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-133, 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
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-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 – 1 x 10^-7 (within one year after calibration).

Temperature Drift – 1 x 10^-7 (10 ºC to 40 ºC).
Reference Level Setting Range – –50 to +30 dBm (1 dB step).
Reference Level Accuracy – ±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 dBm).

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 dBmHz (1 M to 10 MHz, Baseband).
Displayed Average Noise Level (Hi-res IF) (Typical) –
–150 dBmHz (10 M to 20 MHz).
–147 dBmHz (25 M to 2.5 GHz).
–145 dBmHz (2.5 to 3.0 GHz).
–142 dBmHz (3 to 8 GHz).

Displayed Average Noise Level (Normal IF) (Typical) –
–147 dBmHz (10 M to 25 MHz).
–143 dBmHz (25 M to 2.5 GHz).
–141 dBmHz (2.5 to 3 GHz).
–140 dBmHz (3 to 8 GHz).

Displayed Average Noise Level (Wide IF) (Typical) –
–140 dBmHz (50 M to 2.5 GHz).
–140 dBmHz (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 (100 kHz RBW, 1.8 MHz offset).

ACPR (W-CDMA Down Link, Crest Factor = 11 dB) –
65 dB (ACPR Configuration).
Wireless Communication Analyzer  
WCA330 • WCA380

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 ≤15 MHz, RBW=30 kHz, Averaged) (Typical) –
-73 dBc or -93 dBm, whichever greater (Normal/Hi-res IF),
-73 dBc or -93 dBm, whichever greater (Baseband, >1 MHz).

Residual Response of Wide IF (without Signal, Span 30 MHz, RBW=100 kHz, Averaged) (Typical) –
-70 dBc 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 dBc whichever greater (Hi-res, Normal IF).

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

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

Sideband Spurious due to I/Q imbalance (Averaged) (Typical) –
-65 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).

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 4,096 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 – 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.
Wireless Communication Analyzer
WCA330 • WCA380

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 20 kHz Span – 200 µs.
5 k to 2 kHz Span – 2 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, 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).
Eye Diagram Display Format – VQ/Trellis Display (1 to 16 Symbols).
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 dB to −70 dB.
Time Event Trigger Mask Resolution – 1 sample point.
Time Event Trigger Level Range – 0 dB to −40 dB.
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 –
Q Eye Pattern.
Q Eye Pattern.
Teilts.
Symbol Table Format – Binary, Octal, Hexadecimal.
Error Vector Format –
EVM.
Magnitude Error.
Phase Error.
Waveform Quality (q).

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\(^1\)

<table>
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<th>Dimensions</th>
<th>mm</th>
<th>in.</th>
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<tr>
<td>Width</td>
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<tr>
<td>Height</td>
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<tr>
<td>Length</td>
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</tr>
<tr>
<td>Weight (Net)</td>
<td>31</td>
<td>68.3</td>
</tr>
</tbody>
</table>

\(^1\) Without belts, feet, connectors and fan cover.

Environmental

Atmospherics

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

Dynamics

- **Instrument**
  - **Vibration**
    - Operating: 0.27 g\(\text{rms}\), 5 Hz to 50 Hz.
    - Nonoperating: 2.28 g\(\text{rms}\), 5 Hz to 50 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 45°, 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**

Heat Dissipation

- **Maximum Power Dissipation (Fully Loaded)**
  - 350 W max. Maximum line current is 5 A\(\text{rms}\) at 50 Hz, 90 V line, with 5% clipping.

Surge Current

- **MAX30 A peak (25 °C)** 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)

  - **Emissions**
    - EN50081-1.
    - EN50081-2.
  - **Immunity**
    - EN50082-1.
    - EN61000-4-2 Electrostatic Discharge Immunity.
    - EN61000-4-3 RF Radiated Immunity.
    - EN61000-4-4 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.
Wireless Communication Analyzer
WCA330 • WCA380

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 TS3.

WCA330 Options

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 TS3.

WCA380 Options

SL7PCW3 – Software: Display and analysis for PC.

Power Cord Options

Service
Opt. C5 – Calibration Service 5 Years.

SL7PCW3 – Software: Display and analysis for PC.

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

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

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Last Update August 13, 2004