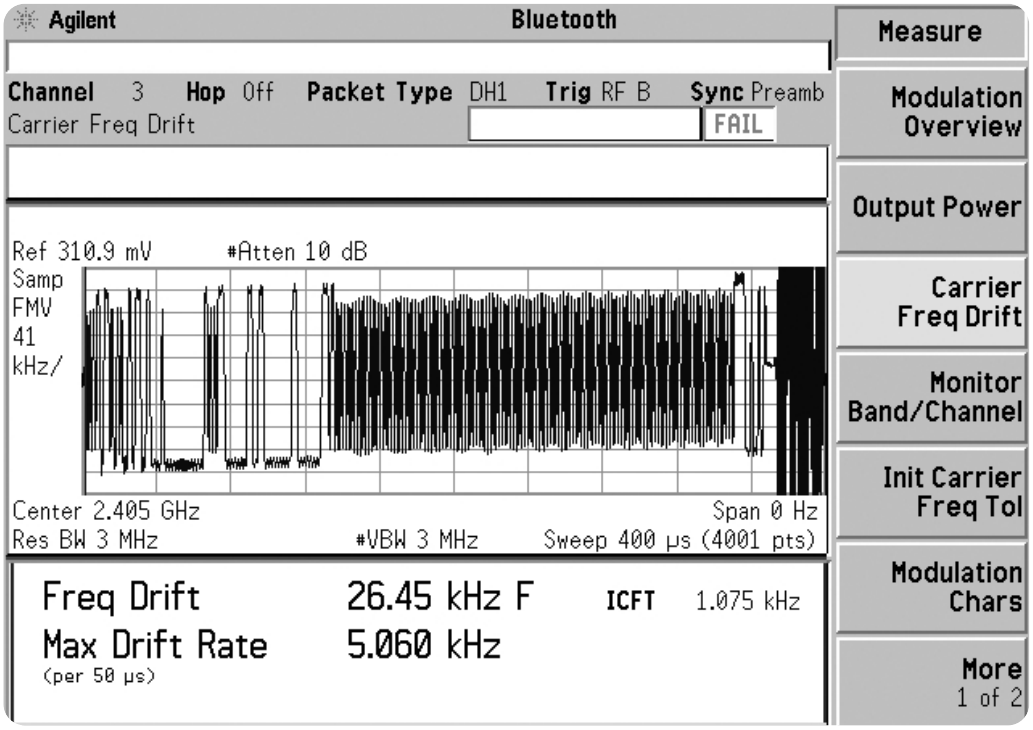
Agilent *Bluetooth*™ Measurement Solution for the ESA-E Series Spectrum Analyzers

Technical Overview



Now the ESA-E series spectrum analyzers have one-button standard-based *Bluetooth* measurements, including output power, initial carrier frequency tolerance (ICFT), frequency drift, modulation characteristics, output spectrum –20 dB bandwidth, and adjacent channel power (ACP).

Agilent Technologies

Accurate, Efficient *Bluetooth* Design Verification and Troubleshooting

The Agilent ESA-E series spectrum analyzers provide flexible general-purpose spectrum analysis and one-button standard compliant *Bluetooth* transmitter measurement capability all in a mid-priced package.

You don't have to be a *Bluetooth* measurement expert to acquire the data you need. The ESA-E series *Bluetooth* measurement personality does that for you, at the push of a button, so you can concentrate on analysis and troubleshooting.

Automated transmitter tests

The *Bluetooth* measurement personality for the ESA-E series spectrum analyzers helps you get to the data you need faster, whether it's your first time making a *Bluetooth* measurement or your hundredth.

Testing to the *Bluetooth* specification can be complex. In several cases, the burst signal must be captured and demodulated, the data packet must be parsed to locate the symbols to measure, the measurement must be made and the raw data processed to get to the final result. Doing all of this takes time to set-up and a good understanding of the specification to do properly.

The ESA-E series *Bluetooth* measurement personality saves you time and complexity by automating the test from signal capture to results display. All you have to do is select the transmitter test you want to perform from the *Bluetooth* measurement menu and press a single button for measurement results.

