

# SHA800A

## Spectrum & Network Analyzer



DataSheet EN\_01A



SIGLENT TECHNOLOGIES CO.,LTD



## General Description

The SIGLENT SHA850A, a handheld portable spectrum analyzer and cable-and-antenna analyzer, is a powerful and flexible tool for those field and outdoor RF applications. Including communication engineering, telecom operation and maintenance, radio management, factory production, education and teaching and many other fields.

With a frequency range up to 7.5 GHz, the analyzer delivers reliable automatic measurements and multiple modes of operation. A spectrum analyzer, including built-in amplifier and independent signal source, fast scanning speed, high sensitivity, can achieve broadcast monitoring, channel power scanning, wireless interference location, power monitoring, electromagnetic compatibility, and other functions. A cable and antenna tester including built-in DC voltage bias, with a 1-path-2-port vector network analysis function, can measure TDR, VSWR, port matching debugging, insertion loss measurement, tower amplifier debugging, cable fault location, Smith chart, etc.

## Features and Benefits

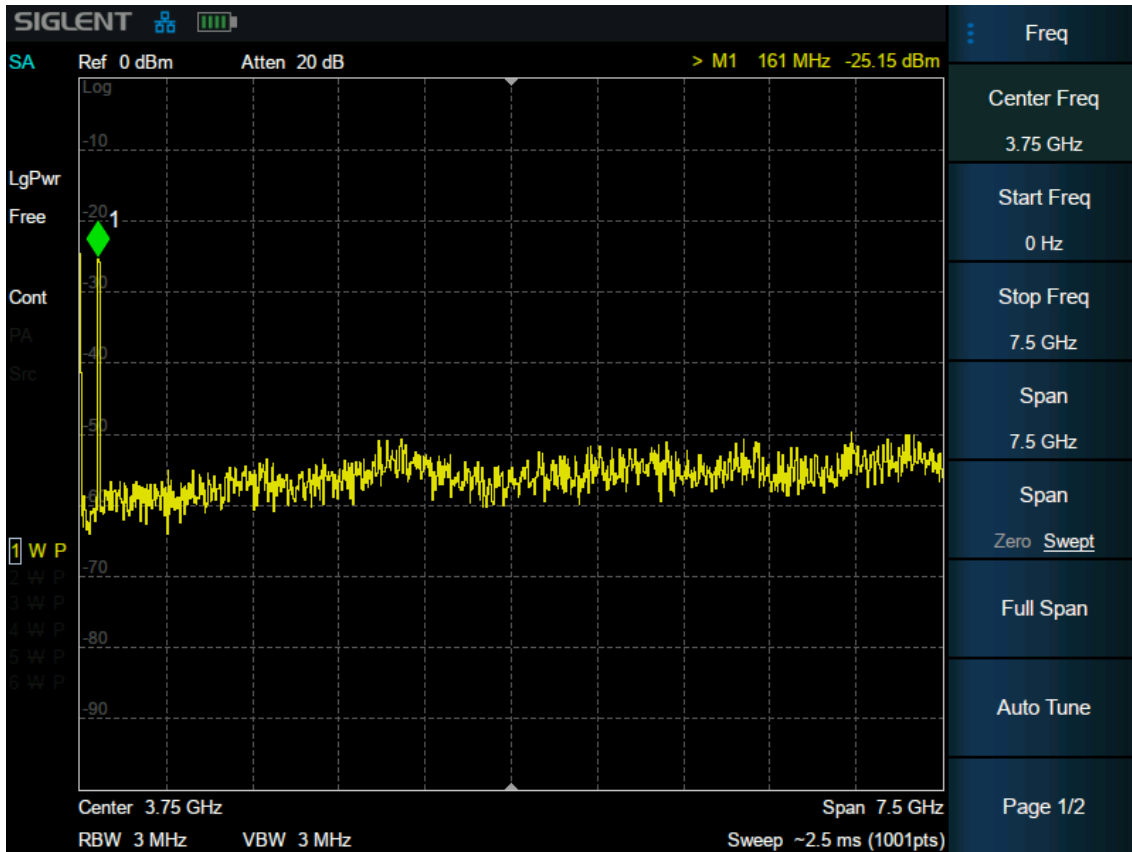
- ◆ Spectrum Analyzer Frequency Range from 9 kHz up to 7.5 GHz, -165 dBm/Hz Displayed Average Noise Level (Typ.), -104 dBc/Hz.@10 kHz Offset Phase Noise (1 GHz, Typ.), 1 Hz up to 10 MHz Minimum Resolution Bandwidth (RBW), Preamplifier and independent signal source up to 7.5 GHz, GPS positioning and logging
- ◆ Cable and Antenna Test Frequency Range from 100 kHz up to 7.5 GHz, Distance To Fault and Time Domain Analysis
- ◆ Vector Network Analyzer, Bias out up to 32VDC
- ◆ Typical working time 4 hours, 3.2 kg net weight, 8.4 Inch Multi-Touch Screen , Mouse and Keyboard supported

