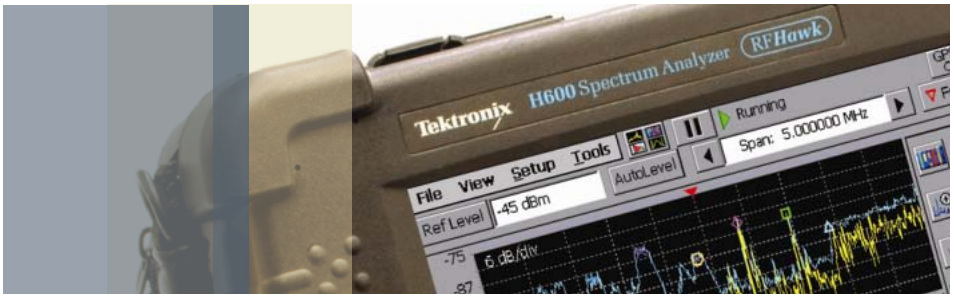


RF*Hawk*™ Signal Hunter

Scan - Classify - Locate

Handheld Signal Hunter providing unique signal scanning, classification and location capabilities.

- DPX ™ for live RF view of the spectrum
- Quick and simple classification of *legitimate* signals for exclusion
- Rapid targeting of *illegitimate* signals with field-proven signal hunting, mapping and documentation tools

Overview

The Tektronix® H600 RF*Hawk* will quickly scan the RF environment, classify the known signals and help you locate the unknown signals with its field-proven signal hunting tools. Featuring Real-Time DPX™ capability the RFHawk offers practical solutions for discovering transient events that slip past conventional spectrum analyzers. It is a handheld, rugged, battery operated RF signal hunter with an intuitive set of field signal hunter tools that are matched to the task. It allows for quick scanning of the RF environment, simple, reliable classification of legitimate signals for exclusion and gives you field-proven signal hunting, mapping and documentation tools. The RF*Hawk* has surveillance grade hardware featuring an outstanding noise figure and the sophisticated tools necessary to rapidly scan, classify and locate illegitimate analog and digital RF transmission sources in the field.

Features & Benefits

- Scan
  - Benchtop Spectrum Analyzer performance in a battery-operated field unit
  - Input Frequency Range to 10kHz-6.2GHz to cover most modern signal sources
  - Excellent sensitivity for detecting very low level signals with -153 dBm DANL at 10 Hz RBW
  - Revolutionary DPX™ spectrum processing provides intuitive understanding of live RF signals using colors based on frequency of occurrence, displaying 10,000 spectrums per sec with a 100% probability of capturing transients with a minimum duration of 125 microseconds
- Classify
  - Match signals to known standards using frequency, bandwidth and other criteria
  - Expert-system help with on-screen profile masks for quick frequency offset estimations
  - Flexibility to upgrade databases
  - Examine cyclo-stationary make-up of a given signal to look for specific cyclic components
- Locate
  - Hunts outdoor signals by plotting measurements directly into GPS-integrated geo-referenced maps
  - Hunts in-building signals with a Tap-and-Walk-and-Tap interface
  - No need to return to the office for analysis of dif ficult problems
- Handheld form factor
  - Field Tested
  - Rugged
  - Touch Screen for intuitive use
  - Long battery life

