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# Report On

Application for Grant of Equipment Authorization of the  
Medicomp, Inc.  
PM700 TelePatch Cardiac Monitor

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

Report No. GJ72109890-5895A

January 2016

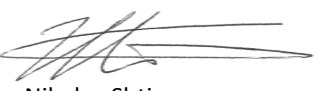


**REPORT ON** Radio Testing of the  
Medicomp, Inc.  
TelePatch Cardiac Monitor

**TEST REPORT NUMBER** GJ72109890-5895A

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**DATED** \_\_\_\_\_  
January 6, 2015



## Revision History

GJ72109890-5895A Medicomp, Inc. PM700 TelePatch Cardiac Monitor					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
01/06/2016	Initial Release				Ferdinand Custodio

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## **SECTION 1**

### **REPORT SUMMARY**

Radio Testing of the  
Medicomp, Inc.  
TelePatch Cardiac Monitor

## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Medicomp, Inc. PM700 TelePatch 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	Medicomp, Inc.
Model Number(s)	TAS0000700
FCC ID Number	2AGDT-PM700
IC Number	21061-PM700
Serial Number(s)	N/A
Number of Samples Tested	2
Test Specification/Issue/Date	<ul style="list-style-type: none"><li>• FCC Part 15 Subpart C §15.247 (October 1, 2015).</li><li>• IC RSS-247 Issue 1 May 2015. Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.</li><li>• IC RSS-Gen Issue 4, November 2014 - General Requirements for Compliance of Radio Apparatus.</li><li>• 558074 D01 DTS Meas Guidance v03r03, (June 09, 2015) Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.</li></ul>
Start of Test	November 30, 2015
Finish of Test	December 10, 2015
Name of Engineer(s)	Nikolay Shtin
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	
2.2	§15.207(a)	RSS-Gen 8.8	Conducted Emissions	N/A	
2.3		RSS-Gen 6.6	99% Emission Bandwidth	Compliant	
2.4	§15.247(a)(2)	RSS-247 5.2(1)	Minimum 6 dB RF Bandwidth	Compliant	
2.5	§15.247(d)	RSS-247 5.5	Out-of-Band Emissions - Conducted	Compliant	
2.6	§15.247(d)	RSS-247 5.5	Band-edge Compliance of RF Conducted Emissions	Compliant	
2.7	§15.247(d)	RSS-Gen 8.9 and 8.10	Spurious Radiated Emissions	Compliant	
2.7		RSS-Gen 7.1	Receiver Spurious Emissions	Compliant	
2.8	§15.247(d)	RSS-Gen 8.9 and 8.10	Radiated Band Edge Measurements	Compliant	
2.9	§15.247(e)	RSS-247 5.2(2)	Power Spectral Density for Digitally Modulated Device	Compliant	

N/A Not performed. EUT is battery powered.

### 1.3 PRODUCT INFORMATION

#### 1.3.1 Technical Description

The Equipment Under Test (EUT) was a Medcomp, Inc. PM700 TelePatch Cardiac Monitor as shown in the photographs below. The TelePatch Cardiac Monitor (Model PM700) is a small (58mm x 38.5mm x 15.5mm), auto triggered, device, prescribed by physicians for patients who are experiencing symptoms that may be attributable to cardiac arrhythmia. The EUT is a battery powered device containing 2.4 GHz Bluetooth LE radio.



**Equipment Under Test**





### 1.3.2 EUT General Description

EUT Description	TelePatch Cardiac Monitor
Model Name	PM700
Model Number(s)	TAS0000700
Rated Voltage (Battery Type)	Lithium Ion Rechargeable Battery (3.7V) Internal Coin Cell Battery (3.0 V)
Mode Verified	BT LE
Capability	Bluetooth LE (Single Mode)
Primary Unit (EUT)	<input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering
Antenna Type	PCB trace antenna
Antenna Gain	-6.77 dBi (Peak Gain)

### 1.3.3 Maximum Conducted Output Power (Peak)

Mode	Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
Bluetooth LE	2402-2480	-3.02	0.5

## 1.4 EUT TEST CONFIGURATION

### 1.4.1 Test Configuration Description

Test Configuration	Description
A	Antenna conducted port test configuration. A modified EUT sample with temporary antenna port connector transmitting at maximum power from the integral antenna on low, mid and high channels.
B	Radiated emissions test configuration. A EUT sample transmitting at maximum power from the integral antenna on low, mid and high channels.

### 1.4.2 EUT Exercise Software

None. No special software was used to exercise the EUT during verification

### 1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
-	-	-

### 1.4.4 Worst Case Configuration

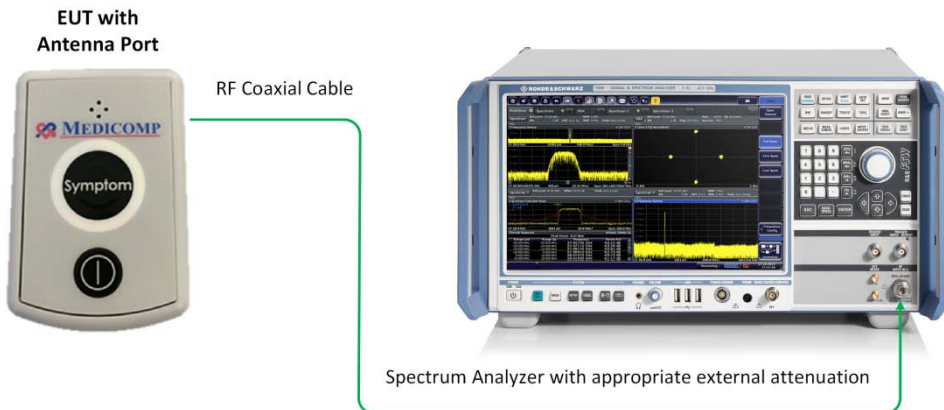
For radiated measurements X, Y and Z orientations were verified. No major variation in emissions observed between the three (3) orientations. Verifications performed using "Y" configuration.

		
<b>"X" Configuration</b>	<b>"Y" Configuration</b>	<b>"Z" Configuration</b>

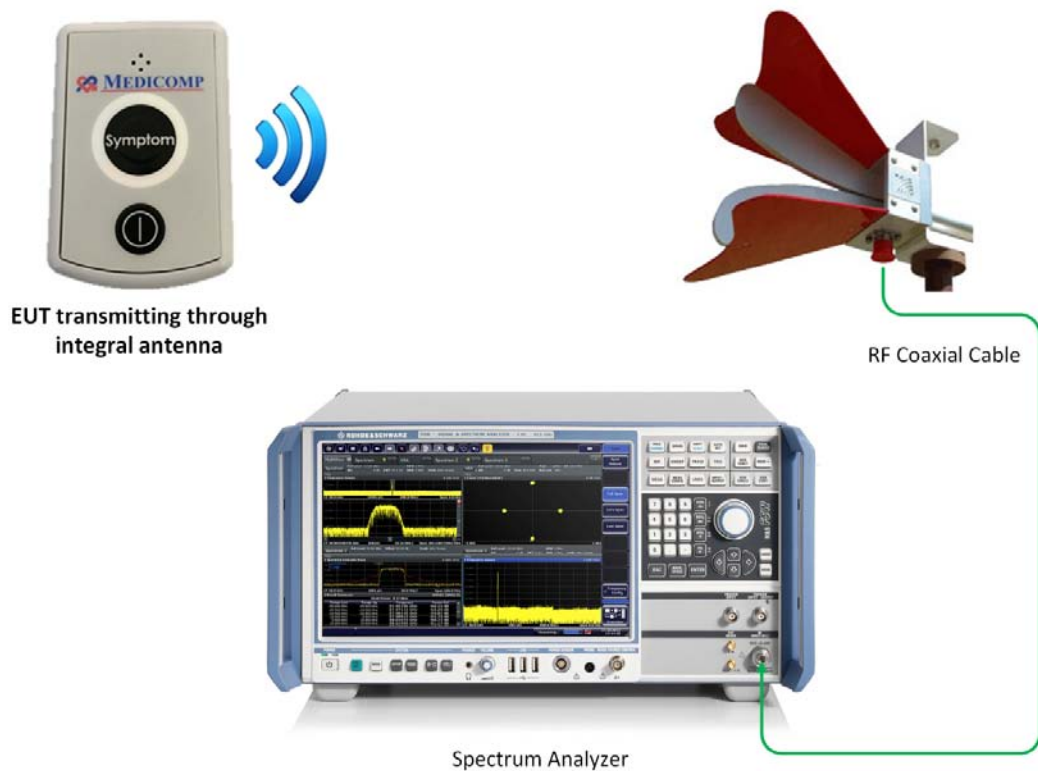
Worst case channel used is High Channel (2480 MHz). This is based from Peak Output Power test results under Section 2.1 of this test report.

#### 1.4.5 Simplified Test Configuration Diagram

##### Conducted Antenna Port Test Configuration



##### Radiated Test Setup Configuration



## 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 N/A		
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 C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

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 C63.4-2014. 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)

Sony Electronics Inc., Building #8 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 Industry Canada (IC) Registration No.: 3067A**

The 10m Semi-anechoic chamber of TÜV SÜD America Inc. (San Diego) has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No. 3067A.



## **SECTION 2**

### **TEST DETAILS**

Radio Testing of the  
Medicomp, Inc.  
TelePatch 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: N/A / Test Configuration A

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

December 1, 2015/NS

### **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	24.8°C
Relative Humidity	30.5 %
ATM Pressure	99.1 kPa

### **2.1.7 Additional Observations**

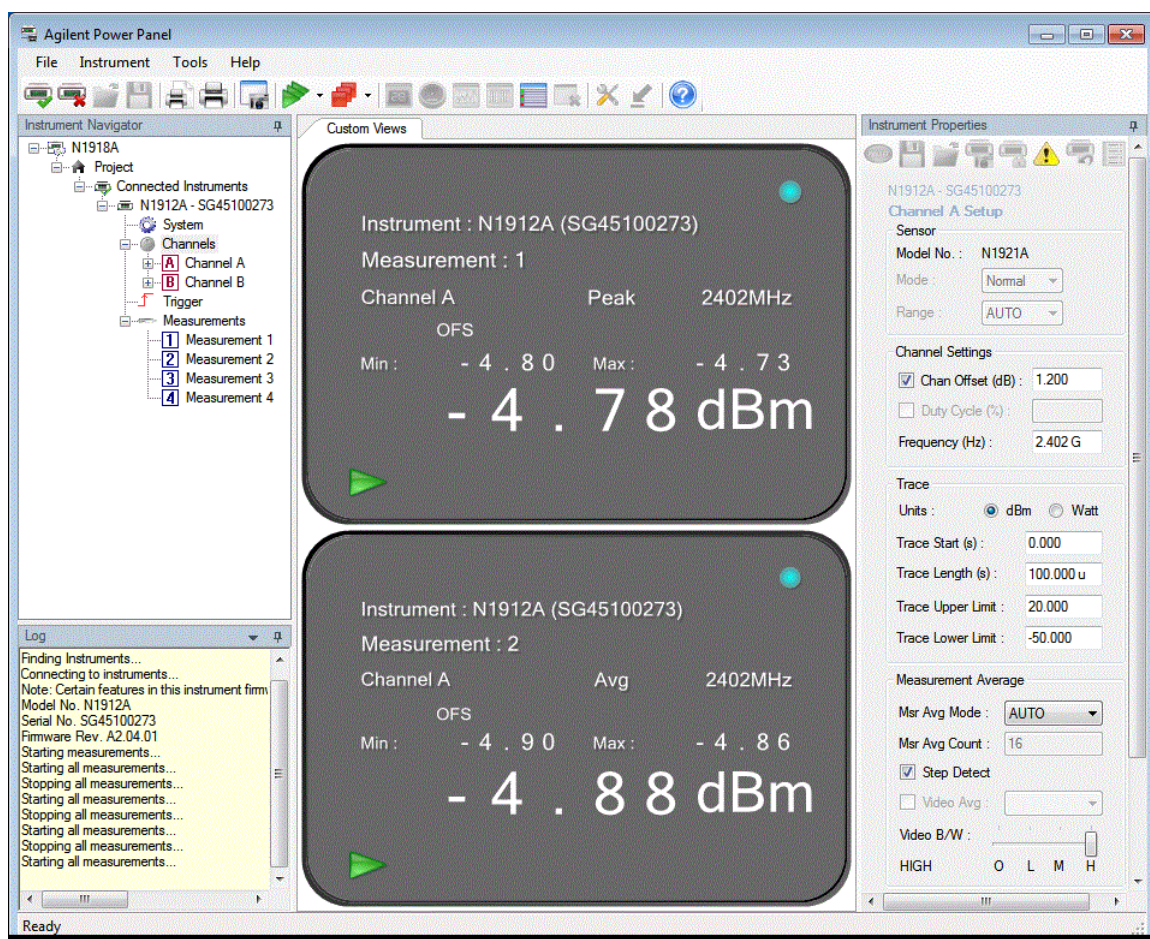
- This is a conducted test (Maximum Peak Conducted Output Power) using direct connection to a spectrum analyzer.
- An offset of 1.2dB was added to compensate for the cable used from the antenna port to the power meter.
- Test methodology is per Clause 9.1.1 of KDB 558074 D01 (DTS Meas Guidance v03r03, June 09, 2015). All conditions under this Clause were satisfied.



