

# Keysight Technologies

## FieldFox Handheld Analyzers

4/6.5/9/14/18/26.5/32/44/50 GHz

### Data Sheet



N9913A  
N9914A  
N9915A N9925A N9935A  
N9916A N9926A N9936A  
N9917A N9927A N9937A  
N9918A N9928A N9938A

N9950A N9960A  
N9951A N9961A  
N9952A N9962A

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This data sheet provides the specified and typical performance of the FieldFox family of portable analyzers. This data sheet should be used in conjunction with the technical overviews and configuration guide, for a complete description of the analyzers.

The specifications and measurement capabilities listed in this document require certain options on the FieldFox analyzer. Refer to the [FieldFox Configuration Guide](http://literature.cdn.keysight.com/litweb/pdf/5990-9836EN.pdf) to obtain option information. The configuration guide (<http://literature.cdn.keysight.com/litweb/pdf/5990-9836EN.pdf>) is the main resource for option/measurement capability information.

## Definitions

### Specification (spec)

Specifications include guardbands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions. Specifications are warranted performance. FieldFox must be within its calibration cycle. No warm-up required for the specifications listed on pages 20 through 39.

### Typical

Describes additional product performance information not covered by the product warranty. It is performance beyond specifications that 80% of the units exhibit with a 95% confidence level over the temperature range  $23 \pm 5$  °C, unless otherwise noted. Typical performance does not include measurement uncertainty. FieldFox must be within its calibration cycle.

### Nominal

A general, descriptive term or design parameter. It is not tested, and not covered by the product warranty. FieldFox must be within its calibration cycle.

## Cable and Antenna Analyzer and Vector Network Analyzer

The performance listed in this section applies to the cable and antenna analyzer (referred to as CAT) and vector network analyzer (VNA) capabilities available in the following models:

- FieldFox RF & microwave (combination) analyzers: N9913A, N9914A, N9915A, N9916A, N9917A, N9918A, N9950A, N9951A, N9952A
- FieldFox microwave vector network analyzers: N9925A, N9926A, N9927A, N9928A

NOTE: Combination analyzers = Cable and antenna tester (CAT) + Vector network analyzer (VNA) + Spectrum analyzer (SA)

### Frequency specifications

|                                                    | Models                                                              | Frequency range    |
|----------------------------------------------------|---------------------------------------------------------------------|--------------------|
| N991xA, N992xA                                     | N9913A                                                              | 30 kHz to 4 GHz    |
|                                                    | N9914A                                                              | 30 kHz to 6.5 GHz  |
|                                                    | N9915A, N9925A                                                      | 30 kHz to 9 GHz    |
|                                                    | N9916A, N9926A                                                      | 30 kHz to 14 GHz   |
|                                                    | N9917A, N9927A                                                      | 30 kHz to 18 GHz   |
|                                                    | N9918A, N9928A                                                      | 30 kHz to 26.5 GHz |
| N995xA                                             | N9950A                                                              | 300 kHz to 32 GHz  |
|                                                    | N9951A                                                              | 300 kHz to 44 GHz  |
|                                                    | N9952A                                                              | 300 kHz to 50 GHz  |
| Frequency reference, -10 to 55 °C                  |                                                                     |                    |
| Accuracy                                           | ± 0.7 ppm (spec) + aging                                            |                    |
|                                                    | ± 0.4 ppm (typical) + aging                                         |                    |
| Accuracy, when locked to GPS                       | ± 0.010 ppm (spec)                                                  |                    |
| Accuracy, when GPS antenna is disconnected         | ± 0.2 ppm (nominal) <sup>1</sup>                                    |                    |
| Aging Rate                                         | ± 1 ppm/yr for 20 years (spec), will not exceed ± 3.5 ppm           |                    |
| Frequency resolution (start, stop, center, marker) | Spec                                                                |                    |
| Frequency ≤ 5 GHz                                  | 1 Hz                                                                |                    |
| Frequency ≤ 10 GHz                                 | 1.34 Hz                                                             |                    |
| Frequency ≤ 20 GHz                                 | 2.68 Hz                                                             |                    |
| Frequency ≤ 40 GHz                                 | 5.36 Hz                                                             |                    |
| Frequency ≤ 50 GHz                                 | 8.04 Hz                                                             |                    |
| Data points of resolution                          |                                                                     |                    |
|                                                    | 101, 201, 401, 601, 801, 1001, 1601, 4001, 10,001                   |                    |
|                                                    | Arbitrary number of points settable through front panel and SCPI    |                    |
| IF bandwidth <sup>2</sup>                          |                                                                     |                    |
|                                                    | 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz |                    |
| System impedance                                   |                                                                     |                    |
|                                                    | 50 Ω (nominal), 75 Ω with appropriate adapter and calibration kit   |                    |

- The maximum drift expected in the frequency reference applicable when the ambient temperature changes ±5 °C from the temperature when the GPS signal was last connected
- VNA mode only. Recommend using averaging in CAT mode



## Cable and Antenna Analyzer and Vector Network Analyzer (continued)

### Test port output specifications

**High power** in N991xA and N992xA refers to the target output power level of the analyzer when the *Power Setting* is set to *High*. As an example, if you have a frequency sweep from 3 to 6.5 GHz, the analyzer will achieve the power level of -1 dBm across the band.

**Low power** level for N991xA and N992xA analyzers is a flat -45 dBm across the whole frequency band, and is the output of the analyzer when the *Power Setting* is set to *Low*.

**High power** in the N995xA refers to the target output power level of the analyzer when the *Power Setting* is set to *High*. As an example, if you have a frequency sweep from 39 to 46 GHz, the analyzer will achieve the power level to -2 dBm across the band.

**Low power** level for N995xA analyzers is the lowest power level that can be set and is the output of the analyzer when the *Power Setting* is set to *Low*.

**Max leveled power** in the N995xA refers to the maximum leveled (flattened) power that can be achieved across the designated frequency range. For example, if you have a frequency sweep from 32 to 44 GHz, and set up the analyzer to measure all four S-parameters, needing both ports 1 and 2, the maximum power the analyzer can be set to is -6 dBm.

| Test port output power (dBm), high power<br>N991xA, N992xA | Typical<br>port 1 or port 2 | Nominal<br>port 1 or port 2 |
|------------------------------------------------------------|-----------------------------|-----------------------------|
| 30 to 300 kHz                                              | -11                         | —                           |
| > 300 kHz to 2 MHz                                         | -3                          | -2                          |
| > 2 to 625 MHz                                             | -2                          | -1                          |
| > 625 MHz to 3 GHz                                         | 1                           | 3                           |
| > 3 to 6.5 GHz                                             | -1                          | 1                           |
| > 6.5 to 9 GHz                                             | -2                          | 0                           |
| > 9 to 14 GHz                                              | -4                          | -2.5                        |
| > 14 to 18 GHz                                             | -6                          | -4.5                        |
| > 18 to 23 GHz                                             | -10                         | -8.5                        |
| > 23 to 26.5 GHz                                           | -12                         | -11                         |
| Test port output power (dBm), low power<br>N991xA, N992xA  | Typical<br>port 1 or port 2 | Nominal<br>port 1 or port 2 |
| 30 kHz to 26.5 GHz                                         | —                           | -45 (flattened)             |

## Cable and Antenna Analyzer and Vector Network Analyzer (continued)

### Test port output specifications (continued)

| Test port output power (dBm), high power |  | Typical                                                                                                                           |        | Nominal |
|------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------|--------|---------|
| N995xA                                   |  | Port 1                                                                                                                            | Port 2 |         |
| 300 kHz to 2 MHz                         |  | 0                                                                                                                                 | 0      | –       |
| > 2 MHz to 1 GHz                         |  | 2                                                                                                                                 | 2      | –       |
| > 1 to 6.5 GHz                           |  | 2                                                                                                                                 | 0      | –       |
| > 6.5 to 18 GHz                          |  | 4                                                                                                                                 | 1      | –       |
| > 18 to 39 GHz                           |  | 1                                                                                                                                 | -2     | –       |
| > 39 to 46 GHz                           |  | -2                                                                                                                                | -5     | –       |
| > 46 to 50 GHz                           |  | -4                                                                                                                                | -7     | –       |
| Test port output power (dBm), low power  |  | Typical                                                                                                                           |        | Nominal |
| N995xA                                   |  | Port 1                                                                                                                            | Port 2 |         |
| 500 kHz to 10 MHz                        |  | -35                                                                                                                               | -38    | –       |
| > 10 MHz to 10 GHz                       |  | -38                                                                                                                               | -42    | –       |
| > 10 to 20 GHz                           |  | -43                                                                                                                               | -47    | –       |
| > 20 to 44 GHz                           |  | -44                                                                                                                               | -50    | –       |
| > 44 to 50 GHz                           |  | -53                                                                                                                               | -55    | –       |
| Max leveled output power (dBm)           |  | Typical                                                                                                                           |        | Nominal |
| N995xA                                   |  | Port 1                                                                                                                            | Port 2 |         |
| 500 kHz to 10 MHz                        |  | -2                                                                                                                                | -2     | –       |
| > 10 MHz to 25 GHz                       |  | 0                                                                                                                                 | 0      | –       |
| > 25 to 32 GHz                           |  | 0                                                                                                                                 | -4     | –       |
| > 32 to 44 GHz                           |  | -3                                                                                                                                | -6     | –       |
| > 44 to 50 GHz                           |  | -7                                                                                                                                | -10    | –       |
| Output power range                       |  |                                                                                                                                   |        |         |
| CAT                                      |  | High, low, and manual. Default (preset) power is high<br>Manual power is flattened.                                               |        |         |
| VNA                                      |  | High, low, and manual. Default (preset) power is manual, –15 dBm.<br>Manual power is flattened.                                   |        |         |
| Power step size                          |  |                                                                                                                                   |        |         |
|                                          |  | Power settable in 1 dB steps across power range. Flat power, in 1 dB steps, is available across the whole frequency span, nominal |        |         |
| Power level accuracy <sup>1</sup>        |  | Typical                                                                                                                           |        |         |
| N991xA, N992xA                           |  | ± 1.5 dB at –15 dBm, for frequencies > 250 kHz                                                                                    |        |         |
| N995xA                                   |  | ± 0.7 dB at -15 dBm, for frequencies > 500 kHz to 10 MHz<br>± 0.5 dB at -15 dBm, for frequencies > 10 MHz to 50 GHz               |        |         |
| Power level linearity                    |  | Nominal                                                                                                                           |        |         |
| N995xA                                   |  | Port 1 or port 2, –25 dBm ≤ P < max leveled power each port                                                                       |        |         |
| 10 MHz to 50 GHz                         |  | ± 0.5 dB                                                                                                                          |        |         |

1. N991xA and N992xA power levels are calibrated in the factory using a broadband power sensor, which means all tones (fundamental and harmonics) are included. N995xA power levels are calibrated based on PNA-X's tuned receiver, which means primarily the fundamental is included (for frequency ≥ 10 MHz).

## Cable and Antenna Analyzer and Vector Network Analyzer (continued)

### System performance specifications

| System dynamic range <sup>1,2</sup> (dB), high power, 300 Hz IFBW, 100 point average, Port 1 or port 2 (-10 to 55 °C) |                                 |                   |                |
|-----------------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------|----------------|
|                                                                                                                       | Frequency                       | Spec              | Typical        |
| N991xA, N992xA                                                                                                        | > 300 kHz to 9 GHz <sup>3</sup> | 95                | 100            |
|                                                                                                                       | > 9 to 14 GHz                   | 91                | 97             |
|                                                                                                                       | > 14 to 18 GHz                  | 90                | 94             |
|                                                                                                                       | > 18 to 20 GHz                  | 87                | 90             |
|                                                                                                                       | > 20 to 25 GHz                  | 74                | 79             |
|                                                                                                                       | > 25 to 26.5 GHz                | 65                | 70             |
| N995xA                                                                                                                | > 300 kHz to 1 MHz              | –                 | 70 (nominal)   |
|                                                                                                                       | > 1 to 10 MHz                   | –                 | 100 (nominal)  |
|                                                                                                                       | > 10 MHz to 20 GHz <sup>4</sup> | 100               | 110            |
|                                                                                                                       | > 20 to 44 GHz <sup>5</sup>     | 90                | 100            |
|                                                                                                                       | > 44 to 50 GHz <sup>6</sup>     | 81                | 90             |
| Temperature stability                                                                                                 |                                 | Nominal           |                |
|                                                                                                                       | Frequency                       | Magnitude (dB/°C) | Phase (deg/°C) |
| N991xA, N992xA                                                                                                        | ≤ 15 GHz                        | ± 0.018           | –              |
|                                                                                                                       | > 15 to 26.5 GHz                | ± 0.080           | –              |
| N995xA                                                                                                                | ≤ 15 GHz                        | ± 0.005           | ± 0.1          |
|                                                                                                                       | ≤ 25 GHz                        | ± 0.030           | ± 0.3          |
|                                                                                                                       | > 25 GHz                        | ± 0.060           | ± 0.6          |
| Measurement speed (Sweep time)                                                                                        |                                 |                   |                |
| CAT                                                                                                                   |                                 | N991xA, N992xA    | N995xA         |
| Return loss, 30 kHz to 26.5 GHz, 1-port cal, 1001 points <sup>7</sup>                                                 |                                 | 433 μs /pt        | –              |
| Return loss, 300 kHz to 50 GHz, 1-port cal, 1001 points                                                               |                                 | –                 | 650 μs /pt     |
| Distance-to-fault, 100 meter cable, 1-port cal, 1001 points <sup>7</sup>                                              |                                 | 480 μs /pt        | 650 μs /pt     |
| VNA                                                                                                                   |                                 | N991xA, N992xA    | N995xA         |
| S11 and S21, 30 kHz to 26.5 GHz, enhanced response cal, 100 kHz IF bandwidth, 1001 points <sup>8</sup>                |                                 | 483 μs /pt        | –              |
| S11 and S21, 300 kHz to 50 GHz, enhanced response cal, 100 kHz IF bandwidth, 1001 points                              |                                 | –                 | 580 μs /pt     |

1. System dynamic range is measured in factory with loads on test ports after thru normalization, test port output power high.
2. For CAT mode, "Insertion loss (2-port)", decrease listed dynamic range specifications by 20 dB, as CAT mode IFBW is fixed at 10 kHz. Can obtain full dynamic range by using S21 measurement in VNA mode with 100 Hz IFBW.
3. < 300 kHz: 63 dB nominal; 2 to 9 MHz: 85 dB spec, 90 dB typical.
4. Decrease by 3 dB between 15 to 15.8 GHz for S21.
5. Decrease by 5 dB between 21.7 to 22.1 GHz for S21.
6. Decrease by 4 dB between 44 to 50 GHz for S21.
7. 850 μs /pt; applicable for FieldFox with serial number prefix < than MY5607/SG5607/US5607 and FieldFox not upgraded with Option N9910HU-100/200/300.
8. 850 μs /pt; applicable for FieldFox with serial number prefix < than MY5607/SG5607/US5607 and FieldFox not upgraded with Option N9910HU-100/200/300/400.

## Cable and Antenna Analyzer and Vector Network Analyzer (continued)

### Test port input specifications

| Trace noise <sup>1</sup> , high power, 300 Hz IFBW, Port 1 or port 2 |                     | Spec (-10 to 55 °C)          |                 |
|----------------------------------------------------------------------|---------------------|------------------------------|-----------------|
|                                                                      | Frequency           | Magnitude (dB rms)           | Phase (deg rms) |
| N991xA, N992xA, N995xA                                               | > 300 kHz to 20 GHz | ± 0.004                      | ± 0.07          |
|                                                                      | > 20 to 26.5 GHz    | ± 0.007                      | ± 0.14          |
|                                                                      | > 26.5 to 32 GHz    | ± 0.007                      | ± 0.14          |
|                                                                      | > 32 to 50 GHz      | ± 0.008                      | ± 0.22          |
| Receiver compression                                                 |                     | Typical                      |                 |
|                                                                      | Frequency           | Port 1 or port 2             |                 |
| N991xA, N992xA                                                       | 500 MHz to 1 GHz    | +10 dBm, 0.15 dB compression |                 |
|                                                                      | > 1 to 26.5 GHz     | +10 dBm, 0.10 dB compression |                 |
| N995xA                                                               | 2 MHz to 50 GHz     | +5 dBm, 0.10 dB compression  |                 |
| Maximum input level                                                  |                     | Port 1 or port 2             |                 |
|                                                                      |                     | Average CW power             | DC              |
| N991xA, N992xA                                                       |                     | +27 dBm, 0.5 watts           | ± 50 VDC        |
| N995xA                                                               |                     | +25 dBm, 0.3 watts           | ± 40 VDC        |
| Immunity to interfering signals                                      |                     | Nominal                      |                 |
|                                                                      |                     | +16 dBm                      |                 |

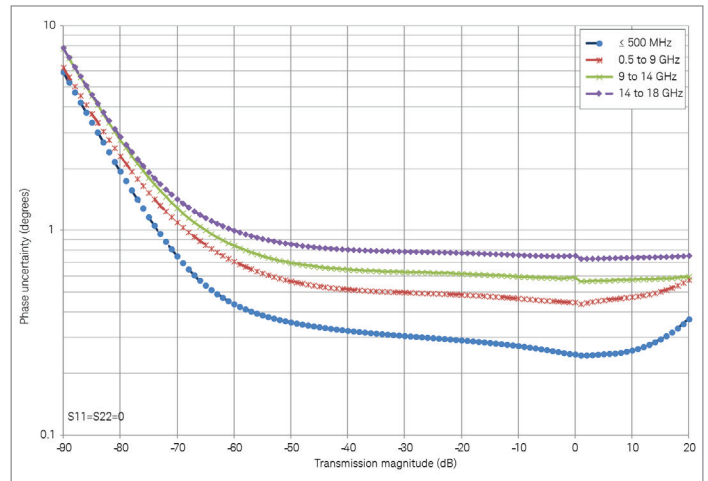
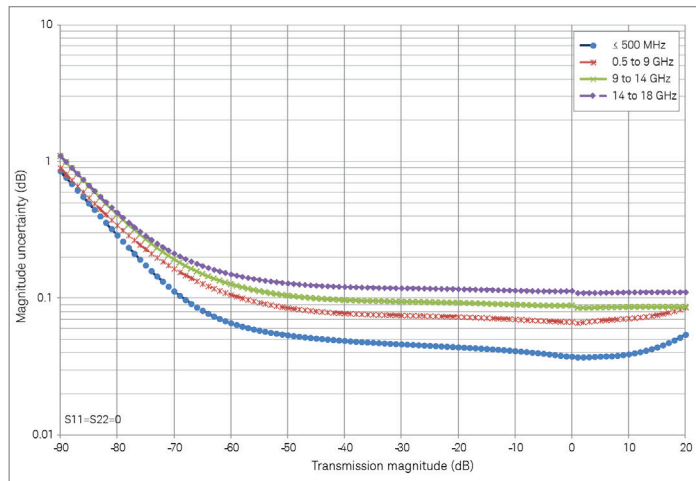
1. For CAT mode, increase trace noise by a factor of 5.7, as CAT mode IFBW is fixed at 10 kHz. Can use averaging in CAT mode to reduce trace noise or use VNA mode with 300 Hz IFBW.

# Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A

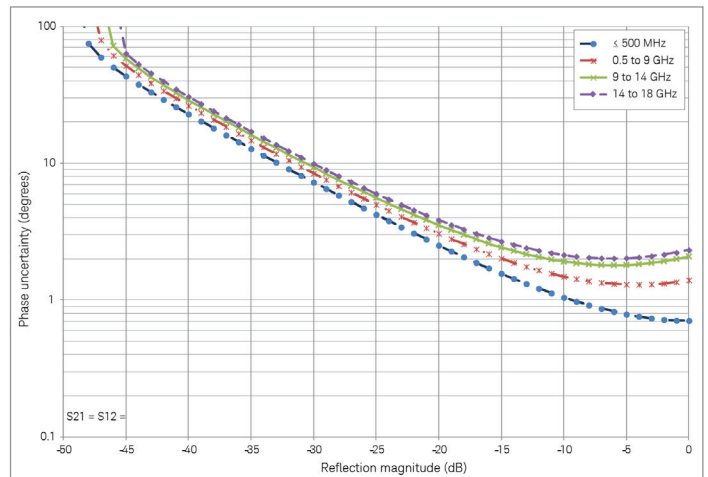
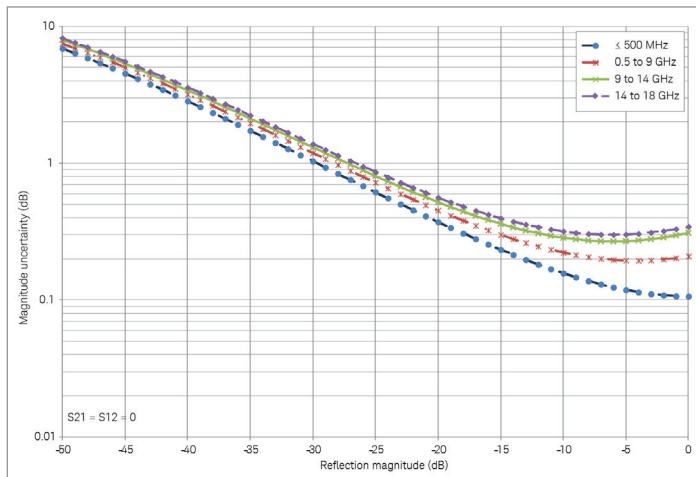
CalReady, Type-N test ports; applies to N9913/4/5/6/7A and N9925/6/7A<sup>1</sup>

Power level of -15 dBm, 10 Hz IF bandwidth, no averaging, battery saver off, and 30-minute warm-up time. Includes uncertainties due to drift, noise, compression, and dynamic accuracy. Coverage factor of x1 applied to uncertainties, for ease of comparison with other industry handheld analyzers.

