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

KEYSIGHT TECHNOLOGIES
Unlocking Measurement Insights

Table of Contents

Definitions . . . 3
Cable and Antenna Analyzer and Vector Network Analyzer . . . 4
Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A . . . 9
Corrected Measurement Uncertainty for N9950A/51A/52A . . . 16
TDR Cable Measurements . . . 18
VNA Time Domain . . . 18
Mixed-Mode S-Parameters . . . 19
Vector Voltmeter (VVM) . . . 19
Spectrum Analyzer . . . 20
Tracking Generator or Independent Source . . . 29
Real-Time Spectrum Analyzer (RTSA) . . . 31
Spectrum Analyzer IF Output . . . 32
Preamplifier . . . 32
Interference Analyzer and Spectrogram . . . 32
Channel Scanner . . . 32
AM/FM Analog demodulation, Tune and Listen . . . 33
Spectrum Analyzer Time Gating . . . 34
Reflection Measurements (RL, VSWR) . . . 34
Extended Range Transmission Analysis (ERTA) . . . 35
Built-in Power Meter . . . 40
External USB Power Sensor Support . . . 41
Pulse Measurements . . . 41
USB Power Sensor Measurements Versus Frequency . . . 41
Built-In GPS Receiver . . . 43
DC Bias Variable-Voltage Source . . . 43
Remote Control Capability . . . 43
General Information . . . 44

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 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 ± 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) [1]	
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 [2]		
	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	

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. 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 **N991xA, N992xA**	**Typical** **port 1 or port 2**	**Nominal** **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 **N991xA, N992xA**	**Typical** **port 1 or port 2**	**Nominal** **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 Manual power is flattened.
VNA	High, low, and manual. Default (preset) power is manual, –15 dBm. 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[1]	**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 ± 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[1,2] (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[3]	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[4]	100	110
	> 20 to 44 GHz[5]	90	100
	> 44 to 50 GHz[6]	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[7]		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[7]		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[8]		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 [1], 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 30 GHz	± 0.007	± 0.14
	> 30 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	

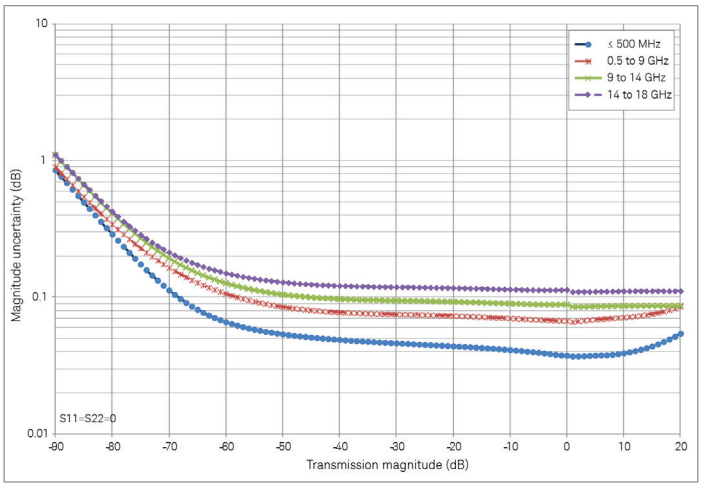
1. For CAT mode, increase trace noise by a factor of 5.7, as CAT mode IFBW is fixed at 10 kHz. Can use averaging in CAT mode to reduce trace noise or use VNA mode with 300 Hz IFBW.

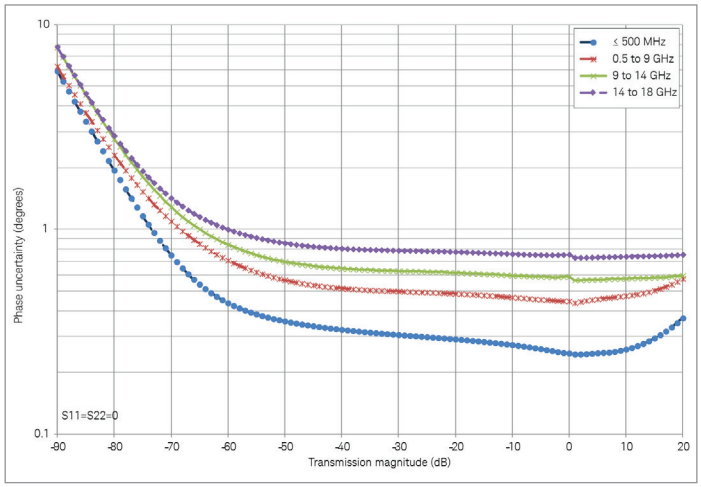
Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A

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

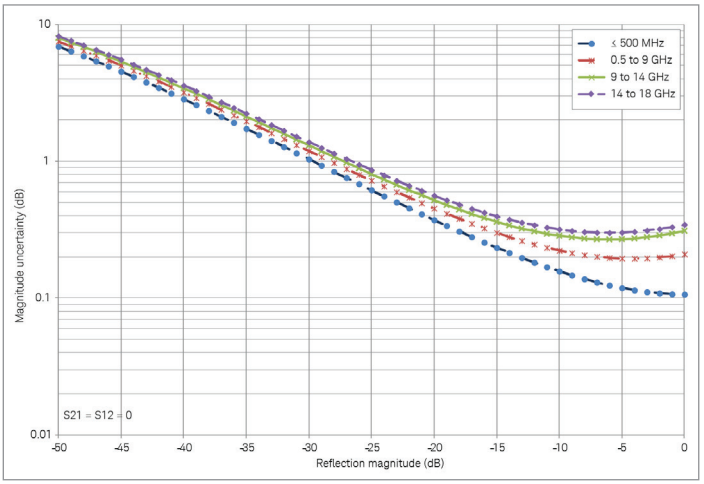
Power level of -15 dBm, 10 Hz IF bandwidth, no averaging, battery saver off, and 30-minute warm-up time. Includes uncertainties due to drift, noise, compression, and dynamic accuracy. Coverage factor of x1 applied to uncertainties, for ease of comparison with other industry handheld analyzers.

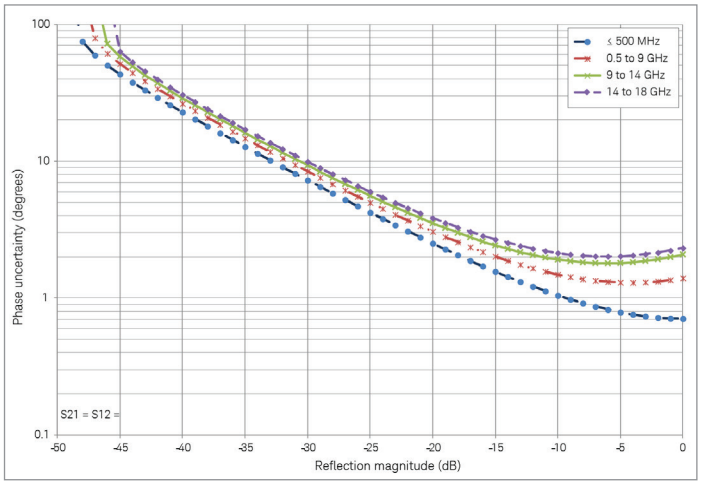
Transmission uncertainty (S21, S12)





Reflection uncertainty (S11, S22)





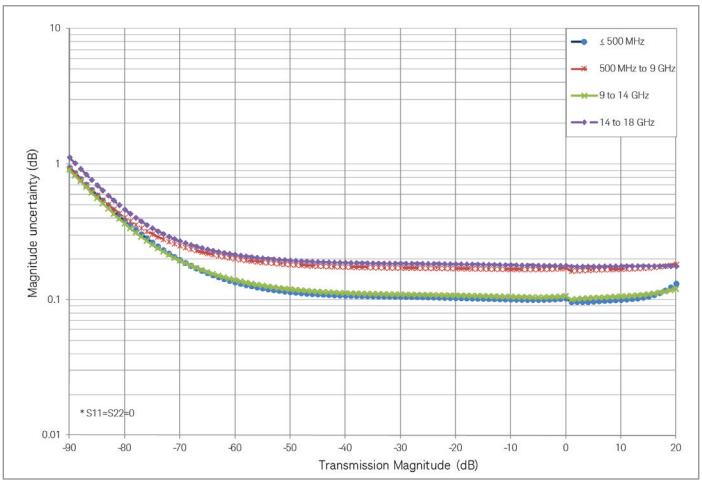
1. Uncertainties shown based on a factory calibration using data-based calibration kits.

