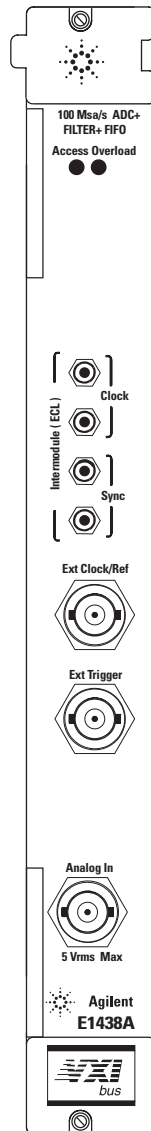


Agilent E1438A

100 MSa/s Digitizer

Technical Specifications

Rev. November 1999



The Agilent E1438A 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.

Abbreviations

F_s = sample rate of DAC.

F_c = 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.

Specification Note

Specifications describe warranted performance over a temperature range of 0° to 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° to 30 °C.



Agilent Technologies

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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 to 40 MHz:	> 18 dB (1.3 VSWR)
Amplitude Accuracy (Power measurement, at 10 MHz, 0 to -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 MHz to 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 50 Ω 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

Intermodulation Distortion

(Two in-band signals 1 MHz apart.
Measured in dBc, relative to one signal.)

0 to 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 to 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
3 rd 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)

$\Delta f = 10$ kHz:	< -128 dBc/Hz (typical)
$\Delta f = 1$ kHz:	< -120 dBc/Hz (typical)
$\Delta f = 100$ Hz, residual only:	< -110 dBc/Hz (typical)

Discrete Sidebands

(5 Hz to 100 kHz Δf , see Notes 1 and 2)

$\Delta f > 20$ kHz:	< -90 dBc
$\Delta f < 20$ 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 MHz to 102.4 MHz

Internal Clock Specifications

Frequency accuracy, 0 to 40 °C:	± 7 ppm
Frequency accuracy, 40 to 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 K Ω impedance. Accepts TTL, ECL, or > -6 dBm sine waves
Trigger input:	BNC connector. ac-coupled comparator with 1 K Ω impedance. Detects pulses > 300 ns with edges > 100 mV
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, 1m 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
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Digital Local Oscillator	< 0.01 Hz tuning resolution
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Regulatory Compliance

Safety Standards	Designed for compliance to EN 61010-1(1993)
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Radiated Emissions and Immunity	EN 61326-1 (see Note 2, page 3)
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Environmental

Operating Restrictions

Maximum altitude:	4600m, above 2285m derate operating temperature by -3.6 °C per 1000m
Ambient Tempature:	0 to 55 °C
Humidity:	10% to 90% at 40 °C, non-condensing

Typical Performance Charts

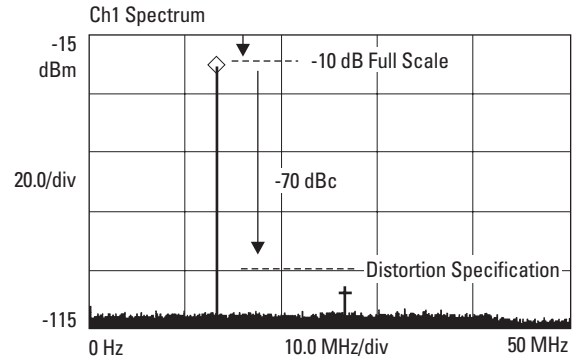
The following charts are included as supplemental, non-warranted characteristics)

Performance Benchmarks

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

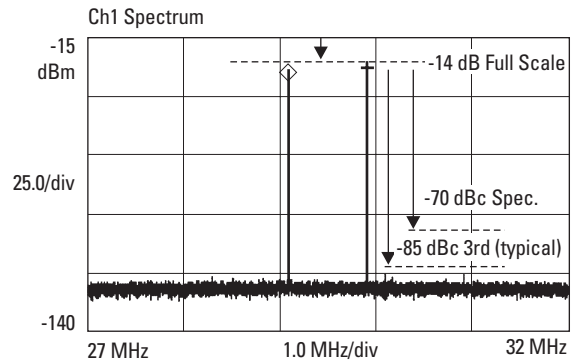
VXI/VME continuous data transfer rate (From E1438A to MXI-II VXI controller, D32 VME word size)	2.2 MBytes/s
Local bus data transfer rate (From E1438A to ideal consumer)	66 MBytes/s
Library function control of module (MXI-II VXI controller)	
Measurement start:	8.5 μ s
center frequency change (raw):	600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

