



Electro Magnetic Compatibility Test Report
Regarding the CE Mark and the
Australia / New Zealand Compliance of the
Aleph Objects
LulzBot Mini “Gladiola” 3D Printer

In Accordance with the Information Technology Standards
AS/NZS CISPR 22, AS/NZS CISPR 32 and EN 55022, EN 55032,
EN 61000-3-2, EN 61000-3-3 for Emissions, Class B for home use

And

AS/NZS CISPR 24 and EN 55024 for Immunity

Report Revision History

Revision	Date	Reason
1.0	6 November 2016	Initial Release

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
Manufacturer: Aleph Objects Inc.

Prepared by EMI Test Lab - EMITestLab.com

Revision 1.0



Description of Equipment Under Test (EUT)

Test Item : LulzBot Mini "Gladiola" 3D Printer
Manufacturer : Aleph Objects, Inc.
Receipt date : 21 October 2016

Manufacturer's information

Manufacturers
Representative : Eric Kuzmenko
Company : Aleph Objects, Inc.
Address : 626 West 66th Street
Loveland, Colorado 80538
U.S.A.
Website : <https://www.alephobjects.com/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, EN 55024, EN 55032, CISPR 22, CISPR 24,
CISPR 32, AS/NZS CISPR 22, 24 and 32, Class B emissions
Tests completed : 26 October 2016

Result of Testing : **The EUT is in Compliance with EN 61000-3-2, EN 61000-3-3
EN 55022:2010, EN 55024:2010+A1:2015, EN 55032:2015,
CISPR 22:2008, CISPR 24:2015, CISPR 32:2015, Class B
AS/NZS CISPR 22:2009, AS/NZS CISPR 24:2013, AS/NZS CISPR 32:2015**

Senior EMC Engineer : Dennis King

Report written by : Dennis King – EMI Test Lab
Test Plan : Dennis King and Eric Kuzmenko for Aleph Objects
Report date : 6 November 2016

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

Test Specification: CISPR 22,24, 32
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1 General

1.1 Applied Standards

The LulzBot Mini “Gladiola” 3D Printer was evaluated for emissions using the international standards CISPR 22:2008, CISPR 32:2015, the European standards EN 55022:2010, EN 55032:2015 and Australia’s standard AS/NZS CISPR 22:2009 and AS/NZS CISPR 32:2015.

Immunity standards applied are the international standards CISPR 24:2015, the European standard EN 55024:2010+A1:2015 and Australia’s standard AS/NZS CISPR 24:2013.

CISPR are the international standards, countries across the world adopt the CISPR standards with sometimes minor changes and sometimes with no changes at all. Europe adopts the CISPR standards and adds the prefix “EN”. Australia and New Zealand adopt the CISPR standards and adopt the prefix AS/NZS, and so on around the world. North America has harmonized with the CISPR emissions standards but has no requirement for immunity.

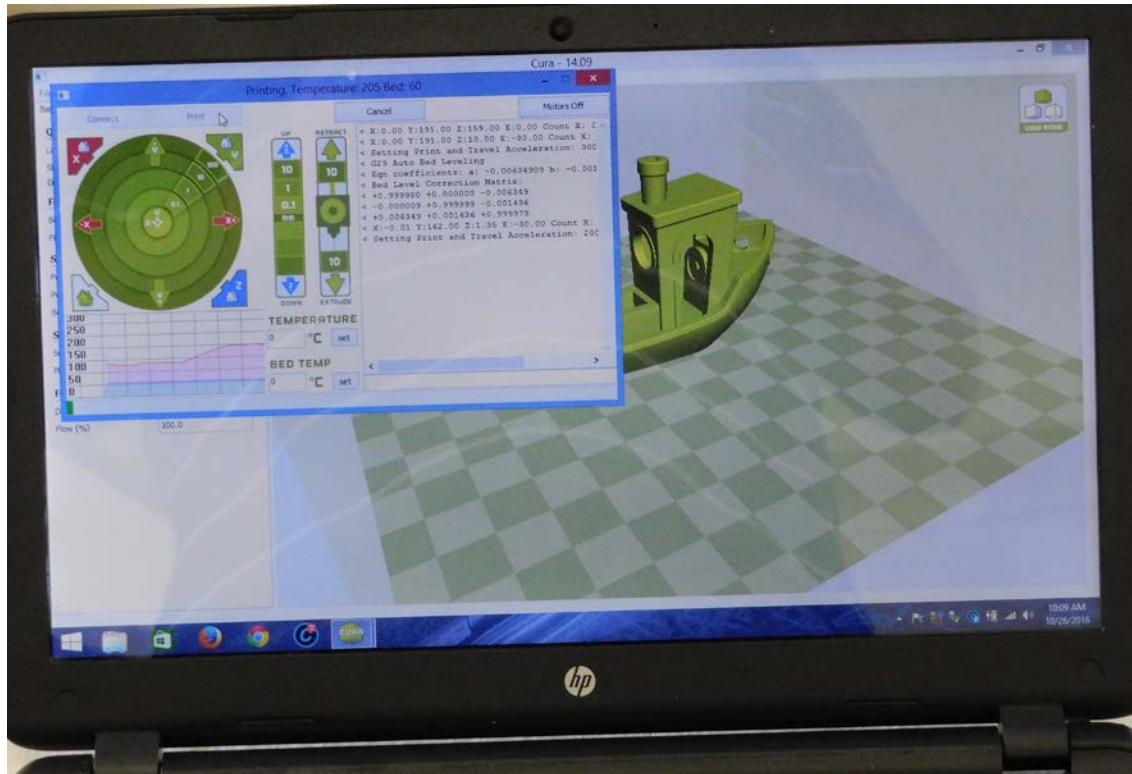
1.2 Detailed description of the test configuration, input and output ports

The 3D Printer was tested while printing. The printer was connected to a laptop through the usb port on the printer. The software was installed on the laptop by Aleph Objects and represents typical software currently used by the end user.

For all test configurations the equipment under test (EUT) is powered by European AC power: 230VAC/50Hz. Conducted power line emissions was also run at 240 VAC 50 Hz for Australian compliance. All I/O cables are less than 3 meters.

LulzBot Mini Software:

The default software for the LulzBot Mini 3D printer is called Cura LulzBot Edition. Cura is a Free Software program that both prepares your files for printing (by converting your model into GCODE), and also allows you to control the operation of your LulzBot 3D printer. The revision used during the testing was 14.09.



Typical screen shot of software used during emissions and immunity testing.

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
Manufacturer: Aleph Objects Inc.

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1.2.1 Description of test configuration

EUT : LulzBot Mini “Gladiola” 3D Printer
Manufacturer : Aleph Objects, Inc.
System model name : Mini
Serial Number : 001 and 002
two units were tested for radiated emissions
Test Voltage : 230/240 VAC 50 Hz
Firmware revision : Marlin v1.1.0.9
Hardware revision : 1.04

1.2.2. Description of tested input and output ports and power supply information

Number of cable type	Type of Cable	From	To	Shielded?	Remarks - length
1	USB	Test Laptop	LulzBot Mini	Yes	6 ft. Tripp Lite model: U023-006 – ferrites on both ends

Power supply location	Manufacturer	Model	Serial number	Shielded	Remarks
Internal AC supply	Delta Electronics, Inc.	PMC-24V150W1AA	Not available	Shielded enclosure	TUV Rheinland Certified – Output; 24V 6.25A

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1.2.2 Operation modes

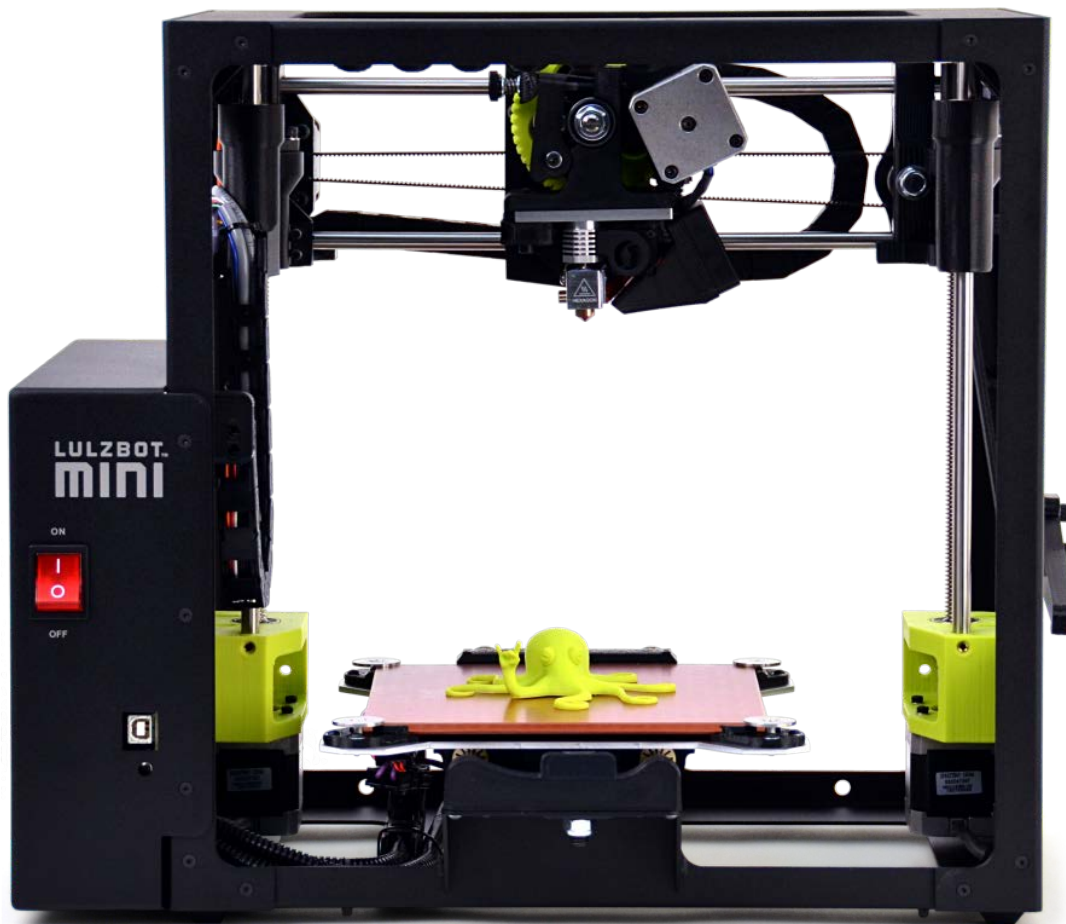
During preliminary testing for emissions it was determined that the following configurations are worst case for emissions and immunity. All further testing was done in these modes.

The system is operating in a typical mode as used by the end user.

The 3D Printer was tested while printing. The printer was connected to a laptop through the usb port on the printer. The software was installed on the laptop by Aleph Objects and represents typical software currently used by the end user.

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The LulzBot Mini – 3D Printer

<https://www.lulzbot.com/blog/lulzbot-mini-3d-printer>

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2 Emissions

The EUT (equipment under test) has been tested to determine conformity with the relevant emissions parts of the EN 55022:2010, EN 55032:2015, CISPR 22, CISPR 32, AS/NZS CISPR 22:2009 and AS/NZS 32:2015.

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

Harmonic currents at the AC mains connection terminals of the EUT were measured in conformance with and according to EN 61000-3-2:2014.

Voltage fluctuations and flicker at the AC mains connection terminals of the EUT were measured in conformance with and according to EN 61000-3-3:2013.