Model	SHA851A	SHA852A
Spectrum Analyzer	9 kHz~3.6 GHz	9 kHz~7.5 GHz
Cable and Antenna Test	100 kHz~3.6 GHz	100 kHz~7.5 GHz

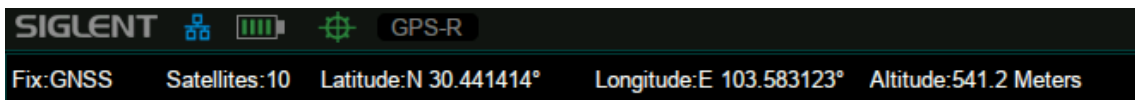
## Design Features

### Spectrum Analyzer

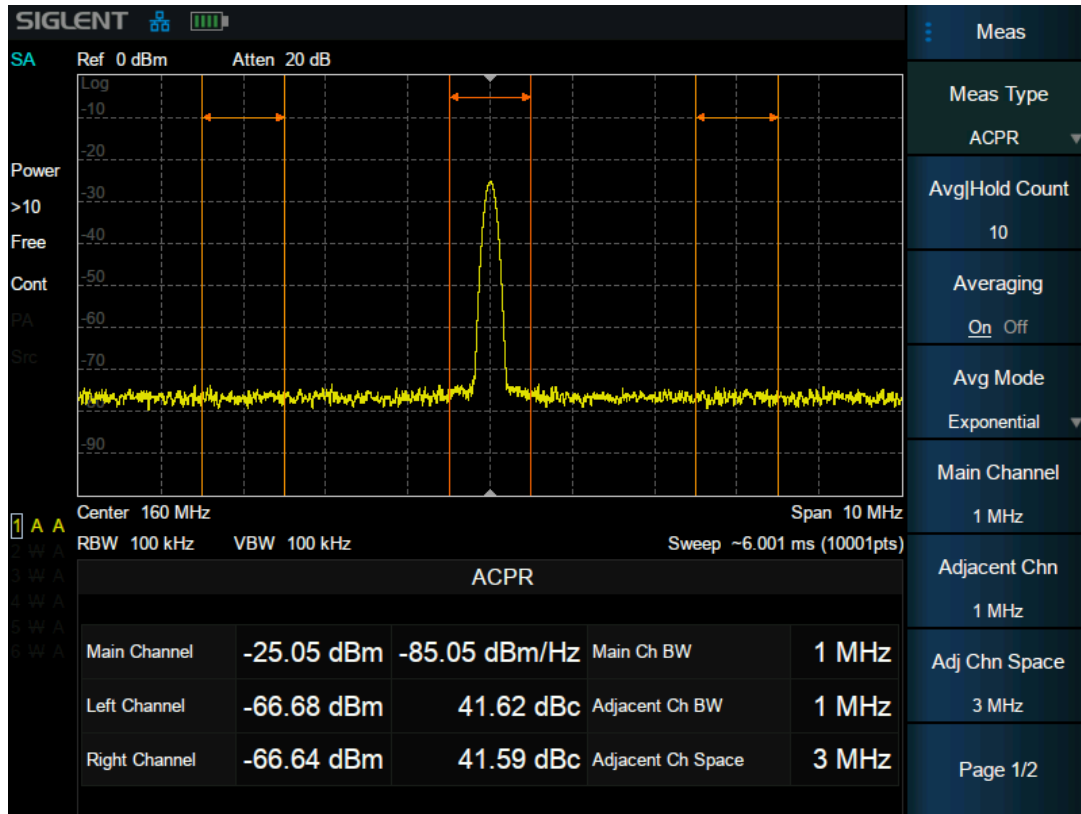
#### 8.4 inch multi-touch screen and full keyboard control



