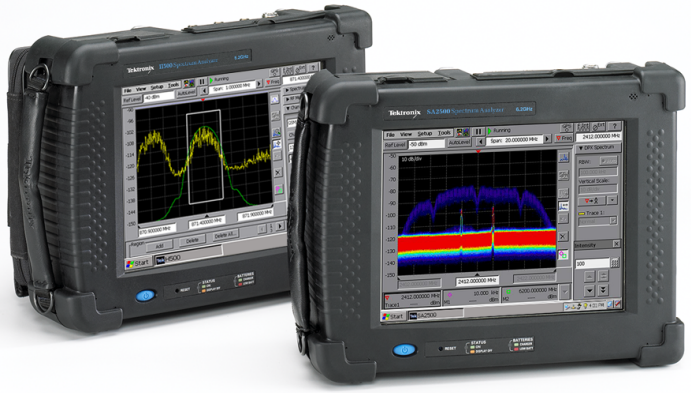
H500 / SA2500

Spectrum Analyzer Datasheet



The H500 and SA2500 will quickly scan the RF environment, classify the known signals, and help you locate the unknown signals with their field-proven signal hunting tools. Featuring real-time DPX™ Live RF spectrum display technology, the H500 and SA2500 offer practical solutions for discovering transient events that slip past conventional spectrum analyzers. The H500 and SA2500 are a great choice for general-purpose spectrum measurements and ideal signal-hunting tools.

Key features

- Scan
  - Revolutionary DPX™ Live RF spectrum display technology with DPX Spectrum Mask provides intuitive understanding of live RF signals using colors based on frequency of occurrence, processing up to 10,000 spectrums/sec with a 100% Probability of Intercept (POI) to capture pulsed signals, radar emissions, hopping signals, and any other intermittent signals with a minimum duration as brief as 125 µs
  - Benchtop spectrum analyzer performance in a ruggedized handheld battery-operated field unit offers better than 70 dB spurious free dynamic range (SFDR), guaranteed ≤ -95 dBc/Hz at 10 kHz offset phase noise specifications from 10 kHz to 6.2 GHz
  - Excellent sensitivity for detecting very low-level signals with -153 dBm DANL at 10 Hz RBW (equivalent to -163 dBm/Hz) such as RF bugs and unauthorized transmitters
  - LAN interface for remote control and unattended monitoring stations for spectrum awareness
- Classify
  - Built-in classification capability for WLAN, GSM, W-CDMA, CDMA, ATSC signals makes quick and simple identification of legitimate signals
  - Flexibility to edit, upgrade, and share signal databases and signal classification database using CSV file formats
  - Ability to export I/Q data into CSV, MATLAB®, and IQT format for additional post-analysis
- Locate
  - Rapid targeting of signals with field-proven signal hunting, mapping, and documentation tools
  - Hunt outdoor signals with built-in GPS receiver by plotting measurements directly into GPS geo-referenced maps such as Pitney Bowes Mapinfo, Google™ Earth, Microsoft® MapPoint®, Bitmap, and many others
  - Improved spectrum awareness with high-accuracy measurement synchronization and time stamping
  - Hunt in-building signals with a single-touch Tap-and-Walk-and-Tap interface
  - Backlit display, viewable in direct sunlight, and extended battery performance with hot-swappable dual batteries
  - Rugged design per MIL-PRF-28800F

Applications

- Spectrum management
- Spectrum monitoring and surveillance
- Interference detection and troubleshooting
- Signal hunting
- Signal identification
- Signal intelligence (SIGINT)
- Homeland Security

