Model RTSA7500 Specification 1.1

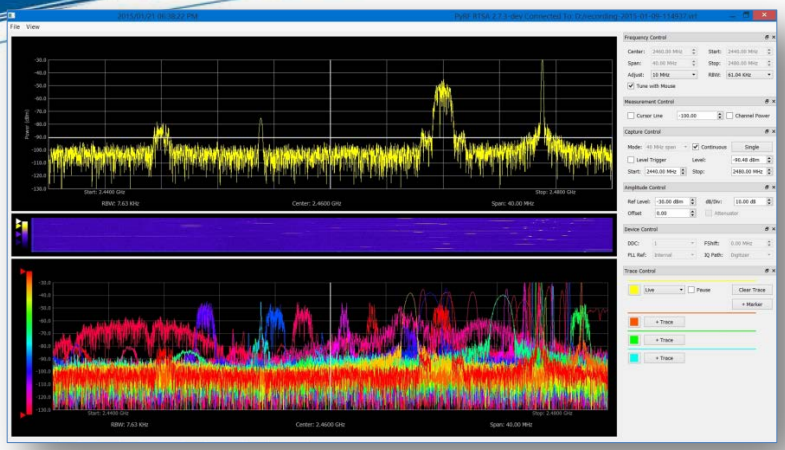
Real-Time Spectrum Analyzers - 100 kHz to 8/18/27 GHz

BNC Berkeley Nucleonics

Test, Measurement and Nuclear Instrumentation since 1963

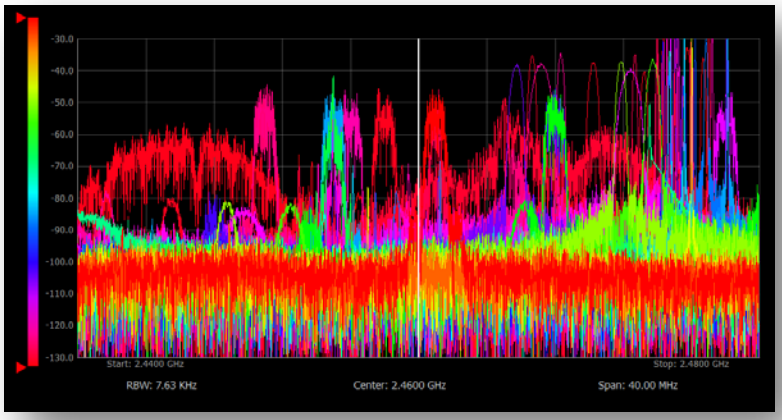
Model RTSA7500 Series

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).

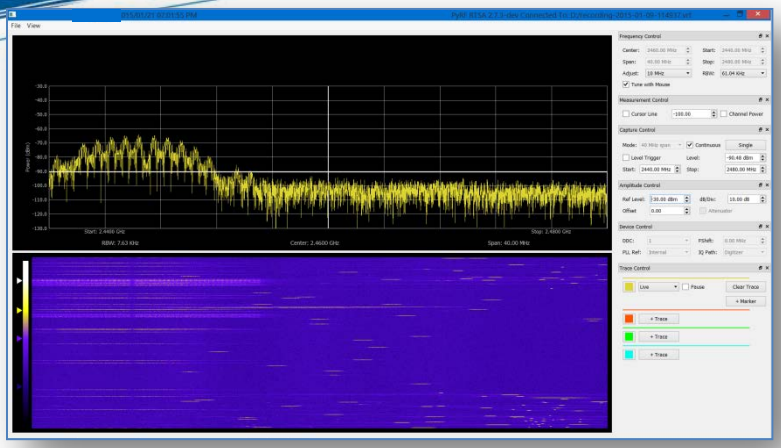
What is the BNC solution?

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

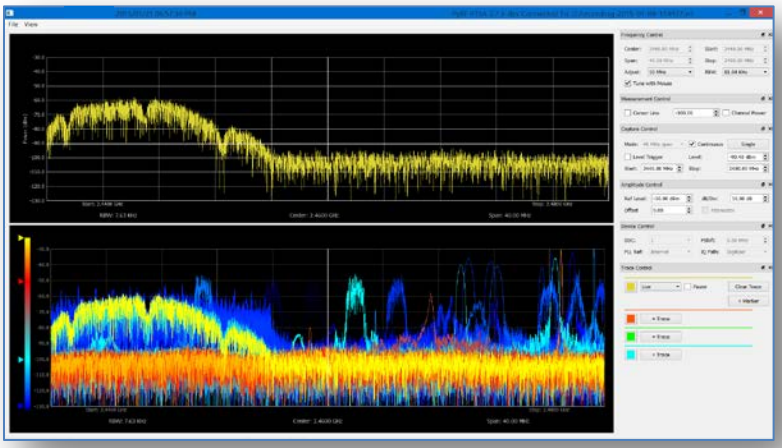
The RTSA7500 can be utilized anywhere in the wireless ecosystem – R & D, Education, Manufacturing, Deployment, and Monitoring.

