



**Electro Magnetic Compatibility Test Report**  
**Regarding the CE Mark Compliance of the**  
**ADALM1000 Analog Learning Tool**  
**In Accordance with the Information Technology Standards**  
**EN 55022:2010 for Emissions**  
**And**  
**EN 55024:2010 for Immunity**

**Revision History**

<b>Release</b>	<b>Date</b>	<b>Description</b>
<b>1.0</b>	<b>6 January 2015</b>	<b>Initial release</b>

# EMI Test Lab LLC



Electro Magnetic Interference Testing  
EmiTestLab.com

## Description of Equipment Under Test (EUT)

Test Item : Analog Learning Tool  
Model number : ADALM1000  
Manufacturer : Analog Devices

## Manufacturer's information

Manufacturers  
Representative : Robin Getz  
Company : Analog Devices  
Address : 804 Woburn St.  
Wilmington, MA 01887  
U.S.A.  
Website : <http://www.analog.com/en/index.html>

## Tests Performed at

Address : EMI Test Lab LLC  
1822 Skyway Drive Unit J  
Longmont, Colorado 80504  
U.S.A  
Website : <http://www.emitestlab.com/>

Test Specifications : EN 55022:2010 and EN 55024:2010  
Tests completed : 15 December 2014

Result of Testing : **The EUT is in Compliance with EN 55022:2010 and EN 55024:2010**

EMC Test Engineer : Dennis King

Report written by : Dennis King – EMI Test Lab  
Report date : 6 January 2015

***These test results relate only to the specific unit that was tested. A periodic production audit to verify continued compliance is recommended.***

Test Specification: EN 55022:2010 and EN 55024:2010      Prepared by EMI Test Lab - EMI Test Lab.com  
Model Name of EUT: ADALM1000  
Manufacturer: Analog Devices      Revision 1.0



**Table of Contents**

- 1. General Test Information.....page 4
  - 1.1. Applied Standards
  - 1.2. Detailed description of test configuration, input and output ports
    - 1.2.1. Description of test configuration
    - 1.2.2. Description of input and output ports
    - 1.2.3. Operating mode(s)
  
- 2. Emissions.....page 10
  - 2.1. AC Mains conducted emissions
  - 2.2. Enclosure radiated emissions
    - 2.2.1. 30-1,000 MHz
    - 2.2.2. 1-6 GHz
  - 2.3. Harmonic current emissions
  - 2.4. Voltage fluctuations and flicker
  
- 3. Immunity.....page 24
  - 3.1. Performance criteria
  - 3.2. Enclosure tests
    - 3.2.1. Radio-frequency electromagnetic fields
    - 3.2.2. Electrostatic discharge
    - 3.2.3. RF common mode on signal and telecom ports
    - 3.2.4. Fast transients on signal and telecom ports
  - 3.3. AC power port tests
    - 3.3.1. Radio-frequency immunity, common mode
    - 3.3.2. Surges
    - 3.3.3. Fast Transients, common mode
    - 3.3.4. Voltage Dips and Interruptions
    - 3.3.5. Power Frequency Magnetic Fields
  
- 4. Modifications During Testing.....page 36
  
- 5. Test equipment.....page 37
  
- 6. Measurement Uncertainty .....page 39
  
- 7. Test Plan.....page 41
  
- 8. Conclusion .....page 45

Test Specification: EN 55022:2010 and EN 55024:2010

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Model Name of EUT: ADALM1000

Manufacturer: Analog Devices

Revision 1.0



## 1 General

### 1.1 Applied Standards

Analog Devices Analog Learning Tool was evaluated for emissions using EN 55022:2010 and for immunity using EN 55024:2010.

EN 55022:2010 is the European Union's version of the international CISPR standard CISPR 22:2008.

EN 55024:2010 is the European Union's version of the international CISPR standard CISPR 24:2010.

### 1.2 Detailed description of the test configuration, input and output ports

#### Test Configuration Definition:

The ADALM1000 Analog Learning Tool is being tested per the Test Instructions provided by Analog Devices.

The ADALM1000 is being tested as a system, running in a typical worst case mode that would be used in the real world by a student. The external circuit board is connected to a host laptop with the usb cable provided in the kit. Two 100 ohm resistors were connected from channel a and b to ground. A 1k ohm resistor was connected across the two power supplies. Unterminated wires were connected to all the pins of the other connector (see the pictures).

Software was run on the laptop to create a continuously running square wave on both channels. This was considered worst case for emissions and immunity.

Production level cables and hardware were used for all testing.

- A usb cable was used from the laptop to the external circuit board, part of the kit.



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### About the ADALM1000 Analog Learning Tool

The **ADALM1000** (M1k) is an analog learning tool available from Analog Devices Inc. It offers two high-precision analog channels, each capable of generating or measuring analog signals at up to 250 kilo samples per second (kSPS). The ADALM1000 is completely self-contained, fits nicely in a shirt pocket or backpack, and is entirely USB powered. With support for MAC, Windows, Linux, Android and Chrome, it allows an exploration and understanding of analog systems no matter where or when the user is.

The ADALM1000 can generate or source (ie. signal generator) up to one watt of electrical power (0-5V, -200 to +200mA). Continuous streaming of voltage and current measurements into a simple GUI allow for a variety of impedance, time, and frequency domain explorations to be carried out with ease.

The following content is currently available:

- [Electrical CAD Documents](#)
- [M1K Microcontroller Firmware](#)
- [Pixelpulse2 - M1K User Interface](#)
- [LibSMU - Library for M1K Functionality](#)
- [Hardware Manual - WIP](#)
- [Design Document - WIP](#)
- [M1K Photographs](#)

<http://wiki.analog.com/university/tools/m1k>

### **What's Included in the Kit:**

- M1k circuit board (see pictures)
- USB cable (Type A to Micro-B)

### CE Test Software:

The software used during testing is typical of what the end user would use.

Here's a link provided by Analog Devices for the testing:

<http://apps.nonolithlabs.com/edge/pixelpulse>

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Manufacturer: Analog Devices

Revision 1.0



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### 1.2.1 Description of test configuration

EUT : Analog Learning Tool  
Manufacturer : Analog Devices  
Part Number : ADALM1000  
Serial Number : SAOP0020  
Test Voltage (host laptop) : 230 VAC 50 Hz

**Note: the M1k board gets its power through the connected usb cable, no other power connected to the M1k board.**

### 1.2.2. Description of tested input and output ports

**Note: Other than the Ethernet cable - all cables are less than 3 meters in length.**

Number of cable type	Type of Cable	From	To	Shielded?	Remarks - length
1	USB Type A to Micro-B	Laptop USB port	M1k board	yes	4 ft.

### 1.2.2 Operation mode

The Equipment Under Test (EUT) was set up per Analog Device's test Instructions.

Square waves were continuously running on both channels. The wave forms were monitored on the laptop display during all the testing for any change in operation or corruption of the wave forms.

