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Report On

Application for Grant of Equipment Authorization of the
Hunter Douglas Window Fashions
PV HUB Bluetooth Window Blind Remote Control

FCC Part 15 Subpart C §15.247: 2014
IC RSS-Gen Issue 4 November 2014
IC RSS-247 Issue 1 May 2015

Report No. SD72101555-0115A

June 2015

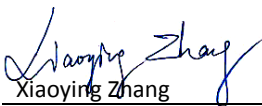


REPORT ON Radio Testing of the
Hunter Douglas Window Fashions
Bluetooth Window Blind Remote Control

TEST REPORT NUMBER SD72101555-0115A

PREPARED FOR Hunter Douglas Window Fashions
One Duette Way, Boomfield, CO 80020

CONTACT PERSON Felipe Cortés
Engineering Supervisor
(619) 216-6400
felipcec@smkusa.com

PREPARED BY 
Xiaoying Zhang
Name
Authorized Signatory
Title: EMC/Wireless Test Engineer

APPROVED BY 
Juan Manuel Gonzalez
Name
Authorized Signatory
Title: Commercial/Wireless EMC Lab Manager

DATED June 09, 2015



Revision History

SD72101555-0115A Hunter Douglas Window Fashions PV HUB Bluetooth Window Blind Remote Control					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
06/09/2015	Initial Release				Juan M. Gonzalez

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SECTION 1

REPORT SUMMARY

Radio Testing of the
Hunter Douglas Window Fashions
Bluetooth Window Blind Remote Control

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Hunter Douglas Window Fashions PV HUB Bluetooth Window Blind Remote Control to the requirements of FCC Part 15 Subpart C §15.247, IC RSS-Gen Issue 4 November 2014 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	Hunter Douglas Window Fashions
Model Name	PV HUB
Model Number(s)	1010512210
FCC ID Number	UXUPC2
IC Number	7316A-PC2
Serial Number(s)	Conducted antenna port testing sample, serial number not available. This is a PCB board only. Radiated testing sample, serial number not available. Proto type sample provided.
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.247 (October 1, 2014). • RSS-247 – Digital Transmission Systems (DTSS) Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices (Issue 1, May 2015). • RSS-Gen - General Requirements for Compliance of Radio Apparatus (Issue 4, November 2014). • KDB558074 D01 DTS Meas Guidance v03r02, (June 05, 2014) Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.
Start of Test	June 01, 2015
Finish of Test	June 05, 2015
Name of Engineer(s)	Xiaoying Zhang
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*	See Note
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-247 5.5	Spurious Radiated Emissions	Compliant	
—		RSS-Gen 7.1	Receiver Spurious Emissions	N/A**	See Note
2.7	§15.247(d)	RSS-247 5.5	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. Refer to the CE EMC report SD72101555-0115C SMK PV Hub_EN 301 489-3 Test Report.

**: Not applicable. EUT has no Stand-Alone receiver port.

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) is a Hunter Douglas Window Fashions PV HUB Bluetooth Window Blind Remote Control as shown in the photograph below. The EUT is a two-way wireless device operating in the 2.4GHz ISM band that works as a bridge between Ethernet and a proprietary RF network. Bluetooth LE function was verified and evaluated in this test report.



Equipment Under Test

1.3.2 EUT General Description

EUT Description	Bluetooth Window Blind Remote Control
Model Name	PV HUB
Model Number(s)	1010512210
Rated Voltage	5.0VDC
Frequency Range	2407 MHz to 2480 MHz in the 2400 MHz to 2483.5 MHz Band
Number of Operating Frequencies	74
Channels Verified	Low Channel 2407MHz Mid Channel 2440MHz High Channel 2480MHz
Modulation Used	GFSK
Antenna Type (used during evaluation)	Integral (Complies with Part 15.203 requirements)

1.3.3 Antenna Details

Manufacturer	SMK
Antenna Type	Monopole folded wire antenna
Antenna Gain	+1 dBi

1.3.4 Maximum Conducted Output Power

Mode	Frequency Range (MHz)	Average Output Power (dBm)	Output Power (mW)
Bluetooth LE	2407-2480	-5.34	0.29

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Conducted antenna port configuration. EUT was set on continuous transmission @ 100% duty cycle modulated in low, mid and high channels for evaluation via temporary antenna port provided by manufacturer.
B	Radiated emissions test configuration. EUT transmitting through the integral antenna. The EUT was a standalone device and set on continuous transmission @ 100% duty cycle modulated in low, mid or high channel for evaluation.

1.4.2 EUT Exercise Software

No special software used during evaluation. A firmware was loaded to the EUT which enable to change channels in Low, Mid and High @ 100% duty cycle (modulated) as well as normal operation and receive modes.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Model	Description
-	USB Cable	-	-
Hewlett Packard	DC Power Supply	E3610A	S/N: D802039

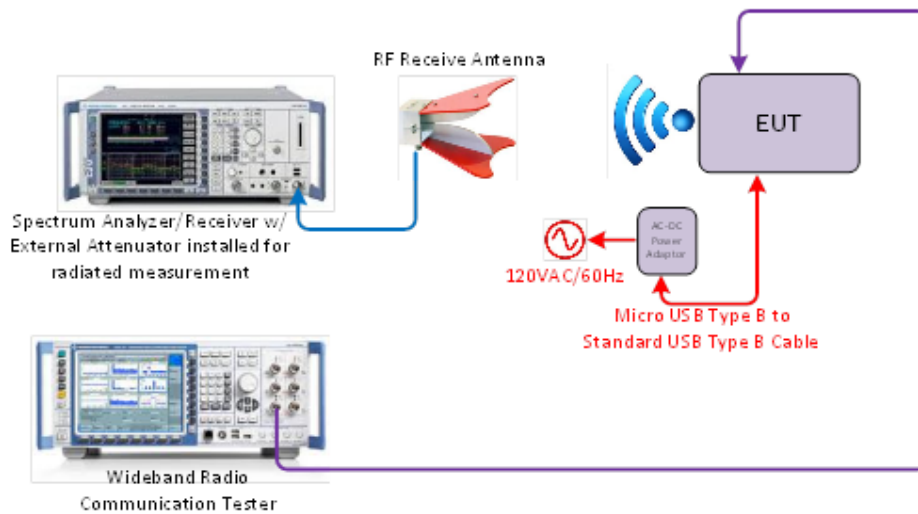
1.4.4 Worst Case Configuration

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

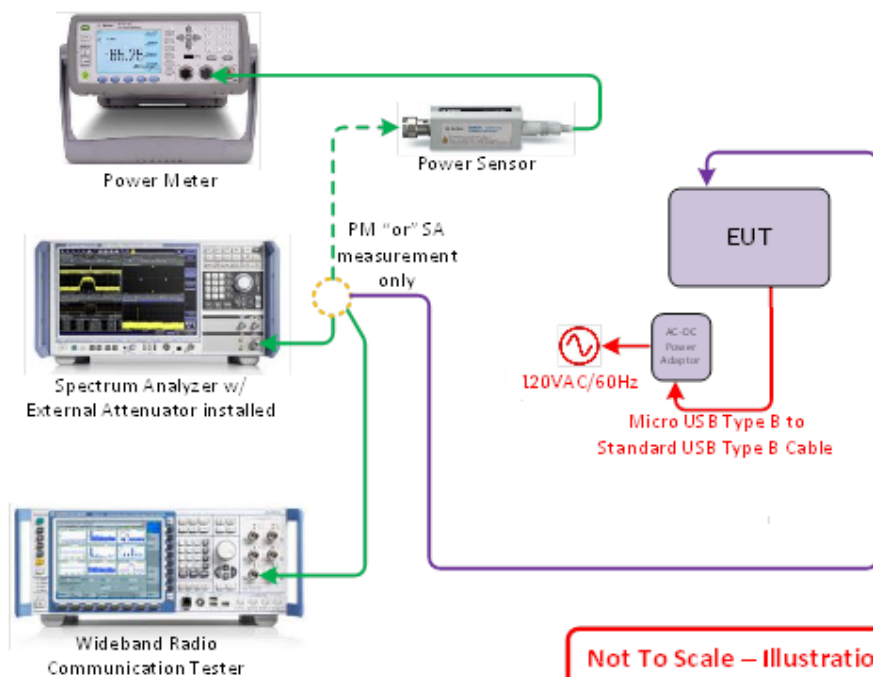


1.4.5 Simplified Test Configuration Diagram

Radiated/Conducted Emission Test Configuration via Conducted Port



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: Conducted antenna port testing sample, serial number not available. PCB board only. Radiated testing sample, serial number not available. Proto type sample provided.		
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 C63.4-2009, 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 C63.4-2009. 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
Hunter Douglas Window Fashions
Bluetooth Window Blind Remote Control

2.1 PEAK OUTPUT POWER

2.1.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(b)(3)
Industry Canada RSS-247, Clause 5.4(4)

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. PCB Board only / Test Configuration A

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

June 02, 2015 / XYZ

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	22.4°C
Relative Humidity	48.1%
ATM Pressure	98.9 kPa

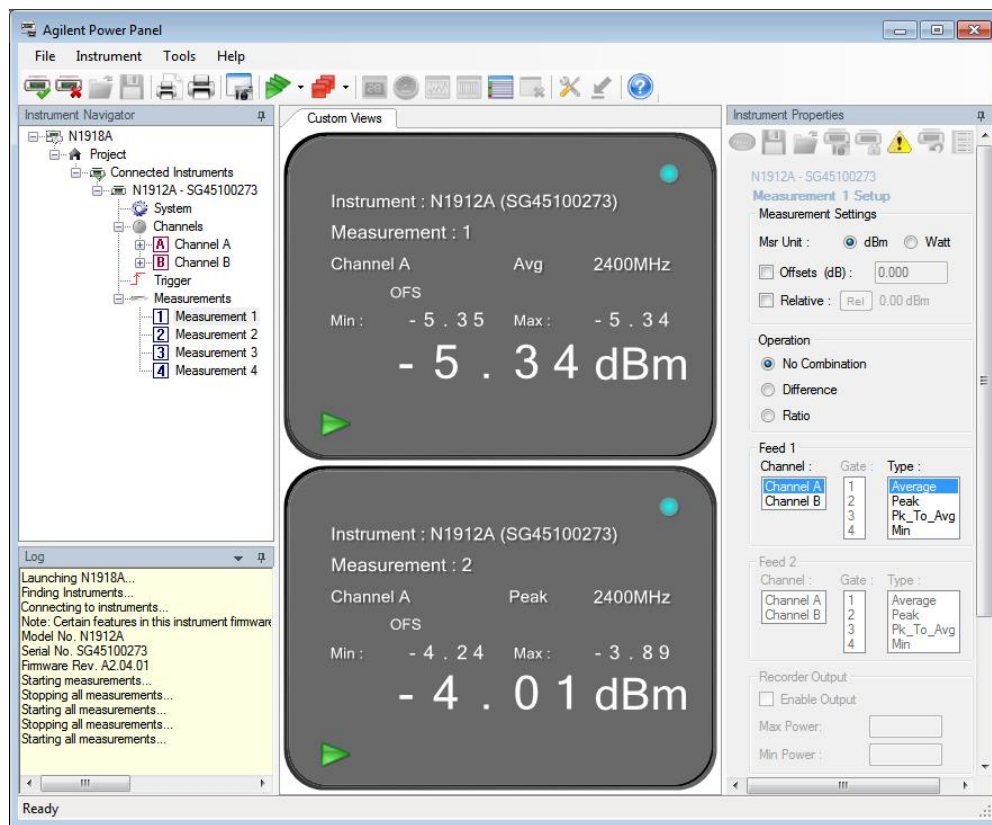
2.1.7 Additional Observations

- This is a conducted test (Maximum conducted [average] output power) using direct connection to a power meter.
- The path loss for Bluetooth LE was measured and entered as a level offset.
- Test methodology is per Clause 9.2.3.1 of KDB 558074 D01 (DTS Meas Guidance v03r02, June 05, 2014). All conditions under this Clause were satisfied.
- Both Peak and Average measurements were recorded.

