DATA SHEET

N9321C Basic Spectrum Analyzer

9 kHz to 4 GHz

Preliminary version

KEYSIGHT TECHNOLOGIES

Definitions and conditions

Specification
Describes the performance of parameters covered by the product warranty and apply to the full temperature range of 5 to 45°C, unless otherwise noted.

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. This data does not include measurement uncertainty.

Nominal
Indicates expected performance or describe product performance that is useful in the application of the product but are not covered by the product warranty.

The analyzer will meet its specifications when:

- It is within its calibration cycle
- It has been turned on at least 30 minutes
- It 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, but outside the allowed operating range

Frequency and Time Specifications

		Supplemental information
Frequency		
Range	9 kHz to 4 GHz	AC coupled
Resolution	1 Hz	
Frequency reference		
	Option PFR	**Standard**
Nominal frequency	10 MHz	10 MHz
Aging rate	± 1 × 10^{-7}/Year	± 1 × 10^{-6}/Year
Temperature stability		
20°C to 30°C	± 1.5 × 10^{-8}	
5°C to 45°C	± 5 × 10^{-8}	± 1 × 10^{-6}
Achievable initial calibration accuracy	± 4 × 10^{-8}	± 1 × 10^{-6}
Frequency readout accuracy (start, stop, center, marker)		
Marker resolution	(frequency span)/(number of sweep point -1)	
Uncertainty	± (freq indication × freq reference uncertainty [1] + 1% × span + 20% × resolution bandwidth + marker resolution + 1 Hz)	
Sweep point	461, fixed	
Marker frequency counter		
Resolution	1 Hz	
Accuracy	± [(marker freq × freq reference uncertainty [1]) + (counter resolution)]	RBW/Span ≥ 0.02 Marker level to displayed noise level > 25 dB, frequency offset = 0 Hz

1. Frequency reference uncertainty = Aging rate x period since adjustment + temperature stability.

Frequency and Time Specifications (Continued)

		Supplemental information
Frequency span (FFT and swept mode)		
Range	0 Hz (zero span), 50 Hz to 4 GHz	
Resolution	1 Hz	
Accuracy	± (0.22% × span + span/(sweep point −1))	Nominal
Sweep time and triggering		
Range	2 ms to 1000 s	Span ≥ 100 Hz
	600 ns to 1000 s	Span = 0 Hz (minimum resolution = 600 ns, when RBW ≥ 30 kHz)
Mode	Continuous, Single	
Sweep time rule	Accuracy or Speed	
Trigger	Free run, video, external, RF burst	
Trigger slope	Selectable positive or negative edge	
Trigger delay	± 12 ms to ± 12 s, nominal	Span = 0 Hz
Time gated sweep (Option TMG)		
Gate sources	External	
	Periodic timer	Sync sources include free and external Period 0 to 20 s (It should be greater than gate delay plus gate length) Offset −5 to +5 s
Gate delay range	12 µs to 10 s	Resolution = 200 ns
Gate length range	84 µs to 10 s	Resolution = 200 ns
RBW range	≥ 1 kHz	VBW is fixed and equal to RBW for efficiency

Frequency and Time Specifications (Continued)

		Supplemental information
Resolution bandwidth (RBW)		
Range (-3 dB bandwidth)	10 Hz to 3 MHz	In 1-3-10 sequence
Accuracy	± 5%, nominal	<10% when RBW = 3 MHz
Resolution filter shape factor	< 5:1, nominal	60 dB/3 dB bandwidth ratio, digital, Gaussian-like
EMI bandwidth (CISPR compliant)	200 Hz, 9 kHz, 120 kHz, 1 MHz	Option EMC required
Accuracy	± 10%, nominal	
Resolution filter shape factor	< 5:1, nominal	-60 dB/-6 dB bandwidth ratio
Video bandwidth (VBW)		
Range	1 Hz to 3 MHz	In 1-3-10 sequence
Accuracy	± 10%, nominal	VBW = 1 Hz to 1 MHz