Test Specification: EN 55022:2010 and EN 55024:2010

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Model Name of EUT: ADALM1000

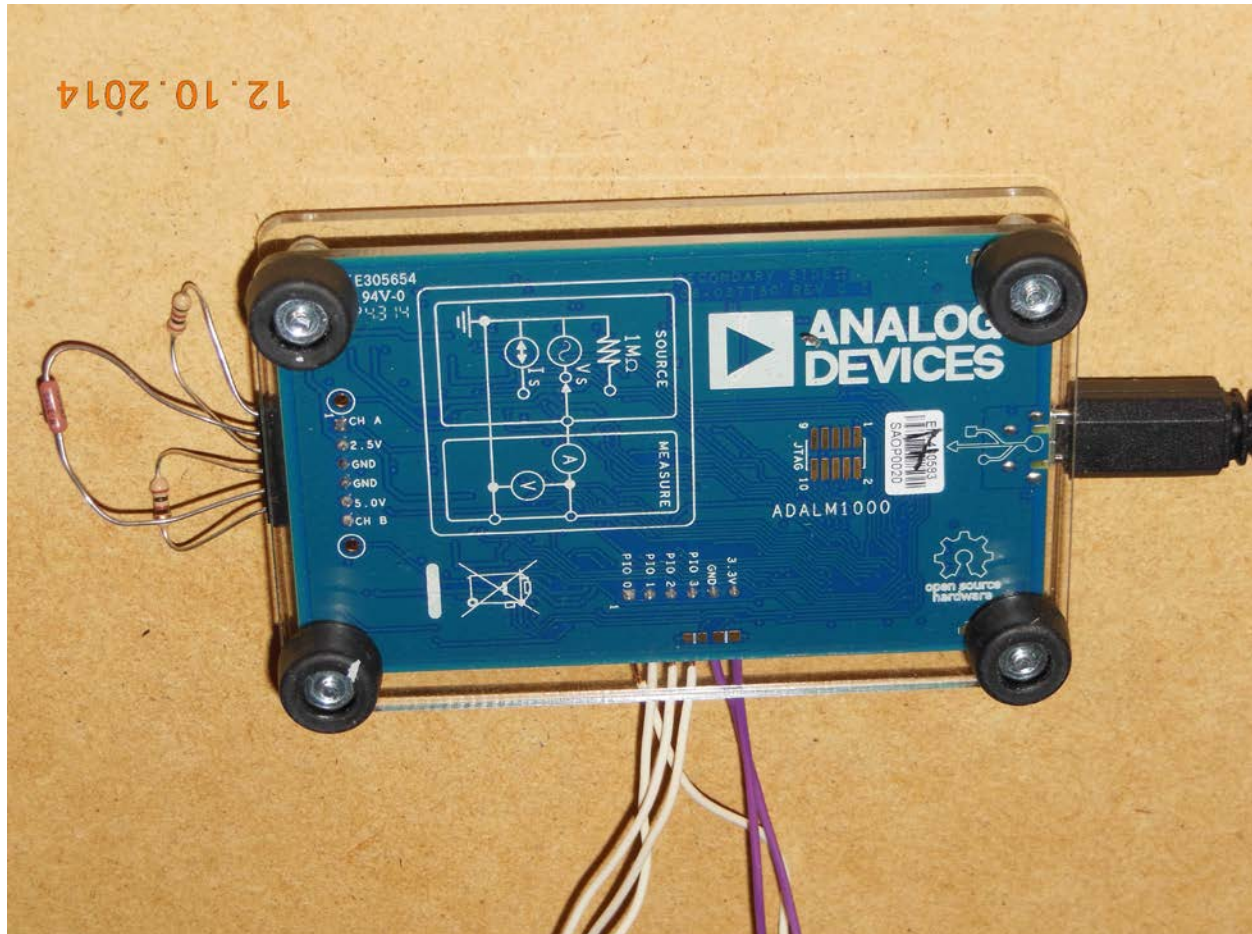
Manufacturer: Analog Devices

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## Analog Devices ADALM1000 – Analog Learning Tool

[Click here for more information about the ADALM1000](#)

Test Specification: EN 55022:2010 and EN 55024:2010

Prepared by EMI Test Lab - EmiTestLab.com

Model Name of EUT: ADALM1000

Manufacturer: Analog Devices

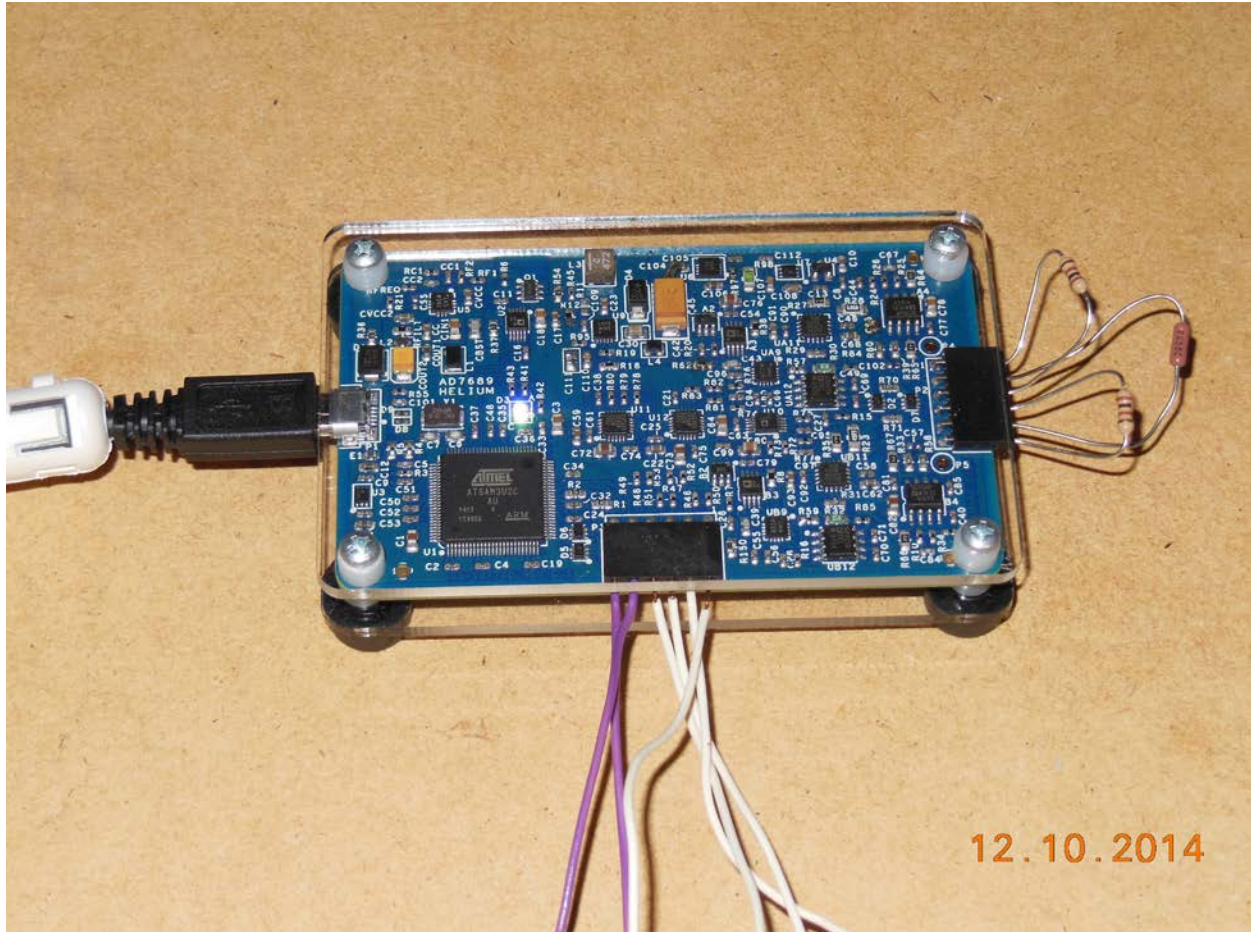
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**Analog Devices ADALM1000 – Analog Learning Tool  
(on the left you can see the ferrite added to pass radiated immunity –  
see modifications section)**

[Click here for more information about the ADALM1000](#)

Test Specification: EN 55022:2010 and EN 55024:2010

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Model Name of EUT: ADALM1000