RTSA7500 RTSA Displays



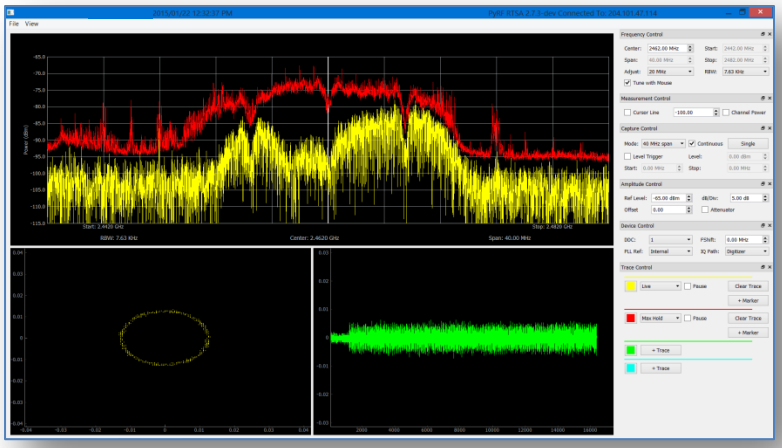
Spectrogram View

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).

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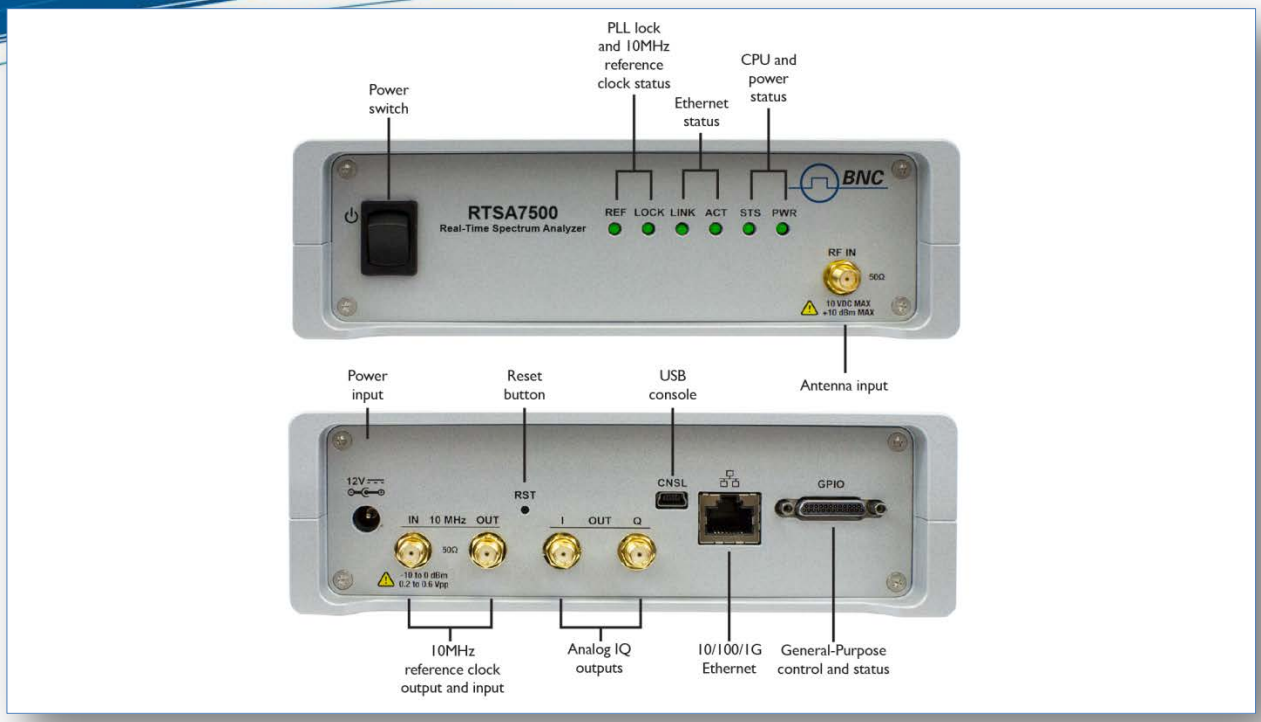
RTSA7500 RTSA Interfaces