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, EN 55032, AS/NZS CISPR 22 and 32
Frequency range 1	:	0.15 – 0.5 MHz
Limit	:	66 dBuV quasi peak, 56 dBuV average Decreasing with the log of frequency to range 2
Frequency range 2	:	0.5 – 5 MHz
Limit	:	56 dBuV quasi peak, 46 dBuV average
Frequency range 3	:	5 – 30 MHz
Limit	:	60 dBuV quasi peak, 50 dBuV average

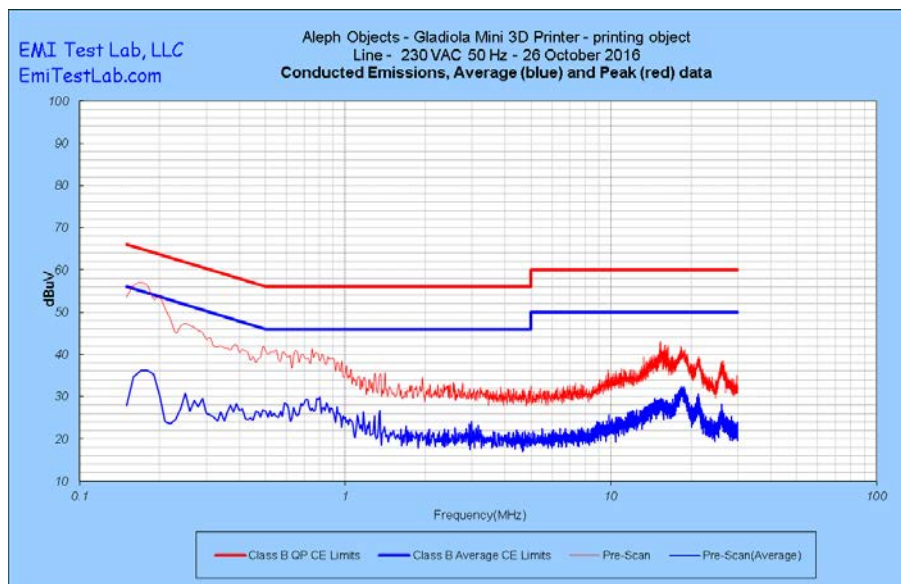
Results of the measurements concerning the emissions of voltage levels at the AC mains input port of the EUT.	<u>PASS Class B</u>
Name of Test Engineer:	Dennis King
Signature:	
Date:	26 October 2016
Remarks: The configuration was tested at 230 and 240VAC 50Hz. <u>Conducted Emission Summary:</u> Passing.	



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230 VAC 50 Hz – Line and Neutral – Peak passing Quasi peak limit – Average data passing the average limit – unit s/n 001



Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
Manufacturer: Aleph Objects Inc.

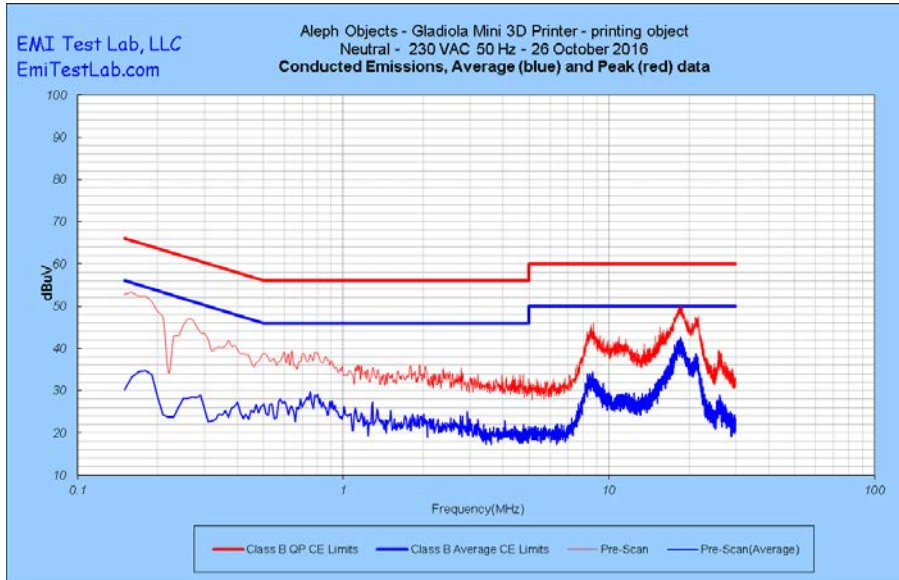
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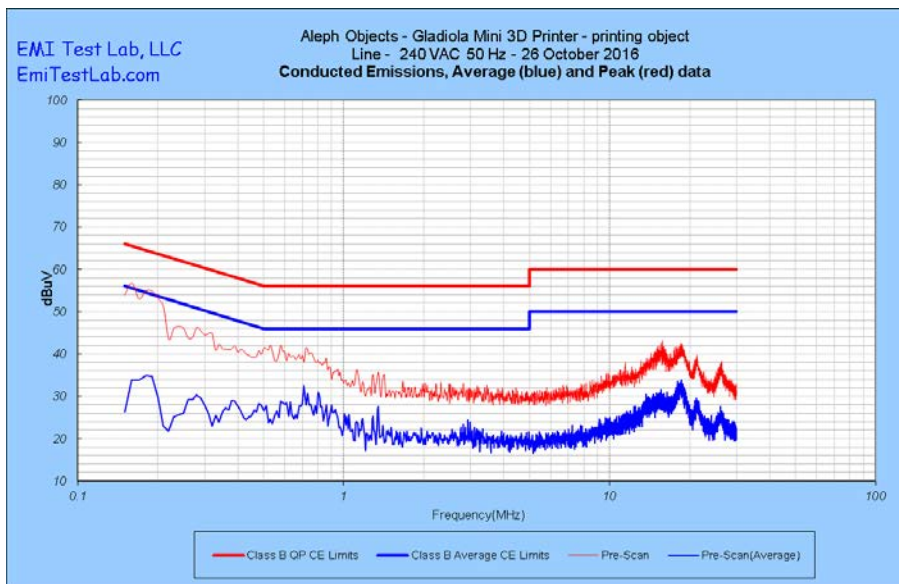


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240 VAC 50 Hz – Line and Neutral – Peak passing Quasi peak limit – Average data passing the average limit – unit s/n 001



Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
Manufacturer: Aleph Objects Inc.

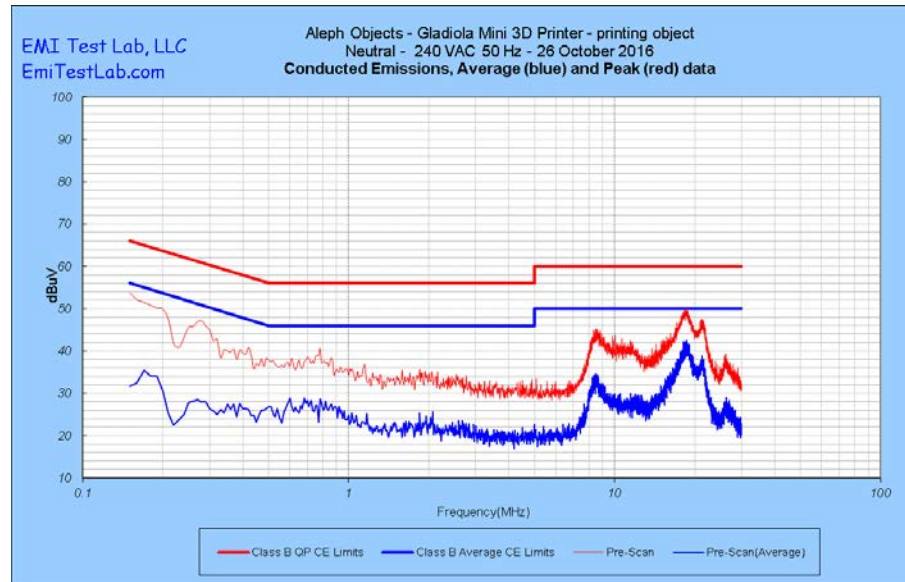
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Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
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Test setup for Conducted Emissions

2.2 Enclosure

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
Manufacturer: Aleph Objects Inc.

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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, EN 55032, AS/NZS CISPR 22 and 32
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	<u>PASS Class B</u>
Name of Test Engineer:	Dennis King
Signature:	
Date:	21 October 2016
Remarks: <u>Radiated Emissions Summary:</u> Two units pass Class B.	

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
Manufacturer: Aleph Objects Inc.

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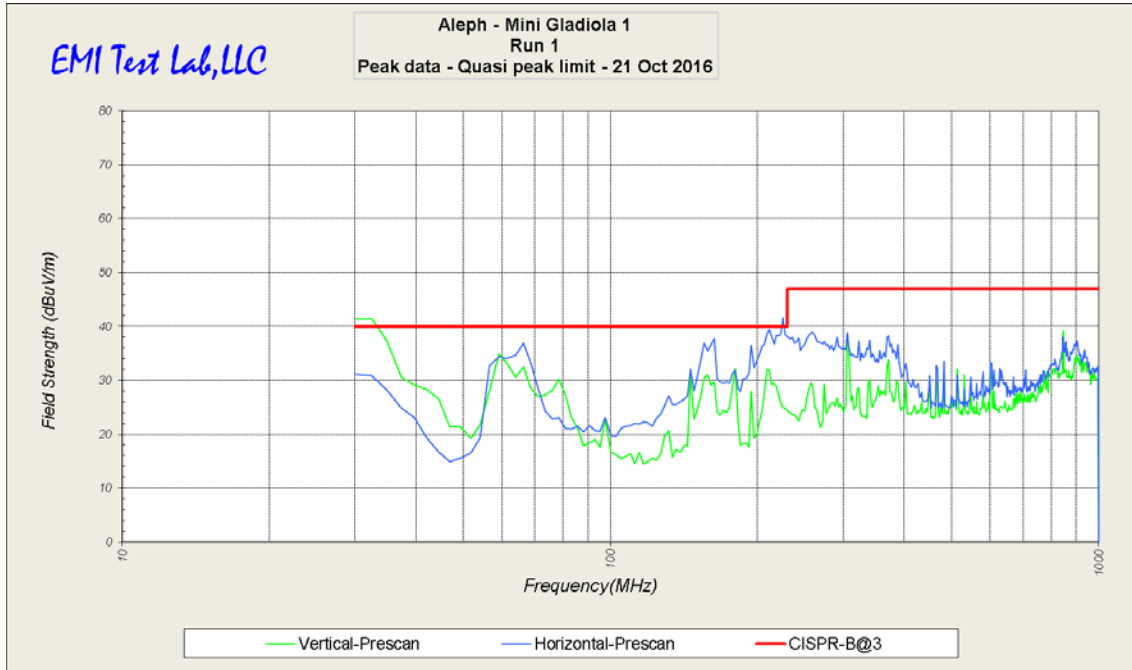
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Peak data compared to a quasi peak limit – see the next chart for the passing quasi peak data



Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
Manufacturer: Aleph Objects Inc.

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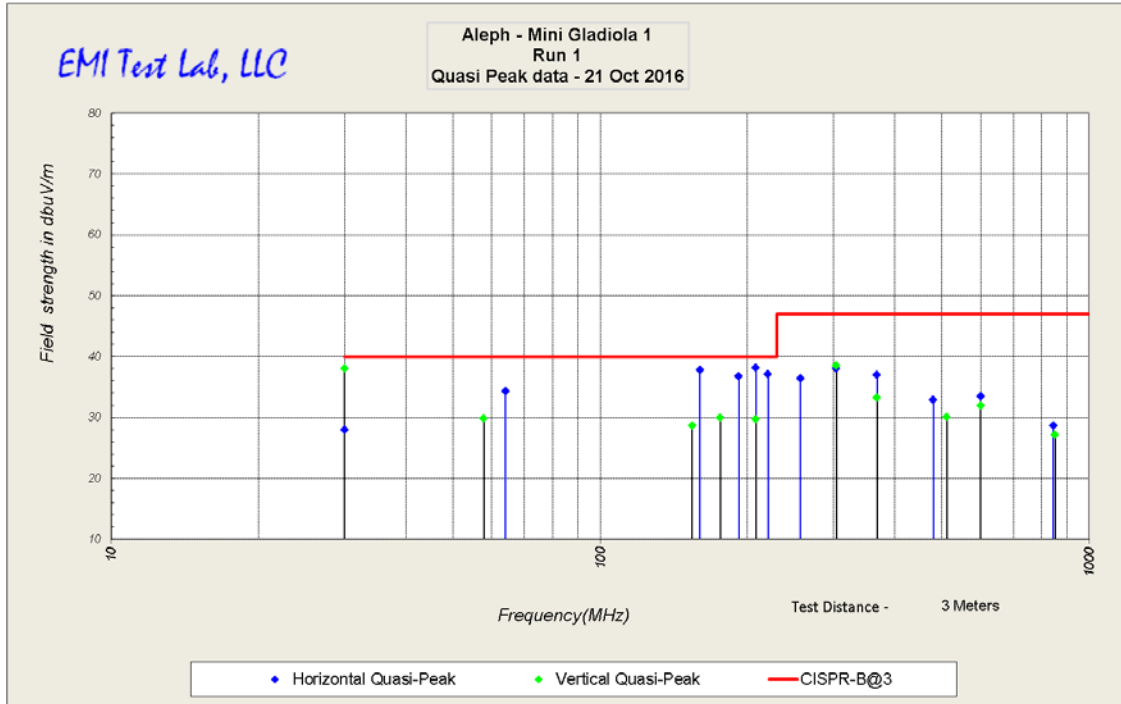
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Passing Quasi peak data compared to the quasi peak limit



Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

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Quasi peak data unit #1

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1822 Skyway Drive, Unit J, Longmont Co
Dennis King dennis@emitestlab.com , Cell 303-746-0611

Frequency	F.S. EUT	Limit	Azimuth	Height	Antenna Polarization	
(MHz)	(dBuV/m)	(dBuV/m)	Degrees	Meters	H or V	Margin
304.01	38.52	47	12.0	1.40	V	-8.48
368.01	33.28	47	20.0	1.40	V	-13.72
511.99	30.06	47	28.0	1.40	V	-16.94
600.01	31.97	47	72.0	1.40	V	-15.03
176.01	29.93	40	84.0	1.40	V	-10.07
154.09	28.71	40	148.0	1.40	V	-11.29
207.97	29.73	40	288.0	1.40	V	-10.27
57.81	29.86	40	320.0	1.40	V	-10.14
851.62	27.13	47	336.0	1.40	V	-19.87
480.00	32.90	47	8.0	1.40	H	-14.10
256.93	36.37	47	20.0	1.40	H	-10.63
220.30	37.07	40	20.0	1.40	H	-2.93
600.02	33.43	47	56.0	1.40	H	-13.57
368.02	37.03	47	120.0	1.40	H	-9.97
304.01	38.04	47	124.0	1.40	H	-8.96
192.00	36.80	40	140.0	1.40	H	-3.20
208.01	38.25	40	168.0	1.40	H	-1.75
208.02	38.18	40	168.0	1.40	H	-1.82
160.01	36.19	40	192.0	1.40	H	-3.81
64.01	34.31	40	276.0	1.40	H	-5.69
845.25	28.69	47	288.0	1.40	H	-18.31
160.01	37.81	40	332.0	1.40	H	-2.19
30.00	38.00	40	37.0	1.40	V	-2.00

Test Specification: CISPR 22,24, 32

Model Name of EUT: LulzBot Mini " Gladiola"

Manufacturer: Aleph Objects Inc.