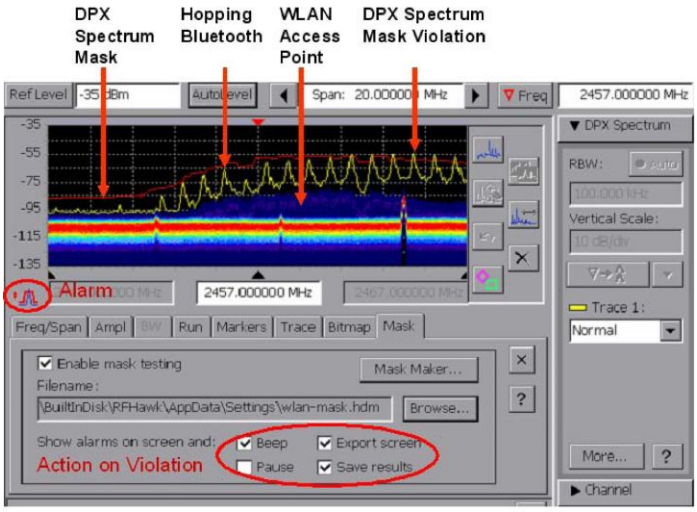
Interference troubleshooting has never been so easy

Evolving digital RF communication standards pose an unprecedented challenge to the surveillance and security community. Identification of unknown signals and determining their precise location has traditionally been accomplished using a combination of lab-grade spectrum analyzers, handheld spectrum analyzers, oscilloscopes, and offline analysis capabilities using PCs. When lab equipment is used in the field, several limitations appear. Such instruments are not meant for field use, can be easily damaged, are not portable, and require AC power. Signal classification using these systems often requires a lot of prior knowledge about these signals, particularly when they are digital. With such systems the unknown signals can be difficult or impossible to identify.

With field-ready, rugged hardware featuring DPX Live technology, outstanding displayed average noise level (DANL), spurious free dynamic range (SFDR), phase noise, and easy LAN networking capability in a handheld unit, the H500 and SA2500 are a great choice for general-purpose spectrum measurements and ideal signal-hunting tools.

Scan

By scanning the RF spectrum users can spot which signal emitters are in the area. Signals with significant power are usually candidates for further analysis, as are signals that are present infrequently. By color-coding events based on the rate of occurrence, the DPX™ Live RF spectrum display provides unparalleled insight into the behavior of signals. Performing 10,000 spectrum updates per second, transients as brief as 125 µs can be "frozen" in the frequency domain. This offers tremendous improvement over swept analysis techniques.



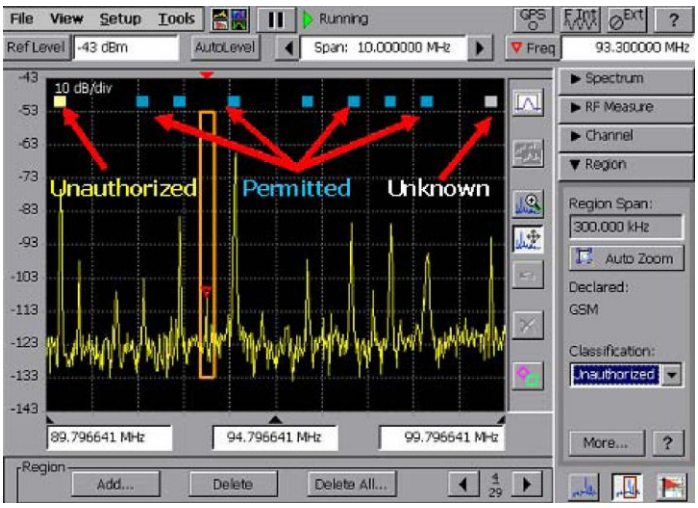
DPX Spectrum Mask captures and logs spectrum violations with options of warning alarm, pausing test, export screen, and result save

Signals that are present in the spectrum today but were not there yesterday are of particular interest. Reference signals can be stored and deviations from this reference can be quickly identified using the trace math feature. The H500 and SA2500 make analysis easier by quickly logging signals that are weak, bursting, hopping, time multiplexed, or intentionally random. It takes advantage of the FFT-based spectrum analysis capability to allow users to see the true shape of the signal, even when it is bursting. Masks can be automatically created from traces captured earlier. You can compare this mask to the current trace and if a mask violation occurs, the trace is logged. Finally, when the spectrogram is paused, you can scroll through the spectrogram's time axis and view the results.