Standard compliant

Check your *Bluetooth* design with confidence. This tool performs *Bluetooth* transmitter tests as defined by the *Bluetooth* standard. Each measurement conforms to the *Bluetooth* SIG documentation. You can even use this tool to pre-check your design for compliance before you submit it for formal conformance testing.

Measurement reliability

Agilent makes spectrum analyzers for RF and microwave design engineers around the world. We've been doing it for over 30 years. In that time our products have earned a reputation for accuracy, flexibility and performance. They provide results you can count on, all day, everyday. That is what we mean by measurement reliability, and that is what you will get from the flexible ESA-E series spectrum analyzers from Agilent Technologies for your *Bluetooth* design verification and RF troubleshooting needs.

Here is How it Benefits You

Easy-to-use

Verify and troubleshoot your design efficiently

- One-button, standard compliant *Bluetooth* transmitter measurements with *Bluetooth* specific displays to speed data gathering
- Easy hook-up and triggering
- Built-in help key for quick reference without manuals

With spectrum analysis

Maximize measurement capability and confidence

- 108 dB[2] third order dynamic range to view low level distortion and inter-modulation
- 1 Hz digital resolution bandwidth up to 220 times faster than analog
- Continuous automatic background alignment that guarantees repeatability over varying temperatures

Upgradeable

Ready for other wireless communication standards

- Versatile card-cage architecture
- Instrument firmware and software upgrades available over the Web
- Wide bandwidth digital demodulation platform

Flexible

Include just the options that you need now or in the future

- GSM and cdmaOne measurement personalities are two of many available
- Load all three personalities in one ESA
- Over 30 hardware options also available

PC connected

Speed analysis of *Bluetooth* transmitter performance data

- Store measurement results in spreadsheet format to disk using the built-in floppy disk drive or transfer directly to your PC with IntuiLink software[1]
- Industry standard SCPI instrument language for remote control
- GPIB (Option A4H), RS-232 (Option 1AX) interface available

Fast

Finish your job quicker

- 5 minute warm-up time for full accuracy
- Quick *Bluetooth* transmitter measurement set-ups

Portable

Sophisticated measurement performance anywhere

- Rugged case, water resistant front panel
- Snap-on battery (E1779A) or 12 Vdc adapter (Option A5D)
- Carrying/operating case (Option AYT/AYU)

Great for R&D and manufacturing plus more

R&D

- Affordable spectrum analysis on every engineer's bench
- *Bluetooth* compliance verification

Manufacturing

- Spurious testing to 26.5 GHz
- Flexible troubleshooting tool for production rework
- Engineering analysis of root cause

Maintenance

- Flexible fault isolation tool for the repair bench
- Portable trouble shooting tool for field repairs

1. For more information about IntuiLink software visit our Web site at: **http://www.agilent.com/find/IntuiLink**
2. Typical

Standard Compliant *Bluetooth* Transmitter Measurements

The Agilent ESA-E series spectrum analyzer with built-in *Bluetooth* measurement capability gives you the tools you need to verify the performance of your *Bluetooth* design and troubleshoot problems.

These key *Bluetooth* transmitter measurement features are available at the press of a single button:

- *Output power*: Measures average power across a burst and peak power in a burst.
- *Initial carrier frequency tolerance (ICFT):* Uses first four bits of burst, as called out by *Bluetooth* specification, to measure carrier behavior at burst turn-on.
- *Carrier frequency drift*: Measures carrier drift and drift rate in the payload field to determine carrier stability during burst.
- *Modulation characteristics:* Measures and compares the frequency deviation of two Bluetooth data patterns.
- *Output spectrum –20 dB bandwidth:* Determines the –20 dB bandwidth of the *Bluetooth* transmitter.
- *Adjacent channel power (ACP*) : Measures channel emission power across the entire Bluetooth operating band (2402 MHz to 2480 MHz) except for the main transmit channel and its immediately adjacent channels.
- *Monitor band/channel*: Sets wideband frequency sweep to show if hopping signal uses the entire band (band mode). Displays the channel using optimum analyzer settings (channel mode).[1]
- *Modulation overview*: Quick measurement of ICFT and modulation metrics at a lower sampling rate.[1]

