



ETSI EN 301 489-1 V1.9.2
ETSI EN 301 489-17 V2.2.1



TEST REPORT

For

Xicato, Inc.

101 Daggett Dr.
San Jose, CA 95134 USA

Model: XIM 9mm

| | | | |
|--|--|--|--|
| Report Type: Original Report | | Product Type: Intelligent LED Module | |
| Prepared By | Shoaib Khan Test Engineer | | |
| Report Number | R1608033-12 | | |
| Report Date | 2016-08-24 | | |
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DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|-----------------|---------------|-------------------------|------------------|
| 0 | R1608033-12 | Original Report | 2016-08-24 |

1 General Information

1.1 General Statements

Bay area Compliance Laboratory Corp. [BACL] hereby makes the following Statements:

- The Unit(s) described in this Test Report were received at BACL's facilities on 03 August 2016. Testing was performed on the Unit(s) described in this Test Report during the period 03 through 10 June 2016.
- The Test Results reported herein apply only to the Unit(s) actually tested, and to substantially identical Units.
- This Test Report must not be used to claim product endorsement by A2LA, or any agency of the U.S. Government, or by any other foreign government.
- This Test Report is the property of BACL, and shall not be reproduced, except in full, without prior written approval of BACL.

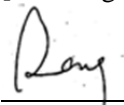
1.2 Purpose

This report is prepared on behalf of *Xicato, Inc.* in accordance with the requirements stated in ETSI EN 301 489-1 V1.9.2 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements" and, to the requirements stated in ETSI EN 301 489-17 V2.2.1 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment; Part 9: Specific conditions for wireless microphones, similar Radio Frequency (RF) audio link equipment, cordless audio and in-ear monitoring devices.

THE DATA CONTAINED IN THIS TEST REPORT WAS COLLECTED AND COMPILED BY:



Shoaib Khan
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1.3 Agent for the Responsible Party

None

1.4 Responsible Party

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1.5 Product Description of the Equipment under Test (EUT)

The “EUT” (Equipment under Test) was a LED light with integrated driver and Bluetooth communication

1.6 Mechanical Description of the EUT

Dimensions: approximately 9.0 cm (L) x 15.0cm (W) x 17.0 cm (H)

Weight: approximately 0.75 kilogrammes.

Serial Number: R1608033-01 (*Note: The EUT was a pre-production prototype that had no Serial Number*).

EUT Photos: See Exhibit C of this Test Report.

1.7 Related Submittal(s)/Grant(s)

None

1.8 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL’s test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Appendix B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL’s BSMI Lab Code Number is: SL2-IN-E-1002R

BACL’s test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

1.9 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3279.02), in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3279.03) to certify

- For the USA (Federal Communications Commission):

- 1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
- 2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
- 3- All Telephone Terminal Equipment within FCC Scope C.

- For the Canada (Industry Canada):

- 1- All Scope 1-Licence-Exempt Radio Frequency Devices;
- 2- All Scope 2-Licensed Personal Mobile Radio Services;
- 3- All Scope 3-Licensed General Mobile & Fixed Radio Services;
- 4- All Scope 4-Licensed Maritime & Aviation Radio Services;
- 5- All Scope 5-Licensed Fixed Microwave Radio Services
- 6- All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.

- For Singapore (Info-Communications Development Authority (IDA)):

- 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2

- For the Hong Kong Special Administrative Region:

- 1 All Radio Equipment, per KHCA 10XX-series Specifications;
- 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
- 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.

- For Japan:

- 1 MIC Telecommunication Business Law (Terminal Equipment):
 - All Scope A1 - Terminal Equipment for the Purpose of Calls;
 - All Scope A2 - Other Terminal Equipment
- 2 Radio Law (Radio Equipment):
 - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
 - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
 - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3279.01) to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

- 1 Electronics and Office Equipment:
 - for Telephony (ver. 3.0)
 - for Audio/Video (ver. 3.0)
 - for Battery Charging Systems (ver. 1.1)
 - for Set-top Boxes & Cable Boxes (ver. 4.1)
 - for Televisions (ver. 6.1)
 - for Computers (ver. 6.0)
 - for Displays (ver. 6.0)
 - for Imaging Equipment (ver. 2.0)
 - for Computer Servers (ver. 2.0)
- 2 Commercial Food Service Equipment
 - for Commercial Dishwashers (ver. 2.0)
 - for Commercial Ice Machines (ver. 2.0)
 - for Commercial Ovens (ver. 2.1)
 - for Commercial Refrigerators and Freezers
- 3 Lighting Products
 - For Decorative Light Strings (ver. 1.5)
 - For Luminaires (including sub-components) and Lamps (ver. 1.2)
 - For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
 - For Integral LED Lamps (ver. 1.4)
- 4 Heating, Ventilation, and AC Products
 - for Residential Ceiling Fans (ver. 3.0)
 - for Residential Ventilating Fans (ver. 3.2)
- 5 Other
 - For Water Coolers (ver. 3.0)

D- A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Industry Canada - IC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
 - o BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
 - o NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
 - o Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC
 - US -EU EMC & Telecom MRA CAB
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA)
APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Development Authority - IDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
 - o ENERGY STAR Recognized Test Laboratory – US EPA
 - o Telecommunications Certification Body (TCB) – US FCC;
- Vietnam: APEC Tel MRA -Phase I;

1.10 Measurement Uncertainties

All measurements involve uncertainties. In the case of EMC Emissions tests, the influence quantities (factors) that make a significant contribution to the measurement uncertainties are detailed in the latest version of CISPR 16-4-2 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Measurement instrumentation uncertainty” (i.e., CISPR 16-4-2:2011-06 + C1:2013-04 +A1:2014-02).

Based on the uncertainty models given in the latest version of CISPR 16-4-2, and, based on the calibration uncertainties of the specific instruments and facilities used at BACL to perform the measurements documented in this Test Report, the following estimates have been made of BACL’s Measurement Uncertainties for the measurements documented in this Test Report.

| Type of Measurement | BACL Typical U_{LAB} Value (for a k=2 Coverage Factor, equivalent to ~ 95% level of confidence) | U_{CISPR} Value worst-allowable values, per Table 1 of the latest version of CISPR 16-4-2 (for a k=2 Coverage Factor, equivalent to ~ 95% level of confidence) |
|--|--|--|
| Conducted Disturbance (Mains Port) 150 kHz to 30 MHz (i.e., AC/DC Line Conducted Emissions measurements made with a Fischer FCC-LISN-50-25-2-10 LISN) | 2.26 | 3.44 dB |
| Radiated Electric Field Disturbance – Horizontal Polarization, 30 MHz – 200 MHz (i.e., Radiated Emissions measured at 10 metres distance) | 4.21 dB | 5.05 dB |
| Radiated Electric Field Disturbance – Vertical Polarization, 30 MHz – 200 MHz (i.e., Radiated Emissions measured at 10 metres distance) | 4.07 dB | 5.03 dB |
| Radiated Electric Field Disturbance – Horizontal Polarization, 200 MHz – 1000 MHz (i.e., Radiated Emissions at 10 metres distance) | 4.17 dB | 5.21 dB |
| Radiated Electric Field Disturbance – Vertical Polarization, 200 MHz – 1000 MHz z (i.e., Radiated Emissions measured at 10 metres distance) | 4.46 dB | 5.22 dB |
| Radiated Electric Field Disturbance Horizontal & Vertical Polarizations, 1 GHz – 6 GHz (i.e., Radiated Emissions measured at 3 metres distance) | 4.94 dB (No Tilting) | 5.18 dB (No Tilting) |

2 System Test Configuration

2.1 Justification

The system was configured for testing according to ETSI EN 301 489-1/-17.

2.2 EUT Exercising Software

The software (XIMtroller) used was provided by Robert Yang and was GUI based featuring Microsoft Windows and Apple IOS.

2.3 Equipment Modifications

None

2.4 Special Equipment

None

2.5 EUT Mode of Operation

The EUT was emitting light at Full intensity powered by 48 V DC.

2.6 Method of Monitoring

Power on; connect to EUT and verify communication.

2.7 Local Support Equipment

The following items of Support Equipment were located locally (i.e., within the Semi-Anechoic Chamber):

| Manufacturer | Description | Model | Serial Number |
|--------------------|--------------------|-------------------|--------------------|
| ROAL living Energy | AC/DC Power Supply | Strato RSLP035-48 | 323K0A73214A000047 |
| Apple | Cell phone | iPhone SE | - |

2.8 Remote Support Equipment

None

2.9 EUT Internal Configuration Details

| Manufacturer | Description | Model | Serial Number |
|--------------|-------------|-----------------------|---------------|
| Xicato, Inc. | Main Board | 2001-00X0-2671 Rev 02 | - |

2.10 External I/O Cabling List and Details

| Cable Descriptions | Length (m) | From | To |
|--------------------|------------|------|----|
| - | - | - | - |

2.11 EUT External Power Supply List and Details

None

3 Emissions Testing Requirements

3.1 EMC Emissions Test Requirements as a function of type of use

Clause 7.1.1 of ETSI EN 301 489-17 V2.2.1 states that EN 301 489-1 contains the applicability of EMC emission measurements to the relevant ports of radio and/or associated ancillary equipment. Table 1 of ETSI EN 301 489-1 V1.9.1 is reproduced below for the convenience of the reader.

Table 1: EMC emission measurements for radio and associated ancillary equipment specified in the present document, overview

| Phenomenon | Application | Equipment test requirement | | | Reference clause in the present document |
|----------------------------------|----------------------------------|---|---|---|--|
| | | Radio and ancillary equipment for fixed use (e.g. base station equipment) | Radio and ancillary equipment for vehicular use (e.g. mobile equipment) | Radio and ancillary equipment for portable use (portable equipment) | |
| radiated emission | enclosure of ancillary equipment | applicable for stand alone testing | applicable for stand alone testing | applicable for stand alone testing | 8.2 |
| conducted emission | DC power input/output port | applicable | applicable | not applicable | 8.3 |
| conducted emission | AC mains input/output port | applicable | not applicable | not applicable | 8.4 |
| harmonic current emissions | AC mains input port | applicable | not applicable | not applicable | 8.5 |
| voltage fluctuations and flicker | AC mains input port | applicable | not applicable | not applicable | 8.6 |
| conducted emission | telecommunication port | applicable | not applicable | not applicable | 8.7 |

3.2 Special Conditions for EMC Emissions Measurements

Clause 7.1.2 of ETSI EN 301 489-17 V2.2.1 states that no special conditions shall apply for Emissions testing of radio equipment.

