

**ELECTRO MAGNETIC TEST, INC.**1547 Plymouth Street, Mountain View, CA 94043 Tel: (650) 965-4000 Fax: (650) 965-3000

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*FCC PART 15.247, SUBPART C  
IC RSS 210, ISSUE 8  
TEST REPORT*

*for**the*

IN HOME GATEWAY

MODEL: BDG-A100

Prepared for

Bidgely, Inc.  
298 S. Sunnyvale Ave, Ste 205  
Sunnyvale, CA 94086

Prepared by:   
GEORGE HSU

Approved by:   
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1547 PLYMOUTH STREET  
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(650) 965-4000

DATE: April 6, 2015

|       | REPORT<br>BODY | APPENDICES |   |   |   | TOTAL |
|-------|----------------|------------|---|---|---|-------|
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| A        | Radiated and Conducted Data Sheets <ul style="list-style-type: none"><li>• Radiated Emissions Test Data (General Requirements, and Restricted Bands)</li><li>• Emissions in Non-Restricted Frequency Bands Test Data</li><li>• Occupied Bandwidth Test Data</li><li>• Maximum Peak Output Power Test Data</li><li>• Maximum Peak Power Spectral Density Test Data</li><li>• Band Edge Test Data</li><li>• Conducted Emissions (AC Powerline) Test Data</li></ul> |
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### GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Electro Magnetic Test, Inc., which is an independent testing and consulting firm. The test report is based on testing performed Electro Magnetic Test, Inc. personnel according to the measurement procedure described in the test specification given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced in any form unless done so in full.

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Federal Government.

The measurement data and conclusions contained in this test report are deemed satisfactory evidence of compliance with Industry Canada Interference-Causing Equipment Standard ICES-003, Issue 5, August 2012.

Electro Magnetic Test, Inc. is recognized by the following agencies for performing EMI/EMC testing:

| COUNTRY                                                              | AGENCY                                                                                                                                                                                                                                     | IDENTIFYING #                      |
|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| USA                                                                  | Federal Communications Commission (FCC)<br>(EMT's test site is recognized by the FCC)                                                                                                                                                      | Registration Number:<br>90576      |
| USA, Canada, Taiwan,<br>Australia/New Zealand,<br>European Community | National Voluntary Lab Accreditation Program (NVLAP)<br>(EMT is accredited by NVLAP. A copy of the NVLAP<br>Scope Of Accreditation is available upon request.)                                                                             | Lab Code: 200147-0                 |
| Canada                                                               | Industry Canada                                                                                                                                                                                                                            | File No.: IC 2804                  |
| Japan                                                                | Voluntary Control Council For Interference (VCCI)                                                                                                                                                                                          | A-0118                             |
|                                                                      | Open Field Test Site "A"                                                                                                                                                                                                                   | -                                  |
|                                                                      | Mains Conducted Emissions Test Site "A"                                                                                                                                                                                                    | -                                  |
|                                                                      | Telecom Conducted Emissions Test Site "A"                                                                                                                                                                                                  | -                                  |
|                                                                      | 3 Meter Semi-Anechoic Chamber Site "E"                                                                                                                                                                                                     | -                                  |
|                                                                      | 3 Meter Semi-Anechoic Chamber Site "E" (1GHz – 6GHz)                                                                                                                                                                                       | -                                  |
|                                                                      | Mains Conducted Emissions Test Site "E"                                                                                                                                                                                                    | -                                  |
|                                                                      | Telecom Conducted Emissions Test Site "E"                                                                                                                                                                                                  | -                                  |
| Korea                                                                | Ministry of Information and Communication's Radio<br>Research Laboratory (RRL) under the Asia Pacific<br>Economic Cooperation (APEC) Mutual Recognition<br>Arrangement (A copy of the Scope Of Accreditation is<br>available upon request) | US0036                             |
| Taiwan                                                               | Bureau Of Standards, Metrology and Inspection (BSMI)                                                                                                                                                                                       | Reference Number:<br>SL2-IN-E-1024 |
| Australia / New Zealand                                              | Australian Communications Authority (AUSTEL)                                                                                                                                                                                               | *                                  |

\*These agencies do not issue an identifying number to test labs.


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**GENERAL REPORT SUMMARY (CONTINUED)**

Device Tested: In Home Gateway  
 Model: BDG-A100  
 S/N: N/A

Product Description: The In-home Gateway is part of an energy management system for residential consumers. The product connects to a Zigbee enabled Smart Energy Meter and Bidgely's cloud using a wired Ethernet connection. The product collects data from the Smart Energy Meter and sends it to the cloud.

Modifications: The EUT was not modified during the testing.

Manufacturer: Bidgely, Inc.  
 298 S. Sunnyvale Ave, Ste 205  
 Sunnyvale, CA 94086

Test Date(s): April 1, and 3, 2015

Test Specifications: EMI requirements  
 Limits: FCC Title 47, Part 15 Subpart C  
 Test Procedure: ANSI C63.4: 2009

Test Deviations: The test procedure was not deviated from during the testing.

**SUMMARY OF TEST RESULTS**

| TEST | DESCRIPTION                                                                           | FCC STANDARD          | IC STANDARD                                         | REMARKS   | RESULTS     |
|------|---------------------------------------------------------------------------------------|-----------------------|-----------------------------------------------------|-----------|-------------|
| 7.1  | Radiated Emissions (General Requirements and Emissions in Restricted Frequency Bands) | 15.209, 15.247        | RSS-GEN Issue 4, [6.1]<br>RSS 210 Issue 8[A2.6]     | Radiated  | <b>PASS</b> |
| 7.2  | Conducted Emissions                                                                   | 15.207(a)             | IC RSS-GEN Issue 4 [7.2.4]                          | Conducted | <b>N/A*</b> |
| 7.3  | Occupied Bandwidth                                                                    | 15.247(a)(2)          | RSS 210 Issue 8, [A8.2] IC<br>RSS-GEN Issue 4 [4.6] | Conducted | <b>N/A*</b> |
| 7.4  | Maximum Peak Output Power                                                             | 15.247 (b)            | RSS 210 Issue 8, [A8.4]                             | Conducted | <b>N/A*</b> |
| 7.5  | Maximum Peak Power Spectral Density                                                   | 15.247(e)             | RSS 210 Issue 8, [A8.2]                             | Conducted | <b>N/A*</b> |
| 7.6  | Emissions in Non-Restricted Frequency Bands                                           | 15.247(d)             | RSS 210 Issue 8, [A8.5]                             | Conducted | <b>N/A*</b> |
| 7.7  | Bandedge                                                                              | 15.247(d)             | RSS 210 Issue 8, [A8.5]                             | Conducted | <b>N/A*</b> |
| 7.8  | Antenna Requirement                                                                   | 15.203, 15.247(b)(4)) | IC RSS-GEN Issue 4 [7.1.2]                          | N/A       | <b>PASS</b> |