Classify

Once signals of interest are found, it becomes necessary to identify and classify each of them. Are they authorized, legal signals, or are they illegitimate, malicious signals? Digital signal classification can be a particularly difficult part of the signal hunter's job requiring extensive knowledge of signal characteristics. The signal may be weak, subject to fading or intermittent conditions. In addition antenna position may be suboptimal. All of this makes classification of signals more challenging when using traditional signal identification tools.

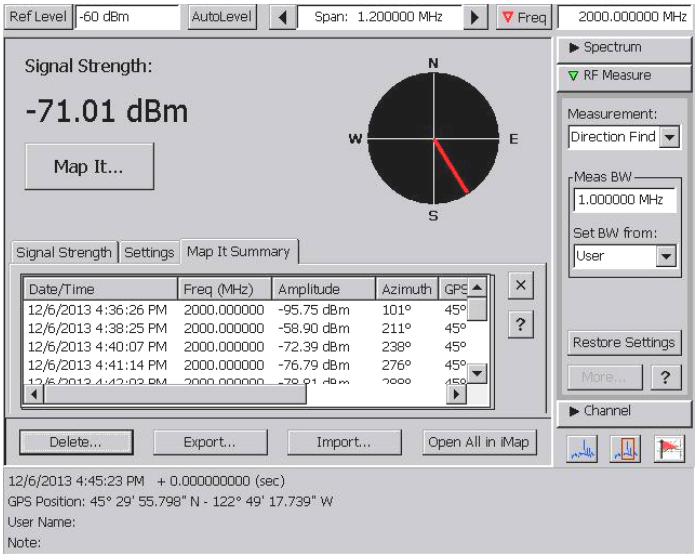
The H500 and SA2500 with Option EP2 offer expert systems guidance to aid the user in classifying signals. It provides graphical tools that allow users to quickly create a spectral region of interest, enabling users to identify and sort signals efficiently. The spectral profile mask, when overlaid on top of a trace, provides signal shape guidance while frequency, bandwidth, channel number, and location are displayed allowing for quick checks.



Color-coded signal classification database can be saved, recalled, imported, exported, and shared to keep track of spectrum activities at different locations

Locate

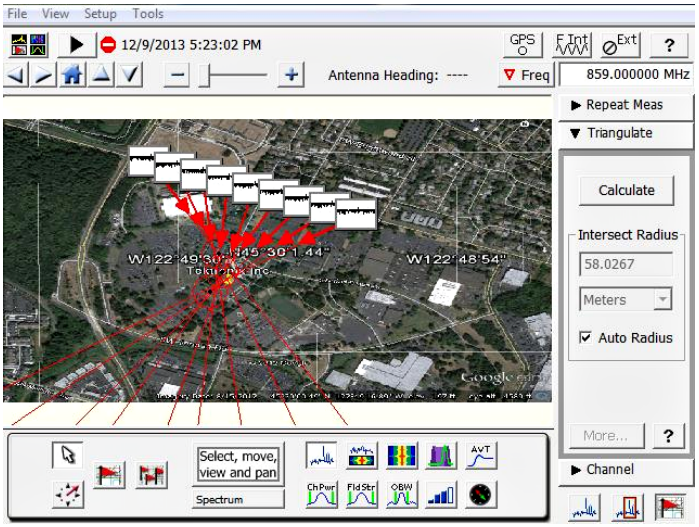
Once the signal has been identified as a threat, the H500 and SA2500 provide various field-proven signal hunting tools to locate the offending signals. For the easier-to-find signals, the signal strength meter produces tones that vary with pitch as a function of the strength of this signal. This allows the operator to look for signals while watching their surroundings, not the screen.



Use Direction Finding display - use compatible antennas and field strength measurements to find the likely directions to signals of interest. Results can be sent to the Mapping application for further geolocation analysis.

For signals that are harder to find, such as signals influenced by multipath, fading, low signal strength, etc, the H500 and SA2500 provide several signal mapping tools to facilitate hunting for these signals. Analyzing mapped signals is a quick way to find signals that can be difficult to find otherwise. The mapping capability is also a way to document what you have found. Traces can be recorded on a map either manually or automatically. Built-in GPS can automatically record signal position and time data as the operator moves. For indoor use, a unique tap-and-walk interface provides signal mapping capability. Color-coded icons automatically record the relevant measurements based on preset thresholds for acceptability.

