Agilent FieldFox Vector Network Analyzers

9/14/18/26.5 GHz

Technical Overview

N9925A

N9926A

N9927A

N9928A

Carry precision with you.

Anticipate ___Accelerate ___Achieve

Agilent Technologies

Get Agilent-quality microwave measurements in the field

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

On land, sea and air, FieldFox is ready for a wide range of applications: satellite communications, microwave backhaul, military communications, radar systems, and more. In harsh conditions and hard-to-reach locations, FieldFox delivers precise results that are consistent with those you'd see on a benchtop analyzer. To get you out of the elements sooner, the task-driven user interface will help you finish the job faster.

FieldFox vector network analyzers give you - and your budget - more flexibility: configure an instrument with transmission/reflection today and add full 2-port S-parameters and other capabilities in the future.

Key Measurements

Vector network analyzer (VNA)

- All four S-parameters, magnitude and phase
- Guided Calibration Wizard, full 2-port cal, TRL, waveguide calibration
- Best trace noise and superior dynamic range for handheld VNAs
- Flat output power across whole frequency span, in 1 dB steps
- 30 kHz to 26.5 GHz

Cable and antenna analyzer

- Distance-to-fault, return loss, and cable loss (1-port and 2-port)
- Integrated QuickCal – no calibration kit required
- Immediate cable and antenna and vector network analysis at the test port with CalReady
- 30 kHz to 26.5 GHz

Vector network analyzer
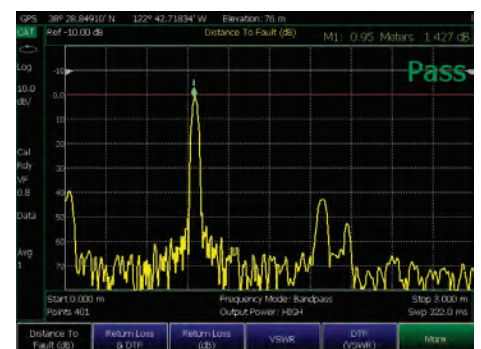
Cable and antenna analyzer

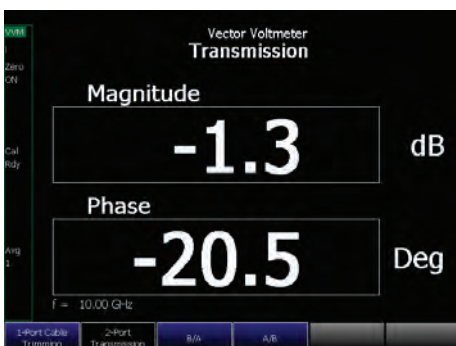# Add the world's most precise handheld microwave analyzer to your kit

Built-in power meter

- Easy to view analog and digital display
- ± 0.5 dB accuracy
- 5 kHz to 26.5 GHz

Power meter using a USB power sensor

- Measure power with USB power sensors
- -60 to +44 dBm (sensor dependent)
- 9 kHz to 24 GHz

Vector voltmeter

- Cable trimming, phase shift and electrical length measurements
- A/B and B/A ratio measurements
- 30 kHz to 26.5 GHz

Designed for you and the work you do everyday

Carry FieldFox wherever you need to go

- Kit friendly 3.0 kg or 6.6 lbs

- Large buttons are easy to operate, even when wearing gloves

- Field swappable battery lasts up to 3 1/2 hours

- Non-slip rubber grip securely fits in your hands and won't slide off the hood of your vehicle

- Vertical "portrait" orientation makes it easy to hold and operate at the same time

Field-proof usability for better answers in less time

- Bright, low-reflection display and backlit keys enable easy viewing in direct sunlight or darkness

- Intuitive user interface is designed for your workflow, enabling measurements in fewer key presses

- One-button measurements simplify complex setups and ensure quick, accurate results with confidence

- Calibration Wizard guides user to ensure simple and accurate calibrations

- 3-year warranty ensures field confidence - especially in harsh environments

Large buttons make it easy to perform vector network analysis measurements—even with gloves on

Rugged enough to meet MIL-specs

- Completely sealed instrument enclosure provides measurement stability in harsh environments

- Specially designed connector bay protects RF connectors from damage due to drops or other external impacts (designed to withstand 4' drop on concrete surface on all 6 faces)

- Water-resistant chassis, keypad and case withstand wide temperature ranges and salty, humid environments

  - Case withstands shock and vibration

  - Wide operating temperature
    -10 to +55 ºC (14 to 131 ºF)

  - Wide storage temperature
    -51 to +71 ºC (-60 to 160 ºF)

- Meets MIL-PRF-28800F Class 2 requirements

- Type tested and meets MIL-STD-810G, Method 511.5, Procedure I requirements for operation in explosive environments