Amplitude Specifications

		Supplemental information
Measurement range		
100 kHz to 1 MHz	Displayed average noise level (DANL) to +10 dBm	Preamp off
1 MHz to 4 GHz	Displayed average noise level (DANL) to +20 dBm	
Input attenuator range	0 to 50 dB, in 1 dB steps	
Maximum damage level		
Average continuous power	+33 dBm, 3 minutes maximum	Input attn ≥ 20 dB, 2 MHz to 4 GHz
DC voltage	± 50 VDC maximum	
Level display range		
Scale units	dBm, dBmV, dBµV, W, V, dBmV EMF, dBµV EMF, V EMF	
Marker level readout	0.01 dB	Log scale
Resolution	< 1% of signal level	Linear scale
Number of traces	4	
Detectors	Normal, positive peak, sample, negative peak, average (video, RMS, voltage), quasi-peak (option EMC required)	
Trace function	Clear/write, maximum hold, minimum hold, average	
Frequency response		
20 to 30°C, 30% to 70% relative humidity, attenuation 20 dB, reference frequency 50 MHz		
9 to 100 kHz	± 0.5 dB nominal	Preamp off
100 kHz to 3 GHz	± 0.7 dB	Preamp off
3 to 4 GHz	± 0.85 dB	Preamp off
100 kHz to 3 GHz	± 0.7 dB	Preamp on
3 to 4 GHz	± 0.9 dB	Preamp on

Amplitude Specifications (Continued)

		Supplemental information
Input attenuation switching uncertainty at 50 MHz		
1 to 50 dB attenuation	± 0.2 dB, typical	Relative to 20 dB reference setting
Resolution bandwidth switching uncertainty		
10 Hz to 3 MHz RBW	+0.1 dB, nominal	
Total absolute amplitude accuracy		
20 to 30°C, 30% to 70% RH, peak detector, RBW 1 kHz, VBW 300 Hz, sweep time Accuracy, input signal −50 to 0 dBm, preamp off, attenuation 20 dB. Add additional ± 0.3 dB when sweep time rule is set to Speed		
At 50 MHz	± 0.3 dB	
At all frequencies	± (0.3 dB + frequency response)	
100 kHz to 3 GHz	± 0.60 dB	95th percentile
3 to 4 GHz	± 0.65 dB	95th percentile
Preamp on		
At 50 MHz	± 0.4 dB	
At all frequencies	± (0.4 dB + frequency response)	
100 kHz to 3 GHz	± 0.60 dB	95th percentile
3 to 4 GHz	± 0.65 dB	95th percentile
Preamplifier (Option P04)		
Frequency range	9 kHz to 4 GHz	
Gain	25 dB, nominal	100 kHz to 4 GHz
	15 dB, nominal	9 to 100 kHz

Dynamic Range Specifications

1 dB gain compression			
20 to 30°C, frequency ≥ 50 MHz, Ref level > −20 dBm, nominal Mixer power level (dBm) = input power (dBm) − input attenuation (dB) when preamp off Total power at the preamp = total power at the input (dBm) − input attenuation (dB) when preamp on			
Preamp off		50 to 200 MHz	+2 dBm
		200 to 500 MHz	+4 dBm
		500 MHz to 4 GHz	+7 dBm
Preamp on		> -32 dBm, total power at the preamp	
Displayed average noise level		**Normalized to 1 Hz**	**Minimum RBW**
20 to 30°C, input terminated 50 Ω, 0 dB input attenuation, RBW = 1 kHz, RMS detector, average ≥ 40			
Preamp off	9 to 100 kHz	-100 dBm, nominal	-90 dBm, nominal
	100 kHz to 1 MHz	-108 dBm, typical -127 dBm	-98 dBm, typical -117 dBm
	1 to 10 MHz	-128 dBm, typical -146 dBm	-118 dBm, typical -136 dBm
	10 to 500 MHz	-142 dBm, typical -146 dBm	-132 dBm, typical -136 dBm
	500 MHz to 2.5 GHz	-141 dBm, typical -145 dBm	-131 dBm, typical -135 dBm
	2.5 to 4 GHz	-140 dBm, typical -144 dBm	-130 dBm, typical -134 dBm
Preamp on	9 to 100 kHz	-110 dBm, nominal	-100 dBm, nominal
	100 kHz to 1 MHz	-131 dBm, typical -150 dBm	-121 dBm, typical -140 dBm
	1 to 10 MHz	-148 dBm, typical -163 dBm	-138 dBm, typical -153 dBm
	10 to 500 MHz	-161 dBm, typical -164 dBm	-151 dBm, typical -154 dBm
	500 MHz to 2.5 GHz	-159 dBm, typical -162 dBm	-149 dBm, typical -152 dBm
	2.5 to 4 GHz	-158 dBm, typical -161 dBm	-148 dBm, typical -151 dBm

