Wireless Communication Analyzer

WCA330 • WCA380

Voice mobile communication has already transitioned from analog to digital, and is now transitioning to include high-speed data transmission. Given these kinds of changes, the challenges facing engineers are signals that are wider in bandwidth, higher in complexity for modulation and coding, and at ever increasing frequencies. The measurement needs for the research and development of products that utilize these new technologies and standards for communication links are not all met by traditional sweeping spectrum analyzers and vector signal analyzers. New measurement tools are needed to deal with these new signals. Analyzers that can look over relatively long periods of time, in several measurement parameters and domains, are necessary to prove performance, as well as troubleshoot design shortcomings and problems. The Wireless Communication Analyzers, WCA330 and WCA380, are designed to satisfy these requirements and have the features of traditional high performance swept spectrum analyzers and modulation analyzers. They add much more in new capabilities such as real-time seamless capture. The captured data is available for time studies of spectrum, digital modulation and analog modulation, as well as transient artifacts. They also have real-time trigger capabilities in the frequency and time domains, which not only make capture possible, but also convenient.

Features & Benefits

DC to 8 GHz Coverage – Seamless Capture Up to 30 MHz BW

65 dB ACLR Measurement (3GPP)

Code Domain Power and Complementary Cumulative Distribution Function (CCDF) for IS-95, 3GPP (3GPP Release 99) Signals

Analyzes in Frequency, Time and Modulation Domains

Seamless Acquisition for Capture of Short Duration or Intermittent Events

Frequency Event Trigger for Acquisition of Burst or Infrequently Occurring Signals

Post Capture 1000:1 Zoom Allows Analysis of Individual Signals After Wideband Capture

Support Demodulation – GFSK, BPSK, QPSK, DQPSK, 8 PSK, OQPSK, 16 QAM, 64 QAM, 256 QAM, GMSK

CCDF for Multi-carrier and 3GPP Signals

Applications

Second- and Third-generation Cellular/PCS R&D – Including GSM, IS-95, T-53, IS-136, PDC, 3GPP

Wireless Access Equipment R&D – Bluetooth

Signature Analysis

Spectrum Monitoring (Interference and Multipath Fading)

Setting Time Measurements for Oscillators and Synthesizers

Capture and Analyze an Unknown Signal

Debugging of Hardware and Failure Analysis of BTS and MS

Tektronix

Enabling Innovation

The WCA330 (DC to 3 GHz) and WCA380 (DC to 8 GHz) are based on real-time spectrum analyzers that allow the seamless capture of signal with spans up to 30 MHz. The ability to measure burst signals and infrequently occurring signals, such as those from GSM, IS-136, PDC or IS-95 over a continuous block of time and span of frequencies and RACH signal of mobile station, allows the user to evaluate significantly more information than traditional sweeping spectrum analyzers. Because of the real-time capture of data, the post-processing capabilities of the WCA enable the user to look at measurements such as Code Domain Power vs. Time, EVM vs. Symbol at each code, CCDF and Transient Spurious. Because the instrument samples these full frames constantly (rather than waiting for each discrete frequency step to be measured), the signal can come or go as it pleases and the real-time spectrum analyzer will detect the change instantly.

The 12.1-inch color TFT display allows easy viewing of spectrum, waterfall displays, spectrograms and digital modulation analysis screens. Constellation and vector diagrams can be displayed, as well as frequency, phase, magnitude, I and Q versus time, for in-depth analysis of digitally modulated signals. Users can move a marker through the time record and analyze the modulation at any point. In particular, signals with symbol rates up to 20.48 Msymbols/sec may be analyzed during and after capture.

In addition, a frequency mask trigger allows capture of randomly occurring or infrequent signals such as intermittent spurious emissions. If the user is not interested in the period between transmission bursts, the frequency mask trigger allows capture of the “burst-on” period, thus maximizing the number of bursts that can be captured in memory for subsequent spectral, time or modulation analysis. The user can graphically define the frequency trigger mask; this allows the trigger condition to be generated by a particular event in the frequency domain irrespective of other activity within the displayed span. This is a major benefit when the trigger condition is used to capture signals arising from intermittent spurious or spectral re-growth events.