Prepared by EMI Test Lab - EMITestLab.com

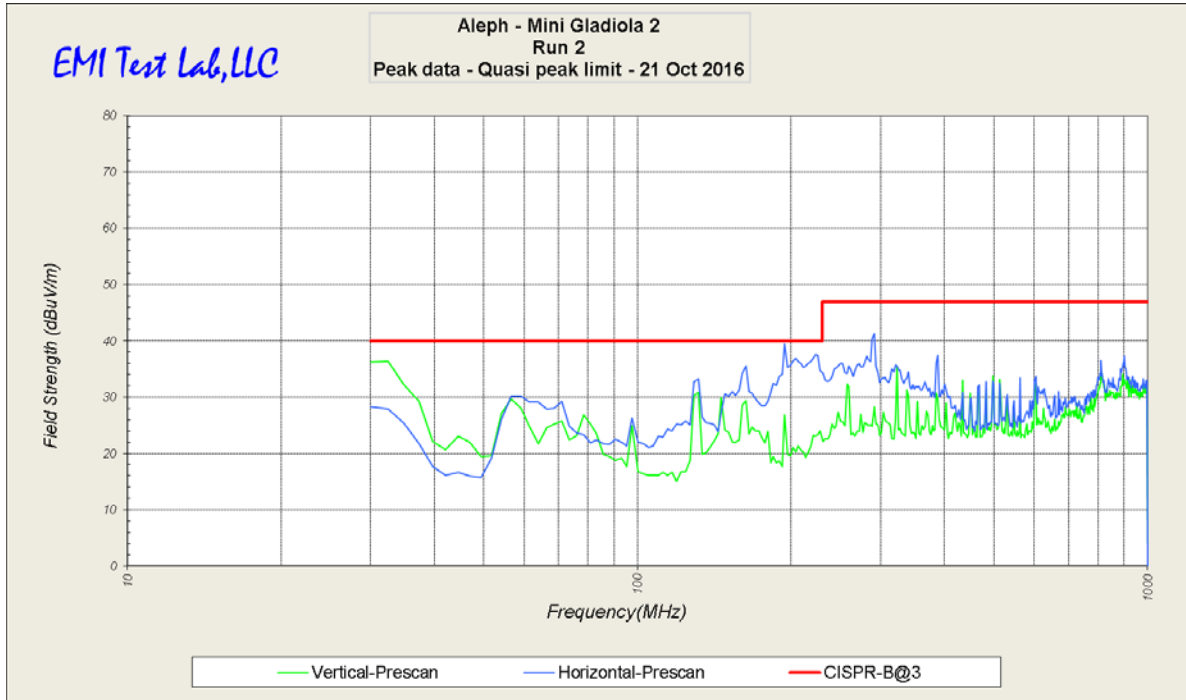
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Peak data compared to a quasi peak limit – see the next chart for the passing quasi peak data



Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

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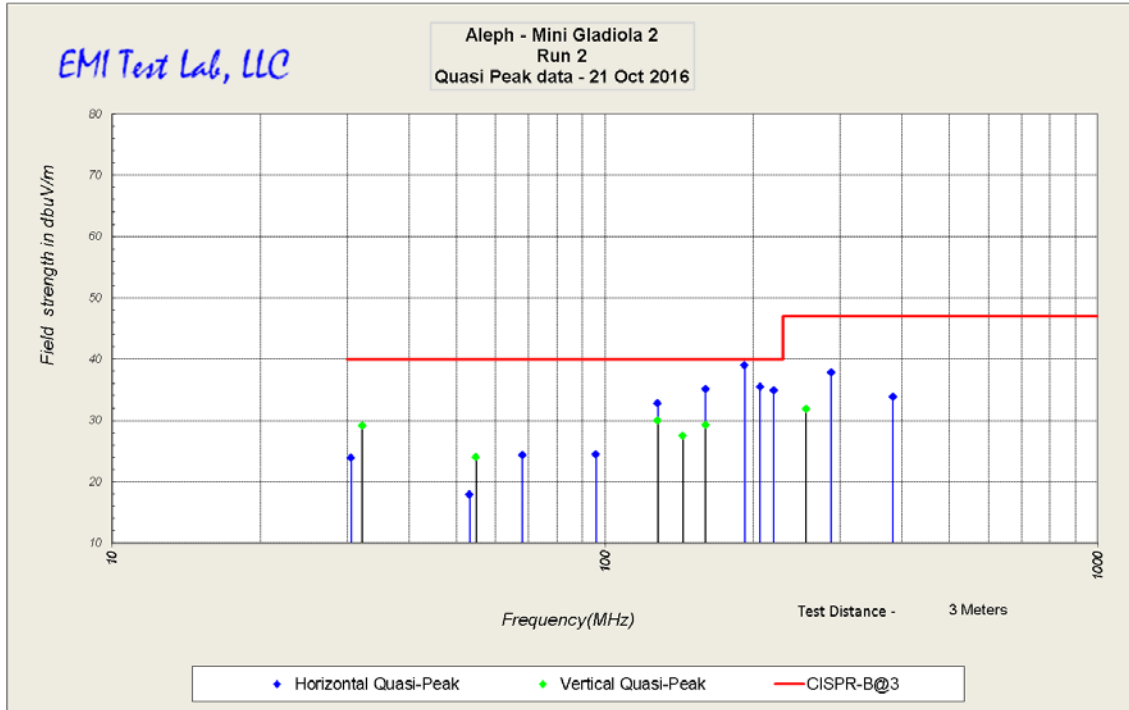
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Passing Quasi peak data compared to the quasi peak limit



Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

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Quasi peak data unit #2

EMI Test Lab

1822 Skyway Drive, Unit J, Longmont Co
Dennis King dennis@emitestlab.com , Cell 303-746-0611

Frequency	F.S. EUT	Limit	Azimuth	Height	Antenna Polarization	
(MHz)	(dBuV/m)	(dBuV/m)	Degrees	Meters	H or V	Margin
255.99	31.86	47	0.0	1.40	V	-15.14
144.02	27.53	40	76.0	1.40	V	-12.47
160.02	29.22	40	92.0	1.40	V	-10.78
128.00	29.93	40	164.0	1.40	V	-10.07
32.18	29.10	40	228.0	1.40	V	-10.90
54.80	23.97	40	320.0	1.40	V	-16.03
219.97	34.84	40	24.0	1.40	H	-5.16
287.99	37.78	47	132.0	1.40	H	-9.22
192.01	39.03	40	152.0	1.40	H	-0.97
30.53	23.81	40	156.0	1.40	H	-16.19
383.98	33.84	47	164.0	1.40	H	-13.16
160.02	35.07	40	188.0	1.40	H	-4.93
68.05	24.34	40	224.0	1.40	H	-15.66
95.98	24.41	40	232.0	1.40	H	-15.59
128.00	32.82	40	236.0	1.40	H	-7.18
206.32	35.48	40	240.0	1.40	H	-4.52
53.13	17.89	40	336.0	1.40	H	-22.11

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

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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.

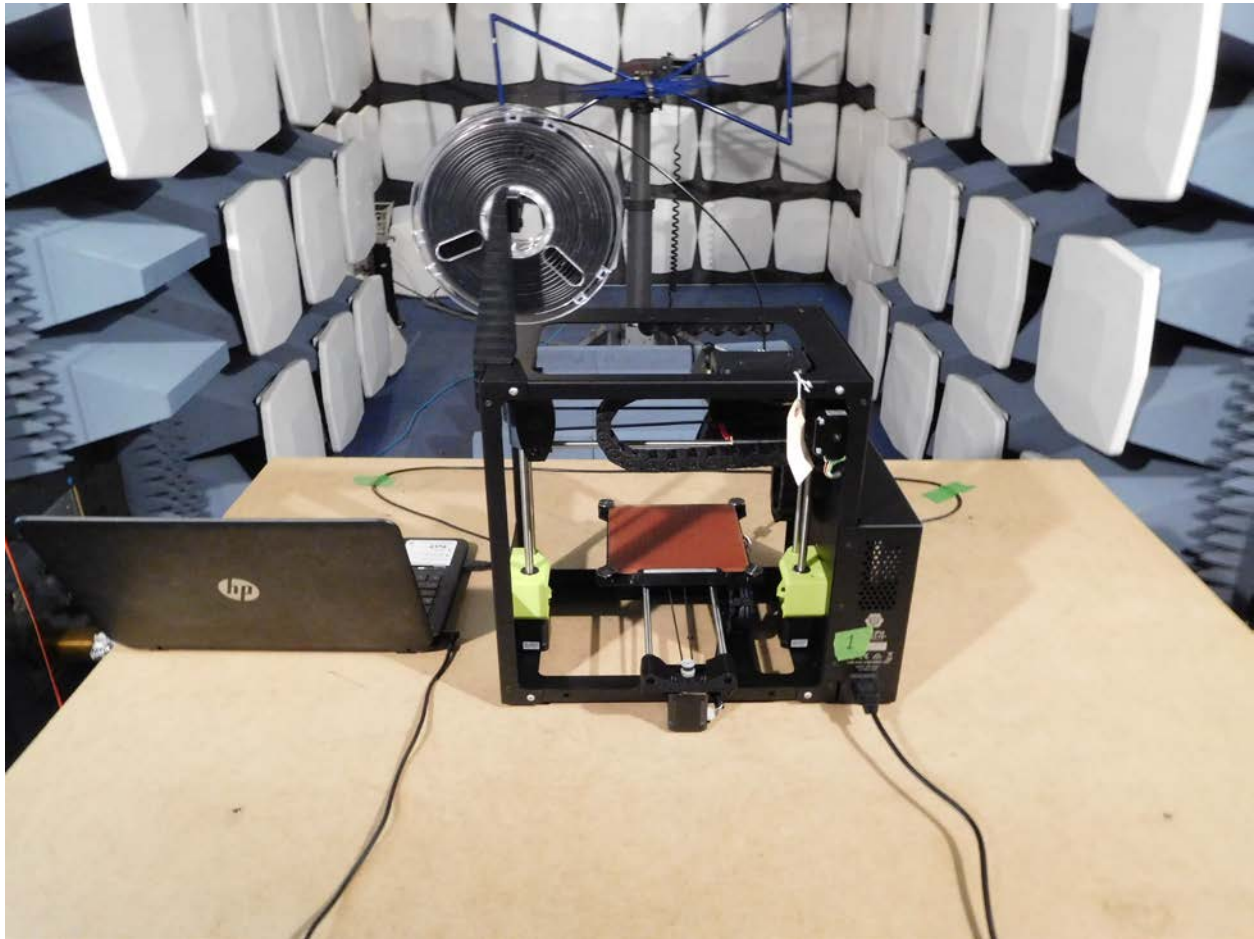
Basic standard	:	CISPR 22:2008
Test setup	:	EN 55022, EN 55032, AS/NZS CISPR 22 and 32
Limit distance	:	3 meters
Frequency range 1	:	1-3 GHz
Limits	:	Average 50 dBuV/m, Peak 70 dBuV/m
Frequency range 2	:	3-6 GHz
Limits	:	Average 54 dBuV/m, Peak 74 dBuV/m

Results of the measurements concerning radiated electromagnetic fields (electric component) emitted by the EUT, enclosure, as a tested system	<u>Not applicable</u>
Name of Test Engineer:	Dennis King
Signature:	
Date:	6 November 2016
Remarks:	All clocks are below 108 MHz.