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)

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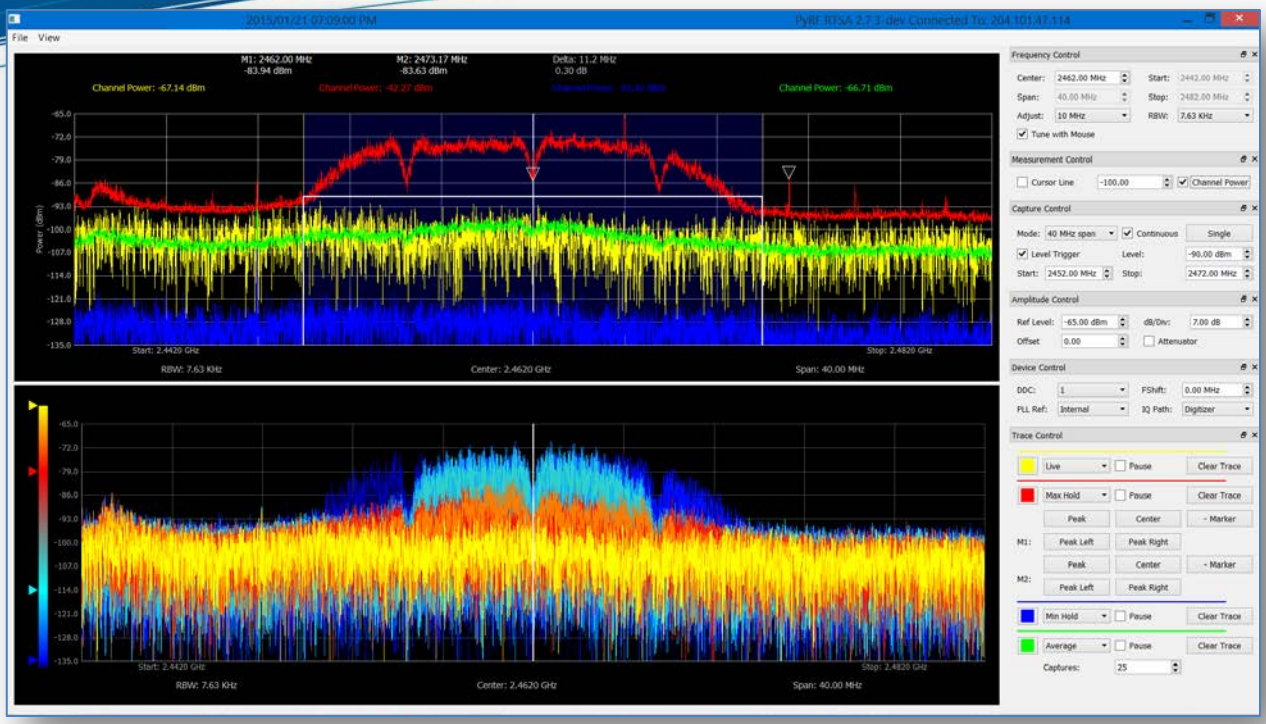
RTSA7500 RTSA Measurements



Make measurements locally or remotely

The above measurement were made remotely via the Internet over 4000 km away (2400 miles). Ideal for monitoring applications.

- The Spectrum graph has Max and Min Hold turned on as well as Averaging for a total of four traces.
- With Channel Power activated you get the Channel Power displayed for all four traces.
- Markers 1 and 2 are displaying their respective frequencies and power values and the delta values between them.
- Real-Time Level Trigger is turned on. This is helpful in viewing signals over the Internet.
- Use Record that stores the data on your local PC and 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.

RTSA7500 Key Features

- **100 kHz to 8, 18, or 27 GHz Frequency Range**
- **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**
- **Fraction of the cost of benchtop/PXIe systems**
- **DSP filtering and decimation**

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 your are dealing with dynamic and agile signals and could be more productive with an RTSA but thought it was out of your budget, then we invite you to seriously consider the BNC RTSA7500. 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.