#### GPS Location and trace log recorder, sync 10MHz reference clock



## Channel Power and ACPR measurement

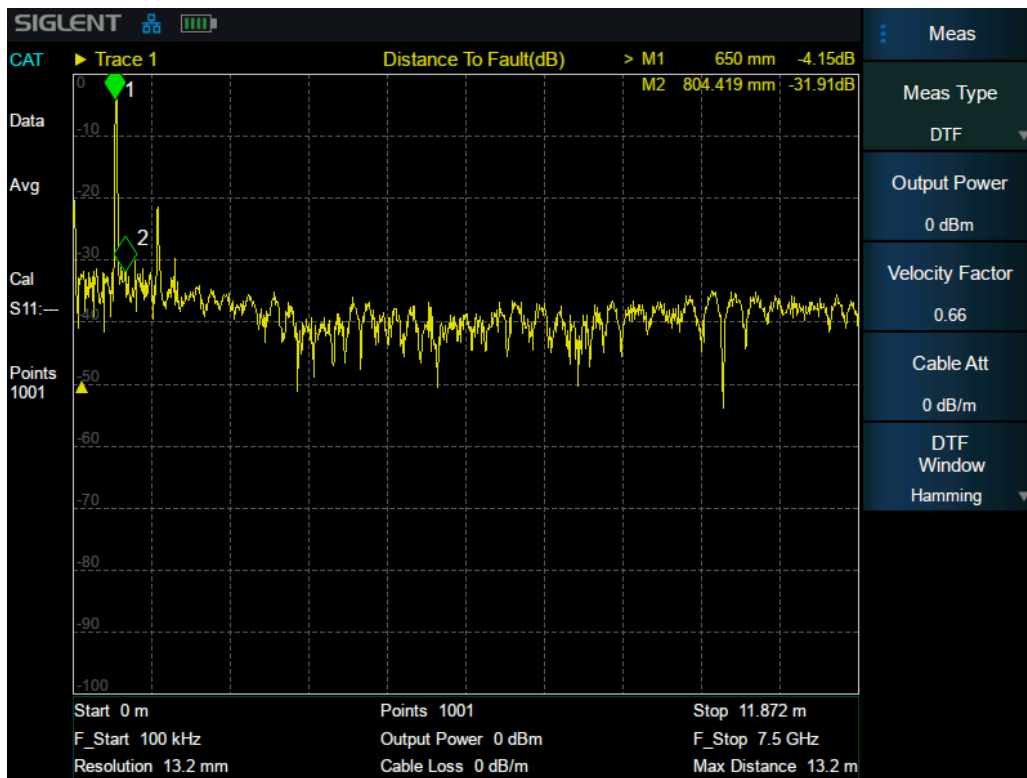


## Interference analysis with directional antenna



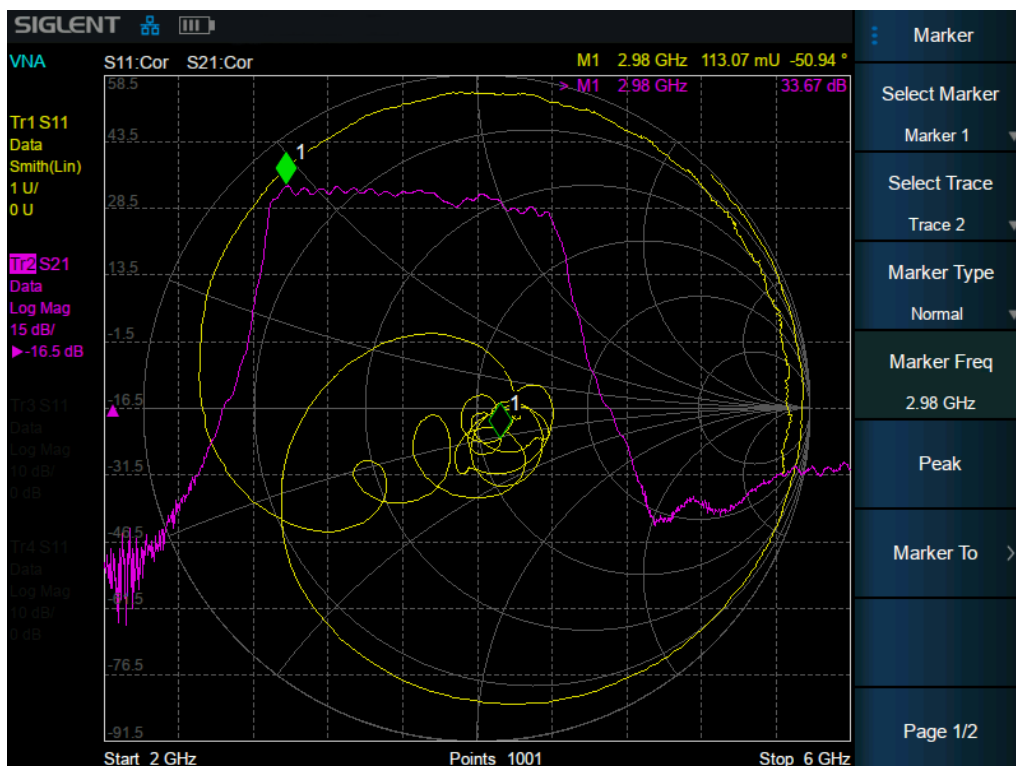
## Cable and Antenna Test

Cable and Antenna Test based on Timing Domain Analysis



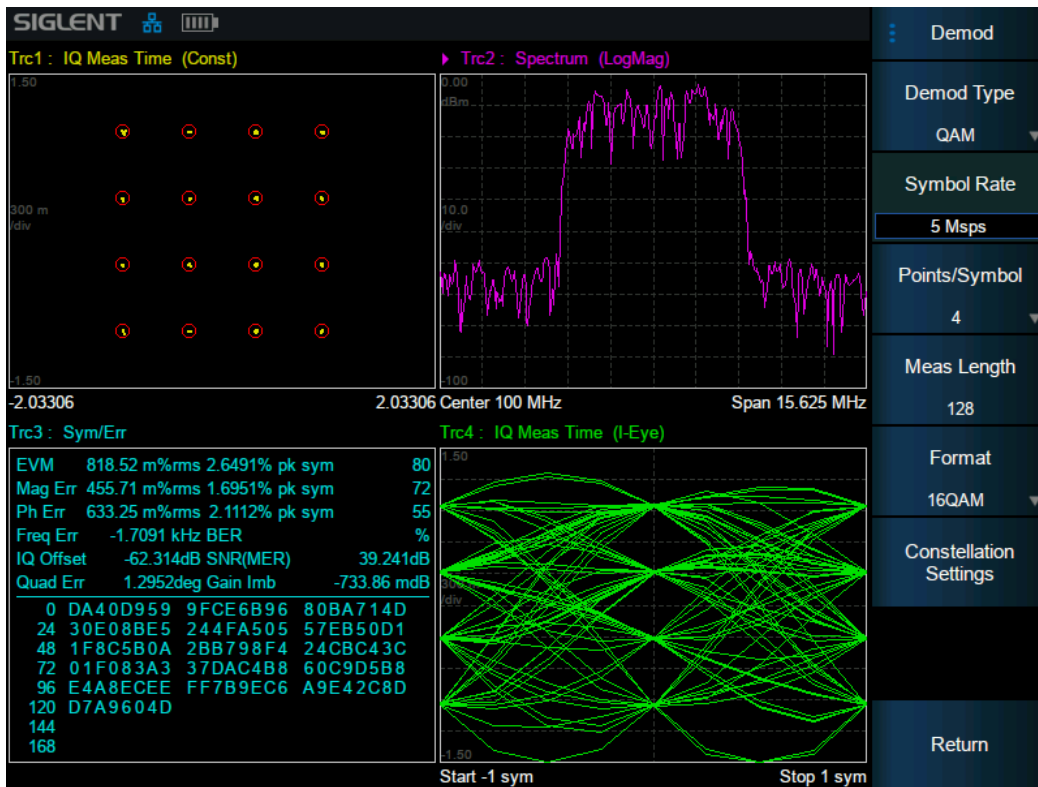
## Vector Network Analyzer

100kHz-7.5GHz Vector S11 and S21 measurement, Multi Formats Overlay Display



## Modulation Analysis

AM/FM/PM analog modulation, and ASK/FSK/PSK/MSK/QAM digital modulation analysis



## Accessories

Utility Kit



Near Field Probe Set



50Ω Calibration Kit



GPS Antenna



Portable Bag



Directional Antenna Kit





## Specifications

Specifications are valid under the following conditions: The instrument is within the calibration period, has been stored between 0 and 50°C for at least 2 hours prior to use, and has been powered on and warmed up for at least 60 minutes. The specifications include the measurement uncertainty, unless otherwise noted.

**Specifications:** All products are guaranteed to meet published specifications when operating at room temperature (approximately 25°C), unless otherwise noted.

**Typical:** Performance deemed typical implies that 80 percent of the measurement results will meet the typical published performance with a 95th percentile confidence level at room temperature (approximately 25°C). Typical performance is not warranted and does not include measurement uncertainty.

**Nominal:** The expected performance or design attribute.

## Spectrum Analyzer

### Frequency and Time Characteristic

Frequency		
	SHA851A	SHA852A
Frequency range	9 kHz~3.6 GHz	9 kHz~7.5 GHz
Frequency resolution	1 Hz	
Frequency Span		
Range	0 Hz, 100 Hz to Max Frequency	
Accuracy	$\pm \text{Span} / (\text{number of display points} - 1)$	
Internal Reference Source		
Reference frequency	10.000000 MHz	
Reference frequency accuracy / uncertainty	$\pm [(\text{time since last adjustment} \times \text{frequency aging rate}) + \text{temperature stability} + \text{initial calibration accuracy}]$	
Initial calibration accuracy	<1 ppm	
Temperature stability	<1 ppm/year, 0 °C ~50 °C	
Frequency aging rate	<0.5 ppm/first year, 3.0 ppm/20 years	
Accuracy, synced to GPS	$\pm 0.01$ ppm	
Accuracy, unsynced to GPS	$\pm 0.4$ ppm	
Marker		
Marker resolution	$\text{Span} / (\text{number of display points} - 1)$	
Marker uncertainty	$\pm [\text{frequency indication} \times \text{reference frequency uncertainty} + 1\% \times \text{span} + \frac{1}{2} * \text{marker resolution} + 1 \text{ Hz}]$	
Frequency Counter resolution	0.1 Hz	
Bandwidths		
Resolution bandwidth (-3dB)	1 Hz ~ 3 MHz, in 1-3-10 sequence	
Resolution filter shape factor	< 4.8 : 1 (60 dB:3 dB), Gaussian-like	
RBW uncertainty	<5%	
Video bandwidth (-3dB)	1 Hz ~ 10 MHz, in 1-3-10 sequence	
VBW uncertainty	<5%	
Sweep and Trigger		
Sweep time	1 ms to 5000 s	1 ms to 7500 s
RBW	Sweep	3 Hz ~ 3 MHz
	FFT	1 Hz ~ 10 kHz
Sweep points	201~10001	
Sweep rule	Single, Continuous	
Trigger source	Free, Video, External, Periodic	
External trigger	5V TTL level, Rising edge/Falling edge	

## Amplitude Accuracy and Range Specifications

Amplitude and Level	
Measurement range	DANL to +10 dBm, 100 kHz ~ 1 MHz, Preamp off DANL to +20 dBm, 1 MHz ~ 7.5 GHz, Preamp off
Reference level	-200 dBm to +30 dBm, 1 dB steps
Preamplifier	25 dB (nom.)
Input attenuation	0~50 dB, 1 dB steps
Maximum input DC voltage	+/- 50 V <sub>DC</sub>
Maximum damage level	33 dBm, $f_c \geq 10$ MHz, att > 20 dBm, preamp off, in 3 minutes

Level Display	
Logarithmic level axis	1 dB to 200 dB
Linear level axis	0% to 100% (reference level)
Units of level axis	dBm, dBmV, dB $\mu$ V, dB $\mu$ A, Volt, Watt
Number of traces	6
Trace detectors	Positive-peak, Negative-peak, Sample, Normal, Average(Voltage/RMS/Video)
Trace functions	Clear write, Max Hold, Min Hold, View, Blank, Average, Math

SSB Phase Noise	
Offset	20 °C to 30 °C, $f_c = 1$ GHz, Normalized to 1 Hz
10 kHz	-100 dBc/Hz, -104 dBc/Hz (typ.)
100 kHz	-100 dBc/Hz, -104 dBc/Hz (typ.)
1 MHz	-114 dBc/Hz, -117 dBc/Hz (typ.)

**Displayed Average Noise Level (DANL)**

	SHA851A	SHA852A	
	20 °C to 30 °C, att = 0 dB, RBW = 1 Hz, sample detector, trace average > 50, TG off		
Preamp off	100 kHz ~1 MHz	-132 dBm, -136 dBm (typ.)	-132 dBm, -136 dBm (typ.)
	1 MHz~10 MHz	-142 dBm,-145 dBm (typ.)	-142 dBm, -145 dBm (typ.)
	10 MHz~600 MHz	-140 dBm, -143 dBm (typ.)	-140 dBm, -143 dBm (typ.)
	600 MHz~1.8 GHz	-138 dBm, -141 dBm (typ.)	-138 dBm, -141 dBm (typ.)
	1.8 GHz~3.05 GHz	-134 dBm, -138 dBm(typ.)	-134 dBm, -138 dBm (typ.)
	3.05 GHz~3.65 GHz	-137 dBm, -141 dBm (typ.)	-137 dBm, -141 dBm (typ.)
	3.65 GHz~4.15 GHz		-137 dBm, -140 dBm (typ.)
	4.15 GHz~5.05 GHz		-135 dBm, -139 dBm (typ.)
	5.05 GHz~5.9 GHz		-135 dBm, -138 dBm (typ.)
	5.9 GHz~6.7 GHz		-136 dBm, -139 dBm (typ.)
			-134 dBm, -137 dBm (typ.)
Preamp on	100 kHz ~1 MHz	-132 dBm, -136 dBm (typ.)	-132 dBm, -136 dBm (typ.)
	1 MHz~10 MHz	-162 dBm, -165 dBm (typ.)	-162 dBm, -165 dBm (typ.)
	10 MHz~600 MHz	-159 dBm, -162 dBm (typ.)	-159 dBm, -162 dBm (typ.)
	600 MHz~1.8GHz	-158 dBm, -161 dBm (typ.)	-158 dBm, -161 dBm (typ.)
	1.8 GHz~3.05 GHz	-156 dBm, -160 dBm (typ.)	-156 dBm, -160 dBm (typ.)
	3.05 GHz~3.65 GHz	-158 dBm, -161 dBm (typ.)	-158 dBm, -161 dBm (typ.)
	3.65 GHz~4.15 GHz		-158 dBm, -160 dBm (typ.)
	4.15 GHz~5.05 GHz		-157 dBm, -160 dBm (typ.)
	5.05 GHz~5.9 GHz		-156 dBm, -159 dBm (typ.)
	5.9 GHz~6.7 GHz		-155 dBm, -158 dBm (typ.)
			-154 dBm, -156 dBm (typ.)



## Source (SHA850-SOR)

### Frequency Parameter

	SHA851A	SHA852A
Frequency Range	100 kHz ~ 3.6 GHz	100 kHz ~ 7.5 GHz
Frequency resolution	1 Hz	
Source Type	CW, CW Offset	

### Power Parameter

Output level	-40 dBm ~ 0 dBm	
Output level resolution	1 dB	
Output flatness	± 2 dB (nom.)	
Normalization Trace	Ref A/B/C/D-> Ref trace	
VSWR	< 2 (nom.)	
Connector and Impedence	N-type female, 50 Ω	
Average safe reverse power	Total 27 dBm (0.5 W)	
Maximum safe reverse level	±50 V DC	

## Advanced Measurement Kit (SHA850-AMK)

### Power Measurement

CHP, Channel Power	Channel Power, Power Spectral Density
ACPR, Adjacent Channel Power Ratio	Main CH Power, Left channel power, Right channel power
OBW, Occupied Bandwidth	Occupied Bandwidth, Transmit Frequency Error
T-Power, Time Domain Power	Zero Span Integrated Power
CNR, Carrier Noise Ratio	C/N, Noise Power

### Non-Linear Measurement

Harmonic measurement	Max Harmonic number 10
TOI, Third-Order Intercept	Measure the third-order products from two tones

### Spectrum Monitor Measurement

Spectrogram
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## Cable and Antenna Test

Measurement	SHA851A	SHA852A
Frequency Range	100 kHz~3.6 GHz	100 kHz~7.5 GHz
Sweep Points	101~10001, default 1001	
Port1 Stimulus Power	-40dBm ~ 0dBm (nom.)	
Maximum Distance (meters)	(Sweep Points - 1) x Velocity Factor x Light of Speed (m/s) / (Stop Frequency - Start Frequency (Hz) )	
Resolution (meters)	Maximum Distance / Sweep Points	
Calibration	Open Response Short Response Response Through Full 1-Port(OSL)	
Velocity Factor	0.1~1	
Cable Loss	-10 dB/m ~ 100 dB/m	
Trace	Mem, Math, Hold, Display	
Meas Type	DTF, Return Loss, VSWR, Cable Loss(1-Port), Insertion Loss(2-Port), TDR, DTF & TDR, DTF & Return Loss, TDR & Return Loss	
Distance to Fault(DTF)	Locate problems or faults in a length of cable or transmission line	
	Format: Log Mag(dB), VSWR, Lin Mag	
	Distance Unit: Meters, Feet Window Type: Rectangular, Hamming	
Time Domain Reflectometry (TDR)	Locate problems and identify the type of problem in a length of cable or transmission line.	
	Format: Impedance(ohm), linear rho	
	Distance Unit: as DTF	
	Stimulus Type: Impulse, Step	
	Frequency Type: Low-pass	
	Window Type: Kaiser Kaiser $\beta$ : 0~13	
Time Gate Type: Band Pass, Notch		
Time Gate Shape: Normal, Maximum, Wide, Minimum		
Time Gate Range: Start Distance ~ Stop Distance		
Cable Loss(1-Port)	Measure the accumulated losses throughout the length of the cable	
Insertion Loss(2-Port)	Measure the loss through a DUT or cable over a specified frequency range	

## Vector Network Analyzer (SHA850-VNA)

Stimulus and Measurement			
	SHA851A	SHA852A	
Frequency Range	100 kHz ~ 3.6 GHz	100 kHz ~ 7.5 GHz	
Measurement	S11, S21		
IFBW	10 kHz		
Port1 Stimulus Power	-40dBm ~ 0dBm (nom)		
Format	Lin Mag, Log Mag, Phase, Group Delay, SWR, Smith Chart (Lin/Phase, Log/Phase, Real/Imag, R+j*X, G+j*B), Polar Chart (Lin/Phase, Log/Phase, Real/Imag)		
Sweep Points	101~10001, default 1001		
Trace	4 traces, Mem, Math, Hold, Overlay		
Marker	(6+Ref)* 4 traces		
Calibration			
Directivity of Calibration	F504ME, Log mag, Average=50, >50MHz > 40 dB		
	S21, IFBW=10 kHz, Port1 level=0 dBm, Log Mag, Average=50		
Dynamic Range	100 kHz ~ 1 MHz	102 dB, 108 dB (typ.)	102 dB, 108 dB (typ.)
	1 MHz ~ 1.5 GHz	109 dB, 114 dB (typ.)	109 dB, 114 dB (typ.)
	1.5 GHz ~ 3.6 GHz	107 dB, 112 dB (typ.)	107 dB, 112 dB (typ.)
	3.6 GHz ~ 6.5 GHz		105 dB, 109 dB (typ.)
	6.5 GHz ~ 7.5 GHz		102 dB, 107 dB (typ.)
Reflection trace noise (IFBW=10 kHz)	frequency	amplitude (dB rms)	phase (deg rms)
	100 kHz~3.5 GHz	0.02	0.3
	3.5 GHz~6.5 GHz	0.03	0.5
Transmission trace Noise (IFBW=10 kHz)	frequency	amplitude (dB rms)	phase (deg rms)
	100 kHz~3.5 GHz	0.015	0.18
	3.5 GHz~7.5 GHz	0.015	0.40
Calibration Type	Short Response		
	Open Response		
	Full 1-Port(OSL)		
	Response Through		
	Enhanced Response		
Port Extensions	Port 1, Port 2, Auto Open Port 1		
System Z0	50 Ω		
Velocity Factor	0.1~1		



## Analog Modulation Analysis (SHA850-AMA)

Common Parameter		
	SHA851A	SHA852A
Carrier Frequency Range	2 MHz ~ 3.6 GHz	2 MHz ~ 7.5 GHz
Carrier Power Accuracy	±2 dB (nom.)	
Carrier Power Range	-30 dBm to +20 dBm (nom.)	
AM		
Modulation rate range	20 Hz to 100 kHz	
Accuracy	1 Hz (nom.)	Modulation rate < 1 kHz
	< 0.1% modulation rate (nom.)	Modulation rate ≥ 1 kHz
Modulation depth range	5% to 95%	
Accuracy	±4% (nom.)	
FM		
Modulation rate range	20 Hz to 200 kHz	
Accuracy	1 Hz (nom.)	Modulation rate < 1 kHz
	< 0.1% modulation rate (nom.)	Modulation rate ≥ 1 kHz
Frequency deviation	1 kHz to 400 kHz	
Accuracy	±4% (nom.)	
PM		
Modulation rate range	50 Hz~50 kHz	
Accuracy	1 Hz(nom.)	Modulation rate < 1 kHz
	< 0.1% modulation rate (nom.)	Modulation rate ≥ 1 kHz
Frequency deviation	0.2~100 rad	
Accuracy	±4%(nom.)	

## Digital Modulation Analysis (SHA850-DMA)

Common Parameter		
	SHA851A	SHA852A
Frequency Range	2 MHz ~ 3.6 GHz	2 MHz ~ 7.5 GHz
Carrier Power Accuracy	± 2 dB (nom.)	
Carrier Power Range	-30 dBm to +20 dBm (nom.)	
Measurement		
Modulation Type	ASK: 2ASK; FSK: 2FSK, 4FSK, 8FSK, 16FSK; MSK: GMSK; PSK: BPSK, QPSK, OQPSK, 8PSK; DPSK: DBPSK, DQPSK, D8PSK, $\pi/4$ -DQPSK, $\pi/8$ -D8PSK; QAM: 16, 32, 64, 128, 256	
Meas Length	16 to 4096	
Points/Symbol	4, 6, 8, 10, 12, 14, 16	
Symbol Rate	1 kspss to 5 Msps, Symbol Rate* Points/Symbol ≤20 Msps	
Trigger Holdoff	500 ms	
Burst	Burst power sync, BERT	
Filter		
Meas/Ref Filter	Nyquist, Sqrt Nyquist, Gauss, Half Sine, Rectangular	
Length	2 to 128	
Alpha/BT	Alpha 0.01~1, BT 0.01~10	
Trace		
Trace Data	IQ Meas Time, IQ Meas Spectrum, IQ Ref Time, IQ Ref Spectrum, Time, Spectrum, IQ Mag Err, IQ Phase Err Symbol Error Chart, Err Vector Time, Err Vector Spectrum,	
Trace Formats	Log mag, Lin mag, Real, Imag, I-Q, Constellation, I-eye, Q-eye, Wrap Phase, Unwrap Phase, Trellis eye	
Symbol Error Chart		
PSK/DPSK/MSK/QAM	EVM (rms EVM, peak EVM), Magnitude error, Phase error, IQ offset, Carrier offset, SNR Quadrature error, Gain imbalance(not support for MSK)	
ASK	ASK Error, ASK depth, carrier offset	
FSK	FSK Error, Magnitude error, FSK deviation, carrier offset	

## Inputs and Outputs

<b>Front Panel</b>	
RF input, Port 2	N-type female, 50 $\Omega$ (nom.)
Source, Port 1	N-type female, 50 $\Omega$ (nom.)
USB Host	USB-A plug, version 2.0
Ear Phone Jack	3.5 mm
USB Device	USB-C plug, version 2.0
LAN	LAN (VXI11), 10/100 Base,RJ-45
GPS Antenna (GPS Receiver)	SMA(F), 3.3V, 50 $\Omega$
Bias out (SHA850-BIAS)	SMB(F), 12V-32V, 0.1V step
10 MHz reference input	10 MHz, -5 to +10 dBm, BNC-type female, 50 $\Omega$ (nom.)
External trigger input	1 K $\Omega$ , 5V TTL level, BNC-type female
<b>Remote Control</b>	
Communication Interface	LAN, USB-TMC,GPIB (USB-GPIB adaptor)
Remote Control Capability	SCPI / Labview / IVI based on USB-TMC / VXI-11 / GPIB / Socket / Telnet NI-MAX Web Browser (HTML 5 Supported);

## General Specification

<b>Structure</b>	
Dimensions	310 mm × 215 mm × 78.5 mm (W×H×D)
Weight	Net: 3.20 kg (7.0 lb)
Display	TFT LCD, 800 × 600, 8.4 inch multi-touch screen
Storage	Internal (Flash) 3.2 GByte, external (USB storage device) 32 GByte
<b>Working Environment</b>	
Source	AC voltage range: 100-240 V, 50/60 Hz or 100-120 V, 400 Hz;
Power consumption	20 W (typ.)
Temperature	Working temperature: 0 °C to 50 °C, Storage temperature: -20 °C to 70 °C
Humidity	0 °C to 30 °C, ≤ 95% Relative humidity 30 °C to 50 °C, ≤ 75% Relative humidity
Altitude	Operating: less than 3 km (10000 feet)
<b>Electromagnetic Compatibility</b>	
EN 61326-1: 2013 / EN 61000-3-2: 2014	Class A (The active input power of the EUT is less than 75 W. According to EN 61000-3-2, no limits are necessary.)
EN 61000-3-3: 2013	Plt: 0.65 Pst: 1.00, dmax: 4.00 % dc: 3.00 % dt Lim: 3.30 % dt>Lim: 500ms
<b>Safety</b>	
CAN/CSA-C22.2 No. 61010-1:2012/A1:2018-11	
CAN/CSA-C22.2 No. 61010-2-030:2018	
UL 61010-1:2012/R:2018-11	
UL 61010-2-030:2018	
<b>RoHS</b>	
2011/65/EU	

## Ordering Information

Product	Description	Order Number	
Product Code	Spectrum & Vector Network Analyzer, 9 kHz~3.6 GHz	SHA851A	
	Spectrum & Vector Network Analyzer, 9 kHz~7.5 GHz	SHA852A	
Standard Accessories	Quick Start, USB type-C cable, Power cord, AC-DC adapter, Rechargeable lithium battery, Portable bag		
Options	SHA851A to SHA852A	SHA850-F2	
	Source	SHA850-SOR	
	Vector Network Analysis	SHA850-VNA	
	Advanced Measurement Kit	SHA850-AMK	
	Analog Modulation Analysis	SHA850-AMA	
	Digital Modulation Analysis	SHA850-DMA	
	DC Bias Out	SHA850-BIAS	
	GPS Receiver	SHA850-GPS	
	GPS Logging(need GPS Receiver)	SHA850-GPSM	
	General Accessories	Rechargeable lithium battery	SHA800-BAT
AC-DC adapter		SHA800-AP	
Portable bag		SHA800-BG	
GPS antenna, SMA(M), 100cm		ANT-GPS1	
S5000 Directional Antenna Suit: S5001-VHF(10 MHz~200 MHz), S5001-UHF(200 MHz~500 MHz), S5001-LP(500 MHz~8 GHz), Preamp(10 dB, 9 kHz~8 GHz)		ANT-DA1	
Near field probe kit: 300 kHz~3 GHz, H-field probes(20 mm,10 mm,5 mm), E-field probe(5 mm)		SRF5030T	
Utility Kit: N(M)-SMA(M) cable(6 GHz), N(M)-N(M) cable(6 GHz), N(M)-BNC(F) adaptor x2, N(M)-SMA(F) adaptor x2, 10 dB 1W attenuator		UKitSSA3X	
N(M)-BNC(M) cable, DC~2 GHz, 700 mm		N-BNC-2L	
N(M)-SMA(M) cable, DC~6 GHz, 700 mm		N-SMA-6L	
N(M)-N(M) cable, DC~6 GHz, 700 mm		N-N-6L	
N(M)-N(M) cable ,DC~18 GHz, 1000 mm		N-N-18L	
N(M)-SMA(M) cable ,DC~18 GHz, 1000 mm		N-SMA-18L	
SMA(M)-SMA(M) cable ,DC~18 GHz, 1000 mm		SMA-SMA-18L	
CAT&VNA Accessories		N type Integrated Calibration Kit, Male, DC~9GHz,50 Ω	Y504MS
		N type Integrated Calibration Kit, Female, DC~9GHz,50 Ω	Y504FS
	N type Precision Calibration Kit, DC~9GHz, 50 Ω	F504TS	
	3.5mm type Precision Calibration Kit, DC~9GHz, 50 Ω	F604TS	

## About SIGLENT

SIGLENT is an international high-tech company, concentrating on R&D, sales, production and services of electronic test & measurement instruments.

SIGLENT first began developing digital oscilloscopes independently in 2002. After more than a decade of continuous development, SIGLENT has extended its product line to include digital oscilloscopes, isolated handheld oscilloscopes, function/arbitrary waveform generators, RF/MW signal generators, spectrum analyzers, vector network analyzers, digital multimeters, DC power supplies, electronic loads and other general purpose test instrumentation. Since its first oscilloscope was launched in 2005, SIGLENT has become the fastest growing manufacturer of digital oscilloscopes. We firmly believe that today SIGLENT is the best value in electronic test & measurement.

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