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

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Test setup for Radiated Emissions



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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 61000-3-2:2014
Test setup : EN 61000-3-2:2014
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	<u>PASS</u>
Name of Test Engineer:	Dennis King
Signature:	
Date:	26 October 2016
Remarks:	The unit was tested at 230VAC 50Hz. The 3D printer was printing during the entire test.

AC Harmonics Data – the EUT is printing

Test Specification: CISPR 22,24, 32

Model Name of EUT: LulzBot Mini “ Gladiola”

Manufacturer: Aleph Objects Inc.

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HA-PC Link Plus. Software v2.02. Firmware v2.81

Report Number : 116

Tested On : 26 October 2016 13:53 for 150 Seconds.

Equipment Under Test : Aleph Objects - Mini Gladiola - 3D printer

Serial Number : #1

Tested by : Dennis King

Supply Voltage : 231.1 Vrms 327.4 Vpk Frequency : 50.07 to 50.17 Hz

Load Power : 71.30 to 99.70 W 183.7 VA Power Factor 0.462

Load Current : 0.7 to 0.9 Arms 3.8 Apk Crest Factor: 4.255

Measurement Standard : EN61000-4-7:2002

Limits Applied : EN61000-3-2 Class A Limits Apply.

Harmonic Number	Limit mA	Average (filtered) mA	% Limit	max. Value (Filtered) mA	% Limit	Assessment
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Fundamental :		426.9				
2 :	1080.0	74.9	6.9	93.1	8.6	Pass
3 :	2300.0	406.3	17.7	460.7	20.0	Pass
4 :	430.0	69.7	16.2	86.3	20.1	Pass
5 :	1140.0	372.5	32.7	420.7	36.9	Pass
6 :	300.0	61.6	20.5	75.8	25.3	Pass
7 :	770.0	326.6	42.4	366.4	47.6	Pass
8 :	230.0	51.6	22.4	63.2	27.5	Pass
9 :	400.0	272.8	68.2	303.1	75.8	Pass
10 :	184.0	40.5	22.0	49.2	26.7	Pass
11 :	330.0	216.3	65.5	237.0	71.8	Pass
12 :	153.3	29.5	19.2	35.6	23.2	Pass
13 :	210.0	161.8	77.0	174.0	82.9	Pass
14 :	131.4	19.4	14.8	23.3	17.7	Pass
15 :	150.0	113.5	75.7	118.6	79.1	Pass
16 :	115.0	11.1	9.7	12.9	11.2	Pass
17 :	132.3	74.2	56.1	75.1	56.8	Pass
18 :	102.2	5.2	5.1	6.1	6.0	Pass
19 :	118.4	45.8	38.7	47.1	39.8	Pass
20 :	92.0	3.0	3.3	3.5	3.8	Pass

Test Specification: CISPR 22,24, 32

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21 :	107.1	28.6	26.7	29.1	27.2	Pass
22 :	83.6	3.7	4.4	4.3	5.1	Pass
23 :	97.8	20.8	21.3	21.5	22.0	Pass
24 :	76.7	4.2	5.5	4.6	6.0	Pass
25 :	90.0	18.1	20.1	18.7	20.8	Pass
26 :	70.8	4.0	5.6	4.3	6.1	Pass
27 :	83.3	16.8	20.2	17.2	20.6	Pass
28 :	65.7	3.6	5.5	3.9	5.9	Pass
29 :	77.6	15.8	20.4	16.9	21.8	Pass
30 :	61.3	3.2	5.2	3.5	5.7	Pass
31 :	72.6	14.9	20.5	15.4	21.2	Pass
32 :	57.5	3.0	5.2	3.5	6.1	Pass
33 :	68.2	13.6	19.9	14.0	20.5	Pass
34 :	54.1	2.8	5.2	3.2	5.9	Pass
35 :	64.3	11.5	17.9	12.2	19.0	Pass
36 :	51.1	2.6	5.1	2.8	5.5	Pass
37 :	60.8	8.8	14.5	9.3	15.3	Pass
38 :	48.4	2.4	5.0	2.5	5.2	Pass
39 :	57.7	6.4	11.1	6.8	11.8	Pass
40 :	46.0	2.1	4.6	2.5	5.4	Pass
21 - 39 :	251.4	52.5	20.9	53.2	21.2	-

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Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

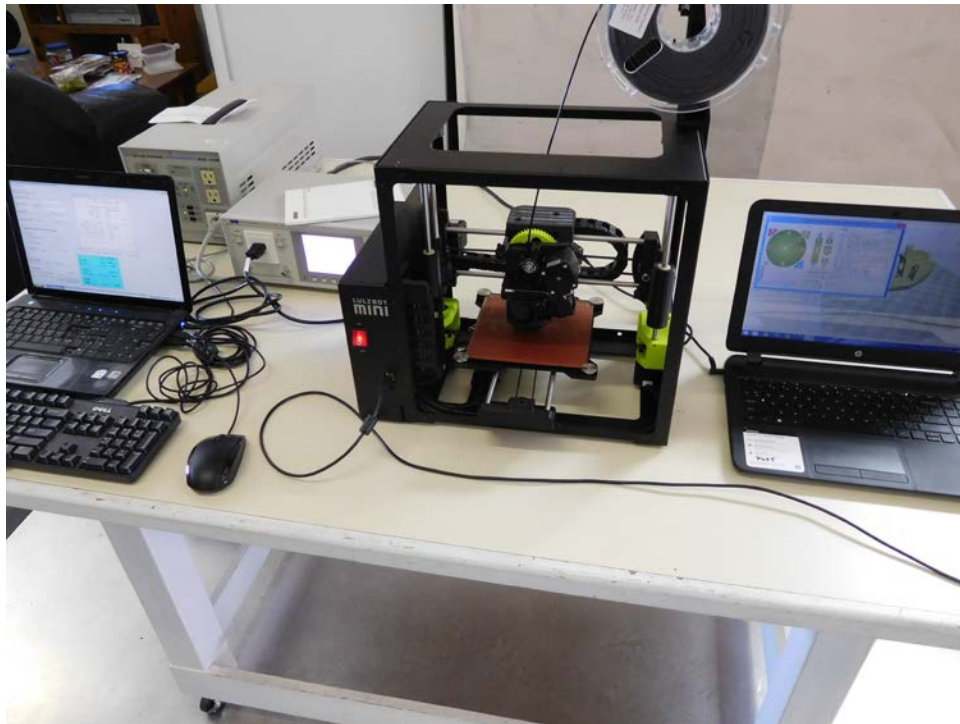
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Test setup for AC power line harmonics EN 61000-3-2

2.4 Voltage fluctuations and flicker

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini "Gladiola"
Manufacturer: Aleph Objects Inc.

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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 61000-3-3:2013
Test setup : EN 61000-3-3:2013

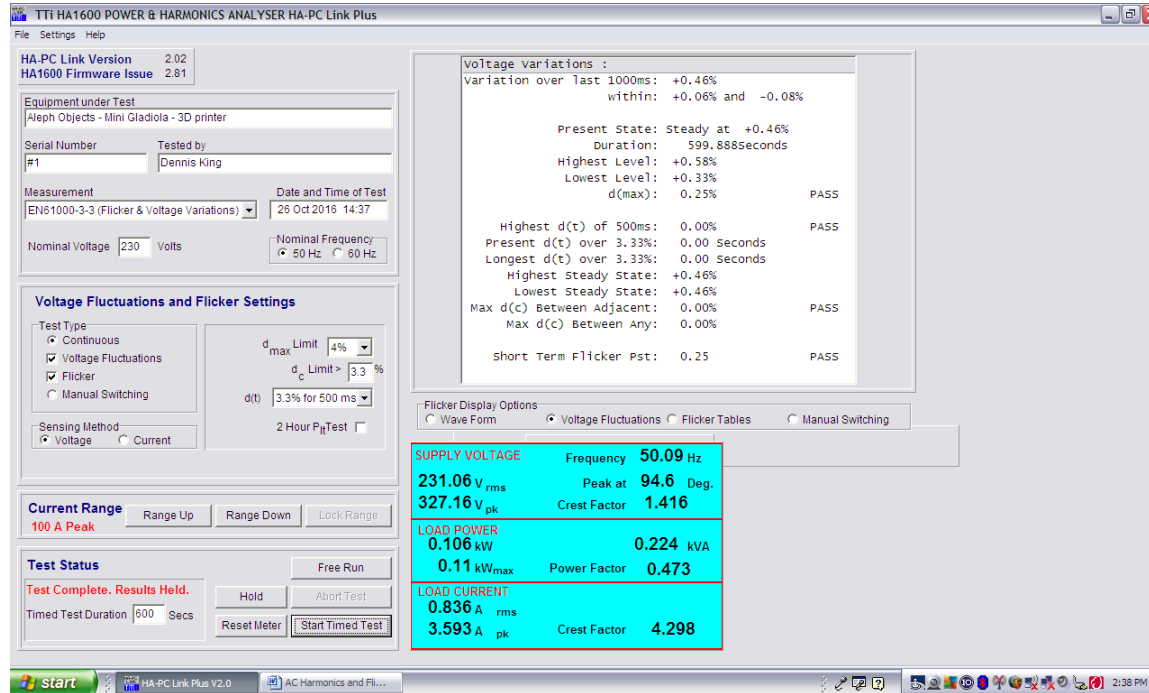
Results of the measurements concerning voltage fluctuations and flicker at the AC mains connection terminals of the EUT	<u>PASS</u>
Name of Test Engineer:	Dennis King
Signature:	
Date:	26 October 2016
Remarks:	The unit was tested at 230VAC 50Hz. The 3D printer was printing during the entire test.

LulzBot Mini Gladiola 3D printer – data - Flicker, Voltage variations

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
Manufacturer: Aleph Objects Inc.

Prepared by EMI Test Lab - EMITestLab.com

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HA-PC Link Plus. Software v2.02. Firmware v2.81

Report Number : 117

Tested On : 26 October 2016 13:57 for 600 Seconds.

Equipment Under Test : Aleph Objects - Mini Gladiola - 3D printer

Serial Number : #1

Tested by : Dennis King

Supply Voltage : 231.1 Vrms 327.3 Vpk Frequency : 50.07 to 50.19 Hz

Load Current : 0.7 to 0.9 Arms 3.8 Apk Crest Factor: 4.236

Test Method: EN61000-3-3:2008

Voltage Variations :

Highest Level: +0.58%

Lowest Level: +0.33%

d(max): 0.25% PASS

Highest d(t) of 500ms: 0.00% PASS

Present d(t) over 3.33%: 0.00 Seconds

Test Specification: CISPR 22,24, 32

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Model Name of EUT: LulzBot Mini " Gladiola"

Manufacturer: Aleph Objects Inc.