## Transmission uncertainty (S21, S12)



## Reflection uncertainty (S11, S22)



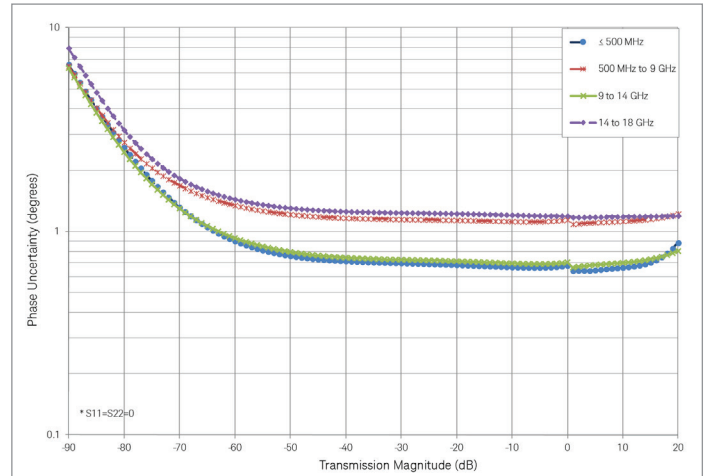
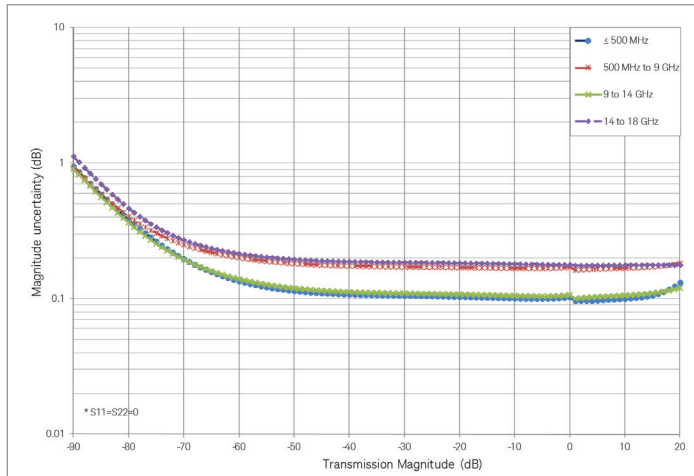
1. Uncertainties shown based on a factory calibration using data-based calibration kits.

## Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A (continued)

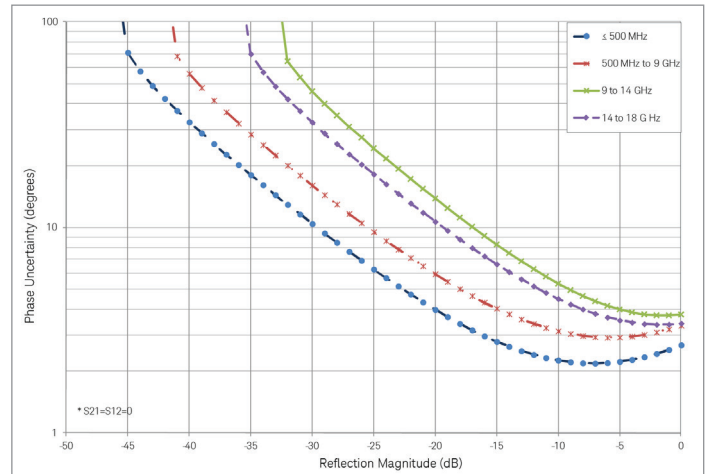
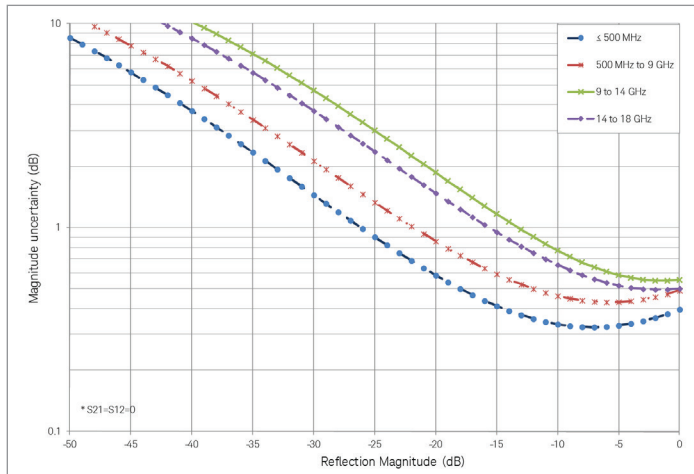
### Full 2-port QuickCal calibration with load, Type-N (m) device<sup>1</sup>

Power level of -15 dBm, 10 Hz IF bandwidth, no averaging, battery saver off, and 30-minute warm-up time. Includes uncertainties due to drift, noise, compression, and dynamic accuracy. Coverage factor of x1 applied to uncertainties, for ease of comparison with other industry handheld analyzers.

#### Transmission uncertainty (S21, S12)



#### Reflection uncertainty (S11, S22)



1. Uncertainties shown based on a factory calibration using data-based calibration kits.

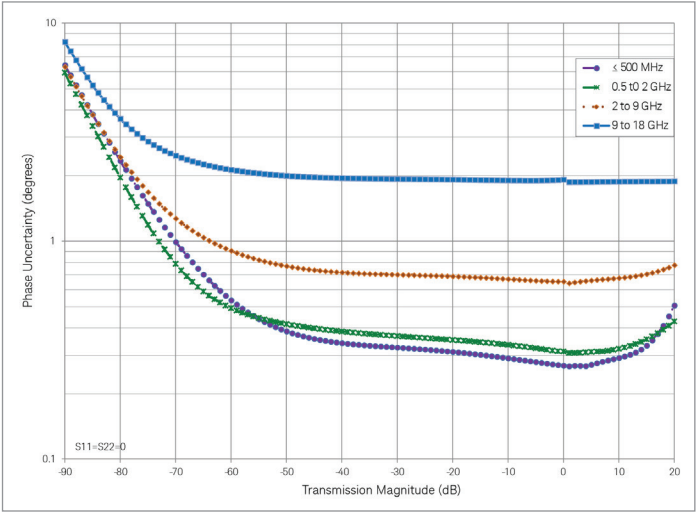
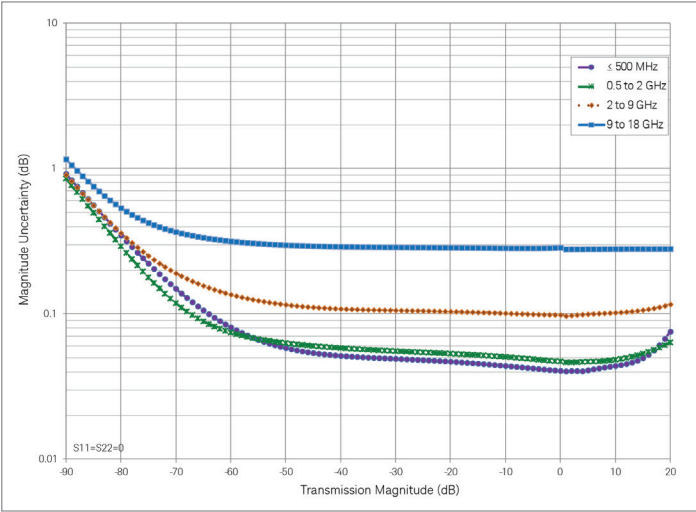
# Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A (continued)

Full 2-port calibration, 85518A or 85519A Type-N (m) calibration kit, spec

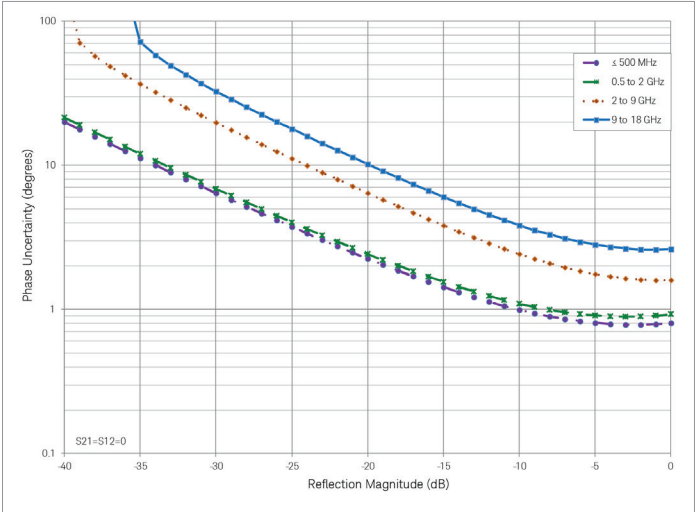
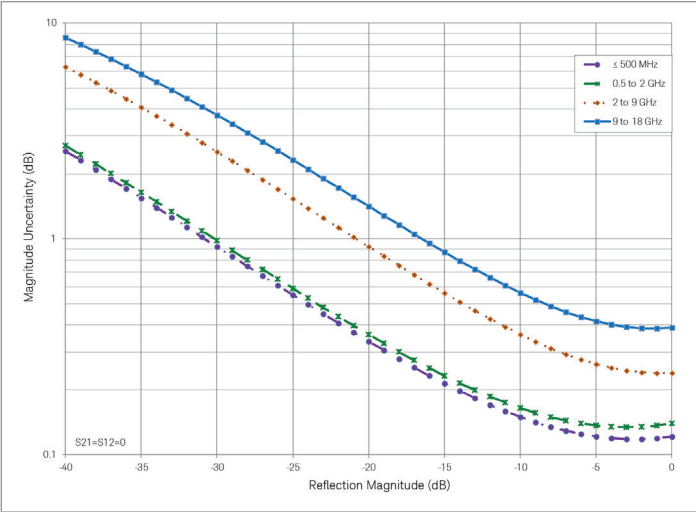
Power level of -15 dBm, 10 Hz IF bandwidth, no averaging, battery saver off, and 60-minute warm-up time. Includes uncertainties due to drift, noise, compression, and dynamic accuracy. Coverage factor of x1 applied to uncertainties, for ease of comparison with other industry handheld analyzers.

| Corrected performance (dB) | ≤ 0.5 GHz | 0.5 to 2 GHz | 2 to 9 GHz | 9 to 18 GHz |
|----------------------------|-----------|--------------|------------|-------------|
| Directivity                | 44        | 42           | 35         | 32          |
| Source match               | 37        | 36           | 33         | 30          |
| Load match                 | 38        | 37           | 31         | 27          |
| Reflection tracking        | ± 0.050   | ± 0.060      | ± 0.070    | ± 0.100     |
| Transmission tracking      | ± 0.070   | ± 0.100      | ± 0.180    | ± 0.500     |

Transmission uncertainty (S21, S12)



Reflection uncertainty (S11, S22)



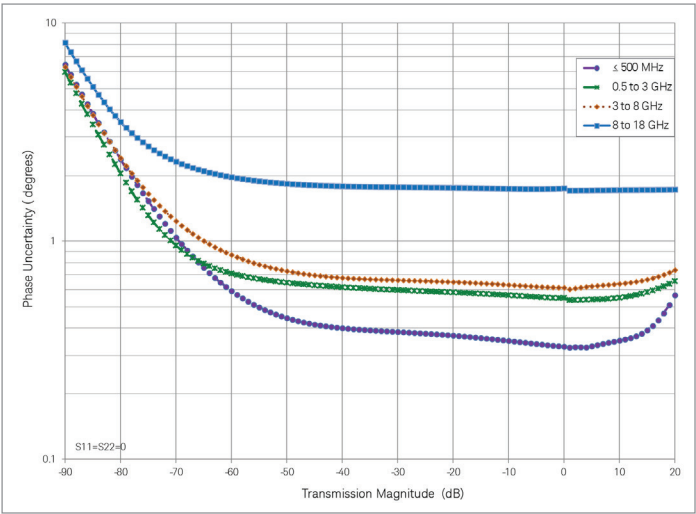
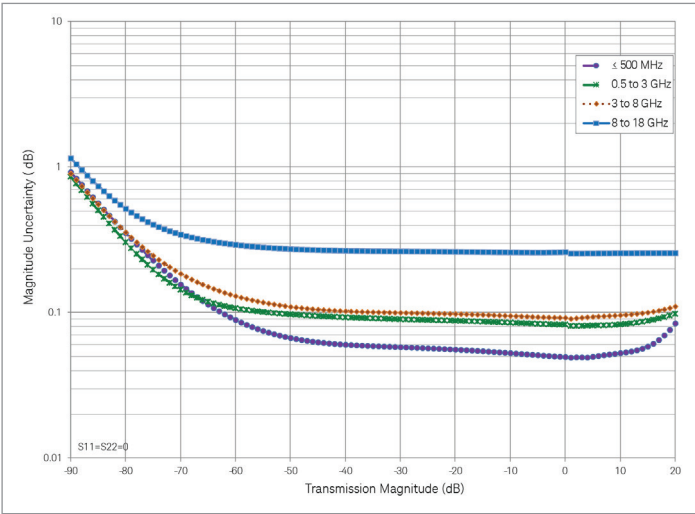
# Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A (continued)

## Full 2-port calibration, 85054D Type-N (m) calibration kit, spec

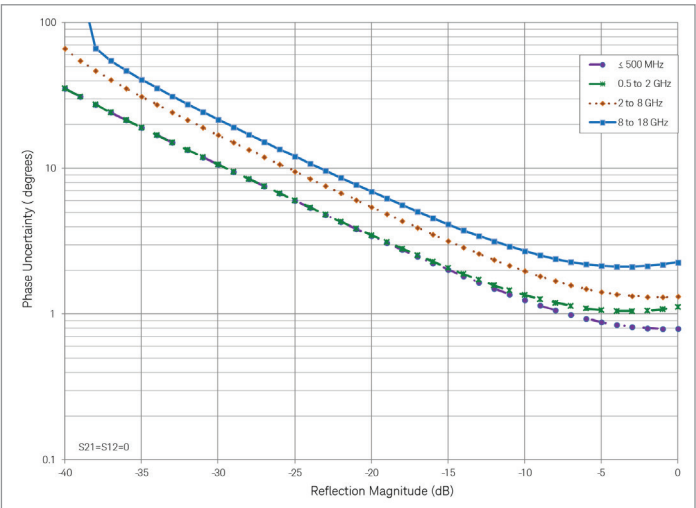
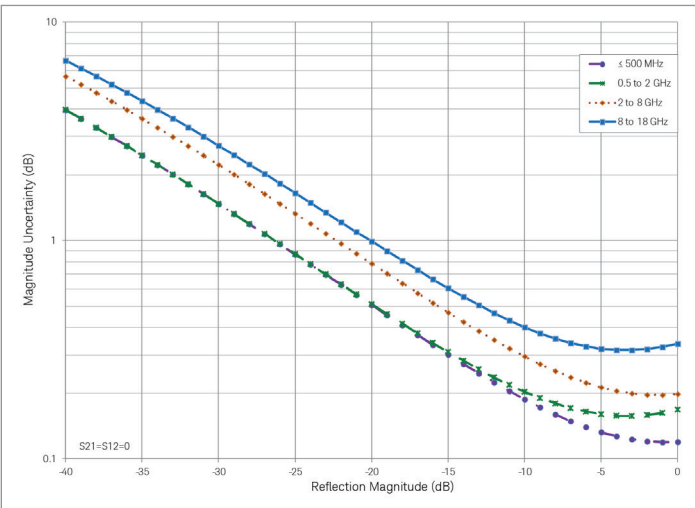
Power level of -15 dBm, 10 Hz IF bandwidth, no averaging, battery saver off, and 60-minute warm-up time. Includes uncertainties due to drift, noise, compression, and dynamic accuracy. Coverage factor of x1 applied to uncertainties, for ease of comparison with other industry handheld analyzers.

| Corrected performance (dB) | ≤ 0.5 GHz | 0.5 to 2 GHz | 2 to 8 GHz | 8 to 18 GHz |
|----------------------------|-----------|--------------|------------|-------------|
| Directivity                | 40        | 40           | 36         | 34          |
| Source match               | 38        | 33           | 33         | 27          |
| Load match                 | 37        | 35           | 32         | 27          |
| Reflection tracking        | ± 0.006   | ± 0.006      | ± 0.009    | ± 0.027     |
| Transmission tracking      | ± 0.070   | ± 0.100      | ± 0.150    | ± 0.430     |

### Transmission uncertainty (S21, S12)



### Reflection uncertainty (S11, S22)



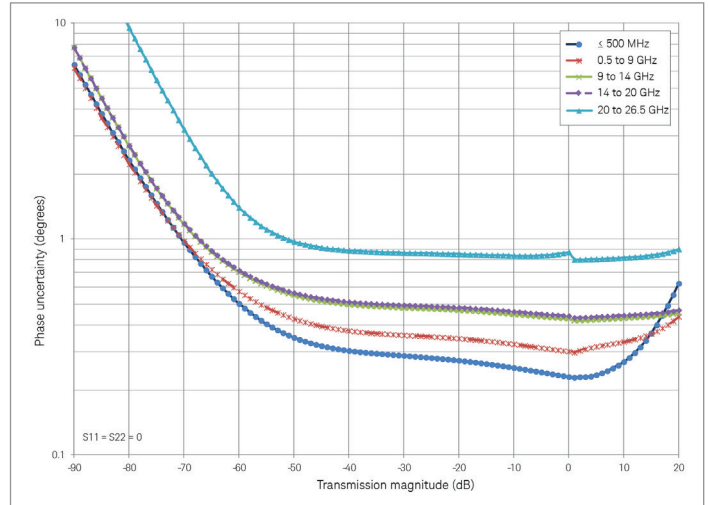
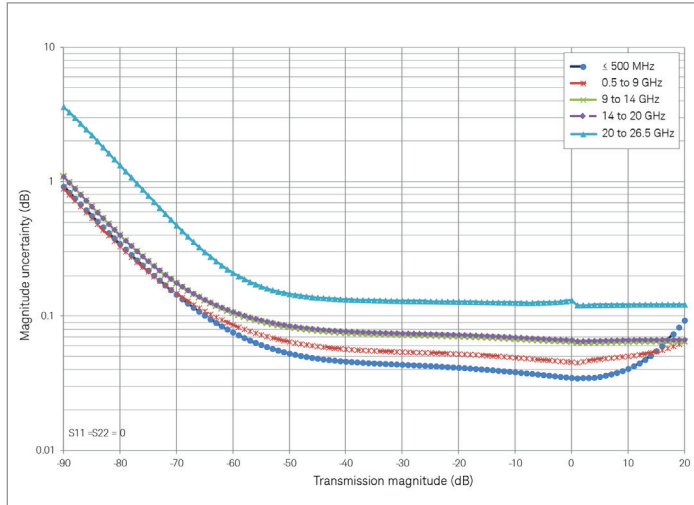


## Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A (continued)

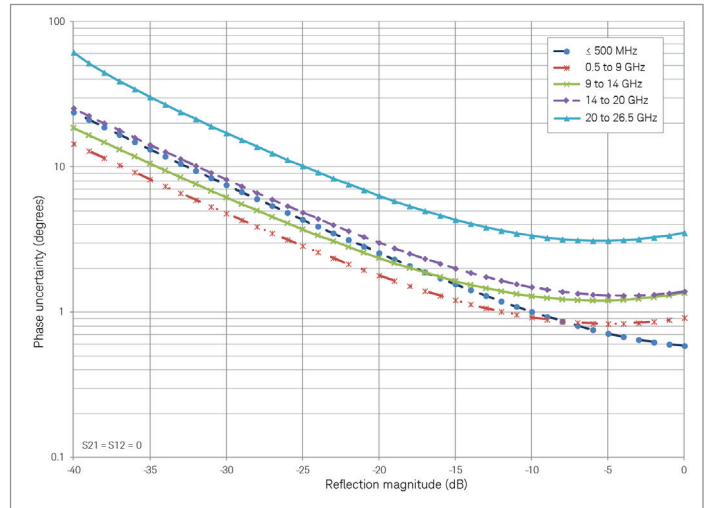
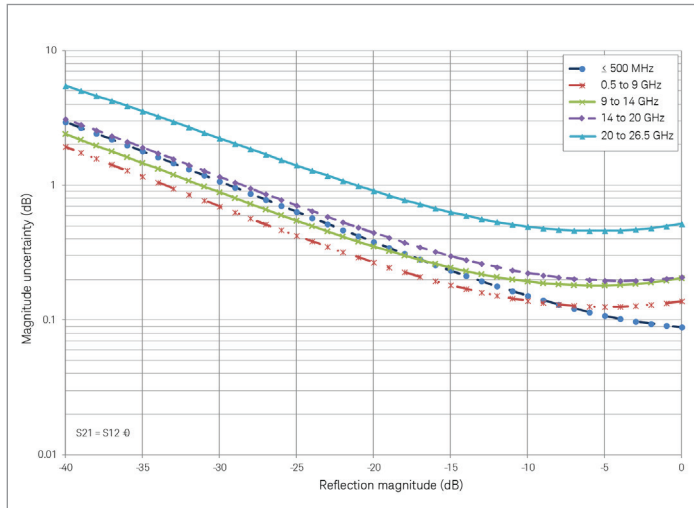
CalReady, 3.5 mm test ports; applies to N9918A, N9928A<sup>1</sup>

Power level of -15 dBm, 10 Hz IF bandwidth, no averaging, battery saver off, and 30-minute warm-up time. Includes uncertainties due to drift, noise, compression, and dynamic accuracy. Coverage factor of x1 applied to uncertainties, for ease of comparison with other industry handheld analyzers.