## 2.1.8 Test Results

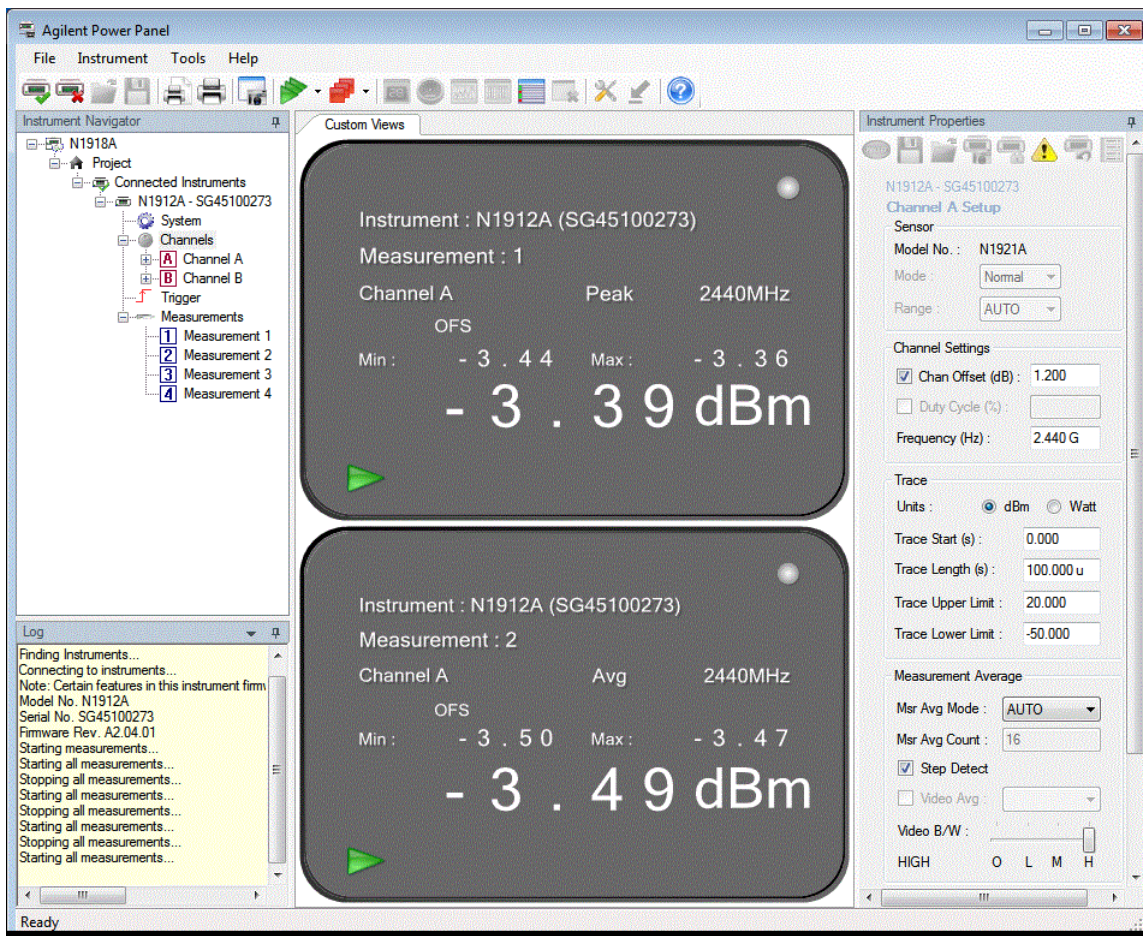
Bluetooth Low Energy (LE)	Channel	Modulation	Measured Peak Power (dBm)	Measured Peak Power (mW)
	37 (2402 MHz)	GFSK @ 1Mbps	-4.73	0.34
	17 (2440 MHz)		-3.36	0.46
	39 (2480 MHz)		-3.02	0.50

## 2.1.9 Test Plots

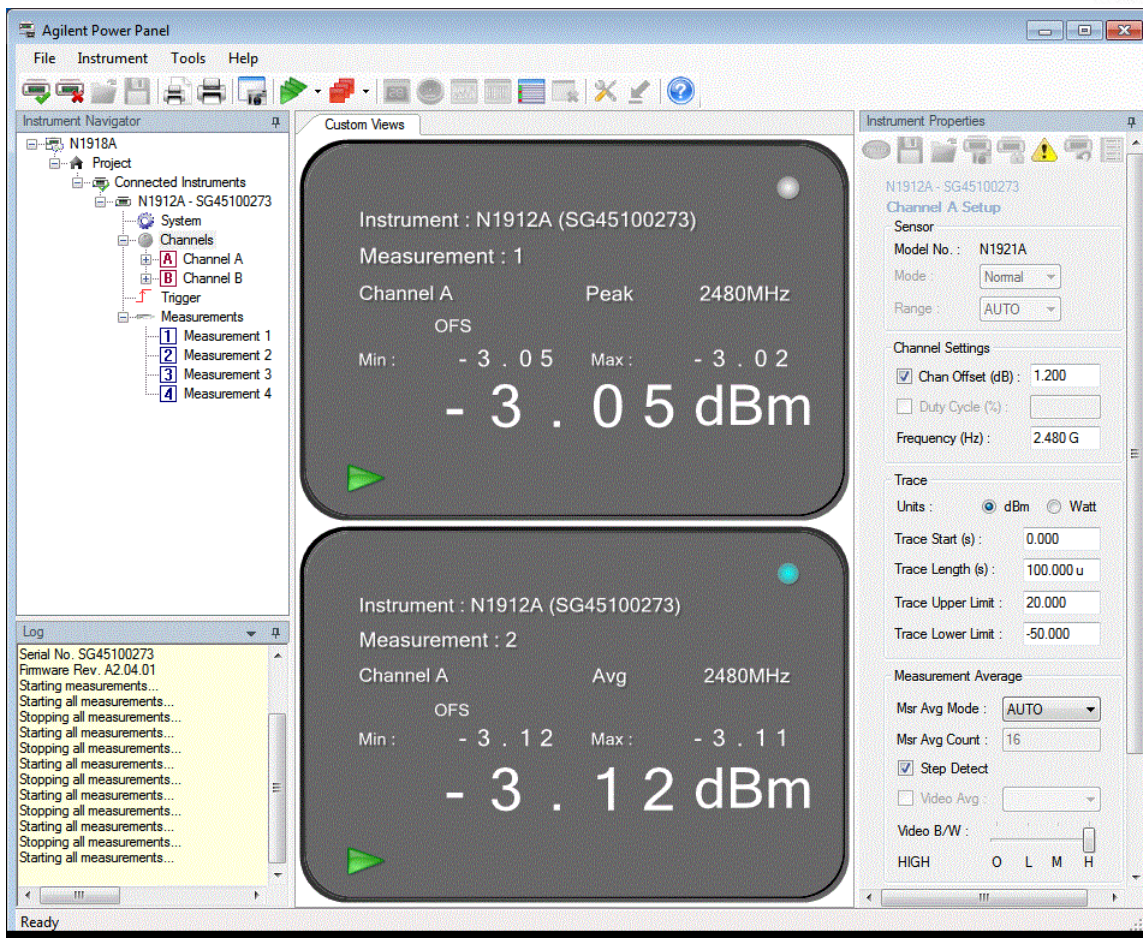


Bluetooth LE. Low Channel





Bluetooth LE. Mid Channel



Bluetooth LE. High Channel

## 2.2 CONDUCTED EMISSIONS

### 2.2.1 Specification Reference

Part 15 Subpart C §15.207(a)

### 2.2.2 Standard Applicable

An intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN).

Frequency of emission (MHz)	Conducted limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*\*Decreases with the logarithm of the frequency.*

### 2.2.3 Equipment Under Test and Modification State

Serial No: N/A /Test Configuration B

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

Not performed. EUT is battery powered.



## **2.3 99% EMISSION BANDWIDTH**

### **2.3.1 Specification Reference**

RSS-Gen Clause 6.6

### **2.3.2 Standard Applicable**

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth.

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 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 (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

Note: Video averaging is not permitted.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level 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 (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

### **2.3.3 Equipment Under Test and Modification State**

Serial No: N/A / Test Configuration A

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

November 30, 2015/NS

### **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 23.1°C  
 Relative Humidity 20.2 %  
 ATM Pressure 99.4 kPa

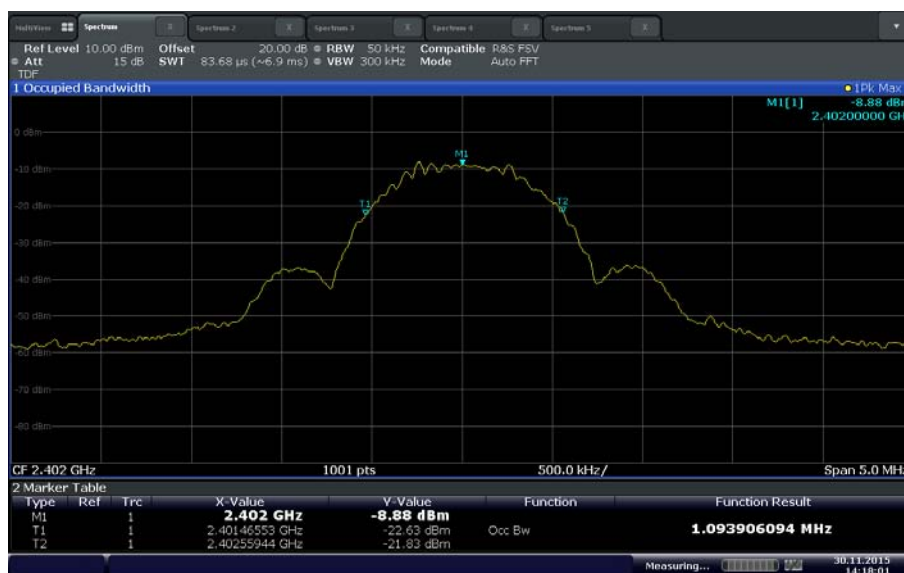
### 2.3.7 Additional Observations

- This is a conducted test.
- A 20 dB offset and a Transducer Factor were added to compensate for the external attenuator, adapter and cables used.
- Span is wide enough to capture the channel transmission.
- RBW is 1% to 5% 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.