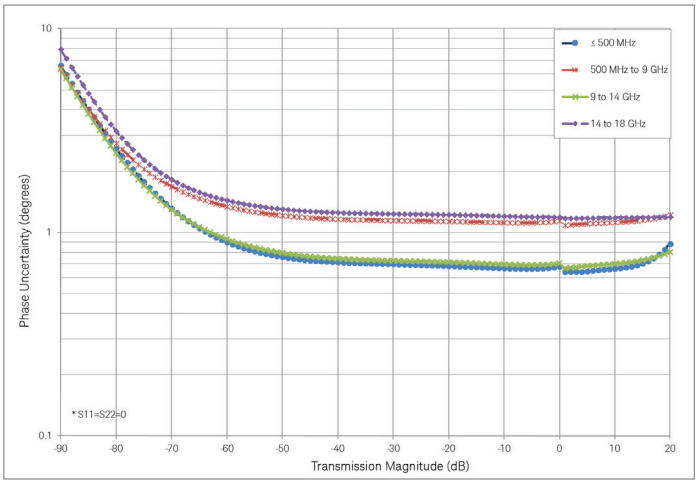
Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A (continued)

Full 2-port QuickCal calibration with load, Type-N (m) device [1]

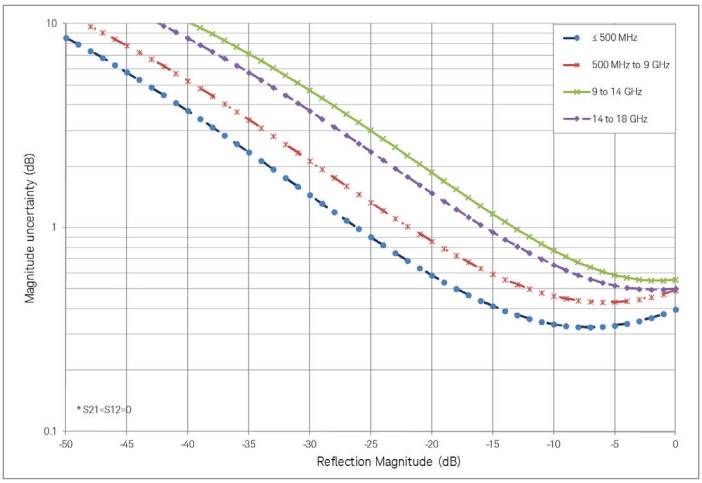
Power level of -15 dBm, 10 Hz IF bandwidth, no averaging, battery saver off, and 30-minute warm-up time. Includes uncertainties due to drift, noise, compression, and dynamic accuracy. Coverage factor of x1 applied to uncertainties, for ease of comparison with other industry handheld analyzers.

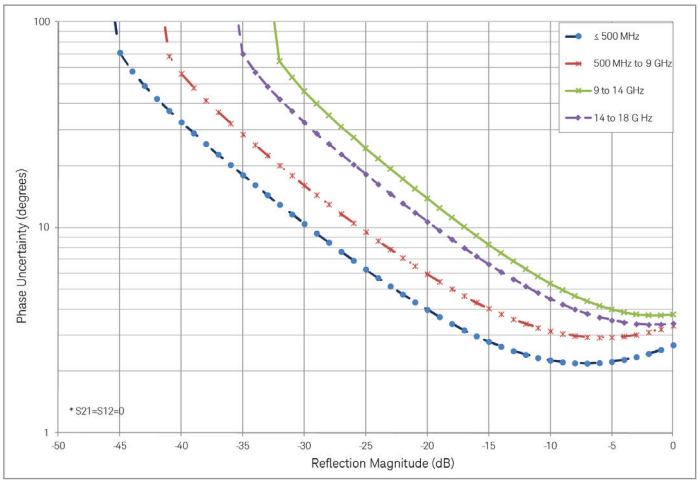
Transmission uncertainty (S21, S12)





Reflection uncertainty (S11, S22)





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

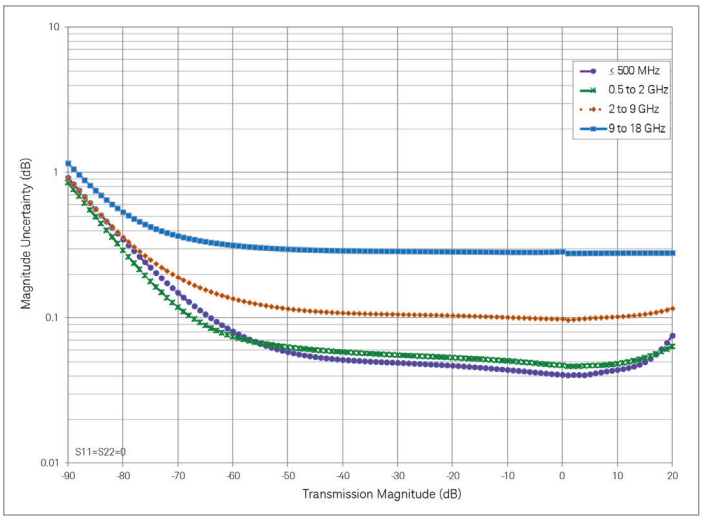
Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A (continued)

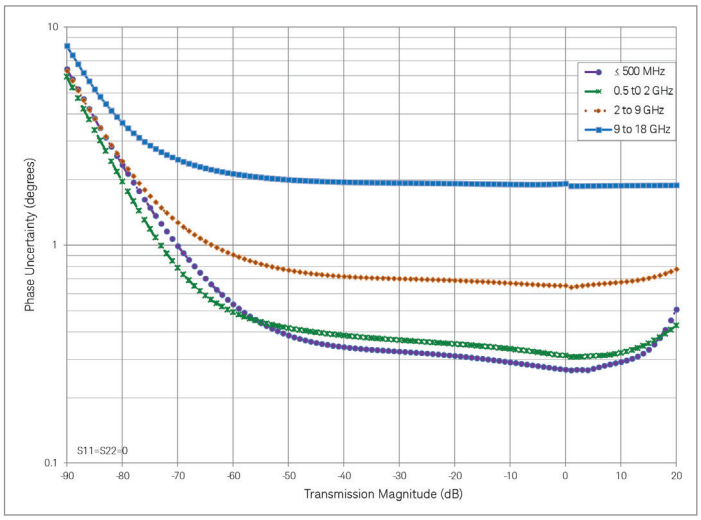
Full 2-port calibration, 85518A or 85519A Type-N (m) calibration kit, spec

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.

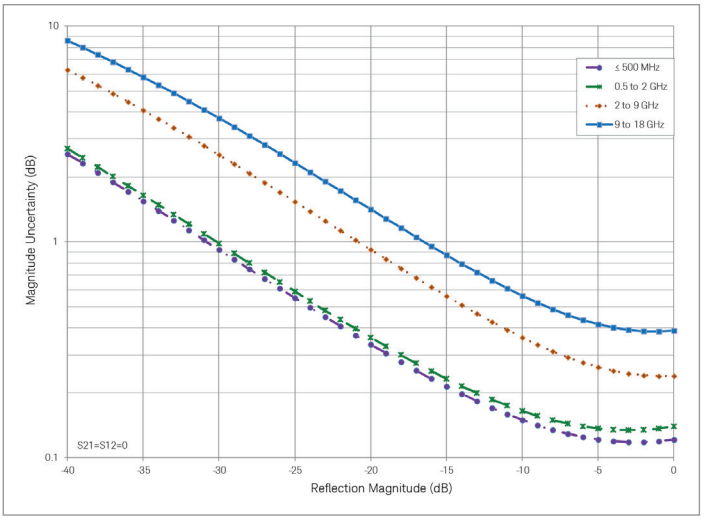
Corrected performance (dB)	≤ 0.5 GHz	0.5 to 2 GHz	2 to 9 GHz	9 to 18 GHz
Directivity	44	42	35	32
Source match	37	36	33	30
Load match	38	37	31	27
Reflection tracking	± 0.050	± 0.060	± 0.070	± 0.100
Transmission tracking	± 0.070	± 0.100	± 0.180	± 0.500

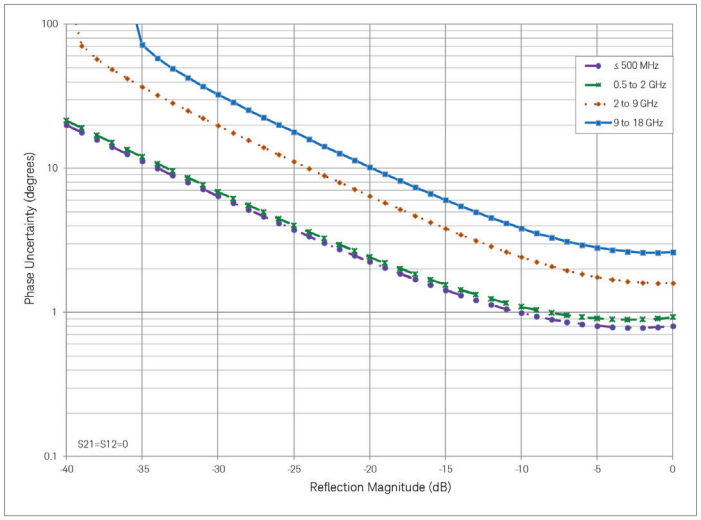
Transmission uncertainty (S21, S12)





Reflection uncertainty (S11, S22)





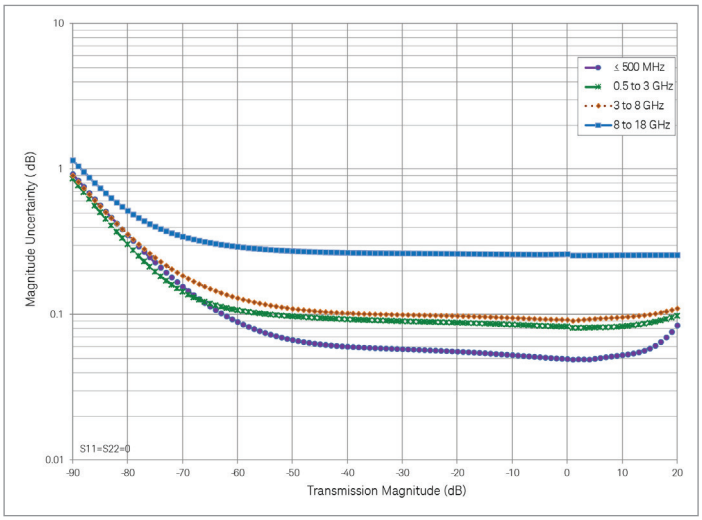
Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A (continued)