1. Not a standard *Bluetooth* test.

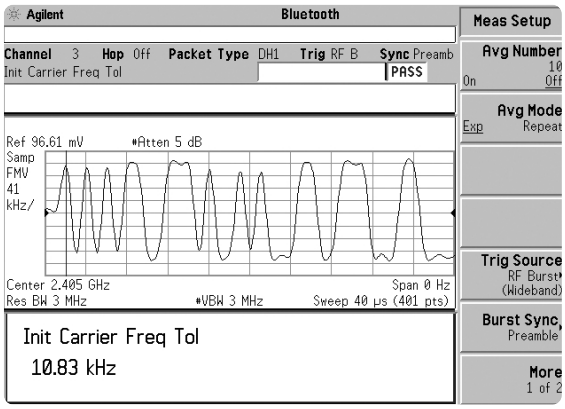


Figure 1. Initial carrier frequency tolerance test

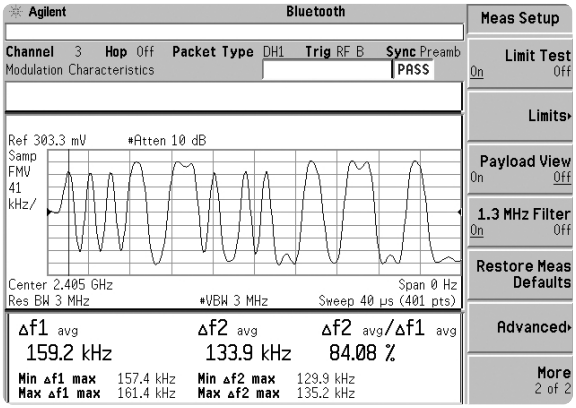


Figure 2. Modulation characteristics test

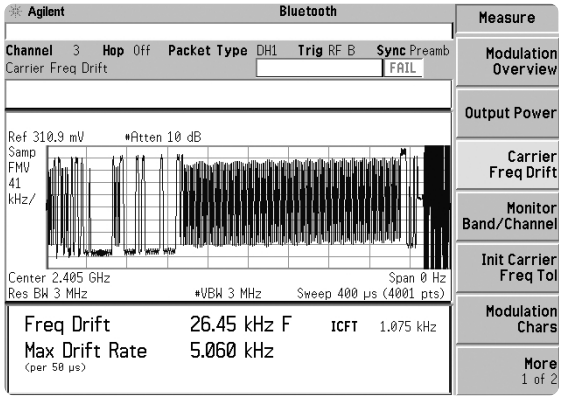


Figure 3. Carrier frequency drift test

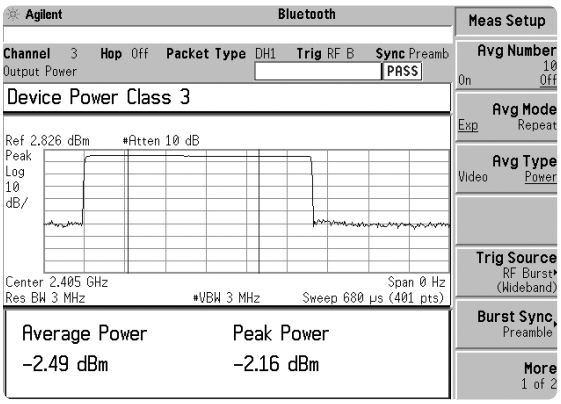
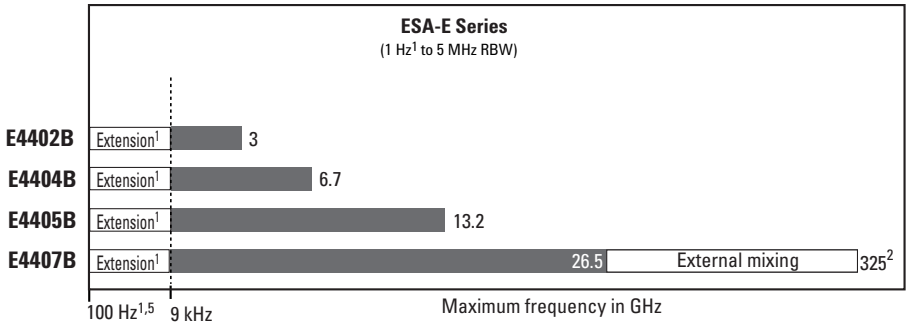