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

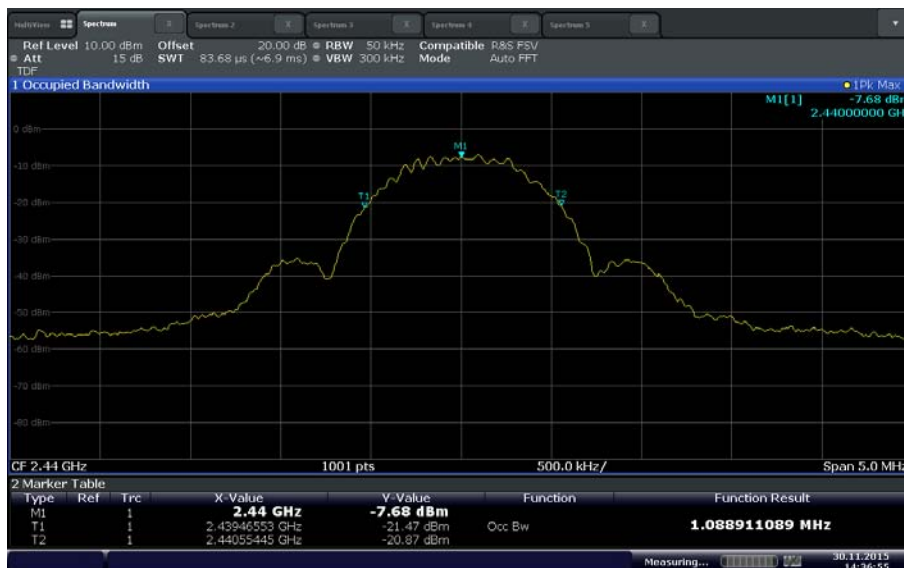
Mode	Channel	Measured 99% Bandwidth (MHz)
Bluetooth LE	37 (2402 MHz)	1.094
	17 (2440 MHz)	1.089
	39 (2480 MHz)	1.099

### 2.3.9 Test Plots



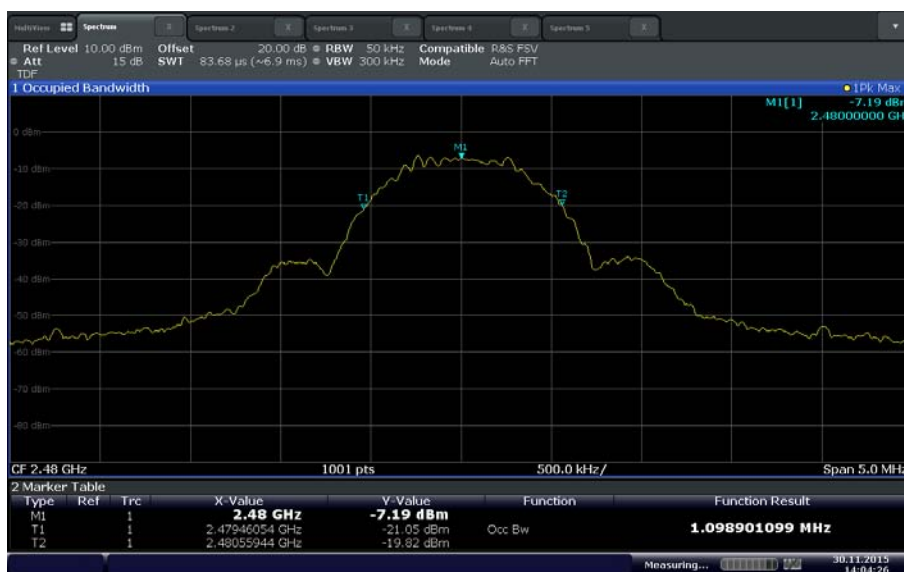
Date: 30 NOV 2015 14:18:01

### Bluetooth LE. Low Channel



Date: 30 NOV 2015 14:36:54

### Bluetooth LE. Mid Channel



Date: 30 NOV 2015 14:04:26

### Bluetooth LE. High Channel

## **2.4 MINIMUM 6 DB RF BANDWIDTH**

### **2.4.1 Specification Reference**

Part 15 Subpart C §15.247(a)(2)

### **2.4.2 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.

### **2.4.3 Equipment Under Test and Modification State**

Serial No: N/A / Test Configuration A

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

November 30, 2015/NS

### **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	23.1°C
Relative Humidity	20.2 %
ATM Pressure	99.4 kPa

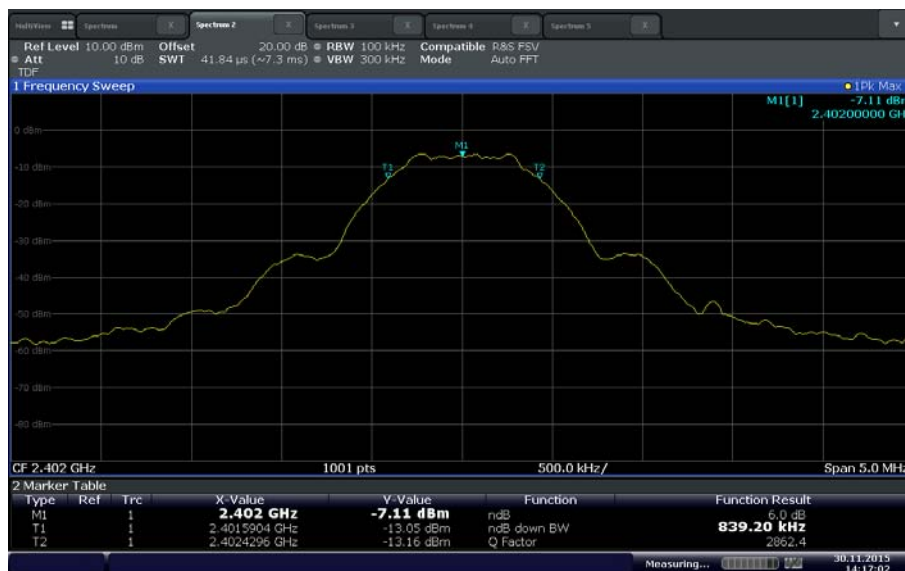
### **2.4.7 Additional Observations**

- This is a conducted test.
- A 20 dB offset and a Transducer Factor were added to compensate for the external attenuator, adapter and cables used.
- Span is wide enough to capture the channel transmission.
- RBW is set to 100 kHz.
- VBW is  $\geq 3X$  RBW.
- Sweep is auto.
- Detector is peak.
- The “n” dB down marker function of the spectrum analyzer was used for this test.

#### 2.4.8 Test Results

Mode	Channel	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Compliance
Bluetooth LE	37 (2402 MHz)	0.839	0.500	Complies
	17 (2440 MHz)	0.814	0.500	Complies
	39 (2480 MHz)	0.824	0.500	Complies

#### 2.4.9 Test Results Plots



Date: 30 NOV 2015 14:17:02

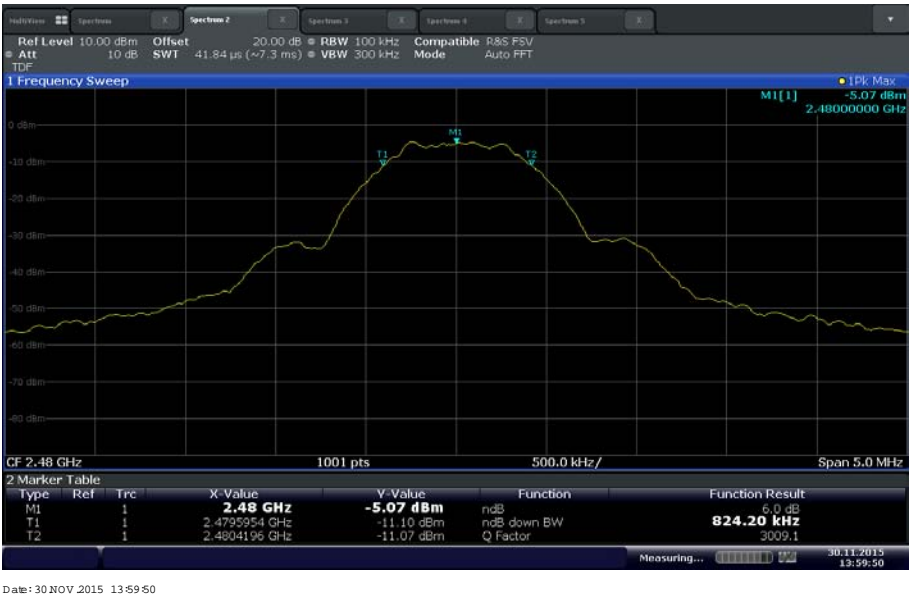
#### Bluetooth LE Low Channel





Date: 30 NOV 2015 14:28:07

Bluetooth LE Mid Channel



Date: 30 NOV 2015 13:59:50

Bluetooth LE High Channel



## **2.5 OUT-OF-BAND EMISSIONS - CONDUCTED**

### **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: N/A / Test Configuration A

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

November 30, 2015/NS

### **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**

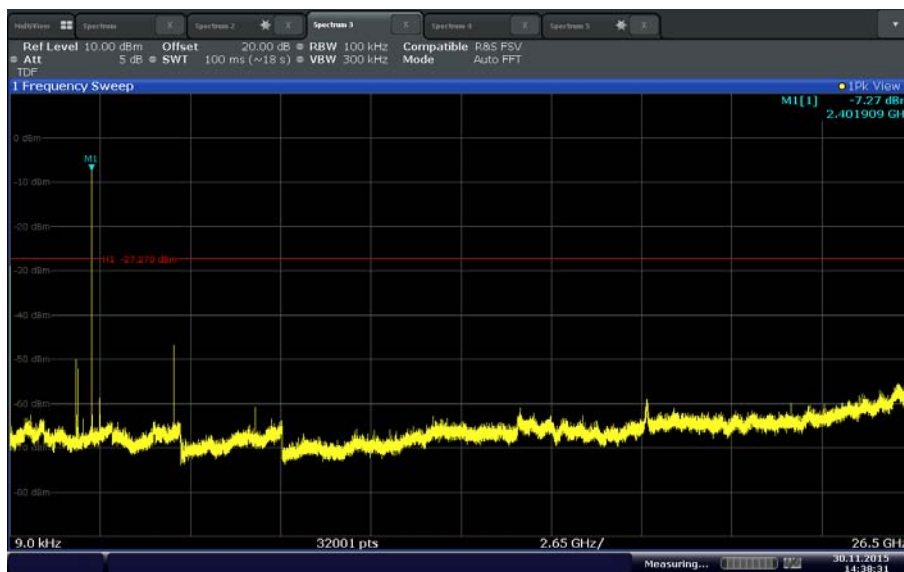
Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.1°C
Relative Humidity	20.2 %
ATM Pressure	99.4 kPa

### **2.5.7 Additional Observations**

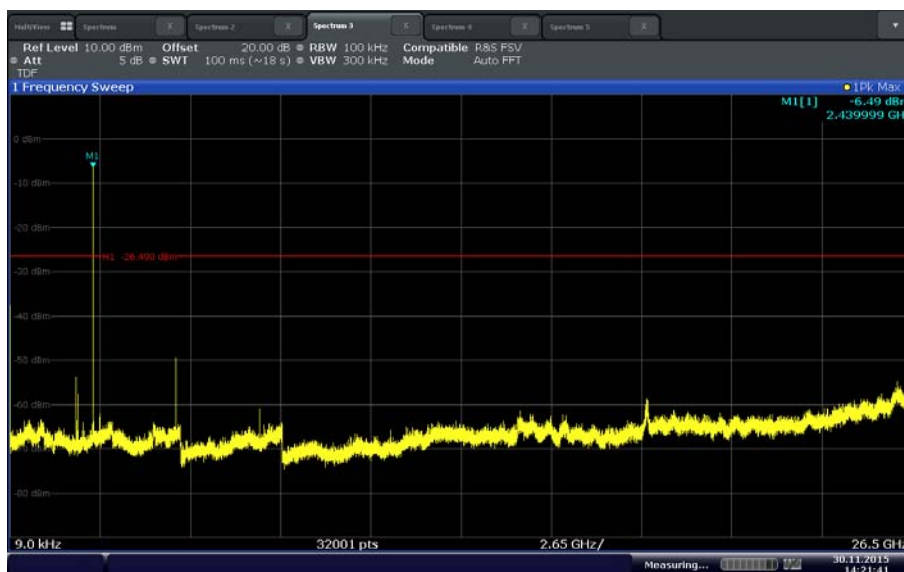
- This is a conducted test.
- A 20 dB offset and a Transducer Factor were added to compensate for the external attenuator, adapter and cables used.
- RBW is 100kHz.VBW is 3X RBW.
- Sweep is auto. Detector is peak. Trace is max hold. Sweep points set to maximum.
- Initial scan was performed to determine the highest level of the desired power within the band. Spurious emissions Limit (display line) was drawn 20dB below that level.
- Spectrum was searched from 9 kHz up to 26.5GHz.

