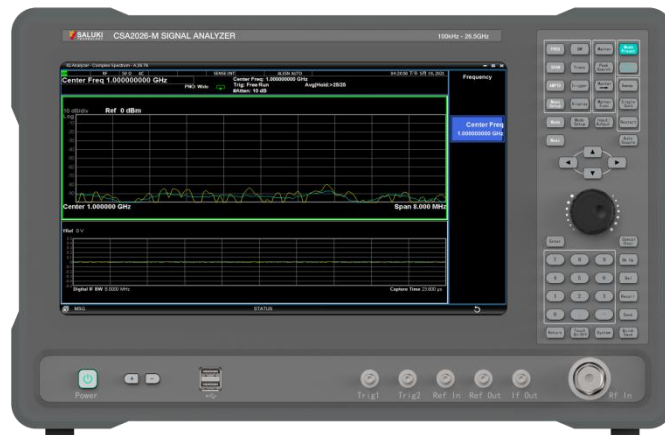




CSA-M Series Signal Analyzer

Datasheet



Saluki Technology Inc.

The document applies to the signal analyzer of the following models:

- CSA2026-M Signal Analyzer (100 kHz - 26.5 GHz)

Standard pack and accessories:

- 1 × Signal Analyzer Host
- 1 × Power Cord
- 1 × USB Cable
- 1 × Certificate of Calibration

Options of the CSA-M series signal analyzer:

Module No.	Item	Description
P26	Pre-amplifier	/
B40	40MHz Analysis Bandwidth	To output real-time signal acquisition data through optical fiber and support signal data output with maximum 40MHz bandwidth.
HAS	High Resolution Step Attenuator	0-50dB, 2dB step
PFR	Precision Frequency Reference	/
RTA	Real Time Analysis	/

Preface

Thank you for choosing Saluki Technology Products.

We devote ourselves to meeting your demands, providing you high-quality measuring instrument and the best after-sales service. We persist with “superior quality and considerate service”, and are committed to offering satisfactory products and service for our clients.

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Saluki Technology

Document Authorization

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Product Quality Assurance

The warranty period of the product is three years from the date of delivery. The instrument manufacturer will repair or replace damaged parts according to the actual situation within the warranty period.

Product Quality Certificate

The product meets the indicator requirements of the document at the time of delivery. Calibration and measurement are completed by the measuring organization with qualifications specified by the state, and relevant data are provided for reference.

Quality/Settings Management

Research, development, manufacturing and testing of the product comply with the requirements of the quality and environmental management system.

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Contents

Definitions and conditions.....	5
Frequency and Time Specifications.....	6
Amplitude Accuracy and Range Specifications.....	8
Dynamic Range Specifications.....	10
General Specifications.....	13
Inputs and Outputs.....	13
I/Q Analyzer.....	14
System Requirements.....	15

Definitions and conditions

Temperatures referred to in this document are defined as follows:

–Full temperature range = Individual module temperature of 5 to 68 °C, as reported by the module, and environment temperature of 0 to 55 °C.

–Controlled temperature range = Individual module temperature of 25 to 40 °C, as reported by the module, and environment temperature of 20 to 30 °C.

Specifications describe the warranted performance of calibrated instruments. Specifications data under the following conditions:

- It is within its calibration cycle
- Under auto couple control, except when Auto Sweep Time Rules = Accy
- The analyzer has been stored at an ambient temperature within the allowed operating range for at least two hours before being turned on; if it had previously been stored at a temperature range inside the allowed storage range, but outside the allowed operating range
- The analyzer has been turned on at least 30 minutes with Auto Align set to normal, or, if Auto Align is set to off or partial, alignments must have been run recently enough to prevent an Alert message; if the Alert condition is changed from Time and Temperature to one of the disabled duration choices, the analyzer may fail to meet specifications without informing the user

95th percentile values indicate the breadth of the population (approx. 2σ) of performance tolerances expected to be met in 95 percent of the cases with a 95 percent confidence, for any ambient temperature in the range of 20 to 30 °C. In addition to the statistical observations of a sample of instruments, these values include the effects of the uncertainties of external calibration references. These values are not warranted.

Typical describes additional product performance information that is not covered by the product warranty. It is performance beyond specifications that 80 percent of the units exhibit with a 95 percent confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.

Nominal values indicate expected performance, or describe product performance that is useful in the application of the product, but are not covered by the product warranty. Data represented in this document are Nominal unless otherwise noted.

