture buffer.

[SENSe:]DDEMod:MQAM:BERate:FRAMes **command/query**

Sets the number of frames (iDEN and DJ-SMRS) or number of words (iDEN Enhanced 6:1, WiDEN) tested by the BER test.

Command Syntax: [SENSe:]DDEMod:MQAM:BERate"FRAMes
 <number> | <step> | <bound>

<number> := a real number (NRf data)

<step> := UP | DOWN

<bound> := MAX | MIN

Example Statements: OUTPUT 719;"SENSe:DDEMod:MQAM:BER:FRAM 16"

OUTPUT 719;"ddemod:mqam:ber:fram 10"

Query Syntax: [SENSe:]DDEMod:MQAM:BERate:FRAMes?

Return Format: Real

Attribute Summary: Synchronization Required: no

Preset State: 16 (iDEN, WiDEN)

SCPI Compliance: instrument-specific

Description:

The size of time-capture RAM determines the maximum number of frames that you can specify. You can increase the size of time-capture RAM by installing Option AY9 (Extended Time-Capture Memory). With Option AY9, you can specify up to 128 frames.

[SENS:]DDEM:MQAM:BER:SMOD:MULT[:STATE] command/query

Specifies single or multiple slots per frame.

Command Syntax	[SENS:]DDEM:MQAM:BER:SMOD:MULT: OFF 0 ON 1
Example Statements:	OUTPUT 719;"SENSE:DDEM:MQAM:BER:SMODE:MULT ON" OUTPUT 719;"ddemod:mqam:berate:smode:multiple 0"
Query Syntax:	[SENS:]DDEM:MQAM:BER:SMOD:MULT?
Return Format:	CHAR
Attribute Summary:	Synchronization Required: no Preset State: OFF SCPI Compliance: instrument-specific

Description:

This command only applies to iDEN Enhanced 6:1, and WiDEN slot types.

ON (1) configures the BER test to measure multiple slots per frame.

OFF (0) configures the BER test to measure one slot per frame.

Specifying multiple slots per frame changes the burst search parameters to allow proper detection of active slots.

[SENSe:]DDEMod:MQAM:BERate:TMODe:SINGle[:STATe] command/query

Determines how the BER test ends.

Command Syntax: [SENSe:]DDEMod:MQAM:BERate:TMODe:SINGle[:STATe] OFF | 0 | ON | 1

Example Statements: OUTPUT 719;"sens:ddemod:mqam:berate:tmod:sing:state ON"
OUTPUT 719;"Ddem:Mqam:Ber:Tmod:Single ON"

Query Syntax: [SENSe:]DDEMod:MQAM:BERate:TMODe:SINGle[:STATe]?

Return Format: Integer

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

Description:

This command determines how the BER test ends. ON (1) configures the BER test to complete one, single measurement, and then stop. OFF (0) configures the BER test to perform consecutive measurements without stopping.

[SENSE:]DDEMod:MQAM:CCOD

command/query

Define the color code and color code extension to define the pilot set for iDEN formats.

Command Syntax SENSE:]DDEMod:MQAM:CCOD <param >

 <param> HEX string 00 to 5F (WiDEN Color Code value)

Example Statements: OUTPUT 719;"SENSE:DDEMod:MQAM:CCOD '27' "
 OUTPUT 719;"ddemod:mqam:ccod '55' "

Query Syntax: SENSE:]DDEMod:MQAM:CCOD?

Return Format: CHAR

Attribute Summary: Synchronization Required: no
 Preset State: 00 (iDEN and WiDEN)
 SCPI Compliance: instrument-specific

Description:

Determines the color code and color code extension for those inbound and outbound formats that use the codes to define pilot and sync symbols.

The codes are entered as a two digit hexadecimal number. The first digit is the color code extension [0-5]. The second digit is the color code [0-F].

[SENSe:]DDEMod:MQAM:FORMat **command/query**

Selects the modulation format used for measurements.

Command Syntax: [SENSe:]DDEMod:MQAM:FORMat IDEN4 | IDEN16 | IDEN64 | MIRS

Example Statements: OUTPUT 719;"Sense:Ddem:Mqam:Form IDEN16"
OUTPUT 719;"DDEMod:MQAM:FORM IDEN64"

Query Syntax: [SENSe:]DDEMod:MQAM:FORMat?

Return Format: CHAR

Attribute Summary: Synchronization Required: no
Preset State: IDEN16 (H02, H02, H03)
SCPI Compliance: instrument-specific

Description:

Format	Description	Applies To
DMCA	Configures the Agilent 89450A application to measure signals that conform to Standard RCR-32.	H01/H02
IDEN4	Configures the Agilent 89450A application to measure M-4QAM modulated signals.	H02/H03
IDEN16	Configures the Agilent 89450A application to measure M-16QAM modulated signals.	H01/H02/H03
IDEN64	Configures the Agilent 89450A application to measure M64QAM modulated signals.	H03
JSMR	Configures the Agilent 89450A application to measure DJ-SMRS signals.	H01/H02
MIRS	Selecting MIRS is the same as selecting IDEN16 (MIRS is provided for backward compatibility).	H01/H02

With options H01, H02, and H03, the default M-QAM format is IDEN16. Otherwise, the default format is DMCA.

