

## *EMC Test Report*

### *Application for Grant of Equipment Authorization*

*Industry Canada RSS-Gen Issue 3 / RSS 210 Issue 8  
 FCC Part 15 Subpart C*

#### *Bluetooth LE MOD PRT-05358*

IC CERTIFICATION #: 6384A- PRT05358  
 FCC ID: PAV05358

APPLICANT: Griffin Technology  
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 Nashville, TN 37203

TEST SITE(S): NTS Silicon Valley  
 41039 Boyce Road.  
 Fremont, CA. 94538-2435

IC SITE REGISTRATION #: 2845B-3; 2845B-5

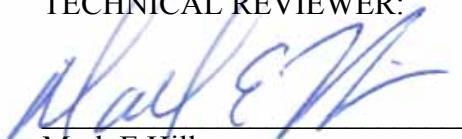
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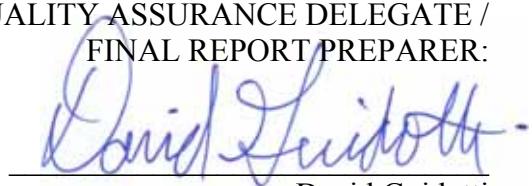
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**REVISION HISTORY**

| Rev# | Date       | Comments                                    | Modified By |
|------|------------|---|-------------|
| -    |            | First release                               |             |
| 1.0  | 05-14-2013 | Updated measurement procedure reference     | MEH         |
| 2.0  | 06-14-2013 | Revised AC conducted emissions test results | MEH         |

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## SCOPE

An electromagnetic emissions test has been performed on the Griffin Technology Bluetooth LE MOD PRT-05358, pursuant to the following rules:

Industry Canada RSS-Gen Issue 3  
RSS 210 Issue 8 “Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment”  
FCC Part 15 Subpart C

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in NTS Silicon Valley test procedures:

ANSI C63.4:2003  
FCC DTS Measurement Procedure KDB558074, Oct 2012

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

## OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer's declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification requirements.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

### ***STATEMENT OF COMPLIANCE***

The tested sample of Griffin Technology Bluetooth LE MOD PRT-05358 complied with the requirements of the following regulations:

Industry Canada RSS-Gen Issue 3  
RSS 210 Issue 8 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"  
FCC Part 15 Subpart C

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

The test results recorded herein are based on a single type test of Griffin Technology Bluetooth LE MOD PRT-05358 and therefore apply only to the tested sample. The sample was selected and prepared by Michael O'Connor of Griffin Technology.

### ***DEVIATIONS FROM THE STANDARDS***

No deviations were made from the published requirements listed in the scope of this report.

**TEST RESULTS SUMMARY****DIGITAL TRANSMISSION SYSTEMS (2400 – 2483.5MHz)**

| FCC Rule Part      | RSS Rule Part    | Description                                    | Measured Value / Comments                                | Limit / Requirement                                   | Result   |
|--------------------|------------------|--|--|---|----------|
| 15.247(a)          | RSS 210 A8.2     | Digital Modulation                             | Systems uses DSSS techniques                             | System must utilize a digital transmission technology | Complies |
| 15.247 (a) (2)     | RSS 210 A8.2 (1) | 6dB Bandwidth                                  | 681 kHz  | >500kHz   | Complies |
| 15.247 (b) (3)     | RSS 210 A8.2 (4) | Output Power (multipoint systems)              | -5.0 dBm (0.3 mW)<br>EIRP = 1.0 mW <small>Note 1</small> | 1Watt, EIRP limited to 4 Watts.                       | Complies |
| 15.247(d)          | RSS 210 A8.2 (2) | Power Spectral Density                         | -19.6 dBm / 3kHz   | 8dBm/3kHz   | Complies |
| 15.247(c)          | RSS 210 A8.5     | Antenna Port Spurious Emissions 30MHz – 25 GHz | N/A - All measurements performed radiated                |   |          |
| 15.247(c) / 15.209 | RSS 210 A8.5     | Radiated Spurious Emissions 30MHz – 25 GHz     | 39.7 dB $\mu$ V/m @ 2485.1 MHz (-14.3 dB)                | 15.207 in restricted bands, all others < -20dBc       | Complies |

Note 1: EIRP calculated using antenna gain of 4 dBi for the highest EIRP system.

**GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS**

| FCC Rule Part                | RSS Rule part         | Description                 | Measured Value / Comments  | Limit / Requirement                            | Result (margin) |
|------------------------------|-----------------------|-----------------------------|--|--|-----------------|
| 15.203                       | -                     | RF Connector                | Antenna is integral to the module  | Unique or integral antenna required            | Complies        |
| 15.207                       | RSS GEN Table 2       | AC Conducted Emissions      | 43.7 dB $\mu$ V @ 0.216 MHz (-19.3 dB)   | Refer to page 17                               | Complies        |
| 15.109                       | RSS GEN 7.2.3 Table 1 | Receiver spurious emissions | N/A – Device tunes above 960MHz  |  |                 |
| 15.247 (b) (5)<br>15.407 (f) | RSS 102               | RF Exposure Requirements    | Refer to MPE calculations in Exhibit 11, RSS 102 declaration and User Manual statements. | Refer to OET 65, FCC Part 1 and RSS 102        | Complies        |
| -                            | RSP 100 RSS GEN 7.1.5 | User Manual                 |  | Statement required regarding non-interference  | Complies        |
| -                            | RSP 100 RSS GEN 7.1.5 | User Manual                 |  | Statement for products with detachable antenna | Complies        |
| -                            | RSP 100 RSS GEN 4.4.1 | 99% Bandwidth               | 1100 kHz   | Information only                               | N/A             |

**MEASUREMENT UNCERTAINTIES**

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

| Measurement Type                        | Measurement Unit | Frequency Range   | Expanded Uncertainty |
|---|------------------|-------------------|----------------------|
| RF power, conducted (power meter)       | dBm              | 25 to 7000 MHz    | ± 0.52 dB            |
| RF power, conducted (Spectrum analyzer) | dBm              | 25 to 7000 MHz    | ± 0.7 dB             |
| Conducted emission of transmitter       | dBm              | 25 to 26500 MHz   | ± 0.7 dB             |
| Conducted emission of receiver          | dBm              | 25 to 26500 MHz   | ± 0.7 dB             |
| Radiated emission (substitution method) | dBm              | 25 to 26500 MHz   | ± 2.5 dB             |
| Radiated emission (field strength)      | dB $\mu$ V/m     | 25 to 1000 MHz    | ± 3.6 dB             |
|   |                  | 1000 to 40000 MHz | ± 6.0 dB             |
| Conducted Emissions (AC Power)          | dB $\mu$ V       | 0.15 to 30 MHz    | ± 2.4 dB             |

**EQUIPMENT UNDER TEST (EUT) DETAILS****GENERAL**

The Griffin Technology model Bluetooth LE MOD PRT-05358 is a Bluetooth LE module.

The sample was received on February 15, 2013 and tested on February 15 and June 12, 2013. The EUT consisted of the following component(s):

| Company | Model                         | Description | Serial Number | FCC ID / IC UPN            |
|---------|-------------------------------|-------------|---------------|----------------------------|
| Griffin | Bluetooth LE MOD<br>PRT-05358 | BLE module  | -             | PAV05358<br>6384A-PRT05358 |

**OTHER EUT DETAILS**

Support Bluetooth LE mode only.

**ANTENNA SYSTEM**

The antenna system consists of an on-board chip antenna, Pulse, W3043 antenna, 4dBi max gain 2.4GHz.

**ENCLOSURE**

The EUT has no enclosure. It is designed to be installed within the enclosure of a host system.

**MODIFICATIONS**

No modifications were made to the EUT during the time the product was at NTS Silicon Valley.

**SUPPORT EQUIPMENT**

The following equipment was used as support equipment for testing:

| Company | Model  | Description  | Serial Number | FCC ID |
|---------|--------|--------------|---------------|--------|
| Griffin | -      | Test Fixture | -             | N/A    |
| HP      | DV6000 | Laptop*      | CNF73411TR    | -      |

\* - used to configure EUT prior to test, removed during testing.

**AC Conducted Emissions**

| Company | Model         | Description            | Serial Number | FCC ID |
|---------|---------------|------------------------|---------------|--------|
| Griffin | -             | Test Fixture           | -             | N/A    |
| Griffin | BI13-050200-I | AC - USB Power Adapter | -             | -      |
| HP      | DV6000        | Laptop*                | CNF73411TR    | -      |

\* - used to configure EUT prior to test, removed during testing.

**EUT INTERFACE PORTS**

The I/O cabling configuration during testing was as follows:

AC Conducted Emissions

| Port             | Connected To | Description        | Cable(s) | Shielded or Unshielded | Length(m) |
|------------------|--------------|--------------------|----------|------------------------|-----------|
| AC - USB Adapter | Test Fixture | USB-Multiconductor |          | Shielded               | 1.0       |

Note – No interface cables were present for radiated measurements.

**EUT OPERATION**

During testing, the EUT was configured to transmit continuously on the noted channel at the maximum power setting.

During AC conducted emissions testing, the EUT was configured to continuously transmit on channel 20, 2446MHz, at full power.

**TEST SITE****GENERAL INFORMATION**

Final test measurements were taken at the test sites listed below. Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission and with industry Canada.

| Site      | Registration Numbers |         | Location                                      |
|-----------|----------------------|---------|---|
|           | FCC                  | Canada  |   |
| Chamber 3 | 769238               | 2845B-3 | 41039 Boyce Road<br>Fremont,<br>CA 94538-2435 |
| Chamber 5 | 211948               | 2845B-5 |   |

ANSI C63.4:2003 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4:2003.

**CONDUCTED EMISSIONS CONSIDERATIONS**

Conducted emissions testing is performed in conformance with ANSI C63.4:2003. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

**RADIATED EMISSIONS CONSIDERATIONS**

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4:2003 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4:2003.

