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# T3SA3100 / T3SA3200 Data Sheet

## 2.1 GHz and 3.2 GHz Spectrum Analyzers

### Broad Measurement Range

#### Frequency Range: 9 kHz to 2.1 GHz / 3.2 GHz



### Tools for Improved Debugging

- Frequency Range from 9 kHz to 3.2 GHz. ✔ More application coverage from a single Spectrum Analyzer.
- -161 dBm/Hz Displayed Average Noise Level (Typ.) ✔ View and measure very small signals.
- -98 dBc/Hz @10 kHz Offset Phase Noise (1 GHz, Typ.) ✔ Improved specification gives more accurate measurement results.
- Optional Tracking Generator  
Optional EMI Pre-compliance Test Kit  
Optional Reflection Measurement Kit ✔ Make fast and simple transmission measurements  
Make EMI Receiver measurements to CISPR 16-1-1  
Measure VSWR, Return Loss, Reflection Coefficient
- Built-in switchable pre-amplifier. ✔ Integrated pre-amplifier allows higher sensitivity measurements.
- 10.1 inch (25.65 cm) color WVGA 1024 x 600 display. ✔ Clear and flexible display aids ease of use.
- USB Device, USB Host and LAN support. ✔ Remote control your measurements.

### Key Specification

Model	T3SA3200	T3SA3100
Frequency Range	9 kHz ~ 3.2 GHz	9 kHz ~ 2.1 GHz
Resolution Bandwidth	1 Hz ~ 1 MHz, in 1-3-10 sequence	1 Hz ~ 1 MHz, in 1-3-10 sequence
Displayed Average Noise Level	-161 dBm/Hz, Normalize to 1 Hz (typ.)	-161 dBm/Hz, Normalize to 1 Hz (typ.)
Phase Noise	< -98 dBc/Hz@1 GHz, 10 kHz offset	< -98 dBc/Hz@1 GHz, 10 kHz offset
Amplitude Precision	< 0.7 dB	< 0.7 dB



# PRODUCT OVERVIEW

**Teledyne Test Tools T3SA3000 Spectrum Analyzer range consists of models with frequency ranges from 9 kHz to 2.1 GHz or 9 kHz to 3.2 GHz. The small footprint and easy user interface is augmented by a high performance specification with many advanced measurement functions and capabilities.**

The high performance Spectrum Analysis capability can be enhanced further with options to extend it's measurement capability.

- Optional Tracking Generator: Adds tracking generator capabilities to your Spectrum Analyzer to make transmission measurements on back planes, cables, filters, amplifiers, etc.
- Optional EMI Pre-compliance test kit: Add EMI Receiver Measurements following CISPR 16-1-1.
- Optional Reflection Measurement Kit: Adds VSWR, Return Loss and Reflection Coefficient measurements.
- Optional Advanced Measurement kit: Adds channel power, adjacent channel power ratio, time domain power, occupied bandwidth, third order intercept, etc, to further enhance the measurement capability of your spectrum analyzer.

Teledyne Test Tools spectrum analyzers offer 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

- 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
- Up to 3.2 GHz Tracking Generator Kit (Opt.)
- Reflection Measurement Kit (Opt.)
- Advanced Measurement Kit (Opt.)
- EMI Pre-compliance Test Kit (Opt.)
- 10.1 Inch WVGA (1024 x 600) Display

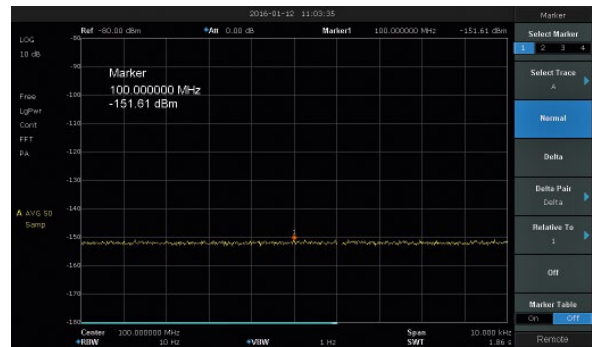


# DESIGN FEATURES

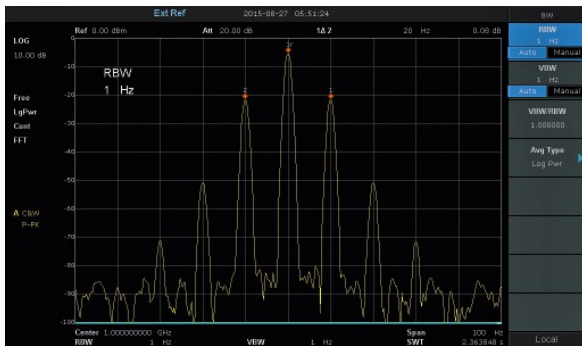
## Supports four independent traces and cursors



