# Model RTSA7500 Specification V3

## Real-Time Spectrum Analyzers - 100 kHz to 8/18/27 GHz


**Featuring**

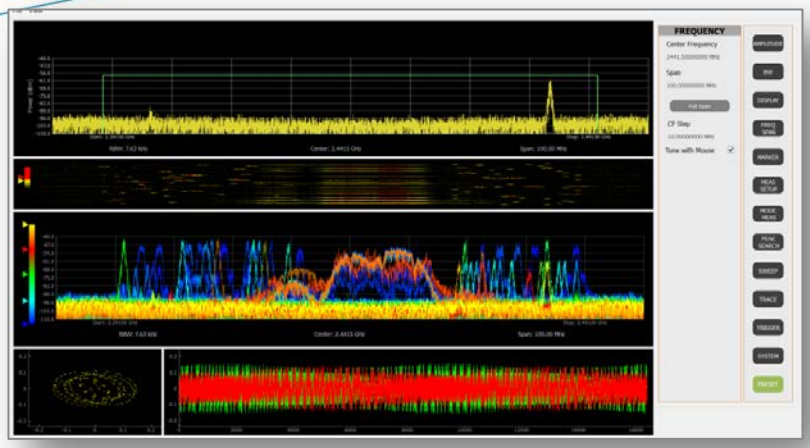
- Real-Time Bandwidth (RTBW) up to 100 MHz
- Probability of Intercept (POI) as short as 1.02 µs
- Spurious Free Dynamic Range (SFDR) up to 100 dBc

BNC Berkeley Nucleonics

Test, Measurement and Nuclear Instrumentation since 1963

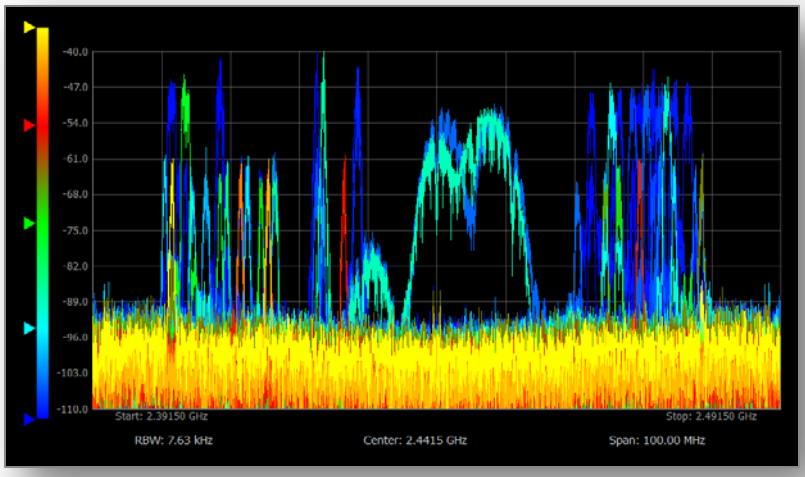
# Model RTSA7500 Series

## Introduction



### What is a Real-Time Spectrum Analyzer?

A Real-Time Spectrum Analyzer (RTSA) processes RF signals at a speed fast enough as to not miss any signals for its given captured bandwidth, known as its Real-Time Bandwidth (RTBW) or Instantaneous Bandwidth (IBW). In addition an RTSA needs to provide views of the spectrum in the frequency and time domains, as well as power spectral density to enable analysis of signals that may be so fast as to be undetectable to the human eye. And finally an RTSA must provide the capability to trigger on events and capture them, and record them for playback enabling deeper analysis.




### Who needs a Real-Time Spectrum Analyzer?

Anyone dealing with signals that may vary dynamically in amplitude or are agile in frequency. Examples include:

- Short duration intermittent signals such as pulsed radar systems, frequency-hopping spread spectrum radios, pulse modulated radios;
- Multi-signal environments such as ISM bands – 915 MHz, 2.4, 5.8, 24 GHz;
- Unwanted signals such as unintentional or self-interference, intentional interference (jammers), and listening devices (bugs).

