

# N9323C Basic Spectrum Analyzer

1 MHz to 13.6 GHz



## 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. This data does not include measurement uncertainty and is valid only at room temperature (approximately 25 °C).

### **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   |
|---|--|--|
| <b>Frequency</b>  |  |  |
| Range   | 1 MHz to 13.6 GHz  | AC coupled   |
| Resolution  | 1 Hz   |  |
| <b>Frequency reference</b>                                      |  |  |
|   | <b>Option PFR</b>  | <b>Standard</b>  |
| Nominal frequency   | 10 MHz   | 10 MHz   |
| Aging rate  | $\pm 1 \times 10^{-7}/\text{Year}$   | $\pm 1 \times 10^{-6}/\text{Year}$   |
| Temperature stability   |  |  |
| 20°C to 30°C  | $\pm 1.5 \times 10^{-8}$   |  |
| 5°C to 45°C   | $\pm 5 \times 10^{-8}$   | $\pm 1 \times 10^{-6}$   |
| Achievable initial calibration accuracy                         | $\pm 4 \times 10^{-8}$   | $\pm 1 \times 10^{-6}$   |
| <b>Frequency readout accuracy (start, stop, center, marker)</b> |  |  |
| Marker resolution   | (frequency span)/(number of sweep point -1)  |  |
| Uncertainty   | $\pm (\text{freq indication} \times \text{freq reference uncertainty}^1 + 1\% \times \text{span} + 20\% \times \text{resolution bandwidth} + \text{marker resolution} + 1 \text{ Hz})$ |  |
| Sweep point   | 461, fixed   |  |
| <b>Marker frequency counter</b>                                 |  |  |
| Resolution  | 1 Hz   |  |
| Accuracy  | $\pm [(\text{marker freq} \times \text{freq reference uncertainty}^1) + (\text{counter resolution})]$  | RBW/Span $\geq 0.02$<br>Marker level to displayed noise level > 25 dB, frequency offset = 0 Hz |

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

|  |  | Supplemental information  |
|--|--|---|
| <b>Frequency span (FFT and swept mode)</b> |  |   |
| Range                                      | 0 Hz (zero span),<br>100 Hz to 13.6 GHz                                  |   |
| Resolution                                 | 1 Hz   |   |
| Accuracy                                   | $\pm (0.22\% \times \text{span} + \text{span}/(\text{sweep point} - 1))$ | Nominal   |
| <b>Sweep time and triggering</b>           |  |   |
| Range                                      | 2 ms to 1000 s   | Span $\geq$ 100 Hz  |
|  | 600 ns to 200 s  | Span = 0 Hz<br>(minimum resolution = 600 ns, when RBW $\geq$ 30 kHz)  |
| Mode                                       | Continuous, Single   |   |
| Sweep time rule                            | Accuracy or Speed  |   |
| Trigger                                    | Free run, video, external<br>RF burst (requires option TMG)              |   |
| Trigger slope                              | Selectable positive or negative edge                                     |   |
| Trigger delay                              | $\pm$ 12 ms to $\pm$ 12 s, nominal                                       | Span = 0 Hz   |
| <b>Time gated sweep (Option TMG)</b>       |  |   |
| Gate sources                               | External, RF burst   |   |
|  | Periodic timer   | Sync sources include free and external<br>Period 0 to 20 s (It should be greater than gate delay plus gate length)<br>Offset -5 to +5 s |
| Gate delay range                           | 12 $\mu$ s to 10 s   | Resolution = 200 ns   |
| Gate length range                          | 84 $\mu$ s to 10 s   | Resolution = 200 ns   |
| RBW range                                  | $\geq$ 1 kHz   | VBW is fixed and equal to RBW for efficiency  |

|                                   |                               | Supplemental information                           |
|-----------------------------------|-------------------------------|--|
| <b>Resolution bandwidth (RBW)</b> |                               |  |
| 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                       |
| <b>Video bandwidth (VBW)</b>      |                               |  |
| Range                             | 1 Hz to 3 MHz                 | In 1-3-10 sequence                                 |
| Accuracy                          | ± 10%, nominal                | VBW = 1 Hz to 1 MHz                                |