Frequency and Time Specifications

Frequency range		
Frequency range	100 kHz to 26.5 GHz	
Band	LO multiple (N)	
0	1	100kHz to 3.05GHz
1	2	2.95GHz to 7.55GHz
2	2	7.45GHz to 9.25GHz
3	2	9.15GHz to 11.05GHz
4	2	10.95GHz to 12.75GHz
5	4	12.65GHz to 14.55GHz
6	4	14.45GHz to 16.55GHz
7	4	16.45GHz to 18.55GHz
8	4	18.45GHz to 20.55GHz
9	4	20.45GHz to 24.55GHz
10	4	24.45GHz to 26.5GHz
Frequency reference		
Accuracy	$\pm[(\text{time since last adjustment} \times \text{aging rate}) + \text{temperature stability} + \text{calibration accuracy}]$	
Aging rate	$\pm 3 \times 10^{-7}$ / year (First year)	
Temperature stability		
20 to 30°C	$\pm 3 \times 10^{-8}$	
Full temperature range	$\pm 3 \times 10^{-8}$	
Achievable initial calibration accuracy	$\pm 8 \times 10^{-8}$	
Example frequency reference accuracy	$= \pm (3 \times 10^{-7} + 3 \times 10^{-8} + 8 \times 10^{-8})$	
1 year after last adjustment	$= \pm 4.1 \times 10^{-7}$	
Residual FM	$\leq 1 \text{Hz p-p in } 20 \text{ ms nominal}$	
Frequency readout accuracy (start, stop, center, marker)		
$\pm(\text{marker frequency} \times \text{frequency reference accuracy} + 0.25 \% \times \text{span} + 5 \% \times \text{RBW} + 2 \text{Hz} + 0.5 \times \text{horizontal resolution})$		
Marker frequency counter		
Accuracy	$\pm(\text{marker frequency} \times \text{frequency reference accuracy} + 0.100 \text{Hz})$	
Delta counter accuracy	$\pm(\text{delta frequency} \times \text{frequency reference accuracy} + 0.141 \text{Hz})$	
Counter resolution	0.001Hz	
Frequency span (FFT and swept mode)		
Range	0Hz(zero span), 10Hz to maximum frequency of instrument	
Resolution	2Hz	
Accuracy		
Swept	$\pm(0.25\% \times \text{span} + \text{horizontal resolution})$	
FFT	$\pm(0.10\% \times \text{span} + \text{horizontal resolution})$	

Sweep time and triggering		
Range	Span = 0Hz	1 μ s to 6000s
	Span \geq 10Hz	1ms to 4000s
Accuracy	Span \geq 10Hz, swept	\pm 0.01% nominal
	Span \geq 10Hz, FFT	\pm 40% nominal
	Span = 0Hz	\pm 1% nominal
Trigger	Free run, video, external, RF burst, periodic timer	
Trigger delay	Span = 0 Hz or FFT	-150 to +500ms
	Span \geq 10 Hz, swept	1 μ s to 500ms
	Resolution	0.1 μ s
Time gating		
Gate methods	Gated LO; gated video; gated FFT	
Gate length range (except method = FFT)	100.0ns to 5.0s	
Gate delay range	0 to 100.0s	
Gate delay jitter	33.3ns p-p nominal	
Sweep (trace) point range		
All spans	1 to 40001	
Resolution bandwidth (RBW)		
Range (-3.01 dB bandwidth)	1 Hz to 3 MHz (10 % steps), 4, 5, 6, 8 MHz	
Bandwidth accuracy (power)	1Hz to 750kHz	\pm 1.0%(\pm 0.044dB) nominal
	820kHz to 1.2MHz	\pm 2.0%(\pm 0.088dB) nominal
	1.3 to 2.0MHz	\pm 0.13dB nominal
	2.2to 3MHz	\pm 0.22dB nominal
	4 to 8MHz	\pm 0.32dB nominal
Bandwidth accuracy (-3.01 dB)	1Hz to 1.3MHz	\pm 2% nominal
RBW range		
Selectivity (-60 dB/-3 dB)	4.1:1 nominal	
Analysis bandwidth		
Maximum bandwidth	25MHz (40MHz Option)	
Video bandwidth (VBW)		
Range	1 Hz to 3 MHz (10 % steps), 4, 5, 6, 8 MHz, and wide open (labeled 50 MHz)	
Accuracy	\pm 6% nominal	
Measurement speed		
Local measurement and display update rate	11ms (90/s) nominal	
Remote measurement and LAN transfer rate	6ms (167/s) nominal	
Marker peak search	5ms nominal	
Center frequency tune and transfer	22ms nominal	
Measurement/mode switching	75ms nominal	