Dynamic Range Specifications (Continued)

Spurious response		
Input terminated and 0 dB input attenuation, preamp off 20 to 30°C		
Residual response	< −90 dBm, typical −98 dBm	
−30 dBm signal at input mixer 20 to 30°C		
Input related spurious	< −75 dBc	
	Exceptions:	
	−65 dBc (F1 - 21.4 MHz, with F1 input frequency)	
	−65 dBc (F1 - 5.35 MHz, with F1 input frequency)	
Mixer signal level at −30 dBm, input attenuation 0 dB, preamp off, 20 to 30°C		
Second harmonic distortion	50 MHz to 3 GHz	< −65 dBc
	3 to 4 GHz	< −70 dBc
Two −20 dBm tones at input mixer, spaced by 100 kHz, input attenuation 0 dB, preamp off, reference level > −20 dBm, 20 to 30°C		
Third order intermodulation distortion (third order intercept)	50 to 300 MHz	+9 dBm, typical +12 dBm
	300 MHz to 4 GHz	+11 dBm, typical +15 dBm
Phase noise		
20 to 30 °C, center frequency = 1 GHz		
Offset from CF signal	10 kHz	Typical –90 dBc/Hz
	100 kHz	–98 dBc/Hz, typical –100 dBc/Hz
	1 MHz	–119 dBc/Hz, typical –121 dBc/Hz
Residual FM		
20 to 30°C, RBW 100 Hz	≤ 10 Hz p–p in 20 ms, nominal	

Option specificaitons

		Supplemental information
Tracking generator (Option TG4)		
Frequency range	5 MHz to 4 GHz	
Output level	0 to –20 dBm	1 dB steps
Resolution bandwidth	3 kHz to 3 MHz	
Output flatness	1 dB	Nominal
VSWR	< 2.0:1	Nominal
Connector and impedance	Type-N female, 50 Ω	
Maximum safe reverse level	30 dBm (1W)	Average total power
	± 50 VDC	DC voltage
Reflection measurement (Option RM4, requires Option TG4)		
Frequency range	5 MHz to 4 GHz	
Frequency resolution	100 kHz	
Output power	−4 to +2 dBm, nominal	
Measurement speed	2 s (full span 5 MHz to 4 GHz)	
Number of data points	461	
Directivity of calibrator	> 40 dB	Mechanical OSL calibrator
Return loss		
Range	0 to 60 dB	
Accuracy	$20 \times \log 10 (1.1 + 10 (^{-(D-RL)/20}) + 0.016 \times 10^{(-RL/20)} + 10^{(-3+RL/20)})$	Nominal, after average D: Directivity of calibrator RL: Return loss of the DUT
Resolution	0.01 dB	

Option specificaitons (Continued)

		Supplemental information
Voltage standing wave ratio		
Range	1 to 65	
Resolution	0.01	
Accuracy	Refer to return loss accuracy	
Insertion loss		
Range	0 to 30 dB	
Resolution	0.01 dB	
Distance-to-fault (DTF)		
Vertical range	0 to 60 dB	Return loss
	1 to 65	VSWR
Range	(Number of data points − 1) × resolution	Number of data points = 461
Resolution (meter)	$(1.5 \times 10^8) \times (V_P)/(F_2 - F_1)$ Hz	VP is the cable's relative propagation velocity F_2 is the stop frequency F_1 is the start frequency
Immunity to interface		
On-channel	+17 dBm	Nominal
On-frequency	−5 dBm	Nominal
AM/FM modulation analysis (Option AMA)		
Frequency range	10 MHz to 4 GHz	
Carrier power accuracy	± 1.8 dB	Nominal
Carrier power range	–30 to +10 dBm	100 kHz to 2 MHz
	–30 to +20 dBm	2 MHz to 4 GHz

Option specificaitons (Continued)