## Amplitude Specifications

|  |   | Supplemental information                         |
|--|---|--|
| <b>Measurement range</b>                               |   |  |
| 1 MHz to 500 MHz                                       | Displayed average noise level (DANL) to +10 dBm   | Preamp off                                       |
| 500 MHz to 13.6 GHz                                    | Displayed average noise level (DANL) to +20 dBm   |  |
| Input attenuator range                                 | 0 to 50 dB, in 5 dB steps   |  |
| <b>Maximum damage level</b>                            |   |  |
| Average continuous power                               | +30 dBm, 3 minutes maximum  | Input attenuator $\geq$ 20 dB, 1 MHz to 13.6 GHz |
| DC voltage   | $\pm$ 50 VDC maximum  |  |
| <b>Level display range</b>                             |   |  |
| Scale units  | dBm, dBmV, dB $\mu$ V, W, V, dBmV EMF, dB $\mu$ V 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  |  |
| <b>Frequency response</b>                              |   |  |
| Attenuation 20 dB, reference frequency 50 MHz, typical |   |  |
| 1 MHz to 50 MHz  | $\pm$ 0.3 dB  |  |
| 50 MHz to 4 GHz  | $\pm$ 0.4 dB  |  |
| 4 GHz to 7 GHz   | $\pm$ 0.45 dB   |  |
| 7 GHz to 13.6 GHz                                      | $\pm$ 0.6 dB  |  |

|  |  | Supplemental information   |
|--|--|--|
| <b>Input attenuation switching uncertainty at 50 MHz</b>   |  |  |
| 1 to 50 dB attenuation   | $\pm 0.2$ dB, typical                              | Relative to 20 dB reference setting  |
| <b>Resolution bandwidth switching uncertainty</b>  |  |  |
| 10 Hz to 3 MHz RBW   | +0.1 dB, typical                                   |  |
| <b>Absolute amplitude accuracy</b>   |  |  |
| Peak detector, RBW 1 kHz, VBW 300 Hz, sweep time Accuracy, input signal $-50$ to $0$ dBm, attenuation 20 dB, typical |  |  |
| At 50 MHz  | $\pm 0.3$ dB                                       |  |
| At all frequencies   | $\pm (0.3 \text{ dB} + \text{frequency response})$ |  |
| <b>Overall amplitude accuracy</b>  |  |  |
| 1 MHz to 7 GHz   | $\pm 1.3$ dB                                       | <ul style="list-style-type: none"> <li>• 20 to 30 °C, 30 to 70% RH, peak detector, preamp off, input signal <math>-50</math> to <math>0</math> dBm, 95% percentile</li> <li>• Swp Time Rule is set to Accuracy</li> <li>• Adds <math>\pm 0.3</math> dB when Swp Time Rule is set to Speed</li> </ul> |
| 7 GHz to 13.6 GHz  | $\pm 1.6$ dB                                       |  |
| <b>Preamplifier (Option P13)</b>   |  |  |
| Frequency range  | 1 MHz to 13.6 GHz                                  |  |
| Gain   | 15 dB  | Nominal  |