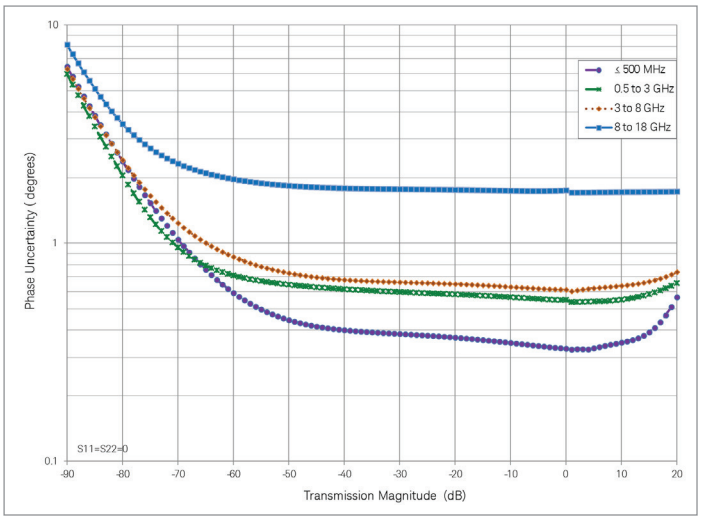
Full 2-port calibration, 85054D Type-N (m) calibration kit, spec

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.

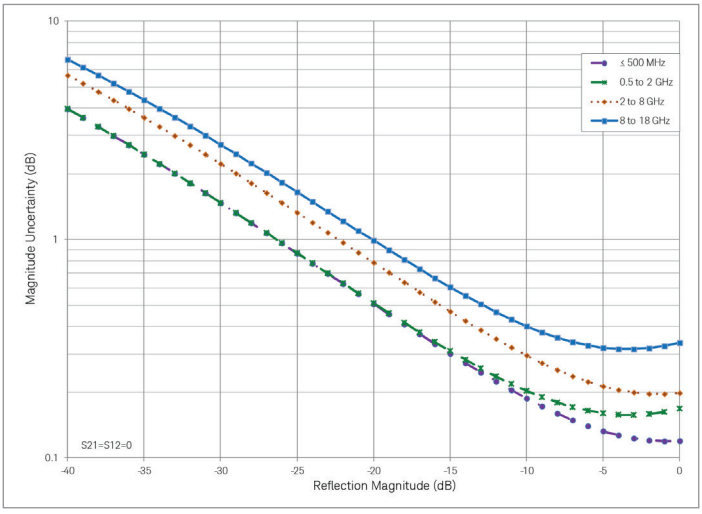
Corrected performance (dB)	≤ 0.5 GHz	0.5 to 2 GHz	2 to 8 GHz	8 to 18 GHz
Directivity	40	40	36	34
Source match	38	33	33	27
Load match	37	35	32	27
Reflection tracking	± 0.006	± 0.006	± 0.009	± 0.027
Transmission tracking	± 0.070	± 0.100	± 0.150	± 0.430

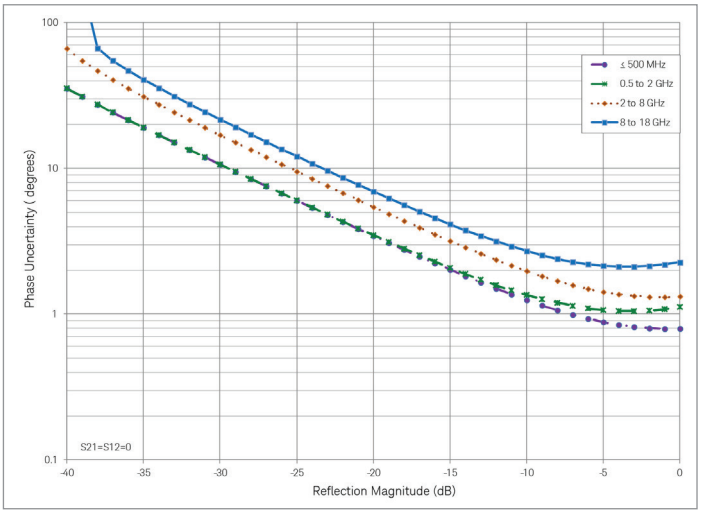
Transmission uncertainty (S21, S12)





Reflection uncertainty (S11, S22)



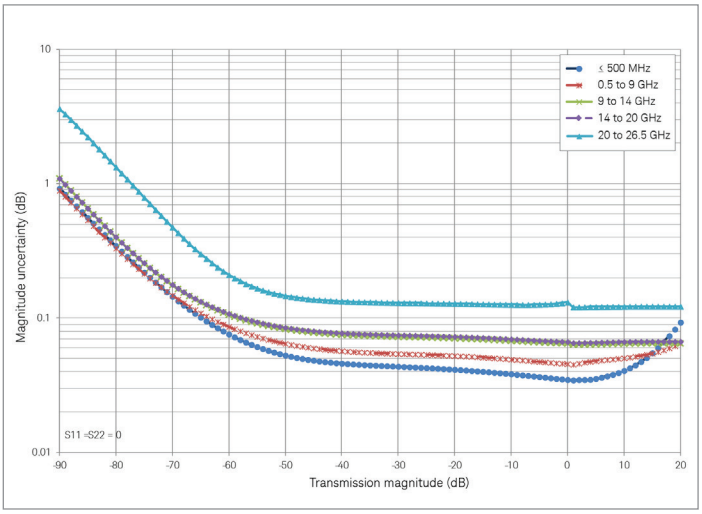


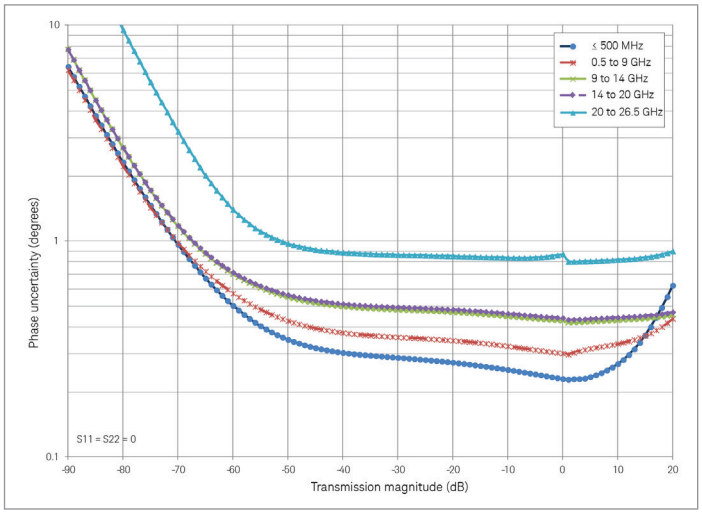
Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A (continued)

CalReady, 3.5 mm test ports; applies to N9918A, N9928A[1]

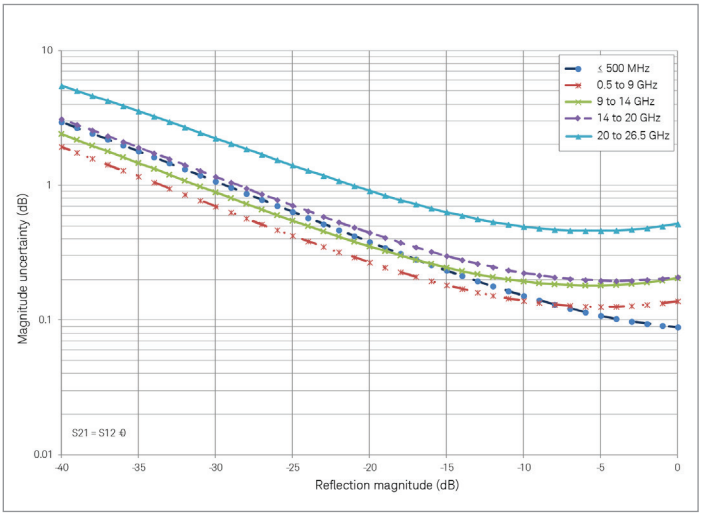
Power level of -15 dBm, 10 Hz IF bandwidth, no averaging, battery saver off, and 30-minute warm-up time. Includes uncertainties due to drift, noise, compression, and dynamic accuracy. Coverage factor of x1 applied to uncertainties, for ease of comparison with other industry handheld analyzers.