\*These tests are not applicable because the permissive change in the antenna does not affect the results


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**TECHNICAL DESCRIPTION OF THE EUT**

|                                |                                                    |                |                        |
|--------------------------------|----------------------------------------------------|----------------|------------------------|
| <b>Manufacturer:</b>           | Bidgley, Inc.                                      |                |                        |
| <b>Manufacturer Address:</b>   | 298 S. Sunnyvale Ave, Ste 205, Sunnyvale, CA 94086 |                |                        |
| <b>EUT Name:</b>               | In Home Gateway                                    |                |                        |
| <b>Model No:</b>               | BDG-A100                                           |                |                        |
| <b>Operation frequency:</b>    | 2405 MHz to 2480 MHz                               |                |                        |
| <b>Channel Number:</b>         | 16                                                 |                |                        |
| <b>Modulation Technology:</b>  | DSSS                                               |                |                        |
| <b>Antenna Type:</b>           | Dipole Antenna                                     |                |                        |
| <b>Antenna Gain:</b>           | 2.1 dB                                             |                |                        |
| <b>Maximum Output Power:</b>   | 17.48 dBm                                          |                |                        |
| <b>Description of Channel:</b> |                                                    |                |                        |
| <b>Zigbee</b>                  |                                                    |                |                        |
| <b>Channel</b>                 | <b>Frequency (MHz)</b>                             | <b>Channel</b> | <b>Frequency (MHz)</b> |
| 11                             | 2405                                               | 19             | 2445                   |
| 12                             | 2410                                               | 20             | 2450                   |
| 13                             | 2415                                               | 21             | 2455                   |
| 14                             | 2420                                               | 22             | 2460                   |
| 15                             | 2425                                               | 23             | 2465                   |
| 16                             | 2430                                               | 24             | 2470                   |
| 17                             | 2435                                               | 25             | 2475                   |
| 18                             | 2440                                               | 26             | 2480                   |

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## **1. PURPOSE**

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the In Home Gateway Model: BDG-A100. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4: 2009. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the specification limits defined in FCC Title 47, Part 15, Subpart C.

## **2. ADMINISTRATIVE DATA**

### **2.1 Location of Testing**

The EMI tests described herein were performed at the test facility of Electro Magnetic Test, Inc., 1547 Plymouth Street, Mountain View, California, 94043.

### **2.2 Traceability Statement**

The calibration certificates of all test equipment used during the test are on file at the location of the test. The measurement results in this report and the calibration of the test equipment are traceable to the National Institute of Standards and Technology (NIST).

### **2.3 Cognizant Personnel**

#### Bidgely, Inc.

Sheetanshu Pandey

VP of Engineering

#### Electro Magnetic Test, Inc.

David Vivanco

Test Technician

George Hsu

Test Technician

Kevin Bothmann

Lab Manager

### **2.4 Date Test Sample was Received**

The test sample was received on June 16, 2014.

### **2.5 Disposition of the Test Sample**

The test sample has not yet been returned to Bidgely, Inc..

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## 2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

|       |                                                       |
|-------|-------------------------------------------------------|
| RF    | Radio Frequency                                       |
| EMI   | Electromagnetic Interference                          |
| EUT   | Equipment Under Test                                  |
| P/N   | Part Number                                           |
| S/N   | Serial Number                                         |
| HP    | Hewlett Packard                                       |
| ITE   | Information Technology Equipment                      |
| CML   | Corrected Meter Limit                                 |
| LISN  | Line Impedance Stabilization Network                  |
| CISPR | International Special Committee On Radio Interference |
| FCC   | Federal Communications Commission                     |

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### 3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this EMI Test Report.

| SPEC                                | TITLE                                                                                                                                 |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| FCC Title 47,<br>Part 15, Subpart C | FCC Rules - Radio frequency devices (including digital devices).                                                                      |
| RSS 210, Issue 8,<br>December 2010  | Licence-exempt Radio Apparatus (All Frequency Bands): Category 1 Equipment                                                            |
| RSS-Gen Issue 4,<br>November 2014   | General Requirements and Information for the Certification of Radio Apparatus                                                         |
| ANSI C63.4<br>2009                  | Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz. |
| FCC Publication<br>KDB558074        | Guidance for Performing Compliance Measurements on Digital Transmissions Systems (DTS) Operating Under 15.247, June 5, 2014           |

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#### **4. DESCRIPTION OF TEST CONFIGURATION**

##### **4.1 Description of Test Configuration – EMI**

The In Home Gateway was connected to a remote network switch via its Ethernet port. The network switch was connected to a remote pc via its Ethernet port. During testing the Zigbee radio was continuously transmitting and the remote PC was pinging to the EUT.

It was determined that the emissions were at their highest level when the EUT was operating in the above configuration. The cables were moved to maximize the emissions. The final conducted as well as radiated data was taken in this mode of operation. All initial investigations were performed with the EMI receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the photographs in Appendix B.

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#### **4.1.1 Cable Construction and Termination**

##### Cables #1

This is a 50 foot unshielded Ethernet cable connecting the EUT to a Ethernet Switch. It has plastic RJ45 connectors on both ends of the cable

##### Cable #2

This is a 5 ft. unshielded power cable connecting the EUT to its AC power supply. It has a 1/4 inch round power connector on the EUT end and is hardwired into the AC power supply.