## Dynamic Range Specifications

| Displayed average noise level   | Normalized to 1 Hz                            | Minimum RBW                |                            |
|---|---|----------------------------|----------------------------|
| RMS detector, average > 40, 0 dB attenuation, input terminated 50 Ω, RBW = 1 kHz, 20 to 30 °C |   |                            |                            |
| Preamp off  | 1 to 10 MHz                                   | -125 dBm, typical -140 dBm | -115 dBm, typical -130 dBm |
|   | 10 MHz to 3 GHz                               | -137 dBm, typical -142 dBm | -127 dBm, typical -132 dBm |
|   | 3 to 7 GHz                                    | -135 dBm, typical -140 dBm | -125 dBm, typical -130 dBm |
|   | 7 to 10 GHz                                   | -139 dBm, typical -142 dBm | -129 dBm, typical -132 dBm |
|   | 10 to 13.6 GHz                                | -137 dBm, typical -140 dBm | -127 dBm, typical -130 dBm |
| Preamp on   | 1 to 10 MHz                                   | -140 dBm, typical -156 dBm | -130 dBm, typical -146 dBm |
|   | 10 MHz to 3 GHz                               | -150 dBm, typical -154 dBm | -140 dBm, typical -144 dBm |
|   | 3 to 6 GHz                                    | -145 dBm, typical -150 dBm | -135 dBm, typical -140 dBm |
|   | 6 to 13.6 GHz                                 | -151 dBm, typical -155 dBm | -141 dBm, typical -145 dBm |
| <b>Spurious response</b>  |   |                            |                            |
| Mixer signal level at -30 dBm, input attenuation 0 dB, preamp off, 20 to 30 °C                |   |                            |                            |
| Second harmonic distortion  | < -65 dBc, typical < -70 dBc, 50 MHz to 7 GHz |                            |                            |
|   | < -80 dBc, typical < -90 dBc, 7 to 13.6 GHz   |                            |                            |



**Spurious response (continued)**

Two – 20 dBm tones at input mixer, spaced by 100 kHz, input attenuation 0 dB, preamp off, reference level  $\geq$  -30 dBm, 20 to 30 °C

|  |                  |                          |
|--|------------------|--------------------------|
| Third order intermodulation distortion (third order intercept) | 50 to 300 MHz    | +8 dBm, typical +9 dBm   |
|  | 300 MHz to 8 GHz | +9 dBm, typical +11 dBm  |
|  | 8 to 13.6 GHz    | +10 dBm, typical +12 dBm |

-30 dBm signal at input mixer, span < 2.9 GHz

Exception: -55 dBc ( $2 \times F1 =$  center frequency – 5,890 MHz,  $7 \text{ GHz} < \text{center frequency} < 10 \text{ GHz}$ , with  $F1$  input frequency)

|                        |                              |  |
|------------------------|------------------------------|--|
| Input related spurious | < -60 dBc, typical < -70 dBc |  |
|------------------------|------------------------------|--|

Input terminated and 0 dB input attenuation, preamplifier off

|                   |                |                             |
|-------------------|----------------|-----------------------------|
| Residual response | 1 MHz to 7 GHz | < -95 dBm, typical -110 dBm |
|                   | 7 to 13.6 GHz  | < -85 dBm, typical -93 dBm  |

**Phase noise**

20 to 30 °C, center frequency = 500 MHz

|                       |         |                                  |
|-----------------------|---------|----------------------------------|
| Offset from CF signal | 10 kHz  | Typical -92 dBc/Hz               |
|                       | 30 kHz  | -86 dBc/Hz, typical -89 dBc/Hz   |
|                       | 100 kHz | -97 dBc/Hz, typical -99 dBc/Hz   |
|                       | 1 MHz   | -115 dBc/Hz, typical -119 dBc/Hz |

## Option Specifications

|  |                             | Supplemental information          |
|--|-----------------------------|-----------------------------------|
| <b>Tracking generator (Option TG7)</b>         |                             |                                   |
| Frequency range                                | 5 MHz to 7 GHz              |                                   |
| Output level                                   | 0 to -20 dBm                | 1 dB steps                        |
| VSWR   | < 2.0:1                     | Nominal                           |
| Connector and impedance                        | Type-N female, 50 $\Omega$  |                                   |
| <b>AM/FM modulation analysis (Option AMA)</b>  |                             |                                   |
| Frequency range                                | 10 MHz to 13.6 GHz          |                                   |
| Carrier power accuracy                         | < 7 GHz, $\pm 1.5$ dB       | Nominal                           |
|  | 7 to 13.6 GHz, $\pm 1.8$ dB | Nominal                           |
| Carrier power range                            | -30 to +10 dBm              | 1 to 500 MHz                      |
|  | -30 to +20 dBm              | 500 MHz to 13.6 GHz               |
| Carrier power displayed resolution             | 0.01 dBm                    |                                   |
| <b>AM measurement (included in option AMA)</b> |                             |                                   |
| 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                                       | $\pm 4\%$                   | Nominal                           |
| <b>FM measurement (included in option AMA)</b> |                             |                                   |
| Modulation rate                                | 20 Hz to 200 kHz            |                                   |
| Deviation                                      | 20 Hz to 400 kHz            |                                   |