Characteristics

Electrical Specification

Frequency Range

WCA330 –
DC to 10 MHz (Baseband).
10 MHz to 3 GHz (RF1 Band).
DC to 16 MHz (I/Q input).
WCA380 –
DC to 10 MHz (Baseband).
10 MHz to 3 GHz (RF1 Band).
2.5 GHz to 3.5 GHz (RF2 Band).
3.5 GHz to 6.5 GHz (RF3 Band).
5 GHz to 8 GHz (RF4 Band).
DC to 16 MHz (I/Q Input).
Center Frequency Setting Resolution – 0.1 Hz.
Residual FM – 2 $Hz_{pk\text{-}pk}$.

Reference Frequency

Aging per Day – 1 x 10^{-9} (after 30 days of operation).
Aging per Year – 1 x 10^{-7} (after 30 days of operation).
Temperature Drift – 1 x 10^{-7}(10 ºC to 40 ºC).
Total Frequency Error – 2 x 10^{-7} (within one year after calibration).
Reference Output Level – > 0 dBm.
External Reference Input – to +6 dBm.

Spectrum Purity (RF ATT=0 dB)

Frequency = 1500 MHz, Carrier offset = 10 kHz –
100 dBc/Hz (Normal IF).
95 dBc/Hz (Hi-res IF).
Frequency = 1500 MHz, Carrier offset = 100 kHz –
103 dBc/Hz (Normal IF).
105 dBc/Hz (Hi-res IF).
Frequency = 1500 MHz, Carrier offset = 1 MHz –
120 dBc/Hz (Normal IF).
125 dBc/Hz (Hi-res IF).

Signal Input

Input Connector –
N type (Except IQ input).
BNC type (IQ input).
Input Impedance – 50 Ω.
VSWR –
>1.5 (2.5 GHz, RF ATT 10 dB).
>2.0 (7.5 GHz, RF ATT 10 dB) (WCA380 only).

Maximum Input Level

Maximum DC Voltage –
0 V (RF Band).
±5 V (Baseband).
±5 V (IQ input).
Maximum Input Power – +30 dBm (RF Band).

Input Attenuator

RF Attenuator –
0 to 50 dB (10 dB step).
0/2/5/7 dB (RF1, RF2 (WCA380 only)).
Baseband Attenuator – 0 to 40 dB (1 dB step).
I/Q Attenuator – 0 to 30 dB (10 dB step).

Reference Level

Reference Level Setting Range –
–50 to +30 dBm (1 dB step, RF).
–30 to +30 dBm (1 dB step, Baseband).
–10 to +20 dB (10 dB step, IQ).
Reference Level Accuracy at 20 ºC to 30 ºC –
±0.8 dB (Baseband).
±1.5 dB (RF1).
±1.5 dB (RF2) (WCA380 only).
±2.0 dB (RF3) (WCA380 only).
±2.0 dB (RF4) (WCA380 only).
Reference Level Accuracy at 10 ºC to 40 ºC –
±1.0 dB (Baseband).
±2.0 dB (RF1).
±2.0 dB (RF2) (WCA380 only).
±2.5 dB (RF3) (WCA380 only).
±2.5 dB (RF4) (WCA380 only).
Level Linearity – ±0.2 dB (0 to –40 dBfs).

Dynamic Range

1 dB Compression Input – +2 dBm (RF ATT=0 dB).
3rd Order Intermodulation Distortion –
73 dBc (Hi-res IF, Signal Level ≤–10 dBfs, 2 GHz).
70 dBc (Normal IF, Signal Level ≤–10 dBfs, 2 GHz).
55 dBc (Wide IF, Signal Level ≤–10 dBfs, 2 GHz).
Displayed Average Noise Level (Baseband) (Typical) – –153 dBm/Hz (1 M to 10 MHz, Baseband).
Displayed Average Noise Level (Hi-res IF) (Typical) –
–150 dBm/Hz (10 M to 25 MHz).
–147 dBm/Hz (25 M to 2.5 GHz).
–145 dBm/Hz (2.5 to 3.0 GHz).
–142 dBm/Hz (3 to 8 GHz).
Displayed Average Noise Level (Normal IF) (Typical) –
–147 dBm/Hz (10 M to 25 MHz).
–143 dBm/Hz (25 M to 2.5 GHz).
–141 dBm/Hz (2.5 to 3 GHz).
–140 dBm/Hz (3 to 8 GHz).
Displayed Average Noise Level (Wide IF) (Typical) –
–140 dBm/Hz (50 M to 3 GHz).
–140 dBm/Hz (3 to 8 GHz) (WCA380 only).
Spectrum Due to Modulation for GSM –
80 dBc (30 kHz RBW, 1.2 MHz offset).
78 dBc (100 kHz RBW, 1.8 MHz offset).
Spectrum Due to Switching Transient for GSM –
78 dBc (30 kHz RBW, 1.2 MHz offset).
78 dBc (30 kHz RBW, 1.8 MHz offset).
ACPR (W-CDMA Down Link, Crest Factor = 11 dB) –
65 dB (ACPR Configuration).