3.3 Declaration of Type of Use

Based upon the technical characteristics of the product, for the purposes of EMC Emissions testing, the EUT was determined to be an item of “radio equipment for fixed use”.

4 Immunity Testing Requirements

4.1 EMC Immunity Test Requirements as a function of type of use

Clause 7.2.1 of ETSI EN 301 489-17 V2.2.1 states that EN 301 489-1 contains the applicability of EMC immunity measurements to the relevant ports of radio and/or associated ancillary equipment. Table 2 of ETSI EN 301 489-1 V1.9.1 is reproduced below for the convenience of the reader.

Table 2: Immunity tests for radio and associated ancillary equipment specified in the present document, overview

| Phenomenon | Application | Equipment test requirement | | | Reference clause in the present document |
|---|--|---|---|---|--|
| | | Radio and ancillary equipment for fixed use (e.g. base station equipment) | Radio and ancillary equipment for vehicular use (e.g. mobile equipment) | Radio and ancillary equipment for portable use (portable equipment) | |
| RF electromagnetic field (80 MHz to 1 000 MHz and 1 400 MHz to 2 700 MHz) | enclosure | applicable | applicable | applicable | 9.2 |
| electrostatic discharge | enclosure | applicable | not applicable | applicable | 9.3 |
| fast transients common mode | signal, telecommunication and control ports, DC and AC power ports | applicable | not applicable | not applicable | 9.4 |
| RF common mode 0,15 MHz to 80 MHz | signal, telecommunication and control ports, DC and AC power ports | applicable | applicable | not applicable | 9.5 |

4.2 Special Conditions for EMC Immunity Measurements

Clause 7.2.2 of ETSI EN 301 489-17 V2.2.1 states that no special conditions shall apply for Immunity testing for products covered in the present document.

4.3 Declaration of Type of Use

Based upon the technical characteristics of the product, for the purposes of EMC Immunity testing, the EUT was determined to be an item of “radio equipment for fixed use”.

4.4 Relevant Performance Criteria

Clause 6 Performance Criteria of ETSI EN 301 489-17 V2.2.1 is reproduced below for the convenience of the reader.

6.1 General performance criteria

The performance criteria are:

- performance criteria A for immunity tests with phenomena of a continuous nature;
- performance criteria B for immunity tests with phenomena of a transient nature;
- performance criteria C for immunity tests with power interruptions exceeding a certain time.

The equipment shall meet the minimum performance criteria as specified in the following clauses.

6.2 Performance table

Table 1: Performance criteria

| Criteria | During test | After test |
|---|--|--|
| A | Shall operate as intended. May show degradation of performance (see note 1). Shall be no loss of function. Shall be no unintentional transmissions. | Shall operate as intended. Shall be no degradation of performance (see note 2). Shall be no loss of function. Shall be no loss of stored data or user programmable functions. |
| B | May show loss of function (one or more). May show degradation of performance (see note 1). No unintentional transmissions. | Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2). Shall be no loss of stored data or user programmable functions. |
| C | May be loss of function (one or more). | Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2). |
| <p>NOTE 1: Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance.</p> <p>If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p> <p>NOTE 2: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p> | | |

6.3 Performance criteria for Continuous phenomena applied to Transmitters (CT)

The performance criteria A shall apply.

Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an ACKnowledgement (ACK) or Not ACKnowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

6.4 Performance criteria for Transient phenomena applied to Transmitters (TT)

The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply.

Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an acknowledgement (ACK) or not-acknowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

6.5 Performance criteria for Continuous phenomena applied to Receivers (CR)

The performance criteria A shall apply.

Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

6.6 Performance criteria for Transient phenomena applied to Receivers (TR)

The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration for which performance criteria C shall apply.

Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

4.5 RF exclusion band of radio communications equipment

Clause 4.3 of ETSI EN 301 489-17 V2.2.1 is reproduced below for the convenience of the reader.

4.3 Exclusion bands

The frequencies on which the transmitter part of the EUT is intended to operate shall be excluded from radiated emission measurements when performed in transmit mode of operation.

There shall be no frequency exclusion band applied to emission measurements of the receiver part of transceivers or the stand alone receiver under test, and/or associated ancillary equipment.

The exclusion band for immunity testing shall be calculated as follows:

- lower limit of exclusion band = lowest allocated band edge frequency -5 %;
- upper limit of exclusion band = highest allocated band edge frequency +5 %.

Using the 2,450 MHz band as an example:

- lower limit of exclusion band = $2\,400 - 120 = 2\,280$ MHz;
- upper limit of exclusion band = $2\,483,5 + 124,175 = 2\,607,675$ MHz;
- thus the exclusion band for 2,45 GHz equipment falling within the scope of the present document extends from 2 280 MHz to 2 607,675 MHz.

5 Summary of Test Results

| Rule | Description of Test | Result | Note |
|--|---|--------|--|
| ETSI EN 301 489-1 Clause 7.1 EMC Emissions | Radiated Emissions (per ETSI EN 301 489-1 V1.9.1 Clause 8.2) | Pass | - |
| | Conducted Emissions, DC Ports (per ETSI EN 301 489-1 V1.9.1 Clause 8.3) | N/A | The DC cable is less than 3m. |
| | Conducted Emissions, AC Mains (per ETSI EN 301 489-1 V1.9.1 Clause 8.4) | N/A | The EUT is DC powered. |
| | Harmonic Current Emissions (EN 61000-3-2 Test Method) (per ETSI EN 301 489-1 V1.9.1 Clause 8.5) | N/A | The EUT is DC powered. |
| | Voltage Fluctuations and Flicker (EN 61000-3-3 Test Method) (per ETSI EN 301 489-1 V1.9.1 Clause 8.6) | N/A | The EUT is DC powered. |
| | Conducted Emissions, Telecom Ports (per ETSI EN 301 489-1 V1.9.1 Clause 8.7) | N/A | The EUT has no telecom ports. |
| ETSI EN 301 489-1 Clause 7.2 Immunity | RF Electromagnetic Fields Immunity (EN 61000-4-3 Test Method) (per ETSI EN 301 489-1 V1.9.1 Clause 9.2) | Pass | - |
| | ESD Immunity (EN 61000-4-2 Test Method) (per ETSI EN 301 489-1 V1.9.1 Clause 9.3) | Pass | - |
| | EFT/Burst Immunity (EN 61000-4-4 Test Method) (per ETSI EN 301 489-1 V1.9.1 Clause 9.4) | N/A | The DC cable is less than 3m. |
| | RF Common Mode (EN 61000-4-6 Test Method) (per ETSI EN 301 489-1 V1.9.1 Clause 9.5) | N/A | The DC cable is less than 3m. |
| | Transients and Surges (ISO 7637-1, -2 Test Methods) (per ETSI EN 301 489-1 V1.9.1 Clause 9.6) | N/A | Only applicable to vehicular use equipment |
| | Voltage Dips and Interruptions IEC 61000-4-11 Test Method) (per ETSI EN 301 489-1 V1.9.1 Clause 9.7) | N/A | The EUT is DC powered |
| | Surges, Line to Line, Line to Ground (EN 61000-4-5 Test Method) (per ETSI EN 301 489-1 V1.9.1 Clause 9.8) | N/A | The DC cable is less than 3m. |

6 ETSI EN 301 489-1 V1.9.1 Clause 8.2) Radiated Emissions

6.1 Applicable Standard

As per EN 301 489-1 Clause 8.2.3

The ancillary equipment shall meet the class B limits given in EN 55022 [1].

As per EN 55022 §6 and CISPR §6: Radiated Emission Limits

The EUT shall meet the limits of the table below when measured at the measuring distance R in accordance with the methods described in Clause 10. If the reading on the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the highest reading shall be recorded, with the exception of any brief isolated high reading, which should be ignored.

Table 5- Limits for radiated disturbance of class B ITE at a measuring distance of 10 m

| Frequency range (MHz) | Quasi-peak limits dB (μ V/m) |
|---|--------------------------------------|
| 30 to 230 | 30 |
| 230 to 1000 | 37 |
| <i>NOTE 1: The lower limit shall apply at the transition frequency.</i> | |
| <i>NOTE 2: Additional provisions may be required for cases where interference occurs.</i> | |

As per EN 55022 §6 and CISPR §6: Limits above 1 GHz

The EUT shall meet the limits of the table below when measured in accordance with the method described in Clause 10 and the conditional testing procedure described below.

Table 7 — Limits for radiated disturbance of Class B ITE at a measurement distance of 3 m.

| Frequency Range (GHz) | Average Limit dB(μ V/m) | Peak Limit dB(μ V/m) |
|---|---------------------------------|------------------------------|
| 1 to 3 | 50 | 70 |
| 3 to 6 | 54 | 74 |
| <i>NOTE 1: The lower limit shall apply at the transition frequency.</i> | | |
| <i>NOTE 2: Additional provisions may be required for cases where interference occurs.</i> | | |

6.2 EUT Setup

The radiated emissions tests were performed in the 5-meter test chamber, using the setup in accordance with CISPR 22 measurement procedures. The specifications used were in accordance with CISPR 22 §6 standard, Class B limits for measurements up to 1 GHz.

The spacing between the peripherals was 10 cm.

The external I/O cables were draped along the test table and bundled as required.

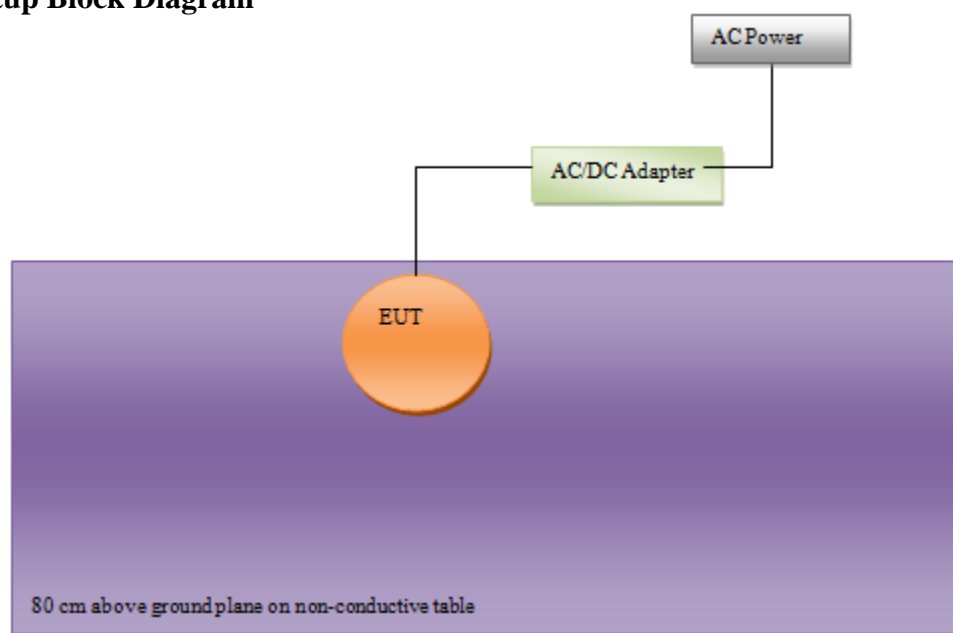
The EUT was connected to an AC line power source.

6.3 Test Procedure

Maximization procedure was performed on the six (6) highest emissions readings to ensure the EUT is compliant with all installation combinations.

All data was recorded in the peak detection mode.

6.4 Test Setup Block Diagram



6.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) was calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator and RF Limiter Loss Factor (AL) to the “raw” Amplitude (Am) reading, and then subtracting the Preamplifier Gain (Gp). The basic equation is as follows:

$$CA = Am + AF + CL + AL - Gp$$

For example, if (at some frequency and measurement distance) we had a measured Amplitude reading (Am) of 50.0 dBμV/m, an Antenna Factor of 17.0 dB/m, a Cable Loss (CL) of 5.8 dB, an Attenuator and RF Limiter Loss (AL) of 0.4 dB, and a Preamplifier Gain of 32.5 dB, the corrected amplitude (CA) would be 40.7 dBμV/m (i.e., $50.0 + 17.0 + 5.8 + 0.4 - 32.5 = 40.7$ dBμV/m).

The “**Margin**” values in the following data tables indicate the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the applicable Limit. The equation for the margin calculation is as follows:

$$\text{Margin (dB)} = \text{Corrected Amplitude (dB}\mu\text{V/m)} - \text{Applicable Limit (dB}\mu\text{V/m)}$$

6.6 Test Equipment List and Details

| BACL Asset # | Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Interval |
|--------------|-----------------------|----------------------|--------------------|---------------|-------------------|----------------------|
| 711 | Keysight Technologies | RF Limiter | 11867A | MY42242931 | 2015-12-15 | 1 year |
| 322 | Rohde & Schwarz | Receiver, EMI Test | ESCI 1166.5950K 03 | 100337 | 2015-06-18 | 2 years |
| 311 | Sunol Sciences | Controller, System | SC104V | 113005-1 | Cal. Not required | Cal. Not required |
| 321 | Sunol Sciences | Antenna, BiConiLog | JB3 | A020106-2 | 2015-07-11 | 2 years |
| 287 | Agilent | Analyzer, Spectrum | E4446A | US44300386 | 2015-10-22 | 1 year |
| 473 | EMCO | Horn Antenna | 3115 | 9511-4627 | 2016-01-28 | 2 years |
| 606 | UTiFLEX | SMA Cable | 64638 | 218625007 | 2016-06-17 | 1 year |
| 601 | UTiFLEX | High Frequency Cable | 223458-002 | 223458-001 | 2016-06-06 | 1 year |
| 00690 | Wireless Solutions | N-Type Coax Cable | LMR 400 | 690 | 2015-07-02 | 1 year |

Statement of Traceability: BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 14 May 2015) "A2LA Policy on Metrological Traceability".

6.7 EMI Measurement Software

The EMI Measurement software package used to perform this test was the EMIsoft[®] VASONA[®] Version 6.00.

6.8 Test Environmental Conditions & Test Personnel

| | |
|-----------------------------|---------------|
| Test Date(s) | 2016-08-03 |
| Test Site | 10m Chamber 1 |
| Temperature: | 23° C |
| Relative Humidity: | 44% |
| Barometric Pressure: | 101.7 kPa |
| Test Personnel: | Shoaib Khan |

6.9 Summary of Test Results

According to the data in the following table, the EUT complied with EN 301 489 -1/17 Standard, Class B limits, and had the worst margin reading of:

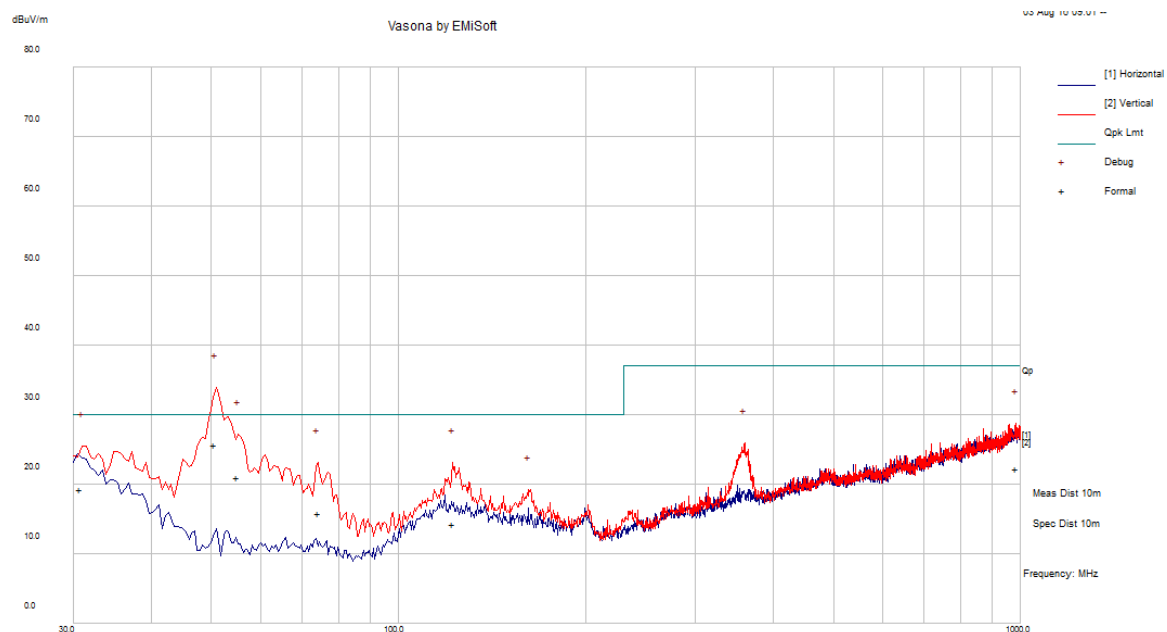
| Frequency Range: 30 MHz to 1000 MHz | | | |
|-------------------------------------|-----------------|---------------------------------------|------------------|
| Margin (dB) | Frequency (MHz) | Polarization (Horizontal/Vertical) | Range (MHz) |
| -4.36 | 50.63 | Vertical | 30MHz to 1000MHz |

| Frequency Range: 1000 MHz to 6000 MHz | | | |
|---------------------------------------|-----------------|---------------------------------------|----------------------|
| Margin (dB) | Frequency (MHz) | Polarization (Horizontal/Vertical) | Range (MHz) |
| -16.15 | 5975 | Vertical | 1000 MHz to 6000 MHz |

6.10 Radiated Emissions Test Plot and Data

30 MHz to 1 GHz at 10 Meter Distance

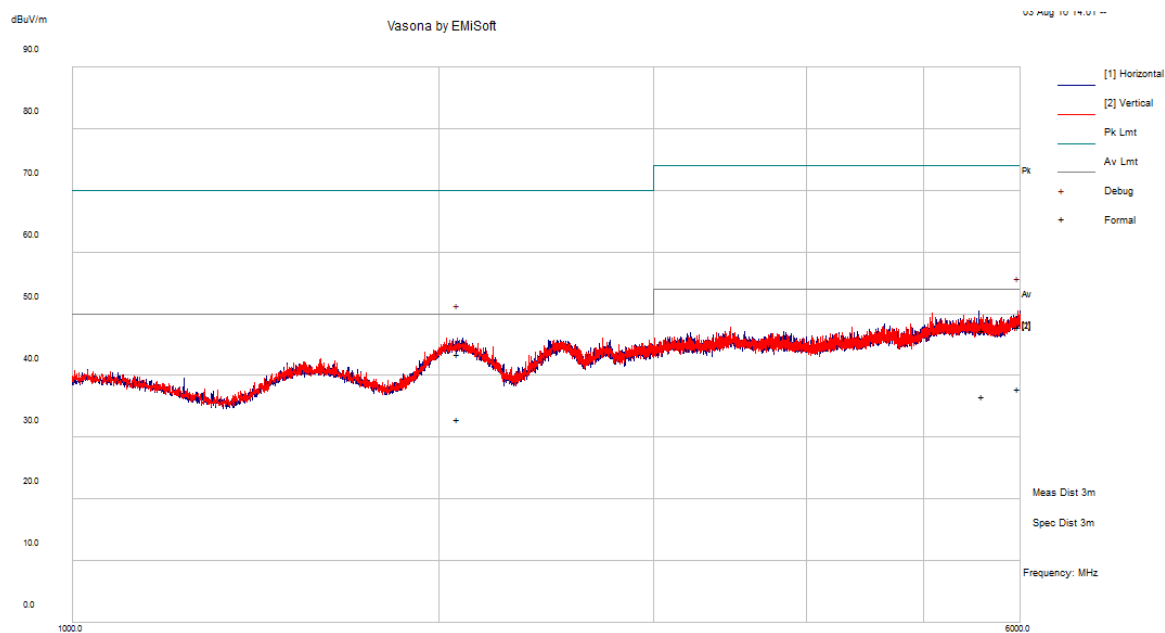
30-1000 MHz Peak Pre-Scan (measured at a 10 meter distance) Plot



Quasi-Peak Measurements:

| Frequency (MHz) | Corrected Amplitude (dBμV/m) | Test Antenna | | Turntable Azimuth (degrees) | Limit (dBμV/m) | Margin (dB) |
|-----------------|------------------------------|--------------|----------------|-----------------------------|----------------|-------------|
| | | Height (cm) | Polarity (H/V) | | | |
| 50.63 | 25.64 | 314 | V | 359 | 30 | -4.36 |
| 55.02 | 21 | 302 | V | 41 | 30 | -9.00 |
| 30.83 | 19.3 | 401 | V | 349 | 30 | -10.70 |
| 74.37 | 15.87 | 264 | V | 361 | 30 | -14.13 |
| 982.72 | 22.3 | 397 | V | 279 | 37 | -14.70 |
| 122.32 | 14.27 | 335 | V | 359 | 30 | -15.73 |

1 GHz to 6 GHz Radiated Emissions



Peak Measurements

| Frequency (MHz) | Peak detector reading (dB μ V/m) | Antenna Height (cm) | Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|--------------------------------------|---------------------|----------------|-----------------------------|----------------------|-------------|
| 5975 | 47.97 | 142 | V | 240 | 74 | -26.03 |
| 2072 | 43.55 | 126 | V | 161 | 70 | -26.45 |
| 5589 | 47.3 | 164 | H | 28 | 74 | -26.7 |

Average Measurements

| Frequency (MHz) | Average detector reading (dB μ V/m) | Antenna Height (cm) | Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|---|---------------------|----------------|-----------------------------|----------------------|-------------|
| 5975 | 37.85 | 142 | V | 240 | 54 | -16.15 |
| 2072 | 32.96 | 126 | V | 161 | 50 | -17.04 |
| 5589 | 36.62 | 164 | H | 28 | 54 | -17.38 |

7 ETSI EN 301 489-1 V1.9.2 Clause 9.2 – Radio Frequency Electromagnetic Field (80 MHz to 1000 MHz and 1400 MHz to 2700 MHz) Immunity Test

7.1 Applicable Test Requirements *per* ETSI EN 301 489-1 V1.9.2 Clause 9.2.2

The test method shall be in accordance with EN 61000-4-3.

