User's Guide

Agilent Technologies
ESA Series Analyzers
EMI Detectors and FM Demodulation
Special Option HYQ

This manual provides documentation for the following instruments:

E4401B (9 kHz- 1.5 GHz)
E4402B (9 kHz - 3.0 GHz)
E4404B (9 kHz - 6.7 GHz)
E4405B (9 kHz - 13.2 GHz)
E4407B (9 kHz - 26.5 GHz)

Requirements: Analyzer firmware revision A.10.00 or greater

Incompatible Options:
Option BAA–FM Demod
Option 106–Bluetooth Demod
Option 228–Bluetooth Measurement Personality
Option BAC–cdmaOne Measurement Personality
Option J35–FM Deviation Measurement Personality
Option J35–Flexible FM Deviation Measurement Personality


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NOTE *Note* calls out special information for the user's attention. It provides operational information or additional instructions of which the user should be aware.

The caution risk of danger symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.

This symbol is used to mark the on position of the power line switch.

This symbol is used to mark the standby position of the power line switch.

This symbol indicates that the input power required is AC.

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.**

WARNING **No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.**

WARNING **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

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http://www.agilent.com/find/esa

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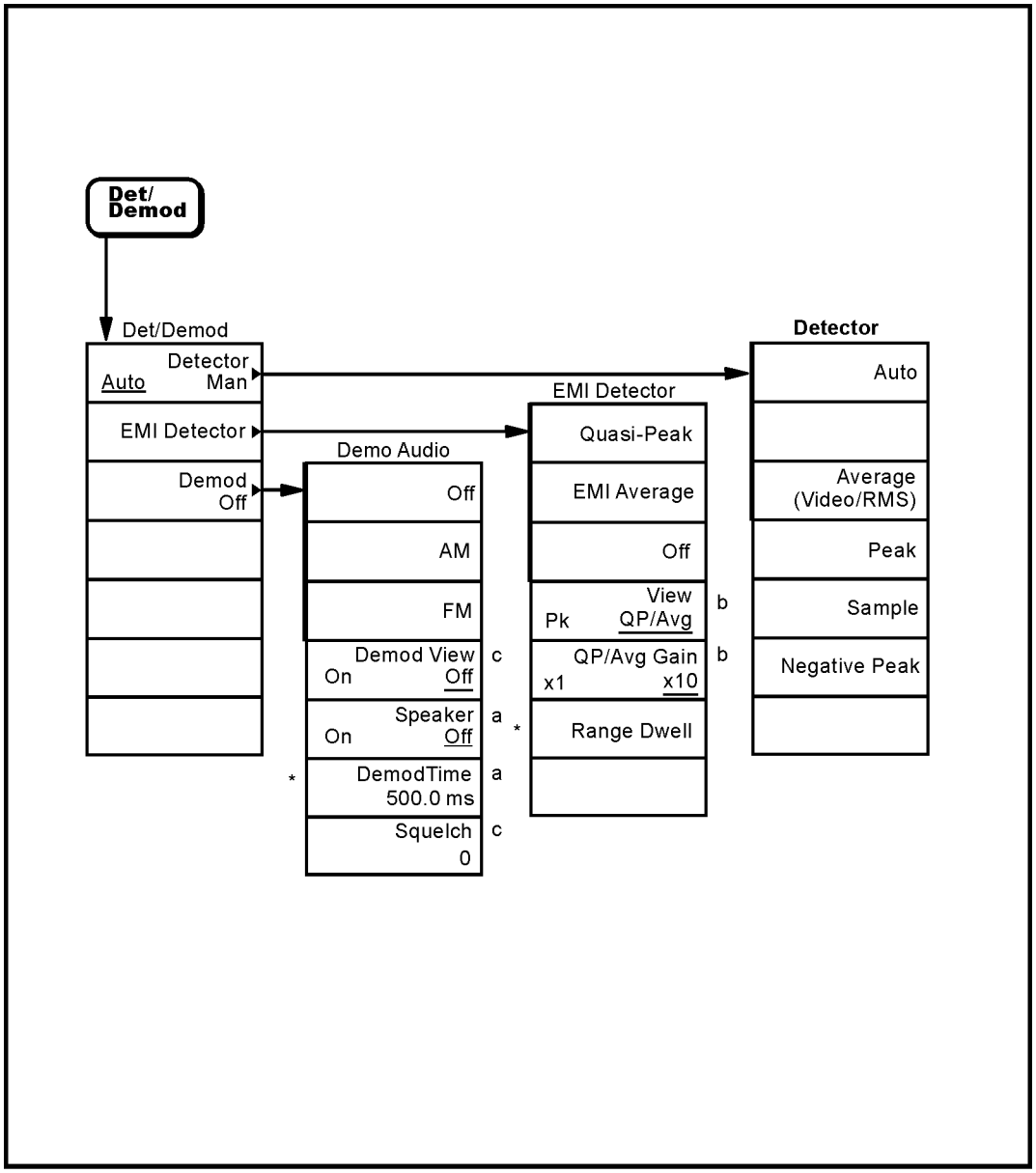
1 Menu Maps