### Transmission uncertainty (S21, S12)



### Reflection uncertainty (S11, S22)



1. Uncertainties shown based on a factory calibration using data-based calibration kits.

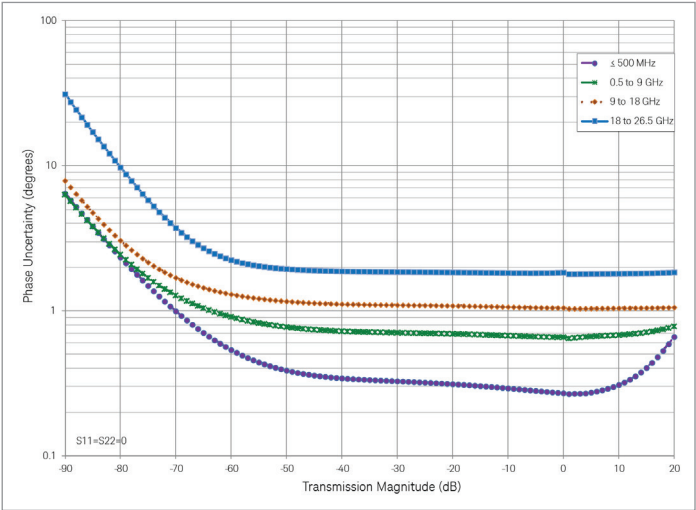
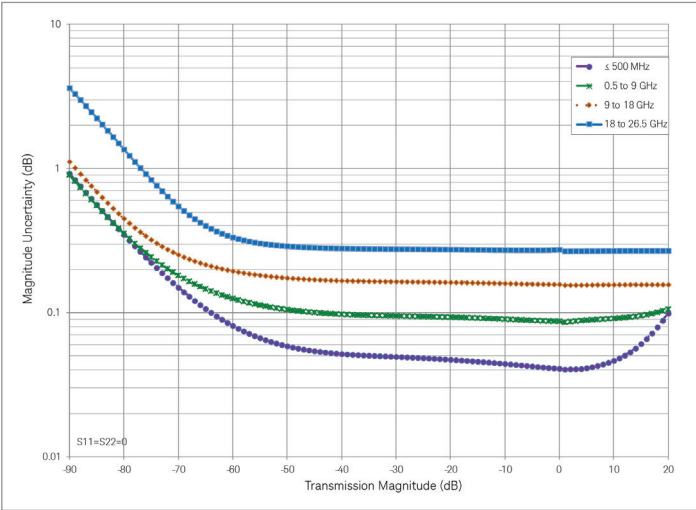
# Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A (continued)

Full 2-port calibration, 85520A or 85521A 3.5 mm (m) calibration kit, spec

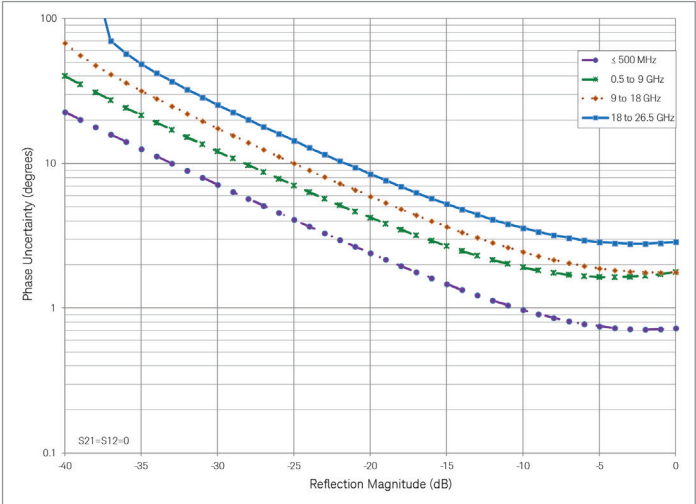
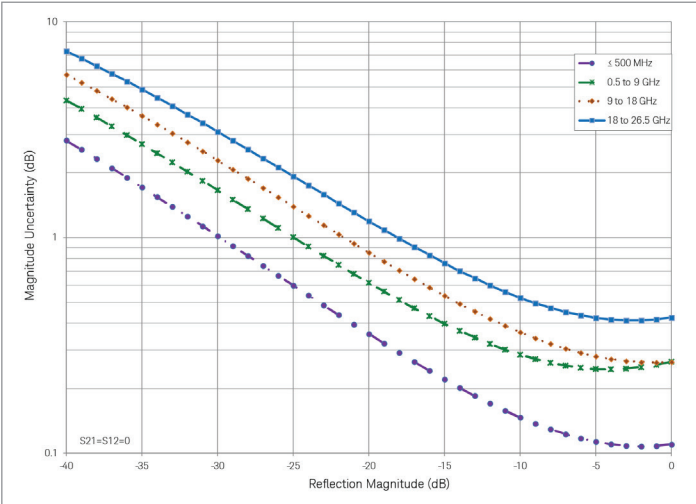
Power level of -15 dBm, 10 Hz IF bandwidth, no averaging, battery saver off, and 60-minute warm-up time. Includes uncertainties due to drift, noise, compression, and dynamic accuracy. Coverage factor of x1 applied to uncertainties, for ease of comparison with other industry handheld analyzers.

| Corrected performance (dB) | ≤ 0.5 GHz | 0.5 to 9 GHz | 9 to 18 GHz | 18 to 26.5 GHz |
|----------------------------|-----------|--------------|-------------|----------------|
| Directivity                | 42        | 36           | 32          | 32             |
| Source match               | 37        | 30           | 28          | 27             |
| Load match                 | 37        | 30           | 28          | 24             |
| Reflection tracking        | ± 0.035   | ± 0.130      | ± 0.140     | ± 0.210        |
| Transmission tracking      | ± 0.070   | ± 0.290      | ± 0.330     | ± 0.520        |

Transmission uncertainty (S21, S12)



Reflection uncertainty (S11, S22)



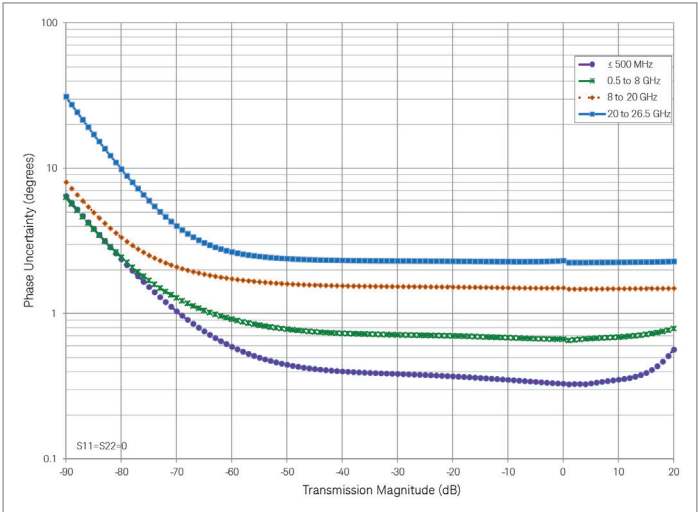
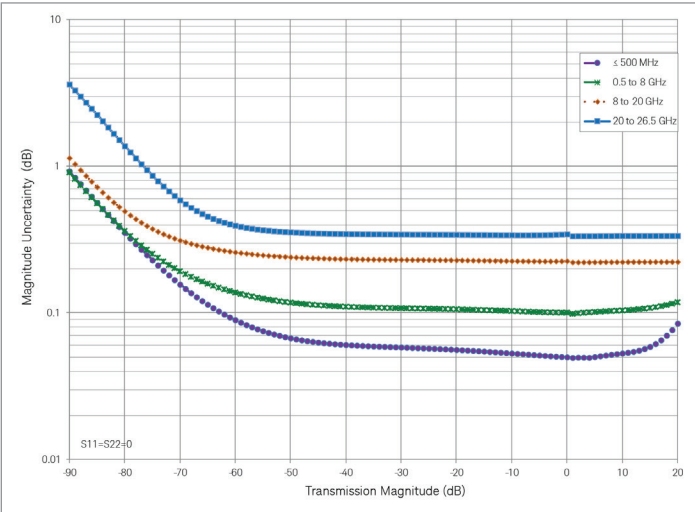
# Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A (continued)

Full 2-port calibration, 85052D 3.5 mm calibration kit, spec

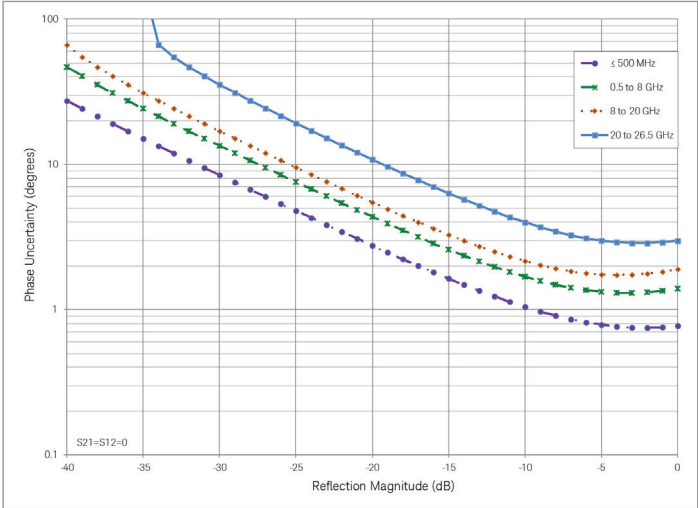
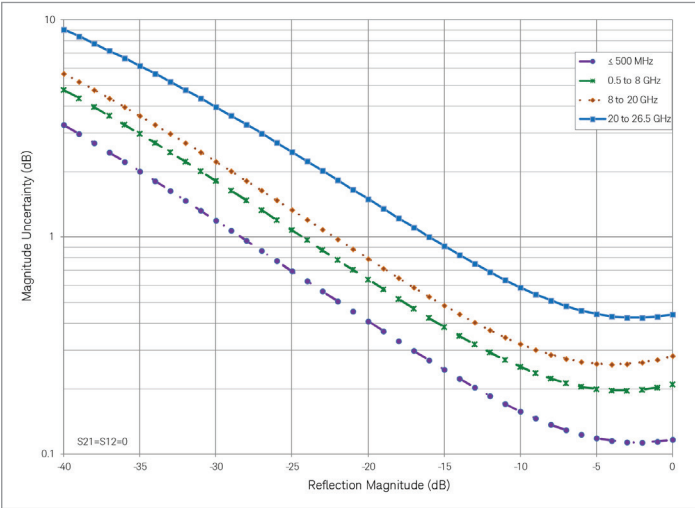
Power level of -15 dBm, 10 Hz IF bandwidth, no averaging, battery saver off, and 60-minute warm-up time. Includes uncertainties due to drift, noise, compression, and dynamic accuracy. Coverage factor of x1 applied to uncertainties, for ease of comparison with other industry handheld analyzers.

| Corrected performance (dB) | ≤ 0.5 GHz | 0.5 to 8 GHz | 8 to 20 GHz | 20 to 26.5 GHz |
|----------------------------|-----------|--------------|-------------|----------------|
| Directivity                | 42        | 38           | 36          | 30             |
| Source match               | 37        | 31           | 28          | 25             |
| Load match                 | 38        | 33           | 29          | 24             |
| Reflection tracking        | ± 0.005   | ± 0.006      | ± 0.009     | ± 0.012        |
| Transmission tracking      | ± 0.070   | ± 0.135      | ± 0.320     | ± 0.500        |

Transmission uncertainty (S21, S12)



Reflection uncertainty (S11, S22)



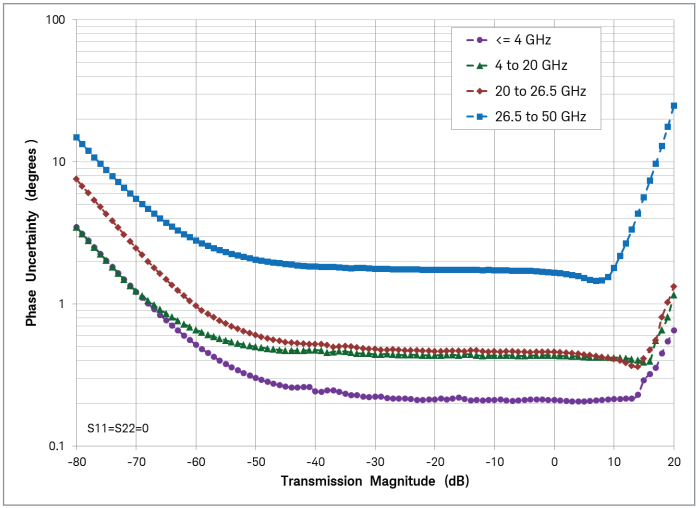
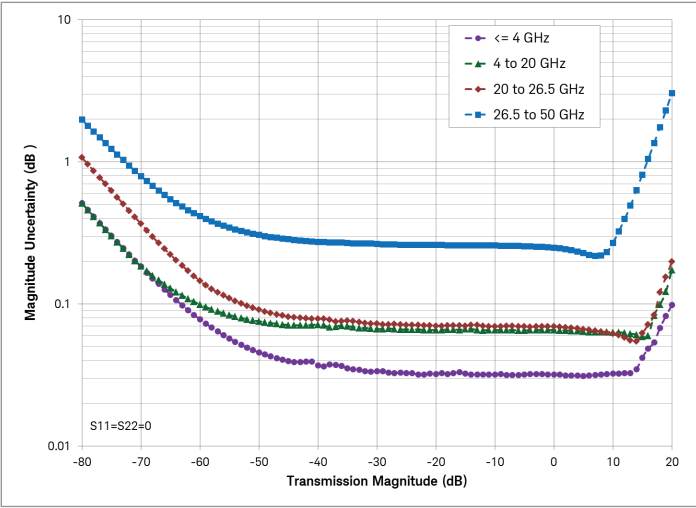
## Corrected Measurement Uncertainty for N9950A/51A/52A

### Full 2-port calibration, 85056D 2.4 mm calibration kit, spec<sup>1</sup>

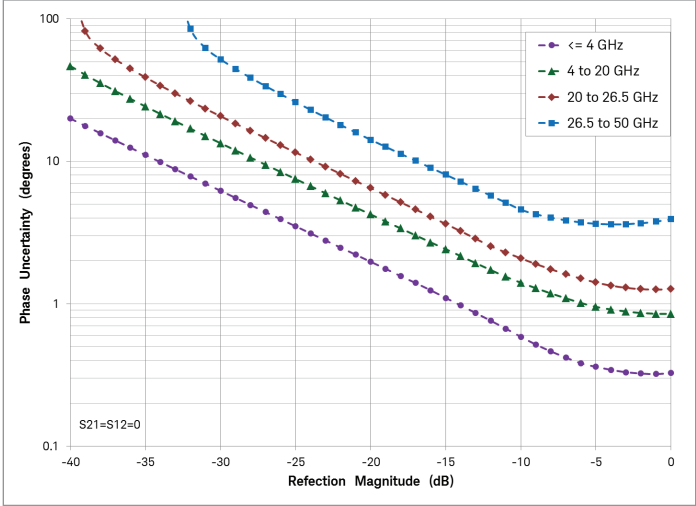
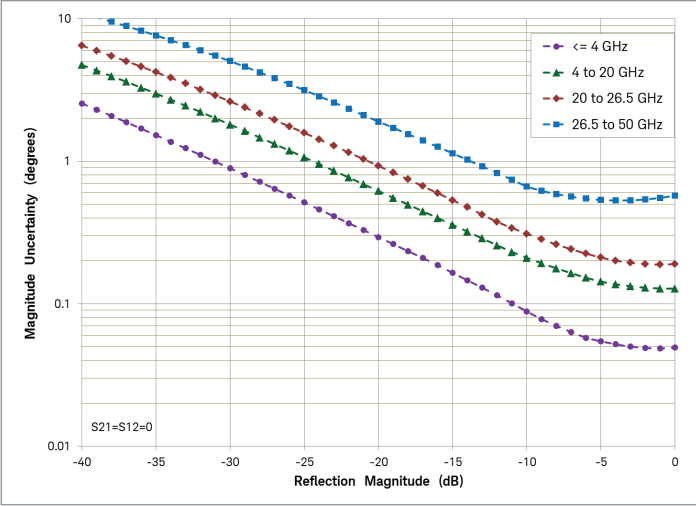
Power level of -15 dBm, 10 Hz IF bandwidth, no averaging, battery saver off, and 60-minute warm-up time. Includes uncertainties due to drift, noise, compression, and dynamic accuracy. Coverage factor of x1 applied to uncertainties, for ease of comparison with other industry handheld analyzers.

| Corrected performance (dB) | ≤ 2 GHz | 2 to 20 GHz | 20 to 40 GHz | 40 to 50 GHz |
|----------------------------|---------|-------------|--------------|--------------|
| Directivity                | 42      | 34          | 26           | 26           |
| Source match               | 39      | 30          | 23           | 23           |
| Load match                 | 42      | 34          | 26           | 26           |
| Reflection tracking        | ± 0.002 | ± 0.029     | ± 0.080      | ± 0.075      |
| Transmission tracking      | ± 0.003 | ± 0.034     | ± 0.109      | ± 0.105      |

### Transmission uncertainty (S21, S12)



### Reflection uncertainty (S11, S22)



1. Uncertainty curves shown are calculated based on ISO GUM methodology. The values in the table are provided for reference only, in accordance to legacy uncertainty methods.

