



# S-Series

## All-in-One RF Test System



**PATENT PENDING**

# Test Bench in a Box™

**It incorporates a...**

- Spectrum Analyzer
- RF Tracking Generator
- Dual Signal Generator
- RF Power Amplifier
- 4 Channel Scope
- RF Power Meter

**all in one, cost-effective piece of equipment!**

**Purchase, Lease and Rental Options Available**

**[www.eliterf.com](http://www.eliterf.com)**

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



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

**PATENT PENDING**



*Note 1: Scalar Network Analysis: The spectrum analyzer and tracking generator can be combined to create a scalar network analyzer*

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

#### Model SA441 includes:

- 1 Hz - 4.4 GHz Spectrum Analyzer
- 10 Hz - 4.4 GHz RF Tracking Generator
- 54 MHz - 13.6 GHz Dual Signal Generator
- 200 MHz 4 Channel Scope

#### Model SPA441 includes:

- 1 Hz - 4.4 GHz Spectrum Analyzer
- 10 Hz - 4.4 GHz RF Tracking Generator
- 54 MHz - 13.6 GHz Dual Signal Generator
- 0.5 - 4.2 GHz / 5 watt RF Power Amplifier
- 200 MHz 4 Channel Scope
- 50 MHz - 4 GHz RF Power Meter

#### Model SA1241 includes:

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

#### Model SPA1241 includes:

- 100 KHz - 12.4 GHz Spectrum Analyzer
- 100 KHz - 12.4 GHz RF Tracking Generator
- 54 MHz - 13.6 GHz Dual Signal Generator
- 100 MHz - 18 GHz RF / 1 watt Power Amplifier
- 200 MHz 4 Channel Scope
- 10 MHz - 12.5 GHz RF Power Meter

#### S-Series options

- 6 GHz Real-Time Spectrum Analyzer
- 20 GHz Real-Time Spectrum Analyzer
- 6 GHz low harmonic signal generator
- 6 GHz true RMS power sensor
- 8 GHz peak and average power sensor
- 20 GHz peak and average power sensor
- 50 MHz - 6 GHz 10 watt class AB power amp
- 20 MHz - 1 GHz 20 watt class A power amp
- 20 MHz - 2.7 GHz 10 watts class A power amp
- 6 GHz - 12 GHz 10 watt class AB power amp
- 2 GHz - 8 GHz 2 watt class A power amp
- 6 GHz - 18GHz 2 watt class A power amp

**Custom configurations available upon request.**



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# TEST BENCH IN A BOX™

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

All of the instruments are accessible through front-panel connectors, except for the oscilloscope, which is accessed from the rear panel. Instrument settings are controlled with a wireless keyboard and mouse, which are provided with the instrument. The unit has Ethernet, USB and Wi-Fi interfaces and an HDMI connector on the rear, 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.



Figure 1

# TEST, MEASURE AND ANALYZE EXAMPLES

**Power Amplifiers:** Power amplifier testing uses the signal generator, spectrum analyzer and power meter, as shown in **Figure 1**. The measurement setup only requires the S-Series 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 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. 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 RF switching relay routes the RF output of the M-Series amplifier to either the S-Series power meter or spectrum analyzer. 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 3**). 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 4**).

**Digital Demodulation:** The S-Series 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 5**) 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.

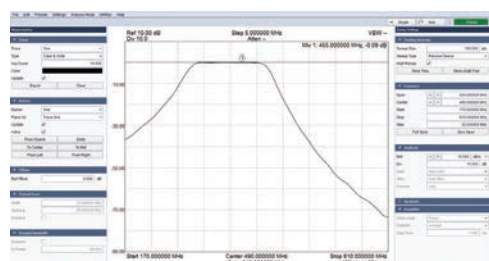


Figure 3

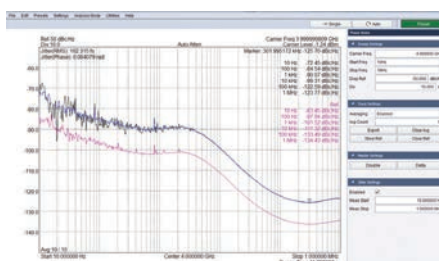


Figure 4

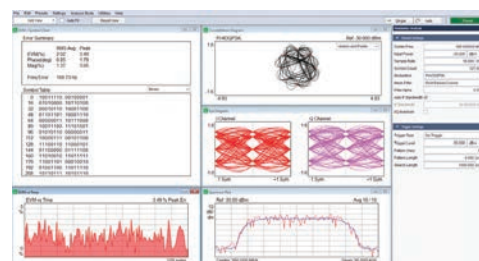


Figure 5



# S-Series SA441/SPA441 Test System Specifications

## System Specifications

- AC Input: 90-260 VAC
- Power: 500 Watts
- Temp Range: 10° - 40°C
- Power Button Off: Standby Mode
- Power Button On: All Systems On
- Temp Range: 10° - 40°C
- Weight: 25 lbs
- Dimensions: 19"x16"x5.5"
- Display Size: 7 inch
- HDMI/Ethernet Ports
- Rack Mountable