2.1.8 Test Results

Bluetooth Low Energy (LE)	Channel (MHz)	Modulation	Measured Average Power (dBm)	Measured Peak Power (dBm)
	2407	GFSK @ 1Mbps	-5.34	-4.01
	2440		-5.57	-4.31
	2480		-5.44	-4.19

2.1.9 Sample Test Display



Bluetooth LE Low Channel

2.2 99% EMISSION BANDWIDTH

2.2.1 Specification Reference

Industry Canada RSS-GEN, Clause 6.6

2.2.2 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.

2.2.3 Equipment Under Test and Modification State

Serial No: N/A. PCB Board only / Test Configuration A

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

June 02, 2015 / XYZ

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 Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature 22.4°C
Relative Humidity 48.1%
ATM Pressure 98.9 kPa

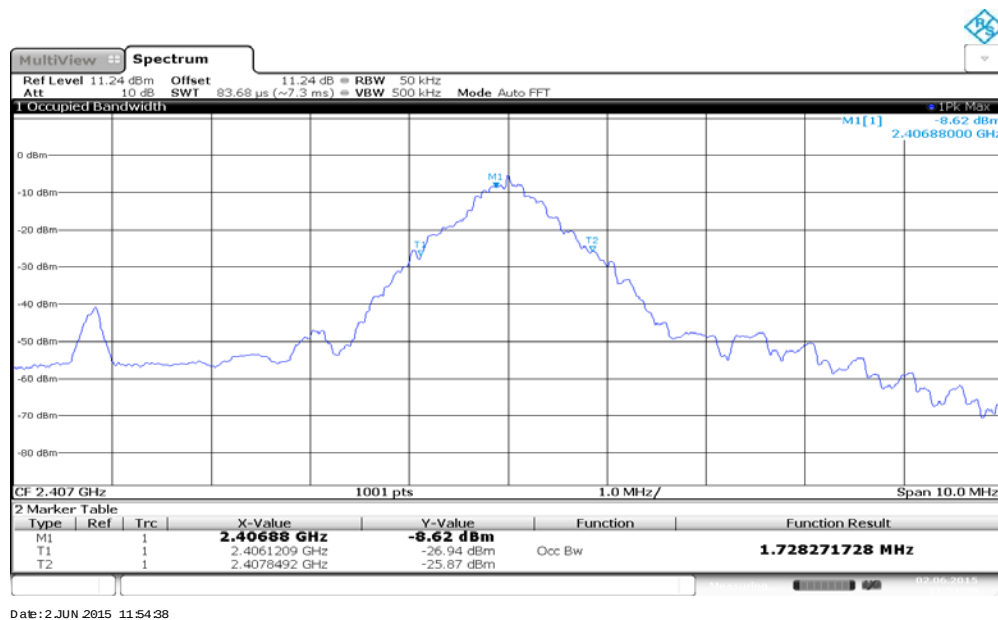
2.2.7 Additional Observations

- This is a conducted test.
- The path loss for Bluetooth LE was measured and entered as a level offset.
- Span is wide enough to capture the channel transmission.
- RBW is in the range of 1% to 5% of the occupied bandwidth.
- VBW is at least 3x RBW.
- Sweep is auto.
- Detector is peak.
- Using the occupied bandwidth measurement function in the spectrum analyzer, the 99% occupied bandwidth was measured.

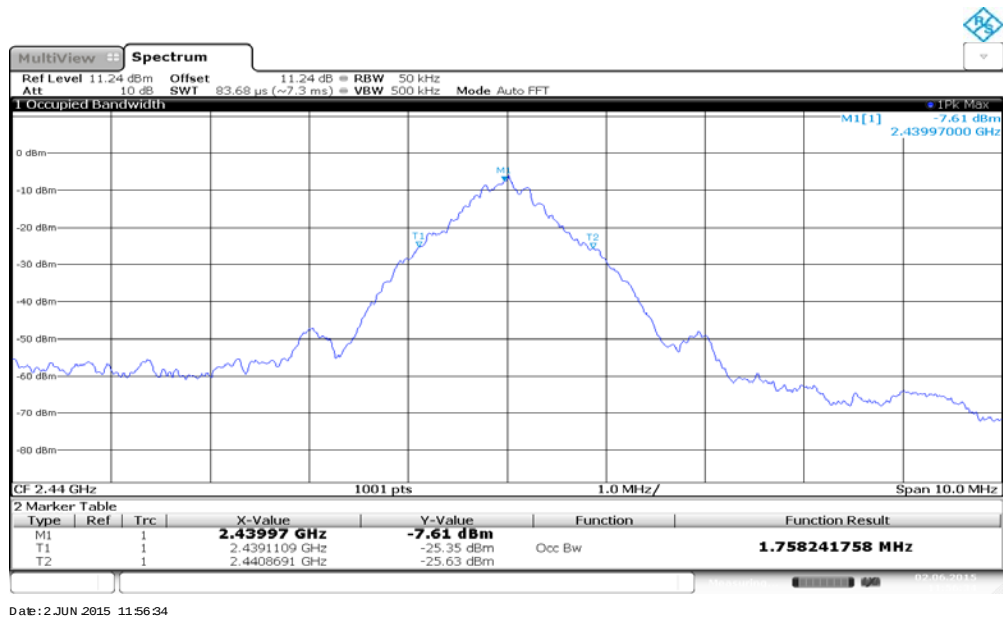
2.2.8 Test Results

Mode	Channel (MHz)	Measured 99% Bandwidth (MHz)
Bluetooth LE	2407	1.728
	2440	1.758
	2480	1.758

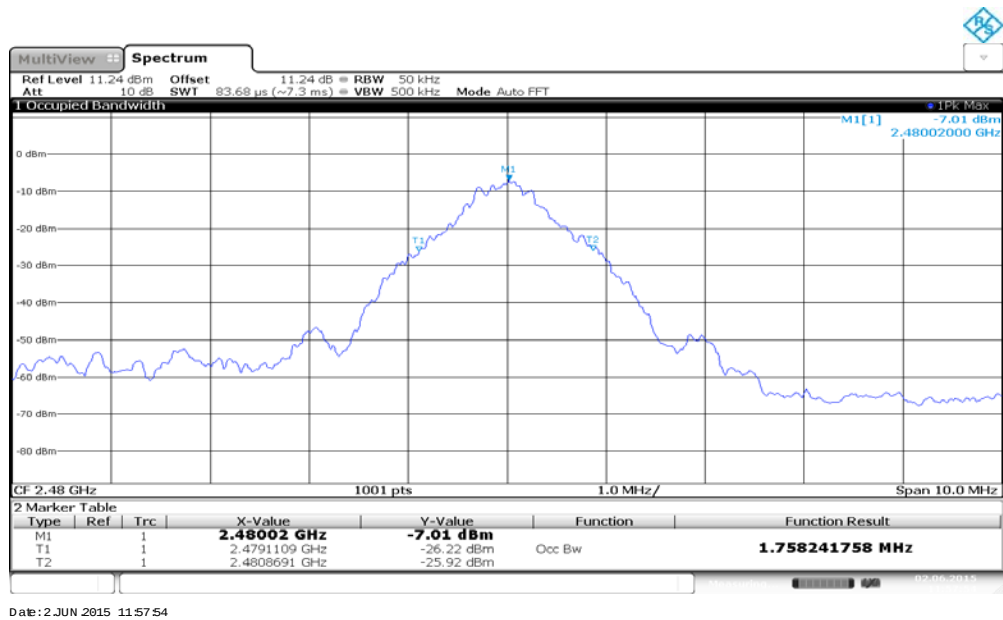
2.2.9 Test Results Plots



Bluetooth LE Low Channel



Bluetooth LE Mid Channel



Bluetooth LE High Channel

2.3 MINIMUM 6 dB RF BANDWIDTH

2.3.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(a)(2)
Industry Canada RSS-247, Clause 5.2(1)

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: N/A. PCB Board only / Test Configuration A

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

June 02, 2015 / XYZ

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 Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.4°C
Relative Humidity	48.1%
ATM Pressure	98.9 kPa

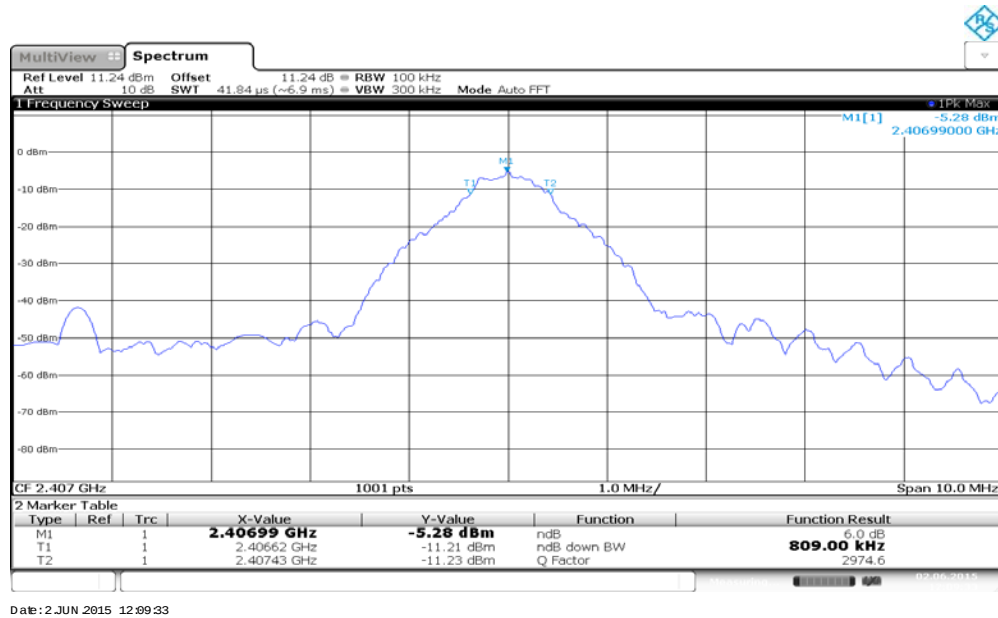
2.3.7 Additional Observations

- This is a conducted test.
- The path loss for Bluetooth LE was measured and entered as a level offset.
- 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.