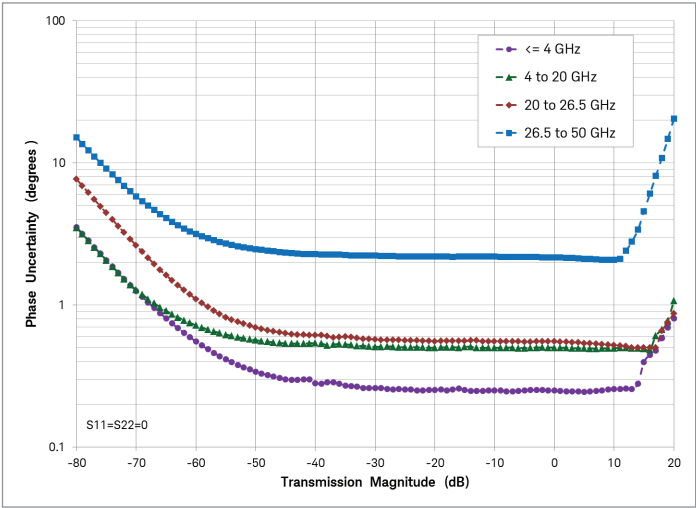
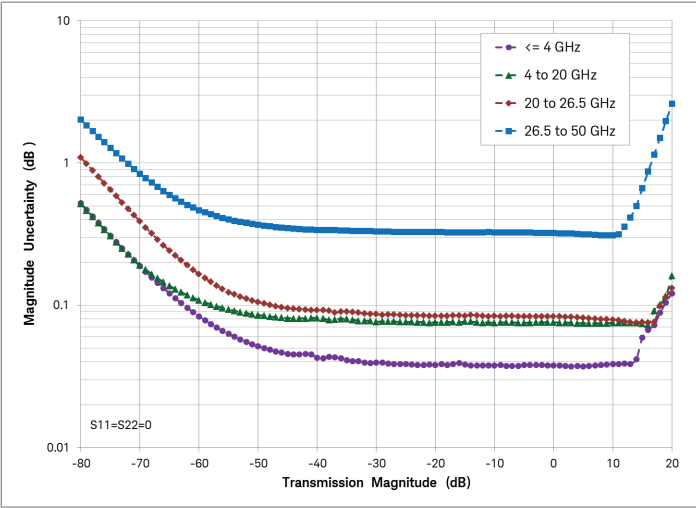
## Corrected Measurement Uncertainty for N9950A/51A/52A (continued)

### Full 2-port calibration, N4693A 2.4 mm ECal kit<sup>1</sup>

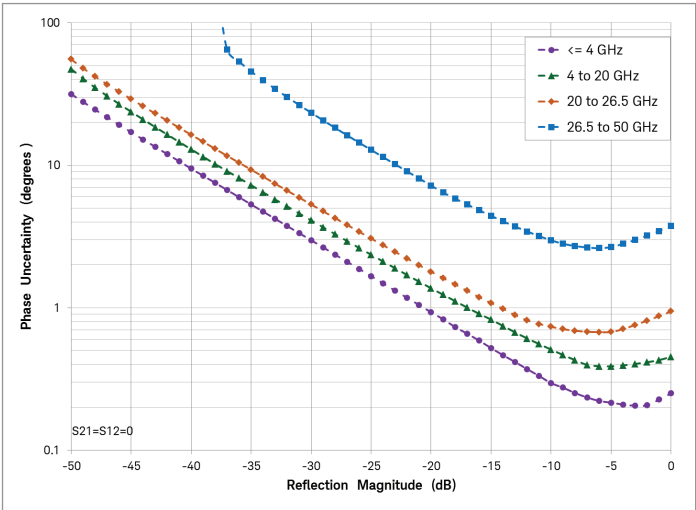
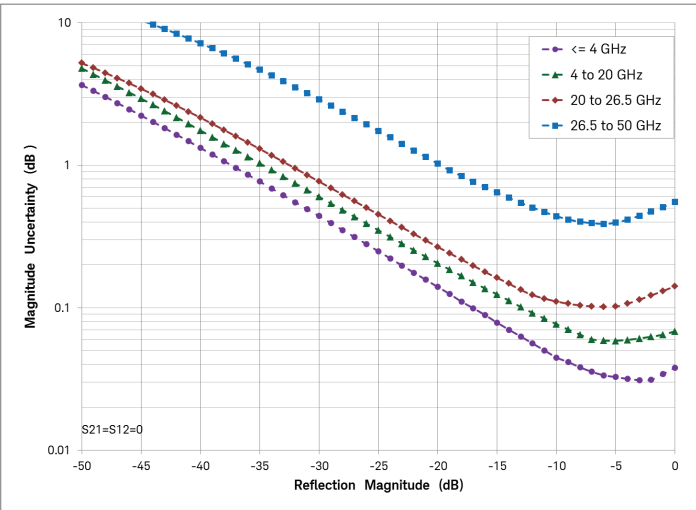
Power level of -15 dBm, 10 Hz IF bandwidth, no averaging, battery saver off, and 60-minute warm-up time. Includes uncertainties due to drift, noise, compression, and dynamic accuracy. Coverage factor of x1 applied to uncertainties, for ease of comparison with other industry handheld analyzers.

| Corrected performance (dB) | 10 to 50 MHz | 50 MHz to 2 GHz | 2 to 10 GHz | 10 to 20 GHz | 20 to 40 GHz | 40 to 50 GHz |
|----------------------------|--------------|-----------------|-------------|--------------|--------------|--------------|
| Directivity                | 32           | 42              | 49          | 45           | 41           | 36           |
| Source match               | 25           | 44              | 42          | 37           | 35           | 32           |
| Load match                 | 25           | 43              | 41          | 36           | 34           | 31           |
| Reflection tracking        | ± 0.050      | ± 0.030         | ± 0.040     | ± 0.050      | ± 0.060      | ± 0.080      |
| Transmission tracking      | ± 0.118      | ± 0.038         | ± 0.047     | ± 0.065      | ± 0.091      | ± 0.134      |

### Transmission uncertainty (S21, S12)



### Reflection uncertainty (S11, S22)



1. Uncertainty curves shown are calculated based on ISO GUM methodology. The values in the table are provided for reference only, in accordance to legacy uncertainty methods.

The performance listed in TDR cable measurements, VNA time domain, mixed-mode S-parameters and vector voltmeter sections applies to the capabilities available in the following models:

- FieldFox RF & microwave analyzers: N9913A, N9914A, N9915A, N9916A, N9917A, N9918A, N9950A, N9951A, N9952A
- FieldFox microwave vector network analyzers: N9925A, N9926A, N9927A, N9928A

See [FieldFox Configuration Guide](#) for option information. Many capabilities listed in this Data Sheet require options.

## TDR Cable Measurements

The TDR cable option adds time domain reflectometry (TDR) measurements to FieldFox's CAT mode. FieldFox's TDR measurements are based on an inverse Fourier transform of the frequency-domain data. TDR measurements are useful in not only identifying the location of faults along cables, but also the nature of the fault. Resistive, inductive and capacitive faults will each have a different response. These differences help engineers and technicians trouble-shoot line faults.

Measurements: TDR (linear rho) and TDR impedance (ohm)

Y-axis: linear (rho) or impedance (ohm)

X-axis: distance (meters or feet)

## VNA Time Domain

In time-domain mode, FieldFox computes the inverse Fourier transform of the frequency-domain data to display reflection or transmission coefficients versus time.

| Setup parameters                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Time                                                                                                                                                                                                                                                                              | Start, stop, center, span                                                                                                                                                                                                    |
| Gating                                                                                                                                                                                                                                                                            | Start, stop, center, span, and on/off                                                                                                                                                                                        |
| Numbers of points, velocity vector, line loss, window shape, independent control for all four traces                                                                                                                                                                              |                                                                                                                                                                                                                              |
| Time stimulus modes                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                              |
| Low-pass step                                                                                                                                                                                                                                                                     | Low-pass step is similar to a traditional time domain reflectometer (TDR) stimulus waveform. It is used to measure low-pass devices. The frequency-domain data should extend from DC (extrapolated value) to a higher value. |
| Low-pass impulse                                                                                                                                                                                                                                                                  | Low-pass impulse response is used to measure low-pass devices.                                                                                                                                                               |
| Bandpass impulse                                                                                                                                                                                                                                                                  | The bandpass impulse simulates a pulsed RF signal and is used to measure the time domain response of band-limited devices.                                                                                                   |
| Windows                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                              |
| The windowing function can be used to filter the frequency domain data and thereby reduce overshoot and ringing in the time domain response.                                                                                                                                      |                                                                                                                                                                                                                              |
| Windows                                                                                                                                                                                                                                                                           | Minimum, medium and maximum, manual entry of Kaiser Beta and impulse width.                                                                                                                                                  |
| Gating                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                              |
| The gating function can be used to selectively remove reflection or transmission time domain responses. In converting back to the frequency domain the effects of the responses outside the gate are removed. The results can be viewed with gating on and off, using two traces. |                                                                                                                                                                                                                              |
| Gate types                                                                                                                                                                                                                                                                        | Notch, bandpass                                                                                                                                                                                                              |
| Gate shapes                                                                                                                                                                                                                                                                       | Maximum, wide, normal, minimum                                                                                                                                                                                               |

## Mixed-Mode S-Parameters

Mixed-mode S-parameters are also known as balanced measurements.

| Measurements       |                                                  |
|--------------------|--------------------------------------------------|
| Sc <sub>c</sub> 11 | Common mode reflection                           |
| S <sub>d</sub> d11 | Differential mode reflection                     |
| Sc <sub>d</sub> 11 | Differential mode stimulus, common mode response |
| S <sub>d</sub> c11 | Common mode stimulus, differential mode response |

FieldFox's mixed-mode S-parameter measurements require the use of the default factory calibration or a user 2-port calibration. So the FieldFox analyzer must be equipped with 2-port measurement functionality to measure mixed-mode S-parameters. Mixed-mode S-parameters are an extension of the VNA capabilities.

## Vector Voltmeter (VVM)

With vector voltmeter mode, you can characterize the difference between two measurements easily. The zeroing function allows you to create a reference signal, and characterize the difference between two device measurements. The results are shown on a large display in digital format.

|                | Models         | Frequency range    |
|----------------|----------------|--------------------|
| N991xA, N992xA | N9913A         | 30 kHz to 4 GHz    |
|                | N9914A         | 30 kHz to 6.5 GHz  |
|                | N9915A, N9925A | 30 kHz to 9 GHz    |
|                | N9916A, N9926A | 30 kHz to 14 GHz   |
|                | N9917A, N9927A | 30 kHz to 18 GHz   |
|                | N9918A, N9928A | 30 kHz to 26.5 GHz |
| N995xA         | N9950A         | 300 kHz to 32 GHz  |
|                | N9951A         | 300 kHz to 44 GHz  |
|                | N9952A         | 300 kHz to 50 GHz  |

| Setup parameters                                                                                |                                                                                                                            |
|-------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 1-port cable trimming                                                                           | Reflection or S11 measurement, magnitude and phase                                                                         |
| 2-port transmission                                                                             | Transmission or S21 measurement, magnitude and phase                                                                       |
| A/B and B/A                                                                                     | Ratio of two receivers or channels, magnitude and phase – Need an external signal generator for the A/B or B/A measurement |
| Frequency (one CW frequency point), IF bandwidth - 10 Hz to 100 kHz, output power - Low or high |                                                                                                                            |

## Ratio accuracy (A/B and B/A)

Must zero, before measuring DUT. Recommend using a high-quality power splitter or 6 dB attenuators to minimize uncertainty due to mismatch.

|                        | Frequency                   | Nominal |
|------------------------|-----------------------------|---------|
| N991xA, N992xA, N995xA | 100 to 300 kHz <sup>1</sup> | ± 1.0   |
|                        | > 300 kHz to 1 MHz          | ± 0.4   |
|                        | > 1 to 100 MHz              | ± 0.2   |
|                        | > 100 to 300 MHz            | ± 0.4   |
|                        | > 300 MHz to 1.5 GHz        | ± 0.6   |
|                        | > 1.5 to 2 GHz              | ± 1.0   |

1. Does not apply to N995xA models, which start at 300 kHz.

## Spectrum Analyzer

The performance listed in this section applies to the spectrum analyzer capabilities available in the following models:

- FieldFox RF & microwave analyzers: N9913A, N9914A, N9915A, N9916A, N9917A, N9918A  
N9950A, N9951A, N9952A
- FieldFox microwave spectrum analyzers: N9935A, N9936A, N9937A, N9938A  
N9960A, N9961A, N9962A

See [FieldFox Configuration Guide](#) for option information. Many capabilities listed in this Data Sheet require options.

## Frequency and time specifications

|                | Models         | Frequency range     |                 |
|----------------|----------------|---------------------|-----------------|
| N991xA, N993xA | N9913A         | 100 kHz to 4 GHz    | Usable to 5 kHz |
|                | N9914A         | 100 kHz to 6.5 GHz  | Usable to 5 kHz |
|                | N9915A, N9935A | 100 kHz to 9 GHz    | Usable to 5 kHz |
|                | N9916A, N9936A | 100 kHz to 14 GHz   | Usable to 5 kHz |
|                | N9917A, N9937A | 100 kHz to 18 GHz   | Usable to 5 kHz |
|                | N9918A, N9938A | 100 kHz to 26.5 GHz | Usable to 5 kHz |
| N995xA, N996xA | N9950A, N9960A | 9 kHz to 32 GHz     | Usable to 5 kHz |
|                | N9951A, N9961A | 9 kHz to 44 GHz     | Usable to 5 kHz |
|                | N9952A, N9962A | 9 kHz to 50 GHz     | Usable to 5 kHz |

The spectrum analyzer is tunable to 0 Hz or DC.



## Spectrum Analyzer (continued)

### Frequency and time specifications (continued)

| Frequency reference, -10 to 55 °C                        |                                                                                                                                                    |                                                                                                                                                  |
|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Accuracy                                                 | ± 0.7 ppm (spec) + aging                                                                                                                           |                                                                                                                                                  |
|                                                          | ± 0.4 ppm (typical) + aging                                                                                                                        |                                                                                                                                                  |
| Accuracy, when locked to GPS                             | ± 0.010 ppm (spec)                                                                                                                                 |                                                                                                                                                  |
| Accuracy, when GPS antenna is disconnected               | ± 0.2 ppm (nominal) <sup>1</sup>                                                                                                                   |                                                                                                                                                  |
| Aging Rate                                               | ± 1 ppm/yr for 20 years (spec), will not exceed ± 3.5 ppm                                                                                          |                                                                                                                                                  |
| Frequency readout accuracy (start, stop, center, marker) |                                                                                                                                                    |                                                                                                                                                  |
|                                                          | ± (readout frequency x frequency reference accuracy + RBW centering + 0.5 x horizontal resolution                                                  | Horizontal resolution = frequency span / (trace points – 1) RBW centering:<br>– 5% x RBW, FFT mode (nominal)<br>– 16% x RBW, step mode (nominal) |
| Marker frequency counter                                 |                                                                                                                                                    |                                                                                                                                                  |
| Accuracy                                                 | ± (marker frequency x frequency reference accuracy + counter resolution)                                                                           |                                                                                                                                                  |
| Resolution                                               | 1 Hz                                                                                                                                               |                                                                                                                                                  |
| Frequency Span                                           | Spec                                                                                                                                               |                                                                                                                                                  |
| Range                                                    | 0 Hz (zero span), 10 Hz to maximum frequency range of instrument                                                                                   |                                                                                                                                                  |
| Resolution                                               | 1 Hz                                                                                                                                               |                                                                                                                                                  |
| Accuracy                                                 | ± (2 x RBW centering + horizontal resolution)                                                                                                      | ± (2 x RBW centering + horizontal resolution) for detector = Normal                                                                              |
| Sweep acquisition, span > 0 Hz                           | Spec                                                                                                                                               |                                                                                                                                                  |
| Range                                                    | 1 to 5000. Number of data acquisitions per measurement. Value is normalized to the minimum required to achieve amplitude accuracy with CW signals. |                                                                                                                                                  |
|                                                          | Auto coupled. For pulsed RF signals manually increase the sweep acquisition value to maximize the pulse spectrum envelope.                         |                                                                                                                                                  |
| Resolution                                               | 1                                                                                                                                                  |                                                                                                                                                  |
| Sweep time readout                                       | Measured value of the time required to complete a sweep from start to finish, including time to tune receiver, acquire data, and process trace.    |                                                                                                                                                  |
| Trace update                                             | N991xA, N993xA                                                                                                                                     | N995xA, N996xA                                                                                                                                   |
| Span = 20 MHz, RBW, VBW = 3 kHz                          | 6.7 updates per second <sup>2</sup>                                                                                                                | 8 updates per second                                                                                                                             |
| Span = 100 MHz, RBW, VBW autocoupled                     | 15.4 updates per second <sup>3</sup>                                                                                                               | 19 updates per second                                                                                                                            |
| Center frequency tune and transfer <sup>4</sup>          | N991xA, N993xA <sup>5</sup>                                                                                                                        | N995xA, N996xA                                                                                                                                   |
| 101 points, zero span                                    | 70 ms                                                                                                                                              | 69 ms                                                                                                                                            |
| 101 points, 1 MHz span                                   | 72 ms                                                                                                                                              | 72 ms                                                                                                                                            |

1. The maximum drift expected in the frequency reference applicable when the ambient temperature changes ± 5 °C from the temperature when the GPS signal was last connected.
2. 1.2 updates per second; applicable for FieldFox with serial number prefix < than MY5607/SG5607/US5607 and FieldFox not upgraded with Option N9910HU-100/200/300.
3. 4.1 updates per second; applicable for FieldFox with serial number prefix < than MY5607/SG5607/US5607 and FieldFox not upgraded with Option N9910HU-100/200/300.
4. Within full frequency range of instrument, not band dependent
5. Only for serial number prefix starting with MY5607/SG5607/US5607 and FieldFox upgraded with Option N9910HU-100/200/300/400.

## Spectrum Analyzer (continued)

### Frequency and time specifications (continued)

| Sweep time, zero span                  |                                                                                              | Nominal                                                                   |
|----------------------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Range                                  | N991xA, N993xA: 1 μs to 1000 s                                                               |                                                                           |
|                                        | N995xA, N996xA: 1 μs to 6000 s                                                               |                                                                           |
| Resolution                             | 100 ns                                                                                       |                                                                           |
| Readout                                | Entered value representing trace horizontal scale range                                      |                                                                           |
| Trigger (for zero span and FFT sweeps) |                                                                                              |                                                                           |
| Trigger type                           | Free run, external, video, RF burst                                                          |                                                                           |
| Trigger slope                          | Positive edge, negative edge                                                                 |                                                                           |
| Trigger delay                          | Range: -150 ms to 10 s                                                                       |                                                                           |
|                                        | Resolution: 100 ns                                                                           |                                                                           |
| Auto trigger                           | Forces a periodic acquisition in the absence of a trigger event                              |                                                                           |
|                                        | Range: 0 (off) to 10 s                                                                       |                                                                           |
| Trigger position (zero span)           | Controls horizontal position of the pulse edge; use sweep time to zoom into pulse edge       |                                                                           |
|                                        | Range: 0 to 10, integer steps; 0 is left edge of graticule, 10 is right edge of graticule    |                                                                           |
| RF burst trigger                       |                                                                                              | Nominal                                                                   |
| Dynamic range                          | 40 dB                                                                                        |                                                                           |
| Bandwidth                              | 20 MHz                                                                                       |                                                                           |
| Operating frequency range              | 20 MHz to maximum instrument frequency                                                       |                                                                           |
| Sweep (trace) point range              |                                                                                              |                                                                           |
| All spans                              | 101, 201, 401, 601, 801, 1001 (defaults to 401); arbitrary 2 to 10,001 settable through SCPI |                                                                           |
| Resolution bandwidth (RBW)             |                                                                                              |                                                                           |
| Range (-3 dB bandwidth)                |                                                                                              |                                                                           |
| Zero span                              | 10 Hz to 5 MHz                                                                               | 1, 3, 10 sequence                                                         |
| Non-zero span                          | 1 Hz to 5 MHz                                                                                | 1, 1.5, 2, 3, 5, 7.5, 10 sequence < 300 kHz, 300 kHz, 1 MHz, 3 MHz, 5 MHz |
|                                        |                                                                                              | Step keys change RBW in 1, 3, 10 sequence                                 |
| Selectivity (-60 dB / -3 dB)           | 4:1                                                                                          |                                                                           |
| Bandwidth accuracy                     |                                                                                              | Nominal                                                                   |
| Zero span                              | 10 Hz to 1 MHz                                                                               | ± 5%                                                                      |
|                                        | 3 MHz                                                                                        | ± 10%                                                                     |
|                                        | 5 MHz                                                                                        | ± 15%                                                                     |
| Non-zero span                          | 1 Hz to 100 kHz                                                                              | ± 1%                                                                      |
|                                        | 300 kHz to 1 MHz                                                                             | ± 5%                                                                      |
|                                        | 3 MHz                                                                                        | ± 10%                                                                     |
|                                        | 5 MHz                                                                                        | ± 15%                                                                     |
| Video bandwidth (VBW)                  |                                                                                              |                                                                           |
|                                        | 1 Hz to 5 MHz                                                                                | 1, 1.5, 2, 3, 5, 7.5, 10 sequence                                         |