Most importantly, new capabilities enable the H500 and SA2500 to use a 'smart' antenna with electronic compass bearing output to automatically add the antenna direction to measurement results. This includes compatibility with the Poynting DF-A0047 Direction Finding antenna through a USB connection.



Locate interference with integrated mapping solution and triangulate multiple measurements with resulting areas of uncertainty

The integrated iMap software in the SA2500 and H500 provides triangulation capability from 2 or more measurements. This includes automatically drawing a circle on all intersections from 2 or more measurements that are within a specified radius. Additionally, an azimuth measurement is included for the signal of interest. This can help easily locate interfering signals in the field.

Performance you can count on

Depend on Tektronix to provide you with performance you can count on. In addition to industry-leading service and support, this product comes backed by a one-year warranty as standard.

Specifications

All specifications apply to all models unless noted otherwise.

Model overview

Model	Real-time bandwidth	Frequency range	Minimum event duration for 100% POI	SFDR (typical)
SA2500	20 MHz	10 kHz - 6.2 GHz	125 µs [1] - 500 µs	<70 dB
H500	20 MHz	10 kHz - 6.2 GHz	125 µs	<70 dB

General performance characteristics

RF input

Operating frequency range
10 kHz - 6.2 GHz

Maximum operating input level
+20 dBm peak envelope power

This is the maximum input level at which the instrument will meet its performance specifications. For a signal without any amplitude variation, peak envelope power = rms.

Maximum Input Power without Damage
50 W_{rms} below 3.2 GHz

15 W_{rms} between 3.2 GHz and 6.2 GHz

IF output

Output impedence
50 Ω

IF center frequency
140 MHz

IF 3 dB bandwidth
24 MHz

IF Output Level (nominal performance at 0 dBm input)

Input frequency	IF output level
1 GHz	-12 dBm
1.6 GHz	-12 dBm
3.6 GHz	-10 dBm
4.35 GHz	-11 dBm
5 GHz	-16 dBm
5.75 GHz	-22 dBm

Internal timebase

Frequency error (factory calibration corrected)
±0.5 PPM from 0 °C to 50 °C

±1.0 PPM aging/year

Twenty-minute warm-up period required to meet accuracy specification

Frequency error (GPS corrected)
±0.01 ppm (typical)

Frequency error (after GPS lock loss)
±0.03 ppm, 10 minute interval after lock loss (unit operated for >20 minutes before lock loss and < 5 °C temperature change over interval) (typical)

1 With option EP1 installed

General performance characteristics

External reference input

impedance	1500 Ω
Frequencey range	1 MHz up to 20 MHz ± 1 PPM, in 1 MHz steps
Input level range	-15 dBm to +15 dBm, 1 MHz to 15 MHz
	-10 dBm to +15 dBm, 16 MHz to 20 MHz
	dBm levels assume 50 ohm source

Integrated GPS receiver

Position Accuracy (typical)	Horizontal: R < 9 meters (P = 90%)
	Altitude: H < 18 meters (P = 90%)
Position Update Rate (nominal)	1 update/sec (Latitude/Longitude/Altitude)

Spectrum analyzer characteristics

Frequency

Span	10 kHz to 6.2 GHz (preamp off)
	10 MHz to 6.2 GHz (preamp on)
Center frequency setting resolution	1 Hz

Swept spans (wide scanning)

Span Range	20 MHz to 6.2 GHz
Spectrums per second	61 (typical)
Scan Speed	1240 MHz per second (typical)

Resolution Bandwidth (RBW)

RBW Range	10 Hz to 3 MHz (Manual)
	10 Hz to 1 MHz (Auto)
RBW setting resolution	1 Hz

Spectral purity

Displayed average noise level, preamp On	-153 dBm, 10 MHz to 2 GHz, 10 Hz RBW
	-152 dBm, 2 GHz to 4 GHz, 10 Hz RBW
	-151 dBm, 4 to 5 GHz, 10 Hz RBW
	-145 dBm, 5 to 6.2 GHz, 10 Hz RBW
Phase noise (entire operating frequency range)	≤ -95 dBc/Hz at 10 kHz offset
	≤ -95 dBc/Hz at 20 kHz offset
	≤ -95 dBc/Hz at 30 kHz offset
	≤ -97 dBc/Hz at 100 kHz offset
	≤ -110 dBc/Hz at 1 MHz offset

