CellSpectrum™1000

*Radio Frequency Spectrum and Channel Analysis*

CellSpectrum™ is an RF Spectrum and Channel Analyzer based on a universal software-defined receiver that enables the capturing, digitizing and analysis of detailed RF & channel characteristics needed for the proper design of 4G networks.

Traditional spectrum measuring equipment only provide for the average received signal level, which is not enough information to properly design a 4G network. Due to this many of the RF channel characteristics are baseless guesses, if considered at all. The main difficulty resides in that RF parameters depend on the physical antenna configuration and these tend to vary for each location in the network.

CellSpectrum™ digitizes up to 100 MHz of spectrum at a time, from 100 MHz to 18 GHz, extracting parameters as: LTE channel response per Resource Element, Multipath delay spread, Average frequency fading, Average time fading, Noise floor & interference, Signal to Noise Ratio along the RF frame, RF channel response along the frame and MIMO antenna correlation over a drive test route. It also supports time synchronized measurements, the decoding of multiple technologies and single or multiple deployments, which also makes it ideal for triangulation.

Additionally, allocation and traffic information can be derived, providing valuable information about the allocation used for Inter Cell Interference Coordination (ICIC). Framed OFDM transmitters, like WiMAX and LTE, provide ideal platforms to characterize the RF channel.
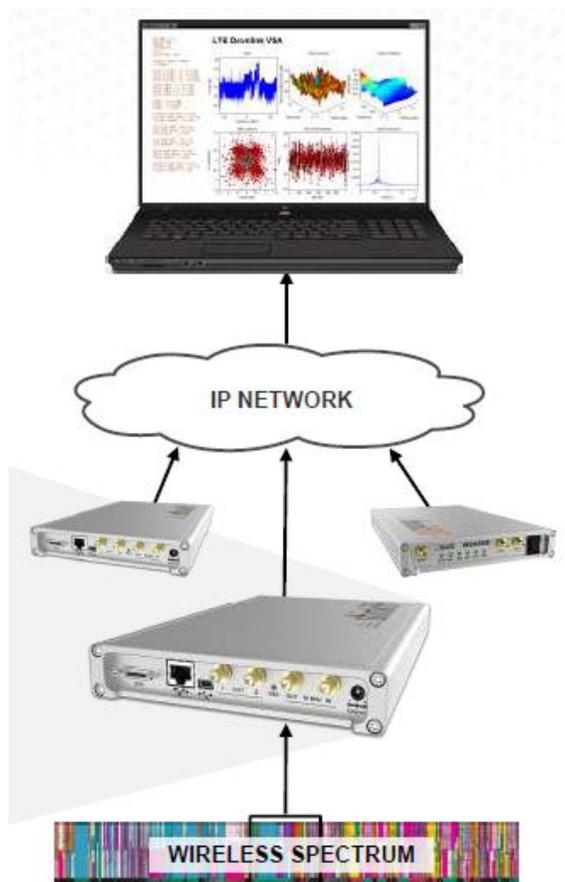
CellSpectrum's Software Defined Receiver (SDR) allows for the continuous addition of new technologies and features as the wireless industry evolves. Its powerful capabilities, small form factor and light weight also makes it the ideal solution for drive test measurements.

The CellSpectrum™ product consists of a Software Defined Receiver (SDRx) combined with Capture, Processing and Analysis Software.

- **CellSpectrum™ 1000** hardware consisting of a Software Defined Receiver (SDR), a regular Spectrum Analyzer, a rugged outdoor multi-satellite GPS with WAAS, a Dead Reckoning unit, a universal antenna (698-960 MHz/1700-2700 MHz), a rugged Windows based PC with Solid-state drives (SSD), and cables. Band-pass filters are not included but should be added for the specific bands being measures to avoid receiver saturation.

- **CellSpectrum™ 1000** software consisting of software capable of capturing, storing and analyzing time and location stamped spectrum data using the CellSpectrum™ 1000 hardware

- Multiple units can be synchronized to analyze simultaneous reception of multiple receive antennas (including PCB mounted ones).
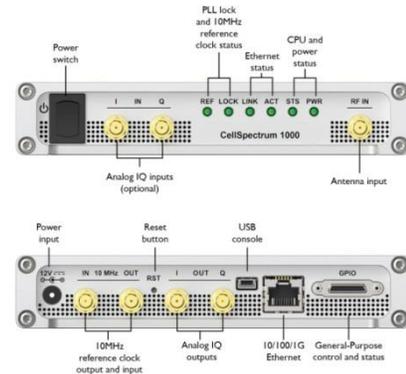
CellSpectrum™ 1000 does not compete with traditional spectrum analyzers, filling instead a gap between field spectrum analyzers and laboratory spectrum analyzers.
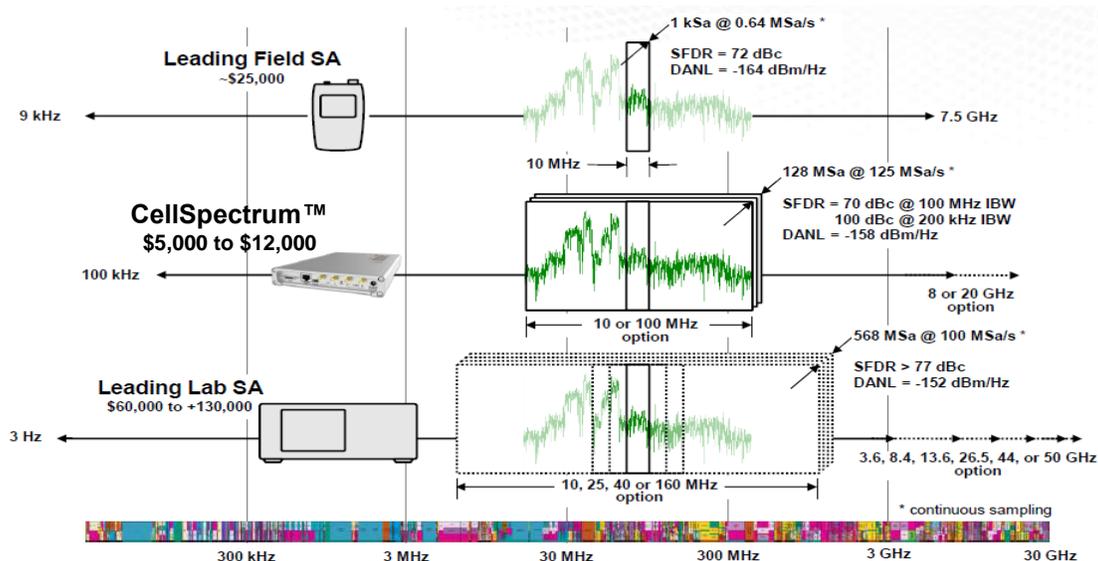
Whether in the lab, facility, field or across the city, **CellSpectrum™** is the only platform that enables universal spectrum analysis and RF path characterization for all wireless communications. It is a unique product in the market and a must have solution for the wireless industry.

CellSpectrum™ 1000

Specifications

Frequency range .... 100 kHz to 20 GHz

Max. Instantaneous bandwidth.....................................10 MHz; 100 MHz

Max. Dynamic Range.. 100 dB

Noise Figure... < 15 dB

Absolute Max. RF input power ....+15 dBm

Max. RF gain... 40 dB

Max. IF gain .... 30 dB

Gain control.. 30 dB; 0.5 dB steps

RF PLL phase noise (2 GHz) ....-100 dBc @ 100 kHz offset

Spectrum scan rate.................................... 200 GHz/s @ 122 kHz RBW

RF PLL lock time...< 100 µs

Power Supply ....+12 VDC

 Power Consumption.. 18 W

Operating Temperature Range .... 0°C to +50°C

Enclosure dimensions ....9.8 (L) x 6.5 (W) x 1.2 (H) inches
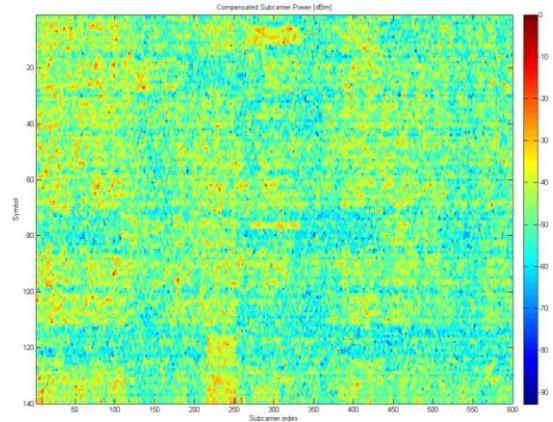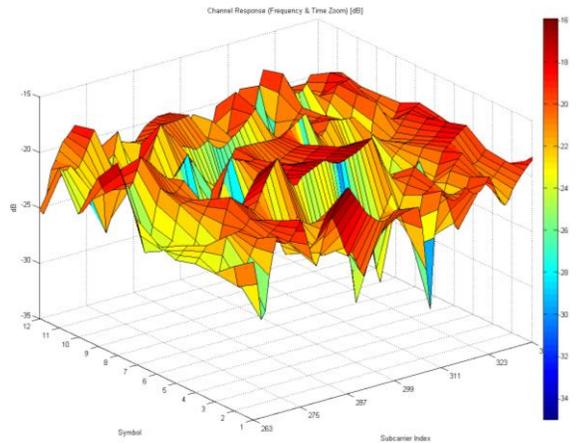
Features

- 10 MHz in/out for multi-channel synchronization*
- Multi-channel ADC sample synchronization option
- Analog I,Q inputs for modulation and time-domain analysis*
- Analog I,Q outputs for higher sampling rate digitization*
- Time triggering, PPS and other GPIO access for external peripheral control
- Gigabit Ethernet based control, data acquisition and streaming

- Universal Software Defined Receiver
- Spectrum Capture and Analysis
  - 100 MHz to 20 GHz range
  - Up to 100 MHz bandwidth analysis
  - Time synchronized measurements
- Single or multiple deployment
  - Ideal for triangulation (time based)
- Multiple Technologies Decoding
- Ideal for drive test measurements
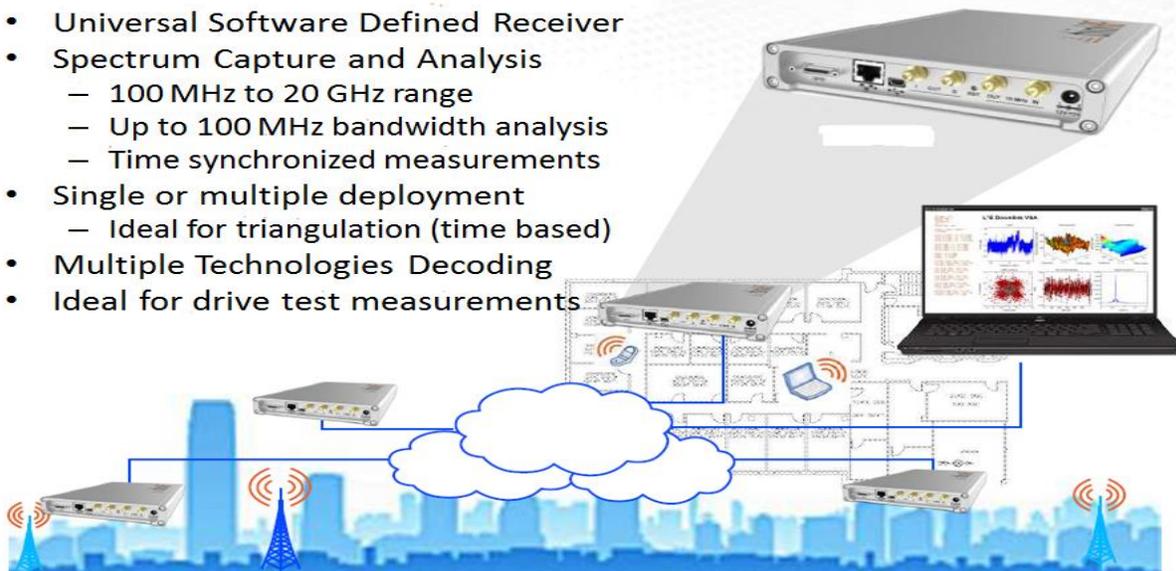
Ordering Information: CellSpectrum™ comes in up to three hard cases with the following components:

- **CellSpectrum™ 1000** consisting of a Software Defined Receiver (SDR), a regular Spectrum Analyzer, a rugged outdoor multi-satellite GPS with WAAS, a Dead Reckoning unit, a universal antenna (698-960 MHz/1700-2700 MHz), a rugged Windows based PC with Solid-state drives (SSD), and cables. Band-pass filters are not included but should be added for the specific bands being measures to avoid receiver saturation.

- **CellSpectrum™ 2000** consisting of software capable of capturing, storing and analyzing time and location stamped spectrum data using the CellSpectrum™ 1000 hardware

CellSpectrum™ 1000- Hardware configuration

Option	Description
101	SDRx: 100 kHz to 8 GHz - 10 MHz
	Rugged case (47 x 35.7 x 17.6 cm), Power Supply, Ethernet cable
102	SDRx: 100 kHz to 8 GHz - 100 MHz
	Rugged case (47 x 35.7 x 17.6 cm), Power Supply, Ethernet cable
103	SDRx: 100 kHz to 20 GHz - 100 MHz
	Rugged case (47 x 35.7 x 17.6 cm), Power Supply, Ethernet cable
201	Rugged PC for data collection and processing
	I5-3340M or similar, 14"LCD, Windows 7 (Win 8 COA), touchscreen, 500GB HDD (7200 rpm), 4GB, Wi-Fi, Bluetooth, DVD, webcam,, back lit keyboard
	Rugged case (
401	Dead Reckoning
600	Walk Test backpack
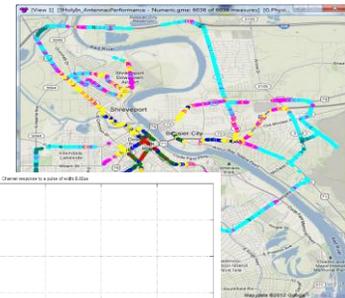
CellSpectrum™ 1000 –Software configuration

Option	Description
301	Spectrum Analyzer
311	LTE Analyzer
321	WiMAX Analyzer
331	UMTS, HSPA Analyzer
341	GSM, GPRS, EDGE Analyzer
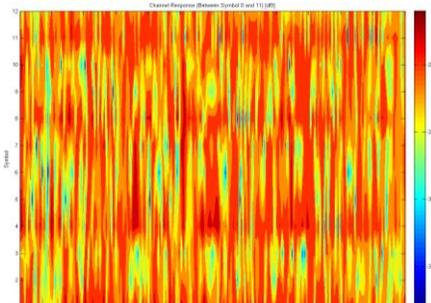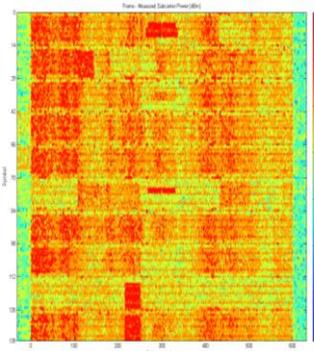
CellSpectrum™ 1000 –Main LTE measurements

1	Received Signal Strength per Resource Element
2	RF channel Response per Reference Signal
3	Interpolated RF Channel Response
4	Corrected Received Signal Strength per Resource Element
5	Impulse Response
6	Multipath Delay Spread
7	RSRP, RSSI, RSRQ (3GPP, RS and PBCH based))
8	Primary Synchronization Signal Power Distribution Profile (PSS PDP)
9	3 D fade mean and variance (frequency and time)
10	Antenna Correlation
11	SNIR
12	Traffic Load Grid (Hot, Mild, Cold) and Traffic Load Percentage

$$r_{xy} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{(n-1)s_x s_y} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}}$$