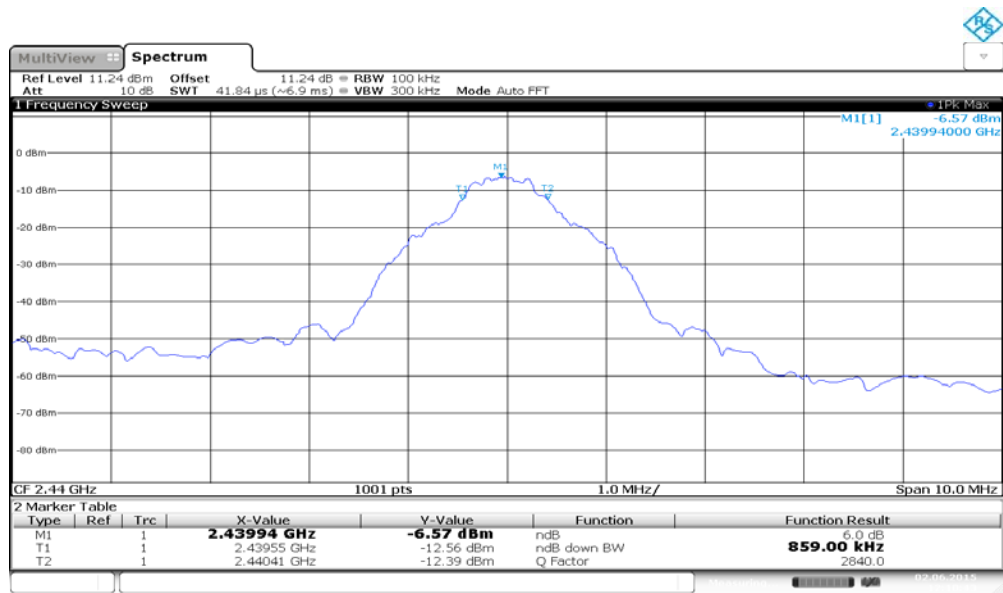
2.3.8 Test Results

Mode	Channel (MHz)	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Compliance
Bluetooth LE	2407	0.809	0.500	Complies
	2440	0.859	0.500	Complies
	2480	0.879	0.500	Complies

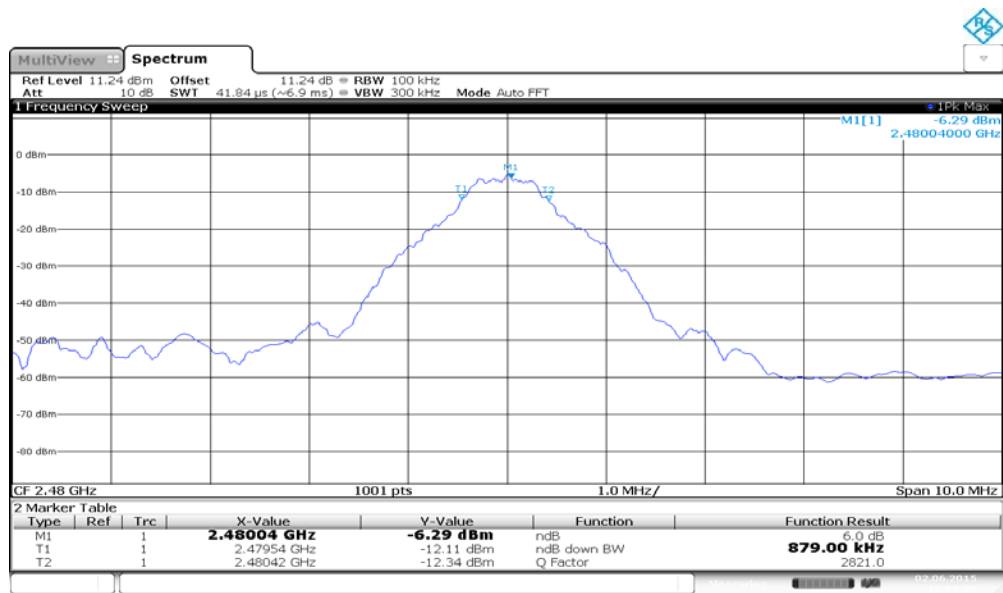
2.3.9 Test Results Plots



Bluetooth LE Low Channel



Bluetooth LE Mid Channel



Bluetooth LE High Channel

2.4 OUT-OF-BAND EMISSIONS - CONDUCTED

2.4.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(d)
Industry Canada RSS-247, Clause 5.5

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: N/A. PCB Board only / Test Configuration A

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

June 02, 2015 / XYZ

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 Location

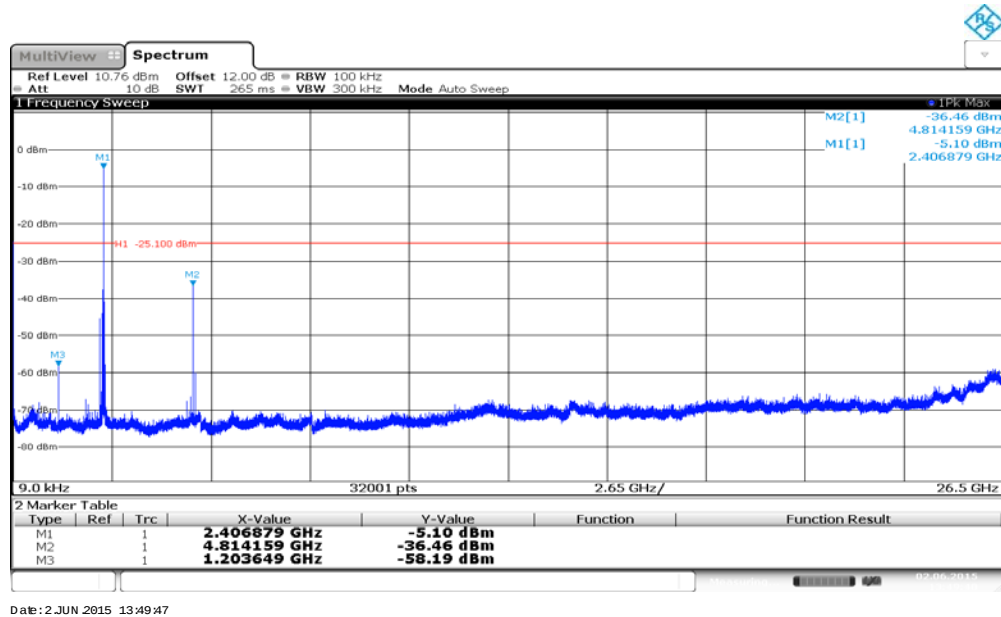
Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.4°C
Relative Humidity	48.1%
ATM Pressure	98.9 kPa

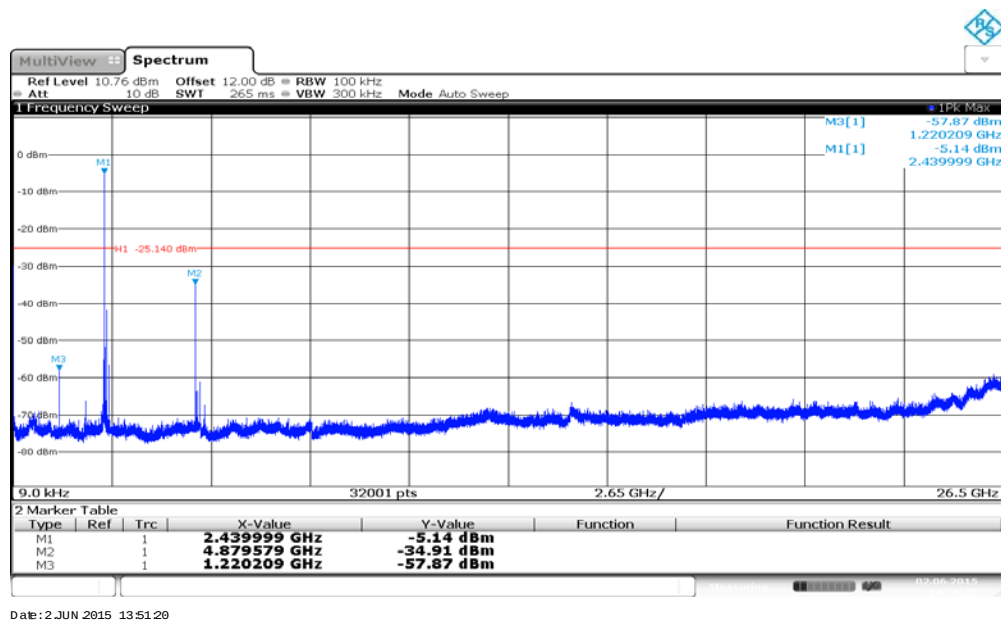
2.4.7 Additional Observations

- This is a conducted test.
- The path loss for Bluetooth LE was measured and entered as a level offset.
- 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 20dB below this level.
- Spectrum was searched from 9 kHz up to 26.5GHz.

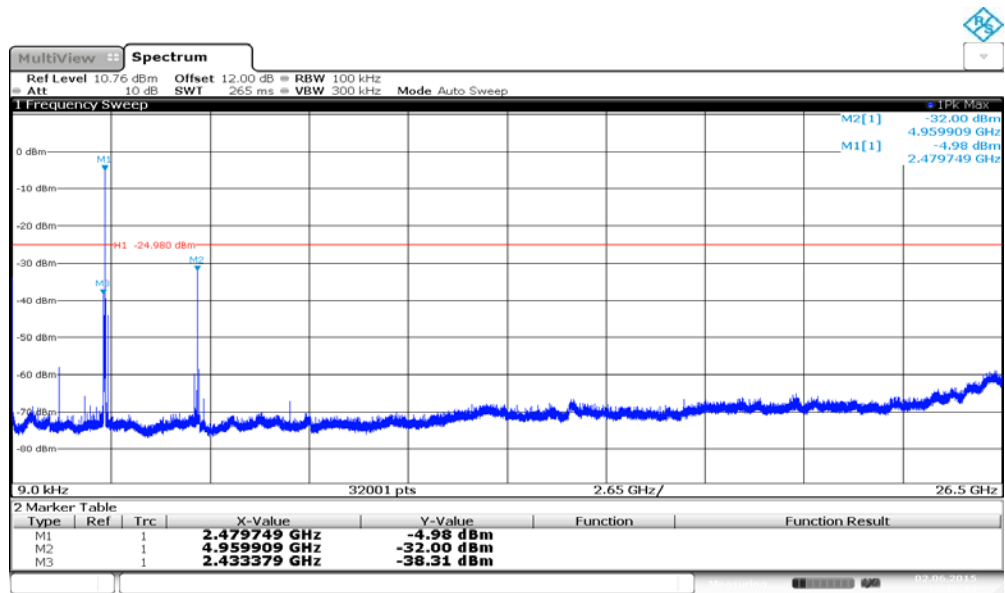
2.4.8 Test Results Plots



Bluetooth LE Low Channel



Bluetooth LE Mid Channel



Bluetooth LE High Channel

2.5 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

2.5.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(d)
Industry Canada RSS-247, Clause 5.5

2.5.2 Standard Applicable

See previous test.