Dust-free design with no vents or fans helps extend instrument reliability

Pick up FieldFox for its ergonomics

Portrait design and large buttons for easy operation—even with gloves on

Convenient side strap makes it easy to hold and carry

Anti-glare 6.5 inch LCD display with LED backlight

Task-driven keys are grouped to easily perform field measurements

Dedicated marker keys for quick marker function access

backlit keypad
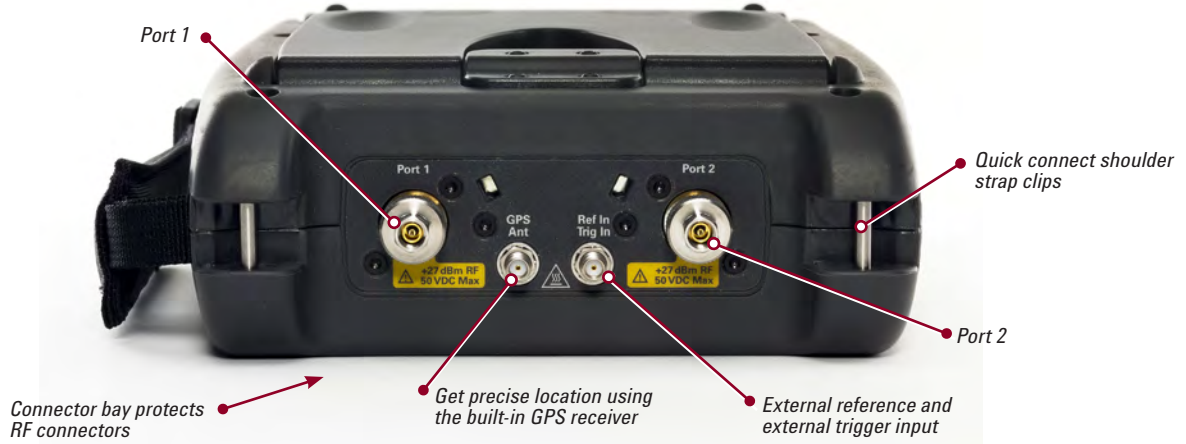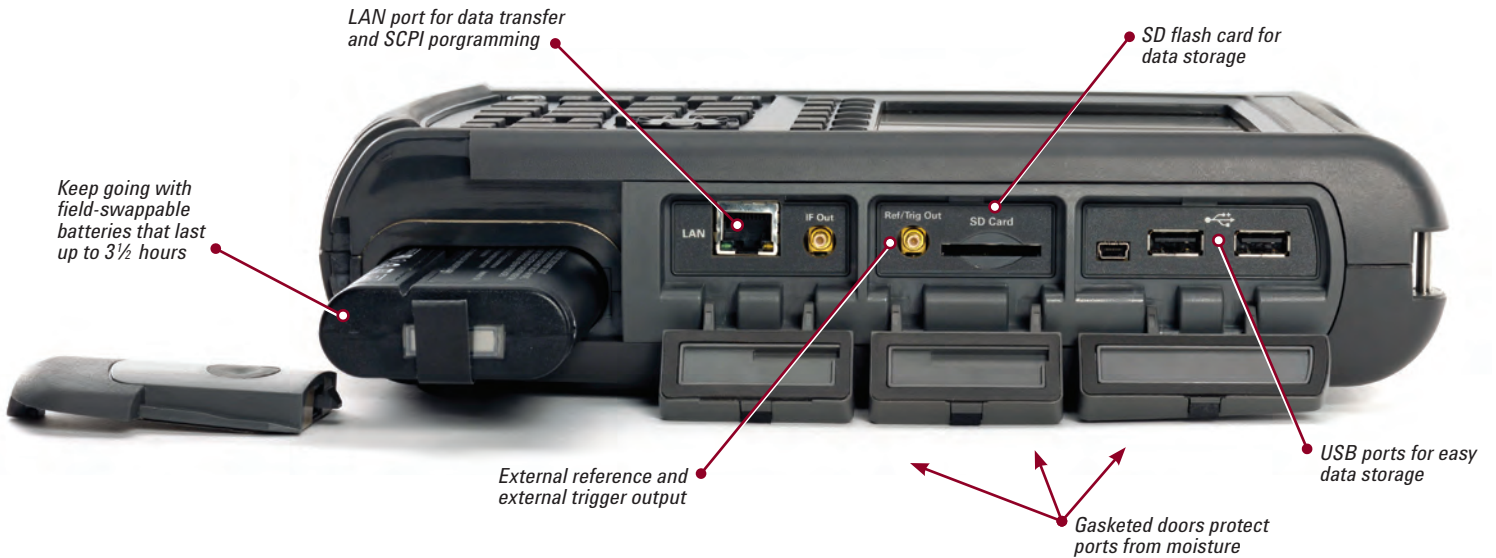
11.5"
(292 mm)

7.4"
(188 mm)

...and depend on its durability and convenience

Port 1

Quick connect shoulder strap clips

Port 2

Connector bay protects RF connectors

Get precise location using the built-in GPS receiver

External reference and external trigger input

Port 1   Port 2

GPS Ant   Ref In Trig In

+27 dBm RF 50 VDC Max   +27 dBm RF 50 VDC Max

RIGHT SIDE

LAN port for data transfer and SCPI porgramming

SD flash card for data storage

Keep going with field-swappable batteries that last up to 3½ hours

LAN   IF Out   Ref/Trig Out   SD Card

External reference and external trigger output

Gasketed doors protect ports from moisture

USB ports for easy data storage

LEFT SIDE

Built-in DC supply for powering external bias-tees, probes, and active devices

15-19 VDC 4 A Max
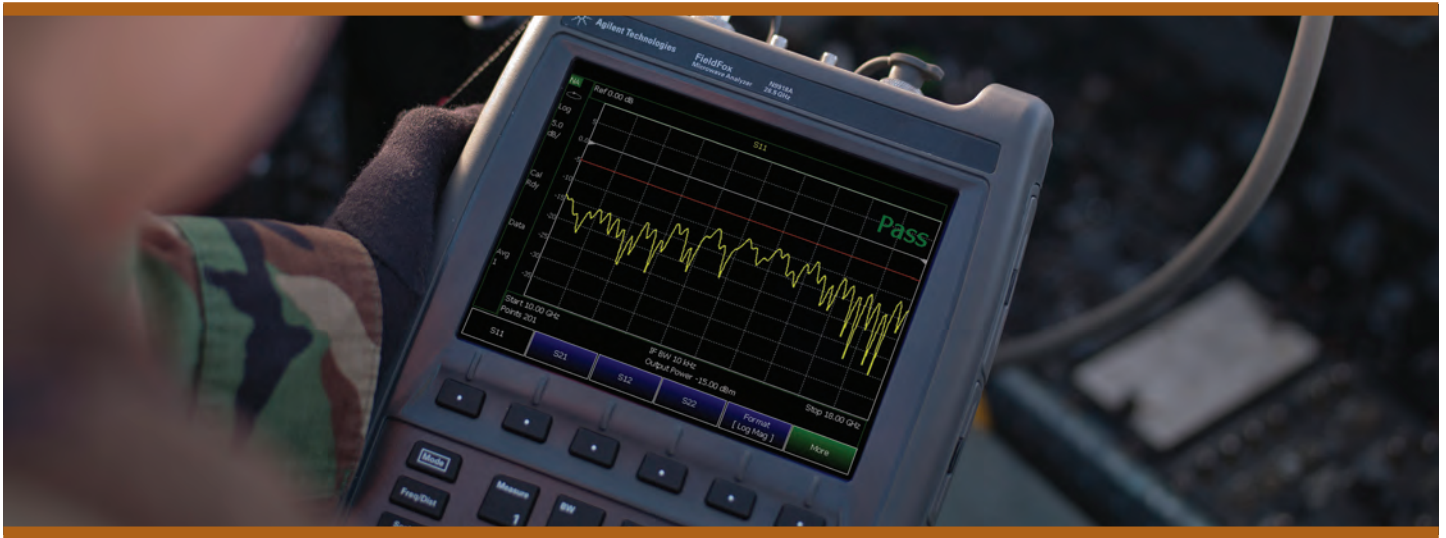
Vector network analyzer

Vector network analyzer

A standard FieldFox vector network analyzer provides vector transmission and reflection measurements (T/R), or S11 and S21, with magnitude and phase. Adding Option 211 (full 2-port S-parameters) brings new levels of accuracy and convenience for testing microwave components.

With a full 2-port network analyzer, you can measure the forward and reverse characteristics of your component without having to disconnect, turn around, and reconnect it to the analyzer. The full 2-port calibration gives you the best measurement accuracy possible.

FieldFox's four independent, sensitive receivers provide 94 dB of dynamic range for measurement of high rejection, narrowband devices such as cavity filters. The receivers also enable full 2-port error correction with the unknown thru method, allowing users to measure non-insertable devices accurately and easily.

FieldFox's calibration engine is the same engine that powers the well-respected Agilent ENA and PNA network analyzers. FieldFox leverages Agilent microwave expertise to deliver consistent measurements with Agilent benchtop VNAs.
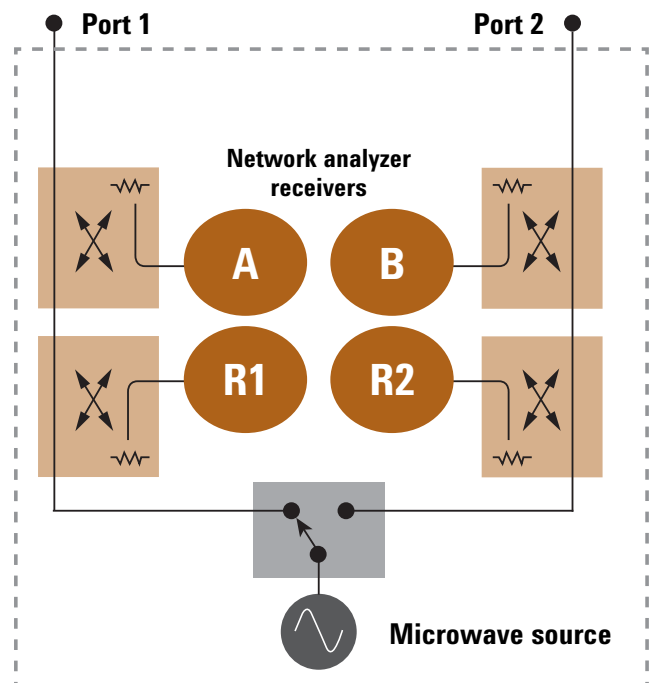
Calibrations

FieldFox's guided Cal Wizard takes guessing out of calibration and allows you to easily perform the following calibrations:

• Full 2-port
• OSL, response, enhanced response
• TRL, LRL, offset short

Simultaneously measure and view all four S-parameters, with a single connection

FieldFox microwave vector network analyzer architecture

Vector network analyzer

Network analyzer time domain

With the time domain option, FieldFox computes the inverse fourier transform of the frequency-domain data to display reflection or transmission coefficients versus time. Time domain gating can be used to remove unwanted responses such as connector mismatch or cable discontinuities, and the results can be displayed in either time or frequency domain.

Waveguide support

Waveguides are widely used to provide transmission links between microwave transmitters and antennas, as waveguides have less loss than coax. FieldFox can be used with Agilent waveguide calibration kits and adapters. FieldFox also provides support for non-Agilent waveguide calibration kit and adapters.
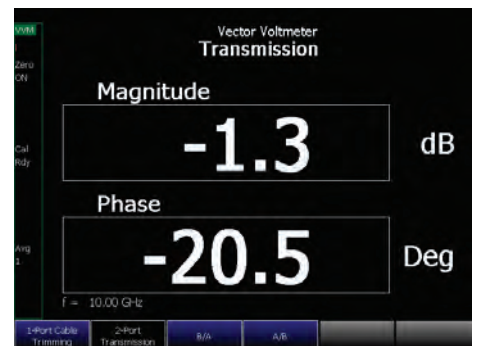
Vector voltmeter

Using FieldFox's vector voltmeter (VVM), the phase shift and electrical length of a device can be measured. You can view results on the large display as far as ten feet or three meters away. VVM also provides ratio measurements of magnitude and phase of two channels, A/B or B/A. You can use this capability to verify the magnitude and phase differences between multiple signal paths such as in an antenna or phased array.

FieldFox offers all the key functionalities of the HP 8508A, in a handheld form factor, and without the need for the source/bridge/accessories required with HP 8508A.
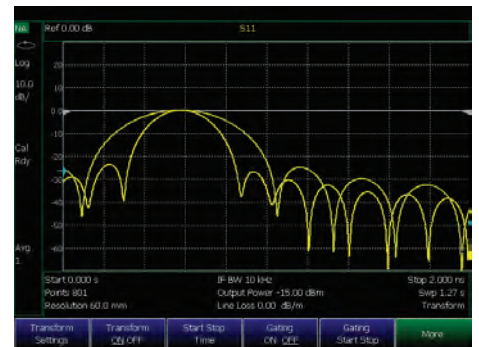
Time domain measurements provide insight into the device under test

Vector voltmeter used for cable trimming

Cable and antenna analyzer
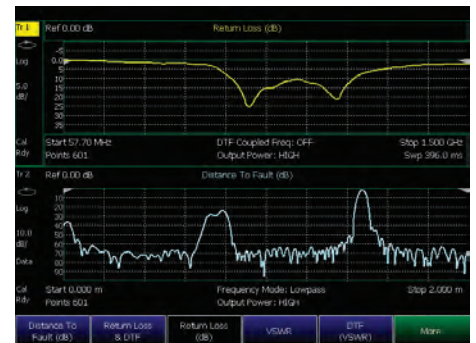
Cable and antenna analyzer

Fifty to sixty percent of microwave-link equipment issues are related to cables, antennas and connectors. Degraded feeder lines cause poor coverage, link failures, and reduced sensitivity on the receive path. To maintain the quality of a microwave link, it is critical to keep the cable and antenna systems in good working condition.

Use FieldFox to make return loss, VSWR, insertion loss, 1-port cable loss, and distance-to-fault measurements. You can test antennas, cables, filters, and amplifiers with a single instrument. The amplifiers can be biased using FieldFox's built-in DC source.

Return loss and distance-to-fault (DTF) measurements

Measuring and viewing return loss and distance-to-fault simultaneously allows you to fix and tune systems much faster. Optionally, you can utilize QuickCal or CalReady to ensure the instrument is always calibrated and ready to make consistent and worry-free measurements.

The built-in cable editor allows you to edit existing cable types on-site, save them as new cable types with user defined names, and share the cable files with your team.

Return loss and DTF display
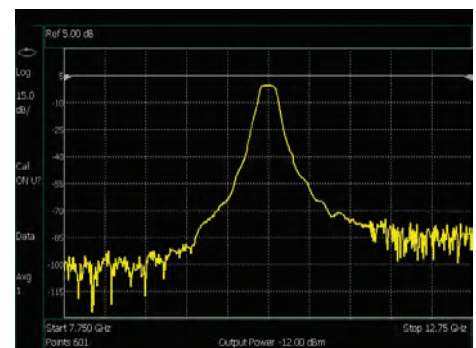
Filter insertion loss display

Cable and antenna analyzer

CalReady-calibrated at power on and ready to go

Save time and get right to work with FieldFox's CalReady feature. With CalReady, the analyzer is ready for measurements, immediately following power on or preset. FieldFox is already calibrated and ready to make accurate measurements such as S11, S22, 1-port cable loss, and DTF measurements without having to connect/disconnect additional calibration devices. CalReady is an accurate calibration, traceable to national standards labs.

Hassle-free calibration in the field with the industry's first and only QuickCal

FieldFox is the industry's first and only handheld network analyzer with a built-in calibration capability that allows you to calibrate the network analyzer without carrying a calibration kit (cal kit) into the field.

With any other test instrument, when you add additional devices to the test port, such as jumper cables or adapters, you need to recalibrate using a cal kit. QuickCal eliminates the need to carry and use a cal kit, and also provides worry-free accuracy and excellent reliability.
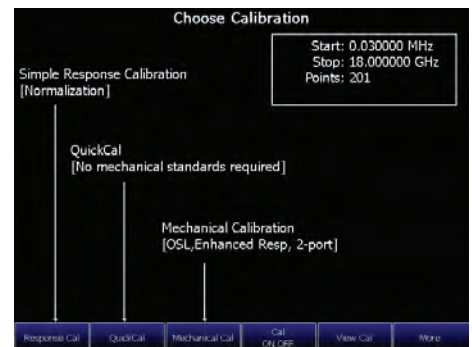
FieldFox's QuickCal supports measurements such as insertion loss/gain, 1-port cable loss, return loss, and DTF.

Broadband calibration

FieldFox allows you to make broadband calibrations, which means the instrument is calibrated over the maximum frequency range. After a broadband calibration, you can change the frequency range or number of points without recalibrating the instrument. The calibration is interpolated, and accuracy is maintained.

User cal kit support

For users who wish to use traditional mechanical calibration kits, FieldFox supports most HP/Agilent cal kits, and also allows you to define your own custom calibration kits.

STEP 1   *FieldFox's QuickCal allows you to perform calibrations without carrying a cal kit*
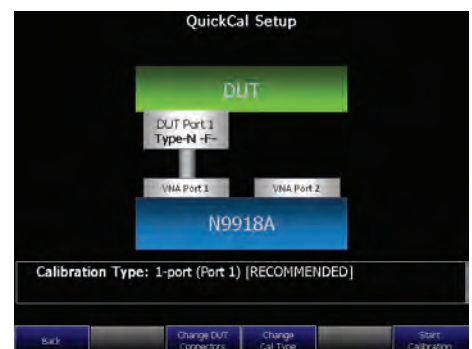
STEP 2

STEP 3

Power measurements and more

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 with accuracy up to ± 0.5 dB.

USB Power sensor support

FieldFox can connect with the Agilent U2000 Series USB power sensors to make RF/microwave power measurements up to 24 GHz. FieldFox provides true average power measurements with a wide dynamic range from -60 dBm to +44 dBm.

Built-in GPS

A built-in GPS receiver provides geo-location tags to measurements. The geo data—time, latitude, longitude, and elevation—can be displayed and saved in data files. In addition to location information, the GPS provides an accurate frequency reference to improve accuracy.

Built-in variable voltage DC bias

FieldFox has a built-in variable voltage DC bias source. The source provides 1 to 32 VDC with maximum current of 650 mA and 8 W maximum power.

The DC bias source can provide DC power to amplifiers under test and bias tower mounted amplifiers (TMA) when engineers need to sweep through the TMA to reach the antenna (bias-tees available separately).

FieldFox's Data Link software makes report generation and documentation easier
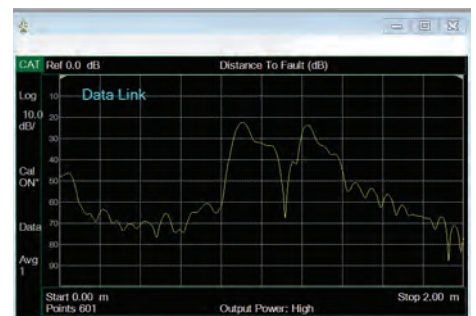
FieldFox's complimentary Data Link software provides data transfer, data definition and report generation. Markers and limit lines can be added to the traces. Cable files and antenna factors can also be loaded using Data Link.

Remote control via LAN and FieldFox programming

FieldFox analyzers are fully SCPI compliant and can be controlled over the LAN.

Easily measure power levels using the built-in channel power meter

Use the complimentary Data Link software to generate reports

Use the built-in GPS to obtain geo-location data

Specifications in brief

See the FieldFox Handheld Analyzer Data Sheet for a complete listing of the specifications:
http://cp.literature.agilent.com/litweb/pdf/5990-9783EN.pdf

Vector network analyzer and cable and antenna 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 (may require options – see configuration guide):
FieldFox microwave combination analyzers: N9913A, N9914A, N9915A, N9916A, N9917A, N9918A
FieldFox microwave vector network analyzers: N9925A, N9926A, N9927A, N9928A

Models	Frequency range
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

Data points or resolution	101, 201, 401, 601, 801, 1001, 1601, 4001, 10,001 Arbitrary number of points settable through SCPI
IF bandwidth[1]	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz
System impedance	50 ohm (nominal), 75 ohm with appropriate adapter and calibration kit

Test port output power: Port 1 or port 2, high power (default power), 23 ± 5 °C

Frequency	Typical
30 kHz to 300 kHz	-11 dBm
> 300 kHz to 2 MHz	-3 dBm
> 2 MHz to 625 MHz	-1.5 dBm
> 625 MHz to 3 GHz	+2 dBm
≥ 3 to 6.5 GHz	0 dBm
≥ 6.5 to 9 GHz	-1 dBm
≥ 9 to 14 GHz	-3.5 dBm
≥ 14 to 18 GHz	-5.5 dBm
≥ 18 to 23 GHz	-9.5 dBm
≥ 23 to 26.5 GHz	-12 dBm

Power level accuracy	± 1.5 dB at -15 dBm (typical)
Power range	CAT: High and low. Low power is -45 dBm (nominal).
	VNA: High, low and manual. Low power is -45 dBm (nominal).
Power step size	Flat power, in 1 dB steps, is available across the whole frequency span (nominal).

1. VNA mode only. Recommend using averaging in CAT mode.

System dynamic range: Port 1 or port 2, high power, 300 Hz IF bandwidth, -10 to 55 °C

Frequency	Spec	Typical
> 300 kHz to 9 GHz[1]	95 dB	100 dB
≥ 9 to 14 GHz	91 dB	97 dB
≥ 14 to 18 GHz	90 dB	94 dB
≥ 18 to 20 GHz	87 dB	90 dB
≥ 20 to 25 GHz	74 dB	79 dB
> 25 to 26.5 GHz	65 dB	70 dB

Trace noise: Port 1 or port 2, high power, 300 Hz IF bandwidth, spec, -10 to 55 °C

Frequency	Magnitude	Phase
> 300 kHz to 10 GHz	± 0.002 dB (rms)	± 0.014 degrees
> 10 to 20 GHz	± 0.004 dB (rms)	± 0.027 degrees
> 20 to 26.5 GHz	± 0.010 dB (rms)	± 0.066 degrees

Measurements	
VNA T/R	S11, S21[2]
VNA S-parameters	S11, S21, S22, S12[3]
CAT	Distance-to-fault (dB), return loss, VSWR, distance-to-fault (VSWR), cable loss (1-port), insertion loss (2-port)[4], distance-to-fault (linear or Rho)
Calibration types	CalReady, 1-port, QuickCal, 1-port , SOL, 1-port, frequency response, enhanced response (also known as one-path, two-port), CalReady, 2-port QuickCal, 2-port SOLT or offset short, 2-port SOLT calibration, 2-port unknown thru calibration
Connectors	Type-N 50 ohm, Type-N 75 ohm, 7/16, TNC, 3.5 mm, 2.4 mm, waveguide bands: X-band WR-90, P-band WR-62, K-band WR-42. Custom coaxial or waveguide calibration kits can be added to any FieldFox analyzer.

1. < 300 kHz, 63 dB (nominal).

2. Standard on N992x VNAs. Option 210 required on N991xA analyzers.

3. Option 211 required to obtain all four S-parameters.

4. All measurements standard are on N991xA analyzers except insertion loss (2-port). Insertion loss (2-port) requires Option 210.
   All measurements are available on N992xA analyzers with Option 305.

Vector voltmeter (VVM), Option 308

The performance listed in this section applies to the VVM mode capabilities available in the following models:
FieldFox microwave combination analyzers: N9913A, N9914A, N9915A, N9916A, N9917A, N9918A
FieldFox microwave vector network analyzers: N9925A, N9926A, N9927A, N9928A

Models	Frequency range
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

Built-in power meter, Option 310

The specifications in the sections that follow apply to these FieldFox analyzers:
FieldFox microwave combination analyzers: N9913A, N9914A, N9915A, N9916A, N9917A, N9918A
FieldFox microwave vector network analyzers: N9925A, N9926A, N9927A, N9928A

Models	Frequency range	
N9913A	100 kHz to 4 GHz	Usable to 5 kHz
N9914A	100 kHz to 6.5 GHz	Usable to 5 kHz
N9915A, N9925A	100 kHz to 9 GHz	Usable to 5 kHz
N9916A, N9926A	100 kHz to 14 GHz	Usable to 5 kHz
N9917A, N9927A	100 kHz to 18 GHz	Usable to 5 kHz
N9918A, N9928A	100 kHz to 26.5 GHz	Usable to 5 kHz

Amplitude accuracy

	Spec (23 ± 5 ºC)	Typical (23 ± 5 ºC)	Spec (-10 to 55 ºC)	Typical (-10 to 55 ºC)
100 kHz to 18 GHz	± 0.8 dB	± 0.35 dB	± 1.0 dB	± 0.50 dB
> 18 GHz to 26.5 GHz	± 1.0 dB	± 0.50 dB	± 1.2 dB	± 0.60 dB

General information

Calibration cycle	1 year
Weight	3.0 kg or 6.6 lbs including battery
Dimensions: H x W x D	292 x 188 x 72 mm 11.5″ x 7.4″ x 2.8″

Environmental

MIL-PRF-28800F Class 2	Operating temperature Storage temperature Operating humidity Random vibration Functional shock Bench drop
MIL-STD-810G, Method 511.5	Type tested and meets Procedure I requirements for operation in explosive environments
Altitude – operating	9144 m or 30,000 ft (using battery)
Altitude – non-operating	15,240 m or 50,000 ft
Complies with European EMC directive 2004/108/EC	IEC/EN 61326–1 CISPR Pub 11 Group 1, class B, Group 1 limit of CISPR 11:203/EN 55011:2007 AS/NZS CISPR 11 ICES/NMB–001
Battery	Lithium ion, 10.8 V, 4.6 A-h, 3.5 hours (typical)
Warranty	3-year warranty standard on all FieldFox instruments

Configuration information in brief

See the FieldFox Configuration Guide for complete information on all FieldFox products and accessories. http://cp.literature.agilent.com/litweb/pdf/5990-9836EN.pdf

| Model	Description	Test port connector
N9925A	FieldFox microwave vector network analyzer, 9 GHz	Type-N (f) test ports, 50 ohm
N9926A	FieldFox microwave vector network analyzer, 14 GHz	Type-N (f) test ports, 50 ohm
N9927A	FieldFox microwave vector network analyzer, 18 GHz	Type-N (f) test ports, 50 ohm
N9928A	FieldFox microwave vector network analyzer, 26.5 GHz	3.5 mm (m) test ports, 50 ohm

Options	Descriptions	Measurements /functions
Base unit for N9925/6/7/8A analyzers	Vector network analyzer – transmission and reflection	S11, S21 magnitude and phase
Option 211	Vector network analyzer – full 2-port S-parameters	Adds reverse S-parameters, S12 and S22, and full 2-port calibration
Option 010 (recommend Option 211)	Vector network analyzer time domain	Time domain and distance domain data Gating/windowing
Option 112	QuickCal	Calibration without using external calibration kit
Option 302	External USB power sensor support	Supports Agilent U2000 series power sensor
Option 305	Cable and antenna analyzer	Return loss, distance to fault, one port cable loss
Option 307	GPS receiver (receiver built-in, external antenna required)	Geo location information Lock internal reference to GPS
Option 308 (for A/B and B/A, requires Option 211)	Vector voltmeter	Cable trimming, 2-port transmission, A/B and B/A
Option 309	DC bias variable-voltage source	+1 to 32 VDC for external bias-tee and other devices
Option 310	Built-in power meter	Built-in power measurement, using the built-in receiver, without a power sensor

