



# **Compliance Testing, LLC**

Previously Flom Test Lab

EMI, EMC, RF Testing Experts Since 1963

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## **Test Report**

**Prepared for: Ubiquiti Networks, Inc**

**Model: Bullet B-DB-AC,  
& Bullet AC-IP67**

**Description: Dual Band Networking Device**

**Serial Number: N/A**

**FCC ID: SWX-BDBAC  
IC: 6545A-BDBAC**

**To**

**FCC Part 15.247  
RSS 247, Issue 2**

**Date of Issue: February 1, 2018**

**On the behalf of the applicant:**

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Project No: p1790008**

**Poona Saber  
Project Test Engineer**

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All results contained herein relate only to the sample tested.



## Test Report Revision History

| Revision | Date                          | Revised By  | Reason for Revision                                                                                                                                                          |
|----------|-------------------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.0      | Dec 6, 2017                   | Poona Saber | Original Document                                                                                                                                                            |
| 2.0      | January 30, 2017              | Poona Saber | -Added annex D for DTS bandwidth plots<br>-Added tables for different antennas for 2.4 GHz Radio on Power and power spectral density<br>-Updated Annex A<br>-Updated Annex B |
| 3.0      | January 31, 2017              | Poona Saber | Updated Annex A, B and Annex C                                                                                                                                               |
| 4.0      | February 1, 2017              | Poona Saber | Updated Annex C                                                                                                                                                              |
| 5.0      | August 8 <sup>th</sup> , 2019 | Poona Saber | Added RSS requirements to table on page 8<br>Added Firmware and Software on page 6<br>Added Measurement Uncertainty<br>Added Bullet AC-IP67 model to the report              |



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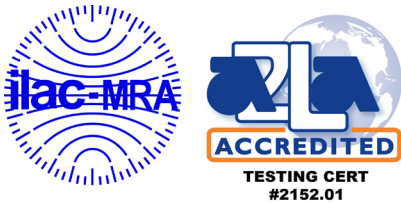
**ILAC / A2LA**

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.

Testing Certificate Number: **2152.01**



**FCC Site Reg. #349717**

**IC Site Reg. #2044A-2**

**Non-accredited tests contained in this report:**

**N/A**



**The applicant has been cautioned as to the following**

**15.21 - Information to User**

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**15.27(a) - Special Accessories**

Equipment marked to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.



## Standard Test Conditions Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.10-2013 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

| Environmental Conditions |              |                 |
|--------------------------|--------------|-----------------|
| Temperature (°C)         | Humidity (%) | Pressure (mbar) |
| 25.4 – 26.6              | 21.4 – 22.5  | 976.7 – 980.9   |

### EUT Operation during Tests

EUT is powered by POE (Power over Ethernet) Ethernet cable.

### EUT Description

**Model:** Bullet B-DB-AC & Bullet AC-IP67

**Description:** Dual Band Networking Device

**Firmware:** V8.6

**Software:** ART

**Serial Number:** NA

**Additional Information:** The Bullet AC (Model: B-DB-AC) is a dual band networking device that is powered over Ethernet (passive POE, 24V) and provides an N-type antenna connection. It features dual-band AC mode operation in 5GHz and 2.4GHz bands, and a dedicated 2.4 GHz WiFi management radio for convenient device setup.

Through this report for the 2.4GHz radio mode AC, Channels 10,20 and 40 MHz has been tested and for the 2.4 GHz Management unit mode N, 20 MHz bandwidth has been tested

Bullet AC-IP67 is electrically identical to B-dB-AC device and it incorporates an outdoor housing which is made of metal instead of plastic

### EUT Operation during Tests

Radio testing has been done conducted and radiated with controlling the device for continuous modulation transmission on low, middle and high channels with client's provided commands through telnet.

### Antenna List

| No. | Model      | Antenna Type | Peak Gain |
|-----|------------|--------------|-----------|
| 1   | UniFi Omni | Omni         | 4         |
| 1   | AMO-2G13   | Omni         | 13        |
| 1   | AM-V2G-Ti  | Sector       | 17        |
| 1   | RD-2G24    | Dish         | 24        |

Note: Management Radio only uses the Omni 4 dBi gain Antenna.



**Accessories:**

| Qty | Description                      | Manufacturer | Model       | S/N |
|-----|----------------------------------|--------------|-------------|-----|
| 1   | Switching mode power supply/ POE | Ubiquiti     | GP-A240-050 | N/A |

**Cables:**

| Qty | Description    | Length (M) | Shielding Y/N | Shielded Hood Y/N | Ferrite Y/N |
|-----|----------------|------------|---------------|-------------------|-------------|
| 2   | Ethernet cable | <3 meters  | N             | N                 | N           |

**Modifications:** None

**15.203: Antenna Requirement:**

- ☐ The antenna is permanently attached to the EUT
- ☐ The antenna uses a unique coupling
- ☒ The EUT must be professionally installed
- ☐ The antenna requirement does not apply