Manufacturer: Analog Devices

Revision 1.0

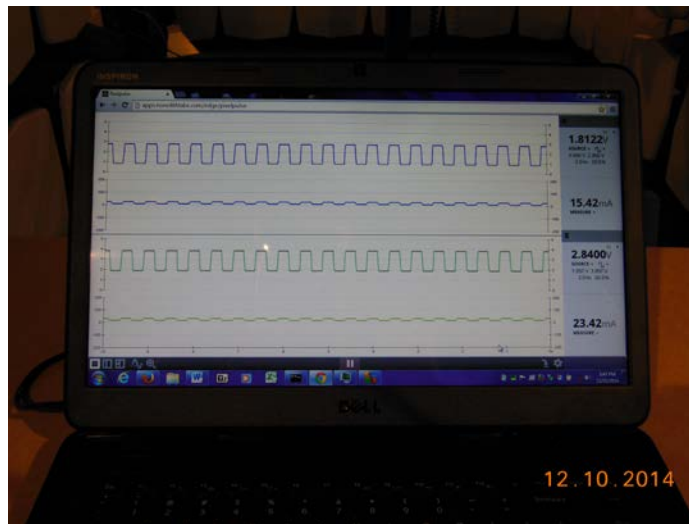


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**USB Cable used for testing w/ ferrite added to pass radiated immunity**



**Analog Devices ADALM1000 – Analog Learning Tool  
Typical screen shot of the software used during testing**

[Click here for more information about the ADALM1000](#)

Test Specification: EN 55022:2010 and EN 55024:2010

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Model Name of EUT: ADALM1000

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Revision 1.0



## **2 Emissions**

The EUT has been tested to determine conformity with the relevant emissions parts of the EN 55022:2010 standard.


AC Power line conducted and radiated field strength measurements concerning the emission of radiated and conducted electromagnetic disturbances were made.

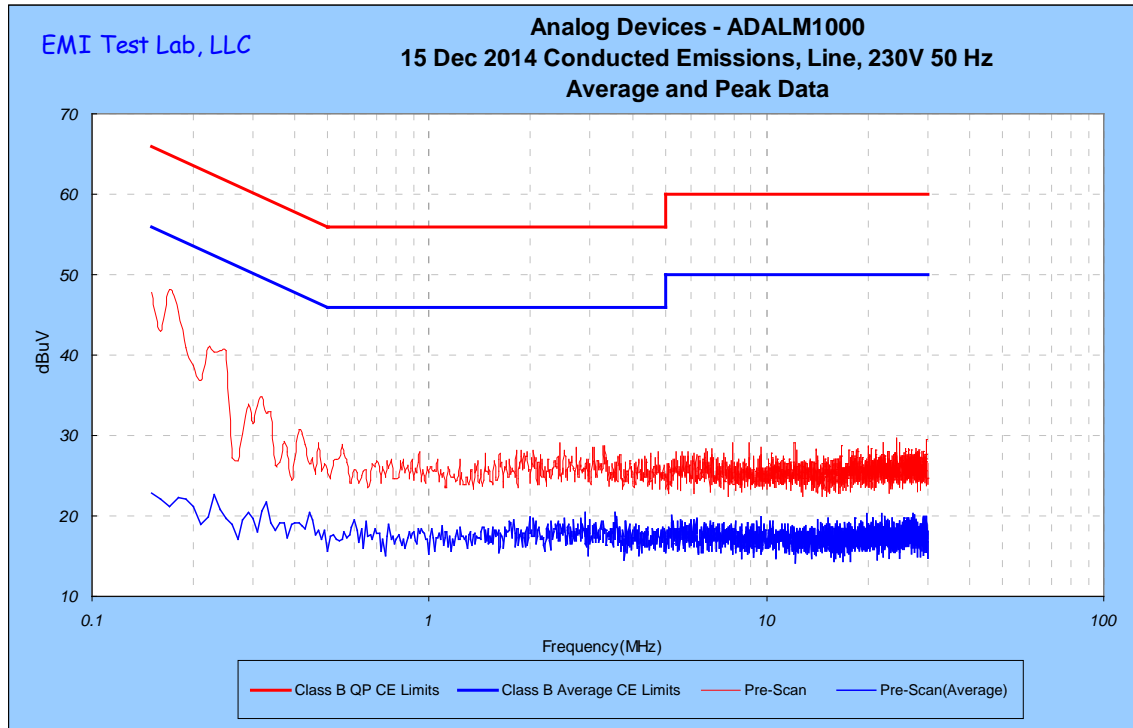


**2.1 AC Mains Power Input Ports**

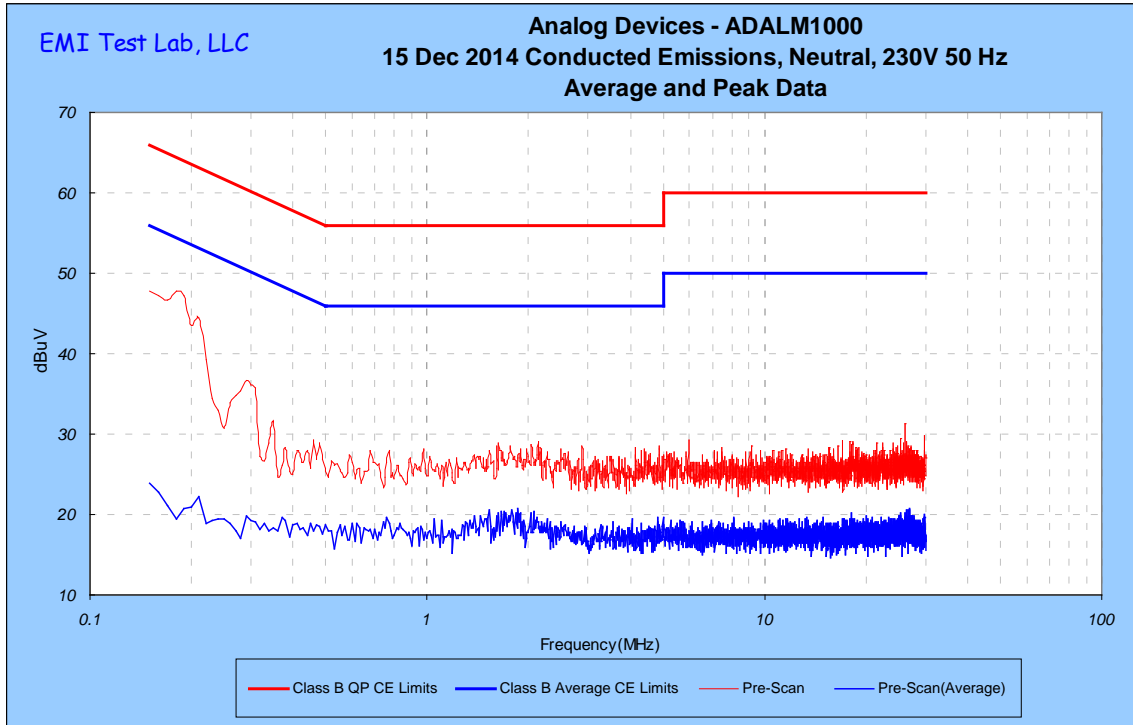
The disturbance voltage emissions levels at the AC mains power port of the EUT were measured in conformity with and according to the criteria as stated below.

- Basic standard : CISPR 22:2008
- Test setup : EN 55022:2010
- Frequency range 1 : 0.15 – 0.5 MHz
- Limit : 79.0 dBuV quasi peak, 66 dBuV average
- Frequency range 2 : 0.5 – 30 MHz
- Limit : 73 dBuV quasi peak, 60 dBuV average

Results of the measurements concerning the emissions of voltage levels at the AC mains input port of the EUT.	<b><u>PASS</u></b>
Name of Test Engineer:	Dennis King
Signature:	
Date:	15 December 2014
Remarks: <b><u>Peak data passed the lower limit (average limit) therefore the unit passes both Quasi Peak and Average limits</u></b>  Running a square wave on both channels.	