Tektronix® Communications

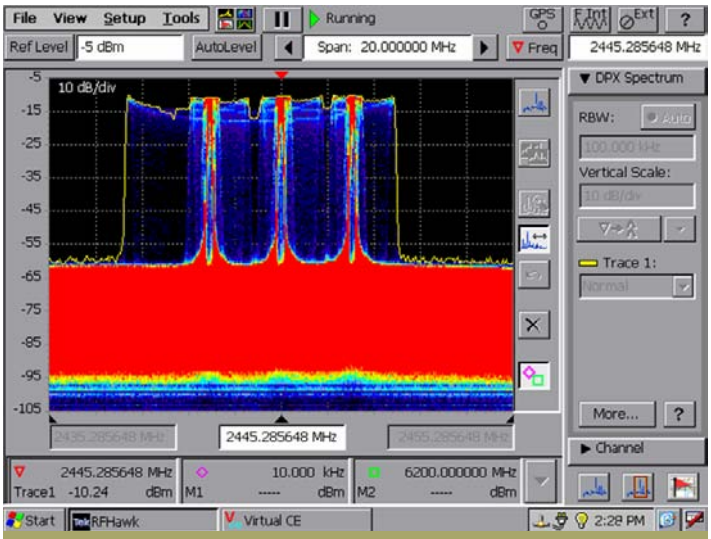
RF*Hawk*: Scan, Classify, Locate

Evolving digital wireless communication standards pose an unprecedented challenge to the surveillance and security community. For this 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 off-line 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.

RF*Hawk*

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 RFHawk's DPX™ 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.



Firgure 1. Scan with dedicated monitoring tools

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 RFHawk makes analysis easier by quickly logging signals that are weak, bursty, 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 bursty. 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 sub-optimal. All of this makes classification of signals more challenging when using traditional signal identification tools. The RF***Hawk*** provides advanced algorithms that are capable of classifying signals that cannot be analyzed with other methods.

The RF***Hawk*** offers unique 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. In-depth analysis is provided by a Spectral Correlation Density (SCD) measurement which will spot hidden cyclo-stationary components. SCD provides information on how well the framing, time slot, chip rates and other internal signal rates match the rates of a valid signal. It is faster than manual signal identification techniques, does not require prior knowledge of the signal, and is robust when working with poor signals. SCD tolerates a poor SNR, large carrier frequency offset and fading.

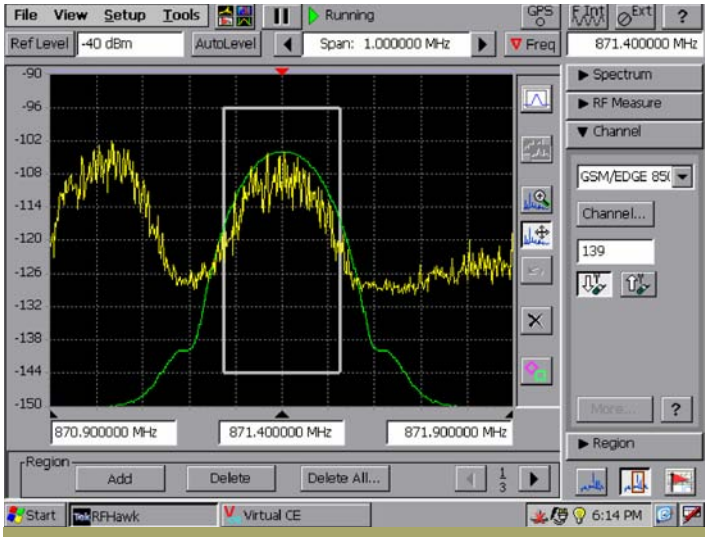


Figure 2. Cross match with known standards

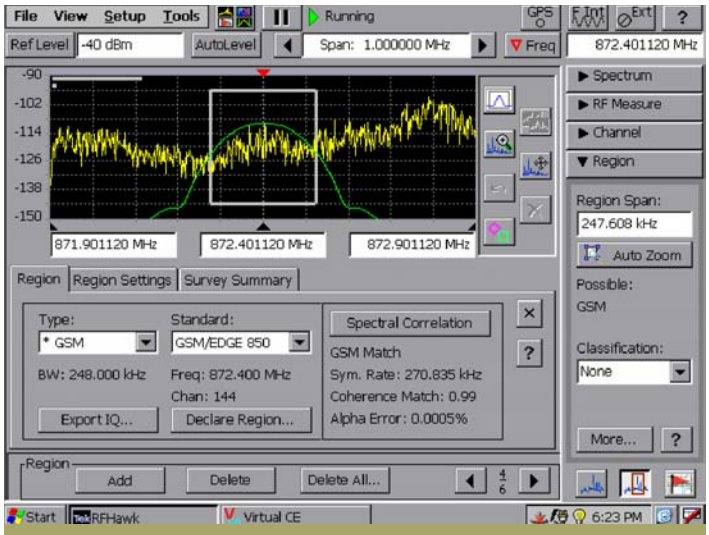


Figure 3. Low SNR signals reliably classified

Locate

Once the signal has been identified as a threat, the RF***Hawk*** provides 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 operators to look for signals while watching their surroundings, not the screen.