## Test Results Summary

| FCC 15.247 Specification        | IC Specification             | Test Name                          | Pass, Fail, N/A | Comments |
|---------------------------------|------------------------------|------------------------------------|-----------------|----------|
| 15.247(b)                       | RSS 247, 5.4 (d)             | Peak Output Power                  | Pass            |          |
| 15.247(d)                       | RSS 247, 5.5                 | Conducted Spurious Emissions       | Pass            |          |
| 15.247(d),<br>15.209(a), 15.205 | RSS 247, 5.5<br>RSS 247, 3.3 | Radiated Spurious Emissions        | Pass            |          |
| 15.247(d),<br>15.209(a), 15.205 | RSS 247, 5.5<br>RSS 247, 3.3 | Emissions At Band Edges            | Pass            |          |
| 15.247(a)(2)                    | RSS 247, 5.2                 | Occupied Bandwidth                 | Pass            |          |
| 15.247(e)                       | RSS 247, 5.2 (b)             | Transmitter Power Spectral Density | Pass            |          |
| 15.207                          | RSS GEN                      | A/C Powerline Conducted Emissions  | Pass            |          |

| References                | Description                                                                                                                       |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| CFR47, Part 15, Subpart B | Unintentional Radiators                                                                                                           |
| CFR47, Part 15, Subpart C | Intentional Radiators                                                                                                             |
| ANSI C63.10-2013          | American National standard for testing Unlicensed Wireless Devices                                                                |
| ANSI C63.4-2014           | Method and Measurements of Radio-Noise Emissions from low-Voltage Electrical and Electronic Equipment in the range 9kHz to 40GHz. |
| ISO/IEC 17025:2005        | General requirements for the Competence of Testing and Calibrations Laboratories                                                  |
| KDB 558074 D01 v04        | Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under §15.247                     |



## Peak Conducted Output Power

**Engineer:** Poona Saber

**Test Date:** 12/4/2017

### Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

RBW = 1MHz

VBW  $\geq 3 \times$  RBW

Detector= Peak

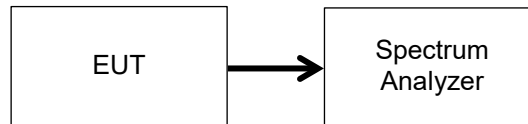
Trace = Max hold

Sweep = auto

The band/channel power measurement function of the device was used with band limits set equal to DTS bandwidth edges to measure the peak power.

The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level.

### Test Setup



### Transmitter Output Power (Management Radio)

| Tuned Frequency (MHz) | Mode | Bandwidth | Measured Value (dBm) | Specification Limit | Result |
|-----------------------|------|-----------|----------------------|---------------------|--------|
| 2412                  | N    | 20        | 6.7                  | 1 W (30 dBm)        | Pass   |
| 2437                  | N    | 20        | 18.71                | 1 W (30 dBm)        | Pass   |
| 2462                  | N    | 20        | 12.66                | 1 W (30 dBm)        | Pass   |



### Transmitter Output Power (2.4 GHz Radio)

Omni 4 dBi

ptmp

#### Conducted Power for 2.4 GHz

| Band Width | Mode | Frequency | Data Rate | TP | Port 1 | Limit | Margin |
|------------|------|-----------|-----------|----|--------|-------|--------|
| MHz        | ac   | MHz       |           |    | dBm    | dBm   | dB     |
| 10         | ac   | 2412      | MCS0      | 11 | 16.1   | 30    | -14.0  |
| 10         | ac   | 2437      | MCS0      | 18 | 23.4   | 30    | -6.6   |
| 10         | ac   | 2462      | MCS0      | 10 | 14.8   | 30    | -15.2  |
| 20         | ac   | 2412      | MCS0      | 12 | 16.9   | 30    | -13.2  |
| 20         | ac   | 2437      | MCS0      | 19 | 24.5   | 30    | -5.5   |
| 20         | ac   | 2462      | MCS0      | 13 | 17.5   | 30    | -12.5  |
| 40         | ac   | 2422      | MCS0      | 11 | 15.6   | 30    | -14.4  |
| 40         | ac   | 2437      | MCS0      | 16 | 20.2   | 30    | -9.8   |
| 40         | ac   | 2452      | MCS0      | 14 | 18.5   | 30    | -11.5  |

Omni 13 dBi

ptmp

| Band Width | Mode | Frequency | Data Rate | TP | Port 1 | Limit | Margin |
|------------|------|-----------|-----------|----|--------|-------|--------|
| MHz        | ac   | MHz       |           |    | dBm    | dBm   | dB     |
| 10         | ac   | 2412      | MCS0      | 11 | 9.05   | 23    | -14.0  |
| 10         | ac   | 2437      | MCS0      | 18 | 16.36  | 23    | -6.6   |
| 10         | ac   | 2462      | MCS0      | 10 | 7.79   | 23    | -15.2  |
| 20         | ac   | 2412      | MCS0      | 12 | 9.85   | 23    | -13.2  |
| 20         | ac   | 2437      | MCS0      | 19 | 17.48  | 23    | -5.5   |
| 20         | ac   | 2462      | MCS0      | 13 | 10.49  | 23    | -12.5  |
| 40         | ac   | 2422      | MCS0      | 11 | 8.64   | 23    | -14.4  |
| 40         | ac   | 2437      | MCS0      | 16 | 13.21  | 23    | -9.8   |
| 40         | ac   | 2452      | MCS0      | 14 | 11.49  | 23    | -11.5  |



