

# Agilent ESA-L Series Spectrum Analyzers

Product Overview

When speed and accuracy  
count as much as your budget

**Expanded to 3 and 26.5 GHz!**



**Agilent Technologies**

Innovating the HP Way



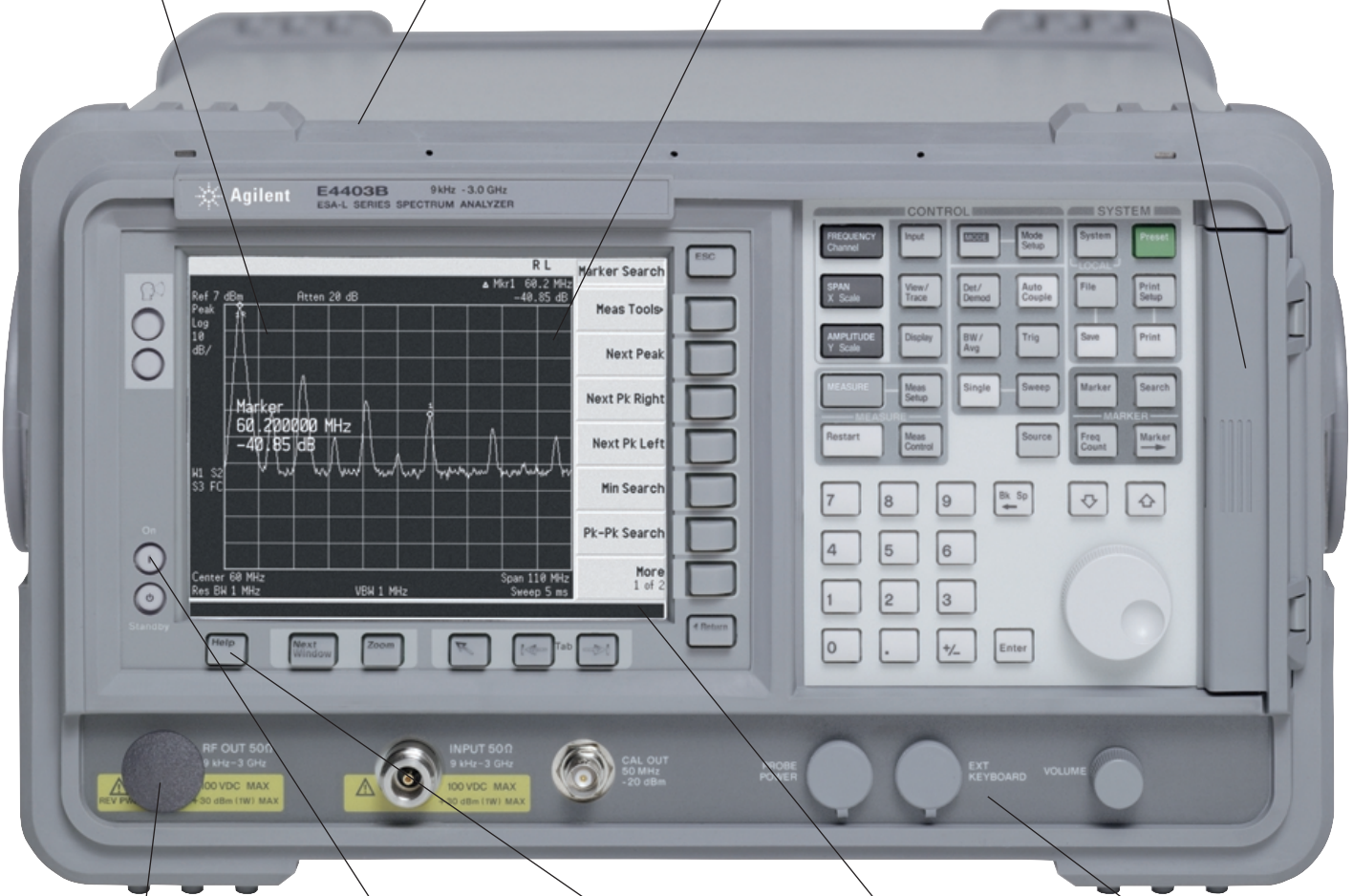
# Speed, accuracy, affordability

High-resolution, high-contrast monochrome display makes viewing multiple traces easy.

Rugged package with rubber-encased frames resists transportation stresses.

Automatic background alignment helps eliminate calibration worries.

Disk drive provides PC compatibility and data archiving.



Built-in tracking generator provides an RF source for scalar network analysis (optional).\*

Full measurement specifications after just a five minute warm-up.

Help key quickly communicates hardkey/softkey functions on screen.

4ms sweep time and virtual real-time display update for easier circuit tuning.

Weather-resistant front panel allows operation in tough environments.

\* These options are available for an additional charge.

# Designed for performance measurements

**Your budget is limited – your test equipment doesn't have to be.**

Now you can get the speed and accuracy you need and still have money left in your budget. The Agilent ESA-L series portable spectrum analyzers have a remarkable four-millisecond RF sweep time and virtual real-time measurement updates to the display or through GPIB interface. With excellent accuracy and easy, reliable operation, the ESA-L series is full of innovations, such as continuously phase-locked synthesizer, all at a surprisingly low cost.