### What is the BNC solution?

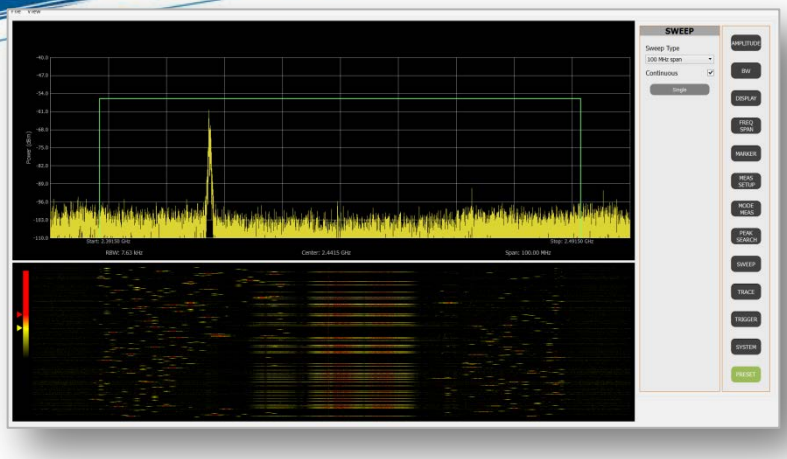
The BNC RTSA7500 is a PC-controlled Real-Time Spectrum Analyzer (RTSA) which includes:

- 100 kHz to 8, 18 or 27 GHz frequency range
- Real-time spectrum graph
- Real-time spectrogram view
- Real-time power spectral density display (persistence)
- Real-Time Triggering
- Real-time I/Q plots
- Real-Time Recording and Playback

The RTSA7500 can be utilized anywhere in the wireless ecosystem – R & D, Education, Manufacturing, Deployment, and Monitoring.

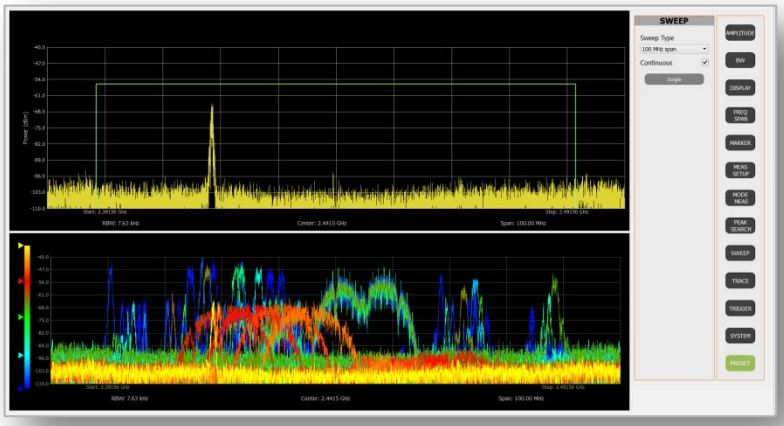
# Model RTSA7500 Series

## RTSA7500 RTSA Displays



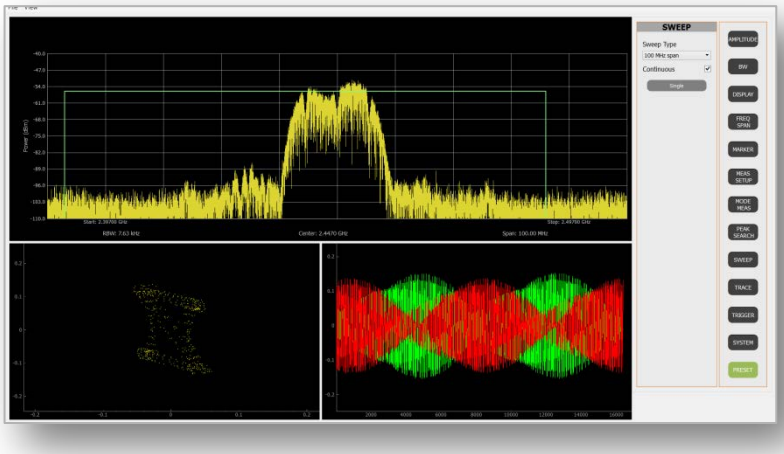

### Spectrogram View

Along with the standard spectrum graph which plots Power versus Frequency the user can select the Spectrogram View. The Spectrogram View provides a 3-dimensional view of the spectrum adding the dimension of Time. Time zero is at the top of the Spectrogram view and measurements in the past scroll down. The color indicates the relative magnitude of the Power. In this case, white being the highest power. Several palettes are available to optimize for best viewing depending on the signals to be evaluated. By looking at Time, one can see the periodicity of any given signal.




### Power Spectral Density Display

The Power Spectral Density Display is commonly called the Persistence Display. Both names give a partial description of what the display does. The color is an indication of how dense or how often the signal is present at the respective power level. In this case yellow represents the level the signal is at most of the time. And signals persist on the screen for a few seconds before fading out allowing you to see signals that come too fast to view in the spectrum graph. One can see the Wi-Fi signal, the Bluetooth Signals, and the Microwave Oven Signals that were present just a few seconds earlier.

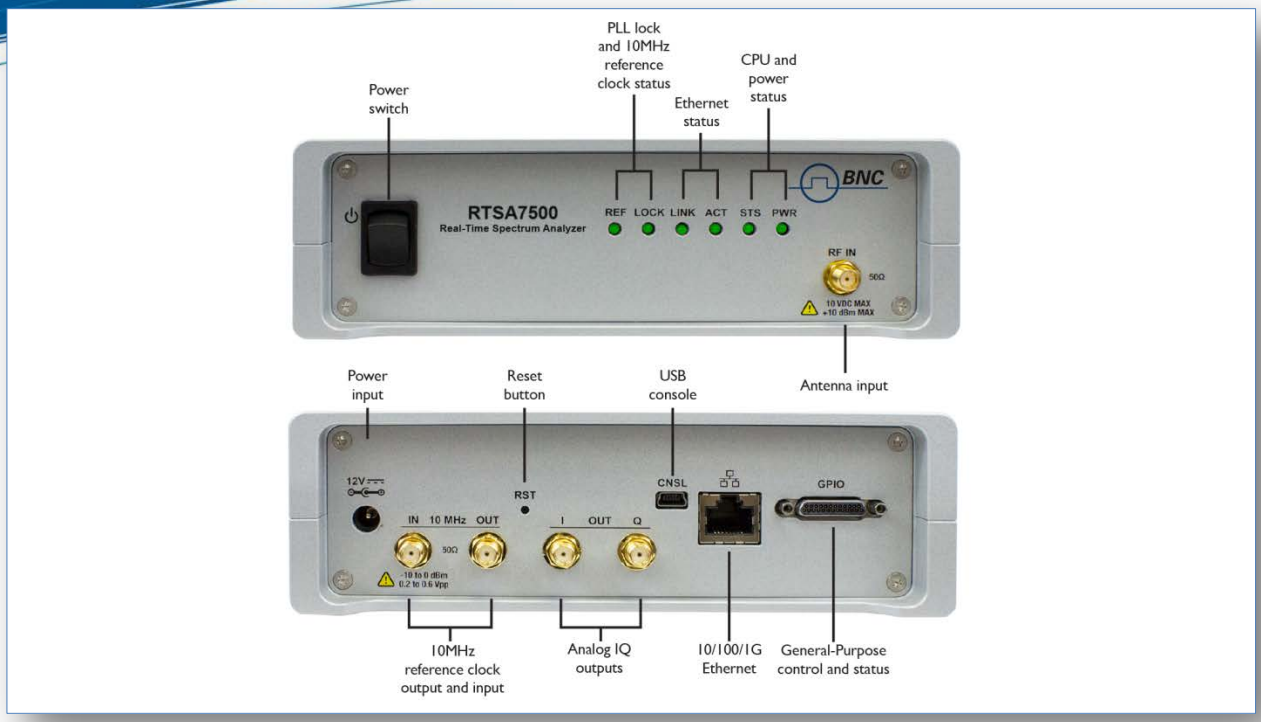



### I /Q Plots

The I/Q plot consists of two plots, the I/Q Constellation (if available) on the left, and the I/Q Time Domain on the right. The Constellation data displays the In-phase (I data) vs. the Quadrature (Q data). The Time domain plot shows a trace for the In-phase (I data in green) and a trace for the Quadrature (Q data in red, if available in the mode).

# Model RTSA7500 Series

## RTSA7500 RTSA Interfaces




**Extensibility of the RTSA7500 for additional functionality and OEMs**

- 10 MHz In for external references and a 10 MHz Out reference for multi-unit synchronization
- Analog I/Q Out enables OEM high speed digitizers and post-processing software tools
- GPIO for external triggers and exterior modules such as antenna switches, downconverters, and GPS
- 10/100/1000 Ethernet port for control and networking the RTSA7500
- +12 V DC power input allowing drive testing with automobile 12 V DC sources and personal mobility with an external 12 Volt battery
- External support for 80 MHz and 160 MHz RTBW (optional)
- External Local Oscillator inputs for phase-coherent radio front-ends (not shown and optional)


**Industry-leading APIs for customization**

BNC utilizes industry-leading APIs/standards and open-source code for easy customization and remote control. University students can take advantage of it as well for their research and develop new applications.

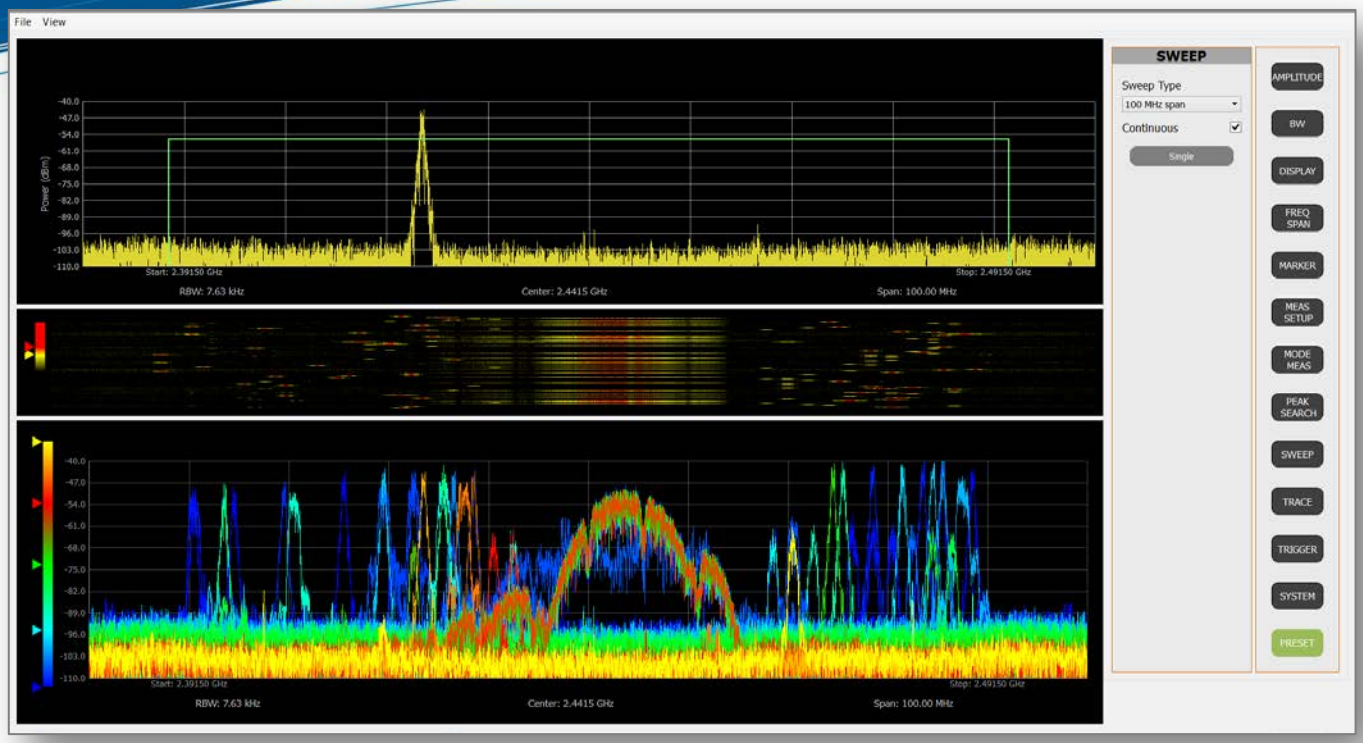
- PyRF RTSA
- LabVIEW Base Development System for Windows
- MATLAB® R2014b
- C++ programming
- SCPI Commands

Standard saved file formats for deeper analysis:

- VITA Radio Transport (VRT)
- Comma Separated Values (CSV)

# Model RTSA7500 Series

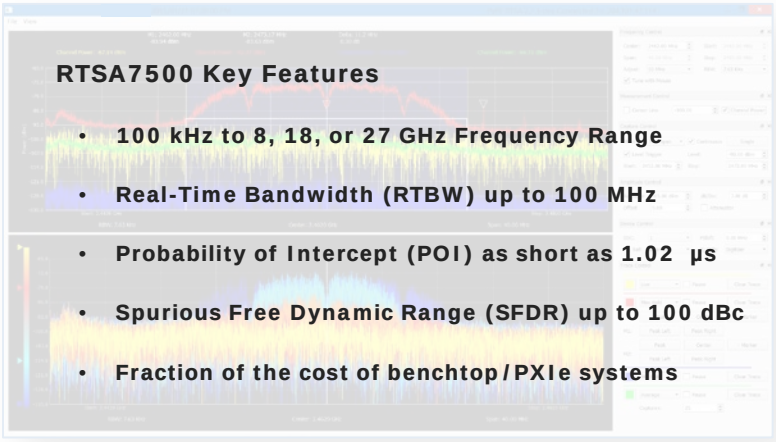
## RTSA7500 RTSA Measurements




### Make measurements locally or remotely

Measurement can be made remotely via the Internet around the globe. Ideal for remote monitoring applications.

- Up to six traces are available as Trace Normal, Trace Average, Max Hold, and Min Hold.
- Twelve Markers are available as Normal (tracking), Delta, and Fixed with Peak Search functions that can be assigned to any trace.
- The Real-Time Level Trigger only captures signals over a certain level and is useful for viewing signals over the Internet.
- For remote applications, Record data on the local PC and then use Playback to view the data without any Internet latency.
- The widescreen view of a laptop or PC monitor enables enhanced viewing not available on instruments with built-in screens.
- The intuitive GUI display makes it easy to operate for anyone familiar with a benchtop spectrum analyzer.




### BNC, the source for real-time analysis

BNC combines patented technology, low-cost digital software-defined radio technology, open source software, standard APIs, and a PC-controlled architecture to provide unparalleled performance for the price. If you are dealing with dynamic and agile signals and could be more productive with an RTSA but thought it was out of your budget, then BNC. Only BNC can deliver these Real-Time Spectrum Analysis features with this performance at a price that is affordable to everyone who can afford a spectrum analyzer. We invite you to BNC in Real-Time!

# Model RTSA7500 Series

| Real-time spectrum analyzer mode | | |
|---|---|---|
| Display Modes | Real-time Spectrum<br>Real-Time Spectrogram<br>Real-Time Persistence Spectrum<br>Real-Time I and Q | |
| Real-time bandwidth (RTBW) | 0.1 / 10 / 40 /100 MHz | |
| 100% Probability of Intercept (POI) | (minimum signal duration)<br>1.02 µs @ 976.56 kHz RBW<br>8.19 µs @ 122.07 kHz RBW | <br>Specification may not be met when the PC is heavily loaded with other processing tasks |
| Spurious free dynamic range (SFDR) | ≥ 60 dBc (nominal)<br>≥ 70 dBc (nominal)<br>≥ 100 dBc (nominal) | 100 MHz RTBW<br>10 / 40 MHz RTBW<br>0.1 MHz RTBW |
| Data Acquisition | | |
| A/D Converter Sampling Rate and Resolution | 125 MS/s,12 bit<br>300 kS/s, 24 bit | 10 / 40 / 100 MHz RTBW<br>0.1 MHz RTBW |
| FFT lengths | 128 to 524288 in powers of 2 | |
| Resolution Bandwidth (RBW) | | |
| Range | 0.24 kHz to 976.56 kHz<br>0.62 Hz to 2543.12 Hz | 10 / 40 /100 MHz RTBW<br>0.1 MHz RTBW |
| Traces | 6 | Clear/Write, Trace Average, Max Hold, Min Hold |
| Markers | 12 | |
| Modes | Normal (tracking), Delta, Fixed | Peak, Next Peak (Right/Left), Center |
| Marker Frequency Resolution | 0.01 Hz | |
| Triggers | 1 | Real-Time Level Trigger |
| APIs | Python™<br>LabVIEW<br>MATLAB®<br>C/C++<br>SCPI | PyRF RTSA<br>LabVIEW Base Development System for Windows<br>MATLAB® Release 2014b<br>ISO/IEC 14882:2011<br>IEEE 488.2 - Standard Commands for Programmable Instruments |
| Record/Playback | VITA Radio Transport (VRT) | VITA-49.0 – 2007 Draft 0.21 |
| Preferences | Save/Load Settings | Save settings for easy recall |
| Export Data | CSV | Comma Separated Values |

| Frequency | | |
|---|---|---|
| Frequency Ranges | | |
| Swept Mode / RTSA Mode (100/40/10/0.1 MHz) | 50 MHz to 8 GHz, 18 GHz or 27 GHz | |
| Baseband Mode | 100 kHz to 62.5 MHz | Non-tunable |
| Frequency Reference | ± 1.0 x 10–6 per year<br>± 1.0 x 10–6 per year | Aging<br>Accuracy + aging |

| Amplitude | | |
|---|---|---|
| Amplitude Accuracy | | |
| 25 °C ± 5 °C, typical | ± 2.00 dB typical<br>± 2.75 dB typical | 100 kHz to 3 GHz<br>>3 GHz to 8 GHz |
| Amplitude Ranges | | |
| Measurement Range | DANL to maximum safe input level | 8 GHz only |
| Attenuator Range | 0 or 20 dB<br>0 to 25 dB, 1 dB steps | IF Attenuator for 18 and 27 GHz only |
| Maximum Safe RF Input Level | +10 dBm, O V DC | |



Berkeley Nucleonics Coporation - 2955 Kerner Blvd - San Rafael CA 94901
800-234-7858 or LiveChat @ www.berkeleynucleonics.com

## Spectral Purity

| SSB Phase Noise<br>25 °C ± 5 °C, typical | at 1 GHz<br>(as an RTSA) | at 1 GHz<br>(as a Receiver) | Carrier Offset |
|---|---|---|---|
| | -80 dBc/Hz typical | -85 dBc/Hz typical | 100 Hz |
| | -90 dBc/Hz typical | -90 dBc/Hz typical | 1 kHz |
| | -97 dBc/Hz typical | -105 dBc/Hz typical | 10 kHz |
| | -102 dBc/Hz typical | -115 dBc/Hz typical | 100 kHz |
| | -123 dBc/Hz typical | -143 dBc/Hz typical | 1 MHz |

| Displayed Average Noise Level (DANL)<br>25 °C ± 5 °C, typical | **7500-8B** | **7500-8, 7500-18** | **7500-27** | **Frequency** |
|---|---|---|---|---|
| | -151 dBm | -164 dBm | -162 dBm | 100 MHz |
| | -151 dBm | -163 dBm | -162 dBm | 500 MHz |
| | -150 dBm | -161 dBm | -160 dBm | 1000 MHz |
| | -149 dBm | -152 dBm | -144 dBm | 2000 MHz |
| | -145 dBm | -157 dBm | -157 dBm | 3000 MHz |
| | -140 dBm | -155 dBm | -154 dBm | 4000 MHz |
| | -142 dBm | -149 dBm | -145 dBm | 5000 MHz |
| | -134 dBm | -143 dBm | -143 dBm | 6000 MHz |
| | -134 dBm | -149 dBm | -143 dBm | 7000 MHz |
| | -131 dBm | -163 dBm | -158 dBm | 8000 MHz |
| | | -162 dBm | -158 dBm | 9000 MHz |
| | | -162 dBm | -157 dBm | 10000 MHz |
| | | -160 dBm | -160 dBm | 11000 MHz |
| | | -158 dBm | -154 dBm | 12000 MHz |
| | | -156 dBm | -146 dBm | 13000 MHz |
| | | -155 dBm | -150 dBm | 14000 MHz |
| | | -159 dBm | -147 dBm | 15000 MHz |
| | | -155 dBm | -150 dBm | 16000 MHz |
| | | -152 dBm | -145 dBm | 17000 MHz |
| | | -149 dBm | -147 dBm | 18000 MHz |
| | | | -147 dBm | 19000 MHz |
| | | | -151 dBm | 20000 MHz |
| | | | -146 dBm | 21000 MHz |
| | | | -145 dBm | 22000 MHz |
| | | | -149 dBm | 23000 MHz |
| | | | -151 dBm | 24000 MHz |
| | | | -148 dBm | 25000 MHz |
| | | | -143 dBm | 26000 MHz |
| | | | -133 dBm | 27000 MHz |

| | | |
|---|---|---|
| Third Order Intercept/(TOI) | +12 dBm, typical | at 1 GHz |

## General Specifications

| | | |
|---|---|---|
| PC Required | | |
| Operating System | Window 7 , 8, 10 (32 or 64 bit) | *For best performance, a dedicated PC is recommended. |
| Minimum RAM Size | 2 GB | |
| Minimum Hard Disk Space | 1 GB | |
| Ethernet Port | 1 GigE | |
| Status Indicators | PLL Lock / 10 MHz reference clock status | |
| | Ethernet Link and Activity status | |
| | CPU and Power status | |
| Connectors | | |
| RF In | SMA female, 50 Ω | |
| 10 MHz Reference In and Out | SMA female, 50 Ω | |
| Analog I and Q Out | SMA female, 50 Ω | 0 or 35 MHz |
| 10/100/1000 Ethernet | RJ45 | |
| USB Console | mini-USB | |
| GPIO | 25-pin male D-Subminiature | |
| Coaxial Power | Type A: 5.5 mm OD, 2.5 mm ID | |
| Physical | | |
| Power Supply | +12 V DC | |
| Power Consumption | 18 W | |
| Operating Temperature Range | 0 °C to +50 °C | |
| Storage Temperature Range | -40 °C to +85 °C | |
| Size | 269 x 173 x 61 mm (10.58 x 6.81 x 2.40 inches) | with mounting feet (shipped installed on unit) |
| | 269 x 173 x 55 mm (10.58 x 6.81 x 2.15 inches) | without mounting feet |
| Weight | 2.7 kg (6 lbs.) | |

# Model RTSA7500 Series

| Ordering Information | | |
|---|---|---|
| 8 GHz RTSA | RTSA7500-8B | 100 kHz to 8 GHz, RTBW up to 10 MHz* |
| 8 GHz RTSA | RTSA7500-8 | 100 kHz to 8 GHz, RTBW up to 100 MHz |
| 18 GHz RTSA | RTSA7500-18 | 100 kHz to 18 GHz, RTBW up to 100 MHz |
| 27 GHz RTSA | RTSA7500-27 | 100 kHz to 27 GHz, RTBW up to 100 MHz |
| 80 MHz and 160 MHz RTBW Support | RTSA7500-xxx-WBIQ ** | External support for 80 MHz Super-Heterodyne and 160 MHz Zero-IF RTBW. The RTBW of 160 MHz is intended for IQ out only. The internal digitizer remains at 125 MSa/s. |
| External Local Oscillator Support | RTSA7500-xxx-ELO ** | External Local Oscillator inputs for phase-coherent radio front-ends |
| High IF | RTSA7500-xxx-HIF ** | Radio receiver front-end with IF output between 800 and 2500 MHz. When this option is selected, the lower IF outputs at 0 or 35 MHz or the RF digitization will not be available |
| 80 MHz and 160 MHz RTBW and External Local Oscillator Support | RTSA7500-xxx-WBIQ-ELO ** | Radio receiver front-end support for external Local Oscillator inputs and 80 MHz Super-Heterodyne and 160 MHz Zero-IF RTBW. The instantaneous BW of 160 MHz is intended for IQ out only. The internal digitizer remains at 125 MSa/s. |
| Software Included | RTSA | Real-Time Spectrum Analyzer software |
| Laptop Accessory | P/N7128 | Laptop accessory - GUI installed for RTSA7500 - includes Toshiba L55-B5276 (or equivilent) loaded with MS Home and Business 2013, Adobe PDF Viewer & Windows 7 or 8 operating software |
| Rack Shelf | P/N7123 | 19" rack shelf supports two horizontally mounted |
| External Battery | P/N7127 | 20,000 mAh 12 V / 1.5 A battery, >3.5 hours typ. |

* The 8P does not include 10 MHz Out or I/Q Out

* * xxx = 8, 18 or 27 for 8 GHz, 18 GHz, or 27 GHz models respectively

| Regulatory Compliance | |
|---|---|
| RoHS Compliance | RoHS/RoHS 2 |
| Marks | CE |
| EMC Directive 2014/30/EU | EN 61326-1:2013 |
| Low Voltage Directive 2006/95/EC | EN 61010-1:2010 Class 1 |



Ref:110215



Berkeley Nucleonics Coporation - 2955 Kerner Blvd - San Rafael CA 94901
800-234-7858 or LiveChat @ www.berkeleynucleonics.com