This chapter provides a visual representation of the Det/Demod front-panel key and the associated menu keys for Option HYQ setup. Refer to Chapter 2 , “Front-Panel Key Reference,” on page 9 for key function descriptions.

Menus

Det/Demod Menu



a. Active if FM Demod or AM Demod is On.
b. Grayed out unless QP/Avg is On.
c. Active if FM Demod is On.
* An active function which allows data entry.

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2 Front-Panel Key Reference

The Det/Demod front-panel key in this chapter is described with the associated menu keys. The menu keys are arranged as they appear in your analyzer menus. Use the following table to locate a specific key.

Key Label	Page Location
AM	page 12
Demod	page 12
Demod Time	page 13
Demod View On Off	page 12
Det/Demod	page 11
EMI Average	page 11
EMI Detector	page 11
FM	page 12
Off	page 11
QP/Avg Gain X1 X10	page 12
Quasi Peak	page 11
Speaker On Off	page 13
View	page 11

Det/Demod

Accesses the menu keys controlling detector functions, demodulation functions, and the speaker.

NOTE The FM Demod internal circuitry must be aligned before use. Press **System**, **Alignments**, **Align Now**, **FM Demod**.

EMI Detector Accesses the Detector menu keys which allow you to select **Quasi-Peak** or **EMI Average** detection. It also allows you to restore settings for reference level and scale type after a Quasi-Peak or EMI Average measurement. The **QP/Avg xGain** and **View** keys are active when either **Quasi Peak** or **EMI Average** is selected.

Key Access: **Det/Demod**

Quasi Peak Enables quasi-peak detection which weights the peak-detected amplitude using specific charge, discharge, and meter time constants as described in CISPR Publication 16. The effect of this detector depends on the characteristics and repetition rate of the input signal.

When the detector is selected, the analyzer is placed in linear amplitude detection mode and the appropriate detector is turned on. The system settings are optimized to accurately measure the amplitude.

When Quasi-Peak is selected, **QPeak** appears in the upper-left corner of the screen and quasi-peak is turned on in the EMI Detector menu.

Key Access: **Det/Demod**, **EMI Detector**

EMI Average Turns EMI average detector On or Off. When the detector is selected, the analyzer is placed in linear amplitude detection mode and the appropriate detector is turned on. The system settings are optimized to accurately measure the amplitude.

When EMI Average is selected, **EmiAv** appears in the upper-left corner of the screen.

Key Access: **Det/Demod**, **EMI Detector**

Off Turns EMI detectors On or Off.

Key Access: **Det/Demod**, **EMI Detector**

View
Pk QP/Avg Selects which view to display.

Key Access: **Det/Demod**, **EMI Detector**

QP/Avg Gain x1 x10

Turns the linear x10 Gain stage in the quasi-peak and average detector signal path on or off. This stage may be set to On or Off whenever the quasi-peak or average detector is first selected. QP/Avg Gain is only an active function when either the quasi-peak or average detector is selected.

Key Access: **Det/Demod**, **EMI Detector**

Range Dwell

Specifies the amount of time the analyzer dwells on a signal during ranging. Ranging is the first step in a signal measurement. During ranging, the analyzer sweeps for the specified range dwell time, before adjusting the signal peak to the top of the screen for further measurements.

If a signal has a pulse repetition slower than 5 Hz, than a larger range dwell than the default of 200 ms is required.

Key Access: **Det/Demod**, **EMI Detector**

Demod

Accesses the menu keys to select **AM** demodulation, **FM** demodulation or demodulation **Off**. It also accesses the **Demod View On Off**, **Speaker On Off,** and **Demod Time** menu keys described below.