## Spectrum Analyzer (continued)

### Amplitude accuracy and range specifications

| Amplitude range                                                                                                                                                                        |                                                               |                             |                     |                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|-----------------------------|---------------------|------------------------|
| Measurement range                                                                                                                                                                      | DANL to +20 dBm                                               |                             |                     |                        |
| Input attenuator range                                                                                                                                                                 | 0 to 30 dB, in 5 dB steps                                     |                             |                     |                        |
| Preamplifier                                                                                                                                                                           |                                                               | Nominal                     |                     |                        |
| Frequency range                                                                                                                                                                        | Full band (100 kHz to maximum frequency of instrument)        |                             |                     |                        |
| Gain                                                                                                                                                                                   | N991xA, N993xA                                                | +20 dB, 100 kHz to 26.5 GHz |                     |                        |
|                                                                                                                                                                                        | N995xA, N996xA                                                | +20 dB, 100 kHz to 7.5 GHz  |                     |                        |
|                                                                                                                                                                                        |                                                               | +15 dB, > 7.5 to 50 GHz     |                     |                        |
| Max safe input level                                                                                                                                                                   | Average CW power                                              | DC                          |                     |                        |
| N991xA, N993xA                                                                                                                                                                         | +27 dBm, 0.5 watts                                            | ± 50 VDC                    |                     |                        |
| N995xA, N996xA                                                                                                                                                                         | +25 dBm, 0.3 watts                                            | ± 40 VDC                    |                     |                        |
| Display range                                                                                                                                                                          |                                                               |                             |                     |                        |
| Log scale                                                                                                                                                                              | 10 divisions                                                  |                             |                     |                        |
|                                                                                                                                                                                        | 0.01 to 100 dB/division in 0.01 dB steps                      |                             |                     |                        |
| Linear scale                                                                                                                                                                           | 10 divisions                                                  |                             |                     |                        |
| Scale units                                                                                                                                                                            | dBm, dBmV, dBμV,dBmA, dBμA, W, V, A, dBμV/m, dBμA/m, dBG, dBT |                             |                     |                        |
| 50 MHz absolute amplitude accuracy (dB)                                                                                                                                                |                                                               |                             |                     |                        |
| 0 dB attenuation, input signal 0 to -35 dBm, peak detector, preamplifier off, 300 Hz RBW, all settings auto-coupled, -10 to 55 °C. No warm-up required.                                |                                                               |                             |                     |                        |
|                                                                                                                                                                                        | Spec (-10 to 55 °C)                                           | Typical (-10 to 55 °C)      |                     |                        |
| N991xA, N993xA                                                                                                                                                                         | ± 0.30                                                        | ± 0.10                      |                     |                        |
| 0 dB attenuation, input signal -5 to -35 dBm, peak detector, preamplifier off, 300 Hz RBW, all settings auto-coupled, -10 to 55 °C. No warm-up required.                               |                                                               |                             |                     |                        |
|                                                                                                                                                                                        | Spec (-10 to 55 °C)                                           | Typical (-10 to 55 °C)      |                     |                        |
| N995xA, N996xA                                                                                                                                                                         | ± 0.45                                                        | ± 0.20                      |                     |                        |
| Total absolute amplitude accuracy (dB)                                                                                                                                                 |                                                               |                             |                     |                        |
| 10 dB attenuation, input signal -15 to -5 dBm, peak detector, preamplifier off, 300 Hz RBW, all settings auto-coupled, includes frequency response uncertainties. No warm-up required. |                                                               |                             |                     |                        |
| N991xA, N993xA <sup>1</sup>                                                                                                                                                            | Spec (23 ± 5 °C)                                              | Spec (-10 to 55 °C)         | Typical (23 ± 5 °C) | Typical (-10 to 55 °C) |
| 100 kHz to 18 GHz                                                                                                                                                                      | ± 0.80                                                        | ± 1.00                      | ± 0.35              | ± 0.50                 |
| > 18 to 26.5 GHz                                                                                                                                                                       | ± 1.00                                                        | ± 1.20                      | ± 0.50              | ± 0.60                 |
| N995xA, N996xA <sup>2</sup>                                                                                                                                                            | Spec (23 ± 5 °C)                                              | Spec (-10 to 55 °C)         | Typical (23 ± 5 °C) | Typical (-10 to 55 °C) |
| 9 to 100 kHz                                                                                                                                                                           | ± 1.60                                                        | ± 2.50                      | ± 0.60              | ± 1.30                 |
| > 100 kHz to 2 MHz                                                                                                                                                                     | ± 1.30                                                        | ± 1.90                      | ± 0.60              | ± 0.80                 |
| > 2 to 15 MHz                                                                                                                                                                          | ± 1.00                                                        | ± 1.20                      | ± 0.30              | ± 0.50                 |
| > 15 MHz to 32 GHz                                                                                                                                                                     | ± 0.80                                                        | ± 1.00 <sup>3</sup>         | ± 0.30              | ± 0.50                 |
| > 32 to 40 GHz                                                                                                                                                                         | ± 0.90                                                        | ± 1.40                      | ± 0.50              | ± 0.70                 |
| > 40 to 43 GHz                                                                                                                                                                         | ± 1.30                                                        | ± 2.00                      | ± 0.50              | ± 0.70                 |
| > 43 to 50 GHz                                                                                                                                                                         | ± 1.40                                                        | ± 2.70                      | ± 0.50              | ± 0.90                 |

1. 9 to 100 kHz: 0.4 dB (nominal) preamp on or off; applicable only for serial number with prefix of MY5607/SG5607/US5607 and FieldFox upgraded with Option N9910HU-100/200/300/400.
2. Also applies for preamplifier on or off for these models, for measurement frequencies > 100 kHz.
3. Increase by 0.2 dB between 18 and 32 GHz.

## Spectrum Analyzer (continued)

### Amplitude accuracy and range specifications (continued)

| Resolution bandwidth switching uncertainty | Nominal                                                                            |
|--------------------------------------------|------------------------------------------------------------------------------------|
| RBW < 5 MHz                                | 0.0 dB                                                                             |
| For signals not at center frequency        | 0.7 dB peak-to-peak                                                                |
| RF input VSWR                              | Nominal                                                                            |
| N991xA, N993xA (10 dB attenuation)         | 10 MHz to 2.7 GHz                                                                  |
|                                            | > 2.7 to 7.5 GHz                                                                   |
|                                            | > 7.5 to 26.5 GHz                                                                  |
| N995xA, N996xA (0 dB attenuation)          | 10 to 100 MHz                                                                      |
|                                            | > 100 to 500 MHz                                                                   |
|                                            | > 500 MHz to 17 GHz                                                                |
|                                            | > 17 to 50 GHz                                                                     |
| Reference level                            |                                                                                    |
| Range                                      | -210 to +90 dBm                                                                    |
| Traces                                     |                                                                                    |
| Detectors                                  | Normal, positive peak, negative peak, sample, average (RMS)                        |
| States                                     | Clear/write, max hold, min hold, average, view, blank                              |
|                                            | Number of averages: 1 to 10,001                                                    |
| Number                                     | 4: all four can be active simultaneously and in different states                   |
| Markers                                    |                                                                                    |
| Number of markers                          | 6                                                                                  |
| Type                                       | Normal, delta, marker table                                                        |
| Marker functions                           | Noise, band power, frequency counter                                               |
| Audio beep                                 | Volume and tone change with signal strength                                        |
| Marker table                               | Display 6 markers                                                                  |
| Marker to →                                | Peak, next peak, peak left, peak right, center frequency, reference level, minimum |
|                                            | Tune frequency, for AM/FM tune and listen                                          |
| Marker properties                          | Peak criteria: peak excursion, peak threshold                                      |
|                                            | Delta reference fixed: Off or On                                                   |
|                                            | Time zero fixed: Off or On                                                         |

## Spectrum Analyzer (continued)

### Dynamic range specifications

#### Displayed average noise level (DANL) - (dBm)

Input terminated, RMS detection, log averaging, 0 dB input attenuation, reference level of -20 dBm, normalized to 1 Hz RBW

#### N991xA, N993xA<sup>1</sup>

| Preamp off                    | Spec (23 ± 5 °C) | Spec (-10 to 55 °C) | Typical (23 ± 5 °C) | Typical (-10 to 55 °C) |
|-------------------------------|------------------|---------------------|---------------------|------------------------|
| 2 MHz to 4.5 GHz <sup>2</sup> | -137             | -135                | -139                | -138                   |
| > 4.5 to 7 GHz                | -133             | -131                | -136                | -130                   |
| > 7 to 13 GHz                 | -129             | -127                | -132                | -130                   |
| > 13 to 17 GHz                | -124             | -122                | -126                | -125                   |
| > 17 to 22 GHz                | -119             | -117                | -122                | -121                   |
| > 22 to 25 GHz                | -114             | -111                | -117                | -114                   |
| > 25 to 26.5 GHz              | -110             | -108                | -112                | -111                   |
| Preamp on                     | Spec (23 ± 5 °C) | Spec (-10 to 55 °C) | Typical (23 ± 5 °C) | Typical (-10 to 55 °C) |
| 2 MHz to 4.5 GHz <sup>2</sup> | -153             | -151                | -155                | -154                   |
| > 4.5 to 7 GHz                | -149             | -147                | -151                | -150                   |
| > 7 to 13 GHz                 | -147             | -145                | -149                | -148                   |
| > 13 to 17 GHz                | -143             | -141                | -145                | -144                   |
| > 17 to 22 GHz                | -140             | -139                | -143                | -142                   |
| > 22 to 25 GHz                | -134             | -132                | -137                | -134                   |
| > 25 to 26.5 GHz              | -128             | -126                | -131                | -129                   |

#### N995xA, N996xA

| Preamp off         | Spec (23 ± 5 °C) | Spec (-10 to 55 °C) | Typical (23 ± 5 °C) | Typical (-10 to 55 °C) |
|--------------------|------------------|---------------------|---------------------|------------------------|
| 9 kHz to 2 MHz     | -91              | -91                 | -118                | -118                   |
| > 2 MHz to 2.1 GHz | -137             | -135                | -143                | -141                   |
| > 2.1 to 2.8 GHz   | -135             | -133                | -142                | -140                   |
| > 2.8 to 4.5 GHz   | -137             | -135                | -143                | -141                   |
| > 4.5 to 7 GHz     | -134             | -133                | -140                | -138                   |
| > 7 to 13 GHz      | -134             | -132                | -141                | -139                   |
| > 13 to 22 GHz     | -132             | -129                | -140                | -137                   |
| > 22 to 35 GHz     | -130             | -127                | -137                | -134                   |
| > 35 to 40 GHz     | -122             | -119                | -132                | -129                   |
| > 40 to 46 GHz     | -119             | -116                | -126                | -123                   |
| > 46 to 50 GHz     | -117             | -112                | -124                | -120                   |
| Preamp on          | Spec (23 ± 5 °C) | Spec (-10 to 55 °C) | Typical (23 ± 5 °C) | Typical (-10 to 55 °C) |
| 9 kHz to 2 MHz     | -94              | -94                 | -131                | -130                   |
| > 2 MHz to 2.1 GHz | -153             | -151                | -159                | -158                   |
| > 2.1 to 2.8 GHz   | -151             | -149                | -157                | -155                   |
| > 2.8 to 4.5 GHz   | -153             | -151                | -158                | -156                   |
| > 4.5 to 7 GHz     | -150             | -149                | -156                | -154                   |
| > 7 to 13 GHz      | -146             | -144                | -152                | -150                   |
| > 13 to 22 GHz     | -142             | -139                | -149                | -147                   |
| > 22 to 35 GHz     | -141             | -139                | -147                | -145                   |
| > 35 to 40 GHz     | -136             | -132                | -144                | -141                   |
| > 40 to 46 GHz     | -131             | -128                | -138                | -135                   |
| > 46 to 50 GHz     | -126             | -123                | -135                | -132                   |

1. 9 kHz to 2 MHz: -116 (nominal) preamp off, -120 (nominal) preamp on, applicable only for FieldFox with serial number prefixes of MY5607/SG5607/US5607 and FieldFox upgraded with Option N9910HU-100/200/300/400.

2. Add 4 dB between 2.1 and 2.8 GHz.

## Spectrum Analyzer (continued)

### Dynamic range specifications (continued)

| Residual responses (dBm)                                             |                | Nominal |                |
|----------------------------------------------------------------------|----------------|---------|----------------|
| Input terminated preamp off, 0 dB attenuation                        | N991xA, N993xA |         | N995xA, N996xA |
| 100 kHz to 13 GHz                                                    | -110           |         | -              |
| > 13 to 20 GHz                                                       | -90            |         | -              |
| > 20 to 26.5 GHz                                                     | -80            |         | -              |
| 100 kHz to 10 MHz                                                    | -              |         | -90            |
| > 10 MHz to 1 GHz                                                    | -              |         | -115           |
| > 1 to 30 GHz                                                        | -              |         | -120           |
| > 30 to 35 GHz                                                       | -              |         | -85            |
| > 35 to 50 GHz                                                       | -              |         | -110           |
| Input related responses (dBc)                                        |                | Nominal |                |
|                                                                      | N991xA, N993xA |         | N995xA, N996xA |
| -30 dBm signal at mixer input<br>(excludes frequencies listed below) | -80            |         | -80            |
| f = center frequency                                                 |                |         |                |
| < 2.6 GHz, f + 2 x 33.75 MHz                                         | -80            |         | -80            |
| < 2.6 GHz, f - 2 x 866.25 MHz                                        | -80            |         | -80            |
| < 2.6 GHz, f + 2 x 3.63375 MHz                                       | -85            |         | -90            |
| ≥ 2.6 to 7.5 GHz, f + 2 x 33.75 MHz                                  | -80            |         | -80            |
| ≥ 2.6 to 7.5 GHz, f + 2 x 866.25 MHz                                 | -80            |         | -80            |
| ≥ 2.6 to 7.5 GHz, f + 2 x 9.86625 GHz                                | -80            |         | -85            |
| ≥ 7.5 to 16.3 GHz, f + 2 x 3.63375 GHz                               | -65            |         | -65            |
| ≥ 16.3 to 26.5 GHz, f - 2 x 3.63375 GHz                              | -60            |         | -              |
| ≥ 7.5 to 26.5 GHz, f + 2 x 33.75 MHz                                 | -80            |         | -              |
| ≥ 7.5 to 26.5 GHz, f - 2 x 866.25 MHz                                | -80            |         | -              |
| ≥ 16.3 to 23 GHz, f - 2 x 3.63375 MHz                                | -              |         | -60            |
| ≥ 23 to 32.5 GHz, f + 2 x 3.63375 MHz                                | -              |         | -65            |
| ≥ 32.5 to 43 GHz, f - 2 x 3.63375 MHz                                | -              |         | -55            |
| ≥ 7.5 to 50 GHz, f - 2 x 866.25 MHz                                  | -              |         | -80            |
| ≥ 7.5 to 50 GHz, f + 2 x 33.75 MHz                                   | -              |         | -80            |
| Other spurious responses (dBc)                                       |                | Nominal |                |
|                                                                      | N991xA, N993xA |         | N995xA, N996xA |
| LO related spurs                                                     | -60            |         | -60            |
| Sideband                                                             | -80            |         | -80            |
| Second harmonic distortion (dBc)                                     |                | Nominal |                |
| -30 dBm signal at mixer input                                        | N991xA, N993xA |         | N995xA, N996xA |
| ≤ 1.3 GHz <sup>1</sup>                                               | -              |         | < -75          |
| > 1.3 GHz                                                            | -              |         | < -60          |
| ≤ 4 GHz <sup>1</sup>                                                 | < -60          |         | -              |
| > 4 GHz                                                              | < -80          |         | -              |

1. Applies for frequencies &gt; 15 MHz

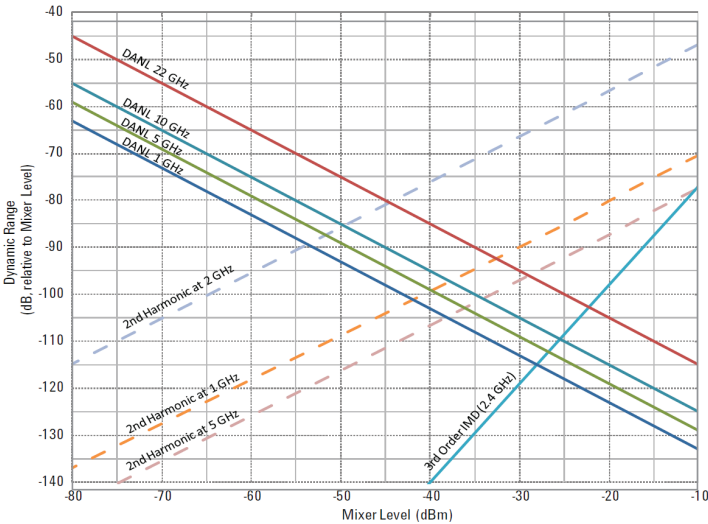
Spectrum Analyzer (continued)

Dynamic range specifications (continued)

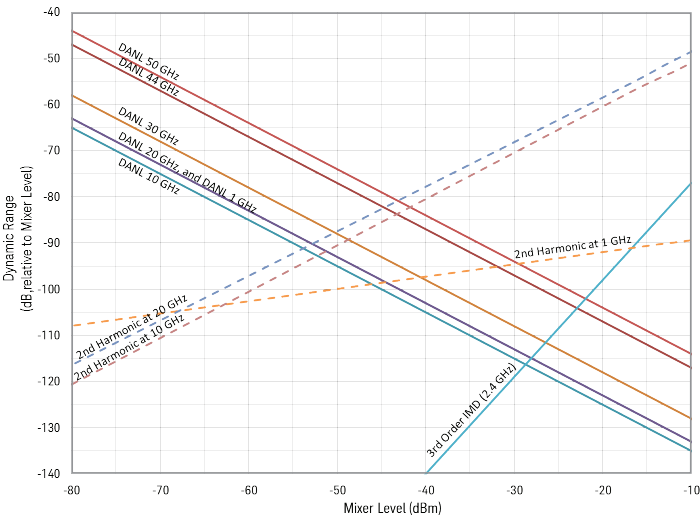
| Third order intermodulation distortion (TOI) - (dBm)                 | Spec            | Typical                 |
|----------------------------------------------------------------------|-----------------|-------------------------|
| Two -20 dBm signals, 100 kHz spacing at input mixer (-10 to 55 °C)   |                 |                         |
| N991xA, N993xA                                                       | At 2.4 GHz, +15 | < 1 GHz, +10            |
|                                                                      |                 | 1 to 7.5 GHz, +15       |
|                                                                      |                 | > 7.5 GHz, +21          |
| N995xA, N996xA                                                       | At 2.4 GHz, +15 | 50 to 500 MHz, +9.5     |
|                                                                      |                 | > 500 MHz to 1 GHz, +13 |
|                                                                      |                 | > 1 to 2.4 GHz, +16     |
|                                                                      |                 | > 2.4 to 2.6 GHz, +12   |
| Spur free dynamic range (dB) at 2.4 GHz 2/3 (TOI - DANL) in 1 Hz RBW | Nominal         |                         |
| N991xA, N993xA                                                       | > 105           |                         |
| N995xA, N996xA                                                       | > 104           |                         |

Nominal distortion and noise limited (10 Hz RBW) dynamic range

Applies to N991xA and N993xA



Applies to N995xA and N996xA

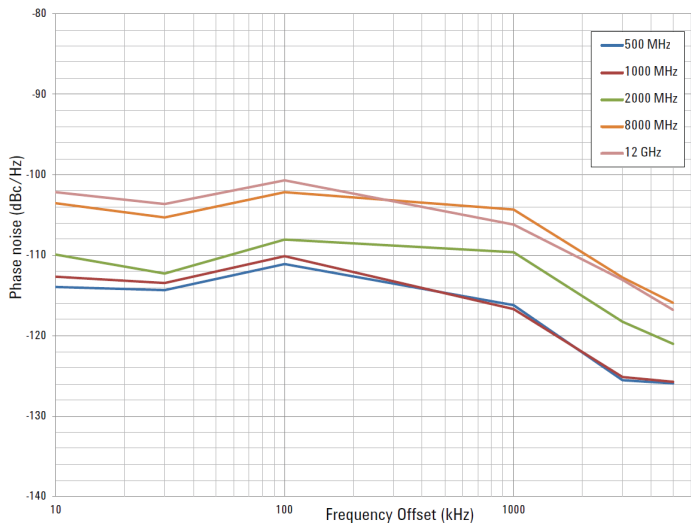


## Spectrum Analyzer (continued)

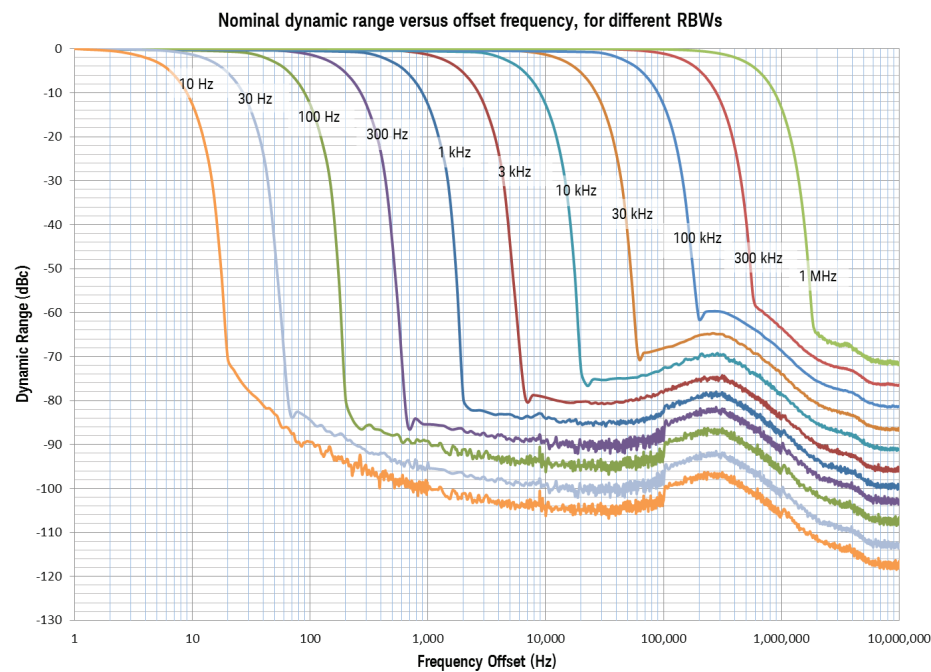
### Dynamic range specifications (continued)

| Phase noise (dBc/Hz) | Noise sidebands, CF = 1 GHz (N991xA, N993xA, N995xA, N996xA) |                  |                     |                     |
|----------------------|--------------------------------------------------------------|------------------|---------------------|---------------------|
|                      | Offset                                                       | Spec (23 ± 5 °C) | Spec (-10 to 55 °C) | Typical (23 ± 5 °C) |
|                      | 10 kHz                                                       | -106             | -106                | -111                |
|                      | 30 kHz                                                       | -106             | -104                | -108                |
|                      | 100 kHz                                                      | -100             | -99                 | -104                |
|                      | 1 MHz                                                        | -110             | -110                | -113                |
|                      | 3 MHz                                                        | -119             | -118                | -122                |
|                      | 5 MHz                                                        | -120             | -120                | -123                |

### Phase noise at different center frequencies (nominal)



### Dynamic range versus offset frequency versus RBW (nominal)





## Tracking Generator or Independent Source

The performance listed in this section applies to the tracking generator and independent source capabilities available in the following models:

- FieldFox RF & microwave analyzers: N9913A, N9914A, N9915A, N9916A, N9917A, N9918A  
N9950A, N9951A, N9952A
- FieldFox microwave spectrum analyzers: N9935A, N9936A, N9937A, N9938A  
N9960A, N9961A, N9962A

See [FieldFox Configuration Guide](#) for option information. Many capabilities listed in this Data Sheet require options.