Figure 4. Output power test

Here is How You Order Your ESA-E Spectrum Analyzer

First, choose your frequency range



Now, choose your option configuration

Tasks	Required option configuration[6]	
• *Bluetooth* testing (test mode only, except for output power measurement) • General RF troubleshooting	**ESA-E series[3] spectrum analyzer plus options:**	
	E440xB-228	*Bluetooth* measurement personality
	E440xB-106	*Bluetooth* FSK demodulator
	E440xB-AYX	Fast zero span sweeps
	E440xB-B72[4]	Memory extension
	Recommended options and accessories:	
	E440xB-1DR	Narrow resolution bandwidths
	E440xB-1DS	3.0 GHz pre-amp
	E440xB-1D5	High stability reference
	E440xB-1D6	Time gated spectrum analysis
	E440xB-UKB	100 Hz low frequency extension
• *Bluetooth* testing (test mode and/or hopping mode) • GSM testing • cdmaOne testing • General RF troubleshooting	**ESA-E series[3] spectrum analyzer plus options:**	
	E440xB-304	*Bluetooth* premium bundle
		or order the following:
	E440xB-228	*Bluetooth* measurement personality
	E440xB-106	*Bluetooth* FSK demodulator
	E440xB-B7D	Digital signal processing and fast ADC
	E440xB-B7E	RF communication hardware
	E440xB-B72[4]	Memory extension
	E440xB-1DS	3.0 GHz pre-amp
	E440xB-1D5	High stability reference
	Recommended options:	
	E440xB-BAC	cdmaOne measurement personality
	E440xB-BAH	GSM measurement personality
	E440xB-1DR	Narrow resolution bandwidths
	E440xB-1D6	Time gated spectrum analysis
	E440xB-UKB	100 Hz low frequency extension
	Accessories:	
	E440xB-A5D	12 Vdc power cable
	E440xB-AXT	Hard transit case
	E440xB-AYT	Soft carrying/operating case (gray)
	E440xB-AYU	Soft carrying/operating case (yellow)
	E440xB-AYZ	External mixing
	E440xB-UK9	Front panel cover
	E440xB-1CP	Rackmount handle kit with slides
	E440xB-B7K	Distance to fault accessory kit
	E1779A	Battery pack
	8498A	Coaxial fixed attenuator
	11970/74	Series harmonic mixers

1. Optional
2. To 110 GHz with Agilent mixers
3. *Bluetooth* and GSM measurement personalities available for all ESA-E series analyzers except the E4401B 1.5 GHz analyzer.
4. Option B72 is standard if the serial prefix number is ≥ US4144 or MY4144.
5. 30 Hz characteristic
6. The option "prefix" is E440xB, where x can equal 2, 4, 5, or 7.

Bluetooth Specifications and Characteristics

All specifications apply over 0° C to +55° C (unless stated otherwise). The analyzer will meet specifications 5 minutes after turn-on when the following conditions are met: the analyzer has been calibrated within the last 12 months, the analyzer has been stored within its operating temperature range for at least 2 hours, Auto Align All has been selected, and Align Now RF has been run within the last 24 hours.

Characteristics provide useful, but non-warranted, information about the functions and performance of the instrument. Typical performance and nominal values are shown in Italics. For spectrum analyzer specifications, see ESA-E Series Technical Specifications.

General characteristics

Unless otherwise noted these characteristics are with RF input range auto, default measurement settings, and all measurements being performed within the *Bluetooth* (ISM) frequency band. The nominal performance described assumes a *Bluetooth* DH1 packet, with a peak-to-peak deviation of ±157.5 kHz. Align Now, FM Demod must have been run to achieve demodulation related measurement nominals.