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**5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT**
**5.1 EUT and Accessory List**

| EQUIPMENT TYPE                                           | MANUFACTURER        | MODEL           | SERIAL NUMBER | FCC ID |
|----------------------------------------------------------|---------------------|-----------------|---------------|--------|
| IN HOME GATEWAY (EUT)                                    | BIDGLEY, INC.       | BDG-A100        | N/A           | N/A    |
| AC ADAPTER                                               | DVE                 | DSA-6PFE-05FUS  | N/A           | DoC    |
| <b>THE FOLLOWING WERE LOCATED OUTSIDE THE TEST SITE:</b> |                     |                 |               |        |
| REMOTE ETHERNET SWITCH                                   | NETGEAR             | GS108Tv2        | 29SA375E0105A | DoC    |
| REMOTE ETHERNET SWITCH POWER SUPPLY                      | NETGEAR             | MT12-Y120100-A1 | N/A           | DoC    |
| REMOTE LAPTOP COMPUTER                                   | MARASST TECHNOLOGY  | ATM2810         | N/A           | DoC    |
| REMOTE LAPTOP POWER SUPPLY                               | ASIAN POWER DEVICES | NB-90B19        | N/A           | DoC    |


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**5.2 EMI Test Equipment**

| EQUIPMENT TYPE         | MANUFACTURER    | MODEL NUMBER | SERIAL NUMBER | CAL. DATE         | CAL. CYCLE |
|------------------------|-----------------|--------------|---------------|-------------------|------------|
| Spectrum Analyzer      | Hewlett Packard | 8566B        | 3013A07296    | August 21, 2014   | 1 Year     |
| RF Preselector         | Hewlett Packard | 85685A       | 3010A01157    | August 21, 2014   | 1 Year     |
| Quasi-Peak Adapter     | Hewlett Packard | 85650A       | 2430A00451    | August 21, 2014   | 1 Year     |
| Radiated EMI Software  | Sector Design   | N/A          | Ver.1.4.6     | N/A               | N/A        |
| Conducted EMI Software | Hewlett Packard | 85869PC      | Ver. A.02.03  | N/A               | N/A        |
| Preamplifier           | Com Power       | PA-102       | 1482          | March 4, 2015     | 1 Year     |
| RF Attenuator          | Mini-Circuits   | CAT-10       | Asset #1000   | December 11, 2014 | 1 Year     |
| LISN                   | Com Power       | LI-200       | 12012         | October 1, 2014   | 1 Year     |
| LISN                   | Com Power       | LI-200       | 12214         | October 1, 2014   | 1 Year     |
| LISN                   | Com Power       | LI-200       | 1767          | October 1, 2014   | 1 Year     |
| LISN                   | Com Power       | LI-200       | 1768          | October 1, 2014   | 1 Year     |
| Biconical Antenna      | Com Power       | AB-100       | 01557         | July 9, 2014      | 1 Year     |
| Log Periodic Antenna   | Com Power       | AL-100       | 16001         | July 9, 2014      | 1 Year     |
| Horn Antenna           | Com Power       | AHA-118      | 711054        | N/A               | N/A        |
| Antenna Mast           | Com Power       | AM-400       | N/A           | N/A               | N/A        |
| Turntable              | Com Power       | TT-100       | N/A           | N/A               | N/A        |
| Computer               | Dell, Inc.      | DHS          | DNSV641       | N/A               | N/A        |
| Printer                | Hewlett Packard | C8124A       | CN39A220ZD    | N/A               | N/A        |


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**5.2 EMI Test Equipment (Continued)**

| <b>EQUIPMENT TYPE</b>                    | <b>MANUFACTURER</b> | <b>MODEL NUMBER</b> | <b>SERIAL NUMBER</b> | <b>CAL. DATE</b>  | <b>CAL. CYCLE</b> |
|------------------------------------------|---------------------|---------------------|----------------------|-------------------|-------------------|
| EMI Receiver                             | Rohde & Schwarz     | ESU40               | 100127               | January 16, 2015  | January 16, 2015  |
| EMI Test Software                        | Rohde & Schwarz     | EMC32               | V8.40.0              | N/A               | N/A               |
| Passive Loop Antenna<br>(9 KHz – 30 MHz) | ETS-Lindgren        | 6512                | 00128210             | October, 28, 2014 | 4 Years           |
| BiConiLog Antenna<br>(30 MHz – 1 GHz)    | ETS-Lindgren        | 3142D               | 00109337             | July 24, 2014     | 1 Year            |
| Horn Antenna<br>(1 GHz – 18 GHz)         | ETS-Lindgren        | 3117                | 00109294             | July 24, 2014     | 1 Year            |
| Preamplifier<br>(1 GHz – 18 GHz)         | Rohde & Schwarz     | TS-PR18             | 100056               | July 24, 2014     | 1 Year            |
| Horn Antenna<br>(18 GHz – 26.5 GHz)      | ETS-Lindgren        | 3160-09             | 102646               | June 17, 2014     | 1 Year            |
| Preamplifier<br>(18 GHz – 26.5 GHz)      | Rohde & Schwarz     | TS-PR26             | 100034               | June 17, 2014     | 1 Year            |
| Antenna Mast                             | ETS-Lindgren        | 2175                | 00095727             | N/A               | N/A               |
| Turntable                                | ETS-Lindgren        | 2187-3.0            | 00118231             | N/A               | N/A               |
| Computer                                 | Dell, Inc.          | OPTIPLEX<br>745     | 4T50WC1              | N/A               | N/A               |
| Multi-Function<br>Controller             | ETS-Lindgren        | 2090                | 00102270             | N/A               | N/A               |

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## **6. TEST SITE DESCRIPTION**

### **6.1 Test Facility Description**

Please refer to the table below and section 7 of this report for the details of which sites were used for testing. All sites are located at 1547 Plymouth Street, Mountain View, California 94043.

| Site Used For Test | Site Description                          |
|--------------------|-------------------------------------------|
|                    | Open Field Test Site "A"                  |
|                    | Mains Conducted Emissions Test Site "A"   |
|                    | Telecom Conducted Emissions Test Site "A" |
| X                  | 3 Meter Semi-Anechoic Chamber Site "E"    |
|                    | Mains Conducted Emissions Test Site "E"   |
|                    | Telecom Conducted Emissions Test Site "E" |

### **6.2 EUT Mounting, Bonding and Grounding**

The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

The EUT was not grounded.