For signals that are harder to find, such as signals influenced by multipath, fading, low signal strength etc, the RF***Hawk*** provides 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 be used to 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 pre-set thresholds for acceptability.

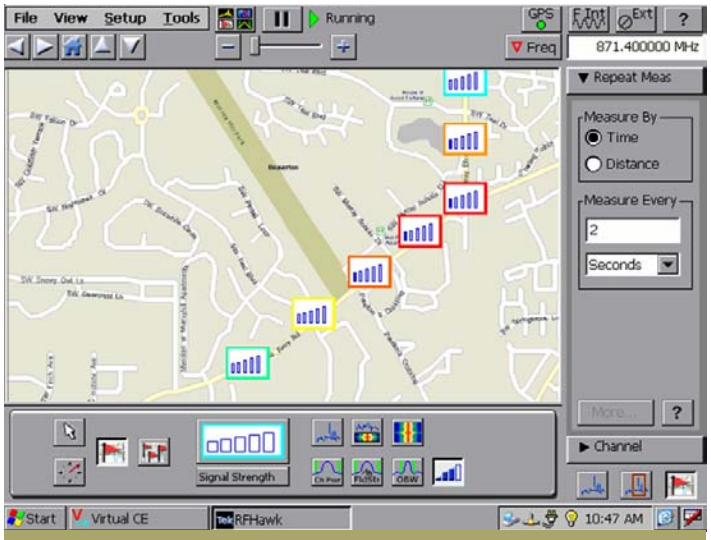
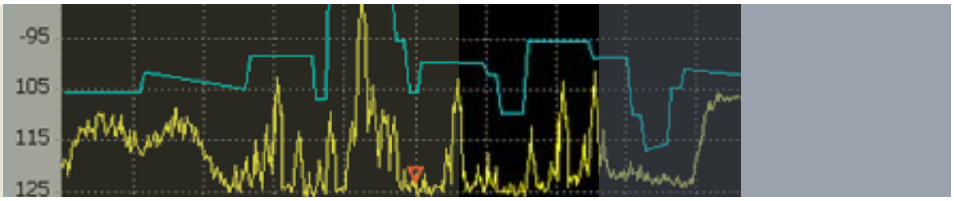


Figure 4. Color-coded measurements for rapid in-field analysis



Specifications

General Performance Characteristics

Characteristic	Description
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 Impedance	50 ohms
IF Center Frequency	140 MHz
IF 3 dB Bandwidth	24 MHz
Internal Timebase	
Error	± 0.5 PPM from 0 °C to 50 °C ± 1.0 PPM aging/year Twenty minute warm-up period required to meet accuracy specification
External Reference Input	
Impedance	1500 ohms
Frequency 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

Spectrum Analyzer Characteristics

Characteristic	Description
Center Frequency	
Range	10 kHz to 6.2 GHz, preamp off 10 MHz to 6.2 GHz, preamp on
Setting Resolution	1 Hz
Span	
Range	10 Hz to 3 MHz (Manual RBW) 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 Reference Level (DANL + 90 dB)
Phase Noise	≤ -95 dBc/Hz @ 10 kHz offset ≤ –95 dBc/Hz @ 20 kHz offset ≤ –95 dBc/Hz @ 30 kHz offset ≤ –97 dBc/Hz @ 100 kHz offset ≤ –110 dBc/Hz @ 1 MHz offset
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 F_{in}= 2.282 GHz ± 20 MHz The reference for 'dBc' for this specification is the total power of all signals present at the input of the instrument regardless of the current span
Input Related Spurious, exception frequencies, typical	≤ –55 dBc F_{in}= 2.282 GHz ± 20 MHz The reference for "dBc" for this specification is the total power of all signals present 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	
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