**MEASUREMENT INSTRUMENTATION****RECEIVER SYSTEM**

An EMI receiver as specified in CISPR 16-1-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

**INSTRUMENT CONTROL COMPUTER**

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

**LINE IMPEDANCE STABILIZATION NETWORK (LISN)**

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

**FILTERS/ATTENUATORS**

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

**ANTENNAS**

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

**ANTENNA MAST AND EQUIPMENT TURNTABLE**

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.4:2003 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

**INSTRUMENT CALIBRATION**

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

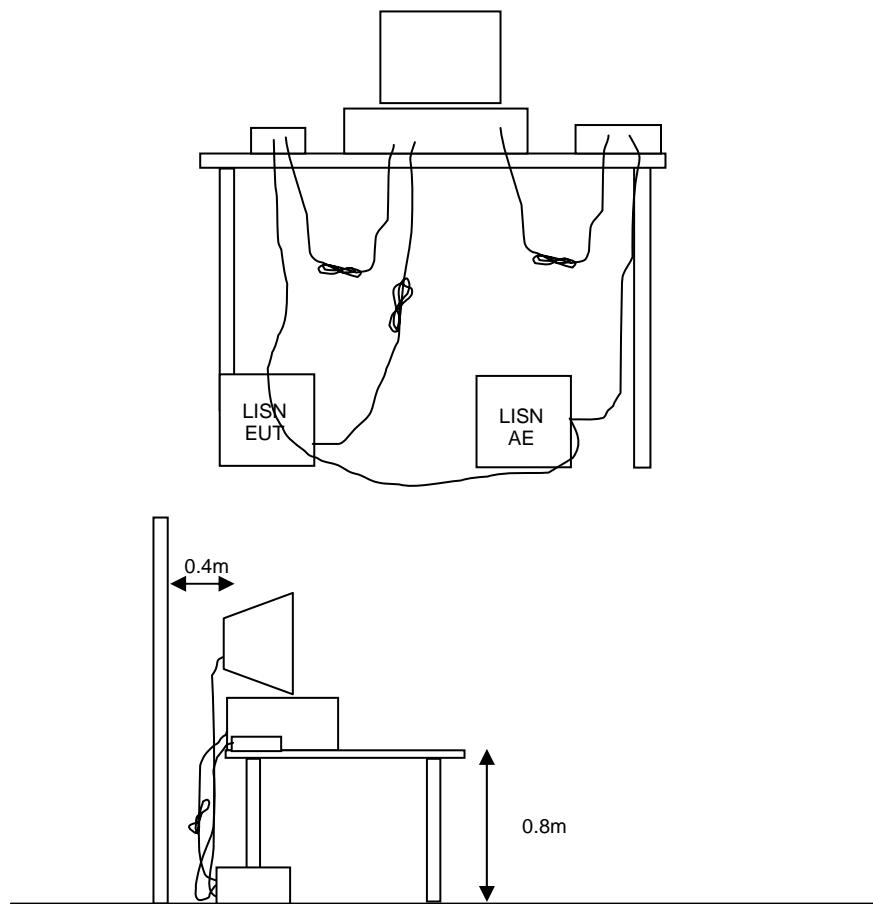
## TEST PROCEDURES

### EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4:2003, and the worst-case orientation is used for final measurements.

### CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.



**Figure 1 Typical Conducted Emissions Test Configuration**

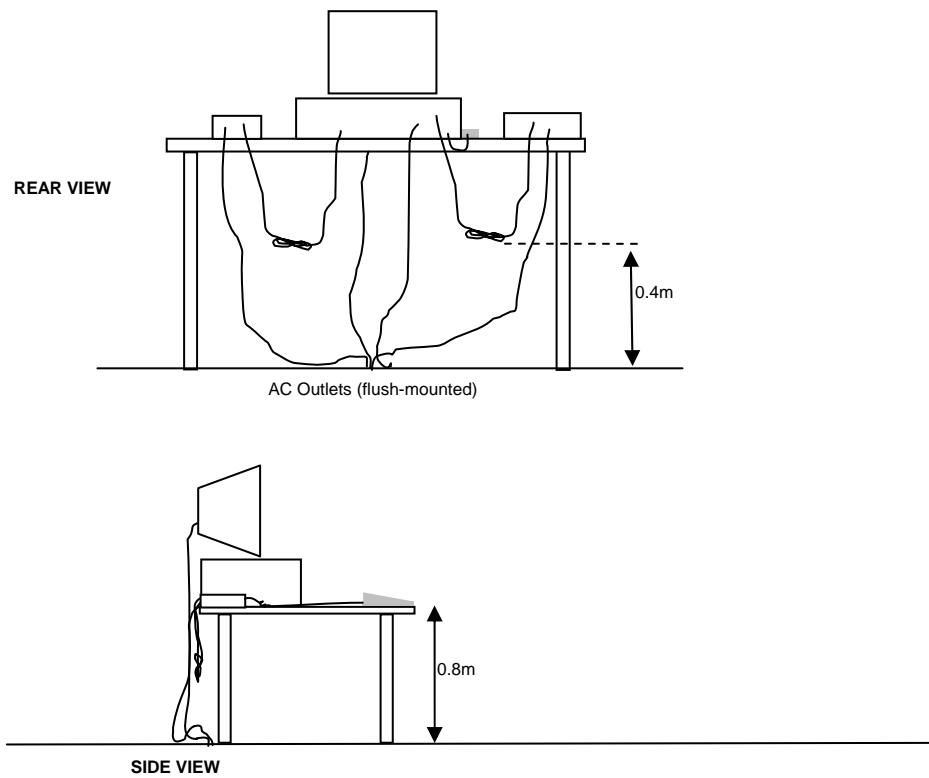
**RADIATED EMISSIONS**

A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

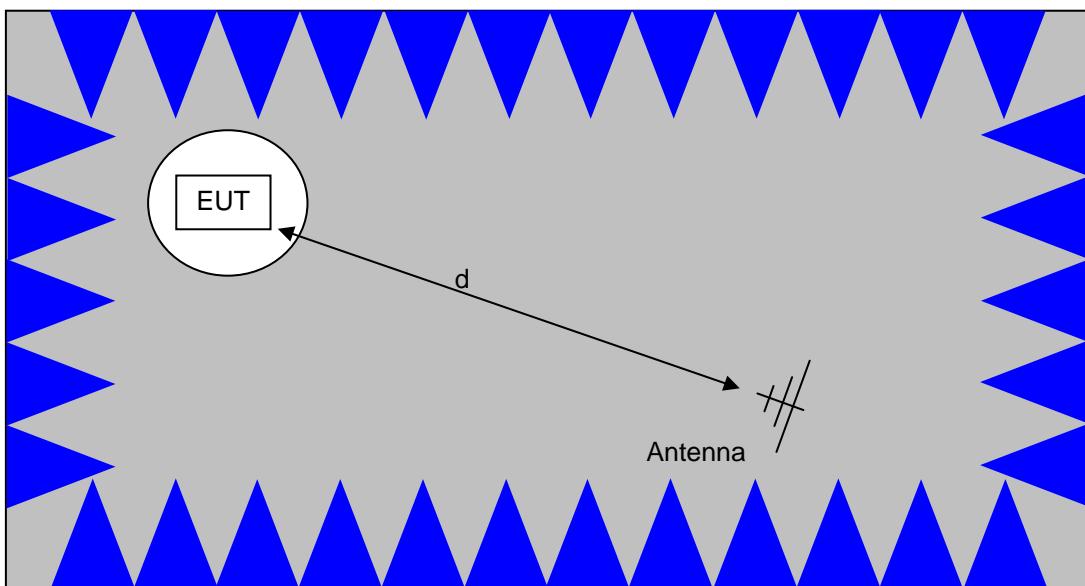
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.

When testing above 18 GHz, the receive antenna is located at 1meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.

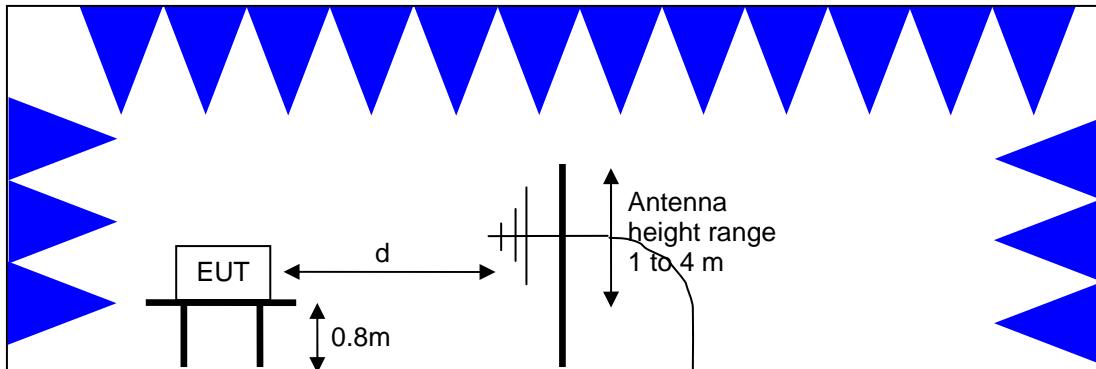


Typical Test Configuration for Radiated Field Strength Measurements



The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used.

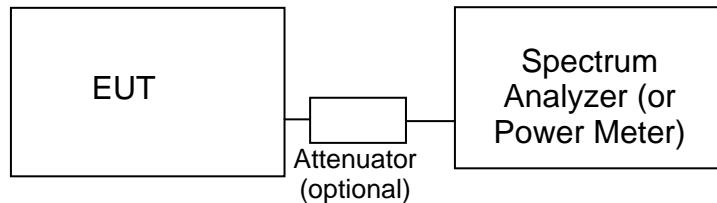
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



Test Configuration for Radiated Field Strength Measurements  
Semi-Anechoic Chamber, Plan and Side Views

**CONDUCTED EMISSIONS FROM ANTENNA PORT**

Direct measurements of power, bandwidth and power spectral density are performed, where possible, with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

**Test Configuration for Antenna Port Measurements**

Measurement bandwidths (video and resolution) are set in accordance with the relevant standards and NTS Silicon Valley's test procedures for the type of radio being tested. When power measurements are made using a resolution bandwidth less than the signal bandwidth the power is calculated by summing the power across the signal bandwidth using either the analyzer channel power function or by capturing the trace data and calculating the power using software. In both cases the summed power is corrected to account for the equivalent noise bandwidth (ENBW) of the resolution bandwidth used.

If power averaging is used (typically for certain digital modulation techniques), the EUT is configured to transmit continuously. Power averaging is performed using either the built-in function of the analyzer or, if the analyzer does not feature power averaging, using external software. In both cases the average power is calculated over a number of sweeps (typically 100). When the EUT cannot be configured to continuously transmit then either the analyzer is configured to perform a gated sweep to ensure that the power is averaged over periods that the device is transmitting or power averaging is disabled and a max-hold feature is used.

If a power meter is used to make output power measurements the sensor head type (peak or average) is stated in the test data table.

***BANDWIDTH MEASUREMENTS***

The 6dB, 20dB and/or 26dB signal bandwidth is measured in using the bandwidths recommended by ANSI C63.4. When required, the 99% bandwidth is measured using the methods detailed in RSS GEN.

