



Mini-Circuits

USB CONTROL | GUI & API

Vector Network Analyzer **eVNA-63+**

300 kHz to 6 GHz

Dynamic Range
132 dB typ

Trace Noise
0.005 dB rms typ

Output Power
-50 to +10 dBm

THE BIG DEAL

- Two-port, two-path S-parameter measurement instrument
- USB control with included GUI & API software
- Standard SCPI command-set for measurement automation
- High measurement speed and throughput
- Integrated bias-tee for active device measurement
- Time domain analysis & gating
- eMCal (electronic calibration) supported
- Port extension & de-embedding
- Touchstone s1p / s2p file import & export
- Offline simulation mode
- 3-year warranty



| | |
|------------|---------------|
| Model No. | eVNA-63+ |
| Case Style | VF3213 |
| Connectors | N-Type Female |

+RoHS Compliant

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

APPLICATIONS

- Production test systems
- RF & microwave product design
- University lab test benches
- Active/passive component characterization
- Antenna tuning / VSWR measurement
- Amplifier P1dB measurement

PRODUCT OVERVIEW

Mini-Circuits' eVNA-63+ is a high performance, software-controlled vector network analyzer (VNA). By moving the complex data processing and calculation required of vector network measurements out of the instrument and into an advanced software environment, Mini-Circuits is able to offer a fully-featured, cost effective VNA for every test bench. In applications where high throughput is needed, the eVNA-63+ used with a separate PC, completely replaces expensive and bulky production test systems saving on space and overall cost of ownership.

The product ships with Mini-Circuits' eVNA User Interface (UI) software, providing a powerful and intuitive control application which will feel familiar to any engineer with experience of legacy VNA instruments. The software also includes the eVNA Application Programming Interface (API) and support for a standardized SCPI command-set, allowing easy automation of VNA calibrations, measurements, trace displays and data exports from a wide range of programming environments.

Download the eVNA Studio software from www.minicircuits.com/WebStore/Vector-Network_Analyzer.html to explore the full eVNA measurement capabilities prior to purchase.





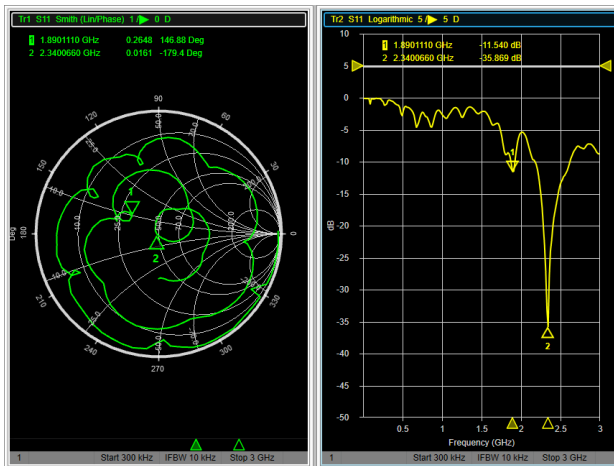
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Key Features

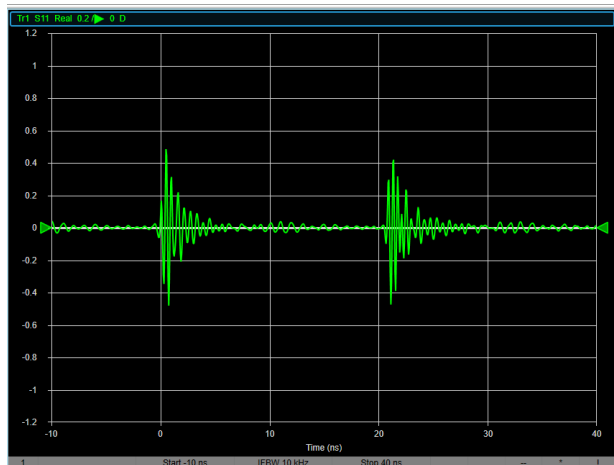


S2P MEASUREMENTS

Full characterization of 1 port and 2 port devices with options to analyze S11, S12, S21, S22 from a single sweep. Vector phase and magnitude data can be visualized in rectangular, Smith chart or polar plot formats, or exported as a Touchstone snp data file.