Spurious Response

Image Suppression (Typical) –
75 dB (RF1, Center 1.5 GHz, Input 9.962 GHz).
75 dB (RF2, Center 3 GHz, Input 11.462 GHz).
70 dB (RF3, Center 5 GHz, Input 5.842 GHz).
70 dB (RF4, Center 6.5 GHz, Input 5.658 GHz).

Alias Suppression (Typical) –
65 dB (Baseband, Center).
60 dB (IQ).

Residual Response (without Signal, Span ≤5 MHz, RBW=30 kHz, Averaged) (Typical) –
–73 dBfs or –93 dBm, whichever greater (Normal/ Hi-res IF).
–73 dBfs or –93 dBm, whichever greater (Baseband, >1 MHz).

Residual Response of Wide IF (without Signal, Span 30 MHz, RBW=100 kHz, Averaged) (Typical) –
–55 dBfs or –85 dBm, whichever greater (within 10 minutes and ±5º from Acquisition Start).

Spurious Response (Signal at Center, Offset >400 kHz, 2 MHz Span, Averaged) (Typical) –
–70 dBc or –75 dBfs whichever greater (Hi-res, Normal IF).

Spurious Response (Signal at Center, 50 kHz ≤Offset ≤400 kHz, 2 MHz Span, Averaged) (Typical) –
–65 dBc or –70 dBfs, whichever greater (Hi-res, Normal IF).

Spurious Response (Signal at Center, Offset >400 kHz, 10 MHz Span, Averaged) (Typical) –
–60 dBc or –65 dBfs, whichever greater (Wide IF).

Sideband Spurious due to I/Q imbalance (Averaged) (Typical) –
–55 dBc (Wide IF).
–60 dBc (Wide IF, within 1 hour and ±5º from self-IQ balance calibration).

Acquisition

Acquisition Mode –
Roll (1 frame data is continuous).
Block (data within acquired block is continuous).

Acquisition Memory Size – 16 MB.

Memory Configuration Mode –
Frequency (All memory is used for frequency data).
Dual (Memory is shared with Time and Frequency data).
Zoom (Memory is shared with Time, Frequency and Zoomed data).

Data Samples in 1 Frame –
256 points (Frequency Mode Only).
1024 points (All Mode).

Block Size –
1 to 16,000 frames (Frequency Mode, 256 points).
1 to 4,000 frames (Frequency Mode, 1024 points).
1 to 2,000 frames (Dual or Zoom Mode).

A/D Converter (Baseband, Normal IF, Hi-res IF) –
14 bits, 25.6 MS/s.

A/D Converter (Wide IF, IQ) – 12 bits, 40.96 MS/s x 2 (for I/Q each signal).

Maximum Vector Span –
30 MHz (Wide IF, IQ).
10 MHz (Baseband).
6 MHz (Normal IF).
5 MHz (Hi-res IF).

Sampling Rate (Baseband, Normal IF, and Hi-res IF)

10 MHz Span (Baseband) – 12.8 MS/s.
6 MHz Span (Normal, RF) – 12.8 MS/s.
5 MHz Span – 6.4 MS/s.
2 MHz Span – 3.2 MS/s.
1 MHz Span – 1.6 MS/s.
500 kHz Span – 800 kS/s.
200 kHz Span – 320 kS/s.
100 kHz Span – 160 kS/s.
50 kHz Span – 80 kS/s.
20 kHz Span – 32 kS/s.
10 kHz Span – 16 kS/s.
5 kHz Span – 8 kS/s.
2 kHz Span – 3.2 kS/s.
1 kHz Span – 1.6 kS/s.
500 Hz Span – 800 S/s.
200 Hz Span – 320 S/s.
100 Hz Span – 160 S/s.

Sampling Rate (Wide IF, IQ)
20 M to 30 MHz Span – 40.96 MS/s.
10 MHz Span – 20.48 MS/s.

