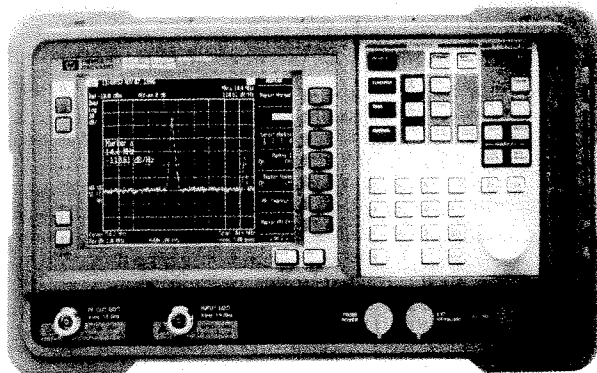


- Frequency range of 9 kHz to 1.5 GHz
- Frequency accuracy of ± 2.0 kHz at 1 GHz (without temperature)
- 5 minute warmup
- Rugged, portable package follows you from lab, to factory, to field



HP ESA-L1500A

HP ESA-L1500A 1.5 GHz Portable Spectrum Analyzer

NEW

HP introduces the ESA-L1500A, our new, low-cost, fully synthesized spectrum analyzer. Now get quick and accurate results every time, at an affordable price. It has the performance of a high-quality spectrum analyzer and the rugged ease of use expected in a field instrument.

Fast measurements

The HP ESA-L1500A gives you a rapid display update rate and state-of-the-art 5 ms sweep time that reduces test time and increases throughput.

Accurate results

The phase-locked synthesizer adds stability and repeatability to frequency measurements, and the automatic background alignment offers continuous calibration. Plus, you'll have specified performance only 5 minutes after power-up.

Reliable operation

Increase your manufacturing up-time: costly repairs can be avoided with the automatic input overload protection, and the use of component integration reduces the probability of failure.

Rugged packaging and construction

Ideal for field environments, the HP ESA-L1500A has a sealed front panel, louvered air vents, and side-mounted fan to protect the instrument in a wide range of weather conditions. Rubber-encased front and rear frames resist the rigors of transportation.

Easy to use

The combination hard key/soft key front panel offers simple operation for basic measurements while providing access to sophisticated features. In addition, testing is simplified with built-in limit lines and pass/fail messages.

Low cost

All this at a very affordable price.

PC Software for the ESA-L1500A

The new HP BenchLink Spectrum Analyzer PC software provides an easy-to-use communications link between your PC and the HP ESA-L1500A spectrum analyzer. Taking full advantage of the Windows® interface, you can easily transfer screen images or trace data via HP-IB or RS-232 interfaces, thereby making it easy to capture, analyze, and document measurement results in your PC. For more information, see page 231.

Specifications

Frequency

Frequency Range

50 ohms: 9 kHz to 1.5 GHz

75 ohms (Option 1DP): 1 MHz to 1.5 GHz

Frequency Reference

Aging: $\pm 2 \times 10^{-6}$ /year

Stability: $\pm 0.5 \times 10^{-6}$

Temperature Stability: $\pm 5 \times 10^{-6}$

Frequency Readout Accuracy

(Start, Stop, Center, Marker): \pm (frequency readout x frequency reference error¹ + span accuracy + 20% of RBW)

Marker Frequency Counter

Resolution: Selectable from 1 Hz to 100 kHz

Accuracy: \pm (marker frequency x frequency reference error¹ + counter resolution)

Frequency Span

Range: 0 Hz (zero span), 100 Hz to 1.5 GHz

Resolution: Four digits or 2 Hz, whichever is greater

Accuracy: $\pm 1\%$ of span

Sweep Time

Range: 5 ms to 2000 s

Accuracy (5 ms to 2000s): $\pm 1\%$

Sweep Trigger: Free Run, Single, Line, Video, External

Resolution Bandwidth

Range (-3 dB width): 1 kHz to 3 MHz, in 1-3-10 sequence.

5 MHz, characteristic

Accuracy (1 kHz to 3 MHz RBW): $\pm 20\%$

Shape (1 kHz to 3 MHz RBW): Approximately Gaussian shape

Selectivity (1 kHz to 3 MHz RBW) (60 dB/3 dB bandwidth ratio):

< 15:1, characteristic

Video Bandwidth (-3 dB)

Range: 30 Hz to 1 MHz in 1-3-10 sequence. 3 MHz, characteristic.

