Report On

Application for Grant of Equipment Authorization of the
Nextivity Inc.
Cel-Fi Quatra Cellphone Signal Booster

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

Report No.SD72113545-0216B **June 2016**

REPORT ON	Radio Testing of the Nextivity Inc. Cel-Fi Quatra Cellphone Signal Booster
TEST REPORT NUMBER	SD72113545-0216B
PREPARED FOR	Nextivity Inc. 12230 World Trade Drive, Suite 250 San Diego, CA 92128
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PREPARED BY	Xiaoying Zhang **Name** Authorized Signatory Title: EMC/Wireless Test Engineer
APPROVED BY	Juan M. Gonzalez **Name** Authorized Signatory Title: Commercial Wireless EMC Lab Manager
DATED	June 21, 2016

Revision History

SD72113545-0216B Nextivity Inc. Cel-Fi Quatra Cellphone Signal Booster					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
06/21/2016	Initial Release				Juan M Gonzalez

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

SECTION 1

REPORT SUMMARY

Radio Testing of the
Nextivity Inc.
Cel-Fi Quatra Cellphone Signal Booster

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

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Nextivity Inc. Cel-Fi Quatra Cellphone Signal Booster to the requirements of the following:

- FCC Part 15 Subpart C §15.247
- 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	Nextivity Inc.
Model Name	Cel-Fi Quatra
Model Number(s)	NU: Q34-2/5/12/66NU CU: Q34-2/5/12/66CU
FCC ID	NU: YETQ34-251266NU CU: YETQ34-251266CU
FCC Classification	Low power Communications device Transmitter (DTS)
IC Number	NU: 9298A-Q34251266NU CU: 9298A-Q34251266CU
Serial Number(s)	258602000335 (NU) and 25955100346 (CU)
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.247 (October 1, 2015). • 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).
Start of Test	April 05, 2016
Finish of Test	April 18, 2016
Name of Engineer(s)	Xiaoying Zhang
Related Document(s)	• KDB 558074 D01 (DTS Meas Guidance v03r04, January 07, 2016). Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247. • 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 and RSS-247 Issue 1 May 2015 with cross-reference to the corresponding IC RSS standard is shown below.

Section	§15.247 Spec Clause	RSS-247/RSS-Gen Clauses	Test Description	Result	Comments/ Base Standard
2.1	§15.247(b)(3)	RSS-247 5.4(4)	Peak Output Power	Compliant	
2.2	§15.207(a)	RSS-Gen 8.8	Conducted Emissions	Compliant	
2.3	-	RSS-Gen 6.6	99% Emission Bandwidth	Compliant	
2.4	§15.247(a)(2)	RSS-247 5.2(1)	Minimum 6 dB RF Bandwidth	Compliant	
2.5	§15.247(d)	RSS-247 5.5	Out-of-Band Emissions - Conducted	Compliant	
2.6	§15.247(d) §15.205	RSS-247 5.5	Band-edge Compliance of RF Conducted Emissions	Compliant	
2.7	§15.247(d)	RSS-247 5.5	Radiated Spurious Emissions	Compliant	
2.8	§15.247(e)	RSS-247 5.2(2)	Power Spectral Density for Digitally Modulated Device	Compliant	

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1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Nextivity Inc. Cel-Fi Quatra Cellphone Signal Booster. The EUT is a WCDMA/LTE Signal Booster to improve voice and data cellular performance in large enterprise environments. The EUT consists of two separate units: the Network Unit (NU) and the Coverage Unit (CU). The NU comprises a transmitter and receiver which communicate with the cell tower and the CU. Users place the NU in an area with the strongest signal from the carrier network. The CU is then placed in the center of the home or office, or in the area where the best signal quality is best needed. The NU and CU are placed at varying distances apart and are communicated via Ethernet cables. Both NU and CU also includes Bluetooth LE connectivity. They are using the same Bluetooth module and antenna. BT Low Energy function of the EUT was verified in this test report. All the conducted testing are performed on NU, and for Radiated Spurious Emissions, both NU and CU are tested.