Note: Traditional tracking generators track the receiver frequency only. In FieldFox analyzers, the tracking generator frequency can be set to either track the receiver frequency, or act as an independent CW source.

|                   | Models                                                       | Tracking generator or independent source frequency range |
|-------------------|--------------------------------------------------------------|----------------------------------------------------------|
| N991xA, N993xA    | N9913A                                                       | 30 kHz to 4 GHz                                          |
|                   | N9914A                                                       | 30 kHz to 6.5 GHz                                        |
|                   | N9915A, N9935A                                               | 30 kHz to 9 GHz                                          |
|                   | N9916A, N9936A                                               | 30 kHz to 14 GHz                                         |
|                   | N9917A, N9937A                                               | 30 kHz to 18 GHz                                         |
|                   | N9918A, N9938A                                               | 30 kHz to 26.5 GHz                                       |
| N995xA, N996xA    | N9950A, N9960A                                               | 300 kHz to 32 GHz                                        |
|                   | N9951A, N9961A                                               | 300 kHz to 44 GHz                                        |
|                   | N9952A, N9962A                                               | 300 kHz to 50 GHz                                        |
| Power step size   |                                                              |                                                          |
|                   | Power settable in 1 dB steps across power range              |                                                          |
| Functions         |                                                              |                                                          |
| Mode              | Continuous wave (CW), CW coupled, tracking (swept frequency) |                                                          |
| Operations        | Normalization, frequency offset, spectral reversal           |                                                          |
| RF output VSWR    | Nominal                                                      |                                                          |
| 10 MHz to 2.7 GHz | 1.7 : 1                                                      |                                                          |
| > 2.7 to 7.5 GHz  | 1.5 : 1                                                      |                                                          |
| > 7.5 GHz         | 2.2 : 1                                                      |                                                          |

## Tracking Generator or Independent Source (continued)

| Output power (dBm) | Frequency          | Typical                             | Nominal              |
|--------------------|--------------------|-------------------------------------|----------------------|
| N991xA, N993xA     | 30 to 300 kHz      | -11                                 | –                    |
|                    | > 300 kHz to 2 MHz | -3                                  | -2                   |
|                    | > 2 to 625 MHz     | -2                                  | -1                   |
|                    | > 625 MHz to 3 GHz | 1                                   | 3                    |
|                    | > 3 to 6.5 GHz     | -1                                  | 1                    |
|                    | > 6.5 to 9 GHz     | -2                                  | 0                    |
|                    | > 9 to 14 GHz      | -4                                  | -2.5                 |
|                    | > 14 to 18 GHz     | -6                                  | -4.5                 |
|                    | > 18 to 23 GHz     | -10                                 | -8.5                 |
|                    | > 23 to 26.5 GHz   | -12                                 | -11                  |
| N995xA, N996xA     | 300 to 500 kHz     | –                                   | -9                   |
|                    | > 500 kHz to 2 MHz | -1                                  | –                    |
|                    | > 2 MHz to 1 GHz   | 2                                   | –                    |
|                    | > 1 to 6.5 GHz     | 2                                   | –                    |
|                    | > 6.5 to 18 GHz    | 4                                   | –                    |
|                    | > 18 to 26.5 GHz   | 2                                   | –                    |
|                    | > 26.5 to 39 GHz   | 1                                   | –                    |
|                    | > 39 to 44 GHz     | -1                                  | –                    |
|                    | > 44 to 46 GHz     | -2                                  | –                    |
|                    | > 46 to 50 GHz     | -4                                  | –                    |
| Dynamic range (dB) | Frequency          | Preamp off<br>Typical, -10 to 55 °C | Preamp on<br>Nominal |
| N991xA, N993xA     | 2 MHz to 2 GHz     | 97                                  | 112                  |
|                    | > 2 to 7 GHz       | 93                                  | 108                  |
|                    | > 7 to 11 GHz      | 88                                  | 103                  |
|                    | > 11 to 16 GHz     | 79                                  | 95                   |
|                    | > 16 to 21 GHz     | 71                                  | 86                   |
|                    | > 21 to 23 GHz     | 55                                  | 70                   |
|                    | > 23 to 25 GHz     | 50                                  | 65                   |
|                    | > 25 to 26.5 GHz   | 45                                  | 60                   |
| N995xA, N996xA     | 500 kHz to 2 MHz   | 79                                  | 100                  |
|                    | > 2 MHz to 2.1 GHz | 101                                 | 115                  |
|                    | > 2.1 to 2.8 GHz   | 99                                  | 112                  |
|                    | > 2.8 to 4.5 GHz   | 101                                 | 115                  |
|                    | > 4.5 to 10 GHz    | 99                                  | 105                  |
|                    | > 10 to 18 GHz     | 88                                  | 95                   |
|                    | > 18 to 40 GHz     | 85                                  | 90                   |
|                    | > 40 to 43 GHz     | 65                                  | 80                   |
|                    | > 43 to 50 GHz     | 73                                  | 76                   |

The performance listed in these sections below applies to the spectrum analyzer capabilities available in the following models:

- FieldFox RF & microwave analyzers: N9913A, N9914A, N9915A, N9916A, N9917A, N9918A  
N9950A, N9951A, N9952A
- FieldFox microwave spectrum analyzers: N9935A, N9936A, N9937A, N9938A  
N9960A, N9961A, N9962A

See [FieldFox Configuration Guide](#) for option information. Many capabilities listed in this Data Sheet require options.

## Spectrum Analyzer IF Output

|                  | Description                                                                                                                                                                                                                                 |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Center Frequency | 33.75 MHz                                                                                                                                                                                                                                   |
| IF bandwidth     | 5 MHz (default), 25 MHz                                                                                                                                                                                                                     |
| Connector        | SMB male                                                                                                                                                                                                                                    |
| Conversion loss  | 0 to 27 dB nominal<br><br>The loss increases approximately linearly as frequency increases, with ~27 dB loss at 26.5 GHz. Conversion loss is defined from RF input to SA output with -10 dBm input power, 0 dB attenuation, and preamp off. |

## Preamplifier

|                 | Nominal                                                                                                                  |
|-----------------|--------------------------------------------------------------------------------------------------------------------------|
| Frequency range | Full band (100 kHz to maximum frequency of instrument)                                                                   |
| Gain            | N991xA, N993xA<br>+20 dB, 100 kHz to 26.5 GHz<br>N995xA, N996xA<br>+20 dB, 100 kHz to 7.5 GHz<br>+15 dB, > 7.5 to 50 GHz |

## Interference Analyzer and Spectrogram

|                              | Description                                                                                                                                                                                       |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Spectrogram display          | Overlay, full screen, top, or bottom with active trace                                                                                                                                            |
| Waterfall angle              | Moderate, steep, gradual, wide angle                                                                                                                                                              |
| Markers                      | Time, delta time                                                                                                                                                                                  |
| Trace playback and recording | Record all spectrum analyzer measurements<br>Store data internally or on USB or SD card<br>Playback recorded data using FieldFox<br>Frequency mask trigger allows recording to occur upon trigger |

## Channel Scanner

|                              | Description                                                                                                                                                                                        |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Scan Mode                    | Range or custom list                                                                                                                                                                               |
| Display Type                 | Bar chart vertical, bar chart horizontal, channel power, strip chart, chart overlay, scan & listen                                                                                                 |
| Data logging mode            | Time with geo tagging                                                                                                                                                                              |
| Trace playback and recording | Record channel power measurement<br>Store data internally or USB or SD card in .csv or .kml format<br>Playback recorded data using FieldFox<br>Data in .kml format can be exported to Google Earth |

The performance listed in this section applies to the AM/FM analog demodulation, tune and listen capabilities available in the following models:

- FieldFox RF & microwave analyzers: N9913A, N9914A, N9915A, N9916A, N9917A, N9918A  
N9950A, N9951A, N9952A
- FieldFox microwave spectrum analyzers: N9935A, N9936A, N9937A, N9938A  
N9960A, N9961A, N9962A

See [FieldFox Configuration Guide](#) for option information. Many capabilities listed in this Data Sheet require options.

## AM/FM Analog demodulation, Tune and Listen

|                              | Description                                                                                  |
|------------------------------|----------------------------------------------------------------------------------------------|
| Display type                 | RF spectrum view, demodulated waveform, including peak+ and peak- traces                     |
| Audio demodulation type      | AM, FM narrow, FM wide, Listen to the tones using FieldFox's built-in speaker or headphones  |
| Audio bandwidth              | 16 kHz                                                                                       |
| Measurement type             | RF carrier power (dBm), RF carrier frequency (Hz), modulation rate (Hz), SINAD (dB), THD (%) |
| <b>Receiver IF bandwidth</b> | <b>Nominal</b>                                                                               |
| AM                           | 35 kHz                                                                                       |
| FM narrow                    | 12 kHz                                                                                       |
| FM wide                      | 150 kHz                                                                                      |
| Listen time range            | 0 to 100 seconds                                                                             |
| <b>AM &amp; FM metrics</b>   | <b>Nominal</b>                                                                               |
| SINAD                        | 2.5 dB to 65 dB                                                                              |
| THD                          | 0 to 75%                                                                                     |
| <b>AM measurements</b>       | <b>Nominal</b>                                                                               |
| Maximum modulation rate      | 5 kHz, demod sweep time: 50 $\mu$ s to 50 ms                                                 |
| Depth                        | (peak-to-peak/2) (%), $\pm$ peak depth (%)                                                   |
| Depth accuracy               | $\pm 2\%$                                                                                    |
| Depth range                  | Modulation: 0.1 % to 99%                                                                     |
| <b>FM measurements</b>       | <b>Nominal</b>                                                                               |
| Maximum modulation rate      | 5 kHz, demod sweep time: 50 $\mu$ s to 50 ms                                                 |
| Frequency deviation          | (Hz), $\pm$ peak deviation (Hz)                                                              |
| Maximum deviation            | 30 kHz (typical)                                                                             |

## Radio standards

With a radio standard applied, pre-defined frequency bands, channel numbers or uplink / downlink selections can be used instead of manual frequency entry. The pre-defined FieldFox radio standards include bands such as W-CDMA, LTE, and GSM. Alternately, users can create custom standards and import them into FieldFox analyzers.

## Spectrum Analyzer Time Gating

With time gating, you can measure the spectrum of a periodic signal during a specified time interval. Pulsed-RF signals are an example of a periodic signal that can be measured with time gating. For example, you can measure the pulse during the on period, not the transition or the off period. Or you can exclude interfering signals such as a periodic transient. Time gating allows you to view spectral components that would otherwise be hidden. FieldFox's time gating method is a Gated FFT.

|                           | Description                               |
|---------------------------|-------------------------------------------|
| Gate method               | Gated FFT                                 |
| Span range                | Any span                                  |
| RBW range                 | 1 Hz to 300 kHz (derived from gate width) |
| Gate delay range          | -150 ms to 10 s                           |
| Gate width (length) range | 6 $\mu$ s to 1.8 s                        |
| Gate sources              | External, RF burst, Video                 |

## Reflection Measurements (RL, VSWR)

The performance listed in this section applies to the reflection measurements capabilities available in the following models:

- FieldFox microwave spectrum analyzers: N9935A, N9936A, N9937A, N9938A<sup>1</sup>  
N9960A, N9961A, N9962A

See [FieldFox Configuration Guide](#) for option information. Many capabilities listed in this Data Sheet require options.

|        | Models              | Reflection Measurements |
|--------|---------------------|-------------------------|
| N993xA | N9935A              | 30 kHz to 9 GHz         |
|        | N9936A              | 30 kHz to 14 GHz        |
|        | N9937A              | 30 kHz to 18 GHz        |
|        | N9938A <sup>1</sup> | 30 kHz to 26.5 GHz      |
| N996xA | N9960A              | 300 kHz to 32 GHz       |
|        | N9961A              | 300 kHz to 44 GHz       |
|        | N9962A              | 300 kHz to 50 GHz       |

### Measurements

Return loss, VSWR normalization using data/memory

1. Reflection measurements in N9938A specifically requires 3.5 mm (m) test ports instead of the standard Type-N (f).

## Extended Range Transmission Analysis (ERTA)

ERTA specifications apply to the following FieldFox models. The RF & microwave analyzers must be equipped with the spectrum analyzer option.

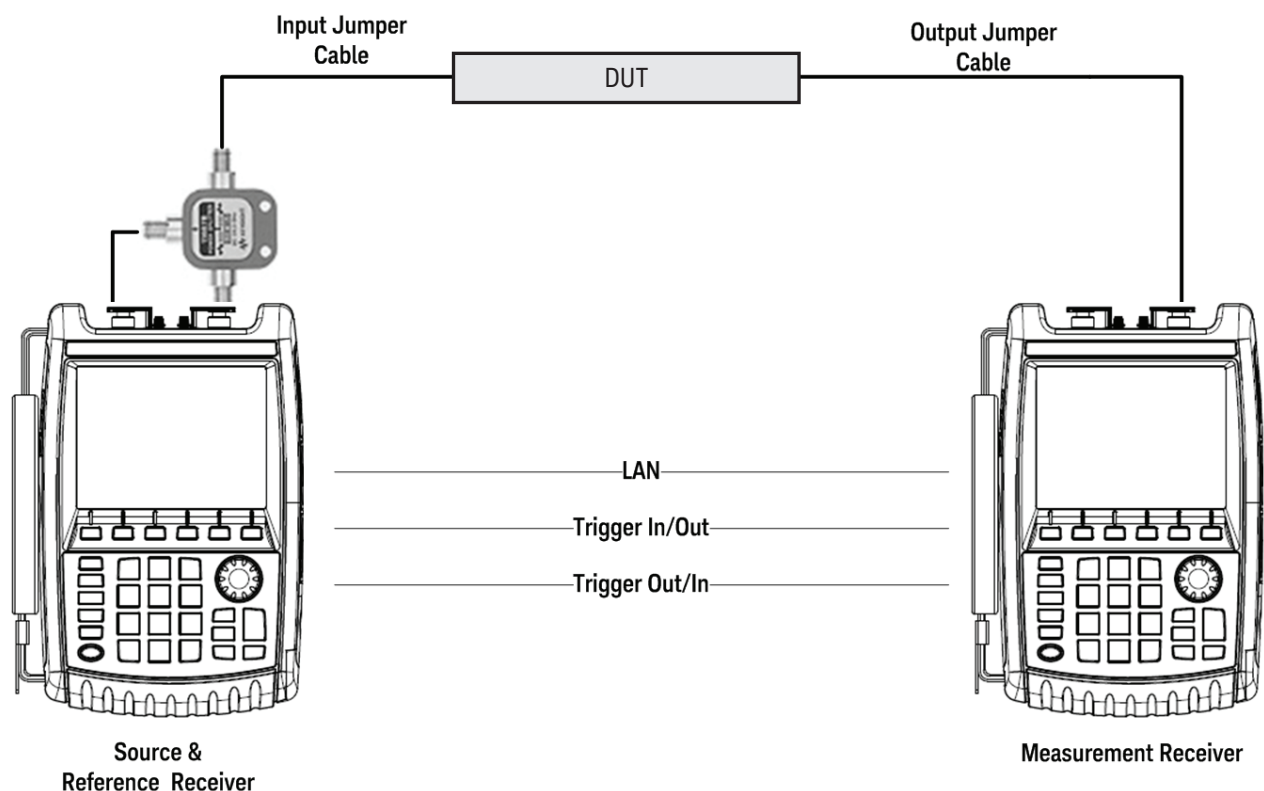
- FieldFox RF & microwave analyzers: N9913A, N9914A, N9915A, N9916A, N9917A, N9918A  
N9950A, N9951A, N9952A
- FieldFox microwave spectrum analyzers: N9935A, N9936A, N9937A, N9938A  
N9960A, N9961A, N9962A

ERTA operation requires two FieldFoxes, each one configured with specific options, and certain accessories. See FieldFox [Configuration Guide](#) for detailed option ordering information. Many capabilities listed in this Data Sheet require options.

### System description

ERTA can be used to measure the scalar transmission gain or loss of an RF system. It is useful when measuring long lossy cables where the two ends cannot easily be brought together, such as those bolted in on ships or aircrafts. It is also useful in measuring the insertion loss of waveguide systems, or using the frequency-offset feature, devices such as mixers and converters.

ERTA measurements are based on two FieldFoxes; one at each end of the measured DUT. One FieldFox is the source and reference receiver (R), while the other is the measurement receiver (B). The two FieldFoxes are synchronized using hardware triggering. By taking advantage of FieldFox's InstAlign technique, ERTA can be used to make accurate gain or loss measurements.



## Extended Range Transmission Analysis (ERTA) (continued)

### Frequency specifications

The ERTA frequency range is limited by each individual analyzer's frequency range.

|                | Models         | Reflection measurements | Receiver frequency range <sup>1</sup> |
|----------------|----------------|-------------------------|---------------------------------------|
| N991xA, N993xA | N9913A         | 30 kHz to 4 GHz         | 100 kHz to 4 GHz                      |
|                | N9914A         | 30 kHz to 6.5 GHz       | 100 kHz to 6.5 GHz                    |
|                | N9915A, N9935A | 30 kHz to 9 GHz         | 100 kHz to 9 GHz                      |
|                | N9916A, N9936A | 30 kHz to 14 GHz        | 100 kHz to 14 GHz                     |
|                | N9917A, N9937A | 30 kHz to 18 GHz        | 100 kHz to 18 GHz                     |
|                | N9918A, N9938A | 30 kHz to 26.5 GHz      | 100 kHz to 26.5 GHz                   |
| N995xA, N996xA | N9950A, N9960A | 300 kHz to 32 GHz       | 300 kHz to 32 GHz                     |
|                | N9951A, N9961A | 300 kHz to 44 GHz       | 300 kHz to 44 GHz                     |
|                | N9952A, N9962A | 300 kHz to 50 GHz       | 300 kHz to 50 GHz                     |

1. The receiver (spectrum analyzer) is usable to 5 kHz, though only specified to 100 kHz or 300 kHz.

#### Frequency reference

Refer to the frequency accuracy specifications on page 21.

#### Source output power

Refer to the test port output power typical data on page 5.