Harmonic Distortion



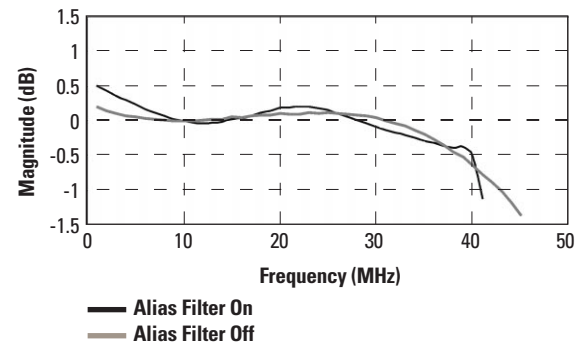
Harmonic Distortion performance with a -25 dBm 13 MHz signal on the -15 dBm range

Intermodulation Distortion

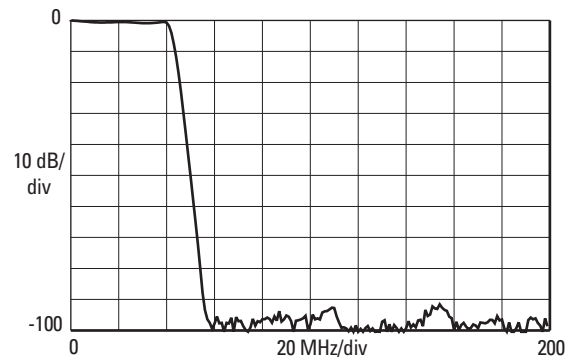


Intermodulation Distortion performance with two -14 dBfs tones near 30 MHz on the -15 dBm range.

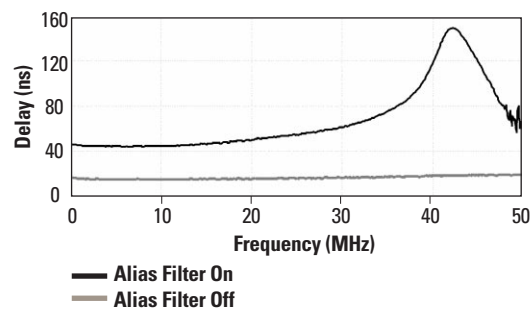
Response vs. Frequency - Pass Band



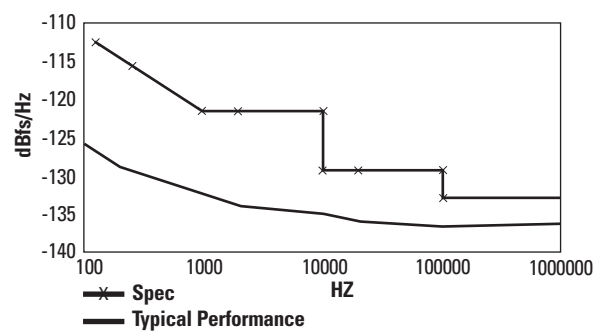
Filter Characteristics for Analog Anti Alias Filter,
Magnitude (dB) vs. Frequency (MHz)



Analog Anti Alias Filter Group Delay vs. Frequency

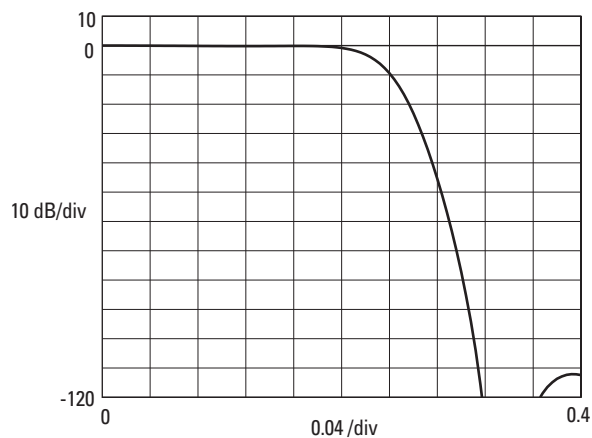


Input Noise Performance

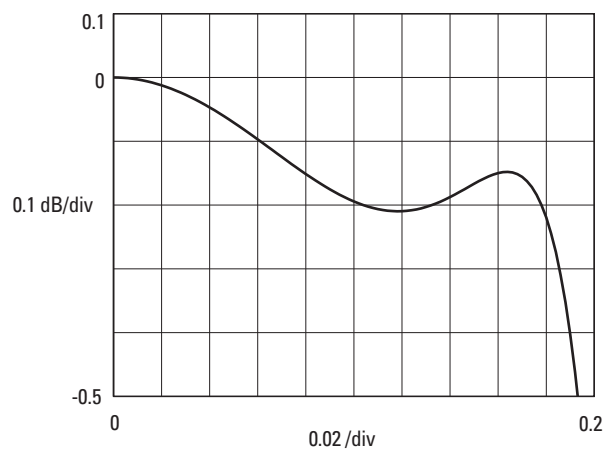


Filter Characteristics for Low-pass Digital Filter Without Decimation sigBw = 3

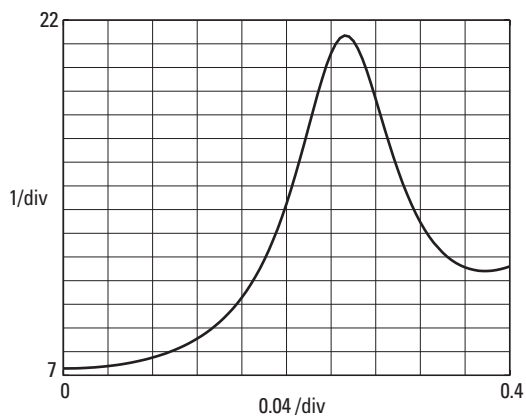
Magnitude (dB) vs Frequency (f/fs)



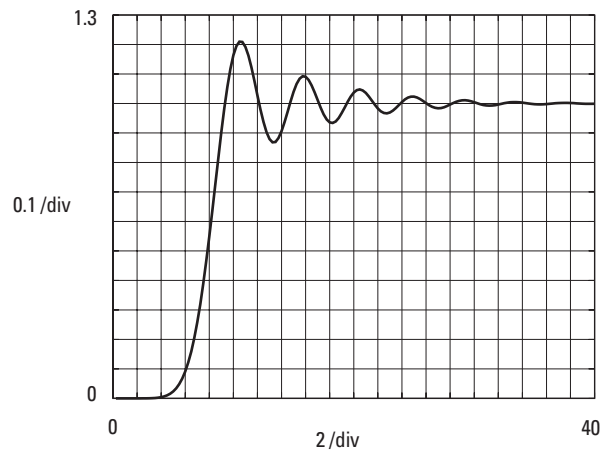
Magnitude (dB) vs Frequency (f/fs)



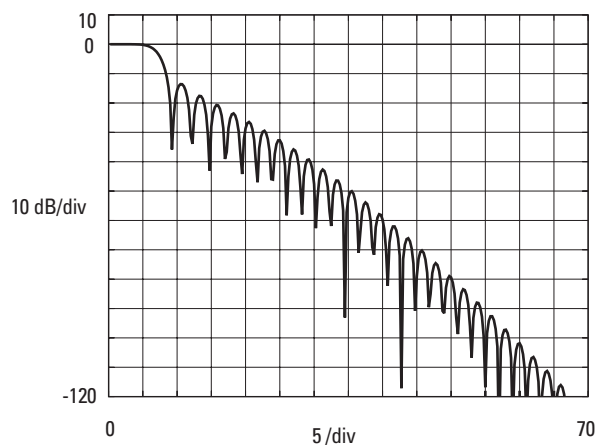
Delay (samples vs Frequency (f/fs)



Response vs Time (sample (normalized to step size)



Response vs 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:	5.7A	0.8A
-5.2V:	3.0A	0.1A
-2V:	1.0A	0.1A
+12V:	0.6A	0.3A
-12V:	0.3A	0.02A
+24V:	0.04A	0.02A
-24V:	0.04A	0.02A
+5V Standby:	0.0A	0.0A
VXI Cooling Requirements		
For 10 °C rise:	3.3 liters/second, 0.67 mm H ₂ O	
For 15 °C rise:	2.2 liters/second, 0.30 mm H ₂ O	
Warm-up Time	15 Minutes	
Calibration Interval	1 Year (no field adjustments)	

Warranty

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

The E1438A 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.

Related Agilent Literature

Agilent Test System and
VXI Products Catalog
p/n 5968-3698EUS
p/n 5968-3698EN
p/n 5968-5609E

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