DPX™ Measurements Processing Characteristics

Characteristic	Description
Spectrum Processing Rate, nominal	10,00 per second (span independent)
Min Signal Duration for 100% Probability of Intercept, typical	125 µs
Span Range	20 kHz to 20 MHz

Battery Life

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

General Purpose RF Measurements Characteristics

Characteristic	Description
General Purpose RF Channel Power Measurement	
Measurement Bandwidth Range	1 kHz - 20 MHz
Accuracy	≤ 1.2 dB; +20 dBm to –60 dBm; Resolution BW < 100 kHz +20 dBm to –40 dBm; Resolution BW ≥ 100 kHz 1 MHz to 3.2 GHz , preamp off ≤ 2 .4 dB; –60 dBm to –75 dBm; Resolution BW < 100 kHz –40 dBm to –55 dBm; Resolution BW ≥ 100 kHz 10 MHz to 3.2 GHz , preamp on ≤ 1.8 dB; +20 dBm to –50 dBm; Resolution BW < 100 kHz +20 dBm to –40 dBm; Resolution BW ≥ 100 kHz 3.2 GHz to 6.2 GHz , preamp off ≤ 3 dB; –50 dBm to –75 dBm; Resolution BW < 100 kHz –40 dBm to –55 dBm; Resolution BW ≥ 100 kHz 3.2 GHz to 6.2 GHz , preamp on 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 Channel Power
Accuracy	Same as Channel Power

Mapping

Native Map Type	Graticule (.gsf)
Map types directly supported	MapInfo (*.mif) Bitmap (*.bmp)
Other Map types accepted using PC application iMap Converter	MapInfo (*.mif) Bitmap (*.bmp) Other raster formats (*.gif, *.jpg, *.png, *.tif) Google Earth Microsoft MapPoint USGS DLG (*.opt) ESRI ArcInfo Shape (*.shp)

Signal Analysis and Monitoring Characteristics

Characteristic	Description
AM Demodulation	Provides an audio output signal after AM demodulation of the user-selected signal
Measurement Frequency	As previously selected
Minimum Input Signal Level, Typical	-100 dBm
Audio Measurement Bandwidth	8 kHz
FM Demodulation	Provides an audio output signal after FM demodulation of the user-selected signal
Measurement Frequency	As previously selected
Minimum 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
Signal Strength Indicator	Provides both an audio tone and a visual display that are related to the strength of the user selected signal
Input Signal Level	-120 dBm, minimum
Measurement Frequency	As previously selected
Measurement Bandwidth	Up to 20 MHz, dependent upon span and RBW setting
Tone Type	Variable beep rate or variable frequency
Update Rate, Typical	10 per second

Environmental characteristics

Characteristic	Description
Temperature	Operating: 0 °C to +50 °C specified performance, –10 °C to +50 °C, typical Nonoperating: –40 °C to +60 °C The temperature specs above are modified with the following options installed: Li-Ion Batteries: Charge 0 °C to +45 °C, Storage –20 °C to +60 °C
Humidity	Operating and Nonoperating: 5% to 95% relative humidity (RH) at up to +30 °C, 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)

Physical characteristics

Characteristic	Description
Dimensions	Height: 25.5 cm. (10.0 in) Width: 33 cm. (13 in) Depth: 12.5 cm. (4.8 in)
Weight	5.56 kg (12.27 lbs)

Display characteristics

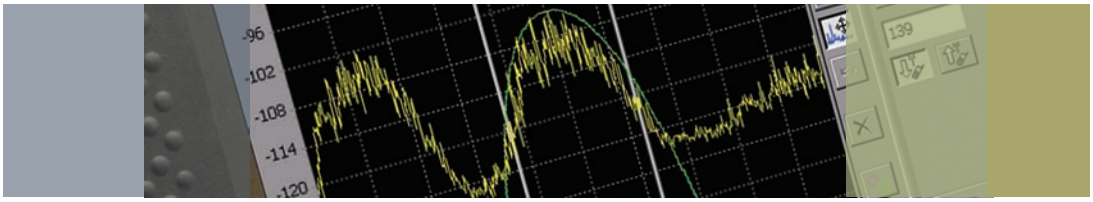
Characteristic	Description
Color Display	10.4 in. (diagonal), transflective LCD Resolution: 640x480 (VGA)