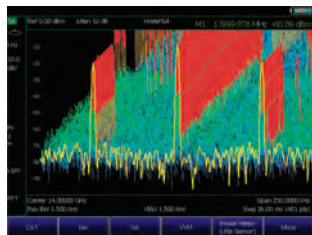*Spectrum analysis*
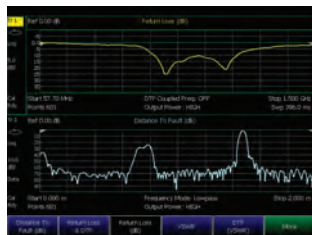
Cable and antenna analysis
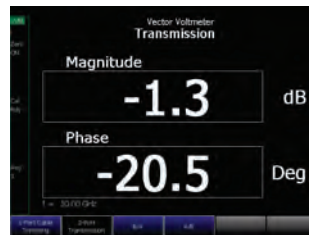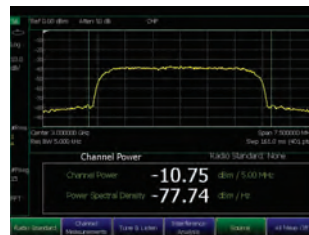

Vector voltmeter measurements

Built-in power meter

Vector network analysis

Interference analysis

Channel power measurement

Tracking generator

FieldFox analyzers

FieldFox	RF & microwave combination analyzers	Microwave vector network analyzers	Microwave spectrum analyzers
Model number	N9913/4/5/6/7/8A	N9925/6/7/8A	N9935/6/7/8A
Maximum frequency range	4, 6.5, 9, 14, 18, 26.5 GHz	9, 14, 18, 26.5 GHz	9, 14, 18, 26.5 GHz
Cable and antenna analyzer	✓	✓	VSWR and reflection
Vector network analyzer	✓	✓	
Spectrum analyzer, Interference analyzer	✓		✓
Tracking generator, Independent source	✓		✓
Vector voltmeter	✓	✓	
Built-in power meter	✓	✓	✓
Power meter with USB sensor	✓	✓	✓

Accessories

The accessories shown here are a subset of the available accessories.
For a complete list, visit www.agilent.com/find/n9910x

N9910X-704 Phase stable cable
- Type-N(m) to TNC(f)
- 13 GHz

N9910X-709 Phase stable cable
- 3.5 mm(f) to 3.5 mm(f)
- 26.5 GHz

N9910X-810 Phase stable cable
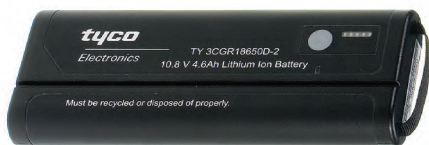- Type-N(m) to Type-N(m)
- 6 GHz

N9910X-845 Adaptor kit

N9910X-860 Fixed attenuator
- 40 dB
- 100 W
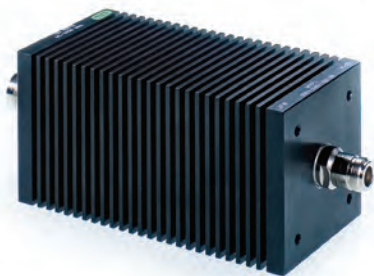
N9910X-870 Extra battery

N9910X-872 External battery charger

N990X-873 AC/DC adaptor

N9910X-874 Bias-tee

N9910X-875 DC car charger and adapter

N9910X-881 Hard transit case
- FieldFox fits inside hard transit case

N9910X-880 Soft transit case
- Comes standard with each FieldFox
- Includes backpack and shoulder straps

Accessories

The accessories shown here are a subset of the available accessories.
For a complete list, visit www.agilent.com/find/n9910x

N9910X-800 3-in-1
- OSL
- 6 GHz
- Type-N(m)
- 50 ohm

85515A 4-in-1
- OSLT
- 9 GHz
- Type-N(f)
- 50 ohm

85518A 4-in-1
- OSLT
- 18 GHz
- Type-N(m)
- 50 ohm

85519A 4-in-1
- OSLT
- 18 GHz
- Type-N(f)
- 50 ohm

85520A 4-in-1
- OSLT
- 26.5 GHz
- 3.5mm (m)
- 50 ohm

85521A 4-in-1
- OSLT
- 26.5 GHz
- 3.5mm (f)
- 50 ohm

N9910X-820 Directional antenna

N9910X-821 Telescopic whip antenna

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 Agilent's FieldFox microwave analyzers. They're equipped to handle routine maintenance, in-depth troubleshooting and anything in between. Better yet, FieldFox delivers Agilent-quality microwave measurements - wherever you need to go. Add FieldFox to your kit and carry precision with you.

Related literature	Number
FieldFox Handheld Analyzers, Brochure	5990-9779EN
FieldFox Spectrum Analyzers, Technical Overview	5990-9782EN
FieldFox Combination Analyzers, Technical Overview	5990-9780EN
FieldFox Handheld Analyzers, Data Sheet	5990-9783EN
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