Spectrum analyzer characteristics

Residual spurious, preamp Off	≤ -90 dBm, 0 dBm attenuator setting
	Exception Frequencies:
	9 MHz to 19 MHz center frequency
	3464 MHz center frequency
	4592 MHz center frequency
	5374 MHz to 5378 MHz center frequency
	6160 MHz center frequency
Residual spurious, preamp On	≤ -105 dBm, 0 dBm attenuator setting
	Exception Frequencies:
	9 MHz to 19 MHz center frequency
	5374 MHz to 5378 MHz center frequency
Third order IMD	≤ -70 dBc for two tones at or below the reference level, preamp Off, all gain settings auto-coupled
Second harmonic	≤ -60 dBc for a single tone at or below the reference level, preamp Off, all gain settings auto-coupled
Input-related spurious	≤ -70 dBc except for Fin= 2.282 GHz ± 20 MHz
	The dBc reference for this specification is the total power of all signals at the input of the instrument regardless of the current span
Input-related spurious, exception frequencies, typical	≤ -55 dBc at Fin= 2.282 GHz ± 20 MHz
	The dBc reference for this specification is the total power of all signals at the input of the instrument regardless of the current span
Third order intercept	≥ +7 dBm, 0 dB input attenuation, preamp Off

Spectral display amplitude

Reference level range	+20 dBm to -160 dBm
Marker power accuracy	±1.75 dB, -50 dBm ≤ input ≤ +20 dBm, preamp off
	±3.0 dB, -80 dBm ≤ input < -50 dBm, preamp on, above 10 MHz
	±3.75 dB, -120 dBm ≤ input < -80 dBm, preamp on, above 10 MHz
	Use peak detector for CW-like signals; use average detector for wideband (signal >> RBW)
	Accuracy guaranteed for CW signals and span set to 20 MHz or less

Display modes

Display modes	Normal – Updates display with each new result
	Max Hold – Updates displayed point only if new point > old
	Min Hold – Updates displayed point only if new point < old
	Max/Min Hold – Displays a vertical bar between Max Hold and Min Hold
	Average – Displays average of N (specified by user) acquisitions
	Average is calculated as follows:
	Last N values are saved in memory; when a new result is available, the earliest result of the N stored values is discarded, the new result is added to the stored values, and a new average is calculated from the stored values. If the number of results is less than N, then all of the results are averaged together
Number of averages	1 ≤ N ≤ 200

General purpose RF measurement characteristics

RF channel power measurement

Bandwidth range	1 kHz - 20 MHz
Accuracy	≤1.2 dB; +20 dBm to -60 dBm; 1 MHz to 3.2 GHz, preamp off, Ref Level > -35 dBm
	≤2.4 dB; -40 dBmto -75 dBm; 10MHz to 3.2 GHz, preamp on, Ref Level ≤ -35 dBm
	≤1.8 dB; +20 dBm to -50 dBm; 3.2 GHz to 6.2 GHz, preamp off, Ref Level > -35 dBm
	≤3 dB; -40 dBm to -75 dBm; Resolution BW < 100 kHz; -40 dBm to -55 dBm; Resolution BW ≥ 100 kHz 3.2GHz to 6.2 GHz, preamp on, Ref Level ≤ -35 dBm
	Specifications apply for default control settings (Auto RBW, Auto Level)

Occupied bandwidth measurement

Percent Power Inclusion Range	50-100%

RF field strength

Channel bandwidth range	Same as RF channel power
Accuracy	Same as RF channel power

Scan, classify, and locate characteristics

DPX™ Live RF spectrum display

Spectrum processing rate, nominal	10,000 spectrums per second, span independent (H500 standard and SA2500 with Option EP1)
	2,500 spectrums per second (SA2500 standard)
Minimum signal duration for 100% probability of intercept (POI), typical	125 µs (H500 standard and SA2500 with Option EP1)
	500 µs (SA2500 standard)
Span Range	5 kHz to 20 MHz