- **Fast measurements**
- **Accurate results**
- **Rugged and reliable**
- **Quick and easy to use**

Available frequency ranges



## Specification summary

|   | Frequency range<br>9 kHz to: | Frequency accuracy<br>(at 1 GHz) | Phase noise<br>(10 kHz offset) | Residual FM             | Resolution bandwidth<br>range | Maximum amplitude<br>range         | Overall amplitude<br>accuracy | Maximum dynamic<br>range<br>(2 <sup>nd</sup> /3 <sup>rd</sup> order) | Measurement<br>rate<br>(characteristic) |
|---|------------------------------|----------------------------------|--------------------------------|-------------------------|-------------------------------|------------------------------------|-------------------------------|--|---|
| <b>E4411B</b><br><b>E4403B</b><br><b>E4408B</b> | 1.5 GHz<br>3 GHz<br>26.5 GHz | ±2 kHz                           | ≤-90 dBc/Hz                    | ≤150 Hz<br>peak to peak | 1 kHz to<br>5 MHz             | -119<br>-117<br>-116<br>to +30 dBm | ±1.1 dB                       | ≥76 dB/83 dB<br>≥79 dB/83 dB<br>≥78 dB/82 dB                         | ≥28 updates/sec                         |

For complete specifications, see page 10. Ordering information is shown on page 13.

# ESA-L series features and benefits

## Performance<sup>1</sup>

|                                  |  |
|----------------------------------|--|
| 4-ms RF sweep time               | Combined with 28 measurements per second, provides virtual real-time updates. Responsive display makes circuit adjustment easier, while increasing the probability of intercepting intermittent signals. |
| High-speed data transfer (GPIB)* | Fast processing helps reduce measurement time in ATE environments (optional).  |
| Fully synthesized design         | Provides continuously phase-locked precision throughout the entire sweep. Improves frequency accuracy, stability, and measurement repeatability, eliminating drift.                                      |
| Amplitude correction             | Calibrates out frequency-related amplitude effects with built-in amplitude correction.   |
| Automatic background alignment   | Continuously calibrates the analyzer. Guarantees repeatability over changing temperatures.   |
| 85-dB calibrated display range   | Allows simultaneous display of large and small signals.  |
| Built-in tracking generator*     | Combines spectrum and scalar test capability in a single instrument (optional). Synthesized design eliminates tracking drift (E4411B only). One-button normalize function for quick setup.               |
| 5-dB step attenuator             | Optimizes distortion-free dynamic range.   |
| Built-in frequency counter       | With 1-Hz resolution, minimizes the need for an external frequency counter.  |

## Portability

|                                      |   |
|--------------------------------------|---|
| Fast warm-up                         | Provides full measurement accuracy after just five minutes.                       |
| Snap-on battery*                     | Eliminates the restrictions of power cords.                                       |
| Rubber-encased front and rear frames | Provides impact protection in the field.  |
| Rain-resistant front panel           | Combined with louvered air vents, allows operation in diverse weather conditions. |
| 12-Vdc power cable*                  | Allows direct operation from automotive and truck batteries.                      |

## Ease-of-use

|  |   |
|--|---|
| Large, monochrome VGA display with output  | 16.8 cm, high-resolution VGA monochrome display with wide viewing angle makes detailed observations easy. Includes 15-pin VGA rear output connector for external monitor.   |
| Parallel port*                             | Supports output to the most popular printers (optional).  |
| Disk drive                                 | Makes saving and moving measurement results to your PC quick and easy.  |
| One-button measurements                    | Save set-up and measurement time with adjacent channel power, occupied bandwidth, channel power, peaks table, and harmonics table features.   |
| AM demodulation                            | Combines with the built-in speaker for tune and listen applications.  |
| 200 trace or instrument state files        | Provides internal storage of measurement data and setups for future analysis or comparison.   |
| Marker functions                           | Provides digital resolution of measurement details through peak search, delta markers, marker table and carrier-to-noise ratio. Signal track keeps unstable signals centered on the screen while band power calculates total power between user-defined limits. |
| Softkey/hardkey interface                  | Provides a simple user interface while retaining access to sophisticated features.  |
| Built-in help button with function display | Eliminates carrying manuals into the field to determine keypad and softkey functions.   |
| Limit lines                                | Built-in-limit lines and pass/fail messages simplify testing.   |
| Built-in clock/calendar                    | Provides storage of time stamps and printed data.   |
| Automatic overload protection              | Protects RF input from overly large signals (only available on the 1.5 GHz E4411B).   |
| Automatic printer setup                    | Identifies connected printer models automatically.  |

**The ESA-L series now comes with a standard THREE-YEAR warranty!**

<sup>1</sup> For higher performance requirements, Agilent also offers the ESA-E series of spectrum analyzers. With its cardcage architecture, the ESA-E series is an investment in a flexible platform and a wider range of options, such as narrow-resolution bandwidth filters for viewing closely spaced signals and a built-in high-gain, low-noise preamplifier for better sensitivity measurements. For more information, order the ESA family literature shown on page 13.

\* These options are available for an additional charge.

# Eliminate measurement speed bottlenecks



With a combination of performance, speed and accuracy at an affordable price, the ESA-L series is ideal for manufacturing.

## Increase manufacturing throughput

Get real-time measurement feedback for circuit tuning and adjustment with up to 28 measurement updates per second and 4-millisecond RF sweep time.

Speed up manual or automated testing with built-in limits lines and easy-to-interpret pass/fail messages.

The ESA-L series is SCPI-compliant (Standard Commands for Programmable Instruments) and reduces test time by automating repetitive measurements using the GPIB interface and *VXIplug&play* drivers.



## Decrease training time

Save training time with the easy-to-use hardkey/softkey interface.

Reduce operator uncertainty with the easy-to-view, high-resolution digital display and numeric marker read-outs.

View large and small signals simultaneously on screen with 85-dB calibrated display range.

Enlarge the display by removing the softkey interface or connecting to an external VGA monitor.

## Increase measurement confidence and reliability

With  $\pm 1.1$  dB amplitude accuracy, the ESA-L series instruments are fully synthesized and phase locked over the entire sweep for frequency accuracy, stability and repeatability.

Automatic background alignment improves accuracy and offers continuous calibration to assure measurement accuracy.