Miscellaneous characteristics

Characteristic	Description
Recommended Instrument Calibration Interval	2 years

Safety compliance

Characteristic	Description
Safety Compliance	ANSI/UL61010-1:2004 Electrical Equipment for Measurement, Control, and Laboratory Use. CSA C22.2 No. 61010.1:2004 Electrical Equipment for Measurement, Control, and Laboratory Use. EN 61010-1:2001 Electrical Equipment for Measurement, Control, and Laboratory Use. IEC61010-1:2001 Electrical Equipment for Measurement, Control, and Laboratory Use. ISA 82.02.01 Electrical Equipment for Measurement, Control, and Laboratory Use.



Ordering Information

H600 RF***Hawk*** Signal Hunter with built-in GPS (includes GPS antenna)

Warranty

- One Year on parts and labor

Language Options

- H600 L0 English manual

Standard Accessories

- H600 RFHawk Quick Start User Manual
- H600 RFHawk installation software
- AC Power Adapter
- Lithium-Ion Battery
- GPS Antenna
- Tilt stand
- Soft carry case
- BNC Connector cover (2)
- N Connector cover (1)
- Audio jack mute plug (mute all audio output from the instrument speaker)

Service Options

- H600 R3 Repair Service 3 Years (including warranty)
- H600 R5 Repair Service 5 Years (including warranty)
- H600 C3 Calibration Service 3 Years
- H600 C5 Calibration Service 5 Years
- H600 CA1 Provides a single calibration event or coverage
- H600 D1 Calibration Data Report
- H600 D3 Calibration Data Report 3 Years (with Option C3)
- H600 D5 Calibration Data Report 5 Years (with Option C5)

Power Options

- H600 L99 No Manual Power Options
- H600 A0 North America
- H600 A1 Universal EURO
- H600 A10 China
- H600 A11 India
- H600 A2 United Kingdom
- H600 A3 Australia
- H600 A5 Switzerland
- H600 A6 Japan
- H600 A99 No Power Cord or AC Adapter

Suggested RF***Hawk*** Accessories

- Antenna

Beam Antenna, 824 to 896 MHz: Order 119-6594-00
Beam Antenna, 896 to 960 MHz: Order 119-6595-00
Beam Antenna, 1710 to 1880 MHz: Order 119-6596-00
Beam Antenna, 1850 to 1990 MHz: Order 119-6597-00
Magnetic Mount Antenna, 824 to 2170 MHz: Order 119-6970-00 (needs adapter 103-0449-00)

- Filters

Pre-Filter, General Purpose, 824 to 2500 MHz, Type-N (f) Connector – Order 119-7246-00
Pre-Filter, General Purpose, 824 to 6200 MHz, Type-N (f) Connector – Order 119-7426-00

- Cables

Cable, 50 Ω, BNC (m) 3 foot (91 cm): Order 012-0482-00
Cable, 50 Ω, Straight Type-N (m) and angled Type-N (m) connector, 1.6 foot (50 cm): Order 174-4977-00
Cable, 50 Ω, Type-N (m) to Type-N (m) connector, 3 foot (91 cm): Order 174-5002-00

- Misc

External Charger: order 119-6030-00
AC Power Supply: order 119-6984-00
DC Vehicle Adapter: order 119-6028-00
Lithium-Ion Battery: order 146-0151-01
Display Protector Sheets (5): order 016-1882-00

About Tektronix:

Tektronix has more than 60 years of experience in providing network operators and equipment manufacturers a comprehensive and unparalleled suite of network diagnostics and management solutions for fixed, mobile, IP and converged multi-service networks.

These solutions support such architectures and applications as fixed mobile convergence, IMS, broadband wireless access, WiMAX, VoIP and triple play, including IPTV.

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/communications

Contact Tektronix:

Please visit www.tektronix.com/communications

Phone:
1-800-833-9200 option 1
+1-469-330-4000

Locate your nearest Tektronix representative at:
www.tektronix.com/contactus

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