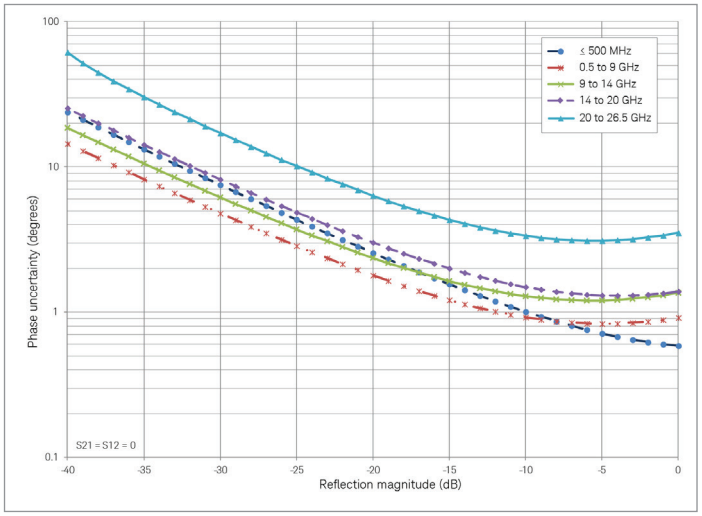
Transmission uncertainty (S21, S12)





Reflection uncertainty (S11, S22)





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

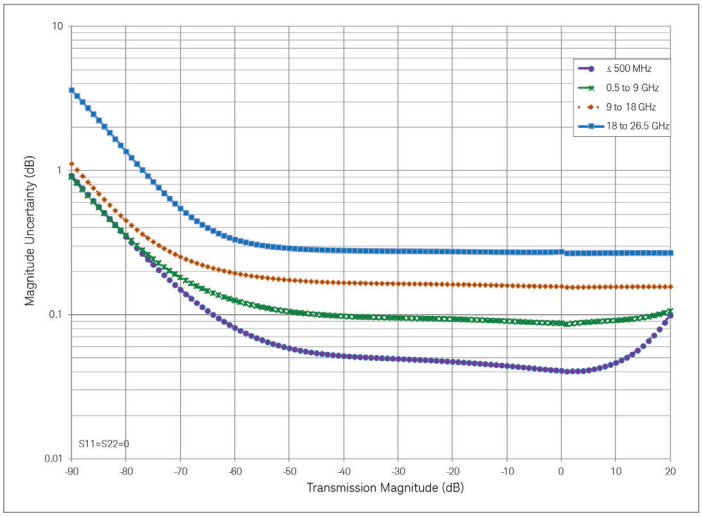
Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A (continued)

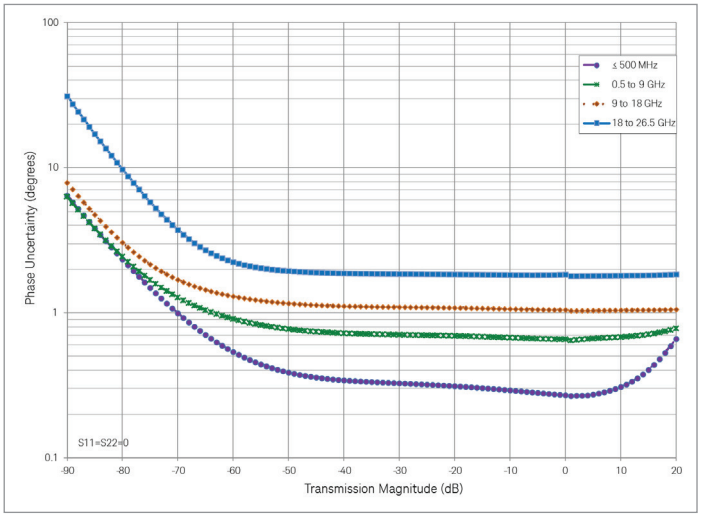
Full 2-port calibration, 85520A or 85521A 3.5 mm (m) calibration kit, spec

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.

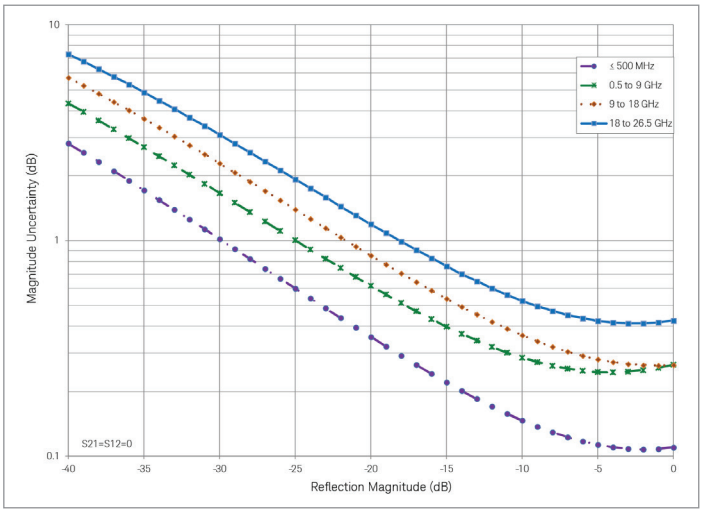
Corrected performance (dB)	≤ 0.5 GHz	0.5 to 9 GHz	9 to 18 GHz	18 to 26.5 GHz
Directivity	42	36	32	32
Source match	37	30	28	27
Load match	37	30	28	24
Reflection tracking	± 0.035	± 0.130	± 0.140	± 0.210
Transmission tracking	± 0.070	± 0.290	± 0.330	± 0.520

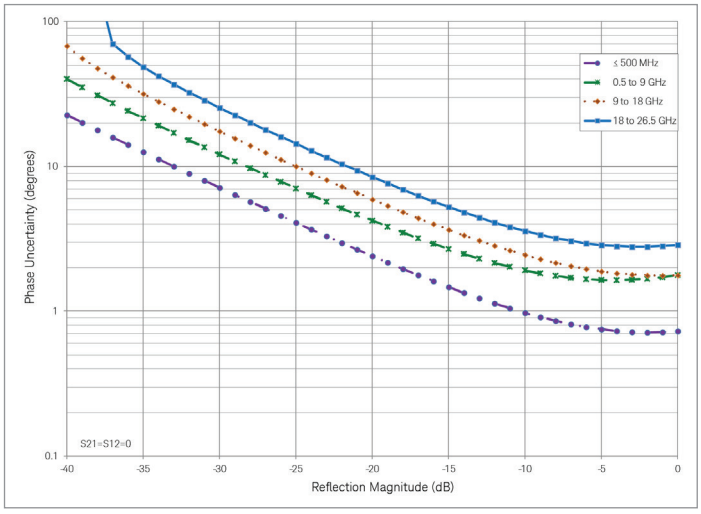
Transmission uncertainty (S21, S12)





Reflection uncertainty (S11, S22)





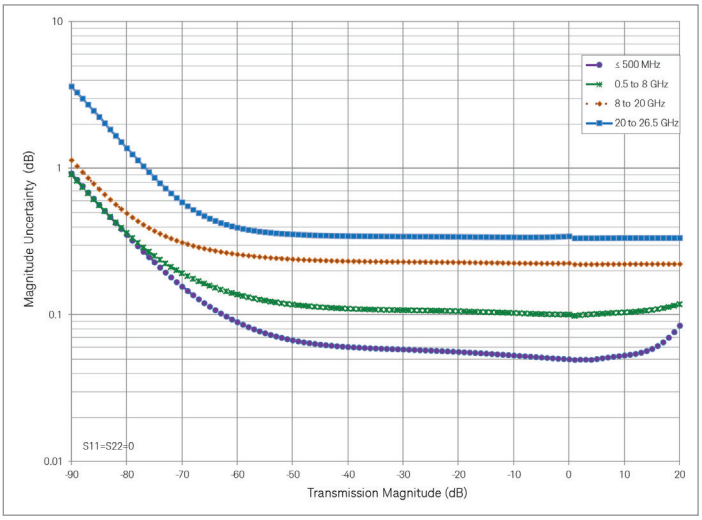
Corrected Measurement Uncertainty for N9913A/14A/15A/16A/17A/18A and N9925A/26A/27A/28A (continued)

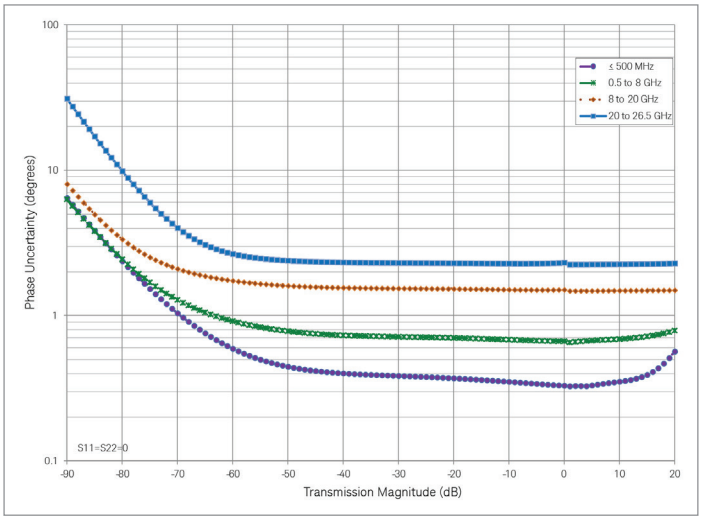
Full 2-port calibration, 85052D 3.5 mm calibration kit, spec

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.

