

# S-Series Pro All-in-One RF Test System

CONTROLLABLE VIA YOUR OWN COMPUTER WITH INCLUDED SOFTWARE OR WITH OPTIONAL 17" OR 28" CONTROLLER/MONITOR



NEW!! S-SERIES PRO MODELS UP TO 20 GHZ



PATENT PENDING

20 GHz S-Series Pro with optional 17 inch Controller/Monitor

# **Test Bench in a Box**<sup>™</sup>

### It incorporates a...

- Real Time Spectrum Analyzer
  - Vector Network Analyzer
    - Signal Generator
    - Tracking Generator
  - Programmable Attenuator
    - 4 Channel Scope
    - RF Power Meter
    - RF Power Amplifier

all in one, cost-effective piece of equipment!

Purchase, Lease and Rental Options Available

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RF Pallets | RF Modules | RF Amplifiers | RF Lab Amps | RF Systems | Test Equipment | Custom Products



The S-Series Pro product line comes with a 2-year warranty and is proudly made in the USA.

## **PATENT PENDING**



Note 1: 2 Port Network Analyzer available for all models.

Note 2: A power amplifier may be added to fit your custom application, frequency ranges up to 18 GHz, power levels up to 50 watts.

Note 3: Controller/Monitor available for all models.

Note 4: System software included SYSTEM REQUIREMENTS Intel i7, 3rd generation or later with a quad core processor, one USB 3.0 port.



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#### Model SP4 includes:

- 1 Hz 4.4 GHz Spectrum Analyzer
- 34 MHz 4.4 MHz Signal Generator
- 250 MHz 4 Channel Scope **Options:**
- 300 KHz 6 GHz Vector Network Analyzer
- 10 Hz to 4.4 MHz Tracking Generator
- 1 MHz 8 GHz Power meter
- 54 MHz 13.6 GHz Dual Signal Generator
- 1 MHz 6 GHz Programmable Attenuator
- 100 MHz 18 GHz / 1 watt amplifier
- 17" Controller/Hi-definition Monitor
- 28" Controller/Hi-definition Monitor

#### **Model SP6 includes:**

- 9 KHz 6 GHz Real Time Spectrum Analyzer
- 1 MHz 6 GHz Filtered Signal Generator
- 250 MHz 4 Channel Scope

#### **Options:**

- 300 KHz 6 GHz Vector Network Analyzer
- 1 MHz 8 GHz Power meter
- 54 MHz 13.6 GHz Dual Signal Generator
- 1 MHz 6 GHz Programmable Attenuator
- 100 MHz 18 GHz / 1 watt amplifier
- 17" Controller/Hi-definition Monitor
- 28" Controller/Hi-definition Monitor

#### Model SA12 includes:

- 100 KHz 12.4 GHz Spectrum Analyzer
- 54 MHz 13.6 GHz Dual Signal Generator
- 250 MHz 4 Channel Scope

#### **Options:**

- 100 KHz 18 GHz Vector Network Analyzer
- 100 KHz to 12.4 MHz Tracking Generator
- 1 MHz 12.5 GHz Power meter
- 100 MHz 18 GHz / 1 watt amplifier
- 17" Controller/Hi-definition Monitor
- 28" Controller/Hi-definition Monitor

#### Model SP20 includes:

- 100 KHz 20 GHz Real Time Spectrum Analyzer
- 100 MHz 20 GHz Signal Generator
- 250 MHz 4 Channel Scope

#### **Options:**

- 100 KHz 18 GHz Vector Network Analyzer
- 1 MHz 26.5 GHz Power meter
- 10 MHz 24 GHz Dual Signal Generator
- 100 MHz 30 GHz Programmable Attenuator
- 100 MHz 18 GHz / 1 watt amplifier
- 17" Controller/Hi-definition Monitor
- 28" Controller/Hi-definition Monitor

Note: Consult factory for options desired as some options are not compatible with each other.

Custom configurations available upon request.