TIME DOMAIN ANALYSIS & GATING

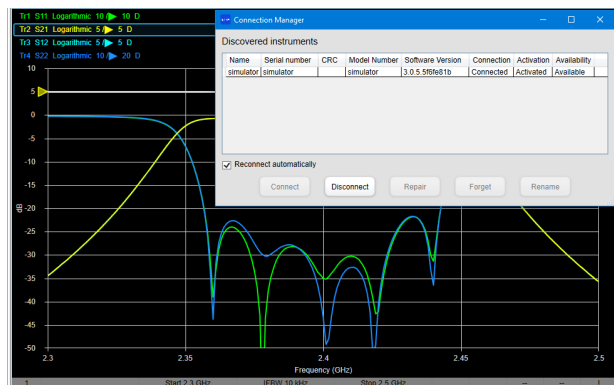
Extend measurement capabilities to include time domain transformation, allowing analysis of the time or distance to impedance changes and discontinuities in a transmission line. This is a highly versatile measurement technique that supports applications such as fault finding in cables (distance to fault & time to fault) and optimizing PCB assemblies (analysis of discontinuities at each stage of the circuit).



Time domain gating adds the ability to mathematically remove undesirable responses from a DUT or test fixture by isolating a section of the circuit that is at a known distance from the measurement port. For example, the effects of a poor connector transition on a test fixture can be easily removed with gating resulting in a more accurate device characterization. These powerful time domain capabilities are included in the eVNA UI software at no extra cost!

SIMULATION MODE

Work with a fully operational VNA with no up-front cost, hardware, or even a DUT (device under test). Connect to an internal simulator in the same way as you would connect to the real hardware and then explore the VNA's capability around a built-in band pass filter measurement. The software also accepts imported Touchstone s-parameter files to allow simulated vector network analysis of a wide range of RF components.



- Explore the full eVNA capability prior to purchase
- Educate yourself on proper VNA configuration and usage
- Design and practice measurement sequences in advance of DUT availability
- Visualize and interact with standard Touchstone s-parameter data files to properly analyze new RF component choices
- Mini-Circuits has 1000s of s-parameter files available on our website www.minicircuits.com

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FLEXIBLE USER CALIBRATION OPTIONS

Support for SOLT (Short, Open, Load, Thru) calibration methods with full calibration kits available for SMA and N-Type DUTs (see accessories). Use any industry standard SOLT calibration kit or define your own calibration standards.

eMCal, Mini-Circuits' electronic calibration standard will be available soon, providing a fully automated method for user calibration of the VNA, without the need for repeated connections of multiple components.

REMOTE API CONTROL & AUTOMATION

The eVNA system is comprised of the eVNA-63+ hardware connected by USB to a host PC with the eVNA UI software installed. The system can be automated using a series of standardized SCPI commands (familiar to users of other VNA models) from most common programming environments, including LabVIEW and Python. Automation programs can be created on the host PC or from a remote PC, connected to the host PC via a TCP / IP network.

```
File Edit Format Run Options Window Help
import socket

evna_ip = 'localhost' # IP address of the host PC (or localhost / 127.0.0.1)
evna_port = 5026 # eVNA requires port 5026

s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.settimeout(3) # Set timeout (seconds)

try:
    s.connect((evna_ip, evna_port)) # Connect the eVNA
    print('Connected:', evna_ip, evna_port)
    connected = 1
except socket.error:
    connected = 0 # Connection failed
    print('Could not connect:', evna_ip, evna_port, socket.error)

if connected == 1:

    eVNA_list = SCPI_Query('SYSTEM:DISCOVER?') # Find all eVNAs USB connected to
    eVNA_name = eVNA_list.split(',') # Comma separated list of eVNA names

    SCPI_Command('SYSTEM:CONNECT ' + eVNA_name[0]) # Connect a specific eVNA by name
    SCPI_Query('*IDN?') # Identify the connected eVNA
    SCPI_Command('SYSTEM:DISCONNECT') # Disconnect the active eVNA
```

INTERNAL BIAS-TEES

Two bias-tee inputs allow provision of up to +24V DC / 200 mA max on either measurement port (or both), ideal for powering amplifiers in-line for S₂₁ / P₁ dB characterization.