Spectrogram (rising raster)

Spectrum processing rate, nominal	20 spectrums per second
Minimum signal duration for time measurement	20 milliseconds (typical)
Span range	5 kHz to 20 MHz

Trigger

Modes	Single or continuous, free run or triggered
Event source	IF level, external input, or internal timebase
Types	Rising edge, falling edge, level above threshold, level below threshold
Delay	0 to 60 s with 1 µs resolution
Position	Settable from 0-100%

IF level trigger

Threshold range	-160 dBm to +20 dBm
Bandwidth range	5 kHz to 20 MHz

External trigger

Maximum input level without damage	±5 V_{peak} continuous
Minimum high threshold	2.0 V

Scan, classify, and locate characteristics

Maximum low threshold	0.8 V
Minimum High/Low time	10 ns
Impedance	10 kΩ
Coupling	DC

Internal timebase trigger

Mode	Single trigger on time, repeat trigger at interval, or both
Resolution	1 µs

Measurement result time stamps

Resolution (nominal)	1 ms before GPS lock obtained; 1 ns after GPS lock obtained.
Accuracy - relative (typical)	±500 ns time-stamp error between multiple measurement results. Internal GPS reference lock required.
Accuracy - GPS reference (typical)	±1 µs, all measurements except DPX spectrum; ±1 ms DPX spectrum. Time-stamp error relative to GPS system absolute time reference. Internal GPS reference lock required, identical acquisition bandwidth setting required.

IQ acquisition time (available in amplitude vs. time measurement)

Span	Sample rate	Maximum acquisition length
20 MHz	28 msps	36 ms
10 MHz	14 msps	73 ms
5 MHz	7 msps	146 ms
2 MHz	2.8 msps	365 ms
1 MHz	1.4 msps	731 ms
500 kHz	700 ksps	1.4 sec
200 kHz	280 ksps	3.6 sec
100 kHz	140 ksps	7.3 sec
50 kHz	72.9 ksps	14 sec
20 kHz	27.3 ksps	37 sec
10 kHz	13.7 ksps	74 sec
5 kHz	6.8 ksps	149 sec

AM demodulation

Measurement frequency	As selected
Minimum input signal level, typical	-100 dBm
Audio measurement bandwidth	8 kHz

FM demodulation

Measurement frequency	As selected
Minimum input signal level, typical	-100 dBm
Maximum signal deviation	Up to 100 kHz
Audio measurement bandwidth	8 kHz, 15 kHz, 75 kHz, or 200 kHz
Maximum audio output bandwidth	15 kHz

Scan, classify, and locate characteristics

Signal strength indicator

Input signal level	-120 dBm, minimum
Measurement frequency	As selected
Measurement bandwidth	Up to 20 MHz, dependant upon span and RBW setting
Tone type	Variable beep rate or variable frequency
Update rate, typical	10 per second

Mapping

Native map type	Graticule (.gsf)
Map types directly supported	Pitney Bowes MapInfo (*.mif), Bitmap (*.bmp), MPS (collection of GSF maps derived from Open Street Map mapping tiles) [2]
Other map types accepted using PC application iMap converter	Google™ earth
	Microsoft® MapPoint®
	USGS DLG (*.opt)
	ESRI ArcInfo Shape (*.shp)
	Other raster formats (*.gif, *.jpg, *.png, *.tif)

Power

Battery life	5 hours of continuous Spectrum mode (with optional second battery). Actual life can be higher depending on usage.

Physical characteristics

Temperature

Operating	0 °C to +50 °C specified performance, -10 °C to +50 °C, typical
Nonoperating	-40 °C to +60 °C
With batteries installed	While charging: 0 °C to +45 °C
	Storage (nonoperating): -20 °C to +60 °C

Humidity

Operating and nonoperating	5% to 95% relative humidity (RH) at up to +30 °C, noncondensing
	5% to 45% RH above +30 °C up to +50 °C, noncondensing

Altitude

Operating	Up to 4,600 meters (15,092 feet)
Nonoperating	Up to 12,192 meters (40,000 feet)

Dimensions

Height	25.5 cm. (10.0 in.)
Width	33 cm. (13 in.)
Depth	12.5 cm.
Weight	5.56 kg (12.27 lb.)

