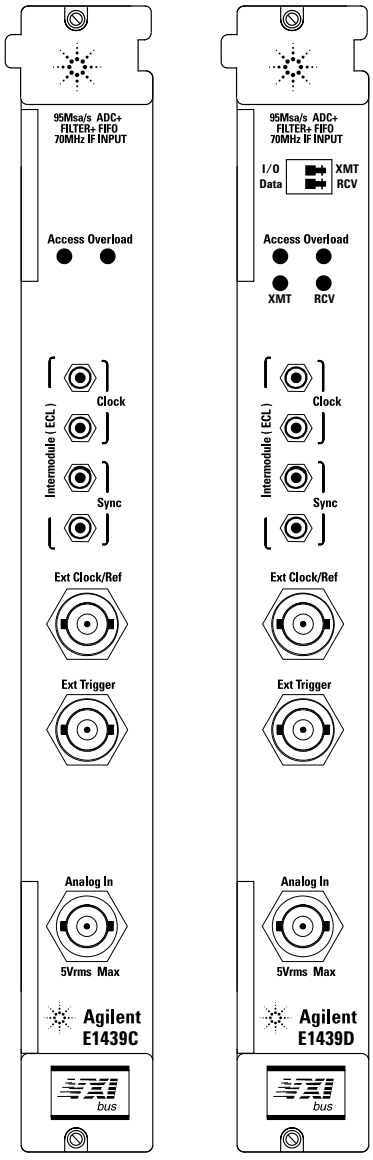
Agilent E1439C/D
95 MSa/s Digitizer with 70 MHz IF Input

Data Sheet



The Agilent E1439C/D 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 C and D versions is the E1439D includes a 2.5 Gbit/sec optical front panel data port and support for the VXI local bus.

Agilent Technologies

Specifications

Input Specification

Input characteristics	BNC connector, shell grounded to chassis. 50 Ω 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.
Input ranges	
Baseband path	One range, –21 dBm, 28.2 mVp
70 MHz IF path	–36 dBm to +12 dBm, in 1 dB steps 5.02 mVp to 1.26 Vp, in 1 dB steps
ADC overload level	0 dBfs (typical)
Maximum input power	+24 dBm
Return loss of 50 Ω input impedance	
Baseband path, 0.1 to 36 MHz	> 15 dB (1.4 : 1 VSWR)
70 MHz IF path, 52 to 88 MHz	> 9 dB (2.1 : 1 VSWR)
Amplitude accuracy (power measurement, 0 to –40 dBfs, anti-alias filter on)	
Baseband path, at 10 MHz	±0.7 dB
70 MHz IF path, at 70 MH	±1.5 dB
Flatness (excluding digital filter response)	
Baseband path, 0 to 36 MHz, relative to 10 MHz	+0.5, –1.2 dB
Baseband path, AAF off, at 100 MHz	–15 dB (typical)
70 MHz IF path, 52 to 88 MHz, relative to 70 MHz	+0.5, –3.2 dB
Phase response deviation from linear phase (group delay) (excluding digital filter response)	
Baseband path, 10 to 36MHz	< 30 ns (typical)
70 MHz IF path, 52 to 88 MH	< 120 ns (typical)
DC offset, baseband path	
Auto-zero accuracy	±5% fs (typical)
Temperature drift	< ±0.1 mV/°C (typical)
Input bias current, baseband path	< 100 µA (typical)
IF filter and anti-alias filter stopband rejection (input range ≤ 0 dBm)	
Baseband path, 59 MHz to 200 MHz	> 65 dB
70 MHz IF path, 0 to 43 MHz and 102 to 200 MHz	> 75 dB

Specifications (continued)

Input Specification (continued)

Signal-to-noise ratio (full scale input, full bandwidth, excluding distortion, anti-alias filter on. See noise, distortion and spur specs.)	> 60 dB (typical)		
Input noise density (before applying amplitude flatness correction, anti-alias filter on, internal sample clock)			
Baseband path			
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)		
70 MHz IF path			
0 dBm range, 52 kHz to 88 MHz	< –132 dBfs/Hz		
Sensitivity, on most sensitive range	< –163 dBm/Hz		
Residual responses (with 50 Ω termination at input connector, in-band responses)	< –90 dBfs		
Harmonic distortion, aliased harmonic distortion, and spurious responses. IF path input signal amplitudes ≤ 0 dBm.			
20—30° C (add 3 dB at other temperatures)		2nd order	3rd order
IF path, input signals 0 to –9 dBfs		< –60 dBc	< –62 dBc
BB path, input signals 0 to –9 dBfs		< –63 dBc	< –65 dBc
Input signals –9 to –20 dBfs		< –68 dBc	< –70 dBc
Input signals < –20 dBfs		< –68 dBc or < –88 dBfs	< –70 dBc or < –90 dBfs
Intermodulaton distortion Two in-band signals 1 MHz apart, ≤ 0 dBm. Measured in dBc, relative to one signal. Includes 2nd order and 3rd order distortion of the baseband path, and 3rd order distortion of the IF path (add 3 dB for 2nd order distortion of IF path).			
20° C to 30° C (add 3 dB at other temperatures)		2nd order	3rd order
Each signal –6 to –14 dBfs		< –63 dBc	< –65 dBc
Each signal –14 to –20 dBfs		< –68 dBc	< –70 dBc
Each signal < –20 dBfs		< –68 dBc or < –88 dBfs	< –70 dBc or < –90 dBfs
3rd order distortion, each input –16 dBfs	–80 dBc (typical)		

Specifications (continued)

Input Specification (continued)

Phase noise density (single sideband power density, absolute or residual. < 0.05G vibration, block data transfer mode, see Note 1.)	
Baseband path, 10 MHz signal	
Δf = 10 kHz	< –128 dBc/Hz (typical)
Δf = 1 kHz	< –120 dBc/Hz (typical)
Δf = 100 Hz, residual only	< –110 dBc/Hz (typical)
IF path, 80 MHz signal	
Δf = 10 kHz	< –110 dBc/Hz (typical)
Δf = 1 kHz	< –102 dBc/Hz (typical)
Δf = 100 Hz, residual only	< –92 dBc/Hz (typical)
Discrete sidebands (5 Hz to 100 kHz Δf, see Notes 1 and 2)	
Baseband path, 10 MHz signal	
Δf > 20 kHz	< –90 dBc
Δf < 20 kHz	< –90 dBc (typical, Note 1)
Inter-module clock via VXI lines	< –80 dBc (typical)
IF path, 80 MHz signal	
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 E1439C/D to have optional RFI backplane shields installed. They are not required for MFRAME1. 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 E1439C/D 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.

Specifications (continued)

Sample Clock and DSP Specifications

Clock sources	
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
Internal clock specifications	
Frequency accuracy, 0—40° C	±7 ppm
Frequency accuracy, 40—55° C	±10 ppm
External reference lock range	±6 ppm (typical)
Clock input/output characteristics	
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 E1439D.)
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
Multi-module sampling skew	
Within mainframe, uncorrected	< 10 ns (typical)
Between mainframes, 1meter 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

Regulatory Compliance

Safety standards	Designed for compliance to EN 61010-1(1993)
Radiated emissions and immunity	EN 61326-1 (see Note 2, page 4)

Environmental

Operating restrictions	
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

Optical serial front panel data port (E1439D only)

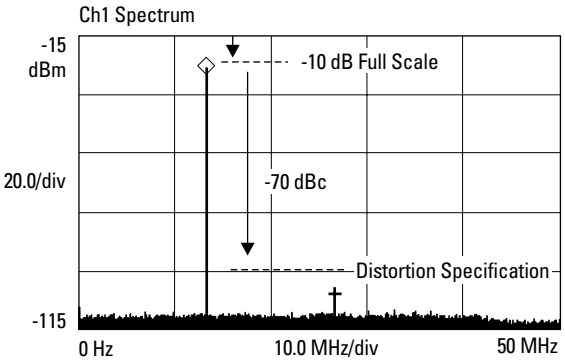
Standard support	Draft standard VITA 17.1, 1 Gbit/sec and 2.5 Gbit/sec
Connector	Dual LC receptacle
Optical type	Multi-mode fiber, 850 mm wavelength
Maximum length	100 meters

Typical Performance Charts

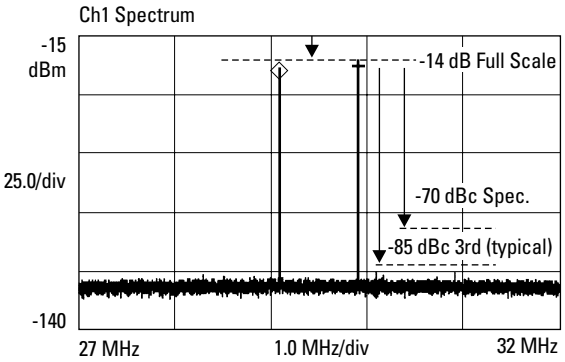
The following charts are included as supplemental, non-warranted characteristics

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

VXI/VME continous data transfer rate (From E1439C to MXI-II VXI controller, D32 VME word size)	2.2 MBytes/s
Local bus data transfer rate (From E1439D to ideal consumer)	63 MBytes/s
Library function control of module (MXI-II VXI controller)	
Measurement start	8.5 µs
Center frequency change (raw)	600 µs