## Spectrum Analyzer and Measuring Receiver FREQUENCY

- Frequency Range: 1Hz to 4.4GHz (RF Preamp Off)  
500kHz to 4.4GHz (RF Preamp On)
- Internal Frequency Reference Accuracy:  $\pm 1$  ppm
- Counter Accuracy:  $\pm (1\text{Hz} + \text{time-base error})$
- Resolution Bandwidth: 0.1Hz to 250kHz and 5MHz

## AMPLITUDE (RBW $\leq 100$ KHZ)

- Range: +10dBm to Displayed Average Noise Level (DANL)
- Absolute Accuracy:  $\pm 1.5\text{dB}$  (0dBm to DANL);  
 $\pm 2.0\text{dB}$  (+10dBm to >0dBm)

**Displayed Average Noise Level:**  
(dBm/Hz with 0dB input attenuation)

FREQUENCY	RF PREAMP OFF	RF PREAMP ON
10Hz	-124 dBm	NA
100Hz to 10kHz	-135 dBm	NA
10KHz to 500kHz	-142 dBm	NA
500kHz to 2.6GHz	-144 dBm	-158 dBm
2.6GHz to 3.3GHz	-135 dBm	-151 dBm
3.3GHz to 4.4GHz	-128 dBm	-134 dBm

## MEASURING RECEIVER

- Operating Frequency: 150kHz to 4.4GHz
- FM Accuracy:  $\pm 1\%$  typical
- AM Accuracy:  $\pm 1\%$  typical
- Synchronous Level Detector:  $\pm 0.25\text{dBc}$  (0dBm to -125 dBm, 150kHz to 1GHz) and [0dBm to -115dBm, 1GHz to 4.4GHz]

## True RMS Power Sensor

### Specifications:

- Frequency: 50 MHz to 4000 MHz
- 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® GUI

## Amplifier 1

### Specifications:

- Frequency: 500 MHz to 4.2 GHz
- Power Output: 5 watts
- Gain: 25

## Amplifier 2

### Specifications:

Custom per your application

## Dual Channel RF Signal Generator

54 MHz – 13.6 GHz

### Features:

- Open source Labview GUI software control via USB
- 96MHz 32 bit ARM processor on board
- Two channel frequency, phase and amplitude control
- Quadrature (or other phase) LO signal generation
- 0.1Hz or less frequency resolution
- 2.5ppm generator frequency accuracy
- 01 degree phase control on each channel
- 4mS RF lock time standard
- 70uS RF lock time (TBD) (subject to export control)
- Up to +20dBm output power
- 16 bit 0.01dB amplitude resolution
- Over 50dB of power control
- Absolute power display on Software GUI
- 10MHz – 100MHz external reference input
- Selectable 10 or 27 MHz internal reference output
- Internal and external FM, AM, Pulse Modulation
- Pulsed FMCW Chirp
- External Sweep, Step and modulation Trigger
- 100 point Frequency and Amplitude Hop Table
- Dual Channel Frequency and Amplitude Lock

## Tracking Generator

### FREQUENCY

- Frequency range: 10 Hz to 4.4 GHz
- Frequency Accuracy:  $\pm 1\text{ppm}$
- Frequency steps: 19 selectable step sizes from 10 Hz to 10 MHz (10 Hz to 4.4 GHz range)

### AMPLITUDE

- Amplitude range: -30 dBm to -10 dBm
- Absolute Amplitude accuracy  $\pm 2$  dB
- Amplitude steps: 1 dB

## Four Channel Digital Oscilloscope

### Features:

- Bandwidth 200MHz
- Channel 4 CH
- Real-time Sampling Rate 1GSa/s
- Memory Depth 64K
- Time Base Precision  $\pm 50\text{ppm}$
- Time Base Range 2ns/div-1000s/div (1-2-4 sequences)
- Input Impedance 1M $\Omega$  25pF
- Input Sensitivity 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
- Trigger Source CH1, CH2, CH3, CH4
- Waveform Frequency DC~25MHz
- DAC 2K~200MHz adjustable
- Frequency Resolution 0.10%
- Channel 1CH waveform output
- Waveform Depth 2KSa
- Vertical Resolution 12 bit
- Frequency Stability <30ppm
- Wave Amplitude  $\pm 3.5\text{V Max.}$
- Output Impedance 50  $\Omega$
- System BW 25M
- Harmonic Distortion -50dBc (1KHz), -40dBc (10KHz)
- Trigger Mode Edge, Pulse, Video, Alternative Positive Width, Negative Width, Duty Cycle



## S-Series SA1241/SPA1241 Test System Specifications

### System Specifications

- AC Input: 90-260 VAC
- Power: 500 Watts
- Temp Range: 10° - 40°C
- Power Button Off: Standby Mode
- Power Button On: All Systems On
- Temp Range: 10° - 40°C
- Weight: 25 lbs
- Dimensions: 19"x16"x5.5"
- Display Size: 7 inch
- HDMI/Ethernet Ports
- Rack Mountable