1.3.2 EUT General Description

EUT Description	Cellphone Signal Booster
Model Name	Cel-Fi Quatra
Model Number(s)	NU: Q34-2/5/12/66NU CU: Q34-2/5/12/66CU
Rated Voltage	UN: 54V DC via external AC/DC adapter CU: 54V DC via POE
Mode Verified	BT LE
Capability	WCDMA (Band 2 and 5), LTE (Band 12 and 4) and BT LE
Primary Unit (EUT)	☐ Production ☒ Pre-Production ☐ Engineering
Manufacturer Declared Temperature Range	0°C to 40°C
Antenna Type	PCB Monopole
Manufacturer	Nextivity Inc.
Antenna Model	N/A
Antenna Gain	0dBi

1.3.3 Maximum Conducted Output Power

Bluetooth Low Energy (LE)	Frequency Range (MHz)	Avg Output Power (dBm)	Avg Output Power (mW)	Peak Output Power (dBm)	Peak Output Power (mW)
	2402-2480	8.68	7.38	9.31	8.53

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	The EUT is connected to a support laptop running Nextivity Conformance Test Software. Test configuration files can be uploaded to the EUT using this application. The manufacturer provided test files to make the EUT work in Transmit mode covering Low, Mid and High channels. For Antenna Conducted Port tests, the manufacturer provided a temporary antenna port disconnecting the integral antenna inside the EUT when used.

1.4.2 EUT Exercise Software

Manufacturer provided a configuration software (ConformanceTest.exe) running from a support laptop where both EUT are connected via USB.

1.4.3 Support Equipment and I/O cables

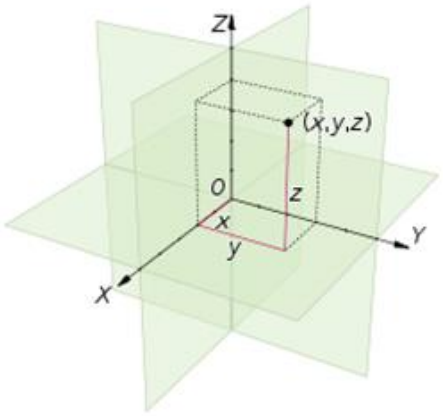
Manufacturer	Equipment/Cable	Description
Phihong	AC/DC Adapter (EUT)	M/N: PSA120u-540l6nt-r Rev 02 No. 026, IP: 100-240VAC, 1.6A, 50-60Hz OP: 54VDC, 2.22A
Netgear	Network patch Cable (1x NU to CU)	4.0m, unshielded, Cat5e 24AWG UTP
-	Support USB cable	1.75 meters, shielded Type A to Micro B connector
-	Support USB cable	Custom 1.0 meter shielded USB Type A to Type B for the Shielded Test Enclosure
Lenovo	Support Laptop	M/N 2912-3vu S/N R9-92MH0 10/11
Lenovo	Support Laptop AC Adapter	M/N 42T4430 S/N 11S42T4430Z1ZGWE27AA9X
Ramsey	Support Shielded Test Enclosure	With custom USB cable

1.4.4 Worst Case Configuration

Worst-case configuration used in this test report as per Radiated Spurious Emission:

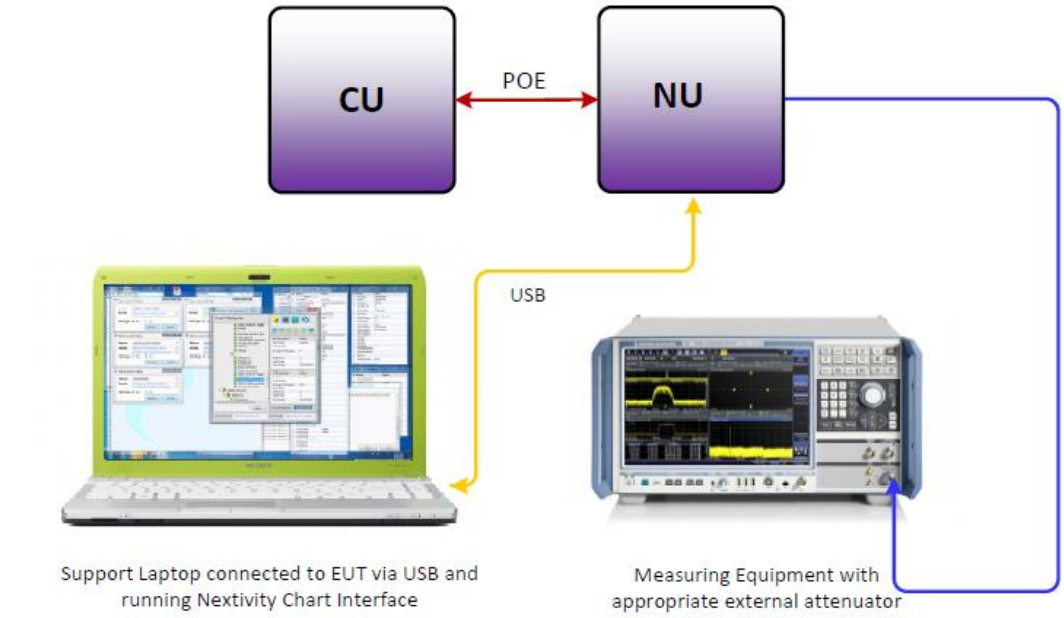
Mode	Channel	Data Rate
Bluetooth LE	17 (Middle Channel)	1Mbps