**SPECIFICATION LIMITS AND SAMPLE CALCULATIONS**

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

***CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; FCC 15.107(a), RSS GEN***

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

| Frequency (MHz) | Average Limit (dBuV)  | Quasi Peak Limit (dBuV)   |
|-----------------|---|---|
| 0.150 to 0.500  | Linear decrease on logarithmic frequency axis between 56.0 and 46.0 | Linear decrease on logarithmic frequency axis between 66.0 and 56.0 |
| 0.500 to 5.000  | 46.0  | 56.0  |
| 5.000 to 30.000 | 50.0  | 60.0  |

**GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS**

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands<sup>1</sup> (with the exception of transmitters operating under FCC Part 15 Subpart D and RSS 210 Annex 9), the limits for all emissions from a low power device operating under the general rules of RSS 310 (tables 3 and 4), RSS 210 (table 2) and FCC Part 15 Subpart C section 15.209.

| Frequency Range (MHz) | Limit (uV/m)                 | Limit (dBuV/m @ 3m)                                  |
|-----------------------|------------------------------|--|
| 0.009-0.490           | 2400/F <sub>KHz</sub> @ 300m | 67.6-20*log <sub>10</sub> (F <sub>KHz</sub> ) @ 300m |
| 0.490-1.705           | 24000/F <sub>KHz</sub> @ 30m | 87.6-20*log <sub>10</sub> (F <sub>KHz</sub> ) @ 30m  |
| 1.705 to 30           | 30 @ 30m                     | 29.5 @ 30m   |
| 30 to 88              | 100 @ 3m                     | 40 @ 3m  |
| 88 to 216             | 150 @ 3m                     | 43.5 @ 3m  |
| 216 to 960            | 200 @ 3m                     | 46.0 @ 3m  |
| Above 960             | 500 @ 3m                     | 54.0 @ 3m  |

**RECEIVER RADIATED SPURIOUS EMISSIONS SPECIFICATION LIMITS**

The table below shows the limits for the spurious emissions from receivers as detailed in FCC Part 15.109, RSS 210 Table 2, RSS GEN Table 1 and RSS 310 Table 3. Note that receivers operating outside of the frequency range 30 MHz – 960 MHz are exempt from the requirements of 15.109.

| Frequency Range (MHz) | Limit (uV/m @ 3m) | Limit (dBuV/m @ 3m) |
|-----------------------|-------------------|---------------------|
| 30 to 88              | 100               | 40                  |
| 88 to 216             | 150               | 43.5                |
| 216 to 960            | 200               | 46.0                |
| Above 960             | 500               | 54.0                |

<sup>1</sup> The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

**OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS**

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

| Operating Frequency (MHz) | Output Power    | Power Spectral Density |
|---------------------------|-----------------|------------------------|
| 902 – 928                 | 1 Watt (30 dBm) | 8 dBm/3kHz             |
| 2400 – 2483.5             | 1 Watt (30 dBm) | 8 dBm/3kHz             |
| 5725 – 5850               | 1 Watt (30 dBm) | 8 dBm/3kHz             |

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

**TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS**

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands are those specified in the general limits sections of FCC Part 15 and RSS 210. All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level (30dB if the power is measured using the sample detector/power averaging method).

**SAMPLE CALCULATIONS - CONDUCTED EMISSIONS**

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_f - S = M$$

where:

$R_f$  = Receiver Reading in dBuV

$S$  = Specification Limit in dBuV

$M$  = Margin to Specification in +/- dB

**SAMPLE CALCULATIONS - RADIATED EMISSIONS**

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

$$F_d = 20 * \text{LOG10} (D_m/D_s)$$

where:

$F_d$  = Distance Factor in dB

$D_m$  = Measurement Distance in meters

$D_s$  = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40 * \text{LOG10} (D_m/D_s)$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

$R_r$  = Receiver Reading in dBuV/m

$F_d$  = Distance Factor in dB

$R_c$  = Corrected Reading in dBuV/m

$L_s$  = Specification Limit in dBuV/m

$M$  = Margin in dB Relative to Spec

**SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION**

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of d (meters) from the equipment under test:

$$E = \frac{1000000 \sqrt{30} P}{d} \text{ microvolts per meter}$$

where P is the eirp (Watts)

For a measurement at 3m the conversion from a logarithmic value for field strength (dBuV/m) to an eirp power (dBm) is -95.3dB.

## Appendix A Test Equipment Calibration Data

### Radiated Emissions: Fundamental, BE, Power, and PSD, 15-Feb-13

| <u>Manufacturer</u> | <u>Description</u>             | <u>Model</u> | <u>Asset #</u> | <u>Cal Due</u> |
|---------------------|--------------------------------|--------------|----------------|----------------|
| EMCO                | Antenna, Horn, 1-18 GHz        | 3115         | 487            | 7/19/2014      |
| Rohde & Schwarz     | EMI Test Receiver, 20 Hz-7 GHz | ESIB7        | 1630           | 5/31/2013      |

### Radiated Emissions, 1000 - 26,500 MHz, 15-Feb-13

| <u>Manufacturer</u> | <u>Description</u>                  | <u>Model</u>   | <u>Asset #</u> | <u>Cal Due</u> |
|---------------------|-------------------------------------|----------------|----------------|----------------|
| EMCO                | Antenna, Horn, 1-18 GHz             | 3115           | 487            | 7/19/2014      |
| Hewlett Packard     | Microwave Preamplifier, 1-26.5GHz   | 8449B          | 785            | 11/9/2013      |
| Hewlett Packard     | SpecAn 30 Hz -40 GHz, SV (SA40) Red | 8564E (84125C) | 1148           | 9/14/2013      |
| Micro-Tronics       | Band Reject Filter, 2400-2500 MHz   | BRM50702-02    | 1683           | 8/2/2013       |

### Radiated Emissions, 30 - 25,000 MHz, 15-Feb-13

| <u>Manufacturer</u> | <u>Description</u>                       | <u>Model</u>             | <u>Asset #</u> | <u>Cal Due</u> |
|---------------------|--|--------------------------|----------------|----------------|
| Hewlett Packard     | Microwave Preamplifier, 1-26.5GHz        | 8449B                    | 263            | 3/29/2013      |
| EMCO                | Antenna, Horn, 1-18 GHz                  | 3115                     | 487            | 7/19/2014      |
| Hewlett Packard     | SpecAn 9 kHz - 40 GHz, FT (SA40) Blue    | 8564E (84125C)           | 1393           | 5/1/2013       |
| Hewlett Packard     | Head (Inc flex cable, (1742,1743) Blue)  | 84125C                   | 1620           | 5/17/2013      |
| Hewlett Packard     | HF Amplifier, 45 MHz -50 GHz (with 1620) | 83051A (84125C)          | 1742           | 5/17/2013      |
| Hewlett Packard     | HF Amplifier, 45 MHz -50 GHz (with 1620) | 83051A (84125C)          | 1743           | 5/17/2013      |
| Hewlett Packard     | Preamplifier, 100 kHz - 1.3 GHz          | 8447D OPT 010            | 1826           | 5/18/2013      |
| A.H. Systems        | Spare System Horn, 18-40GHz              | SAS-574, p/n: 2581       | 2162           | 5/8/2013       |
| Sunol Sciences      | Biconilog, 30-3000 MHz                   | JB3                      | 2197           | 2/7/2014       |
| Rohde & Schwarz     | EMI Test Receiver, 20 Hz-40 GHz          | ESIB40<br>(1088.7490.40) | 2493           | 1/18/2014      |

### AC Conducted Emissions, 12-Jun-13

| <u>Manufacturer</u> | <u>Description</u>              | <u>Model #</u>           | <u>Asset #</u> | <u>Cal Due</u> |
|---------------------|---------------------------------|--------------------------|----------------|----------------|
| EMCO                | LISN, 10 kHz-100 MHz, 25A       | 3825/2                   | 1292           | 14-Feb-14      |
| Rohde & Schwarz     | Pulse Limiter                   | ESH3 Z2                  | 1594           | 15-May-14      |
| Rohde & Schwarz     | EMI Test Receiver, 20 Hz-40 GHz | ESIB40<br>(1088.7490.40) | 2493           | 18-Jan-14      |

*Appendix B Test Data*

T91126 Pages 24 - 43



## *EMC Test Data*

|                        |                      |                  |                 |
|------------------------|----------------------|------------------|-----------------|
| Client:                | Griffin Technology   | Job Number:      | J91125          |
| Product                | BLE Module PRT-05358 | T-Log Number:    | T91126          |
|                        |                      | Account Manager: | Sheareen Jacobs |
| Contact:               | Michael O'Connor     |                  |                 |
| Emissions Standard(s): | FCC 15.247           | Class:           | -               |
| Immunity Standard(s):  | -                    | Environment:     | -               |

## **EMC Test Data**

For The

## **Griffin Technology**

Product

**BLE Module PRT-05358**

Date of Last Test: 6/12/2013



## EMC Test Data

|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |

### RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions

#### Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

#### General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing. All remote support equipment was located approximately 30 meters from the EUT with all I/O connections running on top of the groundplane or routed in overhead in the GR-1089 test configuration.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

#### Ambient Conditions:

Temperature: 20.4 °C  
Rel. Humidity: 36 %

#### Summary of Results - Device Operating in the 2400-2483.5 MHz Band

| Run # | Mode | Channel | Power Setting | Measured Power | Test Performed                    | Limit                        | Result / Margin                           |
|-------|------|---------|---------------|----------------|-----------------------------------|------------------------------|---|
| 1a    | BLE  | low     | 0             | -              | Restricted Band Edge (2390 MHz)   | FCC Part 15.209 / 15.247( c) | 33.2 dB $\mu$ V/m @ 2389.4 MHz (-20.8 dB) |
|       |      |         | 0             | -              | Bandedge (2400 MHz)               | 15.247( c)                   | 46.8 dB $\mu$ V/m @ 2399.2 MHz (-23.0 dB) |
|       |      |         | 0             | -              | Radiated Emissions, 1 - 26 GHz    | FCC Part 15.209 / 15.247( c) | No emissions were found                   |
| 1b    |      | center  | 0             | -              | Radiated Emissions, 1 - 26 GHz    | FCC Part 15.209 / 15.247( c) | No emissions were found                   |
| 1c    |      | high    | 0             | -              | Restricted Band Edge (2483.5 MHz) | FCC Part 15.209 / 15.247( c) | 39.7 dB $\mu$ V/m @ 2485.1 MHz (-14.3 dB) |
|       |      |         | 0             | -              | Radiated Emissions, 1 - 26 GHz    | FCC Part 15.209 / 15.247( c) | No emissions were found                   |

#### Modifications Made During Testing

No modifications were made to the EUT during testing

#### Deviations From The Standard

No deviations were made from the requirements of the standard.



## EMC Test Data

|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |

### Notes

The EUT has a fixed antenna, without provisions for a connector for test purposes. All measurements performed radiated



## EMC Test Data

|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |

### Run #1: Radiated Spurious Emissions, 30 - 25000 MHz. Operating Mode: BLE (GFSK)

Date of Test: 2/14/2013

Test Engineer: Rafael Varelas

Test Location: FT Chamber #3

#### Run #1a: Low Channel @ 2402 MHz

**Fundamental Signal Field Strength:** Peak value measured in 100kHz/100kHz

| Frequency       | Level        | Pol | 15.209 / 15.247 | Detector | Azimuth   | Height  | Comments |
|-----------------|--------------|-----|-----------------|----------|-----------|---------|----------|
| MHz             | dB $\mu$ V/m | v/h | Limit           | Margin   | Pk/QP/Avg | degrees | meters   |
| <b>EUT Side</b> |              |     |                 |          |           |         |          |
| 2401.970        | 84.2         | H   | -               | -        | AVG       | 179     | 2.0      |
| 2402.200        | 85.8         | H   | -               | -        | PK        | 179     | 2.0      |
| 2402.140        | 83.2         | H   | -               | -        | PK        | 179     | 2.0      |
| 2401.970        | 90.0         | V   | -               | -        | AVG       | 205     | 1.0      |
| 2402.150        | 91.5         | V   | -               | -        | PK        | 205     | 1.0      |
| 2401.670        | 89.8         | V   | -               | -        | PK        | 205     | 1.0      |

Fundamental emission level @ 3m in 100kHz RBW: 89.8 dB $\mu$ V/m

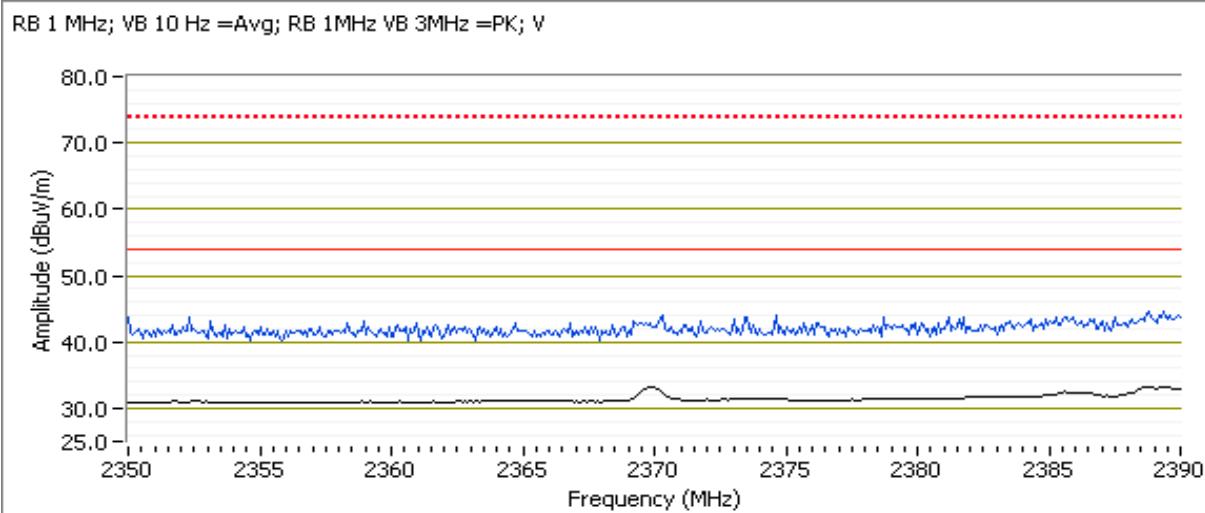
Limit for emissions outside of restricted bands: 69.8 dB $\mu$ V/m

Limit is -20dBc (Peak power measurement)

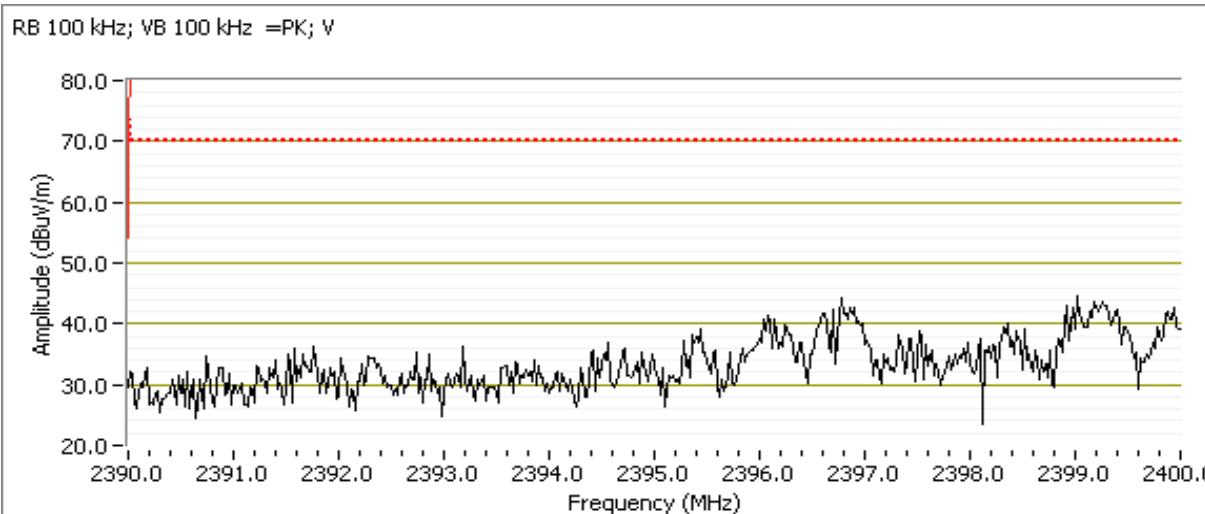
#### Restricted Band Edge Signal Field Strength @ 2390MHz

| Frequency | Level        | Pol | 15.209 / 15.247 | Detector | Azimuth   | Height  | Comments |
|-----------|--------------|-----|-----------------|----------|-----------|---------|----------|
| MHz       | dB $\mu$ V/m | v/h | Limit           | Margin   | Pk/QP/Avg | degrees | meters   |
| 2389.440  | 33.2         | V   | 54.0            | -20.8    | AVG       | 211     | 1.0      |
| 2389.280  | 44.7         | V   | 74.0            | -29.3    | PK        | 211     | 1.0      |
| 2369.880  | 31.4         | H   | 54.0            | -22.6    | AVG       | 312     | 1.3      |
| 2373.810  | 43.0         | H   | 74.0            | -31.0    | PK        | 312     | 1.3      |

|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |


**Band Edge Signal Field Strength @ 2400MHz (using 100k/100k vs -20dBc limit)**

| Frequency | Level        | Pol | 15.209 / 15.247 | Detector | Azimuth   | Height  | Comments |
|-----------|--------------|-----|-----------------|----------|-----------|---------|----------|
| MHz       | dB $\mu$ V/m | v/h | Limit           | Margin   | Pk/QP/Avg | degrees | meters   |
| 2399.180  | 46.8         | V   | 69.8            | -23.0    | PK        | 211     | 1.0      |
| 2399.180  | 40.1         | H   | 69.8            | -29.7    | PK        | 329     | 1.0      |



|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |

**Other Spurious Emissions**

Date of Test: 2/14/2013

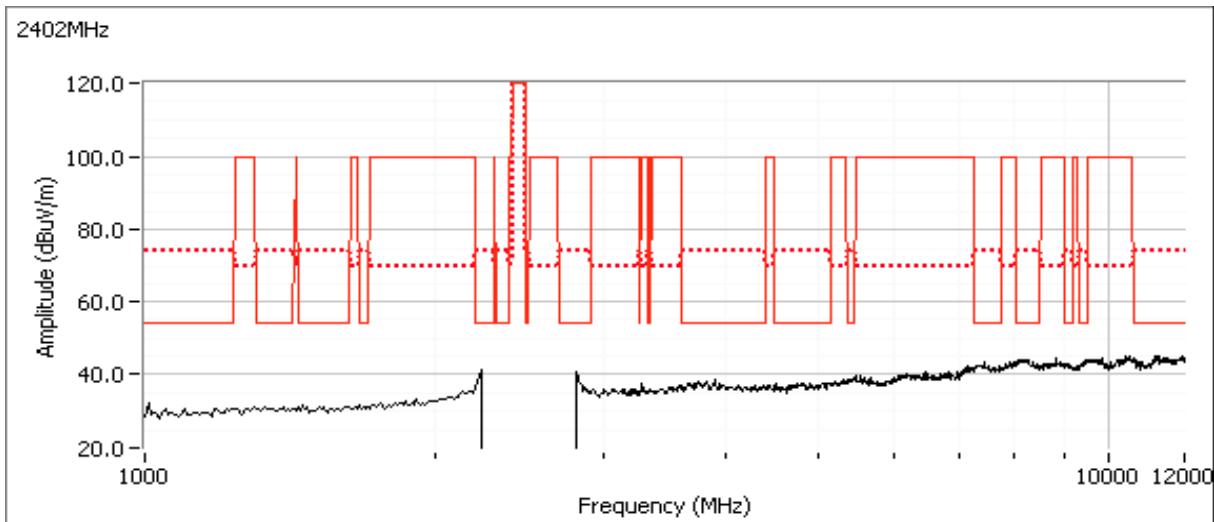
Test Engineer: Joseph Cadigal

Test Location: FT Chamber #3

| Frequency             | Level        | Pol | 15.209 / 15.247 | Detector | Azimuth   | Height  | Comments |
|-----------------------|--------------|-----|-----------------|----------|-----------|---------|----------|
| MHz                   | dB $\mu$ V/m | v/h | Limit           | Margin   | Pk/QP/Avg | degrees | meters   |
| no signals were found |              |     |                 |          |           |         |          |

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental and measured in 100kHz.

Note 2: Signal is not in a restricted band but the more stringent restricted band limit was used.