Color display

Size	10.4 in. (diagonal), transflective LCD, color
Resolution	640×480 (VGA)

2 Maps derived from Open Street Map tiles are © OpenStreetMap contributors. For more information see http://www.openstreetmap.org/copyright.

EMC environment and safety

Electromagnetic compatibility (EMC) compliance	EN61326-1:2006 and EN61326-2:2006 Product Family Standard for Electrical Equipment for Measurement, Control, and Laboratory Use – EMC Requirements.
European Union	
Emissions	CISPR11, group 1, class a
	EN 61000-3-2
	EN 61000-3-3
Immunity	IEC 61000-4-2
	IEC 61000-4-3
	IEC 61000-4-4
	IEC 61000-4-5
	IEC 61000-4-6
	IEC 61000-4-11
Australia/New Zealand	EMC compliance in accordance with the ACMA
USA	FCC, CFR Title 47, Part 15, Subpart B, Class A.
Safety compliance	ANSI/UL610101:2004
	Electrical Equipment for Measurement, Control, and Laboratory Use
	CSA C22.2 No. 61010.1:2004
	Electrical Equipment for Measurement, Control, and Laboratory Use
	EN 610101:2001
	Safety Compliance Electrical Equipment for Measurement, Control, and Laboratory Use
	IEC610101:2001
	Electrical Equipment for Measurement, Control, and Laboratory Use
	ISA 82.02.01
	Electrical Equipment for Measurement, Control, and Laboratory Use

Warranty and calibration

Warranty	1 year on parts and labor
Recommended instrument calibration interval	2 years

Ordering information

Models

H500	Real-time spectrum analyzer with DPX™ Live RF spectrum display of 125 µs minimum signal duration for 100% Probability of Intercept (POI) and signal classification capability. Includes User manual, installation software, AC power adapter, Lithium-ion battery, GPS antenna, flexible monopole antenna, Type-N (m) to BNC (f) adapter, USB A-B cable, tilt stand, soft carry case, audio jack mute plug (mutes all audio output from the instrument speaker), one-year warranty.
SA2500	Real-time spectrum analyzer with DPX™ Live RF spectrum display of 500 µs minimum signal duration for 100% Probability of Intercept (POI). Includes User manual, installation software, AC power adapter, Lithium-ion battery, GPS antenna, flexible monopole antenna, Type-N (m) to BNC (f) adapter, USB A-B cable, tilt stand, soft carry case, audio jack mute plug (mutes all audio output from the instrument speaker), one-year warranty.

Options

SA2500 options

Option EP1	Enhances SA2500 DPX™ Live RF spectrum display to 10,000 spectrums/sec and 125 µs minimum signal duration for 100% Probability of Intercept (POI)
Option EP2	Enhances SA2500 by adding signal classification to the Spectrum Notes capability. Provides capability to notate (label) regions of RF spectrum. Provides capability to compare bandwidth, channel frequency, etc., to internal tables of standards. Can save a mask (stored display) of user-generated mask to enable spectrum violation measurement. Provides database to store these notation results, along with GPS location and time.

Power plug options

Opt. A0	North America power plug (115 V, 60 Hz)
Opt. A1	Universal Euro power plug (220 V, 50 Hz)
Opt. A2	United Kingdom power plug (240 V, 50 Hz)
Opt. A3	Australia power plug (240 V, 50 Hz)
Opt. A5	Switzerland power plug (220 V, 50 Hz)
Opt. A6	Japan power plug (100 V, 110/120 V, 60 Hz)
Opt. A10	China power plug (50 Hz)
Opt. A11	India power plug (50 Hz)
Opt. A12	Brazil power plug (60 Hz)
Opt. A99	No power cord

