Measurement Guide

Agilent Technologies
ESA-E Series Spectrum Analyzers
Bluetooth™ Measurement Personality

This manual provides documentation for the following instruments:

ESA-E Series

E4402B (9 kHz - 3.0 GHz)
E4404B (9 kHz - 6.7 GHz)
E4405B (9 kHz - 13.2 GHz)
E4407B (9 kHz - 26.5 GHz)

Manufacturing Part Number: E4402-90091
Supersedes: E4402-90054

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

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WARNING **This is a Safety Class 1 Product (provided with a protective earth ground incorporated in the power cord). The mains plug shall be inserted only in a socket outlet provided with a protected earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

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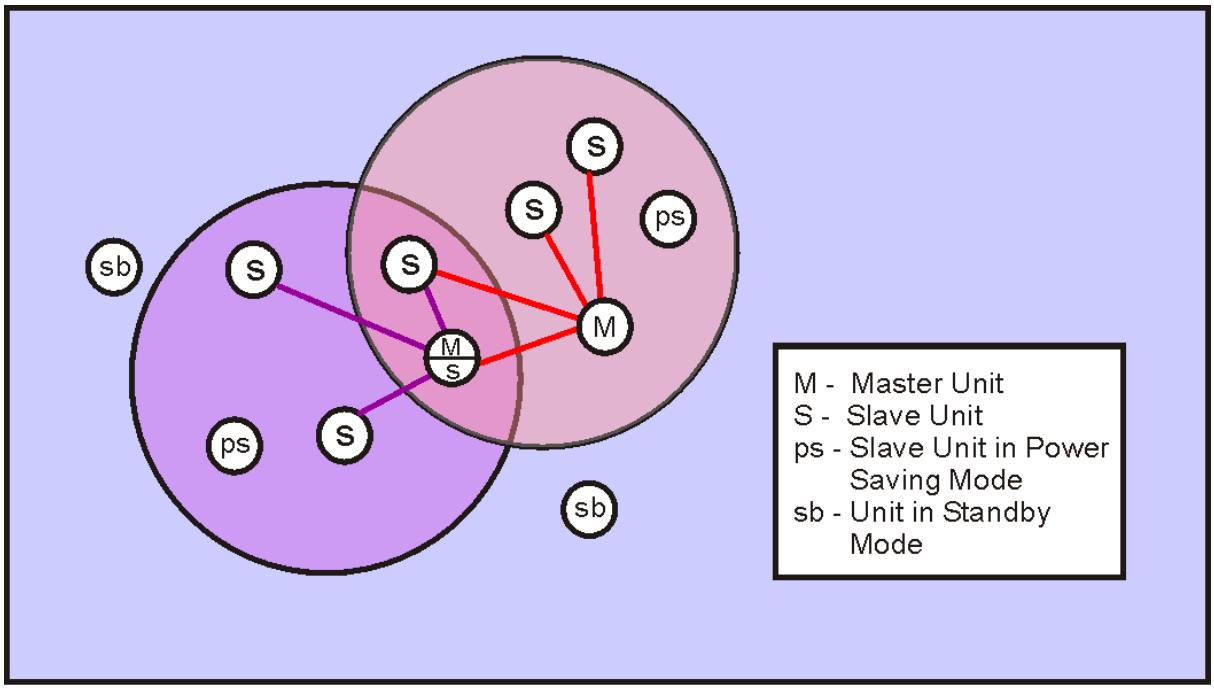
1 Bluetooth Use Model

Bluetooth System Overview

Bluetooth radios may operate as either master or slave units. The link manager sets up the connection between master and slave units and also determines the slave's power saving mode. A master can be actively communicating with up to seven slaves, while another 200+ slaves can be registered and in a non-communicating, power-saving mode.

This area of control is defined as a piconet. A master in one piconet may be a slave to a master from a different piconet. Similarly, multiple masters from different piconets may control a single slave. This network of piconets is referred to as a scatternet. Figure 1-1 depicts two piconets comprising a scatternet. Units that are not part of either piconet remain in standby mode.

Figure 1-1 Bluetooth Network Topology

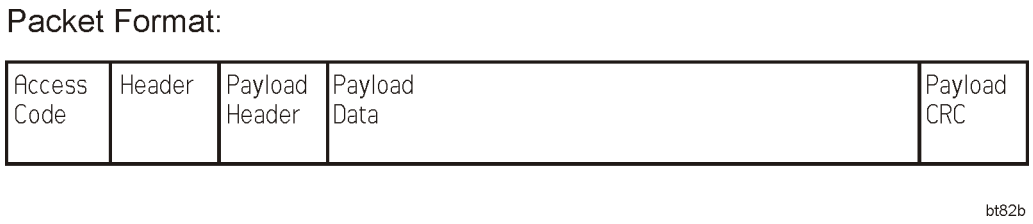


topology

A Bluetooth channel is divided into timeslots, each 625 µs in length. In the Time-Division Duplex (TDD) scheme used, the master transmits in even-numbered timeslots, and the slave in odd-numbered timeslots. Voice or data communication within piconets is transmitted in packets. Data packets may extend over one, three, or five time slots, whereas voice packets are limited to a single time slot. An RF hop occurs at the end of the last time slot associated with the packet.

A packet, shown in Figure 1-2, contains an access code, header and payload. The access code consists of a preamble, a sync word, and an optional trailer. The header contains piconet member address and packet information. The payload data, consisting of payload header, payload data and CRC, carries the user's voice or data information. The payload CRC (Cyclic Redundancy Check) is a 16-bit field at the end of the payload that is used for a data integrity check. Depending on the packet type, a payload starts with a 1 (DH1) or 2 (DH3/5) byte header, and finishes with a 2 byte CRC.

Figure 1-2 Bluetooth General Packet Format



The link manager needs to support the Bluetooth test modes. These test modes should provide key capabilities for testing Bluetooth devices. These capabilities include the ability to place the device into test loopback mode and the ability to define transmit and receive frequencies, power control, and other key parameters.

2 Preparing to Make Bluetooth Measurements

This chapter introduces the basic measurement procedure including mode setup and changing the measurement frequency/channel.

Bluetooth Measurements

The following Bluetooth measurements are available in Bluetooth mode and described in this document:

Modulation Overview	provides a quick indication of overall modulation behavior
Output Power	power measurements in the time domain
Carrier Frequency Drift	tests the frequency drift of the signal
Monitor Band/Channel	view specific channels or the entire band
Initial Carrier Frequency Tolerance	tests accuracy of the transmitter's carrier frequency
Modulation Characteristics	frequency deviation measurement
Output Spectrum Bandwidth	verifies the emissions bandwidth inside the operating frequency
Adjacent Channel Power	verifies the emissions power level inside the operating range

These are referred to as one-button measurements.

When you press the key to select the measurement it becomes the active measurement, using settings and a display unique to that measurement. Data acquisitions automatically begin provided trigger requirements, if any, are met.