2.5.3 Equipment Under Test and Modification State

Serial No: N/A. PCB Board only / Test Configuration A

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

June 02, 2015 / XYZ

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 Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

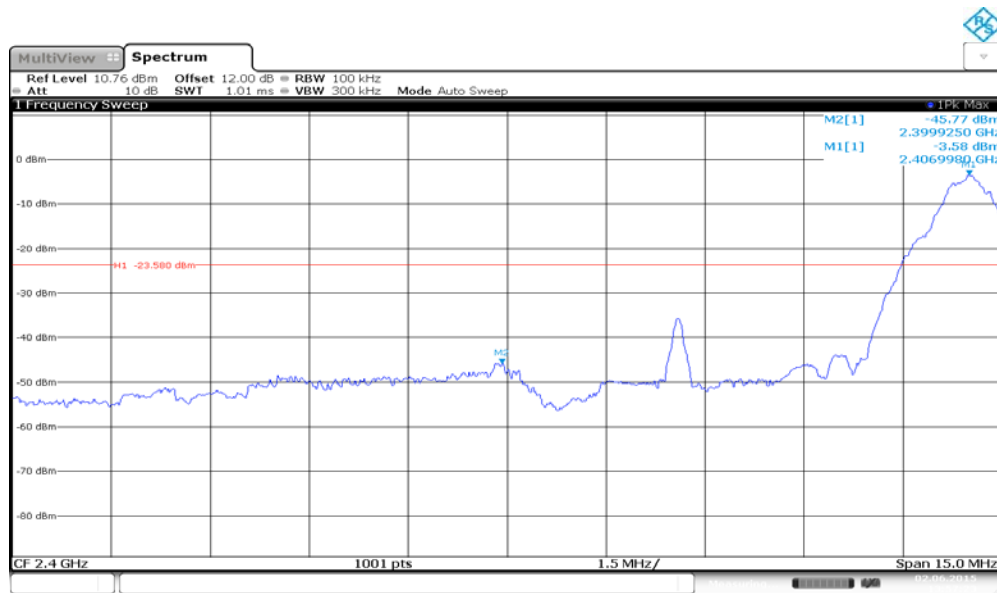
Ambient Temperature	22.4°C
Relative Humidity	48.1%
ATM Pressure	98.9 kPa

2.5.7 Additional Observations

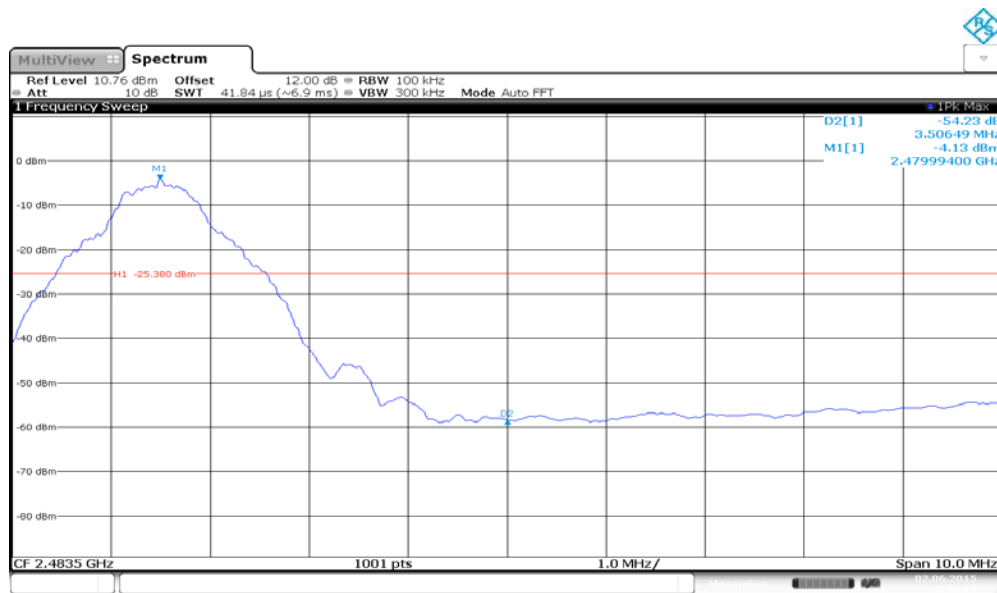
- This is a conducted test.
- The path loss for Bluetooth LE was measured and entered as a level offset.
- RBW is 100kHz.VBW is 3X RBW.
- Sweep is auto. Detector is peak. Trace is max hold.
- Trace was centred on the band-edge frequency.
- Span was set to encompass the band-edge frequency and the peak of the emission.
- Using Marker function, peak of the emission was determined and the delta to the band-edge frequency measured.

2.5.8 Test Results

Complies. See attached plots.



Bluetooth LE Low Channel (2407 MHz)



Bluetooth LE High Channel (2480 MHz)

2.6 SPURIOUS RADIATED EMISSIONS

2.6.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(d)
Industry Canada RSS-247, Clause 5.5

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: N/A. Proto type sample / Test Configuration B

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

June 01 and 05, 2015 / XYZ

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	23.5 - 25.9°C
Relative Humidity	43.2 - 43.7%
ATM Pressure	98.9 - 99.5 kPa

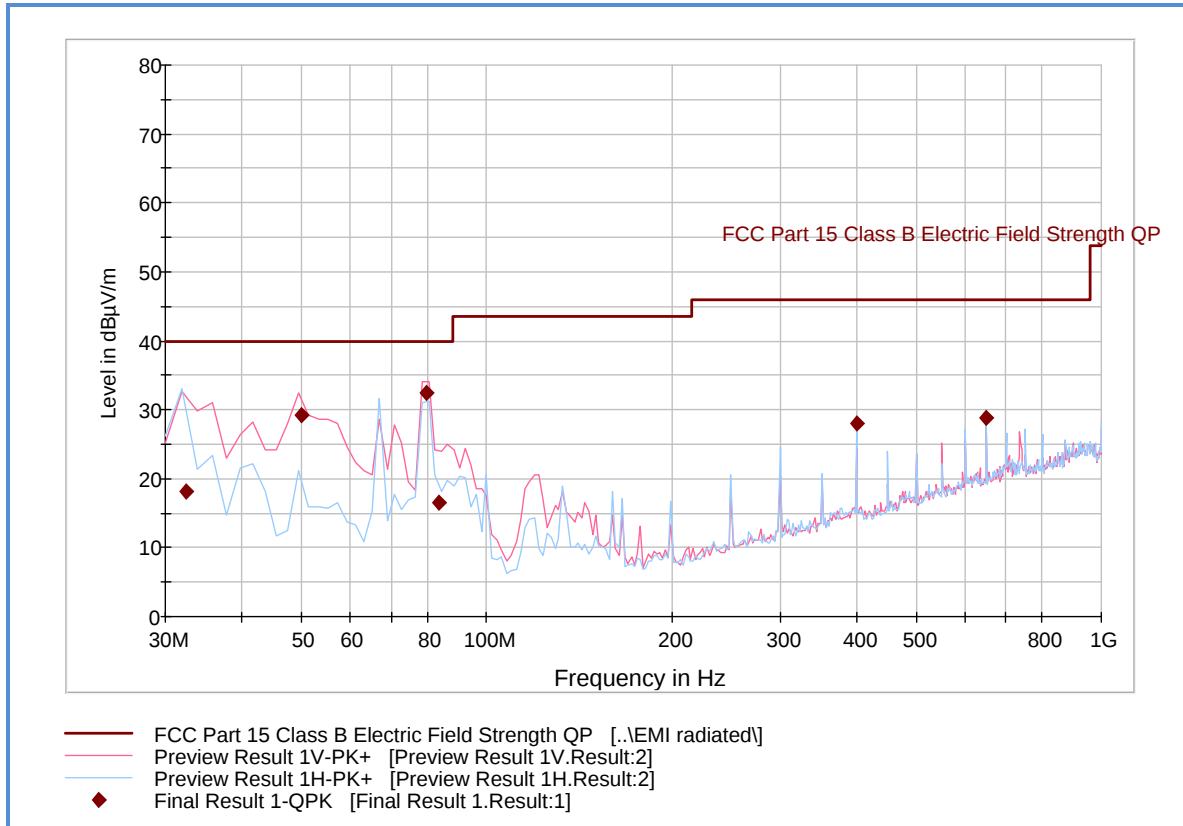
2.6.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 10th 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 the considered worst case WLAN configuration (802.11b, Low Channel, 1Mbps) presented for radiated emissions below 1GHz. There are no significant differences in emissions between all modes 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 (dB μ 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 μ V/m) @ 30MHz			11.8

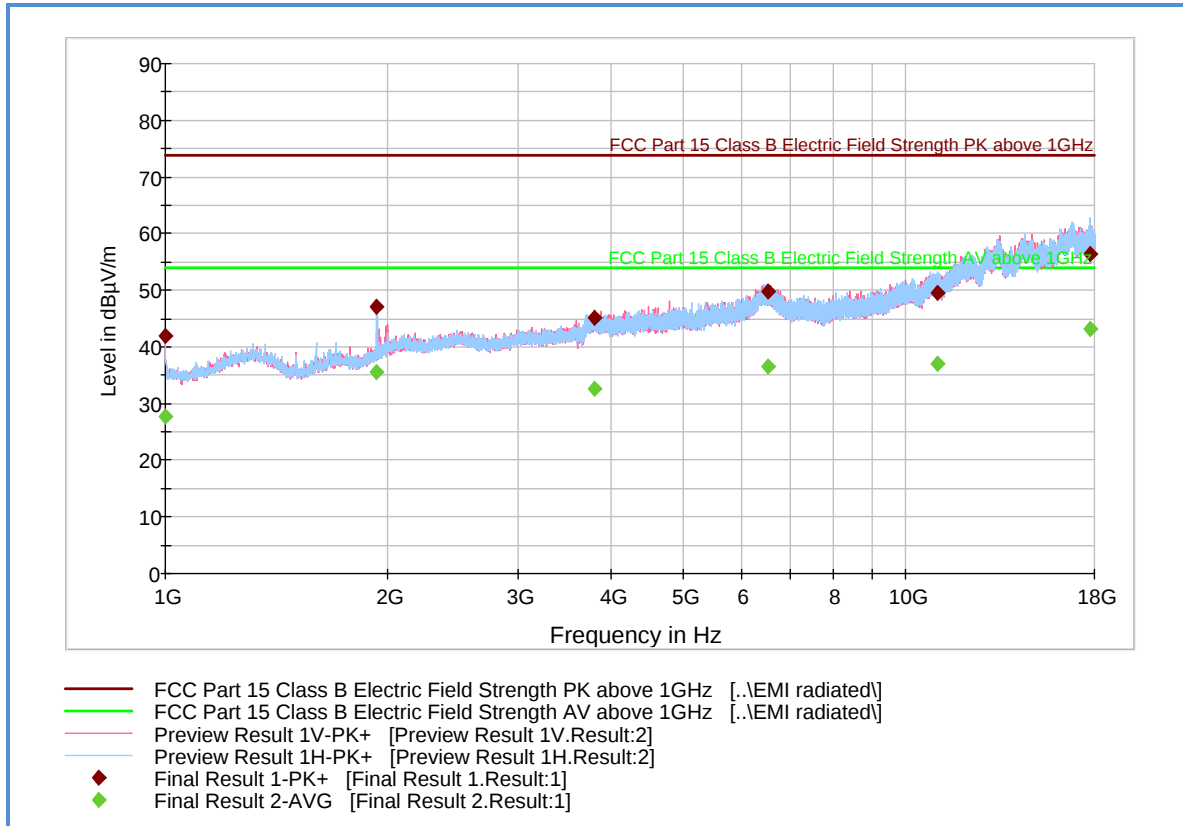
2.6.9 Test Results - Below 1GHz (Receive Mode)



