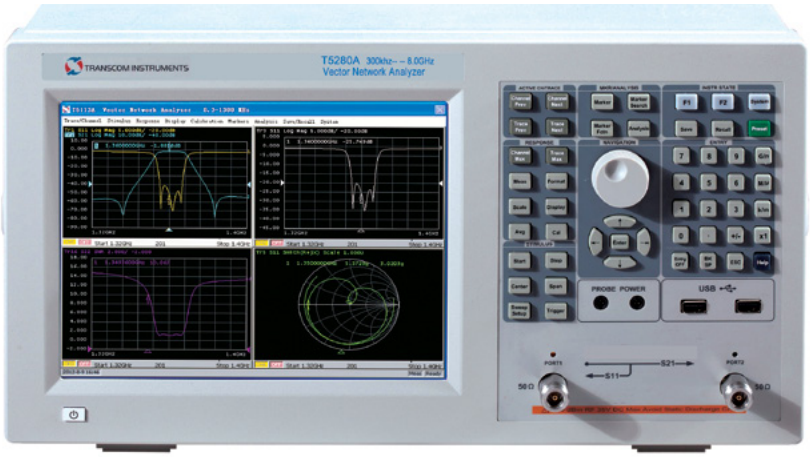
Datasheet

Vector Network Analyzers T - Series



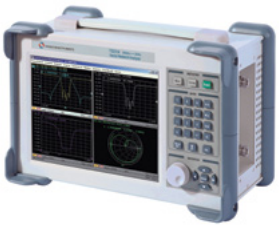
- Wide dynamic range 130 dB typ.
- Low noise level < -120 dBm
- Low trace noise 1 mdB rms
- High measurement speed 125µs/point
- High effective directivity > 45 dB
- Remote control LAN/GPIB/USB

The T-Series high performance VNAs have large dynamic range, low noise level and low trace noise. Their frequencies cover all bands of wireless communication. These VNAs are widely used in microwave device measurement in wireless communication, broadcast, television devices, radar devices, semi conductors and many more. T5215A, T5230A and T5280A are bench-top instruments highly suitable for indoor testing. They are used in production lines, RF laboratories and universities. T5216A, T5231A and T5281A are their respective portable versions, which are specifically designed for field testing. Both bench-top and portable share the same set of specifications.

Models

Model	Frequency Range	Type	Dimensions (in mm)	Weight (in kg)
T5215A	300 kHz to 1.3 GHz	Bench-top	440 x 231 x 360	12.5
T5216A	300 kHz to 1.3 GHz	Portable	350 x 220 x 150	7.1
T5230A	300 kHz to 3.0 GHz	Bench-top	440 x 231 x 360	12.5
T5231A	300 kHz to 3.0 GHz	Portable	350 x 220 x 150	7.1
T5280A	300 kHz to 8.0 GHz	Bench-top	440 x 231 x 360	12.5
T5281A	300 kHz to 8.0 GHz	Portable	350 x 220 x 150	7.1

T5215A



T5231A

T5280A

RF & Microwave Technology

AWT-Global provides advanced telecommunication technology products and analyzers for a variety of RF and Microwave applications.

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Technical Specifications

Measurement Range	
Impedance	50 Ω, 75 Ω[1]
Test port connector	N-type (f)
Number of test ports	2
Frequency range: T5215A, T5216A T5230A, T5231A T5280A, T5281A	 300 kHz to 1.5 GHz 300 kHz to 3.0 GHz 300 kHz to 8.0 GHz
Full CW frequency accuracy	+/- 5 x 10^{-6}
Frequency resolution	1 Hz
Measurement points	2 to 10001
Measurement bandwidths	1 Hz to 30 kHz (in 1/ 1.5/ 2/ 3/ 5/ 7 steps)
Dynamic range	130 dB/135 dB typ. (IFBW=10Hz)

[1] With 75 Ω adapter

Measurement Accuracy	
Accuracy of transmission measurements (magnitude/phase)	
+5 to +15dB	0.2 dB / 2°
-50 to +5 dB	0.1 dB / 1°
-70 to - 50 dB	0.2 dB / 2°
-90 to - 70 dB	1.0 dB / 6°
Accuracy of reflection measurements (magnitude/phase)	
-15 to 0 dB	0.4 dB / 3°
-25 to -15 dB	1.5 dB / 7°
-35 to -25 dB	4.0 dB / 22°
Trace stability	
Trace noise magnitude	1 mdB rms (IFBW = 3 kHz)
Temperature dependence	0.02 dB
(per one degree of temperature variation)	