### Spectrum Analyzer and Measuring Receiver FREQUENCY

- Frequency Range: 100 kHz to 12.4 GHz
- Time base: 10 MHz reference in and out
- Internal Frequency Reference Accuracy:  $\pm 1$ ppm
- Resolution Bandwidth: 1 Hz to 250 kHz and 6 MHz

### AMPLITUDE (RBW $\leq 100$ KHZ)

- Range: +10 dBm to Displayed Average Noise Level (DANL)
- Absolute Accuracy (0dB to DANL):  
 $\pm 1.5$  dB (100 kHz to 6 GHz)  
 $\pm 2.5$  dB (6 GHz to 12.4 GHz)

### DISPLAYED AVERAGE NOISE LEVEL (DBM/HZ)

- 100 kHz to 8.0 GHz -147 dBm
- 8.0 GHz to 11.0 GHz -134 dBm
- 11.0 GHz to 12.4 GHz -129 dBm

### RESIDUAL RESPONSES (RBW = 6.5KHZ)

- 100 kHz to 10 MHz -100 dBm
- 10 MHz to 8.0 GHz -93 dBm
- 8.0 GHz to 12.4 GHz -82 dBm

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

Frequency	Offset dBc/Hz
100 Hz	-72
1 kHz	-80
10 kHz - 100 kHz	-87
1 MHz	-110

### IF OUTPUT

63 MHz with 6 MHz bandwidth for down conversion of NTSC, PAL, SECAM, ATSC, and DTV formatted signals

### MEASURING RECEIVER (TYPICAL AFTER 30 MIN WARM-UP AND $\pm 3^\circ\text{C}$ OF REF. START TEMP.)

- Operating Frequency: 100 kHz to 12.4 GHz
- Modulation Measurement Accuracy:  $\pm 1\%$  for AM & FM

### True RMS Power Sensor

#### Specifications:

- Frequency: 10 MHz to 12.5 GHz
- Dynamic Range: -55 dBm to +20 dBm
- Total Error: 1.95%
- VSWR: 1.20:1
- 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 1

#### Specifications:

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

### Amplifier 2

#### Specifications:

Custom per your application

### Dual Channel RF Signal Generator (54 MHz – 13.6 GHz)

#### Features:

- Open source Labview GUI software control via USB
- 96MHz 32 bit ARM processor on board
- Two channel frequency, phase and amplitude control
- Quadrature (or other phase) LO signal generation
- 0.1Hz or less frequency resolution
- 2.5ppm generator frequency accuracy
- 01 degree phase control on each channel
- 4mS RF lock time standard
- 70uS RF lock time (TBD) (subject to export control)
- Up to +20dBm output power
- 16 bit 0.01dB amplitude resolution
- Over 50dB of power control
- Absolute power display on Software GUI
- 10MHz – 100MHz external reference input
- Selectable 10 or 27 MHz internal reference output
- Internal and external FM, AM, Pulse Modulation
- Pulsed FMCW Chirp
- External Sweep, Step and modulation Trigger
- 100 point Frequency and Amplitude Hop Table
- Dual Channel Frequency and Amplitude Lock

### Tracking Generator

#### FREQUENCY

- Frequency range: 100 kHz to 12.4 GHz
- Frequency Accuracy:  $\pm 1$ ppm
- Frequency steps: 19 selectable step sizes from 10 Hz to 10 MHz (100 kHz to 4 GHz range) and 16 selectable step sizes from 100 Hz to 10 MHz (4 GHz to 12.4 GHz range)

#### AMPLITUDE

- Amplitude range: -30 dBm to -10 dBm
- Absolute Amplitude accuracy  $\pm 2$  dB
- Amplitude steps: 1 dB

### Four Channel Digital Oscilloscope

#### Features:

- Bandwidth 200MHz
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- Time Base Precision  $\pm 50$ ppm
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- Wave Amplitude  $\pm 3.5$ V Max.
- Output Impedance 50  $\Omega$
- System BW 25M
- Harmonic Distortion -50dBc (1KHz), -40dBc (10KHz)
- Trigger Mode Edge, Pulse, Video, Alternative Positive Width, Negative Width, Duty Cycle, Arbitrary Waveform Generator Mode





# All-in-One RF Test System

Tired of looking at small screens?  
S-Series comes with a HDMI port

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 product line is the result of that development.

The new & innovative **S-Series 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 can be used stand-alone or with other external equipment.

The SPA1241 additional features, include:

- 7" Front Panel Display
- USB Ports
- HDMI Output
- Display Remote Control
- LAN
- Internet Access
- RF Power Relay
- Wireless Keyboard/Mouse
- RF Power Attenuator

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.

**The SPA1241 incorporates a...**  
**12.4 GHz Spectrum Analyzer**  
**12.4 GHz RF Tracking Generator**  
**13.6 GHz Dual Signal Generator**  
**18 GHz RF Power Amplifier**  
**200 MHz 4 Channel Scope**  
**12.5 GHz RF Power Meter**  
**all in one piece of equipment!**



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*Optional Power Amplifier #2 can be customized  
to your application.*



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



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