The ESA-L series is manufactured in an ISO 9001-registered facility to Agilent's exacting standards.

# Easy, worry-free field measurements



Designed for field applications, the ESA-L series provides accurate performance in a wide variety of environments.

## Take lab-grade performance into the field

Get fully synthesized performance in a rugged portable package for lasting accuracy in tough environments.

Continuous background alignment provides accuracy over varying temperatures.

The Analyzer conforms to the environmental specifications of MIL-PRF-28800F class 3.

Built-in help eliminates need to carry manuals into the field.

## Calibrated field measurements in just FIVE minutes!

Easy-to-use, portable performance.

Snap-on rechargeable battery for up to 1.9 hours of cordless operation (optional).

12-Vdc power cable for running the analyzer on a vehicle battery (optional).

Built-in tracking generator and frequency counter means less equipment to carry (optional).

Flexible tilt handle for optimum viewing angles on the bench or floor.

Easy data transfer to a computer with built-in floppy disk drive.

## Research and development



### Verify your designs with confidence

The ESA-L series offers  $\pm 1.1$  dB amplitude accuracy,  $\pm 1\%$  span accuracy,  $\pm 2$  kHz frequency accuracy, and a continuously phase-locked synthesizer for stability and repeatability.

Transfer measurement results directly to your computer with the help of the Agilent EEsof Advanced Design System instrument link/driver or BenchLink Spectrum Analyzer software.

Sophisticated performance at a budget price eliminates the need to share analyzers.

Now you don't have to buy a high-priced spectrum analyzer to get advanced technology on every engineer's bench.

## Education

### Save money and stay competitive

For education, equip your students with fast, accurate spectrum analyzers, at an affordable price.

Fully synthesized digital design provides accurate and repeatable measurements.

Rugged design, such as the input overload protection available on the 1.5 GHz E4411B, guards against damage to the analyzer.

Easy-to-understand interface simplifies operation and aids access to more sophisticated functions.



Provide students with fast and accurate spectrum analysis while conserving your budget.



# ESA-L series – a whole product solution

The performance of the ESA-L series spectrum analyzer is only a small part of what you get from Agilent Technologies. Agilent strives to provide complete solutions that go beyond our customers' expectations. Only offers the depth and breadth of enhancements, software, services, connectivity, accessibility and support to help our customers reach their measurements objectives. Please contact us for more information.

## Pre-sales service

- Rentals, leasing, and financing
- Application engineering services
- Application notes
- Custom product modifications

## PC connectivity

- Floppy disk drive
- GPIB or RS232 interfaces
- *VXIplug&play* drivers
- BenchLink spectrum analyzer software
- EEsof Advanced Design System instrument link

## Post-sales support

- Standard three-year global warranty
- Worldwide call center and service center support network
- One-year calibration intervals
- Firmware upgrades downloadable from the Web
- PC-based calibration software



## Product and peripheral interfaces

- 8590-series/ESA programming conversion guide
- Printer support

## Software

- Programming examples on CD ROM
- SCPI (Standard Commands for Programmable Instruments)

## Training and access to information

- Factory service training
- Web-based support of frequently asked questions
- Manuals on CD ROM and on the Web
- User guides available in 9 languages

For the latest information on the ESA-L series see our Web page at: [www.agilent.com/find/esa](http://www.agilent.com/find/esa)

# Specifications

All specifications apply over 0 °C to +55 °C. The analyzer will meet its specifications five minutes after it is turned on, when the analyzer is within one year of calibration cycle, after two hours of storage within the operating temperature range, and Auto Align All is selected. *ITALICS* = supplemental information, characteristics, typical performance, or nominal values.

## Frequency specifications

### Frequency range

|        |                 |                      |
|--------|-----------------|----------------------|
| E4411B | 50 Ω            | 9 kHz to 1.5 GHz     |
|        | 75 Ω(Opt. 1DP)  | 1 MHz to 1.5 GHz     |
| E4403B |                 | 9 kHz to 3.0 GHz     |
| E4408B |                 | 9 kHz to 26.5 GHz    |
| Band   | LO harmonic = N |                      |
| 0      | 1               | 9 kHz to 3.0 GHz     |
| 1      | 1               | 2.85 GHz to 6.7 GHz  |
| 2      | 2               | 6.2 GHz to 13.2 GHz  |
| 3      | 4               | 12.8 GHz to 19.2 GHz |
| 4      | 4               | 18.7 GHz to 26.5 GHz |

### Frequency reference

|                       |   |
|-----------------------|---|
| Aging rate            | $\pm 2 \times 10^{-6}$ /year, $\pm 1.0 \times 10^{-7}$ /day, characteristic |
| Settability           | $\pm 5 \times 10^{-7}$  |
| Temperature stability | $\pm 5 \times 10^{-6}$  |

### Frequency readout accuracy

|                               |  |
|-------------------------------|--|
| (Start, Stop, Center, Marker) | $\pm(\text{frequency readout} \times \text{frequency reference error}^1 + 0.75\% \text{ of span} + 15\% \text{ of RBW} + 10 \text{ Hz} + 1 \text{ Hz} \times N^2)$ |
|-------------------------------|--|

### Marker frequency counter

|            |  |
|------------|--|
| Accuracy   | $\pm(\text{marker frequency} \times \text{frequency reference error}^1 + \text{counter resolution})$ |
| Resolution | Selectable from 1 Hz to 100 kHz  |

### Frequency span

|            |                       |
|------------|-----------------------|
| Range      | 0 Hz (zero span), and |
| E4411B     | 100 Hz to 1.5 GHz     |
| E4403B     | 100 Hz to 3.0 GHz     |
| E4408B     | 100 Hz to 26.5 GHz    |
| Resolution | 2 Hz x N <sup>2</sup> |
| Accuracy   | $\pm 1\%$ of span     |