## EMC Test Data

|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |

### Run #1b: Center Channel @ 2442 MHz

**Fundamental Signal Field Strength:** Peak value measured in 100kHz/100kHz

| Frequency          | Level        | Pol | 15.209 / 15.247 |        | Detector  | Azimuth | Height | Comments                     |
|--------------------|--------------|-----|-----------------|--------|-----------|---------|--------|------------------------------|
| MHz                | dB $\mu$ V/m | v/h | Limit           | Margin | Pk/QP/Avg | degrees | meters |                              |
| <b>EUT Flat</b>    |              |     |                 |        |           |         |        |                              |
| 2441.970           | 75.9         | V   | -               | -      | AVG       | 145     | 1.3    | POS; RB 1 MHz; VB: 10 Hz     |
| 2441.630           | 77.5         | V   | -               | -      | PK        | 145     | 1.3    | POS; RB 1 MHz; VB: 3 MHz     |
| 2442.140           | 75.7         | V   | -               | -      | PK        | 145     | 1.3    | POS; RB 100 kHz; VB: 100 kHz |
| 2441.960           | 88.9         | H   | -               | -      | AVG       | 2       | 1.2    | POS; RB 1 MHz; VB: 10 Hz     |
| 2441.650           | 90.5         | H   | -               | -      | PK        | 2       | 1.2    | POS; RB 1 MHz; VB: 3 MHz     |
| 2441.930           | 88.3         | H   | -               | -      | PK        | 2       | 1.2    | POS; RB 100 kHz; VB: 100 kHz |
| <b>EUT Side</b>    |              |     |                 |        |           |         |        |                              |
| 2441.970           | 90.2         | V   | -               | -      | AVG       | 196     | 1.0    | POS; RB 1 MHz; VB: 10 Hz     |
| 2441.620           | 91.7         | V   | -               | -      | PK        | 196     | 1.0    | POS; RB 1 MHz; VB: 3 MHz     |
| 2441.810           | 89.2         | V   | -               | -      | PK        | 196     | 1.0    | POS; RB 100 kHz; VB: 100 kHz |
| 2441.970           | 82.7         | H   | -               | -      | AVG       | 178     | 1.2    | POS; RB 1 MHz; VB: 10 Hz     |
| 2441.660           | 84.2         | H   | -               | -      | PK        | 178     | 1.2    | POS; RB 1 MHz; VB: 3 MHz     |
| 2441.660           | 82.1         | H   | -               | -      | PK        | 178     | 1.2    | POS; RB 100 kHz; VB: 100 kHz |
| <b>EUT Upright</b> |              |     |                 |        |           |         |        |                              |
| 2441.960           | 86.5         | V   | -               | -      | AVG       | 232     | 1.2    | POS; RB 1 MHz; VB: 10 Hz     |
| 2441.650           | 87.9         | V   | -               | -      | PK        | 232     | 1.2    | POS; RB 1 MHz; VB: 3 MHz     |
| 2441.860           | 85.7         | V   | -               | -      | PK        | 232     | 1.2    | POS; RB 100 kHz; VB: 100 kHz |
| 2441.950           | 87.8         | H   | -               | -      | AVG       | 335     | 1.1    | POS; RB 1 MHz; VB: 10 Hz     |
| 2441.680           | 89.4         | H   | -               | -      | PK        | 335     | 1.1    | POS; RB 1 MHz; VB: 3 MHz     |
| 2441.860           | 87.1         | H   | -               | -      | PK        | 335     | 1.1    | POS; RB 100 kHz; VB: 100 kHz |

Fundamental emission level @ 3m in 100kHz RBW: 89.2 dB $\mu$ V/m

Limit for emissions outside of restricted bands: 69.2 dB $\mu$ V/m

Limit is -20dBc (Peak power measurement)

|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |

**Other Spurious Emissions**

Date of Test: 2/14/2013

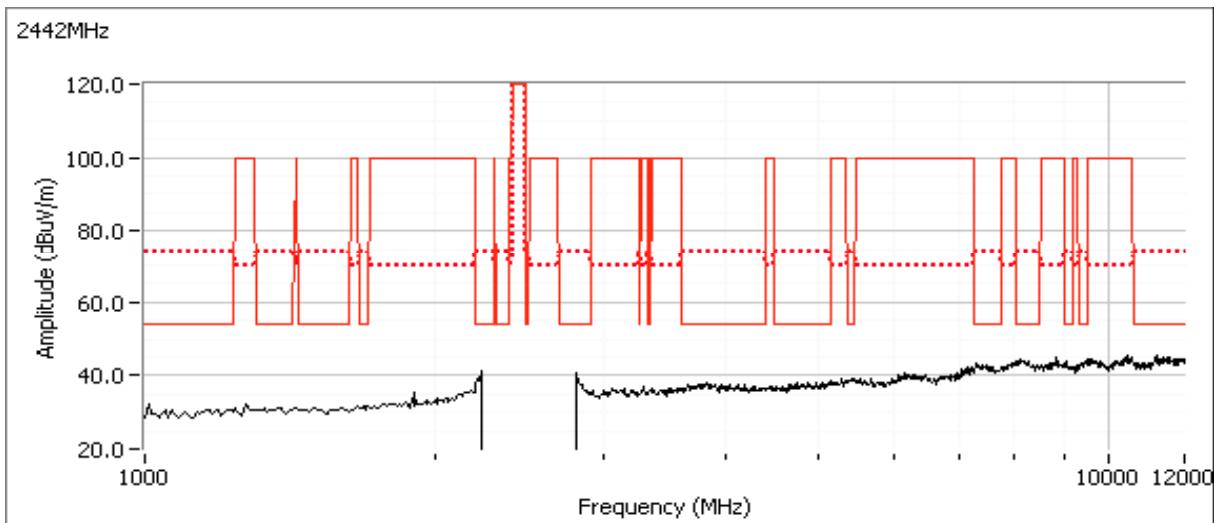
Test Engineer: Joseph Cadigal

Test Location: FT Chamber #3

| Frequency             | Level        | Pol | 15.209 / 15.247 | Detector | Azimuth   | Height  | Comments |
|-----------------------|--------------|-----|-----------------|----------|-----------|---------|----------|
| MHz                   | dB $\mu$ V/m | v/h | Limit           | Margin   | Pk/QP/Avg | degrees | meters   |
| no signals were found |              |     |                 |          |           |         |          |

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental and measured in 100kHz.

Note 2: Signal is not in a restricted band but the more stringent restricted band limit was used.



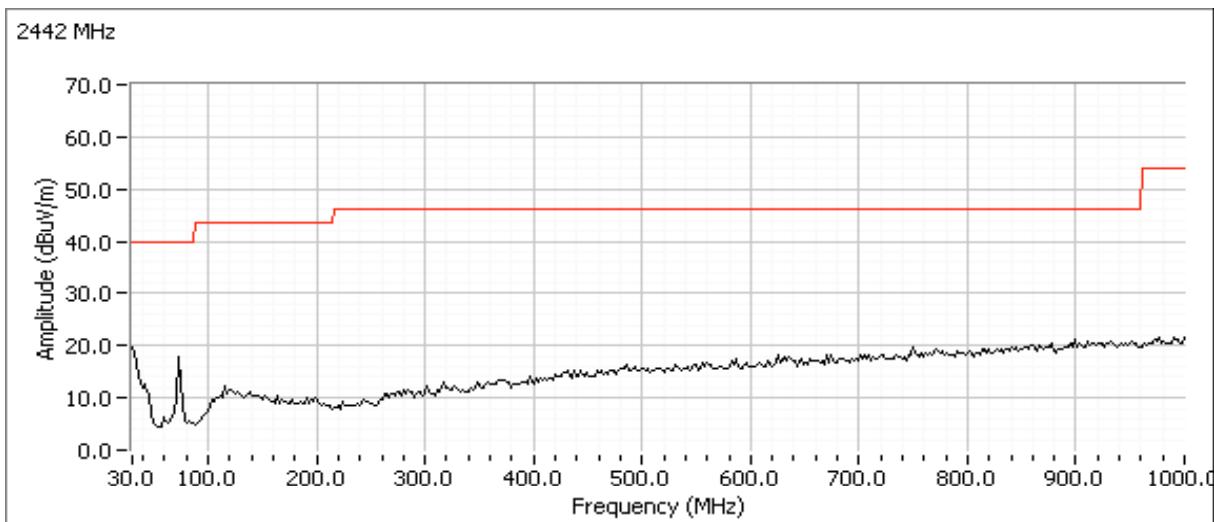
|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |

**Run #1b: Center Channel @ 2442 MHz**

Date of Test: 2/15/2013

Test Engineer: Deniz Demirci

Test Location: FT Chamber #5



Note 1: 30 MHz to 1 GHz emissions measured at center channel and no emission was observed related to the transmitter. Hence low and high channel measurements omitted

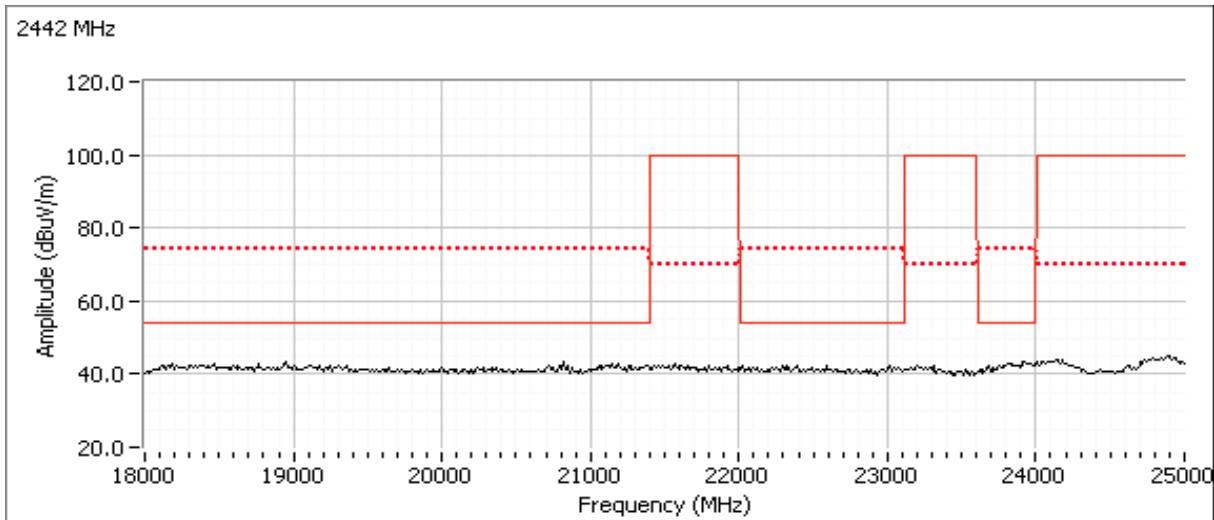
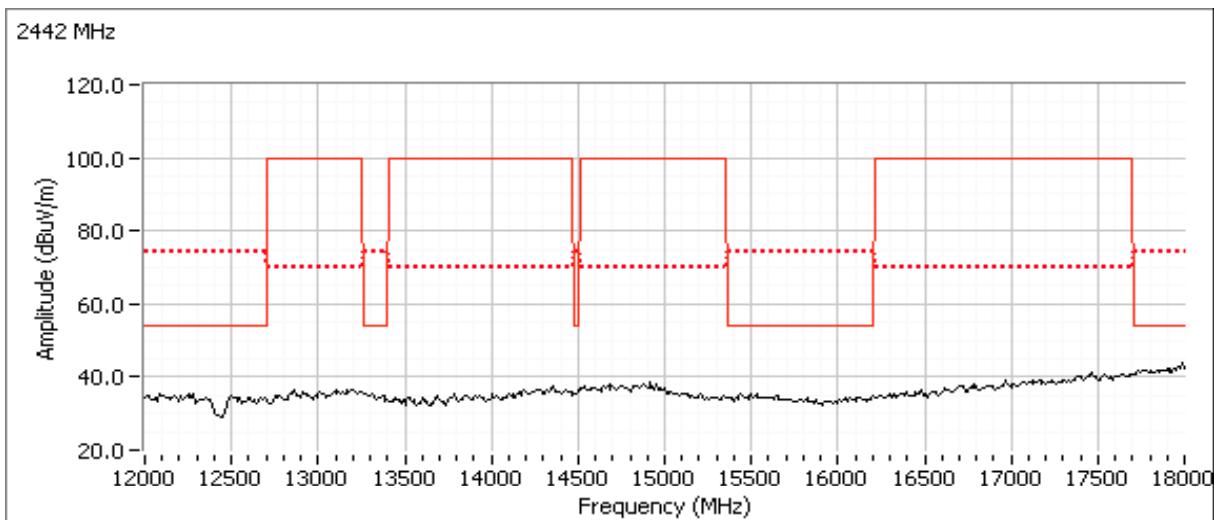
|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |

**Run #1b: Center Channel @ 2442 MHz**

Date of Test: 2/15/2013

Test Engineer: Deniz Demirci

Test Location: FT Chamber #5



Note 1: 12 GHz to 25 GHz emissions measured at center channel and no emission was observed related to the transmitter. Hence low and high channel measurements omitted

|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |

**Run #1c: High Channel @ 2480 MHz**
**Fundamental Signal Field Strength:** Peak value measured in 100kHz/100kHz

| Frequency | Level        | Pol | 15.209 / 15.247 | Detector | Azimuth   | Height  | Comments |
|-----------|--------------|-----|-----------------|----------|-----------|---------|----------|
| MHz       | dB $\mu$ V/m | v/h | Limit           | Margin   | Pk/QP/Avg | degrees | meters   |
| 2479.950  | 81.9         | H   | -               | -        | AVG       | 177     | 1.6      |
| 2479.650  | 83.5         | H   | -               | -        | PK        | 177     | 1.6      |
| 2480.170  | 81.4         | H   | -               | -        | PK        | 177     | 1.6      |
| 2479.970  | 88.8         | V   | -               | -        | AVG       | 202     | 1.0      |
| 2479.680  | 90.3         | V   | -               | -        | PK        | 202     | 1.0      |
| 2479.940  | 89.2         | V   | -               | -        | PK        | 202     | 1.0      |

Fundamental emission level @ 3m in 100kHz RBW: 89.2 dB $\mu$ V/m

Limit for emissions outside of restricted bands: 69.2 dB $\mu$ V/m

Limit is -20dBc (Peak power measurement)

**Restricted Band Edge Signal Field Strength @ 2483.5MHz**

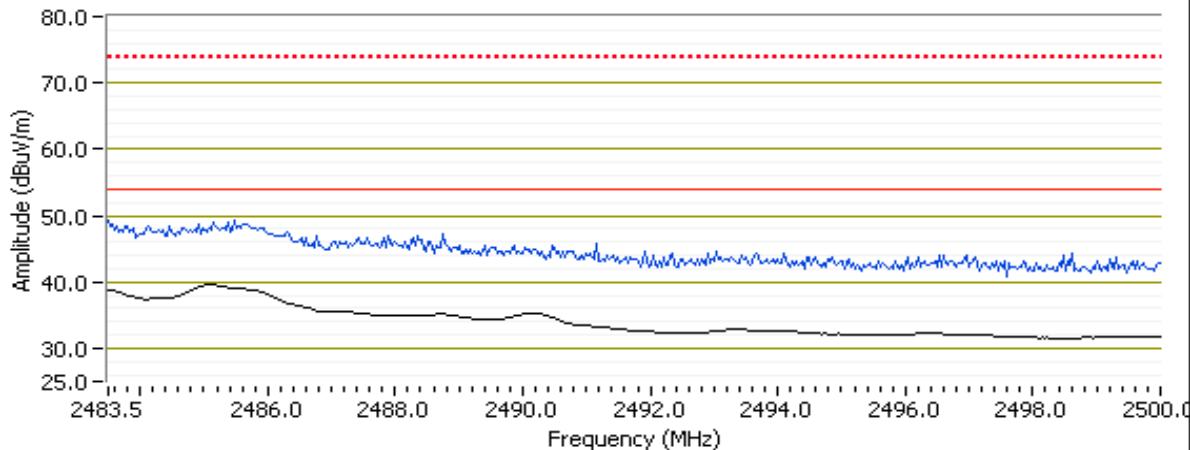
Date of Test: 2/14/2013

Test Engineer: Joseph Cadigal

Test Location: FT Chamber #3

| Frequency | Level        | Pol | 15.209 / 15.247 | Detector | Azimuth   | Height  | Comments |
|-----------|--------------|-----|-----------------|----------|-----------|---------|----------|
| MHz       | dB $\mu$ V/m | v/h | Limit           | Margin   | Pk/QP/Avg | degrees | meters   |
| 2485.090  | 39.7         | V   | 54.0            | -14.3    | AVG       | 197     | 1.0      |
| 2483.500  | 48.5         | V   | 74.0            | -25.5    | PK        | 197     | 1.0      |
| 2485.090  | 35.3         | H   | 54.0            | -18.7    | AVG       | 180     | 1.5      |
| 2485.420  | 45.4         | H   | 74.0            | -28.6    | PK        | 180     | 1.5      |

RB 1 MHz; VB 10 Hz= Avg, RB 1MHz VB 3MHz = Pk,V



|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |

**Other Spurious Emissions**

Date of Test: 2/14/2013

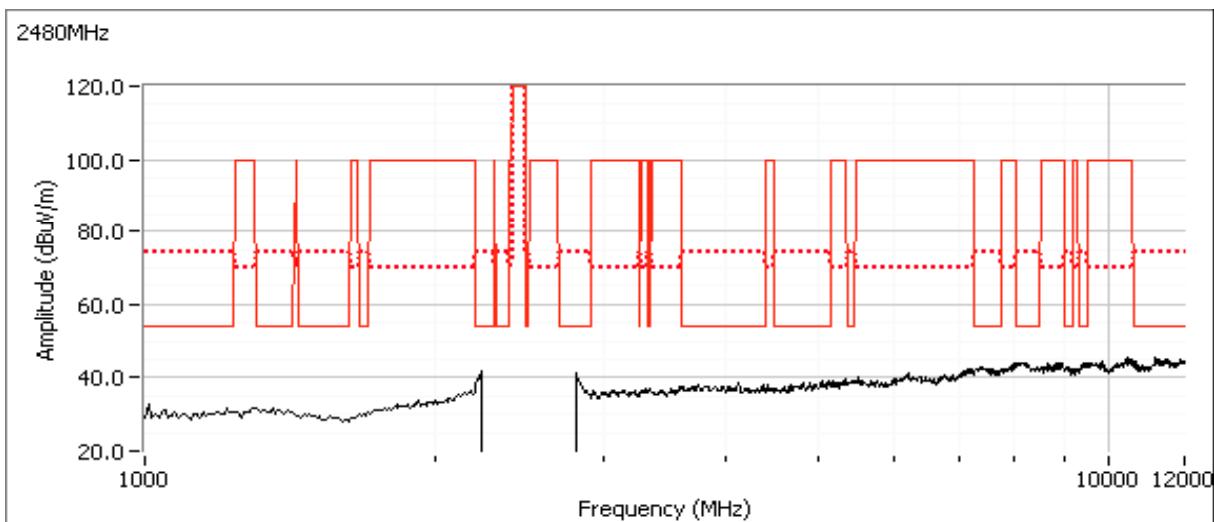
Test Engineer: Joseph Cadigal

Test Location: FT Chamber #3

| Frequency             | Level        | Pol | 15.209 / 15.247 | Detector | Azimuth   | Height  | Comments |
|-----------------------|--------------|-----|-----------------|----------|-----------|---------|----------|
| MHz                   | dB $\mu$ V/m | v/h | Limit           | Margin   | Pk/QP/Avg | degrees | meters   |
| no signals were found |              |     |                 |          |           |         |          |

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental and measured in 100kHz.

Note 2: Signal is not in a restricted band but the more stringent restricted band limit was used.





## EMC Test Data

|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |

### RSS 210 and FCC 15.247 (DTS) Antenna Port Measurements Power, PSD, Bandwidth and Spurious Emissions

#### Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 2/14/2013  
Test Engineer: Rafael Varelas  
Test Location: FT Chamber #3

Config. Used: 1  
Config Change: None  
EUT Voltage: Battery

#### General Test Configuration

The EUT was connected to the spectrum analyzer or power meter via a suitable attenuator. All measurements were made on a single chain.

All measurements have been corrected to allow for the external attenuators used.

#### Ambient Conditions:

Temperature: 20.4 °C  
Rel. Humidity: 36 %

#### Summary of Results

| Run # | Pwr setting | Avg Pwr | Test Performed               | Limit     | Pass / Fail | Result / Margin  |
|-------|-------------|---------|------------------------------|-----------|-------------|------------------|
| 1     | -           | -       | Output Power                 | 15.247(b) | Pass        | -5.0 dBm (0.3mW) |
| 2     | -           | -       | Power spectral Density (PSD) | 15.247(d) | Pass        | -19.6 dBm/3kHz   |
| 3     | -           | -       | Minimum 6dB Bandwidth        | 15.247(a) | Pass        | 681 kHz          |
| 3     | -           | -       | 99% Bandwidth                | RSS GEN   | -           | 1100 kHz         |

#### Modifications Made During Testing

No modifications were made to the EUT during testing

#### Deviations From The Standard

No deviations were made from the requirements of the standard.