Minimum Frame Update Time (Frequency Data Acquisition)
10 MHz Span (Baseband) – 80 µs (1024 points).
500 k to 6 MHz Span –
20 µs (256 points, ≤5 MHz span).
80 µs (1024 points).
50 k to 200 kHz Span – 200 µs.
5 k to 20 kHz Span – 2 ms.
500 to 2 kHz Span – 20 ms.
200 Hz Span – 50 ms.
100 Hz Span – 100 ms.

Minimum Frame Update Time (Dual Data Acquisition)
500 k to 6 MHz Span – 160 µs.
50 k to 200 kHz Span – 400 µs.
5 k to 20 kHz Span – 4 ms.
500 Hz to 2 kHz Span – 40 ms.
200 Hz Span – 100 ms.
100 Hz Span – 200 ms.

Minimum Frame Update Time (Zoom Data Acquisition, Baseband, Normal IF, Hi-res IF)
5 MHz Span – 160 µs.
2 MHz Span – 320 µs.
1 MHz Span – 640 µs.
500 kHz Span – 1.28 ms.
200 kHz Span – 3.2 ms.
100 kHz Span – 6.4 ms.
50 kHz Span – 12.8 ms.
20 kHz Span – 32 ms.
10 kHz Span – 64 ms.
5 kHz Span – 128 ms.
2 kHz Span – 320 ms.
1 kHz Span – 640 ms.
500 Hz Span – 1.28 s.
200 Hz Span – 3.2 s.
100 Hz Span – 6.4 s.

Minimum Frame Update Time (Zoom Data Acquisition, Wide IF, IQ)
30 MHz Span – 25 µs.
20 MHz Span – 25 µs.
10 MHz Span – 50 µs.

Digital Demodulation
Carrier Type – Continuous, Burst.
Modulation Format – BPSK, QPSK, DQPSK, 8 PSK, OQPSK, 16 QAM, 64 QAM, 256 QAM, GMSK.
Measurement Filter – Root Cosine.
Reference Filter – Cosine, Gauss.
Filter Parameter – alpha/BT 0.0001 to 1, 0.0001 step.
Maximum Symbol Rate –
5.3 MS/s (Baseband, Normal IF, Hi-res IF).
20.48 MS/s (Wideband, IQ).
Standard Setup – PDC, PHS, NADC, TETRA, GSM, CDPD, IS-95, T53, 3GPP Down Link.
Vector Diagram Display Format – Symbol, Locus Display, Frequency Error Measurement, Origin Offset Measurement.
Constellation Diagram Display Format – Symbol Display, Frequency Error Measurement, Origin Offset Measurement.
Eye Diagram Display Format – I/Q/Trellis Display (1 to 16 Symbols).
Error Vector Diagram Display Format – EVM, Magnitude Error, Phase Error, Waveform Quality (ρ) Measurement.
Symbol Table – Binary, Octal, Hexadecimal.

Digital Demodulation Accuracy
PDC (100 kHz Span) –
EVM ≤1.2%.
Magnitude Error ≤1.0%.
Phase Error ≤0.8º.
PHS (1 MHz Span) –
EVM ≤1.4%.
Magnitude Error ≤1.2%.
Phase Error ≤0.8º.
GSM (1 MHz Span) –
EVM ≤1.8%.
Magnitude Error ≤1.2%.
Phase Error ≤1.0º.
QPSK, 4.096 MS/s 2 GHz Carrier (20 MHz Span) (Typical) – EVM ≤2.5%.
QPSK, 16.384 MS/s 2 GHz Carrier (30 MHz Span) (Typical) – EVM ≤3.0% (25 ºC ±5 ºC).
64 QAM, 5.3 MS/s 1 GHz Carrier (20 MHz Span) (Typical) – EVM ≤2.5%.

Analog Demodulation Accuracy
AM Demodulation Accuracy (–10 dBfs Input at Center, 10 to 60% Modulation Depth) (Typical) – ±2%.
FM Demodulation Accuracy (–10 dBfs Input at Center) (Typical) – ±3º.
FM Demodulation Accuracy (–10 dBfs Input at Center) (Typical) – ±1% of span.

Resolution Bandwidth Filter

Filter Shape –
Gaussian.
Rectangle.
Root Nyquist.
Range – 1 Hz to 10 MHz.
Maximum Span Setting to Activate RBW Filter – 50 MHz.