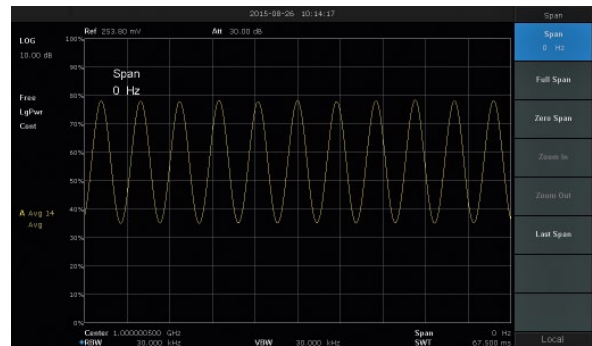
## -151 dBm Displayed Average Noise Level (RBW = 10 Hz)



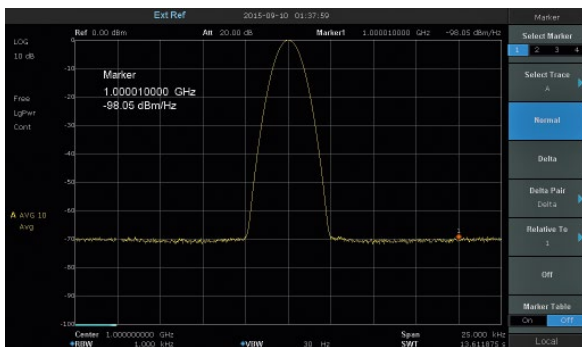
## 1 Hz Minimum Resolution Bandwidth (RBW)



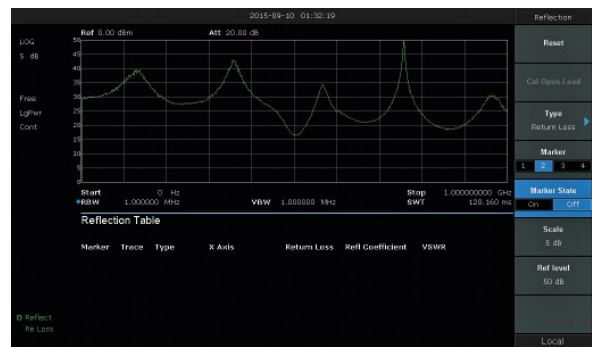
## Zero span and demodulation capabilities



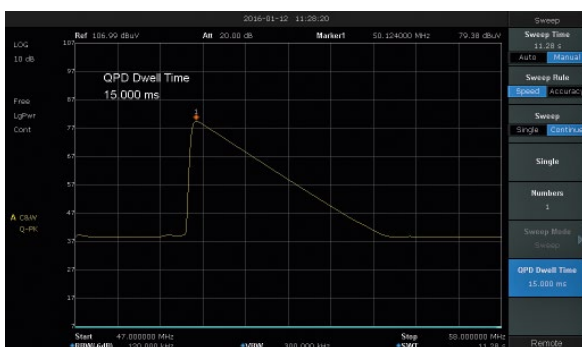
## Phase noise -98 dBc/Hz @ 1 GHz, offset 10 kHz



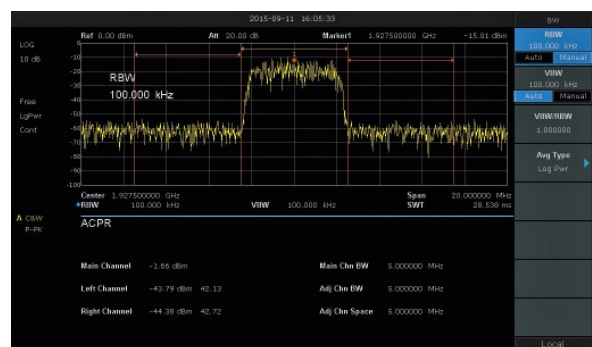
## On-screen VSWR/Return Loss measurements with the reflection measurement option (T3SA3000-RFM)



## EMI filter and Quasi-Peak detector following CISPR 16-1-1 (T3SA3000-EMI)



## Advanced measurement kit (T3SA3000-ADM) includes on-screen ACPR measurements



# 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:** All products are guaranteed to meet published specifications when operating in temperatures from 5 to 45°C, unless otherwise noted.