#### Notes

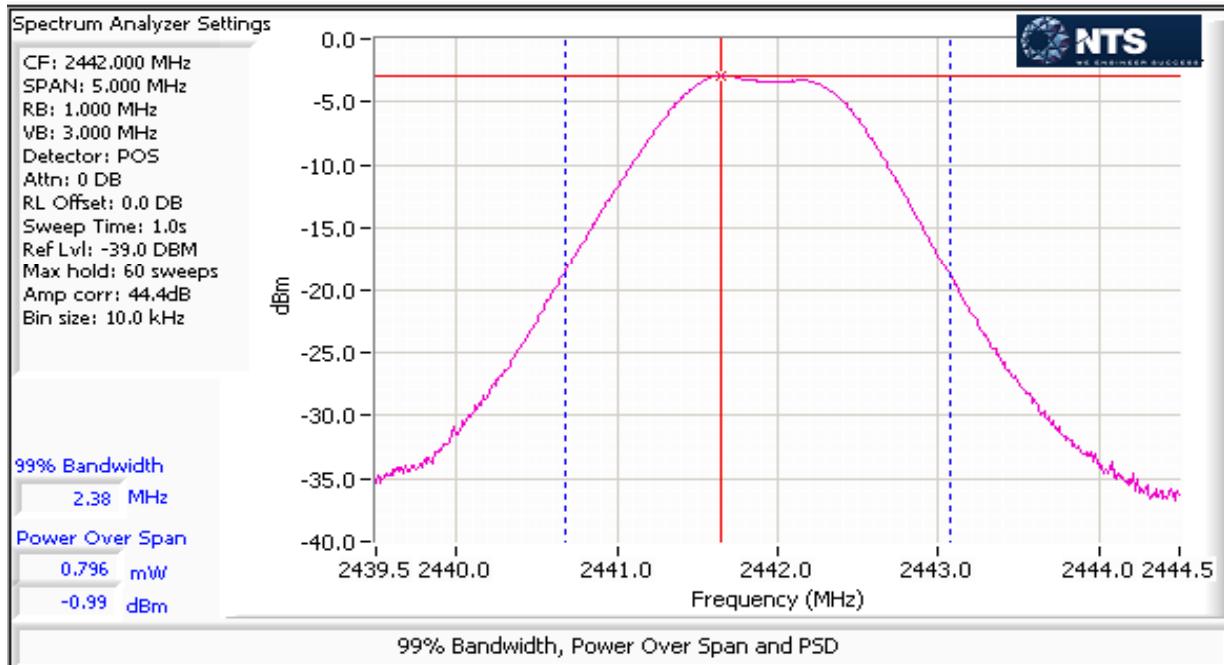
The EUT has a fixed antenna, without provisions for a connector for test purposes. All measurements performed radiated

|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |

**Run #1: Output Power**
**EUT Side**

| Power Setting <sup>2</sup> | Frequency (MHz) | EIRP <sup>1</sup> |       | Antenna Gain (dBi) | Output Power       |     | Result |
|----------------------------|-----------------|-------------------|-------|--------------------|--------------------|-----|--------|
|                            |                 | dBm               | W     |                    | (dBm) <sup>1</sup> | mW  |        |
| 0                          | 2402            | -1.6              | 0.001 | 4.0                | -5.6               | 0.3 | Pass   |
| 0                          | 2442            | -1.0              | 0.001 | 4.0                | -5.0               | 0.3 | Pass   |
| 0                          | 2480            | -3.0              | 0.001 | 4.0                | -7.0               | 0.2 | Pass   |

Note 1: Output power measured radiated using a spectrum analyzer (see plots below) with RBW=1MHz, VB=3 MHz, peak detector, and power integration over 3 MHz (8.1.2, Option #2 of KDB 558074). Spurious limit becomes -20dBc. Output power calculated from the eirp value measured.





## EMC Test Data

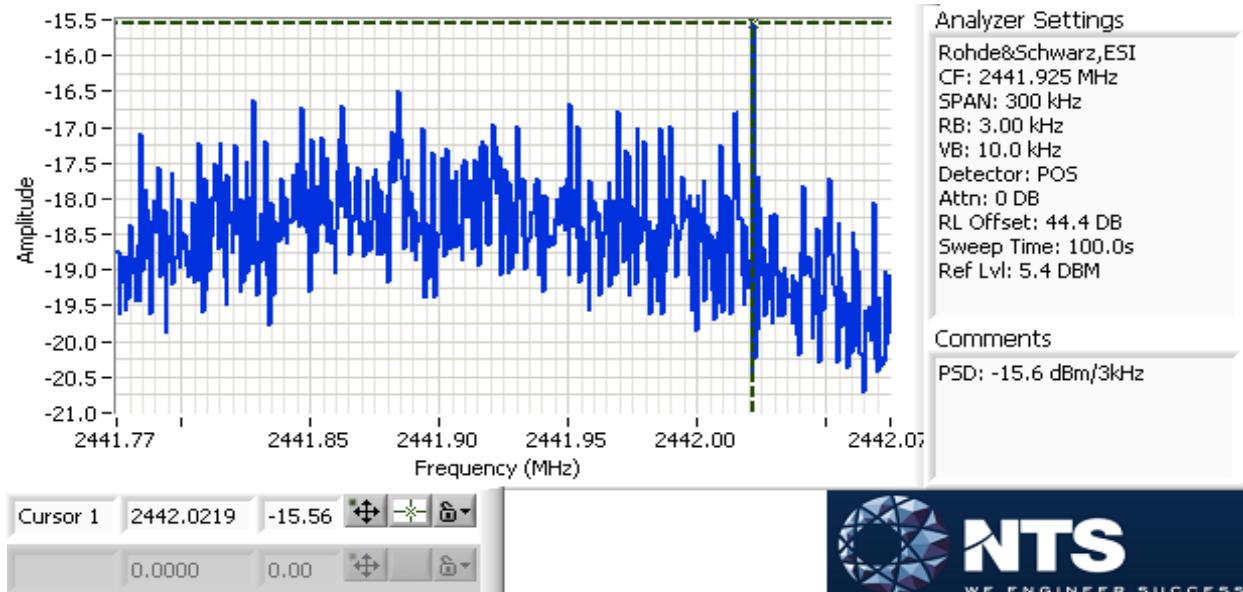
|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |

### Run #2: Power spectral Density

#### EUT Side

| Power Setting | Frequency (MHz) | PSD (eirp)        | Antenna Gain (dBi) | PSD               | Limit dBm/3kHz | Result |
|---------------|-----------------|-------------------|--------------------|-------------------|----------------|--------|
|               |                 | (dBm/3kHz) Note 1 |                    | (dBm/3kHz) Note 1 |                |        |
| 0             | 2402            | -16.0             | 4                  | -20.0             | 8.0            | Pass   |
| 0             | 2442            | -15.6             | 4                  | -19.6             | 8.0            | Pass   |
| 0             | 2480            | -17.7             | 4                  | -21.7             | 8.0            | Pass   |

Note 1: Power spectral density measured radiated using RB=3 kHz, VB=10kHz, analyzer with peak detector and with a sweep time set to ensure a dwell time of at least 1 second per 3kHz. The measurement is made at the frequency of PPSD determined from preliminary scans using RB=3kHz using multiple sweeps at a faster rate over the 6dB bandwidth of the signal. Final PSD calculated from the measured eirp value.

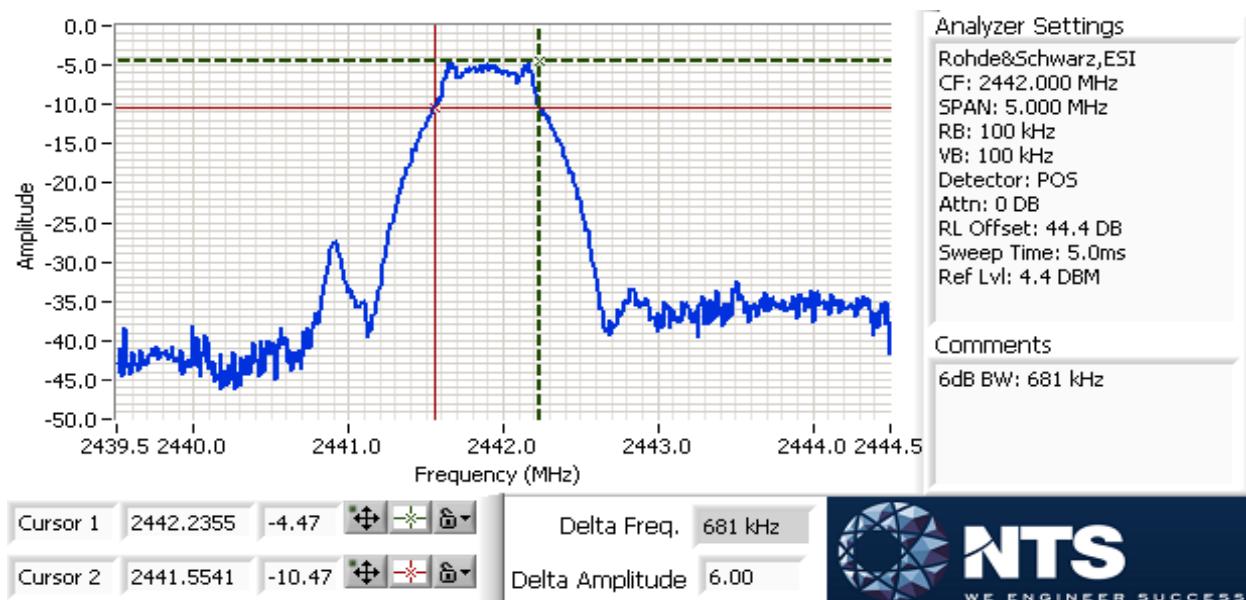


|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |

**Run #3: Signal Bandwidth**

| Power Setting | Frequency (MHz) | Resolution Bandwidth | Bandwidth (kHz) 6dB | Resolution Bandwidth | Bandwidth (kHz) 99% |
|---------------|-----------------|----------------------|---------------------|----------------------|---------------------|
|               |                 | 100kHz               | 651                 | 30kHz                | 1080                |
| 0             | 2402            | 100kHz               | 681                 | 30kHz                | 1100                |
| 0             | 2480            | 100kHz               | 661                 | 30kHz                | 1070                |