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#### **TEST BENCH IN A BOX™**

The S-Series Pro is a general-purpose, all-inclusive RF test bench in one enclosure. The RF equipment built into the S-Series Pro can be used stand-alone or with other external equipment.

All of the instruments are accessible through frontpanel connectors. With the Controller/Monitor options instrument settings are controlled with a wireless keyboard and mouse, which are provided with the instrument. The optional controller unit has Ethernet, USB and Wi-Fi interfaces and an HDMI connector, to connect an external monitor, which allows viewing multiple instrument displays at the same time. The Ethernet and Wi-Fi interfaces enable connection to the internet to access data sheets, test specifications and other documents during testing.

The system software, built on a general-purpose PC platform running Windows 10, allows independent control of the instruments. Each instrument has a unique software application that runs on the PC and can work with other software on the PC. As one example, a Labview test program developed for the system, block or circuit being tested can automatically control the internal instruments to provide a unique RF test environment. The Labview environment can be viewed and controlled using the monitor (internal or external), keyboard and mouse. Power for the instruments and integrated power amplifiers (depending on the model) is provided from modular power supplies and a centralized power distribution circuit board. The power supplies are compatible with 100 to 240 VAC power lines.



20 GHz S-Series Pro with 28 inch Controller/Monitor

#### **TEST, MEASURE AND ANALYZE EXAMPLES**

**Power Amplifiers:** Power amplifier testing uses the signal generator, spectrum analyzer and power meter. The measurement setup only requires the S-Series Pro product and a power supply and external pads for the amplifier being tested. In this example, the harmonic performance of the amplifier, which is putting out 10 W at 915 MHz, is measured with the spectrum analyzer. While all the measurement windows are open and tiled on the external monitor, the display can be configured to show only one of the instruments, such as the spectrum analyzer for a closer view of the amplifier's harmonics.



**Setup and Calibration of an Amplifier:** In this example, the S-Series Pro is used to calibrate an M-Series power amplifier (**above**), which covers 500 to 2500 MHz and provides 25 W output power. The M-Series power amplifier can be calibrated using the built-in functions of the S-Series Pro. To calibrate the power and detected voltage across the frequency band, the test setup uses the signal generator and power meter with a custom program written to store the detected voltage versus power and frequency in the M-Series memory. The power meter measures the output power and gain, and the spectrum analyzer measures the harmonic and spurious signal levels.

Scalar Network Analysis: The spectrum analyzer and tracking generator can be combined to create a scalar network analyzer, to measure the insertion loss of a filter, attenuator or amplifier (*see Figure 1*). Used with a directional coupler, this test setup also measures return loss.

**Phase Noise:** In the phase noise measurement mode, the spectrum analyzer displays the single-sideband phase noise on a logarithmically-scaled spectrum plot (*see Figure 2*).

**Digital Demodulation:** The S-Series Pro also has the capability to demodulate a digitally-modulated RF signal by using the spectrum analyzer as a vector signal analyzer (VSA). Complex communications signals that cannot be described as AM or FM (see *Figure 3*) can be characterized. The built-in software offers common VSA views, such as constellation diagrams, symbol-error charts and symbol tables and the system software demodulates ASK, BPSK, DBPSK, QPSK, DQPSK, 8PSK, D8PSK,  $\pi/4$  DQPSK, OQPSK, N-FSK and 16-QAM.



#### S-Series Pro SP6 Test System Specifications



#### System Specifications

- AC Input: 90-260 VAC
- Power: 500 Watts
- Temp Range: 10° 40°C
- Power Button On: All Systems On
- Temp Range: 10° 40°C
- · Weight: 25 lbs
- Dimensions: 19"x16"x5.5"
- Rack Mountable
- USB Control Port

#### **Real Time Spectrum Analyzer** FREQUENCY

- Frequency Range: 9 kHz to 6.0 GHz
- Streaming calibrated I/Q data: 250kHz to 27MHz of selectable IF bandwidth that is amplitude corrected
- Resolution Bandwidths (RBW): 10 Hz to 10 MHz
- Internal Time-based Accuracy: ±1ppm per year
- Sweep Speed (RBW ≥10 kHz): 24GHz/sec