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Longest d(t) over 3.33%: 0.00 Seconds

Highest Steady State: +0.46%

Lowest Steady State: +0.46%

Max d(c) Between Adjacent: 0.00% PASS

Max d(c) Between Any: 0.00%

Short Term Flicker Pst: 0.25 PASS

Longest d(t) over 3.33%: 0.00 Seconds

Highest Steady State: +0.46%

Lowest Steady State: +0.46%

Max d(c) Between Adjacent: 0.00% PASS

Max d(c) Between Any: 0.00%

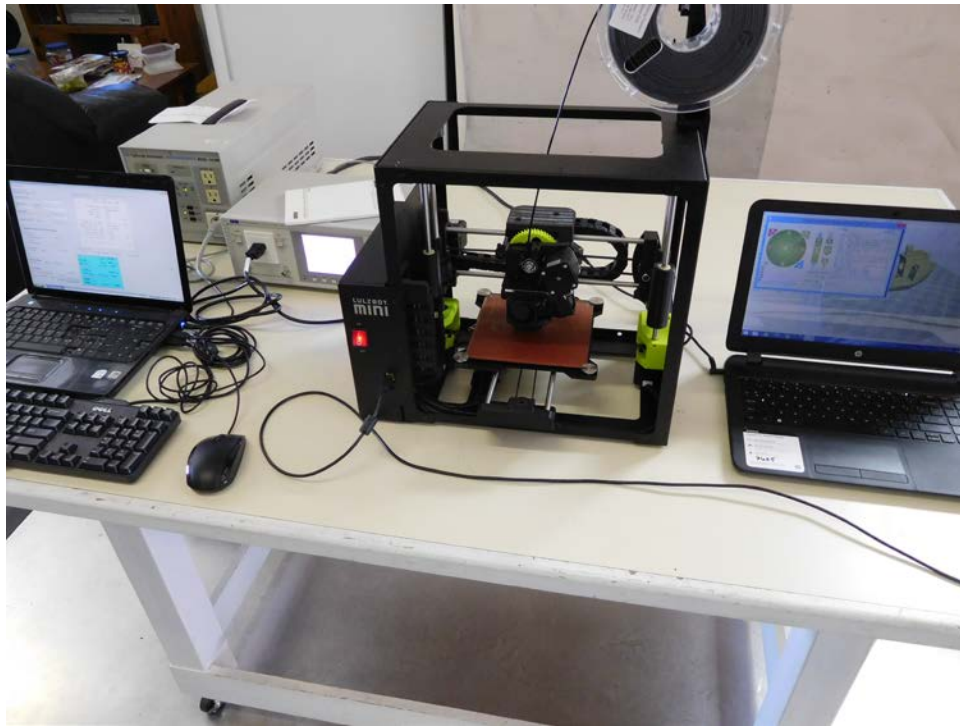
Flicker Results :

Pst Classifier	Plt Calculation
Duration	Flicker Interval Pst
0.1%	1.50
0.7%	0.03
1.0%	0.03
1.5%	0.03
2.2%	0.03
3%	0.03
4%	0.03
6%	0.03
8%	0.03
10%	0.03
13%	0.03
17%	0.03
30%	0.03
50%	0.00
80%	0.00
6%	0.04



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Test setup for Voltage fluctuations and flicker EN 61000-3-3

3 Immunity

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
Manufacturer: Aleph Objects Inc.

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The EUT has been tested in conformity with the standards EN 55024:2010+A1:2015, CISPR 24:2015 and AS/NZS CISPR 24:2013 (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+A1:2015, CISPR 24:2015 and AS/NZS CISPR 24:2013.

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.

3.2 Enclosure Port

Test Specification: CISPR 22,24, 32

Model Name of EUT: LulzBot Mini “ Gladiola”

Manufacturer: Aleph Objects Inc.

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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	:	CISPR 24:2015
Test setup	:	EN 61000-4-3
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	:	Criteria A

Results of the measurements concerning the susceptibility of the EUT to radio-frequency electromagnetic fields	<u>PASS Criteria A</u>
Name of Test Engineer:	Dennis King
Signature:	
Date:	25 October 2016
Remarks: <u>No loss of performance was observed during and after the test, all sides and both antenna polarizations meet Performance Criteria A.</u> Radiated Immunity Summary: Configuration :The printer was printing during the entire test: PASS 3 V/M	

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
Manufacturer: Aleph Objects Inc.

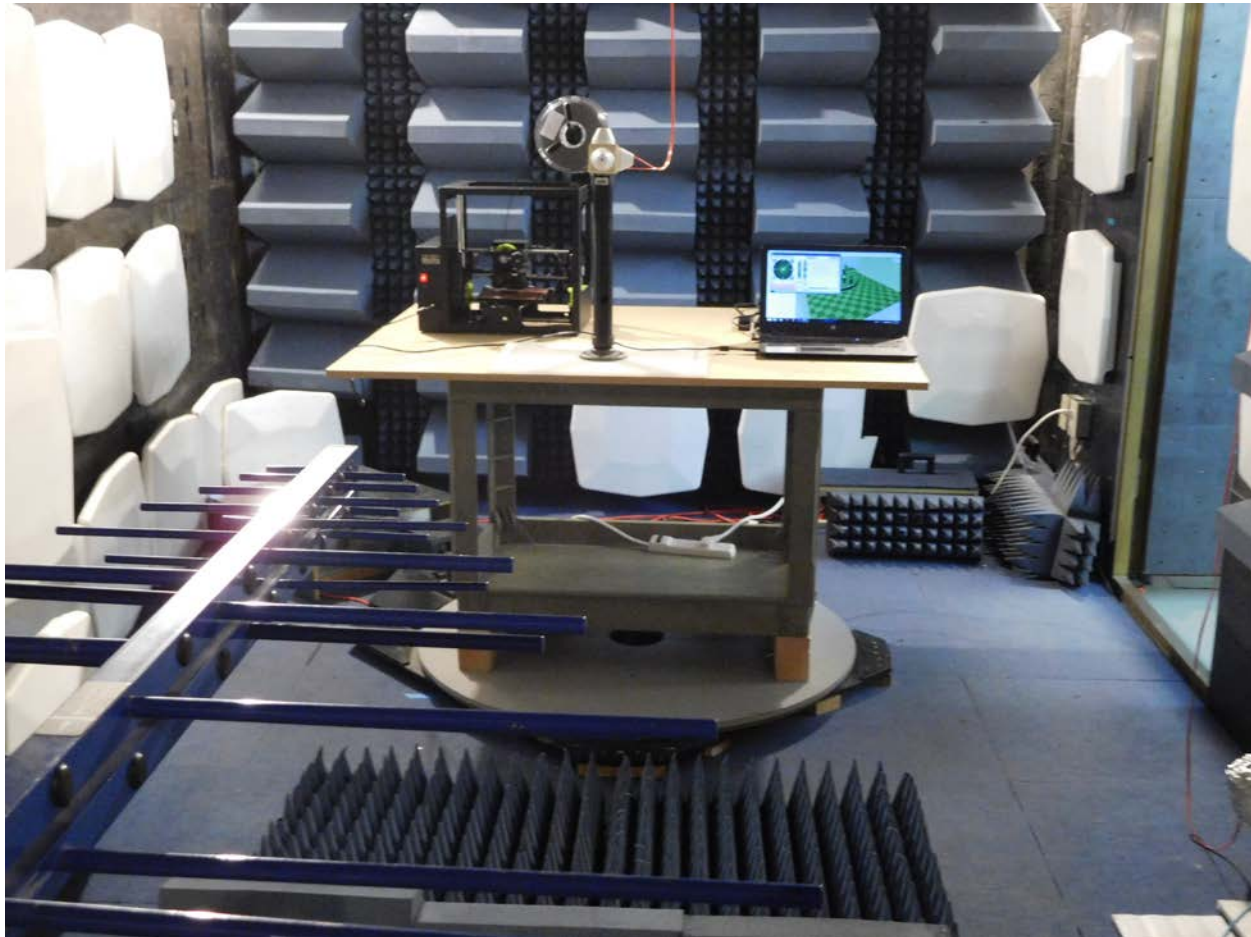
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Radiated immunity test setup – 80-1,000 MHz

**All 4 sides, Vertical and Horizontal were checked at 3 V/M
No errors were detected - passing Criteria A.**

3.2.2 Electrostatic discharge

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
Manufacturer: Aleph Objects Inc.

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The susceptibility of the EUT to electrostatic discharge was tested.

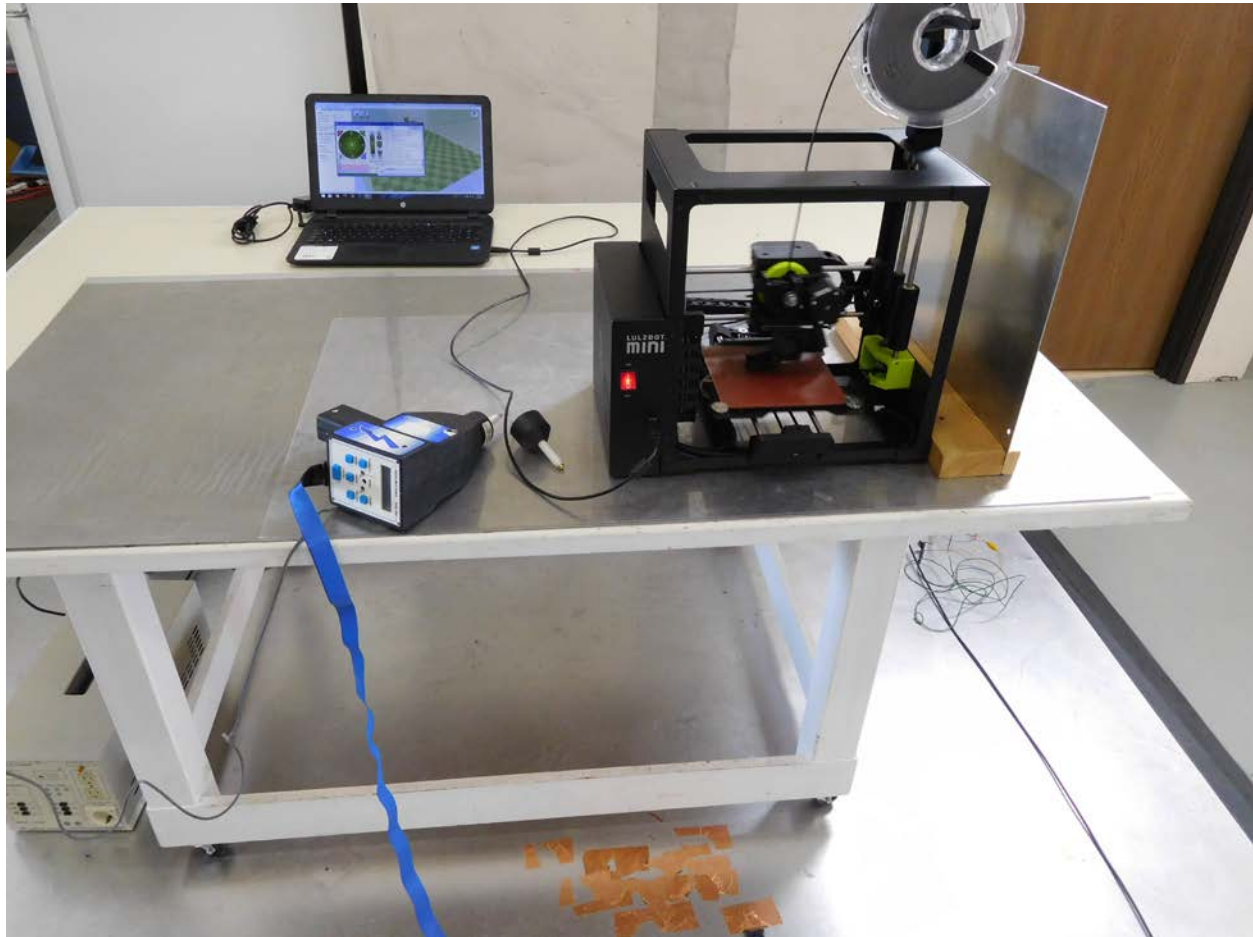
Basic standard : CISPR 24:2015
Test setup : EN 61000-4-2
Test levels : +- 2,4kV and +- 8 kV air discharge
 +- 2kV and +- 4 kV contact discharge
 +- 2kV and +- 4 kV, indirect, horizontal and vertical
 coupling plane.
Performance criteria : B

Results of the test concerning the susceptibility of the EUT to electrostatic discharges (enclosure port)	<u>Pass Criteria A</u>
Name of Test Engineer:	Dennis King
Signature:	
Date:	26 October 2016
Remarks: The printer continued to function as intended during the testing with no loss of data or function.	