Sector 17 dBi  
ptmp

| Band Width | Mode | Frequency | Data Rate | TP | Port 1 | Limit | Margin |
|------------|------|-----------|-----------|----|--------|-------|--------|
| MHz        | ac   | MHz       |           |    | dBm    | dBm   | dB     |
| 10         | ac   | 2412      | MCS0      | 9  | 3.05   | 17    | -14.0  |
| 10         | ac   | 2437      | MCS0      | 19 | 10.36  | 17    | -6.6   |
| 10         | ac   | 2462      | MCS0      | 19 | 1.79   | 17    | -15.2  |
| 20         | ac   | 2412      | MCS0      | 7  | 3.85   | 17    | -13.2  |
| 20         | ac   | 2437      | MCS0      | 19 | 11.48  | 17    | -5.5   |
| 20         | ac   | 2462      | MCS0      | 20 | 4.49   | 17    | -12.5  |
| 40         | ac   | 2422      | MCS0      | 5  | 2.64   | 17    | -14.4  |
| 40         | ac   | 2437      | MCS0      | 20 | 7.21   | 17    | -9.8   |
| 40         | ac   | 2452      | MCS0      | 20 | 5.49   | 17    | -11.5  |

Dish 24 dBi  
ptp

| Band Width | Mode | Frequency | Data Rate | TP | Port 1 | Limit | Margin |
|------------|------|-----------|-----------|----|--------|-------|--------|
| MHz        | ac   | MHz       |           |    | dBm    | dBm   | dB     |
| 10         | ac   | 2412      | MCS0      | 11 | 11.05  | 25    | -14.0  |
| 10         | ac   | 2437      | MCS0      | 18 | 18.36  | 25    | -6.6   |
| 10         | ac   | 2462      | MCS0      | 10 | 9.79   | 25    | -15.2  |
| 20         | ac   | 2412      | MCS0      | 12 | 11.85  | 25    | -13.2  |
| 20         | ac   | 2437      | MCS0      | 19 | 19.48  | 25    | -5.5   |
| 20         | ac   | 2462      | MCS0      | 13 | 12.49  | 25    | -12.5  |
| 40         | ac   | 2422      | MCS0      | 11 | 10.64  | 25    | -14.4  |
| 40         | ac   | 2437      | MCS0      | 16 | 15.21  | 25    | -9.8   |
| 40         | ac   | 2452      | MCS0      | 14 | 13.49  | 25    | -11.5  |



## Conducted RF Measurements (15.209)

**Engineer:** Poona Saber

**Test Date:** 12/5/2017

### Test Procedure

Antenna-port conducted measurements were performed as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands for 15.209.

The following offsets were added to the measurements:

The maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level

A maximum ground reflection factor to the EIRP level, 6 dB for frequencies  $\leq 30$  MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies  $> 1000$  MHz.

The following equations were used to determine the field strength from the conducted values.

$E[\text{dB}\mu\text{V/m}] = \text{EIRP}[\text{dBm}] - 20 \log(d[\text{meters}]) + 104.77$ , where  $E$  = field strength and  $d = 3\text{m}$

$E[\text{dB}\mu\text{V/m}] = \text{EIRP}[\text{dBm}] + 95.2$ , for  $d = 3$  meters.

The Spectrum Analyzer was set to the following:

#### The Spectrum Analyzer was set to the following for emissions $> 1000$ MHz:

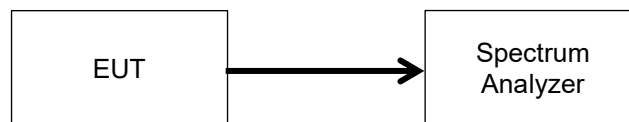
- a. RBW = 1 MHz
- b. VBW  $\geq 3$  MHz
- c. Detector = Peak.
- d. Sweep time = auto
- e. Trace mode = max hold
  - 1. Note: For emissions where the peak exceeded that of the average 15.209 emission limit the following was performed.
- f. RBW = 1 MHz
- g. VBW  $\leq \text{RBW}/100$  (i.e., 10 kHz) but not less than 10 Hz

#### For emissions below 1000 MHz the Spectrum Analyzer settings were as follows:

- a. RBW = 100 kHz
- b. VBW  $\geq 300$  kHz
- c. Detector = Peak
- d. Sweep time = auto
- e. Trace mode = max hold

The EUT was connected to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions. The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. The frequency range from 30 MHz to the 10<sup>th</sup> harmonic of the fundamental transmitter was investigated.

### Test Setup



See Annex A for test data



## Radiated Spurious Emissions

**Engineer:** Poona Saber

**Test Date:** 12/6/2017

### Test Procedure Radiated Spurious Emissions: 30 – 1000 MHz

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The output of the transmitter was connected to a non-radiating balance load. The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360° with the antennas in both the vertical and horizontal orientation and was raised from 1 to 4 meters to ensure the TX signal levels were maximized.

All emissions from 30 MHz to 1 GHz were examined.

Measured Level includes antenna and receiver cable correction factors.