### Sweep time

|                      |  |
|----------------------|--|
| Range                | 4 ms to 4000 sec.  |
| Accuracy             | $\pm 1\%$  |
| Sweep trigger        | Free Run, single, line, video, offset, delayed trigger, and external |
| Offset trigger range | $\pm 327 \text{ ms to } \pm 323 \text{ Ks}$                          |
| Sweep (trace) points | 401  |

### Resolution bandwidth

|          |                    |   |
|----------|--------------------|---|
| Range    | (-3 dB bandwidth)  | 1 kHz to 3 MHz in 1-3-10 sequence and 5 MHz |
|          | (-6 dB bandwidth)  | 9 kHz and 120 kHz                           |
| Accuracy |                    |   |
|          | 1 kHz to 3 MHz RBW | $\pm 15\%$                                  |
|          | 5 MHz RBW          | $\pm 30\%$                                  |

### Selectivity

|                            |                                 |
|----------------------------|---------------------------------|
| 60 dB/3 dB bandwidth ratio | <i>&lt;15:1, characteristic</i> |
|----------------------------|---------------------------------|

### Video bandwidth range

|                   |  |
|-------------------|--|
| (-3 dB bandwidth) | 30 Hz to 1 MHz in 1-3-10 sequence, 3 MHz, characteristic |
|-------------------|--|

### Stability

### Noise sidebands (1 kHz RBW, 30 Hz VBW and sample detector)E4411B

|  |  |
|--|--|
| $\geq 10 \text{ kHz offset from CW signal}$  | $\leq -90 \text{ dBc/Hz}$  |
| $\geq 20 \text{ kHz offset from CW signal}$  | $\leq -100 \text{ dBc/Hz}$   |
| $\geq 30 \text{ kHz offset from CW signal}$  | $\leq -102 \text{ dBc/Hz}$   |
| $\geq 100 \text{ kHz offset from CW signal}$ | $\leq -112 \text{ dBc/Hz}$   |
| E4403B, E4408B                               |  |
| $\geq 10 \text{ kHz offset from CW signal}$  | $\leq -90 \text{ dBc/Hz} + (20 \text{ Log } N^2 \text{ for frequencies } > 6.7 \text{ GHz})$ |
| $\geq 20 \text{ kHz offset from CW signal}$  | $\leq -98 \text{ dBc/Hz} + 20 \text{ Log } N^2$  |
| $\geq 30 \text{ kHz offset from CW signal}$  | $\leq -100 \text{ dBc/Hz} + 20 \text{ Log } N^2$   |
| $\geq 100 \text{ kHz offset from CW signal}$ | $\leq -112 \text{ dBc/Hz} + 20 \text{ Log } N^2$   |
| Residual FM                                  |  |
| 1 kHz RBW, 1 kHz VBW                         | $\leq 150 \text{ Hz peak-to-peak} \times N^2 \text{ in } 100 \text{ ms}$                     |
| System-related sidebands                     |  |
| $\geq 30 \text{ kHz offset from CW signal}$  | $\leq -65 \text{ dBc} + (20 \text{ Log } N^2 \text{ for frequencies } > 6.7 \text{ GHz})$    |

## Amplitude specifications

### Absolute amplitude accuracy

|   |  |
|---|--|
| Overall amplitude accuracy <sup>3</sup> | $\pm(0.6 \text{ dB} + \text{absolute frequency response})$ |
| 20 °C to 30 °C                          |  |
| At reference settings <sup>6</sup>      | $\pm 0.4 \text{ dB}$                                       |

### Measurement range

|   |                           |
|---|---------------------------|
| Displayed average noise level to maximum safe input level |                           |
| Input attenuator range                                    |                           |
| E4411B  | 0 to 60 dB, in 5 dB steps |
| E4403B, E4408B  | 0 to 65 dB, in 5 dB steps |

### Maximum safe input level

|   |                |
|---|----------------|
| Average continuous power                            |                |
| E4411B ( $\geq 15 \text{ dB attenuation}$ )         | +30 dBm (1W)   |
| E4403B, E4408B ( $\geq 30 \text{ dB attenuation}$ ) | +30 dBm (1W)   |
| Peak pulse power                                    |                |
| E4411B ( $\geq 15 \text{ dB attenuation}$ )         | +30 dBm (1W)   |
| E4403B, E4408B ( $\geq 30 \text{ dB attenuation}$ ) | +50 dBm (100W) |

### 1-dB gain compression (total power at input mixer)<sup>4,5</sup>

|        |                      |        |
|--------|----------------------|--------|
| E4411B | 0 dBm                |        |
| E4403B | 0 dBm                |        |
| E4408B |                      |        |
|        | 50 MHz to 6.7 GHz    | 0 dBm  |
|        | 6.7 GHz to 13.2 GHz  | -3 dBm |
|        | 13.2 GHz to 26.5 GHz | -5 dBm |

### Displayed average noise level

(Input terminated, 0 dB attenuation, sample detector, reference level = -70 dBm, 1 kHz RBW, 30 Hz VBW)

|                     |                    |                         |
|---------------------|--------------------|-------------------------|
| E4411B              |                    |                         |
|                     | 400 kHz to 10 MHz  | $\leq -115 \text{ dBm}$ |
|                     | 10 MHz to 500 MHz  | $\leq -119 \text{ dBm}$ |
|                     | 500 MHz to 1.0 GHz | $\leq -117 \text{ dBm}$ |
|                     | 1.0 GHz to 1.5 GHz | $\leq -113 \text{ dBm}$ |
| E4411B (Option 1DP) |                    |                         |
|                     | 1 MHz to 500 MHz   | $\leq -65 \text{ dBmV}$ |
|                     | 500 MHz to 1.0 GHz | $\leq -60 \text{ dBmV}$ |
|                     | 1.0 GHz to 1.5 GHz | $\leq -53 \text{ dBmV}$ |

<sup>1</sup> Frequency reference error = (aging rate x period of time since adjustment + settability + temperature stability).