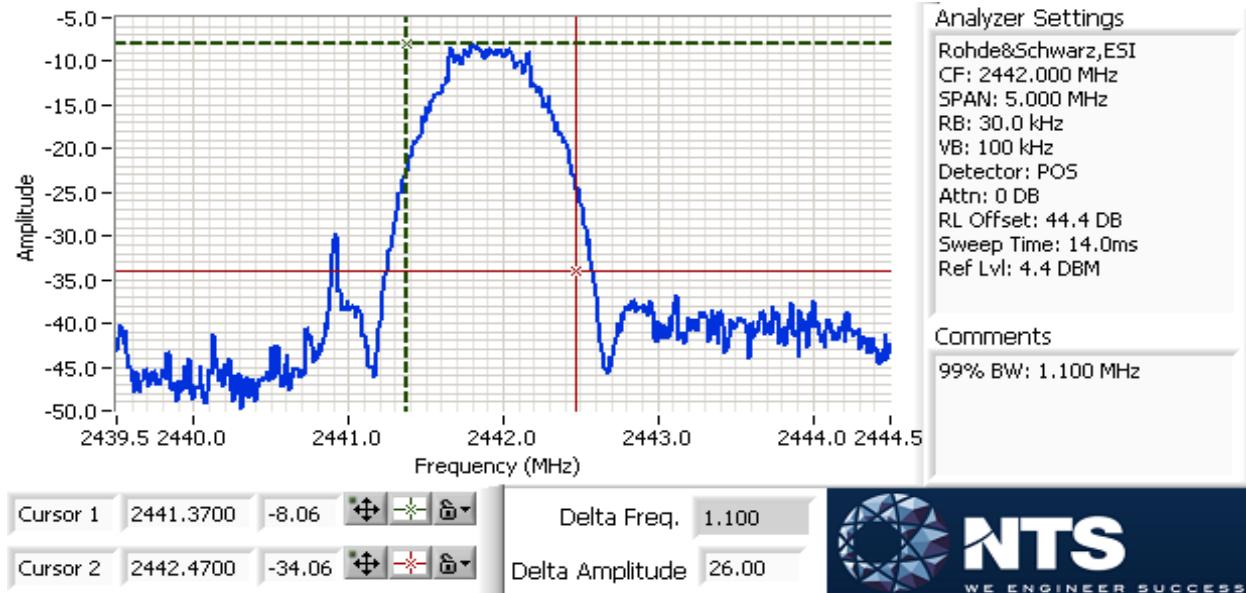
Note 1: 99% bandwidth measured in accordance with RSS GEN, with RB > 1% of the span and VB > 3xRB





## EMC Test Data

|           |                      |                  |                 |
|-----------|----------------------|------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:      | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:    | T91126          |
| Contact:  | Michael O'Connor     | Account Manager: | Sheareen Jacobs |
| Standard: | FCC 15.247           | Class:           | N/A             |





## *EMC Test Data*

|           |                      |                      |                 |
|-----------|----------------------|----------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:          | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:        | T91126          |
| Contact:  | Michael O'Connor     | Project Manager:     | Sheareen Jacobs |
| Standard: | FCC 15.247           | Project Coordinator: | -               |

## Conducted Emissions

*(Elliott Laboratories Fremont Facility, Semi-Anechoic Chamber)*

## Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 6/12/2013 Config. Used: 2  
Test Engineer: Mark Hill Config Change: -  
Test Location: Fremont Chamber #5 EUT Voltage: 120V/60Hz

## General Test Configuration

For tabletop equipment, the EUT was located on a wooden table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN.

Ambient Conditions: Temperature: 22 °C  
Rel. Humidity: 40 %

## Summary of Results

| Run # | Test Performed          | Limit      | Result | Margin                                 |
|-------|-------------------------|------------|--------|--|
| 1     | CE, AC Power, 120V/60Hz | FCC 15.207 | Pass   | 43.7 dB $\mu$ V @ 0.216 MHz (-19.3 dB) |

## Modifications Made During Testing

No modifications were made to the EUT during testing

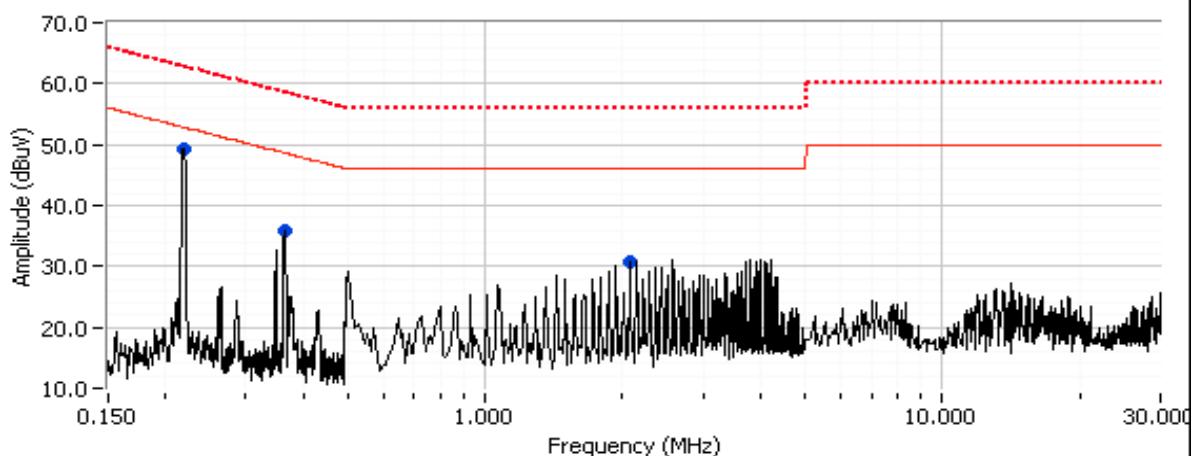
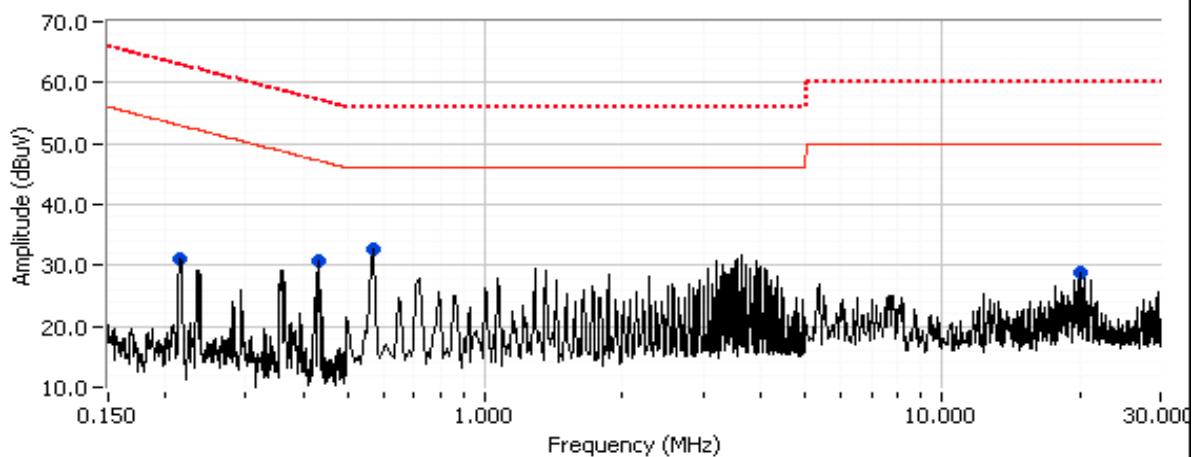
## Deviations From The Standard

No deviations were made from the requirements of the standard.

|           |                      |                      |                 |
|-----------|----------------------|----------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:          | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:        | T91126          |
| Contact:  | Michael O'Connor     | Project Manager:     | Sheareen Jacobs |
| Standard: | FCC 15.247           | Project Coordinator: | -               |

**Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz**

Note: EUT configured to transmit continuously on 2446MHz, at maximum power

**Run #1: 30 - 1000 MHz, Line**

**Run #1: 30 - 1000 MHz, Neutral**




## EMC Test Data

|           |                      |                      |                 |
|-----------|----------------------|----------------------|-----------------|
| Client:   | Griffin Technology   | Job Number:          | J91125          |
| Model:    | BLE Module PRT-05358 | T-Log Number:        | T91126          |
| Contact:  | Michael O'Connor     | Project Manager:     | Sheareen Jacobs |
| Standard: | FCC 15.247           | Project Coordinator: | -               |
| Class:    | -                    |                      |                 |

### Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

| Frequency<br>MHz | Level<br>dB $\mu$ V | AC<br>Line | FCC 15.207 |        | Detector<br>QP/Ave | Comments |
|------------------|---------------------|------------|------------|--------|--------------------|----------|
|                  |                     |            | Limit      | Margin |                    |          |
| 0.219            | 49.3                | Line 1     | 52.9       | -3.6   | Peak               |          |
| 0.363            | 35.9                | Line 1     | 48.6       | -12.7  | Peak               |          |
| 2.074            | 30.9                | Line 1     | 46.0       | -15.1  | Peak               |          |
| 0.216            | 31.1                | Neutral    | 53.0       | -21.9  | Peak               |          |
| 0.432            | 30.7                | Neutral    | 47.2       | -16.5  | Peak               |          |
| 0.574            | 32.7                | Neutral    | 46.0       | -13.3  | Peak               |          |
| 20.015           | 28.7                | Neutral    | 50.0       | -21.3  | Peak               |          |

### Final quasi-peak and average readings

| Frequency<br>MHz | Level<br>dB $\mu$ V | AC<br>Line | FCC 15.207 |        | Detector<br>QP/Ave | Comments    |
|------------------|---------------------|------------|------------|--------|--------------------|-------------|
|                  |                     |            | Limit      | Margin |                    |             |
| 0.216            | 43.7                | Neutral    | 63.0       | -19.3  | QP                 | QP (1.00s)  |
| 0.218            | 42.1                | Line 1     | 62.9       | -20.8  | QP                 | QP (1.00s)  |
| 0.574            | 31.4                | Neutral    | 56.0       | -24.6  | QP                 | QP (1.00s)  |
| 2.074            | 29.4                | Line 1     | 56.0       | -26.6  | QP                 | QP (1.00s)  |
| 0.432            | 28.1                | Neutral    | 57.2       | -29.1  | QP                 | QP (1.00s)  |
| 0.363            | 28.4                | Line 1     | 58.7       | -30.3  | QP                 | QP (1.00s)  |
| 0.574            | 13.4                | Neutral    | 46.0       | -32.6  | AVG                | AVG (0.10s) |
| 2.074            | 11.9                | Line 1     | 46.0       | -34.1  | AVG                | AVG (0.10s) |
| 20.015           | 25.3                | Neutral    | 60.0       | -34.7  | QP                 | QP (1.00s)  |
| 0.216            | 17.3                | Neutral    | 53.0       | -35.7  | AVG                | AVG (0.10s) |
| 0.432            | 11.1                | Neutral    | 47.2       | -36.1  | AVG                | AVG (0.10s) |
| 0.218            | 15.0                | Line 1     | 52.9       | -37.9  | AVG                | AVG (0.10s) |
| 0.363            | 8.5                 | Line 1     | 48.7       | -40.2  | AVG                | AVG (0.10s) |
| 20.015           | 9.5                 | Neutral    | 50.0       | -40.5  | AVG                | AVG (0.10s) |

*End of Report*

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