Key Access: **Det/Demod**

Off

Turns demodulation off.

Key Access: **Det/Demod**, **Demod**

AM

Activating AM demodulation turns off FM demodulation (if it is on). For non-zero spans, a 10 kHz resolution bandwidth is used during demodulation, regardless of the screen annotation.

Key Access: **Det/Demod**, **Demod**

FM

Turning FM demodulation on turns off AM demodulation (if it is on). For non-zero spans, a 100 kHz resolution bandwidth is used during the demodulation, regardless of the screen annotation. When the span is set to zero span, the displayed bandwidth is used. For best results, move the signal to be demodulated to within 3 graticules of the top of the display.

Key Access: **Det/Demod**, **Demod**

Demod View On Off

When **Demod View** (On) is pressed, the vertical scaling of the display is in frequency, and marker will read out

the FM deviation in kHz. When Demod View is On, the following functions are not available: Log/Lin (the display is always linear and calibrated in Hz), Y Axis Units, Normalize, Display Line, Peak Excursion, and Peak Threshold. In AM Demod, pressing **Demod View** (On) has no effect.

Key Access: **Det/Demod**, **Demod**

Speaker On Off

Turns the internal speaker on and off. The volume from the speaker is controlled by the front-panel volume control knob. Selecting AM or FM turns the speaker on. Turning AM or FM off, pressing **Preset** when **Preset Type** is set to **Factory**, or cycling the power sets the speaker function to off.

Key Access: **Det/Demod**, **Demod**

Demod Time

Allows you to set the time, in non-zero spans, to pause and demodulate the signal after each sweep. The demodulated signal can be heard during demodulation when in **Speaker (On)** mode. (In zero span, demodulation is performed (and can be heard) throughout the sweep.) In AM, the Video BW is set to 3 kHz and the Resolution BW is set to 10 kHz. In FM, the Video BW is set to 30 kHz and the Resolution BW is set to 100 kHz.

When AM or FM Demod is enabled, the instrument will tune to the marker frequency and wait for the Demod to take place. For long Demod times, pressing **Preset** when **Preset Type** is set to **Factory** will abort the Demod function. The default value is 500 ms.

Key Access: **Det/Demod**, **Demod**

NOTE

It is normal to hear clicking sounds when the Auto Alignment function is On. During retrace, a small portion of the analyzer circuitry is realigned. Some of the switching of the analyzer circuitry is done using relays. It is the rapid switching of these relays during retrace that causes the clicking sounds. To eliminate the clicking sounds, turn the auto alignment off by pressing **System**, **Alignments**, **Auto Align**, **Off**. When this is done, the **Align Now**, **All** function should be performed periodically. Refer to the Specifications Guide for your instrument to learn more information on how often to perform **Align Now**, **All** when the auto alignment is off.

Squelch

Allows you to adjust the squelch level. The squelch level mutes weak signals and passes strong signals. Only the audio level is affected. If the internal speaker is On, audio signals are not output unless the signal strength exceeds the squelch threshold. The squelch level does

not affect the rear panel AUX VIDEO OUT signal.

Squelch level is indicated on screen by the numbers 0 to 100, with 0 being the minimum threshold (all signals are passed) and 100 being the maximum threshold (no signals are passed). The default squelch value is 0.

Squelch is only active in the FM mode.

Key Access: **Det/Demod**, **Demod**

3 Language Reference

This chapter contains SCPI (Standard Commands for Programmable Instruments) programming commands for Option HYQ installed in the Agilent ESA-E Series Spectrum Analyzers.

SCPI Command Introduction

For common commands specified in IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols and Common Commands for Use with ANSI/IEEE Std 488.1-1987*. New York, NY, 1992, refer to the ESA-E Series programming reference guide.

NOTE Refer to Chapter 2 , “Front-Panel Key Reference,” on page 9 for additional information about the operation of each analyzer function. Use the analyzer HELP key to obtain similar information about analyzer key functions.

Refer to Chapter 6, “Agilent 8590/ESA Analyzers Programming Conversion Guide,” in the ESA Programmers Guide, for specific backwards compatibility information between commands for HP/Agilent 8590-Series spectrum analyzers and Agilent ESA-E Series analyzers.

The SCPI commands in this chapter are listed in alphabetical order. Refer to the following table to locate SCPI commands by page number.

NOTE Additional FM Demod commands can be found in the ESA programming guide.