PORT EXTENSION / DE-EMBEDDING

Correct measurement results to exclude the effect of any test fixture by mathematically moving the reference planes up to the DUT input and output.



BANDWIDTH, LIMIT & RIPPLE TESTS

Automate common measurement activities with powerful marker functions, including filter bandwidth and ripple calculations, and display of pass / fail test results.

POWER SWEEP

Configure an automated power sweep sequence at a fixed frequency, ideal for measurement of linearity or compression of amplifiers and other 2 port devices. Calibrate the power accuracy with support for external USB power meters

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**DYNAMIC RANGE, CROSSTALK & NOISE FLOOR**

| Parameter | Conditions | Frequency (MHz) | Min | Typ | Max | Units |
|--|---|-----------------|-----|-------|-------|--------|
| Dynamic Range (Max Output Power - Noise Floor) | IF BW = 10 Hz | 0.3-1 | 108 | 116 | | dB |
| | | 1-10 | 122 | 132 | | |
| | | 10-200 | 125 | 132 | | |
| | | 200-2000 | 125 | 141 | | |
| | | 2000-4500 | 125 | 137 | | |
| | | 4500-6000 | 121 | 134 | | |
| Noise Floor | IF BW = 10 Hz; POUT = +10 dBm; averaging enabled (10 averages) | 0.3-1 | | -121 | -110 | dBm/Hz |
| | | 1-10 | | -129 | -117 | |
| | | 10-200 | | -126 | -117 | |
| | | 200-2000 | | -135 | -117 | |
| | | 2000-4500 | | -132 | -117 | |
| | | 4500-6000 | | -129 | -115 | |
| Crosstalk | Corrected performance | 0.3-1 | | -101 | -85 | dB |
| | | 1-10 | | -131 | -105 | |
| | | 10-200 | | -120 | -105 | |
| | | 200-2000 | | -124 | -110 | |
| | | 2000-4500 | | -128 | -112 | |
| | | 4500-6000 | | -131 | -115 | |
| Dynamic Accuracy Magnitude (Referenced to -10 dBm Rx Level) | Rx level = +5 to +10 dBm | 10-200 | | 0.35 | | dB |
| | | 200-6000 | | 0.15 | | |
| | Rx level = 0 to +5 dBm | 10-200 | | 0.25 | 0.5 | |
| | | 200-6000 | | 0.1 | 0.4 | |
| | Rx level = -20 to 0 dBm | 10-200 | | 0.1 | 0.4 | |
| | | 200-6000 | | 0.05 | 0.3 | |
| | Rx level = -34 to -20 dBm | 10-200 | | 0.15 | 0.45 | |
| | | 200-6000 | | 0.1 | 0.35 | |
| | Rx level = -50 to -34 dBm | 10-200 | | 0.2 | | |
| | | 200-6000 | | 0.15 | | |
| | Rx level = -60 to -50 dBm | 10-200 | | 0.25 | | |
| | | 200-6000 | | 0.2 | | |
| Trace Noise | Magnitude | 0.3-200 | | 0.004 | 0.009 | dB rms |
| | | 200-6000 | | 0.005 | 0.009 | |
| | Phase | 0.3-200 | | 0.02 | 0.05 | ° rms |
| | | 200-6000 | | 0.03 | 0.05 | |

**TEST PORT OUTPUT**

| Parameter | Conditions | Frequency (MHz) | Min | Typ | Max | Units |
|---------------------|-----------------------------|-----------------|------|-----|-----|-------|
| Output Power | Settable range | | -50 | | 10 | dBm |
| Max Output Power | Output level set to +10 dBm | 0.3-10 | | >4 | | dBm |
| | | 10-200 | 7 | 10 | | |
| | | 200-4500 | 7 | 10 | | |
| | | 4500-6000 | 6.5 | 9 | | |
| Power Accuracy | Output = 0 to +5 dBm | 5-6000 | -2.5 | ±1 | 2.5 | dB |
| | Output = -25 to 0 dBm | 0.3-6000 | -2.5 | ±1 | 2.5 | |
| Harmonic & Spurious | IF BW = 1 Hz Output ≤ 0 dBm | 0.3-200 | | -20 | | dBc |
| | | 200-6000 | | -30 | | |

MEASUREMENT SPEED (MS) [1]

Typical time per point. 1000 MHz-1200 MHz; One Path; Fast Sweep Mode; Display ON

| RBW (kHz) | Points | | |
|-----------|--------|------|-------|
| | 201 | 2001 | 20001 |
| 100 | 0.44 | 0.40 | 0.39 |
| 10 | 0.58 | 0.53 | 0.52 |
| 1 | 2.04 | 2.00 | 1.92 |

Typical time per point. 300 kHz-6 GHz (Full Span); One Path; Fast Sweep Mode; Display ON

| RBW (kHz) | Points | | |
|-----------|--------|------|-------|
| | 201 | 2001 | 20001 |
| 100 | 0.61 | 0.42 | 0.41 |
| 10 | 0.82 | 0.61 | 0.57 |
| 1 | 3.05 | 2.56 | 2.42 |

[1]. System Correction ON, User Correction OFF, S11, S21 traces displayed. Measurement time is typically doubled when measuring both directions and all four S-Parameters.

UNCORRECTED PERFORMANCE

System Correction: ON User Correction: OFF

| Frequency (MHz) | Directivity (dB) Typ. | Source Match (dB) Typ. | Load Match (dB) Typ. | Reflection Tracking (dB) Typ | Transmission Tracking (dB) Typ |
|-----------------|--------------------------|---------------------------|-------------------------|---------------------------------|-----------------------------------|
| 0.3-1 | -42 | -47 | -6 | ±0.1 | ±0.1 |
| 1-10 | -43 | -45 | -10 | ±0.1 | ±0.1 |
| 10-200 | -45 | -44 | -20 | ±0.1 | ±0.1 |
| 200-2000 | -40 | -38 | -14 | ±0.2 | ±0.2 |
| 2000-4500 | -35 | -34 | -12 | ±0.2 | ±0.2 |
| 4500-6000 | -32 | -32 | -10 | ±0.2 | ±0.3 |



Vector Network Analyzer

eVNA-63+**CORRECTED PERFORMANCE**

Conditions: IF BW = 1 kHz; using KSOLT-63-S+ cal kit with 2 ft cables; load match and transmission tracking values apply for insertable device calibrations

| Frequency (MHz) | Directivity (dB) | | Source Match (dB) | | Load Match (dB) | Reflection Tracking (dB) | Transmission Tracking (dB) |
|-----------------|------------------|-----|-------------------|-----|-----------------|--------------------------|----------------------------|
| | Typ | Max | Typ | Max | Max | Typ | Typ |
| 0.3-1 | -50 | -40 | -45 | -38 | -35 | ±0.06 | ±0.04 |
| 1-10 | -51 | -42 | -46 | -38 | -35 | ±0.07 | ±0.03 |
| 10-200 | -50 | -40 | -44 | -36 | -37 | ±0.07 | ±0.03 |
| 200-2000 | -48 | -37 | -41 | -33 | -36 | ±0.09 | ±0.02 |
| 2000-4500 | -39 | -36 | -40 | -30 | -33 | ±0.10 | ±0.04 |
| 4500-6000 | -39 | -36 | -38 | -29 | -32 | ±0.13 | ±0.06 |

CORRECTED PERFORMANCE

Conditions: IF BW = 1 kHz; using KSOLT-63-N+ cal kit with 2 ft cables; load Match and transmission tracking values apply for insertable device calibrations

| Frequency (MHz) | Directivity (dB) | | Source Match (dB) | | Load Match (dB) | Reflection Tracking (dB) | Transmission Tracking (dB) |
|-----------------|------------------|-----|-------------------|-----|-----------------|--------------------------|----------------------------|
| | Typ | Max | Typ | Max | Max | Typ | Typ |
| 0.3-1 | -50 | -40 | -45 | -39 | -36 | ±0.06 | ±0.04 |
| 1-10 | -51 | -42 | -45 | -38 | -36 | ±0.07 | ±0.03 |
| 10-200 | -50 | -40 | -43 | -37 | -37 | ±0.08 | ±0.03 |
| 200-2000 | -48 | -37 | -42 | -32 | -36 | ±0.11 | ±0.03 |
| 2000-4500 | -39 | -36 | -41 | -29 | -33 | ±0.13 | ±0.05 |
| 4500-6000 | -38 | -35 | -38 | -28 | -32 | ±0.18 | ±0.08 |

MAXIMUM RATINGS

| Parameter | Conditions | Frequency (MHz) | Min | Typ | Max | Units |
|-----------------------|-------------|-------------------|------|-----|----------|-------|
| Operating Temperature | | | 5 | | 50 | °C |
| Storage Temperature | | | -35 | | 75 | °C |
| Test Ports 1 & 2 | Input Power | 0.3-10 10-6000 | | | 15 20 | dBm |
| | DC Voltage | | | | 30 | V |
| Bias-Tee Input | Voltage | | -30 | | 30 | V |
| | Current | | -200 | | 200 | mA |
| Trigger Input | Voltage | | | | 5 | V |
| DC Supply | Voltage | | | 5 | 5.25 | V |
| | Current | | | 2 | 2.5 | A |



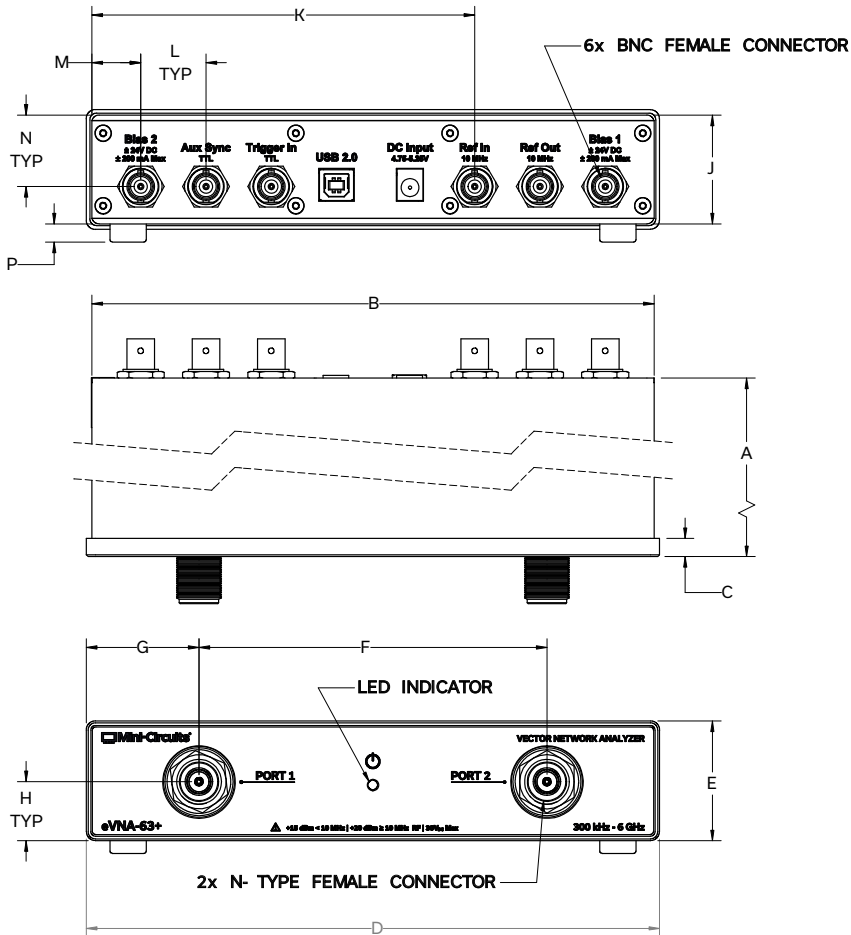
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OUTLINE DRAWING (VF3213)



