

Keysight Technologies

A comparison of Keysight Network Analyzers for Applications < 3 GHz

Selection Guide

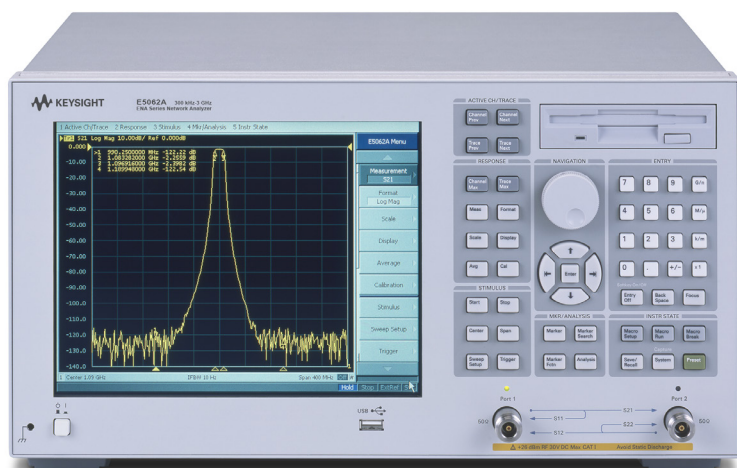
N9923A FieldFox RF Vector Network Analyzer, 2 MHz to 4/6 GHz

Keysight Technologies, Inc. handheld FieldFox RF vector network analyzer (VNA) is designed to make network analysis measurements in the field easier, convenient, and more reliable. For more information on FieldFox, visit www.keysight.com/find/fieldfox



E5062A ENA-L RF Vector Network Analyzer, 300 kHz to 1.5/3 GHz

Keysight's ENA-L VNA provides basic network analysis for a wide range of industries and applications. Designed to reduce tune and test times, the ENA-L provides increased throughput to improve measurement productivity. The affordably priced ENA-L is equipped with the core functions of the industry-standard ENA. For more information on the ENA family, visit www.keysight.com/find/ena



FieldFox N9923A versus the ENA-L E5062A

Parameter	FieldFox N9923A	ENA-L E5062A	Notes
Frequency range	2 MHz to 4 GHz	300 kHz to 3 GHz	A 6 GHz FieldFox and a 1.5 GHz ENA-L are also available, but this comparison is focused on the 4 GHz FieldFox versus the 3 GHz ENA-L. ENA-L has a lower start frequency (300 kHz versus 2 MHz).
Connector type	50 ohm	50 or 75 ohm	75-ohm measurements are possible with FieldFox, but two 50 to 75 ohm adapters are necessary (one for each port). With ENA-L, you can purchase a unit where the front panel connectors are 75-ohm Type-N.
Frequency resolution	1 Hz	1 Hz	
Measurements	S11, S21, S12, S22	S11, S21, S12, S22	The ENA-L is able to convert S-parameters into reflection impedance, transmission impedance, reflection admittance, transmission admittance, and 1/S.
Number of points	101, 201, 401, 601, 801, 1001	2 to 1601	FieldFox has discrete point settings, versus on ENA-L, you can select any value from 2 to 1601. With FieldFox, using SCPI, you can measure up to 10,001 points.
Formats	Log mag, lin mag, phase, Smith, polar, group delay, VSWR	Log mag, lin mag, phase, Smith, polar, group delay, VSWR, expanded phase, real, imaginary	ENA-L offers extended phase, which FieldFox does not.
System dynamic range	90 dB spec, 100 dB typical (300 Hz IFBW)	115 to 120 dB (10 Hz) spec, 130 dB typical	ENA-L has better dynamic range. The question for the user is whether FieldFox's 90 dB of specified dynamic range is sufficient or not. If your filter only has 60 dB stopband rejection, then both instruments work fine. If your filter has 95 dB rejection, then you will want the ENA-L. Parameter important for filter test.
0.1 dB Compression level	+10 dBm	+10 dBm	
IF bandwidths	300 Hz to 30 kHz	10 Hz to 30 kHz	

FieldFox N9923A versus the ENA-L E5062A (continued)

Parameter	FieldFox N9923A	ENA-L E5062A	Notes
Trace noise	0.008 dB rms (300 Hz IFBW)	0.005 to 0.008 dB rms (3 kHz)	Trace noise is important if you are measuring a low loss device (filter passband or low loss cable), and ENA-L has slightly better trace noise. Though both instruments' trace noise should be sufficient. If you have critical passband specs and very low loss (0.5 dB or less) in your passband and want the ultimate in trace noise AND measurement speed, this spec is important for you. You can always decrease trace noise by reducing your IFBW or averaging, but it costs you measurement speed in a FieldFox. Parameter important for filter and cable test.
Temperature stability	0.01 dB/°C	0.01 dB/°C	
Test port output power	+5 dBm or -40 dBm	-5 to +10 dBm, or -45 to +10 dBm with attenuator	FieldFox has two power settings: high and low. You cannot vary the power in between. Also, there is no ALC, but the power is quite stable at the test port. ENA-L's power can be varied over a 15 dB range without the step attenuator, and if you purchase the attenuator option, over a 55 dB range. This is useful for amplifier customers, who often need accurate control over their power. FieldFox's power settings are sufficient for go/no-go testing, but if you need to characterize an amplifier's performance, you may be better off using an ENA-L. For example, it's possible with FieldFox the high power setting (+5) compresses your amplifier, but the low setting (-40) results in too noisy of an isolation measurement. You can always use the high power setting (+5) with an external attenuator, but with ENA-L, that's not necessary. So for amplifier characterization, ENA-L is a better solution. Parameter important for amplifier cable test.
Sweep type	Linear	Linear, log, segment, power sweep	ENA-L has log, segment, and power sweep, which FieldFox does not. Segment sweep can be used to optimize time/dynamic range when testing filters. Power sweep is used for amplifier compression test. Parameter important for filter and amplifier test.

FieldFox N9923A versus the ENA-L E5062A (continued)

Parameter	FieldFox N9923A	ENA-L E5062A	Notes
Channels	1	4	<p>ENA-L has four independent channels. FieldFox has one. What this means is that with ENA-L, you can set one channel to measure 1 to 2 GHz, another 1.5 to 1.6 GHz, another a different frequency, etc. With FieldFox, they are all the same frequency setting. You can look at different traces, but not different frequencies or different stimulus. Sometimes filter manufacturers will set up the VNA to look at both broadband and narrowband at the same time. That's where the ENA-L model is useful. Or an amplifier manufacturers will set up one trace for frequency sweep to look at gain, and another channel for power sweep to look at compression.</p> <p>Significant non-RF difference.</p>
Traces	4	4 traces per channel	<p>With FieldFox, you can see up to 4 traces on the display. With ENA-L, you can view up to 16 total (4 traces x 4 channels)</p>
Markers	6	9 + 1 reference marker	<p>ENA-L has user-defined bandwidth markers, if you use this feature for filter 3-dB tests. FieldFox does not have it.</p> <p>Parameter important for filter test.</p>
Marker formats on Smith/Polar charts	Smith chart marker formats include: real+imag, mag+phase	Smith chart marker formats include: real+imag, linear mag+phase, log mag+phase, R+jx, G+jb.	<p>ENA-L offers admittance markers, which FieldFox does not.</p>
Marker search	Max, min	Max, min, peak, multi-peak, target, multi-target, width parameters with user-defined bandwidth values	<p>For filter manufacturers, the user-defined bandwidths offered by ENA-L can be useful. These are not offered by FieldFox.</p> <p>Parameter important for filter test.</p>
Trace statistics	No	Yes	
Limit lines	Yes	Yes	<p>ENA-L has more limit line capabilities. Specifically ENA-L allows for import and export to .csv files; allows limit line offsets for both mag and frequency; has ripple limit lines and bandwidth limit lines. FieldFox does not offer these features, but does have the basic limit line capability.</p> <p>Parameter important for filter test.</p>
Data savings	USB, SD, or internal	USB, internal, or 3.5 inch floppy drive	
Save formats	state, trace+state, picture(png), csv, S2P, S1P	state, trace+state, picture (png or jpg), csv	<p>With ENA-L, you need to use a macro to save a S2P or touchstone format file. The macro is provided for free and pre-loaded on all ENA-Ls. These features are part of FieldFox's standard firmware.</p>

FieldFox N9923A versus the ENA-L E5062A (continued)

Parameter	FieldFox N9923A	ENA-L E5062A	Notes
Triggering capabilities	Internal, external	Internal, external, manual, or bus trigger	
Direct printing	Cannot directly print. Need to save to USB or use PC software.	Yes	With FieldFox, you cannot directly print. You need to save the image or data to a USB stick (or internal drive), transfer to PC, and then print using your computer. With ENA-L, you can directly print using the parallel or USB port. Significant non-RF difference.
LXI compliance	No	Yes, class C only	
GPIB	No	Yes	FieldFox is programmable, but only over LAN. There is no GPIB connector. Significant non-RF difference.
SCPI programming	Yes	Yes	
COM programming inside the analyzer	No	Yes	
Floppy 3.5" drive	No	Yes	
Built-in visual basic	No	Yes	Significant non-RF difference.
USB ports	2	4	
LAN	Yes	Yes	
Handler I/O port	No	Yes	
Calibration types	Response, 1-port OSL, 2-port OSL (QSOLT and unknown thru), enhanced response, QuickCal, CalReady	Response, 1-port OSL, 2-port OSL, enhanced response	One of the unique capabilities of FieldFox is CalReady, which means at the test port, the analyzer has a 2-port cal. It comes calibrated from the factory. Also, QuickCal is an easy way to get very good measurements at the end of the cables. FieldFox also offers the unknown thru calibration, which allows users to test non-insertable devices (a male-male device) easily, without any degradation in accuracy. ENA-L does not support the unknown thru algorithm. ENA-L does have a factory calibration at the test port.
ECal	Not supported	Supported	The FieldFox family does not support the ECal modules, but offers QuickCal as a simple way to calibrate. Parameter important for filter, amplifier, and cable test
Interpolated error correction	Yes	Yes	

FieldFox N9923A versus the ENA-L E5062A (continued)

Parameter	FieldFox N9923A	ENA-L E5062A	Notes
Corrected performance for a type-N 50 ohm device			The corrected error terms and uncertainty values are listed here. ENA-L's corrected error terms are based on the 85032F cal kit. FieldFox's data is based on the N9910X T-cal kit. If you use the 85032F cal kit with FieldFox, you get the same results. Measurement uncertainty is not a differentiator when comparing these instruments. FieldFox offers the unknown thru calibration, which can improve measurement accuracy, when testing non-insertable devices.
Directivity	42 dB	46 to 49 dB	
Source match	36 dB	40 to 41 dB	
Load match	40 dB	46 to 49 dB	
Transmission tracking	0.02 dB	0.011 to 0.021 dB	
Reflection tracking	0.06 dB	0.015 to 0.018 dB	
Uncertainties, full 2-port Cal			
Assume S21: 2 dB	0.05 dB	0.08 dB	
Assume S21: 2 dB	0.4 degrees	0.6 degrees	
Assume S11: 10 dB	0.4 dB	0.3 dB	
Assume S11: 10 dB	2.5 degrees	2 degrees	
Electrical delay and phase offset	Available in the future	Yes	
Reference port extensions	Available as QuickCal	Yes, but not auto port extension	
Velocity factor	Yes, in CAT mode. Not in NA mode.	Yes	Parameter important for cable test.

FieldFox N9923A versus the ENA-L E5062A (continued)

Parameter	FieldFox N9923A	ENA-L E5062A	Notes
1 to 1.2 GHz, 30 kHz BW, uncorrected, 201 points	400 ms	68 ms	ENA-L is faster than FieldFox. However, many users find the speed of FieldFox sufficient for their needs, as the connection/disconnection time is more significant compared to the sweep time of the network analyzer. In other words, the network analyzer sweep speed is not the bottleneck; whether it's 1 second or 2 seconds makes no difference to them. These differences become critical if you are measuring high rejection devices, and need to lower your IFBW to 100 Hz, or are measuring many points, such as 1001, or have an automated system where VNA sweep speed is the bottle neck. For tuning applications, FieldFox's sweep speed is considered real-time. Significant non-RF difference.
Typical cycle time 1 to 1.2 GHz, 30 kHz IFBW, 201 points, 2-port cal	1 second	103 ms	
2 MHz to 3 GHz, 30 kHz BW, uncorrected, 201 points	400 ms	78 ms	
Absolute power measurements using power sensor	Yes, with option	No	
Vector voltmeter measurements	Yes	Yes	Both instruments address the needs of 8508A customers.
Weight	2.7 kg or 6.0 lbs	13.5 kg or 30 lbs	FieldFox is a handheld unit. ENA-L is a benchtop unit. Significant difference in weight, unit size, and display size. Significant non-RF difference.
Dimensions WxHxD	188 x 292 x 72 mm	425 x 221 x 314 mm	FieldFox is a handheld unit. ENA-L is a benchtop unit. Significant difference in weight, unit size, and display size. Significant non-RF difference.
Display size	6.5" LCD	10.4" LCD	FieldFox is a handheld unit. ENA-L is a benchtop unit. Significant difference in weight, unit size, and display size. Significant non-RF difference.
Touch screen	No	Yes (option)	Significant non-RF difference.

FieldFox N9923A versus the ENA-L E5062A (continued)

Parameter	FieldFox N9923A	ENA-L E5062A	Notes
VGA video output	No	Yes	With FieldFox, you can use PC software over LAN to view the display on a computer, but there is no direct VGA output. Significant non-RF difference.
Battery operated	Yes, 3.5 hours	No	FieldFox's battery can easily be replaced in the field. No tools necessary. ENA-L is an AC-powered unit. Needs to be plugged in. Significant non-RF difference.
Power usage	Battery operated, 14 W, External AC power adapter (115 VAC)	350 VA (AC power)	Significant non-RF difference.
Operating Environment			FieldFox is designed to be used outdoors and is rugged. Significant non-RF difference.
Operating temperature range	-10 to 50 °C	+5 to 40 °C	
Operating humidity	95% RH, 40 °C	20% to 80% RH, +29 °C	
Operating altitude	9144 m (30,000 ft)	2000 m (6561 ft)	
Operating vibration	2.6 G maximum, 5 to 500 Hz	0.5 G maximum, 5 Hz to 500 Hz	
Non-Operating Storage Environment			FieldFox is designed to be used outdoors and is rugged.
Non-operating temperature range	-51 to 71 °C	-10 to 60 °C	
Non-operating humidity	95% RH, 40 °C	20% to 90% RH, +40 °C	
Non-operating altitude	15,240 m (50,000 ft)	4572 m (15,000 ft)	
Non-operating vibration	Swept sine vibration: 1 G maximum, 5 Hz to 500 Hz random vibration: 3.41 G maximum, 5 to 500 Hz	0.5 G maximum, 5 Hz to 500 Hz	
Firmware upgrade	Easy using USB stick	Can use 4 3.5" floppy disks or USB stick	The firmware upgrade process is slightly more cumbersome with the ENA-L. However, most users should not have to upgrade firmware very often.

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