Hardware Availability

If the RF Comms hardware (Option B7E) is installed in the instrument, the measurements will provide support for all of the hardware triggering methods including RF Burst, External, and Free Run. Video triggering is available for the Output Power measurement only.

If the RF Comms hardware (Option B7E) is not installed in the instrument, the measurements cannot provide the full flexibility described in the following pages. Triggering is limited to Free Run, External or Video, with External being the default.

The FM demod hardware (Option 106) must be present to make the measurements. If the FM demod hardware is not installed in the instrument, the demod measurement softkeys:

Modulation Overview
Carrier Freq Drift
ICFT
Modulation Characteristics

will be grayed out in the Measure menu and those measurements will be unavailable. The other measurements will still be available, although the Preamble Burst Sync selection in the Output Power measurement will be grayed out and unavailable.

If the DSP with Fast ADC is not fitted to your analyzer, all softkeys referring to the 1.3 MHz filter will be grayed out, and the following four measurements:

Modulation Overview
Carrier Frequency Drift
Initial Carrier Frequency Tolerance
Modulation Characteristics

will be made at a resolution bandwidth determined by your current Frequency Hopping setting. When Frequency Hopping is On, the RBW is set to 3 MHz. When Frequency Hopping is Off, the RBW is set to 5 MHz.

The Digital Signal Processor and Fast Analog Digital Converter (DSP and Fast ADC) hardware (Option B7D) must be installed on the analyzer to make measurements to the revised 2002 Bluetooth standard. This allows you to make measurements at a measurement bandwidth of 1.3 MHz by using a post-detection filter. Regardless of the 1.3 MHz filter setting, the RBW will still be fixed at 3.0 MHz when Frequency Hopping is On, and at 5 MHz when Frequency Hopping is Off.

NOTE The change in Bluetooth testing specifications was necessary because of an error in the original Bluetooth System Specification, version 1.1 (February 2001). This stated that, ‘The measurement bandwidth of the tester shall be at least 3 MHz’. This was corrected in 2002 to read, ‘The measurement bandwidth of the tester shall be at least 1.3 MHz’.

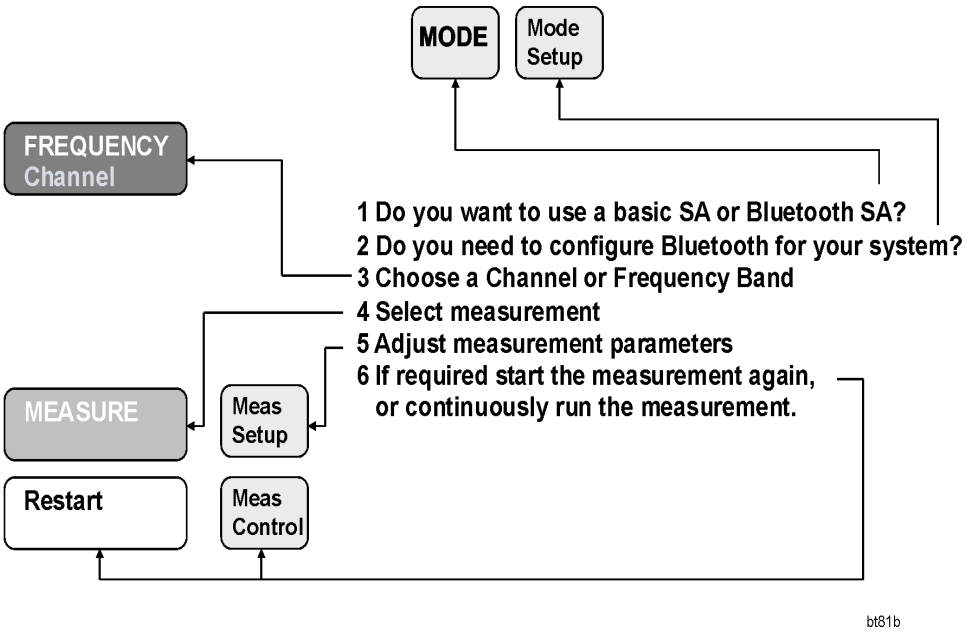
Basic Key Use

The **MODE** key allows you to choose basic Spectrum Analyzer, Bluetooth, or additional loaded personalities. When you select a standard, the analyzer will set measurement parameters to meet the standard requirements. If necessary, change the global measurement settings in the analyzer based on your system using **Mode Setup**.

The **Channel Frequency** or **RF Channel** keys allow you to tune the analyzer to specific frequencies. You can do this by either setting absolute frequencies or by setting the channel number when in the Bluetooth mode.

You can select a number of previously-configured standards based measurements to help you troubleshoot a system using the **Measure** button. Because all measurement situations are different, **Meas Setup** allows you to quickly change some of the measurement parameters. Finally, if you need to quickly start the measurement again, press **Restart** or use **Restart** under **Meas Control**.

Figure 2-1 **Basic Keys**



Preparing to Make Measurements

At initial power up, the analyzer is in spectrum analyzer (SA) mode, with the Meas Off softkey selected in the **MEASURE** menu and the **FREQUENCY Channel** menu displayed.

To access the Bluetooth measurement personality, press the **MODE** front panel key and select the **Bluetooth** menu key.

Initial Settings

Before making a measurement, make sure the mode setup, measurement setup, and frequency channel parameters are set to the appropriate settings. For further information refer to the Mode Setup, Measurement Setup, and FREQUENCY Channel sections in Chapter 5 of the ESA-E Series Spectrum Analyzers Bluetooth Measurement Personality User's Guide.

- Resetting all parameters:
  To set all instrument parameters (including mode setup and measurement setup parameters) to factory default values, press the **Preset** front panel key. Note that the mode is changed from Bluetooth to SA when the **Preset** front panel key is used. After using **Preset** you must use the **MODE** key to return to the Bluetooth mode.

  The **Preset** front panel key can also be used to return the instrument to a set of user preset values.
- Resetting mode setup parameters:
  Mode setup parameters apply to all measurements in the Bluetooth mode. To reset them to factory default values, press **Mode Setup** then **Restore Mode Setup Defaults**.
- Resetting measurement setup parameters:
  Measurement setup parameters affect the current measurement only. To reset them to factory default values (for the current measurement only), press **Meas Setup** then **Restore Meas Defaults**.

How to Make a Measurement

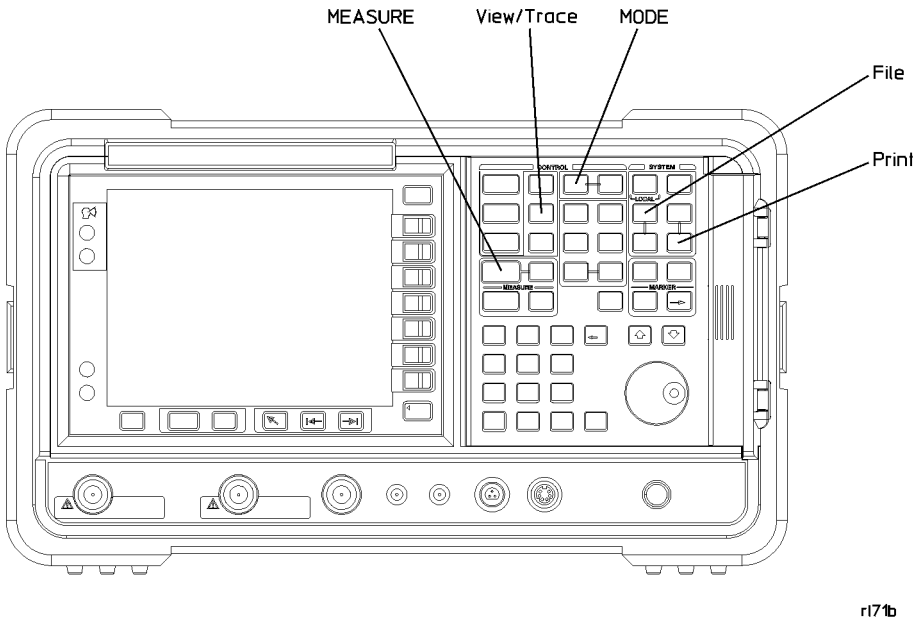
Bluetooth measurements are intended to be used as "one button" measurements. This means the appropriate measurement can be selected and run by a single key press once the instrument has been connected to the equipment to be tested. The measurement is made automatically using default parameters defined by the selected standard and the tuning plan. It will continue to run until: a single measurement is complete, a different measurement is selected, or the analyzer is preset.

Even though the measurements are designed as one-button measurements, you may change the default settings using various setup keys. However, changing the default settings may produce measurement results that are outside of the parameters of the selected standard.

Most measurements can be performed using the simple four-step procedure outlined in the table below. Most measurements are performed using only the primary keys listed in conjunction with a minimum of setup keys. Measurement setup keys (**Meas Setup**) can be used for non-standards compliant testing. For more information see "Initial Settings" above.

Step	Primary Key	Setup Keys	Related Keys
1. Select and setup mode	**MODE**	**Mode Setup**, **FREQUENCY Channel**	**System**
2. Select and setup measurement	**MEASURE**	**Meas Setup**, **Restore Meas Defaults**	**Meas Control**, **Restart**
3. Select and setup view	**View/Trace**	**Span X Scale**[a], **Amplitude Y Scale**[a], **Display**	**Marker**, **Search**
4. Saving and printing results	**File** **Print**	**Print Setup**	**Save**

a. *Span and Amplitude are disabled for all measurements except Monitor Band/Channel*



How to Save Measurement Results

To save measurement results, follow the process shown below. For additional information on file management in the spectrum analyzer, refer to the *ESA Spectrum Analyzers User's Guide*.

1. Press **File**, **Save**, **Type**, **More**, **Measurement Results**.
2. If you want to change the file name, press **Name**, and use the Alpha Editor the enter the new name. For more information on using the Alpha Editor, refer to the *ESA Spectrum Analyzers User's Guide*.
3. Press **Save Now** to complete the file saving process.
4. If you used the default file name and wish to save additional measurement results, press **Save**. The current measurement result will be saved with the next default file name.
5. If you have not used the default file name and wish to save additional measurement results, repeat steps 1 through 3.

3 Making Bluetooth Measurements

Chapter Contents

This chapter details how to make Bluetooth measurements. The following measurements are described:

Making the Modulation Overview Measurement

Purpose

The modulation overview measurement allows you to measure and report several modulation metrics on a burst of any type. This measurement measures and displays:

- Initial Carrier Frequency Tolerance
- Hi Frequency Pattern ('1010') peak deviation
- Low Frequency Pattern (3 or more 1's or 0's) peak deviation
- The ratio Peak High Frequency Dev/ Peak Low Frequency Dev

The first 8 bits of the payload are also displayed which is useful for identifying the different types of test signals (since they usually contain 8 bit repeating patterns).

Measurement Method

In order to perform these measurements to the Bluetooth specification, you should run the individual measurements. They will show whether the results passed or failed. This method provides results more quickly, without having to change signal types (as in the modulation characteristics measurement). It is also convenient for making adjustments in real-time.

Making the Measurement

1. Press the **Measure** key.
2. Press the **Modulation Overview** key.

NOTE

The factory default settings provide a Bluetooth compliant measurement. For special requirements, you may need to change some of the settings. Any changes from the default values may result in invalid measurement data.

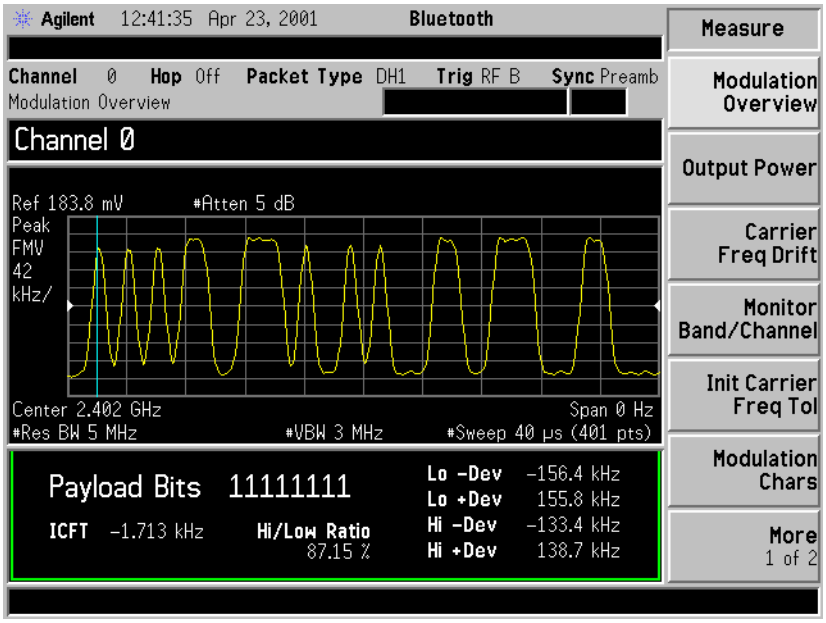
Press **Meas Setup**, **More (1 of 2)**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information, refer to Chapter 1 of this document.

- Measurement setup parameters.
  These are measurement specific parameters that are changed using the measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, **More (1 of 2)** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to the *ESA-E Series Spectrum Analyzers Bluetooth Measurement Personality User's Guide*.

Results

Figure 3-1 **Modulation Overview Measurement Results**



NOTE Frequency discrepancies are normally indicated graphically by the trace moving up or down the screen. However, at frequency offsets greater than approximately plus or minus 50 kHz, a 50 kHz compensation is applied to the trace. This gives you greater measurement accuracy at higher frequency discrepancies, although the trace can appear to indicate a satisfactory signal.

NOTE Results are shown in numeric format beneath the trace. To view this section of the window in its entirety, press the **Next Window** menu key until it is highlighted, then press the **Zoom** menu key. This can also be used for zooming in on the trace window.

Troubleshooting Hints

- If an external attenuator is used, be sure to include the attenuation value in the measurement. This can be accessed by pressing **Input**, **Ext Atten**.

- If an external preamplifier is used, be sure to include the gain value in the measurement. This can be accessed by pressing **Input**, **Ext Gain**.

Making the Output Power Measurement

Purpose

Output power measurements are performed to ensure power levels are high enough to maintain links, yet low enough to minimize interference within the ISM band and to maximize battery life.

Measurement Method

The power measurements covered by this test are average power and peak power for the specified channel or center frequency. The analyzer is set to zero span mode with a sweeptime dependent on the packet type being measured. When the analyzer is triggered, it makes a sweep over the duration of the burst.

The peak power is calculated as the highest point in the burst.

The average power is calculated as the average power over 20% to 80% of the burst duration. You can choose between two methods to determine the burst duration:

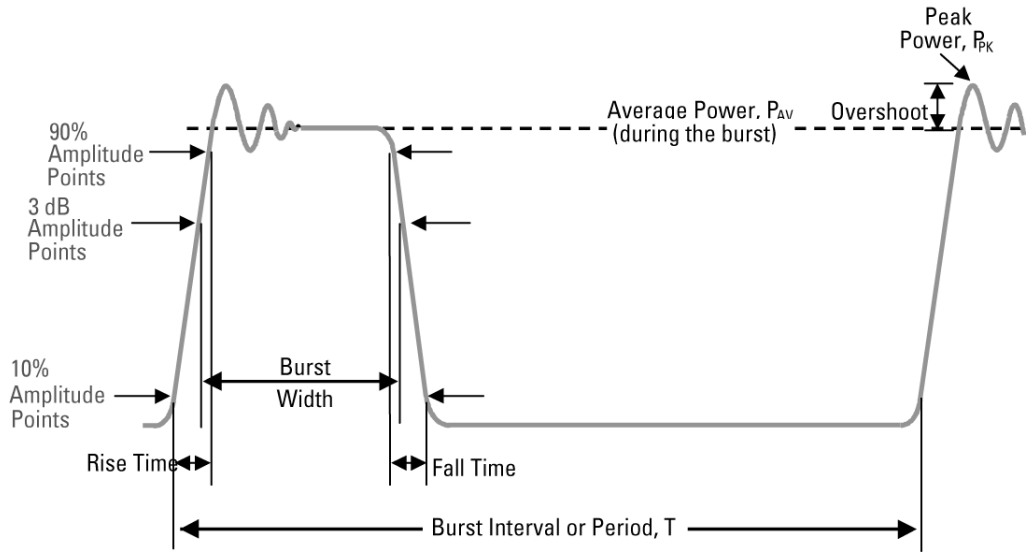
1. The position of p0 can be used to define the start of the burst, or
2. The burst duration is taken as the time between the leading and trailing 3 db points compared to the average power.

The average is calculated by converting each trace element amplitude from dBm into linear power, adding these together, then dividing by the number of trace elements included in the average. The final result is then converted back into logarithmic form (dBm) for display.

For averaged measurements, the user may specify the number of sweeps over which to average the result. This means that for an average number of 10, the power results are obtained from each trace, converted to linear power, and then averaged with the previous average result before being displayed. The running average count and the log of the true averaged linear power will be displayed after each measurement sweep.

Figure 3-2 illustrates power and timing characteristics of a signal burst in the time domain.

Figure 3-2 Time Domain Power and Timing Analysis



Making the Measurement

1. Press the **Measure** key.
2. Press the **Output Power** key.

NOTE

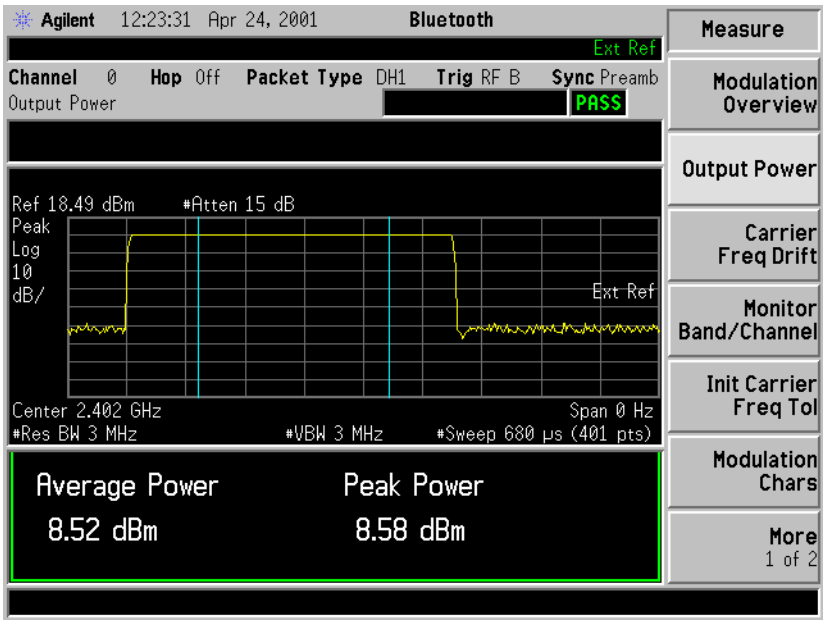
The factory default settings provide a Bluetooth compliant measurement. For special requirements, you may need to change some of the settings. Any changes from the default values may result in invalid measurement data.

Press **Meas Setup**, **More (1 of 2)**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information, refer to Chapter 1 of this document.
- Measurement setup parameters.
  These are measurement specific parameters that are changed using the measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, **More (1 of 2)** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to the *ESA-E Series Spectrum Analyzers Bluetooth Measurement Personality User's Guide*.

Results

Figure 3-3 **Output Power Measurement Results**



NOTE Results are shown in numeric format beneath the trace. To view this section of the window in its entirety, press the **Next Window** menu key until it is highlighted, then press the **Zoom** menu key. This can also be used for zooming in on the trace window.

Troubleshooting Hints

- If an external attenuator is used, be sure to include the attenuation value in the measurement. This can be accessed by pressing **Input**, **Ext Atten**.
- If an external preamplifier is used, be sure to include the gain value in the measurement. This can be accessed by pressing **Input**, **Ext Gain**.

Making the Carrier Frequency Drift Measurement

Purpose

The carrier frequency drift measurement checks the performance of the modulator circuitry and the stability of the Voltage Controlled Oscillator (VCO).

Measurement Method

To make the measurement a demodulated signal is used with the payload data consisting of a repeating 4-bit 1010 sequence. The absolute frequencies of the 4 preamble bits are measured and integrated, providing the initial carrier frequency. The absolute frequencies of each successive 10-bit pattern in the payload are then measured and integrated.

The frequency drift is the maximum difference between the average frequency of the 4 preamble bits and the average frequency of any 10 bits in the payload field. The maximum drift rate applies to the difference between any two 10-bit groups separated by 50 µs within the payload field.