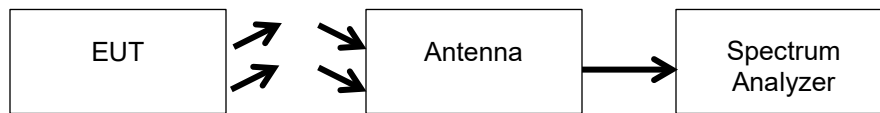
Correction factors were input into the spectrum analyzer before recording “Measured Level”.

RBW = 100 KHz

VBW = 300 KHz

Detector – Quasi Peak

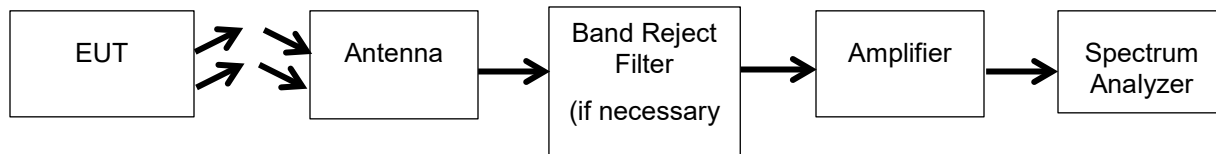
#### Test Setup



### Test Procedure for Radiated Spurious Emissions above 1 GHz

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The output of the transmitter was connected to a non-radiating balance load. The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360° with the antennas in both the vertical and horizontal orientation and was raised from 1 to 4 meters to ensure the TX signal levels were maximized.

#### Test Setup



**See Annex B for Test Data**



## Conducted Spurious Emissions

**Engineer:** Poona Saber

**Test Date:** 12/5/2017

### Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

RBW = 100 kHz

VBW  $\geq 3 \times$  RBW

Peak Detector

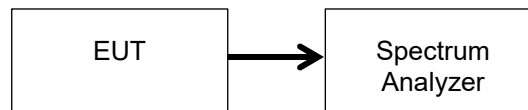
Trace mode = max hold

Sweep = auto couple

Frequency Range = 30MHz – 10<sup>th</sup> Harmonic of the fundamental

The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. The trace was allowed to stabilize. All emission were investigated to insure they were attenuated from the peak fundamental by at least 20dB. If the average power levels were measured then the out-of-band emissions needed to be attenuated by 30dB. In addition emissions were investigated at the band edges to insure all out-of-band emissions were attenuated 20 or 30dB as necessary.

### Test Setup



**See Annex C for Test Data**



## DTS Bandwidth

**Engineer:** Poona Saber

**Test Date:** 12/5/2017

### Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

RBW = 100 kHz

VBW  $\geq 3 \times$  RBW

Peak Detector

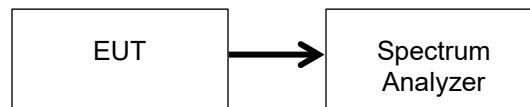
Trace mode = max hold

Sweep = auto couple

Span =  $1.5 \times$  EBW

The EUT was set to transmit at the lowest, middle and highest channels of the band at the maximum power levels. The maximum width of the emission that was determined by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that were attenuated by 6db and this value was used to determine the width of the carrier. Alternatively the spectrum analyzer's automatic bandwidth capability was used.

### Test Setup



### 6 dB Occupied Bandwidth Summary

| Frequency (MHz) | Mode | Bandwidth | Measured Bandwidth (MHz) | Specification Limit (kHz) | Result |
|-----------------|------|-----------|--------------------------|---------------------------|--------|
| 2412            | N    | 20        | 17.837                   | $\geq 500$                | Pass   |
| 2437            | N    | 20        | 17.851                   | $\geq 500$                | Pass   |
| 2462            | N    | 20        | 17.807                   | $\geq 500$                | Pass   |
| 2412            | AC   | 10        | 8.861                    | $\geq 500$                | Pass   |
| 2437            | AC   | 10        | 8.838                    | $\geq 500$                | Pass   |
| 2462            | AC   | 10        | 8.851                    | $\geq 500$                | Pass   |
| 2412            | AC   | 20        | 17.586                   | $\geq 500$                | Pass   |
| 2437            | AC   | 20        | 17.531                   | $\geq 500$                | Pass   |
| 2462            | AC   | 20        | 17.173                   | $\geq 500$                | Pass   |
| 2422            | AC   | 40        | 35.745                   | $\geq 500$                | Pass   |
| 2437            | AC   | 40        | 35.198                   | $\geq 500$                | Pass   |
| 2452            | AC   | 40        | 35.388                   | $\geq 500$                | Pass   |