EUT is a mobile device. Final installation position is unknown at the time of verification. For radiated measurements X, Y and Z orientations of NU and CU were verified. No major variation in emissions observed between the three (3) orientations. Verifications performed using "Z" configuration for both NU and CU.

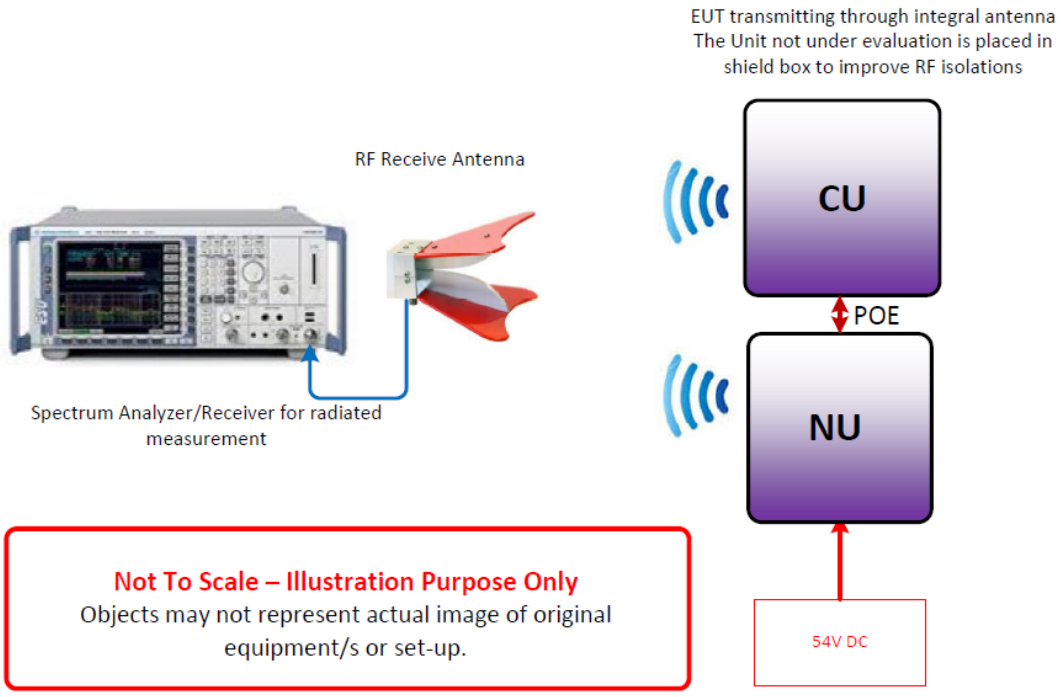


1.4.5 Simplified Test Configuration Diagram

Antenna Conducted Port Test Configuration



Radiated Test Configuration



1.5 DEVIATIONS FROM THE STANDARD

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

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number: 258602000335 (NU), 25955100346 (CU)		
N/A		

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

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
For conducted and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. 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)

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

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

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SECTION 2

TEST DETAILS

Radio Testing of the
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2.1 PEAK OUTPUT POWER