## 2.5.8 Test Results Plots



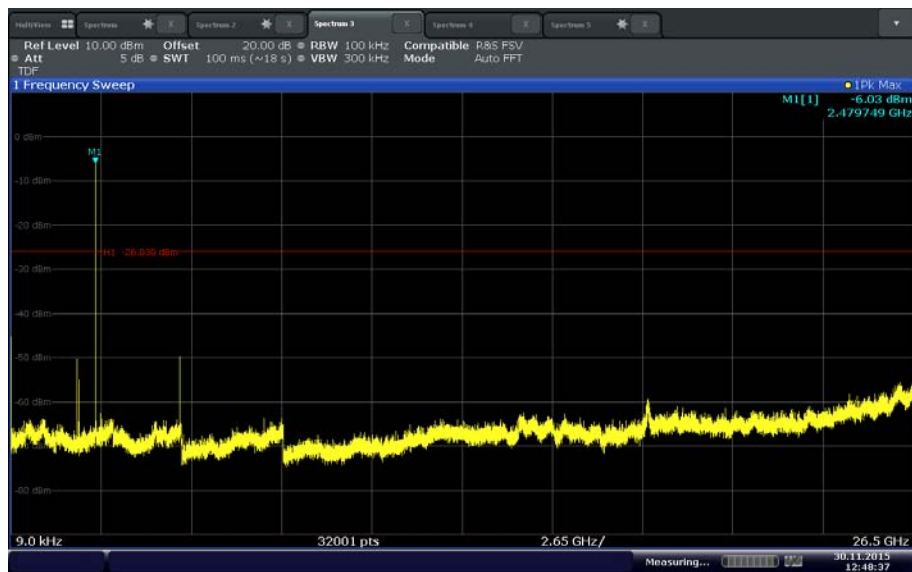
Date: 30 NOV 2015 14:38:31

Bluetooth LE Low Channel



Date: 30 NOV 2015 14:21:41

Bluetooth LE Mid Channel



Date: 30 NOV 2015 12:48:38

### Bluetooth LE High Channel

## **2.6 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS**

### **2.6.1 Specification Reference**

Part 15 Subpart C §15.247(d)

### **2.6.2 Standard Applicable**

See previous test.

### **2.6.3 Equipment Under Test and Modification State**

Serial No: N/A / Test Configuration A

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

November 30, 2015/NS

### **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

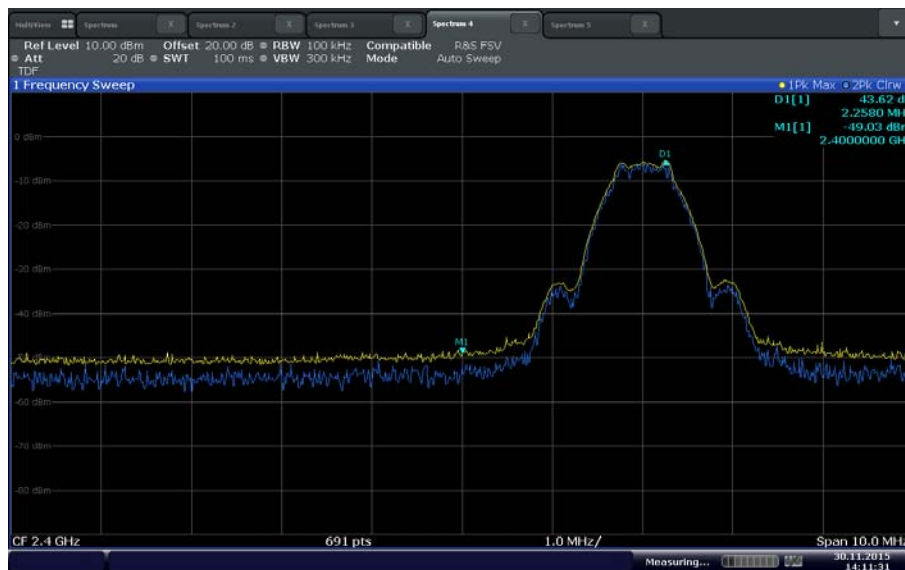
Ambient Temperature	23.1°C
Relative Humidity	20.2 %
ATM Pressure	99.4 kPa

### **2.6.7 Additional Observations**

- This is a conducted test.
- A 20 dB offset and a Transducer Factor were used to compensate for the external attenuator, adapter and cables used.
- RBW is 100kHz.VBW is 3X RBW.
- Sweep is auto. Detector is peak. Trace is max hold.
- Trace was centred on the band-edge frequency.
- Span was set to encompass the band-edge frequency and the peak of the emission.
- Using Marker function, peak of the emission was determined and the delta to the band-edge frequency measured.
- Band-edges were verified  $\leq 20$  dBc.

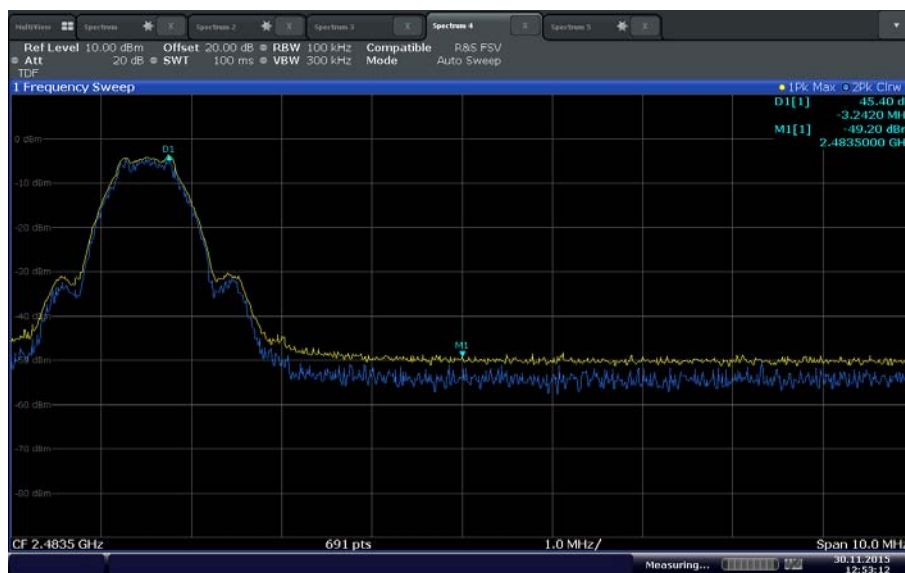
### **2.6.8 Test Results**

Complies. See attached plots.



Date: 30 NOV 2015 14:11:32

### Bluetooth LE Low Channel (2402 MHz)



Date: 30 NOV 2015 12:53:12

### Bluetooth LE High Channel (2480 MHz)

## **2.7 SPURIOUS RADIATED EMISSIONS**

### **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: N/A / Test Configuration B

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

December 9 and December 10, 2015/NS

### **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	23.1-23.7°C
Relative Humidity	38.6-47.3 %
ATM Pressure	98.5-98.9 kPa

### **2.7.7 Additional Observations**

- This is a radiated test. The spectrum was searched from 30MHz to the 10<sup>th</sup> 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 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 2.7.8 for sample computation.

### 2.7.8 Sample Computation (Radiated Emission)

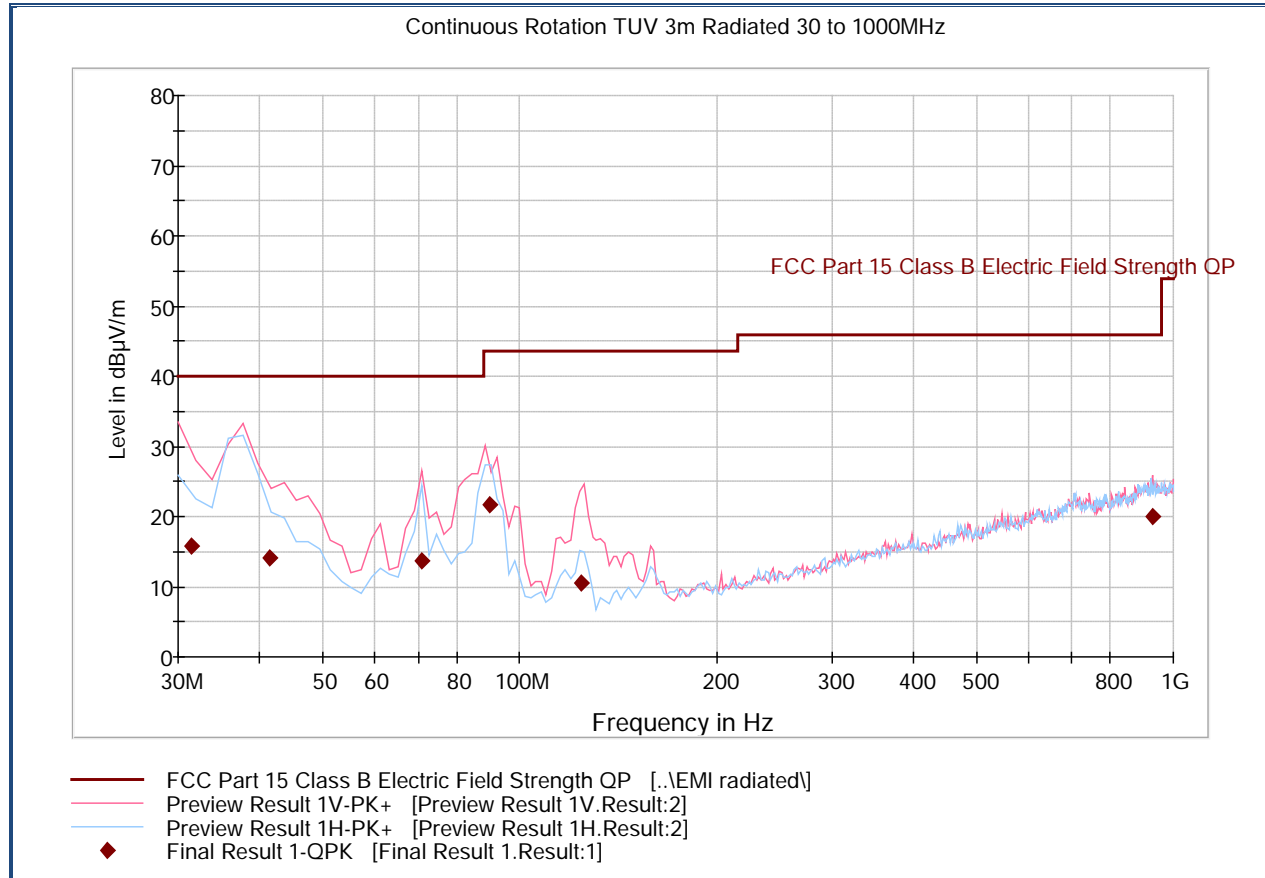
Measuring equipment raw measurement (db $\mu$ V) @ 30 MHz			24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3	-12.6
	Asset# 1172 (cable)	0.3	
	Asset# 1016 (preamplifier)	-30.7	
	Asset# 1175(cable)	0.3	
	Asset# 1002 (antenna)	17.2	
Reported QuasiPeak Final Measurement (db $\mu$ V/m) @ 30MHz			11.8

### 2.7.9 Test Results

See attached plots.



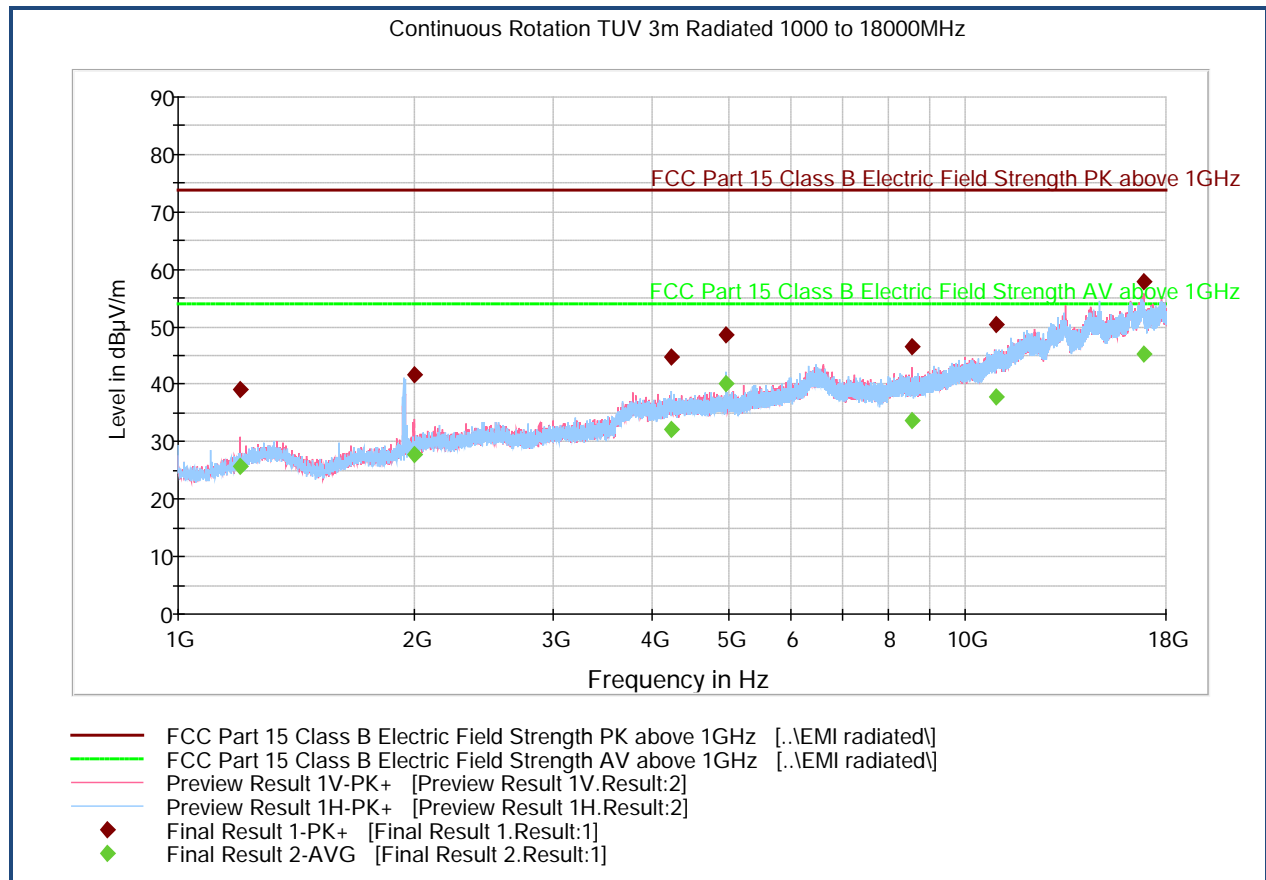
## 2.7.10 Test Results Below 1GHz (Receive Mode)



## 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)
31.440000	15.8	1000.0	120.000	150.0	V	12.0	-12.2	24.2	40.0
41.487214	14.2	1000.0	120.000	100.0	V	267.0	-17.3	25.8	40.0
70.821643	13.7	1000.0	120.000	102.0	V	205.0	-22.4	26.3	40.0
89.716633	21.7	1000.0	120.000	100.0	V	12.0	-20.9	21.8	43.5
123.850501	10.6	1000.0	120.000	200.0	V	349.0	-20.8	32.9	43.5
927.676152	20.0	1000.0	120.000	350.0	V	264.0	1.4	26.0	46.0

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



### Peak Data

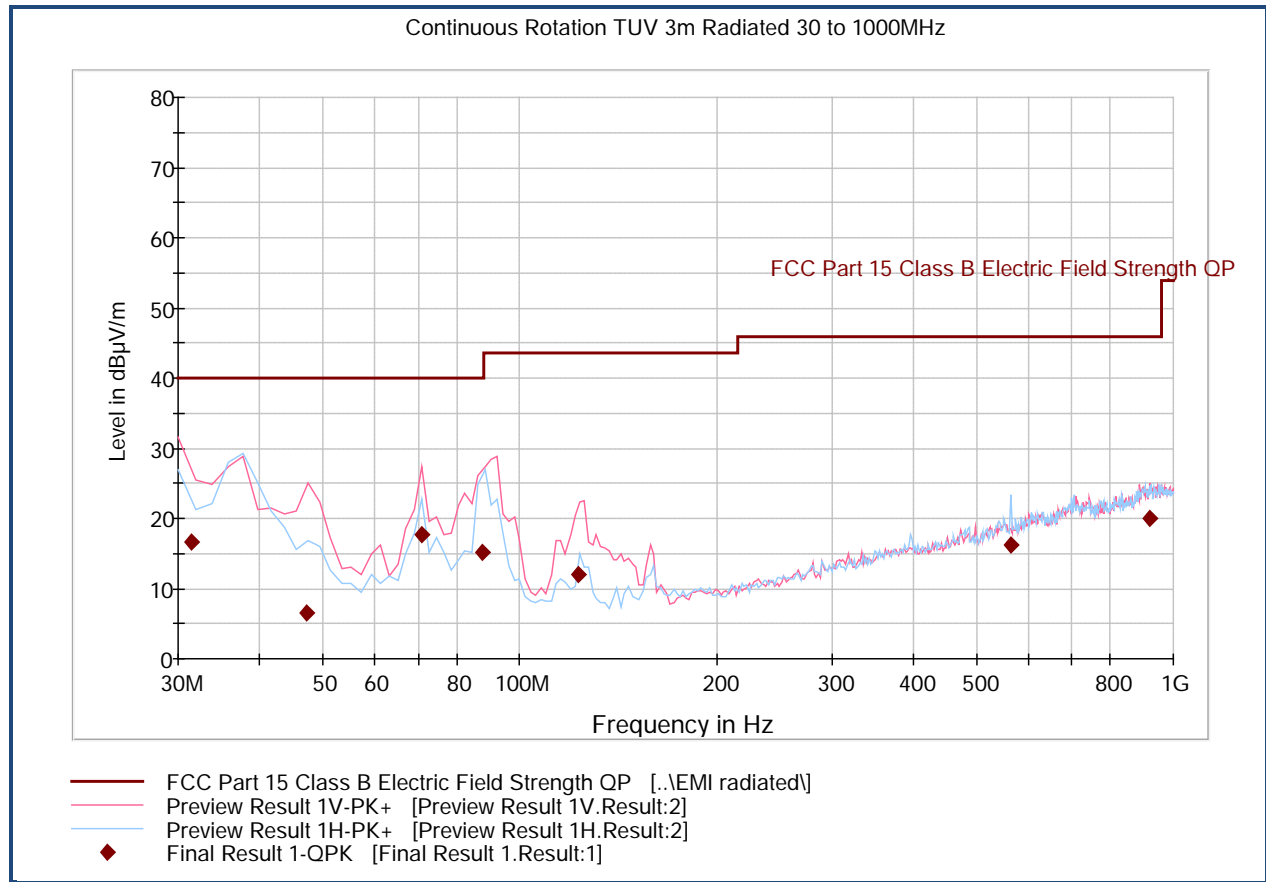
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1199.433333	39.2	1000.0	1000.000	257.0	V	10.0	-6.1	34.7	73.9
1993.733333	41.8	1000.0	1000.000	149.0	V	106.0	-1.8	32.1	73.9
4233.966667	44.7	1000.0	1000.000	151.0	H	323.0	5.4	29.2	73.9
4961.933333	48.5	1000.0	1000.000	100.0	H	32.0	6.5	25.4	73.9
8545.866667	46.5	1000.0	1000.000	259.0	V	176.0	10.3	27.4	73.9
10954.20000	50.3	1000.0	1000.000	176.0	H	-10.0	15.4	23.6	73.9
16837.76666	57.9	1000.0	1000.000	300.0	V	140.0	24.2	16.0	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)
1199.433333	25.7	1000.0	1000.000	257.0	V	10.0	-6.1	28.2	53.9
1993.733333	27.7	1000.0	1000.000	149.0	V	106.0	-1.8	26.2	53.9
4233.966667	32.1	1000.0	1000.000	151.0	H	323.0	5.4	21.8	53.9
4961.933333	40.0	1000.0	1000.000	100.0	H	32.0	6.5	13.9	53.9
8545.866667	33.8	1000.0	1000.000	259.0	V	176.0	10.3	20.1	53.9
10954.20000	37.7	1000.0	1000.000	176.0	H	-10.0	15.4	16.2	53.9
16837.76666	45.3	1000.0	1000.000	300.0	V	140.0	24.2	8.6	53.9

**Test Notes:** No significant emissions observed above 1GHz.

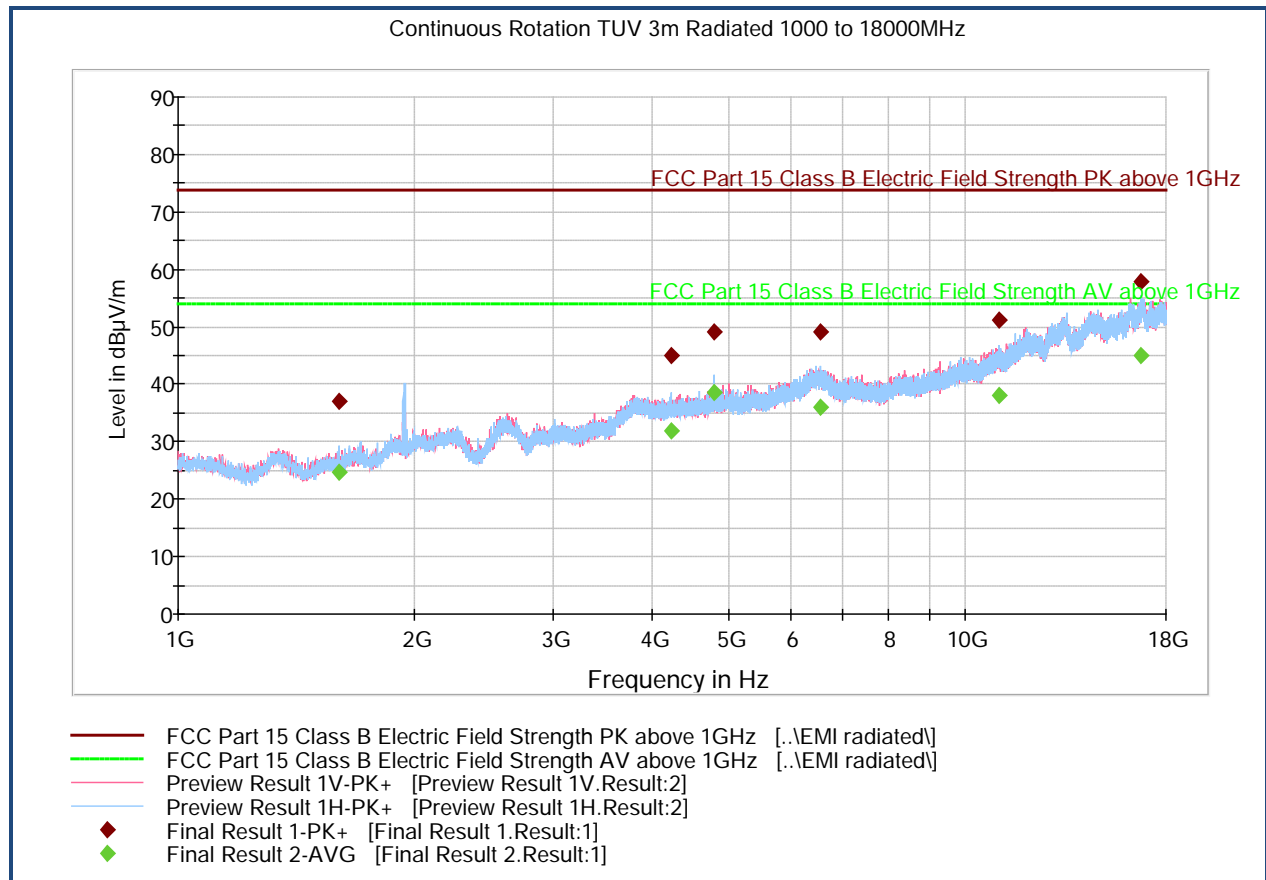
## 2.7.12 Test Results Below 1GHz (High Channel – Worst case channel)



### 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)
31.480000	16.6	1000.0	120.000	169.0	V	11.0	-12.3	23.4	40.0
47.294990	6.6	1000.0	120.000	128.0	V	283.0	-19.3	33.4	40.0
70.781643	17.8	1000.0	120.000	100.0	V	4.0	-22.4	22.2	40.0
87.772745	15.2	1000.0	120.000	300.0	V	-12.0	-21.3	24.8	40.0
122.970501	11.9	1000.0	120.000	100.0	V	15.0	-20.6	31.6	43.5
564.049138	16.2	1000.0	120.000	152.0	H	46.0	-5.4	29.8	46.0
921.284489	19.9	1000.0	120.000	284.0	V	271.0	1.3	26.1	46.0

## 2.7.13 Test Results Above 1GHz (Low Channel)



### Peak Data

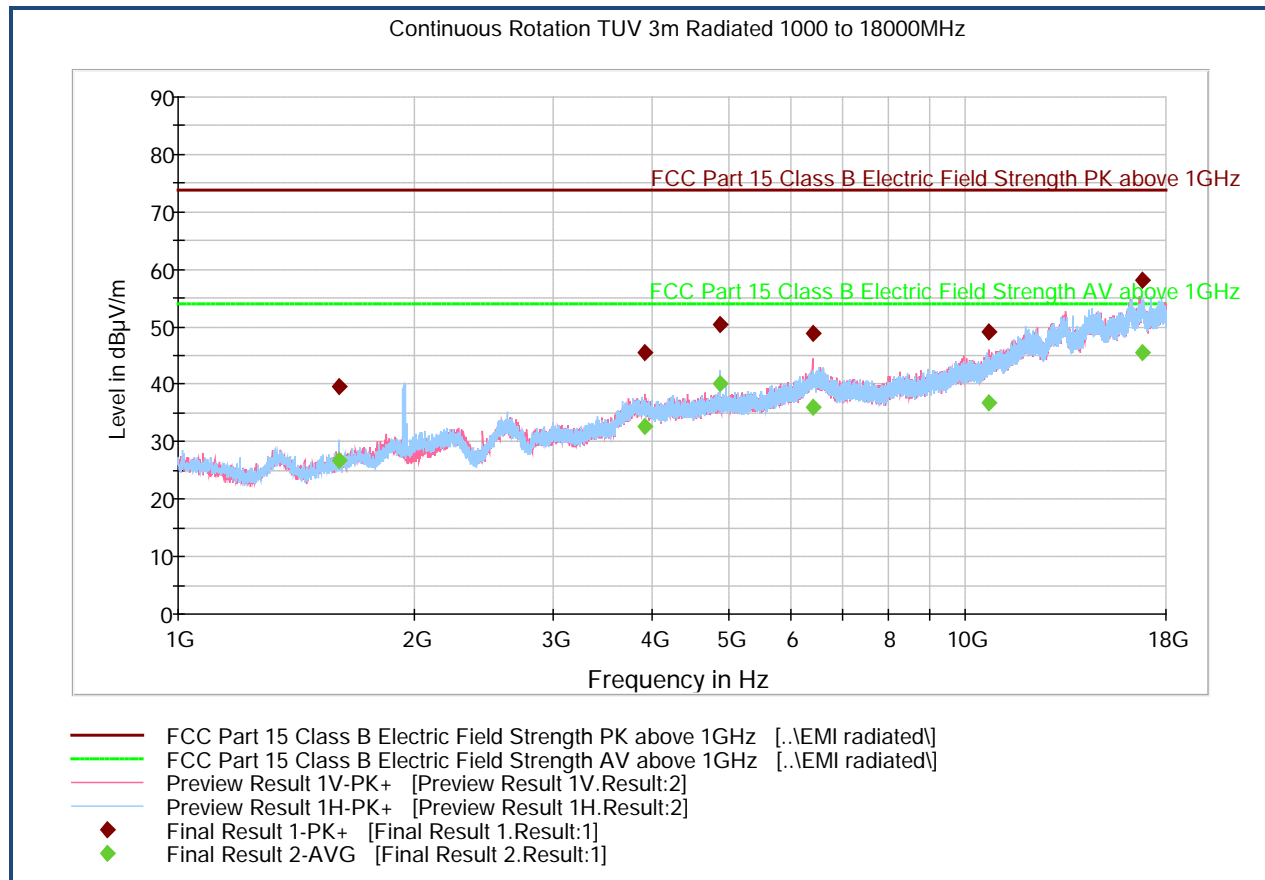
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1598.933333	37.1	1000.0	1000.000	355.0	H	315.0	-5.6	36.8	73.9
4231.166667	45.0	1000.0	1000.000	235.0	H	165.0	5.4	28.9	73.9
4804.400000	49.1	1000.0	1000.000	100.0	H	28.0	5.8	24.8	73.9
6539.700000	49.0	1000.0	1000.000	190.0	H	-15.0	11.5	24.9	73.9
11028.833333	51.1	1000.0	1000.000	410.0	H	152.0	15.5	22.8	73.9
16719.566667	57.9	1000.0	1000.000	232.0	H	296.0	24.3	16.0	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)
1598.933333	24.7	1000.0	1000.000	355.0	H	315.0	-5.6	29.2	53.9
4231.166667	31.8	1000.0	1000.000	235.0	H	165.0	5.4	22.1	53.9
4804.400000	38.5	1000.0	1000.000	100.0	H	28.0	5.8	15.4	53.9
6539.700000	36.0	1000.0	1000.000	190.0	H	-15.0	11.5	17.9	53.9
11028.833333	38.0	1000.0	1000.000	410.0	H	152.0	15.5	15.9	53.9
16719.566667	45.1	1000.0	1000.000	232.0	H	296.0	24.3	8.8	53.9

**Test Notes:** Measurement was performed with a 2.4GHz notch filter. Only the worst configuration presented (Y axis). No significant emissions observed above 18GHz. Measurements above 18GHz were noise floor figures.

## 2.7.14 Test Results Above 1GHz (Mid Channel)



### Peak Data

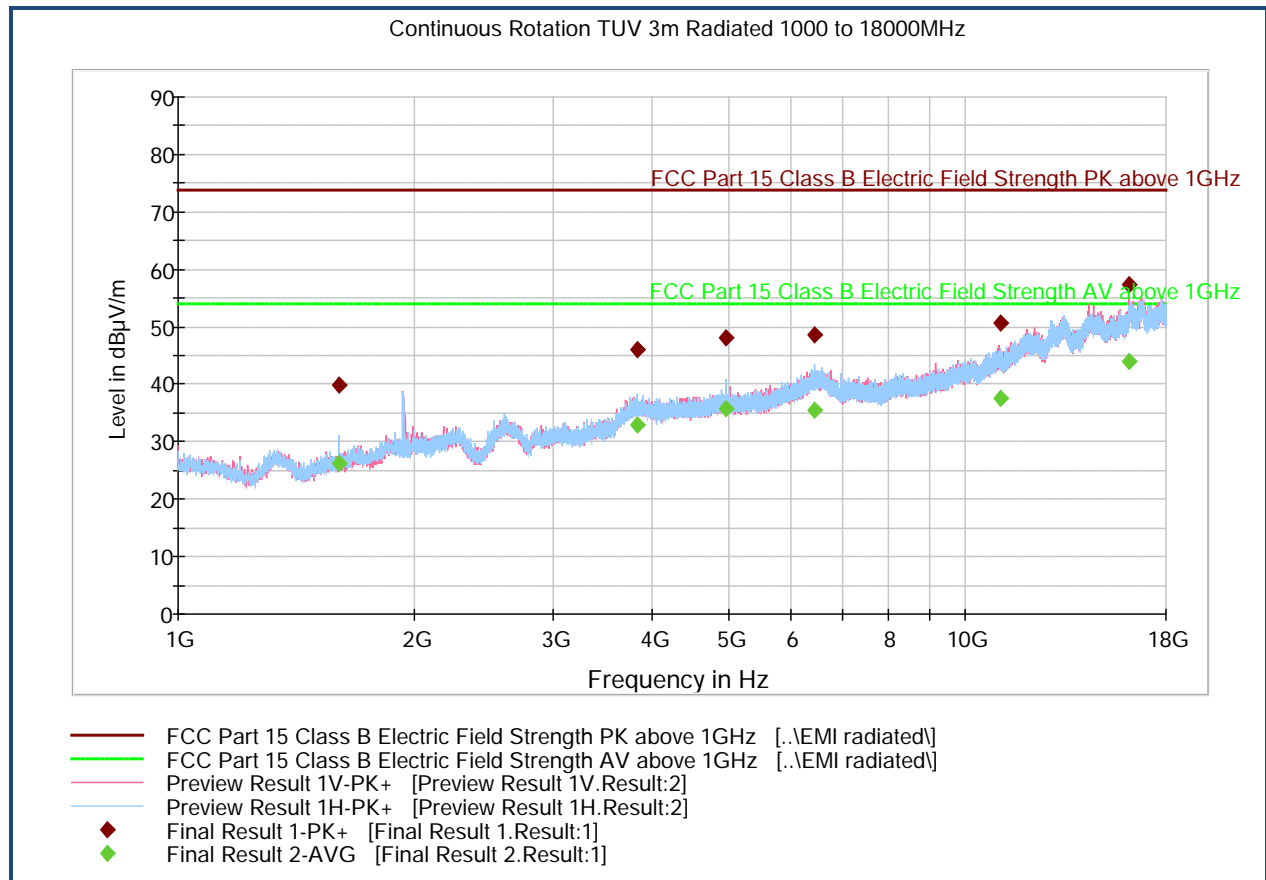
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1599.733333	39.6	1000.0	1000.000	230.0	H	3.0	-5.6	34.3	73.9
3908.666667	45.6	1000.0	1000.000	124.0	V	271.0	5.2	28.3	73.9
4879.600000	50.4	1000.0	1000.000	100.0	H	37.0	6.1	23.5	73.9
6395.800000	48.9	1000.0	1000.000	300.0	V	59.0	11.5	25.0	73.9
10733.200000	49.2	1000.0	1000.000	345.0	V	297.0	14.4	24.7	73.9
16771.666667	58.1	1000.0	1000.000	300.0	H	-3.0	24.6	15.8	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)
1599.733333	26.8	1000.0	1000.000	230.0	H	3.0	-5.6	27.1	53.9
3908.666667	32.6	1000.0	1000.000	124.0	V	271.0	5.2	21.3	53.9
4879.600000	40.2	1000.0	1000.000	100.0	H	37.0	6.1	13.7	53.9
6395.800000	35.9	1000.0	1000.000	300.0	V	59.0	11.5	18.0	53.9
10733.200000	36.7	1000.0	1000.000	345.0	V	297.0	14.4	17.2	53.9
16771.666667	45.5	1000.0	1000.000	300.0	H	-3.0	24.6	8.4	53.9

**Test Notes:** Measurement was performed with a 2.4GHz notch filter. Only the worst configuration presented (Y axis). No significant emissions observed above 18GHz. Measurements above 18GHz were noise floor figures.

## 2.7.15 Test Results Above 1GHz (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)
1600.133333	39.7	1000.0	1000.000	287.3	H	98.0	-5.6	34.2	73.9
3827.633333	46.0	1000.0	1000.000	377.1	H	238.0	5.0	27.9	73.9
4959.500000	48.0	1000.0	1000.000	247.4	H	55.0	6.5	25.9	73.9
6425.966667	48.5	1000.0	1000.000	330.2	H	20.0	11.5	25.4	73.9
11071.600000	50.6	1000.0	1000.000	390.1	V	162.0	15.2	23.3	73.9
16162.133333	57.4	1000.0	1000.000	402.1	V	47.0	22.7	16.5	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)
1600.133333	26.1	1000.0	1000.000	287.3	H	98.0	-5.6	27.8	53.9
3827.633333	32.8	1000.0	1000.000	377.1	H	238.0	5.0	21.1	53.9
4959.500000	35.8	1000.0	1000.000	247.4	H	55.0	6.5	18.1	53.9
6425.966667	35.5	1000.0	1000.000	330.2	H	20.0	11.5	18.4	53.9
11071.600000	37.4	1000.0	1000.000	390.1	V	162.0	15.2	16.5	53.9
16162.133333	44.0	1000.0	1000.000	402.1	V	47.0	22.7	9.9	53.9

**Test Notes:** Measurement was performed with a 2.4GHz notch filter. Only the worst configuration presented (Y axis). No significant emissions observed above 18GHz. Measurements above 18GHz were noise floor figures.



## **2.8 RADIATED BAND-EDGE MEASUREMENTS AND IMMEDIATE RESTRICTED BANDS**

### **2.8.1 Specification Reference**

Part 15 Subpart C §15.247(d)

### **2.8.2 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)).

### **2.8.3 Equipment Under Test and Modification State**

Serial No: N/A / Test Configuration B

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

December 9, 2015/NS

### **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	23.1°C
Relative Humidity	20.2 %
ATM Pressure	99.4 kPa

### **2.8.7 Additional Observations**

- This is a 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.



- Only the worst configuration presented (Y axis) since the EUT is transmitting on all three (3) advertising channels.
- 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 2.8.8 for sample computation.

#### 2.8.8 Sample Computation (Radiated Emission)

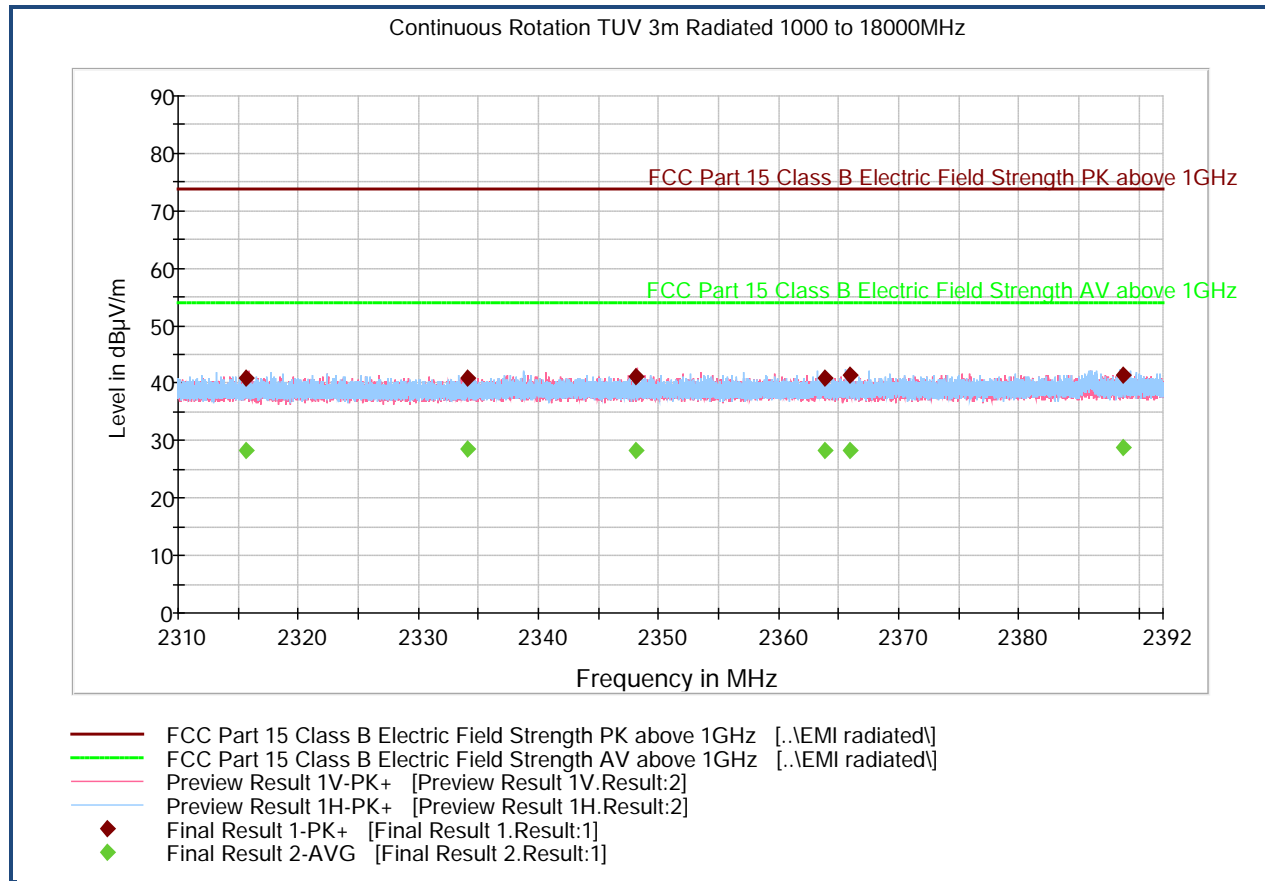
Measuring equipment raw measurement (db $\mu$ V) @ 2400 MHz			53.9
Correction Factor (dB)	Asset# 1153 (cable)	3.4	-0.4
	Asset# 8628(preamplifier)	-36.5	
	Asset#7575 (antenna)	32.7	
<b>Reported Max Peak Final Measurement (db<math>\mu</math>V/m) @ 2400 MHz</b>			<b>53.5</b>

#### 2.8.9 Test Results

See attached plots.



## 2.8.10 Test Results Restricted Band 2310MHz to 2390MHz (Low Channel)



### Peak Data

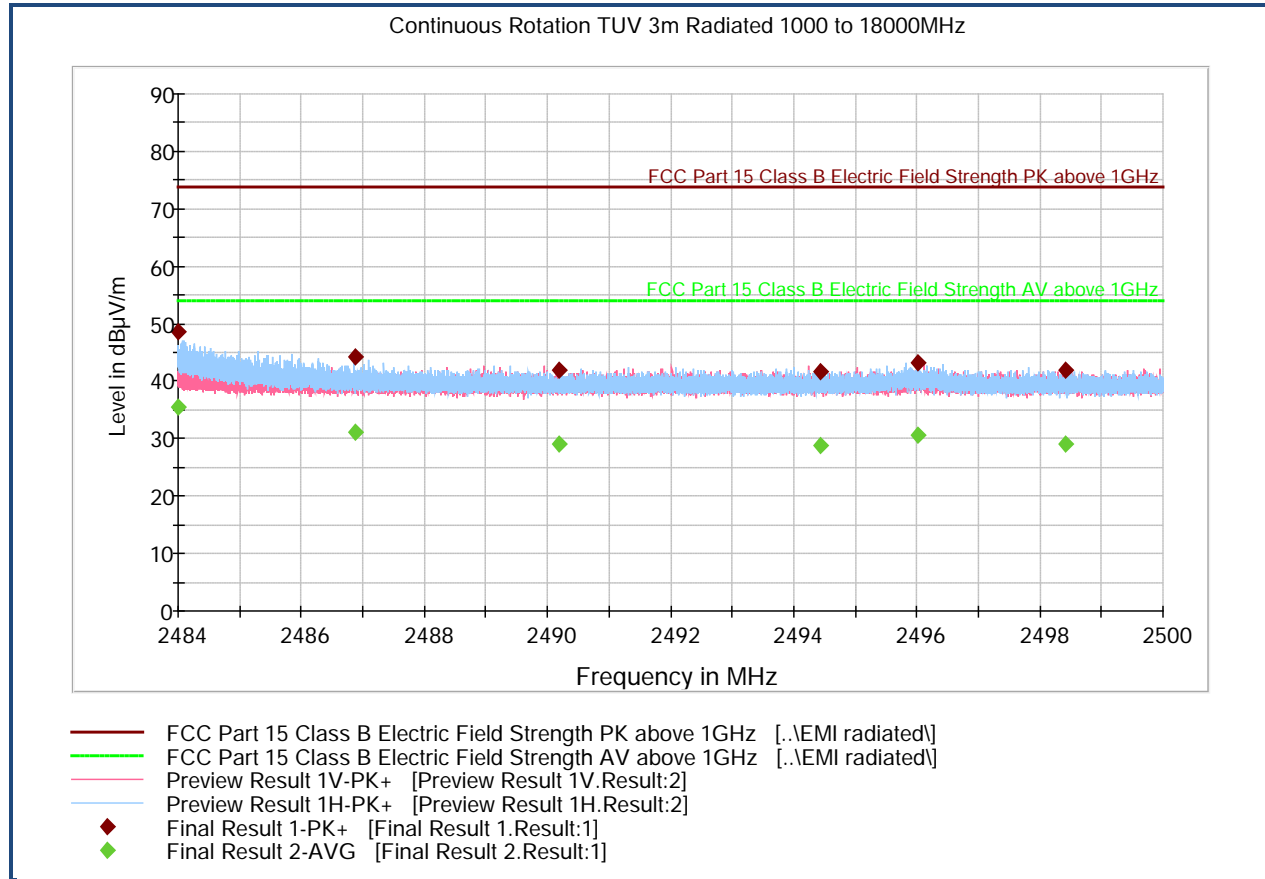
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2315.679400	41.0	1000.0	1000.000	225.0	V	233.0	-0.7	32.9	73.9
2334.115333	41.0	1000.0	1000.000	125.0	H	173.0	-0.6	32.9	73.9
2348.072133	41.2	1000.0	1000.000	199.0	V	-16.0	-0.7	32.7	73.9
2363.804333	41.0	1000.0	1000.000	125.0	H	26.0	-0.7	32.9	73.9
2365.933133	41.3	1000.0	1000.000	125.0	H	20.0	-0.7	32.6	73.9
2388.690400	41.5	1000.0	1000.000	125.0	H	132.0	-0.5	32.4	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)
2315.679400	28.2	1000.0	1000.000	225.0	V	233.0	-0.7	25.7	53.9
2334.115333	28.4	1000.0	1000.000	125.0	H	173.0	-0.6	25.5	53.9
2348.072133	28.4	1000.0	1000.000	199.0	V	-16.0	-0.7	25.5	53.9
2363.804333	28.2	1000.0	1000.000	125.0	H	26.0	-0.7	25.7	53.9
2365.933133	28.2	1000.0	1000.000	125.0	H	20.0	-0.7	25.7	53.9
2388.690400	28.8	1000.0	1000.000	125.0	H	132.0	-0.5	25.1	53.9

### Test Notes:

### 2.8.11 Test Results Restricted Band 2483.5MHz to 2500MHz (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)
2484.000000	48.7	1000.0	1000.000	102.8	H	172.0	-0.1	25.2	73.9
2486.887467	44.1	1000.0	1000.000	126.1	H	179.0	0.0	29.8	73.9
2490.200533	41.9	1000.0	1000.000	220.4	H	170.0	0.0	32.0	73.9
2494.435200	41.7	1000.0	1000.000	102.8	V	212.0	0.0	32.2	73.9
2496.028267	43.1	1000.0	1000.000	114.7	H	141.0	0.0	30.8	73.9
2498.407467	42.0	1000.0	1000.000	126.1	H	0.0	0.0	31.9	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)
2484.000000	35.4	1000.0	1000.000	102.8	H	172.0	-0.1	18.5	53.9
2486.887467	31.2	1000.0	1000.000	126.1	H	179.0	0.0	22.7	53.9
2490.200533	29.1	1000.0	1000.000	220.4	H	170.0	0.0	24.8	53.9
2494.435200	28.9	1000.0	1000.000	102.8	V	212.0	0.0	25.0	53.9
2496.028267	30.5	1000.0	1000.000	114.7	H	141.0	0.0	23.4	53.9
2498.407467	29.1	1000.0	1000.000	126.1	H	0.0	0.0	24.8	53.9

#### Test Notes:

## **2.9 POWER SPECTRAL DENSITY**

### **2.9.1 Specification Reference**

Part 15 Subpart C §15.247(e)

### **2.9.2 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.

### **2.9.3 Equipment Under Test and Modification State**

Serial No: N/A / Test Configuration A

### **2.9.4 Date of Test/Initial of test personnel who performed the test**

November 30, 2015/NS

### **2.9.5 Test Equipment Used**

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

### **2.9.6 Environmental Conditions**

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.1°C
Relative Humidity	20.2 %
ATM Pressure	99.4 kPa

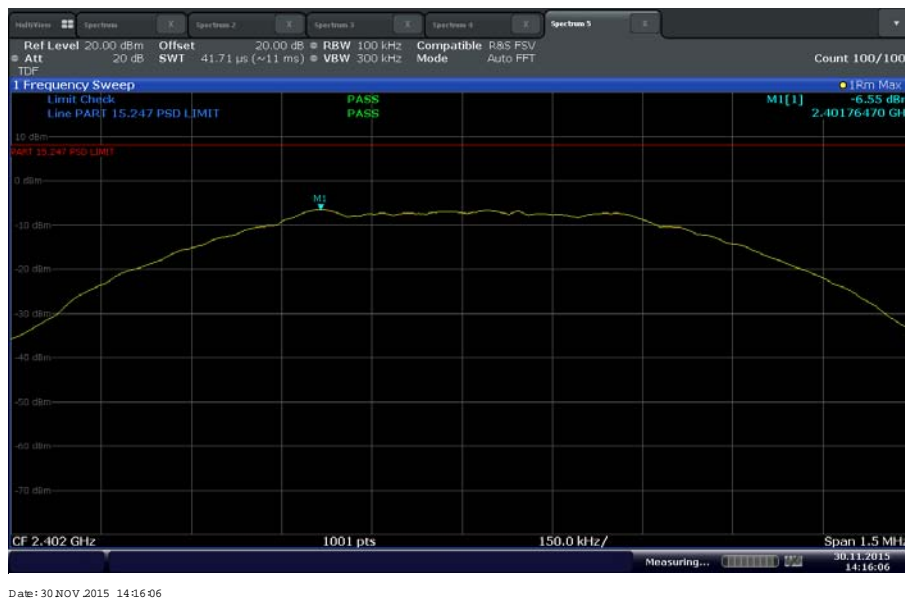
### **2.9.7 Additional Observations**

- This is a conducted test.
- Test procedure is per Section 10.2 of KDB 558074 v03r03, (June 09, 2015).
- A 20 dB offset and a Transducer Factor were used to compensate for the external attenuator, adapter and cables used.
- Detector is Peak.
- Trace Mode is Max hold.
- Sweep time is Auto Couple.
- EUT complies with 100 kHz RBW.

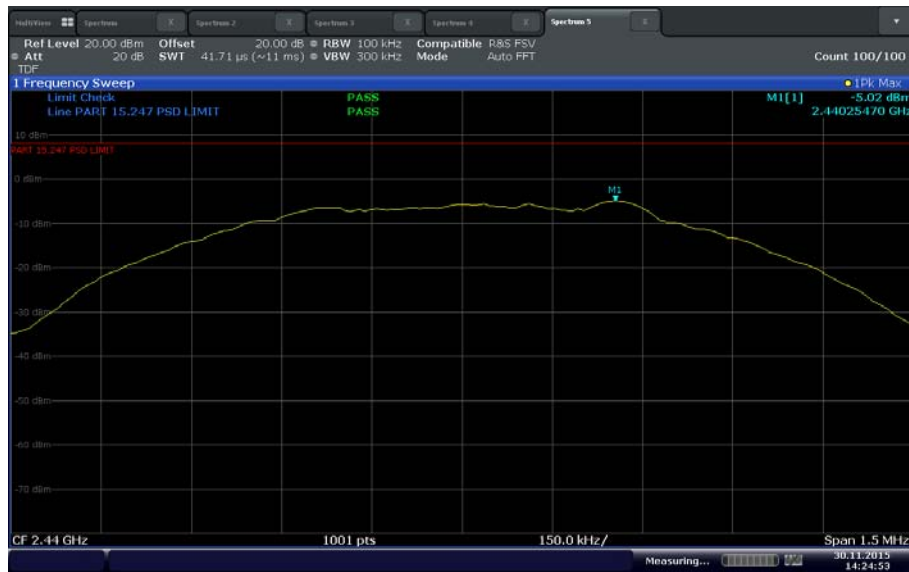
## 2.9.8 Test Results Summary (PKPSD Method)

Mode	Channel	Marker Reading using 100 kHz RBW (dBm)	PSD Limit (dBm)	Compliance
Bluetooth LE	37 (2402 MHz)	-6.55	8	Complies
	17 (2440 MHz)	-5.02	8	Complies
	39 (2480 MHz)	-4.74	8	Complies

## 2.9.9 Test Results Plots

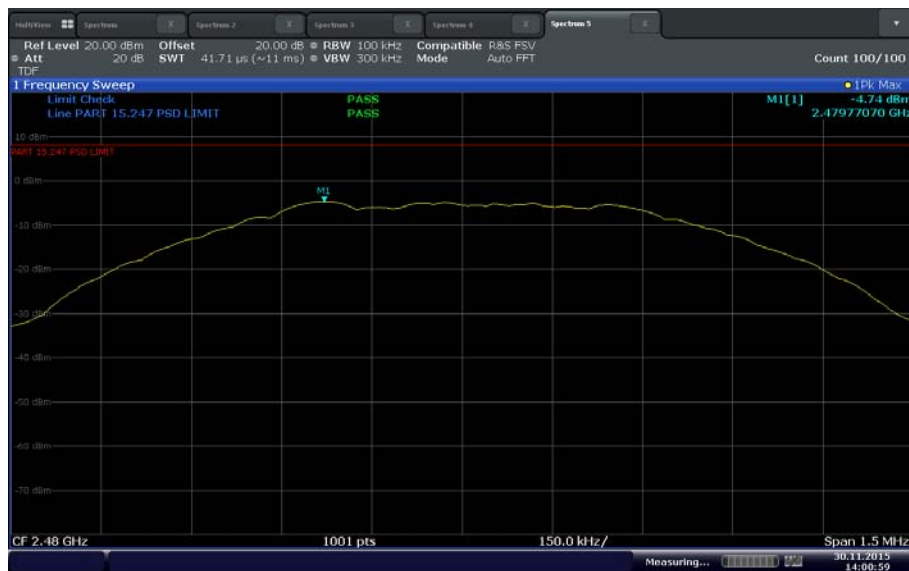


Bluetooth LE Low Channel



Date: 30 NOV 2015 14:24:52

#### Bluetooth LE Mid Channel



Date: 30 NOV 2015 14:00:59

#### 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						
7611	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	03/25/15	03/25/16
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	04/29/15	04/29/16
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
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 1003 and 7611	
Radiated Test Setup						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/30/14	01/30/16
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	09/29/15	09/29/16
1016	Pre-amplifier	PAM-0202	187	PAM	12/10/14	12/10/15
1051	Double-ridged waveguide horn antenna	3115	9408-4329	EMCO	02/28/14	02/28/16
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/11/15	03/11/16
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	03/20/15	03/20/16
1150	Horn antenna	3160-09	012054-004	ETS	07/16/15	07/16/17
1151	Pre-amplifier	TS-PR26	100026	Rhode & Schwarz	05/08/15	05/08/16
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	Verified by 1003 and 7611	
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	Verified by 1003 and 7611	
6815	2.4GHz Band Notch Filter	BRM50702	008	Micro-Tronics	Verified by 1003 and 7611	
Miscellaneous						
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/14/15	08/14/16
11312	Mini Environmental Quality Meter	850027	CF099-56010- 340	Sper Scientific	04/09/15	04/09/16
	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 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

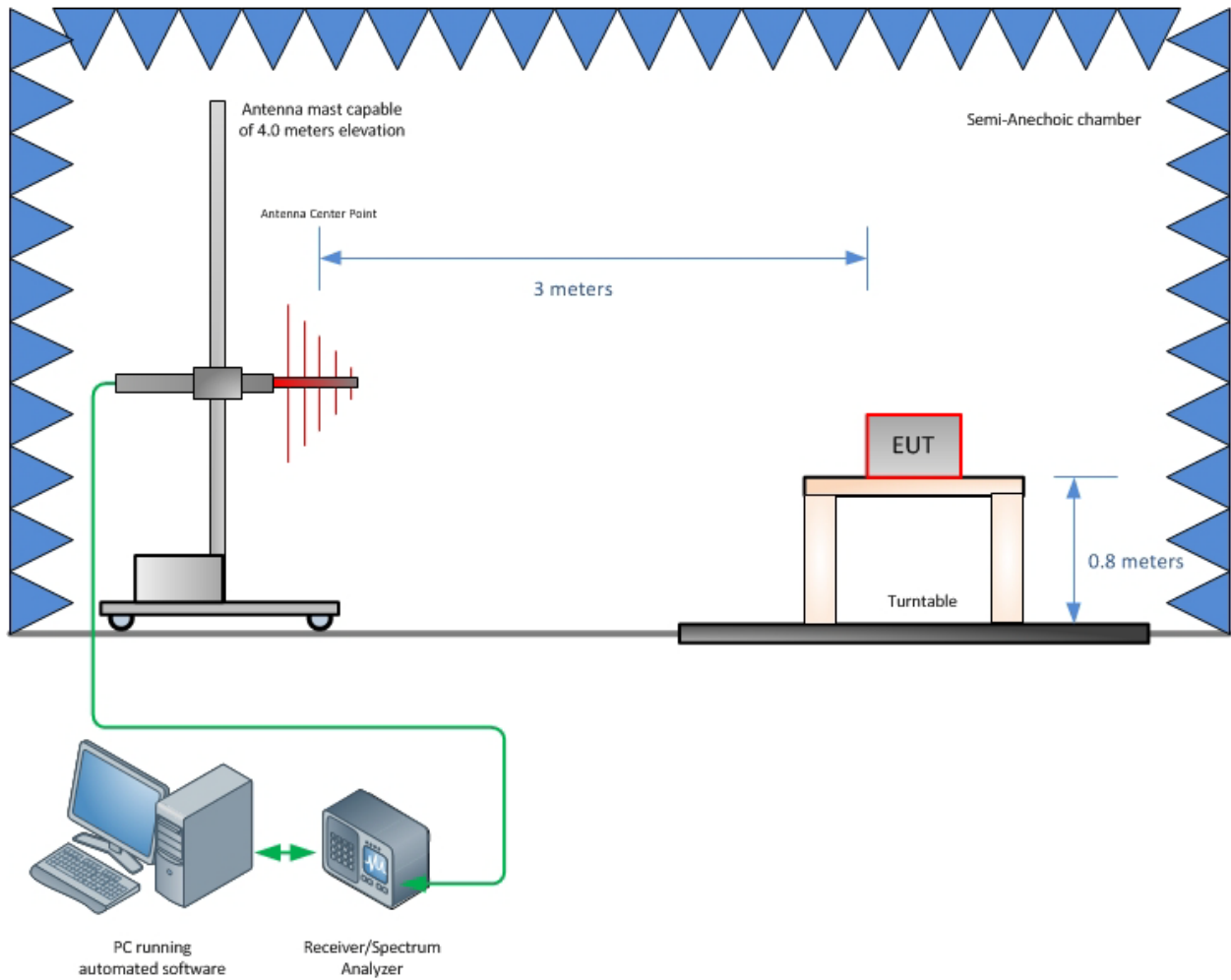
Contribution		Probability Distribution Type	Probability Distribution $x_i$	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.50	0.29	0.08
3	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty ( $u_c$ ):					0.72
Coverage Factor (k):					2
Expanded Uncertainty:					1.45



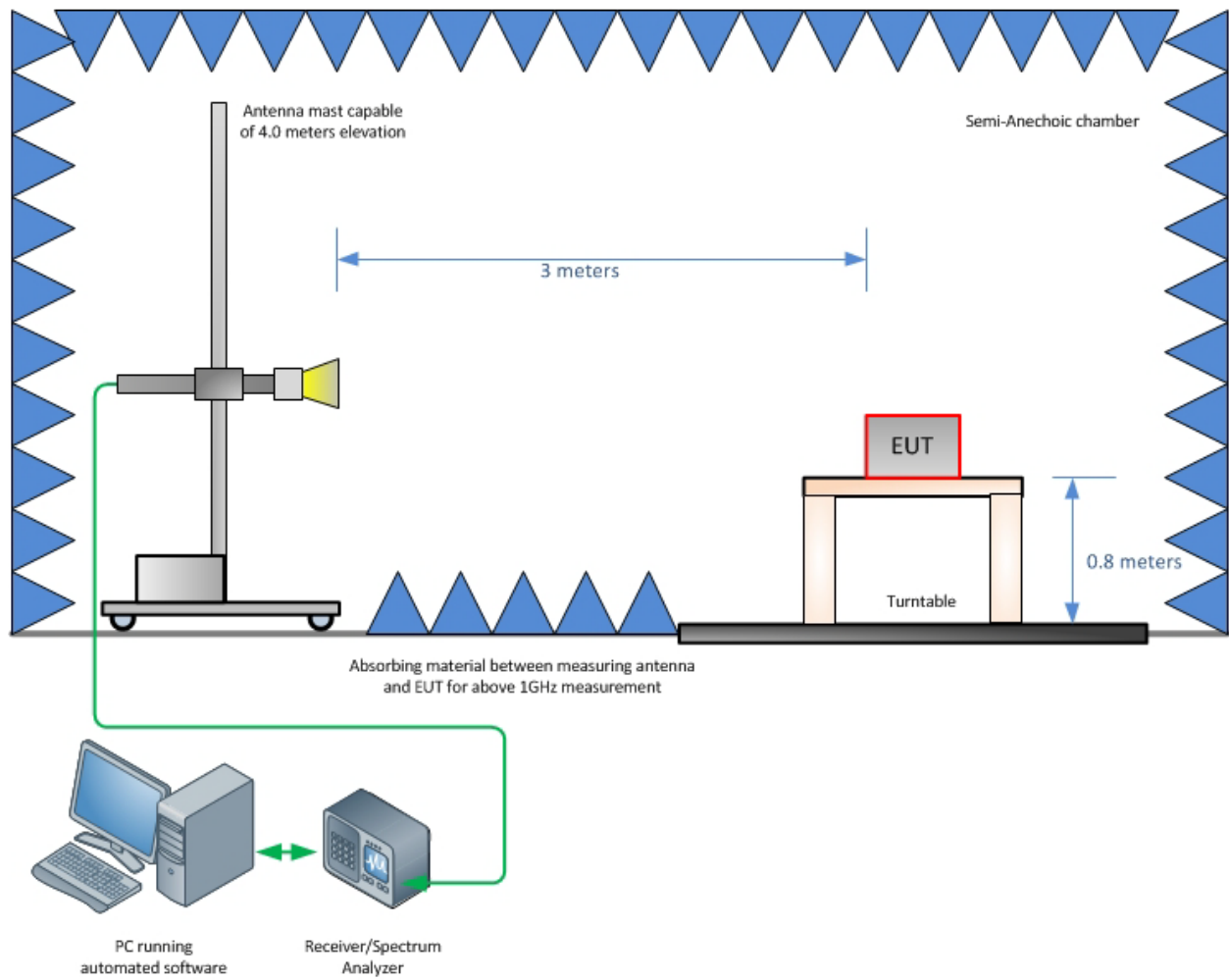
## **SECTION 4**

### **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**

## 5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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