Making the Measurement

1. Press the **Measure** key.
2. Press the **Carrier Freq Drift** key.

NOTE

The factory default settings provide a Bluetooth compliant measurement. For special requirements, you may need to change some of the settings. Any changes from the default values may result in invalid measurement data.

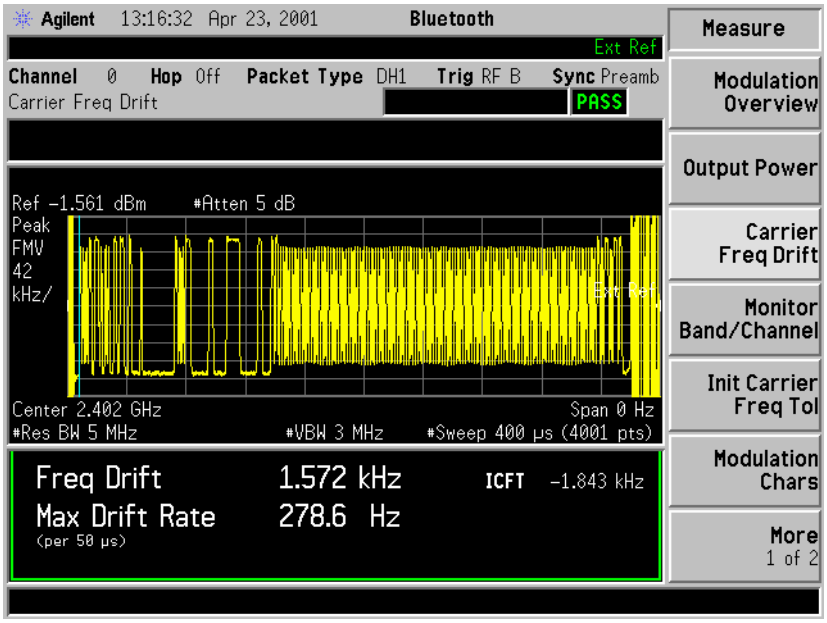
Press **Meas Setup**, **More (1 of 2)**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information, refer to Chapter 1 of this document.

- Measurement setup parameters.
  These are measurement specific parameters that are changed using the measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, **More (1 of 2)** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to the *ESA-E Series Spectrum Analyzers Bluetooth Measurement Personality User's Guide*.

Results

Figure 3-4 **Carrier Frequency Drift Measurement Results**



NOTE Frequency discrepancies are normally indicated graphically by the trace moving up or down the screen. However, at frequency offsets greater than approximately plus or minus 50 kHz, a 50 kHz compensation is applied to the trace. This gives you greater measurement accuracy at higher frequency discrepancies, although the trace can appear to indicate a satisfactory signal.

NOTE Results are shown in numeric format beneath the trace. To view this section of the window in its entirety, press the **Next Window** menu key until it is highlighted, then press the **Zoom** menu key. This can also be used for zooming in on the trace window.

Troubleshooting Hints

- If an external attenuator is used, be sure to include the attenuation value in the measurement. This can be accessed by pressing **Input**, **Ext Atten**.

- If an external preamplifier is used, be sure to include the gain value in the measurement. This can be accessed by pressing **Input**, **Ext Gain**.

Making the Monitor Band/Channel Measurement

Purpose

This measurement can be used to visually check either the Bluetooth band or individual channels. In Monitor Band, you can easily check the channel occupancy and flatness when frequency hopping is on. In Monitor Channel you can verify the correct spectral shape of the selected channel.

Any interfering signals may also be apparent when using this measurement.

Measurement Method

This procedure scans the specified band or channels. By placing markers on the trace it is possible to check the band/channels for interference or other impairments. A Max Hold function enables monitoring over time. This is useful for dealing with hopping signals.

Making the Measurement

1. Press the **Measure** key.
2. Press the **Monitor Band/Channel** key.

NOTE

The factory default settings provide the optimal settings for viewing the Bluetooth band or channels. For special requirements, you may need to change some of the settings.

Press **Meas Setup**, **More (1 of 2)**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

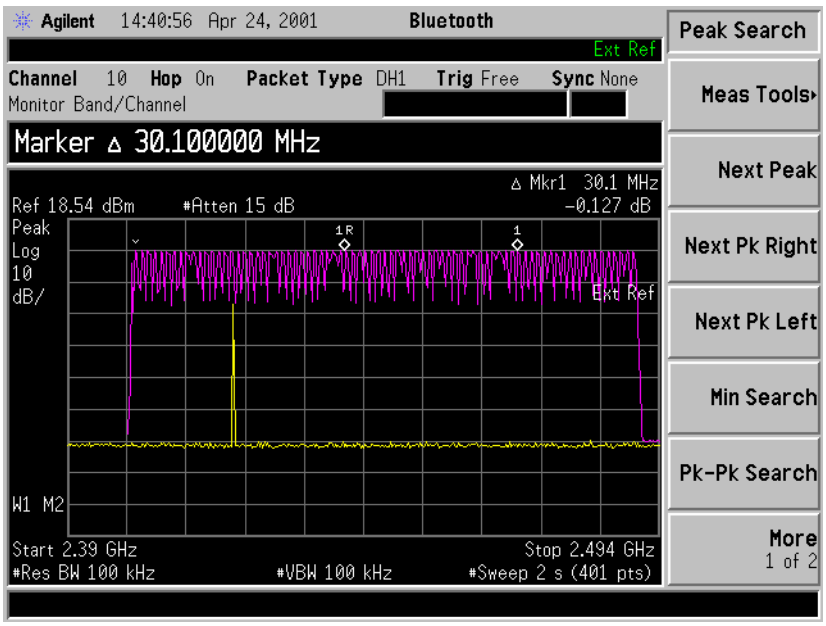
- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information, refer to Chapter 1 of this document.
- Measurement setup parameters.
  These are measurement specific parameters that are changed using the measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, **More (1 of 2)** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to the *ESA-E Series Spectrum Analyzers Bluetooth Measurement Personality User's Guide*.

Results

Checking Channel Occupancy and Flatness Across the Band

Figure 3-5 shows the Monitor Band/Channel display with **Method** set to **Band**, a hopping signal applied, and **Max Hold** turned on. A marker and delta marker have been added using the standard instrument markers.