[SENSE:]DDEMod:MQAM:OCBandwidth:CTOCenter command

Sets the analyzer's center frequency to match the centroid frequency.

Command Syntax	SENSE:]DDEMod:MQAM:OCBandwidth:CTOCenter
Example Statements:	OUTPUT 719;"SENSE:DDEM:MQAM:OCBANDWIDTH:CTOC" OUTPUT 719;"ddemod:mqam:ocb:ctocenter"
Attribute Summary:	Synchronization Required: no Preset State: not applicable SCPI Compliance: instrument-specific

Description:

This command is applicable 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 centroid-determined frequency of a carrier.

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.

WiDEN signals

If there is an odd number of carriers in the Occupied Bandwidth span, this command sets the center frequency to the middle carrier frequency. If there is an even number of carriers in the Occupied Bandwidth span, this sets the center frequency to exactly half between the carrier frequencies.

This command is most useful for RF envelope-based tests, such as, ACP.

[SENSE:]DDEMod:MQAM:OCBandwidth:CTOWiden command

Sets the analyzer's center frequency to the lowest WiDEN carrier frequency.

Command Syntax	SENSE:]DDEMod:MQAM:OCBandwidth:CTOW
Example Statements:	OUTPUT 719;"SENSE:DDEM:MQAM:OCBANDWIDTH:CTOW" OUTPUT 719;"ddemod:mqam:ocb:ctow"
Attribute Summary:	Synchronization Required: no Preset State: not applicable SCPI Compliance: instrument-specific

Description:

This command is applicable only for WiDEN signals and 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 the lowest WiDEN carrier 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.

WiDEN signals

If there is an odd number of carriers in the Occupied Bandwidth span, this command will set the instrument center frequency at the frequency of the middle carrier. If there is an even number of carriers in the Occupied Bandwidth span, this command will set the instrument center frequency to the carrier frequency of the first carrier below the centroid.

This command is most useful for demodulation-based tests, such as, Modulation and BER.

[SENSE:]DDEM:MQAM:OCB:POW:PERC **command/query**

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

Command Syntax [SENSE:]DDEM:MQAM:OCB:POW:PERC <real>

Example Statements: OUTPUT 719;"SENSE:DDEM:MQAM:OCB:POW:PERC 99"
 OUTPUT 719;"ddemod:mqam:ocb:power:percentage 50"

Query Syntax: [SENSE:]DDEM:MQAM:OCB:POW:PERC?

Return Format: Real

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

Description:

This command sets the percentage of power used by the Occupied Bandwidth test. The test uses the percentage of power to compute the occupied bandwidth.

For example, if you send DDEM:MQAM:OCB:POW:PERC 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:]DDEMod:MQAM:OCBandwidth:WIDE command/query

The measurement span for the Occupied Bandwidth test.

Command Syntax	[SENSE:]DDEM:MQAM:OCB:WIDE OFF 0 ON 1
Example Statements:	OUTPUT 719;"SENSE:DDEM:MQAM:OCB:WIDE ON" OUTPUT 719;"ddemod:mqam:ocbandwidth:wide 0"
Query Syntax:	[SENSE:]DDEM:MQAM:OCB:WIDE?
Return Format:	Char
Attribute Summary:	Synchronization Required: no Preset State: On SCPI Compliance: instrument-specific

Description:

You can perform the Occupied Bandwidth measurement in wide or narrow spans.

The initial span for the Occupied Bandwidth measurement is wide enough for the number of carriers implied by the inbound slot type. This key may be used to narrow the span to isolate a single carrier of the W-iDEN signal.

For additional details, see help for the [modulation/full signal] softkey.

[SENSe:]DDEMod:MQAM:PTRack [:STATe] **command/query**

Turns pilot tracking ON or OFF.

Command Syntax: [SENSe:]DDEMod:MQAM:PTRack:STATe: ON | OFF |

Example Statements: OUTPUT 719;"sens:ddemod:mqam:PTRack ON

OUTPUT 719;"Ddem:Mqam:PTR:STATE OFF

Query Syntax: [SENSe:] DDEMod:MQAM:PTRack [:STATe]?

Return Format: Integer

Attribute Summary: Synchronization Required: no

Preset State: ON

SCPI Compliance: instrument-specific

Description:

Send this command to enable (ON) or disable (OFF) pilot tracking.

.[SENSe:]DDEMod:MQAM:SLOT:FORMat command/query

Selects the data slot type.