**Peak data passing both the Quasi Peak and Average limits.**



**Peak data passing both the Quasi Peak and Average limits.**



### **Conducted emissions test setup**

Test Specification: EN 55022:2010 and EN 55024:2010

Model Name of EUT: ADALM1000

Manufacturer: Analog Devices

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### 2.2 Enclosure

#### 2.2.1 30-1,000 MHz

The radiated field strength levels (electric component) have been measured in conformity with and according to the criteria as stated below.

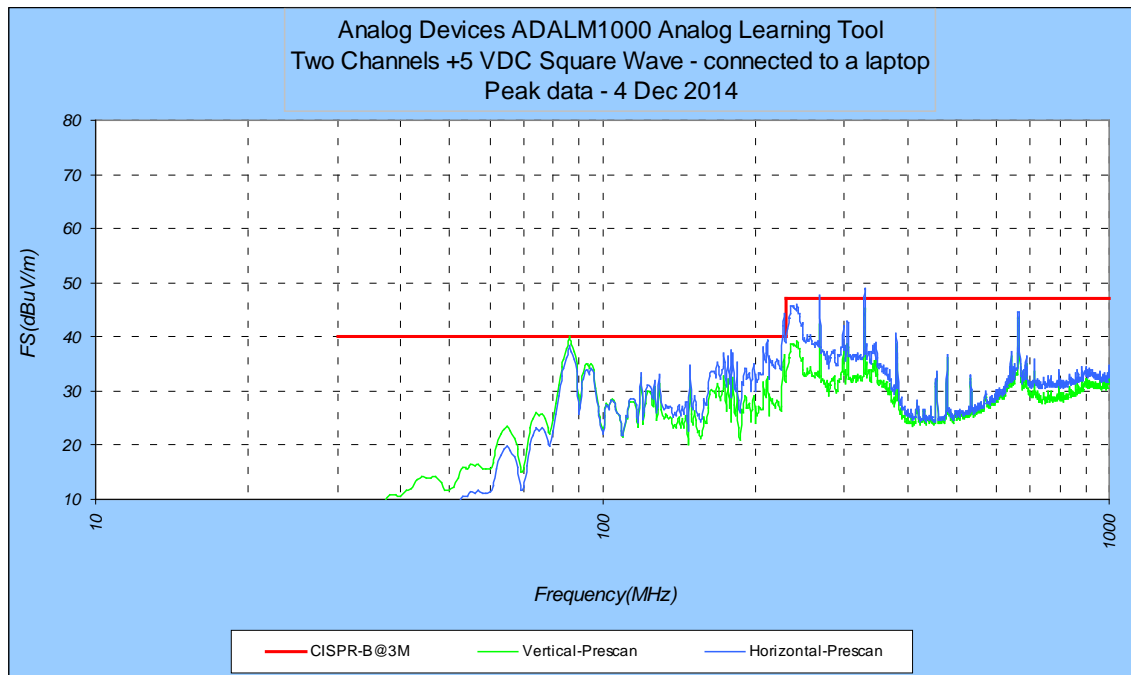
Basic standard	:	CISPR 22:2008
Test setup	:	EN 55022:2010
Limit distance	:	3 meters
Frequency range 1	:	30 -230 MHz
Limits	:	40 dBuV/m
Frequency range 2	:	230 – 1,000 MHz
Limits	:	47 dBuV/m

Results of the measurements concerning radiated electromagnetic fields (electric component) emitted by the EUT, enclosure, as a tested system	<b><u>PASS</u></b>
Name of Test Engineer:	Dennis King
Signature:	
Date:	4 December 2014
Remarks: <b><u>Radiated Emission Summary LF : 30MHz-1GHz (3 meter test distance)</u></b> <b>Running a square wave on both channels.</b>	

Test Specification: EN 55022:2010 and EN 55024:2010  
Model Name of EUT: ADALM1000  
Manufacturer: Analog Devices

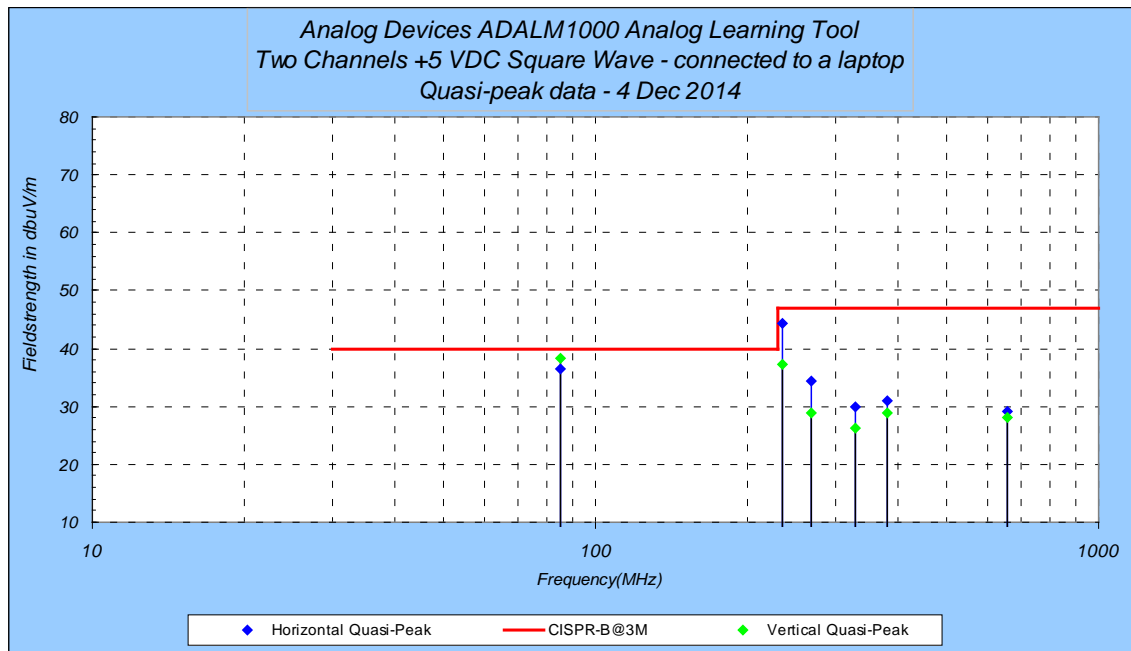
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**Peak data pre-scan – the quasi peak limit is shown in red**

**See the next chart for final quasi peak data to compare against the quasi peak limit**



Frequency(MHz)	Horizontal Quasi-Peak dBuV/m	Vertical Quasi-Peak dBuV/m	Delta from the Class B Limit (dBuV)
85.94	36.58	38.28	<b>-1.72</b>
235.79	44.27	37.19	<b>-2.73</b>
268.75	34.31	28.77	<b>-12.69</b>
329.69	29.99	26.36	<b>-17.01</b>
379.64	31.06	28.94	<b>-15.94</b>
661.35	29.10	28.06	<b>-17.90</b>

Test Specification: EN 55022:2010 and EN 55024:2010

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Model Name of EUT: ADALM1000

Manufacturer: Analog Devices

Revision 1.0




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### 2.2.2 1-6 GHz

The radiated field strength levels (electric component) have been measured in conformity with and according to the criteria as stated below.

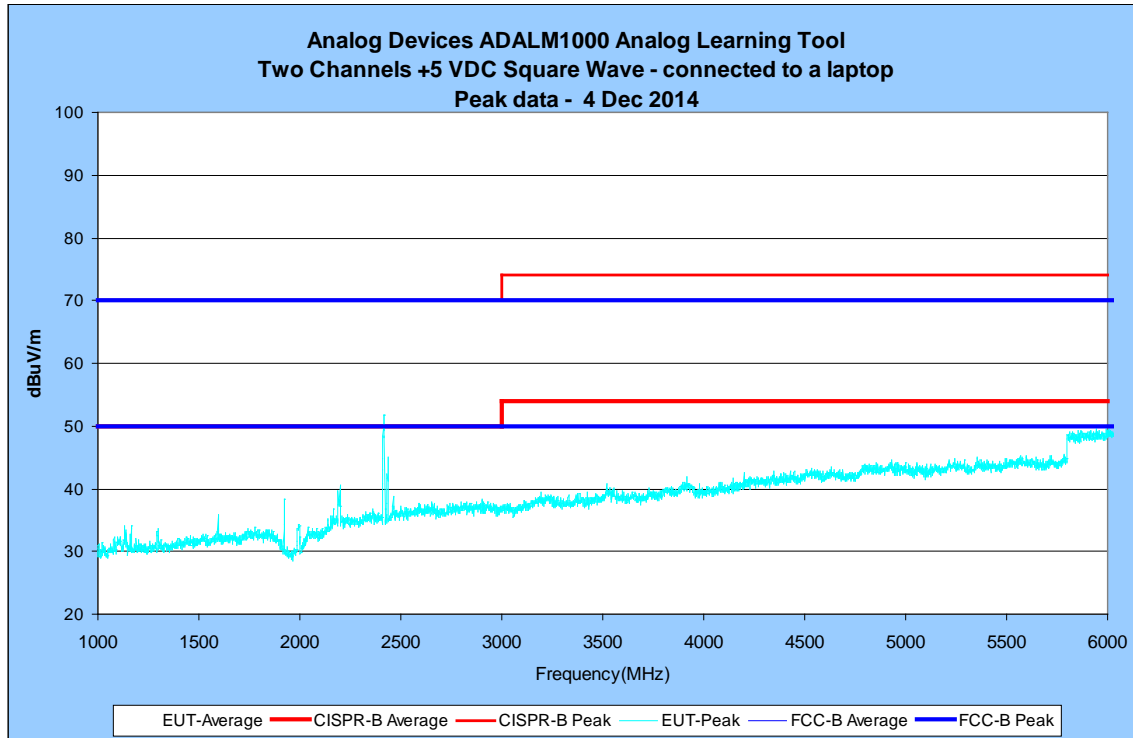
Basic standard	:	CISPR 22:2008
Test setup	:	EN 55022:2010
Limit distance	:	3 meters
Frequency range 1	:	1-3 GHz
Limits	:	Average 50 dBuV/m, Peak 70 dBuV/m
Frequency range 2	:	3-6 GHz
Limits	:	Average 54 dBuV/m, Peak 74 dBuV/m

Results of the measurements concerning radiated electromagnetic fields (electric component) emitted by the EUT, enclosure, as a tested system	<b><u>PASS</u></b> <b><u>Both peak and average scans are passing</u></b>
Name of Test Engineer:	Dennis King
Signature:	
Date:	4 December 2014
Remarks:	<b><u>Radiated Emission Summary HF : 1GHz-6GHz (3 meter test distance)</u></b> Running a square wave on both channels.

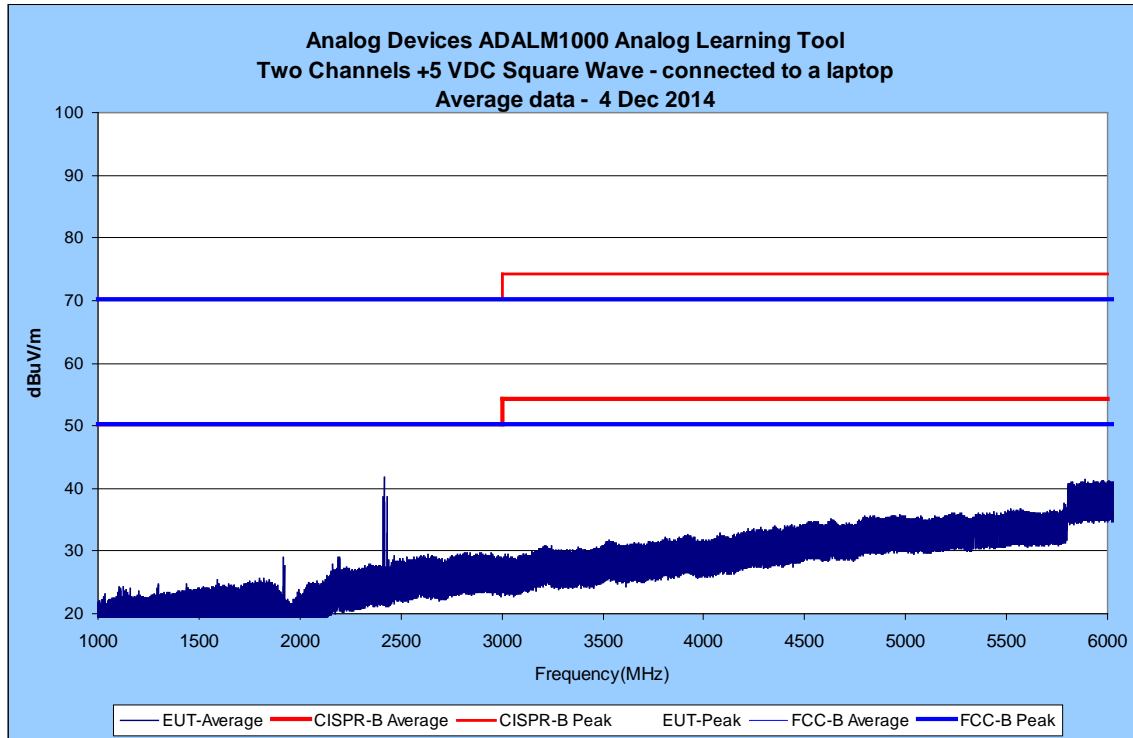
Test Specification: EN 55022:2010 and EN 55024:2010  
Model Name of EUT: ADALM1000  
Manufacturer: Analog Devices

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The above data is peak data to be compared to the upper limit 70 – 74 dBuV/m



The above data is average data to be compared to the lower limit 50 – 54 dBuV/m






**Radiated Emissions Setup Picture**



**2.3 Harmonic current emissions**

The emissions of harmonic currents at the AC mains connection terminals of the EUT were measured in conformance with and according to the criteria as stated below.

Basic standard : EN 61000-3-2  
Test setup : EN 61000-3-2  
Frequency range : 100 Hz – 2000 Hz


Results of the measurements concerning the emission of harmonic currents at the AC mains connection terminals of the EUT	<b><u>PASS per Laptop Manufacturer</u></b>
Name of Test Engineer:	Dennis King
Signature:	
Date:	6 January 2015
Remarks: The power supply was tested at 230VAC 50Hz by Dell, the laptop manufacturer. The Declaration of Conformity and the full test report are available upon request.	



## 2.4 Voltage fluctuations and flicker

Voltage fluctuations and flicker at the AC mains connection terminals of the EUT were measured in conformance with and according to the criteria as stated below.

Basic standard : EN 61000-3-3  
Test setup : EN 61000-3-3

Results of the measurements concerning voltage fluctuations and flicker at the AC mains connection terminals of the EUT	<b><u>PASS per Laptop Manufacturer</u></b>
Name of Test Engineer:	Dennis King
Signature:	
Date:	6 January 2015
Remarks:	The power supply was tested at 230VAC 50Hz by Dell. The Declaration of Conformity and the full test report are available upon request.



### 3 Immunity

The EUT has been tested in conformity with parts of the standard EN 55024:2010 (immunity) concerning susceptibility and transient, conducted and radiated disturbances including electrostatic discharges.

#### 3.1 Performance criteria

The general principles (performance criteria) for the evaluation of the immunity test results are given below. The details are in EN 55024:2010

**Performance Criterion A:** The apparatus shall continue to operate as intended during the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended.

**Performance Criterion B:** The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of function) specified by the manufacturer, when the apparatus is used as intended. During the test, degradation of performance is allowed, however, no change of actual operating state or stored data is allowed.

**Performance Criterion C:** Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls, or by any operation specified in the instructions for use.



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## 3.2 Enclosure Port

### 3.2.1 Radio-frequency electromagnetic field. Amplitude modulated.

The susceptibility of the EUT to radio-frequency electromagnetic fields has been tested in conformity with and according to the criteria as stated below.

- Basic standard : EN55024:2010
- Test setup : EN61000-4-3
- Frequency range : 80 MHz to 1000 MHz
- Field strength level : 3 V/m (selected w/o modulation, applied w/mod.)
- Modulation : 1 kHz AM modulation, 80% depth
- Performance Criteria A : The unit must continue to operate as intended without loss of data or function.

Results of the measurements concerning the susceptibility of the EUT to radio-frequency electromagnetic fields	<b><u>PASS Criterion A</u></b>
<p style="text-align: right;">Name of Test Engineer:</p> <p style="text-align: right;">Signature:</p> <p style="text-align: right;">Date:</p>	<p>Dennis King</p>  <p>10 December 2014</p>
<p><b><u>Remarks: During the first test the unit would lose connection to the host laptop. After adding a ferrite to the usb cable at the M1k end the unit passed 3 V/m. The ferrite shown at the laptop end was not needed to pass.</u></b></p> <p><b><u>After the modification:</u></b>  <b><u>No loss of performance was observed during and after the test. The EUT meets Performance Criteria A.</u></b></p>	

Test Specification: EN 55022:2010 and EN 55024:2010  
Model Name of EUT: ADALM1000  
Manufacturer: Analog Devices

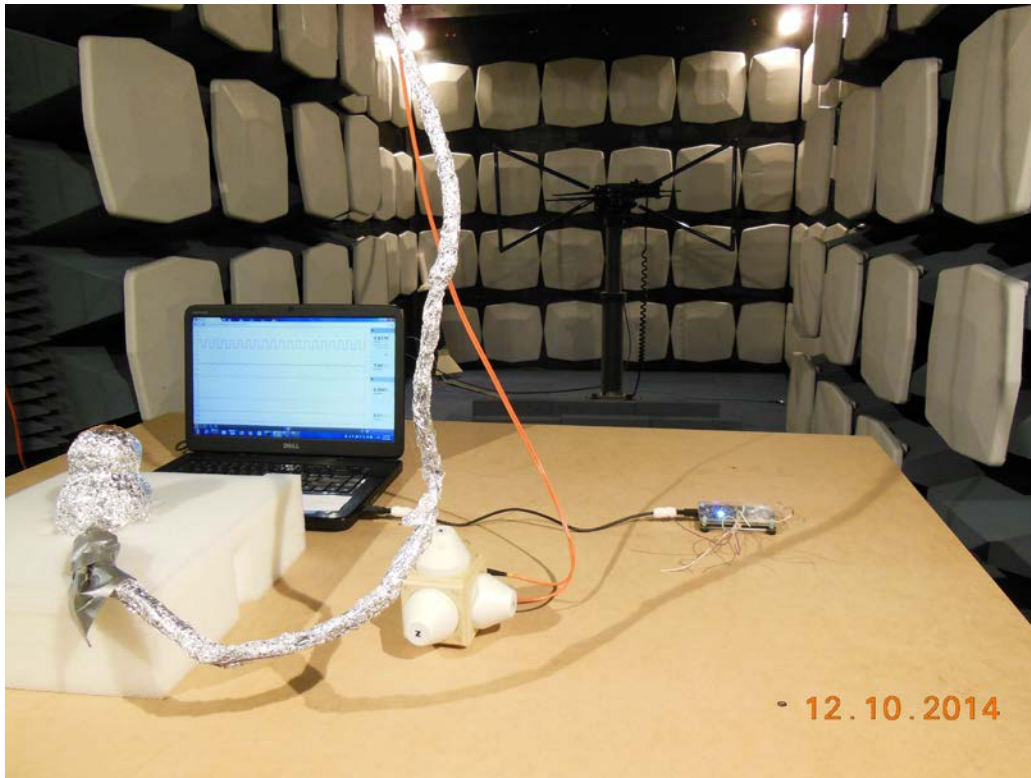
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**Radiated Immunity Summary:**

**Configuration :** The EUT was running a square wave on both channels **PASS 3 V/Meter**



**Radiated immunity test setup – 80-1,000 MHz, 3 V/m**

**The unit continued to run during and after the Immunity testing –  
Passing Criteria A.  
All 4 sides, Vertical and Horizontal were checked at 3V/M  
No errors were detected**






### 3.2.2 Electrostatic discharge

The susceptibility of the EUT to electrostatic discharge was not tested. See notes below.

Basic standard : EN 55024:2010  
Test setup : EN 61000-4-2  
Test levels : +- 4kV and +- 8 kV air discharge  
                  +- 2kV and +- 4 kV contact discharge  
                  +- 2kV and +- 4 kV horizontal and vertical planes  
Performance criteria : B

Results of the test concerning the susceptibility of the EUT to electrostatic discharges (enclosure port)	<b><u>Not tested</u></b>
Name of Test Engineer:	Dennis King
Signature:	
Date:	6 January 2015
Remarks: <b>Due to the open nature of the circuit board, ESD testing is not applicable to this product. Advice will be given to the Users to exercise proper ESD precautions when handling the circuit board.</b>	



**(Not Applicable)**



The red arrows are contact discharge areas, the blue arrows are air discharge areas.




**Signal ports including telecommunication ports**

**3.2.3 Radio-frequency (common mode). Amplitude modulated**

The susceptibility of the EUT to radio-frequency (common mode, amplitude modulated) signals to be tested in conformity with and according to the criteria as stated below

Basic Standard	:	EN 55024:2010
Test setup	:	EN 61000-4-6
Frequency range	:	0.15 – 80 MHz
Test level	:	3 Vrms
Modulation	:	1 kHz AM to a depth of 80%
Source impedance	:	150 Ohms
Performance criteria	:	Criteria A

**Note: Conducted only on ports interfacing with cables whose total length, according to the manufacturer's functional specification, may exceed 3 meters.**

Results of the test concerning the susceptibility of the EUT to radio-frequency signals (common mode, AM modulated applied to signal and telecom ports)	<b><u>N/A – no cables 3 meters or longer</u></b>
Name of Test Engineer:	Dennis King
Signature:	
Date:	6 January 2015
Remarks:	There are no cables 3 meters or longer connected to the EUT.



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### 3.2.4 Fast Transients

The susceptibility of the EUT to fast transients has been tested in conformity with and according to the criteria as stated below.

Basic standard : EN 55024:2010  
Test setup : EN 61000-4-4  
Test level : +- 0.5 KV  
Tr/Th : 5/50 nSec  
Repetition frequency : 5 kHz  
Performance criteria : Criteria B

**Note: Conducted only on ports interfacing with cables whose total length, according to the manufacturer's functional specification, may exceed 3 meters.**

Results of the test concerning the susceptibility of the EUT to fast transients	<b><u>N/A – no cables 3 meters or longer</u></b>
Name of Test Engineer:	Dennis King
Signature:	
Date:	6 January 2015
Remarks:	The Ethernet cable was tested. No loss of function..