### **6.3 Facility Environmental Characteristics**

All tests were performed in a climate controlled building. The temperature was 22° C, humidity 45%, and barometric pressure 102.6 kPa.


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## 7. TEST PROCEDURES

### 7.1 Radiated Emissions Test – Semi-Anechoic Chamber

#### 7.1.1 General Requirements Limit (FCC PART 15 Section 15.209(a)(1), IC-RSS-GEN Issue 4, [6.1])

| Frequency of Emission<br>(MHz) | Field Strength  |                          | Measurement Distance<br>(Meters) |
|--------------------------------|-----------------|--------------------------|----------------------------------|
|                                | $\mu\text{V/m}$ | $\text{dB}\mu\text{V/m}$ |                                  |
| 0.009-0.49                     | 2400/F(kHz)     |                          | 300                              |
| 0.49-1.705                     | 24000/F(kHz)    |                          | 30                               |
| 1.705-30                       | 30              |                          | 30                               |
| 30-88                          | 100             | 40                       | 3                                |
| 88-216                         | 150             | 43.5                     | 3                                |
| 216-960                        | 200             | 46                       | 3                                |
| Above 960                      | 500             | 54                       | 3                                |

#### 7.1.2 Emissions in Restricted Bands Limit (FCC PART 15 Section 15.247(d), RSS 210 Issue 8[A2.6])

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

| Limit                                         |
|-----------------------------------------------|
| See General Limits Requirement In Above Chart |

#### 7.1.3 Test Procedure

The Rohde & Schwarz ESU40 EMI receiver was used as a measuring meter while under software control by the Rohde & Schwarz EMC32 software. To increase the sensitivity of the instrument, the built in preamplifier was used from 9 KHz to 1 GHz and an external

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preamplifier was used from 1 GHz to 26.5 GHz. The EMI receiver was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the EMI receiver records the highest measured reading over all the sweeps. The built in quasi-peak or average detector was used only for those readings which are marked accordingly on the data sheets. The effective measurement bandwidth used for the radiated emissions test was 100 kHz from 9 kHz to 26.5 GHz.

The Loop Antenna, Broadband BiConiLog and horn antennas were used as transducers during the measurement. The Loop antenna was used from 9 KHz to 30 MHz, the BiConiLog antenna was used from 30 MHz to 1000 MHz and horn antennas were used from 1GHz – 26.5 GHz. The frequency spans were wide (9 kHz to 150 kHz, 150 kHz to 30 MHz, 30 MHz to 88 MHz, 88 MHz to 216 MHz, 216 to 300 MHz, 300 MHz to 1 GHz, 1 GHz to 18 GHz and 18 GHz to 26.5 GHz) during preliminary investigations. The final data was taken with a frequency span of 1 MHz. Furthermore, the frequency span was reduced during the preliminary investigations as deemed necessary.

The 5 meter semi-anechoic chamber of Electro Magnetic Test, Inc. was used for radiated emission testing. This test site is set up according to ANSI C63.4: 2009. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. The EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength).

The presence of non EUT signals was verified by turning the EUT off. In case a non EUT signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the other signal does not hide any emissions from the EUT. The EUT was tested at a 3 meter test distance from 9 kHz to 26.5 GHz. to obtain final test data.

Calculation Of Radiated Emission Test Data:

Amplitude - Gain + Antenna Factor + Cable Loss = Corrected Amplitude

Corrected Amplitude - Limit = Margin


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## 7.2 Conducted Emissions Test – Mains Ports

### 7.2.1 Limit (FCC PART 15 Section 15.207(a), IC RSS-GEN Issue 4 [7.2.4])

| Frequency of Emission (MHz) | Conducted Limit (dBμV) |            |
|-----------------------------|------------------------|------------|
|                             | Quasi-peak             | Average    |
| 0.15-0.5                    | 66 to 56 *             | 56 to 46 * |
| 0.5-5                       | 56                     | 46         |
| 5-30                        | 60                     | 50         |

\*Note: Decreases with the logarithm of the frequency

### 7.2.2 Test Procedure

The HP 8566B spectrum analyzer was used as a measuring meter along with the HP 85650A quasi-peak adapter. The data was collected with the spectrum analyzer in the peak detect mode with the "Max Hold" feature activated. The quasi-peak detector was used only where indicated in the data sheets. A 10 dB attenuation pad was used for the protection of the spectrum analyzer input stage, and the spectrum analyzer offset was adjusted accordingly to read the actual data measured. The LISN output was read by the HP 8566B spectrum analyzer. The output of the second LISN was terminated by a 50 ohm termination. The effective measurement bandwidth used for the conducted emissions test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The EUT was powered through the LISN, which was bonded to the ground plane. The LISN power was filtered and the filter was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI C63.4: 2009. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The initial test data was taken in manual mode while scanning the frequency ranges of 0.15 MHz to 1.6 MHz, 1.6 MHz to 5 MHz and 5 MHz to 30 MHz. The conducted emissions from the EUT were maximized for operating mode as well as cable and peripheral placement. Once a predominant frequency (within 12 dB of the limit) was found, it was more closely examined with the spectrum analyzer span adjusted to 1 MHz.

The final data was collected under program control by the HP 85869PC software in several overlapping sweeps by running the spectrum analyzer at a minimum scan rate of 10 seconds per octave.

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### 7.3 Occupied Bandwidth

#### 7.3.1 Limit (FCC PART 15 Section 15.247(a)(2), IC-RSS 210 Issue 8, [A8.2], IC RSS-GEN Issue 4 [4.6])

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz

| Limit                         |
|-------------------------------|
| 6 dB Bandwidth $\geq$ 500 kHz |

#### 7.3.2 Test Procedure

Connect the antenna port of the EUT to the spectrum analyzer via an Attenuator, set the Spectrum Analyzer as below:

RBW: 100 kHz

VBW:  $\geq 3 \times$  RBW

Detector: Peak

Trace Mode: Max Hold

- (1) When the trace is completed, mark the peak value
- (2) Measure the 6db bandwidth using Xdb down function, If this does not encompass the full bandwidth, then “Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission”

#### 7.3.3 Test Result

The EUT meets the requirements. Please see the datasheets in Appendix A for the measurement results.

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## **7.4 Maximum Peak Output Power**

### **7.4.1 Limit (FCC PART 15 Section 15.247(b)(3), IC-RSS 210 Issue 8, [A8.4])**

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

| Limit                                                                 |
|-----------------------------------------------------------------------|
| Maximum Peak Output Power (Digital Modulation) $\leq$ 1Watt or 30 dBm |

### **7.4.2 Test Procedure**

Connect the antenna port of the EUT to the spectrum analyzer via an Attenuator and set the Spectrum Analyzer as below:

RBW > DTS Bandwidth

VBW  $\geq$  3 x RBW

Span  $\geq$  3 \* RBW

Detector: Peak

Trace Mode: Max Hold

- (1) When the trace is completed, mark the peak value

### **7.4.3 Test Result**

The EUT meets the requirements. Please see the datasheets in Appendix A for the measurement results.

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## **7.5 Maximum Peak Power Spectral Density**

### **7.5.1 Limit (FCC PART 15 Section 15.247(e), IC-RSS 210 Issue 8, [A8.2])**

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density

| Limit |
|-------|
| 8 dBm |

### **7.5.2 Test Procedure**

Connect the antenna port of the EUT to the spectrum analyzer via an Attenuator and set the Spectrum Analyzer as below:

$3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$

$\text{VBW} \geq 3 \times \text{RBW}$

$\text{Span} \geq 1.5 \times \text{DTS Bandwidth}$

Detector: Peak

Sweep Time auto

(1) Use Peak Marker Function

(2) If value Exceeds limit, reduce RBW ( no less than 3 kHz)

### **7.5.3 Test Result**

The EUT meets the requirements. Please see the datasheets in Appendix A for the measurement results.


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## 7.6 Emissions in Non-Restricted Frequency Bands

### 7.6.1 Limit (FCC PART 15 Section 15.247(d), IC-RSS 210 Issue 8, [A8.5])

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

| Limit                                     |
|-------------------------------------------|
| 20db Below Peak Power Spectral Density    |
| 30db Below Average Power Spectral Density |

### 7.6.2 Test Procedure

(1) Connect the antenna port of the EUT to the spectrum analyzer via an Attenuator, set the Spectrum Analyzer as below:

RBW: 100 KHz  
 VBW:  $\geq 3 \times$  RBW  
 Detector: Peak  
 Trace Mode: Max Hold  
 Span  $\geq 1.5$  DTS Bandwidth

(2) Set Frequency Span to DTS Channel Center Frequency

(3) Use Peak Marker Function, This is your reference PSD

RBW: 100 KHz  
 VBW:  $\geq 3 \times$  RBW  
 Detector: Peak  
 Trace Mode: Max Hold

(4) Set Span to encompass frequency range

(5) Report 3 highest emissions

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**7.6.3****Test Result**

The EUT meets the requirements. Please see the datasheets in Appendix A for the measurement results.


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**7.7 Bandedge**
**7.7.1 Limit (FCC PART 15 Section 15.247(d), IC-RSS 210 Issue 8, [A8.5] )**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

| Limit                                     |
|-------------------------------------------|
| 20db Below Peak Power Spectral Density    |
| 30db Below Average Power Spectral Density |

**7.7.2 Test Procedure**

(1) Connect the antenna port of the EUT to the spectrum analyzer via an Attenuator, set the Spectrum Analyzer as below:

RBW: 100 KHz  
 VBW:  $\geq 3 \times$  RBW  
 Detector: Peak  
 Trace Mode: Max Hold  
 Span  $\geq 1.5$  DTS Bandwidth

(2) Set Frequency Span to DTS Channel Center Frequency

(3) Use Peak Marker Function, This is your reference PSD

RBW: 100 KHz  
 VBW:  $\geq 3 \times$  RBW  
 Detector: Peak  
 Trace Mode: Max Hold

(4) Set Span to encompass the bandedge

(5) Report 3 highest emissions

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**7.7.3****Test Result**

The EUT meets the requirements. Please see the datasheets in Appendix A for the measurement results.

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## **7.8 Antenna Requirement**

### **7.8.1 Requirement (FCC PART 15 SECTION 15.203,15.247(b)(4), IC RSS-GEN Issue 4 [7.1.2])**

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **7.8.2 Test Result**

The antenna is integrated on the main PCB with no consideration for replacement on the In Home Gateway.

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**8. CONCLUSIONS / COMPLIANCE STATEMENT**

Based upon the results contained in this report, Electro Magnetic Test, Inc. has determined that the In Home Gateway, Model: BDG-A100 meets all of the specification limits defined in FCC Title 47, Part 15, Subpart C.



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## **APPENDIX A**

# ***RADIATED AND CONDUCTED DATA SHEETS***

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**Radiated Emissions**

|                |                 |              |                 |
|----------------|-----------------|--------------|-----------------|
| EUT:           | In Home Gateway | Model Name:  | BDG-A100        |
| Test Mode:     | Zigbee          | Test Date:   | 4/2/2015        |
| Test Engineer: | George Hsu      | Measurement: | 9 KHz to 30 MHz |

The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators were attenuated more than 20 dB below the permissible value



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## **Radiated Emissions**

|                |                 |              |                 |
|----------------|-----------------|--------------|-----------------|
| EUT:           | In Home Gateway | Model Name:  | BDG-A100        |
| Test Mode:     | Zigbee          | Test Date:   | 4/1/15          |
| Test Engineer: | George Hsu      | Measurement: | 30 MHz to 1 GHz |

### **Peak Measurement:**

| Frequency (MHz) | MaxPeak (dBμV/m) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------|-------------|----------------|
| 37.350000       | 32.1             | 100.0       | Vertical     | 257.0         | 15.0       | 7.90        | 40.00          |
| 58.710000       | 36.3             | 212.0       | Vertical     | 323.0         | 8.0        | 3.70        | 40.00          |
| 60.210000       | 34.1             | 135.0       | Vertical     | 23.0          | 8.0        | 5.90        | 40.00          |
| 73.950000       | 34.7             | 127.0       | Vertical     | 352.0         | 8.2        | 5.30        | 40.00          |
| 77.190000       | 35.1             | 135.0       | Vertical     | 316.0         | 8.0        | 4.90        | 40.00          |
| 180.000000      | 41.6             | 100.0       | Vertical     | 336.0         | 12.0       | 1.90        | 43.50          |
| 300.000000      | 39.1             | 100.0       | Vertical     | 3.0           | 14.9       | 6.90        | 46.00          |
| 360.030000      | 42.9             | 100.0       | Horizontal   | 288.0         | 16.7       | 3.10        | 46.00          |
| 360.030000      | 41.2             | 200.0       | Vertical     | 332.0         | 16.7       | 4.80        | 46.00          |
| 720.060000      | 43.0             | 113.0       | Horizontal   | 209.0         | 24.0       | 3.00        | 46.00          |
| 720.060000      | 39.8             | 207.0       | Vertical     | 0.0           | 24.0       | 6.20        | 46.00          |

### **Quasipeak Measurement:**

| Frequency (MHz) | QuasiPeak (dBμV/m) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) |
|-----------------|--------------------|-------------|--------------|---------------|------------|-------------|----------------|
| 37.350000       | 26.6               | 100.0       | Vertical     | 257.0         | 15.0       | 13.40       | 40.00          |
| 58.710000       | 32.3               | 212.0       | Vertical     | 323.0         | 8.0        | 7.70        | 40.00          |
| 60.210000       | 32.5               | 135.0       | Vertical     | 23.0          | 8.0        | 7.50        | 40.00          |
| 73.950000       | 30.5               | 127.0       | Vertical     | 352.0         | 8.2        | 9.50        | 40.00          |
| 77.190000       | 31.8               | 135.0       | Vertical     | 316.0         | 8.0        | 8.20        | 40.00          |
| 180.000000      | 41.0               | 100.0       | Vertical     | 336.0         | 12.0       | 2.50        | 43.50          |
| 300.000000      | 38.2               | 100.0       | Vertical     | 3.0           | 14.9       | 7.80        | 46.00          |
| 360.030000      | 42.3               | 100.0       | Horizontal   | 288.0         | 16.7       | 3.70        | 46.00          |
| 360.030000      | 40.5               | 200.0       | Vertical     | 332.0         | 16.7       | 5.50        | 46.00          |
| 720.060000      | 41.7               | 113.0       | Horizontal   | 209.0         | 24.0       | 4.30        | 46.00          |
| 720.060000      | 38.0               | 207.0       | Vertical     | 0.0           | 24.0       | 8.00        | 46.00          |


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**Radiated Emissions**

|                |                    |              |                 |
|----------------|--------------------|--------------|-----------------|
| EUT:           | In Home Gateway    | Model Name:  | BDG-A100        |
| Test Mode:     | Zigbee, Channel 11 | Test Date:   | 4/1/15          |
| Test Engineer: | George Hsu         | Measurement: | 1 GHz to 18 GHz |

**Peak Measurement:**

| Frequency (MHz) | MaxPeak (dBμV/m) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------|-------------|----------------|
| 4809.440000     | 47.1             | 137.0       | Horizontal   | 73.0          | 6.6        | 26.90       | 74.00          |
| 4809.440000     | 51.0             | 110.0       | Vertical     | 69.0          | 6.6        | 23.00       | 74.00          |

**Average Measurement:**

| Frequency (MHz) | Average (dBμV/m) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------|-------------|----------------|
| 4809.440000     | 39.9             | 137.0       | Horizontal   | 73.0          | 6.6        | 14.10       | 54.00          |
| 4809.440000     | 46.8             | 110.0       | Vertical     | 69.0          | 6.6        | 7.20        | 54.00          |



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## **Radiated Emissions**

|                |                    |              |                 |
|----------------|--------------------|--------------|-----------------|
| EUT:           | In Home Gateway    | Model Name:  | BDG-A100        |
| Test Mode:     | Zigbee, Channel 18 | Test Date:   | 4/3/15          |
| Test Engineer: | George Hsu         | Measurement: | 1 GHz to 18 GHz |

### **Peak Measurement:**

| Frequency (MHz) | MaxPeak (dBμV/m) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------|-------------|----------------|
| 4879.866667     | 51.8             | 100.0       | Vertical     | 72.0          | 6.5        | 22.20       | 74.00          |
| 4879.866667     | 47.5             | 164.0       | Horizontal   | 267.0         | 6.5        | 26.50       | 74.00          |
| 7319.973333     | 52.7             | 100.0       | Vertical     | 122.0         | 11.8       | 21.30       | 74.00          |
| 7319.973333     | 52.7             | 128.0       | Horizontal   | 9.0           | 11.8       | 21.30       | 74.00          |
| 10929.973333    | 49.5             | 397.0       | Vertical     | 110.0         | 17.4       | 24.50       | 74.00          |
| 10929.973333    | 50.7             | 114.0       | Horizontal   | 233.0         | 17.4       | 23.30       | 74.00          |
| 15754.453333    | 57.4             | 379.0       | Horizontal   | 12.0          | 25.8       | 17.40       | 74.00          |
| 15759.520000    | 57.8             | 264.0       | Vertical     | 1.0           | 25.8       | 17.80       | 74.00          |

### **Average Measurement:**

| Frequency (MHz) | Average (dBμV/m) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------|-------------|----------------|
| 4879.866667     | 48.1             | 100.0       | Vertical     | 72.0          | 6.5        | 5.90        | 54.00          |
| 4879.866667     | 41.0             | 164.0       | Horizontal   | 267.0         | 6.5        | 13.00       | 54.00          |
| 7319.973333     | 46.3             | 100.0       | Vertical     | 122.0         | 11.8       | 7.70        | 54.00          |
| 7319.973333     | 46.7             | 128.0       | Horizontal   | 9.0           | 11.8       | 7.30        | 54.00          |
| 10929.973333    | 36.3             | 397.0       | Vertical     | 110.0         | 17.4       | 17.70       | 54.00          |
| 10929.973333    | 36.3             | 114.0       | Horizontal   | 233.0         | 17.4       | 17.70       | 54.00          |
| 15754.453333    | 44.3             | 379.0       | Horizontal   | 12.0          | 25.8       | 9.70        | 54.00          |
| 15759.520000    | 44.3             | 264.0       | Vertical     | 1.0           | 25.8       | 9.70        | 54.00          |


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**Radiated Emissions**

|                |                    |              |                 |
|----------------|--------------------|--------------|-----------------|
| EUT:           | In Home Gateway    | Model Name:  | BDG-A100        |
| Test Mode:     | Zigbee, Channel 26 | Test Date:   | 4/3/15          |
| Test Engineer: | George Hsu         | Measurement: | 1 GHz to 18 GHz |

**Peak Measurement:**

| Frequency (MHz) | MaxPeak (dBμV/m) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------|-------------|----------------|
| 4959.413333     | 46.6             | 167.0       | Horizontal   | 87.0          | 6.6        | 27.40       | 74.00          |
| 4959.413333     | 48.1             | 119.0       | Vertical     | 112.0         | 6.6        | 25.90       | 74.00          |
| 7439.040000     | 47.7             | 173.0       | Vertical     | 267.0         | 11.5       | 26.30       | 74.00          |
| 7439.546667     | 50.2             | 100.0       | Horizontal   | 130.0         | 11.5       | 23.80       | 74.00          |
| 11627.146667    | 49.9             | 248.0       | Vertical     | 167.0         | 18.5       | 24.10       | 74.00          |
| 11638.293333    | 50.0             | 393.0       | Horizontal   | 82.0          | 18.5       | 24.00       | 74.00          |
| 15502.133333    | 55.3             | 110.0       | Vertical     | 42.0          | 23.8       | 19.30       | 74.00          |
| 15905.440000    | 56.0             | 118.0       | Vertical     | 37.0          | 24.1       | 18.00       | 74.00          |
| 17839.386667    | 57.5             | 122.0       | Vertical     | 6.0           | 26.2       | 17.50       | 74.00          |

**Average Measurement:**

| Frequency (MHz) | Average (dBμV/m) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) |
|-----------------|------------------|-------------|--------------|---------------|------------|-------------|----------------|
| 4959.413333     | 38.6             | 167.0       | Horizontal   | 87.0          | 6.6        | 15.40       | 54.00          |
| 4959.413333     | 42.1             | 119.0       | Vertical     | 112.0         | 6.6        | 11.90       | 54.00          |
| 7439.040000     | 34.9             | 173.0       | Vertical     | 267.0         | 11.5       | 19.10       | 54.00          |
| 7439.546667     | 41.3             | 100.0       | Horizontal   | 130.0         | 11.5       | 12.70       | 54.00          |
| 11627.146667    | 36.8             | 248.0       | Vertical     | 167.0         | 18.5       | 17.20       | 54.00          |
| 11638.293333    | 36.9             | 393.0       | Horizontal   | 82.0          | 18.5       | 17.10       | 54.00          |
| 15502.133333    | 42.0             | 110.0       | Vertical     | 42.0          | 23.8       | 12.00       | 54.00          |
| 15905.440000    | 42.6             | 118.0       | Vertical     | 37.0          | 24.1       | 11.40       | 54.00          |
| 17839.386667    | 44.4             | 122.0       | Vertical     | 6.0           | 26.2       | 9.60        | 54.00          |

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**Radiated Emissions**

|                |                 |              |                    |
|----------------|-----------------|--------------|--------------------|
| EUT:           | In Home Gateway | Model Name:  | BDG-A100           |
| Test Mode:     | Zigbee          | Test Date:   | 4/3/15             |
| Test Engineer: | George Hsu      | Measurement: | 18 GHz to 26.5 GHz |

The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators were attenuated more than 20 dB below the permissible value



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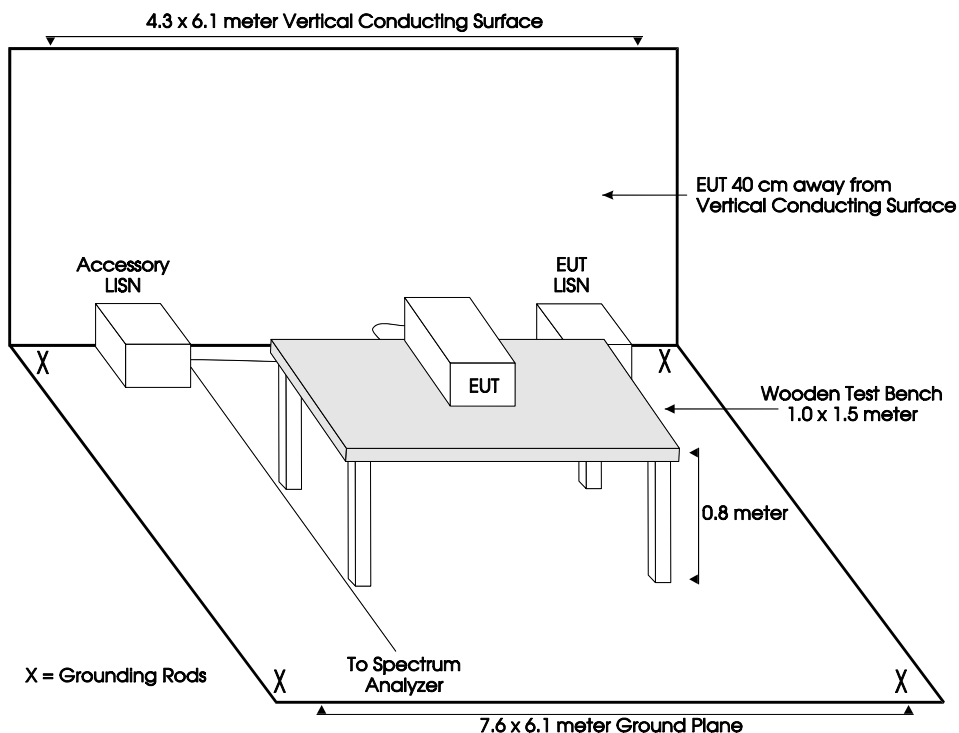
## **APPENDIX B**

### ***TEST SETUP DIAGRAMS***

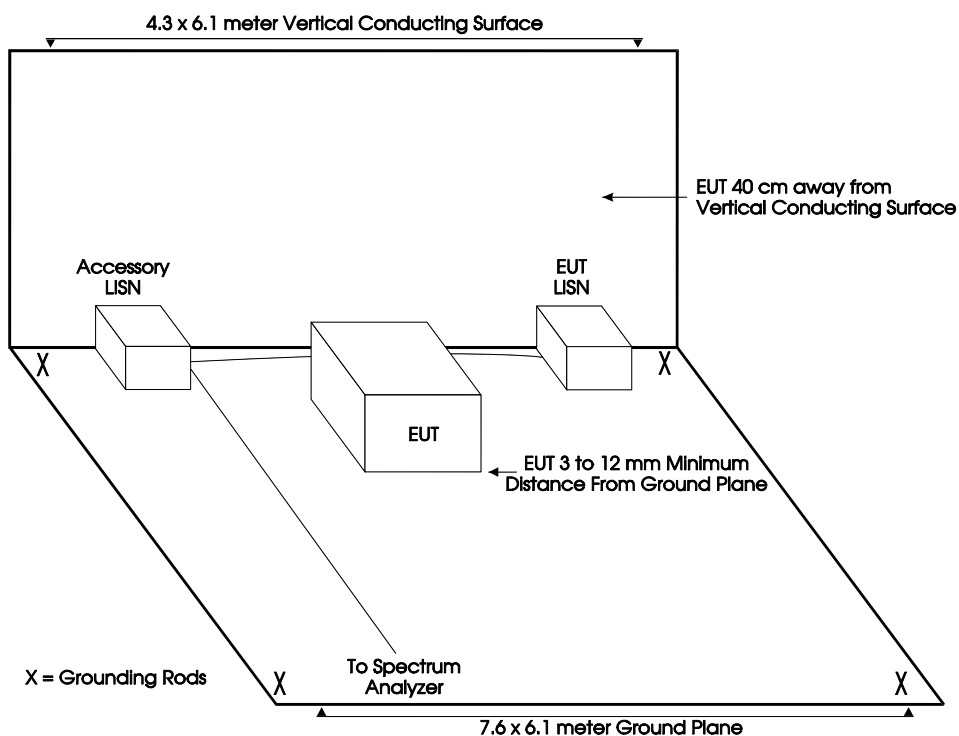


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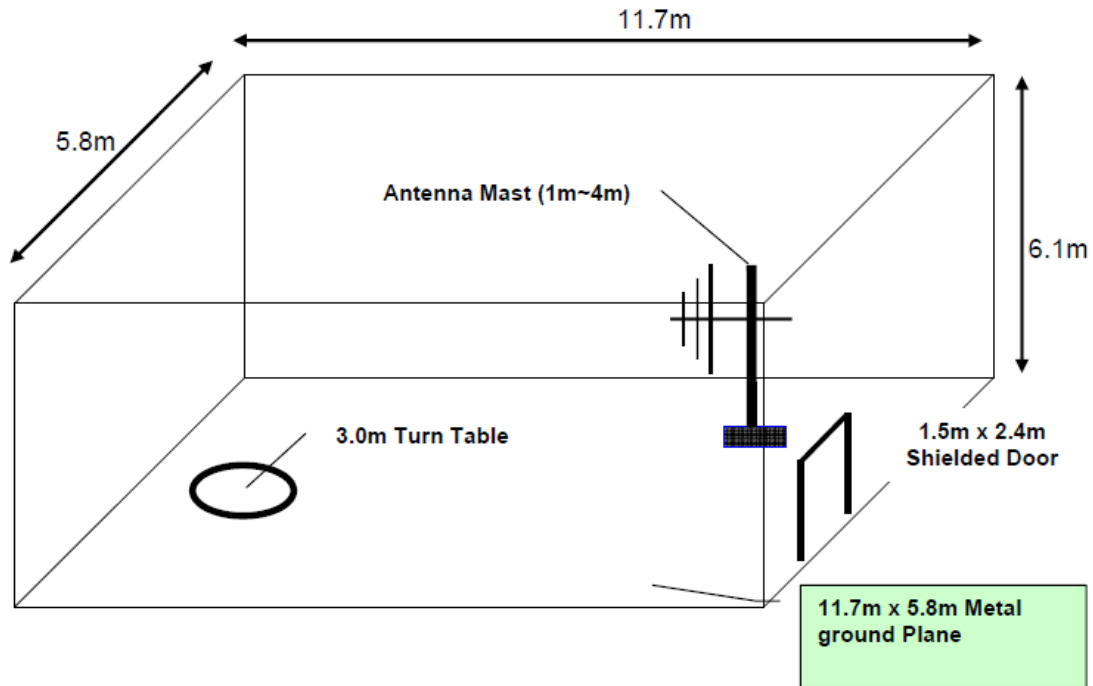
**FIGURE 1 – TABLETOP CONDUCTED EMISSIONS TEST SETUP – SITE “A”**



**FIGURE 1a – FLOORSTANDING CONDUCTED EMISSIONS TEST SETUP – SITE “A”**

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**FIGURE 3 - LAYOUT OF 5 METER SEMI-ANECHOIC CHAMBER**



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## **APPENDIX C**

### ***MODIFICATIONS TO THE EUT***

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## **MODIFICATIONS TO THE EUT**

No modifications were made to the EUT by Electro Magnetic Test, Inc. personnel during the testing.



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## **APPENDIX D**

### ***ADDITIONAL MODELS COVERED UNDER THIS REPORT***

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## **ADDITIONAL MODELS COVERED UNDER THIS REPORT**

There are no additional models to be covered under this report.