Trigger

Trigger Mode (Normal IF, Span ≤6 MHz Hi-res IF, Span ≤5 MHz Baseband) –
Auto (Triggered by Block Acquisition).
Normal (Triggered by Event).
Quick (Triggered by Event, Quick Re-triggerable).
Delayed (Triggered by Event with specified delay).
Interval (Triggered by Interval Timer).
Quick Interval (Triggered by Quick Re-triggerable Timer).
Timeout (Triggered when Event has not appeared within Timer setting).
Trigger Mode (Wide IF, IQ) –
Auto (Triggered by Block Acquisition).
Normal (Triggered by Event).
Trigger Event Source –
Internal (Level Comparator).
External (TTL).
Internal Trigger Comparator Data Source –
Frequency Amplitude.
Time Amplitude.
Pre/Post Trigger Setting – Trigger Position is settable within 0% to 100% of Total Data Length.
Frequency Event Trigger Mask Resolution – 1 bin.
Frequency Event Trigger Level Range – 0 dBfs to –70 dBfs.
Time Event Trigger Mask Resolution – 1 sample point.
Time Event Trigger Level Range – 0 dBfs to –40 dBfs.
External Trigger Threshold Level – 1.6 V.
External Synchronization Timing Uncertainty –
±50 ns (30/20 MHz span of wide IF mode).
±100 ns (10 MHz span of wide IF mode).

Display Format

Waveform Format –
Frequency vs. Amplitude/Phase.
Frequency vs. I/Q voltage.
Time vs. Amplitude/Phase.
Time vs. I/Q voltage.
Spectrogram/Waterfall Format –
Time vs. Frequency vs. Amplitude/Phase.
Time vs. Frequency vs. I/Q voltage.
Time vs. Amplitude/Phase Multi-Frame.
Time vs. I/Q voltage Multi-Frame.
AM Demodulation Format – Time vs. Modulation Depth.
FM Demodulation Format – Time vs. Frequency Deviation.
PM Demodulation Format – Time vs. Phase Deviation.
FSK Demodulation Format – Time vs. Frequency Deviation.
Polar Format –
Vector Diagram.
Constellation Diagram.
Eye Pattern Format –
I Eye Pattern.
Q Eye Pattern.
Trellis.
Symbol Table Format – Binary, Octal, Hexadecimal.
Error Vector Format –
EVM.
Magnitude Error.
Phase Error.
Waveform Quality (ρ).

View

Number of Views – 1/2/4.
Settable Views – 8 (Maximum).
Display Traces – 2 (at Waveform Display).
LCD Panel Size – 12.1 inch.
Display Resolution – 1024x768 pixels.
Color – 256 colors (Maximum).

Marker

Marker Type – Normal, Delta, Band-Power.
Search Function – Peak Right, Peak Left, Maximum.
Link Between Views – On/Off.
Measurement Function –
Noise Power.
Power within Band.
C/N ratio.
Adjacent Channel Power.
Occupied Bandwidth.

Zoom

Digital Zoom Ratio – 2 to 1000.
Maximum Span at Zoom Mode –
5 MHz (Baseband, Normal IF, Hi-res IF).
30 MHz (Wide IF, IQ).

Controller

CPU – Intel Celeron 433 MHz.
DRAM – 128 MB DIMM.
OS – Windows 98.
System Bus – PCI, ISA.
Hard Disk – 10 GB 3.5 inch IDE.
Floppy Disk – 1.44 MB 3.5 inch.
Printer Port – Centronics Parallel.
GPIB – IEEE488.1.
LAN – 10/100Base-T.
Mouse – PS-2.
Keyboard – PC/AT.
Monitor Out – VGA 15 pin.

Physical Characteristics*1

Dimensions	mm	in.
Width	430	16.9
Height	270	10.6
Length	600	23.6
Weight	**kg**	**lb.**
Net	31	68.3

*1 Without belts, feet, connectors and fan cover.

Environmental

Atmospherics

Temperature –
Operating: +10 ºC to +40 ºC.
Nonoperating: –20 ºC to +60 ºC.
Temperature Gradient –
Operating: ≤15 ºC per hour (no condensation).
Nonoperating: ≤30 ºC per hour (no condensation).
Relative Humidity –
Operating: 20% to 80% (no condensation).
Nonoperating: Maximum wet-bulb temperature 29 ºC.
Altitude –
Operating: Up to 3 km (10,000 ft).
Nonoperating: Up to 12 km (40,000 ft).