**99% Bandwidth Summary**

| <b>Frequency (MHz)</b> | <b>Mode</b> | <b>Bandwidth</b> | <b>Measured Bandwidth (MHz)</b> | <b>Specification Limit (kHz)</b> | <b>Result</b> |
|------------------------|-------------|------------------|---------------------------------|----------------------------------|---------------|
| 2412                   | N           | 20               | 20.138                          | ≥ 500                            | Pass          |
| 2437                   | N           | 20               | 18.2586                         | ≥ 500                            | Pass          |
| 2462                   | N           | 20               | 18.804                          | ≥ 500                            | Pass          |
| 2412                   | AC          | 10               | 8.958                           | ≥ 500                            | Pass          |
| 2437                   | AC          | 10               | 8.916                           | ≥ 500                            | Pass          |
| 2462                   | AC          | 10               | 8.938                           | ≥ 500                            | Pass          |
| 2412                   | AC          | 20               | 17.638                          | ≥ 500                            | Pass          |
| 2437                   | AC          | 20               | 17.567                          | ≥ 500                            | Pass          |
| 2462                   | AC          | 20               | 17.603                          | ≥ 500                            | Pass          |
| 2422                   | AC          | 40               | 36.059                          | ≥ 500                            | Pass          |
| 2437                   | AC          | 40               | 35.754                          | ≥ 500                            | Pass          |
| 2452                   | AC          | 40               | 35.832                          | ≥ 500                            | Pass          |

**See Annex D for Test Plots**



## Transmitter Power Spectral Density (PSD)

**Engineer:** Poona Saber

**Test Date:** 12/5/2017

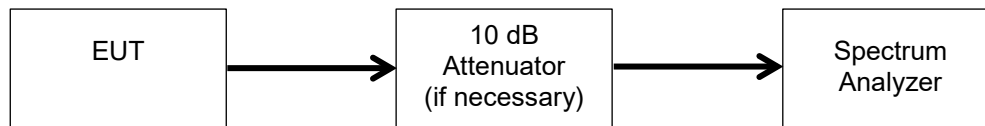
### Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

DTS channel center frequency  
Span  $1.5 \times$  DTS bandwidth  
 $RBW = 3 \text{ kHz} \leq RBW \leq 100 \text{ kHz}$   
 $VBW \geq 3 \times RBW$   
Peak Detector  
Sweep time = auto couple  
Trace mode = max hold

The EUT was set to transmit at the lowest, middle and highest channels of the band at the maximum power levels. Once the trace has stabilize the peak marker was used to determine the peak power spectral density.

### Test Setup



### PSD Summary

#### Management Radio

| Frequency (MHz) | Mode | Bandwidth | Measured Data (dBm) | Specification Limit (dBm) | Result |
|-----------------|------|-----------|---------------------|---------------------------|--------|
| 2412            | N    | 20        | -21.88              | 8                         | Pass   |
| 2437            | N    | 20        | -10.81              | 8                         | Pass   |
| 2462            | N    | 20        | -18.33              | 8                         | Pass   |



## 2.4 GHz Radio

Omni 4 dBi  
ptmp

### Conducted Power Spectral Density for 2.4 GHz

| Band Width | Mode | Frequency | Data Rate | TP | Port 1 | Limit | Margin |
|------------|------|-----------|-----------|----|--------|-------|--------|
| MHz        | ac   | MHz       |           |    | dBm    | dBm   | dB     |
| 10         | ac   | 2412      | MCS0      | 11 | -10.5  | 8     | -18.5  |
| 10         | ac   | 2437      | MCS0      | 18 | -10.5  | 8     | -18.5  |
| 10         | ac   | 2462      | MCS0      | 10 | -12.3  | 8     | -20.3  |
| 20         | ac   | 2412      | MCS0      | 12 | -13.1  | 8     | -21.1  |
| 20         | ac   | 2437      | MCS0      | 19 | -12.4  | 8     | -20.4  |
| 20         | ac   | 2462      | MCS0      | 13 | -12.4  | 8     | -20.4  |
| 40         | ac   | 2422      | MCS0      | 11 | -7.5   | 8     | -15.5  |
| 40         | ac   | 2437      | MCS0      | 16 | -11.6  | 8     | -19.6  |
| 40         | ac   | 2452      | MCS0      | 14 | -13.8  | 8     | -21.8  |

Omni 13  
dBi ptmp

| Band Width | Mode | Frequency | Data Rate | TP | Port 1 | Limit | Margin |
|------------|------|-----------|-----------|----|--------|-------|--------|
| MHz        | ac   | MHz       |           |    | dBm    | dBm   | dB     |
| 10         | ac   | 5160      | MCS0      | 9  | -17.47 | 1     | -18.5  |
| 10         | ac   | 5200      | MCS0      | 19 | -17.45 | 1     | -18.5  |
| 10         | ac   | 5245      | MCS0      | 19 | -19.28 | 1     | -20.3  |
| 20         | ac   | 5165      | MCS0      | 7  | -20.11 | 1     | -21.1  |
| 20         | ac   | 5200      | MCS0      | 19 | -19.37 | 1     | -20.4  |
| 20         | ac   | 5240      | MCS0      | 20 | -19.4  | 1     | -20.4  |
| 40         | ac   | 5175      | MCS0      | 5  | -14.47 | 1     | -15.5  |
| 40         | ac   | 5200      | MCS0      | 20 | -18.62 | 1     | -19.6  |
| 40         | ac   | 5230      | MCS0      | 20 | -20.8  | 1     | -21.8  |