Stability (noise sidebands, offset from CW signal with 1 kHz RBW, 30 Hz VBW and sample detector)

≥ 10 kHz: ≤ -90 dBc/Hz

≥ 20 kHz: ≤ -98 dBc/Hz

≥ 30 kHz: ≤ -102 dBc/Hz

≥ 100 kHz: ≤ -112 dBc/Hz

Residual FM

1 kHz RBW, 1 kHz VBW: ≤ 100 Hz peak-to-peak in 100 ms

System-Related Sidebands, offset from CW signal:

≥ 30 kHz: ≤ -65 dBc

Amplitude

Measurement Range

50 ohms: -120 dBm to $+30$ dBm

75 ohms (Option 1DP): -65 dBmV to $+72$ dBmV

Input Attenuator Range: 0 to 60 dB, in 5 dB steps

Maximum Safe Input Level (Input attenuator setting ≥ 15 dB)

Average Continuous Power: $+30$ dBm (1 W); $+72$ dBmV (0.2 W)

for 75 Ω (Option IDP)

Peak Pulse Power: $+30$ dBm (1 W); $+72$ dBmV (0.2 W)

for 75 Ω (Option IDP)

dc: 100 Vdc

1 dB Gain Compression: Total power at input mixer²: 0 dBm;

75 Ω (Option 1DP): $+54$ dBmV

Displayed Average Noise Level (Input terminated, 0 dB attenuation, 30 Hz VBW, sample detector, 1 kHz RBW)

400 kHz to 1 MHz: ≤ -118 dBm

1 MHz to 500 MHz: ≤ -120 dBm

500 MHz to 1.2 GHz: ≤ -116 dBm

1.2 GHz to 1.5 GHz: ≤ -113 dBm

75 Ω (Option 1DP):

1 MHz to 500 MHz: ≤ -65 dBmV

500 MHz to 1 GHz: ≤ -61 dBmV

1 GHz to 1.5 GHz: ≤ -55 dBmV

Display Range

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: ten divisions

Scale Units: dBm, dBmV, dB μ V, V, and W

Frequency Response (Relative to 50 MHz, 9 kHz to 1.5 GHz)

10 dB attenuation

20 to 30° C: ± 0.75 dB

0 to 55° C: ± 1.0 dB

0 dB, 5 dB, 15 to 60 dB atten.: ± 1.0 dB, characteristic

Input Attenuation Switching Uncertainty at 50 MHz

0 dB to 5 dB attenuation: ± 0.3 dB

10 dB attenuation: Reference

15 dB attenuation: ± 0.3 dB

20 to 60 dB attenuation: $\pm (0.1$ dB + $0.01 \times$ attenuator setting)

Signal Analyzers

Spectrum Analyzers, Portable

HP ESA-
L1500A

Absolute Amplitude Accuracy at reference settings³: ± 0.3 dB

RF Input VSWR (characteristic)

9 kHz to 1.5 GHz (50 ohms) or 1 MHz to 1 GHz (75 ohms (Option 1DP)):

0 to 5 dB attenuation: 1.55:1

10 to 60 dB attenuation: 1.35:1

1 GHz to 1.5 GHz (75 ohms):

0 to 60 dB attenuation: 2.0:1

Resolution Bandwidth Switching Uncertainty (at reference level)

3 kHz RBW: Reference

1 kHz, 10 kHz to 3 MHz RBW: ± 0.4 dB

Reference Level

Range: Adjustable over amplitude measurement range

Resolution

Log Scale: ± 0.01 dB

Linear Scale: $\pm 0.12\%$ of reference level

Accuracy: (at a fixed frequency, a fixed attenuation, and referenced to -35 dBm + attenuation setting))

≥ -70 dBm + atten. setting: $\pm (0.3 \text{ dB} + 0.01 \times \text{absolute value}$

(ref level - atten. setting + 35 dBm))

< -70 dBm + atten. setting: $\pm (0.6 \text{ dB} + 0.01 \times \text{absolute value}$

(ref level - atten. setting + 35 dBm))

Accuracy, 75 Ω (Option 1DP) (at a fixed frequency, a fixed attenuation, and referenced to $+16.76$ dBmV + atten. setting))

≥ -21.24 dBmV + atten. setting: $\pm (0.3 \text{ dB} + 0.01 \times \text{absolute value}$

(ref level - atten. setting - 16.76 dBmV))

< -21.24 dBmV + atten. setting: $\pm (0.6 \text{ dB} + 0.01 \times \text{absolute value}$

(ref level - atten. setting - 16.76 dBmV))

Display Scale Switching Uncertainty

Linear to Log Switching: ± 0.25 dB at reference level

Log Scale Switching: No error

Display Scale Fidelity

Log Maximum Cumulative

0 to -85 dB from reference level: $\pm (0.3 \text{ dB} + 0.01 \times \text{dB from reference level})$

Log Incremental Accuracy

0 to -70 dB from reference level: ± 0.4 dB/4 dB

Linear Accuracy: $\pm 3\%$ of reference level)

Spurious Responses

Second Harmonic Distortion

2 MHz to 1.5 GHz: < -75 dBc for -40 dBm (+ 14 dBmV, 75 Ω)

signal at input mixer² + 35 dBm SHI (second harmonic intercept)

Third Order Intermodulation Distortion

2 MHz to 5 MHz: + 5 dBm (+ 59 dBmV, 75 Ω), characteristic TOI (third order intercept)

5 MHz to 1.5 GHz: < -74 dBc for two -30 dBm (+ 24 dBmV, 75 Ω)

signals at input mixer² and > 50 kHz: separation + 7 dBm

(+ 61 dBmV, 75 Ω) TOI

Other Input Related Spurious

30 kHz \leq offset ≤ 1200 MHz: < -65 dBc, for -20 dBm

(+ 34 dBmV, 75 Ω) signal at input mixer² ≤ 1.5 GHz

Residual Responses (Input terminated and 0 dB attenuation)

150 kHz to 1.5 GHz: < -90 dBm

1 MHz to 1.5 GHz (75 Ω): < -36 dBmV

AM Demod: Tune and listen to AM signals

¹ Frequency reference error = (aging rate x period of time since adjustment + settability + temperature stability)

² Mixer power level (dBm) = input power (dBm) - input attenuation (dB)

³ Settings are: reference level - 25 dBm; input attenuation 10 dB; center frequency 50 MHz; Res BW 3 kHz; video BW 10 kHz; scale linear; span 2 kHz; sweep time coupled, sample detector, signal at reference level

⁴ -16.24 dBmV if frequency is > 1 GHz and resolution bandwidth is 30 kHz.

Options

Tracking Generator Specifications (Option 1DN or 1DQ)

Output Frequency Range

50 Ω (Option 1DN): 9 kHz to 1.5 GHz

75 Ω (Option 1DQ): 1 MHz to 1.5 GHz

Residual FM

1 kHz RBW, 1 kHz VBW: ≤ 100 Hz peak-to-peak in 100 ms, characteristic

Output Power Level

Range

50 Ω (Option 1DN): 0 to -70 dBm

75 Ω (Option 1DQ): $+42.76$ to -27.24 dBmV

Resolution: 0.1 dB

Absolute Accuracy (at 50 MHz with coupled source attenuator):

50 Ω (Option 1DN): ± 0.5 dB, referenced to 0 dBm

75 Ω (Option 1DQ): ± 0.5 dB, referenced to $+42.76$ dBmV

Vernier

Range: 10 dB

Accuracy (with coupled source attenuator):

50 Ω (Option 1DN): ± 0.75 dB, for 0 to -10 dBm, referenced to 0 dBm

75 Ω (Option 1DQ): ± 0.75 dB, for $+42.76$ to $+32.76$ dBmV, referenced to $+42.76$ dBmV

Output Attenuator Range: 0 to 60 dB in 10 dB steps

Output Power Sweep

Range

50 Ω (Option 1DN): (-15 dBm to 0 dBm) - (source attenuator setting)

75 Ω (Option 1DQ): ($+27.76$ to $+42.76$ dBmV) - (source attenuator setting)

Resolution: 0.1 dB

Accuracy (zero span): < 1.5 dB peak-to-peak

Output Flatness (referenced to 50 MHz, 0 dB attenuator)

9 kHz to 10 MHz (50 Ω) and 1 MHz to 10 MHz (75 Ω): ± 2 dB

10 MHz to 1.5 GHz: ± 1.5 dB

Spurious Outputs

50 Ω (Option 1DN), 0 dBm output, 9 kHz to 1.5 GHz;

75 Ω (Option 1DQ), $+42.76$ dBmV output, 1 MHz to 1.5 GHz

Harmonic Spurs: < -25 dBc

Non-Harmonic Spurs: < -35 dBc

Dynamic Range

50 Ω (Option 1DN):

400 kHz to 1 MHz: ≥ 118 dB

1 MHz to 500 MHz: ≥ 120 dB

500 MHz to 1.2 GHz: ≥ 116 dB

1.2 GHz to 1.5 GHz: ≥ 113 dB

75 Ω (Option 1DQ):

1 MHz to 500 MHz: ≥ 107.76 dB

500 MHz to 1 GHz: ≥ 103.76 dB

1 GHz to 1.5 GHz: ≥ 97.76 dB

Output Tracking

Drift: No error

Swept Tracking Error: No error for coupled sweep times

Output VSWR: $< 2.5:1$, characteristic

General

Temperature Range

Operating: 0°C to $+55^\circ\text{C}$

Storage: -40°C to $+75^\circ\text{C}$

Audible Noise (ISO 7779)

Sound pressure at 25°C : < 33 dB (< 4.8 Bels power)

Military Specification: Has been type tested to the environmental specifications of MIL-PRF-28800F Class 3

EMI Compatibility: Conducted and radiated emission is in compliance with CISPR Pub.11/1990 Group 1 Class A

Power Requirements (Uses CUKonverter[®] topology in the power supply)

Voltage: 90 to 250 Vac rms

Frequency: 47 to 440 Hz

Power Consumption, On: < 200 W

Power Consumption, Standby: < 5 W

Weight (without options)

Net: 12.3 kg (27 lb), characteristic

Shipping: 25 kg (55 lb), characteristic

Dimensions

Height: 222 mm (8.75 in)

Width: 373 mm (14.7 in) w/o handle, 408 mm (16.1 in) w/handle

Depth: 409 mm (16.1 in) w/o handle, 516 mm (20.3 in) w/handle

Inputs and Outputs

Internal

50 MHz oscillator

Frequency: 50 MHz
Frequency Accuracy: Frequency reference error¹
Amplitude: -27 dBm, nominal (+ 24.8 dBmV, nominal for 75 Ω)

Front Panel

Input

Connector/Impedance: Type N (f), 50 ohm, nominal; BNC (f), 75 ohm, nominal (Option 1DP)

RF Out

Option 1DN, Connector/Impedance: Type N (f), 50 ohm, nominal
Option 1DQ, Connector/Impedance: BNC (f), 75 Ω, nominal

Probe Power

Voltage/Current: +15 Vdc, -12.6 Vdc at 150 mA max., characteristic

Ext. Keyboard: 6-pin mini-DIN, PC keyboards

Speaker: Front-panel knob controls volume

Headphone: 3.5-mm (1/8 inch) miniature audio jack

Rear Panel

10 MHz Ref Out: BNC (f), 50 ohm, > 0 dBm, characteristic

10 MHz Ref In: BNC (f), -15 to +10 dBm, characteristic

Ext. Trig In: BNC (f), (5 V TTL)

Hi Swp Out: BNC (f), (5 V TTL)

VGA Output: VGA-compatible monitor, 15-pin mini D-SUB, (31.5 kHz horizontal, 60 Hz vertical sync rates, non-interlaced)

Analog RGB, Resolution: 640 x 480

Aux IF Out (Option A4J): BNC (f), 21.4 MHz, nominal (-10 to -70 dBm (uncorrected), characteristic

Aux Video Out (Option A4J): BNC (f), 0 to 1 V (uncorrected), characteristic

Hi Swp in (Option A4J): BNC (f), low stops sweep, (5 V TTL)

Hi Swp out (Option A4J): BNC (f), (5 V TTL)

Swp Out (Option A4J): BNC (f), 0 to +10 V ramp, characteristic

HP-IB Interface (Option A4H): IEEE-488 bus connector

Serial Interface (Option 1AX): RS-232, 9-pin D-SUB

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

¹ Frequency reference error = (aging rate x period of time since adjustment + settability + temperature stability)

Key Literature

HP ESA-L1500A 1.5 GHz Portable Spectrum Analyzer, Product Overview p/n 5965-6309E

Ordering Information

| HP ESA-L1500A (E4411A) 9 kHz to 1.5 GHz Portable Spectrum Analyzer | Price |
|---|---------|
| Opt A4H HP-IB and parallel (Centronics) interfaces (cannot combine with Option 1AX) | \$250 |
| Opt 1AX RS-232 and parallel (Centronics) interfaces (cannot combine with Option A4H) | \$250 |
| Opt A4J IF, Sweep, and Video Ports | \$175 |
| Opt 1DN 50 Ohm Tracking Generator (9 kHz to 1.5 GHz) | \$3,000 |
| Opt 1DP 75 Ohm Input Impedance (1 MHz to 1.5 GHz) | \$0 |
| Opt 1DQ 75 Ohm Tracking Generator (1 MHz to 1.5 GHz) (requires Option 1DP) | \$3,000 |
| Opt A5D 12 Vdc power cable for operating directly from 12 to 20 Vdc power sources such as automotive batteries. 4 m long. | \$135 |
| Opt 1D7 50 to 75 Ohm matching pad (type N(m) to BNC (f)) | \$100 |
| Opt UK9 Front panel protective cover | \$100 |
| Opt 1CP Rackmount kit with handles and slides | \$400 |
| Opt OB1 Additional user and calibration guides | \$90 |
| Opt OBX Assembly level service guide and schematics | \$225 |
| Opt UK6 Commercial calibration certificate with data | \$250 |
| Opt OB0 Delete manuals | \$90 |

Accessories

| | |
|---|---------|
| HP DeskJet 340 (C2655A) portable monochrome/color printer | \$365 |
| HP DeskJet 400 (C2642A) monochrome/color printer | \$223 |
| HP DeskJet 680C (C4549A) color printer | \$323 |
| HP DeskJet 690C (C4562A) color printer | \$332 |
| HP DeskJet 693C (C4589A) color printer | \$332 |
| HP DeskJet 870C (C4565A, C4555A) color printer | \$480 |
| HP C2950A Parallel printer cable (2 meter) | \$14 |
| HP 10833A HP-IB cable (1 meter) | \$90 |
| HP 24542U RS-232 cable (3 meter, 9 pin F to 9 pin F) (for serial 9 pin PC connection to analyzer) | \$25 |
| HP 24542G RS-232 cable (3 meter, 25 pin M to 9 pin F) (for serial 25 pin PC or printer connection to analyzer) | \$45 |
| HP 24542M RS-232 cable (3 meter, 25 pin M to 9 pin F) (for serial 25 pin modem connection to analyzer) | \$45 |
| HP 87405A Preamplifier (10 MHz to 3 GHz, 24 dB gain) (fastened to RF input, powered from analyzer) | \$1,885 |
| HP 85905A 75 Ohm preamplifier (45 MHz to 1 GHz, 20 dB gain) (powered from analyzer) | \$418 |
| HP C1405B Keyboard | \$97 |
| HP 41800A Active probe (5 Hz to 500 MHz) | \$2,205 |
| HP 85024A High frequency active probe (300 kHz to 3 GHz) | \$2,650 |
| HP 85901A Portable AC power source | \$1,340 |
| HP 34397A DC-to-AC power inverter for operating ESA-L1500A from 11 to 15 Vdc power sources such as automotive batteries | \$163 |

HP E4444A BenchLink Spectrum Analyzer Software

NEW

HP BenchLink Spectrum Analyzer provides an easy-to-use communications link between your PC and the HP 856x, 859x* and ESA-L1500A spectrum analyzer families. HP BenchLink Spectrum Analyzer is a member of the HP BenchLink family of PC/basic instrument connectivity solutions, and takes full advantage of the Windows® interface to easily transfer screen images or trace data via HP-IB or RS-232 interfaces.

HP BenchLink Spectrum Analyzer makes it easy to capture, analyze, and document measurement results in your PC. HP has done all the programming for you.

You'll be able to transfer:

- Screen images—you can transfer a picture of the spectrum analyzer screen to your PC for viewing, annotation, storage, or printing. HP BenchLink Spectrum Analyzer provides convenient annotation tools, and Windows makes it easy to cut and paste your annotated image into other applications like word processing, presentation, and graphics packages or E-mail. You can also save your image in PCX, TIF, GIF, and BMP formats. You'll find documenting measurement results to be fast and simple.
- Trace data—HP BenchLink Spectrum Analyzer transfers the trace frequency/amplitude pairs of data from your spectrum analyzer to your PC for further review and analysis. Once the trace data is captured, you can use pan and zoom and trace markers in BenchLink to analyze the trace. Additionally, the frequency/amplitude pairs of trace data can be easily copied as comma-separated-values to spreadsheets or other analysis programs using files or the Windows clipboard.

The software runs on Windows® 3.1, Windows® 3.11, Windows® 95, and Windows NT® 4.0 and includes a complete context-sensitive on-line help system. System requirements are IBM PC compatible with at least 486-25 MHz processor, 8 MB ram, and 2 MB disk space available.

*The 8590 EM-series is not supported.

| Ordering Information | Price |
|---|-------|
| E4444A BenchLink Spectrum Analyzer Software | \$300 |