#### AMPLITUDE (RBW ≤100 KHZ)

- Range: +10dBm to Displayed Average Noise Level (DANL)
- Absolute Accuracy: ±2.0dB (arbitrary & non-native RBWs)
- +2.0dB/–2.6dB (native RBW's-faster DSP)

#### **DISPLAYED AVERAGE NOISE LEVEL (DANL)**

Input Frequency Range	<u>dBm/Hz (Typical)</u>
9kHz to 500kHz	-140dBm/Hz
500kHz to 10MHz 1	-154dBm/Hz
0MHz to 6GHz	-158dBm/Hz + 1.1dB/G

#### SSB PHASE NOISE AT 1 GHZ (TYPICAL)

Offset Frequency	<u>dBc/Hz</u>
100 Hz	-70
1 kHz	-76
10 kHz	-83
100 kHz	-93
1 MHz	-117

#### **True RMS Power Sensor**

- **Specifications:**
- Frequency: 1 MHz to 8 GHz
- Dynamic Range: -35 dBm to +20 dBm
- True RMS detection enables measuring CW, modulated and multi-tone signals.
- 55 dB Dynamic Range
- Good VSWR, 1.05:1 typ.
- Fast measurement speed, 30 msec typ.
- Automatic frequency calibration & temperature compensation
- Effective, easy-to-use Windows<sup>®</sup> GUI

#### **Amplifier**

#### **Specifications:**

- Frequency: 100 MHz to 18 GHz
- Power Output: 1 watt
- Gain: 25dB

• VSWR: 2:1 Output Power: +10 dBm

#### Vector Network Analyzer FREQUENCY

**Signal Generator** FREQUENCY

Setting Time: 2 msec

- 300 kHz to 6 GHz operation
- High speed of > 5000 dual-port s-parameters per second
- Quad RX' four-receiver architecture for optimal accuracy
- 118 dB dynamic range at 10 Hz bandwidth
- 0.005 dB RMS trace noise at bandwidth of 140 kHz
- Time domain and port impedance transformations
- Tabular and graphic print & save formats, including Touchstone
- P1dB, AM to PM, and stand-alone signal generator utilities
- · Fully accessible, guided 8 and 12-term calibration processes · 6 calibration modes, including unknown through and
- connected DUT isolation
- · Calibration and check standards with data for confident measurements

Measurement bandwidth	140 kHz, 70 kHz, 35 kHz, 15 kHz, 10 kHz, 5 kHz, 1 kHz, 500 Hz, 100 Hz, 50 Hz, 10 Hz	
Average displayed noise floor	Typical (dB) –110,–118,–	110
Trace noise, dB RMS	<u>Bandwidth</u> 10 kHz 70 kHz 140 kHz	<u>Typical</u> 0.0008 dB 0.003 dB 0.005 dB

#### Four Channel Digital Oscilloscope

Features:	
Bandwidth	250 MHz
Channel	4 CH
• Real-time Sampling Rate	1GSa/s
Memory Depth	64K
Time Base Precision	±50ppm
<ul> <li>Time Base Range</li> </ul>	2ns/div-1000s/div (1-2-4 sequences)
Input Impedance	1MΩ 25pF
<ul> <li>Input Sensitivity</li> </ul>	2mV/div@10V/div
Vertical Displacement	2mV@10V/div @ x1 probe
	20mV@100V/div @ x10 probe
	200mV@1000V/div @ x100 probe
	2V@10000V/div @ x1000 probe
<ul> <li>Trigger Source</li> </ul>	CH1, CH2, CH3, CH4
<ul> <li>Waveform Frequency</li> </ul>	DC~25MHz
• DAC	2K~200MHz adjustable
<ul> <li>Frequency Resolution</li> </ul>	0.10%
Channel	1CH waveform output
<ul> <li>Waveform Depth</li> </ul>	2KSa
<ul> <li>Vertical Resolution</li> </ul>	8 bit
<ul> <li>Frequency Stability</li> </ul>	<30ppm
Wave Amplitude	±3.5V Max.
<ul> <li>Output Impedance</li> </ul>	50 Ω
System	BW 25M
<ul> <li>Harmonic Distortion</li> </ul>	-50dBc (1KHz), -40dBc (10KHz)
Trigger Mode	Edge, Pulse, Video,
	Alternative Positive Width,
	Negative Width, Duty Cycle