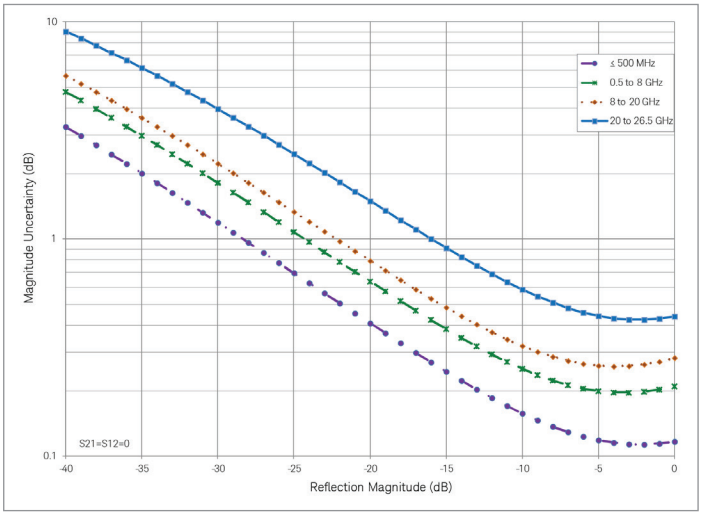
Corrected performance (dB)	≤ 0.5 GHz	0.5 to 8 GHz	8 to 20 GHz	20 to 26.5 GHz
Directivity	42	38	36	30
Source match	37	31	28	25
Load match	38	33	29	24
Reflection tracking	± 0.005	± 0.006	± 0.009	± 0.012
Transmission tracking	± 0.070	± 0.135	± 0.320	± 0.500

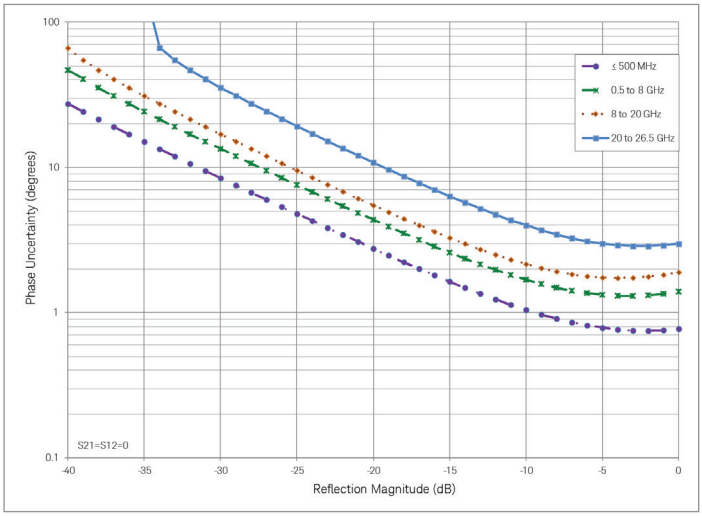
Transmission uncertainty (S21, S12)





Reflection uncertainty (S11, S22)





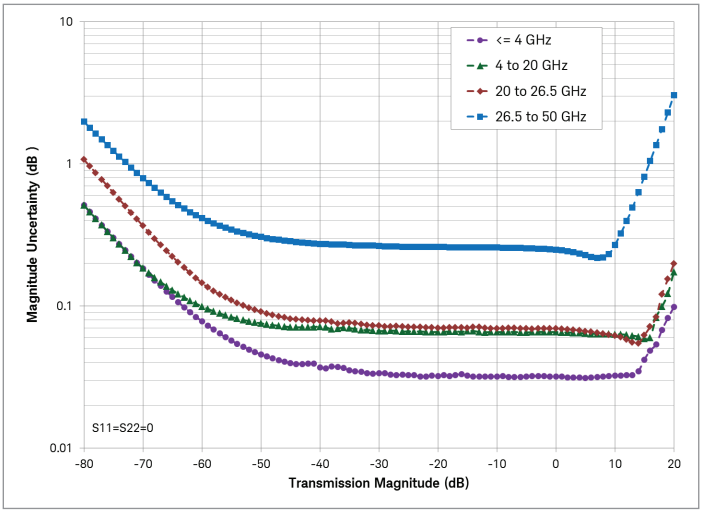
Corrected Measurement Uncertainty for N9950A/51A/52A

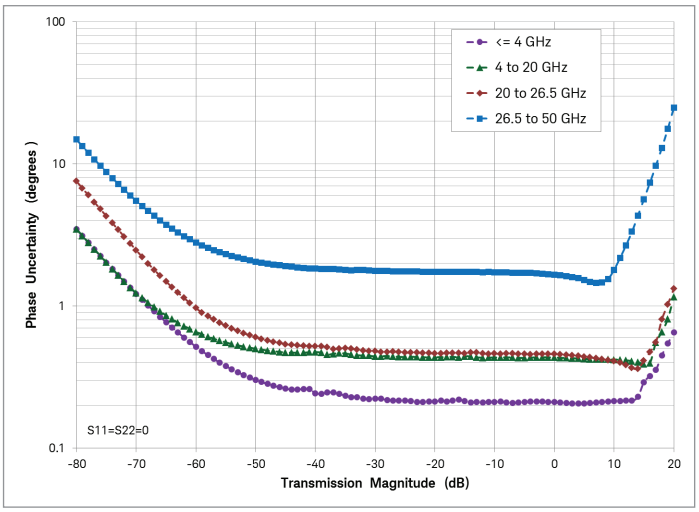
Full 2-port calibration, 85056D 2.4 mm calibration kit, spec[1]

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.

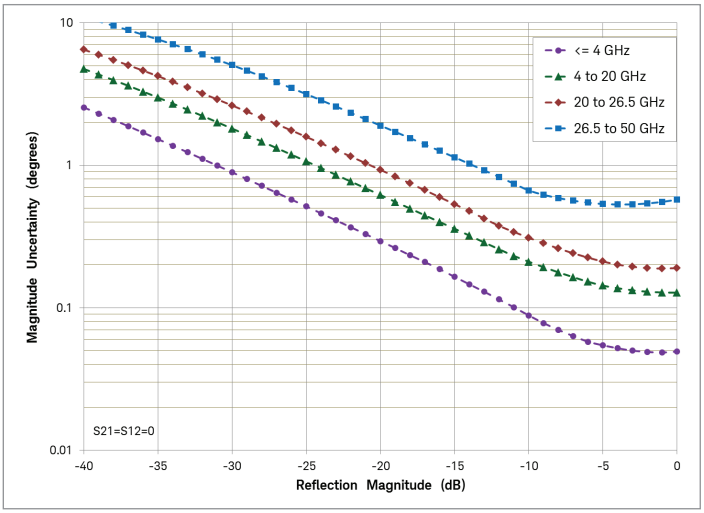
Corrected performance (dB)	≤ 2 GHz	2 to 20 GHz	20 to 40 GHz	40 to 50 GHz
Directivity	42	34	26	26
Source match	39	30	23	23
Load match	42	34	26	26
Reflection tracking	± 0.002	± 0.029	± 0.080	± 0.075
Transmission tracking	± 0.003	± 0.034	± 0.109	± 0.105

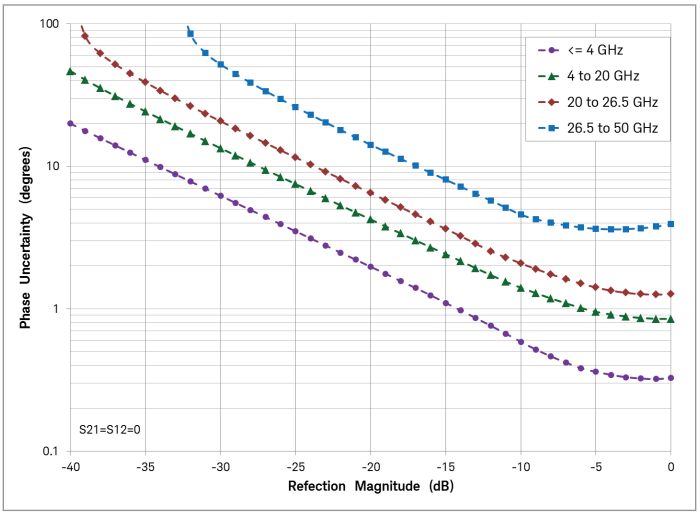
Transmission uncertainty (S21, S12)





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.

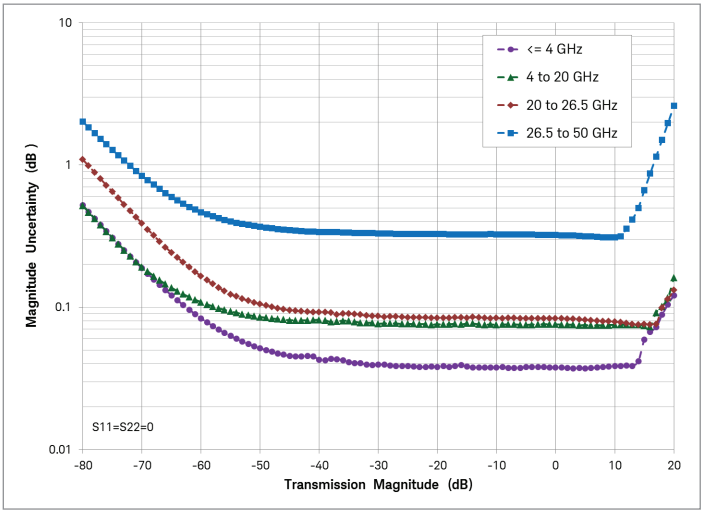
Corrected Measurement Uncertainty for N9950A/51A/52A (continued)

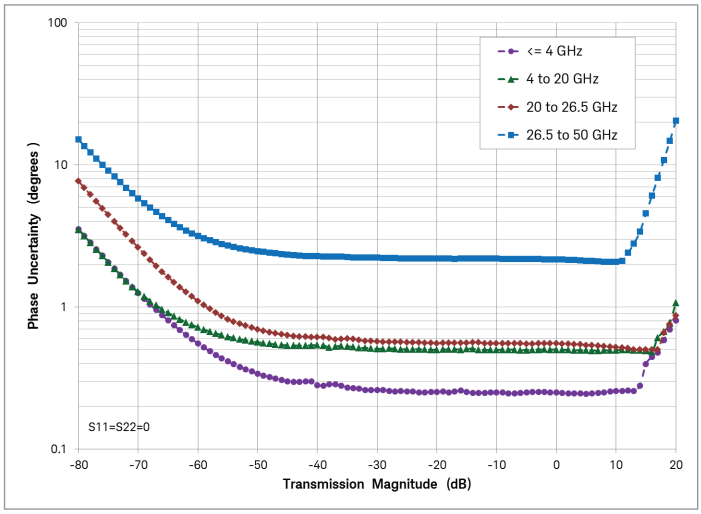
Full 2-port calibration, N4693A 2.4 mm ECal kit[1]

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.