- Command Syntax:** [SENS:]DDEMod:MQAM:SLOT:FORM
INB | OUTB | OB31 | TCH1 | TCH2 | RAP1 | RAP2 | RAP3 | TCH3 | TCHT | TCH6 | I25 |
I50 | O50 | I75 | I100 |
- Example Statements:** OUTPUT 719; sens:ddmod:mqam:slot:format OB31
 OUTPUT 719; "Ddem:Mqam:Slot:Form RAP1
- Query Syntax:** [SENS:]DDEMod:MQAM:SLOT:FORM?
- Return Format:** CHAR
- Attribute Summary:** Synchronization Required: no
 Preset State: outbound
 SCPI Compliance: instrument-specific

Description:

This command selects the data slot type for MQAM measurements.

slot type	Applies To
I25 - WiDEN 25 kHz Inbound slot type	H03
I50 - WiDEN 50 kHz Inbound slot type	H03
I75 - WiDEN 75 kHz Inbound slot type	H03
I100 - WiDEN 100 kHz Inbound slot type	H03
INB - Inbound slot type	H01/H02/H03
ISUB - Inbound sub-slot type	H01/H02/H03
O50 - WiDEN 50 (outer) kHz Inbound slot type	H03
OB31 - New 6:1 Outbound slot type	H03
OUTB - Outbound Full slot type	H01/H02/H03
RAP1 - Full slot Inbound RAP phase 1 time mask	H03
RAP2 - Full slot Inbound RAP phase 2 time mask	H03
RAP3 - New 6:1 Inbound RAP slot type	H03
TCH1 - Full slot reserved phase 1 time mask	H03
TCH2 - Full slot reserved phase 2 time mask	H03
TCH3 - New 6:1 Rsv Pseudo Inbound slot type	H03
TCH6 - Full slot 6:1 Enhanced Inbound format	H03
TCHT - New 6:1 Rsv Training Inbound slot type	H03

GP-IB Commands

The different WiDEN slot types provide different test presets:

- In tests where demodulation is performed, these setups help the instrument firmware isolate and demodulate a single WiDEN carrier.
- For ACP, the WiDEN slot types setup different measurement spans, adjacent channel offset frequencies, and reference bandwidths.
- For OBW, the setups provide different measurement spans in the "wide" span view for the multi-carrier centroid measurement.

[SENSe:]DDEMod:MQAM:TEST

command/query

Selects one of the Agilent 89450A application's tests.

Command Syntax: [SENSe:]DDEMod:MQAM:TEST <selection>
<selection> := MACCuracy | ACPower | OCBandwidth | BURST | BERate | NONE

Example Statements: OUTPUT 719;"sens:ddem:mqam:test NONE"
OUTPUT 719;"Ddemod:Mqam:Test BURST"

Query Syntax: [SENSe:]DDEMod:MQAM:TEST?

Return Format: CHAR

Attribute Summary: Synchronization Required: yes
Preset State: NONE
SCPI Compliance: instrument-specific

Description:

This command selects a test. You can select the:

- Modulation Accuracy test (MACC)
- Adjacent-Channel Power test (ACP)
- Occupied Bandwidth test (OBAN)
- Burst Power test (BURST)
- Bit Error Rate test (BER)

Sending this command configures the analyzer for the selected test. To learn how each test configures the analyzer, see the *Agilent 89450A User's Guide*.

"NONE" deselects a test. If no test is selected, "NONE" does nothing. If a test is selected, "NONE" aborts the current test.

Synchronization is required with this command. Therefore, use *WAI when using this command. For example, to select the Burst Power test, send DDEM:MQAM:TEST BURS;*WAI.

[SENSe:]DDEMod:MQAM:TEST:PRESet

command

Presets the analyzer settings for the currently selected test, if any.

Command Syntax: [SENSe:]DDEMod:MQAM:TEST:PRESet

Example Statements: OUTPUT 719;"Sens:Ddemod:Mqam:Test:Pres"
OUTPUT 719;"DDEM:MQAM:TEST:PRESET"

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

Description:

This command preserves the transmission format, center frequency, M-QAM format, and input range. It then presets the analyzer, restores the parameters saved before the preset, and then reruns the currently selected test, if any.

If no test is currently selected, then this command only presets the analyzer.

SENSe:FREQuency:CENTer **command/query**

Sets the analyzer's center frequency to a desired carrier frequency.

Command Syntax [SENSe]FREQuency:CENTer < param >

Example Statements: OUTPUT 719;"SENSe:FREQ:CENt 901.0e6"
OUTPUT 719;"FREQ:CENt UP"
OUTPUT 719;"sense:freq:cent down"

Query Syntax: FREQ:CENt?

Return Format: Real

Attribute Summary: Synchronization Required: no
Preset State: see *Agilent 89400 GP-IB/HP-IB Command Reference*
SCPI Compliance: instrument-specific

Description:

You can specify an exact center frequency or use UP or DOWN to move to the next carrier frequency.

For more information, see the *Agilent HP-IB/89400 Series HP-IB/GP-IB Command Reference*.