SCPI Command

Squelch

[:SENSe]:DEMod:SQUelch <integer>

Sets the squelch level on FM demod.

Factory Preset and *RST: integer, 0 to 100

Key Access: **Det/Demod, Demod/Audio, Squelch**

Type of EMI Detector

[:SENSe]:DETector[:FUNCtion]: EMI QPEak|AVERage|OFF

[:SENSe]:DETector[:FUNCtion]:EMI?

Specifies the type of EMI detection mode. Quasi-peak detection displays a weighted, sample-detected amplitude using specific, charge, discharge, and meter time constants as described in CISPR Publication 16. Average detection displays the average value of a sample-detected amplitude.

Factory Preset and *RST: Off

Remarks: When either of the EMI detectors are selected for the first time, a ranging operation is performed which adjusts the reference level to a reasonable level for performing measurements.

The ranging operation will first adjust the reference level in LOGarithmic scale units and then in LINear scale units. While doing so, “EMIPk” will be displayed in the upper-left corner of the display.

Once the reference level has been properly adjusted, the selected EMI detector will be activated. Depending on the detector chosen, “EMI QP” or “EMIAv” will be displayed in the upper-left display corner.

When setting the EMI detector to Off, the analyzer performs an UNRange and will display the various instrument settings adjusted by the range operation. The previous detector is also restored.

When the QPeak or AVERage EMI detectors are selected, the detector setting is locked in SAMPle mode and the user is not allowed to adjust this value until the EMI detector is set to Off.

Key Access: **Det/Demod, EMI Detector, Quasi Peak**

Det/Demod, EMI Detector, EMI Average

Det/Demod, EMI Detector, Off

EMI View

`[:SENSe]:DETector[:FUNCtion]EMI:VIEW POSitive|EMI`

`[:SENSe]:DETector[:FUNCtion]EMI:VIEW?`

Selects between Quasi-Peak/Average EMI detector mode or Peak detector mode without reranging. When POSitive is selected only the peak detector is used. When EMI is selected, the previously selected EMI detector is used.

Factory Preset and *RST: EMI

Remarks: This command is not available when the EMI detector is Off.

Key Access: **Det/Demod, EMI Detector, View**

Range Immediate

`[:SENSe]:DETector:RANGe:IMMediate`

Performs detector ranging (if enabled) when an EMI detector is selected.

Unrange

`[:SENSe]:DETector[:UNRange]`

Restores settings prior to last range operation.

Enable/Disable QPD X10 Gain

`[:SENSe]:POWer:QPGain[:STATe]ON|OFF|1|0`

`[:SENSe]:POWer:QPGain[:STATe]?`

Sets the quasi peak (QP) gain state On or Off in the quasi peak detector (QPD) board.

Factory Preset and *RST: Off

Key Access: Det/Demod, EMI Detector, AV/QP Gain X1 X10

4 Measurement Techniques

In this Chapter...

Making Quasi-peak and Average Measurements

Peak detection can be used to quickly scan over the frequency range of interest. Since peak detected amplitudes are always greater or equal to quasi-peak and average amplitudes, this type of measurement yields the worst-case results. After a peak measurement is made, those segments of the spectrum which require further analysis can easily be identified. Such analysis and investigation can be carried out using quasi-peak and average detection.

Because the Quasi Peak detector has a relatively slow time constant, most Quasi Peak measurements are made in zero span. In cases where the signal of interest is unstable or drifting in frequency, a zero span measurement may not capture the maximum signal amplitude or may miss the signal entirely. This results in erroneous test data since the emissions amplitude is not captured completely. In this case, the Quasi Peak measurement is often made over a frequency span, ensuring that the signal is captured correctly.

The Quasi-peak Detector

The implementation of the quasi-peak detector, as called out in CISPR 16 Part 1 (1999-10), consists of a circuit with a specific charge and discharge constant, depending on the measurement frequency range. This detector weights broadband signals as a function of pulse repetition rate. Lower repetition rate emissions cause a lower annoyance factor and thus gets less emphasis. Higher repetition rate signals cause more annoyance in broadcast systems and are emphasized more by the quasi-peak detector. As the repetition rate approaches that of a CW signal, (that is, 100% duty cycle), it reaches the maximum interference potential and therefore no weighting is applied at all. This results in the maximum level at the detector output.