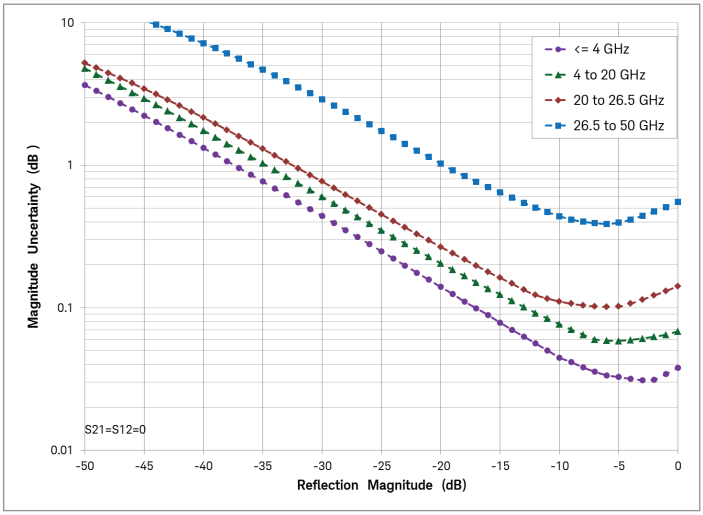
Corrected performance (dB)	10 to 50 MHz	50 MHz to 2 GHz	2 to 10 GHz	10 to 20 GHz	20 to 40 GHz	40 to 50 GHz
Directivity	32	42	49	45	41	36
Source match	25	44	42	37	35	32
Load match	25	43	41	36	34	31
Reflection tracking	± 0.050	± 0.030	± 0.040	± 0.050	± 0.060	± 0.080
Transmission tracking	± 0.118	± 0.038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

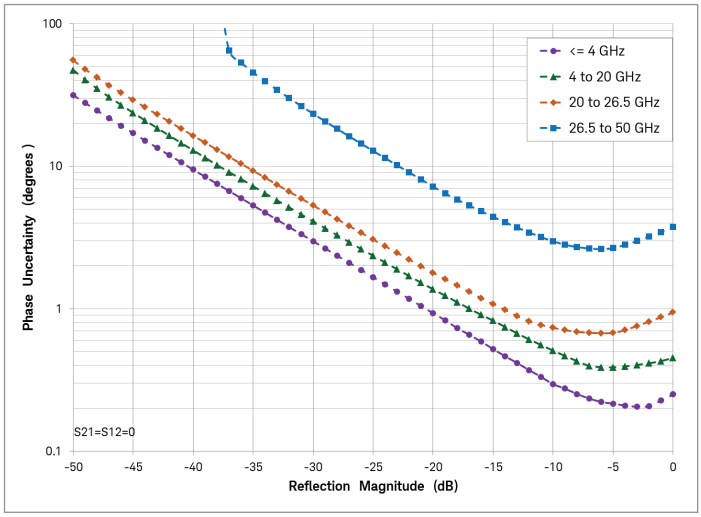
Transmission uncertainty (S21, S12)





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	
Scc11	Common mode reflection
Sdd11	Differential mode reflection
Scd11	Differential mode stimulus, common mode response
Sdc11	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[1]	± 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)[1]	
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: – 5% x RBW, FFT mode (nominal) – 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[2]	8 updates per second
Span = 100 MHz, RBW, VBW autocoupled	15.4 updates per second[3]	19 updates per second
Center frequency tune and transfer[4]	**N991xA, N993xA[5]**	**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[1]	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[2]	**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[3]	± 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	1.7 : 1
	> 2.7 to 7.5 GHz	1.5 : 1
	> 7.5 to 26.5 GHz	2.2 : 1
N995xA, N996xA (0 dB attenuation)	10 to 100 MHz	2.0 : 1
	> 100 to 500 MHz	1.7 : 1
	> 500 MHz to 17 GHz	1.5 : 1
	> 17 to 50 GHz	2.2 : 1
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[1]

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[2]	-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[2]	-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. 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 (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 [1]	–	< -75
> 1.3 GHz	–	< -60
≤ 4 GHz [1]	< -60	–
> 4 GHz	< -80	–

1. Applies for frequencies > 15 MHz

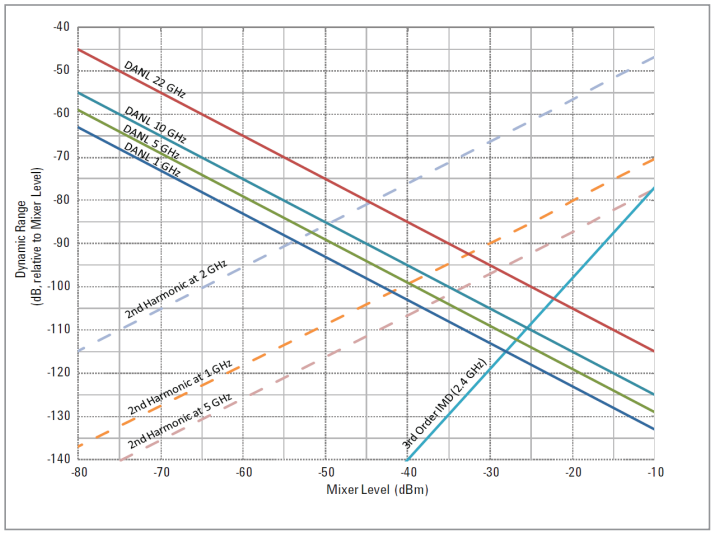
Spectrum Analyzer (continued)

Dynamic range specifications (continued)

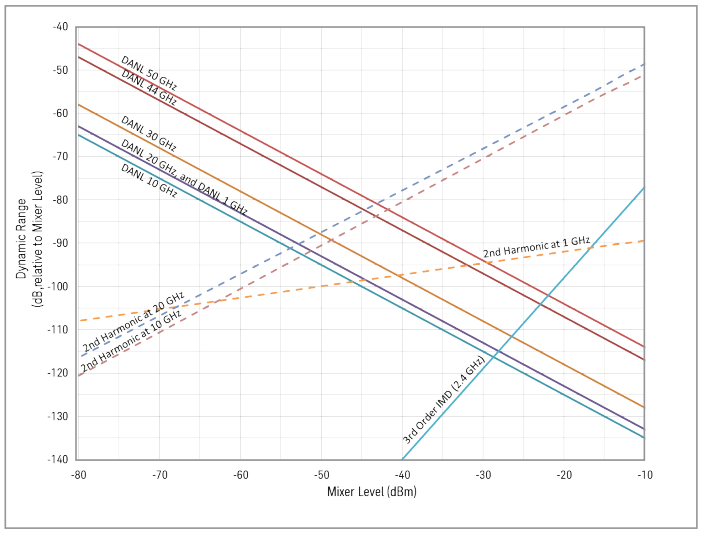
Third order intermodulation distortion (TOI) – (dBm) Two -20 dBm signals, 100 kHz spacing at input mixer (-10 to 55 °C)	**Spec**	**Typical**
N991xA, N993xA	At 2.4 GHz, +15	< 1 GHz, +10
		1 to 7.5 GHz, +15
		> 7.5 GHz, +21
N995xA, N996xA	At 2.4 GHz, +15	50 to 500 MHz, +9.5
		> 500 MHz to 1 GHz, +13
		> 1 to 2.4 GHz, +16
		> 2.4 to 2.6 GHz, +12
		> 2.6 GHz, +13
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

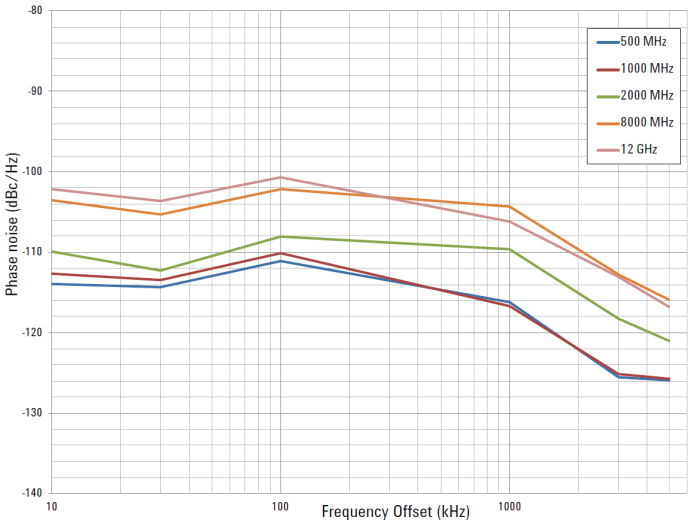


Spectrum Analyzer (continued)

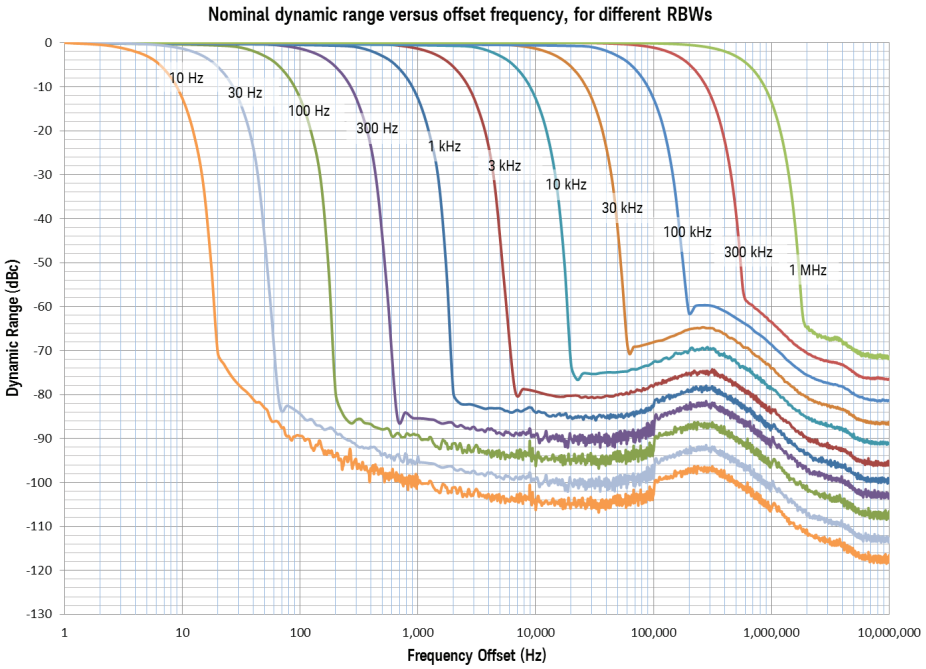
Dynamic range specifications (continued)

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)**	**Typical (-10 to 55 °C)**
10 kHz	–106	–106	–111	–111
30 kHz	–106	–104	–108	–110
100 kHz	–100	–99	–104	–105
1 MHz	–110	–110	–113	–113
3 MHz	–119	–118	–122	–122
5 MHz	–120	–120	–123	–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)		Preamp off	Preamp on
	Frequency	Typical, –10 to 55 °C	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

Real-Time Spectrum Analyzer (RTSA)

The performance listed in this section applies to the real-time 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.

	Models	Real-time analysis 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

Real-time analysis		
Maximum real-time bandwidth	10 MHz	
Resolution bandwidth	1 Hz to 500 kHz	Span dependent, 20 ≤ Span/RBW ≤ 280. Default is 35.7 kHz
Minimum signal duration with 100% probability of intercept (POI) at full amplitude accuracy	12.2 µs	At 10 MHz span, 500 Hz RBW
Minimum detectable signal Absolute amplitude accuracy at center frequency	22 ns	Minimum pulse signal duration where measured amplitude is no worse than 60 dB below a CW signal for a 10 MHz span and auto coupled RBW
Spurious-free dynamic range across maximum BW	63 dB	
FFT rate	120,000 FFT/s	At 10 MHz span
IF flatness *(typical)*	*+/- 0.2 dB <= 26.5 GHz,*	*+/- 0.3 dB > 26.5 GHz*
Number of display points	561	
Min. acquisition time	20 ms	At 10 MHz span
Max. acquisition time	500 ms	At 10 MHz span
Traces		
Number of traces	4: all four can be active simultaneously and in different states	
Detectors	Normal, positive peak, negative peak, sample, average (RMS)	
States	Clear/write, max. hold, min. hold, average, view, blank	
Markers		
Number of markers	6	
Type	Normal, delta, peak	
Marker →	Peak, next peak, center frequency, reference level, minimum	
Trigger		
Trigger type	Free run, external video, RF burst, periodic	

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
	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	+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

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
	Store data internally or on USB or SD card
	Playback recorded data using FieldFox
	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
	Store data internally or USB or SD card in .csv or .kml format
	Playback recorded data using FieldFox
	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 (%)
Receiver IF bandwidth	**Nominal**
AM	35 kHz
FM narrow	12 kHz
FM wide	150 kHz
Listen time range	0 to 100 seconds
AM & FM metrics	**Nominal**
SINAD	2.5 dB to 65 dB
THD	0 to 75%
AM measurements	**Nominal**
Maximum modulation rate	5 kHz, demod sweep time: 50 µs to 50 ms
Depth	(peak-to-peak/2) (%), ± peak depth (%)
Depth accuracy	±2%
Depth range	Modulation: 0.1 % to 99%
FM measurements	**Nominal**
Maximum modulation rate	5 kHz, demod sweep time: 50 µs to 50 ms
Frequency deviation	(Hz), ± 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 µs 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[1]
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[1]	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

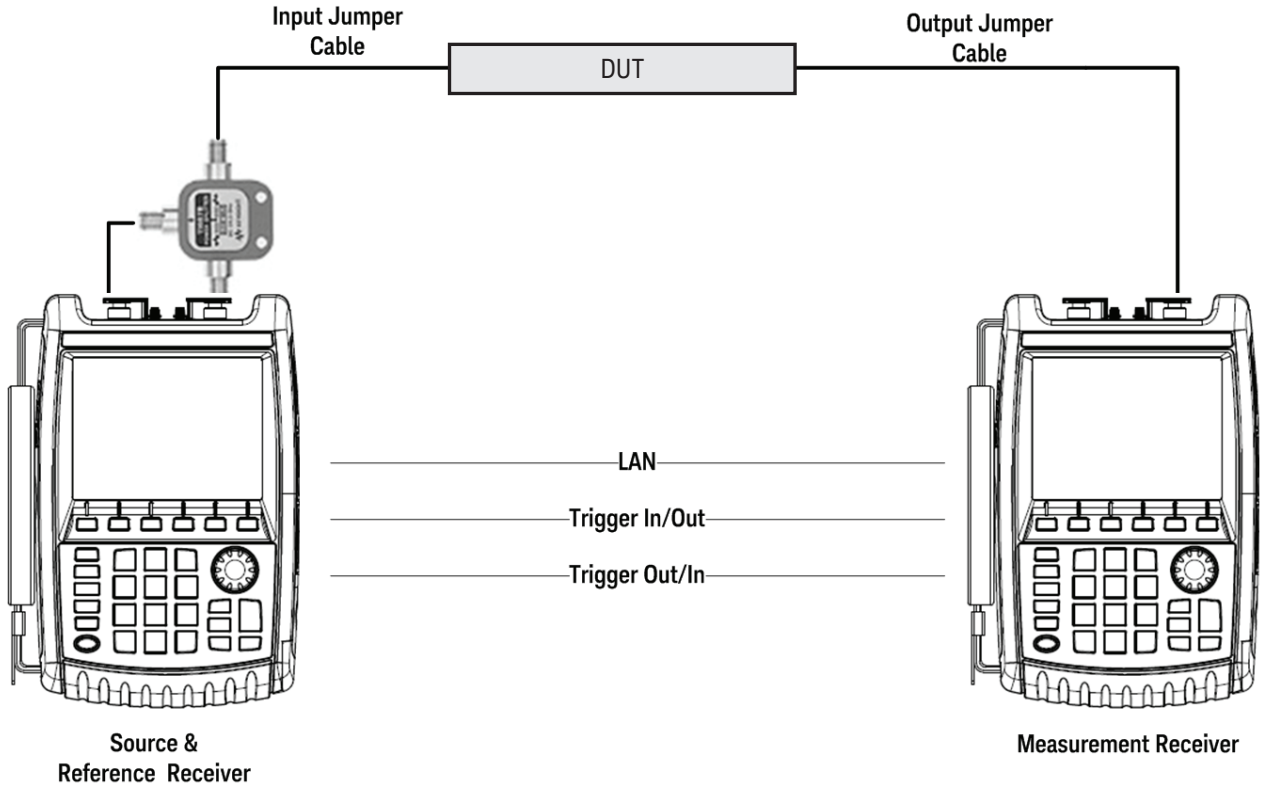
- FieldFox microwave spectrum analyzers: N9935A, N9936A, N9937A, N9938A N9960A, N9961A, N9962A

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[1]
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) 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. [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. [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) Reverse receiver sweep direction (default direction is forward, but can be set to reverse)
Frequency tracking offset	On/Off Offset values: 0, > 0, < 0
Receiver sweep direction	Reversal: Off Default setting Both source and receiver sweep in the forward direction. Receiver stop frequency > Receiver start frequency Source frequency = Offset + Receiver frequency Reversal: On Source and receiver sweep in opposite directions. Source frequency = Offset – Receiver frequency 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[1] 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)

N995xA and N996xA **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)**
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
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)**
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
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)**
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
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)**
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
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)**
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		
	Models	**Frequency range**	
N991xA, N992xA, N993xA	N9913A	30 kHz to 4 GHz	Usable to 5 kHz
	N9914A	30 kHz to 6.5 GHz	Usable to 5 kHz
	N9915A, N9925A,N9935A	30 kHz to 9 GHz	Usable to 5 kHz
	N9916A, N9926A, N9936A	30 kHz to 14 GHz	Usable to 5 kHz
	N9917A, N9927A, N9937A	30 kHz to 18 GHz	Usable to 5 kHz
	N9918A, N9928A, N9938A	30 kHz to 26.5 GHz	Usable to 5 kHz
N995xA, N996xA	N9950A, N9960A	300 kHz to 32 GHz	Usable to 5 kHz
	N9951A, N9961A	300 kHz to 44 GHz	Usable to 5 kHz
	N9952A, N9962A	300 kHz to 50 GHz	Usable to 5 kHz

Amplitude accuracy (dB)				
N991xA, N992xA, N993xA	**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	**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[1]	± 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 others 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.