Sector 17  
dBi ptmp

| Band Width | Mode | Frequency | Data Rate | TP | Port 1 | Limit | Margin |
|------------|------|-----------|-----------|----|--------|-------|--------|
| MHz        | ac   | MHz       |           |    | dBm    | dBm   | dB     |
| 10         | ac   | 5160      | MCS0      | 9  | -23.47 | -5    | -18.5  |
| 10         | ac   | 5200      | MCS0      | 19 | -23.45 | -5    | -18.5  |
| 10         | ac   | 5245      | MCS0      | 19 | -25.28 | -5    | -20.3  |
| 20         | ac   | 5165      | MCS0      | 7  | -26.11 | -5    | -21.1  |
| 20         | ac   | 5200      | MCS0      | 19 | -25.37 | -5    | -20.4  |
| 20         | ac   | 5240      | MCS0      | 20 | -25.4  | -5    | -20.4  |
| 40         | ac   | 5175      | MCS0      | 5  | -20.47 | -5    | -15.5  |
| 40         | ac   | 5200      | MCS0      | 20 | -24.62 | -5    | -19.6  |
| 40         | ac   | 5230      | MCS0      | 20 | -26.8  | -5    | -21.8  |

Dish 24 dBi  
ptp

| Band Width | Mode | Frequency | Data Rate | TP | Port 1 | Limit | Margin |
|------------|------|-----------|-----------|----|--------|-------|--------|
| MHz        | ac   | MHz       |           |    | dBm    | dBm   | dB     |
| 10         | ac   | 5160      | MCS0      | 11 | -15.47 | 3     | -18.5  |
| 10         | ac   | 5200      | MCS0      | 18 | -15.45 | 3     | -18.5  |
| 10         | ac   | 5245      | MCS0      | 10 | -17.28 | 3     | -20.3  |
| 20         | ac   | 5165      | MCS0      | 12 | -18.11 | 3     | -21.1  |
| 20         | ac   | 5200      | MCS0      | 19 | -17.37 | 3     | -20.4  |
| 20         | ac   | 5240      | MCS0      | 13 | -17.4  | 3     | -20.4  |
| 40         | ac   | 5175      | MCS0      | 11 | -12.47 | 3     | -15.5  |
| 40         | ac   | 5200      | MCS0      | 16 | -16.62 | 3     | -19.6  |
| 40         | ac   | 5230      | MCS0      | 14 | -18.8  | 3     | -21.8  |



## A/C Powerline Conducted Emission

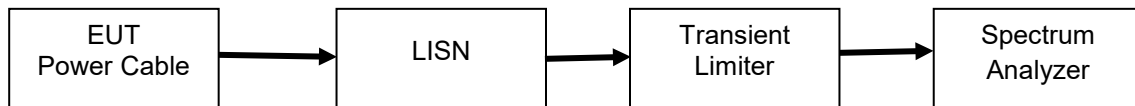
**Engineer:** Poona Saber

**Test Date:** 12/12/17

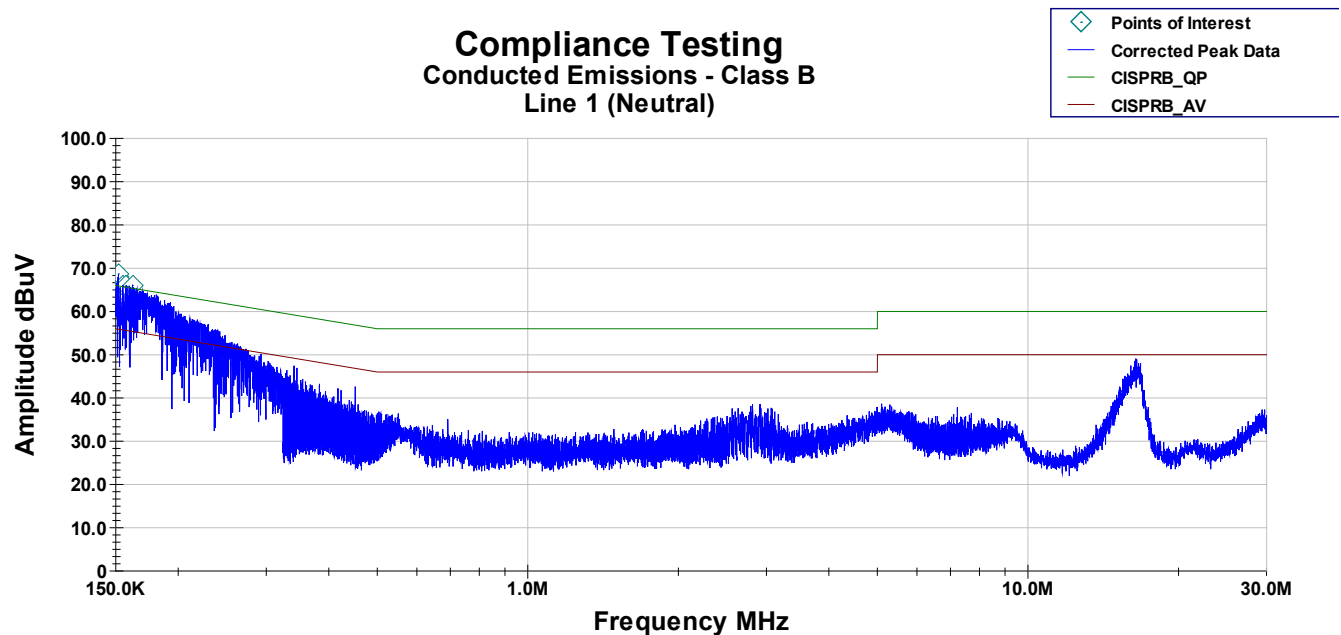
### Test Procedure

The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a transient limiter, which then connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were measured and compared to the specification limits.