The following requirements and evaluation of test results shall apply:

- The test level shall be 3 V/m (measured unmodulated). The test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 000 Hz. If the wanted signal is modulated at 1 000 Hz, then an audio signal of 400 Hz shall be used;
- The test shall be performed over the frequency range 80 MHz to 1 000 MHz and 1 400 MHz to 2 700 MHz with the exception of the exclusion band for transmitters, receivers and duplex transceivers (see clause 4), as appropriate;
- For receivers and transmitters the stepped frequency increments shall be 1 % frequency increment of the momentary used frequency, unless specified otherwise in the part of EN 301 489 series [i.13] dealing with the relevant type of radio equipment;
- Further product related spot frequency tests may be specified in the relevant part of EN 301 489 series [i.13] dealing with the particular type of radio equipment;
- Responses on receivers occurring at discrete frequencies, which are narrow band responses, shall be disregarded from the test (see clause 4);
- The frequencies selected and used during the test shall be recorded in the test report.

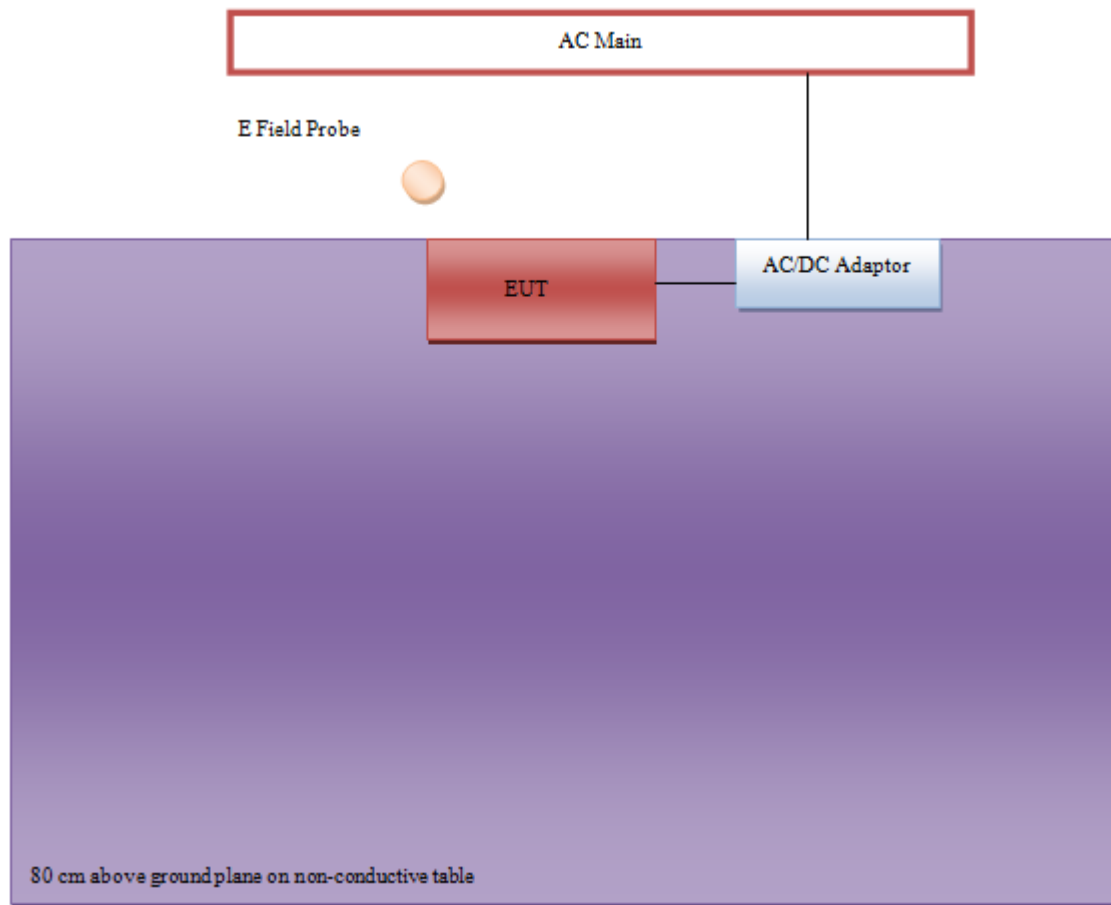
7.2 Application of the Electromagnetic Field

The EUT was setup and tested according to EN 61000-4-3.

The electromagnetic field was established at the front edge of the EUT. Except for the applicable Exclusion Bands (as defined in ETSI EN 301 489-17 V2.2.1), the frequency range was swept from 80 to 1000 MHz and from 1400 to 2700 MHz using a power level necessary to obtain the required 3 volt/meter, 1 kHz AM sine wave modulated at 80% depth, field directed at the EUT. The test was performed successively in both Horizontal and Vertical Polarizations, with each of the four sides (i.e., front, left, rear, and right) of the EUT aligned to the calibration plane.

See Section 4.5 of this Test Report for details regarding the application of Exclusion Band(s) during the RF Radiated Fields Immunity Testing of the EUT.

7.3 Test Setup Block Diagram



7.4 Test Equipment List and Details

| BACL Asset # | Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|--------------|-----------------------------|--------------------------------|------------|---------------|-------------------|----------------------|
| 343 | HP | Generator, Signal | 8648C | 3847M00143 | 2015-12-16 | 1 year |
| 665 | Narda Safety Test Solutions | Field Meter | NBM 520 | D0887 | 2015-03-31 | 2 years |
| 731 | Narda Safety Test Solutions | E-field probe | EF 1891 | D0375 | 2015-03-31 | 2 years |
| 742 | HP | Signal Generator | 83620B | 3844A00849 | 2016-07-07 | 1 Year |
| 743 | Amplifier Research | Power Head | PH2000 | 303715 | 2015-09-25 | 1 Year |
| 754 | Amplifier Research | Power Meter | PM2002 | 307653 | 2015-09-25 | 1 Year |
| 13 | IFI | Amplifier | CMX5001 | 2194-1296 | Cal. Not required | Cal Not required |
| 495 | Amplifier Research | Coupler | DC6180A | 320286 | Cal. Not required | Cal. Not required |
| 514 | ETS | Antenna, Biconi-Log | 3140 | 1019 | Cal. Not required | Cal. Not required |
| 820 | Amplifier Research | Stacked Log-Periodic Antenna | ATS700M11G | 345747 | Cal. Not required | Cal. Not required |
| 587 | IFI | Amplifier, Traveling Wave Tube | ST181-20 | E012-0101 | Cal. Not required | Cal. Not required |
| 668 | rf/ microwave Instrument | Dual Directional Coupler | DC7420 | 342372 | Cal. Not required | Cal. Not required |
| 312 | Panasonic | Camera System Controller | WV-CU161C | EGR00083 | Cal. Not required | Cal. Not required |
| 311 | Sunol Sciences | Controller, System | SC104V | 113005-1 | Cal. Not required | Cal. Not required |

¹ the test setup, including the couplers, was verified each time by monitoring the field strength level on the field meter.

Statement of Traceability: BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 14 May 2015) "A2LA Policy on Metrological Traceability".

7.5 Test Environmental Conditions

| | |
|---------------------------|--------------|
| Testing Date: | 2016-08-10 |
| Testing Site: | 5m Chamber 2 |
| Temperature: | 23 °C |
| Relative Humidity: | 44 % |
| ATM Pressure: | 101.8kPa |
| Testing Personnel: | Kevin Wu |

7.6 EN 61000-4-3 Radiated RF-Electromagnetic Field Immunity Test Results

| Frequency Range (MHz) | V/m | Front Side | | Rear Side | | Left Side | | Right Side | |
|-----------------------|-----|------------|------------|-----------|------------|-----------|------------|------------|------------|
| | | Vertical | Horizontal | Vertical | Horizontal | Vertical | Horizontal | Vertical | Horizontal |
| 80 - 1000 | 3 | A | A | A | A | A | A | A | A |

Note: A ---- Performance Criteria A
 B ---- Performance Criteria B
 C ---- Performance Criteria C
 - ---- Not Applicable

The EUT was subjected to a 3 volt/meter, 80% Amplitude modulated, 1 kHz sine wave field. The EUT was subjected to continuous radiated disturbance required by EN 301 489-1/-17. During testing a 3 second dwell time with 1% step from 80 MHz to 1000 MHz was used. The distance from the antenna to the EUT is 3 meters.

| Frequency Range (MHz) | V/m | Front Side | | Rear Side | | Left Side | | Right Side | |
|-----------------------|-----|------------|------------|-----------|------------|-----------|------------|------------|------------|
| | | Vertical | Horizontal | Vertical | Horizontal | Vertical | Horizontal | Vertical | Horizontal |
| 1400-2700 | 3 | A | A | A | A | A | A | A | A |

Note: A ---- Performance Criteria A
 B ---- Performance Criteria B
 C ---- Performance Criteria C
 - ---- Not Applicable

The EUT was subjected to a 3 volt/meter, 80% Amplitude modulated, 1 kHz sine wave. The EUT was subjected to continuous radiated disturbance required by EN 301 489-1/-17. During testing a 3 second dwell time with 1% step from 1400 MHz to 2700 MHz was used. The distance from the antenna to the EUT is 1 meter.