In-band frequency range

***Bluetooth* (ISM) band: 2400 to 2483.5 MHz**

Output power[1]

Range at RF input:
+30 to –40 dBm (+30 to –60 dBm with preamp Option 1DS)
Absolute amplitude accuracy: See base instrument Absolute Accuracy.
Average type: Video, power
Average mode: Exponential, repeat
Trigger source: Video, RF burst[2], external, free run
Burst synch: RF amplitude, preamble[3], none

Modulation characteristics [4,5]

Range at RF input:
+30 to –40 dBm (+30 to –60 dBm with Option 1DS preamp)
FM deviation range:
±200 kHz full scale, nominal
FM deviation accuracy:
(25 measurement averages, signal level > –30 dBm) ±3 kHz, nominal
Payload data: 11110000, 10101010, auto-detect
Average mode: Exponential, repeat
Trigger source: RF burst[2], external, free run
Burst synch: Preamble[3], none
Limits: $\Delta f_2/Df_1$ lower, Δf_1 max lower/upper, Δf_2 max lower/upper
Filter: 1.3 MHz post detection ON/OFF

Initial carrier frequency tolerance (ICFT) [4,5]

Range at RF input:
+30 to –40 dBm (+30 to –60 dBm with preamp Option 1DS)
Measurement range:
±100 kHz, nominal
Measurement accuracy:
(25 measurement averages, signal level > –30 dBm) ±4 kHz, nominal
Average mode: Exponential, repeat
Trigger source: RF burst[2], external, free run
Burst synch: Preamble[3], none
Limits: ICFT upper/lower
Filter: 1.3 MHz post detection ON/OFF

Carrier frequency drift [4,5]

Range at RF input:
+30 to –40 dBm (+30 to –60 dBm with preamp Option 1DS)
Measurement range:
±100 kHz, nominal
Measurement accuracy:
(25 measurement averages, signal level > –30 dBm) ±4 kHz, nominal
Average mode: Exponential, repeat
Trigger source: RF burst[2], external, free run
Burst synch: Preamble[3], none
Filter: 1.3 MHz post detection ON/OFF

Tx output spectrum - 20 dB bandwidth [4]

Range at RF input:
+30 to -40 dBm (+30 to -60 dBm with preamp Option 1DS)
Average mode: Exponential, repeat
Trigger source: Freerun
Burst synch: None
Limits: Upper

Adjacent channel power (ACP)[4]

Range at RF input:
+30 to -40 dBm (+30 to -60 dBm with preamp Option 1DS)
Average mode: Exponential, repeat
Detector: Average, peak
Trigger source: Freerun
Burst synch: None
Limits: Upper

1. Requires Option AYX or B7D.
2. Requires Option B7E RF communications hardware.
3. Requires Option 106 *Bluetooth* FM demodulation.
4. The DUT must have frequency-hopping disabled.
5. Requires Option 106 and AYX or B7D.

Product Literature

- *ESA-E Series Spectrum Analyzers*, Brochure, P/N 5968-3278E
- *ESA-E Series Spectrum Analyzers*, Data Sheet, P/N 5968-3386E
- *ESA/EMC Spectrum Analyzers*, Configuration Guide, P/N 5968-3412E
- *Select the Right Portable Spectrum Analyzer*, Selection Guide, P/N 5968-3413E
- *ESA Snap-On Battery Pack*, Product Overview, P/N 5966-1851E
- *IntuiLink Software*, Data Sheet, P/N 5980-3115EN

Application Note Literature

- *Bluetooth RF Measurement Fundamentals*, Application Note 1333-1, P/N 5988-3760EN
- *Investigating Bluetooth Modules: The First Step in Enabling Your Device with a Wireless Link*, Application Note 1333-2, P/N 5988-2417EN
- *Bluetooth Manufacturing Test: A Guide to Getting Started*, Application Note 1333-4, P/N 5988-5412EN

For further information go to:
www.agilent.com/find/esa
www.agilent.com/find/bluetooth

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(fax) (82 2) 2004 5115
Latin America:
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(fax) (305) 269 7599
Taiwan:
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(fax) 0800 286 331
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