 Frequency Resolution: 3/6 Hz Output Power accuracy: • Frequency Accuracy: 1 PPM +/- 1 dB Harmonics and

• Frequency Range: 1 MHz to 6 GHz • Dynamic Range: 85 dB

Sub-Harmonics: -50 dBc Typ.

#### S-Series Pro SP20 Test System Specifications



#### System Specifications

- AC Input: 90-260 VAC
- Power: 500 Watts
- Temp Range: 10° 40°C
- Weight: 25 lbs
- Dimensions: 19"x16"x5.5"
- Rack Mountable
  USB Control Port
- Power Button On: All Systems On

#### Real Time Spectrum Analyzer FREQUENCY

- Frequency Range: 100 kHz to 20.0 GHz
- Calibrated Streaming I/Q: 5 kHz to 40 MHz of selectable I/Q bandwidth.
- Resolution Bandwidths (RBW): 0.1 Hz (≤200kHz span) to 3 MHz (any span) using 40 MHz IBW; 30 kHz to 10 MHz using 160 MHz IBW

#### SWEEP SPEED

<u>RBW</u>
1 MHz
100 kHz
30 kHz
10 kHz
1 kHz

#### DISPLAYED AVERAGE NOISE LEVEL (DANL) Input Frequency Range dBm/Hz (Typical)

Input Frequency Range	<u>dBm/Hz (T</u>
100 kHz to 700 MHz	-156 dBm
700 MHz to 2.7 GHz	-160 dBm
2.7 GHz to 4.5 GHz	-158 dBm
4.5 GHz to 8.5 GHz	-153 dBm
8.5 GHz to 15 GHz	-154 dBm
15 GHz to 20 GHz	-149 dBm

#### SSB PHASE NOISE AT 10 GHZ (TYPICAL)

<u>Offset Frequency</u>	<u>dBc/Hz</u>
10 Hz	-76
100 Hz	-108
1 kHz	-123
10 kHz	-132
100 kHz	-136
1MHz	-133

#### True RMS Power Sensor

#### Specifications:

- Frequency: 1 MHz to 26.5 GHz
- Dynamic range: -60 dBm to +26 dBm
- Total error: 1.71%
- VSWR: <1.14:1
- Average Power Measurements: 2000/second
- · General purpose scalar measurements
- General average RF and microwave power measurements requiring leading edge accuracy: CW & pulsed signals
- Narrow and wide band signals: CDMA, W-CDMA, QAM, OFDM, GSM, TDMA, QPSK, FSK, AM, FM, etc.
- Average Power, Duty Cycle-Computed Pulse Power, Data Logging

#### **Amplifier**

#### Specifications:

- Frequency: 100 MHz to 18 GHz
- Power Output: 1 watt
   Gain: 27dB

#### Signal Generator FREQUENCY

- Frequency Range: 100 MHz to 20 GHz
- 1 Hz tuning resolution (exact frequency)
- < -30 dBm to +10 dBm leveled output</li>
- Spurious signals <-70 dBc typical
- Low residual phase noise typically -118 dBc/Hz at 10 kHz offset from 10 GHz
- · Dual independent channels
- 2nd order Harmonics >-20 dBc
- Sub-Harmonics > -70 dBc