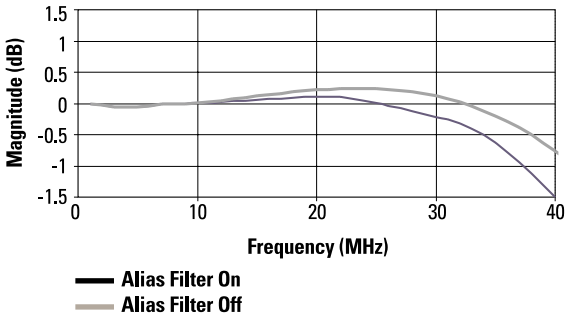
Harmonic Distortion performance with a –25 dBm 13 MHz signal on the –15 dBm range



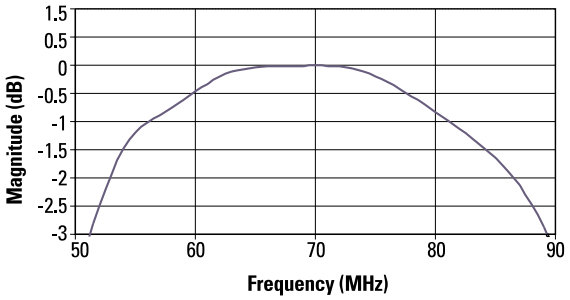
Intermodulation Distortion performance with two –14 dBfs tones near 30 MHz on the –15 dBm range

Typical Performance Charts (continued)

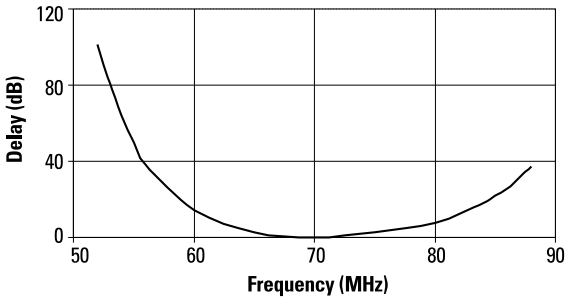
The following charts are included as supplemental, non-warranted characteristics



Baseband Path Response versus Frequency



IF Path Response versus Frequency



IF Path Group Delay versus Frequency

General

VXI standard information	Conforms to VXI revision 1.4. See Note 1, page 4 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.	
VXI power requirements	dc Current	Dynamic Current
+5V (E1439C):	5 A	0.8 A
+5V (E1439D):	7 A	0.8 A
–5.2V:	2 A	0.1 A
–2V:	1.0 A	0.1 A
+12V:	1 A	0.3 A
–12V:	0.4 A	0.1 A
+24V:	0.04 A	0.06 A
–24V:	0.04 A	0.06 A
+5V Standby:	0.0 A	0.0 A
VXI cooling requirements		
E1439C		
For 10° C rise above < 55° C:	3.3 liters/second, 0.67 mm H_2O	
For 15° C rise above < 50° C:	2.2 liters/second, 0.30 mm H_2O	
E1439D		
For 10° C rise above < 55° C:	4.2 liters/second, 1.00 mm H_2O	
For 15° C rise above < 50° C:	2.8 liters/second, 0.50 mm H_2O	
Warm-up time	15 Minutes	
Calibration interval	1 Year (no field adjustments)	

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.

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

The E1439C/D 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

E1439C/D	95 MSa/s AD with filter and memory
E1439C/D-001	1.2 GB FIFO memory
E1439C/D-144	144 MB FIFO memory
E1439C/D-288	288 MB FIFO memory

Product Web site

For the most up-to-date and complete application and product information, please visit our product Web site at:
www.agilent.com/find/vxi

Agilent Communications Intelligence Information:
www.agilent.com/find/AD

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

Related Literature

Publication Title	Publication Type	Publication Number
E1437A 20 MSample/Second ADC with Filter and FIFO	Product Overview	5965-6893E
E1437A 20 MSample/Second ADC with Filter and FIFO	Technical Specifications	5965-9774E
E1438C/D 100 MSample/Second Digitizer with DSP and Memory	Product Overview	5968-7348E
E1438C/D 100 MSample/Second Digitizer with DSP and Memory	Data Sheet	5968-8233E
E1439C/D VXI 70 MHz IF ADC with Filters and Memory	Product Overview	5980-1261E
E9830A Delay Memory Module	Product Overview	5968-7349E
Agilent Test System and VXI	Products Catalog	5980-0307E

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Printed in USA April 11, 2003
5980-1260E

Agilent Technologies