<sup>2</sup> N = Harmonic mixing mode. N = 1 for E4411B and E4403B.

<sup>3</sup> For reference level 0 to -50 dBm: input attenuation, 10 dB; 50 MHz; RBW, 3 kHz; VBW, 3 kHz; log range 0 to 50 dB; sweep time coupled, signal input, 0 to -50 dBm; span,  $\leq -60 \text{ kHz}$ .

<sup>4</sup> Mixer Power Level (dBm) = Input Power (dBm) - Input Attenuator. (dB).

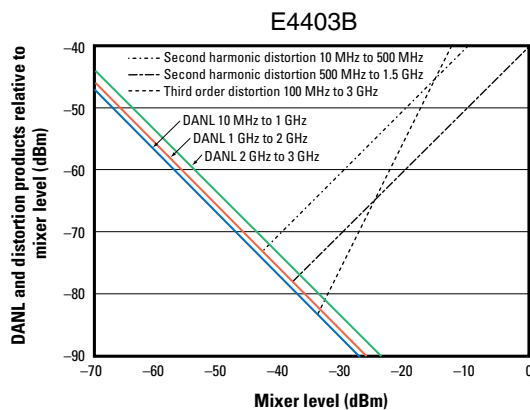
<sup>5</sup> For RBW  $\leq 30 \text{ kHz}$ , maximum input signal amplitude must be  $\leq$  reference level + 10 dB.

<sup>6</sup> Settings are: reference level -25 dBm for E4411B, -20 dBm for E4403B and E4408B; input attenuation 10 dB; center frequency 50 MHz; resolution bandwidth 3 kHz; video bandwidth 3 kHz; span 2 kHz; sweep time coupled; signal at reference level.

# Specifications, continued

|   |   |   |
|---|---|---|
| <b>E4403B</b>                                 | 10 MHz to 1.0 GHz   | ≤-117 dBm   |
|   | 1.0 GHz to 2.0 GHz  | ≤-116 dBm   |
|   | 2.0 GHz to 3.0 GHz  | ≤-114 dBm   |
| <b>E4408B</b>                                 | 10 MHz to 1.0 GHz   | ≤-116 dBm   |
|   | 1.0 GHz to 2.0 GHz  | ≤-115 dBm   |
|   | 2.0 GHz to 6.0 GHz  | ≤-112 dBm   |
|   | 6.0 GHz to 12.0 GHz   | ≤-110 dBm   |
|   | 12.0 GHz to 22.0 GHz  | ≤-107 dBm   |
|   | 22.0 GHz to 26.5 GHz  | ≤-101 dBm   |
| <b>Spurious responses</b>                     |   |   |
| Second harmonic distortion                    |   |   |
| <b>E4411B</b>                                 | 2 MHz to 750 MHz  | <-75 dBc for -40 dBm signal at input mixer <sup>1</sup>                           |
| <b>E4403B, E4408B</b>                         | 10 MHz to 500 MHz   | <-60 dBc for -30 dBm signal at input mixer <sup>1</sup>                           |
|   | 500 MHz to 1.5 GHz  | <-70 dBc for -30 dBm signal at input mixer <sup>1</sup>                           |
|   | 1.5 GHz to 2.0 GHz  | <-80 dBc for -10 dBm signal at input mixer <sup>1</sup>                           |
|   | 2.0 GHz to 13.25 GHz  | <-95 dBc for -10 dBm signal at input mixer <sup>1</sup>                           |
| Maximum achievable second order dynamic range |   |   |
|   | E4411B (at 1 GHz)   | 76 dB (+35 dBm S.H.I.)  |
|   | E4403B (at 1 GHz)   | 79 dB (+40 dBm S.H.I.)  |
|   | E4408B (at 1 GHz)   | 78 dB (+40 dBm S.H.I.)  |
| Third order intermodulation distortion        |   |   |
| <b>E4411B</b>                                 | 10 MHz to 1.5 GHz   | <-75 dBc for two -30 dBm signals at input mixer <sup>1</sup> , >50 kHz separation |
| <b>E4403B, E4408B</b>                         | 100 MHz to 6.7 GHz  | <-75 dBc for two -30 dBm signals at input mixer <sup>1</sup> , >50 kHz separation |
|   | 6.7 GHz to 26.5 GHz   | <-70 dBc for two -30 dBm signals at input mixer <sup>1</sup> , >50 kHz separation |
| Maximum achievable third order dynamic range  |   |   |
|   | E4411B (at 1.0 GHz)   | 83 dB (+7.5 dBm T.O.I.)   |
|   | E4403B (at 1.0 GHz)   | 83 dB (+7.5 dBm T.O.I.)   |
|   | E4408B (at 1.0 GHz)   | 82 dB (+7.5 dBm T.O.I.)   |
| Other input-related spurious                  |   |   |
| <b>E4411B</b>                                 | <-65 dBc, 30 kHz ≤ offset ≤ 1.2 GHz, for -20 dBm signal at input mixer <sup>1</sup> |   |
| <b>E4403B, E4408B</b>                         | <-65 dBc, >30 kHz offset, for -20 dBm signal at input mixer <sup>1</sup>            |   |

|  |                       |   |
|--|-----------------------|---|
| <b>Residual responses</b>  |                       |   |
| Input terminated and 0 dB attenuation  |                       | <-90 dBm  |
| <b>Display range</b>   |                       |   |
| Log scale  |                       | 0 to -85 dB from reference level is calibrated; 0.1, 0.2, 0.5 dB/division and 1 to 20 dB/division in 1 dB steps; ten divisions displayed. |
| Linear scale   |                       | 10 divisions  |
| Scale units  |                       | dBm, dBmV, dBμV, V, W, and Hz   |
| <b>Marker readout resolution</b>   |                       |   |
| Log scale  |                       | 0.04 dB   |
| Linear scale   |                       | 0.01% of reference level  |
| <b>Reference level</b>   |                       |   |
| Range  |                       | -149.9 dBm to maximum mixer level + attenuator setting  |
| Resolution   |                       |   |
| Log scale  |                       | ±0.1 dB   |
| Linear scale   |                       | ±0.12% of reference level   |
| Accuracy (at a fixed frequency, a fixed attenuation, and referenced to -35 dBm)                    |                       |   |
| Reference level - input attenuator setting   |                       |   |
| -10 dBm to > -60 dBm   |                       | ±0.3 dB   |
| -60 dBm to > -85 dBm   |                       | ±0.5 dB   |
| -85 dBm to > -90 dBm   |                       | ±0.7 dB   |
| <b>Frequency response</b> (10 dB attenuation, 20 °C to 30 °C)                                      |                       |   |
|  | Absolute <sup>2</sup> | Relative <sup>3</sup>   |
| 9 kHz to 3.0 GHz   | ±0.5 dB               | ±0.5 dB   |
| 3.0 GHz to 6.7 GHz   | ±1.5 dB               | ±1.3 dB   |
| 6.7 GHz to 26.5 GHz  | ±2.0 dB               | ±1.8 dB   |
| <b>Resolution bandwidth switching uncertainty</b><br>(Referenced to 1 kHz RBW, at reference level) |                       |   |
| 3 kHz to 3 MHz RBW   |                       | ±0.3 dB   |
| 5 MHz RBW  |                       | ±0.6 dB   |
| <b>Linear to log switching</b>   |                       |   |
|  |                       | ±0.15 dB at reference level   |
| <b>Display scale fidelity</b>  |                       |   |
| Log maximum cumulative   |                       |   |
| 0 to -85 dB from reference level   |                       | ±(0.3 dB + 0.01 x dB from reference level)  |
| Log incremental accuracy   |                       |   |
| 0 to -80 dB from reference level   |                       | ±0.4 dB/4 dB  |
| Linear accuracy  |                       | ±2% of reference level  |



## General specifications

|  |  |               |               |
|--|--|---------------|---------------|
| <b>Measurement speed (characteristic)</b>              |  |               |               |
| Local measurement and display update rate <sup>4</sup> | <b>E4411B</b>  | <b>E4403B</b> | <b>E4408B</b> |
|  | ≥35/sec  | ≥30/sec       | ≥28/sec       |
| Remote measurement and GPIB transfer rate <sup>5</sup> | ≥30/sec  | ≥30/sec       | ≥30/sec       |
| RF center frequency <sup>6</sup> tuning time           | ≤90ms  | ≤90ms         | ≤90ms         |
| <b>Temperature range</b>                               |  |               |               |
| Operating  | 0 °C to +55 °C   |               |               |
| Storage  | -40 °C to +75 °C   |               |               |
| Disk drive   | 10 °C to 40 °C   |               |               |
| <b>EMI compatibility</b>                               |  |               |               |
|  | Conducted and radiated emission is in compliance with CISPR Pub. 11/1990 Group 1 Class A |               |               |

<sup>1</sup> Mixer power level (dBm) = Input power (dBm) - Input attenuator. (dB).  
<sup>2</sup> Referenced to amplitude at 50 MHz.  
<sup>3</sup> Referenced to midpoint between highest and lowest frequency response deviations.  
<sup>4</sup> Autoalign Off, fixed center frequency, factory preset, RBW = 1 MHz, stop frequency ≤ 3 GHz, span > 10 MHz and ≤ 600 MHz (E4411B: span > 102 MHz and ≤ 400 MHz)  
<sup>5</sup> Display Off, factory preset, fixed center frequency, single sweep, autoalign off, RBW = 1 MHz, stop frequency ≤ 3 GHz, span = 20 MHz, GPIB interface  
<sup>6</sup> Includes CF tuning + measurement + GPIB transfer time, stop frequency ≤ 3 GHz, factory preset, autoalign off, RBW = 1 MHz, span = 20 MHz, CF tune step size = 50 MHz

# Specifications, continued

## Audible noise (ISO 7779)

Sound pressure at 25 °C <40 dBA, (<5.3 Bels power)

## Power requirements

ac Voltage 90 to 132 Vrms, 195 to 250 Vrms  
 Frequency 47 to 440 Hz, 47 to 66 Hz  
 Power consumption, on <300 W  
 Power consumption, standby <5 W  
 dc Voltage 12 to 20 Vdc  
 Power consumption <200 W

## Weight (without options)

E4411B 13.2 kg (29.1 lb), characteristic  
 E4403B 15.5 kg (34.2 lb), characteristic  
 E4408B 17.1 kg (37.7 lb), characteristic

## Dimensions

Height 222 mm (8.75 in)  
 Width 373 mm (14.7 in) without handle  
 408 mm (16.1 in) with handle  
 Depth 409 mm (16.1 in) without handle  
 516 mm (20.3 in) with handle

## Data storage

Internal 200 traces or states, nominal

## Inputs/outputs

### Amplitude reference<sup>1</sup>

Internal  
 E4411B -25 dBm, nominal  
 E4411B, Option 1DP +28.75 dBmV, nominal  
 External, BNC (f)  
 E4403B, E4408B -20 dBm, nominal

### Front panel connectors

Input Type N (f), 50 Ω nominal  
 Option 1DP ( E4411B) BNC (f), 75 Ω nominal  
 Option BAB ( E4408B) APC 3.5 (m)  
 RF Out  
 Option 1DN Type N (f), 50 Ω nominal  
 Option 1DQ ( E4411B) BNC (f), 75 Ω nominal  
 Probe power, voltage/current +15 Vdc, -12.6 Vdc at 150 mA maximum  
 Speaker Front-panel knob controls volume  
 Headphone 3.5 mm (1/8 in) miniature audio jack  
 External keyboard 6-pin mini-din

### Rear panel connectors

10 MHz ref output BNC (f), 50 Ω, >0 dBm, characteristic  
 10 MHz ref input BNC (f), 50 Ω, -15 to +10 dBm, characteristic  
 External trigger input BNC (f), (5V TTL)  
 VGA output VGA compatible, 15-pin mini D-SUB, 640 x 480 resolution

### IF sweep and video ports (Option A4J)

Aux IF output BNC (f), 21.4 MHz, nominal -10 to -70 dBm (uncorrected), characteristic  
 Aux video out BNC (f), 0 to 1 V (uncorrected), characteristic  
 Hi swp in BNC (f), (5 V TTL)  
 Hi swp out BNC (f), (5 V TTL)  
 Swp out BNC (f), 0 to +10 V ramp, characteristic

### GPIB interface

Option A4H IEEE-488 bus connector

## Serial interface

Option 1AX 9-pin D-SUB (m), RS-232

## Parallel printer interface

Option A4H or 1AX 25-pin D-SUB (f), printer port only

## Tracking generator (Option 1DN and Option 1DQ)

### Output frequency range

E4411B 50 Ω (Opt. 1DN) 9 kHz to 1.5 GHz  
 E4411B 75 Ω (Opt. 1DQ) 1 MHz to 1.5 GHz  
 E4403B, E4408B (Opt. 1DN) 9 kHz to 3.0 GHz

### Output power level<sup>2</sup>

Range  
 E4411B 50 Ω 0 to -70 dBm (20 °C to 30 °C)  
 E4411B 75 Ω +42.75 to -27.25 dBmV  
 E4403B, E4408B 50 Ω -2 to -66 dBm  
 Vermier  
 E4411B  
 Range 10 dB  
 Output attenuator range 0 to 60 dB, 10 dB steps  
 E4403B, E4408B  
 Range 9 dB  
 Output attenuator range 0 to 56 dB, 8 dB steps

### Output power sweep<sup>2</sup>

Range  
 E4411B 50 Ω -15 dBm to 0 dBm - (source attenuator setting)  
 +27.76 dBmV to +42.76 dBmV - (source attenuator setting)  
 E4411B 75 Ω -10 dBm to -1 dBm - (source attenuator setting)  
 E4403B, E4408B 50 Ω

### Output flatness

E4411B 50 Ω (referenced to 50 MHz, 0 dB attenuation)  
 10 MHz to 1.5 GHz ±1.5 dB  
 E4411B 75 Ω (referenced to 50 MHz, 0 dB attenuation)  
 10 MHz to 1.5 GHz ±2 dB  
 E4403B, E4408B 50 Ω (referenced to 50 MHz, -20 dB signal level)  
 10 MHz to 3.0 GHz ±2 dB

### Spurious output

Harmonic spurs  
 E4411B, 50 Ω (0 dBm output), 75 Ω (+42.8 dBmV output)  
 20 MHz to 1.5 GHz <-25 dBc  
 E4403B, E4408B 50 Ω (-1 dBm output)  
 9 MHz to 3 GHz <-25 dBc

### Dynamic range

Maximum output power level - displayed average noise level

### Output tracking

E4411B  
 Drift No error  
 Swept tracking error No error for coupled sweep times  
 E4403B, E4408B  
 Drift 1.5 kHz/5 minutes, characteristic  
 Swept tracking error Usable in 1 kHz RBW after 5 minutes of warm up

### Output VSWR

E4411B <2.5:1, characteristic  
 E4403B, E4408B  
 0 dB attenuation <2.0:1, characteristic  
 >8 dB attenuation <1.5:1, characteristic

<sup>1</sup> Amplitude reference actual power might differ from the nominal value. Actual calibration power is stored internally.

<sup>2</sup> E4411B: 20 °C to 30 °C.

# Ordering information

- E4411B RF Spectrum Analyzer  
9 kHz to 1.5 GHz
- E4403B RF Spectrum Analyzer  
9 kHz to 3.0 GHz
- E4408B Microwave Spectrum Analyzer  
9 kHz to 26.5 GHz

## Options

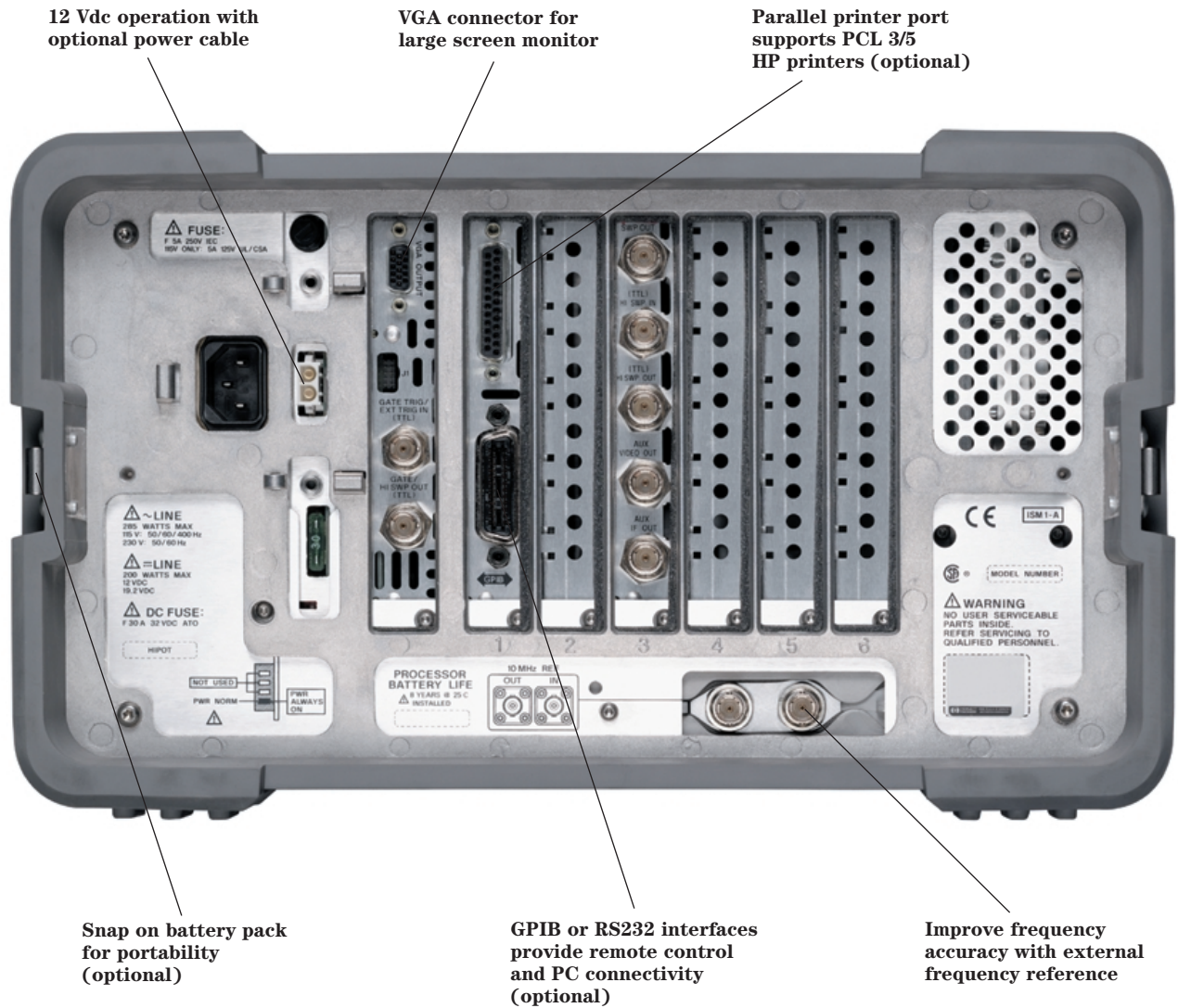
- A4H** GPIB and parallel (Centronics) interfaces  
(not compatible with Option 1AX)
- 1AX** RS-232 and parallel (Centronics) interfaces  
(not compatible with Option A4H)
- A4J** IF, sweep, and video ports
- BAB** APC 3.5mm input connector (E4408B only)
- 1DN** 50-Ohm tracking generator  
(9 kHz to 1.5 GHz for E4411B)  
(9 kHz to 3.0 GHz for E4403B and E4408B)
- 1DP** 75-Ohm input impedance  
(1 MHz to 1.5 GHz) E4411B only
- 1DQ** 75-Ohm tracking generator  
(1 MHz to 1.5 GHz) (requires Option 1DP)
- 1D7** 50 to 75-Ohm matching pad  
(type n (m) to BNC (f))
- A5D** 12-Vdc power cable
- AYT** Soft operating/carrying case (grey)
- AYU** Soft operating/carrying case (yellow)
- AXT** Hard transit case
- UK9** Front-panel protective cover
- 1CP** Rack-mount kit with handles and slides
- 0B0** Deletes printed manuals (retains  
CD-ROM manuals)
- 0BV** Component level service documentation
- 0B1** Additional user and calibration guides
- 0BW** Assembly-level service guide
- UK6** Commercial calibration certificate with data
- 8ZE** Refurbished spectrum analyzer (as available)
- W32** Three-year calibration
- W50/52** Additional two-year service and support/  
five-year calibration

## Accessories

- C2950A** Parallel printer cable (2 meter)
- 10833A** GPIB cable (1 meter)
- 24542U** RS-232 cable (3 meter, 9 pin  
F to 9 pin F) (for serial 9 pin  
PC connection to analyzer)
- 24542G** RS-232 cable (3 meter, 25 pin M  
to 9 pin F) (for serial 25 pin PC  
or printer connection to analyzer)
- 24542M** RS-232 cable (3 meter, 25 pin M  
to 9 pin F) (for serial 25 pin modem  
connection to analyzer)
- 87405A** Preamplifier (10 MHz to 3 GHz,  
24 dB gain) (fastened to RF input,  
powered from analyzer)
- 85905A** 75 Ohm preamplifier (45 MHz to  
1 GHz, 20 dB gain) (powered  
from analyzer)
- 41800A** Active probe (5 Hz to 500 MHz)
- 85024A** High frequency active probe  
(300 kHz to 3 GHz)
- E1779A** Battery pack
- E4444A** BenchLink Spectrum Analyzer  
software (PC image and data  
transfer)
- VXIplug&play** instrument drivers available via the  
World Wide Web at:  
[http://www.agilent.com/find/inst\\_drivers](http://www.agilent.com/find/inst_drivers)  
(Click on *VXIplug&play* universal  
instrument drivers.)

## Literature

- ESA Self-Guided demo 5968-3658E
- Spectrum Analysis Basics, AN 150 5952-0292
- ESA-E series  
spectrum analyzer brochure 5968-3278E
- ESA-E series specifications 5968-3386E
- 8560 EC-series  
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- E4444A BenchLink  
spectrum analyzer product overview 5966-0676E
- E1779A rechargeable battery pack 5966-1851E
- ESA cable TV service and  
installation analyzer product overview 5980-0845E





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