The quasi-peak detector circuit also includes a network that simulates an analog meter movement. This time constant provides a smoothing function to the signal at the output of the previous detector stages so that a single value reading can be obtained. The quasi-peak value will always be less than or equal to the peak value of the emission.

The Average Detector

The average detector is used in measurements of narrowband signals for overcoming problems associated with either modulation content or the presence of broadband noise. Using the average detector it is possible to recover the amplitude of any narrowband signal that might be buried beneath broadband signals, such as pulses or a modulation envelope.

The average detector, also called a carrier detector, does this by stripping the modulation content from narrowband signals and suppressing the broadband signal content in the spectrum of interest. This makes it possible to measure the amplitude of the remaining carriers.

The use of average detection, when measuring narrowband signals, is based on the observation that combined narrowband and broadband signals may cause more annoying interference than is indicated by a quasi-peak measurement alone. Since a quasi-peak detector responds predominantly to the peaks of a broadband impulsive signal, the pulses may mask a lower amplitude continuous sine wave signal. The characteristics of the average detector, on the other hand, very effectively suppress broadband impulsive signals and recover the amplitude of the underlying sine wave or narrowband signal.

Making a Quasi-peak Measurement in Zero Span

Manual quasi-peak and average measurements in *Zero Spans* can be made using the procedure described here.

Procedure 4-1 How to make a quasi-peak measurement in Zero Span

	Step	Comments
1	**Specify a center frequency.**	a. Press **FREQUENCY** and enter the center frequency.
2	**Specify a desired RBW and VBW.**	a. Press **BW/Avg** and enter desired RBW setting:.
3	**Put the analyzer in zero span and tune the center frequency to the frequency of the signal of interest.**	a. Press **Span**, **Zero Span**. b. Press **FREQUENCY**, **CF**, and then enter the desired frequency.

Procedure 4-1 How to make a quasi-peak measurement in Zero Span

Step		Comments
4 Make the quasi-peak measurement.	• Press **Det/Demod**, **EMI Detector**, **Quasi Peak**.	• When you press **Quasi Peak**: a. The autorange function is invoked to adjust the peak of the trace close to the reference level. b. The display mode will be changed to Lin, because the Quasi Peak detector requires a linear amplification for undistorted display and accurate measurement. c. The sweep time is calculated and applied to the span to be measured. d. The sweep begins.
	• Press **Marker** and read the marker value results.	• Note: If, after pressing **Quasi Peak** your measurement lies at the bottom graticule of the screen, use the post detection x10 gain function to raise the display signal amplitude by 20 dB (see Procedure 4-3 below).

Making a Quasi-peak Measurement on a Drifting or Unstable Signal

Manual quasi-peak and average measurements over *non-zero frequency spans* can be made using the procedure described here.

Procedure 4-2 How to make a quasi-peak measurement (non-zero span)

Step		Comments
1 Specify a center frequency.	a. Press **Frequency** and enter the center frequency. b. Press **Span** and enter the frequency span c. Observe the trace to determine locations of suspect signals.	Use peak detection to preform steps 1 through 3.

Procedure 4-2 How to make a quasi-peak measurement (non-zero span)

	Step		Comments
2	**Adjust the sweep time if necessary.**	• Press **Sweep**, **Sweep Time** and use the numeric keypad or knob to specify a value that produces a stable signal on the screen.	• To capture broadband signals adequately, a longer sweep time or dwell time may be required. This allows more spectral components of the broadband signals to be displayed in the selected frequency span, making the identification of critical segments of the spectrum easier.
3	**Identify the critical frequency segment.**	a. Press **Marker**, **Normal**. b. Use the knob to scroll the marker to the start or stop frequency of the critical frequency segment. c. Press **Marker**, **Delta** and use the knob to scroll the Δ marker to the other frequency boundary, defining the critical frequency segment.	• You are using the marker functionality to identify a critical segment in the peak detected spectrum of interest. • The frequency range defined by the normal and D markers will be the span within which the new measurement sweep will take place.
		d. Press **Marker ->**, **Mkr Δ-> Span** to enter the frequency range defined by the normal and D markers.	• The displayed frequency span will be set to the frequency range defined by the normal and Δ markers.