2.1.1 Specification Reference

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

2.1.2 Standard Applicable

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands, the maximum peak conducted output shall not exceed 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: 258602000335 (NU) / Default Test Configuration

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

April 05, 2016/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

Ambient Temperature	26.1°C
Relative Humidity	35.2%
ATM Pressure	99.4 kPa

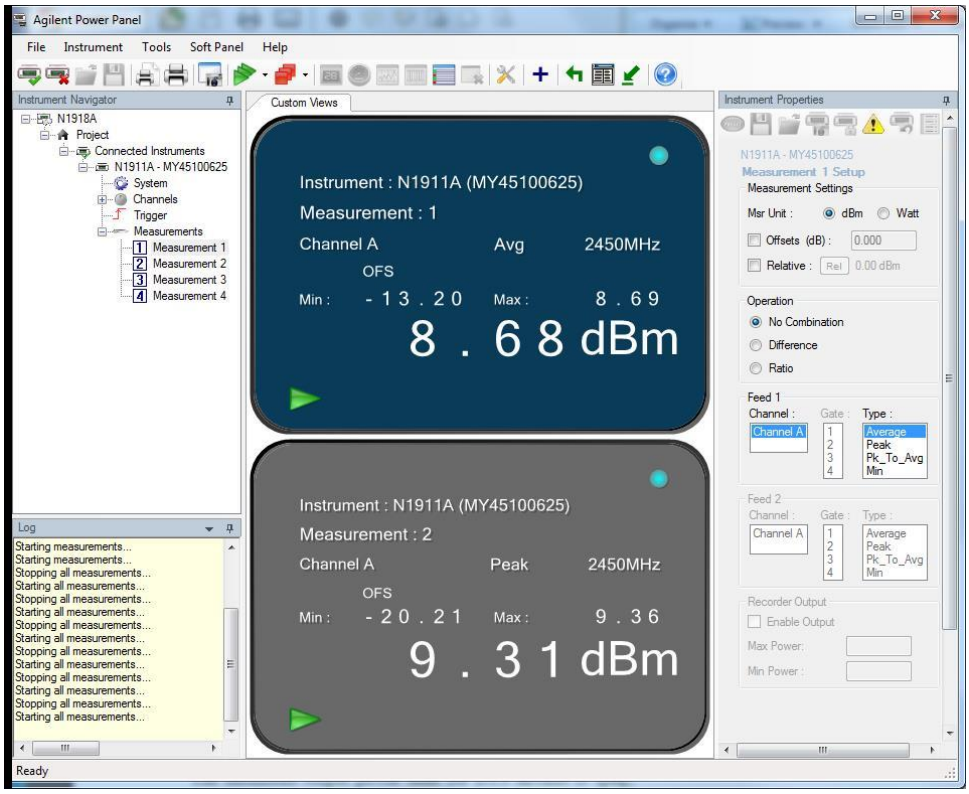
2.1.7 Additional Observations

- This is a conducted test (Maximum conducted [average] output power) using direct connection to a power meter.
- The path loss was measured and entered as a level offset.
- Test methodology is per Clause 9.2.3.1 of KDB 558074 D01 (DTS Meas Guidance v03r04, January 07, 2016). All conditions under this Clause are satisfied.
- Both Peak and Average measurements were recorded.

2.1.8 Test Results

Bluetooth Low Energy (LE)	Channel	Modulation	Measured Average Power (dBm)	Measured Peak Power (dBm)
	37 (2402 MHz)	GFSK @ 1Mbps	8.06	8.71
	17 (2440 MHz)		**8.68**	**9.31**
	39 (2480 MHz)		8.54	9.18

2.1.9 Sample Test Display



Bluetooth LE. Mid Channel 1Mbps

2.2 CONDUCTED EMISSIONS

2.2.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.207(a)
RSS-GEN, Clause 8.8

2.2.2 Standard Applicable

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

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

**Decreases with the logarithm of the frequency.*

2.2.3 Equipment Under Test and Modification State

Serial No: 258602000335 (NU) / Default Test Configuration

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

April 07, 2016/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

Ambient Temperature	24.4 °C
Relative Humidity	53.6.%
ATM Pressure	98.9 kPa

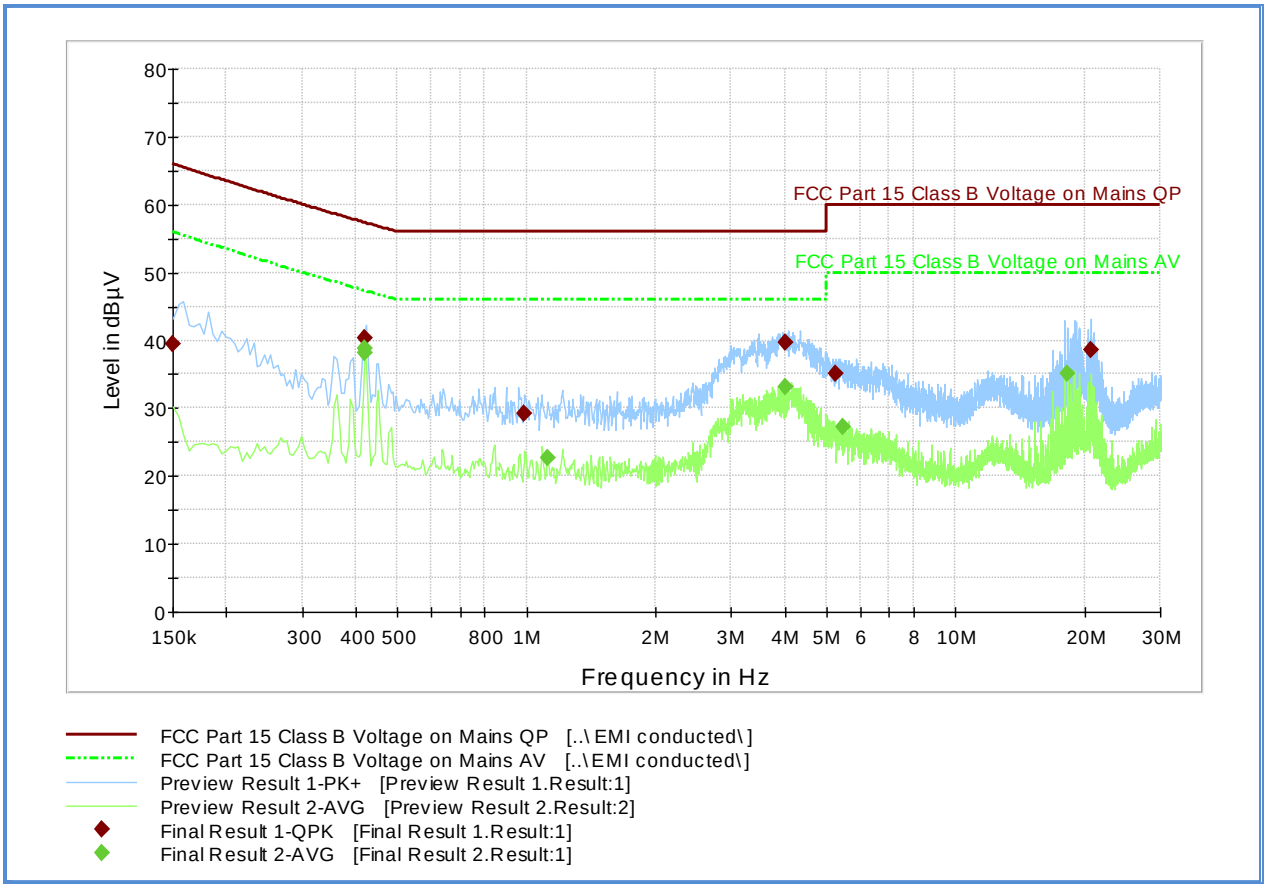
2.2.7 Additional Observations

- The EUT was verified using AC adapter supplied by the manufacturer.
- EUT verified using input voltage of 120VAC 60Hz.
- There are no significant variations in test results between each operating modes. Only the Middle channel operation mode is 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 2.2.8 for sample computation.

2.2.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (dbµV) @ 150kHz			5.5
Correction Factor (dB)	Asset# 8607 (20 dB attenuator)	19.9	20.7
	Asset# 1177 (cable)	0.15	
	Asset# 1176 (cable)	0.35	
	Asset# 7567 (LISN)	0.30	
Reported QuasiPeak Final Measurement (dbµV) @ 150kHz			**26.2**

2.2.9 Test Results - NU Conducted Emissions Line 1 – Hot



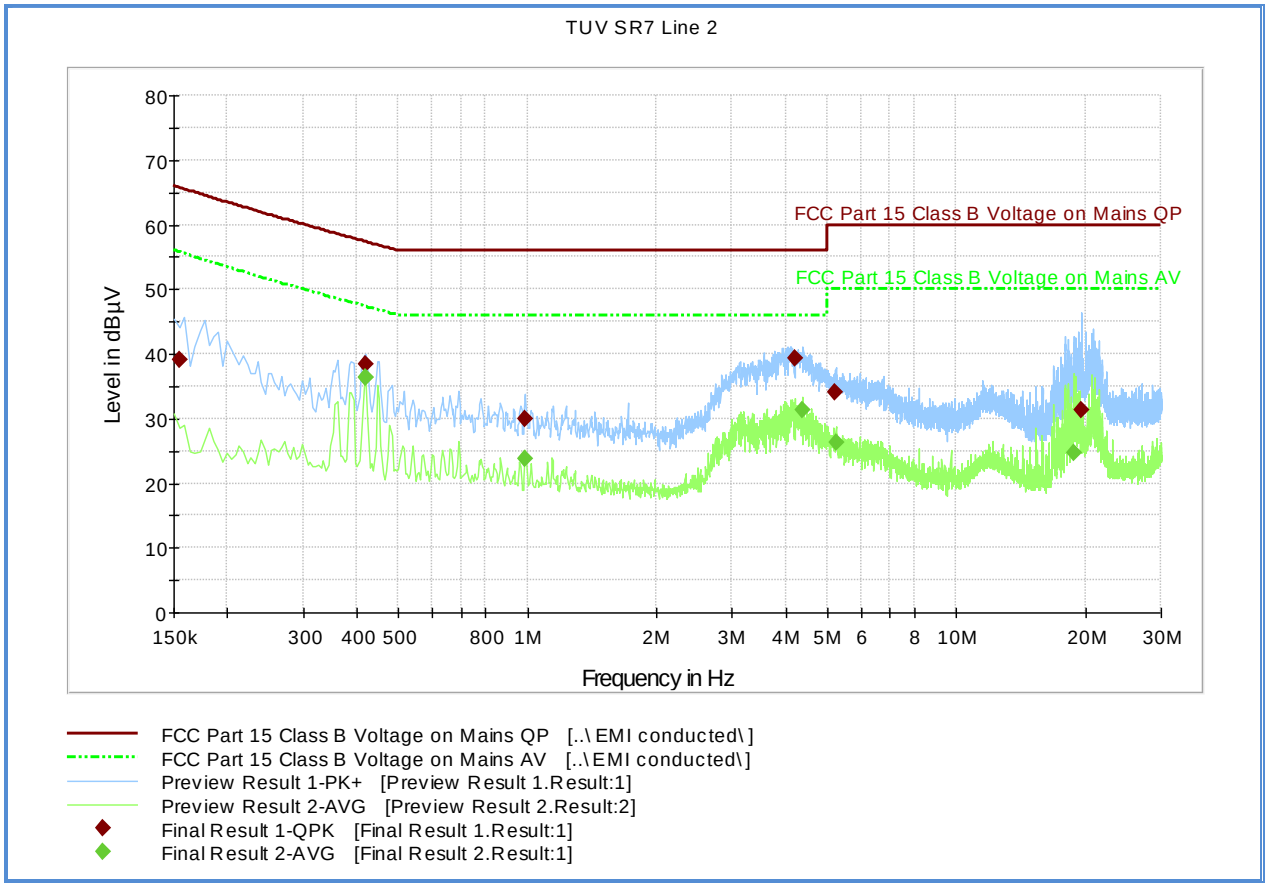
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150000	39.5	1000.0	9.000	Off	L1	20.2	26.5	66.0
0.420000	40.3	1000.0	9.000	Off	L1	20.0	17.1	57.3
0.991500	29.2	1000.0	9.000	Off	L1	20.0	26.8	56.0
4.015500	39.8	1000.0	9.000	Off	L1	20.1	16.2	56.0
5.253000	35.2	1000.0	9.000	Off	L1	20.1	24.8	60.0
20.665500	38.5	1000.0	9.000	Off	L1	20.4	21.5	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.420000	38.2	1000.0	9.000	Off	L1	20.0	9.1	47.3
0.420000	38.9	1000.0	9.000	Off	L1	20.0	8.5	47.3
1.117500	22.6	1000.0	9.000	Off	L1	20.0	23.4	46.0
4.011000	33.1	1000.0	9.000	Off	L1	20.1	13.0	46.0
5.460000	27.2	1000.0	9.000	Off	L1	20.1	22.8	50.0
18.195000	35.1	1000.0	9.000	Off	L1	20.4	14.9	50.0

2.2.10 Test Result - NU Conducted Emissions Line 2 – Neutral



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.154500	39.0	1000.0	9.000	Off	N	20.2	26.8	65.7
0.420000	38.5	1000.0	9.000	Off	N	20.0	18.8	57.3
0.987000	29.9	1000.0	9.000	Off	N	20.0	26.1	56.0
4.200000	39.2	1000.0	9.000	Off	N	20.1	16.8	56.0
5.212500	34.0	1000.0	9.000	Off	N	20.1	26.0	60.0
19.567500	31.2	1000.0	9.000	Off	N	20.4	28.8	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.420000	36.3	1000.0	9.000	Off	N	20.0	11.0	47.3
0.420000	36.4	1000.0	9.000	Off	N	20.0	10.9	47.3
0.991500	23.8	1000.0	9.000	Off	N	20.0	22.2	46.0
4.384500	31.2	1000.0	9.000	Off	N	20.1	14.8	46.0
5.266500	26.2	1000.0	9.000	Off	N	20.1	23.8	50.0
18.802500	24.8	1000.0	9.000	Off	N	20.4	25.2	50.0

2.3 99% EMISSION BANDWIDTH

2.3.1 Specification Reference

RSS-Gen Clause 6.6

2.3.2 Standard Applicable

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth.
When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- • The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- • The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

Note: Video averaging is not permitted.
A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.
The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.
The difference between the two recorded frequencies is the 99% occupied bandwidth.

2.3.3 Equipment Under Test and Modification State

Serial No: 258602000335 (NU) / Default Test Configuration

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

April 06, 2016/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	26.1°C
Relative Humidity	35.2%
ATM Pressure	99.4kPa

2.3.7 Additional Observations

- This is a conducted test.
- TDF (Transducer Factor) was used to compensate for the external attenuator and cable used.
- Span is wide enough to capture the channel transmission.
- RBW is 100kHz.
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.
- Trace mode is max hold.
- The % Power Bandwidth setting in the spectrum analyzer was set to 99% (default).
- The Channel Bandwidth measurement function of the spectrum analyzer was used for this test.

2.3.8 Test Results (For reporting purposes only)

Mode	Channel	Measured 99% Bandwidth (MHz)
Bluetooth LE	37 (2402 MHz)	1.102
	17 (2440 MHz)	1.096
	39 (2480 MHz)	1.096

2.3.9 Test Results Plots

Date: 5.APR.2016 15:24:46

Bluetooth LE Low Channel

Date: 5.APR.2016 15:22:33

Bluetooth LE Mid Channel

Date: 5.APR.2016 15:20:54

Bluetooth LE High Channel

2.4 MINIMUM 6 dB RF BANDWIDTH

2.4.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(a)(2)

2.4.2 Standard Applicable

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

2.4.3 Equipment Under Test and Modification State

Serial No: 258602000335 (NU) / Default Test Configuration

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

April 06, 2016/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	26.1°C
Relative Humidity	35.2%
ATM Pressure	99.4kPa

2.4.7 Additional Observations

- This is a conducted test.
- TDF (Transducer Factor) was used 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.
- Trace is maxhold.
- The “n” dB down marker function of the spectrum analyzer was used for this test.