#### Frequency setup parameters

|                           |                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Receiver frequency        | Center/span or start/stop (standard spectrum analyzer settings)<br>Reverse receiver sweep direction (default direction is forward, but can be set to reverse)                                                                                                                                                                                                                                       |
| Source frequency [Remote] | [Tracking] – FieldFox source tracks the receiver by default. The frequencies are identical.<br>[CW] – FieldFox's source can be set to a CW frequency independent of FieldFox's receiver frequency. FieldFox's source is at a single CW frequency; FieldFox's receiver is swept.<br>[Coupled CW] – FieldFox's source CW frequency is auto-coupled to FieldFox's receiver [Center Frequency] setting. |

#### Frequency-offset capability

This feature allows the FieldFox's source frequency to be offset from FieldFox's receiver frequency. The offset frequency can be negative, zero, or positive. The frequency-offset capability is useful when characterizing the scalar transmission response of devices such as mixers and converters.

#### Frequency-offset setup parameters

|                           |                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Receiver frequency        | Center/span or start/stop (standard spectrum analyzer settings)<br>Reverse receiver sweep direction (default direction is forward, but can be set to reverse)                                                                                                                                                                                               |
| Frequency tracking offset | On/Off<br>Offset values: 0, > 0, < 0                                                                                                                                                                                                                                                                                                                        |
| Receiver sweep direction  | Reversal: Off<br>Default setting<br>Both source and receiver sweep in the forward direction. Receiver stop frequency > Receiver start frequency<br>Source frequency = Offset + Receiver frequency<br><br>Reversal: On<br>Source and receiver sweep in opposite directions.<br>Source frequency = Offset – Receiver frequency<br>Offset > receiver frequency |

## Extended Range Transmission Analysis (ERTA) (continued)

### Dynamic range and maximum attenuation

**Dynamic range** is the difference between the maximum output power available from FieldFox’s source and the noise floor of the second FieldFox, while ensuring that neither FieldFox’s ADC goes into over-range. Dynamic range also accounts for the loss of the power splitter. Dynamic range is applicable when testing devices such as filters, where there is low loss in the passband, and significant loss in the stopband, and both passband and stopband need to be on the display at the same time (same sweep).

**Maximum attenuation** is the difference between maximum output power available from FieldFox’s source and the noise floor of FieldFox. It also accounts for the loss of power splitter. Maximum attenuation is applicable when testing devices such as cables, which have relatively uniform loss over the swept frequency range.

The values shown are based on the recommended minimum RBW of 3 kHz when the frequency references are locked via GPS, and 300 kHz when the frequency references are unlocked. Locking the frequency references to GPS allows for greater frequency accuracy of the FieldFoxes and use of a narrower RBW, which in turn results in a lower DANL, and hence a wider measurement range. When the GPS signals cannot be present at all times, the GPS hold-over mode can be used.

| Dynamic range (dB)            |                                               | Typical                                       |                                            |                                            |
|-------------------------------|-----------------------------------------------|-----------------------------------------------|--------------------------------------------|--------------------------------------------|
| N991xA, N993xA                | Preamp off                                    | Preamp on                                     | Preamp off                                 | Preamp on                                  |
|                               | Frequency references locked to GPS, RBW 3 kHz | Frequency references locked to GPS, RBW 3 kHz | Frequency references unlocked, RBW 300 kHz | Frequency references unlocked, RBW 300 kHz |
| > 2 MHz <sup>1</sup> to 6 GHz | 88                                            | 83                                            | 68                                         | 63                                         |
| > 6 to 13 GHz                 | 86                                            | 83                                            | 66                                         | 63                                         |
| > 13 to 22 GHz                | 70                                            | 86                                            | 50                                         | 66                                         |
| > 22 to 25 GHz                | 63                                            | 83                                            | 43                                         | 63                                         |
| > 25 to 26.5 GHz              | 58                                            | 77                                            | 38                                         | 57                                         |
| Maximum attenuation (dB)      |                                               | Typical                                       |                                            |                                            |
| N991xA, N993xA                | Preamp off                                    | Preamp on                                     | Preamp off                                 | Preamp on                                  |
|                               | Frequency references locked to GPS, RBW 3 kHz | Frequency references locked to GPS, RBW 3 kHz | Frequency references unlocked, RBW 300 kHz | Frequency references unlocked, RBW 300 kHz |
| > 2 MHz to 6 GHz              | 93                                            | 108                                           | 73                                         | 88                                         |
| > 6 to 13 GHz                 | 86                                            | 103                                           | 66                                         | 83                                         |
| > 13 to 22 GHz                | 70                                            | 91                                            | 50                                         | 71                                         |
| > 22 to 25 GHz                | 63                                            | 83                                            | 43                                         | 63                                         |
| > 25 to 26.5 GHz              | 58                                            | 77                                            | 38                                         | 57                                         |

1. Dynamic range is decreased from 3 to 9 dB at 2 MHz.



## Extended Range Transmission Analysis (ERTA) (continued)

### Dynamic range and maximum attenuation (continued)

| Dynamic range (dB) |                                               | Typical                                       |                                            |                                            |
|--------------------|-----------------------------------------------|-----------------------------------------------|--------------------------------------------|--------------------------------------------|
| N995xA, N996xA     | Preamp off                                    | Preamp on                                     | Preamp off                                 | Preamp on                                  |
|                    | Frequency references locked to GPS, RBW 3 kHz | Frequency references locked to GPS, RBW 3 kHz | Frequency references unlocked, RBW 300 kHz | Frequency references unlocked, RBW 300 kHz |
| > 2 to 5 MHz       | 83                                            | 87                                            | 62                                         | 58                                         |
| > 5 MHz to 11 GHz  | 93                                            | 97                                            | 69                                         | 68                                         |
| > 11 to 19 GHz     | 95                                            | 96                                            | 71                                         | 70                                         |
| > 19 to 22 GHz     | 93                                            | 94                                            | 69                                         | 68                                         |
| > 22 to 40 GHz     | 88                                            | 90                                            | 63                                         | 65                                         |
| > 40 to 43 GHz     | 82                                            | 89                                            | 57                                         | 64                                         |
| > 43 to 46 GHz     | 81                                            | 93                                            | 56                                         | 68                                         |
| > 46 to 50 GHz     | 77                                            | 88                                            | 52                                         | 63                                         |

| Maximum attenuation (dB) |                                               | Typical                                       |                                            |                                            |
|--------------------------|-----------------------------------------------|-----------------------------------------------|--------------------------------------------|--------------------------------------------|
| N995xA, N996xA           | Preamp off                                    | Preamp on                                     | Preamp off                                 | Preamp on                                  |
|                          | Frequency references locked to GPS, RBW 3 kHz | Frequency references locked to GPS, RBW 3 kHz | Frequency references unlocked, RBW 300 kHz | Frequency references unlocked, RBW 300 kHz |
| > 2 MHz to 13 GHz        | 100                                           | 113                                           | 74                                         | 88                                         |
| > 13 to 18 GHz           | 101                                           | 110                                           | 76                                         | 85                                         |
| > 18 to 22 GHz           | 99                                            | 108                                           | 74                                         | 83                                         |
| > 22 to 35 GHz           | 95                                            | 105                                           | 70                                         | 80                                         |
| > 35 to 40 GHz           | 88                                            | 100                                           | 63                                         | 75                                         |
| > 40 to 46 GHz           | 81                                            | 93                                            | 56                                         | 63                                         |
| > 46 to 50 GHz           | 77                                            | 88                                            | 52                                         | 63                                         |

### Absolute power and gain measurement uncertainties

Verified with input level of -10 dBm, peak detector, 10 dB attenuation, preamplifier off, all settings auto-coupled, no warm-up required. Includes frequency response uncertainties. Assumes an ERTA system using a Keysight 11667A, 11667B, or 11667C power splitter.

| N991xA and N993xA                                                                              |                  |                     |                     |                        |
|------------------------------------------------------------------------------------------------|------------------|---------------------|---------------------|------------------------|
| Input power (R) measurements uncertainty, 30 kHz RBW (dB)                                      |                  |                     |                     |                        |
|                                                                                                | Spec (23 ± 5 °C) | Spec (-10 to 55 °C) | Typical (23 ± 5 °C) | Typical (-10 to 55 °C) |
| 100 kHz to 18 GHz                                                                              | ± 1.10           | ± 1.30              | ± 0.40              | ± 0.50                 |
| > 18 to 26.5 GHz                                                                               | ± 1.40           | ± 1.50              | ± 0.50              | ± 0.60                 |
| Output power (B) measurement uncertainty, frequency references locked to GPS, RBW ≥ 3 kHz (dB) |                  |                     |                     |                        |
|                                                                                                | Spec (23 ± 5 °C) | Spec (-10 to 55 °C) | Typical (23 ± 5 °C) | Typical (-10 to 55 °C) |
| 100 kHz to 18 GHz                                                                              | ± 1.00           | ± 1.20              | ± 0.40              | ± 0.50                 |
| > 18 to 26.5 GHz                                                                               | ± 1.20           | ± 1.40              | ± 0.50              | ± 0.60                 |
| Output power (B) measurement uncertainty, frequency references unlocked, RBW ≥ 300 kHz (dB)    |                  |                     |                     |                        |
|                                                                                                | Spec (23 ± 5 °C) | Spec (-10 to 55 °C) | Typical (23 ± 5 °C) | Typical (-10 to 55 °C) |
| 100 kHz to 18 GHz                                                                              | ± 1.00           | ± 1.30              | ± 0.40              | ± 0.50                 |
| > 18 to 26.5 GHz                                                                               | ± 1.40           | ± 1.60              | ± 0.50              | ± 0.60                 |
| Gain/Loss (B/R) measurement uncertainty, frequency references locked to GPS, RBW ≥ 3 kHz (dB)  |                  |                     |                     |                        |
|                                                                                                | Spec (23 ± 5 °C) | Spec (-10 to 55 °C) | Typical (23 ± 5 °C) | Typical (-10 to 55 °C) |
| 100 kHz to 18 GHz                                                                              | ± 1.30           | ± 1.70              | ± 0.60              | ± 0.70                 |
| > 18 to 26.5 GHz                                                                               | ± 1.70           | ± 2.10              | ± 0.70              | ± 0.90                 |
| Gain/Loss (B/R) measurement uncertainty, frequency references unlocked, RBW ≥ 300 kHz (dB)     |                  |                     |                     |                        |
|                                                                                                | Spec (23 ± 5 °C) | Spec (-10 to 55 °C) | Typical (23 ± 5 °C) | Typical (-10 to 55 °C) |
| 100 kHz to 18 GHz                                                                              | ± 1.40           | ± 1.70              | ± 0.70              | ± 0.70                 |
| > 18 to 26.5 GHz                                                                               | ± 2.00           | ± 2.10              | ± 0.90              | ± 1.00                 |

## Extended Range Transmission Analysis (ERTA) (continued)

### Absolute power and gain measurement uncertainties (continued)

| <b>N995xA and N996xA</b>                                                                              |                         |                            |                            |                               |
|-------------------------------------------------------------------------------------------------------|-------------------------|----------------------------|----------------------------|-------------------------------|
| <b>Input power (R) measurements uncertainty, 30 kHz RBW (dB)</b>                                      |                         |                            |                            |                               |
|                                                                                                       | <b>Spec (23 ± 5 °C)</b> | <b>Spec (-10 to 55 °C)</b> | <b>Typical (23 ± 5 °C)</b> | <b>Typical (-10 to 55 °C)</b> |
| 2 MHz to 18 GHz                                                                                       | ± 1.10                  | ± 1.30                     | ± 0.50                     | ± 0.60                        |
| > 18 to 32 GHz                                                                                        | ± 1.20                  | ± 1.50                     | ± 0.50                     | ± 0.70                        |
| > 32 to 40 GHz                                                                                        | ± 1.30                  | ± 1.80                     | ± 0.60                     | ± 0.80                        |
| > 40 to 43 GHz                                                                                        | ± 1.60                  | ± 2.30                     | ± 0.70                     | ± 1.10                        |
| > 43 to 50 GHz                                                                                        | ± 1.70                  | ± 3.20                     | ± 0.80                     | ± 1.40                        |
| <b>Output power (B) measurement uncertainty, frequency references locked to GPS, RBW ≥ 3 kHz (dB)</b> |                         |                            |                            |                               |
|                                                                                                       | <b>Spec (23 ± 5 °C)</b> | <b>Spec (-10 to 55 °C)</b> | <b>Typical (23 ± 5 °C)</b> | <b>Typical (-10 to 55 °C)</b> |
| 2 MHz to 18 GHz                                                                                       | ± 0.40                  | ± 1.00                     | ± 0.40                     | ± 0.50                        |
| > 18 to 32 GHz                                                                                        | ± 0.45                  | ± 1.30                     | ± 0.40                     | ± 0.60                        |
| > 32 to 40 GHz                                                                                        | ± 0.50                  | ± 1.50                     | ± 0.50                     | ± 0.70                        |
| > 40 to 43 GHz                                                                                        | ± 0.80                  | ± 2.30                     | ± 0.70                     | ± 1.00                        |
| > 43 to 50 GHz                                                                                        | ± 0.90                  | ± 3.00                     | ± 0.80                     | ± 1.40                        |
| <b>Output power (B) measurement uncertainty, frequency references unlocked, RBW ≥ 300 kHz (dB)</b>    |                         |                            |                            |                               |
|                                                                                                       | <b>Spec (23 ± 5 °C)</b> | <b>Spec (-10 to 55 °C)</b> | <b>Typical (23 ± 5 °C)</b> | <b>Typical (-10 to 55 °C)</b> |
| 2 MHz to 18 GHz                                                                                       | ± 1.00                  | ± 1.10                     | ± 0.40                     | ± 0.50                        |
| > 18 to 32 GHz                                                                                        | ± 1.20                  | ± 1.50                     | ± 0.50                     | ± 0.60                        |
| > 32 to 40 GHz                                                                                        | ± 1.60                  | ± 1.90                     | ± 0.60                     | ± 0.80                        |
| > 40 to 43 GHz                                                                                        | ± 2.10                  | ± 2.50                     | ± 0.70                     | ± 1.30                        |
| > 43 to 50 GHz                                                                                        | ± 2.60                  | ± 3.60                     | ± 1.00                     | ± 1.60                        |
| <b>Gain/Loss (B/R) measurement uncertainty, frequency references locked to GPS, RBW ≥ 3 kHz (dB)</b>  |                         |                            |                            |                               |
|                                                                                                       | <b>Spec (23 ± 5 °C)</b> | <b>Spec (-10 to 55 °C)</b> | <b>Typical (23 ± 5 °C)</b> | <b>Typical (-10 to 55 °C)</b> |
| 2 MHz to 18 GHz                                                                                       | ± 1.40                  | ± 1.70                     | ± 0.60                     | ± 0.70                        |
| > 18 to 32 GHz                                                                                        | ± 1.50                  | ± 2.00                     | ± 0.70                     | ± 0.90                        |
| > 32 to 40 GHz                                                                                        | ± 1.60                  | ± 2.30                     | ± 0.80                     | ± 1.00                        |
| > 40 to 43 GHz                                                                                        | ± 2.20                  | ± 3.10                     | ± 1.00                     | ± 1.40                        |
| > 43 to 50 GHz                                                                                        | ± 2.40                  | ± 4.00                     | ± 1.20                     | ± 1.90                        |
| <b>Gain/Loss (B/R) measurement uncertainty, frequency references unlocked, RBW ≥ 300 kHz (dB)</b>     |                         |                            |                            |                               |
|                                                                                                       | <b>Spec (23 ± 5 °C)</b> | <b>Spec (-10 to 55 °C)</b> | <b>Typical (23 ± 5 °C)</b> | <b>Typical (-10 to 55 °C)</b> |
| 2 MHz to 18 GHz                                                                                       | ± 1.40                  | ± 1.70                     | ± 0.70                     | ± 0.70                        |
| > 18 to 32 GHz                                                                                        | ± 1.80                  | ± 2.10                     | ± 0.80                     | ± 1.00                        |
| > 32 to 40 GHz                                                                                        | ± 2.10                  | ± 2.80                     | ± 1.00                     | ± 1.30                        |
| > 40 to 43 GHz                                                                                        | ± 2.70                  | ± 3.50                     | ± 1.40                     | ± 1.70                        |
| > 43 to 50 GHz                                                                                        | ± 3.00                  | ± 4.80                     | ± 1.60                     | ± 2.40                        |

### Cable correction

Input and output jumper cable losses can be accounted for using ERTA's cable correction wizard.

The performance listed in built-on power meter, external USB power sensor support, pulse measurements, USB power sensor measurements versus frequency sections applies to the capabilities available in the following models:

- FieldFox RF & microwave analyzers: N9913A, N9914A, N9915A, N9916A, N9917A, N9918A  
N9950A, N9951A, N9952A
- FieldFox microwave vector network analyzers: N9925A, N9926A, N9927A, N9928A
- FieldFox microwave spectrum analyzers: N9935A, N9936A, N9937A, N9938A  
N9960A, N9961A, N9962A

See [FieldFox Configuration Guide](#) for option information. Many capabilities listed in this Data Sheet require options.

## Built-in Power Meter

Using the built-in power meter, FieldFox is able to make very accurate channel power measurements. The channel bandwidth can be set wide to simulate average power meter measurements. This measurement function provides the flexibility to make user definable channel power measurements.

| Description             |                                                                                                        |
|-------------------------|--------------------------------------------------------------------------------------------------------|
| Setup parameters        | Center frequency, including selection of radio standards and channel selection, span or channel width  |
| Functions               | Relative/absolute measurements, offsets, units of dBm or watts, or dB or %, minimum and maximum limits |
|                         | <div>ModelsFrequency range</div>                                                                       |
| N991xA, N992xA, N993xA  | N9913A30 kHz to 4 GHzUsable to 5 kHz                                                                   |
|                         | N9914A30 kHz to 6.5 GHzUsable to 5 kHz                                                                 |
|                         | N9915A, N9925A,N9935A30 kHz to 9 GHzUsable to 5 kHz                                                    |
|                         | N9916A, N9926A, N9936A30 kHz to 14 GHzUsable to 5 kHz                                                  |
|                         | N9917A, N9927A, N9937A30 kHz to 18 GHzUsable to 5 kHz                                                  |
|                         | N9918A, N9928A, N9938A30 kHz to 26.5 GHzUsable to 5 kHz                                                |
| N995xA, N996xA          | N9950A, N9960A300 kHz to 32 GHzUsable to 5 kHz                                                         |
|                         | N9951A, N9961A300 kHz to 44 GHzUsable to 5 kHz                                                         |
|                         | N9952A, N9962A300 kHz to 50 GHzUsable to 5 kHz                                                         |
| Amplitude accuracy (dB) |                                                                                                        |
| N991xA, N992xA, N993xA  | <div>Spec (23 ± 5 °C)Spec (–10 to 55 °C)Typical (23 ± 5 °C)Typical (–10 to 55 °C)</div>                |
| 100 kHz to 18 GHz       | ± 0.80± 1.00± 0.35± 0.50                                                                               |
| > 18 to 26.5 GHz        | ± 1.00± 1.20± 0.50± 0.60                                                                               |
| N995xA, N996xA          | <div>Spec (23 ± 5 °C)Spec (-10 to 55 °C)Typical (23 ± 5 °C)Typical (-10 to 55 °C)</div>                |
| 9 to 100 kHz            | ± 1.60± 2.50± 0.60± 1.30                                                                               |
| > 100 kHz to 2 MHz      | ± 1.30± 1.90± 0.60± 0.80                                                                               |
| > 2 to 15 MHz           | ± 1.00± 1.20± 0.30± 0.50                                                                               |
| > 15 MHz to 32 GHz      | ± 0.80± 1.00 <sup>1</sup> ± 0.30± 0.50                                                                 |
| > 32 to 40 GHz          | ± 0.90± 1.40± 0.50± 0.70                                                                               |
| > 40 to 43 GHz          | ± 1.30± 2.00± 0.50± 0.70                                                                               |
| > 43 to 50 GHz          | ± 1.40± 2.70± 0.50± 0.90                                                                               |

1. Increase by 0.2 dB between 18 and 32 GHz.

## External USB Power Sensor Support

The external USB power sensor option supports various Keysight USB power sensors. For an up-to-date listing of the supported power sensors, visit <http://www.keysight.com/find/fieldfoxsupport>.

|                  | Description                                                                                                                           |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Setup parameters | Frequency                                                                                                                             |
| Functions        | Relative/absolute measurements, offsets, units of dBm or watts, or dB or %, minimum and maximum limits.                               |
| Internal source  | FieldFox's internal source can be turned on in the USB power sensor mode. CW frequency and nominal power level control are available. |

## Pulse Measurements

FieldFox's pulse measurement option can be used to characterize RF pulses such as those used in radar and electronic warfare systems. Measurements are made using FieldFox and Keysight's USB peak power sensors.

Performance specifications such as frequency, dynamic range and minimum pulse width depend on the peak power sensor. Supported peak power sensors: <http://www.keysight.com/find/fieldfoxsupport>

|                  | Description                                                                             |
|------------------|-----------------------------------------------------------------------------------------|
| Setup parameters | Frequency, time (center), time/division, gating, triggering, video bandwidth, averaging |
| Functions        | Average power, peak power, and peak to average ratio                                    |
|                  | Analog gauge display and digital display, dBm and watts                                 |
|                  | Relative/absolute measurements, offset, dB or %, minimum and maximum limits             |
|                  | Trace graph for pulse profiling with gating                                             |
|                  | Rise time, fall time, pulse width, pulse period, pulse repetition frequency             |

## USB Power Sensor Measurements versus Frequency

This feature allows FieldFox's source frequency to be set independently from the power sensor (receiver) frequency. With frequency-offset using power sensor (FOPS), the frequency of both the source and receiver are swept, and the two track each other. The offset frequency can be negative, zero, or positive.

FOPS can be used to characterize the scalar transmission response of devices such as mixers and converters. This frequency-offset capability is necessary for conversion loss/gain measurements on frequency-translating devices, since by definition, the input and output frequencies of the DUT are different. The FieldFox source stimulates the DUT and the power sensor is used as the measurement receiver.

Since power sensors are inherently broadband devices (not frequency-selective), the user should ensure that only the signal of interest is present at the power sensor input and that all other signals are filtered appropriately.

| Setup parameters                                                         |                                        |
|--------------------------------------------------------------------------|----------------------------------------|
| Source frequency                                                         | Center/span or start/stop              |
| Receiver frequency                                                       | Range determined by power sensor range |
| Frequency offset                                                         | Positive offset or negative offset     |
| Frequency step size                                                      | 30 kHz minimum                         |
| Number of points                                                         | 2 to 1601                              |
| Combination of number of points and frequency step size limited by span. |                                        |
| Dwell time/point                                                         | 0 to 1.0 sec                           |

## USB Power Sensor Measurements versus Frequency (continued)

Source frequency span must be equal to receiver frequency span.

Receiver sweep direction: forward (default setting) or reverse.

For some DUTs, the output frequency may sweep in a reverse direction, as compared to the source frequency. The basic relationships between the source, receiver and offset frequencies are shown in the table below. The FieldFox analyzer includes an offset calculator that ensures a fast measurement setup.

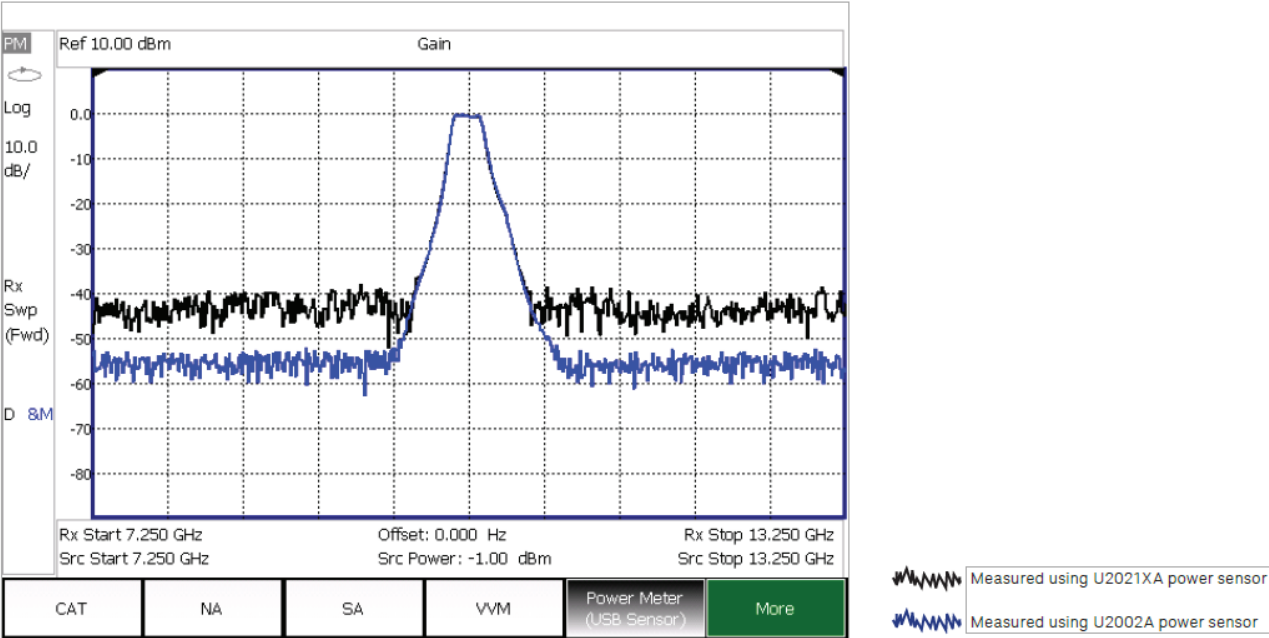
| Src sweep direction               | Rx sweep direction              | Frequency calculations                                                      |
|-----------------------------------|---------------------------------|-----------------------------------------------------------------------------|
| Forward $f_{2\_src} > f_{1\_src}$ | Forward $f_{2\_rx} > f_{1\_rx}$ | Receiver frequency = Source frequency $\pm$ Offset                          |
| Forward $f_{2\_src} > f_{1\_src}$ | Reverse $f_{2\_rx} > f_{1\_rx}$ | Receiver frequency = Offset – Source Frequency<br>Offset > Source frequency |

See [FieldFox Configuration Guide](#) for option information. Many capabilities listed in this Data Sheet require options.

|               | Description                                                                                                                                                                                                                                |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Measurements  | Source power, gain/loss and receiver (Rx) power<br>Gain = Rx power / source power (memory). Source power (memory) is measured during setup.                                                                                                |
| Output power  | Refer to the test port output power typical data on page 5.                                                                                                                                                                                |
| Dynamic range | The dynamic range with FOPS is dependent on FieldFox's output power and the power sensor's dynamic range.<br>Supported USB power sensors: <a href="http://www.keysight.com/find/fieldfoxsupport">www.keysight.com/find/fieldfoxsupport</a> |

The graph below shows a filter measurement using two different power sensors, the U2002A (–60 to +20 dBm) and the U2021XA (–45 to +20 dBm). While a filter is not commonly measured using FOPS, it is a useful device for demonstrating dynamic range.

For both measurements, the FieldFox source power was set to –1 dBm, the maximum available in the selected frequency range of 7.25 to 13.25 GHz. An external amplifier was not used in this case, but one can be added to increase the source power and hence dynamic range.



Example showing typical dynamic range of FOPS

## Built-In GPS Receiver

|                       | Description                                                                                                                                             |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| GPS receiver          | The internal GPS receiver can be used as a frequency reference. <sup>1</sup>                                                                            |
| Modes                 | Off, internal, external                                                                                                                                 |
| Sync clock            | On, off                                                                                                                                                 |
| Functionality         | Geo-location: latitude, longitude, altitude (elevation), time, sync time/data<br>Requires external GPS antenna (can use N9910X-825, GPS active antenna) |
| Connector for antenna | SMA (f), 3.3 V                                                                                                                                          |

1. External GPS USB receivers can be used to provide geo-location data. However, they cannot be used for frequency reference locking.

## DC Bias Variable-Voltage Source

|                               | Description                                                                                                                                          |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | Nominal                                                                                                                                              |
| Connector                     | SMB (m)                                                                                                                                              |
| Voltage                       | +1 to +32 V                                                                                                                                          |
| Resolution                    | 0.1 V                                                                                                                                                |
| Maximum current <sup>1</sup>  | 0.65 A                                                                                                                                               |
| DC current readout resolution | 0.01 A                                                                                                                                               |
| Maximum power <sup>1</sup>    | 7 watts                                                                                                                                              |
| Display read out              | Voltage, current                                                                                                                                     |
| Overload trip protection      | Automatically engages when voltage source is on.<br>The trip circuit can be reset from front panel without presetting or power cycling the analyzer. |

1. Battery life will be reduced when DC source is used. A trip function turns off the power supply when the rated current or power is exceeded.

## Remote Control Capability

Option 030 adds remote control capability to FieldFox analyzers, so that FieldFox can be controlled via an iOS device. The FieldFox app, running on the iOS device, combined with Option 030 on the FieldFox analyzer provides full control of the instrument from a remote location. The app emulates the front panel of FieldFox, so users can press the FieldFox hardkeys or softkeys using their iPhone or iPad, and make measurements remotely.

For example, a tower climber can be on the tower with a FieldFox analyzer, while the technician controls and makes the measurements down below, using an iPad. The iPad and FieldFox communicate via a network connection.

iOS device requirements

- iPad, iPhone, or iPod Touch
- iOS of 6.1 or higher
- A WiFi or 3G/4G connection

The FieldFox app communicates with FieldFox via a network connection, so both the iOS device and FieldFox need to be on a network where both devices can reach the other. For example, a company intranet or a site installation using a wireless router. FieldFox can directly be connected to a LAN cable, or if wired LAN is not available, a user supplied wireless router can be configured to work with FieldFox. FieldFox does not include a wireless router.

## Remote Control Capability (continued)

### FieldFox app without Option 030

The FieldFox app can be installed on an iOS device independent of the presence of Option 030 on the analyzer. Without Option 030, users can view the live display screen of their FieldFox remotely, but cannot control the instrument. With 030 purchased and installed on their FieldFox, users can both view and control their FieldFox. Control refers to the ability to press hardkeys, softkeys, make or change measurements, etc.

Option 030 does not include the iOS device itself. Users must supply their own iOS device. Option 030 is a license on the FieldFox analyzer.

Option 030 and the FieldFox app are not applicable to Android, BlackBerry, or Windows phone/tablet devices.

## General Information

| Calibration cycle           |                                                                                                                                                                             |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                             | 1 year                                                                                                                                                                      |
| Weight                      |                                                                                                                                                                             |
| N991xA, N992xA, N993xA      | 3.0 kg or 6.6 lb including battery                                                                                                                                          |
| N995xA, N996xA              | 3.2 kg or 7.1 lb including battery                                                                                                                                          |
| Dimensions: H x W x D       |                                                                                                                                                                             |
|                             | 292 x 188 x 72 mm (11.5 in x 7.4 in x 2.8 in)                                                                                                                               |
| Environmental               |                                                                                                                                                                             |
| MIL-PRF-28800F Class 2      | Operating temperature                                                                                                                                                       |
|                             | Storage temperature                                                                                                                                                         |
|                             | Operating humidity                                                                                                                                                          |
|                             | Random vibration                                                                                                                                                            |
|                             | Functional shock                                                                                                                                                            |
|                             | Bench drop                                                                                                                                                                  |
| Maximum humidity            | 95% RH at 40 °C for 5 days                                                                                                                                                  |
| Altitude – operating        | 9,144 m or 30,000 ft (using battery)                                                                                                                                        |
| Altitude – Non-operating    | 15,240 m or 50,000 ft                                                                                                                                                       |
| Altitude – AC to DC adapter | 3,000 m or 9,840 ft                                                                                                                                                         |
| Ingress protection          |                                                                                                                                                                             |
|                             | This product has been type tested to meet the requirements for ingress protection IP53 in accordance with IEC/EN 60529 (IP rating for instrument by itself, with no cover). |
| Temperature range           |                                                                                                                                                                             |
| Operating, AC power, spec   | –10 to 55 °C (14 to 131 °F)                                                                                                                                                 |
| Operating, battery, spec    | –10 to 50 °C (14 to 122 °F)                                                                                                                                                 |
| Operating, battery, typical | –10 to 55 °C (14 to 131 °F)                                                                                                                                                 |
| Storage, spec <sup>1</sup>  | –51 to 71 °C (–60 to 160 °F)                                                                                                                                                |

1. The battery packs should be stored in an environment with low humidity. Extended exposure to temperature above 45 °C could degrade battery performance and life.

## General Information (continued)

**EMC:** Complies with the essential requirements of the European EMC Directive as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity):

IEC/EN 61326-1

CISPR Pub 11 Group 1, class B

AS/NZS CISPR 11

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 the essential requirements of the European Low Voltage Directive as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity):

IEC/EN 61010-1

Canada: CSA C22.2 No. 61010-1

USA: UL std no. 61010-1

To find a current Declaration of Conformity for a specific Keysight product, go to: <http://www.keysight.com/go/conformity>

### Explosive environment

This product has been type tested to meet the requirements for operation in explosive environments in accordance with MIL-STD-810G, Method 511.5, Procedure I.

### Power supply

External DC input 15 to 19 VDC, 40 watts maximum when battery charging

External AC power adapter Efficiency level IV

Input 100 to 250 VAC, 50 to 60 Hz, 1.25 to 0.56 A

Output 15 VDC, 4 A

Power consumption 14 watts typical, mode dependent

### Battery

Lithium ion 10.8 V, 4.6 A-h

Operating time 3.5 hours (typical), mode dependent

Charge time A fully discharged battery takes about 1.5 hours to recharge to 80%. Four hours to 100%.

Discharge temperature limits -10 to 60 °C, ≤ 85% RH

Charge temperature limits 0 to 45 °C, ≤ 85% RH

Storage temperature limits -20 to 50 °C, ≤ 85% RH

The battery packs should be stored in an environment with low humidity. Extended exposure to temperature above 45 °C could degrade battery performance and life.

### Test port connectors

≤ 18 GHz models Type-N (f)

26.5 GHz models 3.5 mm (m) for FieldFox microwave analyzer, N9918A and FieldFox microwave VNA analyzer, N9928A. On FieldFox SA N9938A, you may choose 3.5 mm (m) or Type-N (f). Type-N (f) port connector is not available for the 26.5 GHz microwave analyzer, N9918A or 26.5 GHz microwave VNA analyzer, N9928A

≥ 32 GHz models NMD 2.4mm (m), torque .9 Nm or 8 in-lb, use torque wrench N9910X-886

### Display

6.5" transfective color VGA-LED backlit

### Headphone jack connector

3.5 mm (1/8 inch) miniature audio jack



## General Information (continued)

|                                                                                                                                                                     |                                                                                                                                                                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>USB-A, 2-ports</b>                                                                                                                                               |                                                                                                                                                                                          |
|                                                                                                                                                                     | Hi-speed USB 2.0                                                                                                                                                                         |
| <b>Mini USB, 1 port<sup>1</sup></b>                                                                                                                                 |                                                                                                                                                                                          |
|                                                                                                                                                                     | Hi-speed USB 2.0; used for SCPI programming; USBTMC (USB IEEE488)                                                                                                                        |
| <b>Keyboard</b>                                                                                                                                                     |                                                                                                                                                                                          |
|                                                                                                                                                                     | USB keyboards are supported (user must supply their own keyboard)                                                                                                                        |
| <b>LAN</b>                                                                                                                                                          |                                                                                                                                                                                          |
| Connector                                                                                                                                                           | RJ-45                                                                                                                                                                                    |
|                                                                                                                                                                     | Used for programming, data saving, remote control, and connection to DataLink software                                                                                                   |
| N991xA, N992xA, N993xA                                                                                                                                              | 100/10 base-T (auto switching)                                                                                                                                                           |
| N995xA, N996xA                                                                                                                                                      | 1000/100/10 base-T (auto switching)                                                                                                                                                      |
|                                                                                                                                                                     | SCPI over LAN using sockets and VX11 (LAN IEEE488); HTTP                                                                                                                                 |
| <b>Programming</b>                                                                                                                                                  |                                                                                                                                                                                          |
|                                                                                                                                                                     | SCPI, using the built-in LAN interface                                                                                                                                                   |
| <b>Languages</b>                                                                                                                                                    |                                                                                                                                                                                          |
|                                                                                                                                                                     | English, Spanish, German, Italian, French, Russian, Japanese, Chinese, Turkish, Korean, and Portuguese                                                                                   |
| <b>Preset</b>                                                                                                                                                       |                                                                                                                                                                                          |
|                                                                                                                                                                     | User preset for both mode preset and complete system preset                                                                                                                              |
| <b>Limit lines</b>                                                                                                                                                  |                                                                                                                                                                                          |
| The limit line capabilities listed in this section apply to the cable and antenna analyzer, network analyzer and spectrum analyzer modes in all FieldFox analyzers. |                                                                                                                                                                                          |
| Limit lines can be a combination of horizontal lines, sloping lines, or discrete data points                                                                        |                                                                                                                                                                                          |
| Limit types: Fixed or relative                                                                                                                                      |                                                                                                                                                                                          |
| Each trace can have its own limit line                                                                                                                              |                                                                                                                                                                                          |
| Limit lines can be built from a current trace                                                                                                                       |                                                                                                                                                                                          |
| Limit segments > 100, limited by memory size                                                                                                                        |                                                                                                                                                                                          |
| Max limit line number of points: 10,001                                                                                                                             |                                                                                                                                                                                          |
| Beep: Beep off, Beep on fail, Beep on pass                                                                                                                          |                                                                                                                                                                                          |
| Pass/fail warning: on/off                                                                                                                                           |                                                                                                                                                                                          |
| Offset and margin: An increase or decrease in the limit line                                                                                                        |                                                                                                                                                                                          |
| Save/recall limit lines                                                                                                                                             |                                                                                                                                                                                          |
| <b>Data storage</b>                                                                                                                                                 |                                                                                                                                                                                          |
| Internal                                                                                                                                                            | Internal Minimum: 4 GB                                                                                                                                                                   |
|                                                                                                                                                                     | Minimum states and traces: 1000                                                                                                                                                          |
| External                                                                                                                                                            | Supports USB 2.0 compatible memory devices and SD/SDHC memory cards                                                                                                                      |
| Data types                                                                                                                                                          | Trace, trace+state, picture (png), data (csv), S2P                                                                                                                                       |
| <b>Secure operation</b>                                                                                                                                             |                                                                                                                                                                                          |
| Frequency blanking                                                                                                                                                  | For protection of sensitive data all frequency information can be turned off.                                                                                                            |
| Erase user data                                                                                                                                                     | All user data can be erased on a FieldFox analyzer. For more information visit:<br><a href="http://www.keysight.com/find/securefieldfox">http://www.keysight.com/find/securefieldfox</a> |

1. SCPI over USB for the N991x/2x/3x models is only available for serial number prefix starting with MY5607/SG5607/US5607 or upgraded with Option N9910HU-100/200/300/400.

## General Information (continued)

| Reference out/trigger out |                                                                         |
|---------------------------|-------------------------------------------------------------------------|
| Connector                 | SMB (m), 50 $\Omega$                                                    |
| Output amplitude          | $\geq 0$ dBm                                                            |
| Frequency                 | 10 MHz (1 + frequency reference accuracy)                               |
| Trigger out               | Reserved for future use; currently only used for ERTA 2-box handshaking |
| Reference in/trigger in   |                                                                         |
| Connector                 | SMA (f), 50 $\Omega$                                                    |
| Reference input           | 10 MHz, $-5$ to $+10$ dBm                                               |
| Trigger input             | 3.3 or 5 V TTL logic levels                                             |

## Carry Precision With You

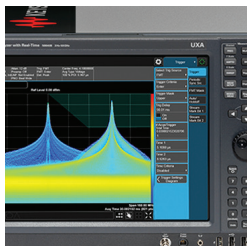
Every piece of gear in your field kit had to prove its worth. Measuring up and earning a spot is the driving idea behind Keysight’s FieldFox analyzers. They’re equipped to handle routine maintenance, in-depth troubleshooting and anything in between. Better yet, FieldFox delivers precise microwave measurements—wherever you need to go. Add FieldFox to your kit and carry precision with you.

| Related literature                                                     | Publication number |
|------------------------------------------------------------------------|--------------------|
| <i>FieldFox Handheld Analyzers</i> , Configuration Guide               | 5990-9836EN        |
| <i>FieldFox Handheld Analyzers</i> , Technical Overview                | 5992-0772EN        |
| <i>FieldFox N9923A RF Vector Network Analyzer</i> , Technical Overview | 5990-5087EN        |
| <i>FieldFox N9923A RF Vector Network Analyzer</i> , Data Sheet         | 5990-5363EN        |
| <i>FieldFox N9912A RF Analyzer</i> , Technical Overview                | 5989-8618EN        |
| <i>FieldFox N9912A RF Analyzer</i> , Data Sheet                        | N9912-90006        |

Download application notes, watch videos, and learn more: [www.keysight.com/find/fieldfox](http://www.keysight.com/find/fieldfox)

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| Switzerland    | 0800 805353   |
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|                | Opt. 3 (IT)   |
| United Kingdom | 0800 0260637  |

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