| CASE# | A | B | C | D | E | F | G | H | J | K | L | M | N | P | WT. GRAMS |
|--------|------------------|-----------------|--------------|-----------------|----------------|-----------------|----------------|---------------|----------------|---------------|---------------|---------------|-------------|--------------|-----------|
| VF3213 | 10.02 (254.5) | 7.75 (196.9) | .25 (6.4) | 7.90 (200.7) | 1.65 (41.9) | 4.80 (121.8) | 1.55 (39.4) | .81 (20.7) | 1.50 (38.1) | 5.28 (134) | .90 (22.9) | .67 (17.1) | .98 (25) | .25 (6.4) | 2360 |

Dimensions are in inches (mm). Tolerances: 2 Pl. .03; 3 Pl. .015

CONNECTIONS

| Port Name | Description | Location | Connector Type |
|-----------------|-------------------------|-------------|---------------------------|
| Port 1, 2 | VNA Measurement Ports | Front Panel | N-Type Female, Brass |
| Bias 1, 2 | Bias Tee "DC" Ports | Rear Panel | BNC |
| Ref In, Ref Out | 10 MHz Reference In/Out | Rear Panel | BNC |
| Trigger In | External Trigger Input | Rear Panel | BNC |
| Aux Sync | Auxiliary Trigger | Rear Panel | BNC |
| USB 2.0 | USB Connection to PC | Rear Panel | USB type B |
| DC Input | Power Supply DC Input | Rear Panel | 2.5 x 5.5 x 9.5 mm barrel |

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Vector Network Analyzer **eVNA-63+**

RECOMMENDED MECHANICAL CALIBRATION KITS

KSOLT-63-N+

N-type mechanical calibration kit, comprising:

- Short / Open / Load standards (female)
- Short / Open / Load standards (male)
- Through standard (female to male)
- Through standard (male to male)
- Through standard (female to female)
- Torque wrench



KSOLT-63-S+

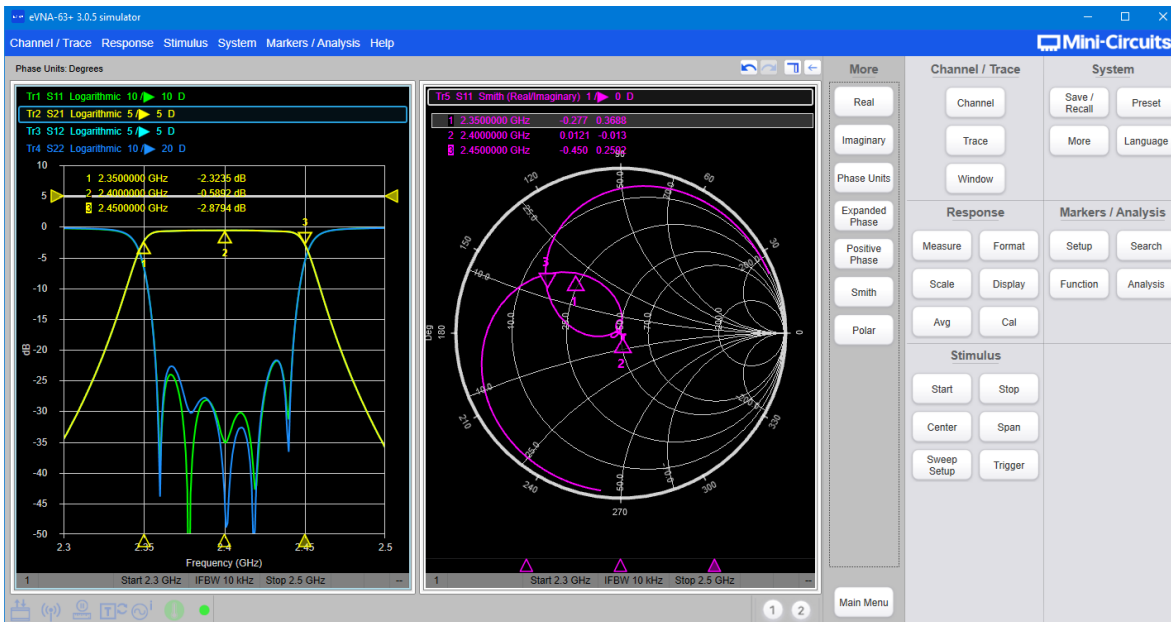
SMA mechanical calibration kit, comprising:

- Short / Open / Load standards (female)
- Short / Open / Load standards (male)
- Through standard (female to male)
- Through standard (male to male)
- Through standard (female to female)
- Torque wrench





EVNA SOFTWARE



MEASUREMENT AND DISPLAY CAPABILITIES

- Full two Port S-Parameters (S_{11} , S_{21} , S_{12} , S_{22})
- Absolute receiver quantities from reference and reflection receivers
- Up to 16 independent measurement channels
- Up to 16 display traces per channel
- Up to 9 markers per trace
- Store traces for recall or trace math operations: Data + Mem, Data - Mem, Data * Mem, Data / Mem
- Flexible trace format options: Log Mag, Phase (Deg), Phase (Rad), Group Delay, Lin Mag, SWR, Real, Imaginary, Unwrapped Phase, Positive Phase, Smith, Polar

• SWEEP STIMULUS

- Sweep Type: Lin Freq, Log Freq, Power, Segmented
- Sweep Mode: Normal or Fast
- Number of points: Up to 20,001
- IF Bandwidth: 1 Hz to 500 kHz
- Port Power Setting: -50 dBm to +10 dBm
- Power Slope Setting: -2 to +2 dB/GHz

ANALYSIS AND MARKER FUNCTIONS

- Marker Search: Max, Min, Peak, Target
- Marker Function: Set sweep and scaling settings using markers as reference

- Limit and Bandwidth Tests: Integrated Pass/Fail testing for Min/Max, ripple, and bandwidth limits
- Time Domain Transform: Lowpass and Bandpass Time Domain transform
- Time Domain Gating: Fixture De-Embedding using time-domain techniques

DATA EXPORT OPTIONS

- S-parameter File
- CSV trace data
- Trace screenshot
- Instrument / calibration / data states

CALIBRATION AND CORRECTION CAPABILITIES

- Response
- Enhanced Response
- 1-port SOL
- 2-Port SOLT
- Electronic Calibration
- Port Extension
- Power Calibration



Vector Network Analyzer **eVNA-63+**

SOFTWARE SPECIFICATIONS

SOFTWARE & DOCUMENTATION DOWNLOAD:

- Mini-Circuits' eVNA software package, user guide, programming manual and examples can be downloaded from www.minicircuits.com/softwaredownload/evna.html
- Please contact testsolutions@minicircuits.com for support

MINIMUM SYSTEM REQUIREMENTS:

| Parameter | Required |
|--------------------------------|----------------------------------|
| Interface | USB 2.0 or later |
| System Requirements (Host PC) | Windows 7, 10 |
| Test Port Input Power < 10 MHz | +15 dBm |
| Hardware | i3 CPU or equivalent 8 GB RAM |

APPLICATION PROGRAMMING INTERFACE (API)

The eVNA software suite incorporates an API which allows custom automation programs to be created for the eVNA. Most common programming environments are supported, including Python, LabVIEW, C# and MatLab.

SCPI CONTROL

eVNA-63+ supports a comprehensive set of SCPI control commands which should be familiar to anyone that has previously programmed with a VNA. These commands expose the full range of eVNA capabilities, from calibration to display configuration, to measurement, to data processing.

API CONTROL FROM THE HOST PC

The host PC has the eVNA software package installed and is connected by USB to the eVNA-63+. The API can be used to create custom automation programs running on the host PC, using SCPI commands to control the eVNA.

API CONTROL FROM A REMOTE PC

The complete eVNA system (host PC + eVNA software + eVNA-63+ instrument) can be configured to allow remote control over a network connection. The remote PC connects to the eVNA host PC using a TCP/IP connection and then has access to the full range of SCPI commands for eVNA control.



RECOMMENDED TEST ACCESSORIES

| Part No. | Cables |
|-------------------------------|--------------------------------------|
| CBL-2FT-NMNM+ | N Male to N Male, Precision Test |
| CBL-2FT-SMNM+ | N Male to SMA Male, Precision Test |
| CBL-2FT-SFNM+ | N Male to SMA Female, Precision Test |
| Part No. | Adapters |
| SF-SM50+ | Adapter SMA-M to SMA-F |
| SM-SM50+ | Adapter SMA-M to SMA-M |
| SF-SF50+ | Adapter SMA-F to SMA-F |
| NF-NM50+ | Adapter N-M to N-F |
| NM-NM50+ | Adapter N-M to N-M |
| NF-NF50+ | Adapter N-F to N-F |
| NF-SF50+ | Adapter N-F to SMA-F |
| NF-SM50+ | Adapter N-F to SMA-M |
| NM-SF50+ | Adapter N-M to SMA-F |
| NM-SM50+ | Adapter N-M to SMA-M |
| Part No. | Terminations |
| ANNE-50+ | Termination SMA Male |
| ANNEF-50+ | Termination SMA Female |
| KARN-50+ | Termination N Male |
| Part No. | Wrenches |
| TRQ-516-08 | SMA Torque Wrench |
| TRQ-N34-8 | N-Type Torque Wrench 3/4" 8 lb-in |
| TRQ-N20-8 | N-Type Torque Wrench 20 mm 8 lb-in |
| Part No. | Calibration Kits |
| KSOLT-63-S+ | SMA calibration kit |
| KSOLT-63-N+ | N-type calibration kit |
| Part No. | Connector Gauges |
| ACUDIAL-SMA | SMA connector gauge kit |
| ACUDIAL-N | N-type connector gauge kit |










Vector Network Analyzer **eVNA-63+**

ORDERING INFORMATION

Price and availability: www.minicircuits.com

| Model | Description |
|----------|-----------------------------------|
| eVNA-63+ | USB Vector Network Analyzer 6 GHz |

| Included Accessories | Part No. | Description |
|---|---------------|---|
|  | AC/DC-5-3W | AC/DC 24 VDC Grounded Power Adaptor. Operating temperature: 0°C to +40°C, I _{MAX} =4A |
| See Below | CBL-3W-XX | AC Power Cord (Select one power cord from below with each Switch Matrix box) |
|  | USB-CBL-AB-3+ | 2.7 ft (0.8 m) USB Cable: USB type A(Male) to USB type B(Male) |

| AC Power Cords ⁵ | Part No. | Description |
|---|-----------|------------------------------------|
|  | CBL-3W-US | Power Cord for United States |
|  | CBL-3W-EU | Power Cord for Europe |
|  | CBL-3W-UK | Power Cord for United Kingdom |
|  | CBL-3W-AU | Power Cord for Australia and China |
|  | CBL-3W-IL | Power Cord for Israel |

5. If you need a Power cord for a country not listed please contact testsolutions@minicircuits.com

OPTIONAL ACCESSORIES

| | |
|----------------|--|
| USB-CBL-AB-3+ | 2.7 ft (0.8 m) USB Cable: USB type A(Male) to USB type B(Male) |
| USB-CBL-AB-7+ | 6.8 ft (2.1 m) USB Cable: USB type A(Male) to USB type B(Male) |
| USB-CBL-AB-11+ | 11 ft (3.4 m) USB Cable: USB type A(Male) to USB type B(Male) |

NOTES

- Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the standard. Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp