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# Report On

Application for Grant of Equipment Authorization of the
St. Jude Medical IESD
SJM Confirm™ DM3500 Implantable Cardiac Monitor

FCC Part 15 Subpart C §15.247
IC RSS-247 Issue 1 May 2015

**Report No. SD72113533-0216A** **April 2016**

| | |
|---|---|
| **REPORT ON** | Radio Testing of the<br>St. Jude Medical IESD<br>SJM Confirm™ DM3500 Implantable Cardiac Monitor |
| **TEST REPORT NUMBER** | SD72113533-0216A |
| **PREPARED FOR** | St. Jude Medical IESD<br>15900 Valley View Court<br>Sylmar, CA 91342<br>USA |
| **CONTACT PERSON** | Jorge Amely-Velez<br>Senior Principal Engineer<br>(818) 493-2818<br>jamely-velez@sjm.com |
| **PREPARED BY** | Alex Chang<br>**Name**<br>Title: EMC/Wireless Test Engineer |
| **APPROVED BY** | Juan Manuel Gonzalez<br>**Name**<br>Authorized Signatory<br>Title: Commercial/Wireless EMC Lab Manager |
| **DATED** | April 26, 2016 |

**Revision History**

| SD72113533-0216A<br>St. Jude Medical IESD<br>SJM Confirm™ DM3500 Implantable Cardiac Monitor | | | | | |
|---|---|---|---|---|---|
| DATE | OLD REVISION | NEW REVISION | REASON | PAGES AFFECTED | APPROVED BY |
| 04/26/2016 | Initial Release | | | | Juan M. Gonzalez |
| | | | | | |
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**CONTENTS**





TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

**SECTION 1**

**REPORT SUMMARY**

Radio Testing of the
St. Jude Medical IESD
SJM Confirm™ DM3500 Implantable Cardiac Monitor

## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the St. Jude Medical IESD SJM Confirm™ DM3500 Implantable Cardiac Monitor to the requirements of FCC Part 15 Subpart C §15.247 and IC RSS-247 Issue 1 May 2015.

| | |
|---|---|
| Objective | To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out. |
| Manufacturer | St. Jude Medical IESD |
| Model Name | SJM Confirm™ |
| Model Number(s) | DM3500 |
| FCC ID Number | RIASJMRFICMDM3500 |
| IC Number | 8454A-DM3500123 |
| Serial Number(s) | 136.01 (Temporary Conducted port sample)<br>138.01 (Radiated sample) |
| Number of Samples Tested | 2 |
| Test Specification/Issue/Date | • FCC Part 15 Subpart C §15.247 (October, 2015).<br>• IC RSS-247 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Device (Issue 1 May 2015)<br>• RSS-Gen - General Requirements for Compliance of Radio Apparatus (Issue 4, November 2014).<br>• 558074 D01 DTS Meas Guidance v03r04 (January 07, 2016) Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.<br>• ANSI C63.10-2013. America National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices. |
| Start of Test | April 04, 2016 |
| Finish of Test | April 06, 2016 |
| Name of Engineer(s) | Alex Chang |
| Related Document(s) | • None. Supporting documents for EUT certification are separate exhibits. |

## 1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart C §15.247 with cross-reference to the corresponding IC RSS standard is shown below.

| Section | §15.247 Spec Clause | RSS | Test Description | Result | Comments/ Base Standard |
|---|---|---|---|---|---|
| 2.1 | §15.247(b)(3) | RSS-247 5.4(4) | Peak Output Power | Compliant | |
| — | §15.207(a) | RSS-Gen 8.8 | Conducted Emissions | N/A * | |
| 2.2 | | RSS-Gen 6.6 | 99% Emission Bandwidth | Compliant | |
| 2.3 | §15.247(a)(2) | RSS-247 5.2(1) | Minimum 6 dB RF Bandwidth | Compliant | |
| 2.4 | §15.247(d) | RSS-247 5.5 | Out-of-Band Emissions - Conducted | Compliant | |
| 2.5 | §15.247(d) | RSS-247 5.5 | Band-edge Compliance of RF Conducted Emissions | Compliant | |
| 2.6 | §15.247(d) | RSS-Gen 8.9 and 8.10 | Spurious Radiated Emissions | Compliant | |
| 2.6 | | RSS-Gen 7.1 | Receiver Spurious Emissions | Compliant | |
| 2.7 | §15.247(d) | RSS-Gen 8.9 and 8.10 | Radiated Band Edge Measurements | Compliant | |
| 2.8 | §15.247(e) | RSS-247 5.2(2) | Power Spectral Density for Digitally Modulated Device | Compliant | |

* Not applicable. EUT is battery operated device.

## 1.3 PRODUCT INFORMATION

### 1.3.1 Technical Description

The Equipment Under Test (EUT) was a St. Jude Medical IESD Implantable Cardiac Monitor SJM Confirm™, Model DM3500. The EUT is an implantable patient-activated and automatically activated monitoring system that records subcutaneous ECGs. EUT Bluetooth Low Energy (BLE) mode was verified and evaluated in this test report.

### 1.3.2 EUT General Description

| | |
|---|---|
| EUT Description | Implantable Cardiac Monitor |
| Model Name | SJM Confirm™ |
| Model Number(s) | DM3500 |
| Rated Voltage | Internal 3.2VDC |
| Mode Verified | Bluetooth LE |
| Capability | Bluetooth LE |
| Primary Unit (EUT) | ☐ Production |
| | ☒ Pre-Production |
| | ☐ Engineering |
| Antenna Type | Monopole |
| Manufacture | St. Jude Medical IESD |
| Antenna Gain | -12.5 dBi |

### 1.3.3 Maximum Conducted Output Power

| Bluetooth Low Energy (LE) | Mode | Frequency Range (MHz) | Output Power (dBm) | Output Power (mW) |
|---|---|---|---|---|
| | Bluetooth LE | 2402 – 2480 | -3.14 | 0.49 |

## 1.4 EUT TEST CONFIGURATION

### 1.4.1 Test Configuration Description

| Test Configuration | Description |
|---|---|
| A | Antenna conducted port test configuration. All measurements were performed on the temporary antenna port and associated with support equipment/programmable boards. The EUT is programmed via USB-to-Serial port using IDLE commands to modify channels number, and Tx power level. |
| B | Radiated emissions test configuration. The EUT is programmed with support equipment and remotely controlled via Bluetooth connection by a support iPhone app provided by client. |

### 1.4.2 EUT Exercise Software

"Orion_RCT – BT LE Radio Test" software app was provided by client to exercise the EUT to perform radiated emission.
No special software used for conducted port measurement. EUT is programmed via USB-to-Serial connection using IDLE commands to exercise the EUT. IDLE version 2.7.9 was used during evaluation.

### 1.4.3 Support Equipment and I/O cables

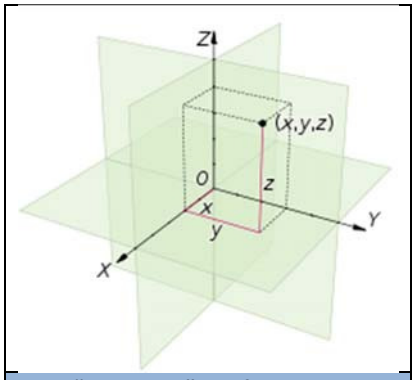
| Manufacturer | Equipment/Cable | Description |
|---|---|---|
| Dell | Support Laptop | Model: PP18L |
| Dell | Support Laptop External Power Supply | Model: DA90PS1-00 |
| — | Phantom Cylinder | — |
| Zurich Med Tech | Phantom Liquid (Fat Liquid Material) | P/N: ZL AAF245 CA |

### 1.4.4 Worst Case Configuration

Worst-case configuration used in this test report as per maximum conducted output power measurements:

| Mode | Channel | Data Rate |
|---|---|---|
| Bluetooth LE | 0 (Low Channel) | 1Mbps |

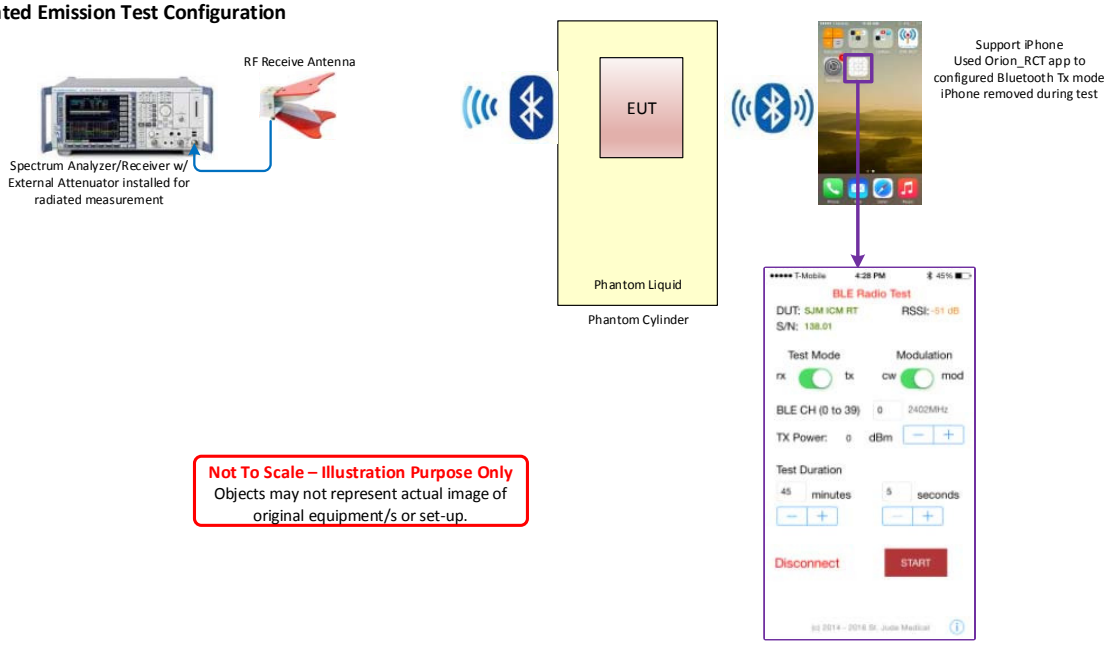
EUT is a portable device. For radiated measurements X, Y and Z orientations were verified. Worst case position is "Z".




**"X, Y and Z" Configuration**

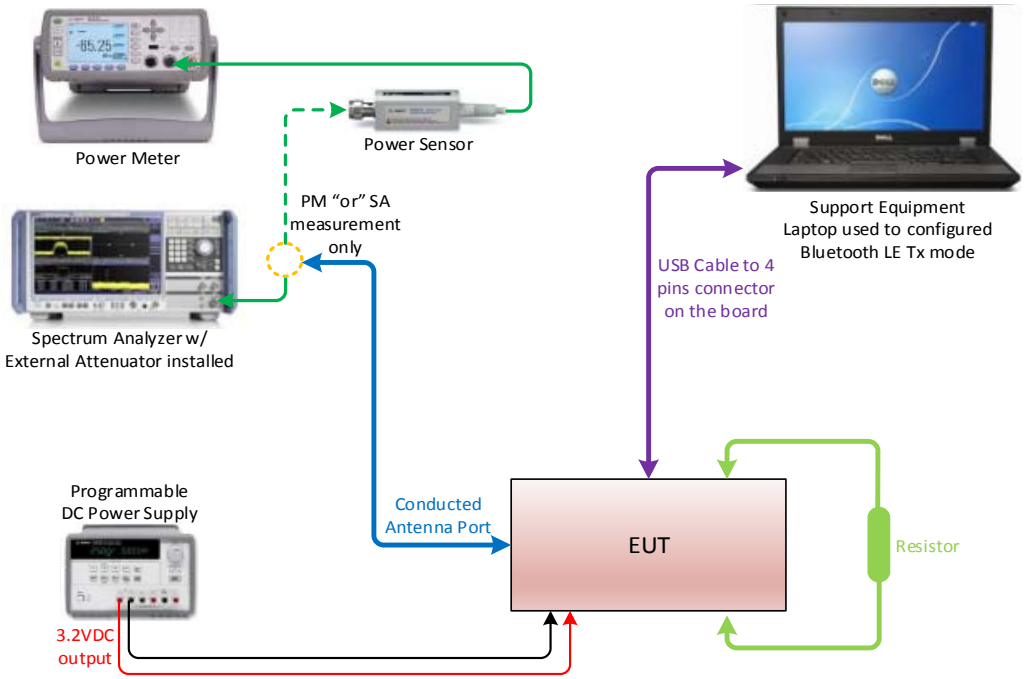
### 1.4.5 Simplified Test Configuration Diagram

**Radiated Emission Test Configuration**




**Not To Scale – Illustration Purpose Only**
Objects may not represent actual image of original equipment/s or set-up.

**Conducted (Antenna Port) Test Configuration**




**Not To Scale – Illustration Purpose Only**
Objects may not represent actual image of original equipment/s or set-up.

## 1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

## 1.6 MODIFICATION RECORD

| Description of Modification | Modification Fitted By | Date Modification Fitted |
|---|---|---|
| Serial Number: 136.01(Temporary Conducted port sample) and 138.01(Radiated sample). | | |
| N/A | — | — |

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

## 1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, America National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

For conducted and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.10-2013. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

## 1.8 TEST FACILITY LOCATION

### 1.8.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: 858 678 1400 FAX: 858-546 0364

### 1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)

16530 Via Esprillo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 942 5542 FAX: 858-546 0364

## 1.9 TEST FACILITY REGISTRATION

### 1.9.1 FCC – Registration No.: US1146

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.948 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US1146.

### 1.9.2 Innovation, Science and Economic Development Canada Registration No.: 3067A

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 3067A.

**SECTION 2**

**TEST DETAILS**

Radio Testing of the
St. Jude Medical IESD
SJM Confirm™ DM3500 Implantable Cardiac Monitor

## 2.1 PEAK OUTPUT POWER

### 2.1.1 Specification Reference

Part 15 Subpart C §15.247(b)(3)

### 2.1.2 Standard Applicable

(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

### 2.1.3 Equipment Under Test and Modification State

Serial No: 136.01 / Test Configuration A

### 2.1.4 Date of Test/Initial of test personnel who performed the test

April 04, 2016 / AC

### 2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.1.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---|---|
| Ambient Temperature | 25.4 °C |
| Relative Humidity | 41.1 % |
| ATM Pressure | 99.5 kPa |

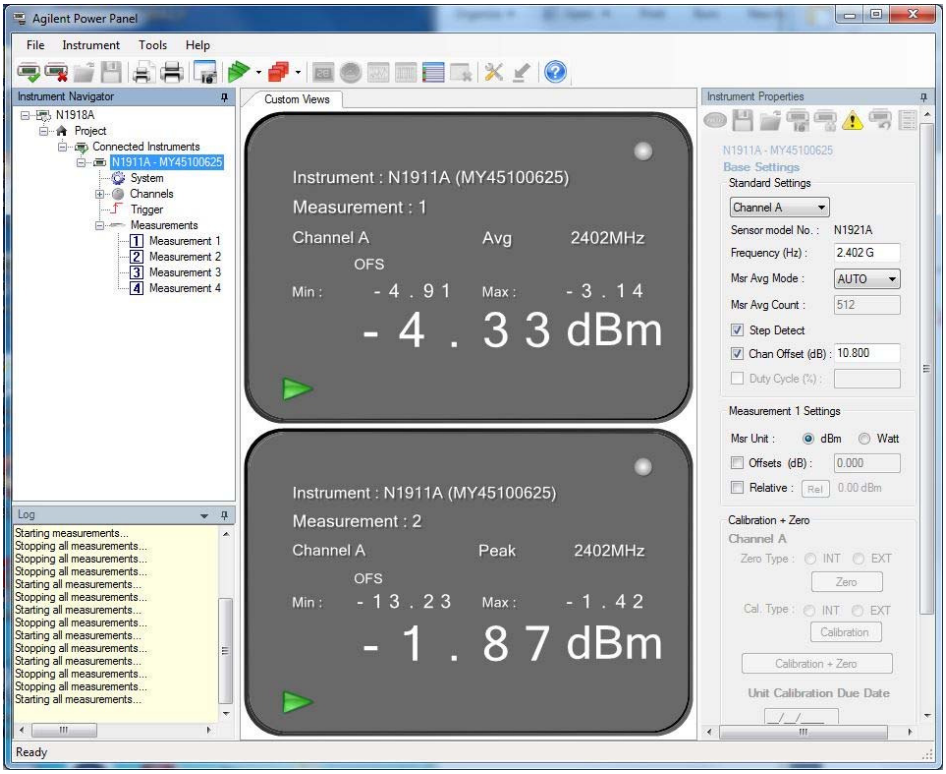
### 2.1.7 Additional Observations

- This is a conducted test (Maximum conducted [average] output power) using direct connection to a power meter.
- An offset of 10.8dB was added to compensate for the external attenuator and cable used from the antenna port to the power sensor.
- Test methodology is per Clause 9.2.3.1 of KDB 558074 D01 (DTS Meas Guidance v03r04, January 07, 2016). All conditions under this Clause are satisfied.
- Both Peak and Average measurements were recorded.

### 2.1.8 Test Results

| Bluetooth Low Energy (LE) | Channel | Modulation | Measured Average Power (dBm) | Measured Peak Power (dBm) |
|---|---|---|---|---|
| | 0 (2402 MHz) | GFSK @ 1Mbps | **-3.14** | **-1.42** |
| | 19 (2440 MHz) | | -4.10 | -2.15 |
| | 39 (2480 MHz) | | -4.94 | -3.01 |

### 2.1.9 Sample Test Display




**Bluetooth LE. Low Channel**

## 2.2 99% EMISSION BANDWIDTH

### 2.2.1 Specification Reference

RSS-Gen Clause 4.6.1

### 2.2.2 Standard Applicable

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.
The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.
The trace data points are recovered and directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

### 2.2.3 Equipment Under Test and Modification State

Serial No: 136.01 / Test Configuration A

### 2.2.4 Date of Test/Initial of test personnel who performed the test

April 04, 2016 / AC

### 2.2.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.2.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---|---|
| Ambient Temperature | 25.4 °C |
| Relative Humidity | 41.1 % |
| ATM Pressure | 99.5 kPa |

### 2.2.7 Additional Observations

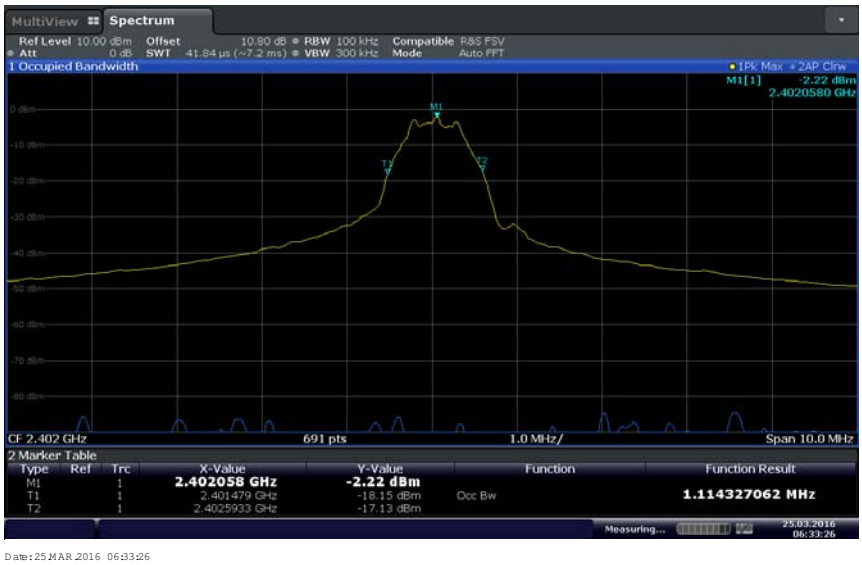
- This is a conducted test.
- An offset of 10.8dB was added to compensate for the external attenuator and cable used.
- Span is wide enough to capture the channel transmission.
- RBW is 1% of the span.
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.

- The % Power Bandwidth setting in the spectrum analyzer was set to 99% (default).
- The Channel Bandwidth measurement function of the spectrum analyzer was used for this test.

### 2.2.8 Test Results (For reporting purposes only)

| Bluetooth Low Energy (LE) | Channel | Measured 99% Bandwidth (MHz) |
|---|---|---|
| | 0 (2402 MHz) | 1.114 |
| | 19 (2440 MHz) | 1.114 |
| | 39 (2480 MHz) | 1.114 |

### 2.2.9 Test Results Plots

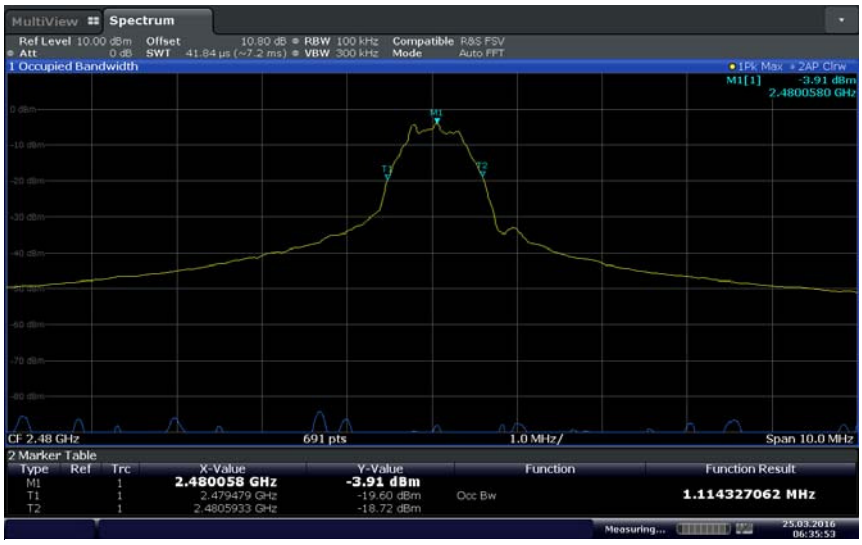



Date: 25.MAR.2016 06:33:26

**Bluetooth LE Low Channel**


Date: 25.MAR.2016 06:34:47

**Bluetooth LE Mid Channel**




Date: 25.MAR.2016 06:35:53

**Bluetooth LE High Channel**

## 2.3 MINIMUM 6 dB RF BANDWIDTH

### 2.3.1 Specification Reference

Part 15 Subpart C §15.247(a)(2)

### 2.3.2 Standard Applicable

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

### 2.3.3 Equipment Under Test and Modification State

Serial No: 136.01 / Test Configuration A

### 2.3.4 Date of Test/Initial of test personnel who performed the test

April 04, 2016 / AC

### 2.3.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.3.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---|---|
| Ambient Temperature | 25.4 °C |
| Relative Humidity | 41.1 % |
| ATM Pressure | 99.5 kPa |

### 2.3.7 Additional Observations

- This is a conducted test.
- An offset of 10.8 dB was added to compensate for the external attenuator and cable used.
- Span is wide enough to capture the channel transmission.
- RBW is set to 100 kHz.
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.
- The “n” dB down marker function of the spectrum analyzer was used for this test.
- For signal modulation where “n” dB down marker function is not practical, a peak measurement is performed while the trace is in max hold.

### 2.3.8 Test Results

| Bluetooth Low Energy (LE) | Channel | Measured Bandwidth (kHz) | Minimum Bandwidth (kHz) | Compliance |
|---|---|---|---|---|
| | 0 (2402 MHz) | 695.0 | 500 | Complies |
| | 19 (2440 MHz) | 709.0 | 500 | Complies |
| | 39 (2480 MHz) | 724.0 | 500 | Complies |

### 2.3.9 Test Results Plots


Date: 25.MAR.2016 06:41:07

**Bluetooth LE Low Channel**


Date: 25.MAR.2016 06:39:49

**Bluetooth LE Mid Channel**


Date: 25.MAR.2016 06:38:18

**Bluetooth LE High Channel**

## 2.4 OUT-OF-BAND EMISSIONS - CONDUCTED

### 2.4.1 Specification Reference

Part 15 Subpart C §15.247(d)

### 2.4.2 Standard Applicable

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

### 2.4.3 Equipment Under Test and Modification State

Serial No: 136.01 / Test Configuration A

### 2.4.4 Date of Test/Initial of test personnel who performed the test

April 04, 2016 / AC

### 2.4.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.4.6 Environmental Conditions

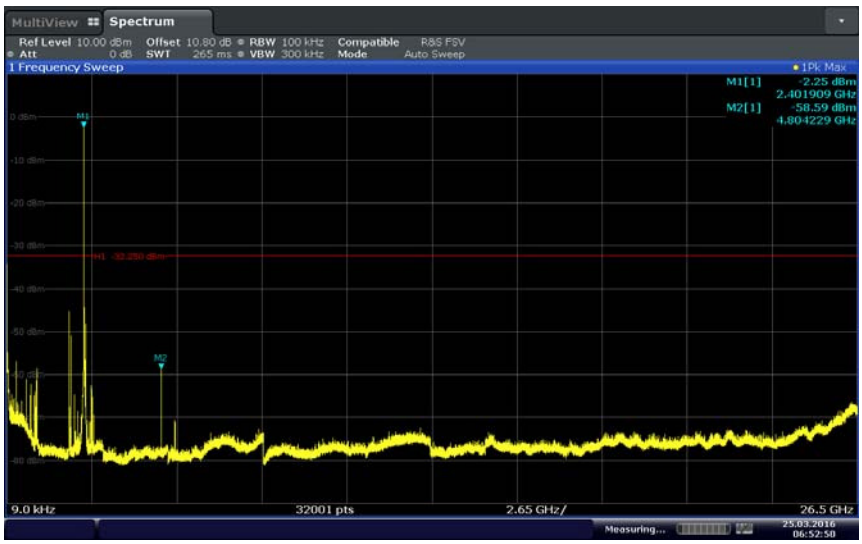
Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---|---|
| Ambient Temperature | 25.4 °C |
| Relative Humidity | 41.1 % |
| ATM Pressure | 99.5 kPa |

### 2.4.7 Additional Observations

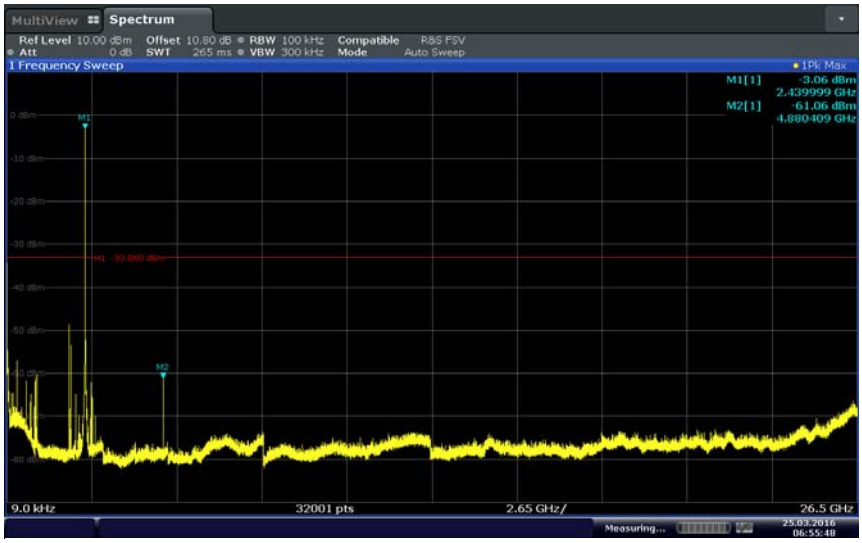
- This is a conducted test.
- An offset of 10.8dB was added to compensate for the external attenuator and cable used.
- RBW is 100kHz.VBW is 3X RBW.
- Sweep is auto. Detector is peak. Trace is max hold.
- Initial scan was performed to determine the highest level of the desired power within the band. Limit (display line) was drawn 30dB below this level.
- Spectrum was searched from 9 kHz up to 26.5GHz.

### 2.4.8 Test Results Plots



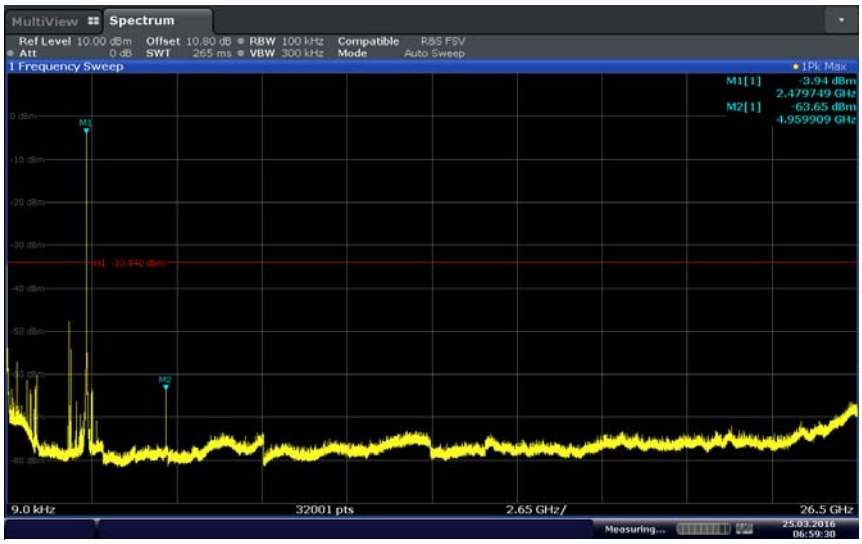

Date: 25.MAR.2016 06:52:50

**Bluetooth LE Low Channel**




Date: 25.MAR.2016 06:55:48

**Bluetooth LE Mid Channel**




**Bluetooth LE High Channel**

## 2.5 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

### 2.5.1 Specification Reference

Part 15 Subpart C §15.247(d)

### 2.5.2 Standard Applicable

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

### 2.5.3 Equipment Under Test and Modification State

Serial No: 136.01 / Test Configuration A

### 2.5.4 Date of Test/Initial of test personnel who performed the test

April 04, 2016 / AC

### 2.5.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.5.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---|---|
| Ambient Temperature | 25.4 °C |
| Relative Humidity | 41.1 % |
| ATM Pressure | 99.5 kPa |

### 2.5.7 Additional Observations

- This is a conducted test.
- Setup is identical to “Out-of-Band Emissions – Conducted“ test (previous test).
- Both 2.4GHz band-edge 2400MHz and 2483.5MHz emissions was verified in this test.
- Test methodology is per Clause 13.1 of KDB 558074 D01 DTS Meas Guidance v03r04, January 07, 2016)
- Limits are from Section 2.4 of this test report. These are 30dBc from the highest level of the desired power within the band.

### 2.5.8 Test Results

Complies. See attached plots.


Date: 25.MAR.2016 07:04:38

**Bluetooth LE Lower Edge**


Date: 25.MAR.2016 07:05:50

**Bluetooth LE Higher Edge**

## 2.6 SPURIOUS RADIATED EMISSIONS

### 2.6.1 Specification Reference

Part 15 Subpart C §15.247(d)

### 2.6.2 Standard Applicable

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

### 2.6.3 Equipment Under Test and Modification State

Serial No: 138.01 / Test Configuration B

### 2.6.4 Date of Test/Initial of test personnel who performed the test

April 05 and 06, 2016 / AC

### 2.6.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.6.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---|---|
| Ambient Temperature | 26.6 °C |
| Relative Humidity | 35.7 % |
| ATM Pressure | 99.2 kPa |

### 2.6.7 Additional Observations

- This is a radiated test.
- The spectrum was searched from 30MHz to the 10$^{th}$ harmonic.
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d).
- Only considered worst case configuration (Low Channel) presented for radiated emissions below 1GHz. There are no significant differences in emissions between channels below 1GHz.
- Only noise floor measurements observed above 18GHz.

- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.6.8 for sample computation.

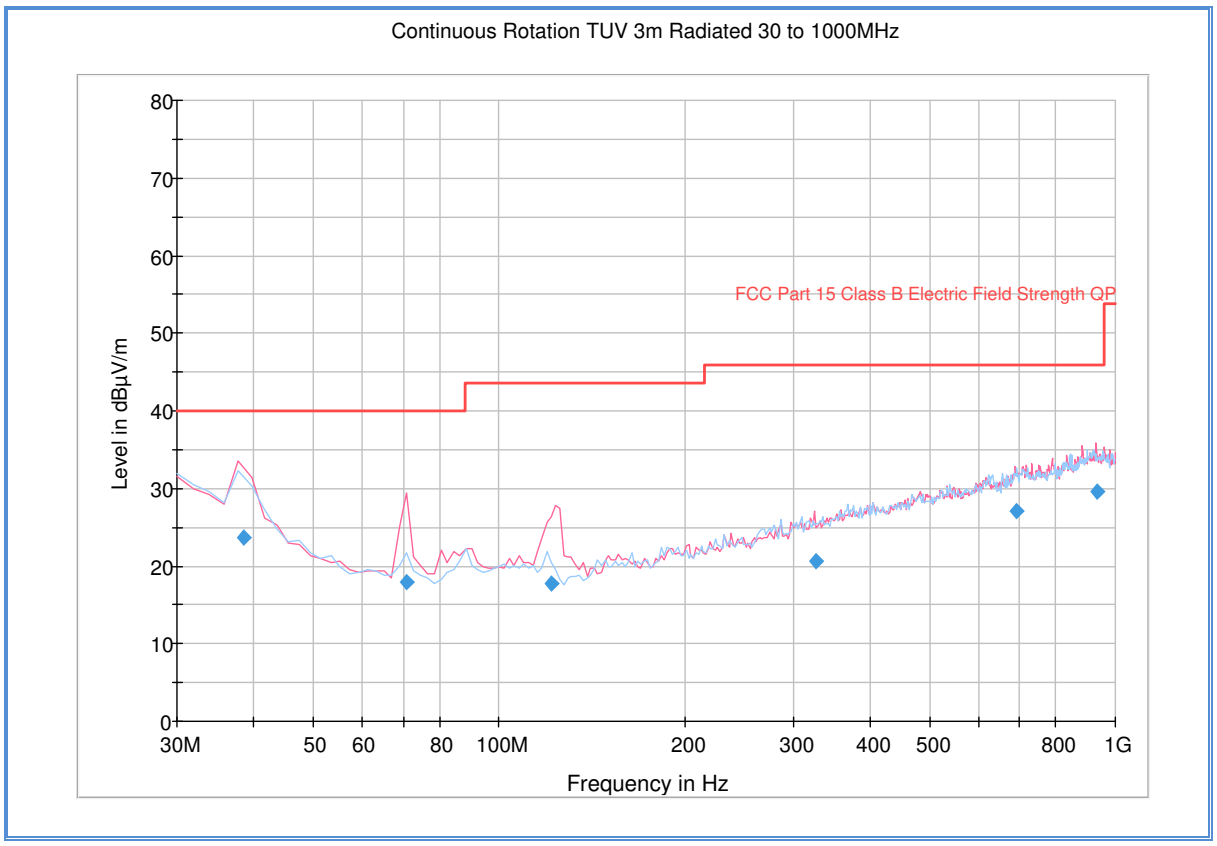
### 2.6.8 Sample Computation (Radiated Emission)

| | | | |
|---|---|---|---|
| Measuring equipment raw measurement (dBµV) @ 30 MHz | | | 24.4 |
| Correction Factor (dB) | Asset# 1066 (cable) | 0.3 | -12.6 |
| | Asset# 1172 (cable) | 0.3 | |
| | Asset# 1016 (preamplifier) | -30.7 | |
| | Asset# 1175(cable) | 0.3 | |
| | Asset# 1002 (antenna) | 17.2 | |
| **Reported Quasi Peak Final Measurement (dBµV/m) @ 30MHz** | | | **11.8** |

### 2.6.9 Test Results

See attached plots.