Test Port Output	
Match (w/o system error correction)	18 dB
Power range: 300 kHz to 1.5 / 3.0 / 6.0 GHz 6.0 GHz to 8.0 GHz *System dependent	 -55 dBm to +10 dBm -60 dBm to +5 dBm
Power accuracy	+/- 1.5 dB
Power resolution	0.05 dB
Harmonics distortion	< -25 dBc
Non harmonics distortion	< -30 dBc

Test Port Input	
Match (w/o system error correction)	18 dB
Damage level	+26 dBm
Maximum DC voltage	+35 V
Noise level	< -120 dBm (IFBW = 10 Hz)

Effective System Data[1]	
Effective directivity	45 dB
Effective source match	40 dB
Effective load match	45 dB

[1] Applies over the temperature range of 23 °C +/- 5°C after 40 minutes of warming-up, with less than 1°C deviation from the full two-port calibration temperature, at output power of -5 dBm and IF bandwidth 10 Hz

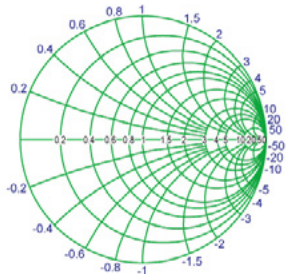
Measurement Speed	
Measurement time per point	125 µs
Source to receiver port switch overtime	<10 ms
Typical cycle times versus number of measurement points (IFBW = 30kHz)	51, 201, 401, 1601
Uncorrected (start 300 kHz, Stop 10MHz)	13.1, 51.3, 102.3, 408.3 (ms)
Full two-port calibration (start 300 kHz, stop 10 MHz)	45.5, 122.0, 230.5, 840.5 (ms)
Uncorrected (start 10 MHz, stop 8 GHz)	6.5, 21.1, 40.5, 157.7 (ms)
Full two-port calibration (start 10 MHz, stop 8 GHz)	32.4, 61.7, 100.3, 333.0 (ms)

General Data	
Display	10.4 inch TFT color LCD, touch screen
External Trigger input connector	BNC (f), input level range: 0 to +5V
External reference frequency	BNC (f), 10MHz, 2 dBm +/- 2 dB
VGA video output	15-pin mini D-sub; (f); driving the VGA compatible monitors
GPIB connector (optional)	24-pin D-sub (type D-24) (f); compatible with IEEE -488
USB connector	(f) provides connection to printer, ECal module, USB storage
LAN connector	10/100/1000 Base T Ethernet, 8-pin configuration
Operating temperature	+5° to +40°C
Storage temperature	-45° to +55°C
Humidity (max.)	90% (25°C)
Atmospheric pressure	84 to 106.7 kPa
Calibration Interval	2 years
Power Supply	110 to 240V (AC), 50/60 Hz
Power Consumption	60 W
Dimensions (W x H x D) in mm	
Bench-top / Portable	440 x 231 x 360 / 330 x 220 x 150
Weight	
Bench-top / Portable	12.5 kg / 7.1 kg

Technical Specifications

Measurement Capabilities

Measure parameters	S_{11}, S_{12}, S_{21}, S_{22}
Measurement Channels	Up to 16 independent logical channels. Each logical channel is epresented on the screen as an individual channel window. A logical channel is defined by such stimulus signal settings as frequency rang, number of test points, power level, etc.
Data traces	Up to 16 data traces can bedisplayed in each channel window. A data trace represents one of such parameters of the DUT as S-parameters, response in time domain, input power response.
Memory traces	Each of the 16 data traces can be saved into memory for further comparison with the currrent values.
Data display formats	Logarithmic magnitude, linear magnitude, phase, expanded phase, group delay, SWR, real and imaginary parts, Smith chart diagram and polar diagram.



Smith Chart Format

Trace Functions

Trace Display	Data trace, memory trace or simultaneous indication of data and memory traces.
Trace math	Data trace modification by math operations: addition, subtraction, multiplication or division, of measured complex values and memory data.
Autoscaling	Automatic selection of scale division and reference level value to have the trace most effectively displayed.
Electrical delay	Calibration plane moving to compensate for the delay in low-less tests setup. Compensation for electrical delay in a DUT during measurements of deviation from linear phase.
Phase offset	Phase offset defined in degrees
Statistics	Calculation and display of mean, standard deviation and peak-to-peak deviation for a data trace.

Data Analysis

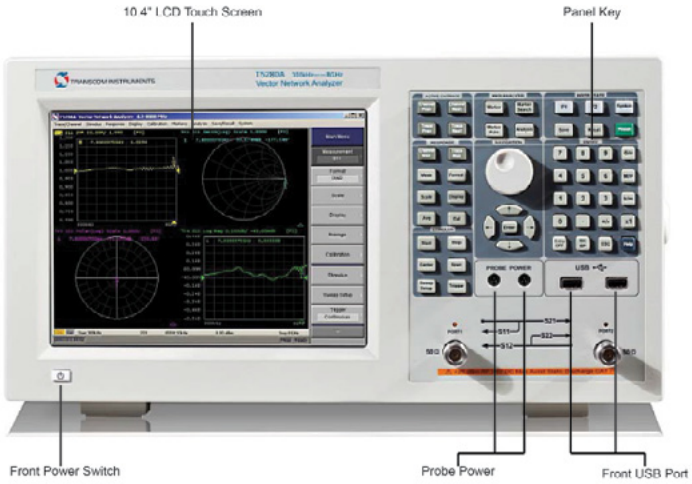
Port impedance conversion	The function of conversion of the S-parameters measured at 50 Ω port into the values, which could be determined if measured at a test port with an arbitrary impedance.
De-embedding	The function allows to mathematicaly exclude from the measurements result the effect of the future circuit connected between the calibration plane and the DUT. This circuit should be described by an S-parameter matrix in a Touchstone file
Embedding	The function allows to mathematically simulate the DUT parameters after virtual integration of a fixturecircuit between the calibration plane and the DUT. This circuit should be described by an S-parameter matrix in a Touchstone file.
S-parameter conversion	The function allows conversion of the measured S-parametersto the following parameter. reflection impedance and admittance, transmission impedance and admittance and inverse S-parameters.
Time domain transformation	The function performs data transformation from frequency domain into response of the DUT to various stimulus types in time domain. Modeled stimulus types: bandpass, lowpass impulse, and lowpass step.Time domain span is set by the user arbitrarily from zero to maximum, which is determined by the frequency step. Windows of various forms are used for better tradeoff between resolution and level o spurious sidelobes.
Time domain gating	The function mathematically removes unwanted response in time domain what allows for obtaining frequency response without influence from the fixture elements. The function applies reverse transformation
Limit Test	The limit test is a function to perform the pass/fail judgment based on the limit line you set in the limit table. In limit test, if the measured value is within the upper or lower limits indicated by the limit lines, the result is pass; if it is exceeded, the result is fail for all measurment points on the trace. Measure ment points in the stimulus range with no limit lines are consider pass.
Ripple Test	The ripple test is a function for evaluating the results on a pass/fail basis based on the ripple limit,which is set using the ripple limit table. You can specify up to 12 frequency bands, which permits a test for each frequency band.

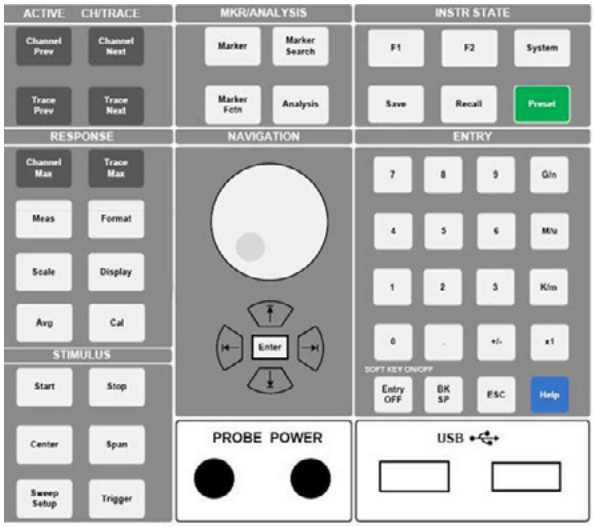
Technical Specifications

Accurracy Enhancement

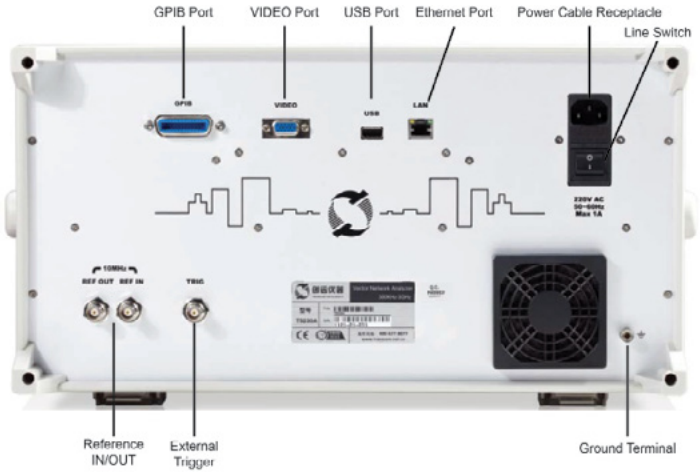
Calibration	Calibration of a test setup (which includes the Analyzer, cables and adapters) significantly increases the accuracy of measurements. Calibration allows for correction of the errors caused by imperfections in the measurement system: system directivity, source and load match, tracking and isolation.
Calibration methods	The following calibration methods with various sophistication and accuracy enhancement level are available: - reflection and transmission normalization - full one-port calibration - one-path two-port calibration - full two-port calibration
Reflection and transmission	Magnitude and phase correction of normalizationfrequency response errors for reflection or transmission measurements.
Full one-port calibration	Magnitude and phase correction of frequency response, correction of directivity and source match errors for one-port reflection measurments.
One-path two-port calibration	Calibration for reflection and one way transmission measurements. Similar to one-port calibration for reflection measurements. Magnitude and phase correction of frequency response and correctionof source match errors for transmission measurements.
Full two-port calibration	Calibration for full S-parameter matrix measurement of a DUT. Magnitude and phase correction of frequency response directivity, source match, load match and isolation. Isolation calibration can be omitted.
Directivity calibration (optional)	Correction of directivity additional to the reflection normalization.
Isolation callibration (optional)	Correction of isolation additional to the transmission normalization, one path two-port calibration or full two-port callibration.
Error correction interpolation	When the user changes the settings such as start/stop frequencies and number of sweep points, which are different from the settings at the time of calibration interpolation or extrapolation of the calibration coefficients will be applied.

Front and Rear Panels, Screen





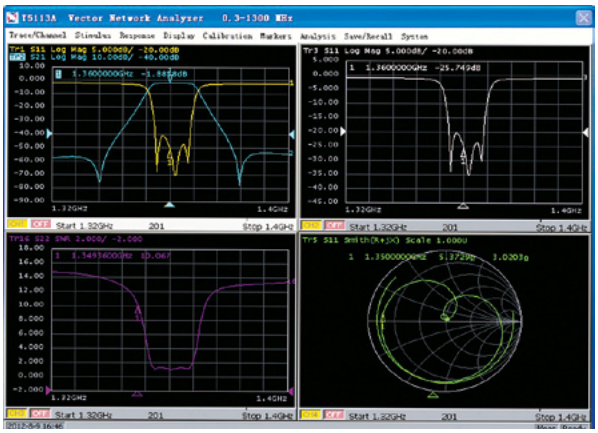
Front Panel Buttons



Technical Specifications

Marker Functions	
Data markers	Up to 16 markers for each trace. Reference marker available for delta marker operation. Smith chart diagram supports 5 marker formats: linear magnitude/phase, log magnitude/phase, real/imaginary, R + jX and G + jB Polar diagram supports 3 marker formats: linear magnitude/phase, log magni tude/phase, and real/imaginary.
Reference marker	Enables indication of any maker values as relative to the reference marker.
Marker search	Search for max, min, peak or target values on trace.
Marker search additional features	User-definable search range. A function for specific condition tracking or single operation search.
Setting parameters by markers	Setting of start, stop and center frequencies by the stimulus value of the marker and setting of reference level by the response value of the marker.
Marker math functions	Statistics, bandwidth
Statistics	Calculation and display of mean,standard deviation and peak-to-peak in a frequency range limited by two markers on a trace.
Bandwidth	Determines the bandwidth between cutoff frequency points of an active marker or absolute maximum. The bandwidth value, center frequency, upper and lower frequencies, Q value and insertion loss are displayed.

Sweep Features	
Measured points per sweep	Set by the user from 2 to 10001
Sweep type	Linear frequency sweep, logarithmic frequency sweep and segment frequency sweep, when the stimulus power is a fixed value, and linear power sweep when frequency is a fixed value.
Segment sweep features	A frequency sweep within several independent user-defined segments. Frequency range, number of sweep points, source power and IF Bandwidth should be set for each segment.
Power	Source power from -55 dBm to +10 dBm with resolution of 0.05 dB. In frequency sweep mode the power slope can be set up to 2 dB/GHz for compensation of high frequency attenuation in connection wires.
Sweep trigger	Trigger modes: continuous, single, hold Trigger sources: internal, manual, external



10.4" LCD Touch Screen

Order Information

Model	Description
T5215A	T-Series Vector Network Analyzer, 2 port, Frequency Range 300 kHz to 1.3 GHz, Bench-top, Dimensions 440 mm x 231 mm x 360 mm, Weight 12.5 kg
T5216A	T-Series Vector Network Analyzer, 2 port, Frequency Range 300 kHz to 1.3 GHz, Portable,Dimensions 350 mm x 220 mm x 150 mm, Weight 7.1 kg
T5230A	T-Series Vector Network Analyzer, 2 port, Frequncy Range 300 kHz to 3.0 GHz, Bench-top, Dimensions 440 mm x 231 mm x 360 mm, Weight 12.5 kg
T5231A	T-Series Vector Network Analyzer, 2 port, Frequency Range 300 kHz to 3.0 GHz, Poratble, Dimensions 350 mm x 220 mm x 150 mm, Weight 7.1 kg
T5280A	T-Series Vector Network Analyzer, 2 port, Frequency Range 300 kHz to 8.0 GHz, Bench-top Dimensions 440 mm x 231 mm x 360 mm, Weight 12.5 kg
T5281A	T-Series Vector Network Analyzer, 2 port, Frequency Range 300 kHz to 8.0 GHz, Portable, Dimensions 350 mm x 220 mm x 150 mm, Weight 7.1 kg

Accessories

Model	Description
TCAL3N	VNA Calibration Kit, DC-3 GHz, N-Connectors, 50 Ohms, SOL N(f), SOL N(m), THROUGH N(f)-N(f), THROUGH N(m)-N(m)
TCAL9N	VNA Calibration Kit, DC - 9 GHz, 50 Ohms, N-Connectors, SHORT N(f) & N(m), OPEN N(f) & N(m), LOAD N(f) & N(m), THROUGH N(f)-N(f) & N(m) - N(m)
TCAL9S	VNA Calibration Kit, DC - 9 GHz, 50 Ohms, SMA-Connectors, SOL SMA(f), SOL SMA (m), THROUGH SMA(f)-SMA(f), THROUGH SMA(m)-SMA(m)
TCAB-PN6N	Phase Noise Test Cable, DC-6GHz, 50 Ohms, 1m, N(m)-N(m), VSWR 1.1:1
TCAB-PN6NS	Phase Noise Test Cable, DC-6GHz, 50 Ohms, 1m, N(m)-SMA(m), VSWR 1.1:1
TCAB-PN18N	Phase Noise Test Cable, DC-18GHz, 50 Ohms, 1m, N(m)-N(m)
TCAB-PN18NS	Phase Noise Test Cable, DC-18GHz, 50 Ohms, 1m, N(m)-SMA(m)
TVNASW	ATE Software for remote controlling VNAs
T5-RM	VNA Rack Mount Kit for T5215, T5230, T5280
T5-FH	VAN front Handle Kit for T5215, T5230, T5280

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