### Test Setup



### Line 1 Peak results



**Operator:** PS

**EN55032 Class B\_85462 EMI Rec\_15.til**

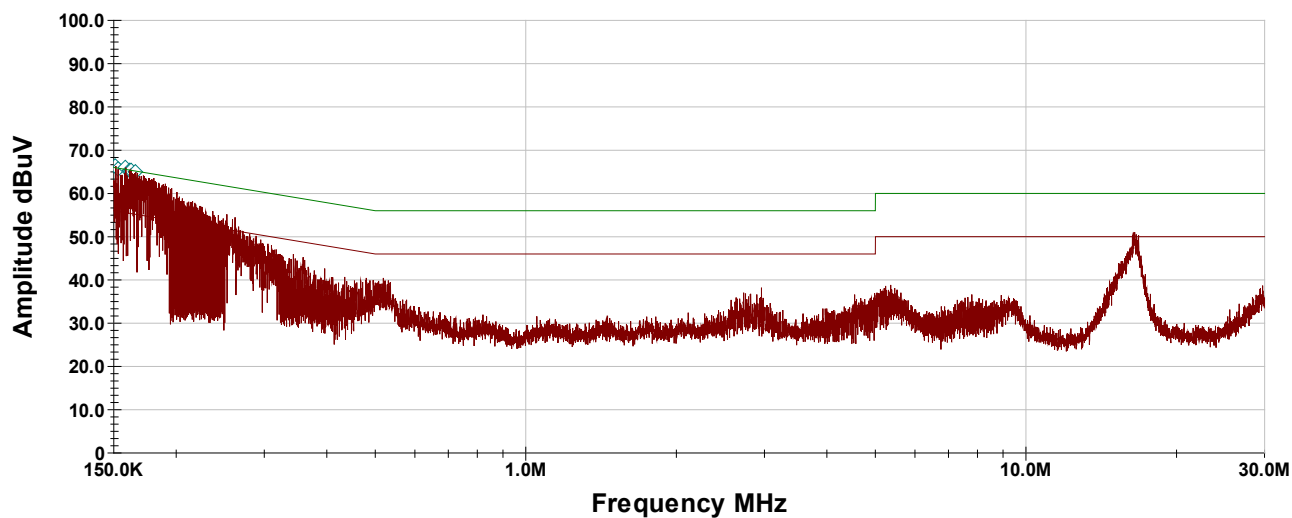
**Job #:**



## Line 2 Peak Results

### Compliance Testing Conducted Emissions - Class B Line 2 (Phase)

- Points of Interest
- Corrected Peak Data
- CISPRB\_QP
- CISPRB\_AV



Operator: PS

EN55032 Class B\_85462 EMI Rec\_15.til

Job #:



**Line 1 Neutral Avg Detector**

| Frequency  | Measured Value (dBuV) | LISN Correction Factor (dB) | Cable Loss (dB) | Transient Limiter (dB) | Final Data (dBuV) | Limit (dBuV) | Avg Margin (dB) |
|------------|-----------------------|-----------------------------|-----------------|------------------------|-------------------|--------------|-----------------|
| 153.2 KHz  | 25.63                 | 0.27                        | 0.02            | 10.2                   | 36.121            | 55.909       | -19.787         |
| 154.33 KHz | 25.4                  | 0.26                        | 0.02            | 10.2                   | 35.877            | 55.876       | -20             |
| 155.15 KHz | 26.55                 | 0.25                        | 0.02            | 10.2                   | 37.018            | 55.853       | -18.834         |
| 158.93 KHz | 26.23                 | 0.21                        | 0.02            | 10.2                   | 36.661            | 55.745       | -19.084         |
| 159.05 KHz | 25.85                 | 0.21                        | 0.02            | 10.2                   | 36.283            | 55.741       | -19.459         |
| 157.2 KHz  | 26.45                 | 0.23                        | 0.02            | 10.2                   | 36.898            | 55.794       | -18.896         |

**Line 2 Phase Avg Detector**

| Frequency  | Measured Value (dBuV) | LISN Correction Factor (dB) | Cable Loss (dB) | Transient Limiter (dB) | Final Data (dBuV) | Limit (dBuV) | Avg Margin (dB) |
|------------|-----------------------|-----------------------------|-----------------|------------------------|-------------------|--------------|-----------------|
| 154.35 KHz | 25.58                 | 0.26                        | 0.02            | 10.2                   | 36.06             | 55.876       | -19.816         |
| 156.73 KHz | 26.39                 | 0.23                        | 0.02            | 10.2                   | 36.843            | 55.808       | -18.965         |
| 156.98 KHz | 26.38                 | 0.23                        | 0.02            | 10.2                   | 36.834            | 55.801       | -18.967         |
| 158.83 KHz | 25.4                  | 0.21                        | 0.02            | 10.2                   | 35.832            | 55.748       | -19.916         |
| 159.0 KHz  | 26.05                 | 0.21                        | 0.02            | 10.2                   | 36.48             | 55.743       | -19.263         |
| 163.82 KHz | 28.61                 | 0.2                         | 0.02            | 10.162                 | 38.992            | 55.605       | -16.613         |