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Real-time spectrum analyzer mode		
Display Modes	Real-time Spectrum Real-Time Spectrogram Real-Time Persistence Spectrum Real-Time I and Q	
Real-time bandwidth (RTBW)	0.1 / 10 / 40 /100 MHz	
100% Probability of Intercept (POI)		
	1.02 µs minimum signal duration	976.56 kHz RBW
	8.2 µs minimum signal duration	122.07 kHz RBW
Spurious free dynamic range (SFDR)	≥ 60 dBc (nominal)	100 MHz RTBW
	≥ 70 dBc (nominal)	10 / 40 MHz RTBW
	≥ 100 dBc (nominal)	0.1 MHz RTBW
Data Acquisition		
A/D Converter Sampling Rate and Resolution	125 MS/s,12 bit	10 / 40 / 100 MHz RTBW
	300 kS/s, 24 bit	0.1 MHz RTBW
FFT lengths	128 to 524288 in powers of 2	
Resolution Bandwidth (RBW)		
Range	0.24 kHz to 976.56 kHz	10 / 40 /100 MHz RTBW
	0.62 Hz to 2543.12 Hz	0.1 MHz RTBW
Traces	4	Live, Pause, Max Hold, Min Hold, Average, Clear
Markers	2	Peak, Next Peak (Right/Left), Center
Triggers	3	Level, External, Signal Capture
APIs	Python™	PyRF RTSA
	LabVIEW	LabVIEW Base Development System for Windows
	MATLAB®	MATLAB® Release 2014b
	C/C++	ISO/IEC 14882:2011
	SCPI	IEEE 488.2 - Standard Commands for Programmable Instruments
Record/Playback	VITA Radio Transport (VRT)	VITA-49.0 – 2007 Draft 0.21
Export Data	CSV	Comma Separated Values

Frequency		
Frequency Ranges		
Swept Mode	100 kHz to 8 GHz, 18 GHz or 27 GHz	Usable to 0 Hz
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	Usable to 0 Hz
Frequency Reference	± 1.0 x 10–6 per year	Aging
	± 1.0 x 10–6 per year	Accuracy + aging

Amplitude		
Amplitude Accuracy		
25 °C ± 5 °C	± 2.00 dB typical	100 kHz to 3 GHz
	± 2.75 dB typical	>3 GHz to 8 GHz
Amplitude Ranges		
Measurement Range	DANL to maximum safe input level	
Attenuator Range	0 or 20 dB	8 GHz models only, N/A on 18/27 GHz models
Maximum Safe RF Input Level	+10 dBm	

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Spectral Purity		
SSB Phase Noise	at 1 GHz	Carrier Offset
	-85 dBc/Hz typical	100 Hz
	-90 dBc/Hz typical	1 kHz
	-105 dBc/Hz typical	10 kHz
	-115 dBc/Hz typical	100 kHz
	-143 dBc/Hz typical	1 MHz
Displayed Average Noise Level (DANL)	without preamp	Frequency
25 °C ± 5 °C	-151 dBm/Hz typical	100 MHz
	-151 dBm/Hz typical	500 MHz
	-150 dBm/Hz typical	1000 MHz
	-149 dBm/Hz typical	2000 MHz
	-145 dBm/Hz typical	3000 MHz
	-140 dBm/Hz typical	4000 MHz
	-142 dBm/Hz typical	5000 MHz
	-134 dBm/Hz typical	6000 MHz
	-134 dBm/Hz typical	7000 MHz
	-131 dBm/Hz typical	8000 MHz
Third Order Intercept/(TOI)	at 1 GHz	
	+12 dBm, typical	

General Specifications		
PC Required		
Operating System	Windows XP (32 bit)	
	Window 7 and 8 (32 or 64 bit)	
RAM	2 GB	
Hard Disk	1 GB	
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 5 mm (10.58 x 6.81 x 2.15 inches)	
Weight	2.7 kg (6 lbs.)	

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

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Ordering Information		
8 GHz RTSA	RTSA7500-308-8B	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
Rack Shelf	P/N7123	19" rack shelf supports two horizontally mounted RTSA7500 or six vertically mounted RTSA7500 (requires vertical mounting kit) including fasteners
Rack Kit	P/N7124	Vertical mounting kit for 19" rack shelf. Kit contains six vertical mounts including fasteners. Does not include the rack shelf.
Wall Bracket	P/N7125	Wall bracket. Includes fasteners
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

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These specifications are preliminary, non-warranted, and subject to change without notice

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