Test Specification: EN 55022:2010 and EN 55024:2010

Model Name of EUT: ADALM1000

Manufacturer: Analog Devices

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### 3.3 AC input and AC output power ports

#### 3.3.1 Radio-frequency (common mode, amplitude modulated)

The susceptibility of the EUT to radio-frequency signals (common mode, amplitude modulated, has been tested in conformity with and according to the criteria as stated below.

Basic standard	:	EN 55024:2010
Test setup	:	EN61000-4-6
Frequency range	:	0.15 – 80 MHz
Test level	:	3 Vrms
Source impedance	:	150 Ohms
Performance criteria	:	Criteria A

Results of the test concerning the susceptibility of the EUT to radio-frequency signals (common mode, amplitude modulated) – AC input and AC output power ports	<b><u>PASS per Dell</u></b>
Name of Test Engineer:	Dennis King
Signature:	
Date:	6 January 2015
Remarks: <b>Configuration :</b> The EUT has no AC connection, it gets power through the usb cable. <b>The Dell host laptop has been tested and passes.</b> <b>PASS 3 V/Meter per Dell</b>	

Test Specification: EN 55022:2010 and EN 55024:2010

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Model Name of EUT: ADALM1000

Manufacturer: Analog Devices

Revision 1.0




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### 3.3.2 Surges

The susceptibility of the EUT to surges has been tested in conformity with and according to the criteria as stated below

Basic Standard	:	EN 55024:2010
Test setup	:	EN 61000-4-5
Test level 1	:	+0.5 kV, +- 1.0 kV Differential Mode
Test level 2	:	+ 2 kV common Mode
Tr/Th	:	1.2/50(8/20) micro Seconds
Number of pulses		
Per phase angle/voltage	:	5
Performance criteria	:	Criteria B
Note	:	<b><u>Applicable only to input AC ports</u></b>

Results of the test concerning the susceptibility of the EUT to surges (AC input and AC output power ports)	<b><u>PASS per Dell</u></b>
Name of Test Engineer:	Dennis King
Signature:	
Date:	6 January 2015
Remarks: <b>Configuration :</b> The EUT has no AC connection, it gets power through the usb cable. <b>The Dell host laptop has been tested and passes.</b>	

Test Specification: EN 55022:2010 and EN 55024:2010

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Model Name of EUT: ADALM1000

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Revision 1.0






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### 3.2.4 Fast Transients

The susceptibility of the EUT to fast transients (common mode) has been tested in conformity with and according to the criteria as stated below.

- Basic standard : IEC/EN 60601-1-2:2007
- Test setup : EN 61000-4-4
- Test level : +- 1 KV
- Tr/Th : 5/50 nSec
- Repetition frequency : 5 kHz
- Performance criteria : Criteria B
- Note : **Conducted on the AC input.**

Results of the test concerning the susceptibility of the EUT to fast transients (common mode, AC input and AC output ports)	<b><u>PASS per Dell</u></b>
<p style="text-align: right;">Name of Test Engineer:</p> <p style="text-align: right;">Signature:</p> <p style="text-align: right;">Date:</p>	<p>Dennis King</p>  <p>6 January 2015</p>
<p>Remarks:</p> <p><b>Configuration :</b> The EUT has no AC connection, it gets power through the usb cable. The Dell host laptop has been tested and passes.</p>	




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### 3.3.4 Voltage Dips and Interruptions

The susceptibility of the EUT to voltage dips and interruptions has been tested in conformity with and according to the criteria as stated below.

Basic Standard	:	EN 55024:2010
Test setup	:	EN61000-4-11
Test level (a)	:	Line at 0% of nominal for 0.5 cycles
Test level (b)	:	Line at 40% of nominal for 5 cycles
Test level (c)	:	Line at 70% of nominal for 25 cycles
Test level (d)	:	Line at 0% of nominal for 250 cycles

Results of the test concerning the susceptibility of the EUT to voltage dips and interruptions – AC input and AC output ports	<b><u>PASS per Dell</u></b>
Name of Test Engineer:	Dennis King
Signature:	
Date:	6 January 2015
Remarks:	<b>Configuration :</b> The EUT has no AC connection, it gets power through the usb cable. The Dell host laptop has been tested and passes.

Test Specification: EN 55022:2010 and EN 55024:2010

Model Name of EUT: ADALM1000

Manufacturer: Analog Devices

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### 3.3.5 Power Frequency Magnetic Fields

The susceptibility of the EUT to power frequency magnetic fields has been tested in conformity with and according to the criteria as stated below.

Basic Standard : EN 55024:2010  
Test setup : EN61000-4-8  
Test level : 1 Amp per meter, X,Y and Z axis

Results of the test concerning the susceptibility of the EUT to	<b><u>Not Applicable</u></b>
Name of Test Engineer:	Dennis King
Signature:	
Date:	6 January 2015
Remarks:	There are no magnetically sensitive components in this product.

Test Specification: EN 55022:2010 and EN 55024:2010  
Model Name of EUT: ADALM1000  
Manufacturer: Analog Devices

Prepared by EMI Test Lab - EMITestLab.com

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## 4.0 Modifications

A clamp-on ferrite was added to the usb cable at the circuit board end to help pass radiated immunity, type 28 material made by Steward.



Test Specification: EN 55022:2010 and EN 55024:2010

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Revision 1.0



**5.0 Test equipment**  
**Table of Test Equipment**

<b>Equipment</b>	<b>Description and Test</b>	<b>Model number</b>	<b>Serial number</b>	<b>Next cal due</b>
HP Spectrum Analyzer	Used for Radiated and Conducted Emissions	8566B	2607A02760	3 June 2015
HP Quasi-Peak Adapter	Used for Radiated and Conducted Emissions	85650A	8574A00233	3 June 2015
Com-Power transient Limiter	Conducted Emissions	HZ560	001	3 June 2015
RF Bay Pre-Amp	Radiated emissions – 100kHz to 10 GHz	LPA-10-20	0643	2 Dec 2015
GTEM	Radiated Emissions and Radiated Immunity	5317	9703-1209	26 April 2015 – Field Uniformity Cal per IEC 61000-4-20
HP Signal Generator	Radiated Immunity	8657A	STD0578	3 May 2015
HP Synthesized Sweep Generator .01-20 GHz	Radiated Immunity 1 GHz to 2.5 GHz	83752B	34462	3 May 2015
Amplifier Research .800 – 4.2 GHz Amp	Radiated Immunity – 1 GHz to 2.5 GHz	10S1G4	34516	4 May 2015
Kalmus Power Amplifier	Radiated Immunity 150kHz – 1 GHz	747LC-CE	7894-1	10 May 2015
Amplifier Research E- Field Probe	Radiated Immunity	FP 2000	12845	10 May 2015
Com-Power LISN	Conducted emissions	LI-115	241010	17 May 2015
Com-Power LISN	Conducted emissions	LI-115	241011	11 September 2015

Test Specification: EN 55022:2010 and EN 55024:2010

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Model Name of EUT: ADALM1000

Manufacturer: Analog Devices

Revision 1.0



California Instruments 1000 VA Power Source	Emissions and Immunity - used as a 100/120/230/240-VAC 50/60 Hz AC source	1001WP	L04788	4 June 2015
EMI Labs CDN	Conducted Immunity	EMICDN	001	9 Dec 2015
Schaffner ESD Gun	Electro Static Discharge	NSG435	54711	11 Dec 2015
KeyTek ECAT	Fast transients / Burst	E412	32612	5 June 2015
FCC Inc. RF Current Probe	Monitor Conducted Immunity signal	F-33-1	423	9 Dec 2015
EMI Labs Mag Loop	Magnetic Loop Antenna	Mag100	80162	12 Dec 2015
Thermo Keytek CE Master	Surge/ AC Dips and Interrupts	CE Master	0405277	15 Dec 2015

*All equipment used for testing has been calibrated or verified for cal using NIST traceable standards. Each piece of test equipment has a cal verification procedure that is conducted before and after each test.*



## 6.0 Measurement Uncertainty – Radiated Emissions

Table of Uncertainty Calculation					
√	Contribution	Designation	Probability Distribution	k	Uncertainty (dB)
	Equipment Under Test Uncertainties	$U_{EUT}$			Note 1
√	Measuring Receiver Amplitude Accuracy	$U_{RXaccuracy}$	rectangular	$\sqrt{3}$	± 0.9
√	GTEM Uniformity	$U_{Uniformity}$	rectangular	$\sqrt{3}$	± 4.0
√	Secondary Field Components	$U_{Secondary}$			Excluded by Test Method
√	Mismatch Uncertainty-GTEM to Pre-Amplifier	$U_{Mismatch}$	U-shaped	$\sqrt{2}$	+0.63 and -0.65
√	Mismatch Uncertainty-Pre-Amplifier to Spectrum Analyzer	$U_{Mismatch}$	U-shaped	$\sqrt{2}$	+0.92 and -1.03
√	System Sensitivity Error	$U_{Sensitivity}$	rectangular	$\sqrt{3}$	0.28
√	GTEM Electric-Field Frequency Response	$U_{E-Field}$	rectangular	$\sqrt{3}$	± 1.6
	Ambient Signal Uncertainty	$U_{Ambient}$			Not Significant
√	GTEM to OATS Correlation	$U_{Corr}$	rectangular	$\sqrt{3}$	±1.2
√	Septum Height Variation	$U_{Septum}$	normal	2	+0.72 and -0.82
	Coaxial Cable Temperature Variations	$U_{CableTemperature}$			Not Significant
√	Coaxial Cable Calibration	$U_{CableCalibration}$	rectangular	$\sqrt{3}$	±0.05
√	Pre-amplifier Calibration Uncertainty	$U_{Pre-Amp}$	rectangular	$\sqrt{3}$	±0.05
	Combined Uncertainty(dB) Positive Terms				2.77
	Combined Uncertainty(dB) Negative Terms				-2.75
	Expanded Uncertainty Positive Terms		Normal	2	5.54
	Expanded Uncertainty Negative Terms		Normal	2	-5.50

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Revision 1.0



**Typical Measurement Uncertainty for the following Tests:**

The estimated combined standard uncertainty for ESD testing, EN 61000-4-2 is $\pm 4\%$
The estimated combined standard uncertainty for Radiated Immunity, EN 61000-4-3 is $\pm 2.7\text{dB}$
The estimated combined standard uncertainty for EFT/Burst, EN 61000-4-4 is $\pm 5.8\%$
The estimated combined standard uncertainty for Surge, EN 61000-4-5 is $\pm 8\%$
The estimated combined standard uncertainty for Conducted Immunity, EN 61000-4-6 is $\pm 1.5\text{ dB}$
The estimated combined standard uncertainty for Magnetic Fields, EN 61000-4-8 is $\pm 0.6\%$
The estimated combined standard uncertainty for Voltage Dips and Interrupts, EN 61000-4-11 is $\pm 4.3\%$
The estimated combined standard uncertainty for Conducted Emissions, CISPR 11 is $\pm 1.2\text{dB}$
The estimated combined standard uncertainty for Harmonic current and flicker is $\pm 11.6\%$





## **7.0 Test Plan**

### **Objective:**

The ADALM1000 is to be tested for CE Mark Compliance and shall pass Class B Radiated and Conducted Emissions.

The Kit shall also pass all immunity tests that apply.

- ESD
- RF Immunity
- EFT/Burst
- Surge
- Conducted Immunity
- AC Dips and Interrupts
- Power Frequency Magnetic Field

Reliance upon CE MARK Compliance of the power supply shall be utilized for the power supply tests, as applicable, some re-testing is required due to system level testing.

### **CE Class B Emissions Test:**

- **Radiated Emissions – Frequency Range <30MHz-1GHz > (3 meter test distance)**
  - Class B Spec: EN 55022:2010
  - Test Method: CISPR 22:2008
- **Radiated Emissions – Frequency Range <1GHz-6GHz > (3 meter test distance)**
  - Class A Spec: EN 55022:2010
  - Test Method: CISPR 22:2008
- **Conducted Emissions – Frequency Range <150kHz-30MHz > Hot line & Neutral line, Peak and Quasi-Peak measurements**
  - Class A Spec: EN 55022:2010
  - Test Method: CISPR 22:2008



## CE Immunity Tests:

- **Radiated Immunity – at 3V/m – EN 61000-4-3**  
4 Sides Vertical and 4 Sides Horizontal polarization (directional antenna orientation)  
Frequency Range <80MHz-1GHz w/ 1KHz 80% AM modulation>
  - Spec: EN 55024:2010
  - Test Method: EN 61000-4-3
- **Conducted Immunity – at 3 Vrms – EN 61000-4-6**  
Frequency Range <0.15 – 80 MHz w/ 1KHz 80% AM modulation>
  - Spec: EN 55024:2010
  - Test Method: EN 61000-4-6
  
- EN 61000-4-2 Electro Static Discharge
- EN 61000-4-4 EFT / Burst
- EN 61000-4-5 Surge
- EN 61000-4-8 Mag Fields
- EN 61000-4-11 AC Dips and Interrupts

## Test Configuration Definition:

The EUT is a circuit board that is connected to a host laptop that runs the software for the unit. The unit will be run with both channels producing a square wave. A 100 ohm resistor will be connected from channel A and B to ground. A 1k ohm resistor will be connected from 5 VDC to 2.5 VDC.

The unused pins of the Pmod connector will have wires connected and unterminated, about 6 inches long.

## **Software provided:**

<http://apps.nonolithlabs.com/edge/pixelpulse>



## **Test Instructions**

### **How to run the Analog Devices ADALM1000**

Basic instructions:

>>

>> 1: plug the ADALM1000 into your Windows laptop, wait for windows to give up trying to install the driver.

>> 2: download <http://zadig.akeo.ie> and run it.

>> 3: choose Helium from the big dropdown box. Make sure WinUSB is selected in the little dropdown.

>> 4: click install and follow the instructions.

>> 5: download [itdaniher.com/static/nonolith-connect.exe](http://itdaniher.com/static/nonolith-connect.exe) and run it from a command line, with the device attached.

This is a dos command - in dos go to the directory where it is saved, type the file name "nonolith-connect.exe" hit enter, nothing happens but the program is executed for the next step to work,

<http://itdaniher.com/static/nonolith-connect.exe>

>> 6: open [apps.nonolithlabs.com/edge/pixelpulse](http://apps.nonolithlabs.com/edge/pixelpulse) in chrome or firefox.

>> <http://apps.nonolithlabs.com/edge/pixelpulse>

Now you should see the program GUI running, go to the example link below and run the device, I use 5v and run a square wave, worst case for emissions,

The tutorial walk-through can be found at

[http://wiki.nonolithlabs.com/cee/App\\_Notes/I-V\\_Curve\\_Tracing/](http://wiki.nonolithlabs.com/cee/App_Notes/I-V_Curve_Tracing/)

Older version of the hardware, but same UI and functionality.

- the documentation on the design, not completely finished, including schems and manual, can be found at

<http://wiki.analog.com/university/tools/m1k>

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I'll send you a written copy of the testing diagram we discussed including the reduction of chA/chB resistors from 1k to 100o, the addition of wire leads to the PIO port, and a 1ko resistor across the 2v5 and 5v0 rails.

Thanks,  
Ian

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Revision 1.0



## **8.0 Conclusion**

**Analog Devices ADALM1000 complies with;**

**the emissions standard EN 55022:2010**

**and the immunity standard EN 55024:2010**

**in the configuration and operating mode as stated in this test report.**

**End of Report**