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Report On

Application for Grant of Equipment Authorization of the
St. Jude Medical IESD
IPG (Implantable Pulse Generator)
Models: SCS (Spinal Cord Stimulation) and DBS (Deep Brain
Stimulation)

FCC Part 15 Subpart C §15.247
IC RSS-210 Issue 8 December 2010

Report No. SC1406553A Rev.02

February 2015



REPORT ON Radio Testing of the
St. Jude Medical IESD
IPG (Implantable Pulse Generator)

TEST REPORT NUMBER SC1406553A Rev.02

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DATED

February 02, 2015



Revision History

SC1406553A Rev.02 St. Jude Medical IESD IPG (Implantable Pulse Generator) SCS (Spinal Cord Stimulation) and DBS (Deep Brain Stimulation)					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
01/14/2015	Initial Release				Ferdinand Custodio
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SECTION 1

REPORT SUMMARY

Radio Testing of the
St. Jude Medical IESD
IPG (Implantable Pulse Generator)



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the St. Jude Medical IESD IPG (Implantable Pulse Generator) models: SCS (Spinal Cord Stimulation) and DBS (Deep Brain Stimulation) to the requirements of FCC Part 15 Subpart C §15.247 and IC RSS-210 Issue 8 December 2010.

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 Number(s)	3660, 3661, 3662, 3663 (radiated samples), 3662 (conducted sample) were provided for final evaluation. 6660, 6661, 6662, 6663, 3665 and 3667 are RF identical to models provided above. See Section 1.3.2 for model differences in detail.
FCC ID Number	RIASJMRFC
IC Number	8454A-M3660123
Serial Number(s)	XJ1054, XJ1060, XJ1051 and XJ0993 for radiated testing XH4444 temporary antenna connection for conducted port testing
Number of Samples Tested	5
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.247 (October, 2014). • RSS-210 - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment (Issue 8, December 2010). • RSS-Gen - General Requirements and Information for the Certification of Radio Apparatus (Issue 4, November 2014). • 558074 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	September 23, 2014
Finish of Test	October 28, 2014
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-210 A8.4 (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-210 A8.2(a)	Minimum 6 dB RF Bandwidth	Compliant	
2.4	§15.247(d)	RSS-210 A8.5	Out-of-Band Emissions - Conducted	Compliant	
2.5	§15.247(d)	RSS-210 A8.5	Band-edge Compliance of RF Conducted Emissions	Compliant	
2.6	§15.247(d)	RSS-210 A8.5	Spurious Radiated Emissions	Compliant	
2.6		RSS-210 A8.5	Receiver Spurious Emissions	Compliant	
2.7	§15.247(d)	RSS-210 A8.2(b)	Radiated Band Edge Measurements	Compliant	
2.8	§15.247(e)	RSS-Gen 7.1	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 IPG (Implantable Pulse Generator) models for SCS (Spinal Cord Stimulation) and DBS (Deep Brain Stimulation). The EUT uses Bluetooth Low Energy (BLE) technology for communications. The Bluetooth LE function was verified in this test report. Models 3660, 3661, 3662, 3663 provided for final evaluation are RF identical to models 6660, 6661, 6662, 6663, 3665 and 3667; therefore, no further evaluation to models 6660, 6661, 6662, 6663, 3665 and 3667 considered necessary. See Section below for model differences.

1.3.2 Model Differences

Model Number	Description
3660	Orion IPG, 5.3Ah, SCS, SJM header
3661	Orion IPG, 5.3Ah, SCS, 1.27mm header
3662	Orion IPG, 7.5Ah, SCS, SJM header
3663	Orion IPG, 7.5Ah, SCS, 1.27mm header
6660	Orion IPG, 5.3Ah, DBS, Tonic, SJM header
6661	Orion IPG, 5.3Ah, DBS, Tonic, 1.27mm header
6662	Orion IPG, 7.5Ah, DBS, Tonic, SJM header
6663	Orion IPG, 7.5Ah, DBS, Tonic, 1.27mm header
3665	Orion IPG, 5.3Ah, SCS, Tonic, SJM header
3667	Orion IPG, 7.5Ah, SCS, Tonic, SJM header

Models 6660 and 3665 are RF identical to model 3660
Models 6662 and 3667 are RF identical to model 3662
Model 6661 is RF identical to model 3661
Model 6663 is RF identical to model 3663



1.3.3 EUT General Description

EUT Description	IPG (Implantable Pulse Generator)
Model Name	SCS (Spinal Cord Stimulation) and DBS (Deep Brain Stimulation)
Model Number(s)	3660, 3661, 3662, 3663, 6660, 6661, 6662, 6663, 3665 and 3667
Rated Voltage	Internal 2.5VDC
Mode Verified	Bluetooth LE
Capability	Bluetooth LE
Primary Unit (EUT)	☒ Production ☐ Pre-Production ☐ Engineering
Antenna Type	Patch
Antenna Gain	-11.5 dBi

1.3.4 Maximum Conducted Output Power

Mode	Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
Bluetooth LE	2402 – 2480	-1.13	0.77

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 Tera Term commands to modify channels number, data rates 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 iPod 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 Tera Term commands to exercise the EUT.

1.4.3 Support Equipment and I/O cables

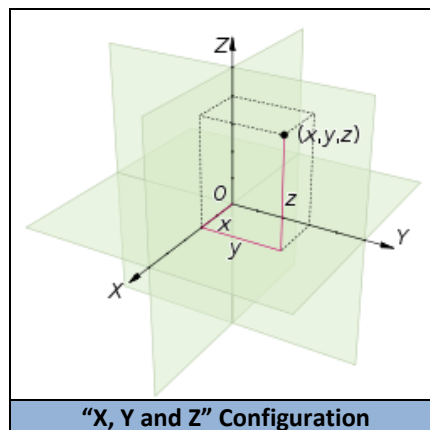
Manufacturer	Equipment/Cable	Description
Dell	Support Laptop	Model: LATITUDE E6400
Dell	Support Laptop AC Power Supply	Model: PA-1900-02D2
St. Jude Medical	Support DTM3 Telemetry Box	Model: 60007120-001 Rev. P07
CUI Inc.	Support DTM3 Telemetry Box AC Power Supply	Model: EPA-121DA-05
St. Jude Medical	Inductive Wand	Model: 3630
Apple	iPod Touch	Model: A1509
Nordic Semiconductor	Nordic Motherboard (PCB)	nRF6310
Segger	J-Link Debugger (PCB)	J-Link Lite CortexM
—	Phantom Cylinder	—
Zurich Med Tech	Phantom Liquid (Fat Liquid Material)	P/N: ZL AAF245 CA
—	USB Cable	Connection from laptop to J-Link debugger
—	USB Cable	Connection from laptop to Nordic Motherboard
—	RS232 Serial Cable	Connection from laptop to Nordic Motherboard
—	10 Pins Flat Cable	Connection from J-Link debugger to EUT
—	2-Lead Patch Cable	Connection from Nordic Motherboard to EUT

1.4.4 Worst Case Configuration

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

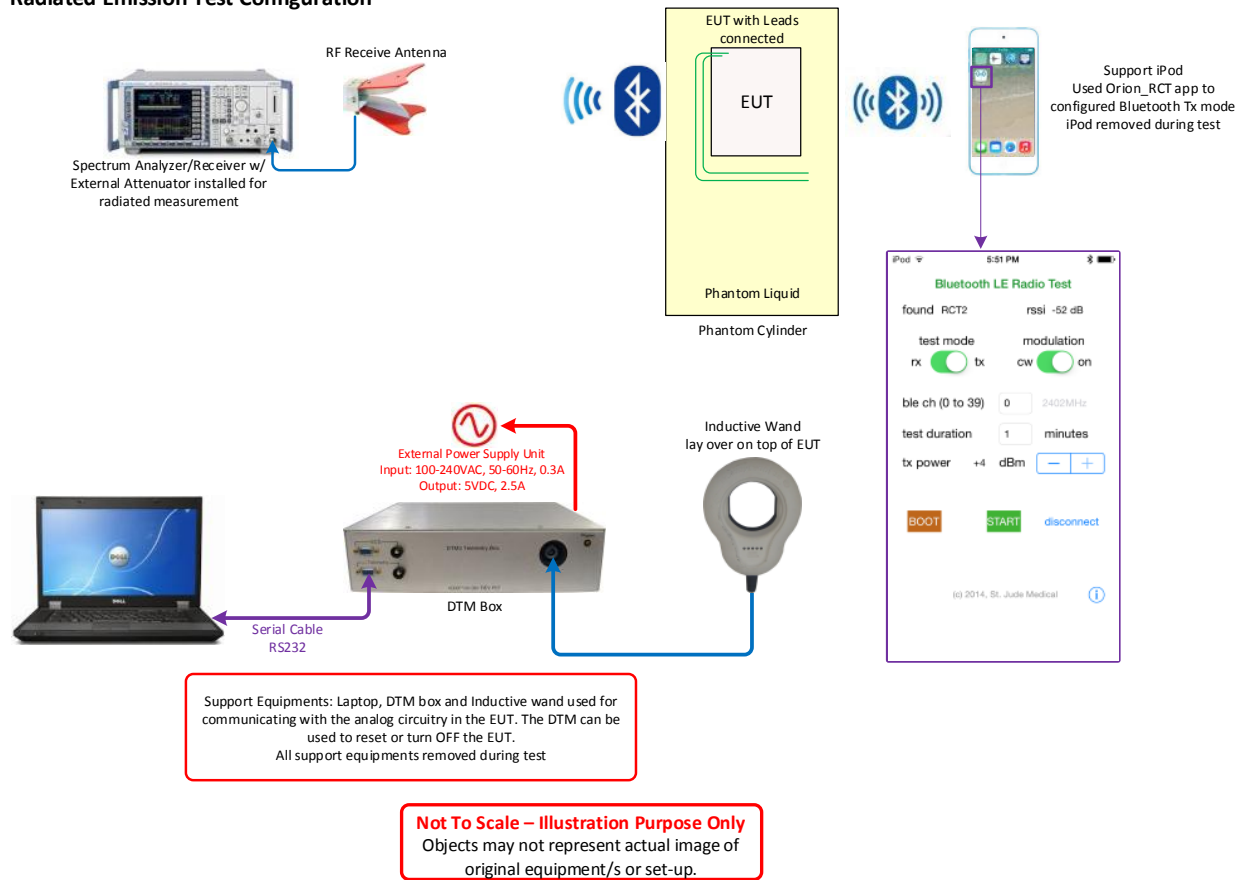
Mode	Channel	Data Rate
Bluetooth LE	00 (Low Channel)	1Mbps

EUT is a mobile device. For radiated measurements X, Y and Z orientations were verified. Worst case position is "X" (EUT flat on the test fixture).

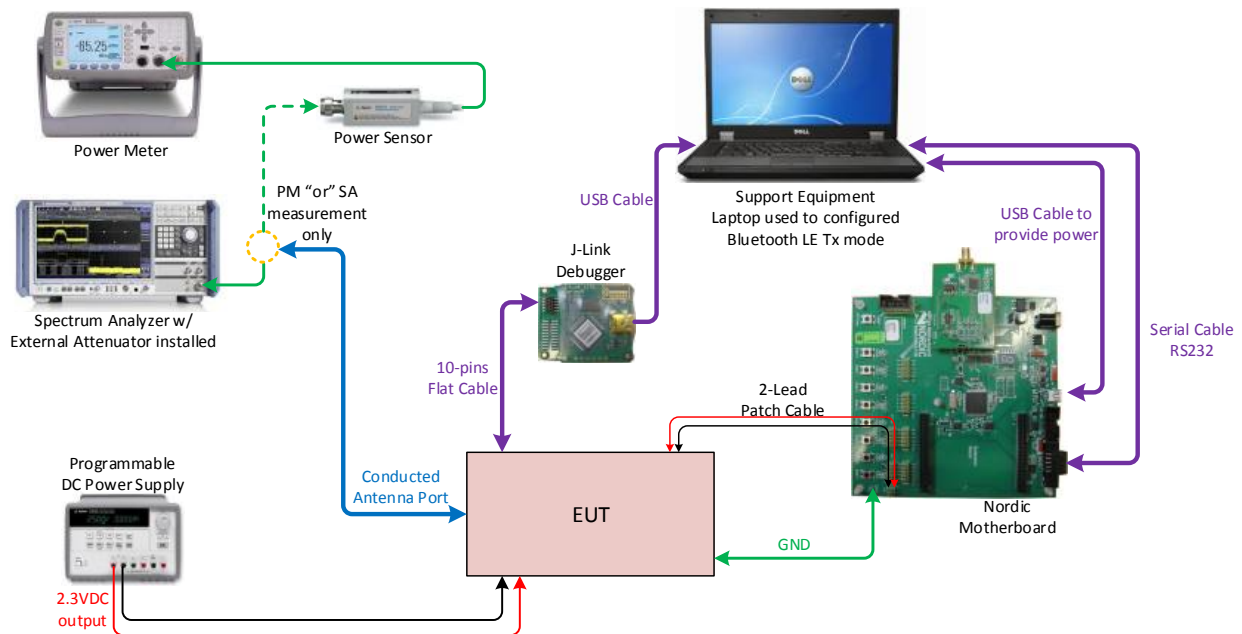


1.4.5 Simplified Test Configuration Diagram

Radiated Emission Test Configuration



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: XJ1054, XJ1060, XJ1051, XJ0993 and XH4444		
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
St. Jude Medical IESD
IPG (Implantable Pulse Generator)



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: XH4444 / Test Configuration A

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

September 23, 2014 / 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	25.0°C
Relative Humidity	51.4%
ATM Pressure	99.0 kPa

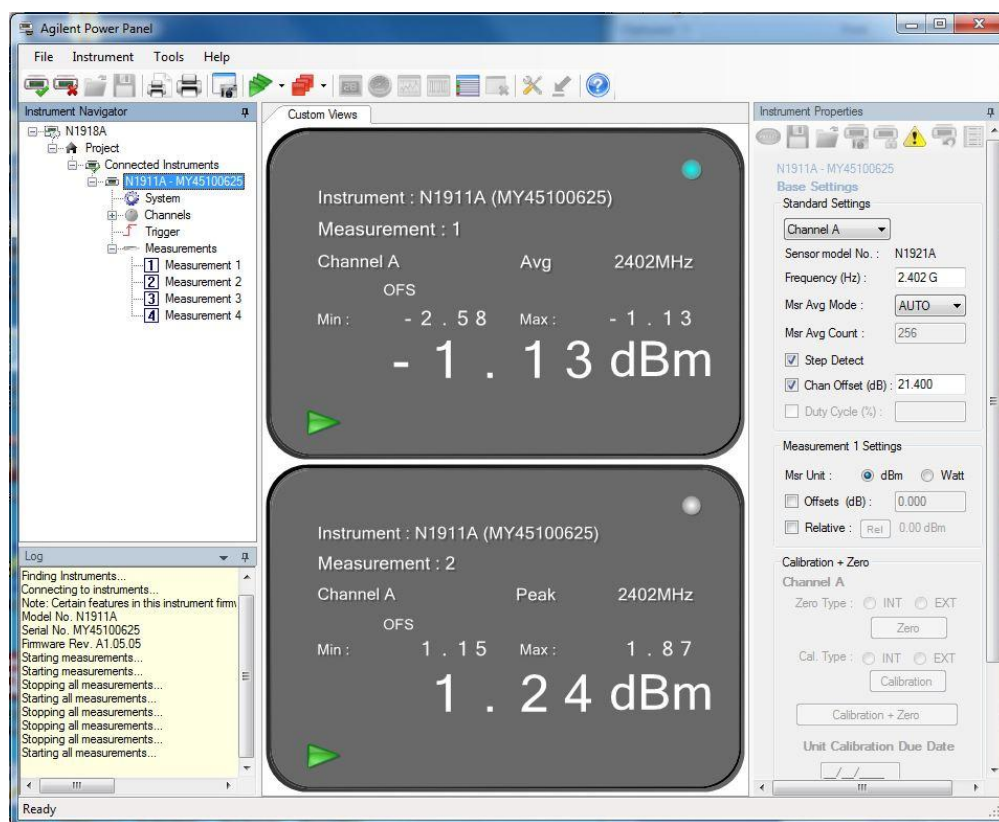
2.1.7 Additional Observations

- This is a conducted test (Maximum conducted [average] output power) using direct connection to a power meter.
- An offset of 21.4dB 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 v03r02, June 05, 2014). 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)
	00 (2402 MHz)	GFSK @ 1Mbps	-1.13	1.87
	19 (2440 MHz)		-3.86	0.89
	39 (2480 MHz)		-5.98	0.33

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: XH4444 / Test Configuration A

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

September 23, 2014 / 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	25.0°C
Relative Humidity	51.4%
ATM Pressure	99.0 kPa

2.2.7 Additional Observations

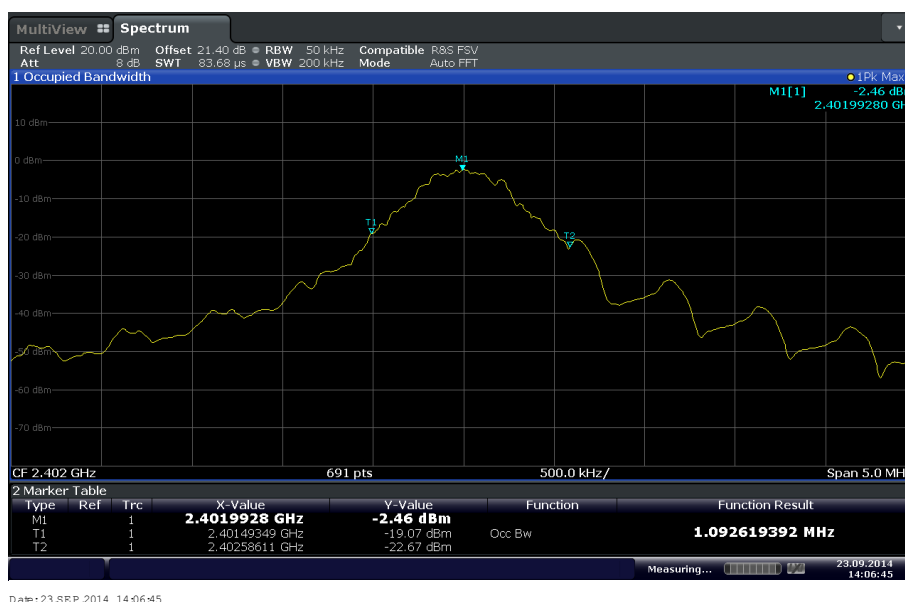
- This is a conducted test.
- An offset of 21.4dB was added to compensate for the external attenuator and cable used.
- Span is wide enough to capture the channel transmission.
- RBW is 1% of the span.
- VBW is 3X RBW.
- Sweep is auto.

- 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.

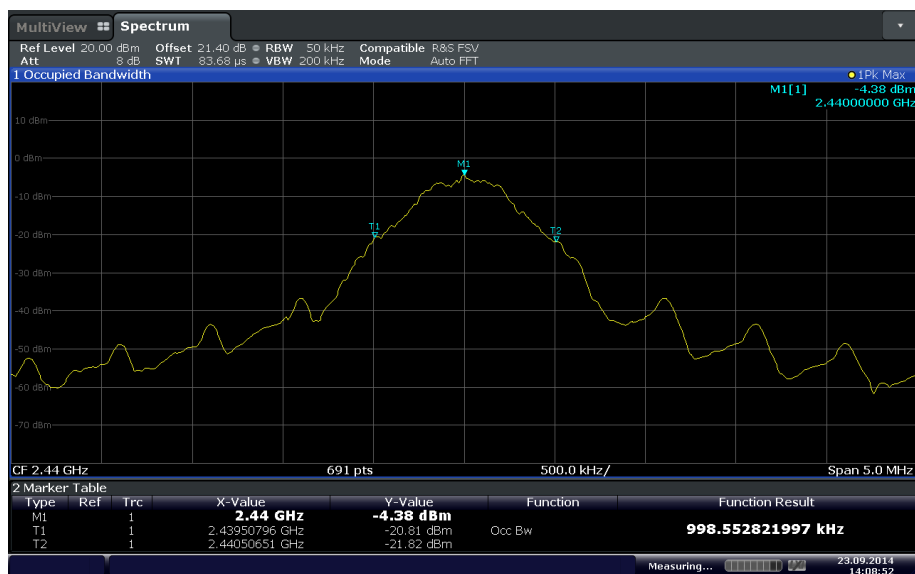
2.2.8 Test Results (For reporting purposes only)

Mode	Channel	Measured 99% Bandwidth (MHz)
Bluetooth LE	00 (2402 MHz)	1.093
	19 (2440 MHz)	0.999
	39 (2480 MHz)	0.962

2.2.9 Test Results Plots

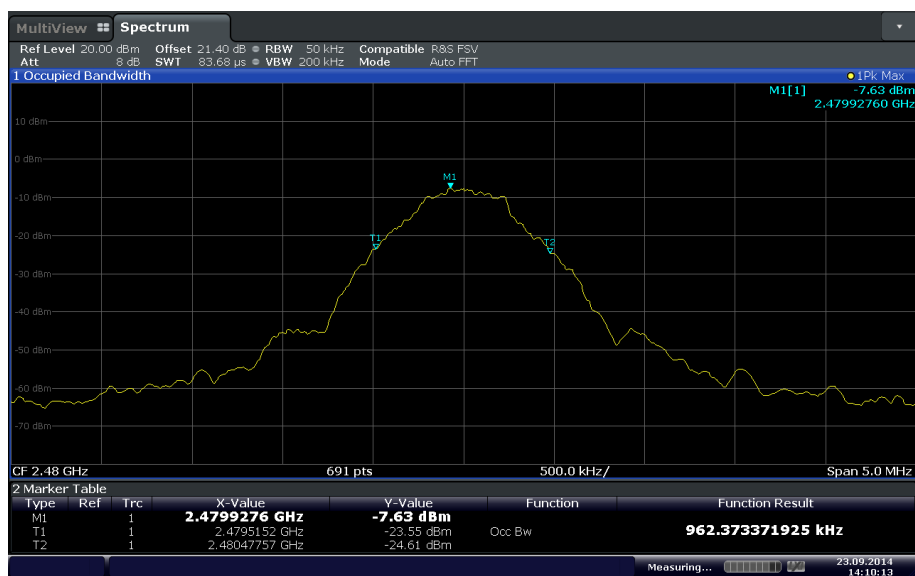


Bluetooth LE Low Channel



Date: 23.SEP.2014 14:08:52

Bluetooth LE Mid Channel



Date: 23.SEP.2014 14:10:13

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: XH4444 / Test Configuration A

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

September 23, 2014 / 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	25.0°C
Relative Humidity	51.4%
ATM Pressure	99.0 kPa

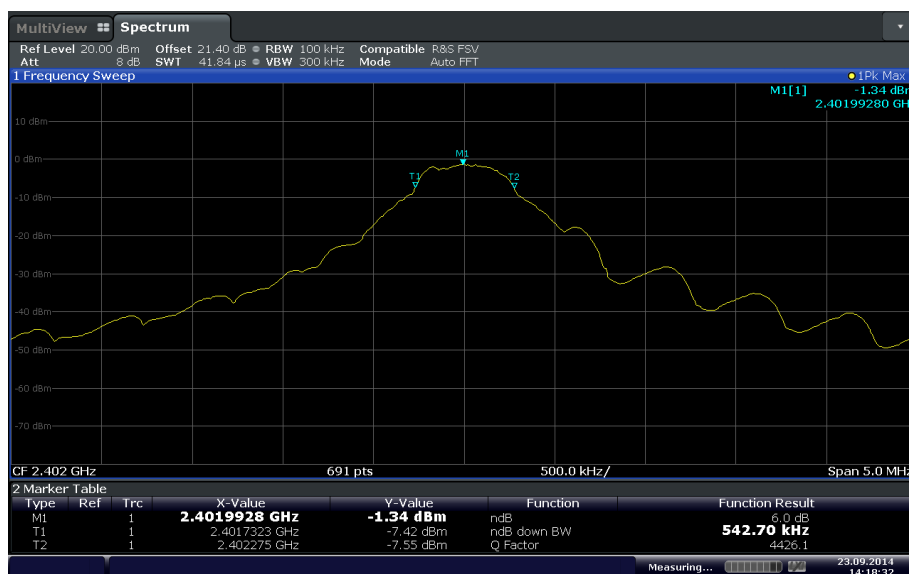
2.3.7 Additional Observations

- This is a conducted test.
- An offset of 21.4 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.

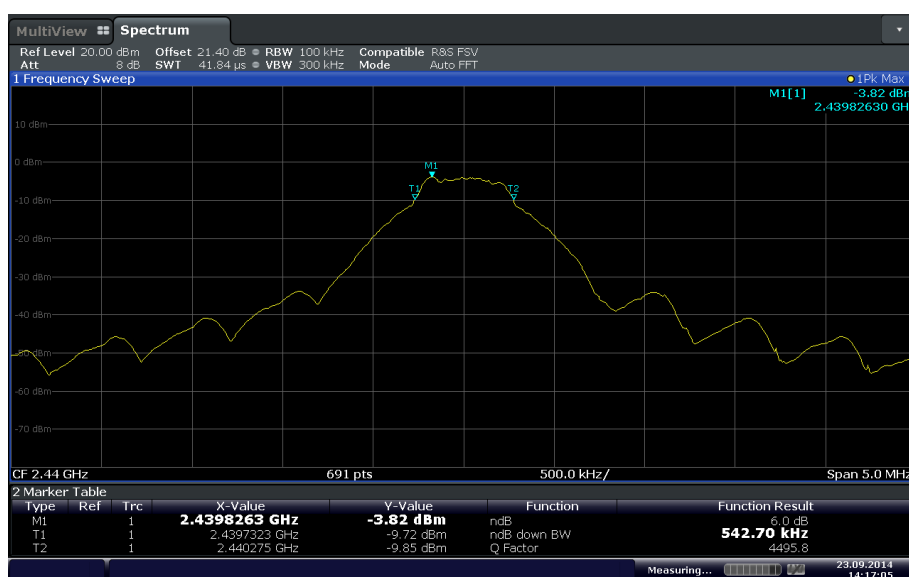
2.3.8 Test Results

Mode	Channel	Measured Bandwidth (kHz)	Minimum Bandwidth (kHz)	Compliance
Bluetooth LE	00 (2402 MHz)	542.7	500	Complies
	19 (2440 MHz)	542.7	500	Complies
	39 (2480 MHz)	542.7	500	Complies

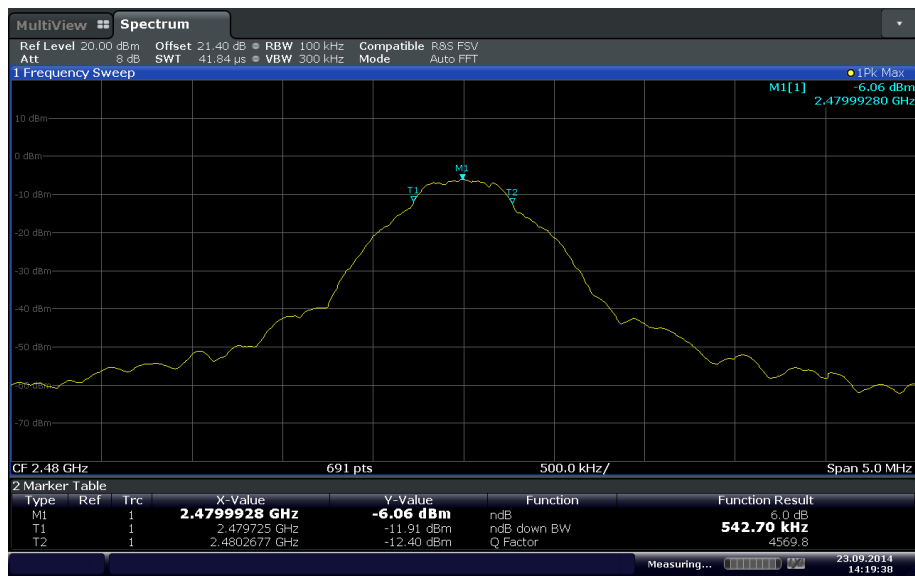
2.3.9 Test Results Plots



Bluetooth LE Low Channel



Bluetooth LE Mid Channel



Date: 23 SEP 2014 14:19:38

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: XH4444 / Test Configuration A

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

September 23, 2014 / 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

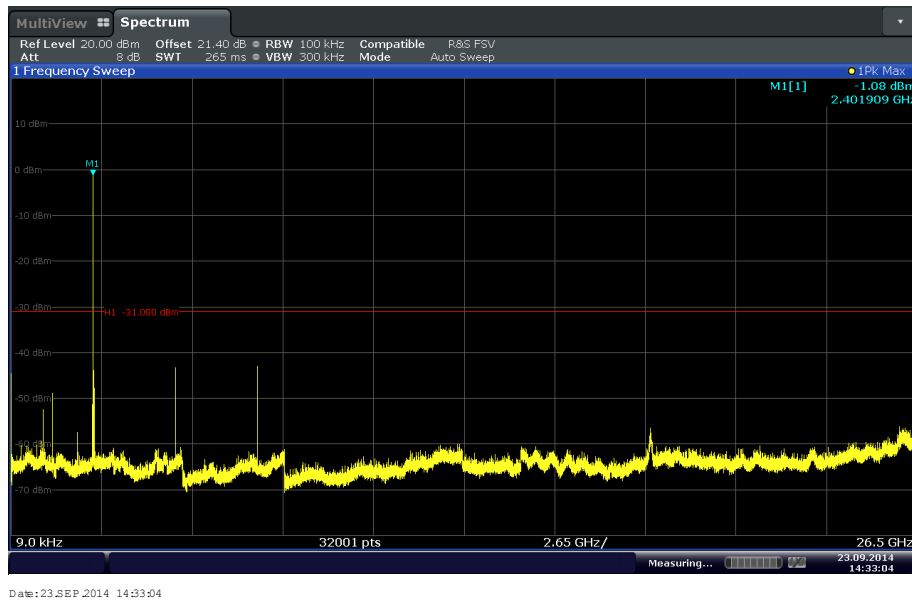
Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.0°C
Relative Humidity	51.4%
ATM Pressure	99.0 kPa

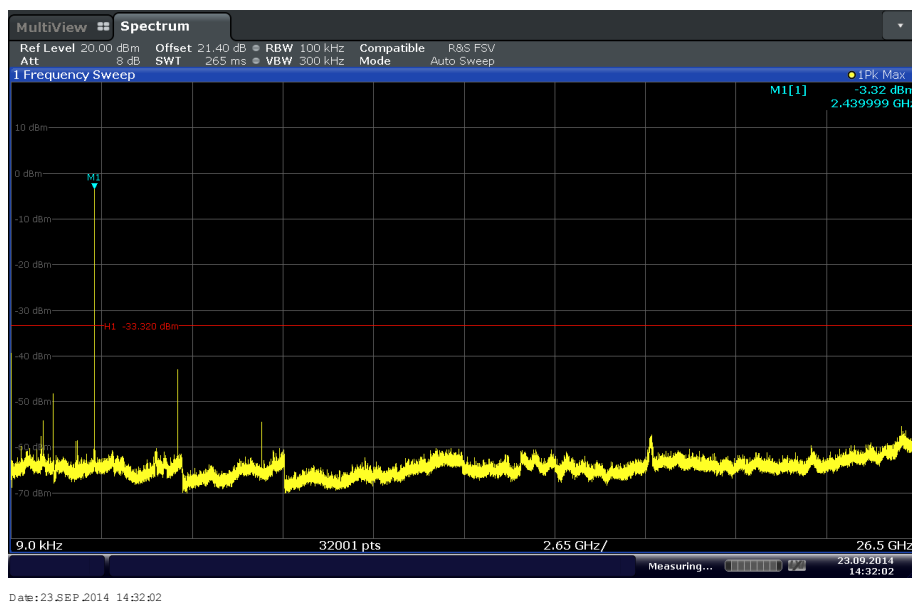
2.4.7 Additional Observations

- This is a conducted test.
- An offset of 21.4dB 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.

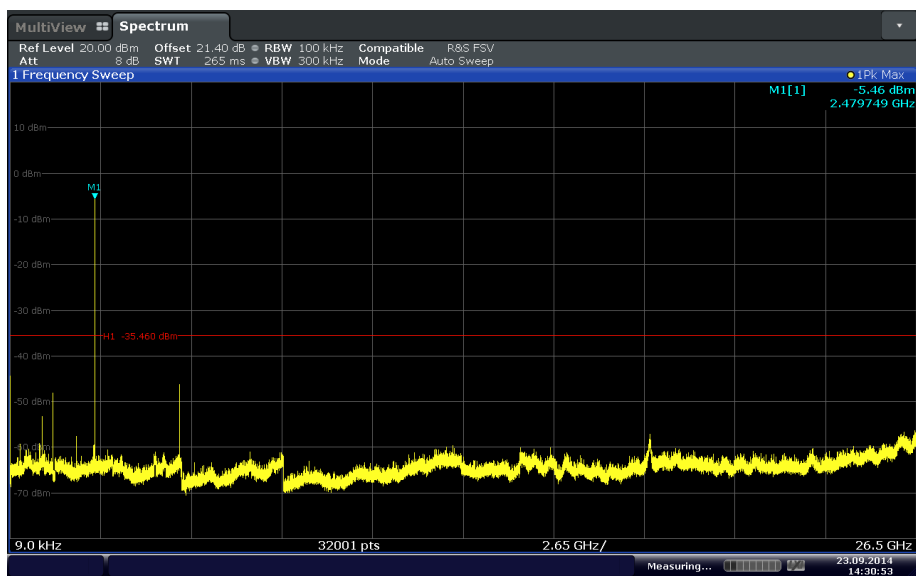
2.4.8 Test Results Plots



Bluetooth LE Low Channel



Bluetooth LE Mid Channel



Date: 23 SEP 2014 14:30:53

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

See previous test.

2.5.3 Equipment Under Test and Modification State

Serial No: XH4444 / Test Configuration A

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

September 23, 2014 / 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

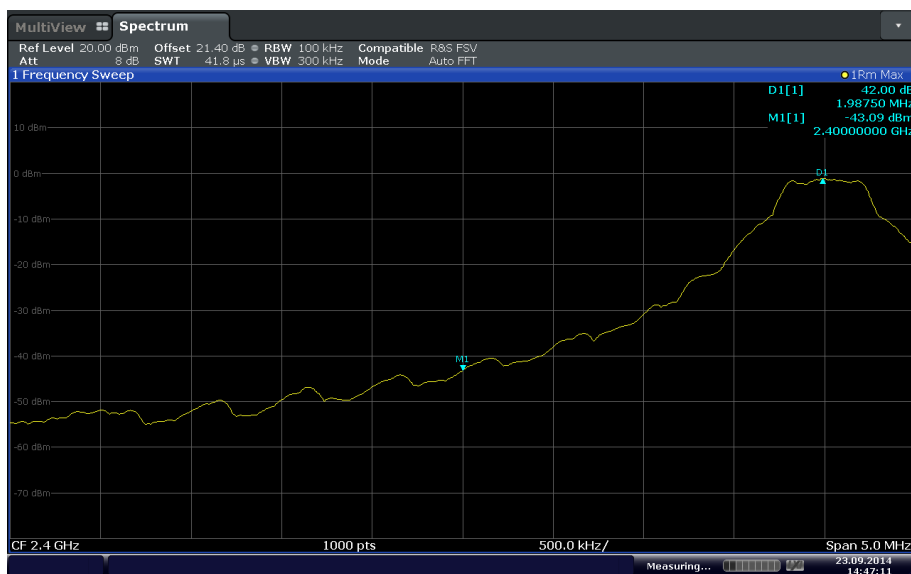
Ambient Temperature	25.0°C
Relative Humidity	51.4%
ATM Pressure	99.0 kPa

2.5.7 Additional Observations

- 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 13.3.1 of KDB 558074 D01 DTS Meas Guidance v03r02, June 05, 2014); trace averaging with continuous EUT transmission at full power.
- Limits are from Section 2.4 of this test report. These are 30dBc from the highest level of the desired power within the band.

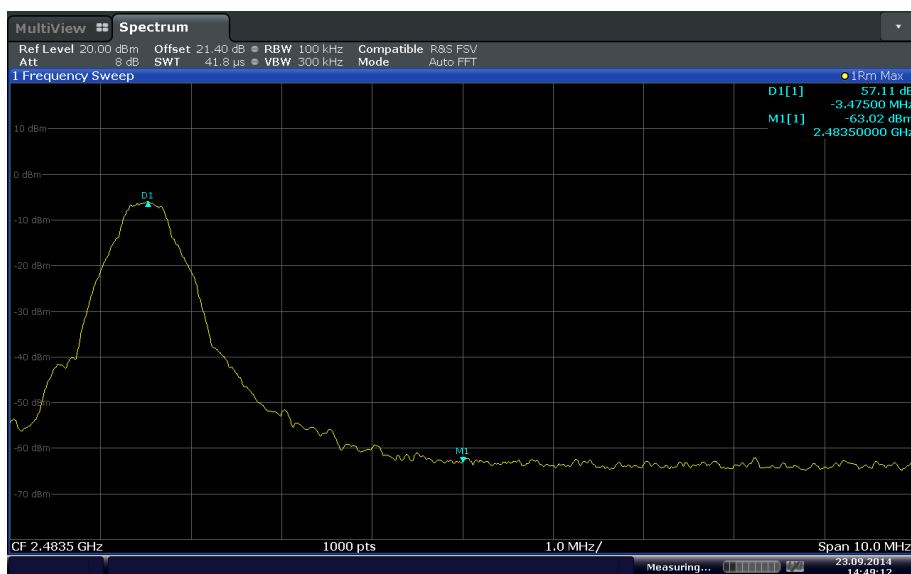
2.5.8 Test Results

Complies. See attached plots.



Date: 23.SEP.2014 14:47:11

Bluetooth LE Lower Edge



Date: 23.SEP.2014 14:49:11

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: XJ1054, XJ1060, XJ1051, XJ0993 / Test Configuration B

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

October 20 and 21, 2014 / 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	24.1°C
Relative Humidity	55.6%
ATM Pressure	99.0 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 considered worst case configuration (Low Channel) presented for radiated emissions below 1GHz. There are no significant differences in emissions between all models and 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.

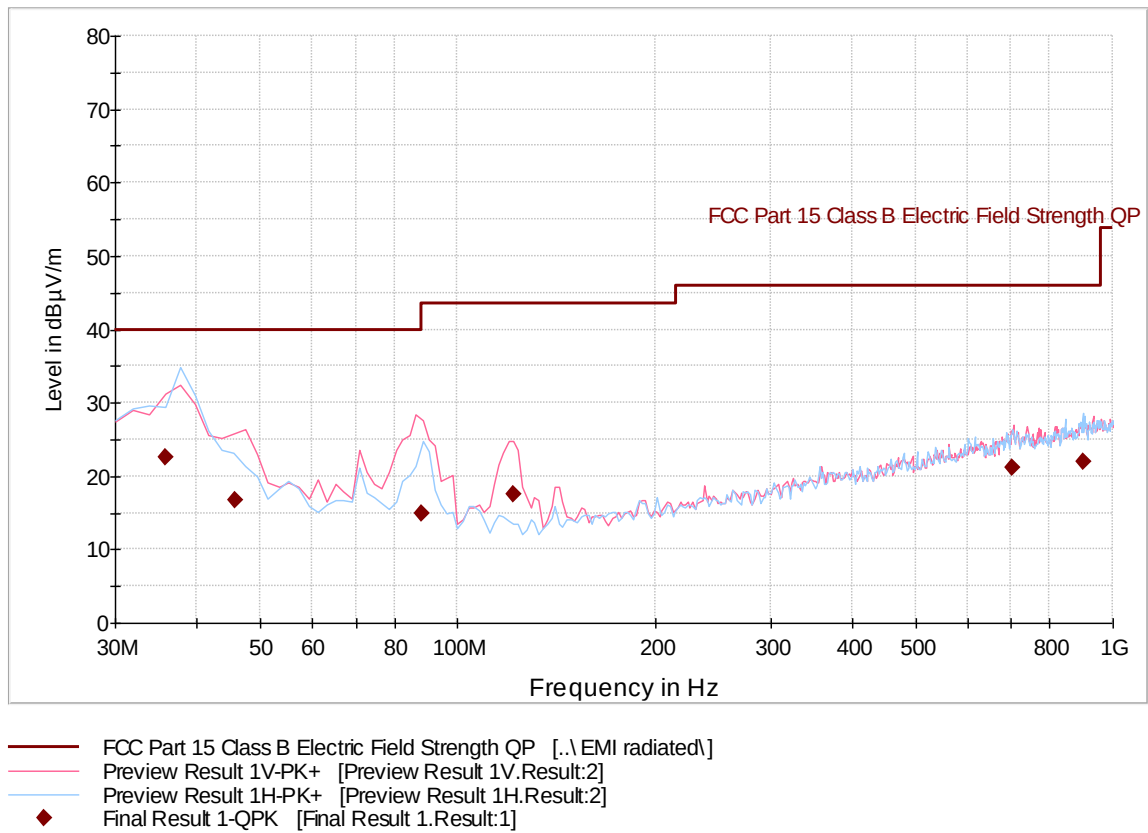
2.6.8 Sample Computation (Radiated Emission)

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 QuasiPeak Final Measurement (dbμV/m) @ 30MHz			11.8

2.6.9 Test Results

See attached plots.

2.6.10 Test Results Below 1GHz (Bluetooth LE)

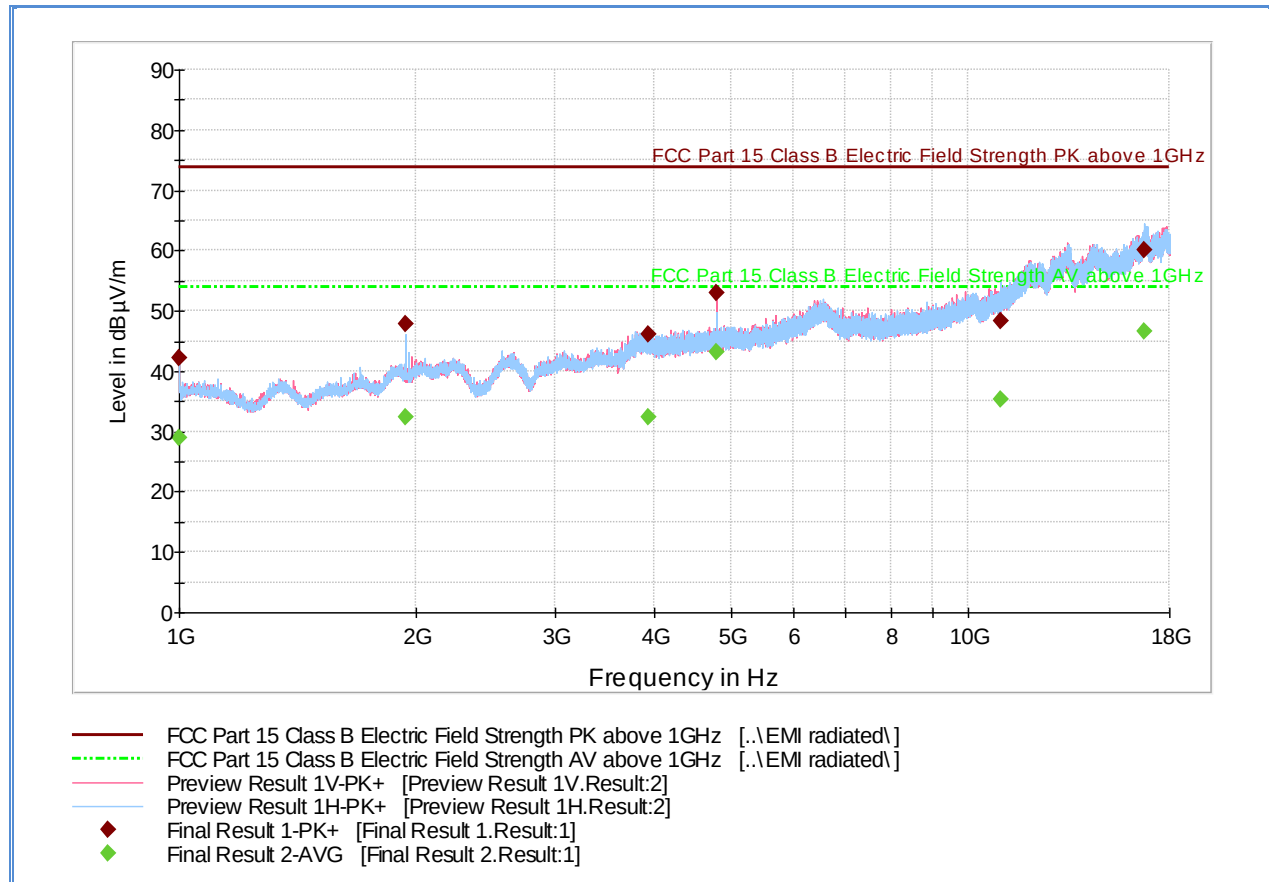


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
35.735551	22.5	1000.0	120.000	291.0	H	21.0	-13.7	17.5	40.0
45.694990	16.8	1000.0	120.000	103.0	V	296.0	-17.6	23.2	40.0
88.172745	14.9	1000.0	120.000	103.0	V	-4.0	-20.2	28.6	43.5
121.842725	17.5	1000.0	120.000	103.0	V	-11.0	-19.7	26.0	43.5
700.425170	21.2	1000.0	120.000	250.0	H	285.0	-0.5	24.8	46.0
900.237836	21.9	1000.0	120.000	184.0	H	320.0	2.2	24.1	46.0

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

2.6.11 Test Results Above 1GHz (Bluetooth LE Low Channel of Model 3660)



Peak Data

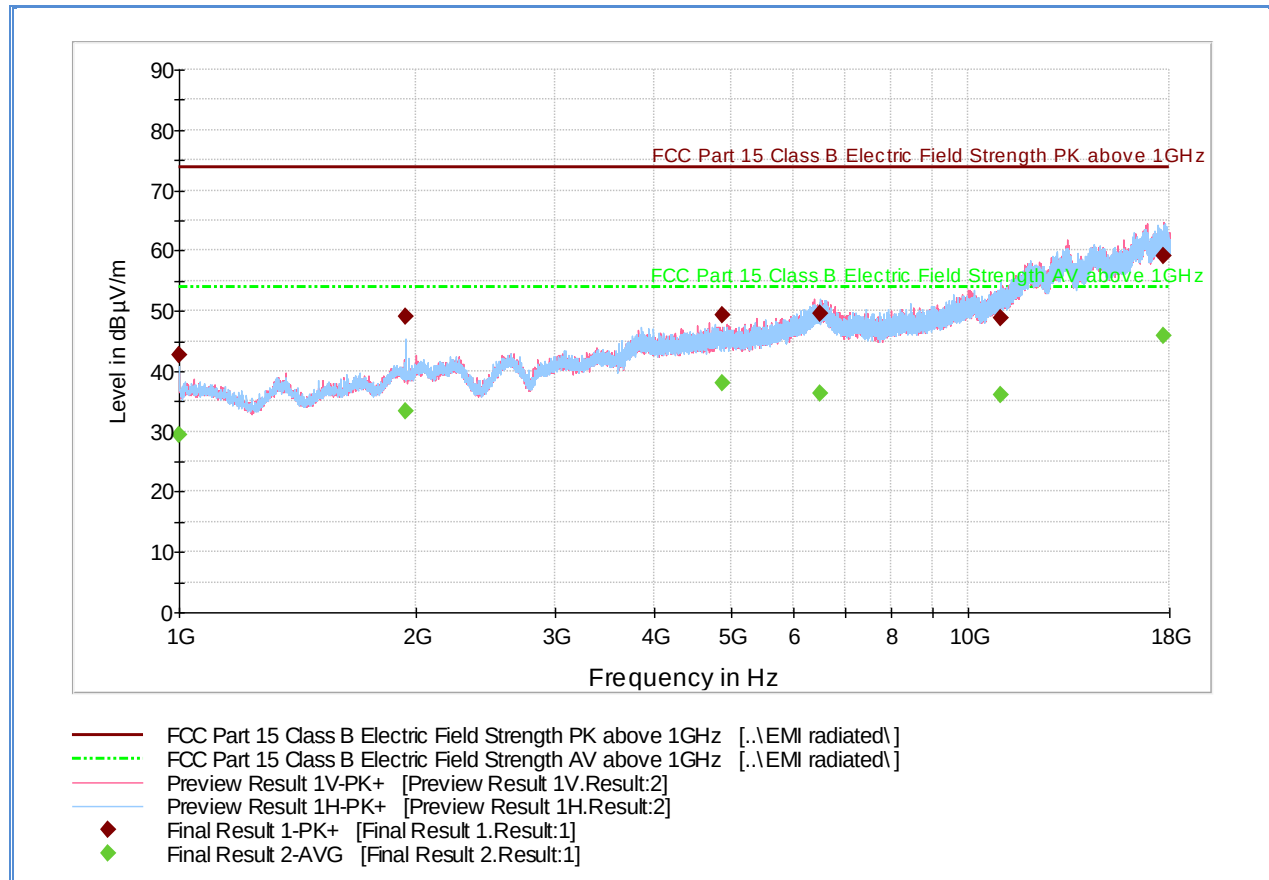
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1000.000000	42.2	1000.0	1000.000	200.0	V	4.0	-7.0	31.7	73.9
1937.466667	47.8	1000.0	1000.000	337.0	H	-3.0	-1.4	26.1	73.9
3932.366667	46.1	1000.0	1000.000	264.0	V	137.0	6.0	27.8	73.9
4804.266667	53.1	1000.0	1000.000	164.0	V	319.0	6.8	20.8	73.9
10999.600000	48.4	1000.0	1000.000	100.0	H	20.0	17.1	25.5	73.9
16735.400000	60.0	1000.0	1000.000	300.0	H	183.0	25.9	13.9	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)
1000.000000	29.0	1000.0	1000.000	200.0	V	4.0	-7.0	24.9	53.9
1937.466667	32.2	1000.0	1000.000	337.0	H	-3.0	-1.4	21.7	53.9
3932.366667	32.5	1000.0	1000.000	264.0	V	137.0	6.0	21.4	53.9
4804.266667	43.0	1000.0	1000.000	164.0	V	319.0	6.8	10.9	53.9
10999.600000	35.4	1000.0	1000.000	100.0	H	20.0	17.1	18.5	53.9
16735.400000	46.7	1000.0	1000.000	300.0	H	183.0	25.9	7.2	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz are noise floor figures.

2.6.12 Test Results Above 1GHz (Bluetooth LE Mid Channel of Model 3660)



Peak Data

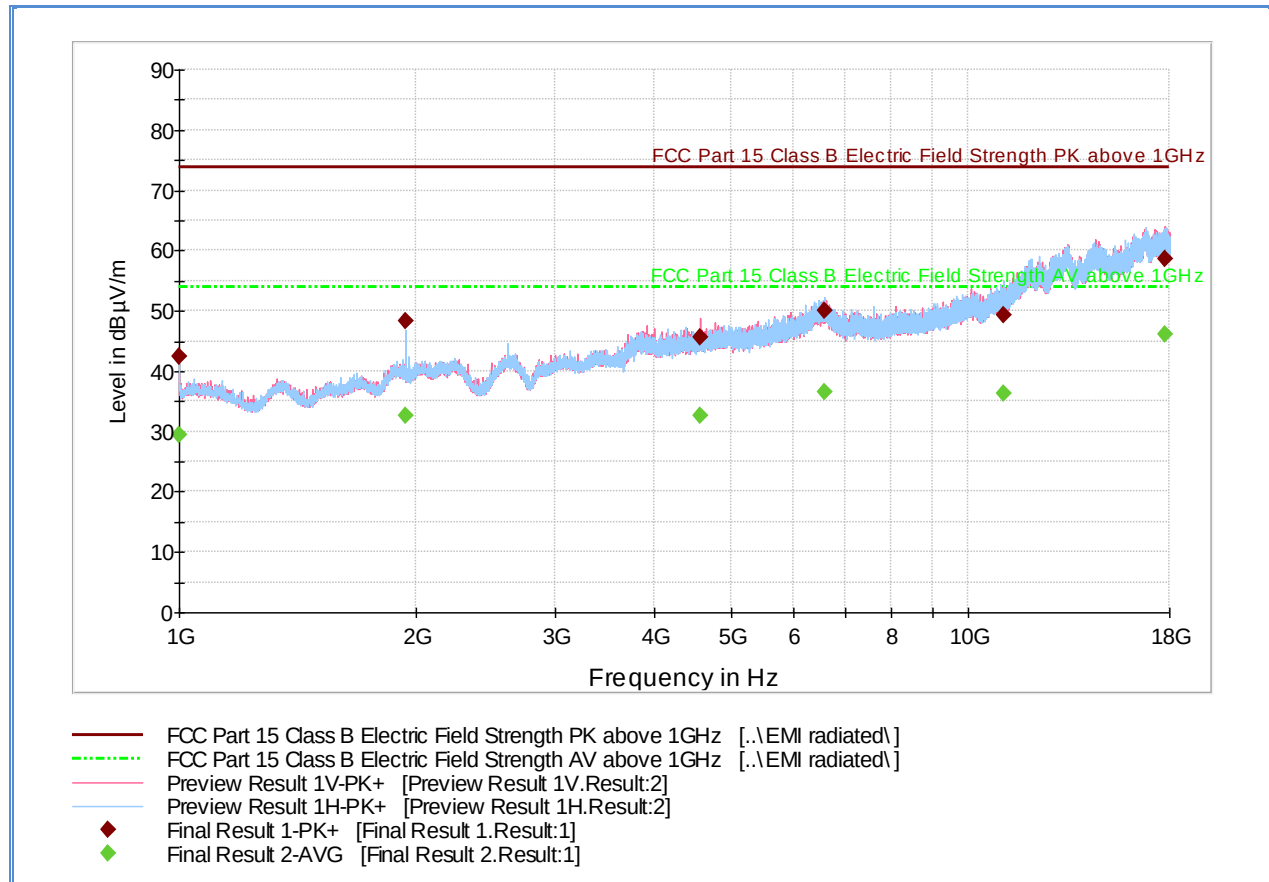
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1000.000000	42.6	1000.0	1000.000	100.1	H	289.0	-7.0	31.3	73.9
1937.666667	49.2	1000.0	1000.000	400.1	H	348.0	-1.4	24.7	73.9
4879.600000	49.2	1000.0	1000.000	177.0	V	317.0	7.1	24.7	73.9
6503.866667	49.5	1000.0	1000.000	358.0	H	34.0	12.7	24.4	73.9
11020.366667	48.8	1000.0	1000.000	200.0	H	353.0	17.0	25.1	73.9
17729.500000	59.1	1000.0	1000.000	300.0	V	219.0	25.7	14.8	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)
1000.000000	29.5	1000.0	1000.000	100.1	H	289.0	-7.0	24.4	53.9
1937.666667	33.3	1000.0	1000.000	400.1	H	348.0	-1.4	20.6	53.9
4879.600000	38.0	1000.0	1000.000	177.0	V	317.0	7.1	15.9	53.9
6503.866667	36.2	1000.0	1000.000	358.0	H	34.0	12.7	17.7	53.9
11020.366667	36.1	1000.0	1000.000	200.0	H	353.0	17.0	17.8	53.9
17729.500000	45.9	1000.0	1000.000	300.0	V	219.0	25.7	8.0	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz are noise floor figures.

2.6.13 Test Results Above 1GHz (Bluetooth LE High Channel of Model 3660)



Peak Data

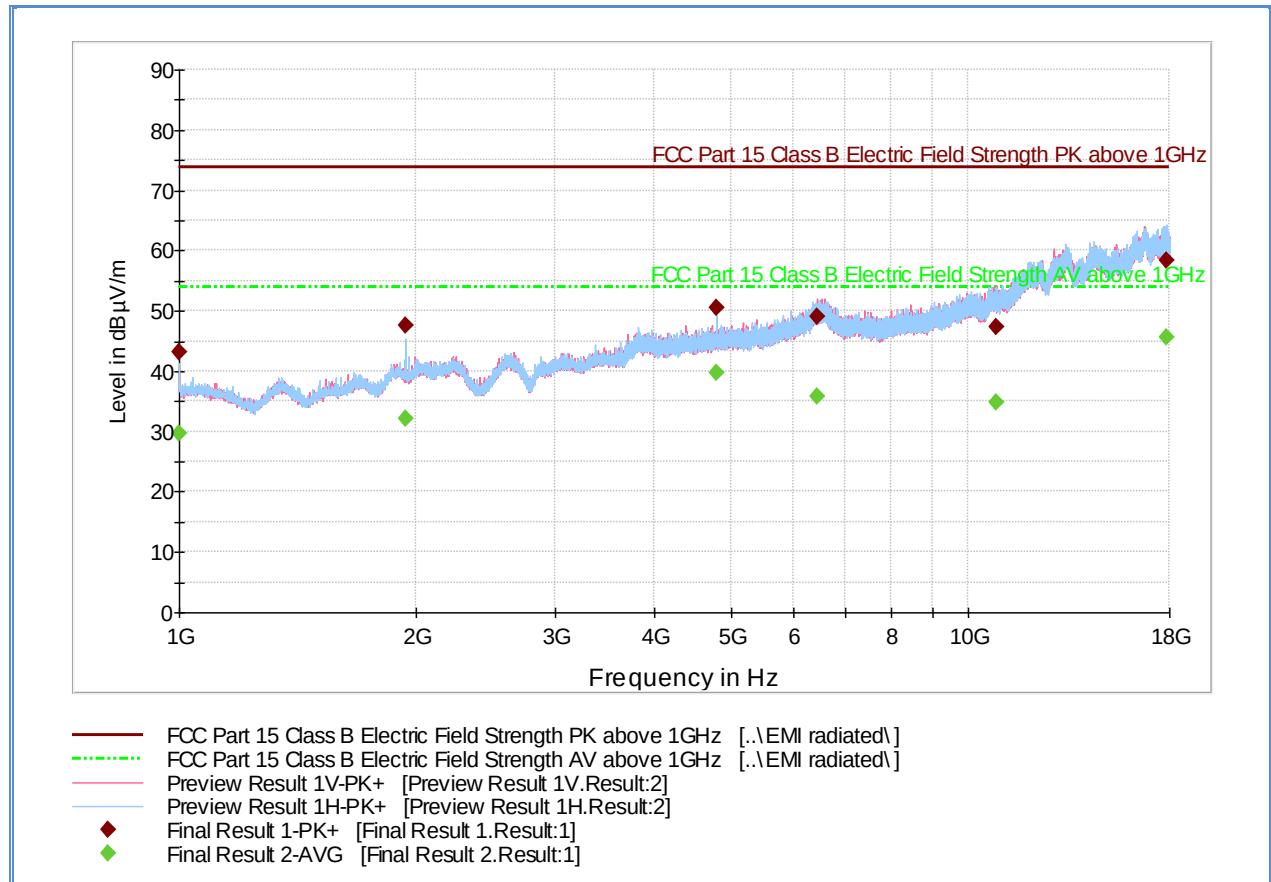
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1000.000000	42.4	1000.0	1000.000	124.0	H	3.0	-7.0	31.5	73.9
1937.466667	48.2	1000.0	1000.000	410.0	H	90.0	-1.4	25.7	73.9
4571.666667	45.5	1000.0	1000.000	406.9	V	196.0	7.0	28.4	73.9
6579.766667	49.9	1000.0	1000.000	163.0	H	234.0	12.8	24.0	73.9
11081.766667	49.2	1000.0	1000.000	166.0	H	150.0	16.6	24.7	73.9
17731.633333	58.7	1000.0	1000.000	178.0	V	20.0	25.7	15.2	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	124.0	H	3.0	-7.0	24.5	53.9
1937.466667	32.6	1000.0	1000.000	410.0	H	90.0	-1.4	21.3	53.9
4571.666667	32.6	1000.0	1000.000	406.9	V	196.0	7.0	21.3	53.9
6579.766667	36.6	1000.0	1000.000	163.0	H	234.0	12.8	17.3	53.9
11081.766667	36.2	1000.0	1000.000	166.0	H	150.0	16.6	17.7	53.9
17731.633333	46.0	1000.0	1000.000	178.0	V	20.0	25.7	7.9	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz are noise floor figures.

2.6.14 Test Results Above 1GHz (Bluetooth LE Low Channel to Model 3661)



Peak Data

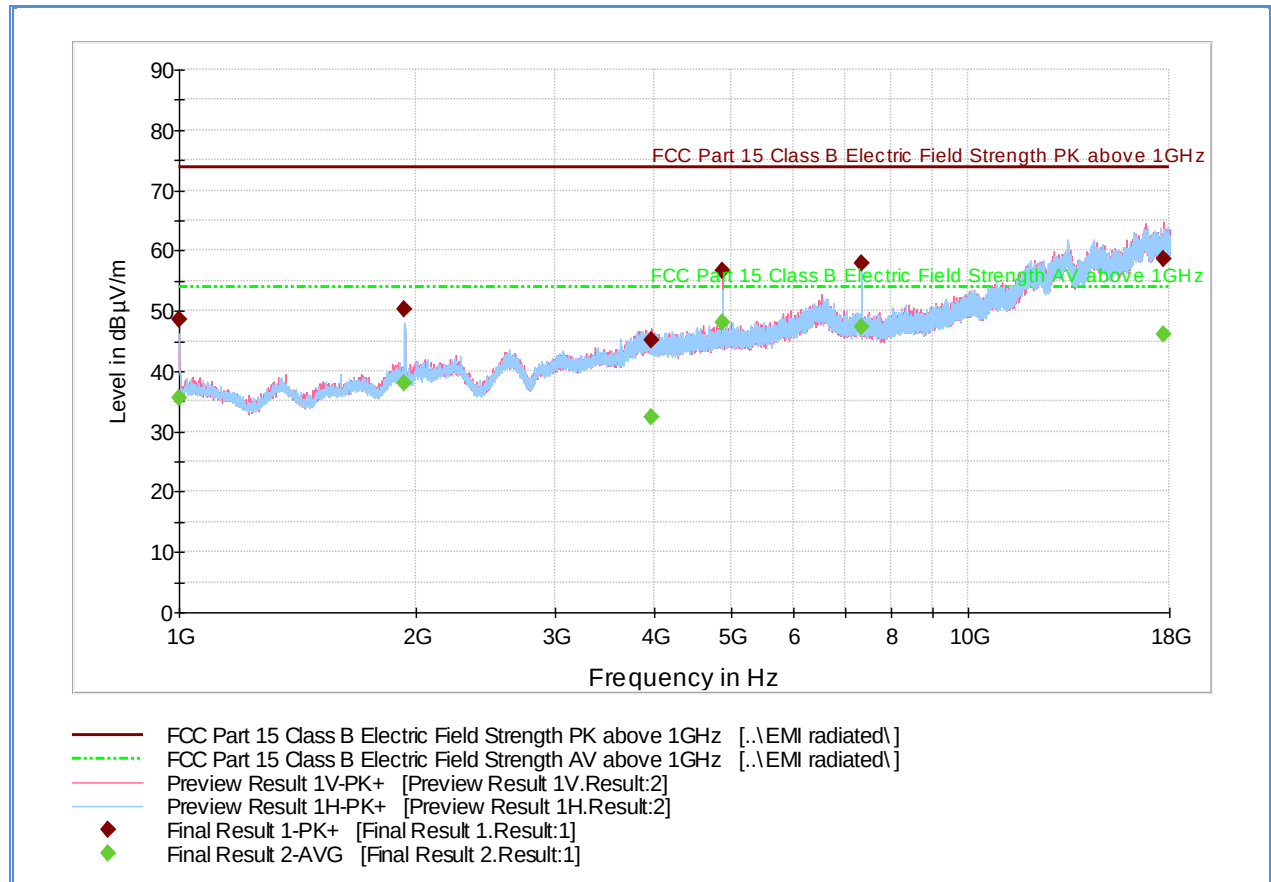
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	43.3	1000.0	1000.000	100.0	H	24.0	-7.0	30.7	73.9
1937.666667	47.5	1000.0	1000.000	410.0	H	314.0	-1.4	26.4	73.9
4803.666667	50.4	1000.0	1000.000	124.0	H	332.0	6.8	23.5	73.9
6447.733333	49.1	1000.0	1000.000	200.0	V	191.0	12.7	24.8	73.9
10863.233333	47.3	1000.0	1000.000	200.0	V	259.0	16.6	26.6	73.9
17828.300000	58.3	1000.0	1000.000	204.0	H	124.0	25.7	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	29.7	1000.0	1000.000	100.0	H	24.0	-7.0	24.2	53.9
1937.666667	32.1	1000.0	1000.000	410.0	H	314.0	-1.4	21.8	53.9
4803.666667	39.8	1000.0	1000.000	124.0	H	332.0	6.8	14.1	53.9
6447.733333	35.8	1000.0	1000.000	200.0	V	191.0	12.7	18.1	53.9
10863.233333	34.7	1000.0	1000.000	200.0	V	259.0	16.6	19.2	53.9
17828.300000	45.5	1000.0	1000.000	204.0	H	124.0	25.7	8.4	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz are noise floor figures.

2.6.15 Test Results Above 1GHz (Bluetooth LE Mid Channel to Model 3661)



Peak Data

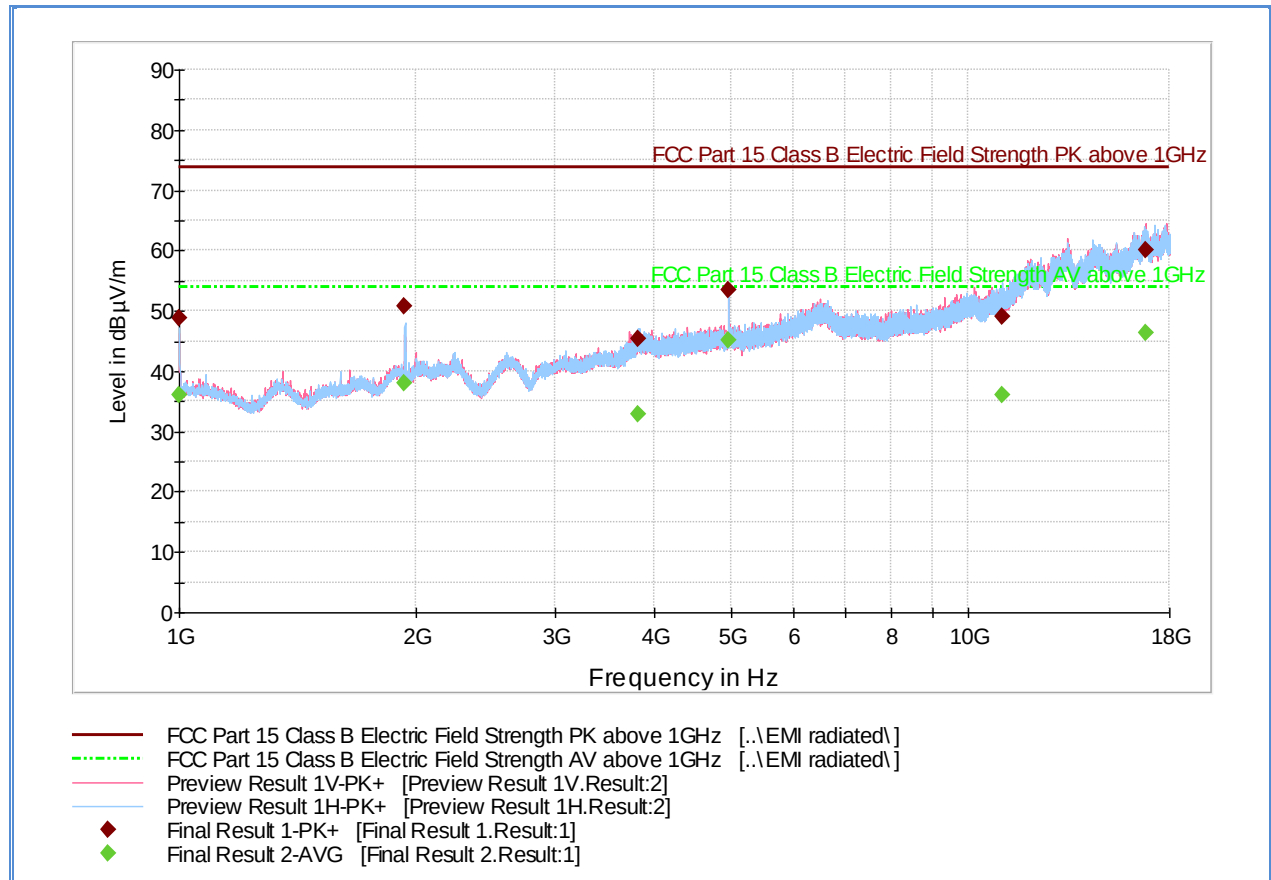
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	48.5	1000.0	1000.000	176.6	H	15.0	-7.0	25.4	73.9
1932.600000	50.3	1000.0	1000.000	409.3	H	15.0	-1.4	23.6	73.9
3964.633333	45.1	1000.0	1000.000	151.6	V	131.0	5.9	28.8	73.9
4879.600000	56.6	1000.0	1000.000	152.6	V	99.0	7.1	17.3	73.9
7320.000000	58.0	1000.0	1000.000	266.3	H	54.0	11.1	16.0	73.9
17708.533333	58.6	1000.0	1000.000	124.7	V	20.0	25.6	15.3	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)
1000.000000	35.5	1000.0	1000.000	176.6	H	15.0	-7.0	18.4	53.9
1932.600000	38.1	1000.0	1000.000	409.3	H	15.0	-1.4	15.8	53.9
3964.633333	32.3	1000.0	1000.000	151.6	V	131.0	5.9	21.6	53.9
4879.600000	48.0	1000.0	1000.000	152.6	V	99.0	7.1	5.9	53.9
7320.000000	47.3	1000.0	1000.000	266.3	H	54.0	11.1	6.6	53.9
17708.533333	46.1	1000.0	1000.000	124.7	V	20.0	25.6	7.8	53.9

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

2.6.16 Test Results Above 1GHz (Bluetooth LE High Channel to Model 3661)



Peak Data

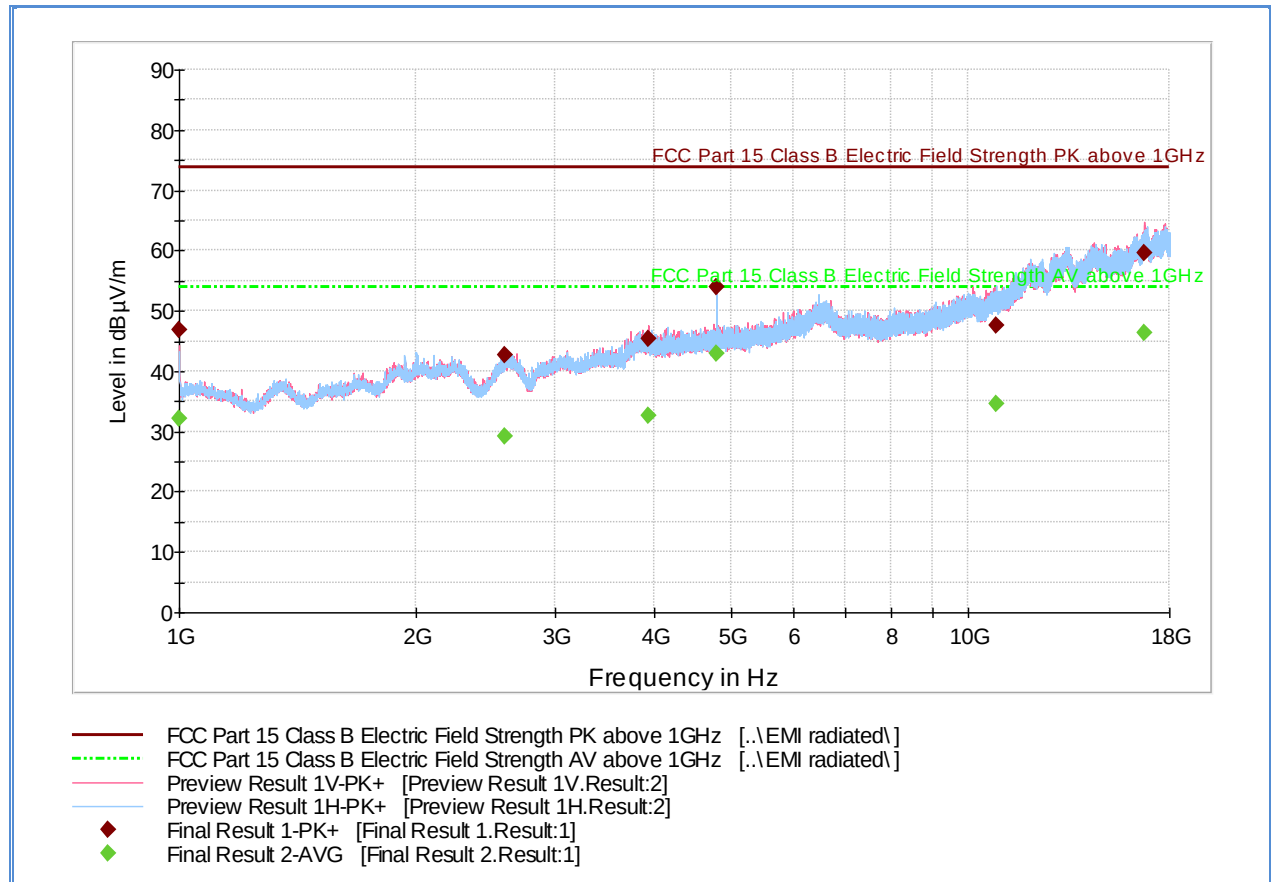
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	48.9	1000.0	1000.000	173.6	H	156.0	-7.0	25.0	73.9
1932.133333	50.9	1000.0	1000.000	409.3	H	307.0	-1.4	23.0	73.9
3820.700000	45.4	1000.0	1000.000	409.3	H	16.0	6.0	28.5	73.9
4959.866667	53.6	1000.0	1000.000	102.7	H	39.0	7.4	20.3	73.9
11065.666667	48.9	1000.0	1000.000	409.3	H	89.0	16.7	25.0	73.9
16816.200000	60.2	1000.0	1000.000	180.6	V	311.0	25.6	13.7	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	36.1	1000.0	1000.000	173.6	H	156.0	-7.0	17.8	53.9
1932.133333	37.9	1000.0	1000.000	409.3	H	307.0	-1.4	16.0	53.9
3820.700000	32.8	1000.0	1000.000	409.3	H	16.0	6.0	21.1	53.9
4959.866667	45.1	1000.0	1000.000	102.7	H	39.0	7.4	8.8	53.9
11065.666667	36.0	1000.0	1000.000	409.3	H	89.0	16.7	17.9	53.9
16816.200000	46.3	1000.0	1000.000	180.6	V	311.0	25.6	7.6	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz are noise floor figures.

2.6.17 Test Results Above 1GHz (Bluetooth LE Low Channel to Model 3662)



Peak Data

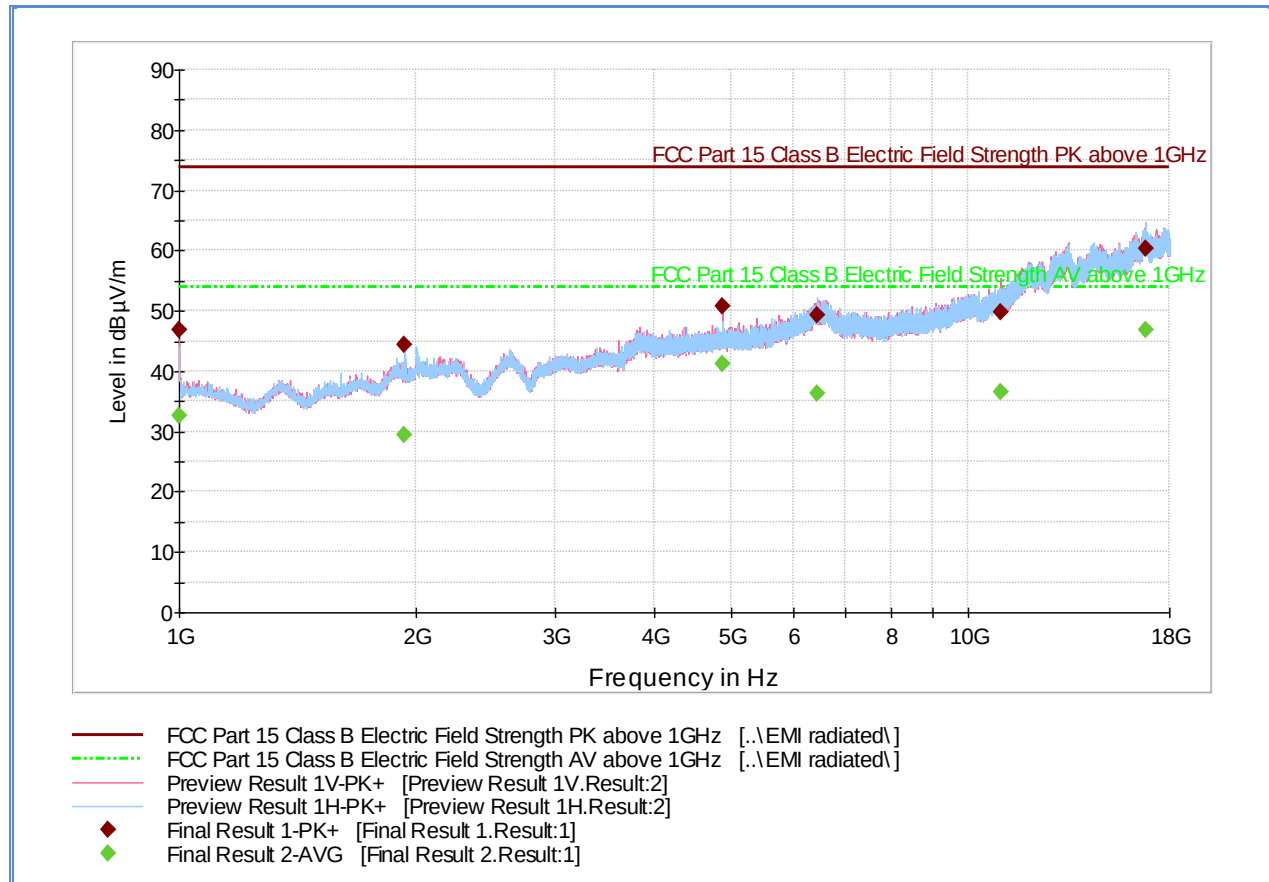
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.400000	46.8	1000.0	1000.000	173.6	V	72.0	-7.0	27.2	73.9
2591.766667	42.7	1000.0	1000.000	309.2	H	282.0	-0.2	31.2	73.9
3929.500000	45.4	1000.0	1000.000	406.7	V	265.0	6.0	28.5	73.9
4804.466667	54.0	1000.0	1000.000	152.6	V	309.0	6.8	19.9	73.9
10853.966667	47.5	1000.0	1000.000	401.1	H	138.0	16.6	26.4	73.9
16695.900000	59.6	1000.0	1000.000	378.1	V	86.0	25.7	14.3	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)
1000.400000	32.2	1000.0	1000.000	173.6	V	72.0	-7.0	21.7	53.9
2591.766667	29.3	1000.0	1000.000	309.2	H	282.0	-0.2	24.6	53.9
3929.500000	32.5	1000.0	1000.000	406.7	V	265.0	6.0	21.4	53.9
4804.466667	42.8	1000.0	1000.000	152.6	V	309.0	6.8	11.1	53.9
10853.966667	34.5	1000.0	1000.000	401.1	H	138.0	16.6	19.4	53.9
16695.900000	46.3	1000.0	1000.000	378.1	V	86.0	25.7	7.6	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz are noise floor figures.

2.6.18 Test Results Above 1GHz (Bluetooth LE Mid Channel to Model 3662)



Peak Data

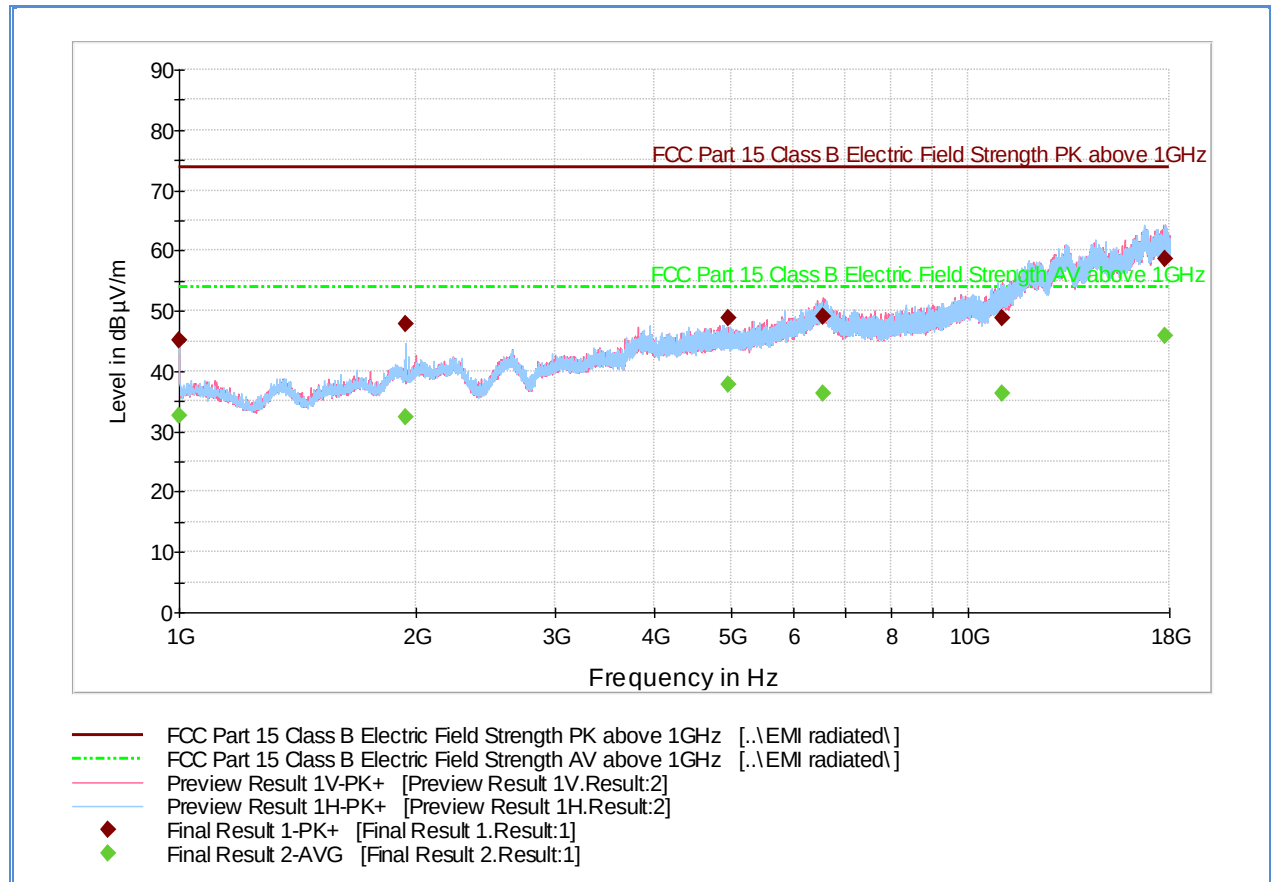
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1000.400000	46.7	1000.0	1000.000	234.4	V	89.0	-7.0	27.2	73.9
1932.566667	44.3	1000.0	1000.000	410.0	H	290.0	-1.4	29.6	73.9
4879.966667	50.7	1000.0	1000.000	148.7	V	313.0	7.1	23.2	73.9
6442.500000	49.4	1000.0	1000.000	226.4	H	290.0	12.7	24.5	73.9
10999.233333	49.8	1000.0	1000.000	202.5	V	355.0	17.1	24.1	73.9
16771.866667	60.4	1000.0	1000.000	321.1	H	181.0	25.9	13.5	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)
1000.400000	32.5	1000.0	1000.000	234.4	V	89.0	-7.0	21.4	53.9
1932.566667	29.3	1000.0	1000.000	410.0	H	290.0	-1.4	24.6	53.9
4879.966667	41.2	1000.0	1000.000	148.7	V	313.0	7.1	12.7	53.9
6442.500000	36.2	1000.0	1000.000	226.4	H	290.0	12.7	17.7	53.9
10999.233333	36.6	1000.0	1000.000	202.5	V	355.0	17.1	17.3	53.9
16771.866667	46.8	1000.0	1000.000	321.1	H	181.0	25.9	7.1	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz are noise floor figures.

2.6.19 Test Results Above 1GHz (Bluetooth LE High Channel to Model 3662)



Peak Data

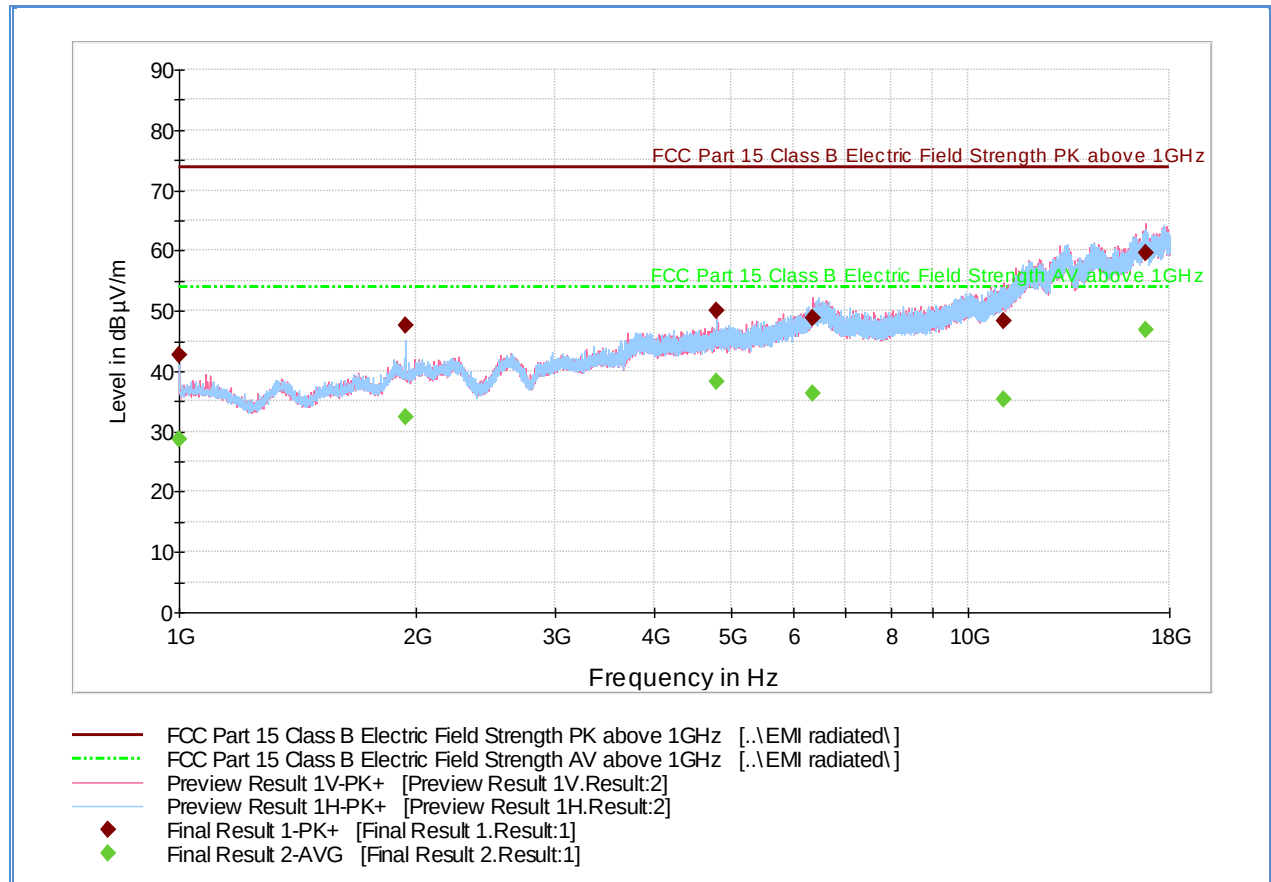
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1000.000000	45.2	1000.0	1000.000	100.0	H	31.0	-7.0	28.7	73.9
1937.466667	47.8	1000.0	1000.000	410.0	H	-3.0	-1.4	26.1	73.9
4959.866667	48.7	1000.0	1000.000	153.0	V	301.0	7.4	25.2	73.9
6535.566667	49.2	1000.0	1000.000	152.0	V	99.0	12.8	24.7	73.9
11061.700000	48.9	1000.0	1000.000	400.0	V	330.0	16.7	25.0	73.9
17771.200000	58.6	1000.0	1000.000	406.9	V	171.0	25.8	15.3	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)
1000.000000	32.7	1000.0	1000.000	100.0	H	31.0	-7.0	21.2	53.9
1937.466667	32.3	1000.0	1000.000	410.0	H	-3.0	-1.4	21.6	53.9
4959.866667	37.9	1000.0	1000.000	153.0	V	301.0	7.4	16.0	53.9
6535.566667	36.3	1000.0	1000.000	152.0	V	99.0	12.8	17.6	53.9
11061.700000	36.2	1000.0	1000.000	400.0	V	330.0	16.7	17.7	53.9
17771.200000	45.9	1000.0	1000.000	406.9	V	171.0	25.8	8.0	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz are noise floor figures.

2.6.20 Test Results Above 1GHz (Bluetooth LE Low Channel to Model 3663)



Peak Data

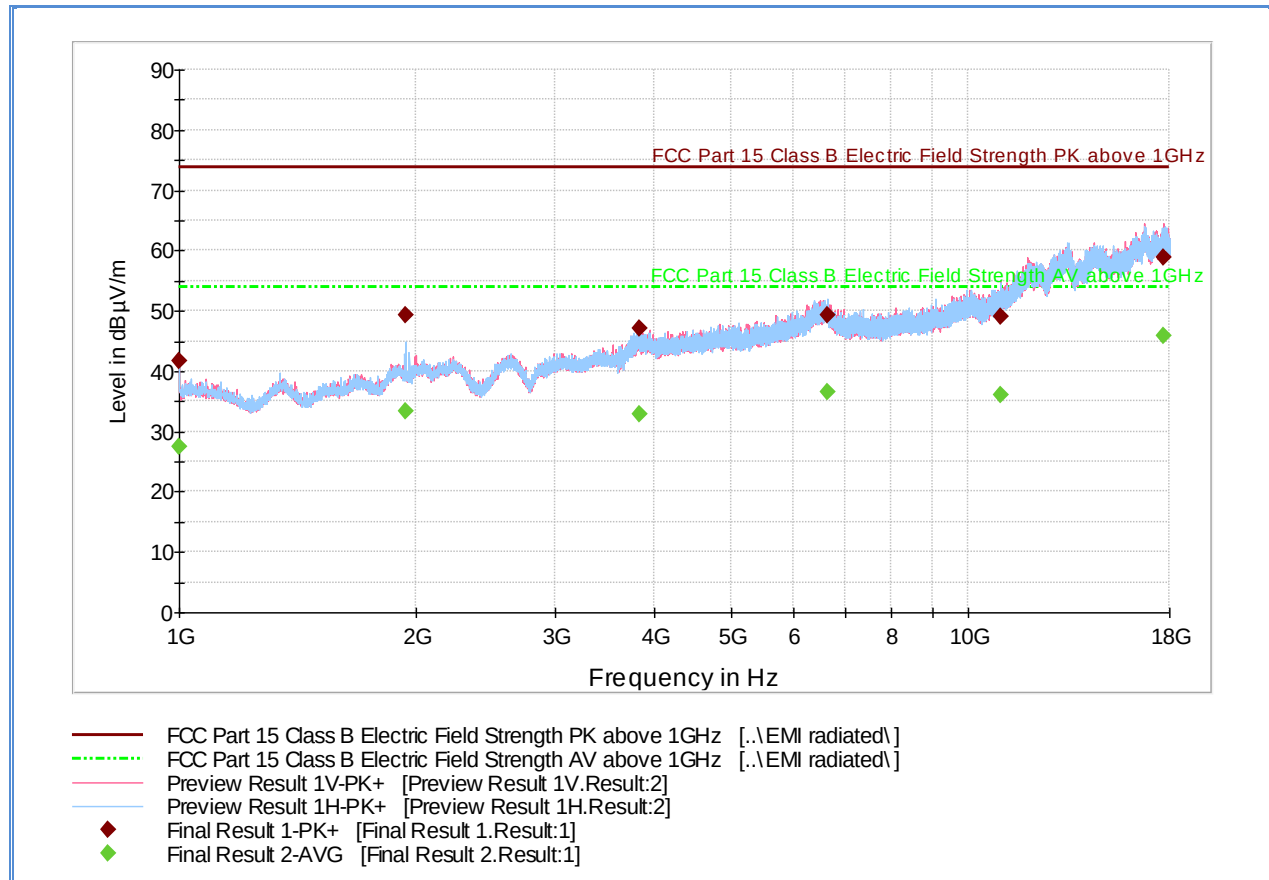
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.400000	42.6	1000.0	1000.000	100.0	H	-3.0	-7.0	31.3	73.9
1937.266667	47.6	1000.0	1000.000	391.0	H	263.0	-1.4	26.3	73.9
4803.866667	49.9	1000.0	1000.000	177.0	V	299.0	6.8	24.0	73.9
6366.000000	48.9	1000.0	1000.000	138.0	V	350.0	12.6	25.0	73.9
11112.600000	48.3	1000.0	1000.000	206.0	V	16.0	16.5	25.6	73.9
16800.166667	59.6	1000.0	1000.000	324.0	V	135.0	25.9	14.3	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)
1000.400000	28.7	1000.0	1000.000	100.0	H	-3.0	-7.0	25.2	53.9
1937.266667	32.3	1000.0	1000.000	391.0	H	263.0	-1.4	21.6	53.9
4803.866667	38.2	1000.0	1000.000	177.0	V	299.0	6.8	15.7	53.9
6366.000000	36.3	1000.0	1000.000	138.0	V	350.0	12.6	17.6	53.9
11112.600000	35.3	1000.0	1000.000	206.0	V	16.0	16.5	18.6	53.9
16800.166667	46.7	1000.0	1000.000	324.0	V	135.0	25.9	7.2	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz are noise floor figures.

2.6.21 Test Results Above 1GHz (Bluetooth LE Mid Channel to Model 3663)



Peak Data

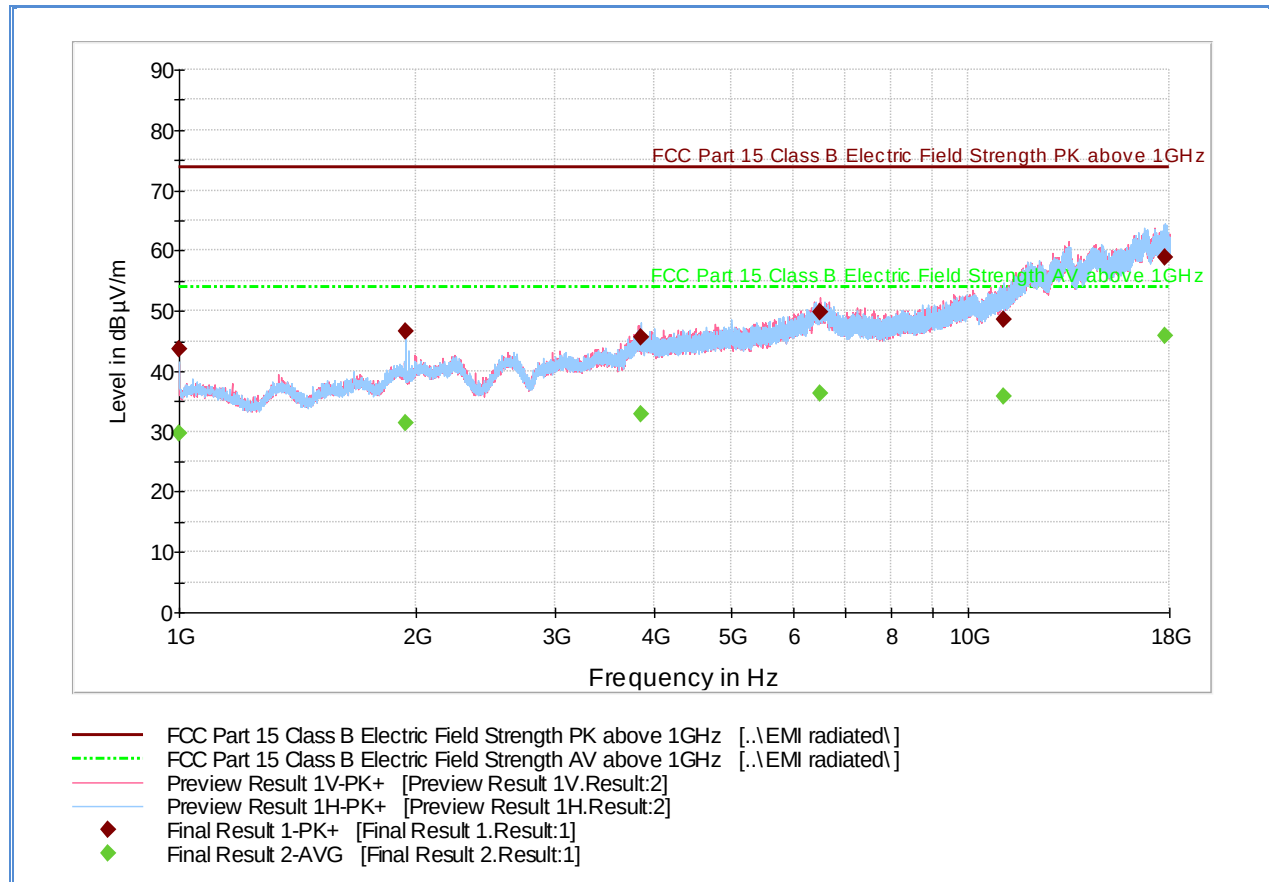
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.400000	41.6	1000.0	1000.000	220.0	H	4.0	-7.0	32.3	73.9
1937.500000	49.4	1000.0	1000.000	391.0	H	353.0	-1.4	24.5	73.9
3836.733333	47.0	1000.0	1000.000	300.0	H	356.0	6.1	26.9	73.9
6633.800000	49.3	1000.0	1000.000	258.0	H	247.0	12.6	24.6	73.9
11018.100000	49.1	1000.0	1000.000	338.0	V	87.0	17.0	24.8	73.9
17708.000000	58.9	1000.0	1000.000	100.0	V	336.0	25.6	15.0	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	27.6	1000.0	1000.000	220.0	H	4.0	-7.0	26.3	53.9
1937.500000	33.3	1000.0	1000.000	391.0	H	353.0	-1.4	20.6	53.9
3836.733333	32.9	1000.0	1000.000	300.0	H	356.0	6.1	21.0	53.9
6633.800000	36.7	1000.0	1000.000	258.0	H	247.0	12.6	17.2	53.9
11018.100000	36.0	1000.0	1000.000	338.0	V	87.0	17.0	17.9	53.9
17708.000000	45.9	1000.0	1000.000	100.0	V	336.0	25.6	8.0	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz are noise floor figures.

2.6.22 Test Results Above 1GHz (Bluetooth LE High Channel to Model 3663)



Peak Data

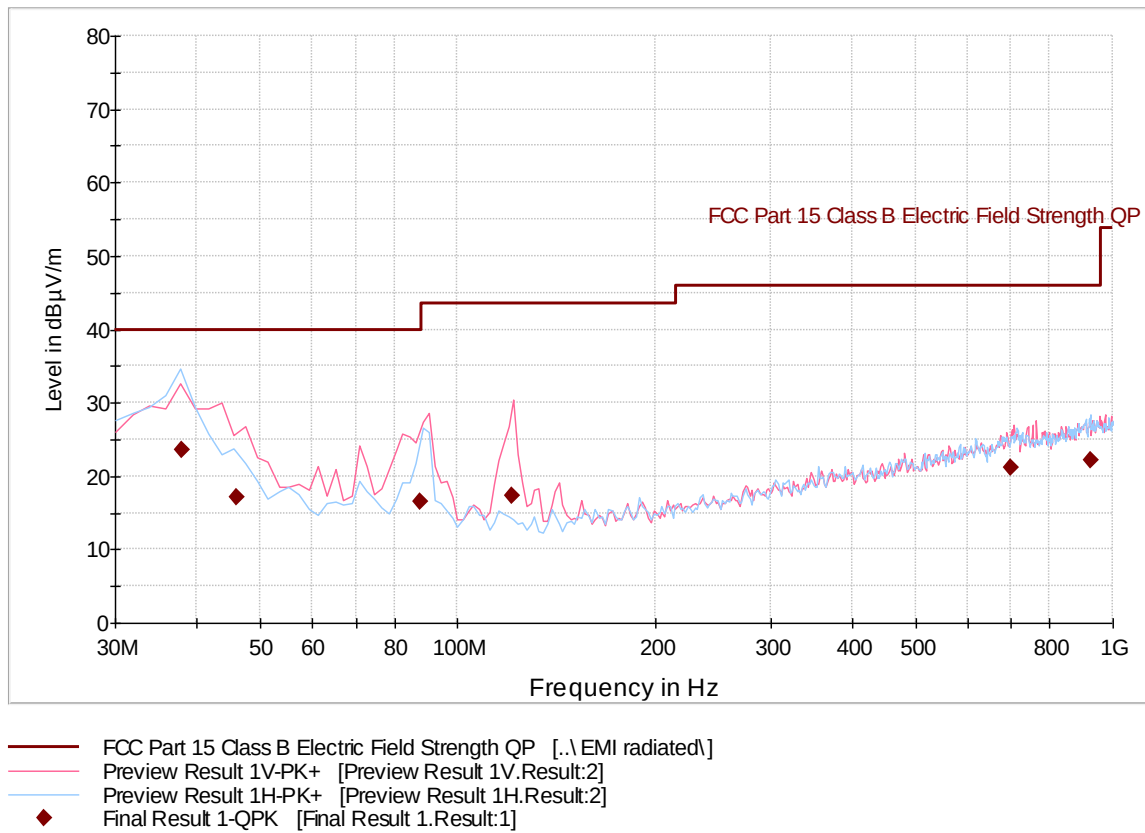
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	43.5	1000.0	1000.000	100.0	H	219.0	-7.0	30.4	73.9
1937.466667	46.6	1000.0	1000.000	377.0	H	269.0	-1.4	27.3	73.9
3843.333333	45.7	1000.0	1000.000	371.0	H	291.0	6.0	28.2	73.9
6499.300000	49.7	1000.0	1000.000	400.0	V	213.0	12.7	24.2	73.9
11112.400000	48.6	1000.0	1000.000	200.0	H	309.0	16.5	25.3	73.9
17747.966667	58.9	1000.0	1000.000	391.0	H	50.0	25.8	15.0	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)
1000.000000	29.8	1000.0	1000.000	100.0	H	219.0	-7.0	24.1	53.9
1937.466667	31.4	1000.0	1000.000	377.0	H	269.0	-1.4	22.5	53.9
3843.333333	32.7	1000.0	1000.000	371.0	H	291.0	6.0	21.2	53.9
6499.300000	36.4	1000.0	1000.000	400.0	V	213.0	12.7	17.5	53.9
11112.400000	35.8	1000.0	1000.000	200.0	H	309.0	16.5	18.1	53.9
17747.966667	45.9	1000.0	1000.000	391.0	H	50.0	25.8	8.0	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz are noise floor figures.

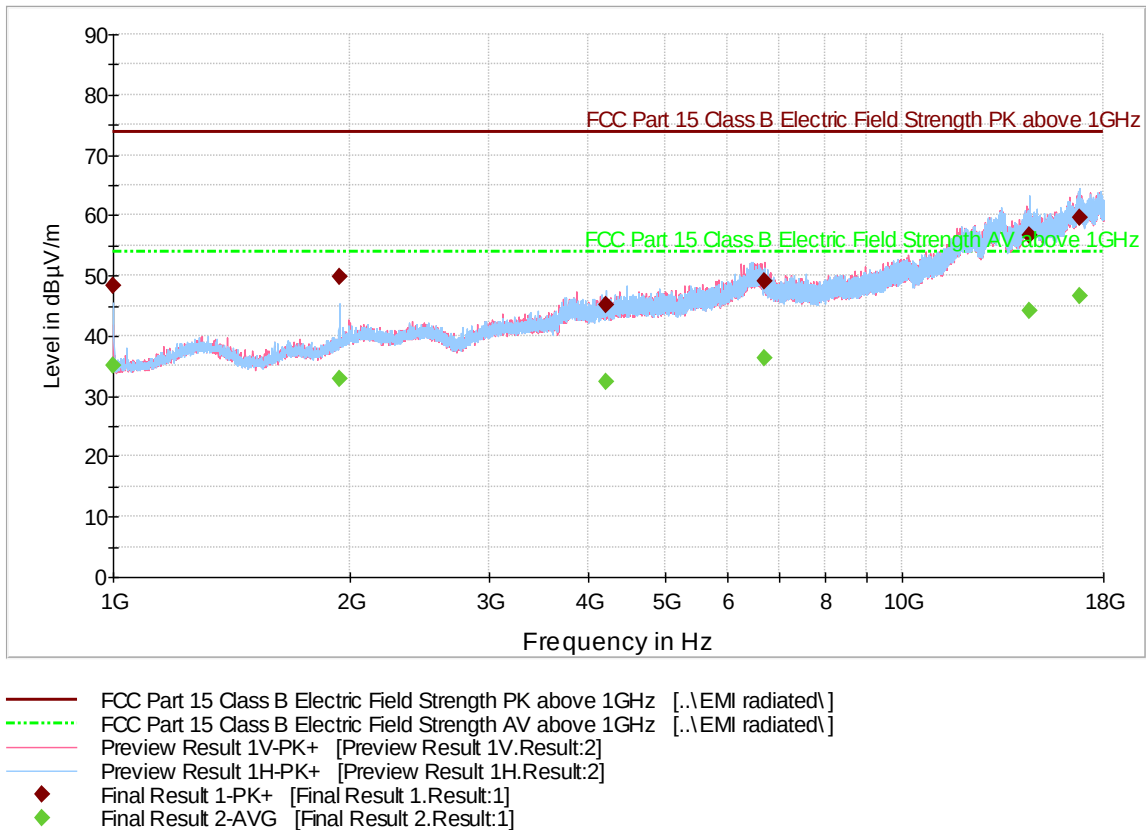
2.6.23 Test Results Below 1GHz (Receive Mode)



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)
37.975551	23.6	1000.0	120.000	356.0	H	15.0	-14.8	16.4	40.0
45.847214	17.2	1000.0	120.000	153.0	V	285.0	-17.6	22.8	40.0
87.580521	16.4	1000.0	120.000	103.0	V	1.0	-20.3	23.6	40.0
121.122725	17.4	1000.0	120.000	103.0	V	-12.0	-19.5	26.1	43.5
699.761283	21.1	1000.0	120.000	233.0	V	313.0	-0.6	24.9	46.0
922.548377	22.2	1000.0	120.000	250.0	H	354.0	2.2	23.8	46.0

2.6.24 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	48.3	1000.0	1000.000	100.0	H	174.0	-7.0	25.6	73.9
1937.666667	49.9	1000.0	1000.000	410.0	H	105.0	-1.4	24.0	73.9
4221.900000	45.2	1000.0	1000.000	257.0	H	215.0	6.2	28.7	73.9
6679.933333	49.0	1000.0	1000.000	384.0	V	50.0	12.3	24.9	73.9
14524.766666	56.7	1000.0	1000.000	124.0	H	188.0	23.0	17.2	73.9
16814.566666	59.5	1000.0	1000.000	191.0	H	328.0	25.6	14.4	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	35.1	1000.0	1000.000	100.0	H	174.0	-7.0	18.8	53.9
1937.666667	32.9	1000.0	1000.000	410.0	H	105.0	-1.4	21.0	53.9
4221.900000	32.4	1000.0	1000.000	257.0	H	215.0	6.2	21.5	53.9
6679.933333	36.2	1000.0	1000.000	384.0	V	50.0	12.3	17.7	53.9
14524.766666	44.1	1000.0	1000.000	124.0	H	188.0	23.0	9.8	53.9
16814.566666	46.6	1000.0	1000.000	191.0	H	328.0	25.6	7.3	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: XJ1051/ Test Configuration B

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

October 20, 2014 / 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	24.1°C
Relative Humidity	55.6%
ATM Pressure	99.0 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.
- Only worst-case model presented.



- 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.

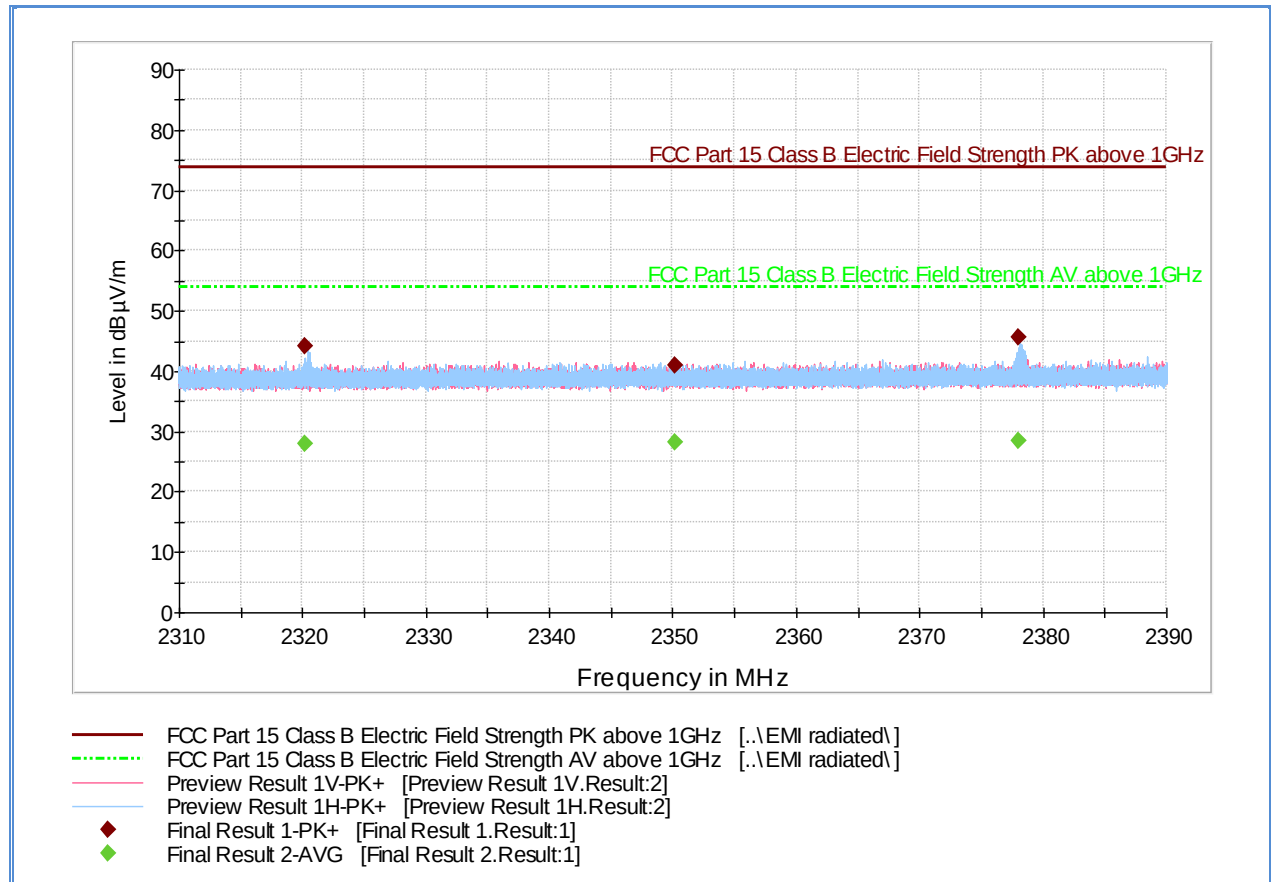
2.7.8 Sample Computation (Radiated Emission)

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 (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

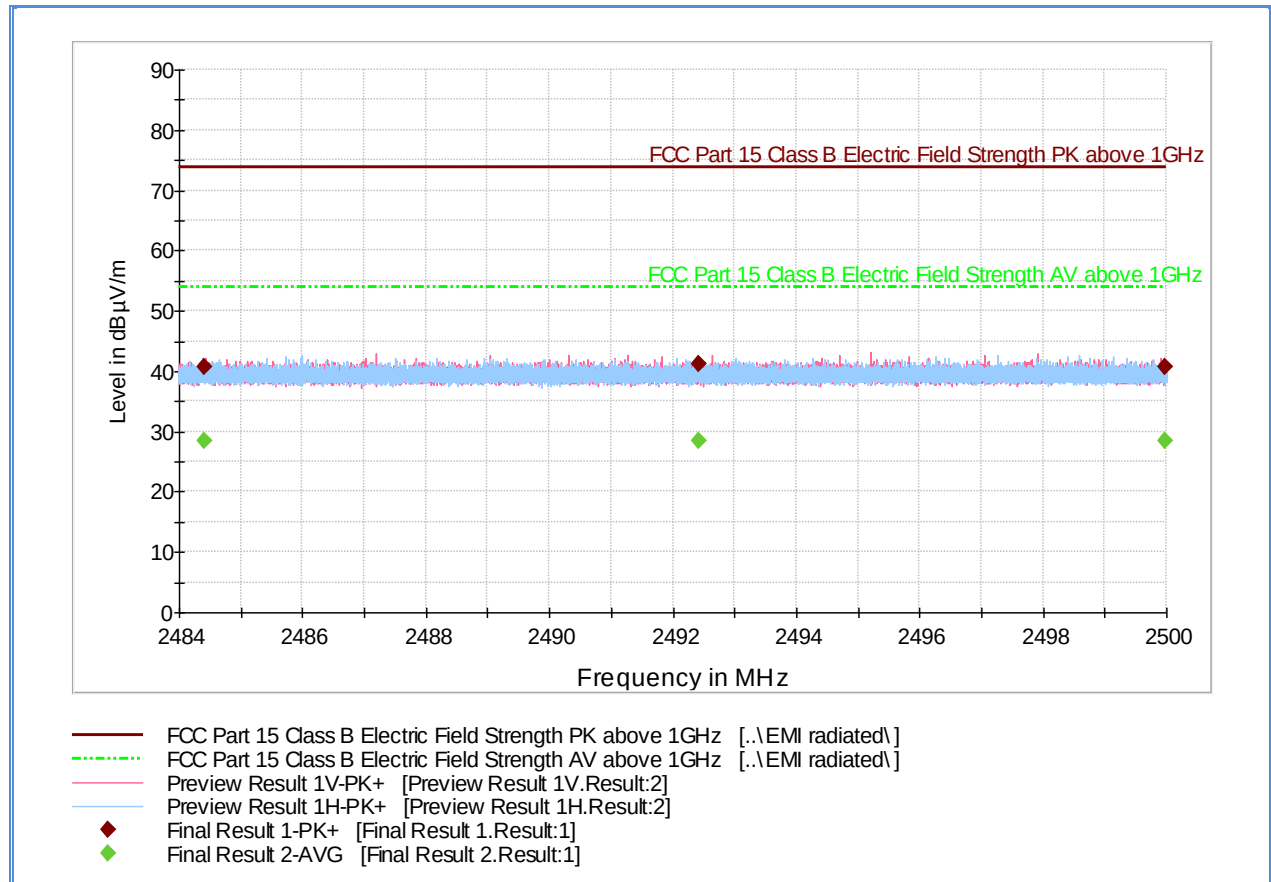
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2320.240000	44.1	1000.0	1000.000	100.1	H	-9.0	-0.5	29.8	73.9
2350.133333	40.9	1000.0	1000.000	200.0	V	303.0	-0.4	33.0	73.9
2377.976000	45.7	1000.0	1000.000	100.1	H	16.0	-0.3	28.2	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)
2320.240000	28.0	1000.0	1000.000	100.1	H	-9.0	-0.5	25.9	53.9
2350.133333	28.1	1000.0	1000.000	200.0	V	303.0	-0.4	25.8	53.9
2377.976000	28.3	1000.0	1000.000	100.1	H	16.0	-0.3	25.6	53.9

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

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)
2484.400000	40.7	1000.0	1000.000	245.0	V	280.0	0.2	33.2	73.9
2492.422400	41.3	1000.0	1000.000	200.0	V	244.0	0.2	32.6	73.9
2499.966933	40.8	1000.0	1000.000	224.0	V	64.0	0.2	33.1	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)
2484.400000	28.5	1000.0	1000.000	245.0	V	280.0	0.2	25.4	53.9
2492.422400	28.5	1000.0	1000.000	200.0	V	244.0	0.2	25.4	53.9
2499.966933	28.5	1000.0	1000.000	224.0	V	64.0	0.2	25.4	53.9

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



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: XH4444 / Test Configuration A

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

September 23, 2014 / 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	25.0°C
Relative Humidity	51.4%
ATM Pressure	99.0 kPa

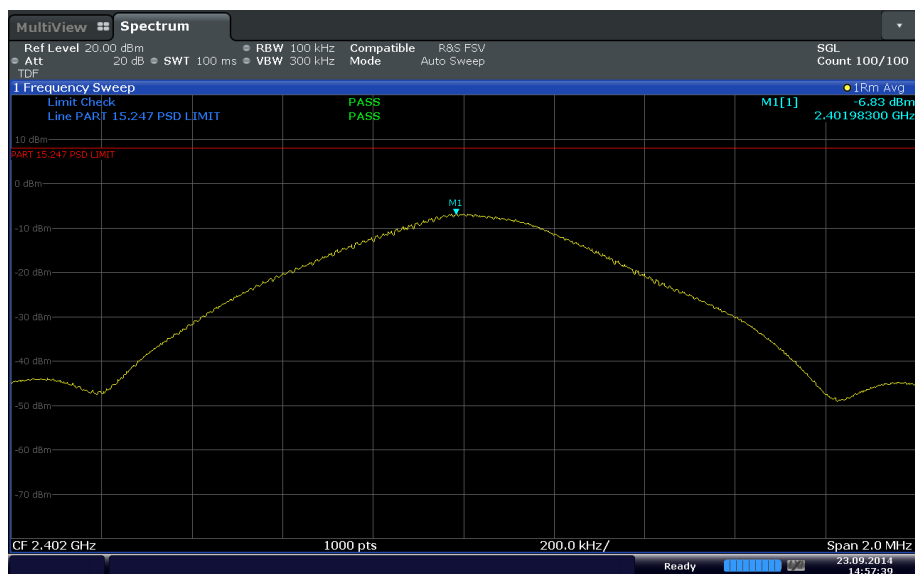
2.8.7 Additional Observations

- This is a conducted test.
- Test procedure is per Section 10.3 of KDB 558074 (April 09, 2013).
- An offset of 21.4dB 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.

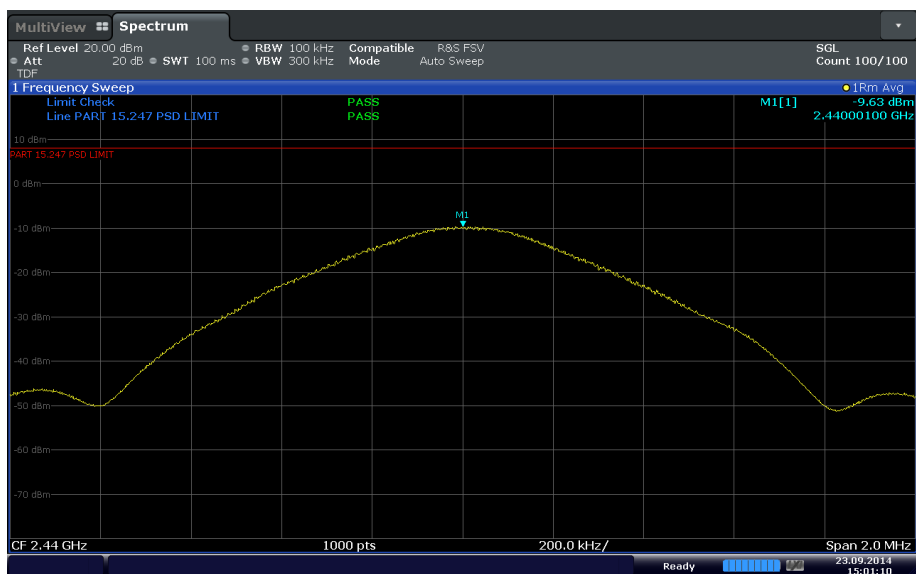
2.8.8 Test Results Summary

Mode	Channel	Marker Reading using 100 kHz RBW (dBm)	PSD Limit (dBm)	Margin (dB)	Compliance
Bluetooth LE	00 (2402 MHz)	-6.83	8	14.83	Complies
	19 (2440 MHz)	-9.63	8	17.63	Complies
	39 (2480 MHz)	-11.80	8	19.80	Complies

2.8.9 Test Results Plots

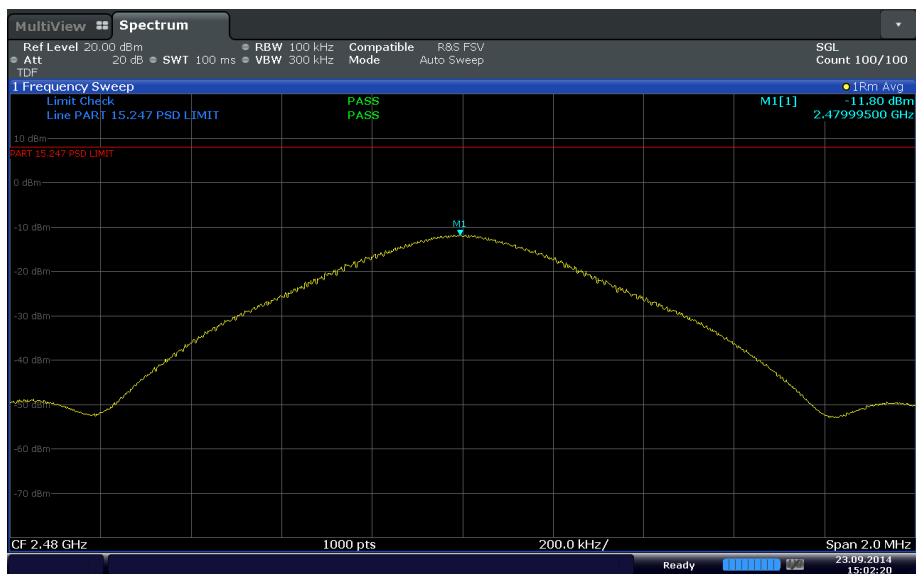


Bluetooth LE Low Channel



Date: 23.SEP.2014 15:01:11

Bluetooth LE Mid Channel



Date: 23.SEP.2014 15:02:20

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	04/22/14	04/22/15
7570	50MHz-18GHz Wideband Power Sensor	N1921A	MY45240588	Agilent	04/09/14	04/09/15
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	11/19/13	11/19/14
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	01/20/14	01/20/15
-	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 1003 and 7582	
Radiated Test Setup						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/30/14	01/30/16
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	04/08/14	04/08/15
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	04/03/14	04/03/15
1150	Horn antenna	3160-09	012054-004	ETS	04/26/13	04/26/15
1151	Pre-amplifier	TS-PR26	100026	Rhode & Schwarz	05/02/13	05/02/15
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	08/29/14	08/29/15
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/17/14	03/17/15
8816	2.4GHz Band Notch Filter	BRM50702	133	Micro-Tronics	Verified by 1189 and 7582	
1016	Pre-amplifier	PAM-0202	187	PAM	05/05/14	05/05/15
Miscellaneous						
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/12/14	08/12/14
7560	Barometer/Temperature /Humidity Transmitter	iBTHX-W	1240476	Omega	01/30/14	01/30/15
1123	DC Power Supply	E3631A	N/A	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

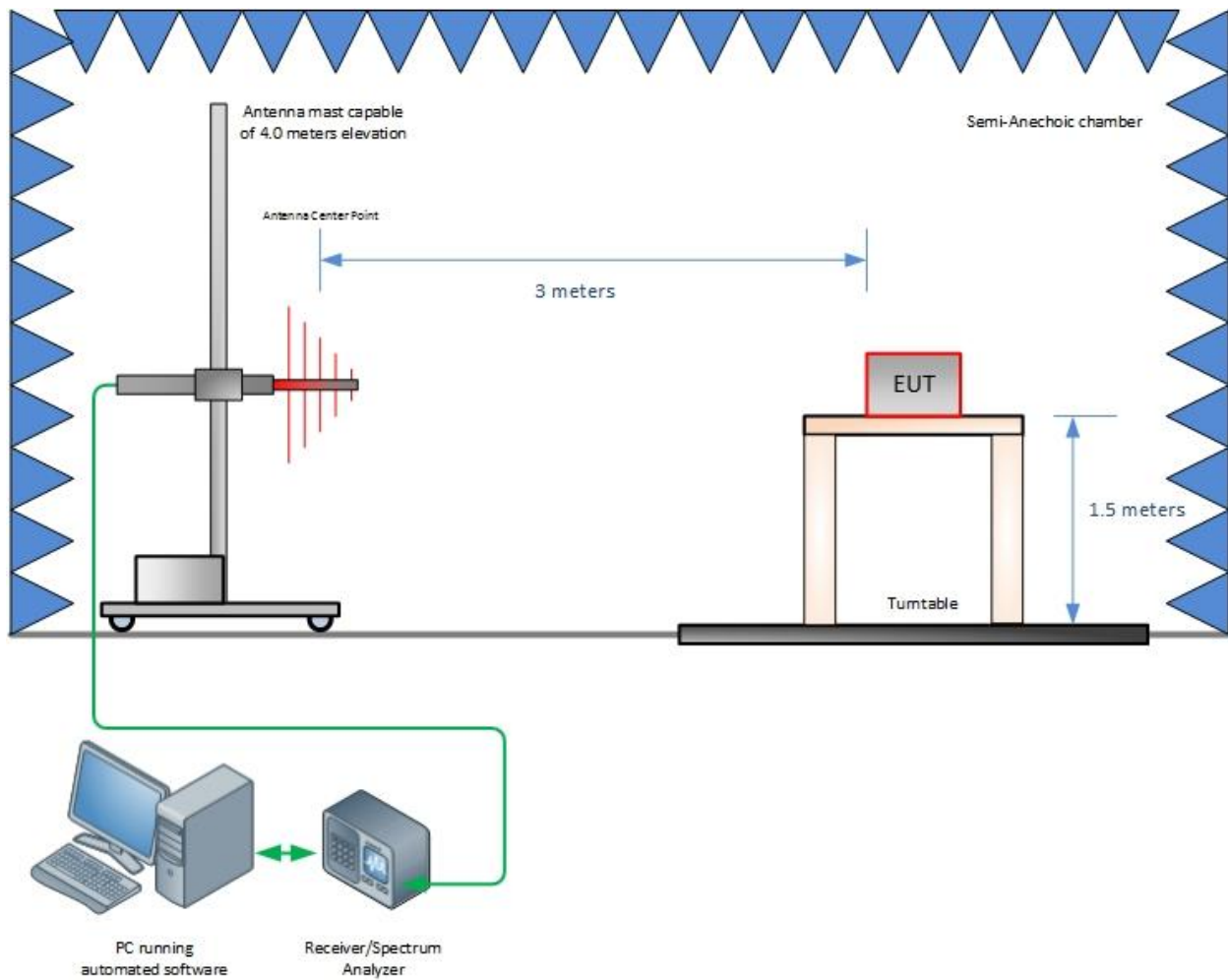
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.50	0.29	0.08
3	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					0.72
Coverage Factor (k):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



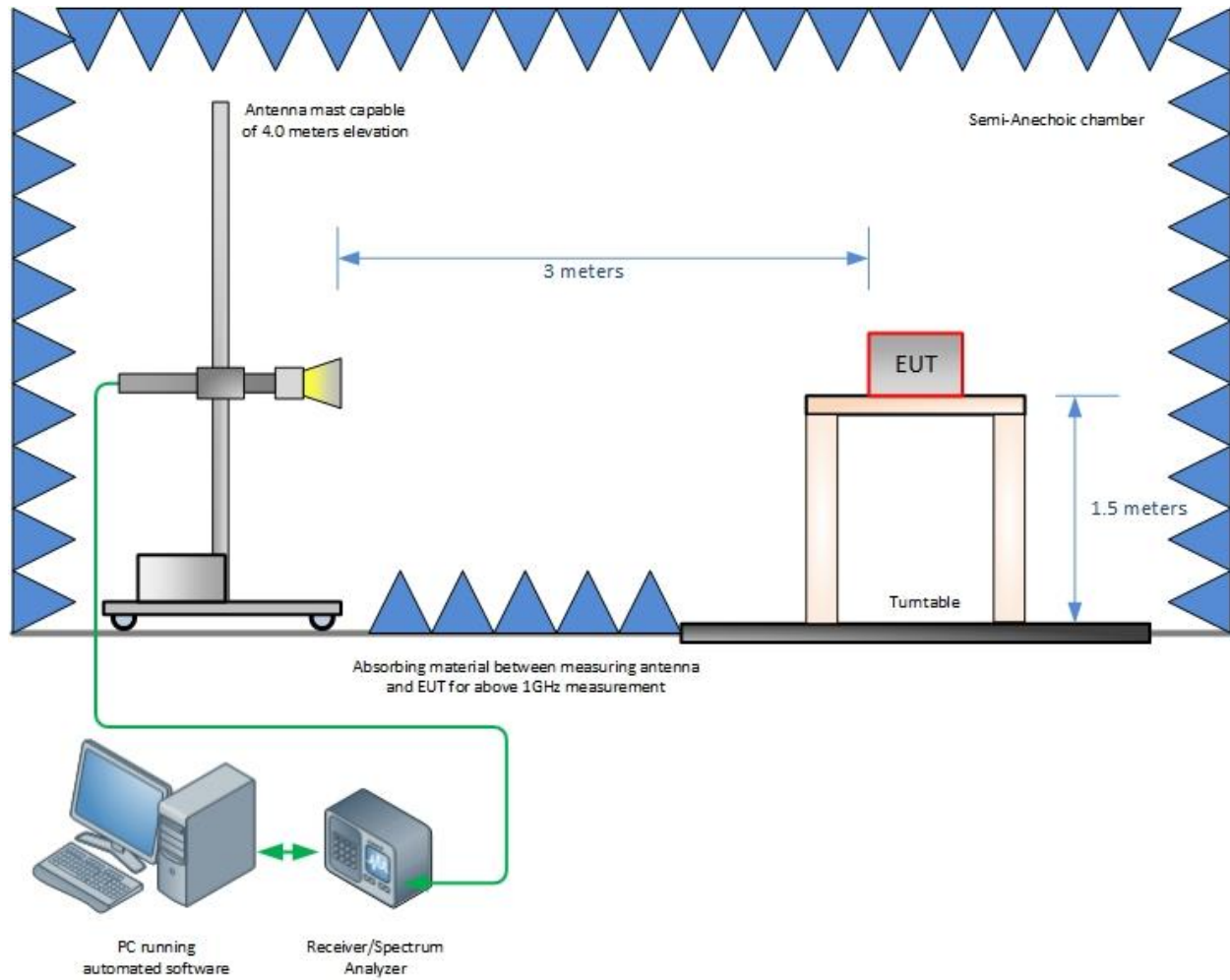
SECTION 4

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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