### 2.6.10 Test Results Below 1GHz – (Tx mode in low channel 2402MHz worst case)

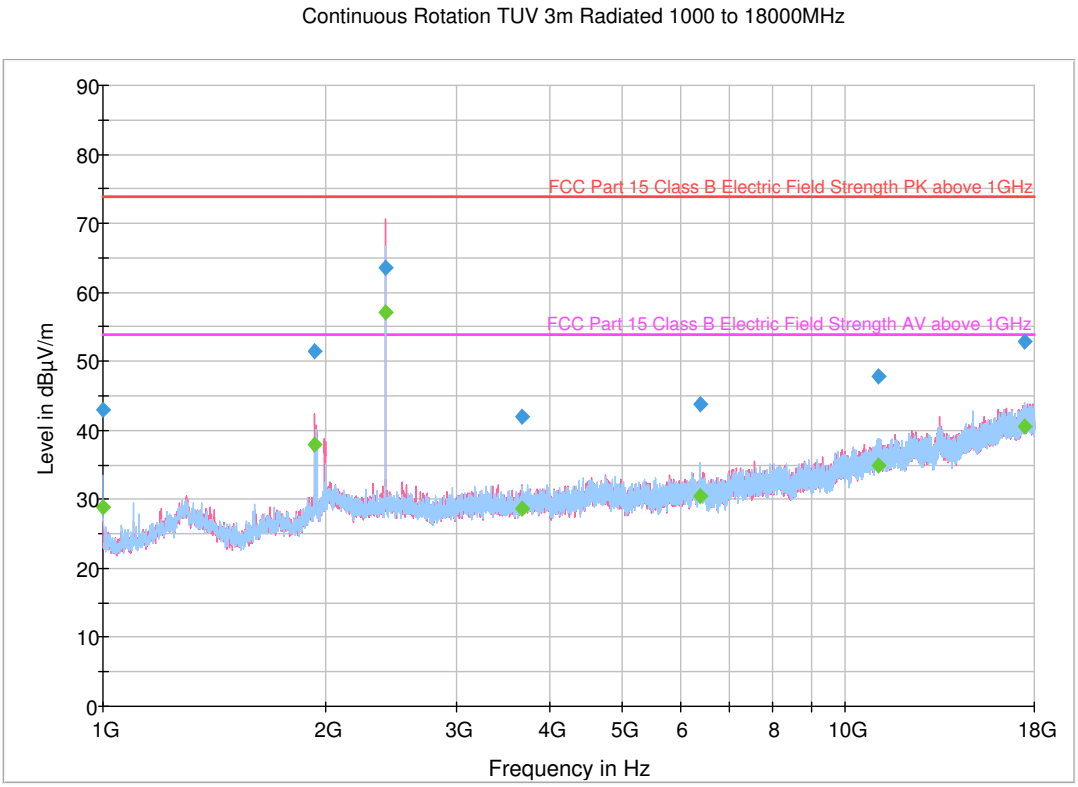



**Quasi Peak Data**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 38.455551 | 23.7 | 1000.0 | 120.000 | 120.0 | V | 121.0 | -10.3 | 16.3 | 40.0 |
| 70.781643 | 17.9 | 1000.0 | 120.000 | 100.0 | V | 15.0 | -16.8 | 22.1 | 40.0 |
| 121.826613 | 17.8 | 1000.0 | 120.000 | 100.0 | V | -13.0 | -15.4 | 25.7 | 43.5 |
| 326.270942 | 20.7 | 1000.0 | 120.000 | 105.0 | V | 110.0 | -6.3 | 25.3 | 46.0 |
| 692.097956 | 27.1 | 1000.0 | 120.000 | 214.0 | V | 281.0 | 2.7 | 18.9 | 46.0 |
| 934.563928 | 29.6 | 1000.0 | 120.000 | 100.0 | V | 341.0 | 6.3 | 16.4 | 46.0 |

**Test Notes:** Only worst case channel presented for spurious emission below 1GHz.

### 2.6.11 Test Results Above 1GHz (Bluetooth LE Low Channel 2402MHz)




**Peak Data**

| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 1000.400000 | 43.1 | 1000.0 | 1000.000 | 238.3 | H | 204.0 | -7.8 | 30.8 | 73.9 |
| 1932.000000 | 51.5 | 1000.0 | 1000.000 | 301.2 | V | 95.0 | -1.0 | 22.4 | 73.9 |
| 2401.733333 | 63.6 | 1000.0 | 1000.000 | 140.6 | V | 202.0 | -1.1 | *) | |
| 3678.300000 | 41.9 | 1000.0 | 1000.000 | 334.1 | V | 53.0 | 1.1 | 32.0 | 73.9 |
| 6387.333333 | 43.8 | 1000.0 | 1000.000 | 335.1 | H | 20.0 | 6.1 | 30.1 | 73.9 |
| 11078.566667 | 47.8 | 1000.0 | 1000.000 | 203.3 | H | 333.0 | 12.8 | 26.1 | 73.9 |
| 17455.266667 | 52.9 | 1000.0 | 1000.000 | 405.4 | H | 224.0 | 20.1 | 21.0 | 73.9 |

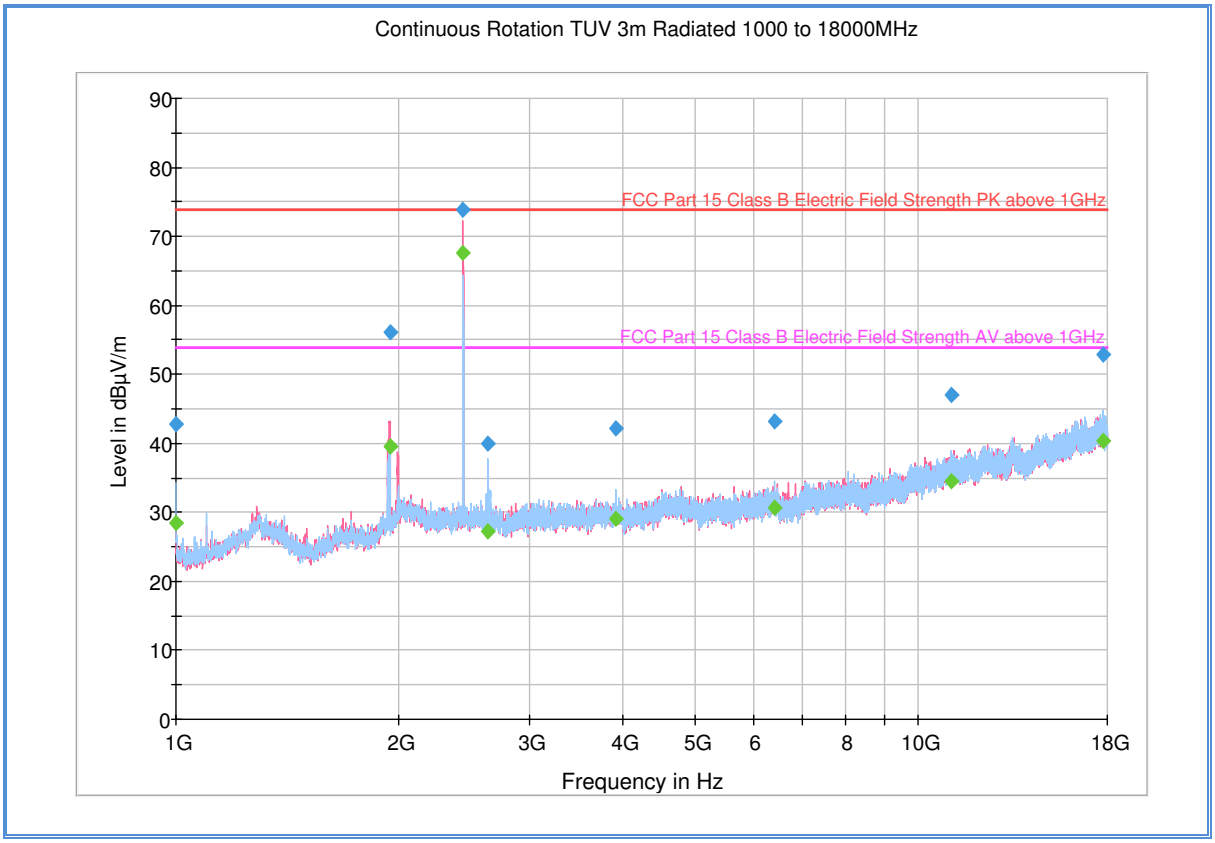
**Average Data**

| Frequency (MHz) | Average (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 1000.400000 | 28.8 | 1000.0 | 1000.000 | 238.3 | H | 204.0 | -7.8 | 25.1 | 53.9 |
| 1932.000000 | 37.9 | 1000.0 | 1000.000 | 301.2 | V | 95.0 | -1.0 | 16.0 | 53.9 |
| 2401.733333 | 57.1 | 1000.0 | 1000.000 | 140.6 | V | 202.0 | -1.1 | *) | |
| 3678.300000 | 28.6 | 1000.0 | 1000.000 | 334.1 | V | 53.0 | 1.1 | 25.3 | 53.9 |
| 6387.333333 | 30.5 | 1000.0 | 1000.000 | 335.1 | H | 20.0 | 6.1 | 23.4 | 53.9 |
| 11078.566667 | 34.8 | 1000.0 | 1000.000 | 203.3 | H | 333.0 | 12.8 | 19.1 | 53.9 |
| 17455.266667 | 40.6 | 1000.0 | 1000.000 | 405.4 | H | 224.0 | 20.1 | 13.3 | 53.9 |

***)** This is the fundamental frequency and not part of evaluation. Data provided for information purpose only.

**Test Notes:** No significant emissions observed above 6GHz. Measurements above 6GHz are noise floor figures.

### 2.6.12 Test Results Above 1GHz (Bluetooth LE Mid Channel 2440MHz)




**Peak Data**

| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 1000.500000 | 42.9 | 1000.0 | 1000.000 | 258.3 | H | 232.0 | -7.8 | 31.0 | 73.9 |
| 1941.066667 | 56.0 | 1000.0 | 1000.000 | 405.4 | V | -3.0 | -1.1 | 17.9 | 73.9 |
| 2439.733333 | 73.8 | 1000.0 | 1000.000 | 336.1 | V | 225.0 | -0.9 | *) | |
| 2636.766667 | 39.9 | 1000.0 | 1000.000 | 382.0 | H | 118.0 | -1.0 | 34.0 | 73.9 |
| 3916.266667 | 42.1 | 1000.0 | 1000.000 | 191.5 | H | 20.0 | 2.2 | 31.8 | 73.9 |
| 6400.133333 | 43.3 | 1000.0 | 1000.000 | 103.7 | H | 206.0 | 6.1 | 30.6 | 73.9 |
| 11100.466667 | 47.1 | 1000.0 | 1000.000 | 289.2 | H | 20.0 | 12.9 | 26.8 | 73.9 |
| 17747.866667 | 52.9 | 1000.0 | 1000.000 | 405.4 | H | 145.0 | 20.3 | 21.0 | 73.9 |

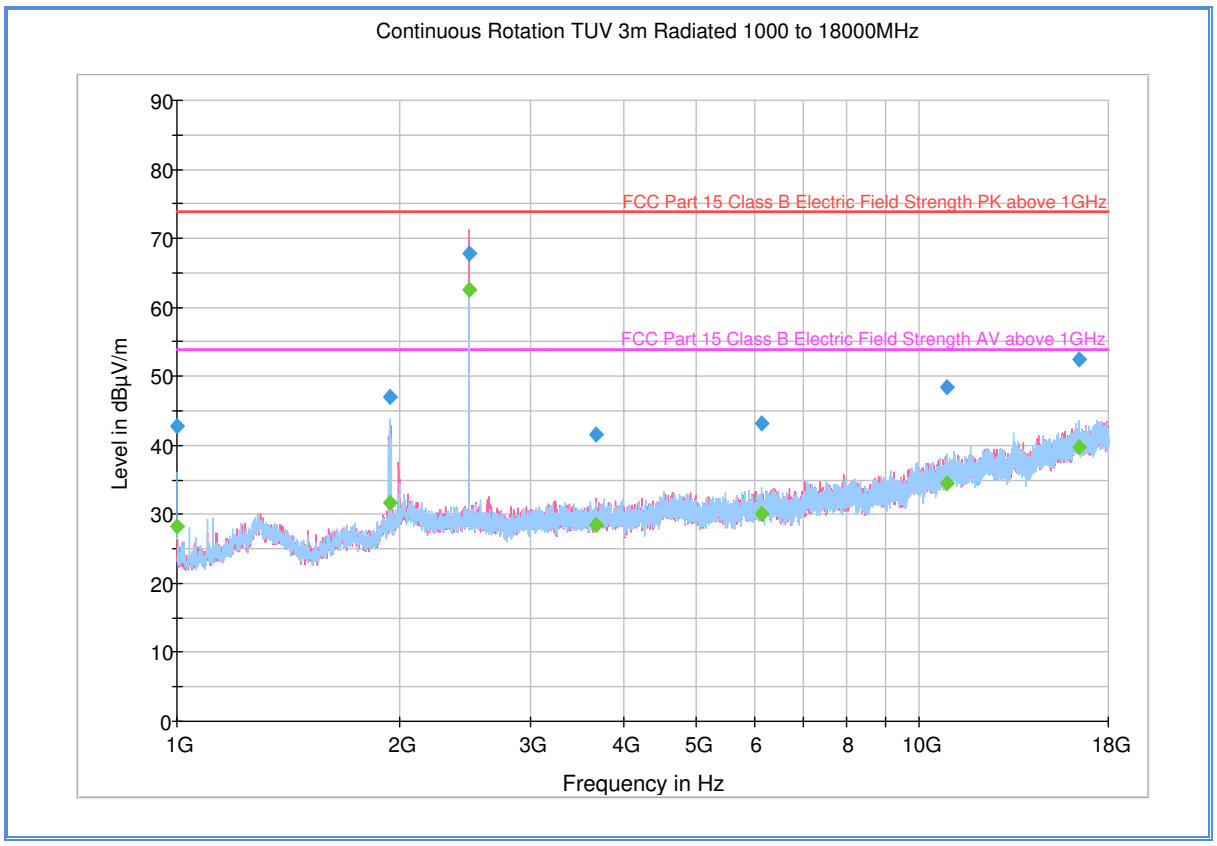
**Average Data**

| Frequency (MHz) | Average (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 1000.500000 | 28.5 | 1000.0 | 1000.000 | 258.3 | H | 232.0 | -7.8 | 25.4 | 53.9 |
| 1941.066667 | 39.5 | 1000.0 | 1000.000 | 405.4 | V | -3.0 | -1.1 | 14.4 | 53.9 |
| 2439.733333 | 67.7 | 1000.0 | 1000.000 | 336.1 | V | 225.0 | -0.9 | *) | |
| 2636.766667 | 27.2 | 1000.0 | 1000.000 | 382.0 | H | 118.0 | -1.0 | 26.7 | 53.9 |
| 3916.266667 | 29.0 | 1000.0 | 1000.000 | 191.5 | H | 20.0 | 2.2 | 24.9 | 53.9 |
| 6400.133333 | 30.8 | 1000.0 | 1000.000 | 103.7 | H | 206.0 | 6.1 | 23.1 | 53.9 |
| 11100.466667 | 34.6 | 1000.0 | 1000.000 | 289.2 | H | 20.0 | 12.9 | 19.3 | 53.9 |
| 17747.866667 | 40.4 | 1000.0 | 1000.000 | 405.4 | H | 145.0 | 20.3 | 13.5 | 53.9 |

***)** This is the fundamental frequency and not part of evaluation. Data provided for information purpose only.

**Test Notes:** No significant emissions observed above 4GHz. Measurements above 4GHz are noise floor figures.

### 2.6.13 Test Results Above 1GHz (Bluetooth LE High Channel 2480MHz)




**Peak Data**

| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 1000.500000 | 42.7 | 1000.0 | 1000.000 | 257.3 | H | 121.0 | -7.8 | 31.2 | 73.9 |
| 1932.733333 | 47.0 | 1000.0 | 1000.000 | 368.1 | H | 16.0 | -1.1 | 26.9 | 73.9 |
| 2480.166667 | 67.8 | 1000.0 | 1000.000 | 202.3 | V | 295.0 | -0.7 | *) | |
| 3668.666667 | 41.5 | 1000.0 | 1000.000 | 357.1 | V | 261.0 | 1.0 | 32.4 | 73.9 |
| 6146.700000 | 43.1 | 1000.0 | 1000.000 | 122.7 | H | 307.0 | 5.5 | 30.8 | 73.9 |
| 10905.133333 | 48.4 | 1000.0 | 1000.000 | 405.4 | H | 23.0 | 12.8 | 25.5 | 73.9 |
| 16410.500000 | 52.6 | 1000.0 | 1000.000 | 405.4 | H | 346.0 | 19.1 | 21.3 | 73.9 |

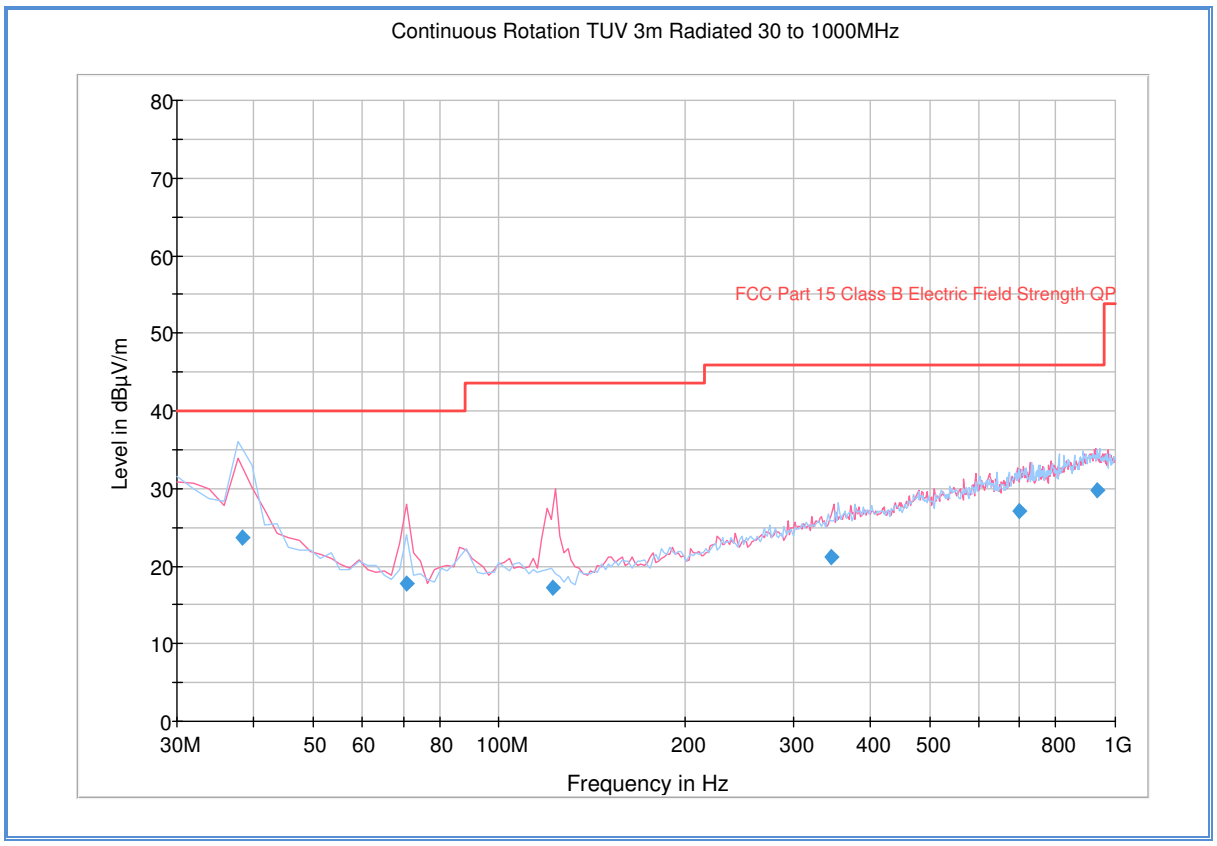
**Average Data**

| Frequency (MHz) | Average (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 1000.500000 | 28.3 | 1000.0 | 1000.000 | 257.3 | H | 121.0 | -7.8 | 25.6 | 53.9 |
| 1932.733333 | 31.7 | 1000.0 | 1000.000 | 368.1 | H | 16.0 | -1.1 | 22.2 | 53.9 |
| 2480.166667 | 62.6 | 1000.0 | 1000.000 | 202.3 | V | 295.0 | -0.7 | *) | |
| 3668.666667 | 28.4 | 1000.0 | 1000.000 | 357.1 | V | 261.0 | 1.0 | 25.5 | 53.9 |
| 6146.700000 | 30.1 | 1000.0 | 1000.000 | 122.7 | H | 307.0 | 5.5 | 23.8 | 53.9 |
| 10905.133333 | 34.6 | 1000.0 | 1000.000 | 405.4 | H | 23.0 | 12.8 | 19.3 | 53.9 |
| 16410.500000 | 39.8 | 1000.0 | 1000.000 | 405.4 | H | 346.0 | 19.1 | 14.1 | 53.9 |

***)** This is the fundamental frequency and not part of evaluation. Data provided for information purpose only.

**Test Notes:** No significant emissions observed above 4GHz. Measurements above 4GHz are noise floor figures.

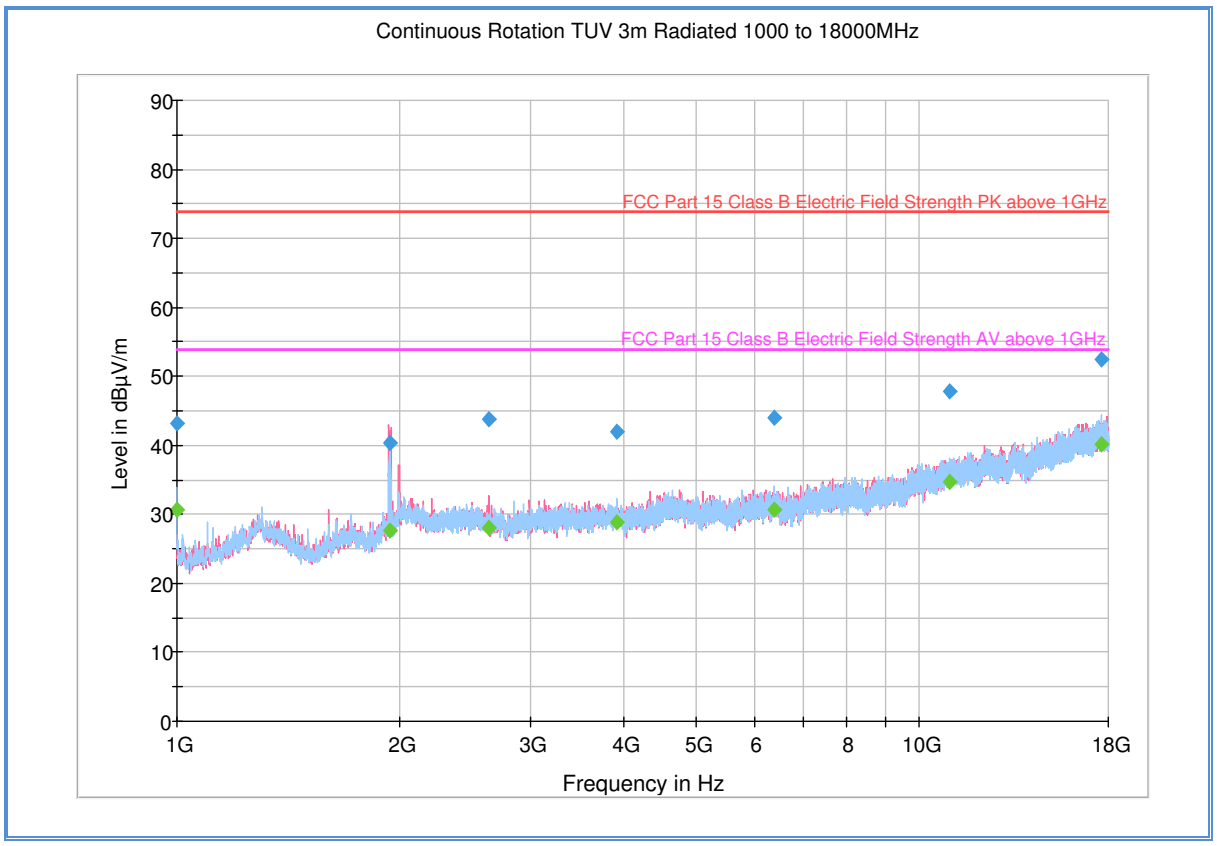
### 2.6.14 Test Results Below 1GHz (Receive Mode)




**Quasi Peak Data**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 38.255551 | 23.7 | 1000.0 | 120.000 | 371.0 | H | 30.0 | -10.2 | 16.3 | 40.0 |
| 70.821643 | 17.7 | 1000.0 | 120.000 | 200.0 | V | 342.0 | -16.8 | 22.3 | 40.0 |
| 122.306613 | 17.2 | 1000.0 | 120.000 | 109.0 | V | 13.0 | -15.4 | 26.3 | 43.5 |
| 345.837595 | 21.1 | 1000.0 | 120.000 | 150.0 | V | 317.0 | -5.8 | 24.9 | 46.0 |
| 697.289619 | 27.1 | 1000.0 | 120.000 | 133.0 | V | 197.0 | 2.8 | 18.9 | 46.0 |
| 932.243928 | 29.8 | 1000.0 | 120.000 | 150.0 | V | 260.0 | 6.3 | 16.2 | 46.0 |

### 2.6.15 Test Results Above 1GHz (Receive Mode)




**Peak Data**

| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 1000.000000 | 43.2 | 1000.0 | 1000.000 | 378.0 | H | 63.0 | -7.8 | 30.7 | 73.9 |
| 1932.766667 | 40.3 | 1000.0 | 1000.000 | 165.0 | V | 0.0 | -1.1 | 33.6 | 73.9 |
| 2628.633333 | 43.9 | 1000.0 | 1000.000 | 206.0 | V | 164.0 | -1.0 | 30.0 | 73.9 |
| 3914.733333 | 42.0 | 1000.0 | 1000.000 | 139.0 | H | 47.0 | 2.2 | 31.9 | 73.9 |
| 6378.633333 | 44.0 | 1000.0 | 1000.000 | 234.0 | H | 295.0 | 6.1 | 29.9 | 73.9 |
| 11011.13333 | 47.8 | 1000.0 | 1000.000 | 233.0 | H | 11.0 | 12.8 | 26.1 | 73.9 |
| 17611.80000 | 52.5 | 1000.0 | 1000.000 | 400.0 | H | 115.0 | 20.0 | 21.4 | 73.9 |

**Average Data**

| Frequency (MHz) | Average (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 1000.000000 | 30.7 | 1000.0 | 1000.000 | 378.0 | H | 63.0 | -7.8 | 23.2 | 53.9 |
| 1932.766667 | 27.7 | 1000.0 | 1000.000 | 165.0 | V | 0.0 | -1.1 | 26.2 | 53.9 |
| 2628.633333 | 28.1 | 1000.0 | 1000.000 | 206.0 | V | 164.0 | -1.0 | 25.8 | 53.9 |
| 3914.733333 | 29.0 | 1000.0 | 1000.000 | 139.0 | H | 47.0 | 2.2 | 24.9 | 53.9 |
| 6378.633333 | 30.8 | 1000.0 | 1000.000 | 234.0 | H | 295.0 | 6.1 | 23.1 | 53.9 |
| 11011.13333 | 34.7 | 1000.0 | 1000.000 | 233.0 | H | 11.0 | 12.8 | 19.2 | 53.9 |
| 17611.80000 | 40.2 | 1000.0 | 1000.000 | 400.0 | H | 115.0 | 20.0 | 13.7 | 53.9 |

**Test Notes:** No significant emissions observed above 18GHz.

## 2.7 RADIATED BAND EDGE MEASUREMENTS AND IMMEDIATE RESTRICTED BANDS

### 2.7.1 Specification Reference

Part 15 Subpart C §15.247(d)

### 2.7.2 Standard Applicable

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

### 2.7.3 Equipment Under Test and Modification State

Serial No: 138.01 / Test Configuration B

### 2.7.4 Date of Test/Initial of test personnel who performed the test

April 05, 2016 / AC

### 2.7.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.7.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---|---|
| Ambient Temperature | 26.6 °C |
| Relative Humidity | 35.7 % |
| ATM Pressure | 99.2 kPa |

### 2.7.7 Additional Observations

- This is radiated test.
- The spectrum was searched from 2310MHz to 2390MHz for lower immediate restricted band and 2483.5MHz to 2500MHz for the upper immediate restricted band.
- There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.
- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.7.8 for sample computation.

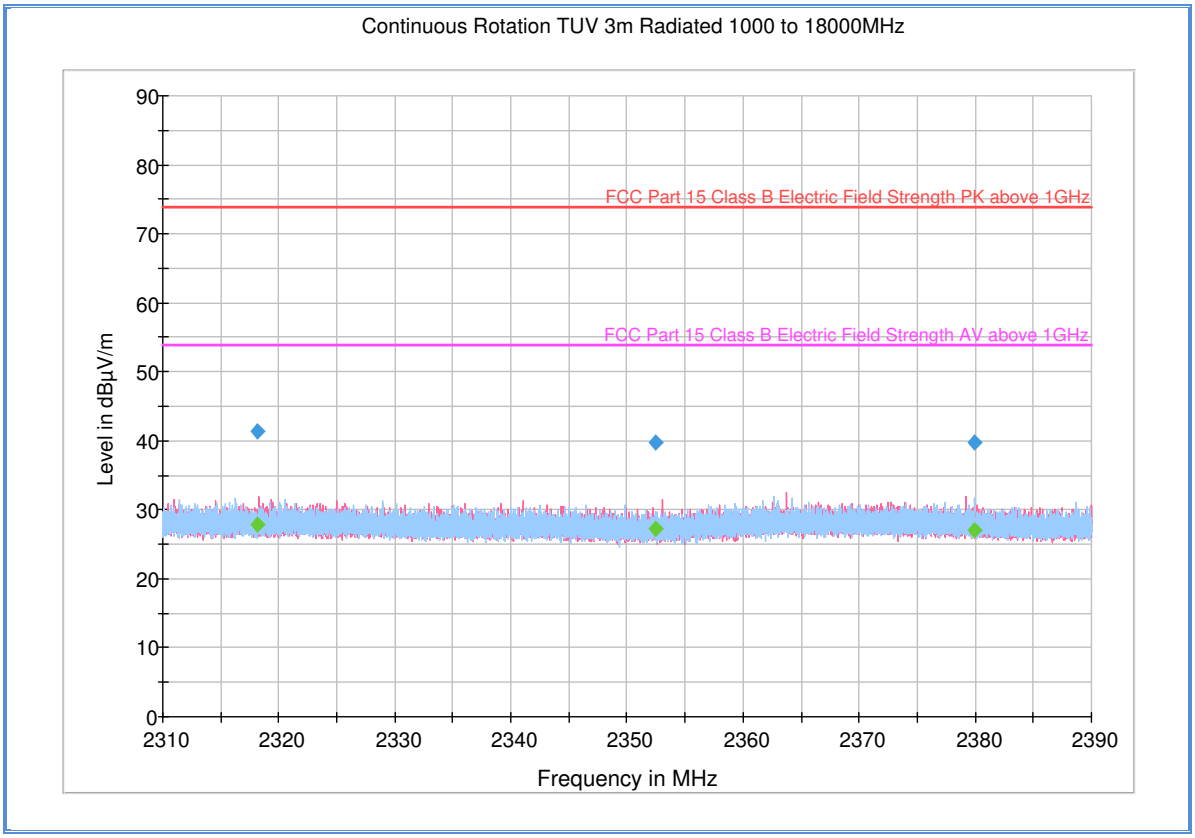
### 2.7.8 Sample Computation (Radiated Emission)

| | | | |
|---|---|---|---|
| Measuring equipment raw measurement (dBµV) @ 2400 MHz | | | 53.9 |
| Correction Factor (dB) | Asset# 1153 (cable) | 3.4 | -0.4 |
| | Asset# 8628(preamplifier) | -36.5 | |
| | Asset#7575 (antenna) | 32.7 | |
| **Reported Max Peak Final Measurement (dBµV/m) @** 2400 MHz | | | **53.5** |

### 2.7.9 Test Results

See attached plots.

### 2.7.10 Test Results Restricted Band 2310MHz to 2390MHz (Bluetooth LE Low Channel)



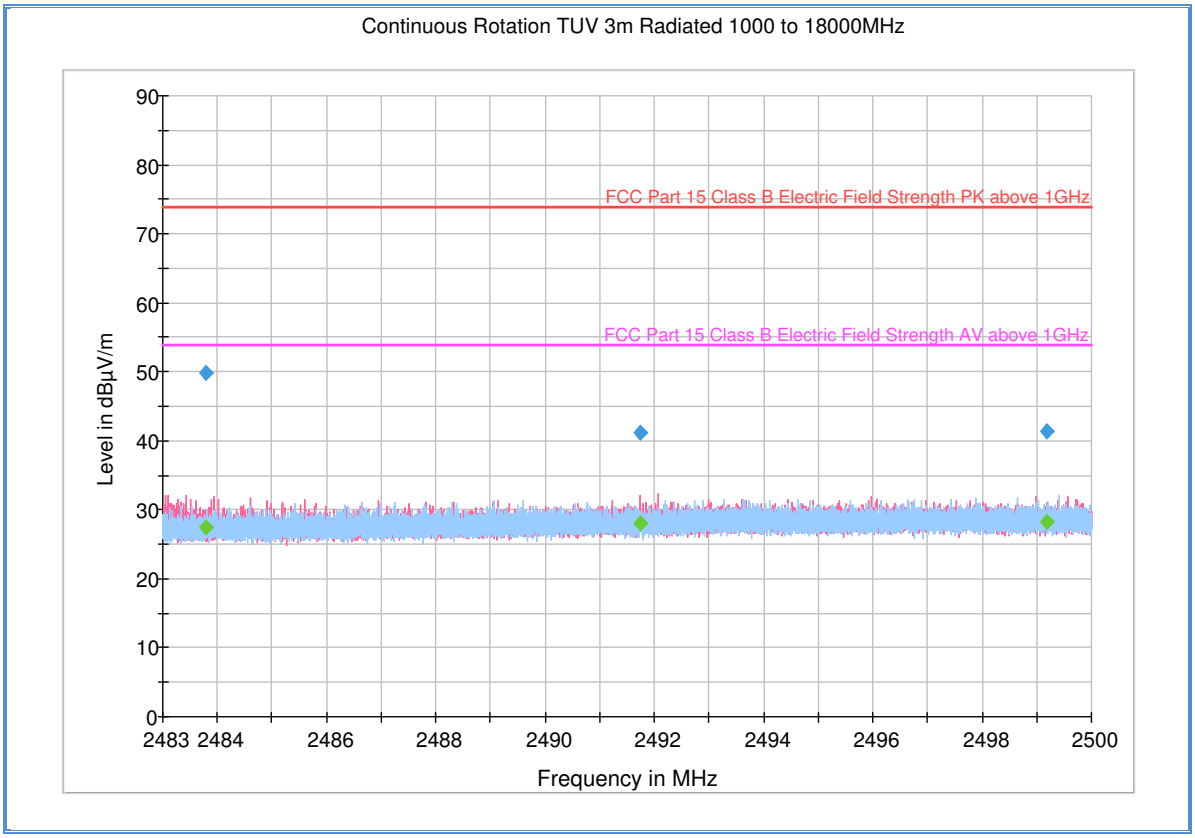

**Peak Data**

| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 2318.104000 | 41.3 | 1000.0 | 1000.000 | 124.7 | V | 149.0 | -1.1 | 32.6 | 73.9 |
| 2352.485333 | 39.8 | 1000.0 | 1000.000 | 334.1 | V | 342.0 | -1.2 | 34.1 | 73.9 |
| 2379.898667 | 39.8 | 1000.0 | 1000.000 | 400.0 | H | 110.0 | -1.1 | 34.1 | 73.9 |

**Average Data**

| Frequency (MHz) | Average (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 2318.104000 | 27.9 | 1000.0 | 1000.000 | 124.7 | V | 149.0 | -1.1 | 26.0 | 53.9 |
| 2352.485333 | 27.2 | 1000.0 | 1000.000 | 334.1 | V | 342.0 | -1.2 | 26.7 | 53.9 |
| 2379.898667 | 27.0 | 1000.0 | 1000.000 | 400.0 | H | 110.0 | -1.1 | 34.1 | 73.9 |

### 2.7.11 Test Results Restricted Band 2483.5MHz to 2500MHz (Bluetooth LE High Channel)




**Peak Data**

| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 2483.800000 | 49.8 | 1000.0 | 1000.000 | 103.7 | V | 272.0 | -0.7 | 24.1 | 73.9 |
| 2491.749900 | 41.1 | 1000.0 | 1000.000 | 99.7 | V | 344.0 | -0.6 | 32.8 | 73.9 |
| 2499.173767 | 41.4 | 1000.0 | 1000.000 | 394.0 | V | 220.0 | -0.6 | 32.5 | 73.9 |

**Average Data**

| Frequency (MHz) | Average (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 2483.800000 | 27.5 | 1000.0 | 1000.000 | 103.7 | V | 272.0 | -0.7 | 26.4 | 53.9 |
| 2491.749900 | 28.1 | 1000.0 | 1000.000 | 99.7 | V | 344.0 | -0.6 | 25.8 | 53.9 |
| 2499.173767 | 28.3 | 1000.0 | 1000.000 | 394.0 | V | 220.0 | -0.6 | 25.6 | 53.9 |

## 2.8 POWER SPECTRAL DENSITY

### 2.8.1 Specification Reference

Part 15 Subpart C §15.247(e)

### 2.8.2 Standard Applicable

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

### 2.8.3 Equipment Under Test and Modification State

Serial No: 136.01 / Test Configuration A

### 2.8.4 Date of Test/Initial of test personnel who performed the test

April 04, 2016 / AC

### 2.8.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.8.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---|---|
| Ambient Temperature | 26.0 °C |
| Relative Humidity | 40.9 % |
| ATM Pressure | 99.5 kPa |

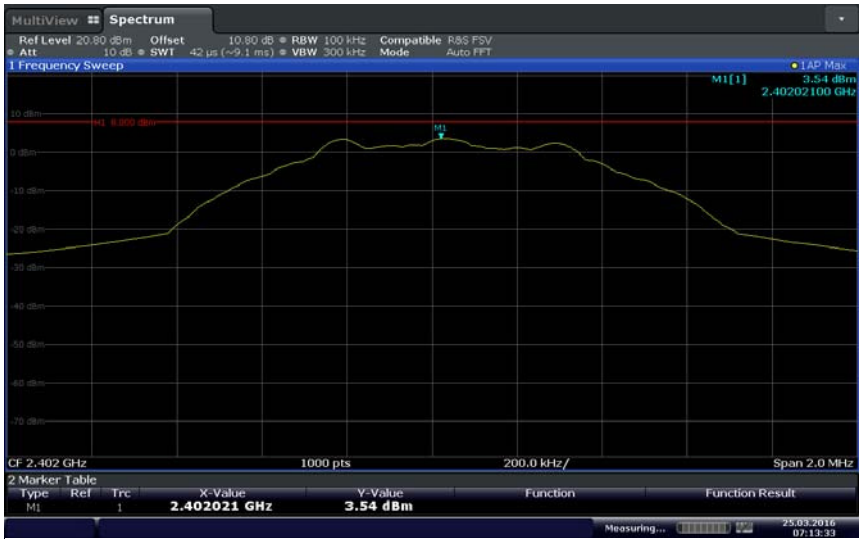
### 2.8.7 Additional Observations

- This is a conducted test.
- Test procedure is per Section 10.2 of KDB 558074 (January 07, 2016).
- An offset of 10.8dB was added to compensate for the external attenuator and cable used.
- Detector is RMS power averaging.
- Trace averaging mode over 100 traces.
- Sweep time is Auto Couple.
- EUT complies with 100 kHz RBW.

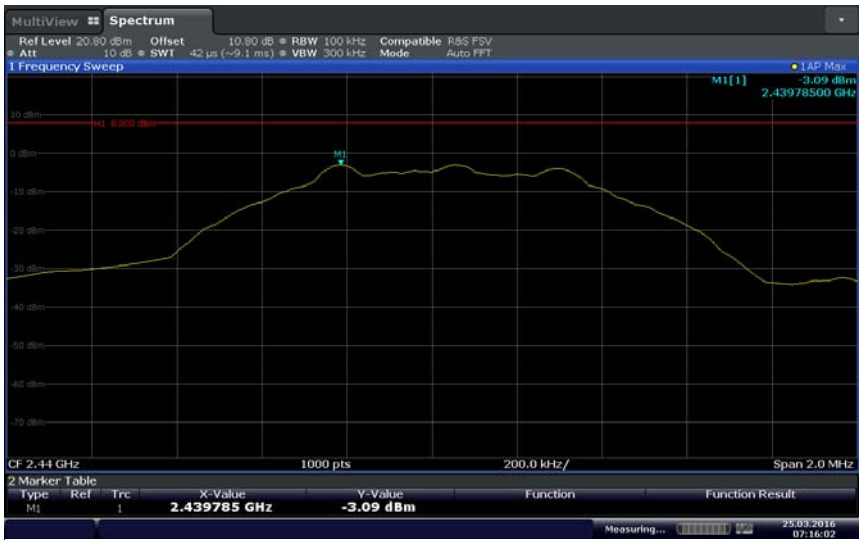
### 2.8.8 Test Results Summary

| Bluetooth Low Energy (LE) | Channel | Marker Reading using 100 kHz RBW (dBm) | PSD Limit (dBm) | Margin (dB) | Compliance |
|---|---|---|---|---|---|
| | 0 (2402 MHz) | 3.54 | 8 | 4.46 | Complies |
| | 19 (2440 MHz) | -3.09 | 8 | 11.09 | Complies |
| | 39 (2480 MHz) | -3.95 | 8 | 11.95 | Complies |

### 2.8.9 Test Results Plots

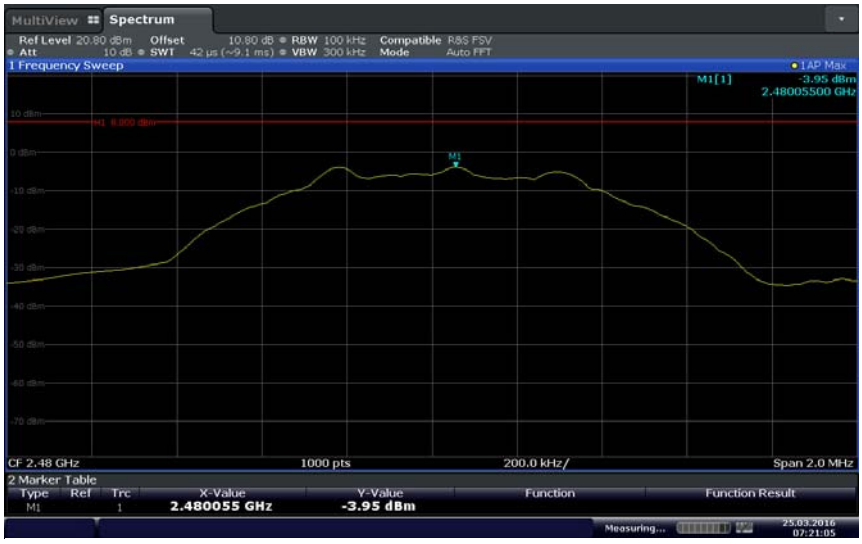



**Bluetooth LE Low Channel**




Date: 25.MAR.2016 07:16:02

**Bluetooth LE Mid Channel**




Date: 25.MAR.2016 07:21:05

**Bluetooth LE High Channel**

**SECTION 3**

**TEST EQUIPMENT USED**

### 3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

| ID Number (SDGE/SDRB) | Test Equipment | Type | Serial Number | Manufacturer | Cal Date | Cal Due Date |
|---|---|---|---|---|---|---|
| Antenna Conducted Port Setup | | | | | | |
| 7569 | Series Power Meter | N1911A P- | MY45100625 | Agilent | 06/19/15 | 06/19/16 |
| 7605 | 50MHz-18GHz Wideband Power Sensor | N1921A | MY51100054 | Agilent | 04/10/15 | 04/10/16 |
| 7611 | Signal/Spectrum Analyzer | FSW26 | 102017 | Rhode & Schwarz | 02/01/16 | 02/01/17 |
| 7579 | Temperature Chamber | 115 | 151617 | TestQuity | 08/14/15 | 08/14/16 |
| 8808 | 10dB Attenuator | ATX3396-10 | N/A | RF Precision Cables | 09/23/15 | 09/23/16 |
| Radiated Test Setup | | | | | | |
| 1033 | Bilog Antenna | 3142C | 00044556 | EMCO | 09/25/14 | 09/25/16 |
| 7575 | Double-ridged waveguide horn antenna | 3117 | 00155511 | EMCO | 04/27/15 | 04/27/16 |
| 8628 | Pre-amplifier | QLJ 01182835-JO | 8986002 | QuinStar Technologies Inc. | 01/11/16 | 01/11/17 |
| 1040 | EMI Test Receiver | ESIB40 | 100292 | Rhode & Schwarz | 09/29/15 | 09/29/16 |
| 1049 | EMI Test Receiver | ESU | 100133 | Rhode & Schwarz | 03/17/16 | 03/17/17 |
| 1016 | Pre-amplifier | PAM-0202 | 187 | PAM | 12/15/15 | 12/15/16 |
| Miscellaneous | | | | | | |
| 6792 | Multimeter | 3478A | 2911A70964 | Hewlett Packard | 08/14/15 | 08/14/16 |
| 7560 | Barometer/Temperature /Humidity Transmitter | iBTHX-W | 1240476 | Omega | 10/19/15 | 10/19/16 |
| | DC Power Supply | 35010M | D102007S | Protek | Verified by 6792 | |
| | Test Software | EMC32 | V8.53 | Rhode & Schwarz | N/A | |

## 3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

### 3.2.1 Radiated Emission Measurements (Below 1GHz)

| | Contribution | Probability Distribution Type | Probability Distribution $x_i$ | Standard Uncertainty $u(x_i)$ | $[u(x_i)]^2$ |
|---|---|---|---|---|---|
| 1 | Receiver/Spectrum Analyzer | Rectangular | 0.45 | 0.26 | 0.07 |
| 2 | Cables | Rectangular | 0.50 | 0.29 | 0.08 |
| 3 | Preamp | Rectangular | 0.50 | 0.29 | 0.08 |
| 4 | Antenna | Rectangular | 0.75 | 0.43 | 0.19 |
| 5 | Site | Rectangular | 2.70 | 1.56 | 2.43 |
| 6 | EUT Setup | Rectangular | 1.00 | 0.58 | 0.33 |
| | | | | Combined Uncertainty ($u_c$): | 1.78 |
| | | | | Coverage Factor (k): | 2 |
| | | | | Expanded Uncertainty: | 3.57 |

### 3.2.2 Radiated Emission Measurements (Above 1GHz)

| | Contribution | Probability Distribution Type | Probability Distribution $x_i$ | Standard Uncertainty $u(x_i)$ | $[u(x_i)]^2$ |
|---|---|---|---|---|---|
| 1 | Receiver/Spectrum Analyzer | Rectangular | 0.57 | 0.33 | 0.11 |
| 2 | Cables | Rectangular | 0.70 | 0.40 | 0.16 |
| 3 | Preamp | Rectangular | 0.50 | 0.29 | 0.08 |
| 4 | Antenna | Rectangular | 0.37 | 0.21 | 0.05 |
| 5 | Site | Rectangular | 2.70 | 1.56 | 2.43 |
| 6 | EUT Setup | Rectangular | 1.00 | 0.58 | 0.33 |
| | | | | Combined Uncertainty ($u_c$): | 1.78 |
| | | | | Coverage Factor (k): | 2 |
| | | | | Expanded Uncertainty: | 3.56 |

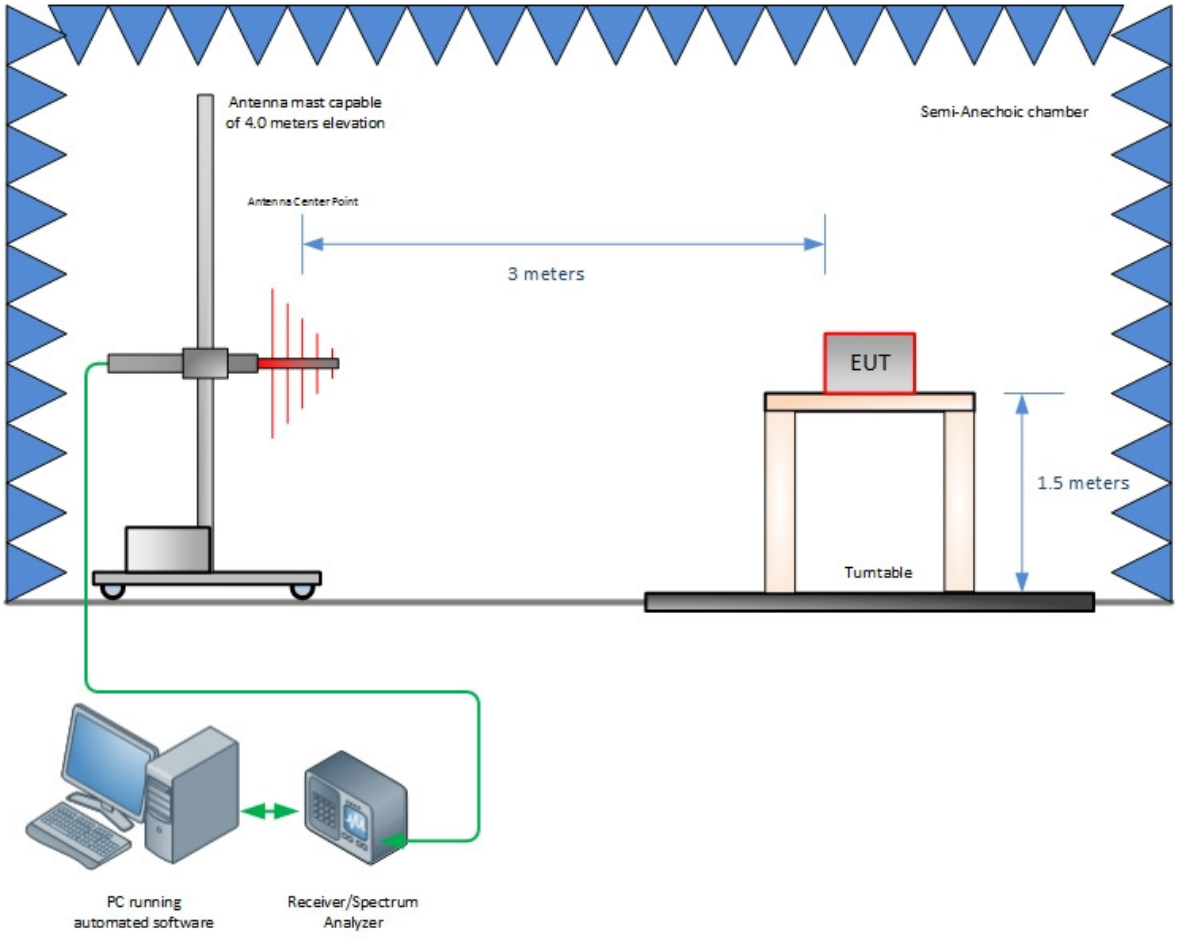
### 3.2.3 Conducted Antenna Port Measurement

| | Contribution | Probability Distribution Type | Probability Distribution $x_i$ | Standard Uncertainty $u(x_i)$ | $[u(x_i)]^2$ |
|---|---|---|---|---|---|
| 1 | Receiver/Spectrum Analyzer | Rectangular | 0.34 | 0.20 | 0.04 |
| 2 | Cables | Rectangular | 1.00 | 0.58 | 0.33 |
| 3 | EUT Setup | Rectangular | 0.50 | 0.29 | 0.08 |
| | | | | Combined Uncertainty ($u_c$): | 0.67 |
| | | | | Coverage Factor (k): | 1.96 |
| | | | | Expanded Uncertainty: | 1.32 |

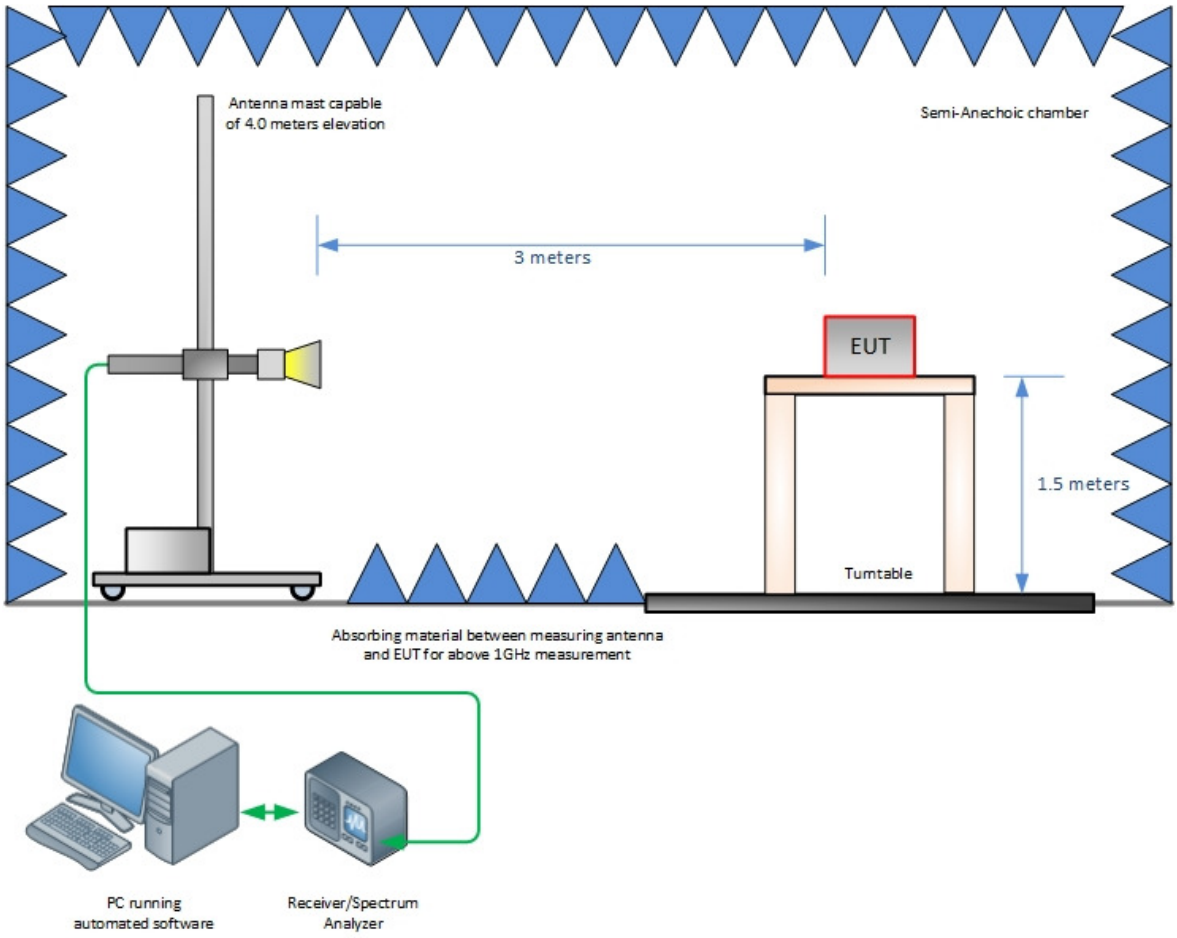
**SECTION 4**

**DIAGRAM OF TEST SETUP**

## 4.1 TEST SETUP DIAGRAM




**Radiated Emission Test Setup (Below 1GHz)**




**Radiated Emission Test Setup (Above 1GHz)**

**SECTION 5**

**ACCREDITATION, DISCLAIMERS AND COPYRIGHT**

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