|   |                        | Supplemental information          |
|---|------------------------|-----------------------------------|
| <b>FM measurement (included in option AMA, continued)</b> |                        |                                   |
| Accuracy  | 1 Hz                   | Nominal (modulation rate < 1 kHz) |
|   | < 0.1% modulation rate | Nominal (modulation rate > 1 kHz) |
| Accuracy  | ± 4%                   | Nominal                           |
| <b>ASK/FSK modulation analysis (Option DMA)</b>           |                        |                                   |
| Frequency range   | 2.5 MHz to 6 GHz       |                                   |
| Carrier power accuracy                                    | ± 2 dB                 | Nominal                           |
| Carrier power range                                       | -30 to +20 dBm         | Nominal                           |
| Carrier power displayed resolution                        | 0.01 dBm               |                                   |
| <b>ASK measurement (included in option DMA)</b>           |                        |                                   |
| Symbol rate range   | 100 Hz to 100 kHz      |                                   |
| Modulation depth/index                                    | 5 to 95%               |                                   |
| Accuracy  | ± 4%                   | Nominal                           |
| Displayed resolution                                      | 0.1%                   |                                   |
| <b>FSK measurement (included in option DMA)</b>           |                        |                                   |
| FSK deviation   | 100 Hz to 400 kHz      |                                   |
| Symbol rate range   | 100 Hz to 20 kHz       | $1 \leq \beta^1 \leq 20$          |
|   | 20 to 50 kHz           | $1 \leq \beta \leq 8$             |
|   | 50 to 100 kHz          | $1 \leq \beta \leq 4$             |
| Accuracy  | ± 4%                   | Nominal                           |
| Displayed resolution                                      | 0.01 Hz                |                                   |

1.  $\beta$  is the ratio of frequency deviation to symbol rate (deviation/rate).

|  |   | Supplemental information  |
|--|---|---|
| <b>Time-gated spectrum analysis (Option TMG)</b> |   |   |
| Gate sources                                     | External  |   |
|  | RF burst  |   |
|  | Periodic timer  | <ul style="list-style-type: none"> <li>• Sync sources include free, external, and RF burst</li> <li>• Period: 0 to 20.0 s</li> <li>• (It should be greater than gate delay plus gate length)</li> <li>• Offset: -5 to +5 s</li> </ul> |
| Gate delay range                                 | 12 $\mu$ s to 10 s  | Resolution = 200 ns   |
| Gate length range                                | 84 $\mu$ s to 10 s  | Resolution = 200 ns   |
| RBW range  | $\geq$ 1 kHz  | VBW is fixed and equal to RBW for efficiency  |
| <b>Channel scanner (Option SCN)</b>              |   |   |
| Scan modes                                       | Top N, bottom N, and list                                   |   |
| Channels displayed                               | 1 to 20   |   |
| Displayed orientation                            | Vertical  | Number of channels $\leq$ 5   |
|  | Horizontal  | Number of channels $>$ 5  |
| Chart  | Bar chart, and time chart                                   |   |
| Log file   | *.csv   |   |
| <b>Spectrum monitor (Option MNT)</b>             |   |   |
| Display modes                                    | Spectrogram   |   |
|  | Spectrum trace  |   |
|  | Combination of spectrogram and spectrum trace in one screen |   |

|   |  | Supplemental information  |
|---|--|---|
| <b>Security features (Option SEC)</b>                         |  |   |
| 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  |   |
| <b>Task planner (Option TPN)</b>                              |  |   |
| Task plan execution mode                                      | Auto, manual, and manual if fail   |   |
| Task plan file  | *.TPN  | Complementary task plan editor is available with<br><b>Keysight HSA and BSA PC software</b> |
| 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 <a href="http://www.keysight.com/find/taskplanner">www.keysight.com/find/taskplanner</a> |   |
| <b>USB average power sensor support (Option PWM)</b>          |  |   |
| 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  |
| <b>USB peak and average power sensor support (Option PWP)</b> |  |   |
| 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  |

## Inputs and Outputs

| Front panel             |                                      |   |
|-------------------------|--------------------------------------|---|
| RF input connector      | N-type female, 50 $\Omega$ , nominal |   |
| VSWR                    | 1 MHz to 7 GHz                       | < 1.5:1, nominal, $\geq$ 10 dB attenuation                  |
|                         | 7 to 13.6 GHz                        | < 2:1, nominal, $\geq$ 10 dB attenuation                    |
| Calibration output      | Amplitude                            | $-25 \pm 0.25$ dBm  |
|                         | Frequency                            | 40 MHz  |
|                         | Connector and impedance              | BNC-type female, 50 $\Omega$ , nominal                      |
| Probe power             | Voltage/Current                      | +15 V, 150 mA maximum                                       |
|                         |                                      | -12.6 V, 150 mA maximum                                     |
| RF output connector     | N-type female, 50 $\Omega$ , nominal | Option TG7 installed  |
| USB interface (host)    | A plug, version 1.1                  |   |
| Rear panel              |                                      |   |
| 10 MHz reference output | Output amplitude                     | > 0 dBm   |
|                         | Frequency                            | 10 MHz $\pm$ (10 MHz $\times$ frequency reference accuracy) |
|                         | Connector and impedance              | BNC-type female, 50 $\Omega$ , nominal                      |
| 10 MHz reference input  | Input amplitude                      | - 5 to +10 dBm, nominal                                     |
|                         | Frequency                            | 10 MHz  |
|                         | Connector and impedance              | BNC-type female, 50 $\Omega$ , 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 $\Omega$                              |
| LAN TCP/IP interface    | 100Base-T, RJ-45 connector           |   |

| Rear panel (Continued) |                             |                        |
|------------------------|-----------------------------|------------------------|
| USB interface (device) | B plug, version 1.1         |                        |
| Mini USB (device)      | Mini-AB female, version 1.1 |                        |
| GPIO 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                                 |               |
| <ul style="list-style-type: none"> <li>• IEC/EN 61010-1 3.1 Edition</li> </ul>          |               |
| <ul style="list-style-type: none"> <li>• Canada: CAN/CSA-C22.2 No 61010-1-12</li> </ul> |               |
| <ul style="list-style-type: none"> <li>• USA: UL 61010-1 3.1 Edition</li> </ul>         |               |

| <b>Audio noise</b>  |  |
|---|--|
| Normal position. Per ISO 7779.  |  |
| Acoustic noise emission   | LpA < 70 dB                                |
| <b>Environmental stress</b>   |  |
| 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 |  |
| <b>Power requirements</b>   |  |
| Voltage and frequency (nominal)   | 100 to 240 VAC, 50 to 60 Hz, Auto ranging  |
| Power consumption   | ≤ 25 W, < 20 W, typical                    |
| <b>Display</b>  |  |
| Resolution  | 640 x 480                                  |
| Size  | 165.1 mm (6.5 inch) diagonal (nominal)     |
| <b>Data storage</b>   |  |
| Internal  | 64 MB nominal                              |
| External  | Supports USB 3.0 compatible memory devices |
| <b>Weight (without options)</b>   |  |
| Net   | 7.9 kg (17.4 lbs), nominal                 |
| Shipping  | 14.5 kg (30.9 lbs), nominal                |



| Dimensions   |                     |
|--|---------------------|
| Height   | 132.5 mm (5.2 inch) |
| Width  | 320 mm (12.6 inch)  |
| Length   | 400 mm (15.7 inch)  |
| Warranty   |                     |
| The N9323C 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](http://www.keysight.com)

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