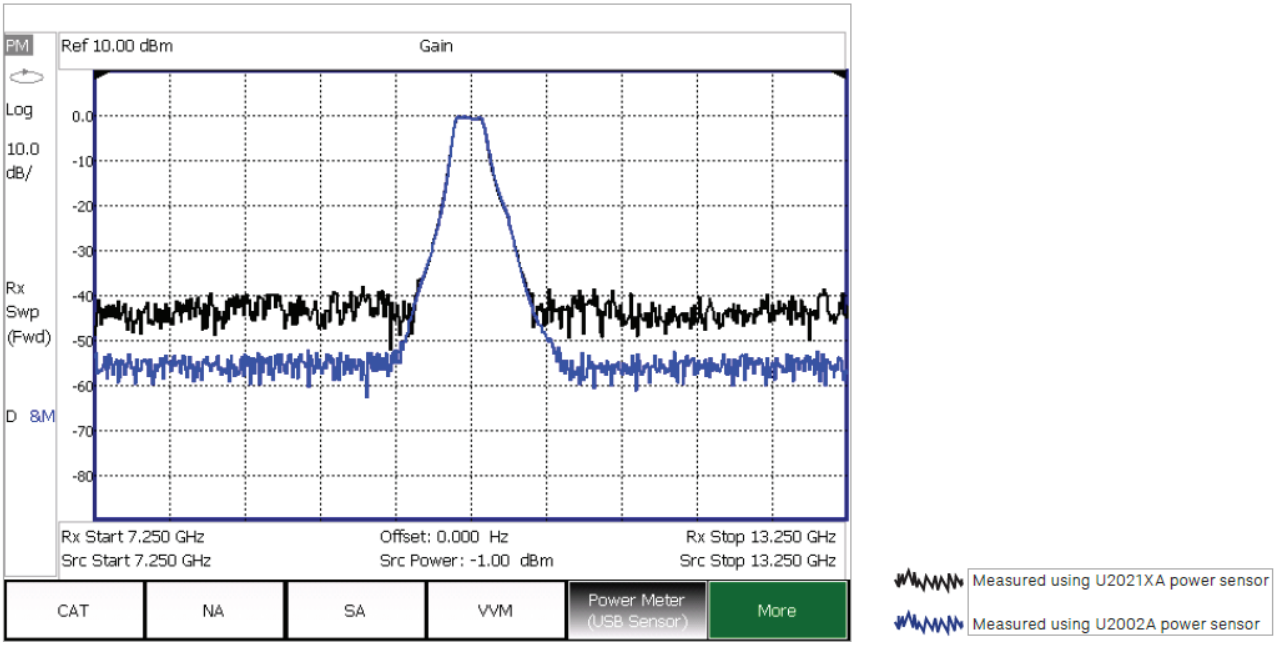
Src sweep direction	Rx sweep direction	Frequency calculations
Forward $f2_{src} > f1_{src}$	Forward $f2_{rx} > f1_{rx}$	Receiver frequency = Source frequency ± Offset
Forward $f2_{src} > f1_{src}$	Reverse $f2_{rx} > f1_{rx}$	Receiver frequency = Offset – Source Frequency Offset > Source frequency

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
	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. Supported USB power sensors: www.keysight.com/find/fieldfoxsupport

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.[1]
Modes	Off, internal, external
Sync clock	On, off
Functionality	Geo-location: latitude, longitude, altitude (elevation), time, sync time/data
	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[1]	0.65 A
DC current readout resolution	0.01 A
Maximum power[1]	7 watts
Display read out	Voltage, current
Overload trip protection	Automatically engages when voltage source is on. 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) (-10 to 45 C/14 to 113F in RTSA mode)
Operating, battery, spec	–10 to 50 °C (14 to 122 °F)
Operating, battery, typical	–10 to 55 °C (14 to 131 °F)
Storage, spec[1]	–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 a 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” transflective color VGA-LED backlit
Headphone jack connector	
	3.5 mm (1/8 inch) miniature audio jack

General Information (continued)

USB-A, 2-ports	
	Hi-speed USB 2.0
Mini USB, 1 port[1]	
	Hi-speed USB 2.0; used for SCPI programming; USBTMC (USB IEEE488)
Keyboard	
	USB keyboards are supported (user must supply their own keyboard)
LAN	
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
Programming	
	SCPI, using the built-in LAN interface
Languages	
	English, Spanish, German, Italian, French, Russian, Japanese, Chinese, Turkish, Korean, and Portuguese
Preset	
	User preset for both mode preset and complete system preset
Limit lines	
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	
Data storage	
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
Secure operation	
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: http://www.keysight.com/find/securefieldfox

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 Ω
Output amplitude	≥ 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 Ω
Reference input	10 MHz, –5 to +10 dBm
Trigger input	3.3 or 5 V TTL logic levels

Carry Precision With You

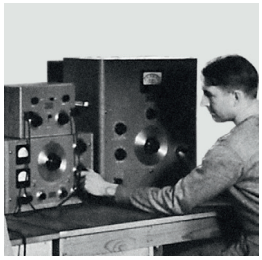
Every piece of gear in your field kit had to prove its worth. Measuring up and earning a spot is the driving idea behind Keysight's FieldFox analyzers. They're equipped to handle routine maintenance, in-depth troubleshooting and anything in between. Better yet, FieldFox delivers precise microwave measurements—wherever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

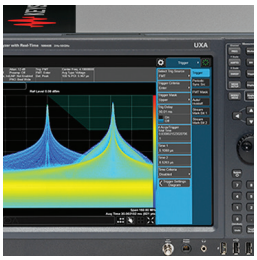
Related literature	**Publication number**
FieldFox Handheld Analyzers, Configuration Guide	5990-9836EN
FieldFox Handheld Analyzers, Technical Overview	5992-0772EN
FieldFox N9923A RF Vector Network Analyzer, Technical Overview	5990-5087EN
FieldFox N9923A RF Vector Network Analyzer, Data Sheet	5990-5363EN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

Download application notes, watch videos, and learn more: **www.keysight.com/find/fieldfox**

Evolving

Our unique combination of hardware, software, support, and people can help you reach your next breakthrough. We are unlocking the future of technology.







From Hewlett-Packard to Agilent to Keysight

myKeysight

myKeysight
www.keysight.com/find/mykeysight
A personalized view into the information most relevant to you.

Keysight Infoline

Keysight Infoline
www.keysight.com/find/Infoline
Keysight's insight to best in class information management. Free access to your Keysight equipment company reports and e-library.

KEYSIGHT SERVICES

Keysight Services
www.keysight.com/find/service
Our deep offering in design, test, and measurement services deploys an industry-leading array of people, processes, and tools. The result? We help you implement new technologies and engineer improved processes that lower costs.

STANDARD 3 YR WARRANTY

Three-Year Warranty
www.keysight.com/find/ThreeYearWarranty
Keysight's committed to superior product quality and lower total cost of ownership. Keysight is the only test and measurement company with three-year warranty standard on all instruments, worldwide. And, we provide a one-year warranty on many accessories, calibration devices, systems and custom products.

CALIBRATION UP TO 10 YEARS WARRANTY ASSURANCE PLANS

Keysight Assurance Plans
www.keysight.com/find/AssurancePlans
Up to ten years of protection and no budgetary surprises to ensure your instruments are operating to specification, so you can rely on accurate measurements.

Keysight Channel Partners
www.keysight.com/find/channelpartners
Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

www.keysight.com/find/fieldfox

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

Americas

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 11 2626
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

Europe & Middle East

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	800 000154
Sweden	0200 882255
Switzerland	0800 805353 Opt. 1 (DE) Opt. 2 (FR) Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:
www.keysight.com/find/contactus
(BP-06-08-16)

DEKRA Certified
ISO9001 Quality Management System

www.keysight.com/go/quality
Keysight Technologies, Inc.
DEKRA Certified ISO 9001:2015
Quality Management System

KEYSIGHT TECHNOLOGIES
Unlocking Measurement Insights

This information is subject to change without notice.
© Keysight Technologies, 2014 - 2016
Published in USA, August 29, 2016
5990-9783EN
www.keysight.com