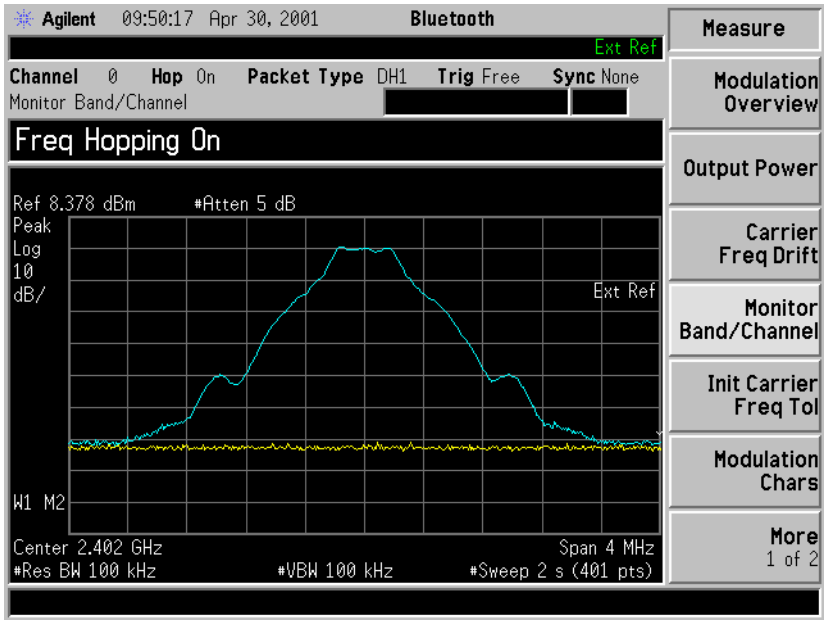
Figure 3-5 Monitor Band/Channel–Band Method



Checking Individual Channels for Signs of Interference

Figure 3-6 shows the Monitor Band/Channel display with **Method** set to **Channel**, **Channel Span** set to **Three**, a hopping signal applied, and **Max Hold** turned on. **Center Freq** is set to 2402 MHz (Channel 0).

Figure 3-6 **Monitor Band/Channel–Channel Method**



Troubleshooting Hints

- If an external attenuator is used, be sure to include the attenuation value in the measurement. This can be accessed by pressing **Input**, **Ext Atten**.
- If an external preamplifier is used, be sure to include the gain value in the measurement. This can be accessed by pressing **Input**, **Ext Gain**.

Making the Initial Carrier Frequency Tolerance Measurement

Purpose

The initial carrier frequency tolerance measurement is designed to verify the accuracy of the transmitter's initial carrier frequency.

Measurement Method

This is measured by integrating over the frequency deviations of the packets first 4 bits (the preamble bits). The result is either a positive or negative number in Hz indicating the frequency difference from the specified nominal carrier frequency.

This measurement requires the signal to be demodulated to measure the frequency deviation of each symbol. After demodulation, the frequency offset of each of the preamble bits is measured and averaged.

Making the Measurement

1. Press the **Measure** key.
2. Press the **Init Carrier Freq Tol** key.

NOTE

The factory default settings provide a Bluetooth compliant measurement. For special requirements, you may need to change some of the settings. Any changes from the default values may result in invalid measurement data.

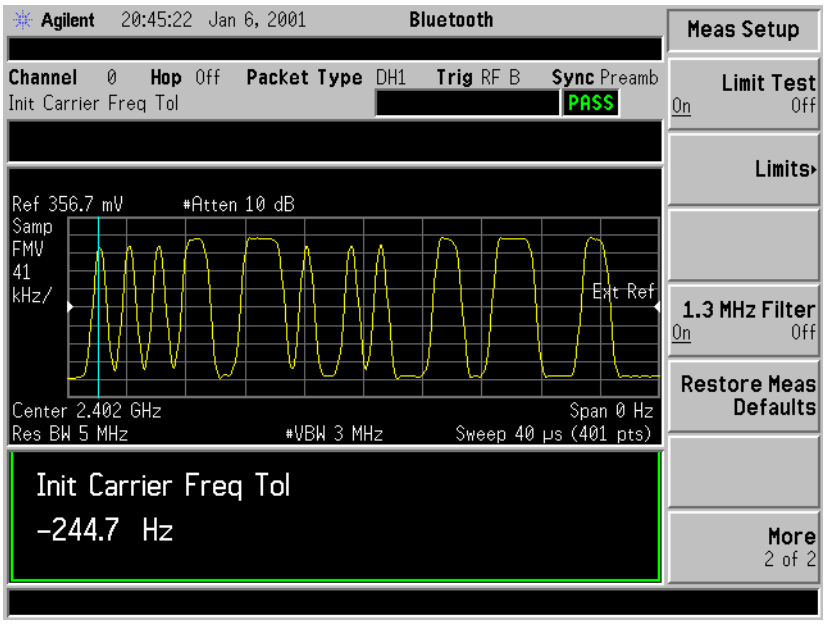
Press **Meas Setup**, **More (1 of 2)**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information, refer to Chapter 1 of this document.
- Measurement setup parameters.
  These are measurement specific parameters that are changed using the measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, **More (1 of 2)** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to the *ESA-E Series Spectrum Analyzers Bluetooth Measurement Personality User's Guide*.

Results

This result is either a positive or negative number in Hz indicating the frequency difference between the measured frequency and the specified nominal carrier frequency.

Figure 3-7 **Initial Carrier Frequency Tolerance Measurement Results**



NOTE Frequency discrepancies are normally indicated graphically by the trace moving up or down the screen. However, at frequency offsets greater than approximately plus or minus 50 kHz, a 50 kHz compensation is applied to the trace. This gives you greater measurement accuracy at higher frequency discrepancies, although the trace can appear to indicate a satisfactory signal.

NOTE Results are shown in numeric format beneath the trace. To view this section of the window in its entirety, press the **Next Window** menu key until it is highlighted, then press the **Zoom** menu key. This can also be used for zooming in on the trace window.

Troubleshooting Hints

- If an external attenuator is used, be sure to include the attenuation value in the measurement. This can be accessed by pressing **Input**, **Ext Atten**.
- If an external preamplifier is used, be sure to include the gain value in the measurement. This can be accessed by pressing **Input**, **Ext Gain**.

Making the Modulation Characteristics Measurement

Purpose

Modulation characteristics is a frequency deviation measurement which is designed to verify both the modulator performance and the accuracy of the pre-modulation 0.5BT Gaussian Filter.

Measurement Method

Two separate test signals are required for this measurement, each one containing an 8-bit repeating sequence in the payload. These repeating sequences are 11110000 and 10101010.

The measurement is performed in 2 stages, each stage requiring a different packet: one carrying the 11110000 payload, the other carrying the 10101010 payload.

Using the 11110000 payload

The average frequency over the first 8 bits in the payload is calculated and then the maximum deviation from this average over bits 2,3,6 & 7 is measured. The maximum for each repeating 8-bit sequence in the payload is measured in the same way, each time calculating a new average frequency over the respective 8 bits. Eventually, the average of all these maximums is calculated and shown in the results window as Δf1 Avg.

Using the 10101010 payload

The average frequency over the first 8 bits in the payload is calculated and then the maximum deviation from this average over all 8 bits is measured. The maximum for each repeating 8-bit sequence in the payload is measured in the same way, each time calculating a new average frequency over the respective 8 bits. Eventually the average of all these maximums is calculated and shown in the results window as Δf2 Avg.

Once the measurement has acquired values for Δf1 Avg and Δf2 Avg, the ratio of Δf2 Avg to Δf1 Avg is also displayed.

Since this measurement requires human interaction (to manually change test signals), it will display only either Δf1 Avg or Δf2 Avg the first time it is run, depending on the signal type. The first result must be “held” using the **Hold Result** parameter and the measurement restarted. At this point the other signal type should be supplied, and the measurement restarted.

If a remote query of all three results is requested after having obtained only one result, then 3 values will be returned, although only 1 result will be correct and the other 2 will contain NaN.

Making the Measurement

1. Press the **Measure** key.
2. Press the **Modulation Chars** key.

NOTE

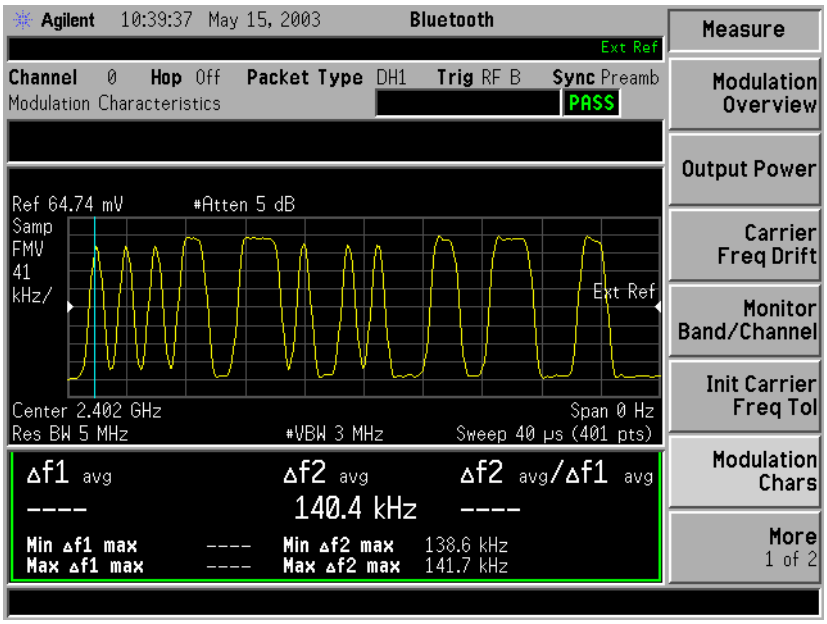
The factory default settings provide a Bluetooth compliant measurement. For special requirements, you may need to change some of the settings. Any changes from the default values may result in invalid measurement data.

Press **Meas Setup**, **More (1 of 2)**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information, refer to Chapter 1 of this document.
- Measurement setup parameters.
  These are measurement specific parameters that are changed using the measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, **More (1 of 2)** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to the *ESA-E Series Spectrum Analyzers Bluetooth Measurement Personality User's Guide*.

Results

Figure 3-8 **Modulation Characteristics Measurement Results**



NOTE Frequency discrepancies are normally indicated graphically by the trace moving up or down the screen. However, at frequency offsets greater than approximately plus or minus 50 kHz, a 50 kHz compensation is applied to the trace. This gives you greater measurement accuracy at higher frequency discrepancies, although the trace can appear to indicate a satisfactory signal.

NOTE Results are shown in numeric format beneath the trace. To view this section of the window in its entirety, press the **Next Window** menu key until it is highlighted, then press the **Zoom** menu key. This can also be used for zooming in on the trace window.

Troubleshooting Hints

- If an external attenuator is used, be sure to include the attenuation value in the measurement. This can be accessed by pressing **Input**, **Ext Atten**.
- If an external preamplifier is used, be sure to include the gain value in the measurement. This can be accessed by pressing **Input**, **Ext Gain**.

Making the Output Spectrum Bandwidth Measurement

Purpose

The ouput spectrum bandwidth measurement is used to verify if the emissions inside the operating frequency are within the limits.

Measurement Method

To perform this measurement the analyzer is tuned to the channel to be measured and the span is set to 2 MHz. The peak of the current trace is identified. The measurement then places markers at the points highest and lowest in frequency in the current span where the signal drops –20dB from this peak value. The frequency between these two points is measured as the output spectrum bandwidth.

Making the Measurement

1. Press the **Measure** key.
2. Press the **More** key.
3. Press the **Output Spectrum Bandwidth** key.

NOTE

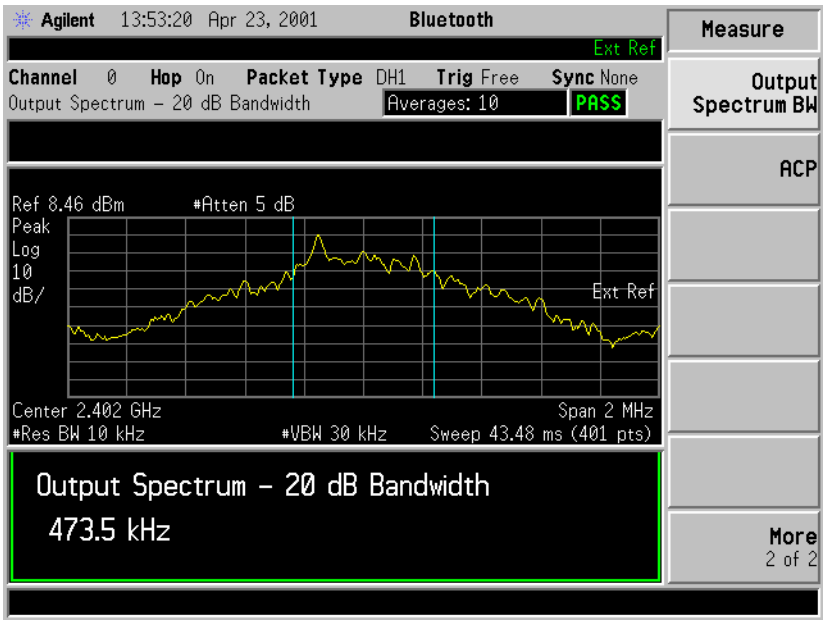
The factory default settings provide a Bluetooth compliant measurement. For special requirements, you may need to change some of the settings. Any changes from the default values may result in invalid measurement data.

Press **Meas Setup**, **More (1 of 2)**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information, refer to Chapter 1 of this document.
- Measurement setup parameters.
  These are measurement specific parameters that are changed using the measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, **More (1 of 2)** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to the *ESA-E Series Spectrum Analyzers Bluetooth Measurement Personality User's Guide*.

Results

Figure 3-9 **Output Spectrum Bandwidth Measurement Results**



NOTE Results are shown in numeric format beneath the trace. To view this section of the window in its entirety, press the **Next Window** menu key until it is highlighted, then press the **Zoom** menu key. This can also be used for zooming in on the trace window.

Troubleshooting Hints

- If an external attenuator is used, be sure to include the attenuation value in the measurement. This can be accessed by pressing **Input**, **Ext Atten**.
- If an external preamplifier is used, be sure to include the gain value in the measurement. This can be accessed by pressing **Input**, **Ext Gain**.

Adjacent Channel Power (ACP) Measurement

Purpose

The adjacent channel power measurement is used to verify if the emissions levels in adjacent channels are within the limits.

Measurement Method

To perform this measurement, the analyzer is tuned to the channel to be measured and the span is set to zero span with a sweep time of 210 ms and a RBW of 100 kHz. The measurement is performed in Freerun trigger. The power measurements covered by this test are average peak power and overall power for the specified channel.

Making the Measurement

1. Press the **Measure** key.
2. Press the **More** key.
3. Press the **ACP** key.

NOTE

The factory default settings provide a Bluetooth compliant measurement. For special requirements, you may need to change some of the settings. Any changes from the default values may result in invalid measurement data.

Press **Meas Setup**, **More (1 of 2)**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

- Mode setup and frequency/channel parameters.
  Use the **Mode Setup** and **Frequency Channel** keys to change these parameters for all measurements made within the current mode. For further information, refer to Chapter 1 of this document.
- Measurement setup parameters.
  These are measurement specific parameters that are changed using the measurement setup (**Meas Setup**) menu. Parameters can be returned to default settings at any time by pressing **Meas Setup**, **More (1 of 2)** and **Restore Meas Defaults**. For further information on measurement setup parameters, refer to the *ESA-E Series Spectrum Analyzers Bluetooth Measurement Personality User's Guide*.

Results

Figure 3-10 **ACP Measurement Results RF Envelope View**

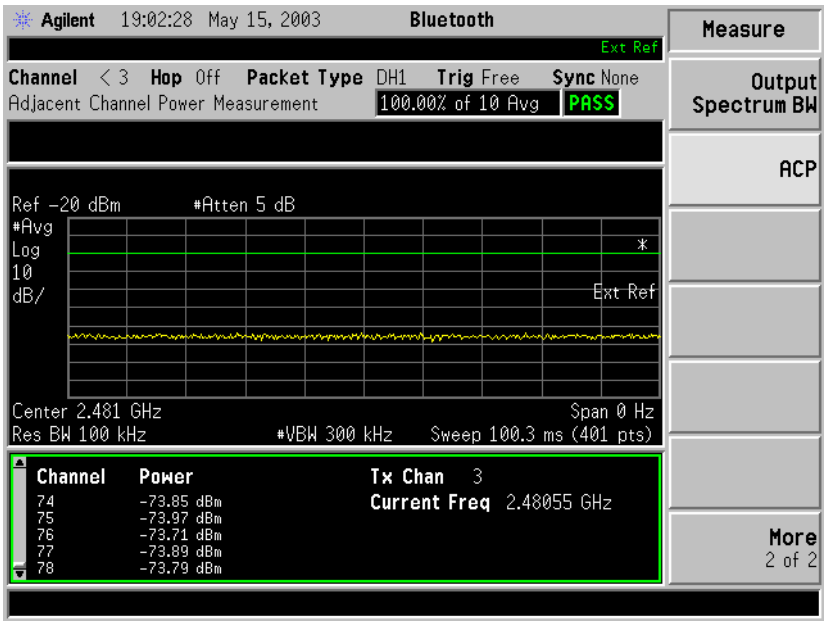
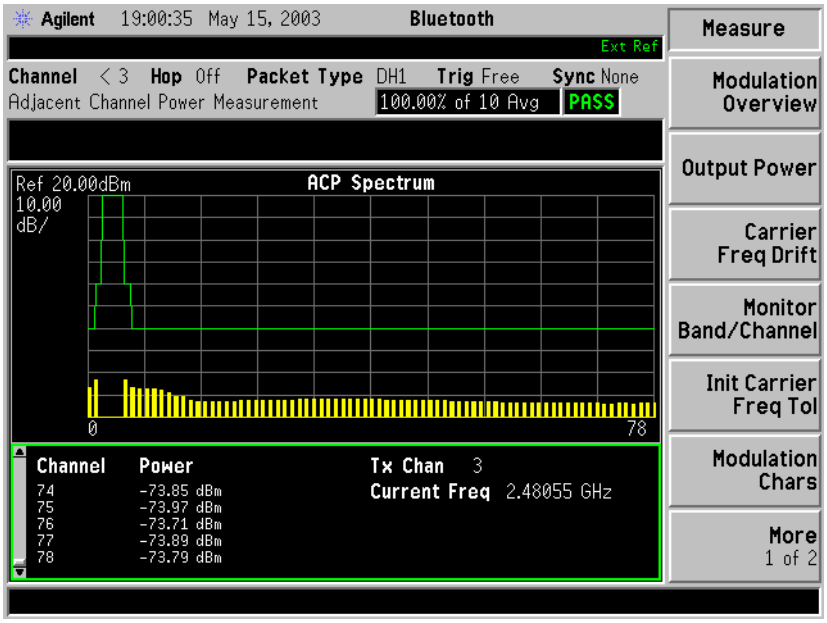
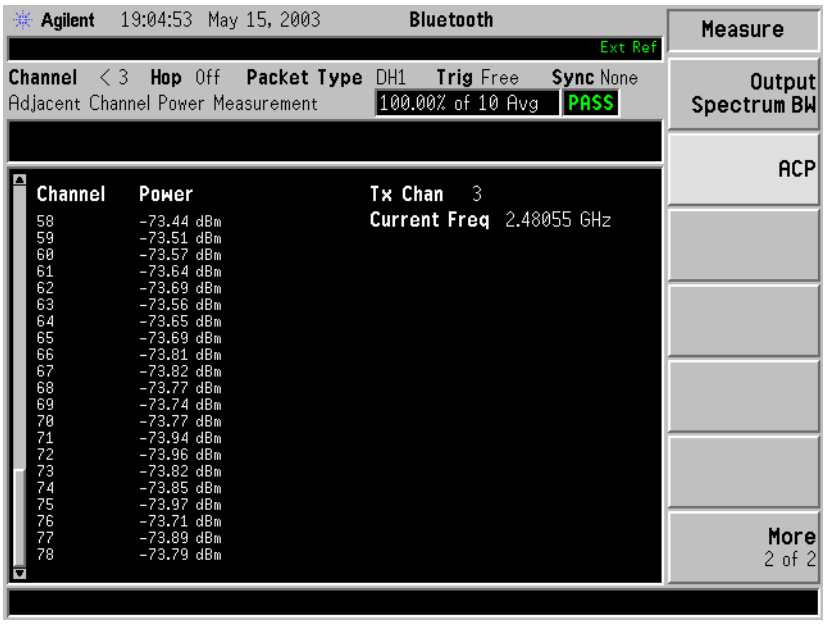


Figure 3-11 **ACP Measurement Results Spectrum View**



NOTE Results are shown in numeric format beneath the trace. To view this section of the window in its entirety, press the **Next Window** menu key until it is highlighted, then press the **Zoom** menu key. This can also be used for zooming in on the trace window.

Figure 3-12 **ACP Measurement Results Numeric Window**



Troubleshooting Hints

- If an external attenuator is used, be sure to include the attenuation value in the measurement. This can be accessed by pressing **Input**, **Ext Atten**.
- If an external preamplifier is used, be sure to include the gain value in the measurement. This can be accessed by pressing **Input**, **Ext Gain**.