

EMC TEST REPORT

FULL COMPLIANCE

Report Number: 102442722DEN-001

Project Number: G102442722

Report Issue Date: January 21, 2016

Model Tested: LulzBot TAZ 6

Standards: FCC 47CFR 15B
ICES-003 Issue 5 (2012-11)
CISPR 22: Ed 6 (2008-29)
EN 55022: Ed 6 (2010-12)
CISPR 24: Ed 2 (2015-04)
EN 55024: Ed 2 (2010-11)
CISPR 32: Ed 2 (2015-03)
EN 55032: Ed 1 (2012-10)
AS/NZS CISPR22(2010-12)
AS/NZS CISPR24 (2013-06)
AS/NZS CISPR32 (2013)

Tested by:
Intertek Testing Services, NA Inc.
1795 Dogwood St. Suite 200
Louisville, CO 80027
USA

Client:
Aleph Objects Inc.
626 W 66th St
Loveland, CO 80538
USA

Report prepared by Reviewer



Son La / Project Engineer

Report reviewed by



Michael Spataro/EMC Team Leader

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1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

| Section | Test full name | Result |
|---------|--|--------|
| 6 | Radiated Emissions (CISPR 22: 2008-09-24 Ed:6; FCC CFR47 part 15 subpart B) | Pass |
| 7 | AC Mains Conducted Emissions (CISPR 22: 2011/11/23 Ed:5.2; FCC CFR47 part 15 subpart B) | Pass |
| 8 | Harmonics (IEC 61000-3-2: Ed 4.0 2014) | Pass |
| 9 | Flicker (IEC 61000-3-3: Ed 3.0 2013) | Pass |
| 10 | Electro-Static Discharge Immunity Test (IEC 61000-4-2: Ed.20 2008) | Pass |
| 11 | Radiated, Radio-Frequency, Electromagnetic Immunity (IEC 61000-4-3: Ed. 3.2 2010) | Pass |
| 12 | Electrical Fast Transient/Burst Immunity Test (IEC 61000-4-4: Ed 3.0 2012) | Pass |
| 13 | Immunity to Surges (IEC 61000-4-5: Ed 3.0 2014) | Pass |
| 14 | Conducted, Radio-Frequency, Electromagnetic Immunity Test (IEC 61000-4-6: 2013 (COR1 2015)) | Pass |
| 15 | Voltage Dips/Interruptions Immunity Test (IEC 61000-4-11: Ed 2.0 2004) | Pass |
| 16 | Power Frequency Magnetic Field Immunity Test (IEC 61000-4-8: Ed 2.02009) | Pass |

3 Client Information

This EUT was tested at the request of:

Client: Aleph Objects Inc.
626 W 66th St
Loveland, CO 80538
USA

Contact: Eric Kuzmenko
Telephone: (970) 377-1111
Fax: NA
Email: kuzmenko@alephobjects.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: Aleph Objects Inc.
626 W 66th St
Loveland, CO 80538
USA

| Equipment Under Test | | | |
|---|--------------------|---------------|-------------------|
| Description | Manufacturer | Model Number | Serial Number |
| LulzBot TAZ 6 Desktop FFF 3D Printer | Aleph Objects Inc. | LulzBot TAZ 6 | KT-PR0041NA-00001 |

| | |
|---------------------|------------|
| Receive Date: | 01/19/2016 |
| Received Condition: | Good |
| Type: | Production |

| Description of Equipment Under Test (provided by client) |
|--|
| 3D printer, extrudes filament from a nozzle and moves gantry to form 3D object. Can print via SD card or via USB connection. |

| Equipment Under Test Power Configuration | | | |
|--|---------------|-----------------|------------------|
| Rated Voltage | Rated Current | Rated Frequency | Number of Phases |
| 100 - 240 | 7.0 A | 50/60 | 1 |

Operating modes of the EUT:

| No. | Descriptions of EUT Exercising |
|-----|---|
| 1 | Mode 1: Printing 3D object via SD card. |
| | |

Software used by the EUT:

| No. | Descriptions of EUT Exercising |
|-----|------------------------------------|
| 1 | Aleph Objects Cura LulzBot Edition |

Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

NA

5 System Setup and Method

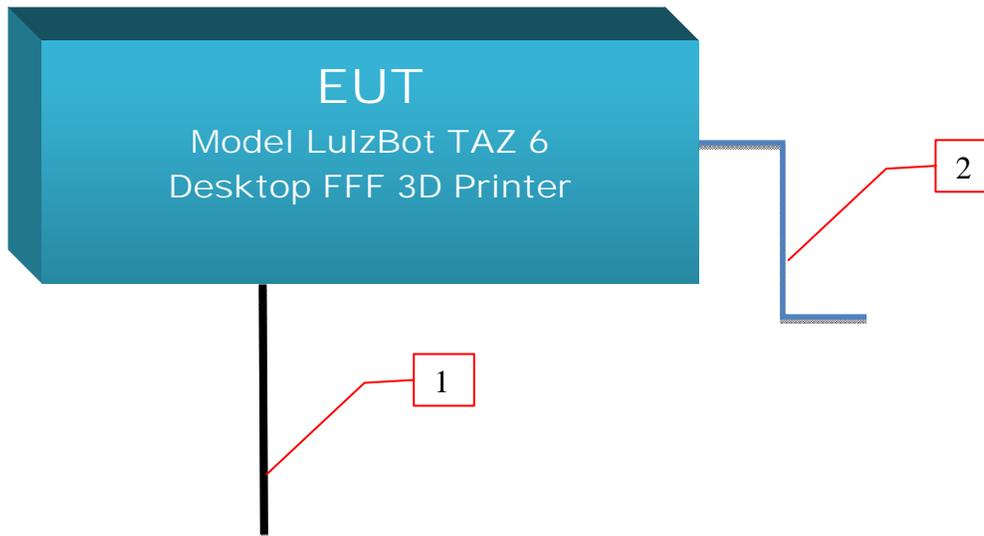
| Cables | | | | | |
|--------|-------------|------------|-----------|----------|-------------|
| ID | Description | Length (m) | Shielding | Ferrites | Termination |
| 1 | Power Cord | 1.83 | No | No | -- |
| 2 | USB Cable | 1.83 | Yes | Yes | -- |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| Support Equipment | | | |
|-------------------|--------------|--------------|---------------|
| Description | Manufacturer | Model Number | Serial Number |
| None | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

5.1 Method:

Configuration as required by ANSI C63.4 and CISPR 16. Unless otherwise stated no deviations were made from FCC 15.109, ICES-003, CISPR22, CISPR24, CISPR32

5.2 EUT Block Diagram:



5.3 EUT Performance Criteria and Monitoring:

Performance as required by ANSI C63.4 and CISPR 16. Unless otherwise stated no deviations were made from CISPR24.

Product Specific Performance:

| No. | Description |
|-----|--|
| 1 | CISPR24 Table 1 and Table 4: Performance criterion "A" : 61000-4-3, 61000-4-6, 61000-4-8, |
| 2 | CISPR24 Table 1 and Table 4: Performance criterion "B": 61000-4-2, 61000-4-4, 61000-4-5, 61000-4-6 |
| 3 | CISPR24 Table 4:: Performance criterion "C": 61000-4-11 |
| 4 | No interruption of printing, temperatures are stable, all components are functional. |

Description of how performance was observed during testing:

| No. | Description |
|-----|--|
| 1 | Mode 1: Examine the machines operation and ensure motion/extrusion is occurring as expected. |
| | |

General notes: None

6 Radiated Emissions

6.1 Method

Tests are performed in accordance with CISPR 22.

TEST SITE: 3m SAC

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

The EMC Lab has one Semi-anechoic Chamber and Fully-anechoic Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

Measurement Uncertainty

| Measurement | Frequency Range | Expanded Uncertainty (k=2) | U _{CISPR} |
|------------------------|-----------------|----------------------------|--------------------|
| Radiated Emissions, 3m | 30-200MHz HP | 3.6 dB | 6.3 dB |
| Radiated Emissions, 3m | 30-200MHz VP | 4.5 dB | 6.3 dB |
| Radiated Emissions, 3m | 200-1000MHz HP | 3.7 dB | 6.3 dB |
| Radiated Emissions, 3m | 200-1000MHz VP | 3.7 dB | 6.3 dB |
| Radiated Emissions, 3m | 1-26 GHz | 5.4 dB | 5.5 dB |

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
 AF = 7.4 dB/m
 CF = 1.6 dB
 AG = 29.0 dB
 FS = 32 dB μ V/m

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where UF = Net Reading in } \mu\text{V}$$

$$NF = \text{Net Reading in dB}\mu\text{V}$$

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

6.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---------|--------------------------------------|-----------------|--|------------------------------|------------|------------|
| 18912 | 9 kHz- 1.3GHz Pre Amp | Hewlett-Packard | HP | 5 | 5/19/2015 | 5/19/2016 |
| 19937 | Bilog Antenna 30MHz - 6GHz | Sunol Sciences | JB6 | A050707-2 | 4/10/2015 | 4/10/2016 |
| DEN-073 | EMI Receiver (10Hz – 26.5GHz) | RHODE & SCHWARZ | ESU 26 | 100265 | 12/19/2015 | 12/19/2016 |
| CC1-E2 | Radiated Cable | Teledyne | 90-206-300; PN:F-130-S1S1-100; 90-206-072; | E2-A; 5026702002; E2-C; E2-D | 11/17/2015 | 11/17/2016 |
| LAB-012 | Wireless BP, Tem and Humidity sensor | Omega | zED-BTH | 0070368 | 9/01/2015 | 9/1/2016 |

Software Utilized:

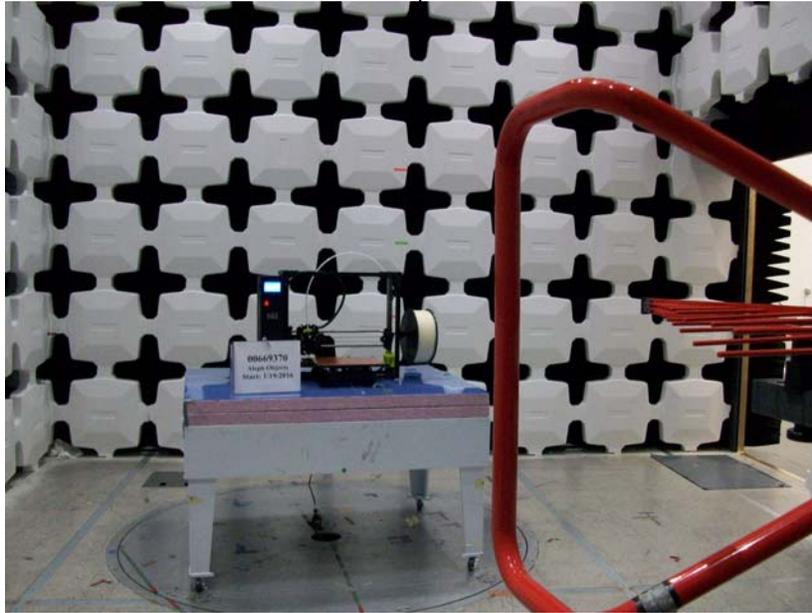
| Name | Manufacturer | Version |
|--|--------------|-----------------|
| SW-6: Software for Radiated and Conducted emissions. | Intertek | OATS cvi, V.1.0 |

6.3 Results:

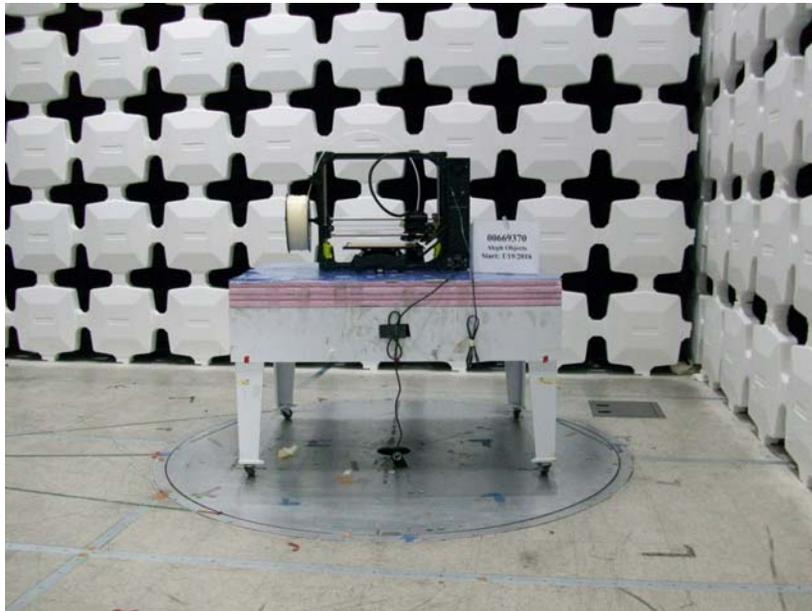
The sample tested was found to Comply.

6.4 Setup Photographs:

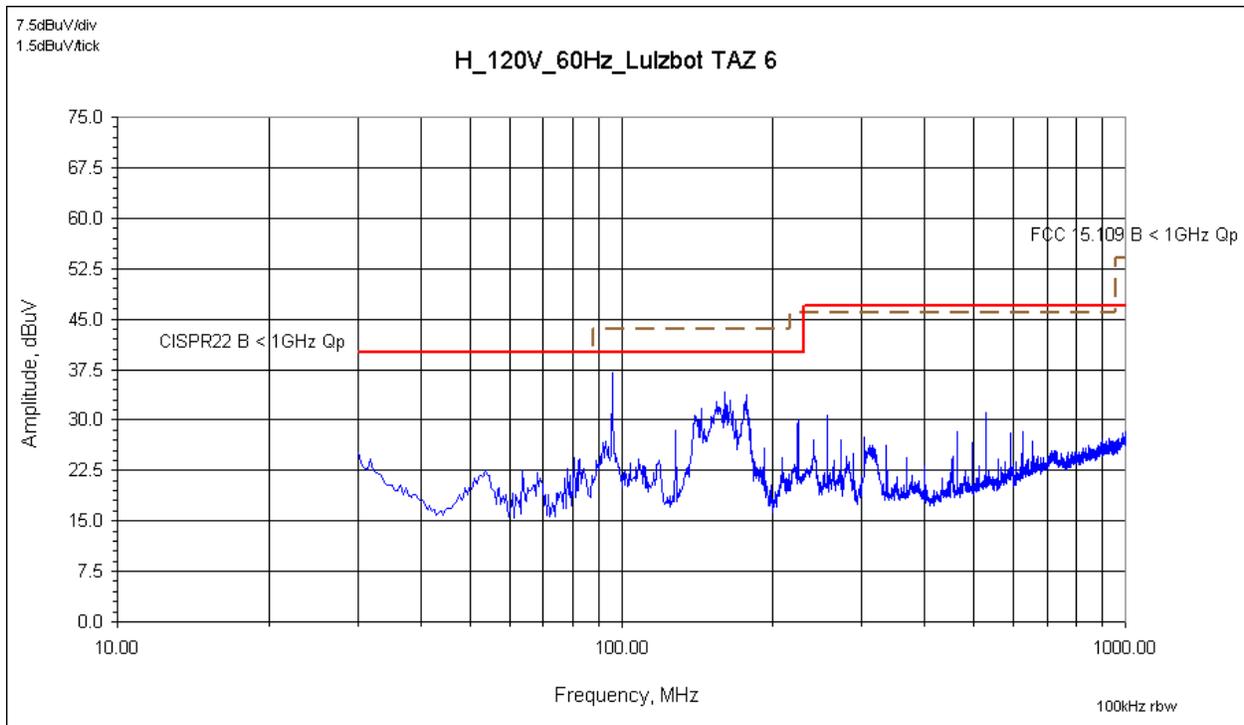
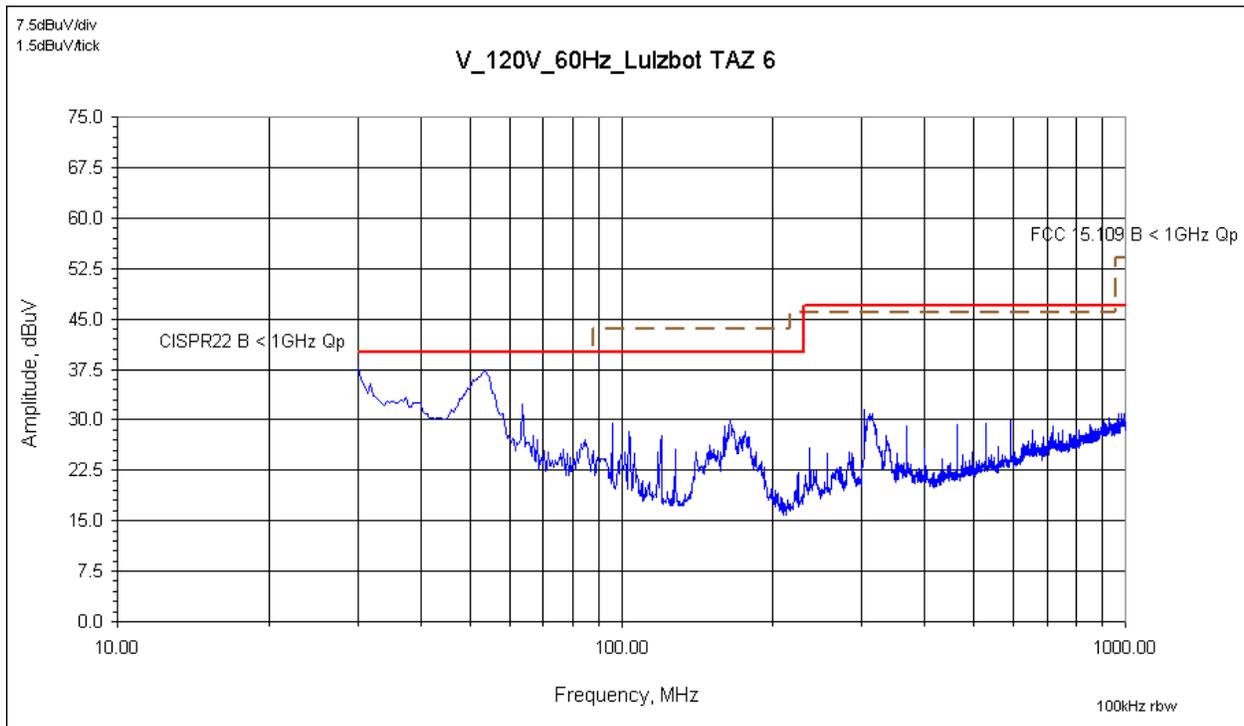
Test setup - Front