**Typical:** Performance deemed typical implies that 80 percent of the measurement results will meet the typical published performance with a 95<sup>th</sup> 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.



## Frequency Characteristic

	T3SA3200	T3SA3100
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### Frequency

Frequency range	9 kHz – 3.2 GHz	9 kHz – 2.1 GHz
Frequency resolution	1 Hz	1 Hz

### Frequency Span

Range	0 Hz, 100 Hz to 3.2 GHz	0 Hz, 100 Hz to 2.1 GHz
Accuracy	$\pm$ Span / (number of sweep points - 1)	

### Internal Reference Source

Reference frequency	10.000000 MHz
Frequency reference accuracy	$\pm$ [(time since last adjustment $\times$ frequency aging rate) + temperature stability + 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 sweep points - 1)
Marker uncertainty	$\pm$ [frequency indication $\times$ frequency reference uncertainty + 1% $\times$ span + 10% $\times$ resolution bandwidth + marker resolution]
Frequency counter resolution	1 Hz
Frequency counter uncertainty	$\pm$ [frequency indication $\times$ frequency reference accuracy + counter resolution]

### Bandwidths

Resolution bandwidth (-3 dB)	1 Hz ~ 1 MHz <sup>1)</sup> , 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
VBW uncertainty	< 5%

<sup>1)</sup> The DANL with RBW set to 1 or 3 Hz will be similar to 10 Hz.

## Amplitude Characteristic

	T3SA3200	T3SA3100	
<b>Amplitude and Level</b>			
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	-100 dBm to +30 dBm, 1 dB steps Preamplifier 20 dB (nom.), 9 kHz ~ 3.2 GHz Input attenuation 0 ~ 51 dB, 1 dB steps		
Maximum input DC voltage	±50 VDC		
Maximum average RF power	30 dBm, 3 minutes, $f_c \geq 10$ MHz, attenuation > 20 dBm, preamp off Maximum		
damage level	33 dBm, $f_c \geq 10$ MHz, attenuation > 20 dBm, preamp off		
<b>Displayed Average Noise Level (DANL)</b>			
	20°C ~ 30°C, attenuation = 0 dB, sample detector, trace average > 50		
Preamp off	RBW = 10 Hz	Normalization to 1 Hz	
	9 kHz ~ 100 kHz	-100 dBm (nom.)	-110 dBm (nom.)
	100 kHz ~ 1 MHz	-97 dBm, -101 dBm (typ.)	-107 dBm, -111 dBm (typ.)
	1 MHz ~ 10 MHz	-122 dBm, -126 dBm (typ.)	-132 dBm, -136 dBm (typ.)
	10 MHz ~ 200 MHz	-127 dBm, -131 dBm (typ.)	-137 dBm, -141 dBm (typ.)
	200 MHz ~ 2.1 GHz	-125 dBm, -129 dBm (typ.)	-135 dBm, -139 dBm (typ.)
	2.1 GHz ~ 3.2 GHz	-116 dBm, -122 dBm (typ.)	-126 dBm, -132 dBm (typ.)
Preamp on	9 kHz ~ 100 kHz	-107 dBm (nom.)	-117 dBm (nom.)
	100 kHz ~ 1 MHz	-122 dBm, -127 dBm (typ.)	-132 dBm, -137 dBm (typ.)
	1 MHz ~ 10 MHz	-138 dBm, -144 dBm (typ.)	-148 dBm, -154 dBm (typ.)
	10 MHz ~ 200 MHz	-146 dBm, -151 dBm (typ.)	-156 dBm, -161 dBm (typ.)
	200 MHz ~ 2.1 GHz	-145 dBm, -148 dBm (typ.)	-155 dBm, -158 dBm (typ.)
	2.1 GHz ~ 3.2 GHz	-135 dBm, -139 dBm (typ.)	-145 dBm, -149 dBm (typ.)
<b>Phase Noise</b>			
	20°C ~ 30°C, $f_c = 1$ GHz		
Phase Noise	<-95 dBc/Hz @10 kHz offset, <-98 dBc/Hz (typ.)		
	<-96 dBc/Hz @100 kHz offset, <-97 dBc/Hz (typ.)		
	<-115 dBc/Hz @1 MHz offset, <-117 dBc/Hz (typ.)		
<b>Level Display</b>			
Logarithmic level axis	10 dB to 200 dB		
Linear level axis	0 to reference level		
Units of level axis	dBm, dBmV, dBμV, dBμA, V, W		
Number of display points	751		
Number of traces	4		
Trace detectors	Positive-peak, Negative-peak, Sample, Normal, Average (Voltage/RMS/Video), Quasi-peak (with EMI option)		
Trace functions	Clear write, Max Hold, Min Hold, View, Blank, Average		
<b>Frequency Response</b>			
	20°C to 30°C, 30 % to 70 % relative humidity, attenuation = 20 dB, reference frequency 50 MHz		
Preamp off	±0.8 dB		
	±0.4 dB, (typ.)		
Preamp on	±0.9 dB		
	±0.5 dB, (typ.)		

# SPECIFICATIONS

## Amplitude Characteristic

	T3SA3200	T3SA3100
<b>Error and Accuracy</b>		
Resolution bandwidth switching uncertainty	10 kHz RBW Logarithmic resolution $\pm 0.2$ dB, liner resolution $\pm 0.01$ , nominal	
Input attenuation switching uncertainty	20 to 30 , $f_c = 50$ MHz, preamp off, Relative to 20 dB, 1 to 51 dB attenuation $\pm 0.5$ dB	
Absolute amplitude accuracy	20°C to 30°C, $f_c = 50$ MHz, RBW = 1 kHz, VBW = 1 kHz, peak detector, attenuation = 20 dB, 95th percentile reliability	
	preamp off $\pm 0.4$ dB, input signal -20 dBm	
	preamp on $\pm 0.5$ dB, input signal -40 dBm	
Total amplitude accuracy	20°C to 30°C, $f_c > 100$ kHz, input signal -50 dBm ~ 0 dBm, RBW = 1 kHz, VBW = 1 kHz, peak detector, attenuation = 20 dB, preamp off, 95th percentile reliability $\pm 0.7$ dB	
RF input VSWR	input attenuation 10 dB, 1 MHz ~ 3.2 GHz <1.5, nominal	

## Distortion and Spurious Responses

Second harmonic distortion	$f_c \geq 50$ MHz, mixer level -30 dBm, attenuation = 0 dB, preamp off, 20°C to 30°C, typ. -65 dBc	
Third-order intercept	$f_c \geq 50$ MHz, two -20 dBm tones at input mixer spaced by 100 kHz, attenuation = 0 dB, preamp off, 20°C to 30°C, typ. +10 dBm	
1dB Gain Compression	$f_c \geq 50$ MHz, attenuation = 0 dB, preamp off, 20°C to 30°C, nom. >-5 dBm	
Residual response	input terminated = 50 $\Omega$ , attenuation = 0 dB, 20°C to 30°C, typ. <-90 dBm	
Input related spurious	Mixer level = -30 dBm, 20°C to 30°C <-65 dBc	

## Sweep and Trigger

Sweep time	1 ms to 3000 s	
Sweep accuracy	Accuracy, Speed	
Sweep mode	Sweep	FFT
	RBW = 30 Hz ~ 1 MHz	RBW = 1 Hz ~ 10 kHz
Sweep rule	Single, Continuous	
Trigger source	Free, Video, External	
External trigger	5 V TTL level, rising edge/falling edge	

## Tracking Generator (Option T3SA3000-TG)

Frequency range	100 kHz ~ 3.2 GHz	100 kHz~2.1 GHz
RBW	30 Hz ~ 1 MHz, only sweep mode	
Output level	-20 dBm ~ 0 dBm	
Output level resolution	1 dB	
Output flatness	$\pm 3$ dB	
Output maximum reverse level	Mean power: 30 dBm, DC: $\pm 50$ VDC	

## EMI Receiver Measurement (Option T3SA3000-EMI)

Resolution bandwidth (6 dB)	200 Hz, 9 kHz, 120 kHz
Detector	Quasi-peak (following CISPR 16-1-1)
Dwell time	0 $\mu$ s ~ 10 s

## Reflection Measurement (Option T3SA3000-RFM-KIT)

Function	VSWR, Return loss, Reflection coefficient (The T3SA3000-RFM-KIT option REQUIRES the T3SA3000-TG Option)
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## Advanced Measurement (Option T3SA3000-ADM)

	T3SA3200	T3SA3100
Function	Channel power, Adjacent channel power ratio, Time domain power, Occupied bandwidth, Third-order intercept, Spectrum monitor	

## External input and external output

Front panel RF input	50 Ω, N-female Front
panel TG output	50 Ω, N-female
10 MHz reference output	<b>A</b> 10 MHz, >0 dBm, 50 Ω, BNC-female
10 MHz reference input	<b>B</b> 10 MHz, -5 dBm ~ +10 dBm, 50 Ω, BNC-female
External Trigger input	<b>C</b> 1 kΩ, 5 V TTL, BNC-female
Security	<b>D</b> Kensington Lock point

## Communication Interface

USB Host	USB-A 2.0 + USB
Device	<b>E</b> USB-B 2.0
LAN	<b>F</b> 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 45 Hz ~ 440 Hz, Power consumption 30 W
Temperature	Working temperature 0°C to 50°C, Storage temperature -20°C to 70°C
Humidity	0°C to 30°C, ≤ 95 % Relative humidity; 30°C to 50°C, ≤ 75 % Relative humidity
Dimensions	393 mm × 207 mm × 116.5 mm (W × H × D)
Weight	Including the tracking generator 4.60 kg (10.1 lb)

## Electromagnetic Compatibility and Safety

EMC	EN 61326-1:2013
Electrical safety	EN 61010-1:2010





## Ordering Information

Product Description	T3SA3000 Spectrum Analyzer	Order Number	
<b>Product code</b>	Spectrum Analyzer, 9 kHz ~ 3.2 GHz	T3SA3200	
	Spectrum Analyzer, 9 kHz ~ 2.1 GHz	T3SA3100	
<b>Standard configurations</b>	A Quick Start, A USB Cable, A Calibration Certificate Power cord		
	Tracking Generator Kit	T3SA3000-TG	
	Advanced Measurement Kit	T3SA3000-ADM	
<b>Utility Options</b>	Utility Kit: N(M)-SMA(M) cable N(M)-N(M) cable N(M)-BNC(F) adaptor (2 pcs) N(M)-SMA(F) adaptor (2 pcs) 10 dB attenuator	T3SA3000-UTL	
<b>EMI Options</b>	EMI Measurement Kit: EMI Filter and Quasi Peak Detector	T3SA3000-EMI	
	Near Field Probe: H field probe sets (25 mm, 10 mm, 5 mm, 2 mm), 30 MHz ~ 3.0 GHz	T3SA3000-NFP	
	Tracking Generator Kit	T3SA3000-TG	The T3SA3000-RFM-KIT option REQUIRES the T3SA3000-TG to be installed to work correctly.
<b>Reflect Measurement Options</b>	Reflection Measurement Kit software only. This is the software installed on the T3SA3000 spectrum analyzer	T3SA3000-RFM	T3SA3000-RFM REQUIRES a VSWR Reflection measurement bridge and the T3SA3000-TG Tracking Generator to work correctly.
	Reflection Measurement Kit hardware only. This is the hardware VSWR Bridge (1 MHz ~ 2 GHz), N(M)-N(M) adaptor (2 pcs) for use with the T3SA3000 spectrum analyzer	T3SA3000-RLB	T3SA3000-RLB REQUIRES the T3SA3000-RFM and the T3SA3000-TG Tracking Generator to work correctly.
	Reflect Measurement Kit: This kit comprises of the T3SA3000-RFM Software, and the T3SA3000-RLB hardware: VSWR Bridge (1 MHz ~ 2 GHz), N(M)-N(M) adaptor (2 pcs)	T3SA3000-RFM-KIT	The T3SA3000-RFM-KIT comprises both the T3SA3000-RFM and the T3SA3000-RLB. This kit does not include the T3SA3000-TG option. The T3SA3000-TG option should be ordered separately.



# 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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T3 stands for Teledyne Test Tools.