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)
32.440000	18.2	1000.0	120.000	143.0	H	204.0	-12.8	21.8	40.0
49.998878	29.2	1000.0	120.000	100.0	V	231.0	-19.9	10.8	40.0
79.981082	32.5	1000.0	120.000	133.0	V	175.0	-22.0	7.5	40.0
83.692745	16.6	1000.0	120.000	150.0	V	231.0	-21.7	23.4	40.0
400.018677	28.1	1000.0	120.000	100.0	H	98.0	-9.0	17.9	46.0
650.020200	28.8	1000.0	120.000	106.0	H	69.0	-3.8	17.2	46.0

2.6.10 Test Results - Above 1GHz (Receive Mode)



Peak Data

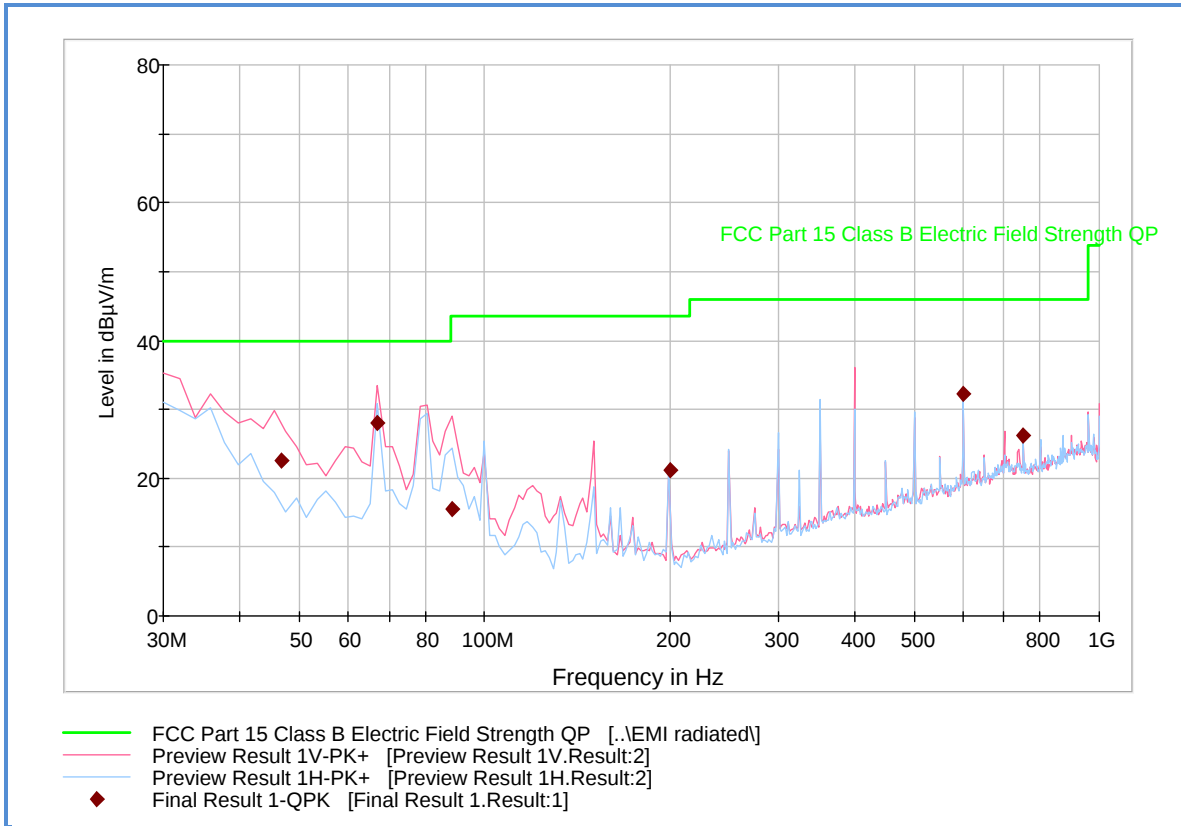
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1000.400000	42.0	1000.0	1000.000	401.6	H	170.0	-7.2	31.9	73.9
1932.366667	47.2	1000.0	1000.000	298.3	H	164.0	-2.3	26.7	73.9
3794.633333	45.2	1000.0	1000.000	115.8	H	-9.0	4.9	28.7	73.9
6528.966667	49.7	1000.0	1000.000	102.8	H	-7.0	11.2	24.2	73.9
11035.500000	49.4	1000.0	1000.000	164.6	H	212.0	14.8	24.5	73.9
17774.833333	56.3	1000.0	1000.000	190.6	H	13.0	23.0	17.6	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	27.6	1000.0	1000.000	401.6	H	170.0	-7.2	26.3	53.9
1932.366667	35.6	1000.0	1000.000	298.3	H	164.0	-2.3	18.3	53.9
3794.633333	32.6	1000.0	1000.000	115.8	H	-9.0	4.9	21.3	53.9
6528.966667	36.5	1000.0	1000.000	102.8	H	-7.0	11.2	17.4	53.9
11035.500000	37.1	1000.0	1000.000	164.6	H	212.0	14.8	16.8	53.9
17774.833333	43.1	1000.0	1000.000	190.6	H	13.0	23.0	10.8	53.9

Test Notes: No significant emissions observed above 1GHz.

2.6.11 Test Results - Below 1GHz (Bluetooth LE Mid Channel)

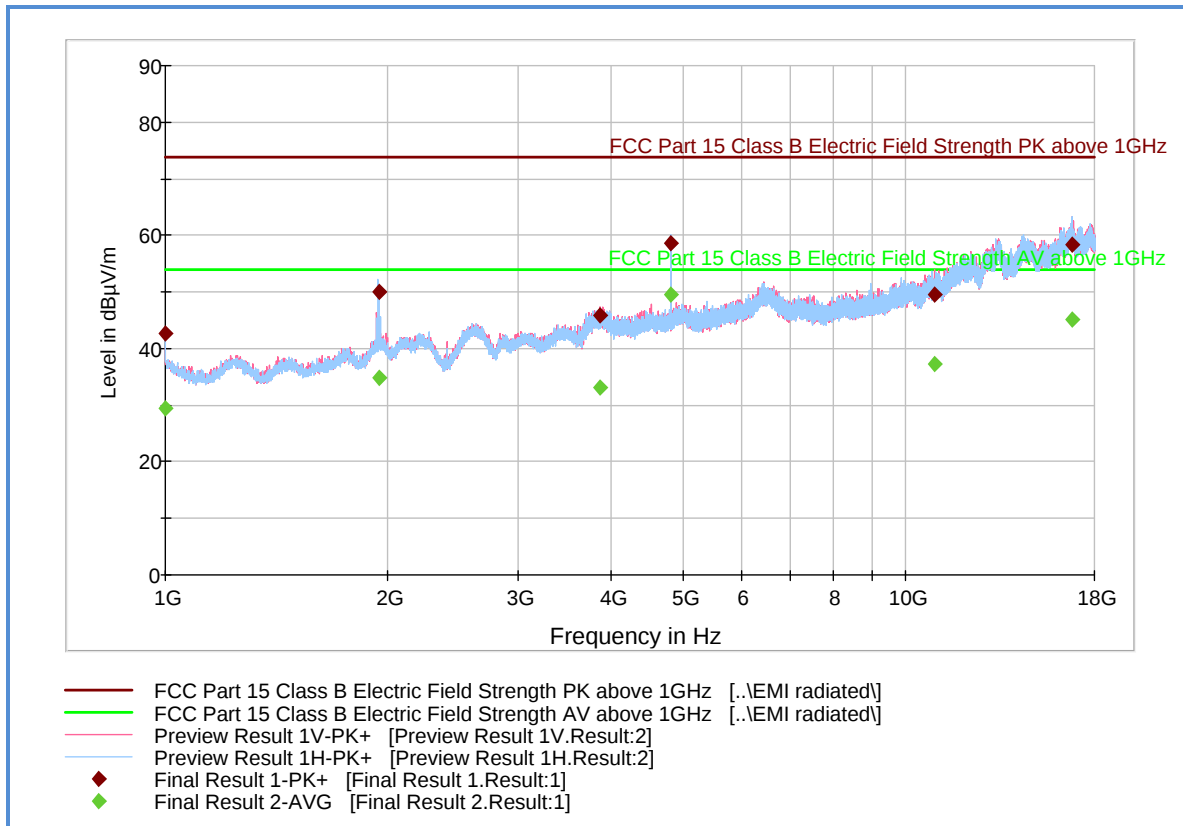


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
46.694990	22.5	1000.0	120.000	100.0	V	-8.0	-19.1	17.5	40.0
66.773868	28.1	1000.0	120.000	207.0	V	298.0	-22.3	11.9	40.0
88.316633	15.5	1000.0	120.000	400.0	V	350.0	-21.1	28.0	43.5
199.998236	21.2	1000.0	120.000	301.0	H	28.0	-17.0	22.3	43.5
600.023006	32.3	1000.0	120.000	106.0	H	122.0	-4.3	13.7	46.0
750.022365	26.2	1000.0	120.000	176.0	V	176.0	-2.0	19.8	46.0

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

2.6.12 Test Results - Above 1GHz (Bluetooth LE Low Channel)



Peak Data

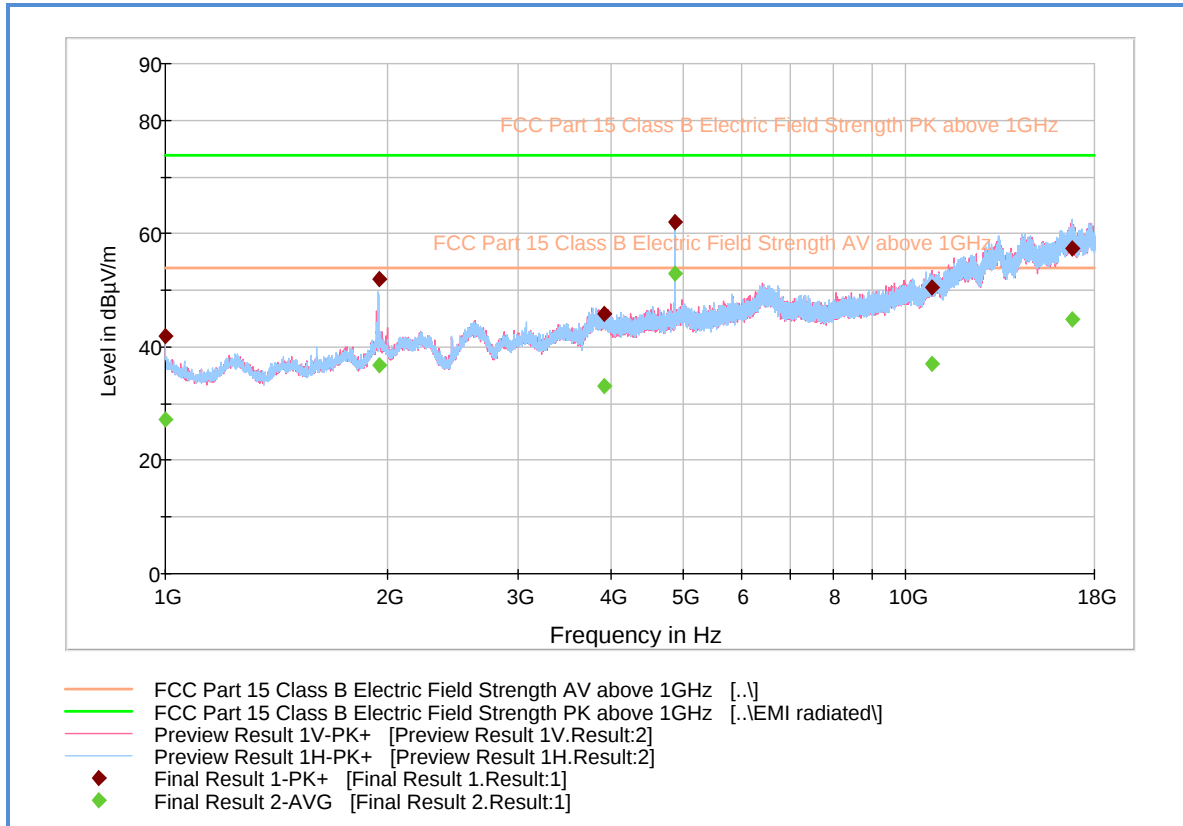
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1000.000000	42.7	1000.0	1000.000	181.6	H	23.0	-7.2	31.2	73.9
1941.666667	50.0	1000.0	1000.000	366.1	H	96.0	-2.3	23.9	73.9
3868.866667	45.8	1000.0	1000.000	103.7	V	81.0	4.9	28.1	73.9
4813.300000	58.6	1000.0	1000.000	116.7	H	173.0	5.6	15.3	73.9
10941.600000	49.5	1000.0	1000.000	368.1	V	70.0	14.7	24.4	73.9
16788.033333	58.3	1000.0	1000.000	379.1	H	187.0	23.8	15.6	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	29.4	1000.0	1000.000	181.6	H	23.0	-7.2	24.5	53.9
1941.666667	34.7	1000.0	1000.000	366.1	H	96.0	-2.3	19.2	53.9
3868.866667	33.2	1000.0	1000.000	103.7	V	81.0	4.9	20.7	53.9
4813.300000	49.5	1000.0	1000.000	116.7	H	173.0	5.6	4.4	53.9
10941.600000	37.2	1000.0	1000.000	368.1	V	70.0	14.7	16.7	53.9
16788.033333	45.1	1000.0	1000.000	379.1	H	187.0	23.8	8.8	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 8GHz. Measurements above 18GHz were noise floor figures.

2.6.13 Test Results - Above 1GHz (Bluetooth LE Mid Channel)



Peak Data

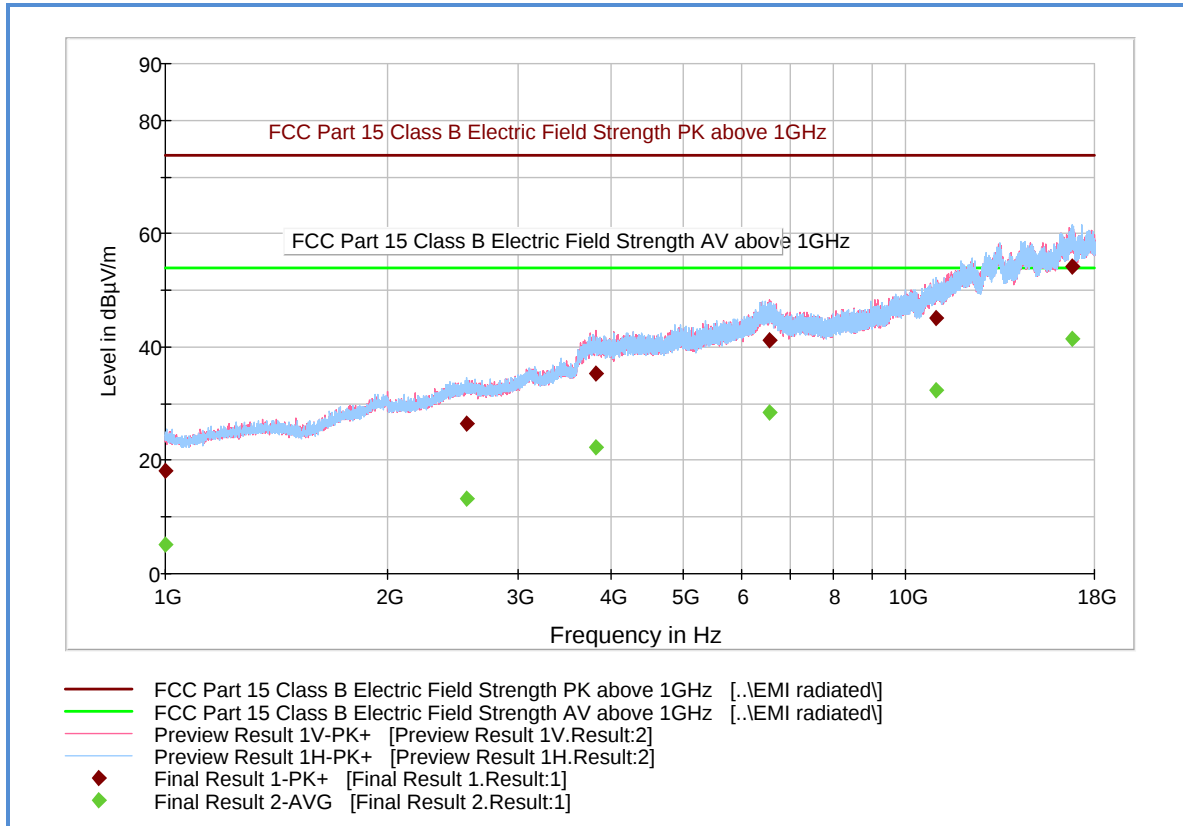
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.400000	41.9	1000.0	1000.000	302.0	V	43.0	-7.2	32.0	73.9
1941.066667	52.0	1000.0	1000.000	391.0	H	109.0	-2.3	21.9	73.9
3921.400000	45.9	1000.0	1000.000	400.0	V	184.0	5.0	28.0	73.9
4879.200000	62.0	1000.0	1000.000	125.0	H	187.0	6.1	11.9	73.9
10838.700000	50.5	1000.0	1000.000	406.9	V	83.0	14.3	23.4	73.9
16810.533333	57.5	1000.0	1000.000	138.0	H	202.0	23.7	16.5	73.9
1000.400000	41.9	1000.0	1000.000	302.0	V	43.0	-7.2	32.0	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	27.3	1000.0	1000.000	302.0	V	43.0	-7.2	26.6	53.9
1941.066667	36.8	1000.0	1000.000	391.0	H	109.0	-2.3	17.1	53.9
3921.400000	33.0	1000.0	1000.000	400.0	V	184.0	5.0	20.9	53.9
4879.200000	53.1	1000.0	1000.000	125.0	H	187.0	6.1	0.8	53.9
10838.700000	37.0	1000.0	1000.000	406.9	V	83.0	14.3	16.9	53.9
16810.533333	44.8	1000.0	1000.000	138.0	H	202.0	23.7	9.1	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 18GHz. Measurements above 8GHz were noise floor figures.

2.6.14 Test Results - Above 1GHz (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)
1000.500000	18.1	1000.0	1000.000	401.7	H	214.0	-7.2	55.8	73.9
2551.966667	26.4	1000.0	1000.000	364.1	H	300.0	0.1	47.5	73.9
3822.533333	35.3	1000.0	1000.000	322.2	V	16.0	4.9	38.6	73.9
6543.933333	41.2	1000.0	1000.000	356.2	V	169.0	11.3	32.7	73.9
11001.866667	45.1	1000.0	1000.000	391.1	H	292.0	14.9	28.8	73.9
16820.400000	54.2	1000.0	1000.000	367.1	H	339.0	23.6	19.7	73.9
1000.500000	18.1	1000.0	1000.000	401.7	H	214.0	-7.2	55.8	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)
1000.500000	5.0	1000.0	1000.000	401.7	H	214.0	-7.2	48.9	53.9
2551.966667	13.2	1000.0	1000.000	364.1	H	300.0	0.1	40.7	53.9
3822.533333	22.4	1000.0	1000.000	322.2	V	16.0	4.9	31.5	53.9
6543.933333	28.4	1000.0	1000.000	356.2	V	169.0	11.3	25.5	53.9
11001.866667	32.5	1000.0	1000.000	391.1	H	292.0	14.9	21.4	53.9
16820.400000	41.4	1000.0	1000.000	367.1	H	339.0	23.6	12.5	53.9
1000.500000	5.0	1000.0	1000.000	401.7	H	214.0	-7.2	48.9	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 18GHz. Measurements above 8GHz were noise floor figures.

2.7 RADIATED BAND EDGE MEASUREMENTS AND IMMEDIATE RESTRICTED BANDS

2.7.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(d)
Industry Canada RSS-247, Clause 5.5

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. Proto type sample / Test Configuration B

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

June 04, 2015 / XYZ

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 Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.9 °C
Relative Humidity	43.7%
ATM Pressure	98.9 kPa

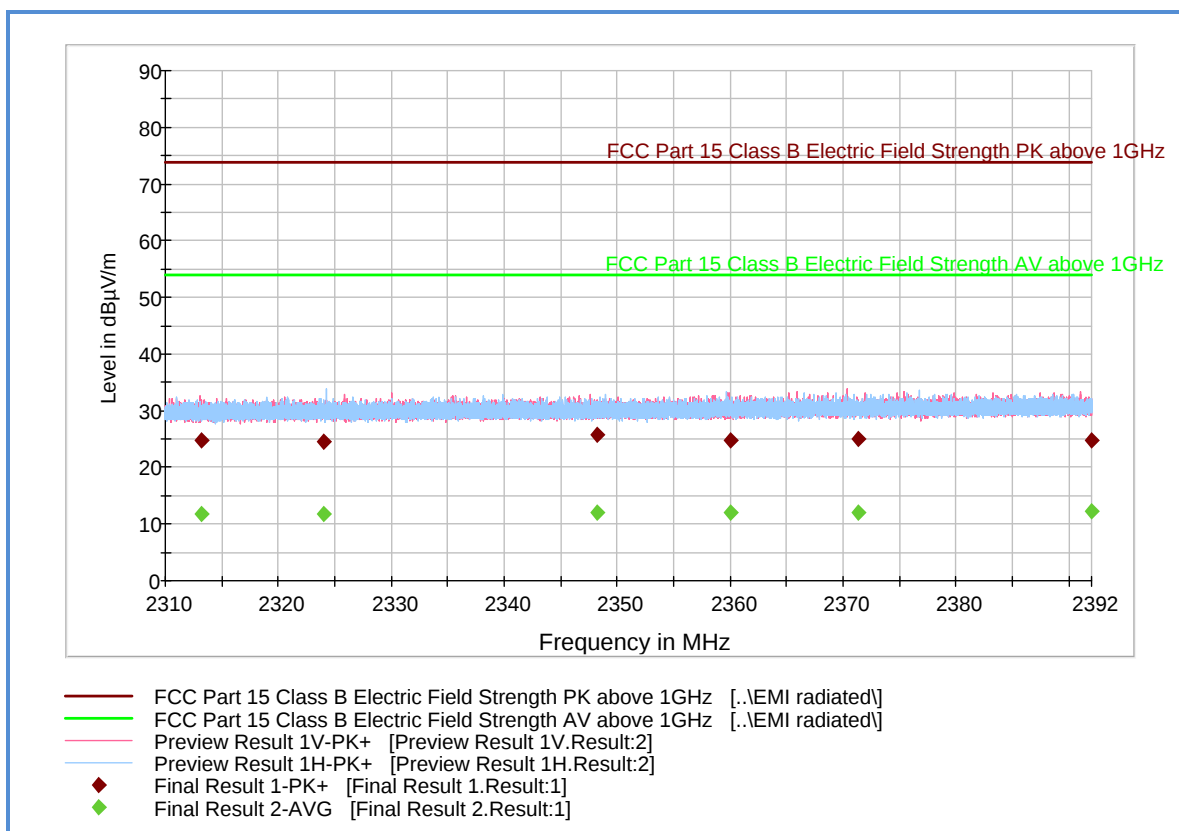
2.7.7 Additional Observations

- 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.
- 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 μ 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	
Reported Max Peak Final Measurement (dB μ V/m) @ 2400 MHz			53.5

2.7.9 Test Results - Restricted Band 2310MHz to 2490MHz (Bluetooth LE Low Channel)



Peak Data

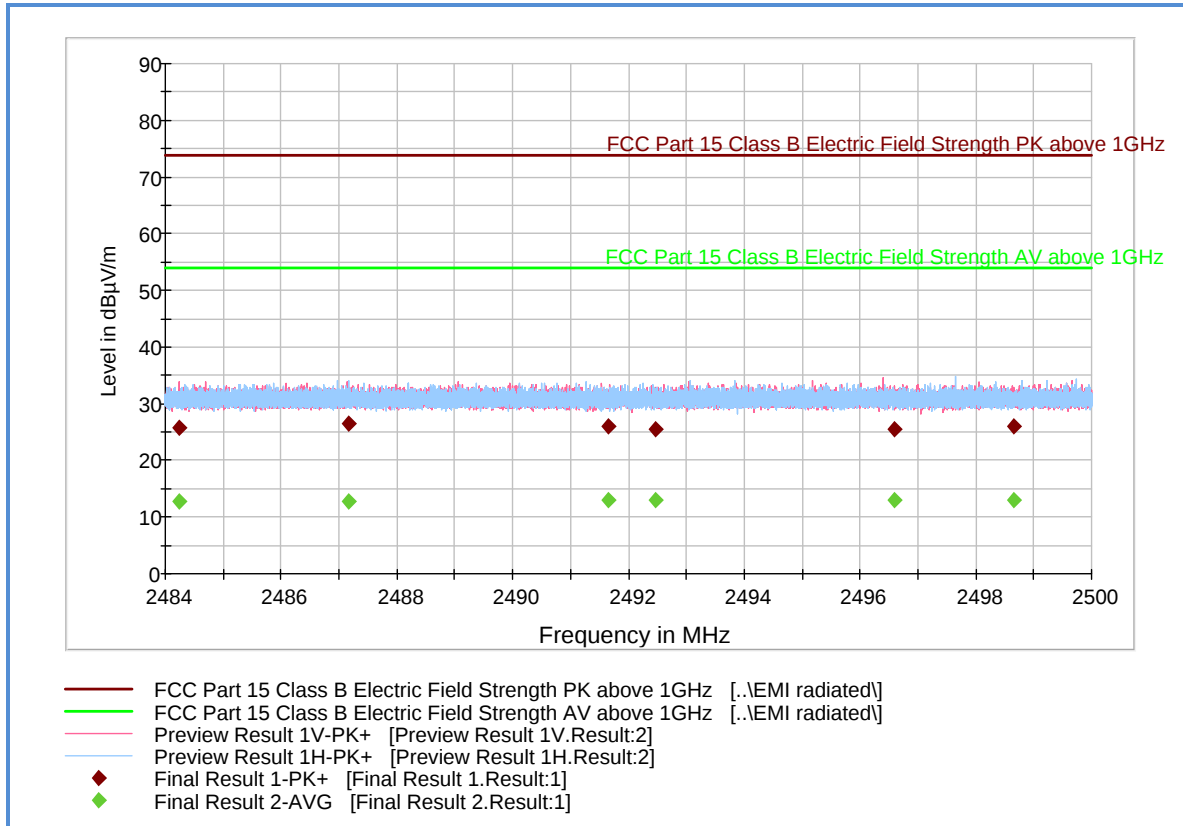
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2313.236733	24.7	1000.0	1000.000	116.7	V	17.0	-0.8	49.2	73.9
2324.048867	24.5	1000.0	1000.000	283.3	H	234.0	-0.7	49.4	73.9
2348.180600	25.7	1000.0	1000.000	172.6	V	207.0	-0.8	48.2	73.9
2360.015467	24.7	1000.0	1000.000	401.6	H	263.0	-0.7	49.2	73.9
2371.403933	24.9	1000.0	1000.000	401.6	V	169.0	-0.7	49.0	73.9
2392.000000	24.8	1000.0	1000.000	354.2	V	119.0	-0.6	49.1	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)
2313.236733	11.7	1000.0	1000.000	116.7	V	17.0	-0.8	42.2	53.9
2324.048867	11.8	1000.0	1000.000	283.3	H	234.0	-0.7	42.1	53.9
2348.180600	11.9	1000.0	1000.000	172.6	V	207.0	-0.8	42.0	53.9
2360.015467	12.0	1000.0	1000.000	401.6	H	263.0	-0.7	41.9	53.9
2371.403933	12.1	1000.0	1000.000	401.6	V	169.0	-0.7	41.8	53.9
2392.000000	12.3	1000.0	1000.000	354.2	V	119.0	-0.6	41.6	53.9

Test Notes: 2.4GHz notch filter removed for this test.

2.7.10 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)
2484.233067	25.9	1000.0	1000.000	127.1	V	274.0	-0.1	48.0	73.9
2487.173333	26.6	1000.0	1000.000	225.4	H	279.0	-0.1	47.3	73.9
2491.659200	26.1	1000.0	1000.000	126.1	H	171.0	-0.1	47.8	73.9
2492.470933	25.6	1000.0	1000.000	200.5	H	256.0	-0.1	48.3	73.9
2496.600533	25.5	1000.0	1000.000	209.5	V	86.0	-0.1	48.4	73.9
2498.649600	25.9	1000.0	1000.000	115.8	H	3.0	-0.1	48.0	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)
2484.233067	12.9	1000.0	1000.000	127.1	V	274.0	-0.1	41.0	53.9
2487.173333	12.9	1000.0	1000.000	225.4	H	279.0	-0.1	41.0	53.9
2491.659200	12.9	1000.0	1000.000	126.1	H	171.0	-0.1	41.0	53.9
2492.470933	12.9	1000.0	1000.000	200.5	H	256.0	-0.1	41.0	53.9
2496.600533	12.9	1000.0	1000.000	209.5	V	86.0	-0.1	41.0	53.9
2498.649600	12.9	1000.0	1000.000	115.8	H	3.0	-0.1	41.0	53.9

Test Notes: 2.4GHz notch filter removed for this test.

2.8 POWER SPECTRAL DENSITY

2.8.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(e)
Industry Canada RSS-247, Clause 5.2(2)

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: N/A. PCB Board only / Test Configuration A

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

June 02, 2015 / XYZ

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 Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.4°C
Relative Humidity	48.1%
ATM Pressure	98.9 kPa

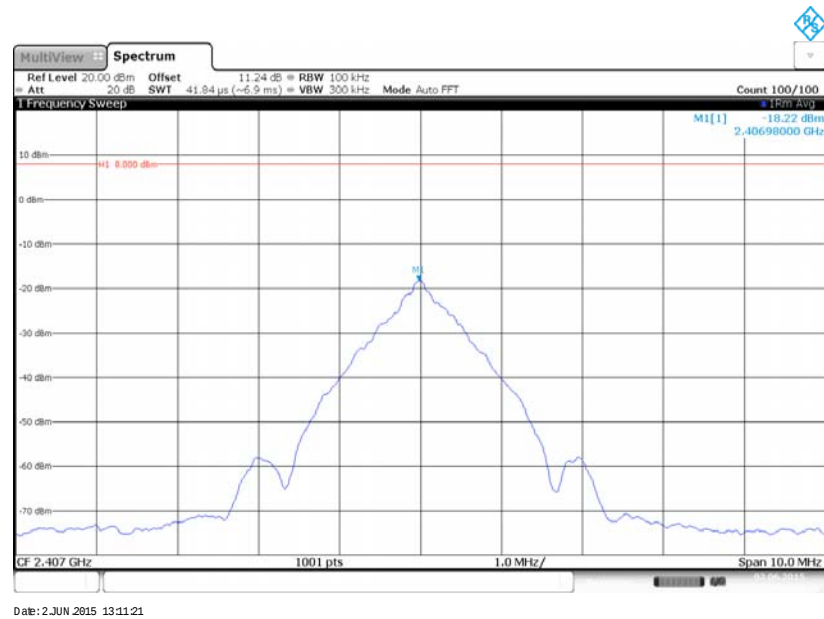
2.8.7 Additional Observations

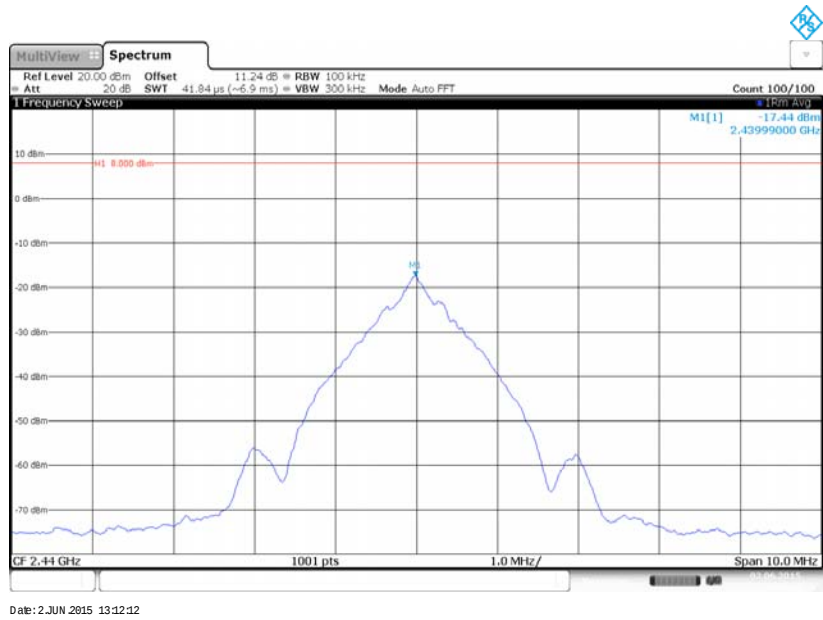
- This is a conducted test.
- Test procedure is per Section 10.3 of KDB 558074 (June 05, 2014).
- The path loss for Bluetooth LE was measured and entered as a level offset.
- Detector is RMS power averaging.
- Trace averaging mode over 100 traces.
- Sweep time is Auto Couple.
- EUT complies with 100 kHz RBW.

2.8.8 Test Results Summary

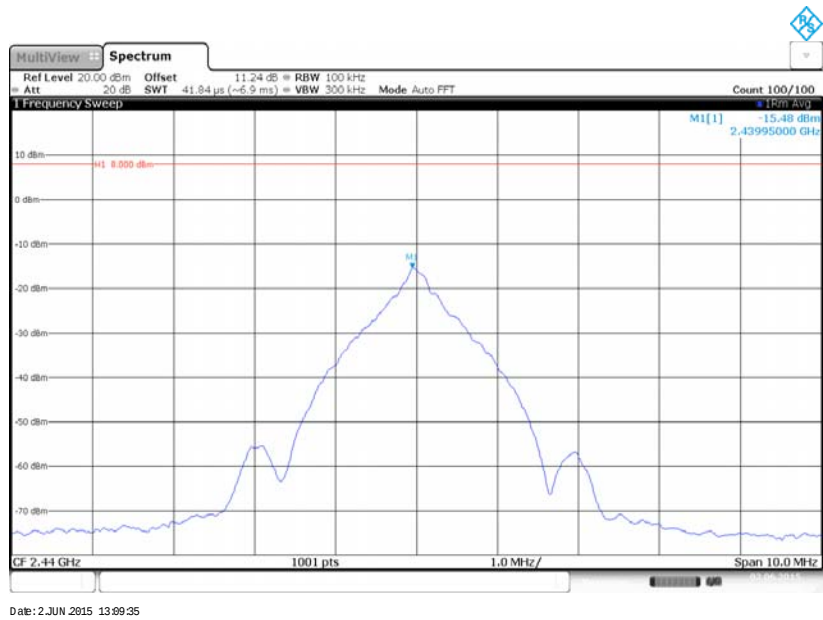
Mode	Channel (MHz)	Marker Reading using 100 kHz RBW (dBm)	PSD Limit (dBm)	Margin (dB)	Compliance
Bluetooth LE	2407	-18.22	8	26.22	Complies
	2440	-17.44	8	25.44	Complies
	2480	-15.48	8	23.48	Complies

2.8.9 Test Results Plots





Bluetooth LE Mid Channel



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						
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	12/22/14	12/22/15
1003	Signal Generator	SMR 40	1104.0002.40	Rhode & Schwarz	04/29/15	04/29/16
7604	Series Power Meter	N1912A	SG45100273	Agilent	05/27/15	05/27/16
7605	50MHz-18GHz Wideband Power Sensor	N1921A	MY51100054	Agilent	04/10/15	04/10/16
Radiated Test Setup						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/30/14	01/30/16
1051	Double-ridged waveguide horn antenna	3115	9408-4329	EMCO	02/28/14	02/28/16
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	03/20/15	03/20/16
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	09/29/14	09/29/15
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/11/15	03/11/16
1016	Pre-amplifier	PAM-0202	187	PAM	12/10/14	12/10/15
Miscellaneous						
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/12/14	08/12/15
1072	DC Power Supply	E3610A	KR51311519	Hewlett Packard	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	3.89	2.25	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					2.41
Coverage Factor (k):					2
Expanded Uncertainty:					4.82

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	3.89	2.25	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					2.40
Coverage Factor (k):					2
Expanded Uncertainty:					4.81

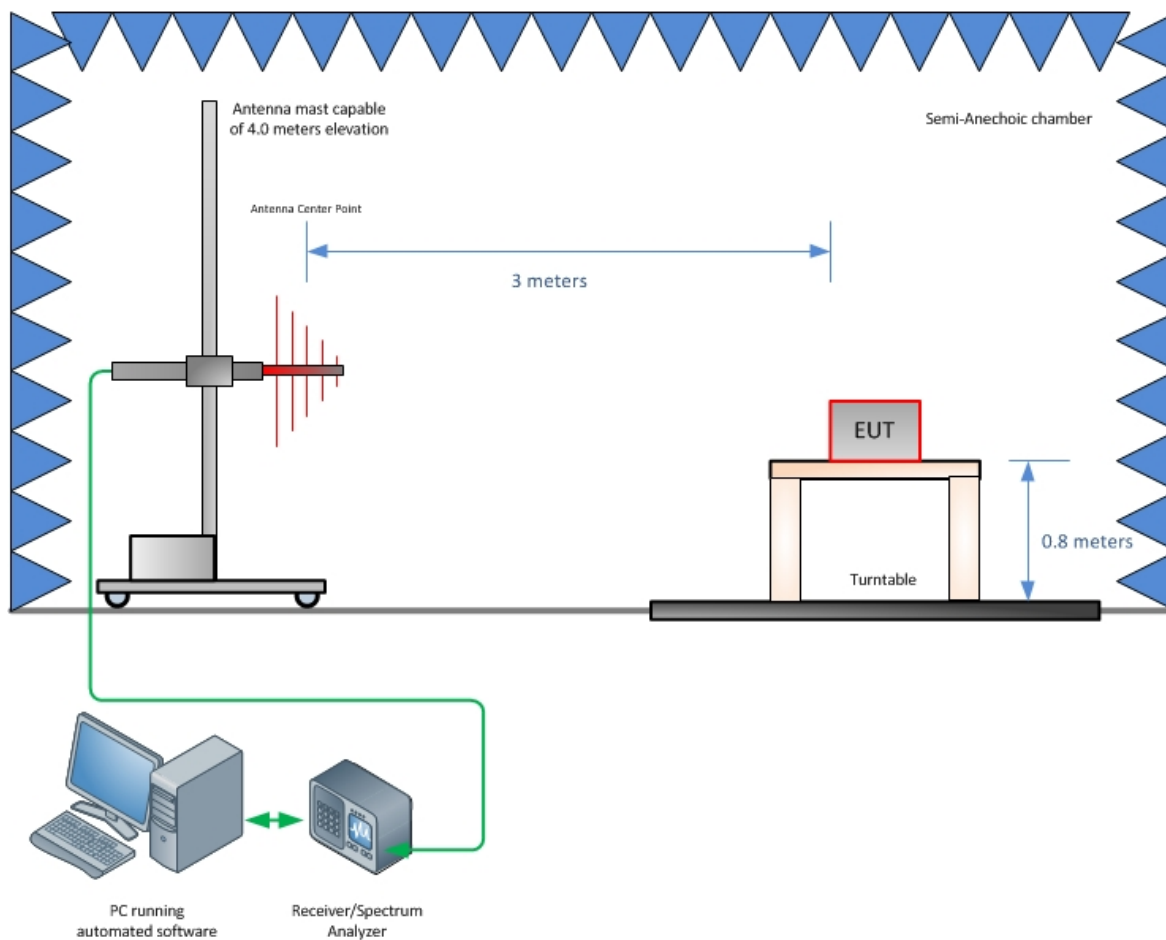
3.2.3 Conducted Antenna Port Measurement

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

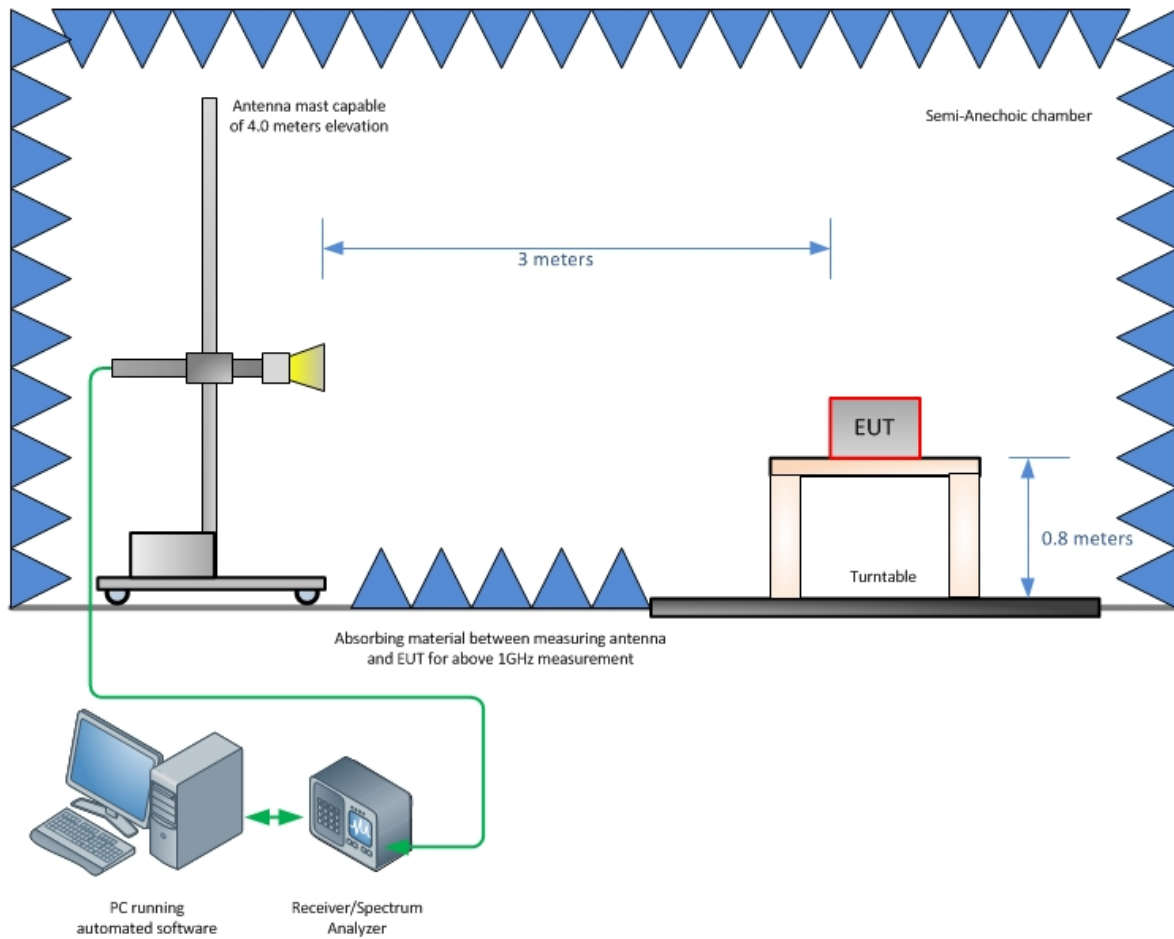
SECTION 4

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

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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