8 ETSI EN 301 489-1 Clause 9.3 – Electrostatic Discharge Immunity Test

8.1 Applicable Test Requirements *per* ETSI EN 301 489-1 V1.9.2 Clause 9.3.2

The test shall be as per EN 61000-4-2.

The test method shall be in accordance with EN 61000-4-2 [2].

For radio equipment and ancillary equipment the following requirements and evaluation of test results shall apply.

The test severity level for contact discharge shall be 4 kV and for air discharge 8 kV. All other details, including intermediate test levels, are contained within EN 61000-4-2 [2].

Electrostatic discharges shall be applied to all exposed surfaces of the EUT except where the user documentation specifically indicates a requirement for appropriate protective measures (see EN 61000-4-2 [2]).

Note: per EN 61000-4-2, testing shall also be satisfied at the lower levels given in table 1

Table 1 – Test levels

| 1a- Contact Discharge | | 1b – Air Discharge | |
|---|-------------------|--------------------|-------------------|
| Level | Test Voltage (kV) | Level | Test Voltage (kV) |
| 1 | 2 | 1 | 2 |
| 2 | 4 | 2 | 4 |
| 3 | 6 | 3 | 8 |
| 4 | 8 | 4 | 15 |
| x ¹⁾ | Special | x ¹⁾ | Special |
| ¹⁾ “x” is an open level. The level has to be specified in the dedicate equipment. If higher voltages than those shown are specified, special test equipment may be need. | | | |

8.2 Application of Electrostatic Discharges

The ESD Immunity Tests were conducted in the following Discharge Mode order: Air Discharge, Direct Contact Discharge, Indirect Contact Discharge to the Horizontal Coupling Plane, and Indirect Contact Discharge to the Vertical Coupling Plane. The ESD test levels were set and discharges for the different discharge modes were applied at the appropriate locations.

The locations of the ESD Discharges (i.e., the Test Points) are shown in the photographs on the next two pages of this Test Report.

8.3 Electrostatic Discharge Immunity Test Points (**Red – Air Discharge** and **Blue – Direct Contact**)

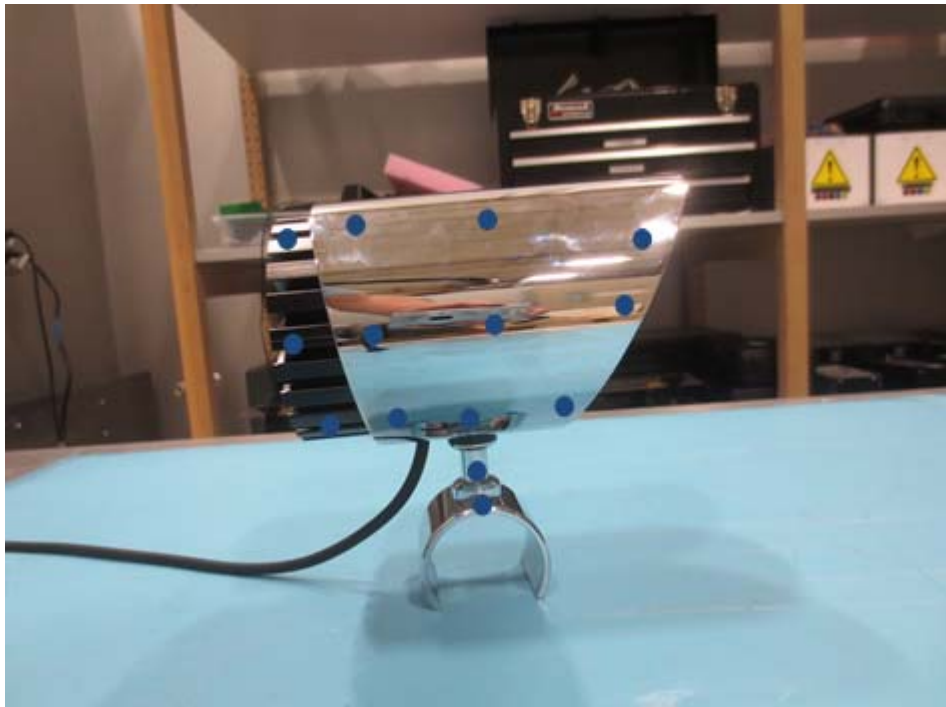
Front View



Rear View



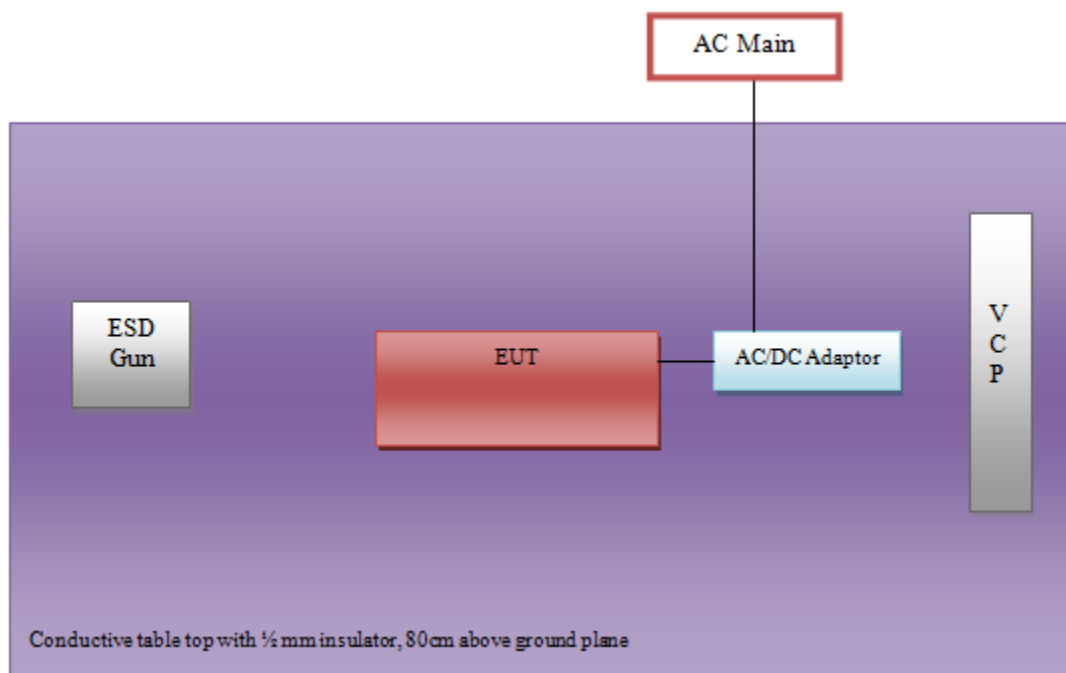
Left Side View



Right Side View



8.4 Test Setup Block Diagram



8.5 Test Equipment List and Details

| BACL Asset # | Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|--------------|------------------------|---------------------|----------|---------------|-------------------|----------------------|
| 573 | Fluke Corp | Multimeter, Digital | 233 | 23790031 | 2016-07-13 | 1 year |
| 651 | TESEQ AG | ESD Generator | NSG 438 | 1282 | 2015-10-28 | 1 year |
| 277 | California Instruments | Source, AC | 6000L-1P | 54502 | Cal. Not required | Cal. Not required |

¹ the output level was verified each time before testing.

Statement of Traceability: BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 14 May 2015) “A2LA Policy on Metrological Traceability”.

8.6 Test Environmental Conditions

| | |
|---------------------------|--------------------------|
| Testing Date: | 2016-08-09 |
| Testing Site: | Outside Immunity Room 1B |
| Temperature: | 25 °C |
| Relative Humidity: | 44 % |
| ATM Pressure: | 101.2 kPa |
| Testing Personnel: | Ray Li |

8.7 ESD Immunity Test Results

Table 1: Electrostatic Discharge (Air Discharge)

| EN 61000-4-2 Test Point | Test Level (kV) | | | | | | | | | | | |
|----------------------------|-----------------|----|----|----|----|----|----|----|-----|-----|-----|-----|
| | -2 | +2 | -4 | +4 | -6 | +6 | -8 | +8 | -15 | +15 | -20 | +20 |
| Front Side | | | | | | | | | | | | |
| Right Side | | | | | | | | | | | | |
| Rear Side | | | | | | | | | | | | |
| Left Side | | | | | | | | | | | | |

*Shaded area indicates no discharge was present.

Table 2: Electrostatic Discharge (Direct Contact)

| EN 61000-4-2 Test Point | Test Level (kV) | | | | | | | | | | | |
|----------------------------|-----------------|----|----|----|----|----|----|----|-----|-----|-----|-----|
| | -2 | +2 | -4 | +4 | -6 | +6 | -8 | +8 | -15 | +15 | -20 | +20 |
| Front Side | | | | | | | | | | | | |
| Right Side | | | | | | | | | | | | |
| Rear Side | | | | | | | | | | | | |
| Left Side | | | | | | | | | | | | |

*Shaded area indicates no discharge was present.

Table 3: Electrostatic Discharge (Indirect Contact HCP)

| EN 61000-4-2 Test Point | Test Level (kV) | | | | | | | | | | | |
|----------------------------|-----------------|----|----|----|----|----|----|----|-----|-----|-----|-----|
| | -2 | +2 | -4 | +4 | -6 | +6 | -8 | +8 | -15 | +15 | -20 | +20 |
| Front Side | A | A | A | A | - | - | - | - | - | - | - | - |
| Right Side | A | A | A | A | - | - | - | - | - | - | - | - |
| Rear Side | A | A | A | A | - | - | - | - | - | - | - | - |
| Left Side | A | A | A | A | - | - | - | - | - | - | - | - |

Table 4: Electrostatic Discharge (Indirect Contact VCP)

| EN 61000-4-2 Test Point | Test Level (kV) | | | | | | | | | | | |
|----------------------------|-----------------|----|----|----|----|----|----|----|-----|-----|-----|-----|
| | -2 | +2 | -4 | +4 | -6 | +6 | -8 | +8 | -15 | +15 | -20 | +20 |
| Front Side | A | A | A | A | - | - | - | - | - | - | - | - |
| Right Side | A | A | A | A | - | - | - | - | - | - | - | - |
| Rear Side | A | A | A | A | - | - | - | - | - | - | - | - |
| Left Side | A | A | A | A | - | - | - | - | - | - | - | - |

Note: A ---- Performance Criteria A
 B ---- Performance Criteria B
 C ---- Performance Criteria C
 - ---- Not Applicable

The EUT was subjected to ESD Immunity Tests as required by Clause 9.3 of EN 301 489-1 V1.9.2. The ESD Discharges were applied at the levels specified therein. During and after the test, the EUT operated as intended, with no loss function and no degradation of performance.

9 Appendix A – EUT Photographs

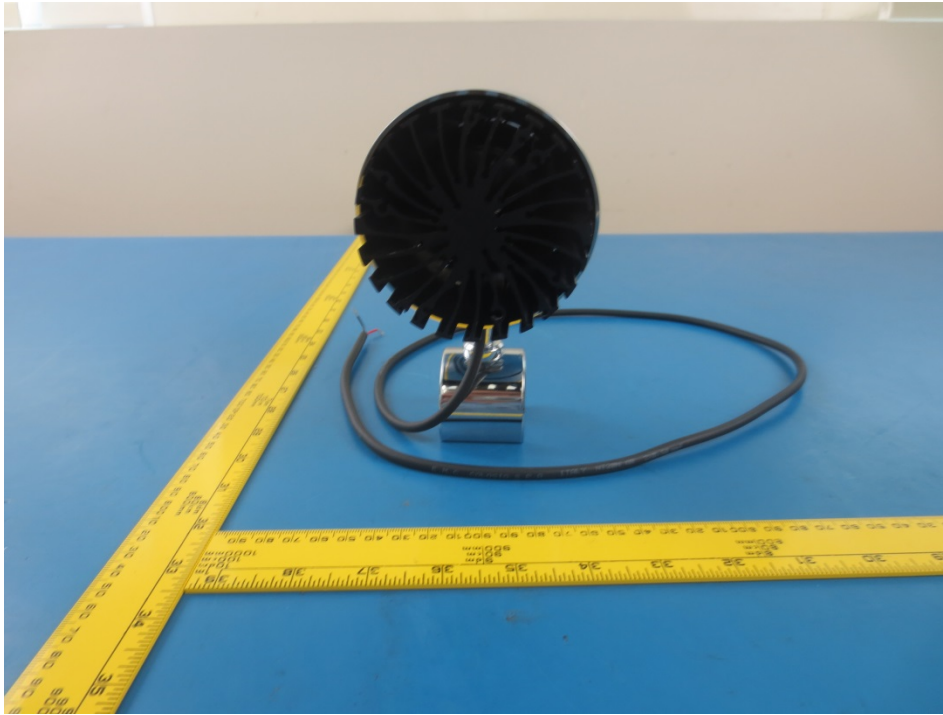
9.1 EUT Front View



9.2 EUT Right View



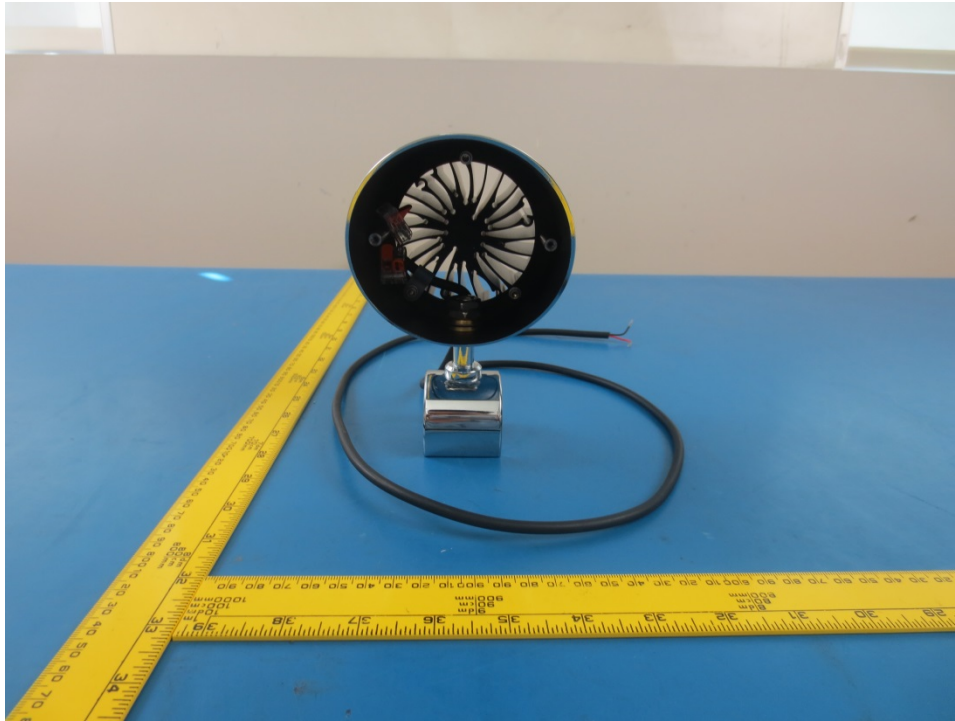
9.3 EUT Rear View



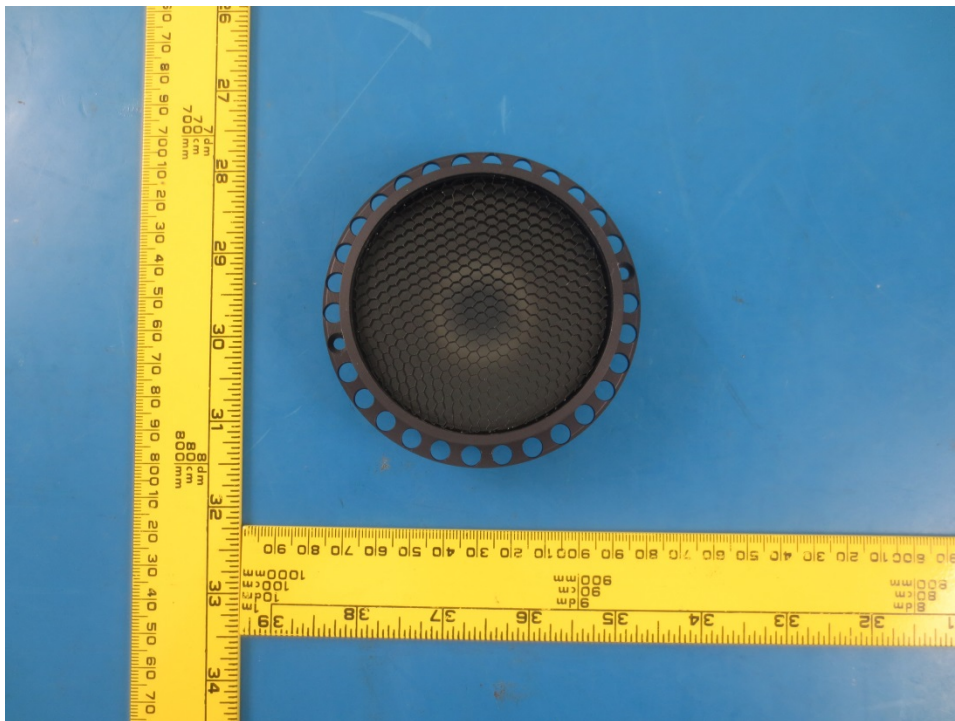
9.4 EUT Left View



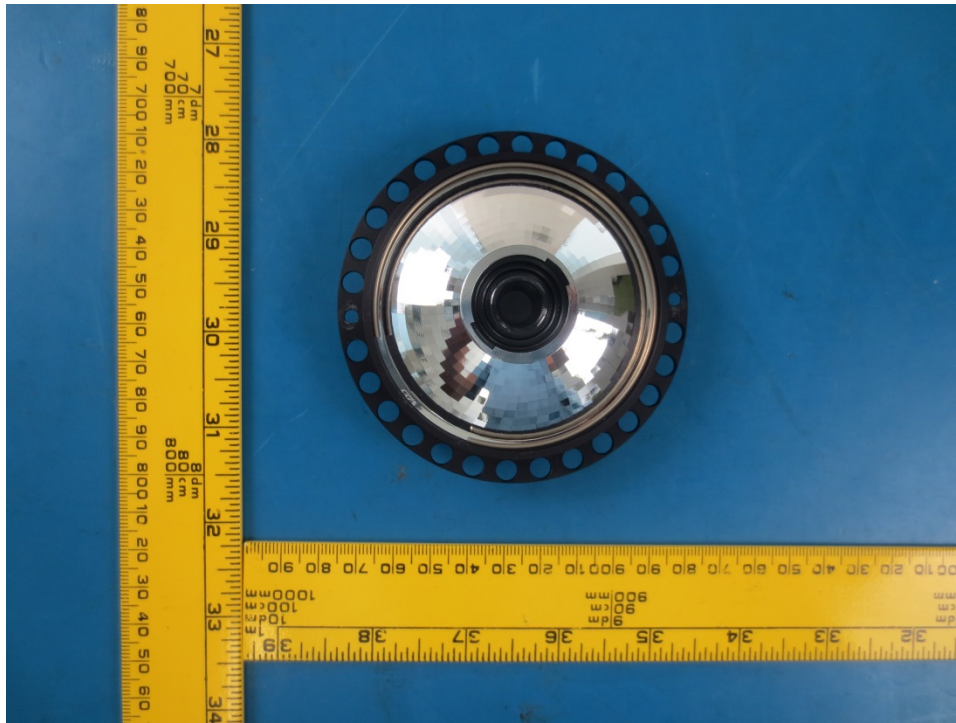
9.5 EUT Stand View



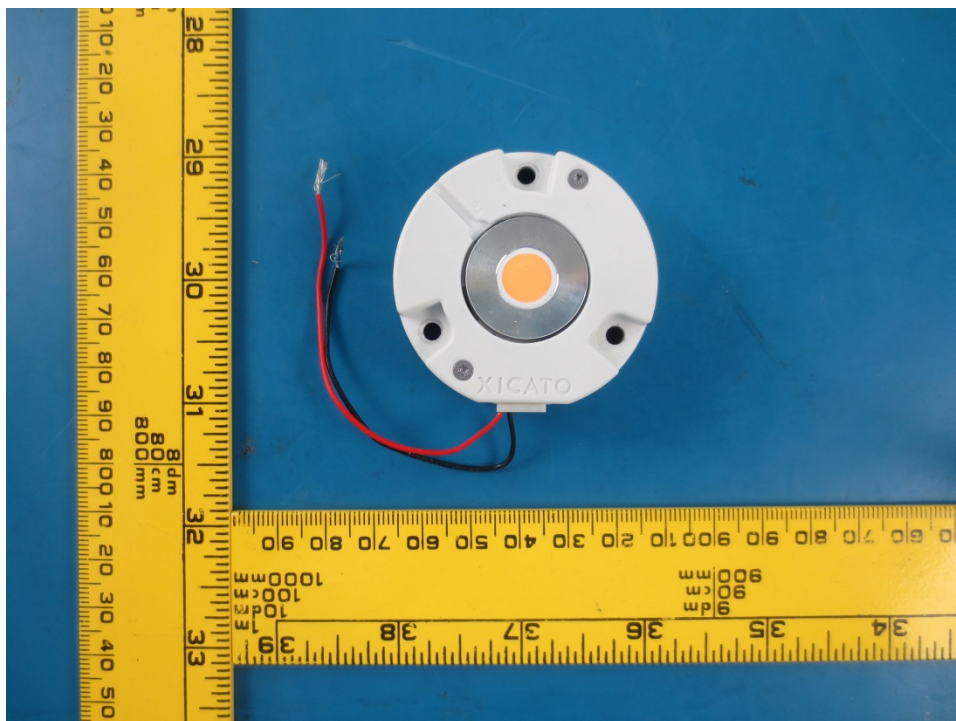
9.6 EUT Lampshade Front View



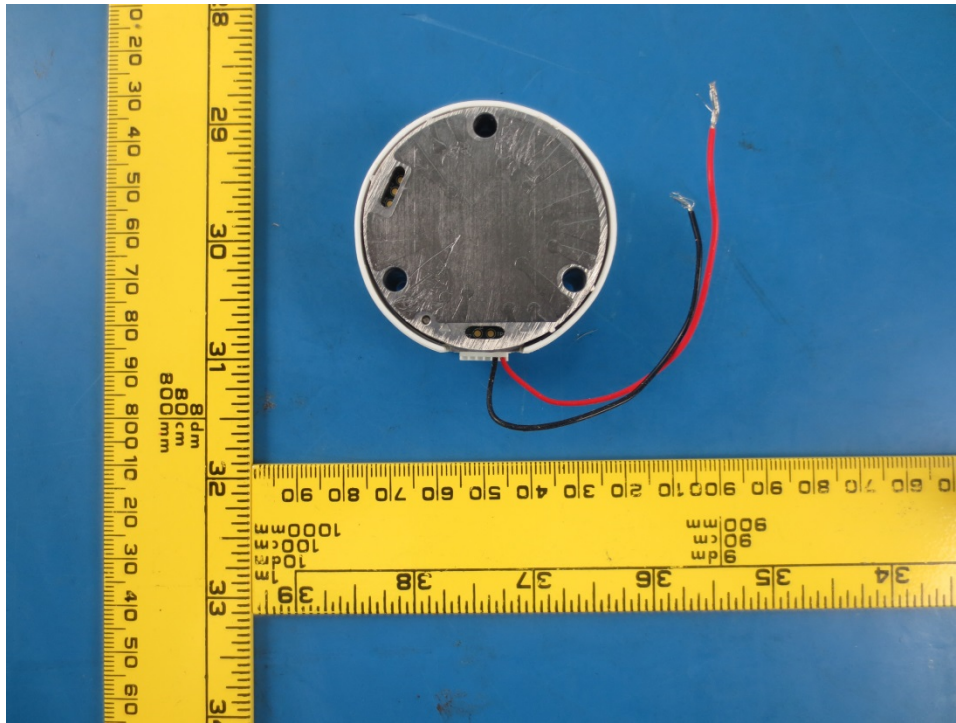
9.7 EUT Lampshade Bottom View



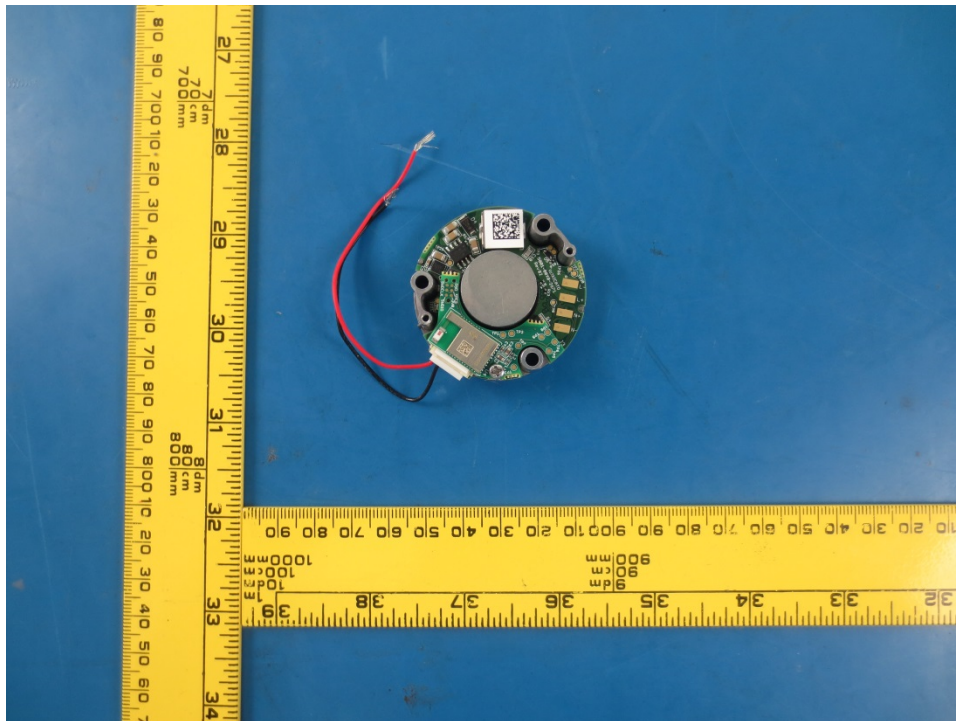
9.8 Main EUT Top View



9.9 Main EUT Bottom View



9.10 EUT Main Board View



10 Appendix B – “CE MARK” Product Labeling

10.1 Label Information

1. The CE conformity marking must consist of the initials ‘CE’ taking the form below. If the CE marking is reduced or enlarged the proportions must be respected.



2. The CE marking must have a height of at least 5 mm except where this is not possible on account of the nature of the apparatus.

The EMC Directive recognizes that there are circumstances where it is “not possible or warranted on account of the nature of the product” to have the marking affixed to the apparatus or to its data plate. In such cases it is allowed to have the CE marking’ affixed on the packaging, refer to the Blue Guide when such exemptions are allowed.

3. The CE marking must be affixed to the product or to its data plate. Additionally it must be affixed to the packaging, if any, and to the accompanying documents, where the directive concerned provides for such documents.
4. The CE marking must be affixed visibly, legibly, and indelibly.
5. Other labeling requirements maybe required if the product(s) is/are subject to several directives.

Specifications: Text is black or white in color and is left justified. Labels are printed in indelible ink on permanent adhesive backing or silk-screened and shall be affixed at a conspicuous location on the EUT. The label cannot be positioned on a removable portion of the EUT (e.g. battery cover).

11 Appendix C – Product Label

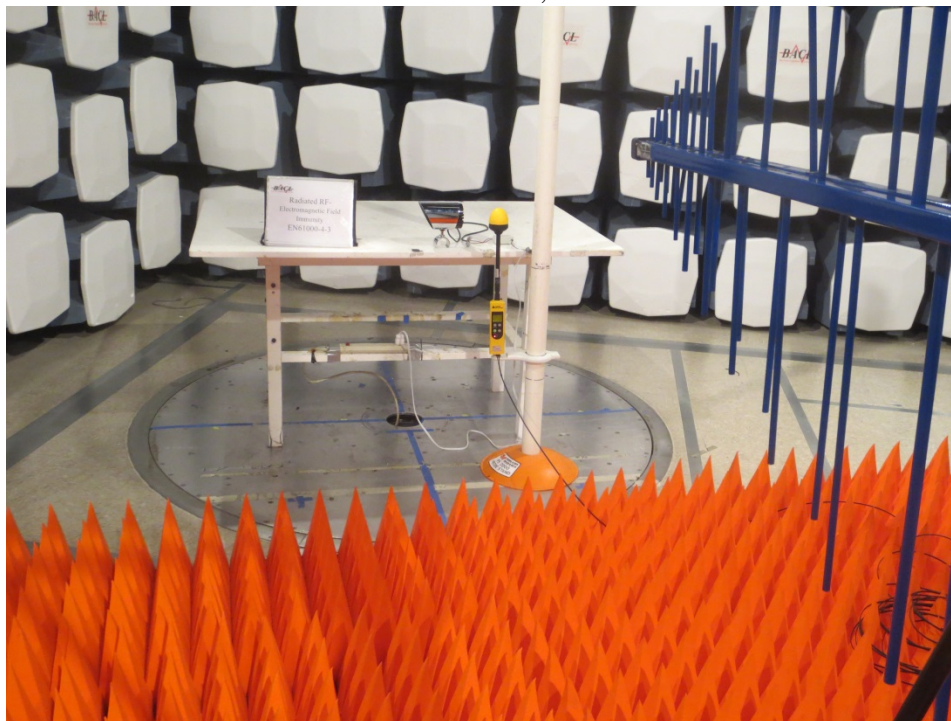
11.1 Suggested Label Location on EUT and Label Appearance



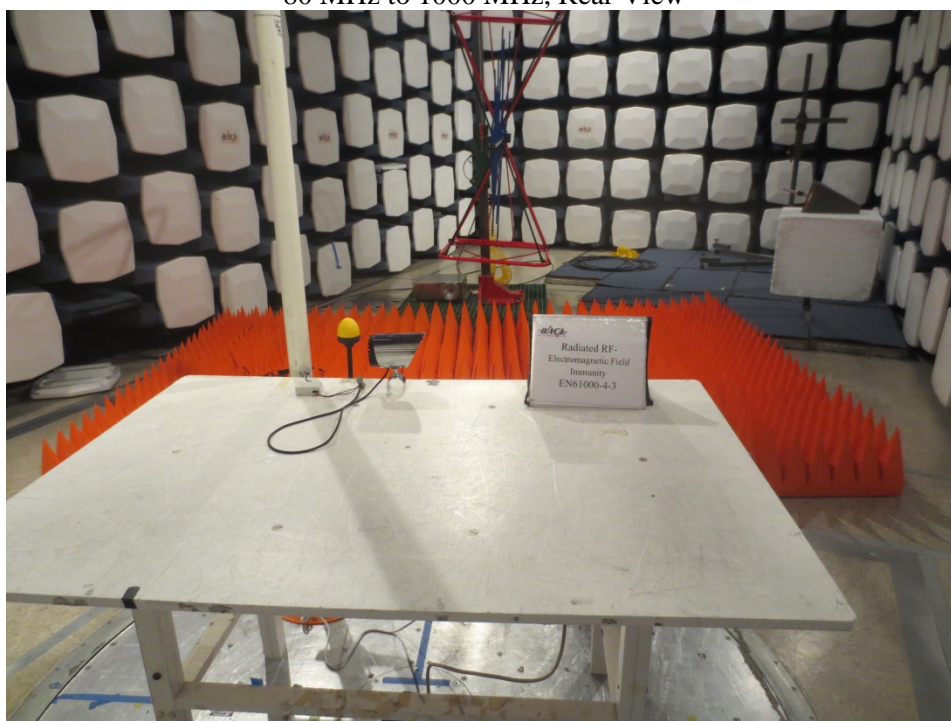
12 Appendix D – Test Setup Photographs

12.1 Electromagnetic Field Immunity (EN 61000-4-3)

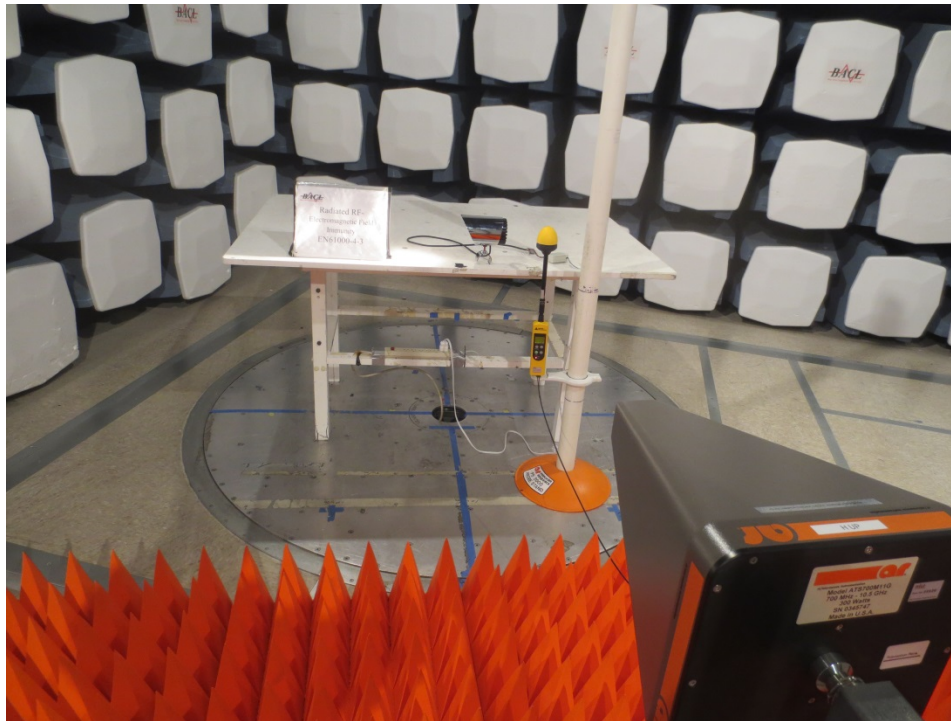
80 MHz to 1000 MHz, Front View



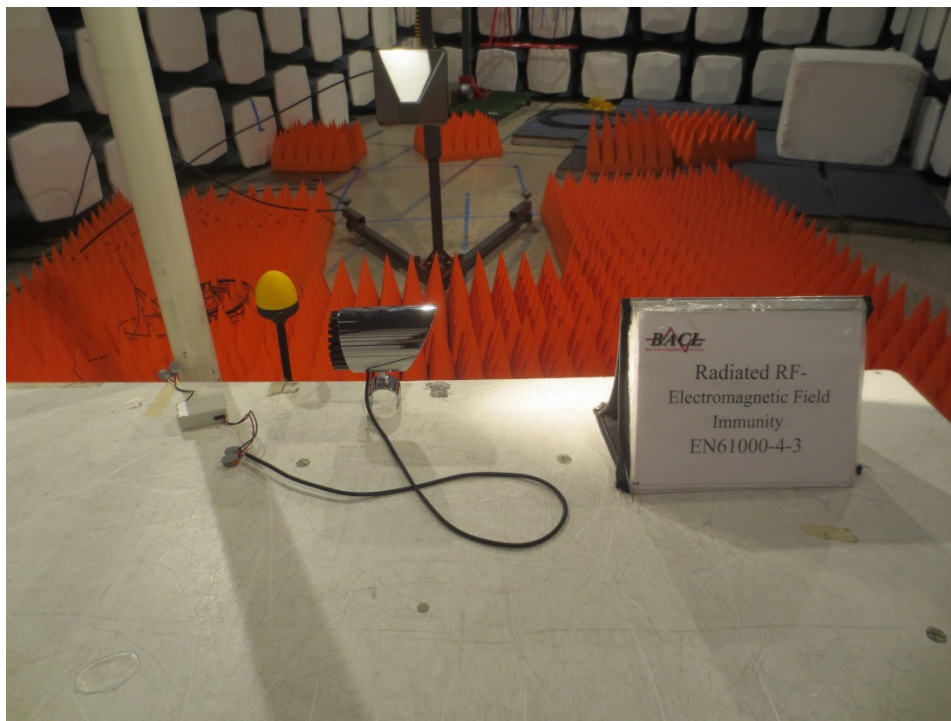
80 MHz to 1000 MHz, Rear View



1400 MHz to 2700 MHz, Front View

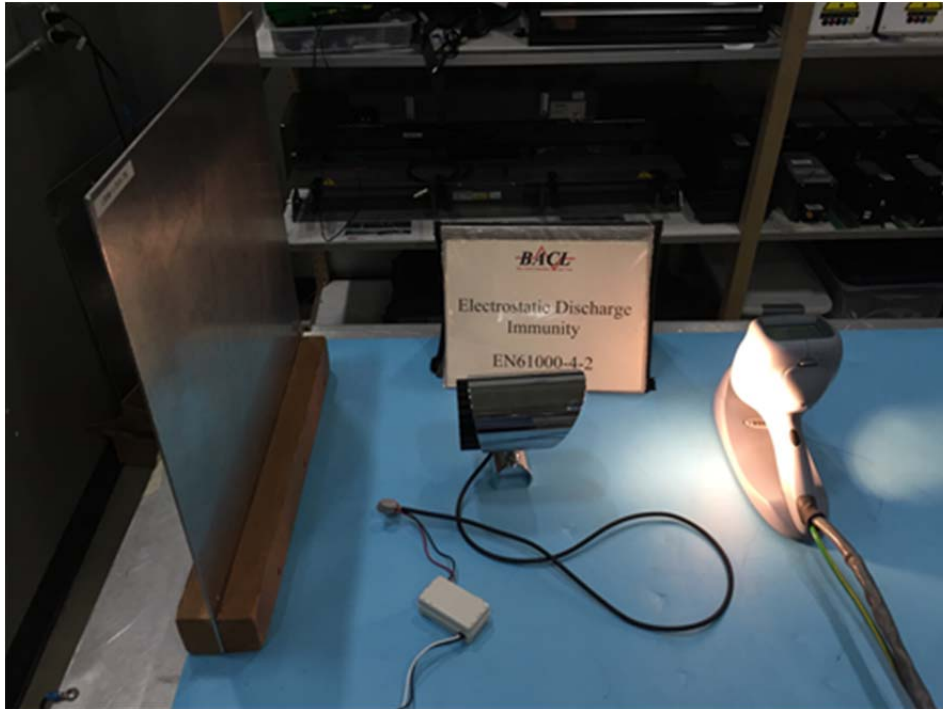


1400 MHz to 2700 MHz, Rear View

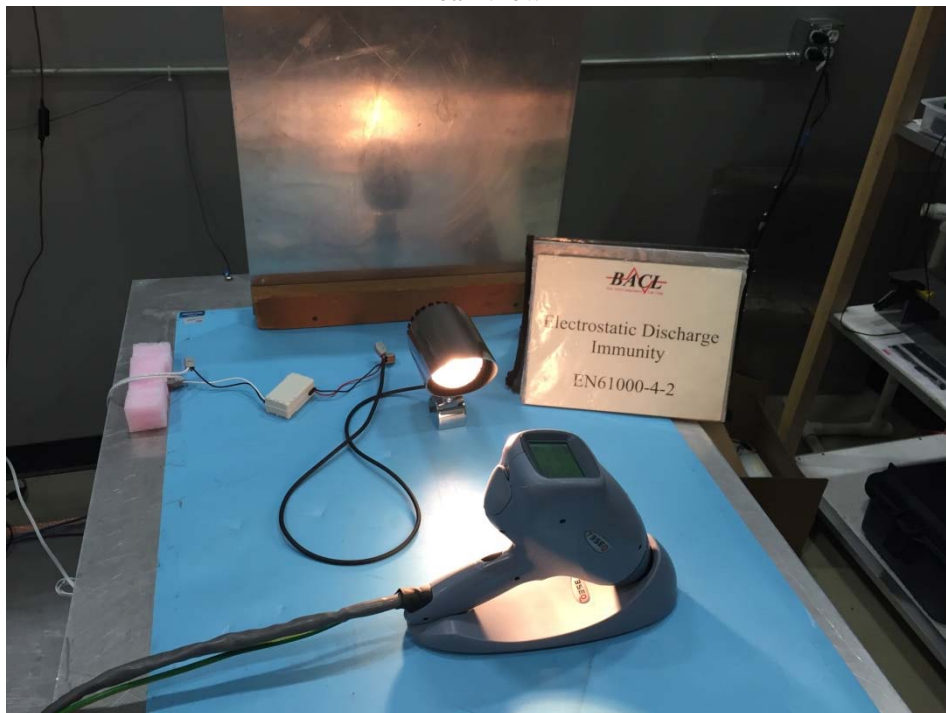


12.2 Electrostatic Discharge Immunity (EN 61000-4-2)

Front View



Rear View



---END OF REPORT---