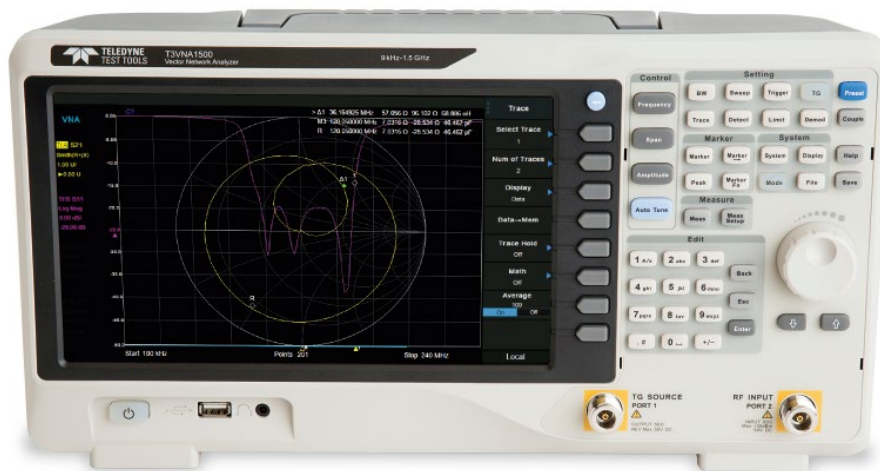


T3VNA Data Sheet

1.5 GHz and 3.2 GHz Vector Network Analyzers

Broad Measurement Range

Frequency Range: 9 kHz to 3.2 GHz



Tools for Improved Debugging

- Vector Network Analyzer, Spectrum Analyzer and Distance To Fault modes.
 - -161 dBm/Hz Displayed Average Noise Level (Typ.)
 - -98 dBc/Hz @ 10 kHz Offset Phase Noise (1 GHz, Typ.)
 - Optional EMI Pre-compliance Test Kit
Optional Modulation Analysis Mode
 - Built-in switchable pre-amplifier.
 - 10.1 inch (25.65 cm) color WVGA 1024 x 600 display.
 - USB Device, USB Host and LAN support.

 - ✔ More application coverage from a single instrument.
 - ✔ View and measure very small signals.
 - ✔ Improved specification gives more accurate measurement results.
 - ✔ Make EMI Receiver measurements to CISPR 16-1-1
Add Vector Signal Modulation Analysis measurements.
 - ✔ Integrated pre-amplifier allows higher sensitivity measurements.
 - ✔ Clear and flexible display aids ease of use.
 - ✔ Remote control your measurements.

Key Specifications

Model	T3VNA1500	T3VNA3200
Vector Network Analyzer Frequency Range	10 MHz to 1.5 GHz	100 kHz to 3.2 GHz
Spectrum Analyzer Frequency Range	9 kHz to 1.5 GHz	9 kHz to 3.2 GHz
Resolution Bandwidth	1 Hz to 1 MHz	1 Hz to 1 MHz
Displayed Average Noise Level	-156 dBm/Hz	-161 dBm/Hz
Phase Noise	< -98 dBc/Hz	< -98 dBc/Hz
Total Amplitude Accuracy	< 1.2 dB	< 0.7 dB

PRODUCT OVERVIEW

Teledyne Test Tools T3VNA family of Vector Network Analyzers consists of models with various Vector Network Analysis frequency ranges from as low as 100 kHz up to 3.2 GHz and Spectrum Analysis frequency range from 9 kHz up to 3.2 GHz depending on model. The small footprint and easy user interface is augmented by a high performance specification with many advanced measurement functions and capabilities.

The high performance Vector Network Analysis capability is enhanced further by the full featured Spectrum Analysis capability. Options can be added to further extend its measurement capability.

- Optional EMI Pre-compliance test kit: Add EMI Receiver Measurements following CISPR 16-1-1.
- Optional Digital Modulation Analysis function of ASK, FSK, MSK, PSK, QAM.
- Optional Analog Modulation Analysis function of AM and FM.

Teledyne Test Tools vector network analyzers offers comprehensive measurement capabilities even in the base units. The enhancement options support the user when conducting more complex measurements and make daily measurement tasks easier and faster.

Typical Applications

- Research Laboratory
- Development Laboratory
- Repair and Maintenance
- Calibration Laboratory
- Automatic Production Test
- General bench-top use

User-friendly Design

- 10.1 inch (25.65 cm) 1024*600 display
- Intuitive, easy to use menu system
- "Preset" and "Auto Tune" for quick set up
- Built-in front panel accessible help system
- File management (support for U-disc and local storage)
- Lightweight, small footprint, easy to transport

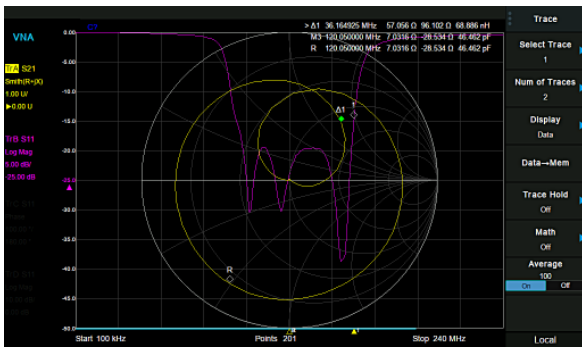
Features and Benefits

- Vector Network Analyzer Frequency Range from 100 kHz up to 3.2 GHz
- Spectrum Analyzer Frequency Range from 9 kHz up to 3.2 GHz
- -161 dBm/Hz Displayed Average Noise Level (Typ.)
- -98 dBc/Hz @ 10 kHz Offset Phase Noise (1 GHz, Typ.)
- Total Amplitude Accuracy < 0.7 dB
- 1 Hz Minimum Resolution Bandwidth (RBW)
- All-Digital IF Technology
- Standard Preamplifier
- Distance to fault capability using VNA time domain analysis
- Up to 3.2 GHz Tracking Generator Kit
- Built-in Advanced Measurement capability (CHP, ACPR, OBW, CNR, TOI, etc)
- EMI Pre-compliance Test Kit (Opt.)
- 10.1 Inch WVGA (1024 x 600) Display

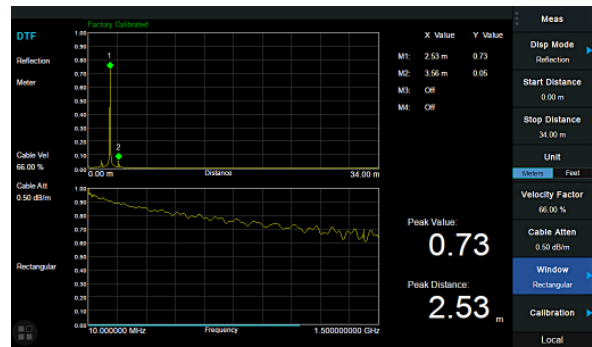


DESIGN FEATURES

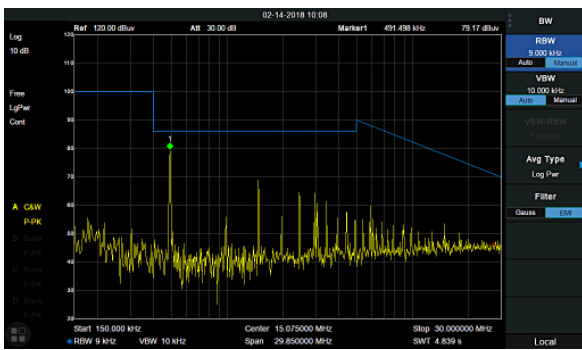
Vector Network Analyzer Mode with multi-format overlay display



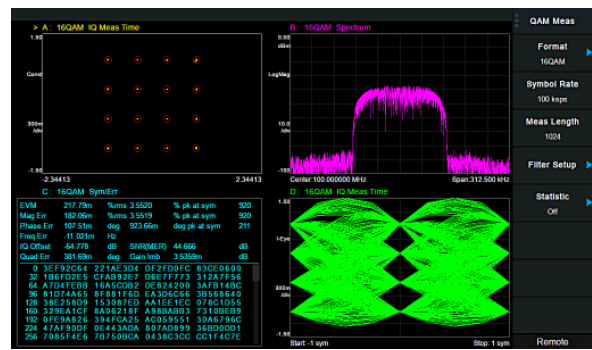
Distance to Fault Mode based on time domain analysis



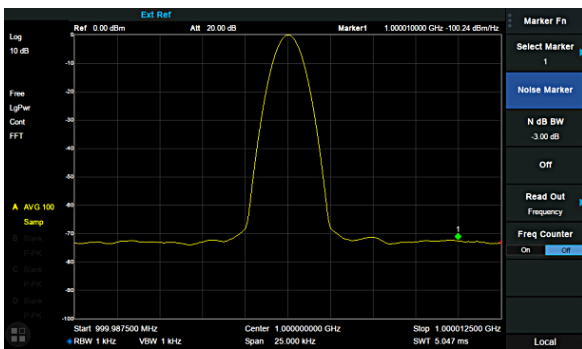
Optional CISPR 16-1-1 EMI filter and Quasipeak Detector



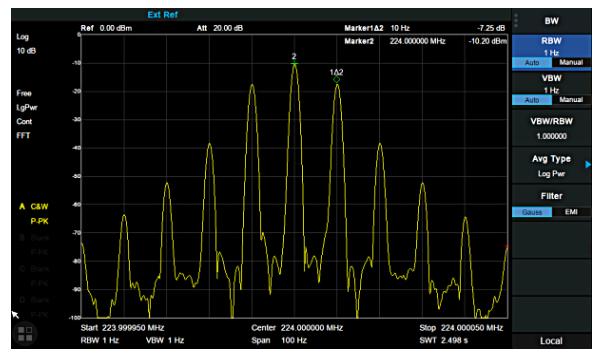
Optional Vector Signal Modulation Analysis Modes



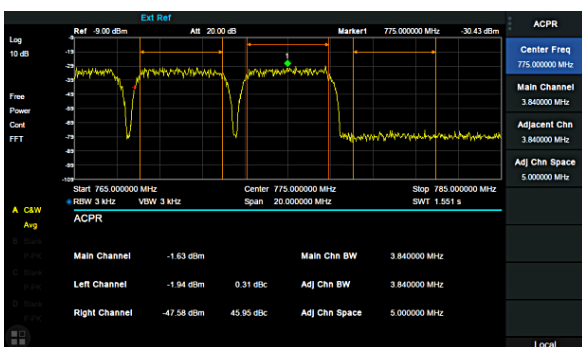
Phase noise -98 dBc/Hz @1 GHz, offset 10 kHz



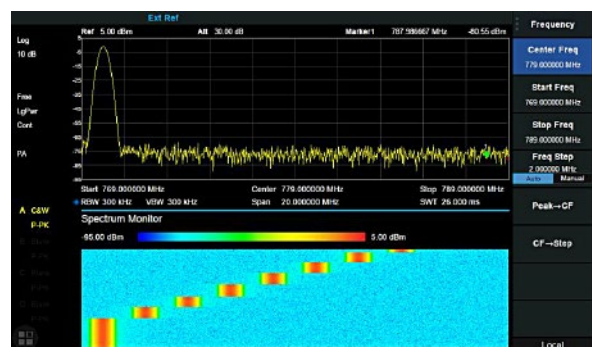
Minimum 1 Hz Resolution Bandwidth



Adjacent Channel Power Ratio (ACPR) in advanced measurement mode



2D Time – Frequency spectrogram in advanced measurement mode



DESIGN FEATURES

	T3VNA1500	T3VNA3200
Vector Network Analyzer Frequency Range	10 MHz – 1.5 GHz	100 kHz – 3.2 GHz
Spectrum Analyzer Frequency Range	9 kHz – 1.5 GHz	9 kHz – 3.2 GHz
Resolution Bandwidth	1 Hz – 1 MHz	1 Hz – 1 MHz
Displayed Average Noise Level	-156 dBm/Hz	-161 dBm/Hz
Phase Noise	<-98 dBc/Hz	<-98 dBc/Hz
Total Amplitude Accuracy	< 1.2 dB	< 0.7 dB
Tracking Generator	5 MHz – 1.5 GHz	100 kHz – 3.2 GHz
Touch Screen	Multi Touch, Mouse and Keyboard supported	
Advanced Measurement	CHP, ACPR, OBW, CNR, Harmonic, TOI, Monitor	
Vector Network Analysis	Vector S11, Vector S21	
Distance to Fault	VNA Timing Domain Analysis	
Modulation Analysis	AM, FM, ASK, FSK, MSK, PSK, QAM	
EMI Test	EMI Filter and Quasi-Peak Detector, Log Scale and Limit Line	
Communication Interface	LAN, USB Device, USB Host(USB-GPIB)	
Remote Control Capability	SCPI/Labview/IVI based on USB-TMC/VXI-11/Socket/Telnet	
Remote Controller	NI-MAX, Web Browser, File Explorer	

SPECIFICATIONS

Specifications are valid under the following conditions:

The instrument is within the calibration period, has been stored between 0 and 50 °C for at least 2 hours prior to use, and has been powered on and warmed up for at least 40 minutes. The specifications include the measurement uncertainty, unless otherwise noted.

Specifications: The T3VNA1500 and T3VNA3200 are guaranteed to meet published specifications when operating at room temperature (approximately 25 °C), unless otherwise noted.

Typical: Performance deemed typical implies that 80 percent of the measurement results will meet the typical published performance with a 95th percentile confidence level at room temperature (approximately 25 °C). Typical performance is not warranted and does not include measurement uncertainty.

Nominal: The expected performance or design attribute.



SPECIFICATIONS

Vector Network Analyzer Mode

	T3VNA1500	T3VNA3200
Stimulus and Measurement		
Frequency Range	10 MHz – 1.5 GHz	100 kHz – 3.2 GHz
Measurement	S11, S21	S11, S21
IFBW	10 kHz	10 kHz
Port1 Stimulus Power	0 dBm (Nom.)	-5 dBm (Nom.)
Format	Lin Mag, Log Mag, Phase, Group Delay, SWR, Smith Chart (Lin/Phase, Log/Phase, Real/Imag, R+j*X, G+j*B), Polar Chart (Lin/Phase, Log/Phase, Real/Imag)	
Sweep Points	101 – 751, default 201	
Trace	4 traces, Mem, Math, Hold, Overlay	
Marker	(6 + Ref) * 4 traces	
Calibration		
Directivity of Calibration	S11, Log mag, Average = 50, >50MHz	
Dynamic Range	> 40 dB	
	S21, IFBW = 10 kHz, Port1 level = -5 dBm, Log Mag, Average = 50	
	100 kHz – 10 MHz	75 dB
	10 MHz – 1.5 GHz	80 dB
	1.5 GHz – 3.2 GHz	80 dB
Trace Noise	10 kHz RBW, Log mag, Average = 50, >10 MHz	
	0.1 dB	
Calibration	Full 1-Port(OSL), Open Response, Short Response Response Through, Enhanced Response,	
Mechanical Calibration Kit	Open, Short, Load, Through; User Cal Kit	
Port Extensions	Port 1, Port 2, Auto Open Port 1	
System Z0	50 Ω	
Velocity Factor	0.1 – 1	

Spectrum Analyzer Mode

Frequency		
Frequency range	9 kHz – 1.5 GHz	9 kHz – 3.2 GHz
Frequency resolution	1 Hz	
Frequency Span		
Range	0 Hz, 100 Hz to Max Frequency	
Accuracy	± Span / (number of display points - 1)	
Internal Reference Source		
Reference frequency	10.000000 MHz	
Reference frequency accuracy / uncertainty	± [(time since last adjustment × frequency ageing rate) + temperature stability + initial calibration accuracy]	
Initial calibration accuracy	<1 ppm	
Temperature stability	<1 ppm/year, 0°C – 50°C	
Frequency aging rate	<0.5 ppm/first year, 3.0 ppm/20 years	
Marker		
Marker resolution	Span / (number of display points - 1)	
Marker uncertainty	± [frequency indication × reference frequency uncertainty + 1% × span + 10% × resolution bandwidth + marker resolution]	
Freq Counter resolution	0.01 Hz	
Bandwidths		
Resolution bandwidth (-3 dB)	1 Hz – 1 MHz, in 1-3-10 sequence	1 Hz – 3 MHz, in 1-3-10 sequence
Resolution filter shape factor	< 4.8 : 1 (60 dB : 3 dB), Gaussian-like	
RBW uncertainty	<5 %	
Video bandwidth (-3 dB)	1 Hz – 3 MHz, in 1-3-10 sequence	1 Hz – 10 MHz, in 1-3-10 sequence
VBW uncertainty	<5 %	

SPECIFICATIONS

	T3VNA1500	T3VNA3200
Sweep and Trigger		
Sweep time	1 ms to 1500 s	1 ms to 3200 s
Sweep mode	RBW = 30 Hz – 1 MHz, Sweep RBW = 1 Hz – 10 kHz, FFT	
Sweep rule	Single, Continuous	
Trigger source	Free, Video, External	
External trigger	5 V TTL level, Rising edge/Falling edge	

Amplitude Accuracy and Range Specifications

Amplitude and Level		
Measurement range	DANL to +10 dBm, 100 kHz – 1 MHz, preamplifier off DANL to +20 dBm, 1 MHz – 3.2 GHz, preamplifier off	
Reference level	-200 dBm to +30 dBm, 1 dB steps	
Preamplifier	20 dB (nom.)	
Input attenuation	0 – 30 dB, 1 dB steps	0 – 50 dB, 1 dB steps
Maximum input DC voltage	+/- 50 V _{DC}	
Maximum average power	30 dBm, 3 minutes, f _c ≥ 10 MHz, attenuation > 20 dBm, preamp off	
Maximum damage level	33 dBm, f _c ≥ 10 MHz, attenuation > 20 dBm, preamp off	

Displayed Average Noise Level (DANL)		
	20°C to 30°C, attenuation = 0 dB, sample detector, trace average > 50, Normalized to 1 Hz, TG off	
Preamp off	100 kHz – 1 MHz	-101 dBm, -107 dBm (typ.)
	1 MHz – 10 MHz	-124 dBm, -130 dBm (typ.)
	10 MHz – 200 MHz	-128 dBm, -134 dBm (typ.)
	200 MHz – 1.5 GHz	-121 dBm, -127 dBm (typ.)
	1.5 GHz – 3.2 GHz	-126 dBm, -132 dBm (typ.)
Preamp on	100 kHz – 1 MHz	-120 dBm, -128 dBm (typ.)
	1 MHz – 10 MHz	-147 dBm, -152 dBm (typ.)
	10 MHz – 200 MHz	-150 dBm, -156 dBm (typ.)
	200 MHz – 1.5 GHz	-142 dBm, -148 dBm (typ.)
	1.5 GHz – 3.2 GHz	-145 dBm, -149 dBm (typ.)

SSB Phase Noise		
	20°C to 30°C, f _c = 1 GHz, Normalized to 1 Hz	
10 kHz offset	< -95 dBc/Hz, < -99 dBc/Hz (typ.)	< -95 dBc/Hz, < -98 dBc/Hz (typ.)
100 kHz offset	< -96 dBc/Hz, < -98 dBc/Hz (typ.)	< -96 dBc/Hz, < -97 dBc/Hz (typ.)
1 MHz offset	< -115 dBc/Hz, < -120 dBc/Hz (typ.)	< -115 dBc/Hz, < -117 dBc/Hz (typ.)

Level Display	
Logarithmic level axis	1 dB to 200 dB
Linear level axis	0 to reference level
Units of level axis	dBm, dBmV, dBμV, dBμA, Volt, Watt
Number of display points	751
Number of traces	4
Trace detectors	Positive-peak, Negative-peak, Sample, Normal, Average(Voltage/RMS/Video), Quasi-peak
Trace functions	Clear write, Max Hold, Min Hold, View, Blank, Average, Math

Frequency Response	
	20°C to 30°C, 30% to 70 % relative humidity, att = 20 dB, relative to f _c = 50 MHz
Preamp off	±0.8 dB, ±0.4 dB (typ.)
Preamp on	±1.2 dB, ±0.5 dB (typ.)

SPECIFICATIONS

	T3VNA1500	T3VNA3200
Error and Accuracy		
Resolution bandwidth switching uncertainty	Logarithmic resolution, relative to RBW = 10 kHz ± 0.2 dB (nom.)	
Input attenuation switching uncertainty	20°C to 30°C, fc = 50 MHz, preamp off, relative to att = 20 dB ± 0.5 dB	
Absolute amplitude accuracy	20°C to 30°C, fc = 50 MHz, RBW = VBW = 1 kHz, att = 20 dB, peak detector, 95 % reliability ±0.4 dB, input signal -20 dBm, Preamp off ±0.6 dB, input signal -40 dBm, Preamp on	
Total amplitude accuracy	20°C to 30°C, fc >100 kHz, input signal -50 dBm – 0 dBm, att = 20 dB, RBW = VBW = 1 kHz, peak detector, preamp off, 95 % reliability ±1.2 dB	
RF input VSWR	Att = 10 dB, >1 MHz <1.5 (nom.)	±0.7 dB

Distortion and Spurious Responses		
Second harmonic distortion (SHI)	20°C to 30°C, fc ≥ 50 MHz, mixer level -20 dBm, att = 0 dB, preamp off -65 dBc / +45 dBm (nom.)	
Third-order intercept (TOI)	20°C to 30°C, fc ≥ 50 MHz, two -20 dBm tones spaced by 100 kHz, att = 0 dB, preamp off +10 dBm (typ.)	
1 dB gain compression	20°C to 30°C, fc ≥ 50 MHz, att = 0 dB, preamp off > -5 dBm (nom.)	
Residual response	20°C to 30°C, input terminated = 50 Ω, att = 0 dB < -90 dBm	
Input related spurious	20°C to 30°C, mixer level = -30 dBm < -65 dBc	

Tracking Generator

Frequency Parameter		
Frequency Range	5 MHz – 1.5 GHz	100 kHz – 3.2 GHz
Frequency resolution	1 Hz, Zero Span	
RBW	100 Hz – 1 MHz, sweep mode	
Power Parameter		
Output level	-20 dBm – 0 dBm	
Output level resolution	1 dB	
Output flatness	+/-3 dB (nom.)	
Normalization Trace	Ref A/B/C/D → Ref	
VSWR	< 2 (nom.)	
Connector and Impedance	N-type female, 50 Ω	
Average safe reverse power	Total : 30 dBm (1 W)	
Maximum safe reverse level	Voltage: ±50 V _{DC}	

EMI Filter and Quasi-Peak Detector Kit (Option T3VNA-EMI)

Measurement	
EMI filter RBW (-6 dB)	200 Hz, 9 kHz, 120 kHz, 1MHz (following CISPR 16-1-1)
Detector	Peak, Average, RMS, Quasi-peak (following CISPR 16-1-1)
QPD Dwell time	0 μs – 10 s
Frequency axis	Linear, Logarithmic
EMI Receiver Software	EasySpectrum EMI pre-compliance test software

SPECIFICATIONS

Analog Modulation Analysis (Option T3VNA-AMA)

	T3VNA1500	T3VNA3200
AM		
Modulation rate range	20 Hz to 100 kHz	
Accuracy	1 Hz (nom.)	Modulation rate < 1 kHz
	< 0.1 % modulation rate (nom.)	Modulation rate ≥ 1 kHz
Modulation depth range	5 % to 95 %	
Accuracy	±4 % (nom.)	
FM		
Modulation rate range	20 Hz to 200 kHz	
Accuracy	1 Hz (nom.)	Modulation rate < 1 kHz
	< 0.1 % modulation rate (nom.)	Modulation rate ≥ 1 kHz
Frequency deviation	1 kHz to 400 kHz	
Accuracy	±4 % (nom.)	

Digital Modulation Analysis (Option T3VNA-DMA)

Measurement	
Modulation Type	ASK: 2ASK; FSK: 2, 4, 8, 16 level; MSK: GMSK; PSK: BPSK, QPSK, OQPSK, 8PSK; DPSK: DBPSK, DQPSK, D8PSK, $\pi/4$ -DQPSK, $\pi/8$ -D8PSK; QAM: 16, 32, 64, 128, 256
Meas Length	16 to 4096
Points/Symbol	4, 6, 8, 10, 12, 14, 16
Symbol Rate	1 kspss to 2.5 Msps, Symbol Rate* Points/Symbol ≤ 10 Msps
Filter	
Meas/Ref Filter	Nyquist, Sqrt Nyquist, Gauss, Half Sine, Rectangular
Length	2 to 128
Alpha/BT	Alpha 0.01 – 1, BT 0.01 – 10
Trace	
Trace Data	IQ Meas Time, IQ Meas Spectrum, IQ Ref Time, IQ Ref Spectrum, Time, Spectrum, Symbol Error Chart, Err Vector Time, Err Vector Spectrum, IQ Mag Err, IQ Phase Err,
Layout	Single, Stacked 2, Grid 1 2, Grid 2*2
Trace Formats	Log mag, Lin mag, Real, Imag, I-Q, Constellation, I-sys, Q-eye, Wrap Phase, Unwrap Phase, Trellis eye
Symbol Error Chart	
PSK/DPSK/MSK/QAM	EVM (rms EVM, peak EVM), Magnitude error, Phase error, IQ offset, Carrier offset, SNR Quadrature error, Gain imbalance (no support for MSK),
ASK	ASK Error, ASK depth, carrier offset
FSK	FSK Error, Magnitude error, FSK deviation, carrier offset

SPECIFICATIONS

Advanced Measurements

	T3VNA1500	T3VNA3200
Power Measurement		
CHP, Channel Power	Channel Power, Power Spectral Density	
ACPR, Adjacent Channel Power Ratio	Main CH Power, Left channel power, Right channel power	
OBW, Occupied Bandwidth	Occupied Bandwidth, Transmit Frequency Error	
T-Power, Time Domain Power	Zero Span Integrated Power	
CNR, Carrier Noise Ratio	C/N, Noise Power	
Non-Linear Measurement		
Harmonic measurement	Max Harmonic number 10	
TOI, Third-Order Intercept	Measure the third-order products and intercepts from two tones	
Spectrum Monitor Measurement		
Spectrogram		

Distance to Fault Mode

Measurement		
Frequency Range	10 MHz – 1.5 GHz	100 kHz – 3.2 GHz
Maximum Distance (meters)	$(76800 \times \text{Velocity Factor}) / (\text{stop freq} - \text{start freq (MHz)})$	
Resolution (meters)	$(150 \times \text{Velocity Factor}) / (\text{stop freq} - \text{start freq (MHz)})$	
Windows	Rectangular, Hamming	
Calibration	Full 1-Port (OSL)	
Velocity Factor	0.1 – 1	

Modulation Analysis Mode

Common Parameter		
Frequency range	2 MHz to 1.5 GHz	2 MHz to 3.2 GHz
Carrier Power Accuracy	± 2 dB (nom.)	
Carrier Power Range	-30 dBm to +20 dBm (nom.)	
Recording		
Data Packing	I = Q = 4 Byte	
Memory	60 MByte	
Length (IQ pairs)	7.5 Msample (60 MB / 8 B)	
Length (Time units)	Samples / (Span \times 1.25)	
PC Software	Analysis and Playback in Easy VSA Software	
Playback	Easy VSA, Easy IQ	

SPECIFICATIONS

External input and external output

	T3VNA1500	T3VNA3200
Front panel RF input, Port 2	50 Ω, N-female Front	
Front panel TG output, Port 1	50 Ω, N-female Front	
10 MHz reference output	A 10 MHz, >0 dBm, 50 Ω, BNC-female	
10 MHz reference input	B 10 MHz, -5 dBm to +10 dBm, 50 Ω, BNC-female	
External Trigger input	C 10 kΩ, 5 V TTL , BNC-female	
Security	D Kensington Lock point	

Communication Interface

USB Host	USB-A 2.0
USB Device	E USB-B 2.0
LAN	F LAN (VXI11), 10/100 Base, RJ-45

General Specification

Display	TFT LCD, 1024 × 600 (waveform area 751 × 501), 10.1 inch (25.65 cm)	
Storage	Internal (Flash) 256 MByte, External (USB storage device) 32 GByte	
Source	Input voltage range (AC) 100 V – 240 V, AC frequency supply 50/60 Hz or 100 – 120V 400 Hz, Power consumption 35 W	
Temperature	Working temperature 0°C to 40°C, Storage temperature -20°C to 70°C	
Humidity	90 % RH up to 30°C; derates to 50 % at 50°C	
Dimensions	393 mm × 207 mm × 116.5 mm (W × H × D)	
Weight	T3VNA1500 4.30 kg (9.5 lb)	T3VNA3200 4.40 kg (9.7 lb)
Warranty	3 years return to Teledyne LeCroy	

Electromagnetic Compatibility and Safety

EMC	EN 61326-1:2013
Electrical safety	EN 61010-1:2015



Ordering Information

Product Description	T3VNA Vector Network Analyzer	Order Number
Product code	Vector Network Analyzer, 9 kHz – 1.5 GHz Vector Network Analyzer, 9 kHz – 3.2 GHz	T3VNA1500 T3VNA3200
Standard configurations	A Quick Start, A USB Cable, A Calibration Certificate, Power cord, Calibration Kit, Utility Kit	
EMI Options	EMI Measurement Kit: EMI Filter and Quasi Peak Detector	T3VNA-EMI
	Near Field Probe: H field probe set, 30 MHz – 3.0 GHz (4 H Field Probes: 25 mm, 10 mm, 5 mm, 2 mm)	T3SA3000-NFP
	Near Field Probe: H / E field probe set, 300 kHz – 3.0 GHz (3 H Field Probes: 20 mm, 10 mm, 5 mm) (1 E Field Probe: 5 mm)	T3NFP3
Modulation Analysis Options	Digital Modulation Analysis: ASK, FSK, MSK, PSK, QAM	T3VNA-DMA
	Analog Modulation Analysis: AM, FM	T3VNA-AMA

ABOUT TELEDYNE TEST TOOLS



Company Profile

Teledyne LeCroy is a leading provider of oscilloscopes, protocol analyzers and related test and measurement solutions that enable companies across a wide range of industries to design and test electronic devices of all types. Since our founding in 1964, we have focused on creating products that improve productivity by helping engineers resolve design issues faster and more effectively. Oscilloscopes are tools used by designers and engineers to measure and analyze complex electronic signals in order to develop high-performance systems and to validate electronic designs in order to improve time to market.

The Teledyne Test Tools brand extends the Teledyne LeCroy product portfolio with a comprehensive range of test equipment solutions. This new range of products delivers a broad range of quality test solutions that enable engineers to rapidly validate product and design and reduce time-to-market. Designers, engineers and educators rely on Teledyne Test Tools solutions to meet their most challenging needs for testing, education and electronics validation.

Location and Facilities

Headquartered in Chestnut Ridge, New York, Teledyne Test Tools and Teledyne LeCroy has sales, service and development subsidiaries in the US and throughout Europe and Asia. Teledyne Test Tools and Teledyne LeCroy products are employed across a wide variety of industries, including semiconductor, computer, consumer electronics, education, military/aerospace, automotive/industrial, and telecommunications.

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16apr20

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Largest Supplier of Electrical and Electronic Components

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