Procedure 4-2 How to make a quasi-peak measurement (non-zero span)

Step		Comments
4 **Make the quasi-peak measurement.**	• Press **Det/Demod**, **EMI Detector**, **Quasi Peak**.	• When you press **Quasi Peak**: a. The autorange function is invoked to adjust the peak of the trace close to the reference level. b. The display mode will be changed to Lin, because the Quasi Peak detector requires a linear amplification for undistorted display and accurate measurement. c. The sweep time is calculated and applied to the span to be measured. d. The sweep begins. • Note: If, after pressing **Quasi Peak** your measurement lies at the bottom graticule of the screen, use the post detection x10 gain function to raise the display signal amplitude by 20 dB (see Procedure 4-3 below).

When to use QP/AVG X10 Gain

When using the quasi-peak or average detector, the EMC analyzer is in linear amplitude scale display mode. Because the digital display has 10,000 display points to represent the measured amplitude values, a signal at the reference level has a digital value of 10,000 display units. A midscreen signal is 6 dB down and has a value of 5000 display units. The smallest display unit is 1/10000 or 80 dB down. This is enough dynamic range to make a quasi-peak or average measurement, but the screen resolution decreases with lower amplitudes. To address the need for improved resolution, a post detection gain (x10 Gain) can be switched into the signal path to raise the signal amplitude on the display by 20 dB and thus improve the screen resolution.

NOTE This function is only available if either Quasi Peak or Average functions have been selected in the EMI Detector menu as described in "Making a Quasi-peak Measurement on a Drifting or Unstable Signal" above.

Procedure 4-3 How to add gain to improve screen resolution

	Step		Comments
1	**Add gain to improve screen resolution.**	• Press **Det/Demod**, **EMI Detector**, **QP/Avg Gain (x10)**.	• The trace will rise by 20 dB. • The reference level setting is adjusted to account for the extra gain. • Even if signals exceed the reference level after the extra gain is applied, on-screen signals are still measured accurately.

Changing Detector Views

Changing detector views makes it possible to quickly switch back and forth between peak and quasi-peak/average measurements. Sweep times which have previously been used, are restored for each measurement type (peak or quasi-peak/average). By comparing peak, and average or quasi-peak, signal characteristics (for example, narrowband or broadband type, modulation content, and so forth) can be determined.

NOTE This function is only available if either Quasi Peak or Average functions have been selected in the EMI Detector menu as described in "Making a Quasi-peak Measurement on a Drifting or Unstable Signal" on page 22 above.

Procedure 4-4 How the change detector views

Step		Comments
1 **Select the view of interest.**	• Press **Det/Demod**, **EMI Detector**, **View (Pk)** or **View (QP/Avg)**. • Select either **Pk** or **QP/Avg** depending on which view is of interest.	• Note: the **View (Pk)** or **View (QP/Avg)** function invokes the measurement again, using the selected detector.

Demodulation (Tune and Listen) Example

This example illustrates the use of demodulation for EMI measurements. For a general explanation of Demodulation please refer to the “Signal Analysis Measurement Guide”.

NOTE For the purposes of this example, the following known input signal was used: 99.5 MHz at –65 dBm (signal coupled in with the FM Band).

The goal of this example will be to find the signal emanating from the EUT using the demodulation capabilities of the spectrum analyzer.

Procedure 4-5 How to Identify a modulated signal

	Step	Comments
1	**Set the Analyzer up for making a measurement in a portion of the FM Band.**	a. Press **Preset**. b. Press **Span**, **Zone**, **Zone (On)**. c. Press **Zone Center**, 98 **MHz**. d. Press **Zone Span**, 10 **MHz**.
2	**Set up the analyzer to demodulate signals.**	a. Press **Det/Demod**, **Demod**, **FM**. b. Press **Speaker (On)**. c. Press **Demod Time** and use the knob or numeric keypad to specify **3 s**.

Procedure 4-5 How to Identify a modulated signal

Step		Comments
3 Search for the signal emanating from EUT.	a. Press **Peak Search**. b. Adjust the Volume level for acceptable level. c. Press **Next Pk Right** or **Next Pk Left** to step through signal peaks.	• Depending on the frequencies of local FM radio stations, signal peaks may exist at different points. • **Next Pk Right** and **Next Pk Left** will use the Peak Excursion and Threshold Level when locating the next signal. The default values for Peak Excursion and Threshold Level are 6 dB and 16 dBmV, respectively. **Next Pk Right** and **Next Pk Left** will move to the next signal which meets these parameters. The message "No Peak Found" will be displayed if no signal can be found which meets both parameters. For more information on setting the search criteria, refer to the **Peak Search** menu key description in the Front Panel Key Reference chapter of the ESA Series Analyzers user's guide
4 Determine if the signal is an FM radio station.	• Listen to the signal. Observe its signature, if possible.	• If the signal does not produce an audio response, it is more than likely emanating from the EUT and should be measured.
5 Measure the signal.	• For the procedure to measure the signal, refer to "Making a Quasi-peak Measurement in Zero Span" on page 21.	

NOTE It is recommended that, when you exit the Demodulation Mode, you first deactivate the Speaker before turning demodulation Off.

5 Characteristics

About This Chapter

This chapter contains characteristics for the Agilent ESA-E Series spectrum analyzers. The distinction between specifications and characteristics is described as follows.

- Specifications describe the performance of parameters covered by the product warranty. (The temperature range is 0 °C to 55 °C, unless otherwise noted.)
- Characteristics describe product performance that is useful in the application of the product, but is not covered by the product warranty.
- Typical performance describes additional product performance information that is not covered by the product warranty. It is performance beyond specification that 80% of the units exhibit with a 95% confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.
- Nominal values indicate the expected performance, or describe product performance that is useful in the application of the product, but is not covered by the product warranty.

The following conditions must be met for the analyzer to meet characteristics.

❏ The analyzer is within the one year calibration cycle.

❏ If **Auto Align All** is selected:

— After 2 hours of storage within the operating temperature range.

— 5 minutes after the analyzer is turned on with sweep times less than 4 seconds[1].

❏ If **Auto Align Off** is selected:

— When the analyzer is at a constant temperature, within the operating temperature range, for a minimum of 90 minutes.

— After the analyzer is turned on for a minimum of 90 minutes and **Align Now All** has been run.

— When **Align Now All** is run:

- Every hour

1. A Warm-up time of 25 minutes is required for a sweep time of 20 seconds.

- If the ambient temperature changes more than 3 °C
- If the 10 MHz reference changes

❑ If **Auto Align All but RF** is selected:

— When the analyzer is at a constant temperature, within the operating temperature range, for a minimum of 90 minutes.

— After the analyzer is turned on for a minimum of 90 minutes and **Align Now RF** has been run.

— When **Align Now RF** is run:

- Every hour
- If the ambient temperature changes more than 3 °C.

EMI Detectors and FM Demod (Option HYQ)

	Characteristics	Supplemental Information
Quasi-Peak Detector	The quasi-peak detector provides the quasi-peak amplitude of pulsed radio frequency (RF) or continuous wave (CW) signals. The amplitude response conforms to Publication 16 of CISPR Part 1, Clause 4, except as indicated in the Relative Quasi-Peak Response Table.	

Relative Quasi-Peak Response to a CISPR Pulse (dB)			
Frequency Band Characteristics			
Pulse Repetition Frequency	**120 kHz EMI BW 0.03 to 1 GHz**	**9 kHz EMI BW 0.15 to 30 MHz**	**200 Hz EMI BW 9 to 150 kHz**
1000 Hz	+8.0 ± 1.0	+4.5 ± 1.0	N/A
100 Hz	0 dB reference[1]	0 dB reference[1]	+4.0 ± 1.0
60 Hz	N/A	N/A	+3.0 ± 1.0
25 Hz	N/A	N/A	0 dB reference[1]
20 Hz	–9.0 ± 1.0	–6.5 ± 1.0	N/A
10 Hz	–14.0 ± 1.5	–10.0 ± 1.5	–4.0 ± 1.0
5 Hz	N/A	N/A	–7.5 ± 1.5
2 Hz	–26.0 ± 2.0	–20.5 ± 2.0	–13.0 ± 2.0
1 Hz		–22.5 ± 2.0	–17.0 ± 2.0
Isolated Pulse		–23.5 ± 2.0	–19.0 ± 2.0

1. Reference pulse amplitude accuracy relative to a 66 dBµV CW signal is <1.5 dB as specified in CISPR Publication 16. CISPR reference pulse: 0.044 µVs for 30 MHz to 1.0 GHz, 0.316 µVs for 15 kHz to 30 MHz, and 13.5 µVs for 9 to 150 kHz.

	Characteristics	Supplemental Information
FM Demodulation		
Input level		(–60 dBm + attenuator setting), characteristic
Signal level		0 to –30 dB below reference level, characteristic

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