Dynamics

Instrument

Vibration –
Operating: 0.27 G_{RMS}, 5 Hz to 500 Hz.
Nonoperating: 2.28 G_{RMS}, 5 Hz to 500 Hz.
Shock – Nonoperating:196 m/s^2 (20 G), half-sine, 11 ms duration. Three shocks per axis in each direction (18 shocks total).
Bench Handling – Operating: Drop from 10 cm (4-inch) tilt, or 45º, whichever less (Tilt not to balance to point).

Package Product

Vibration and Bounce – ASTM D999-75, Method A, Para. 3.1g, (NSTA proj.1-A-B-1).
Drop – ASTM D999-75, Method 1, Para. 5, (NSTA proj.1-A-B-2).

Heat Dissipation

Maximum Power Dissipation (Fully Loaded) – 350 W max. Maximum line current is 5 A_{RMS} at 50 Hz, 90 V line, with 5% clipping.

Surge Current

Surge Current – MAX30 A peak (25 ºC) for 5 line cycles, After product has been turned off for at least 30 s.

Cooling Clearance

Clearance –
Bottom: 20 mm (0.79 in.).
Both sides: 50 mm (1.97 in.).
Rear: 50 mm (1.97 in.) from rear fan cover.

Electromagnetic Compatibility (EMC)

EC Council Directive 89/336/EEC (EC-92)

Emissions – EN50081-1.
Enclosure: EN 55011 Class A limits for radiated emissions.
AC Main:
- EN 55011Class A limits for conducted emissions.
- EN 61000-3-2 Power line harmonics.
- EN 61000-3-3 Line voltage alteration and flicker.

Immunity – EN50082-1.
EN 61000-4-2 Electrostatic Discharge Immunity.
EN61000-4-3 RF Radiated Immunity.
EN61000-4-6 RF Conducted Immunity.
EN61000-4-5 Surge Immunity.
EN61000-4-4 Electrical Fast Transient Immunity.
EN61000-4-8 Power Frequency Electromagnetic Field.
EN61000-4-11 Power Line Interruption Immunity.

Safety

Third Party Certification –
UL 3111-1.
CSA C22.2 No.1010.1.
Self-Declaration –
EN61010-1 with second amendment.
IEC61010-1 with second amendment.

Ordering Information

WCA330

DC to 3 GHz real-time spectrum analyzer.

Includes: Mouse, keyboard, manual and power cord are included as standard. The standard demodulation software includes PDC, PHS, W-CDMA Down Link, NADC, TETRA, GSM, CDPD, IS-95 and T53.

WCA330 Options

Opt. 1R – Rackmount kit.

Opt. C3 – Service, 3 years of calibration services (initial certification and 2 calibrations).

Opt. D1 – Calibration data report.

Opt. D3 – Service, test data (requires Opt. C3).

Opt. R3 – Repair warranty, extended to cover 3 years.

SL7PCW3 – Software: Display and analysis for PC.

WCA380

DC to 8 GHz real-time spectrum analyzer.

Includes: Mouse, keyboard, manual and power cord are included as standard. The standard demodulation software includes PDC, PHS, W-CDMA Down Link, NADC, TETRA, GSM, CDPD, IS-95 and T53.

WCA380 Options

Opt. 1R – Rackmount kit.

Opt. C3 – Service, 3 years of calibration services (initial certification and 2 calibrations).

Opt. D1 – Calibration data report.

Opt. D3 – Service, test data (requires Opt. C3).

Opt. R3 – Repair warranty, extended to cover 3 years.

SL7PCW3 – Software: Display and analysis for PC.

WCA11G – Software: Capture and analysis of 802.11a, b and g signals for PC.

Power Cord Options

Opt. A1 – Power Cord, European.

Opt. A2 – Power Cord, United Kingdom.

Opt. A3 – Power Cord, Australia.

Opt. A4 – Power Cord, USA.

Opt. A5 – Power Cord, Switzerland.

Service

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. R3 – Repair Service 3 Years.

Opt. R5 – Repair Service 5 Years.

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Our most up-to-date product information is available at:
www.tektronix.com

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

Product Area Assessed: The planning, design/ development and manufacture of electronic Test and Measurement instruments.

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