Amplitude Accuracy and Range Specifications

Amplitude range

Measurement range

Preamp off Displayed average noise level (DANL) to +27dBm

Input attenuator range

0 to 50 dB in 2dB steps

Maximum safe input level

Average total power

+27dBm(0.5W)	Input attenuation \geq 10dB, preamp off
+27dBm(0.5W)	Input attenuation \geq 20dB, preamp on

Peak pulse power

+47dBm(50W)	< 10 μ s pulse width, < 1% duty cycle, and input attenuation \geq 30dB
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DC volts

AC coupled	\pm 16Vdc
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Display range

Log scale	0.1 to 1dB/division in 0.1dB steps
	1 to 20dB/division in 1dB steps (10 display divisions)
Linear scale	10 divisions
Scale units	dBm , dBmV , dB μ V , dBmA , dB μ A , V , W , A

Frequency response

 (10dB input attenuation, 20 to 30°C, σ = nominal standard deviation)

Specification

95% (\approx 2 σ)

9kHz to 10MHz	\pm 0.50dB	\pm 0.4dB
10MHz to 3GHz	\pm 0.65dB	\pm 0.5dB
3 to 13.6GHz	\pm 1.30dB	\pm 0.8dB
13.6 to 19.3GHz	\pm 1.50dB	\pm 1.0dB
19.3 to 24.2GHz	\pm 2.20dB	\pm 1.3dB
24.2 to 26.5GHz	\pm 2.50dB	\pm 1.3dB

Preamp on

100kHz to 10MHz	\pm 0.5dB
10MHz to 3GHz	\pm 1.0dB
3 to 7.5GHz	\pm 1.2dB
7.5 to 13.6GHz	\pm 1.0dB
13.6 to 21GHz	\pm 1.2dB
21 to 24.2GHz	\pm 1.8dB
24.2 to 26.5GHz	\pm 2.4dB

Input attenuation switching uncertainty

Specifications

Additional information

Attenuation > 2dB, preamp off	50MHz (reference frequency)	\pm 0.3dB	\pm 0.15dB typical
Relative to 10 dB (reference setting)	100kHz to 3.0GHz		\pm 0.30dB nominal
	3.0 to 7.5GHz		\pm 0.50dB nominal

7.5 to 26.5GHz

 $\pm 0.70\text{dB}$ nominal

Total absolute amplitude accuracy

 (10dB attenuation, 20 to 30°C, $1\text{Hz} \leq \text{RBW} \leq 1\text{MHz}$, input signal -10 to -50dBm, all settings auto-coupled except Auto Swp Time = Accy, any reference level, any scale, σ = nominal standard deviation)

 At 50MHz $\pm 0.40\text{dB}$

 At all frequencies $\pm(0.40\text{dB} + \text{frequency response})$

 100kHz to 3GHz $\pm 0.60\text{dB}(95\% \approx 2\sigma)$

 Preamp on $\pm(0.36\text{dB} + \text{frequency response})$
(95%)

Input voltage standing wave ratio (VSWR) (0dB attenuation)

10MHz to 26.5GHz < 2.0 nominal

Resolution bandwidth switching uncertainty (referenced to 30 kHz RBW)

 1Hz to 3MHz RBW $\pm 0.15\text{dB}$

 4 , 5 , 6 , 8MHz RBW $\pm 1.0\text{dB}$
Reference level

Range

Log scale -170 to +23dBm in 0.01dB steps

Linear scale Same as log (707pV to 3.16V)

Accuracy 0dB

Display scale switching uncertainty

Switching between linear and log 0dB

Log scale/div switching 0dB

Display scale fidelity
 $-80\text{dBm} \leq \text{input mixer level} < -10\text{dBm}$ $\pm 0.15\text{dB}$ total

Trace detectors

Normal, peak, sample, negative peak, log power average, RMS average, and voltage average

Preamplifier

Frequency range 100kHz to 26.5GHz

Gain 100kHz to 26.5GHz +20dB nominal

Noise figure 10MHz to 26.5GHz DANL+176.24dB nominal

Dynamic Range Specifications

1dB gain compression (two-tone)

		Total power at input mixer
Preamp off	10MHz to 7.5GHz	+6dBm nominal
	7.5 to 26.5GHz	+4dBm nominal
Preamp on	10MHz to 7.5GHz	-15dBm nominal
	7.5 to 26.5GHz	-19dBm nominal

Displayed average noise level (DANL) (Input terminated, sample or average detector, averaging type = Log, 0dB input attenuation, IF Gain = High, 20 to 30°C) Parentheses indicate typical performance

	Preamplifier OFF	Preamplifier ON
100kHz to 1MHz	(-125)dBm	
1 to 10MHz	-144,(-148)dBm	-154,(-158)dBm
10MHz to 1.5GHz	-148,(-150)dBm	-160,(-163)dBm
1.5 to 4.5GHz	-146,(-149)dBm	-160,(-163)dBm
4.5 to 7GHz	-141,(-145)dBm	-157,(-161)dBm
7 to 9.5GHz	-144,(-147)dBm	-158,(-160)dBm
9.5 to 13GHz	-136,(-140)dBm	-156,(-160)dBm
13 to 14.5GHz	-142,(-145)dBm	-158,(-161)dBm
14.5 to 19.3GHz	-132,(-138)dBm	-153,(-157)dBm
19.3 to 23GHz	-134,(-139)dBm	-152,(-157)dBm
23 to 24GHz	-132,(-137)dBm	-150,(-155)dBm
24 to 26.5GHz	-128,(-133)dBm	-144,(-149)dBm

Spurious responses

Residual response (Input terminated and 0dB attenuation)	200kHz to 26.5GHz(swept) Zero span or FFT or other frequencies	-90dBm -100dBm nominal		
Image responses (First mixer)	Tuned frequency (f)	Mixer level	Response	
	10MHz to 26.5GHz	-10dBm	-70dBc(-80dBc typical)	
Image responses (Second mixer)	Tuned frequency (f)	Excitation Freq	Mixer level	Response
	10MHz to 20.5GHz	f+1470MHz	-10dBm	-70dBc(-80dBc typical)
	20.5GHz to 26.5GHz	f-1470MHz	-10dBm	-70dBc(-80dBc typical)
LO-related spurious	10MHz to 26.5GHz		-10dBm	-64dB typical
Other spurious responses	Mixer level	Response		
IF feedthrough	-10dBm	-75dBc(-80dBc typical)		
First RF order (f ≥ 10 MHz from carrier)	-10dBm	-70dBc(-80dBc nominal)		
High RF order (f ≥ 10 MHz from carrier)	-10dBm	-70dBc(-80dBc nominal)		

Second harmonic distortion (SHI)

Source frequency	SHI(nominal)
10MHz to 3.75GHz	+50dBm
3.75 to 13.25GHz	+62dBm

Third-order intermodulation distortion (TOI)

Parentheses indicate typical performance

Preamp off (Two -20 dBm tones at input mixer spaced by 100 kHz, 0 dB attenuation, 20 to 30 °C)	10MHz to 2GHz	+12dBm,(+16)dBm
	2 to 3GHz	+12dBm,(+17)dBm
	3 to 7.5GHz	+12dBm,(+16)dBm
	7.5 to 13.6GHz	+11dBm,(+15)dBm
	13.6 to 26.5GHz	+10dBm,(+14)dBm
Preamp on (Two -45 dBm tones at input mixer spaced by 100 kHz, 0 dB attenuation, 20 to 30 °C)	10MHz to 26.5GHz	-8dBm nominal

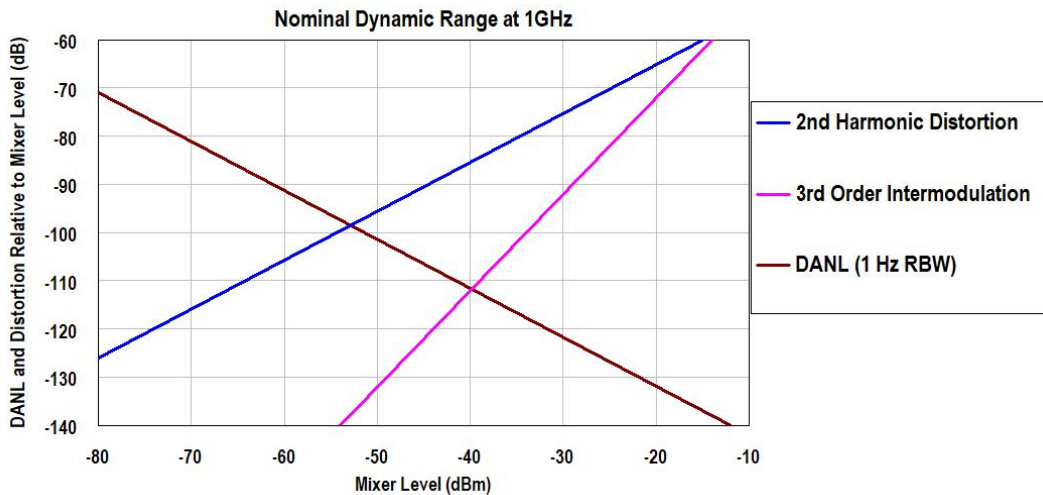


Figure 1. Nominal dynamic range for Band 0, for second and third order distortion, 10 MHz to 3 GHz

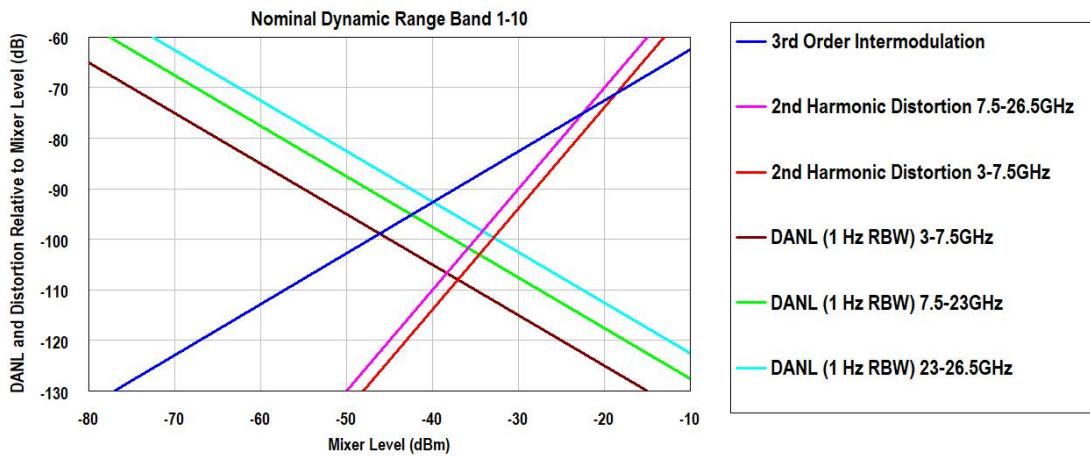


Figure 2. Nominal dynamic range, for second and third order distortion, 3 GHz to 26.5 GHz

Phase noise	Offset	Specification	Typical
Noise sidebands (20 to 30°C, CF=1 GHz)	100Hz		-80dBc/Hz nominal
	1kHz	-100dBc/Hz	-102dBc/Hz

10kHz	-106dBc/Hz	-108dBc/Hz
100kHz	-108dBc/Hz	-110dBc/Hz
1MHz	-130dBc/Hz	-132dBc/Hz