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

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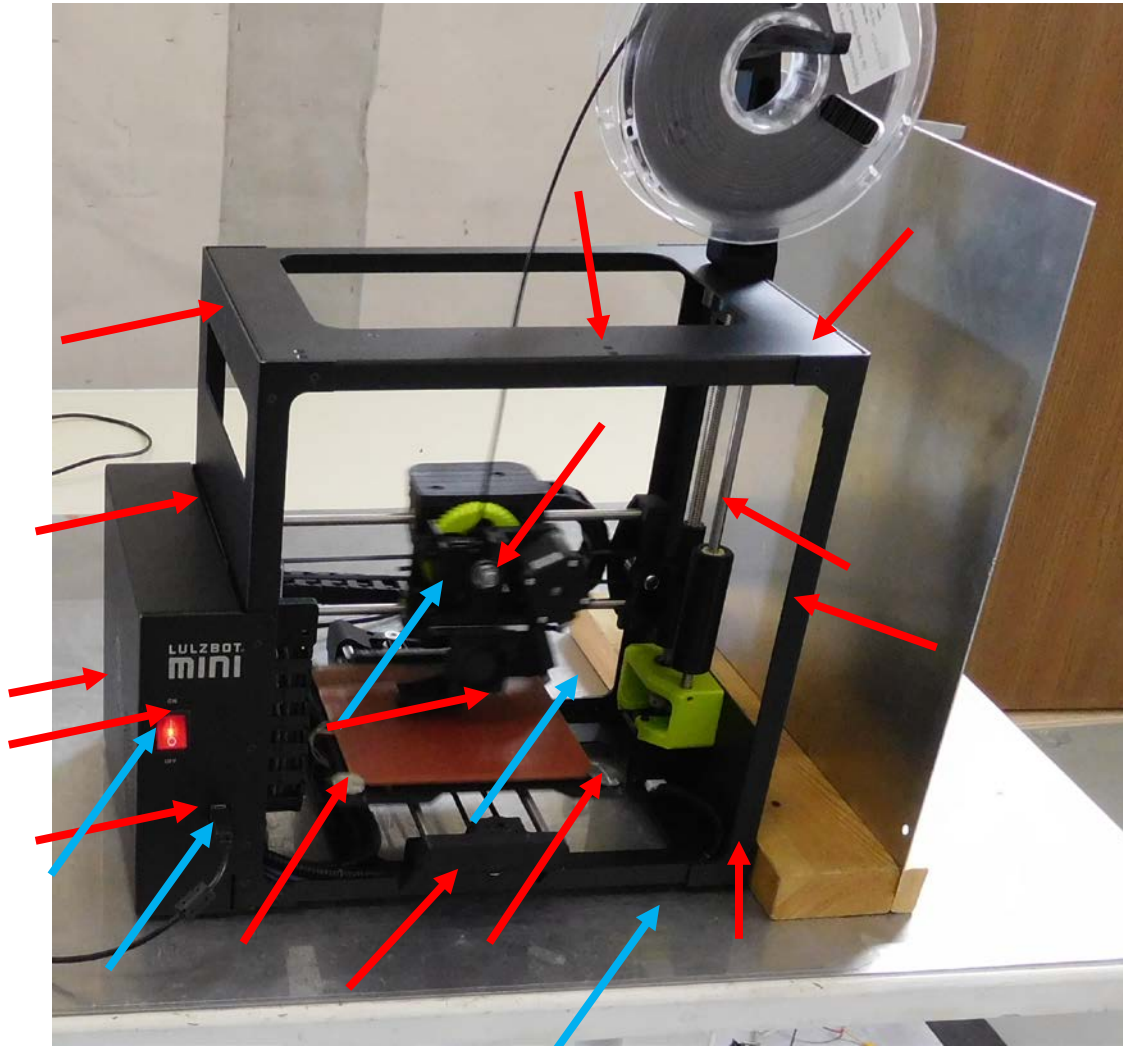


**ESD test setup per EN 61000-4-2
Horizontal and Vertical coupling planes were also checked**



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ESD Test Setup per EN 61000-4-2:2009

**Blue arrows are places that were checked for Air Discharge
Red arrows are places that were checked for Contact Discharge**

All metal parts that the user might touch were tested for contact discharge. All plastic areas that the user might touch were tested for air discharge.

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

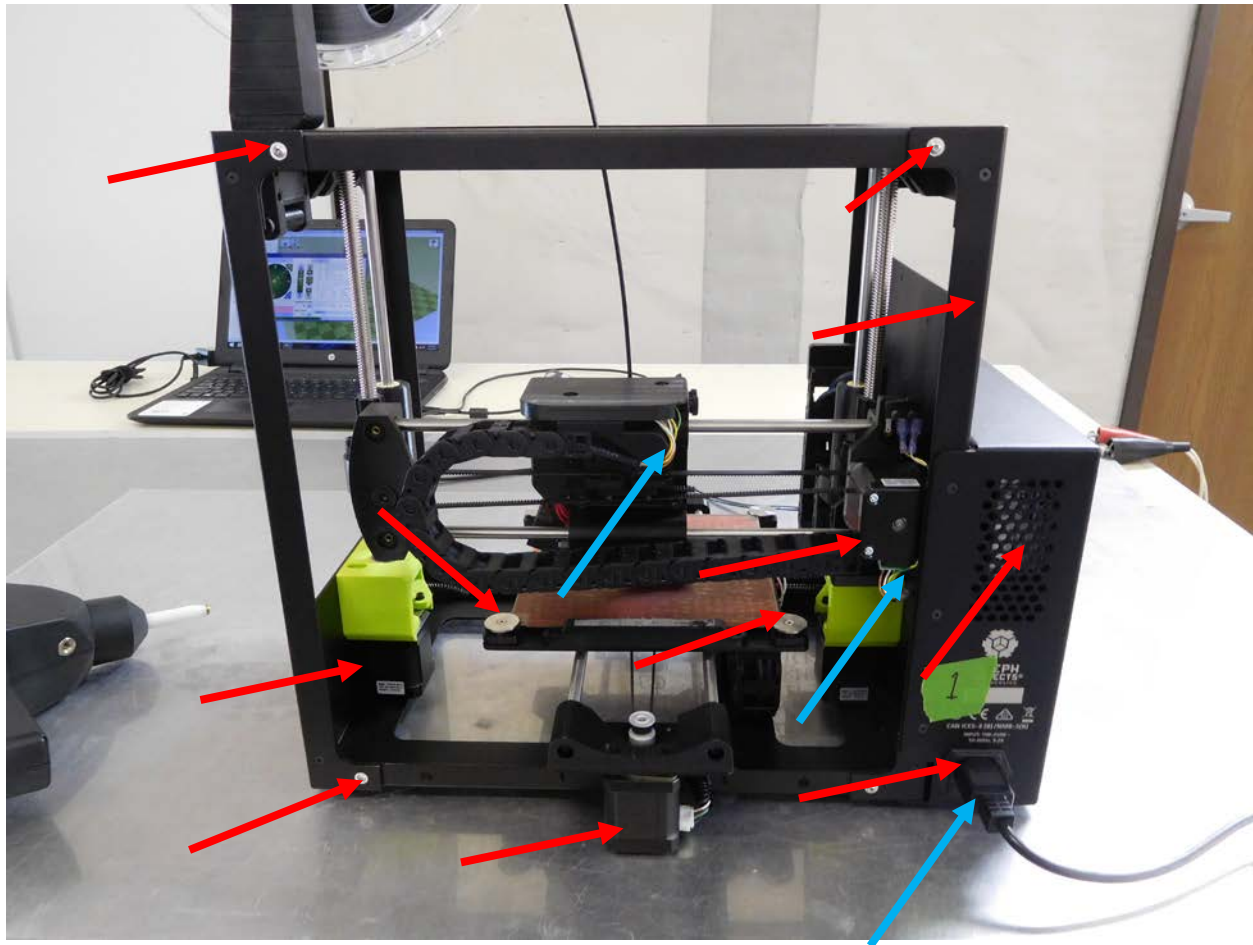
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ESD Test Setup per EN 61000-4-2:2009

Blue arrows are places that were checked for Air Discharge
Red arrows are places that were checked for Contact Discharge

All metal parts that the user might touch were tested for contact discharge. All plastic areas that the user might touch were tested for air discharge.

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
Manufacturer: Aleph Objects Inc.

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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	:	CISPR 24:2015
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)	<u>Not Applicable</u>
Name of Test Engineer:	Dennis King
Signature:	
Date:	6 November 2016
Remarks: No I/O cables 3 meters or longer. There are no interconnecting cables on the unit that exceed 3 meters. See the test plan.	

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
Manufacturer: Aleph Objects Inc.

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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 : CISPR 24:2015
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	<u>Not Applicable</u>
Name of Test Engineer:	Dennis King
Signature:	
Date:	6 November 2016
Remarks:	There are no interconnecting cables on the unit that exceed 3 meters.

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

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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	:	CISPR 24:2015
Test setup	:	EN 61000-4-6
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	<u>Pass Criteria A – 3 Vrms</u>
Name of Test Engineer:	Dennis King
Signature:	
Date:	25 October 2016
Remarks: Tested at 230 VAC 50 Hz – the EUT continued to operate as intended with no loss of data or function. The Mini Gladiola passed Criteria A, 3 Vrms PASS	

Test Specification: CISPR 22,24, 32
 Model Name of EUT: LulzBot Mini “ Gladiola”
 Manufacturer: Aleph Objects Inc.

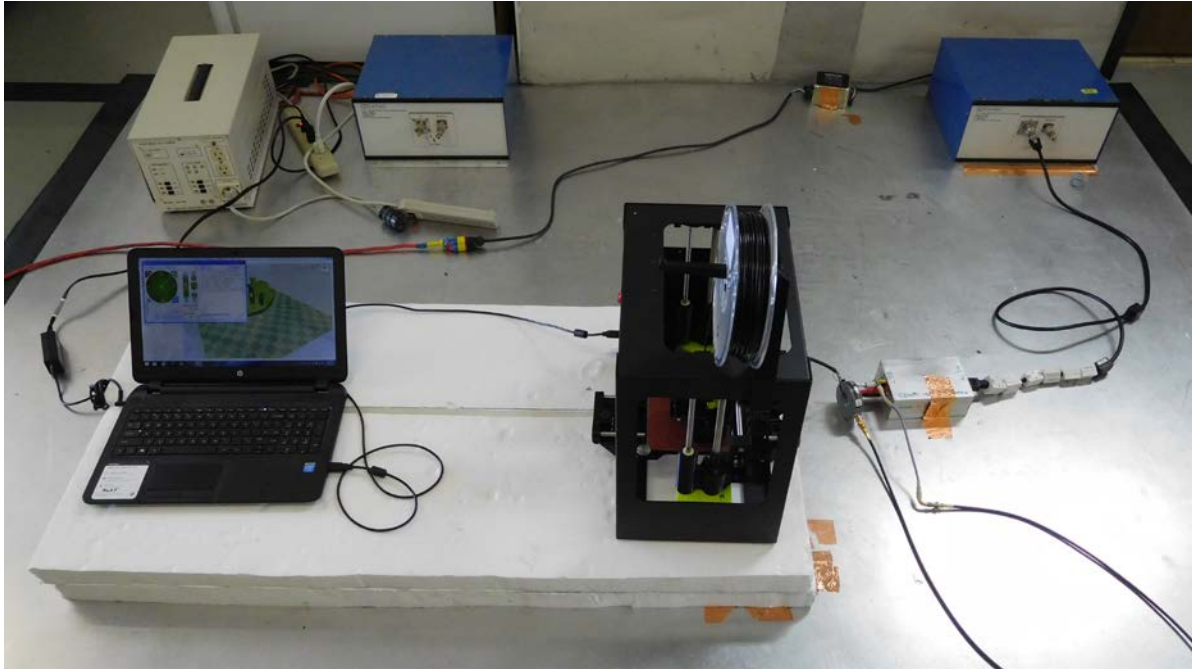
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Revision 1.0



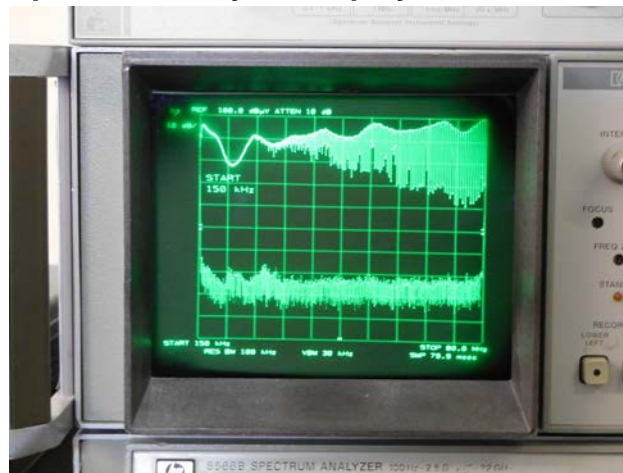
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AC power line conducted immunity setup per EN 61000-4-6
The injected signal is monitored with the current clamp

The spectrum analyzer display is recorded below



Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

Prepared by EMI Test Lab - EMI Test Lab.com

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	:	CISPR 24:2015
Test setup	:	EN 61000-4-5
Test level 1	:	+/- 0.5 kV, +/- 1.0 kV, Differential mode
Test level 2	:	+/- 0.5 kV, +/- 1.0 kV, +/- 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	:	<u>Applicable only to input AC ports</u>

Results of the test concerning the susceptibility of the EUT to surges (AC input and AC output power ports)	<u>Pass Criteria A</u>
Name of Test Engineer:	Dennis King
Signature:	
Date:	25 October 2016
Remarks:	Tested at the highest voltage levels since this is a confirmation of the original passing data from the power supply manufacturer. PASS

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

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Surge Test Data

Aleph Objects

25 October 2016

REMOTE/TESTER RUN

Versions: SW v3.00 FW v3.01 Str v3.00 CEMASTER

Operator: Dennis King

Sequence File: CISPR 24 - ITE Equipment - Quick Check - 1kV Diff 2kV CM.SEQ

EUT: Mini Gladiola - 3D Printer

230 VAC - Quick test verification of power supply passing DoC

04:25:27A SEQUENCE START

SEQUENCE	TYPE	SEQUENCE DESCRIPTION
Srg 1.2/50	User Defined	EN 61000-4-5 Surge - Diff 1kV - CM 2kV

	Waveform	Voltage	Output:LC	Phs Ref	Phs Ang	Tests	Delay
04:25:27A	2 Ohm	1000V	MAINS:L1/L2	L1	0 deg.	3	45 sec.
04:27:48A	2 Ohm	1000V	MAINS:L1/L2	L1	90 deg.	3	45 sec.
04:30:09A	2 Ohm	1000V	MAINS:L1/L2	L1	270 deg.	3	45 sec.
04:32:30A	2 Ohm	-1000V	MAINS:L1/L2	L1	0 deg.	3	45 sec.
04:34:51A	2 Ohm	-1000V	MAINS:L1/L2	L1	90 deg.	3	45 sec.
04:37:13A	2 Ohm	-1000V	MAINS:L1/L2	L1	270 deg.	3	45 sec.
04:39:34A	12 Ohm	2000V	MAINS:L1/PE	L1	0 deg.	3	60 sec.
04:42:39A	12 Ohm	2000V	MAINS:L1/PE	L1	90 deg.	3	60 sec.
04:45:44A	12 Ohm	2000V	MAINS:L1/PE	L1	270 deg.	3	60 sec.
04:48:49A	12 Ohm	-2000V	MAINS:L1/PE	L1	0 deg.	3	60 sec.
04:51:55A	12 Ohm	-2000V	MAINS:L2/PE	L1	90 deg.	3	60 sec.
04:55:00A	12 Ohm	-2000V	MAINS:L2/PE	L1	270 deg.	3	60 sec.

04:58:05A SEQUENCE COMPLETE

EUT passes Criteria A.

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

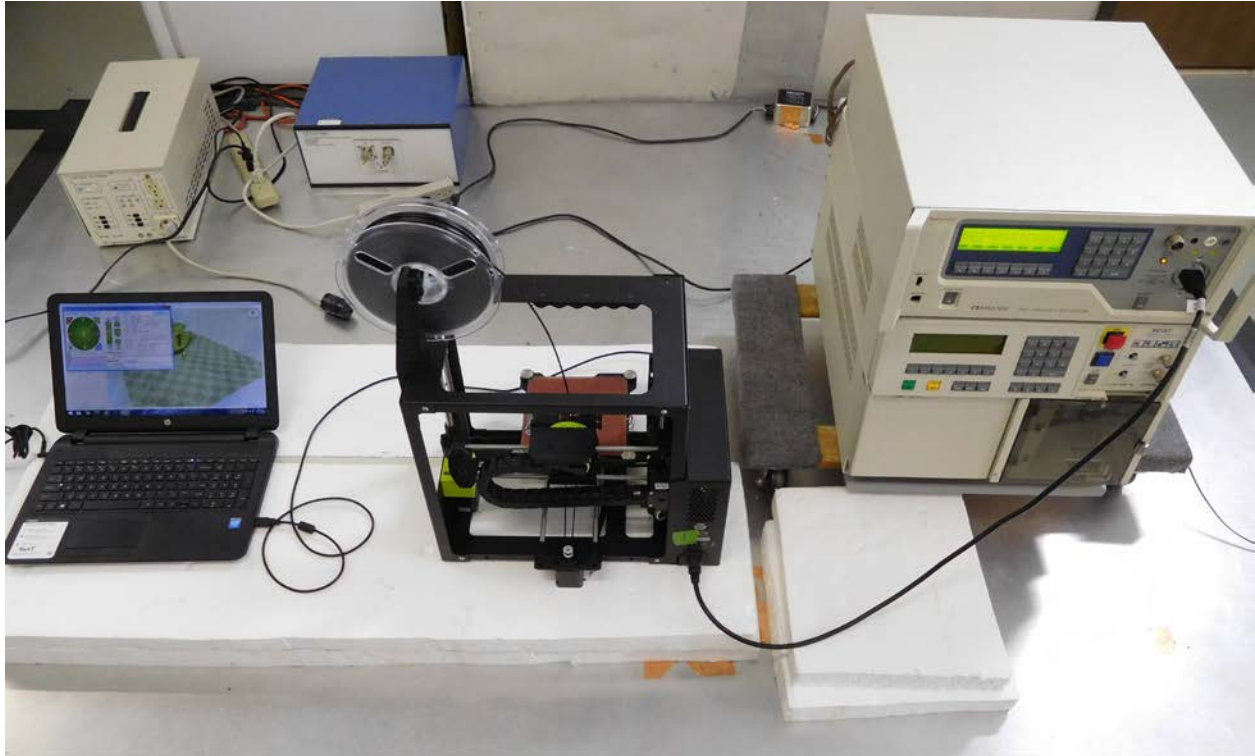
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Test setup according to EN 61000-4-5, Surge

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini “ Gladiola”
Manufacturer: Aleph Objects Inc.

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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	:	CISPR 24:2015
Test setup	:	EN 61000-4-4
Test level	:	+ - 1 KV
Tr/Th	:	5/50 nSec
Repetition frequency	:	5 kHz
Performance criteria	:	Criteria B
Note	:	<u>Conducted on the AC input.</u>

Results of the test concerning the susceptibility of the EUT to fast transients (common mode, AC input and AC output ports)	<u>Pass Criteria A</u>
<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>25 October 2016</p>
<p>Remarks: Tested at 230 VAC 50 Hz while printing. The unit continued to function as intended.</p>	



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Test Data

KeyTek Instrument Co. ECAT Log File
 Software:E400 Burstware V4.15 (c)1996
 Firmware:: 5.11.v
 Modules:
 Row 1 Right:E412 SN:-32612
 Test Started at 5:49.39 on OCT 25,2016
 Test File:C:\KEYTEK\ECAT\LEFT\ITE_1KV.EFT
 Operator :dennis king
 EUT:Aleph Gladiola Mini 3D Printer
 Comments: 230 VAC
 E400:Name:Aleph Objects - Mini Gladiola 3D Printer
 Coupling:Coupler:AC
 Coupling:All
 Voltage:Fixed 1000 V
 Polarity:Alternate 1 each
 Units:mSec
 Frequency:Fixed 5000 Hz
 Period:Fixed 300 ms
 Phase:Fixed 0 dg
 Duration:Fixed 15 mS
 Repeat:0
 E400:Wait time 10 Seconds
 E400:Duration time 1 Minute
 E400:EUT power:ON
 E400:Phase Mode Period
 E400:Order:Repeat,Polarity,Coupling

Time	Action	Volts(V)	Freq	Dur.	Period	Phase	Source	At	Cpl			
5:49.48:	Burst	1000	5000	Hz	15	mS	300	RND	E412	E412	L1	
5:50.49:	EFT Step Ended											
5:53.42:	Burst	1000	5000	Hz	15mS	300	RND	E412	E412	L1,L2		
5:54.42:	EFT Step Ended											
5:54.52:	Burst	1000	5000	Hz	15	mS	300	RND	E412	E412	L1,PE	
5:55.52:	EFT Step Ended											
5:56.02:	Burst	1000	5000	Hz	15	mS	300	RND	E412	E412	L1,L2,PE	
5:57.02:	EFT Step Ended											
5:57.12:	Burst	1000	5000	Hz	15	mS	300	RND	E412	E412	L2	
5:58.12:	EFT Step Ended											
5:58.22:	Burst	1000	5000	Hz	15	mS	300	RND	E412	E412	L2,PE	
5:59.22:	EFT Step Ended											
5:59.32:	Burst	1000	5000	Hz	15	mS	300	RND	E412	E412	PE	
6:00.32:	EFT Step Ended											
6:00.42:	Burst	-1000	5000	Hz	15	mS	300	RND	E412	E412	L1	
6:01.42:	EFT Step Ended											
6:01.52:	Burst	-1000	5000	Hz	15	mS	300	RND	E412	E412	L1,L2	
6:02.52:	EFT Step Ended											
6:03.02:	Burst	-1000	5000	Hz	15	mS	300	RND	E412	E412	L1,PE	
6:04.02:	EFT Step Ended											
6:04.12:	Burst	-1000	5000	Hz	15	mS	300	RND	E412	E412	L1,L2,PE	
6:05.12:	EFT Step Ended											
6:05.22:	Burst	-1000	5000	Hz	15	mS	300	RND	E412	E412	L2	
6:06.22:	EFT Step Ended											
6:06.32:	Burst	-1000	5000	Hz	15	mS	300	RND	E412	E412	L2,PE	
6:07.32:	EFT Step Ended											
6:07.42:	Burst	-1000	5000	Hz	15	mS	300	RND	E412	E412	PE	
6:08.42:	EFT Step Ended											
6:08.42:	Test Complete											
6:08.42:	Log Closed											

Test Specification: CISPR 22,24, 32
 Model Name of EUT: LulzBot Mini " Gladiola"
 Manufacturer: Aleph Objects Inc.

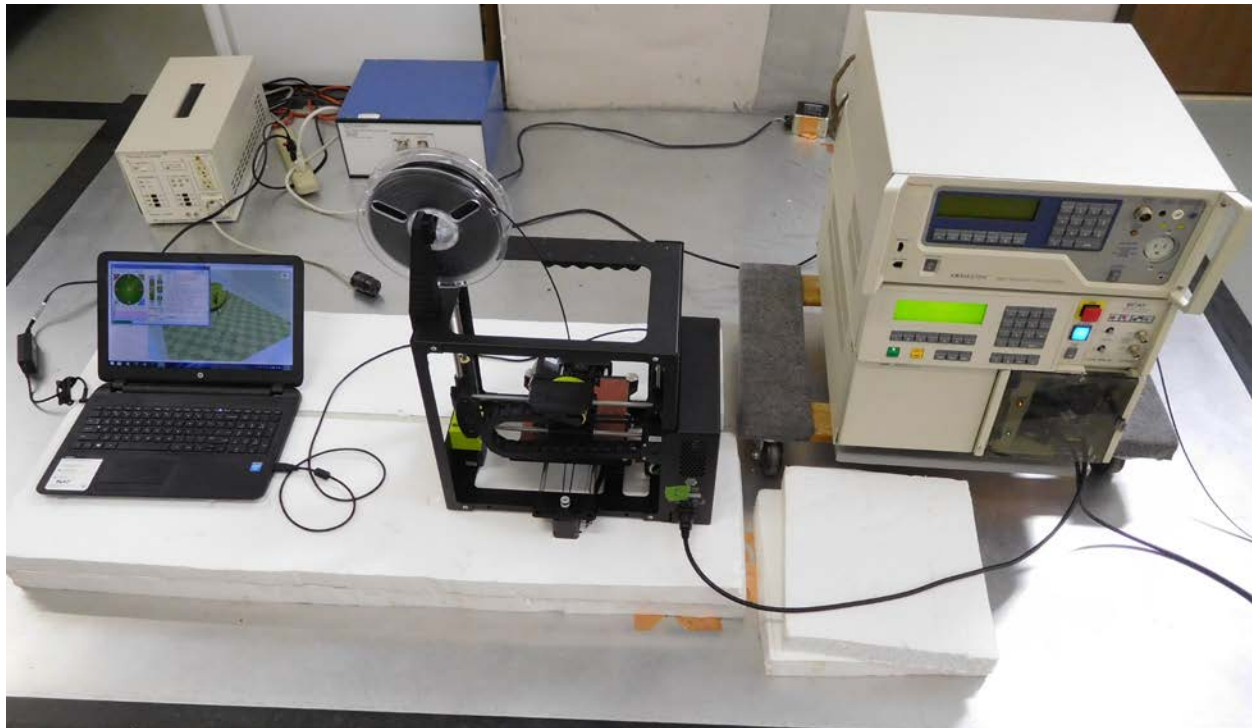
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Test Setup per EN 61000-4-4

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

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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 : CISPR 24:2015
Test setup : EN 61000-4-11
Test level (a) : Line at <5% of nominal for 0.5 cycles
Test level (b) : Line at 70% of nominal for 25 cycles
Test level (c) : Line at <5% 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	Pass
Name of Test Engineer:	Dennis King
Signature:	
Date:	25 October 2016
Remarks:	Tested at 230 VAC 50 Hz while printing. The unit continued to function as intended.



EMI Test Lab LLC

Electro Magnetic Interference Testing
EmiTestLab.com

Test Data

=====
Aleph Objects 25 October 2016
=====

REMOTE/TESTER RUN

Versions: SW v3.00 FW v3.01 Str v3.00 CEMASTER
Operator: Dennis King
Sequence File: ITE AC Dips EN 61000-4-11.SEQ
EUT: Gladiola Mini 3D Printer
=====

230 VAC

05:06:50A SEQUENCE START

SEQUENCE	TYPE	SEQUENCE DESCRIPTION
PQF	User Defined	ITE Equipment

	Test Level	Phs	Ang	Dur.	Value	Duration	Tests	Delay
05:06:50A	0% Open	0 deg.	0.50	cyc	3	10 sec.		
05:07:26A	0% Open	90 deg.	0.50	cyc	3	10 sec.		
05:08:01A	0% Open	180 deg.	0.50	cyc	3	10 sec.		
05:08:36A	0% Open	270 deg.	0.50	cyc	3	10 sec.		
05:09:11A	70% Dip	0 deg.	25.00	cyc	3	10 sec.		
05:09:48A	70% Dip	90 deg.	25.00	cyc	3	10 sec.		
05:10:24A	70% Dip	180 deg.	25.00	cyc	3	10 sec.		
05:11:00A	70% Dip	270 deg.	25.00	cyc	3	10 sec.		
05:11:36A	0% Open	0 deg.	250.00	cyc	3	10 sec.		
05:12:24A	0% Open	180 deg.	250.00	cyc	3	10 sec.		

05:13:11A SEQUENCE COMPLETE

EUT Passes the appropriate criteria.

Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

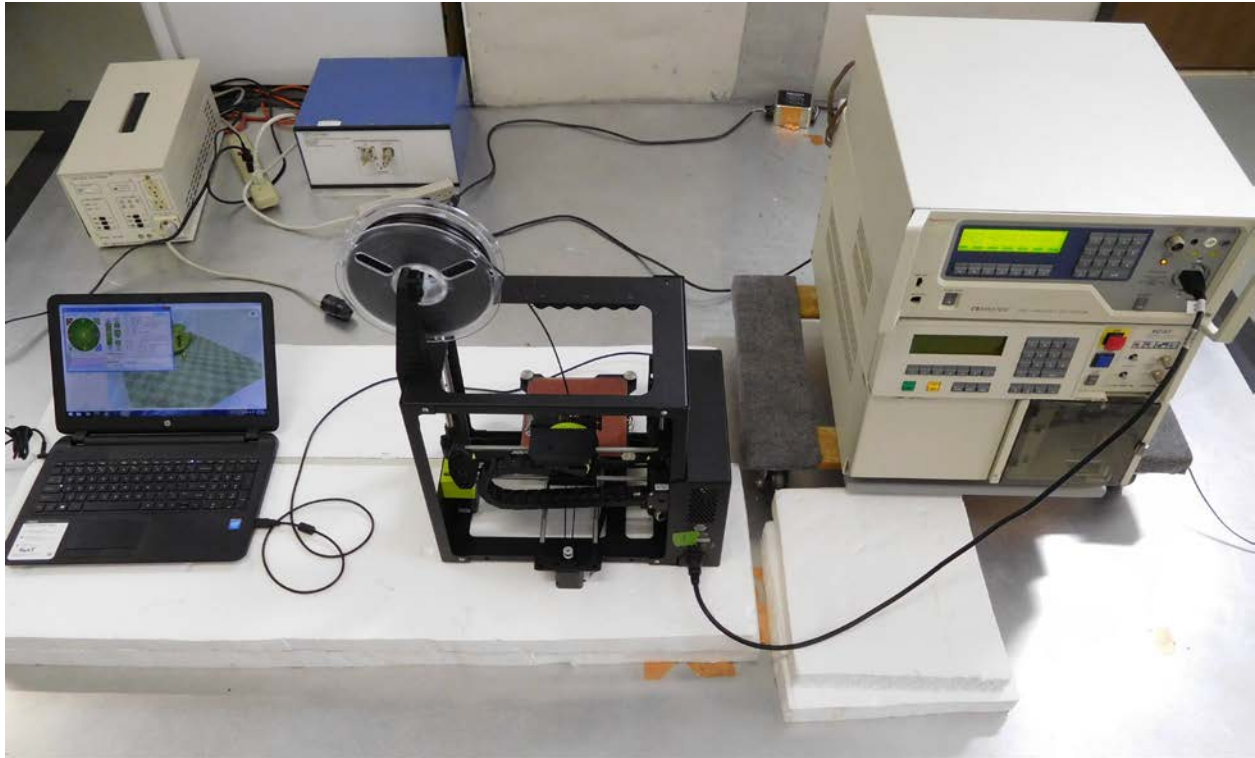
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Test setup according to EN 61000-4-11

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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.

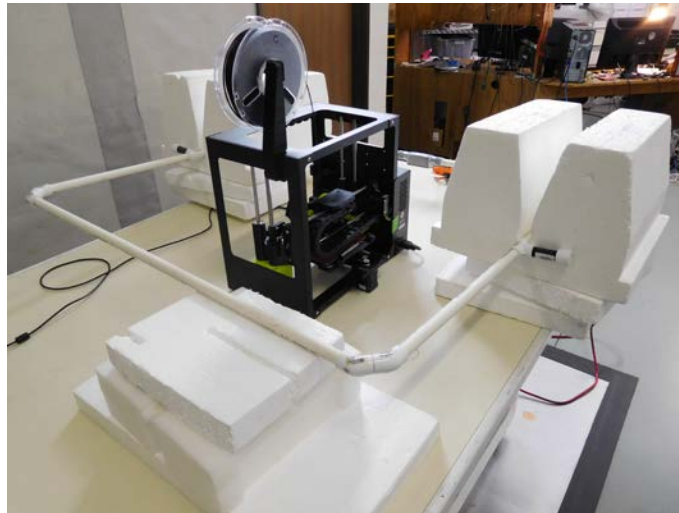
Basic Standard : CISPR 24:2015
Test setup : EN 61000-4-8
Test level : 3 Amps per meter, X,Y and Z axis

Results of the test concerning the susceptibility of the EUT to	<u>Pass</u>
Name of Test Engineer:	Dennis King
Signature:	
Date:	26 October 2016
Remarks:	The unit was actually tested up to 30 amps per meter with no effect, 1 minute.

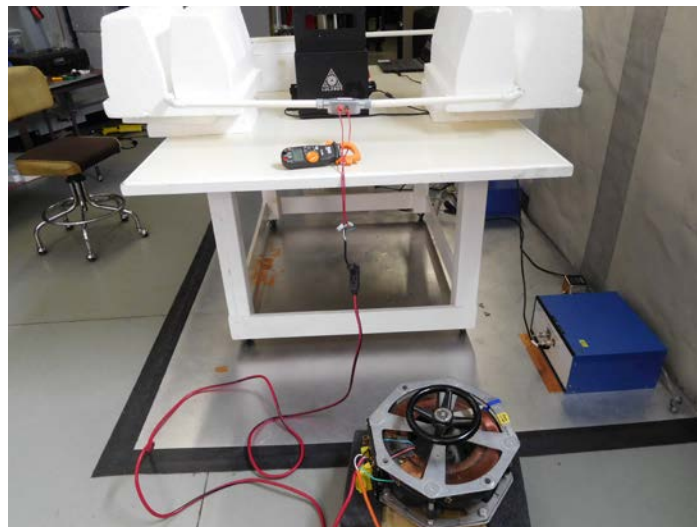
Test Specification: CISPR 22,24, 32
Model Name of EUT: LulzBot Mini " Gladiola"
Manufacturer: Aleph Objects Inc.

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Test setup Power Frequency Magnetic Fields – EN 61000-4-8



The EUT was tested at 30 amps per meter – no effect

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4.0 Modifications

No modifications were made to the units that were tested in order to pass.

Test Specification: CISPR 22,24, 32
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5.0 Test equipment and Environmental Conditions

All tests were conducted within parameters specified for each test, for example >30% humidity for ESD. The lab temperature during all testing was between 72-74 degrees F. 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.

Table of Test Equipment

Equipment	Description and Test	Model number	Serial number	Next cal due
HP Spectrum Analyzer	Used for Radiated and Conducted Emissions	8566B	2607A02760	3 June 2017
HP Quasi-Peak Adapter	Used for Radiated and Conducted Emissions	85650A	8574A00233	3 June 2017
Advantest Spectrum Analyzer	Used for Radiated and Conducted Emissions	R3361A	01730556	20 October 2017
Com-Power transient Limiter	Conducted Emissions	HZ560	001	3 June 2017
TTi	AC Harmonics and Flicker	HA1600A	353276	17 July 2017
RF Bay Pre-Amp	Radiated emissions – 100kHz to 10 GHz	LPA-10-20	0643	2 Dec 2016
GTEM	Radiated Emissions and Radiated Immunity	5317	9703-1209	26 April 2017 – Field Uniformity Cal per IEC 61000-4-20
3 Meter FAR – Fully Anechoic Room	Radiated Immunity and Emissions	N/A	FAR #1	15 October 2017 Field Uniformity per IEC/EN 61000-4-3 and Correlation data to GTEM
ComPower Horn Antenna	1-18 GHz – Radiated Immunity and Emissions	AH 118	071040	20 March 2017
Chase BiLog Antenna	Radiated Emissions and Immunity	CBL6111	1121	20 March 2017
Marconi Instruments – Signal Generator	Radiated Immunity	2031	1196061031	20 October 2017

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10kHz – 2.7 GHz				
HP Signal Generator	Radiated Immunity	8657A	STD0578	3 May 2017
HP Synthesized Sweep Generator .01-20 GHz	Radiated Immunity 1 GHz to 2.7 GHz	83752B	34462	3 May 2017
Amplifier Research .800 – 4.2 GHz Amp	Radiated Immunity – 1 GHz to 2.7 GHz	10S1G4	34516	4 May 2017
Antenna Research Associates – 100 Watt amplifier w/controller	Radiated Immunity – 80-1000 MHz in the FAR	ARAPS/PC757LC ARA757LC-CE	587V7 587V7	20 October 2017
Kalmus Power Amplifier	Radiated Immunity 150kHz – 1 GHz – in the GTEM	747LC-CE	7894-1	10 May 2017
Amplifier Research E- Field Probe	Radiated Immunity	FP 2000	12845	10 May 2017
Com-Power LISN	Conducted emissions	LI-115	241010	17 May 2017
Com-Power LISN	Conducted emissions	LI-115	241011	11 September 2017
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 2017
EMI Labs CDN	Conducted Immunity	EMICDN	001	9 Dec 2016
Schaffner ESD Gun	Electro Static Discharge	NSG435	54711	11 Dec 2016
KeyTek ECAT	Fast transients / Burst	E412	32612	5 June 2017
FCC Inc. RF Current Probe	Monitor Conducted Immunity signal	F-33-1	423	9 Dec 2016
EMI Labs Mag Loop	Magnetic Loop Antenna	Mag100	80162	12 Dec 2016
Thermo Keytek CE Master	Surge/ AC Dips and Interrupts	CE Master	0405277	15 Dec 2016

Test Specification: CISPR 22,24, 32
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6.0 Measurement Uncertainty - Radiated Emissions example;

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_{Abient}			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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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 is $\pm 1.2\text{dB}$
The estimated combined standard uncertainty for Harmonic current and flicker is $\pm 11.6\%$

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7.0 Test Plan

Testing required

The LulzBot Mini Gladiola 3D Printer will be tested for Radiated and Conducted emissions, Harmonics and Flicker and all applicable Immunity tests as required for the EMC portion of the CE Mark and the Australia / New Zealand EMC standards.

Two units will be tested for radiated emissions.

Test Setup

The LulzBot Mini Gladiola will be operating in a typical use mode, printing an object during all the testing.

The user software is installed on a laptop and is controlling the 3D printer. There are no other I/O cables on the 3D Printer.

The ferrites that were used to pass radiated emissions will be in place during all the testing. Also, the USB cable with ferrites on both ends, used to pass radiated emissions, will be used during the entire test. Typical software that the end user would use will be used during the testing.

Failure Criteria

If the unit stops working or the printing process is altered by the injected noise, this would be considered a failure.

I/O cables

The unit has only one I/O cable, the USB cable that is used to control the printer from software installed on the host computer. There are no I/O cables on the unit 3 meters or longer.

Status of the test unit

Production level.



8.0 Conclusion

The Aleph Objects – LulzBot Mini Gladiola 3D Printer complies with the emissions standards:

- 1. AS/NZS CISPR 22:2009**
- 2. AS/NZS CISPR 32:2015**
- 3. EN 55022:2010**
- 4. EN 55032:2015**
- 5. EN 61000-3-2:2014**
- 6. EN 61000-3-3:2013**

and the immunity standards:

- 1. AS/NZS CISPR 24:2013**
- 2. EN 55024:2015**

in the configurations and operating modes as stated in this test report.

End of Report