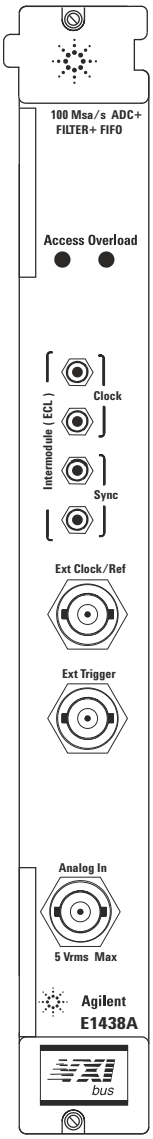
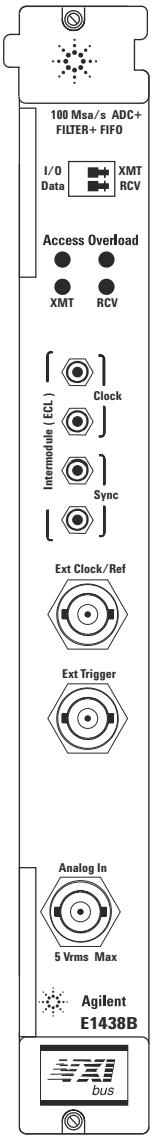
Agilent E1438A/B
100 MSa/s Digitizer with DSP and Memory

Data Sheet





The Agilent E1438A/B is ideal for application in signal acquisition and analysis, high resolution ATE and radar testing. This single-channel 100 MSa/s digitizer combines exceptional spurious-free dynamic range with alias-protected signal conditioning, center frequency tunable digital filtering, and a large signal capture memory, in a single-wide C-size VXI module. The only difference between the A and B versions is the E1438B includes a 2.5 Gbit/sec optical front panel data port.

Agilent Technologies

Specifications

Input Specification	
Input Characteristics	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. 40 MHz anti-alias filter with bypass switch.
Input Ranges	**+30 to –21 dBm in 3 dB steps**
dBm 50Ω	**Volts peak**
30 dBm	10.0 Vp
27 dBm	7.08 Vp
24 dBm	5.01 Vp
21 dBm	3.55 Vp
18 dBm	2.51 Vp
15 dBm	1.78 Vp
12 dBm	1.26 Vp
9 dBm	891 mVp
6 dBm	631 mVp
3 dBm	447 mVp
0 dBm	316 mVp
–3 dBm	224 mVp
–6 dBm	158 mVp
–9 dBm	112 mVp
–12 dBm	79.4 mVp
–15 dBm	56.2 mVp
–18 dBm	39.8 mVp
–21 dBm	28.2 mVp
ADC Overload Level	0 dBfs (typical)
Return Loss of 50Ω Input Impedance	
0.1—40 MHz	>18 dB (1.3 VSWR)
Amplitude Accuracy (Power measurement, at 10 MHz, 0—40 dBfs)	
Alias filter on	±0.7 dB
Flatness (dB relative to 10 MHz, excluding digital filter response)	
Alias filter on, freq <40 MHz	±1.0 dB
Alias filter off, freq <40 MHz	±2.0 dB
Alias filter off, at 100 MHz	–18 dB (typical)
DC Offset	
Auto-zero accuracy	±2% fs (typical)
Temperature drift	<±0.1 mV/°C (typical)
Input Bias Current	<50 µA (typical)
Anti Alias Filter Stopband Rejection (60—200 MHz, typical value for +27 and +30 dBm ranges)	>90 dB

Signal-to-Noise Ratio (full scale input, full bandwidth, excluding distortion. See noise, distortion and spur specs)	
Alias filter on	>60 dB (typical)
Alias filter off	>55 dB (typical)
Input Noise Density (Alias filter on, internal sample clock)	
100 kHz to 40 MHz	<–133 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	<–155 dBm/Hz (typical)
Residual Responses (with 50Ω termination at input connector, 2 kHz to 40 MHz)	<–90 dBfs
Harmonic Distortion, Aliased Harmonic Distortion, and Spurious Responses.	
Input signals >–10 dBfs	<–65 dBc
Input signals –10 to –20 dBfs	<–70 dBc
Input signals <–20 dBfs	<–70 dBc or <–90 dBfs
Intermodulaton Distortion (Two in-band signals 1 MHz apart. Measured in dBc, relative to one signal.)	
0—30 MHz input signals	
each signal –6 to –14 dBfs	<–65 dBc
each signal –14 to –20 dBfs	<–70 dBc
each signal < –20 dBfs	<–70 dBc or <–90 dBfs
30—40 MHz input signals	
each signal –6 to –14 dBfs	<–62 dBc
each signal –14 to –23 dBfs	<–67 dBc
each signal <–23 dBfs	<–67 dBc or <–90 dBfs
3rd Order products, each input –16 dBfs	–85 dBc (typical)
Phase Noise Density (single sideband power density of 10 MHz signal, <0.05G vibration, absolute or residual. Block data transfer mode, see Note 1)	
Δf = 10 kHz	<–128 dBc/Hz (typical)
Δf = 1 kHz	<–120 dBc/Hz (typical)
Δf = 100 Hz, residual only	<–110 dBc/Hz (typical)
Discrete Sidebands (5 Hz to 100 kHz Δf, see Notes 1 and 2)	
Δf >20 kHz	<–90 dBc
Δf <20 kHz	<–90 dBc (typical, Note 1)
Inter-module clock via VXI lines	<–80 dBc (typical)

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 E1438 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 E1438 External Clock input must be disconnected when not being used. Dynamic range specifications require 24-bit data resolution.

Sample Clock and DSP Specifications	
Clock Sources	
Internal sample clock frequency	100 MSa/s or 102.4 MSa/s (program control)
External reference for internal clock	10 MHz for 100 MSa/s, 10.24 MHz for 102.4 MSa/s
External sample clock frequency range	10—102.4 MHz
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 E1438B.)
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 3)

Environmental	
Operating Restrictions	
Maximum altitude	4600 meters, above 2285 meters derate operating temperature by –3.6° C per 1000 meters
Ambient Tempture	0—55° C
Humidity	10—90% at 40° C, non-condensing

Optical serial front panel data port (E1438B 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

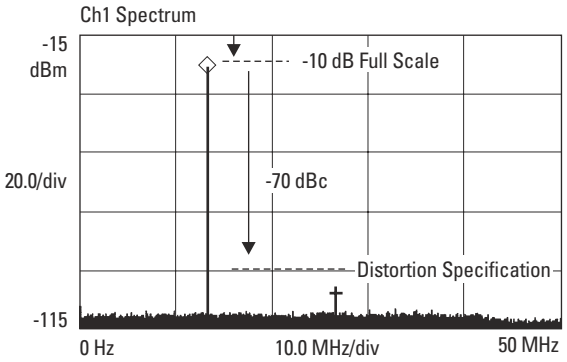
The following charts are included as supplemental, non-warranted characteristics)

Performance Benchmarks

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

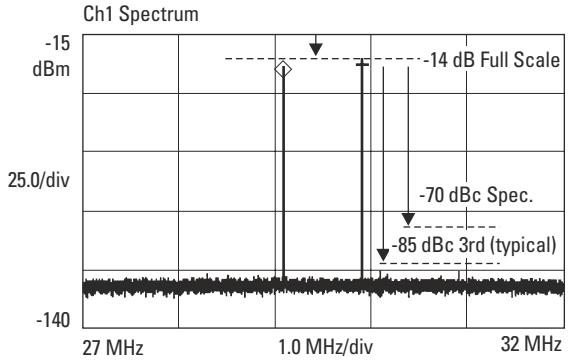
VXI/VME continous data transfer rate (From E1438A/B to MXI-II VXI controller, D32 VME word size)	2.2 MBytes/s
Local bus data transfer rate (From E1438A/B to ideal consumer)	66 MBytes/s
Library function control of module (MXI-II VXI controller)	
Measurement start	8.5 µs
Center frequency change (raw)	600 µs

Harmonic Distortion



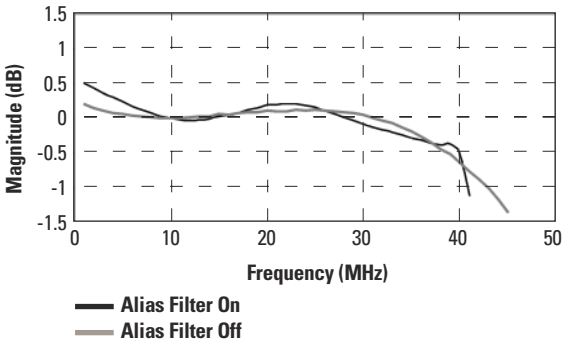
Harmonic Distortion performance with a –25 dBm 13 MHz signal on the –15 dBm range

Intermodulation Distortion

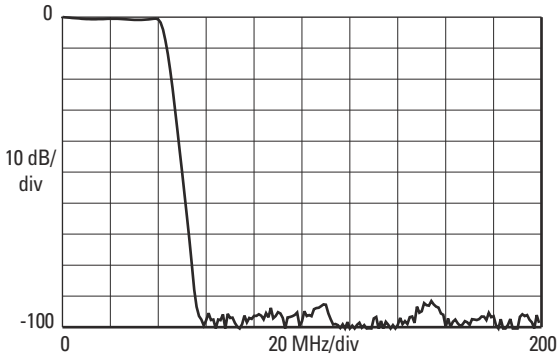


Intermodulation Distortion performance with two –14 dBfs tones near 30 MHz on the –15 dBm range.

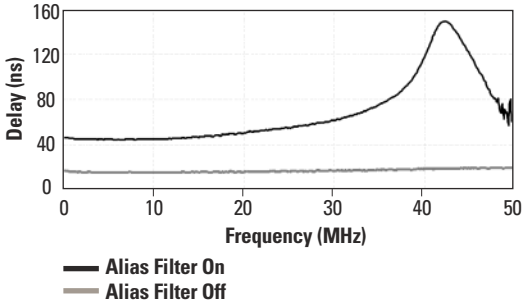
Response versus Frequency - Pass Band



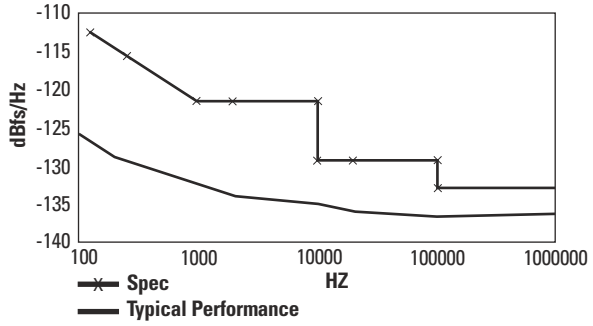
Filter Characteristics for Analog Anti Alias Filter, Magnitude (dB) versus Frequency (MHz)



Analog Anti Alias Filter Group Delay vs. Frequency

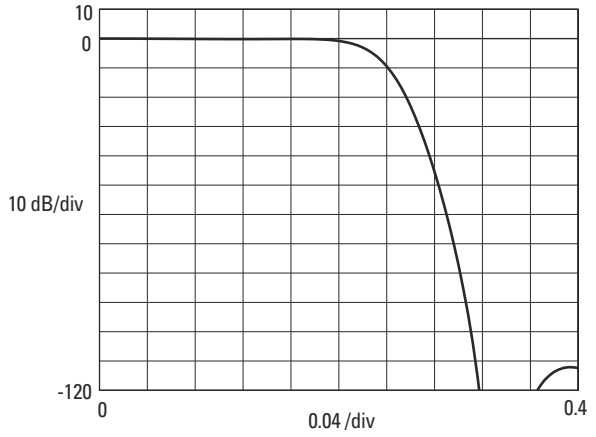


Input Noise Performance

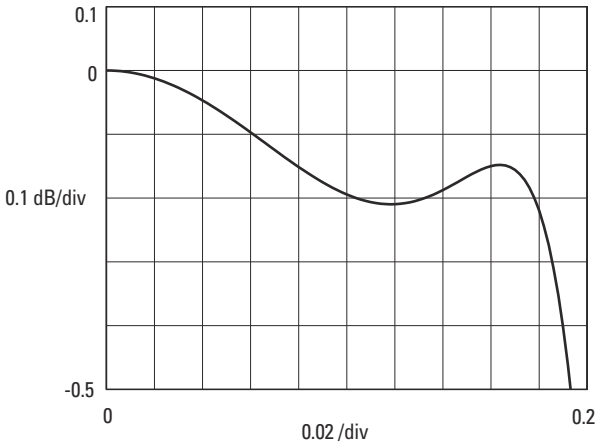


Filter Characteristics for Low-pass Digital Filter Without Decimation sigBw = 3

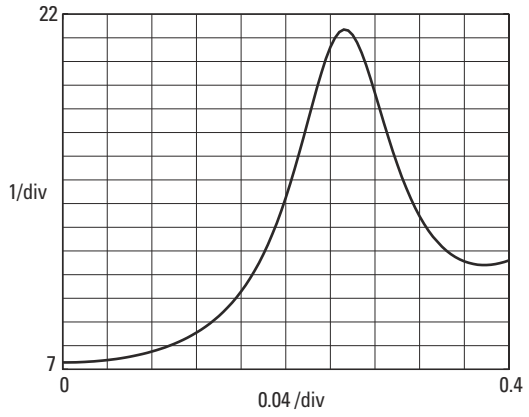
Magnitude (dB) versus Frequency (f/fs)



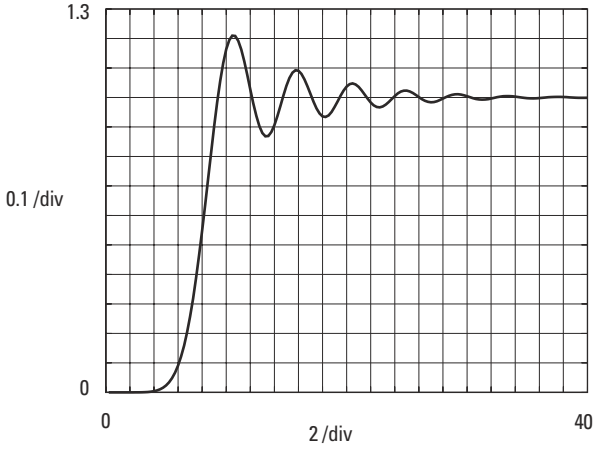
Magnitude (dB) versus Frequency (f/fs)



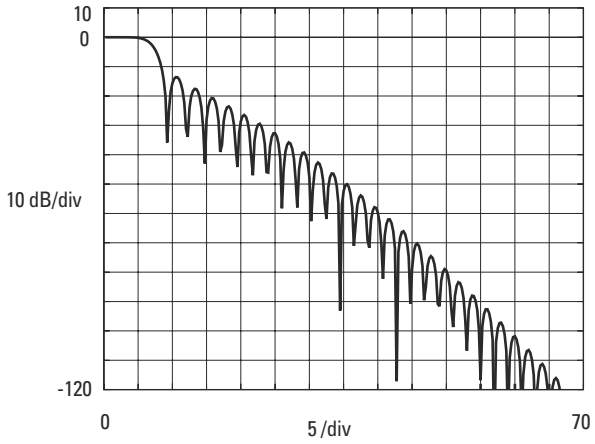
Delay (samples versus Frequency (f/fs)



Response versus Time (sample (normalized to step size)



Response versus Time (sample) (normalized to step size)



fs = output sample rate

General		
VXI Standard Information	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.	
VXI Power Requirements	**dc Current**	**Dynamic Current**
+5V (E1438A):	5.7 A	0.8 A
+5V (E1438B):	7.1 A	0.8 A
–5.2V:	3.0 A	0.1 A
–2V:	1.0 A	0.1 A
+12V:	0.6 A	0.3 A
–12V:	0.3 A	0.02 A
+24V:	0.04 A	0.02 A
–24V:	0.04 A	0.02 A
+5V Standby:	0.0 A	0.0 A
VXI Cooling Requirements		
E1438A		
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	
E1438B		
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)	

Agilent accessories available

The E1438A/B "sync" and "clk" connectors may be connected to other E1438A/B modules in synchronized multi-channel applications. The following cable and terminator to connect the modules are available from Agilent. (See the Agilent VXI Source Book for additional cables.)

1250-0676	SMB 50Ω load
8120-5623	175 mm cable with SMB connectors

Backplane connector shields

The backplane connector shields are required for RFI compliance with the EN55011 and CISPR11 standards. Specify one Option 918 with the purchase of an Agilent VXI mainframe. Specify this kit for retrofitting an existing mainframe (E1400-80920 or E1421-80920).

Warranty

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

The E1438A/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

Agilent E1438A/B	100 MSa/s AD with filter and memory
Option 001	1.2 GB FIFO memory
Option 144	144 MB FIFO memory
Option 288	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

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

E1439A/B VXI 70MHz IF ADC with Filters and Memory Data Sheet
literature number 5980-1260E

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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Agilent Communications Intelligence Information — www.agilent.com/find/COMINT

Agilent VXI Product Information — www.agilent.com/find/vxi

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