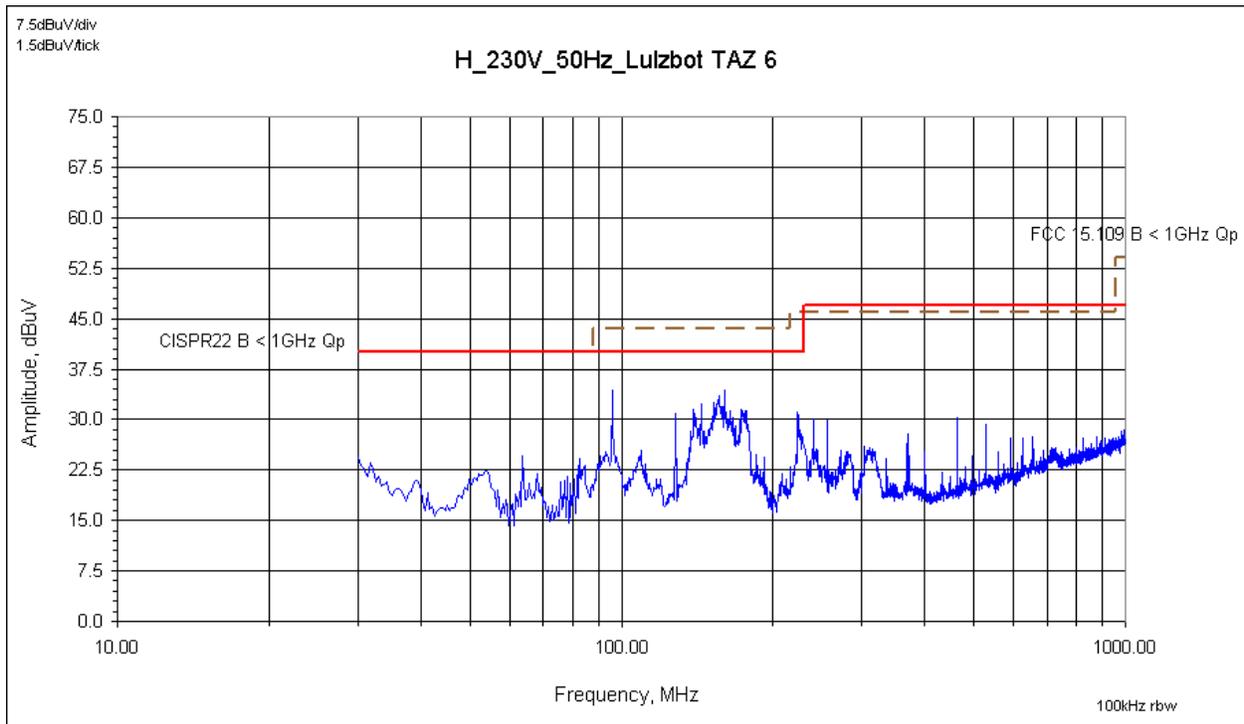
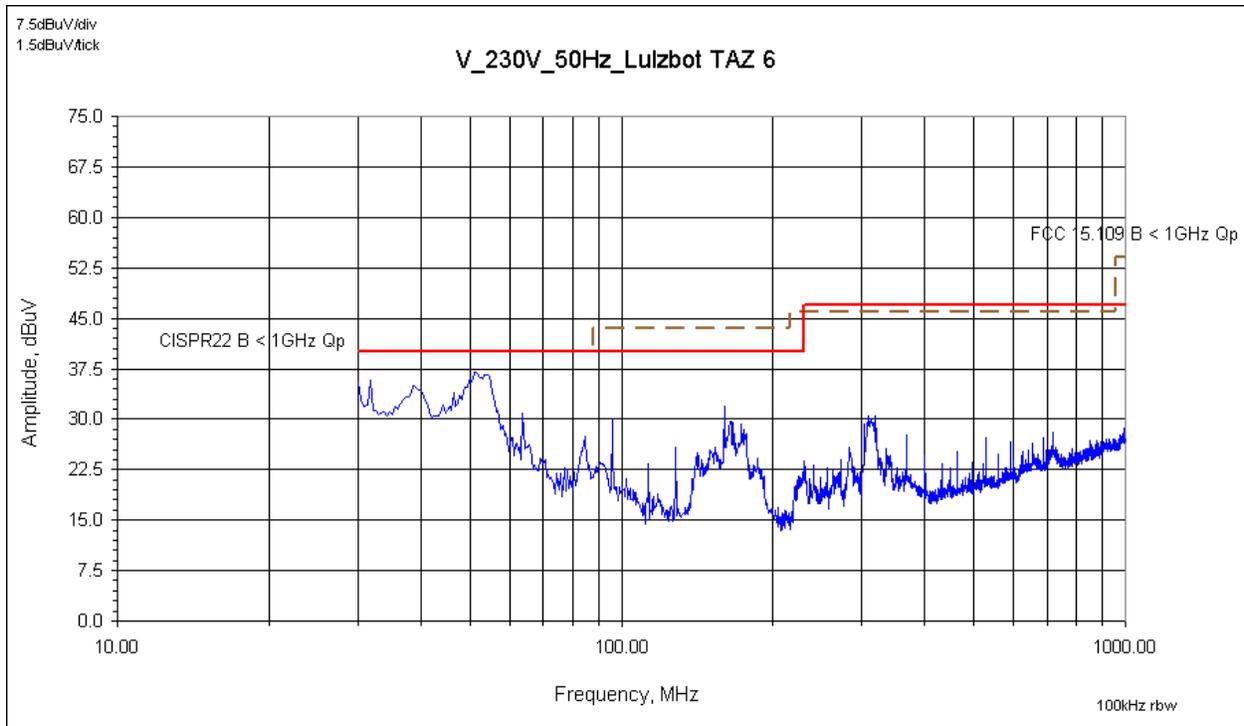


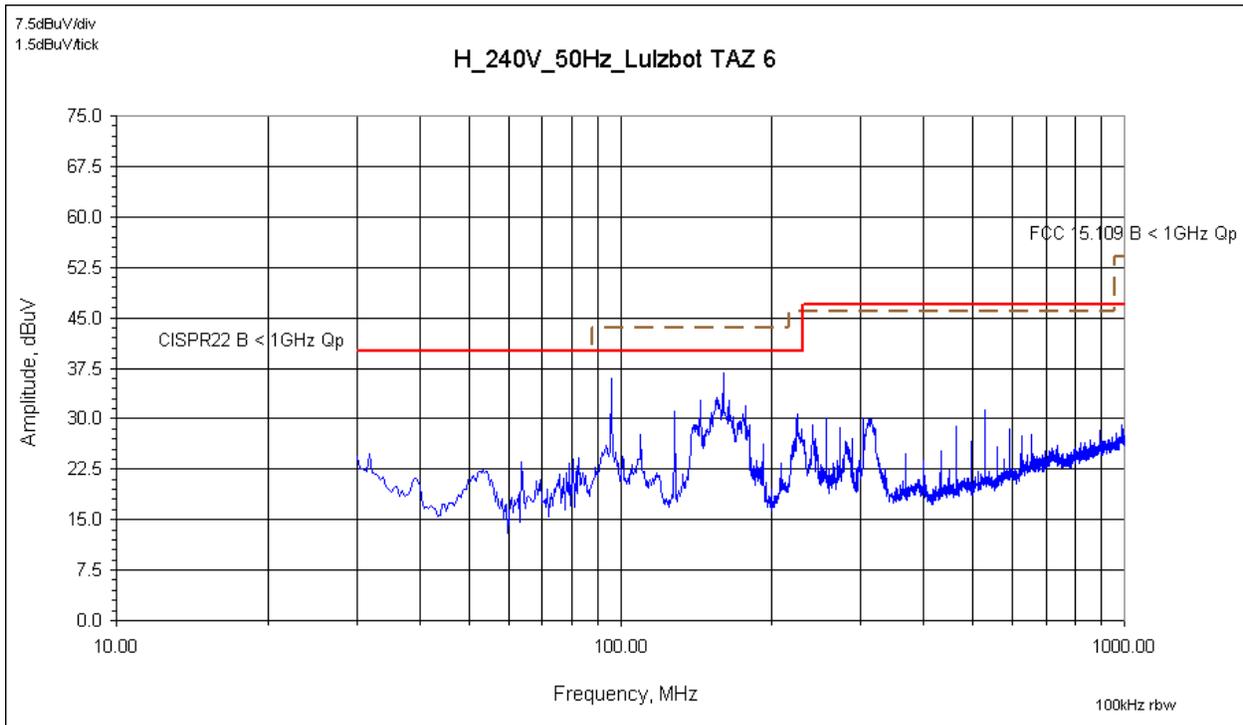
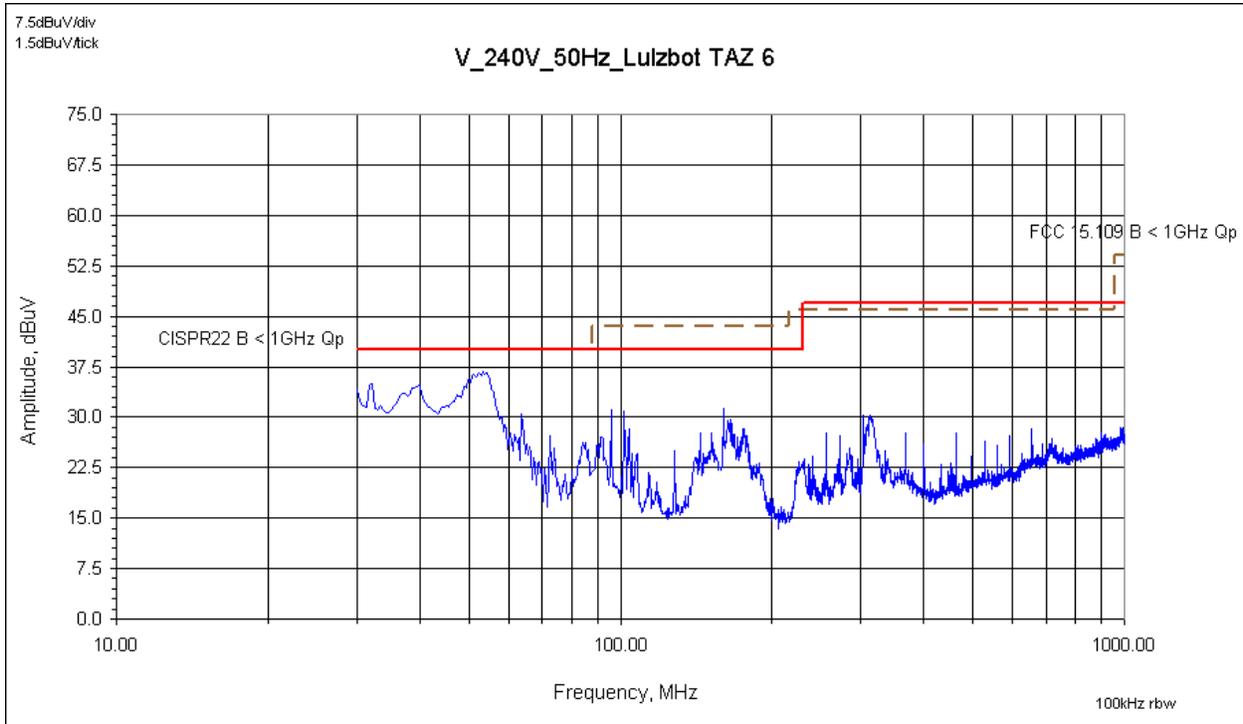
Test setup - Rear



6.5 Plots/Data:







Intertek

Report Number: 102442722DEN-001

Issued: 01/21/2016

| FREQ | LEVEL | DET | CABLE | ANT | PREAMP | ATTEN | FINAL | POL | HT | AZ | DELTA1 | DELTA2 | RBW |
|---------------------------|-------|-----------------------|--------|----------|--------|--------|----------|-------|------|-------|---------------------------|------------------------------|-------|
| MHz | dBuV | Qp Av Pk Rms | + [dB] | + [dB/m] | - [dB] | + [dB] | = [dBuV] | (V/H) | (m) | (DEG) | CISPR22 B < 1GHz Qp | FCC 15.109 B < 1GHz Qp | (MHz) |
| V_120V_60Hz_Lulzbot TAZ 6 | | | | | | | | | | | | | |
| 30.43 | 39.05 | Qp | 0.48 | 20.80 | 28.04 | 0.00 | 32.29 | V | 1.00 | 146.0 | NA | - 7.71 | 0.120 |
| 54.66 | 52.88 | Qp | 0.66 | 7.70 | 27.97 | 0.00 | 33.26 | V | 1.00 | 264.0 | NA | - 6.74 | 0.120 |
| 63.75 | 43.72 | Qp | 0.72 | 7.97 | 27.95 | 0.00 | 24.47 | V | 1.00 | 0.0 | NA | - 15.53 | 0.120 |
| 95.77 | 33.15 | Qp | 0.88 | 9.55 | 27.82 | 0.00 | 15.76 | V | 1.00 | 166.0 | NA | - 27.76 | 0.120 |
| 165.43 | 39.42 | Qp | 1.16 | 12.36 | 27.47 | 0.00 | 25.46 | V | 2.67 | 148.0 | NA | - 18.06 | 0.120 |
| 303.99 | 44.06 | Qp | 1.57 | 13.68 | 26.96 | 0.00 | 32.34 | V | 1.50 | 142.0 | NA | - 13.68 | 0.120 |
| H_120V_60Hz_Lulzbot TAZ 6 | | | | | | | | | | | | | |
| 96.00 | 51.87 | Qp | 0.88 | 9.60 | 27.82 | 0.00 | 34.53 | H | 1.80 | 220.0 | NA | - 8.99 | 0.120 |
| 159.99 | 48.09 | Qp | 1.13 | 12.80 | 27.50 | 0.00 | 34.52 | H | 1.50 | 120.0 | NA | - 9.01 | 0.120 |
| 177.55 | 41.47 | Qp | 1.19 | 11.50 | 27.40 | 0.00 | 26.77 | H | 1.23 | 220.0 | NA | - 16.76 | 0.120 |
| 223.99 | 44.74 | Qp | 1.34 | 10.96 | 27.11 | 0.00 | 29.93 | H | 1.10 | 240.0 | NA | - 16.09 | 0.120 |
| 255.99 | 45.96 | Qp | 1.42 | 11.66 | 26.97 | 0.00 | 32.07 | H | 1.00 | 300.0 | NA | - 13.95 | 0.120 |
| 527.98 | 38.07 | Qp | 2.06 | 18.44 | 28.23 | 0.00 | 30.34 | H | 1.40 | 0.0 | NA | - 15.68 | 0.120 |
| V_230V_50Hz_Lulzbot TAZ 6 | | | | | | | | | | | | | |
| 30.00 | 35.70 | Qp | 0.48 | 21.10 | 28.04 | 0.00 | 29.24 | V | 1.40 | 0.0 | - 10.76 | - 10.76 | 0.120 |
| 31.73 | 34.16 | Qp | 0.50 | 20.11 | 28.04 | 0.00 | 26.73 | V | 1.00 | 240.0 | - 13.27 | - 13.27 | 0.120 |
| 52.07 | 53.06 | Qp | 0.64 | 7.99 | 27.98 | 0.00 | 33.71 | V | 1.00 | 95.0 | - 6.29 | - 6.29 | 0.120 |
| 96.00 | 45.63 | Qp | 0.88 | 9.60 | 27.82 | 0.00 | 28.29 | V | 3.30 | 0.0 | - 11.71 | - 15.23 | 0.120 |
| 159.99 | 40.67 | Qp | 1.13 | 12.80 | 27.50 | 0.00 | 27.10 | V | 3.30 | 0.0 | - 12.90 | - 16.43 | 0.120 |
| 316.27 | 33.71 | Qp | 1.59 | 13.83 | 27.02 | 0.00 | 22.10 | V | 3.30 | 0.0 | - 24.90 | - 23.92 | 0.120 |
| H_230V_50Hz_Lulzbot TAZ 6 | | | | | | | | | | | | | |
| 96.00 | 53.94 | Qp | 0.88 | 9.60 | 27.82 | 0.00 | 36.60 | H | 1.80 | 280.0 | - 3.40 | - 6.92 | 0.120 |
| 128.22 | 27.47 | Qp | 1.02 | 13.58 | 27.69 | 0.00 | 14.38 | H | 1.60 | 250.0 | - 25.62 | - 29.15 | 0.120 |
| 159.81 | 38.11 | Qp | 1.13 | 12.80 | 27.51 | 0.00 | 24.53 | H | 1.00 | 200.0 | - 15.47 | - 18.99 | 0.120 |
| 223.99 | 44.20 | Qp | 1.34 | 10.96 | 27.11 | 0.00 | 29.39 | H | 1.00 | 200.0 | - 10.61 | - 16.63 | 0.120 |
| 463.98 | 38.49 | Qp | 1.93 | 16.80 | 28.04 | 0.00 | 29.18 | H | 1.97 | 250.0 | - 17.82 | - 16.84 | 0.120 |
| 527.98 | 35.85 | Qp | 2.06 | 18.44 | 28.23 | 0.00 | 28.12 | H | 1.30 | 250.0 | - 18.88 | - 17.90 | 0.120 |
| V_240V_50Hz_Lulzbot TAZ 6 | | | | | | | | | | | | | |
| 30.00 | 35.82 | Qp | 0.48 | 21.10 | 28.04 | 0.00 | 29.36 | V | 1.00 | 1.0 | - 10.64 | - 10.64 | 0.120 |
| 32.16 | 34.65 | Qp | 0.50 | 19.87 | 28.04 | 0.00 | 26.98 | V | 1.00 | 90.0 | - 13.02 | - 13.02 | 0.120 |
| 39.95 | 42.62 | Qp | 0.56 | 13.83 | 28.02 | 0.00 | 29.00 | V | 1.00 | 50.0 | - 11.00 | - 11.00 | 0.120 |
| 54.66 | 51.75 | Qp | 0.66 | 7.70 | 27.97 | 0.00 | 32.13 | V | 1.10 | 300.0 | - 7.87 | - 7.87 | 0.120 |
| 101.83 | 34.48 | Qp | 0.90 | 10.87 | 27.80 | 0.00 | 18.44 | V | 1.00 | 0.0 | - 21.56 | - 25.08 | 0.120 |
| 159.81 | 33.27 | Qp | 1.13 | 12.80 | 27.51 | 0.00 | 19.69 | V | 1.00 | 175.0 | - 20.31 | - 23.83 | 0.120 |
| H_240V_50Hz_Lulzbot TAZ 6 | | | | | | | | | | | | | |
| 96.00 | 55.73 | Qp | 0.88 | 9.60 | 27.82 | 0.00 | 38.39 | H | 1.80 | 0.0 | - 1.61 | - 5.13 | 0.120 |
| 127.99 | 43.07 | Qp | 1.02 | 13.60 | 27.69 | 0.00 | 30.00 | H | 1.00 | 180.0 | - 10.00 | - 13.52 | 0.120 |
| 159.99 | 48.15 | Qp | 1.13 | 12.80 | 27.50 | 0.00 | 34.58 | H | 1.80 | 0.0 | - 5.42 | - 8.95 | 0.120 |
| 224.28 | 39.27 | Qp | 1.35 | 10.97 | 27.11 | 0.00 | 24.48 | H | 1.20 | 277.0 | - 15.52 | - 21.55 | 0.120 |
| 315.50 | 44.19 | Qp | 1.58 | 13.81 | 27.02 | 0.00 | 32.57 | H | 1.00 | 71.0 | - 14.43 | - 13.46 | 0.120 |
| 527.98 | 38.53 | Qp | 2.06 | 18.44 | 28.23 | 0.00 | 30.80 | H | 1.30 | 180.0 | - 16.20 | - 15.22 | 0.120 |

Test Personnel: Son La
 Supervising/Reviewing Engineer: Michael Spataro
 (Where Applicable) Product Standard: CISPR 22/FCC15 Subpart B
 Input Voltage: 120V, 60Hz, 230V, 240V, 50Hz
 Pretest Verification w/ Ambient Signals or BB Source: EMCO site source

Test Date: 1/19/2016
 Limit Applied: Class B
 Ambient Temperature: 22.2 °C
 Relative Humidity: 16.4 %
 Atmospheric Pressure: 836.8 mbars

Deviations, Additions, or Exclusions: None

7 AC Mains Conducted Emissions

7.1 Method

Tests are performed in accordance with CISPR 22.