**Line 1 Neutral QP Detector**

| Frequency  | Measured Value (dBuV) | LISN Correction Factor (dB) | Cable Loss (dB) | Transient Limiter (dB) | Final Data (dBuV) | Limit (dBuV) | QP Margin (dB) |
|------------|-----------------------|-----------------------------|-----------------|------------------------|-------------------|--------------|----------------|
| 153.2 KHz  | 47.9                  | 0.268                       | 0.02            | 10.2                   | 58.388            | 65.909       | -7.521         |
| 154.33 KHz | 48.21                 | 0.257                       | 0.02            | 10.2                   | 58.687            | 65.876       | -7.19          |
| 155.15 KHz | 48.64                 | 0.249                       | 0.02            | 10.2                   | 59.108            | 65.853       | -6.744         |
| 158.93 KHz | 48.67                 | 0.211                       | 0.02            | 10.2                   | 59.101            | 65.745       | -6.644         |
| 159.05 KHz | 48.85                 | 0.21                        | 0.02            | 10.2                   | 59.279            | 65.741       | -6.462         |
| 157.2 KHz  | 48.2                  | 0.228                       | 0.02            | 10.2                   | 58.648            | 65.794       | -7.146         |

**Line 2 Phase QP Detector**

| Frequency  | Measured Value (dBuV) | LISN Correction Factor (dB) | Cable Loss (dB) | Transient Limiter (dB) | Final Data (dBuV) | Limit (dBuV) | QP Margin (dB) |
|------------|-----------------------|-----------------------------|-----------------|------------------------|-------------------|--------------|----------------|
| 154.35 KHz | 47.75                 | 0.26                        | 0.02            | 10.2                   | 58.226            | 65.876       | -7.649         |
| 156.73 KHz | 48.53                 | 0.23                        | 0.02            | 10.2                   | 58.983            | 65.808       | -6.825         |
| 156.98 KHz | 48.5                  | 0.23                        | 0.02            | 10.2                   | 58.95             | 65.801       | -6.85          |
| 158.83 KHz | 48.48                 | 0.21                        | 0.02            | 10.2                   | 58.912            | 65.748       | -6.836         |
| 159.0 KHz  | 47.65                 | 0.21                        | 0.02            | 10.2                   | 58.08             | 65.743       | -7.663         |
| 163.82 KHz | 50.96                 | 0.2                         | 0.02            | 10.162                 | 61.342            | 65.605       | -4.263         |



## Measurement Uncertainty

| Test Procedure                   | Uncertainty            |
|----------------------------------|------------------------|
| Conducted RF Power               | $\pm 0.75\text{dB}$    |
| Conducted Emissions (AC Line)    | $\pm 3.21\text{dB}$    |
| Radiated Emissions (Signal Line) | $\pm 4.5\text{dB}$     |
| Radiated Spurious Emissions      | $\pm 4.82$             |
| Conducted Spurious Emissions     | $\pm 2.49\text{ dB}$   |
| Occupied Bandwidth               | $\pm 5\%$              |
| Power Spectral Density           | $\pm 1.8\text{dB}$     |
| DTS Bandwidth                    | $\pm 3\%$              |
| Frequency                        | $\pm 1\text{Hz}$       |
| Harmonic Currents                | 95%                    |
| Voltage Flicker                  | 95%                    |
| AC Voltage                       | $\pm 2.3\%$            |
| DC Voltage                       | $\pm 0.12\%$           |
| Temperature                      | $\pm 1.0\text{ deg C}$ |
| Humidity                         | $\pm 4.32\%$           |

## Test Equipment Utilized

| Description                   | Manufacturer | Model #                       | CT Asset # | Last Cal Date | Cal Due Date |
|-------------------------------|--------------|-------------------------------|------------|---------------|--------------|
| Horn Antenna                  | ARA          | DRG-118/A                     | i00271     | 6/16/16       | 6/16/18      |
| Horn Antenna, Amplified       | ARA          | MWH-1826/B                    | i00273     | 4/22/15       | 4/22/18      |
| Humidity / Temp Meter         | Newport      | IBTHX-W-5                     | i00282     | 6/9/17        | 6/9/18       |
| Spectrum Analyzer             | Agilent      | E4407B                        | i00331     | 11/21/2017    | 11/21/2018   |
| Bi-Log Antenna                | Schaffner    | CBL 6111D                     | i00349     | 8/3/16        | 8/3/18       |
| EMI Analyzer                  | Agilent      | E7405A                        | i00379     | 2/22/17       | 2/22/18      |
| 3 Meter Semi-Anechoic Chamber | Panashield   | 3 Meter Semi-Anechoic Chamber | i00428     | 8/15/16       | 8/15/19      |
| Preamplifier                  | Miteq        | AFS44 00101 400 23-10P-44     | i00509     | N/A           | N/A          |

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT