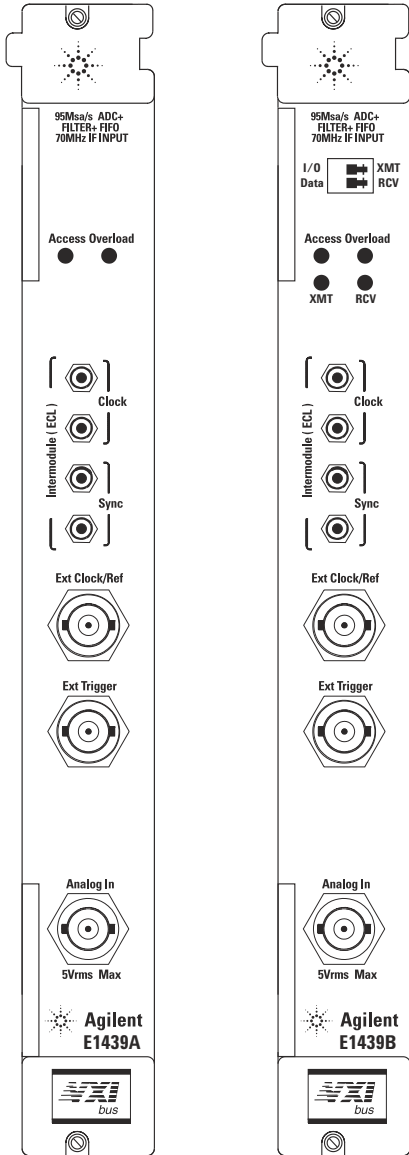


# Agilent E1439A/B 95 MSa/s Digitizer with 70 MHz IF Input

## Data Sheet



The Agilent E1439A/B is ideal for applications in RF signal acquisition, analysis, and high-resolution ATE. It has a baseband input and a 70 MHz IF input, both with 36 MHz bandwidth. The single-channel 95 MSa/s digitizer combines exceptional spurious-free dynamic range with alias-protected signal conditioning, center-frequency tunable digital filters, and a large signal capture memory, all in a single-wide C-size VXI module. The only difference between the A and B versions is the E1439B includes a 2.5 Gbit/sec optical front panel data port.

# Specifications

<b>Input Specifications</b>	
<b>Input Characteristics</b>	BNC Connector, shell grounded to chassis. 50Ω Impedance. DC Coupled or ac Coupled through 0.2 μF capacitor. Input signal can be switched to ground. 36 MHz anti-alias filter with bypass switch.
<b>Input Ranges</b>	
<b>Baseband Path</b>	One range, -21 dBm, 28.2 mVp
<b>70 MHz IF Path</b>	-36 dBm to +12 dBm, in 1 dB steps 5.02 mVp to 1.26 Vp, in 1 dB steps
<b>ADC Overload Level</b>	0 dBfs (typical)
<b>Maximum Input Power</b>	+24 dBm
<b>Return Loss of 50Ω Input Impedance</b>	
<b>Baseband Path, 0.1 to 36 MHz</b>	>15 dB (1.4 : 1 VSWR)
<b>70 MHz IF Path, 52 to 88 MHz</b>	>9 dB (2.1 : 1 VSWR)
<b>Amplitude Accuracy</b> (Power measurement, 0 to -40 dBfs, anti-alias filter ON)	
<b>Baseband Path, at 10 MHz</b>	±0.7 dB
<b>70 MHz IF Path, at 70 MHz</b>	±1.5 dB
<b>Flatness</b> (Excluding digital filter response)	
<b>Baseband Path, 0 to 36 MHz, relative to 10 MHz</b>	+0.5, -1.2 dB
<b>Baseband Path, AAF off, at 100 MHz</b>	-15 dB (typical)
<b>70 MHz IF Path, 52 to 88 MHz, relative to 70 MHz</b>	+0.5, -3.2 dB
<b>Phase Response Deviation from Linear Phase</b> (Group delay) (excluding digital filter response)	
<b>Baseband Path, 10 to 36 MHz</b>	<30 ns (typical)
<b>70 MHz IF Path, 52 to 88 MHz</b>	<120 ns (typical)
<b>DC Offset, Baseband Path</b>	
<b>Auto-zero accuracy</b>	±5% fs (typical)
<b>Temperature drift</b>	<±0.1 mV / °C (typical)
<b>Input Bias Current, Baseband Path</b>	<100 μA (typical)
<b>IF Filter and Anti-alias Filter Stopband Rejection</b> (input range ≤0 dBm)	
<b>Baseband Path, 59 MHz to 200 MHz</b>	>65 dB
<b>70 MHz IF Path, 0 to 43 MHz and 102 to 200 MHz</b>	>75 dB
<b>Signal-to-Noise Ratio</b> (full scale input, full bandwidth, excluding distortion, anti-alias filter on. See noise, distortion and spur specs)	>60 dB (typical)

<b>Input Noise Density</b> (before applying amplitude flatness correction, anti-alias filter on, internal sample clock)	
<b>Baseband Path</b>	
100 kHz to 36 MHz	<-132 dBfs/Hz
10 kHz to 100 kHz	<-130 dBfs/Hz
1 kHz to 10 kHz	<-122 dBfs/Hz
100 Hz to 1 kHz	<(-92 -10 LOG(f)) dBfs/Hz
Sensitivity:	<-154 dBm/Hz (typical)
<b>70 MHz IF Path</b>	
0 dBm range, 52 kHz to 88 MHz	<-132 dBfs/Hz
Sensitivity, on most sensitive range	<-163 dBm/Hz
<b>Residual Responses</b> (with 50Ω termination at input connector, in-band responses)	
	<-90 dBfs
<b>Harmonic Distortion, Aliased Harmonic Distortion, and Spurious Responses.</b> IF path input signal amplitudes ≤0 dBm. 20—30° C (add 3 dB at other temperatures)	
<b>IF path, input signals 0 to -9 dBfs</b>	<-62 dBc
<b>BB path, input signals 0 to -9 dBfs</b>	<-65 dBc
<b>input signals -9 to -20 dBfs</b>	<-70 dBc
<b>input signals &lt;-20 dBfs</b>	<-70 dBc or <-90 dBfs
<b>Intermodulation Distortion</b> Two in-band signals 1 MHz apart, ≤0 dBm. Measured in dBc, relative to one signal. Includes 2 <sup>nd</sup> order and 3 <sup>rd</sup> order distortion of the baseband path, and 3 <sup>rd</sup> order distortion of the IF path (add 3 dB for 2 <sup>nd</sup> order distortion of IF path). 20° C to 30° C (add 3 dB at other temperatures)	
<b>Each signal -6 to -14 dBfs</b>	<-65 dBc
<b>Each signal -14 to -20 dBfs</b>	<-70 dBc
<b>Each signal &lt;-20 dBfs</b>	<-70 dBc or <-90 dBfs
<b>3<sup>rd</sup> Order distortion, each input -16 dBfs</b>	-80 dBc (typical)
<b>Phase Noise Density</b> (single sideband power density, absolute or residual. <0.05 G vibration, Block data transfer mode. See Note 1)	
<b>Baseband Path, 10 MHz signal</b>	
Δf = 10 kHz	<-128 dBc/Hz (typical)
Δf = 1 kHz	<-120 dBc/Hz (typical)
Δf = 100 Hz, residual only	<-110 dBc/Hz (typical)
<b>IF Path, 80 MHz signal</b>	
Δf = 10 kHz	<-110 dBc/Hz (typical)
Δf = 1 kHz	<-102 dBc/Hz (typical)
Δf = 100 Hz, residual only	<-92 dBc/Hz (typical)
<b>Discrete Sidebands</b> (5 Hz to 100 kHz Δf, see Notes 1 and 2)	
<b>Baseband Path, 10 MHz signal</b>	
Δf >20 kHz	<-90 dBc
Δf <20 kHz	<-90 dBc (typical, Note 1)
Inter-module clock via VXI lines	<-80 dBc (typical)
<b>IF Path, 80 MHz signal</b>	
Δf >20 kHz	<-72 dBc
Δf <20 kHz	<-72 dBc (typical, Note 1)

Note 1. Phase Noise and Sidebands performance at frequency offsets of less than 20 kHz may be degraded by noise and ripple on the VXI power supplies.

Note 2. Specifications for Dynamic Range, Spurious Responses and Sidebands require the mainframe containing the E1439 to have Option 918 (connector shields E1400-80920) installed. In addition, all modules in the mainframe must comply with the VXI 1.4 specification for ECL trigger lines, the 10 MHz VXI system clock must be turned off, and the E1439 External Clock input must be disconnected when not being used. Dynamic range specifications require 24-bit data resolution, and the level of any External Clock or External Reference must be at least 0 dBm.

<b>Sample Clock and DSP Specifications</b>	
<b>Clock Sources</b>	
Internal sample clock frequency	95 MSa/s
External reference for internal clock	10 MHz
External sample clock frequency range	10 MHz to 102.4 MHz, baseband only
<b>Internal Clock Specifications</b>	
Frequency accuracy, 0—40° C	±7 ppm
Frequency accuracy, 40—55° C	±10 ppm
External reference lock range	±6 ppm (typical)
<b>Clock Input/Output Characteristics</b>	
External sample clock/reference input	BNC connector. ac-coupled comparator with 1 kΩ impedance. Accepts TTL, ECL, or >−6 dBm sine waves
External trigger input	For ECL, the input is ac coupled, 1 kΩ, edge sensitive. For TTL, the input is dc coupled, 1 kΩ, TTL levels. (TTL trigger is currently only available on the E1439B.)
Inter-module front panel clock/sync	SMB connector, ECL-10K compatible.
Inter-module VXI backplane clock/Sync	VXI backplane ECLTRG lines.
10 MHz reference output	SMB connector +8 dBm
<b>Multi-module Sampling Skew</b>	
Within mainframe, uncorrected	<10 ns (typical)
Between mainframes, 1 meter cable, uncorrected	<25 ns (typical)
Resolution of correction	5 ps (nominal)
Digital Decimation Filters	17 octave steps (40 MHz to 305 Hz), <0.215 dB ripple, software correctable
Digital Local Oscillator	<0.01 Hz tuning resolution
<b>Regulatory Compliance</b>	
Safety Standards	Designed for compliance to EN 61010-1(1993)
Radiated Emissions and Immunity	EN 61326-1 (see Note 2, page 3)
<b>Environmental</b>	
<b>Operating Restrictions</b>	
Maximum altitude	4600 meters, above 2285 meters derate operating temperature by −3.6° C per 1000 meters
Ambient Temperature	0—55° C
Humidity	10—90% at 40° C, non-condensing
<b>Optical serial front panel data port (E1439B only)</b>	
Standard support	Draft standard VITA 17.1, 1 Gbit/sec and 2.5 Gbit/sec
Connector	Dual LC receptacle
Optical type	Multi-mode fiber, 850 nm wavelength
Maximum length	100 meters

# Typical Performance Charts

The following charts are included as supplemental, non-warranted characteristics.

## Performance Benchmarks

(Benchmarks are included as supplemental, non-warranted characteristics)

**VXI/VME continous data transfer rate** 2.2 MBytes/s

(From E1439A to MXI-II VXI controller, D32 VME word size)

**Local bus data transfer rate** 63 MBytes/s

(From E1439A to ideal consumer)

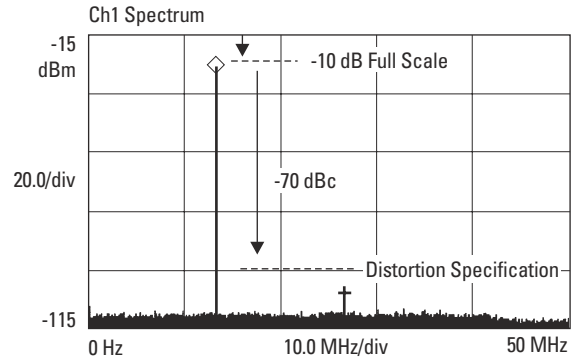
## Library function control of module

(MXI-II VXI controller)

**Measurement start** 8.5  $\mu$ s

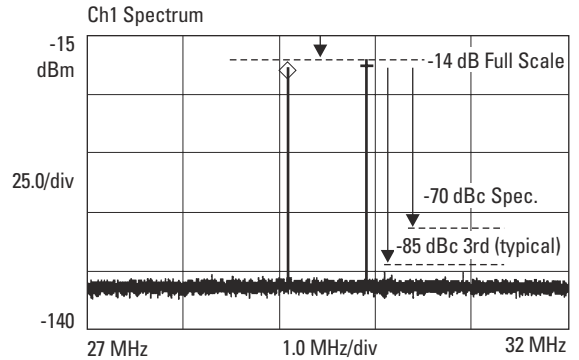
**Center frequency change (raw)** 600  $\mu$ s

## Harmonic Distortion



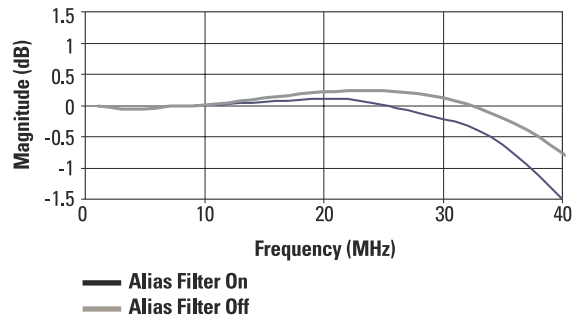
Harmonic Distortion performance with a -25 dBm 13 MHz signal on the -15 dBm range

## Intermodulation Distortion

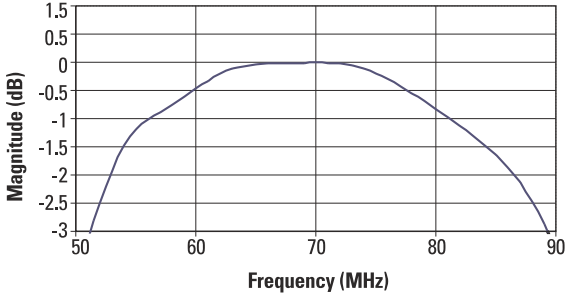


Intermodulation Distortion performance with two -14 dBfs tones near 30 MHz on the -15 dBm range.

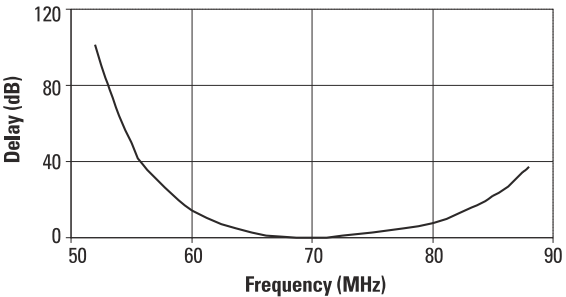
## Baseband Path Response versus Frequency



IF Path Response versus Frequency



IF Path Group Delay versus Frequency



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**General**

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<b>VXI Standard Information</b>	Conforms to VXI revision 1.4. See Note 1, page 3 concerning section B.8.6, Conducted Susceptibility.  C-size, single slot width.  Register based programming.  "Slave" Data Transfer Bus functionality.  A16 address capability.  D16/D32 data capability.  Local Bus capability  Requires ECLTRG0 and ECLTRG1 lines for module synchronization.
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<b>VXI Power Requirements</b>	<b>dc Current</b>	<b>Dynamic Current</b>
+5V (E1439A):	5.7 A	0.8 A
+5V (E1439B):	7.1 A	0.8 A
-5.2 V	3.0 A	0.1 A
-2 V	1.0 A	0.1 A
+12 V	1.2 A	0.3 A
-12 V	0.2 A	0.02 A
+24 V	0.04 A	0.02 A
-24 V	0.04 A	0.02 A
+5 V Standby	0.0 A	0.0 A

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**VXI Cooling Requirements****E1439A**

For 10° C rise above <55° C:  
For 15° C rise above <50° C:

3.3 liters/second, 0.67 mm H<sub>2</sub>O  
2.2 liters/second, 0.30 mm H<sub>2</sub>O

**E1439B**

For 10° C rise above <55° C:  
For 15° C rise above <50° C:

4.2 liters/second, 1.00 mm H<sub>2</sub>O  
2.8 liters/second, 0.50 mm H<sub>2</sub>O

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**Warm-up Time**

15 Minutes

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**Calibration Interval**

1 Year (no field adjustments)

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## Specification Note

Specifications describe warranted performance over a temperature range of 0–55° C, after a 15-minute warm up from ambient conditions. Supplemental characteristics identified as “typical” and “characteristic” provide useful information by giving non-warranted performance parameters. Typical performance is applicable from 20–30° C.

## Abbreviations

Fs: sample rate of DAC.

Fc: cut off frequency of high pass or low pass filters.

dBfs: dB relative to full scale amplitude range.

dBc: dB relative to carrier amplitude.

Typical: Typical, non-warranted, performance specification included to provide general product information.

## Warranty

This product is distributed, warranted, and supported by Agilent Technologies.

The E1439A/B comes with a 3-year warranty. During that period, the unit will either be replaced or repaired, at Agilent Technologies’ option, and returned to the customer without charge.

## Ordering Information

<b>Agilent E1439A/B</b>	95 MSa/s AD with filter and memory
<b>Option 001</b>	1.2 GB FIFO memory
<b>Option 144</b>	144 MB FIFO memory
<b>Option 288</b>	288 MB FIFO memory

## Related Agilent Literature

*E1437A 20 MSample/Second ADC with Filter and FIFO*  
*Product Overview*  
literature number 5965-6893E

*E1437A 20 MSample/Second ADC with Filter and FIFO*  
*Technical Specifications*  
literature number 5965-9774E

*E1438A/B 100 MSample/Second Digitizer with DSP and Memory*  
*Product Overview*  
literature number 5968-7348E

*E1438A/B 100 MSample/Second Digitizer with DSP and Memory*  
*Data Sheet*  
literature number 5968-8233E

*E1439A/B VXI 70MHz IF ADC with Filters and Memory*  
*Product Overview*  
literature number 5980-1261E

*E9830A Delay Memory Module*  
*Product Overview*  
literature number 5968-7349E

*Agilent Test System and VXI Products Catalog*  
literature number 5980-0307E

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