TEST SITE: 3m SAC

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

The EMC Lab has one Semi-anechoic Chamber and Fully-anechoic Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

Measurement Uncertainty

| Measurement | Frequency Range | Expanded Uncertainty (k=2) | Ucisp |
|-----------------------------|------------------------|-----------------------------------|--------------|
| AC Line Conducted Emissions | 150 kHz - 30 MHz | 3.3 dB | 3.4dB |

As shown in the table above our conducted emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculations

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where NF = Net Reading in dB μ V

RF = Reading from receiver in dB μ V

LF = LISN or ISN Correction Factor in dB

CF = Cable Correction Factor in dB

AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where UF = Net Reading in } \mu\text{V}$$

NF = Net Reading in dB μ V

Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 285.1 \mu\text{V/m}$$

7.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|--------------|---|----------------------|--------------|---------------|-----------------|----------------|
| 18914 | Single Phase LISN | EMCO | 3816/NM | 9408-1003 | 04/13/2015 | 04/13/2016 |
| 18730 | Transient Limiter | Hewlett-Packard | 11947A | 2820A00277 | 06/24/2015 | 06/24/2016 |
| DEN-073 | EMI Receiver (10Hz – 26.5GHz) | RHODE & SCHWARZ | ESU 26 | 100265 | 12/19/2015 | 12/19/2016 |
| CC1-001A | 50 Ohm Cable | Pasternak Enterprise | RG-223/U | N/A | 05/27/15 | 05/27/16 |
| CC1-001B | 50 Ohm Cable | Pasternak Enterprise | RG-223/U | N/A | 05/27/15 | 05/27/16 |
| LAB-012 | Wireless BP, Tem and Humidity sensor | Omega | zED-BTH | 0070368 | 9/01/2015 | 9/1/2016 |

Software Utilized:

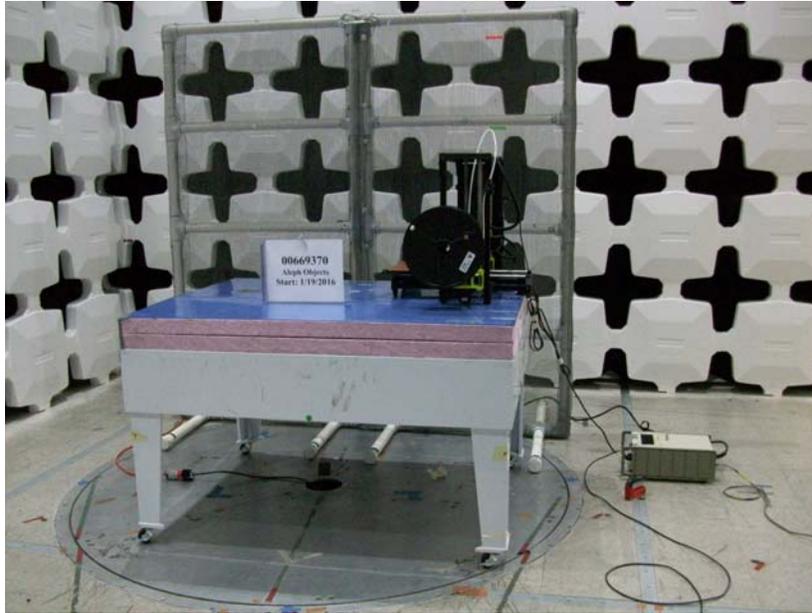
| Name | Manufacturer | Version |
|---|---------------------|-----------------|
| SW-6: Software for Radiated and Conducted emissions. | Intertek | OATS cvi, V.1.0 |

7.3 Results:

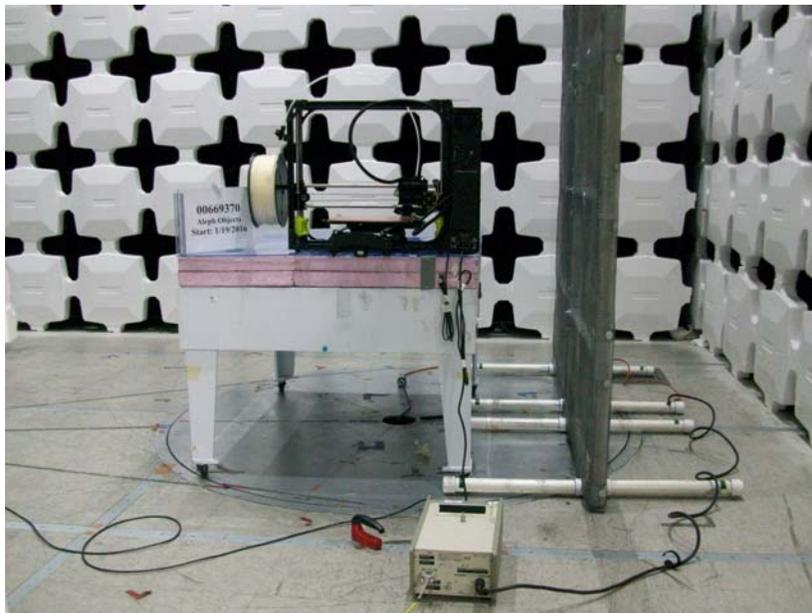
The sample tested was found to Comply.

7.4 Setup Photographs:

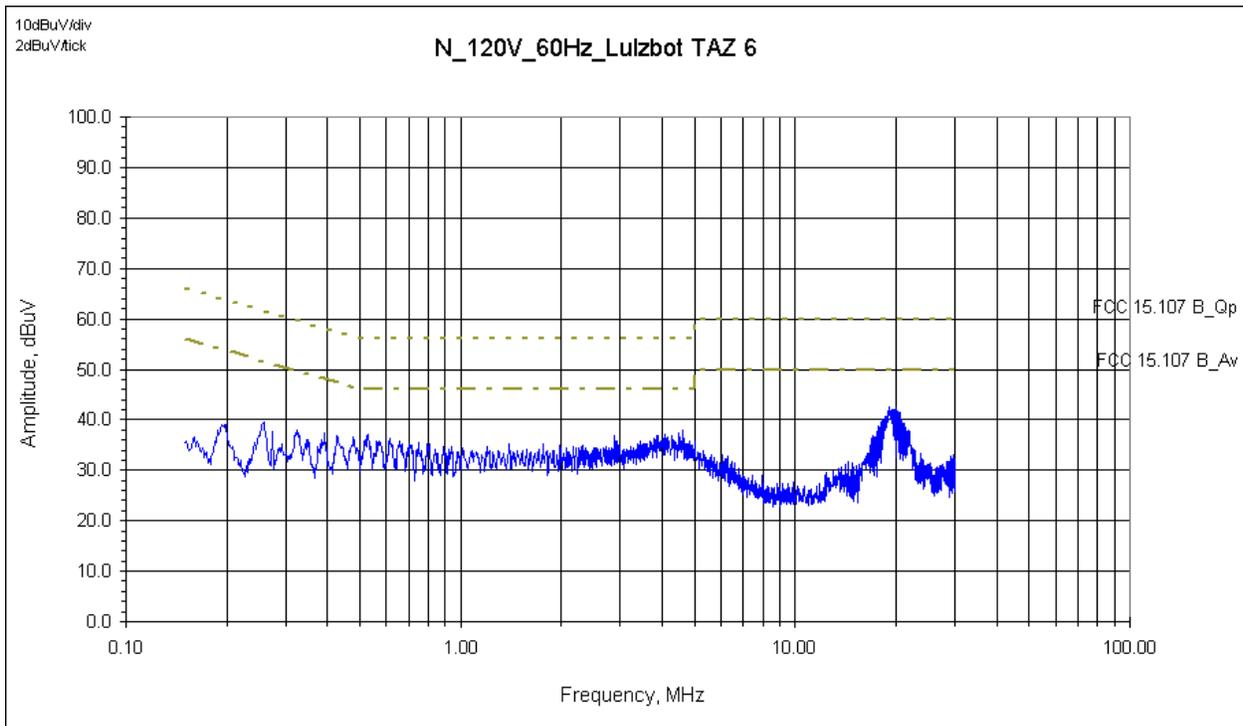
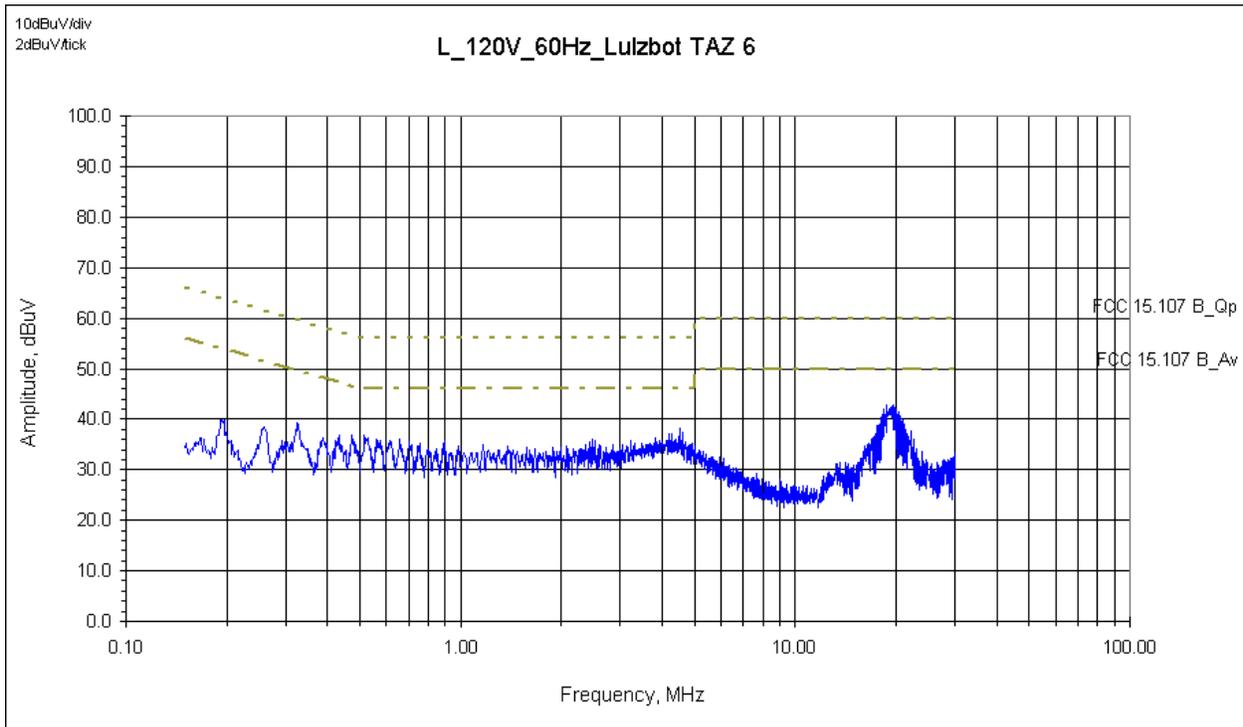
Test setup – Front

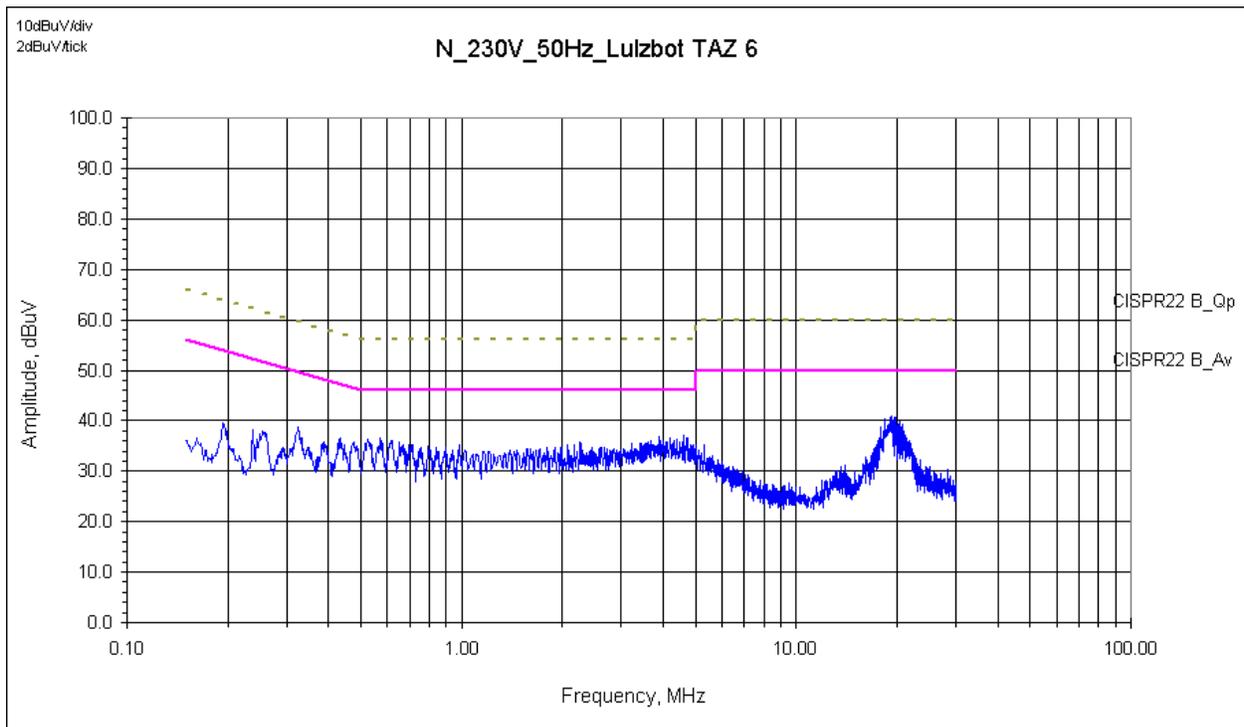
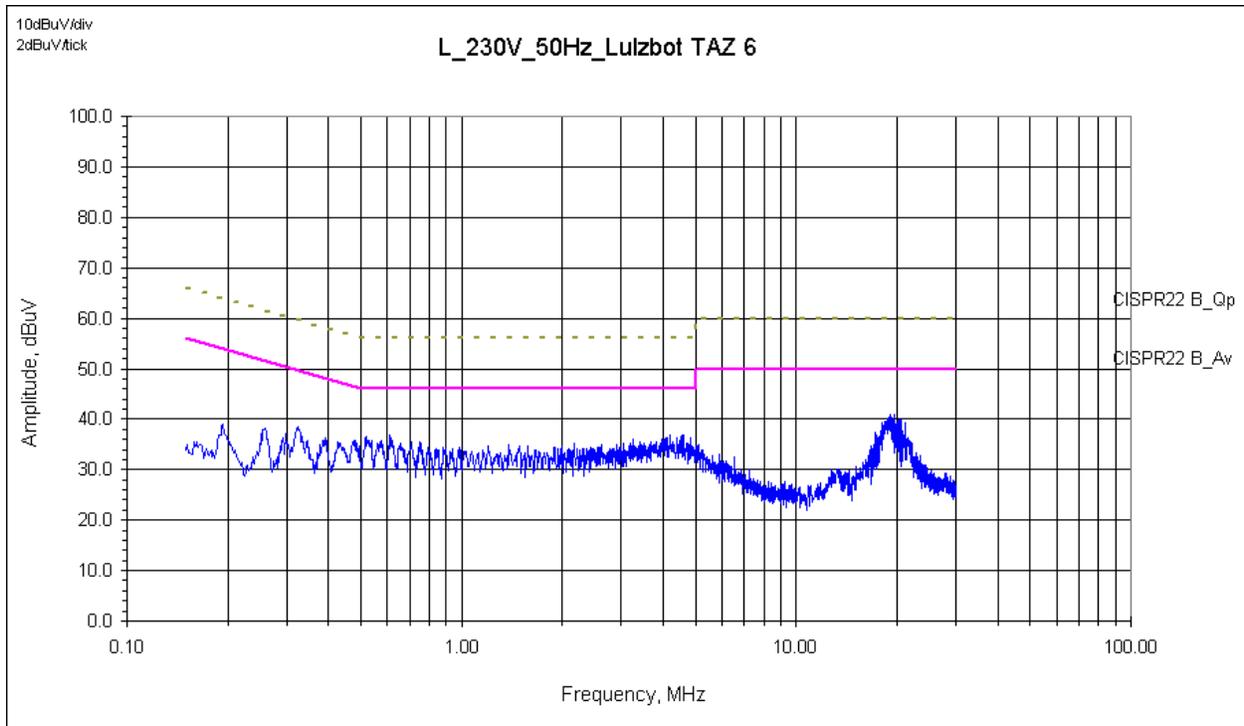