Language options

Opt. L0	English manual
Opt. L99	No manual

Service options

Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
Opt. D1	Calibration Data Report
Opt. D3	Calibration Data Report 3 Years (with Opt. C3)
Opt. D5	Calibration Data Report 5 Years (with Opt. C5)
Opt. G3	Complete Care 3 Years (includes loaner, scheduled calibration, and more)
Opt. G5	Complete Care 5 Years (includes loaner, scheduled calibration, and more)
Opt. R3	Repair Service 3 Years (including warranty)
Opt. R5	Repair Service 5 Years (including warranty)

Recommended accessories

119-6594-xx	Beam antenna, 824 to 896 MHz
119-6595-xx	Beam antenna, 896 to 960 MHz
119-6596-xx	Beam antenna, 1710 to 1880 MHz
119-6597-xx	Beam antenna, 1850 to 1990 MHz
119-6970-xx	Magnetic mount antenna, 824 to 2170 MHz (requires adapter 103-0449-00)
119-7246-xx	Pre-filter, general purpose, 824 to 2500 MHz, Type-N (f) connector
119-7426-xx	Pre-filter, general purpose, 2400 to 6200 MHz, Type-N (f) connector
012-0482-xx	Cable, 50 Ω, BNC (m) 3 foot (91 cm)
174-4977-xx	Cable, 50 Ω, straight Type-N (m) and angled Type-N (m) connector, 1.6 foot (50 cm)
174-5002-xx	Cable, 50 Ω, Type-N (m) to Type-N (m) connector, 3 foot (91 cm)
119-6030-xx	External battery charger (2-slot)
119-7755-xx	AC power supply
146-0151-xx	Lithium-Ion battery
016-1882-xx	Display protector sheets
Poynting DF-A0047 Direction Finding antenna	Poynting smart antenna with electronic compass; order from manufacturer (poyntingdefence.com)

Upgrades

SA2500F Option EP1	Field Upgrade Kit for Enhanced Performance. Increases the SA2500 DPX™ live RF spectrum rate to 10,000 spectrums/s and 125 µs minimum signal duration for 100% probability of Intercept (POI), typical.
SA2500F Option EP2	Field upgrade for enhanced performance. Adds signal classification capability to notable regions of RF spectrum. Provides capability to compare bandwidth, channel frequency, etc., to internal tables of standards. Can save mask (stored display) of user-generated masks to enable spectrum violation measurements. Provides database to store these notation results, along with GPS location and time.

CE

Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.

GPIB IEEE-488

Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

ASEAN / Australasia (65) 6356 3900
Belgium 00800 2255 4835*
Central East Europe and the Baltics +41 52 675 3777
Finland +41 52 675 3777
Hong Kong 400 820 5835
Japan 81 (3) 6714 3010
Middle East, Asia, and North Africa +41 52 675 3777
People's Republic of China 400 820 5835
Republic of Korea 001 800 8255 2835
Spain 00800 2255 4835*
Taiwan 886 (2) 2722 9622

Austria 00800 2255 4835*
Brazil +55 (11) 3759 7627
Central Europe & Greece +41 52 675 3777
France 00800 2255 4835*
India 000 800 650 1835
Luxembourg +41 52 675 3777
The Netherlands 00800 2255 4835*
Poland +41 52 675 3777
Russia & CIS +7 (495) 6647564
Sweden 00800 2255 4835*
United Kingdom & Ireland 00800 2255 4835*

Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777
Canada 1 800 833 9200
Denmark +45 80 88 1401
Germany 00800 2255 4835*
Italy 00800 2255 4835*
Mexico, Central/South America & Caribbean 52 (55) 56 04 50 90
Norway 800 16098
Portugal 80 08 12370
South Africa +41 52 675 3777
Switzerland 00800 2255 4835*
USA 1 800 833 9200

* European toll-free number. If not accessible, call: +41 52 675 3777

Updated 10 April 2013

For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit www.tektronix.com.

Copyright © Tektronix, Inc. All rights reserved. Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specification and price change privileges reserved. TEKTRONIX and TEK are registered trademarks of Tektronix, Inc. All other trade names referenced are the service marks, trademarks, or registered trademarks of their respective companies.

14 Jul 2014

37W-28527-2

www.tektronix.com

Tektronix®