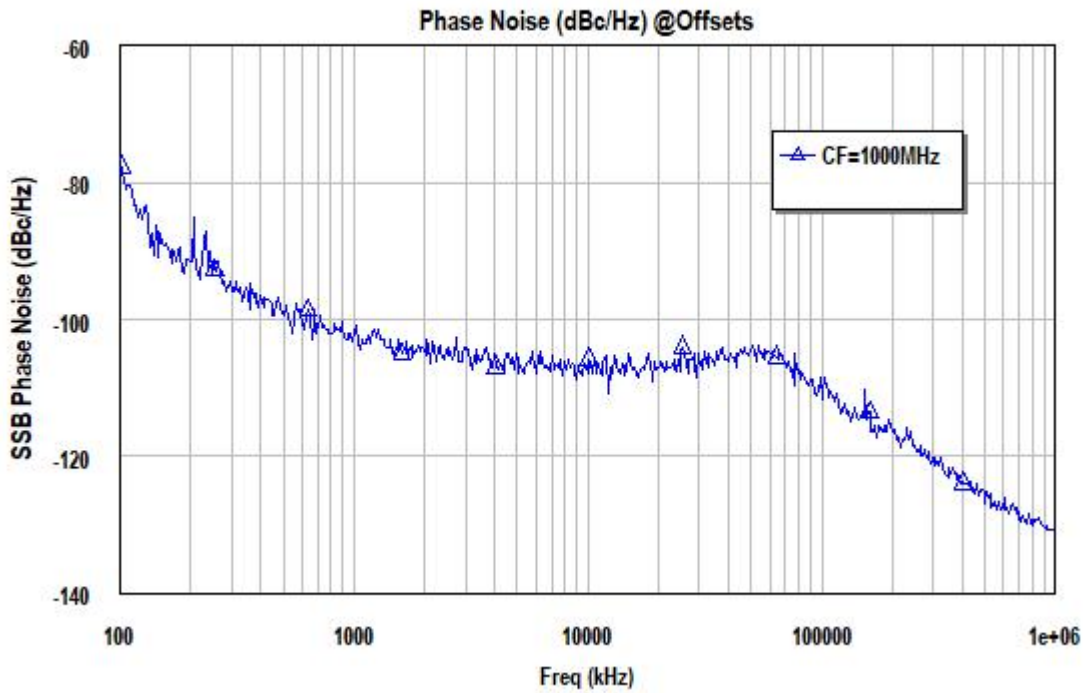


Figure 3. Nominal phase noise at different center frequencies

General Specifications

Temperature range

Operating	0 to 55°C
Storage	-40 to 70°C

Environmental stress

Samples of this product have been type tested in accordance with the Saluki Technology Environmental Test Manual and verified to be robust against the environmental stresses of storage, transportation, and end-use; those stresses include, but are not limited to, temperature, humidity, shock, vibration, altitude, and power line conditions.

Power requirement

Power drawn from chassis	≤90W
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Display	13.3 inch touch screen
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Weight

Net	9kg(19.8 lbs)
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Dimensions

Height	285mm(11.2 in)
Depth	225mm(8.9 in)
Length	440mm(17.3 in)

Calibration cycle

The recommended calibration cycle is one year; calibration services are available through Saluki Technology service centers

Inputs and Outputs

RF input

Connector	2.92mm-K,50Ω nominal
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10 MHz in

Connector	SMA-K,50Ω nominal
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10 MHz out

Connector	SMA-K,50Ω nominal
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Trigger in

Connector	SMA-K,10kΩ nominal
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Trigger out

Connector	SMA-K,50Ω nominal
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Analog out

Connector	SMA-K,50Ω nominal
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I/Q Analyzer

Frequency

Frequency span

Standard instrument	100kHz to 25MHz
Option B40	100kHz to 40MHz

Resolution bandwidth (spectrum measurement)

Range

Overall	100mHz to 3MHz
Span = 1MHz	50Hz to 1MHz
Span = 10kHz	1Hz to 10kHz
Span = 100Hz	100mHz to 100Hz

Window shapes

Flat top, Uniform, Hanning, Gaussian, Blackman, Blackman-Harris, Kaiser Bessel (K-B 70 dB, K-B 90 dB and K-B 110 dB)

Analysis bandwidth

Standard instrument	100kHz to 25MHz
Option B40	100kHz to 40MHz

IF frequency response (standard 10 MHz IF path)

IF frequency response (demodulation and FFT response relative to the center frequency, 20 to 30°C)

Center frequency (GHz)	Span (MHz)	Max. error	RMS (nominal)
≤3.0	≤10	±0.40dB	0.03dB
3.0<f≤26.5	≤10		0.10dB

IF phase linearity (deviation from mean phase linearity, nominal)

Center frequency (GHz)	Span (MHz)	Peak-to-peak	RMS
≤3.0	≤10	0.5°	0.2°
3.0<f≤7.5	≤10	0.5°	0.4°
7.5<f≤26.5	≤10	0.5°	0.4°

Data acquisition (standard 10 MHz IF path)

Time record length	4,000,000 IQ sample pairs
Sample rate	90MSa/s
ADC resolution	14 Bits

Data acquisition (B40 IF path)

Time record length

IQ analyzer	4,000,000 IQ sample pairs
Sample rate	90MSa/s
ADC resolution	14 Bits

System Requirements

Operating system	Windows10 (64 bit)
Processor speed	1.86 GHz minimum
Available memory	4 GB minimum
	8 GB recommended
Available disk space	4GB
Video	Support for DirectX 10 graphics with 128 MB graphics recommended (SuperVGA supported)
Browser	Microsoft Internet Explorer 7.0 or greater

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