		Supplemental information
AM measurement (included in option AMA)		
Modulation rate	20 Hz to 100 kHz	
Accuracy	1 Hz	Nominal (modulation rate < 1 kHz)
	< 0.1% modulation rate	Nominal (modulation rate > 1 kHz)
Depth	5 to 95%	
Accuracy	± 4%	Nominal
FM measurement (included in option AMA)		
Modulation rate	20 Hz to 200 kHz	
Accuracy	1 Hz	Nominal (modulation rate < 1 kHz)
	< 0.1% modulation rate	Nominal (modulation rate > 1 kHz)
Deviation	20 Hz to 400 kHz	
Accuracy	± 4%	Nominal
ASK/FSK modulation analysis (Option DMA)		
Frequency range	2.5 MHz to 4 GHz	
Carrier power accuracy	± 2 dB	Nominal
Carrier power range	–30 to +20 dBm	Nominal
Carrier power displayed resolution	0.01 dBm	
ASK measurement (included in option DMA)		
Symbol rate range	100 Hz to 100 kHz	
Modulation depth/index	5 to 95%	
Accuracy	± 4%	Nominal
Displayed resolution	0.1%	

Option specificaitons (Continued)

		Supplemental information
FSK measurement (included in option DMA)		
FSK deviation	100 Hz to 400 kHz	
Symbol rate range	100 Hz to 20 kHz	1 ≤ ß[1] ≤ 20
	20 to 50 kHz	1 ≤ ß ≤ 8
	50 to 100 kHz	1 ≤ ß ≤ 4
Accuracy	± 4%	Nominal
Displayed resolution	0.01 Hz	
Channel scanner (Option SCN)		
Scan modes	Top N, bottom N, and list	
Channels displayed	1 to 20	
Displayed orientation	Vertical	Number of channels ≤ 5
	Horizontal	Number of channels > 5
Chart	Bar chart, and time chart	
Log file	*.csv	
Spectrum monitor (Option MNT)		
Display modes	Spectrogram	
	Spectrum trace	
	Combination of spectrogram and spectrum trace in one screen	
Port control	Disable or enable LAN or USB connectors	

1. ß is the ratio of frequency deviation to symbol rate (deviation/rate).

Option specificaitons (Continued)

		Supplemental information
Security features (Option SEC)		
Security erase method	Erase the entire user flash memory by writing single character “1” over all memory locations	Non-recoverable
Port control	Disable or enable LAN or USB connectors	
Task planner (Option TPN)		
Task plan execution mode	Auto, manual, and manual if fail	
Task plan file	*.TPN	Complementary task plan editor is available with Keysight HSA and BSA PC software
Number of tasks	Maximum 20 in a single .TPN file	
Measurements supported	Spectrum analysis and power suite (channel power, ACPR and OBW)	
	For more information, visit www.keysight.com/find/taskplanner	
USB average power sensor support (Option PWM)		
Power sensor supported	Keysight U2000 Series USB power sensor	
Frequency range	9 kHz to 24 GHz	Sensor dependent
Dynamic range	−60 to +44 dBm	Sensor dependent
USB peak and average power sensor support (Option PWP)		
Power sensor supported	Keysight U2020 and U2042/44 X-Series USB peak and average power sensor	
Frequency range	50 MHz to 40 GHz	Sensor dependent
Dynamic range	−30 to +20 dBm	Sensor dependent

Option specificaitons (Continued)

		Supplemental information
Base band input (Option BB1)		
Frequency range	9 kHz to 10 MHz	
Frequency span	100 kHz to 9.997 MHz	
Frequency resolution	1 Hz	
Measurement ranged	DANL to +10 dBm (9 kHz to 2 MHz)	
	DANL to +20 dBm (2 MHz to 10 MHz)	
Overall amplitude accuracy		
20 to 30°C, 30 to 70% RH, peak detector, input signal −50 to 0 dBm, 95th percentile		
9 to 100 kHz	± 2.5 dB	
100 kHz to 10 MHz	± 1.5 dB	
Displayed average noise level		
20 to 30°C, 30 to 70% RH, 10 Hz RBW, 1 Hz VBW, 50 Ω termination on input, 0 dB attenuation, RMS detector, Trace average > 40, reference level < −35 dBm		
9 to 100 kHz	−135 dBm	Nominal
100 kHz to 10 MHz	−145 dBm	
Phase noise		
Fc = 5 MHz, RBW = 1 kHz, VBW = 30 Hz. Ref level −30 dBm, input attenuation 0 dB, input signal −20 dBm, average > 40		
Offset 30 kHz	−120 dBc/Hz	Nominal
Offset 100 kHz	−127 dBc/Hz	Nominal
Offset > 200 kHz	−130 dBc/Hz	Nominal

Option specificaitons (Continued)

		Supplemental information
Base band input (Option BB1, continued)		
Residual response		
	< −120 dBm, nominal	20 to 30°C, Ref level < −35 dBm 50 Ω termination on input 0 dB attenuation
Second harmonic distortion		
	< −55 dBc nominal	F > 100 kHz Signal level −30 dBm Ref level −30 dBm Attenuation 0 dB
Third order intermodulation distortion		
	< −55 dBc, nominal	F > 100 kHz −20 dBm tones at 100 kHz apart Ref level −20 dBm Attenuation 0 dB

Inputs and Outputs

Front panel		
RF input connector	N-type female, 50 Ω, nominal	
VSWR	10 MHz to 3 GHz	< 1.5:1, nominal, ≥ 10 dB attenuation
	3 to 4 GHz	< 2.0:1, nominal, ≥ 10 dB attenuation
Calibration output	Amplitude	−25 ± 0.25 dBm
	Frequency	40 MHz
	Connector and impedance	BNC-type female, 50 Ω, nominal
Probe power	Voltage/Current	+15 V, 150 mA maximum
		−12.6 V, 150 mA maximum
RF output connector	N-type female, 50 Ω, nominal	Option TG4 installed
USB interface (host)	A plug, version 1.1	
Rear panel		
10 MHz reference output	Output amplitude	> 0 dBm
	Frequency	10 MHz ± (10 MHz × frequency reference accuracy)
	Connector and impedance	BNC-type female, 50 Ω, nominal
10 MHz reference input	Input amplitude	−5 to +10 dBm, nominal
	Frequency	10 MHz
	Connector and impedance	BNC-type female, 50 Ω, nominal
External trigger input	Input amplitude	5 V TTL level, −12.6 V, 150 mA max (nominal)
	Connector and impedance	BNC-type female, 10 k Ω
LAN TCP/IP interface	100Base-T, RJ-45 connector	
USB interface (device)	B plug, version 1.1	

Inputs and Outputs (Continued)

Rear panel (Continued)		
Mini USB (device)	Mini-AB female, version 1.1	
GPIB interface	IEEE-488 bus connector	Optional G01 installed

General

Temperature and relative humidity	
Operating temperature range	+5 to +45°C
Storage temperature range	–20 to +70°C
Relative humidity	< 95%
EMC	
Complies with European EMC Directive 2014/30/EU	
IEC/EN 61326-1	
CISPR Pub 11 group 1, class A	
AS/NZS-AS CISPR 11:2017	
ICES/NMB-001	
This ISM device complies with Canadian ICES-001	
Cet appareil ISM est conforme à la norme NMB-001 du Canada	
Safety	
Complies with European Low Voltage Directive 2014/35/EU	
• IEC/EN 61010-1 3.1 Edition	
• Canada: CAN/CSA-C22.2 No 61010-1-12	
• USA: UL 61010-1 3.1 Edition	

General (Continued)

Audio noise	
Normal position. Per ISO 7779.	
Acoustic noise emission	LpA < 70 dB
Environmental stress	
Samples of this product have been type tested in accordance with the Keysight 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. Test methods are aligned with IEC 60068-2 and levels are similar to MILPRF-28800F Class 3	
Power requirements	
Voltage and frequency (nominal)	100 to 240 VAC, 50 to 60 Hz, Auto ranging
Power consumption	≤ 25 W, < 20 W, typical
Display	
Resolution	640 x 480
Size	165.1 mm (6.5 inch) diagonal (nominal)
Data storage	
Internal	64 MB nominal
External	Supports USB 3.0 compatible memory devices
Weight (without options)	
Net	7.9 kg (17.4 lbs), nominal
Shipping	14.5 kg (30.9 lbs), nominal

General (Continued)

Dimensions	
Height	132.5 mm (5.2 inch)
Width	320 mm (12.6 inch)
Length	400 mm (15.7 inch)
Warranty	
The N9321C spectrum analyzer is supplied with a five-year warranty	
Calibration cycle	
The recommended calibration cycle is one year. Calibration services are available through Keysight service centers	

Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

KEYSIGHT TECHNOLOGIES

This information is subject to change without notice. © Keysight Technologies, 20XX - 2021, Published in USA, Month XX, 2021, XXXX-XXXX.EN