Test Equipment Solutions Datasheet

Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as spectrum analyzers, signal generators, oscilloscopes, power meters, logic analysers etc from all the major suppliers such as Agilent, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. As such, we fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 2 year warranty. Our staff have extensive backgrounds in T&M, totalling over 150 years of combined experience, which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, covering the cost of warranty returns BOTH ways (plus supplying a loan unit, if available) and supplying a free business tool with every order.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based near Heathrow Airport in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

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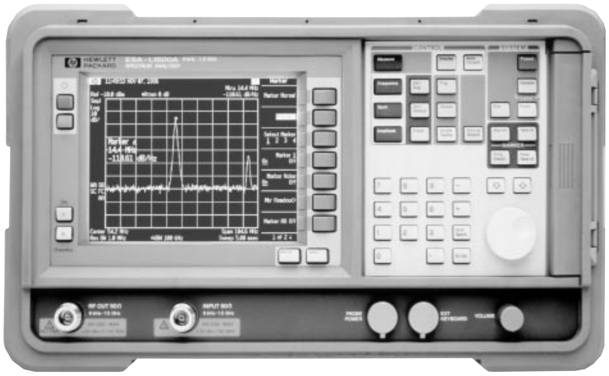
- Frequency range of 9 kHz to 1.5 GHz
- Frequency accuracy of ± 2.0 kHz at 1 GHz (without temperature)
- 5 minute warmup
- Rugged, portable package follows you from lab, to factory, to field



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 NEW

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: ± 2 x 10^{-6} /year
Settability: ± 0.5 x 10^{-6}
Temperature Stability: ± 5 x 10^{-6}

Frequency Readout Accuracy
(Start, Stop, Center, Marker): ± (frequency readout x frequency reference error[1] + span accuracy + 20% of RBW)

Marker Frequency Counter
Resolution: Selectable from 1 Hz to 100 kHz
Accuracy: ± (marker frequency x frequency reference error[1] + 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: ± 1% of span

Sweep Time
Range: 5 ms to 2000 s
Accuracy (5 ms to 2000s): ± 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): ± 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 mixer[2]: 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, dBμV, 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: ± (0.1 dB + 0.01 x attenuator setting)

HP ESA-L1500A

Absolute Amplitude Accuracy at reference settings[3]: ± 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: ± 0.12% of reference level
Accuracy: (at a fixed frequency, a fixed attenuation, and referenced to (–35 dBm + attenuation setting))
≥ –70 dBm + atten. setting: ± (0.3 dB + 0.01 x absolute value (ref level–atten. setting + 35 dBm))
< –70 dBm + atten. setting: ± (0.6 dB + 0.01 x 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[4] + atten. setting: ± (0.3 dB + 0.01 x absolute value [ref level–atten. setting–16.76 dBmV])
< –21.24 dBmV[4] + atten. setting: ± (0.6 dB + 0.01 x 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: ± (0.3 dB + 0.01 x dB from reference level)
Log Incremental Accuracy
0 to –70 dB from reference level: ± 0.4 dB/4 dB
Linear Accuracy: ± 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 mixer[2] + 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 mixer[2] and > 50 kHz: separation + 7 dBm (+ 61 dBmV, 75 Ω) TOI
Other Input Related Spurious
30 kHz ≤ offset ≤ 1200 MHz: < –65 dBc, for –20 dBm (+ 34 dBmV, 75 Ω) signal at input mixer[2] ≤ 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 IDQ): ± 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° C
Storage: –40 °C to + 75° 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 CUKonvertor® 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 error[1]
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 (⅛ 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
Opt A4H HP-IB and parallel (Centronics) interfaces (cannot combine with Option 1AX)
Opt 1AX RS-232 and parallel (Centronics) interfaces (cannot combine with Option A4H)
Opt A4J IF, Sweep, and Video Ports
Opt 1DN 50 Ohm Tracking Generator (9 kHz to 1.5 GHz)
Opt 1DP 75 Ohm Input Impedance (1 MHz to 1.5 GHz)
Opt 1DQ 75 Ohm Tracking Generator (1 MHz to 1.5 GHz) (requires Option 1DP)
Opt A5D 12 Vdc power cable for operating directly from 12 to 20 Vdc power sources such as automotive batteries. 4 m long.
Opt 1D7 50 to 75 Ohm matching pad (type N(m) to BNC (f))
Opt UK9 Front panel protective cover
Opt 1CP Rackmount kit with handles and slides
Opt 0B1 Additional user and calibration guides
Opt 0BX Assembly level service guide and schematics
Opt UK6 Commercial calibration certificate with data
Opt 0B0 Delete manuals

Accessories

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

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

E4444A BenchLink Spectrum Analyzer Software