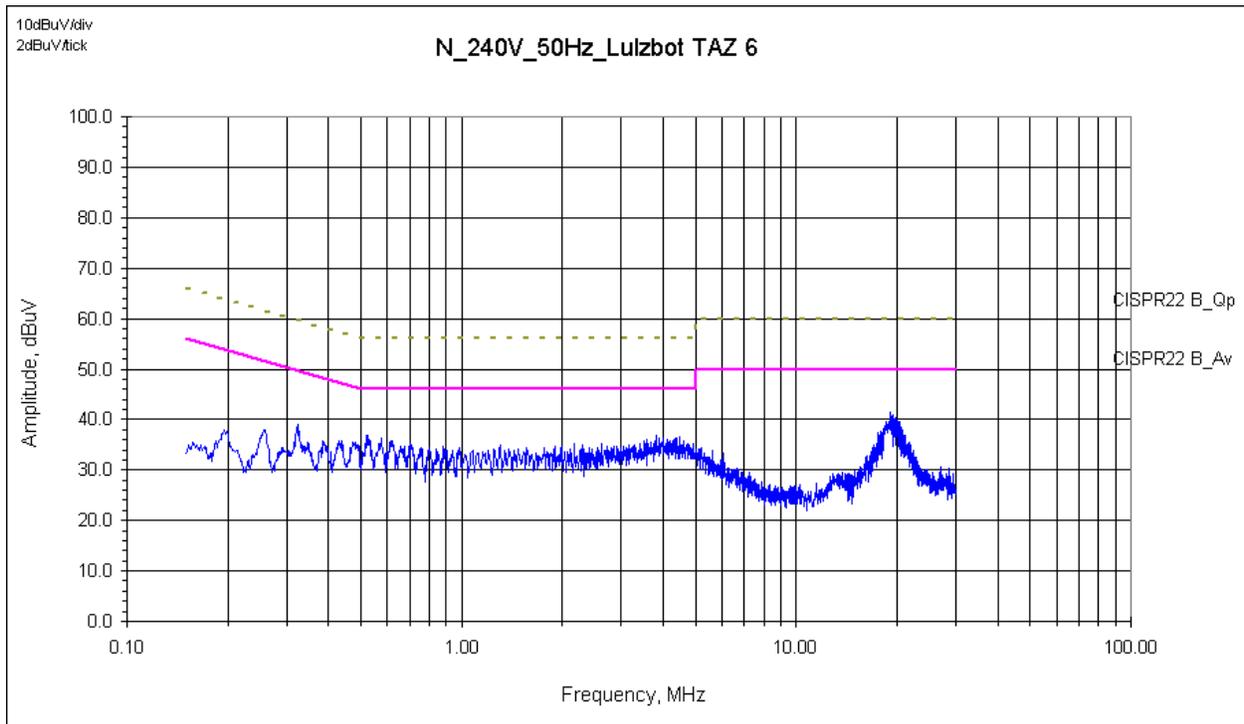
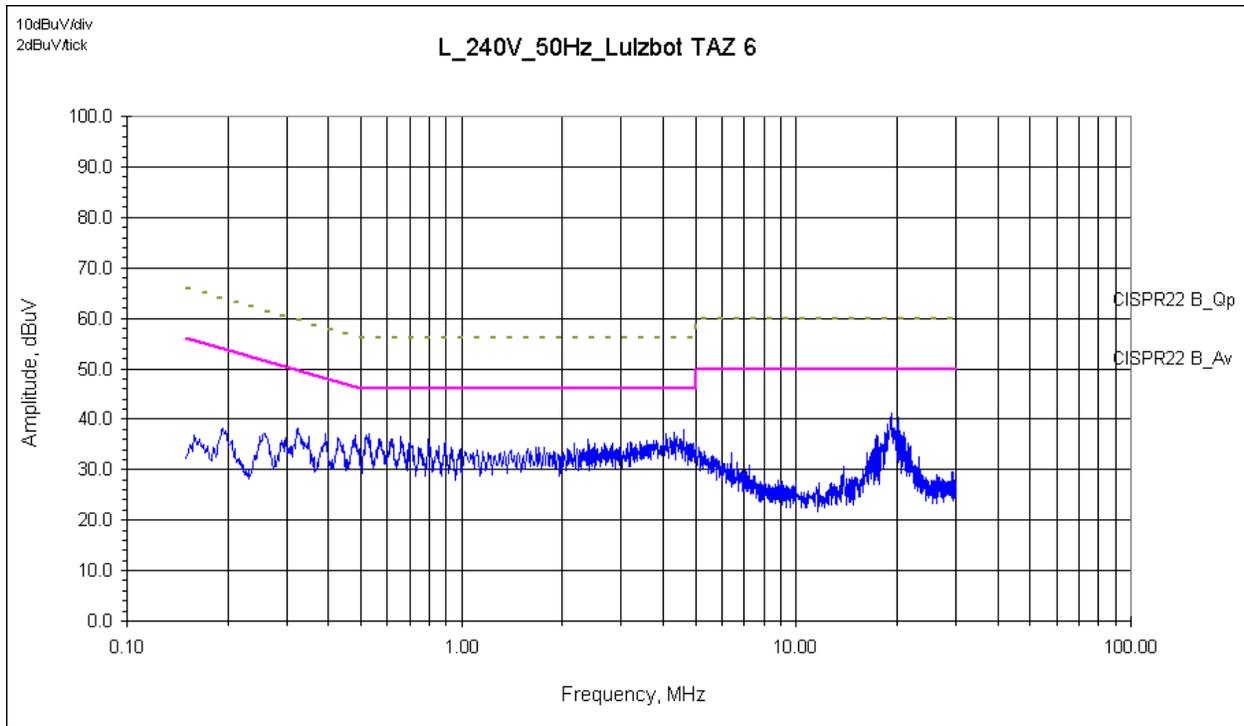
Test setup – Side



7.5 Plots/Data:







| FREQ | LEVEL | DET | CABLE | LISN | PREAMP | ATTEN | FINAL | TEST POINT | DELTA1 | DELTA2 | RBW |
|---------------------------|-------|----------------|--------|----------|--------|--------|----------|-----------------------------|-----------------|-----------------|-------|
| MHz | dBuV | Qp Av Pk | + [dB] | + [dB/m] | - [dB] | + [dB] | = [dBuV] | Other - N - L1 - L2 - L3 | CISPR22 B_Av | CISPR22 B_Qp | (MHz) |
| L_230V_50Hz_Lulzbot TAZ 6 | | | | | | | | | | | |
| 0.26 | 24.13 | Qp | 0.12 | 0.08 | 0.00 | 9.95 | 34.27 | Line 1 | NA | - 27.18 | 0.009 |
| 0.26 | 24.13 | Qp | 0.12 | 0.08 | 0.00 | 9.95 | 34.27 | Line 1 | NA | - 27.18 | 0.009 |
| 0.62 | 20.84 | Qp | 0.14 | 0.06 | 0.00 | 9.95 | 30.98 | Line 1 | NA | - 25.02 | 0.009 |
| 4.61 | 19.69 | Qp | 0.34 | 0.18 | 0.00 | 9.97 | 30.17 | Line 1 | NA | - 25.83 | 0.009 |
| 13.78 | 14.21 | Qp | 0.59 | 0.79 | 0.00 | 10.00 | 25.59 | Line 1 | NA | - 34.41 | 0.009 |
| 20.58 | 26.21 | Qp | 0.74 | 1.34 | 0.00 | 10.03 | 38.33 | Line 1 | NA | - 21.67 | 0.009 |
| 0.26 | 20.72 | Av | 0.12 | 0.08 | 0.00 | 9.95 | 30.86 | Line 1 | - 20.59 | NA | 0.009 |
| 0.26 | 20.72 | Av | 0.12 | 0.08 | 0.00 | 9.95 | 30.86 | Line 1 | - 20.59 | NA | 0.009 |
| 0.62 | 15.95 | Av | 0.14 | 0.06 | 0.00 | 9.95 | 26.09 | Line 1 | - 19.91 | NA | 0.009 |
| 4.61 | 14.85 | Av | 0.34 | 0.18 | 0.00 | 9.97 | 25.33 | Line 1 | - 20.67 | NA | 0.009 |
| 13.78 | 8.63 | Av | 0.59 | 0.79 | 0.00 | 10.00 | 20.01 | Line 1 | - 29.99 | NA | 0.009 |
| 20.58 | 21.86 | Av | 0.74 | 1.34 | 0.00 | 10.03 | 33.98 | Line 1 | - 16.02 | NA | 0.009 |
| N_230V_50Hz_Lulzbot TAZ 6 | | | | | | | | | | | |
| 0.33 | 21.72 | Qp | 0.12 | 0.07 | 0.00 | 9.95 | 31.86 | Line 2 | NA | - 27.68 | 0.009 |
| 0.84 | 19.69 | Qp | 0.15 | 0.08 | 0.00 | 9.95 | 29.86 | Line 2 | NA | - 26.14 | 0.009 |
| 2.17 | 15.04 | Qp | 0.22 | 0.10 | 0.00 | 9.95 | 25.31 | Line 2 | NA | - 30.69 | 0.009 |
| 3.91 | 19.02 | Qp | 0.30 | 0.16 | 0.00 | 9.96 | 29.44 | Line 2 | NA | - 26.56 | 0.009 |
| 13.04 | 9.95 | Qp | 0.57 | 0.79 | 0.00 | 10.00 | 21.31 | Line 2 | NA | - 38.69 | 0.009 |
| 19.81 | 24.27 | Qp | 0.72 | 1.26 | 0.00 | 10.03 | 36.29 | Line 2 | NA | - 23.71 | 0.009 |
| 0.33 | 17.76 | Av | 0.12 | 0.07 | 0.00 | 9.95 | 27.90 | Line 2 | - 21.64 | NA | 0.009 |
| 0.84 | 14.27 | Av | 0.15 | 0.08 | 0.00 | 9.95 | 24.44 | Line 2 | - 21.56 | NA | 0.009 |
| 2.17 | 10.43 | Av | 0.22 | 0.10 | 0.00 | 9.95 | 20.70 | Line 2 | - 25.30 | NA | 0.009 |
| 3.91 | 14.47 | Av | 0.30 | 0.16 | 0.00 | 9.96 | 24.89 | Line 2 | - 21.11 | NA | 0.009 |
| 13.04 | 5.00 | Av | 0.57 | 0.79 | 0.00 | 10.00 | 16.36 | Line 2 | - 33.64 | NA | 0.009 |
| 19.81 | 19.09 | Av | 0.72 | 1.26 | 0.00 | 10.03 | 31.11 | Line 2 | - 18.89 | NA | 0.009 |
| L_240V_50Hz_Lulzbot TAZ 6 | | | | | | | | | | | |
| 0.33 | 19.29 | Qp | 0.12 | 0.07 | 0.00 | 9.95 | 29.44 | Line 1 | NA | - 30.02 | 0.009 |
| 0.67 | 19.06 | Qp | 0.14 | 0.06 | 0.00 | 9.95 | 29.21 | Line 1 | NA | - 26.79 | 0.009 |
| 0.89 | 19.41 | Qp | 0.15 | 0.08 | 0.00 | 9.95 | 29.59 | Line 1 | NA | - 26.41 | 0.009 |
| 2.39 | 19.42 | Qp | 0.23 | 0.10 | 0.00 | 9.96 | 29.71 | Line 1 | NA | - 26.29 | 0.009 |
| 4.60 | 20.33 | Qp | 0.34 | 0.18 | 0.00 | 9.97 | 30.81 | Line 1 | NA | - 25.19 | 0.009 |
| 19.29 | 22.33 | Qp | 0.71 | 1.08 | 0.00 | 10.03 | 34.15 | Line 1 | NA | - 25.85 | 0.009 |
| 0.33 | 15.87 | Av | 0.12 | 0.07 | 0.00 | 9.95 | 26.02 | Line 1 | - 23.44 | NA | 0.009 |
| 0.67 | 14.52 | Av | 0.14 | 0.06 | 0.00 | 9.95 | 24.67 | Line 1 | - 21.33 | NA | 0.009 |
| 0.89 | 14.50 | Av | 0.15 | 0.08 | 0.00 | 9.95 | 24.68 | Line 1 | - 21.32 | NA | 0.009 |
| 2.39 | 14.31 | Av | 0.23 | 0.10 | 0.00 | 9.96 | 24.60 | Line 1 | - 21.40 | NA | 0.009 |
| 4.60 | 15.31 | Av | 0.34 | 0.18 | 0.00 | 9.97 | 25.79 | Line 1 | - 20.21 | NA | 0.009 |
| 19.29 | 14.57 | Av | 0.71 | 1.08 | 0.00 | 10.03 | 26.39 | Line 1 | - 23.61 | NA | 0.009 |
| N_240V_50Hz_Lulzbot TAZ 6 | | | | | | | | | | | |
| 0.33 | 24.09 | Qp | 0.12 | 0.07 | 0.00 | 9.95 | 34.23 | Line 2 | NA | - 25.33 | 0.009 |
| 0.58 | 20.36 | Qp | 0.13 | 0.05 | 0.00 | 9.95 | 30.49 | Line 2 | NA | - 25.51 | 0.009 |
| 2.04 | 17.51 | Qp | 0.21 | 0.10 | 0.00 | 9.95 | 27.77 | Line 2 | NA | - 28.23 | 0.009 |
| 3.69 | 19.76 | Qp | 0.29 | 0.15 | 0.00 | 9.96 | 30.16 | Line 2 | NA | - 25.84 | 0.009 |
| 4.60 | 20.36 | Qp | 0.34 | 0.20 | 0.00 | 9.97 | 30.86 | Line 2 | NA | - 25.14 | 0.009 |
| 19.74 | 23.94 | Qp | 0.72 | 1.25 | 0.00 | 10.03 | 35.94 | Line 2 | NA | - 24.06 | 0.009 |
| 0.33 | 22.18 | Av | 0.12 | 0.07 | 0.00 | 9.95 | 32.32 | Line 2 | - 17.24 | NA | 0.009 |
| 0.58 | 15.71 | Av | 0.13 | 0.05 | 0.00 | 9.95 | 25.84 | Line 2 | - 20.16 | NA | 0.009 |
| 2.04 | 12.27 | Av | 0.21 | 0.10 | 0.00 | 9.95 | 22.53 | Line 2 | - 23.47 | NA | 0.009 |
| 3.69 | 14.81 | Av | 0.29 | 0.15 | 0.00 | 9.96 | 25.21 | Line 2 | - 20.79 | NA | 0.009 |
| 4.60 | 15.20 | Av | 0.34 | 0.20 | 0.00 | 9.97 | 25.70 | Line 2 | - 20.30 | NA | 0.009 |
| 19.74 | 18.55 | Av | 0.72 | 1.25 | 0.00 | 10.03 | 30.55 | Line 2 | - 19.45 | NA | 0.009 |

| FREQ | LEVEL | DET | CABLE | LISN | PREAMP | ATTEN | FINAL | TEST POINT | DELTA1 | DELTA2 | RBW |
|---------------------------|-------|----------------|--------|----------|--------|--------|----------|-----------------------------|-----------------------|-----------------------|-------|
| MHz | dBuV | Qp Av Pk | + [dB] | + [dB/m] | - [dB] | + [dB] | = [dBuV] | Other - N - L1 - L2 - L3 | FCC 15.107 B_Qp | FCC 15.107 B_Av | (MHz) |
| L_120V_60Hz_Lulzbot TAZ 6 | | | | | | | | | | | |
| 0.33 | 20.13 | Qp | 0.12 | 0.08 | 0.00 | 9.95 | 30.28 | Line 1 | - 29.21 | NA | 0.009 |
| 0.92 | 17.04 | Qp | 0.15 | 0.08 | 0.00 | 9.95 | 27.22 | Line 1 | - 28.78 | NA | 0.009 |
| 2.39 | 18.81 | Qp | 0.23 | 0.10 | 0.00 | 9.96 | 29.10 | Line 1 | - 26.90 | NA | 0.009 |
| 4.63 | 17.25 | Qp | 0.34 | 0.18 | 0.00 | 9.97 | 27.73 | Line 1 | - 28.27 | NA | 0.009 |
| 14.29 | 11.05 | Qp | 0.60 | 0.86 | 0.00 | 10.01 | 22.51 | Line 1 | - 37.49 | NA | 0.009 |
| 20.19 | 29.23 | Qp | 0.73 | 1.26 | 0.00 | 10.03 | 41.25 | Line 1 | - 18.75 | NA | 0.009 |
| 0.33 | 16.95 | Av | 0.12 | 0.08 | 0.00 | 9.95 | 27.10 | Line 1 | NA | - 22.39 | 0.009 |
| 0.92 | 11.97 | Av | 0.15 | 0.08 | 0.00 | 9.95 | 22.15 | Line 1 | NA | - 23.85 | 0.009 |
| 2.39 | 14.03 | Av | 0.23 | 0.10 | 0.00 | 9.96 | 24.32 | Line 1 | NA | - 21.68 | 0.009 |
| 4.63 | 12.49 | Av | 0.34 | 0.18 | 0.00 | 9.97 | 22.97 | Line 1 | NA | - 23.03 | 0.009 |
| 14.29 | 3.81 | Av | 0.60 | 0.86 | 0.00 | 10.01 | 15.27 | Line 1 | NA | - 34.73 | 0.009 |
| 20.19 | 23.92 | Av | 0.73 | 1.26 | 0.00 | 10.03 | 35.94 | Line 1 | NA | - 14.06 | 0.009 |
| N_120V_60Hz_Lulzbot TAZ 6 | | | | | | | | | | | |
| 0.26 | 25.08 | Qp | 0.12 | 0.07 | 0.00 | 9.95 | 35.22 | Line 2 | - 26.25 | NA | 0.009 |
| 0.53 | 19.51 | Qp | 0.13 | 0.05 | 0.00 | 9.95 | 29.64 | Line 2 | - 26.36 | NA | 0.009 |
| 1.40 | 19.43 | Qp | 0.18 | 0.08 | 0.00 | 9.95 | 29.64 | Line 2 | - 26.36 | NA | 0.009 |
| 4.63 | 18.91 | Qp | 0.34 | 0.20 | 0.00 | 9.97 | 29.42 | Line 2 | - 26.58 | NA | 0.009 |
| 14.74 | 12.12 | Qp | 0.61 | 1.00 | 0.00 | 10.01 | 23.74 | Line 2 | - 36.26 | NA | 0.009 |
| 20.38 | 26.99 | Qp | 0.73 | 1.38 | 0.00 | 10.03 | 39.14 | Line 2 | - 20.86 | NA | 0.009 |
| 0.26 | 21.79 | Av | 0.12 | 0.07 | 0.00 | 9.95 | 31.93 | Line 2 | NA | - 19.54 | 0.009 |
| 0.53 | 16.25 | Av | 0.13 | 0.05 | 0.00 | 9.95 | 26.38 | Line 2 | NA | - 19.62 | 0.009 |
| 1.40 | 14.41 | Av | 0.18 | 0.08 | 0.00 | 9.95 | 24.62 | Line 2 | NA | - 21.38 | 0.009 |
| 4.63 | 14.44 | Av | 0.34 | 0.20 | 0.00 | 9.97 | 24.95 | Line 2 | NA | - 21.05 | 0.009 |
| 14.74 | 4.00 | Av | 0.61 | 1.00 | 0.00 | 10.01 | 15.62 | Line 2 | NA | - 34.38 | 0.009 |
| 20.38 | 21.80 | Av | 0.73 | 1.38 | 0.00 | 10.03 | 33.95 | Line 2 | NA | - 16.05 | 0.009 |

Test Personnel: Son La
 Supervising/Reviewing Engineer: _____
 (Where Applicable) Michael Spataro
 Product Standard: CISPR 22/FCC15 Subpart B
 Input Voltage: 120V, 60Hz, 230V, 240V, 50hz
 Pretest Verification w/ Ambient Signals or BB Source: Yes

Test Date: 1/19/2016
 Limit Applied: Class B
 Ambient Temperature: 22.2 °C
 Relative Humidity: 16.4 %
 Atmospheric Pressure: 836.8 mbars

Deviations, Additions, or Exclusions: None

8 Harmonics

8.1 Method

Tests are performed in accordance with IEC 61000-3-2.

TEST SITE: Ground Plane

Site Designation:

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

The EMC Lab has one Semi-anechoic Chamber and Fully-anechoic Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

Measurement Uncertainty

| Measurement | Parameter | Expanded Uncertainty (k=2) | Permitted Error |
|-------------|-----------|----------------------------|-----------------|
| Harmonics | Current | 3% | ±5.0% |

As shown in the table above our Expanded Measurement Uncertainty for harmonic current U_{lab} is less than the corresponding measurement error allowed by IEC61000-3-2 and IEC61000-4-7, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required. There are currently no U_{CISPR} reference values in CISPR 16 for Harmonics.

8.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---------|--------------------------------------|----------------------|--------------------|---------|-----------|-----------|
| 18815 | Flicker and Harmonics Equipment | CALIFORNIA INSTRUMEN | 5001IX-CTS-LNS-160 | 71643 | 10/6/2015 | 10/6/2016 |
| LAB-012 | Wireless BP, Tem and Humidity sensor | Omega | zED-BTH | 0070368 | 9/01/2015 | 9/1/2016 |

Software Utilized:

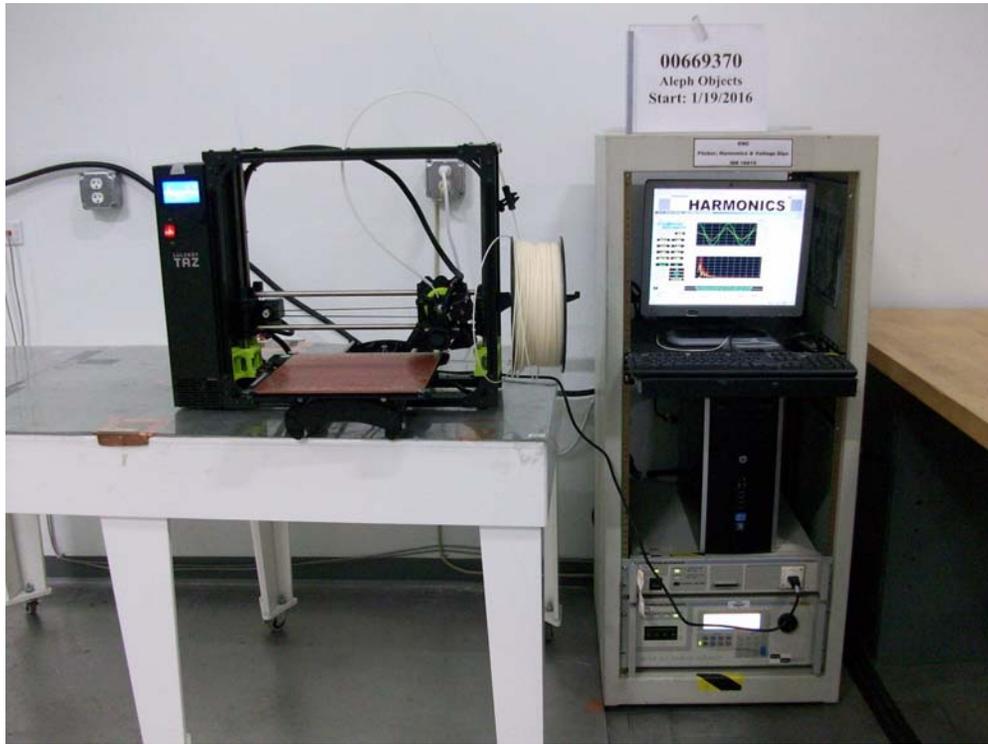
| Name | Manufacturer | Version |
|--|------------------|-----------------|
| SW-1: Software application for Harmonics and Flicker | California Inst. | OATS cvi, V.1.0 |

8.3 Results:

The sample tested was found to Comply.

8.4 Setup Photographs:

Test setup



Test setup – Close up



8.5 Plots/Data:

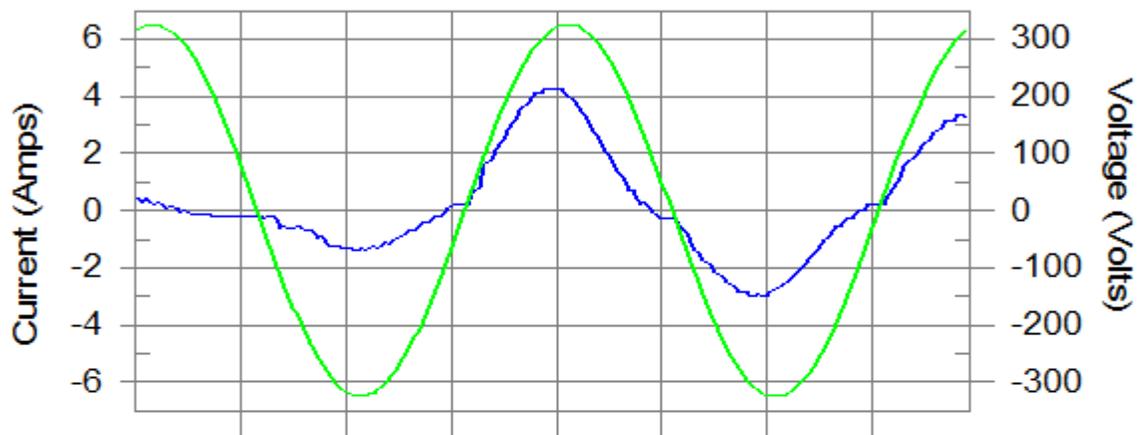
Harmonics – Class-A per Ed. 3.2 (2009)(Run time)

EUT: Model: Lulzbot TAZ 6
Test category: Class-A per Ed. 3.2 (2009) (European limits)
Test date: 1/19/2016
Test duration (min): 30
Comment: European Voltage 230V
Customer: Aleph Objects

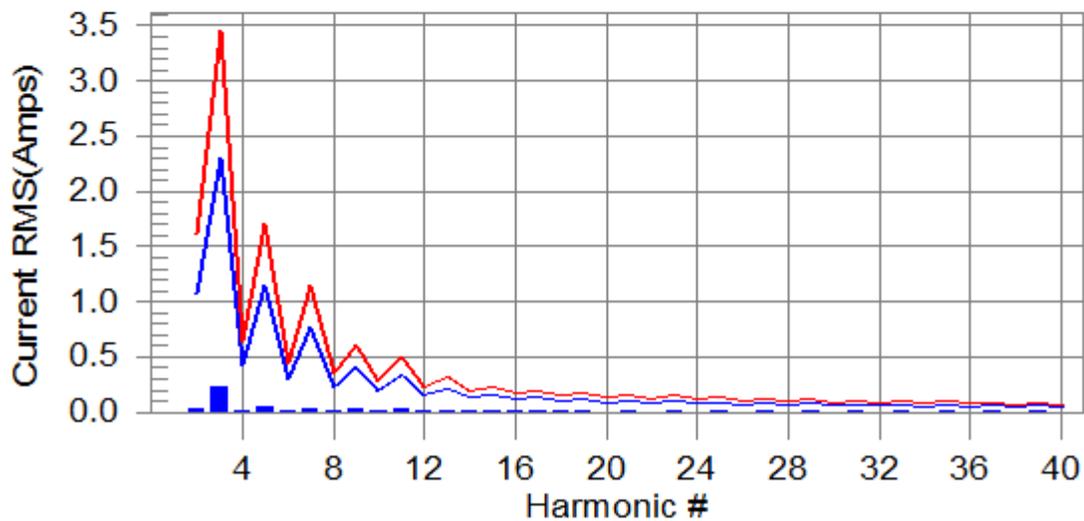
Tested by: Son La
Test Margin: 100
Start time: 6:39:58 PM
End time: 7:10:20 PM
Data file name: H-000014.cts_data

Test Result: Pass Source qualification: Normal

Current & voltage waveforms



Harmonics and Class A limit line European Limits



Test result: Pass Worst harmonic was #23 with 10.27% of the limit.

Current Test Result Summary (Run time)

EUT: Model: Lulzbot TAZ 6 Tested by: Son La
 Test category: Class-A per Ed. 3.2 (2009) (European limits) Test Margin: 100
 Test date: 1/19/2016 Start time: 6:39:58 PM End time: 7:10:20 PM
 Test duration (min): 30 Data file name: H-000014.cts_data
 Comment: European Voltage 230V
 Customer: Aleph Objects

Test Result: Pass Source qualification: Normal
 THC(A): 0.21 I-THD(%): 14.45 POHC(A): 0.000 POHC Limit(A): 0.251

Highest parameter values during test:

| | |
|-----------------------|----------------------|
| V RMS (Volts): 230.02 | Frequency(Hz): 50.00 |
| I Peak (Amps): 4.338 | I RMS (Amps): 1.973 |
| I Fund (Amps): 1.714 | Crest Factor: 5.280 |
| Power (Watts): 379.1 | Power Factor: 0.912 |

| Harm# | Harms(avg) | 100%Limit | %of Limit | Harms(max) | 150%Limit | %of Limit | Status |
|-------|------------|-----------|-----------|------------|-----------|-----------|--------|
| 2 | 0.021 | 1.080 | 1.9 | 0.037 | 1.620 | 2.27 | Pass |
| 3 | 0.197 | 2.300 | 8.6 | 0.235 | 3.450 | 6.82 | Pass |
| 4 | 0.005 | 0.430 | 1.2 | 0.016 | 0.645 | 2.43 | Pass |
| 5 | 0.044 | 1.140 | 3.9 | 0.053 | 1.710 | 3.09 | Pass |
| 6 | 0.003 | 0.300 | 1.1 | 0.009 | 0.450 | 1.95 | Pass |
| 7 | 0.029 | 0.770 | 3.8 | 0.036 | 1.155 | 3.08 | Pass |
| 8 | 0.003 | 0.230 | 1.1 | 0.007 | 0.345 | 2.01 | Pass |
| 9 | 0.019 | 0.400 | 4.7 | 0.025 | 0.600 | 4.13 | Pass |
| 10 | 0.002 | 0.184 | 1.2 | 0.006 | 0.276 | 2.25 | Pass |
| 11 | 0.017 | 0.330 | 5.2 | 0.021 | 0.495 | 4.28 | Pass |
| 12 | 0.002 | 0.153 | 1.3 | 0.006 | 0.230 | 2.39 | Pass |
| 13 | 0.013 | 0.210 | 6.4 | 0.017 | 0.315 | 5.31 | Pass |
| 14 | 0.002 | 0.131 | 1.2 | 0.004 | 0.197 | 2.22 | Pass |
| 15 | 0.009 | 0.150 | 6.0 | 0.011 | 0.225 | 4.71 | Pass |
| 16 | 0.001 | 0.115 | 1.3 | 0.004 | 0.173 | 2.33 | Pass |
| 17 | 0.007 | 0.132 | 5.2 | 0.011 | 0.199 | 5.66 | Pass |
| 18 | 0.001 | 0.102 | 1.3 | 0.003 | 0.153 | 2.21 | Pass |
| 19 | 0.005 | 0.118 | 4.0 | 0.009 | 0.178 | 5.22 | Pass |
| 20 | 0.001 | 0.092 | 1.4 | 0.003 | 0.138 | 2.24 | Pass |
| 21 | 0.005 | 0.107 | 4.7 | 0.009 | 0.161 | 5.88 | Pass |
| 22 | 0.001 | 0.084 | 1.5 | 0.003 | 0.125 | 2.33 | Pass |
| 23 | 0.007 | 0.098 | 6.9 | 0.015 | 0.147 | 10.27 | Pass |
| 24 | 0.001 | 0.077 | 1.6 | 0.003 | 0.115 | 2.43 | Pass |
| 25 | 0.005 | 0.090 | 5.9 | 0.008 | 0.135 | 5.64 | Pass |
| 26 | 0.001 | 0.071 | 1.4 | 0.002 | 0.106 | 2.31 | Pass |
| 27 | 0.005 | 0.083 | 6.0 | 0.007 | 0.125 | 5.33 | Pass |
| 28 | 0.001 | 0.066 | 1.6 | 0.002 | 0.099 | 2.44 | Pass |
| 29 | 0.005 | 0.078 | 6.0 | 0.007 | 0.116 | 5.67 | Pass |
| 30 | 0.001 | 0.061 | 1.5 | 0.002 | 0.092 | 2.57 | Pass |
| 31 | 0.004 | 0.073 | 5.5 | 0.007 | 0.109 | 6.40 | Pass |
| 32 | 0.001 | 0.058 | 1.6 | 0.002 | 0.086 | 2.34 | Pass |
| 33 | 0.003 | 0.068 | 4.7 | 0.005 | 0.102 | 4.81 | Pass |
| 34 | 0.001 | 0.054 | 1.7 | 0.002 | 0.081 | 2.29 | Pass |
| 35 | 0.003 | 0.064 | 4.4 | 0.005 | 0.096 | 4.80 | Pass |
| 36 | 0.001 | 0.051 | 1.9 | 0.002 | 0.077 | 2.52 | Pass |
| 37 | 0.004 | 0.061 | 5.8 | 0.005 | 0.091 | 5.57 | Pass |
| 38 | 0.001 | 0.048 | 1.8 | 0.002 | 0.073 | 2.66 | Pass |
| 39 | 0.003 | 0.058 | 5.1 | 0.004 | 0.087 | 5.07 | Pass |
| 40 | 0.001 | 0.046 | 2.3 | 0.002 | 0.069 | 2.84 | Pass |

Voltage Source Verification Data (Run time)

EUT: Model: Lulzbot TAZ 6
 Test category: Class-A per Ed. 3.2 (2009) (European limits)
 Test date: 1/19/2016
 Test duration (min): 30
 Comment: European Voltage 230V
 Customer: Aleph Objects

Tested by: Son La
 Test Margin: 100
 Start time: 6:39:58 PM
 End time: 7:10:20 PM
 Data file name: H-000014.cts_data

Test Result: Pass Source qualification: Normal

Highest parameter values during test:

Voltage (Vrms): 230.02
 I Peak (Amps): 4.338
 I Fund (Amps): 1.714
 Power (Watts): 379.1

Frequency(Hz): 50.00
 I RMS (Amps): 1.973
 Crest Factor: 5.280
 Power Factor: 0.912

| Harm# | Harmonics V-rms | Limit V-rms | % of Limit | Status |
|-------|-----------------|-------------|------------|--------|
| 2 | 0.069 | 0.460 | 15.04 | OK |
| 3 | 0.394 | 2.070 | 19.04 | OK |
| 4 | 0.051 | 0.460 | 11.02 | OK |
| 5 | 0.057 | 0.920 | 6.23 | OK |
| 6 | 0.025 | 0.460 | 5.41 | OK |
| 7 | 0.029 | 0.690 | 4.17 | OK |
| 8 | 0.028 | 0.460 | 6.09 | OK |
| 9 | 0.020 | 0.460 | 4.30 | OK |
| 10 | 0.016 | 0.460 | 3.53 | OK |
| 11 | 0.016 | 0.230 | 7.14 | OK |
| 12 | 0.018 | 0.230 | 7.96 | OK |
| 13 | 0.014 | 0.230 | 6.28 | OK |
| 14 | 0.009 | 0.230 | 3.97 | OK |
| 15 | 0.011 | 0.230 | 4.69 | OK |
| 16 | 0.012 | 0.230 | 5.35 | OK |
| 17 | 0.013 | 0.230 | 5.76 | OK |
| 18 | 0.014 | 0.230 | 6.16 | OK |
| 19 | 0.012 | 0.230 | 5.06 | OK |
| 20 | 0.016 | 0.230 | 7.07 | OK |
| 21 | 0.013 | 0.230 | 5.80 | OK |
| 22 | 0.008 | 0.230 | 3.55 | OK |
| 23 | 0.013 | 0.230 | 5.66 | OK |
| 24 | 0.006 | 0.230 | 2.82 | OK |
| 25 | 0.011 | 0.230 | 4.87 | OK |
| 26 | 0.008 | 0.230 | 3.40 | OK |
| 27 | 0.008 | 0.230 | 3.67 | OK |
| 28 | 0.006 | 0.230 | 2.66 | OK |
| 29 | 0.011 | 0.230 | 4.85 | OK |
| 30 | 0.007 | 0.230 | 3.20 | OK |
| 31 | 0.012 | 0.230 | 5.33 | OK |
| 32 | 0.006 | 0.230 | 2.72 | OK |
| 33 | 0.008 | 0.230 | 3.39 | OK |
| 34 | 0.004 | 0.230 | 1.54 | OK |
| 35 | 0.006 | 0.230 | 2.47 | OK |
| 36 | 0.004 | 0.230 | 1.93 | OK |
| 37 | 0.011 | 0.230 | 4.90 | OK |
| 38 | 0.003 | 0.230 | 1.14 | OK |
| 39 | 0.007 | 0.230 | 3.10 | OK |
| 40 | 0.012 | 0.230 | 5.22 | OK |

Test Personnel: Son La
Supervising/Reviewing
Engineer: _____
(Where Applicable) Michael Spataro
Product Standard: EN61000-3-2
Input Voltage: 230V/50Hz
Pretest Verification w/
Artifact: ---

Test Date: 1/19/2016
Limit Applied: A
Ambient Temperature: 22.1 °C
Relative Humidity: 16.6 %
Atmospheric Pressure: 836.8 mbars

Deviations, Additions, or Exclusions: None

9 Flicker

9.1 Method

Tests are performed in accordance with IEC 61000-3-3.

TEST SITE: Ground Plane

Site Designation:

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

The EMC Lab has one Semi-anechoic Chamber and Fully-anechoic Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

Measurement Uncertainty

| Measurement | Parameter | Expanded Uncertainty (k=2) | Permitted Error |
|-------------|-----------|----------------------------|-----------------|
| Flicker | Pst | 4 % | ±8.0% |
| Flicker | dc | 4 % | ±8.0% |

As shown in the table above our Expanded Measurement Uncertainty for Pst and dc U_{lab} is less than the corresponding measurement error allowed by IEC 61000-3-3, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required. There are currently no U_{CISPR} reference values in CISPR 16 for Flicker.

9.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---------|--------------------------------------|----------------------|--------------------|---------|-----------|-----------|
| 18815 | Flicker and Harmonics Equipment | CALIFORNIA INSTRUMEN | 50011X-CTS-LNS-160 | 71643 | 10/6/2015 | 10/6/2016 |
| LAB-012 | Wireless BP, Tem and Humidity sensor | Omega | zED-BTH | 0070368 | 9/01/2015 | 9/1/2016 |

Software Utilized:

| Name | Manufacturer | Version |
|--|------------------|-----------------|
| SW-1: Software application for Harmonics and Flicker | California Inst. | OATS cvi, V.1.0 |

9.3 Results:

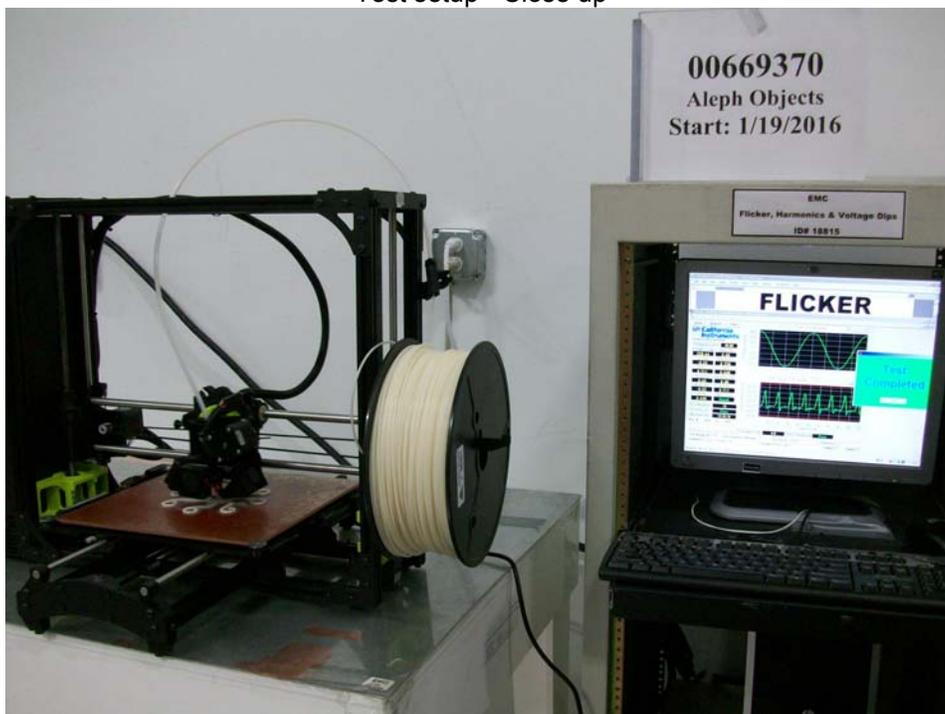
The sample tested was found to Comply.

9.4 Setup Photographs:

Test setup



Test setup - Close up



9.5 Plots/Data:

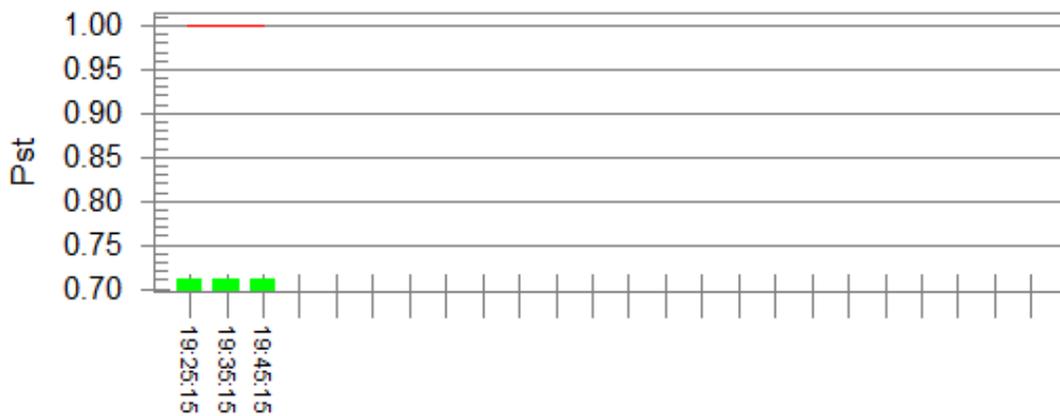
Flicker Test Summary per EN/IEC61000-3-3 (Run time)

EUT: Model: Lulzbot TAZ 6
 Test category: All parameters (European limits)
 Test date: 1/19/2016 Start time: 7:14:55 PM End time: 7:45:16 PM
 Test duration (min): 30 Data file name: F-000015.cts_data
 Comment: European Voltage 230V
 Customer: Aleph Objects

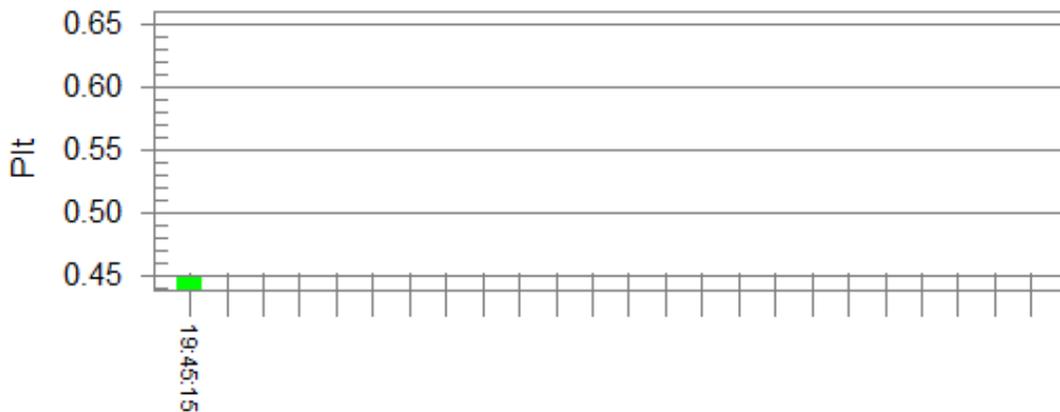
Test Result: Pass Status: Test Completed

Pst and limit line

European Limits



Plt and limit line



Parameter values recorded during the test:

| | | | |
|---------------------------------|--------|------------------|------------|
| Vrms at the end of test (Volt): | 229.12 | | |
| Highest dt (%): | 0.44 | Test limit (%): | 3.30 Pass |
| Time(mS) > dt: | 0.0 | Test limit (mS): | 500.0 Pass |
| Highest dc (%): | -0.22 | Test limit (%): | 3.30 Pass |
| Highest dmax (%): | 0.48 | Test limit (%): | 4.00 Pass |
| Highest Pst (10 min. period): | 0.711 | Test limit: | 1.000 Pass |
| Highest Plt (2 hr. period): | 0.448 | Test limit: | 0.650 Pass |

Test Personnel: Son La
Supervising/Reviewing
Engineer:
(Where Applicable) Michael Spataro
Product Standard: EN61000-3-3
Input Voltage: 230V/50Hz
Pretest Verification w/
Artifact: ---

Test Date: 1/19/2016
Limit Applied: A
Ambient Temperature: 22.1 °C
Relative Humidity: 16.6 %
Atmospheric Pressure: 836.8 mbars

Deviations, Additions, or Exclusions: None

10 Electrostatic Discharge Immunity Test

10.1 Method

Tests are performed in accordance with IEC 61000-4-2.

TEST SITE: Ground Plane

Site Designation:

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

The EMC Lab has one Semi-anechoic Chamber and Fully-anechoic Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

10.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---------|--------------------------------------|--------------------|----------|------------|-----------|-----------|
| DEN-034 | ESD Simulator and Gun | NOISEKEN | ESS-2002 | ESS0838103 | 06/21/15 | 06/21/16 |
| DEN-077 | 2 Channel 500 MHz Oscilloscope | TEKTRONIX | TDS 520 | B022197 | 02/20/15 | 02/20/16 |
| DEN-144 | Precision Psychrometer | Extech Instruments | RH390 | 12083570 | 09/04/15 | 09/04/16 |
| DEN-136 | DMM | Fluke | 87 V | 20100152 | 8/16/2015 | 8/16/2016 |
| LAB-012 | Wireless BP, Tem and Humidity sensor | Omega | zED-BTH | 0070368 | 9/01/2015 | 9/1/2016 |

Software Utilized:

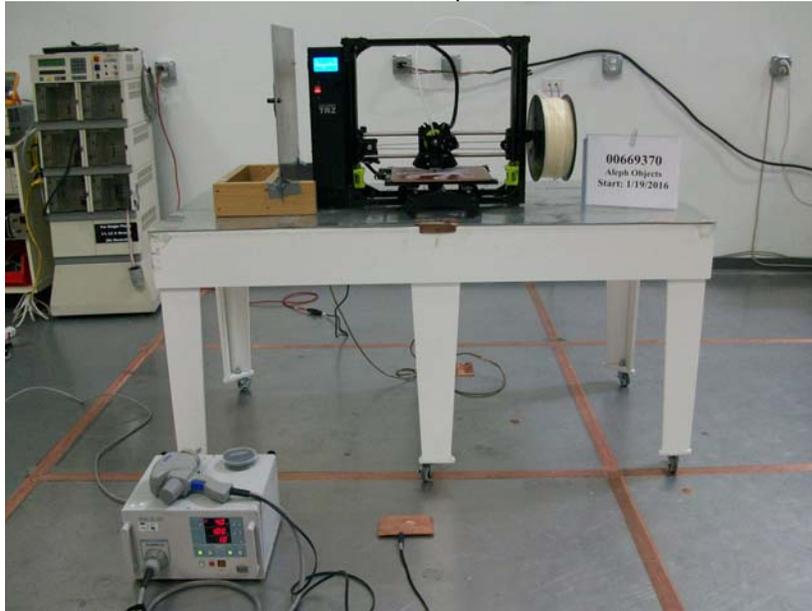
| Name | Manufacturer | Version |
|-------|--------------|---------|
| None. | | |

10.3 Results:

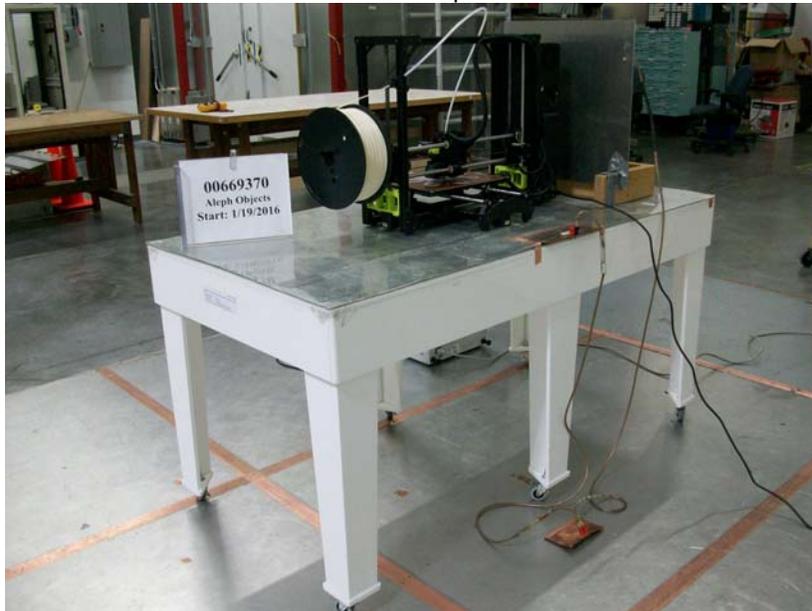
The sample tested was found to Comply.

10.4 Setup Photographs:

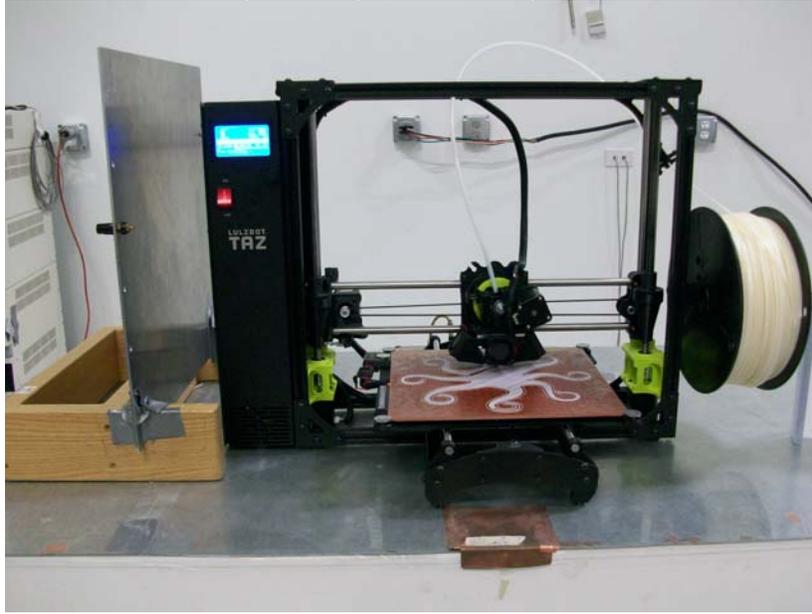
ESD Test Setup - Front



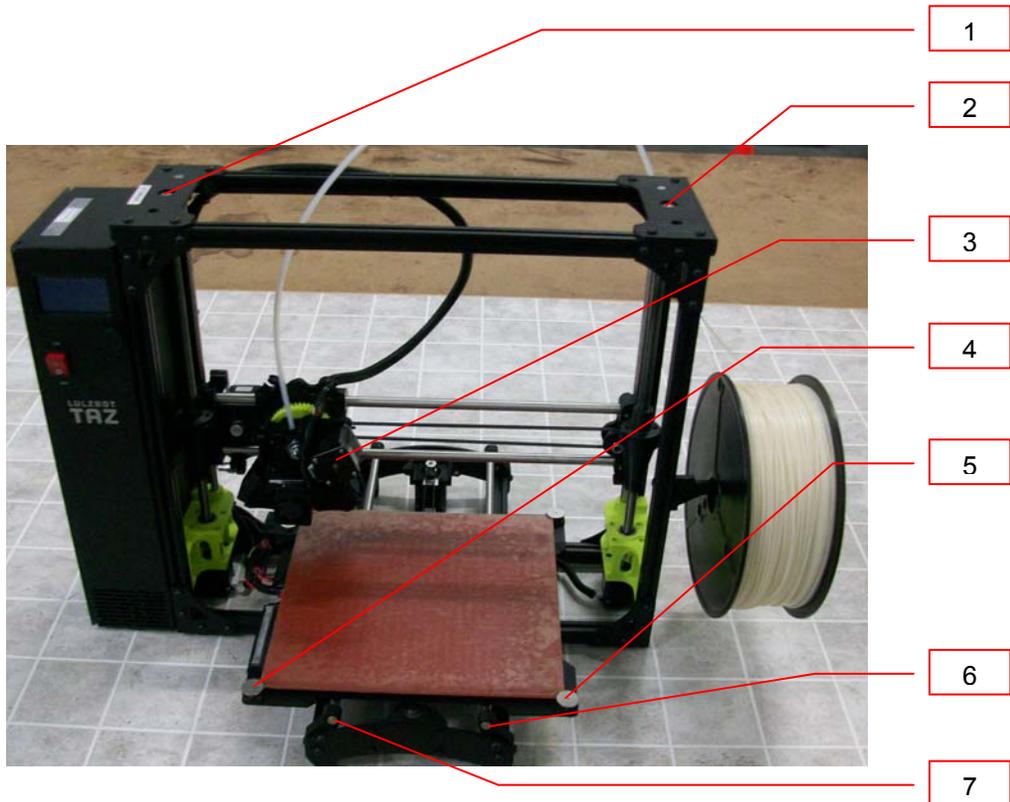
ESD Test Setup - Rear



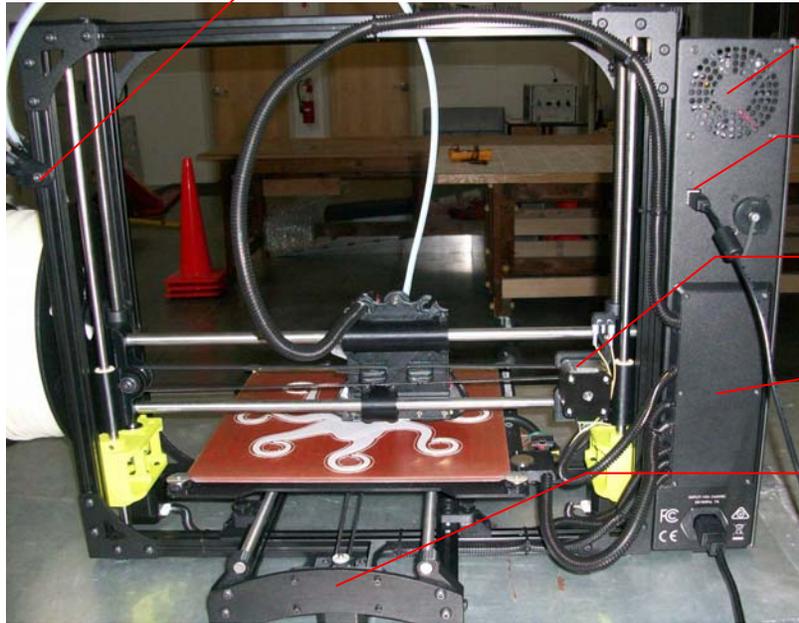
Test Setup - Front (HCP and VCP) all four sides



ESD Locations - Photo #1 - (Contact Discharge)



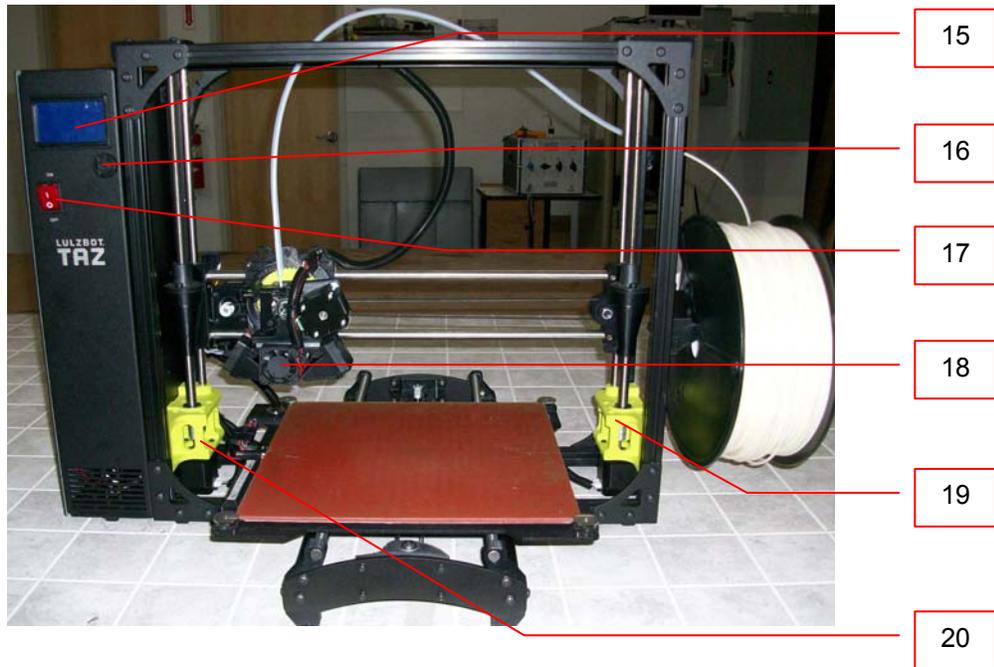
ESD Locations - Photo #2 - (Contact Discharge)



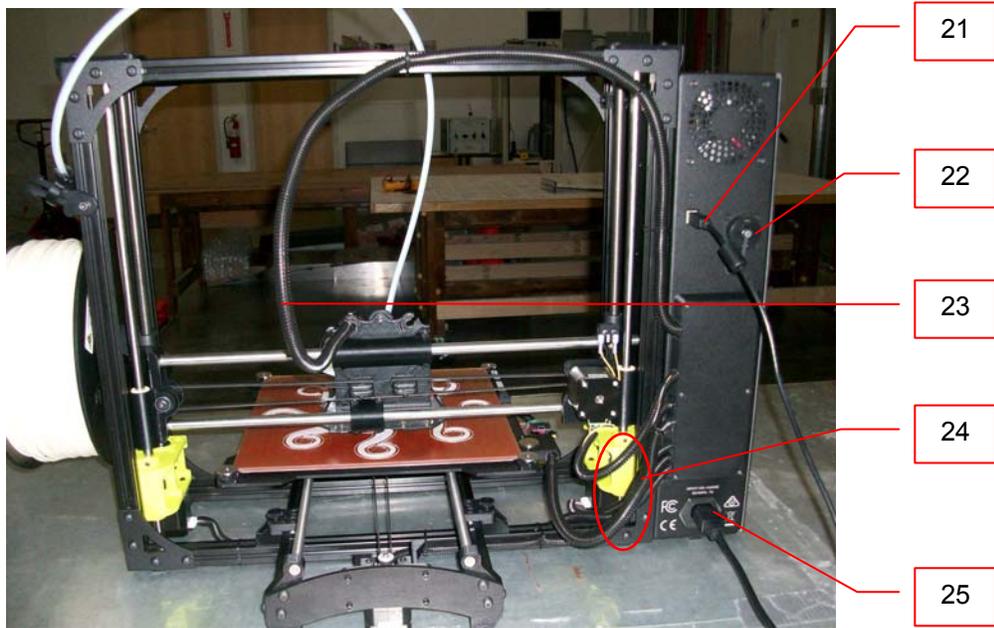
ESD Locations - Photo #3 - (Contact Discharge)



ESD Locations - Photo #4 - (Air Discharge)



ESD Locations - Photo #5 - (Air Discharge)



10.5 Data:

| Test Point | Discharge Voltage Type | Test Voltages, Polarities and Result Classification | | | | | | | | | | | | | |
|------------|------------------------|---|-----|------|-----|------|-----|------|-----|--------------------------------|-------|-----|-----|-----|--|
| | | 2 kV | | 4 kV | | 6 kV | | 8 kV | | Air Discharges only above 8 kV | 15 kV | | kV | | |
| | | Pos | Neg | Pos | Neg | Pos | Neg | Pos | Neg | | Pos | Neg | Pos | Neg | |
| HCP | Contact | | | A | A | | | | | Air Discharges only above 8 kV | | | | | |
| VCP | Contact | | | A | A | | | | | | | | | | |
| 1-14 | Contact | | | A | A | | | | | | | | | | |
| 15-25 | Air | ND | ND | ND | ND | ND | ND | ND | ND | | | | | | |
| | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | |

Test Personnel: Son La
 Supervising/Reviewing Engineer: Michael Spataro
 (Where Applicable)
 Product Standard: EN 61000-4-2
 Input Voltage: 230V/50Hz
 Waveform Verified on Oscilloscope: Yes
 470k x 2 Strap(s) Verified: 895kΩ

Test Date: 1/20/2016
 Required Performance: B
 Test Levels: +/- 4kV contact, +/- 2kV, 4kV 8kV air 25 pulses per voltage per polarity
 Ambient Temperature: 21.8 °C
 Relative Humidity: 12.0 %
 Atmospheric Pressure: 828.9 mbars

Notes:

- (1) Discharged to Horizontal Coupling Plane, 4 locations.
- (2) Discharged to Vertical Coupling Plane, 4 locations
- (3) No discharge (ND) to the test point of interest.
- (4) Product meets A as indicated in above matrix
- (5) The EUT met the requirements without any degradation of performance.

Deviations, Additions, or Exclusions: None

11 Radiated, radio-frequency, electromagnetic field immunity test

11.1 Method

Tests are performed in accordance with IEC 61000-4-3.

TEST SITE: CC2

Site Designation:

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

The EMC Lab has one Semi-anechoic Chamber and Fully-anechoic Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

11.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---------|-------------------------------------|------------------------|-------------|------------|------------|------------|
| 18763 | 30DB Directional Coupler | WERLATONE | C5091 | 5768 | 05/16/2015 | 05/16/2016 |
| 18708 | RF Electric Field Probe | Amplifier Research | FP5080 | 20238 | 04/01/2015 | 04/01/2016 |
| 18739 | Power Meter (set 3) | Hewlett-Packard | 436A | 2446A21023 | 02/18/2015 | 02/18/2016 |
| 18764 | Antenna | EMCO | 3142 | 9706-1190 | VBU | VBU |
| 18769 | Directional Coupler (1.7-12.4 GHz) | Hewlett-Packard | 779D | 1144A05973 | 6/5/2015 | 6/6/2016 |
| 18775 | Power Sensor (set 1) | Hewlett-Packard | 8482A | 2625A12387 | 10/16/2014 | 10/16/2015 |
| 18777 | Directional Coupler (80-1000 MHz) | WERLATONE | C3736 | 4153 | 05/14/2015 | 05/14/2016 |
| 18779 | Broadband amplifier (80MHz - 1GHz) | Amplifier Research | 200W1000M7A | 16049 | VBU | VBU |
| 18781 | Signal Generator | MARCONI INSTRUMENTS | 2031 | 119537 | 4/24/2015 | 4/24/2016 |
| 18796 | High-gain Horn Antenna | Amplifier Research | AT4510 | 27653 | VBU | VBU |
| DEN-003 | 10W .8-4.2GHz amplifier | Amplifier Research | 10S1G4A | 0327889 | VBU | VBU |

Software Utilized:

| Name | Manufacturer | Version |
|---|--------------|------------------|
| SW-7: Software application for Radiated and Conducted Immunity. | CKC | EMITest V.3.15.1 |

11.3 Results:

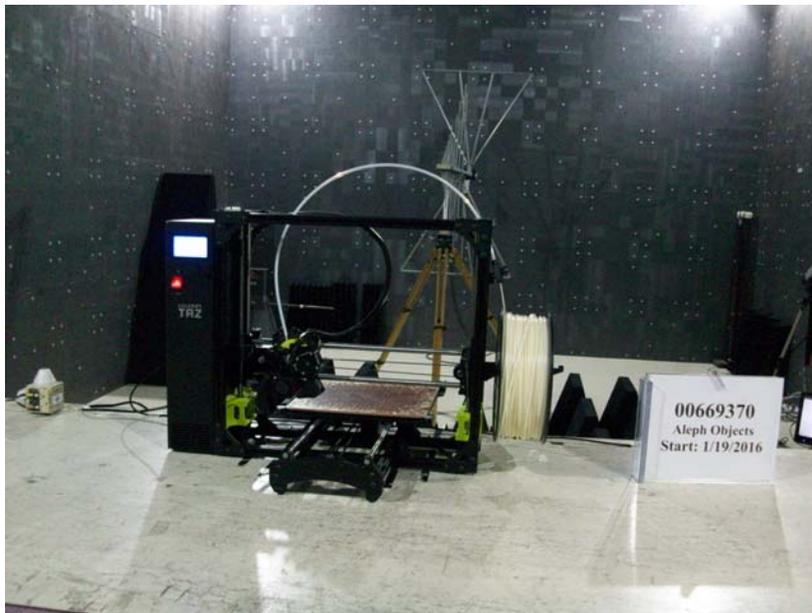
The sample tested was found to Comply.

11.4 Setup Photographs:

Test setup – Front



Test setup – Rear



11.5 Data:

| Field Level (V/m) | Frequency Range MHz | Antenna Polarity, Azimuths and Result Classification | | | | | | | |
|-------------------|---------------------|--|----|-----|-----|------------|----|-----|-----|
| | | Vertical | | | | Horizontal | | | |
| | | 0 | 90 | 180 | 270 | 0 | 90 | 180 | 270 |
| 3 | 80-1000 | A | A | A | A | A | A | A | A |
| | | | | | | | | | |
| | | | | | | | | | |

Test Personnel: Son La
 Supervising/Reviewing Engineer: _____
 (Where Applicable) Michael Spataro
 Product Standard: EN61000-4-3
 Input Voltage: 230V/50Hz

 Field Level Monitored: Yes

Test Date: 1/19/2016
 Modulation: 80% at 1kHz

 Required Performance: A
 Test Levels: See Table Above

 Ambient Temperature: 22.0 °C
 Relative Humidity: 16.8 %
 Atmospheric Pressure: 836.8 mbars

Notes:

(1) The EUT met the requirements without any degradation of performance.

Deviations, Additions, or Exclusions: None

12 Electrical Fast Transient/Burst Immunity Test

12.1 Method

Tests are performed in accordance with IEC 61000-4-4.

TEST SITE: Ground Plane

Site Designation:

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

The EMC Lab has one Semi-anechoic Chamber and Fully-anechoic Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

12.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---------|--------------------------------------|--------------|---------|---------|-------------|------------|
| 18813 | EMC Pro Surge/EFT Generator | KeyTek | EMC Pro | 9904187 | 04/21/2015 | 04/21/2016 |
| DEN-077 | 2 Channel 500 MHz Oscilloscope | TEKTRONIX | TDS 520 | B022197 | 02/20/15 | 02/20/16 |
| LAB-012 | Wireless BP, Tem and Humidity sensor | Omega | zED-BTH | 0070368 | 909/01/2015 | 9/1/2016 |

Software Utilized:

| Name | Manufacturer | Version |
|--|--------------|------------------|
| SW-3: Software application for control of EMCpro, 4-4/4-5 testing. | KeyTek | CEWare 32, V.3.0 |

12.3 Results:

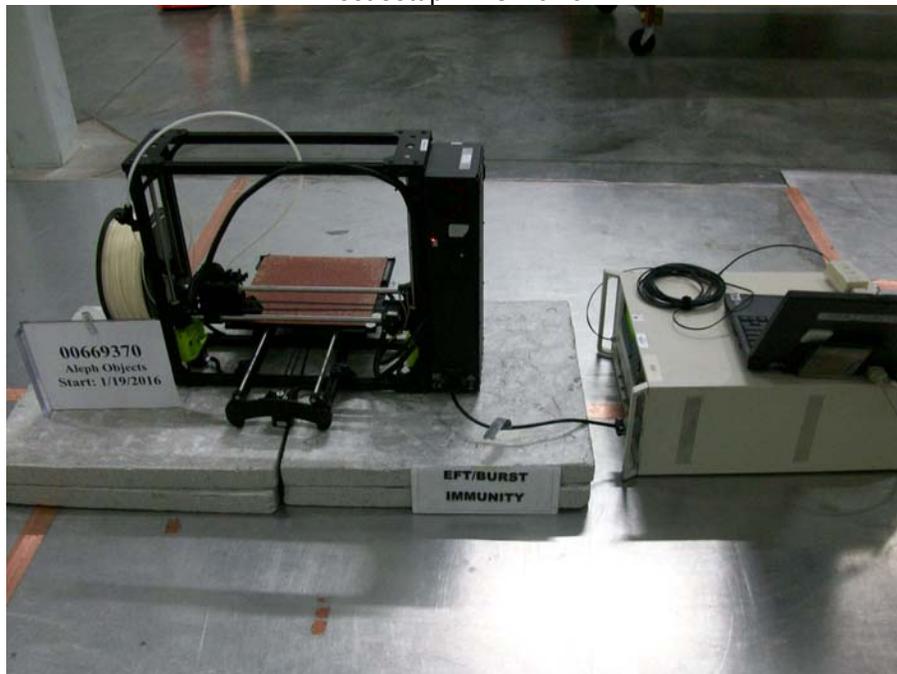
The sample tested was found to Comply.

12.4 Setup Photographs:

Test setup



Test setup – AC Power



12.5 Test Data:

| Test Point | Coupling Method | Test Voltages, Polarities, and Result Classification | | | | | | | | | |
|------------|-----------------|--|-----|-------|-----|------|-----|------|-----|------|-----|
| | | 0.25kV | | 0.5kV | | 1 kV | | 2 kV | | 4 kV | |
| | | pos | neg | pos | neg | pos | neg | pos | neg | pos | neg |
| Power L1 | Direct | | | | | A | A | | | | |
| Power L2 | Direct | | | | | A | A | | | | |
| Power PE | Direct | | | | | A | A | | | | |

Test Personnel: Duan Wei Lin
 Supervising/Reviewing Engineer: Michael Spataro
 (Where Applicable) Michael Spataro
 Product Standard: EN 61000-4-4
 Input Voltage: 230V/50Hz
 Waveform Verified on Oscilloscope: Yes

Test Date: 1/19/2016
 Pulse Repetition Frequency: 5kHz
 Required Performance: B
 Test Levels: See Table Above
 Ambient Temperature: 20.6 °C
 Relative Humidity: 12.9 %
 Atmospheric Pressure: 830.2 mbars

Notes:

(1) The EUT met the requirements without any degradation of performance.

Deviations, Additions, or Exclusions: None

13 Immunity to Surge

13.1 Method

Tests are performed in accordance with IEC 61000-4-5.

TEST SITE: Ground Plane

Site Designation:

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

The EMC Lab has one Semi-anechoic Chamber and Fully-anechoic Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

13.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---------|--------------------------------------|--------------|---------|---------|-------------|------------|
| 18813 | EMC Pro Surge/EFT Generator | KeyTek | EMC Pro | 9904187 | 04/21/2015 | 04/21/2016 |
| DEN-077 | 2 Channel 500 MHz Oscilloscope | TEKTRONIX | TDS 520 | B022197 | 02/20/15 | 02/20/16 |
| LAB-012 | Wireless BP, Tem and Humidity sensor | Omega | zED-BTH | 0070368 | 909/01/2015 | 9/1/2016 |

Software Utilized:

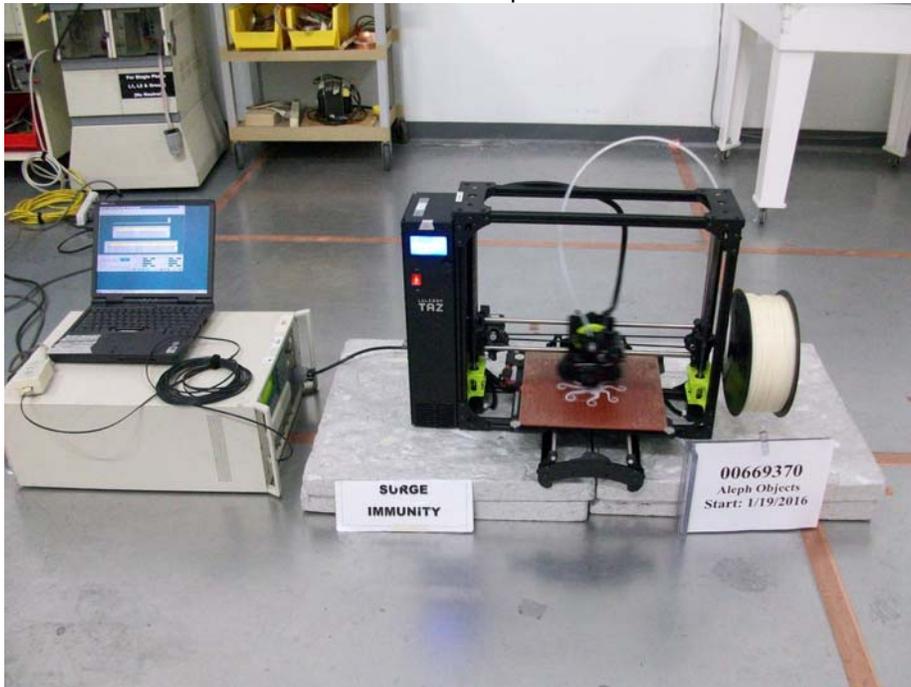
| Name | Manufacturer | Version |
|--|--------------|------------------|
| SW-3: Software application for control of EMCpro, 4-4/4-5 testing. | KeyTek | CEWare 32, V.3.0 |

13.3 Results:

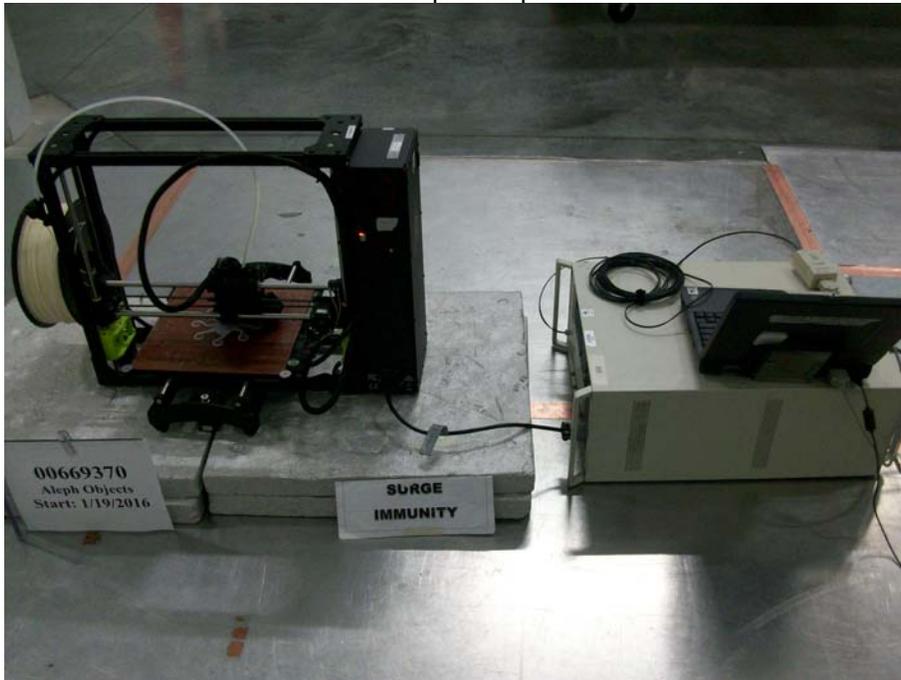
The sample tested was found to Comply.

13.4 Setup Photographs:

Test setup



Test setup – AC power



13.5 Test Data:

| Test | Test Voltages, Polarities, and Result Classification | | | | | | | |
|-------------------|--|-----|-----|-----|-----|-----|-----|-----|
| | 0.5kV | | 1kV | | 2kV | | 4kV | |
| | pos | neg | pos | neg | pos | neg | pos | neg |
| L1-PE, at 0 deg | A | A | A | A | A | A | | |
| L1-PE, at 90 deg | A | A | A | A | A | A | | |
| L1-PE, at 180 deg | A | A | A | A | A | A | | |
| L1-PE, at 270 deg | A | A | A | A | A | A | | |
| N-PE, at 0 deg | A | A | A | A | A | A | | |
| N-PE, at 90 deg | A | A | A | A | A | A | | |
| N-PE, at 180 deg | A | A | A | A | A | A | | |
| N-PE, at 270 deg | A | A | A | A | A | A | | |
| L1-N, at 0 deg | A | A | A | A | | | | |
| L1-N, at 90 deg | A | A | A | A | | | | |
| L1-N, at 180 deg | A | A | A | A | | | | |
| L1-N, at 270 deg | A | A | A | A | | | | |

Test Personnel: Son La
 Supervising/Reviewing Engineer: _____
 (Where Applicable) Michael Spataro
 Product Standard: EN 61000-4-5
 Input Voltage: 230V/50HZ
 Waveform Verified on Oscilloscope: Yes

Test Date: 1/19/2016 and 1/20/2016
 Required Performance: B
 Test Levels: See Table Above
 Ambient Temperature: 20.6 °C
 Relative Humidity: 12.9 %
 Atmospheric Pressure: 830.2 mbars

Notes:

(1) The EUT met the requirements without any degradation of performance.

Deviations, Additions, or Exclusions: None

14 Conducted, radio-frequency, electromagnetic field immunity test**14.1 Method**

Tests are performed in accordance with IEC 61000-4-6.

TEST SITE: CC2**Site Designation:**

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

The EMC Lab has one Semi-anechoic Chamber and Fully-anechoic Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

14.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---------|--------------------------------------|-------------------------------|----------------|------------|-------------|------------|
| 18859 | RF Current Probe | Fischer Custom Communications | F-62 | 33 | 5/20/2015 | 05/19/2016 |
| 18724 | 6 db Attenuator | JFW | 50FH-006-100 | 00332 | 05/01/2015 | 05/01/2016 |
| 18816 | Coupling / Decoupling Network | Fisher Custom Comm. | FCC-801-M3-16A | 9953 | 06/22/2015 | 06/22/2016 |
| 18739 | Power Meter (set 3) | Hewlett-Packard | 436A | 2446A21023 | 02/18/2015 | 02/18/2016 |
| DEN-030 | 30DB Directional Coupler | WERLATONE | C5091 | 5768 | 05/16/2015 | 05/16/2016 |
| 18740 | Power Sensor Set 3 | Hewlett-Packard | 8482A | 2349A14570 | 02/19/2015 | 02/19/2016 |
| 18781 | Signal Generator | MARCONI INSTRUMENTS | 2031 | 119537 | 4/24/2015 | 04/24/2016 |
| LAB-012 | Wireless BP, Tem and Humidity sensor | Omega | zED-BTH | 0070368 | 909/01/2015 | 09/01/2016 |

Software Utilized:

| Name | Manufacturer | Version |
|---|--------------|------------------|
| SW-7: Software application for Radiated and Conducted Immunity. | CKC | EMITest V.3.15.1 |

14.3 Results:

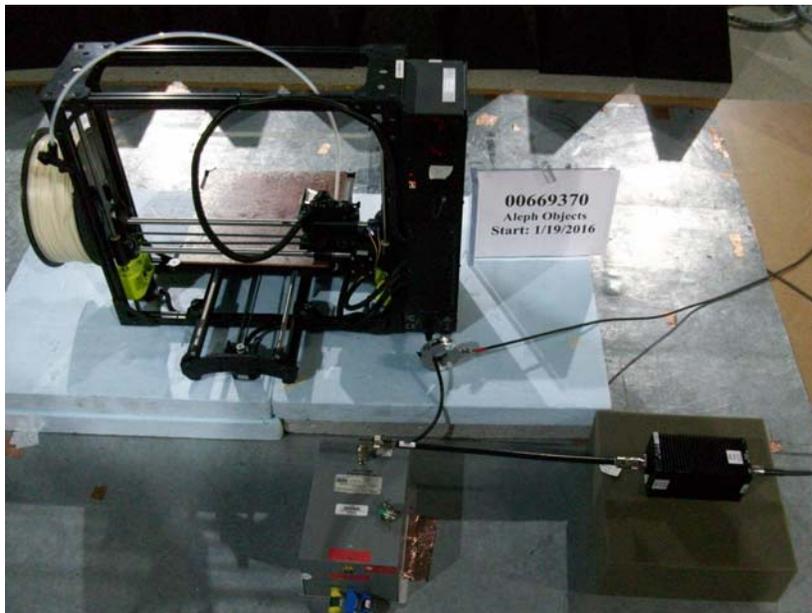
The sample tested was found to Comply.

14.4 Setup Photographs:

Test setup – Front



Test setup – AC power



Test Data:

| Injection Device Type | Port Description | Test Level (Vrms) | Result Classification |
|-----------------------|------------------|-------------------|-----------------------|
| CDN | AC power | 3 | A |
| | | | |
| | | | |
| | | | |

Test Personnel: Son La
 Supervising/Reviewing Engineer: _____
 (Where Applicable) Michael Spataro
 Product Standard: EN61000-4-6
 Input Voltage: 230V/50Hz
 Test Level Verification Performed: Yes

Test Date: 1/19/2016
 Modulation: 80% at 1kHz
 Required Performance: A
 Test Levels: See Table Above
 Ambient Temperature: 22.0 °C
 Relative Humidity: 16.8 %
 Atmospheric Pressure: 836.8 mbars

Notes:

(1) The EUT met the requirements without any degradation of performance.

Deviations, Additions, or Exclusions: None

15 Voltage Dips / Interruptions Immunity Tests

15.1 Method

Tests are performed in accordance with IEC 61000-4-11.

TEST SITE: Ground Plane

Site Designation:

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

The EMC Lab has one Semi-anechoic Chamber and Fully-anechoic Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

15.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---------|--------------------------------------|----------------------|--------------------|---------|-------------|-----------|
| 18815 | Flicker and Harmonics Equipment | CALIFORNIA INSTRUMEN | 5001IX-CTS-LNS-160 | 71643 | 10/6/2015 | 10/6/2016 |
| LAB-012 | Wireless BP, Tem and Humidity sensor | Omega | zED-BTH | 0070368 | 909/01/2015 | 9/1/2016 |

Software Utilized:

| Name | Manufacturer | Version |
|---|------------------|---------------------|
| SW-1: Software Application for 61000-4-11 testing with California Inst. Power supply. | California Inst. | GUI 32, V. 1.27.0.7 |

15.3 Results:

The sample tested was found to Comply.

15.4 Setup Photographs:

Test setup



Test setup – Close up



15.5 Test Data:

| Specification | Rated Voltage (Vac) | Frequency (Hz) | Voltage Test Level (%) | Voltage Dip (%) | Test Voltage (Vac) | Duration (Periods) | Result Classification | |
|-----------------------|---------------------|----------------|------------------------|-----------------|--------------------|--------------------|-----------------------|-------|
| | | | | | | | 0 deg | Requ. |
| Test Specification #1 | 100-240 | 50 | >95 | 0 | 100 | 0.5 | A | B |
| Test Specification #2 | 100-240 | 50 | 30 | 70 | 100 | 25 | A | C |
| Test Specification #3 | 100-240 | 50 | >95 | 0 | 100 | 250 | C (2) | C |
| Test Specification #1 | 100-240 | 50 | >95 | 0 | 240 | 0.5 | A | B |
| Test Specification #2 | 100-240 | 50 | 30 | 70 | 240 | 25 | A | C |
| Test Specification #3 | 100-240 | 50 | >95 | 0 | 240 | 250 | C (2) | C |

Test Personnel: Son La
 Supervising/Reviewing Engineer:
 (Where Applicable) Michael Spataro
 Product Standard: EN61000-4-11
 Input Voltage: 100-240V, 50/60Hz
 Waveform Verified on Oscilloscope: ---

Test Date: 1/19/2016
 Required Performance: B and C
 Test Levels: See Table Above
 Ambient Temperature: 22.1 °C
 Relative Humidity: 16.6 %
 Atmospheric Pressure: 836.8 mbars

Notes:

- (1) The EUT met the requirements without any degradation of performance.
- (2) The product has no battery backup – therefore, voltage interruption performance Criterion “C”

Deviations, Additions, or Exclusions: None

16 Power Frequency Magnetic Field Immunity Test

16.1 Method

The test methods used comply with ANSI C63.4 and CISPR 16. Unless otherwise stated no deviations were made from IEC 61000-4-8.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

TEST SITE: Ground Plane

Site Designation:

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

The EMC Lab has one Semi-anechoic Chamber and Fully-anechoic Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

16.2 Test Equipment Used:

| Asset | Description | Manufacturer | Model | Serial | Cal Date | Cal Due |
|---------|-------------------------------|--------------------|---------|--------------|----------|----------|
| 18705 | Auto Transformer | POWERSTAT | 3PN226 | 124202 | VBU | VBU |
| DEN-044 | ELT-400 Exposure Level Tester | NARDA | 2304/03 | M-0356 | 08/13/15 | 08/13/16 |
| 18949 | AC/DC Low Current Clamp Meter | LEM HEME | LH41 | 106140063335 | 02/19/15 | 02/19/16 |
| DEN-144 | Precision Psychrometer | Extech Instruments | RH390 | 12083570 | 09/04/15 | 09/04/16 |

Software Utilized:

| Name | Manufacturer | Version |
|-------|--------------|---------|
| None. | | |

16.3 Results:

The sample tested was found to Comply.

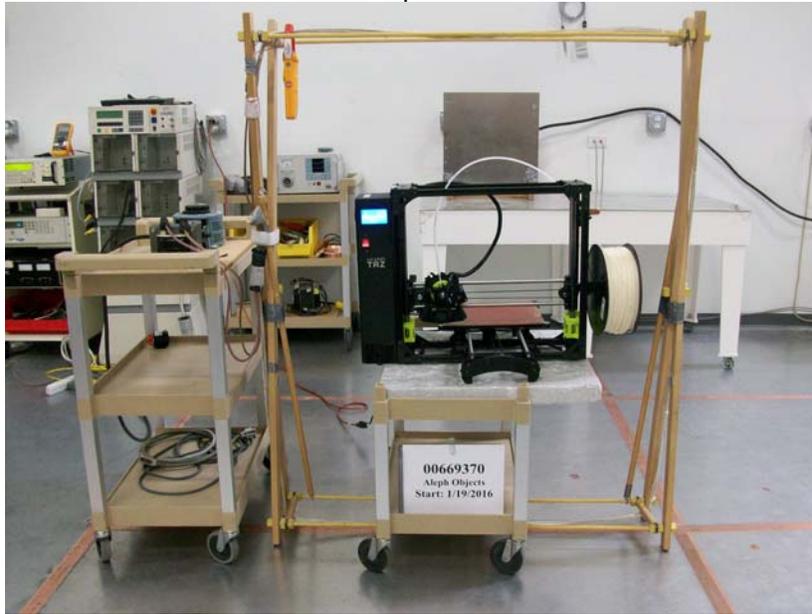
Test setup – Ambient



Test setup – Ambient



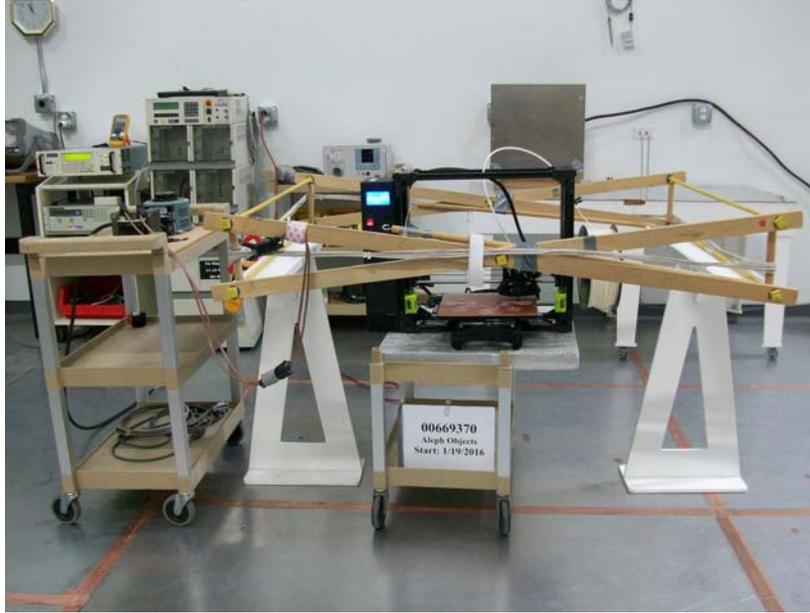
Test Setup – Axis –X



Test Setup – Axis – Y



Test Setup – Axis – Z



16.4 Test Data:

| Test Location/ Mode/ EUT AC Input | Test Level (A/m) | Frequency (Hz) | Result Classification | | |
|--------------------------------------|------------------|----------------|-----------------------|---------|---------|
| | | | X- Axis | Y- Axis | Z- Axis |
| Enclosure/ Operating/ 230 Vac, 50 Hz | 30 | 50 | A | A | A |
| Enclosure/ Stand-by/ 230 Vac, 60 Hz | 30 | 60 | A | A | A |
| | | | | | |
| | | | | | |

Test Personnel: Son La
 Supervising/Reviewing Engineer: _____
 (Where Applicable) Michael Spataro
 Product Standard: EN 61000-4-8
 Input Voltage: 230V, 50/60Hz
 Ambient Field Level: X microTesla
 Test Field Level Verified: Yes

Test Date: 1/20/2016
 Required Performance: A
 Test Levels: See Table Above
 Ambient Temperature: 21.8 °C
 Relative Humidity: 12.0 %
 Atmospheric Pressure: 828.9 mbars

Notes:

- (1) Only to magnetically sensitive components.
- (2) The EUT met the requirements without any degradation of performance.

Deviations, Additions, or Exclusions: None

17 Revision History

| Revision Level | Date | Report Number | Prepared By | Reviewed By | Notes |
|----------------|-----------|------------------|-------------|-------------|----------------|
| 0 | 1/20/2016 | 102442722DEN-001 | SL | MAS | Original Issue |
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