#### Vector Network Analyzer

• 100 KHz to 18 GHz operation

- Measured parameters: S11, S21, S12, S22
- Sweep types: Linear frequency, log frequency, segment, power sweep
- Dynamic range: 130 dB
- Wide output power adjustment range: -40 dBm to +10 dBm
- Measurement time per point: 30 µs per point, min typ.
- Tabular and graphic print and save formats, including Touchstone
- Up to 16 logical channels with 16 traces each max
- Automation programming in LabView, Python, MATLAB, .NET, etc.
- Time domain and gating conversion included
- Frequency offset mode, including vector mixer calibration measurements
- Up to 200,001 measurement points
- Multiple precision calibration methods and automatic calibration

#### Noise Floor

100 kHz to 300 kHz	-80 dBm/Hz
300 kHz to 10 MHz	-115 dBm/Hz
10 MHz to 7 GHz	-130 dBm/Hz (135 dBm/Hz typ.)
7 GHz to 12 GHz	-125 dBm/Hz (130 dBm/Hz typ.)
12 GHz to 16 GHz	-122 dBm/Hz (127 dBm/Hz typ.)
16 GHz to 18 GHz	-120 dBm/Hz (125 dBm/Hz typ.)

250 MHz

4 CH

#### Four Channel Digital Oscilloscope

F	eatures:
•	Bandwidth

- Channel
- Real-time Sampling Rate 1GSa/s
- Memory Depth
- Time Base Precision
- Time Base Range
- Input Impedance
- Input Sensitivity
- Vertical Displacement
- Trigger Source
- Waveform Frequency
- DAC
- Frequency Resolution
- Channel
- Waveform Depth
- Vertical Resolution
- Frequency Stability
- Wave Amplitude
- Output Impedance
- System BW
- Harmonic Distortion

64K ±50ppm 2ns/div-1000s/div (1-2-4 sequences) 1MΩ 25pF 2mV/div~10V/div 2mV~10V/div @ x1 probe; 20mV~100V/div @ x10 probe 200mV~1000V/div @ x100 probe 2V~10000V/div @ x1000 probe CH1, CH2, CH3, CH4 DC~25MHz 2K~200MHz adjustable 0.10% 1CH waveform output 2KSa 8 bit <30ppm ±3.5V Max. 50 Ω 25M -50dBc (1KHz), -40dBc (10KHz)



Turn-key ATE systems available

# All-in-One RF Test System

6 GHz system with 17 inch Controller/Monitor

A compact and cost-effective alternative to bulky and expensive test equipment has been the dream of many an engineer. Elite RF tasked its engineers to develop a multi-purpose RF test equipment product that would be a workhorse for the RF engineer. The goals were to be as versatile as possible, have a small footprint — yet remain affordable compared to the typical RF test equipment on the market. The S-Series Pro product line is the result of that development.

The new & innovative **S-Series Pro Multi-Purpose RF Test System**. It is a flexible alternative to expensive & bulky RF test equipment and can be used for R&D characterization on the bench, EMC assessment and automated production test in the factory. The RF equipment built into the S-Series Pro can be used standalone or with other external equipment.

Base Model is controllable via a USB port with on screen GUI. Compatible computer required along with included S-Series Pro software

#### The S Series Pro with controller features:

- 17" or 28" display
- USB Ports
- HDMI Output
- LAN
- Internet Access
- Keyboard and trackpad

Independent control of each RF system allows for maximum test flexibility and the system can be connected to a larger monitor for viewing multiple windows at the same time.



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### The SP20 incorporates...

- 100 KHz 20 GHz Real Time Spectrum Analyzer
- 100 MHz 20 GHz Signal Generator
- 250 MHz 4 Channel Scope

#### **Options:**

- 100 KHz 18 GHz Vector Network Analyzer
- 1 MHz 26.5 GHz Power meter
- 10 MHz 24 GHz Dual Signal Generator
- 100 MHz 30 GHz Programmable Attenuator
- 100 MHz 18 GHz / 1 watt amplifier
- 17" Controller/Monitor
- 28" Controller/Monitor

all in one piece of equipment!

# Starting at \$9,995.00

Optional Power Amplifier can be customized to your application.

#### Purchase, Lease and Rental Options Available



The S-Series Pro product line comes with a 2-year warranty and is proudly made in the USA.