2.4.8 Test Results

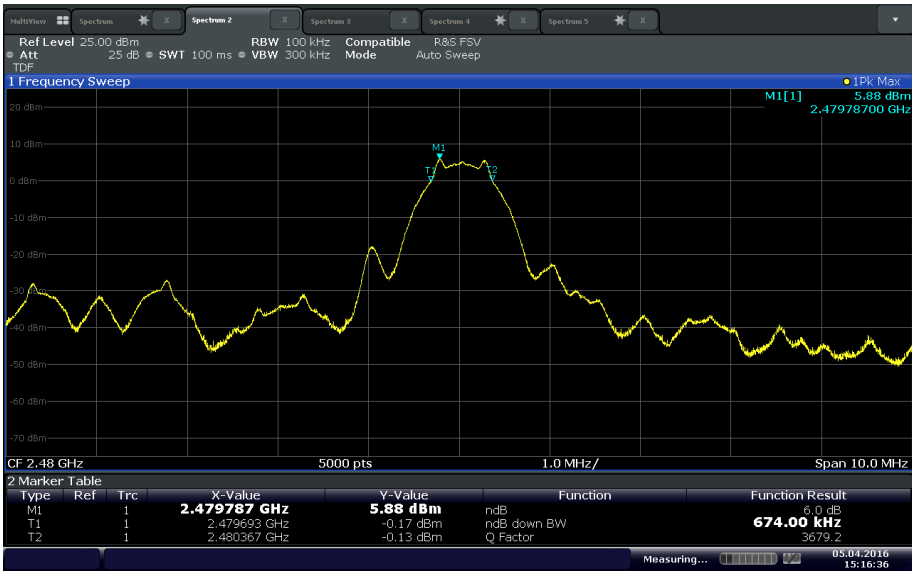
Mode	Channel	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Compliance
Bluetooth LE	37 (2402 MHz)	0.676	0.500	Complies
	17 (2440 MHz)	0.690	0.500	Complies
	39 (2480 MHz)	0.674	0.500	Complies

2.4.9 Test Results Plots

Bluetooth LE Low Channel

Date:5.APR.2016 15:12:22

Bluetooth LE Mid Channel



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Bluetooth LE High Channel

2.5 OUT-OF-BAND EMISSIONS - CONDUCTED

2.5.1 Specification Reference

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

2.5.2 Standard Applicable

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

2.5.3 Equipment Under Test and Modification State

Serial No: 258602000335 (NU) / Default Test Configuration

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

April 06, 2016/XYZ

2.5.5 Test Equipment Used

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

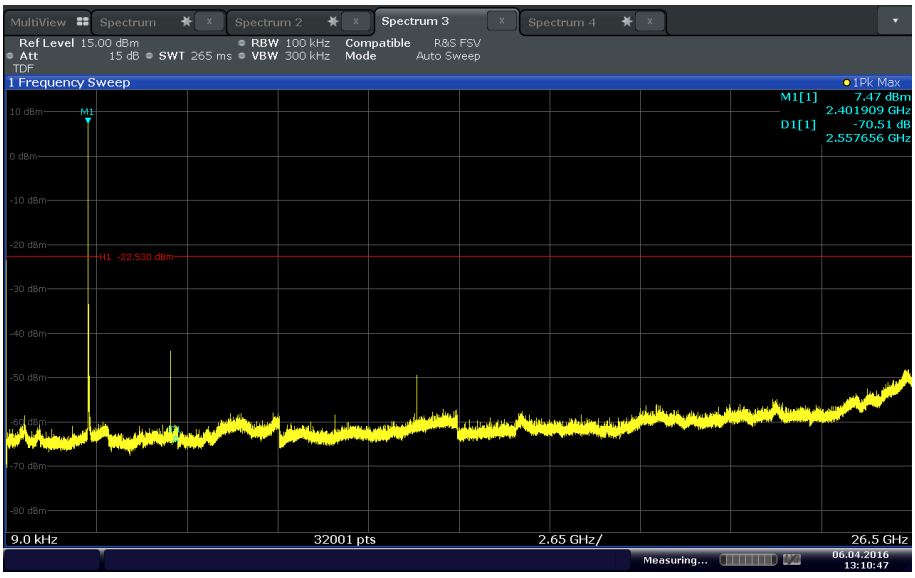
2.5.6 Environmental Conditions

Ambient Temperature	25.9°C
Relative Humidity	36.9%
ATM Pressure	99.2kPa

2.5.7 Additional Observations

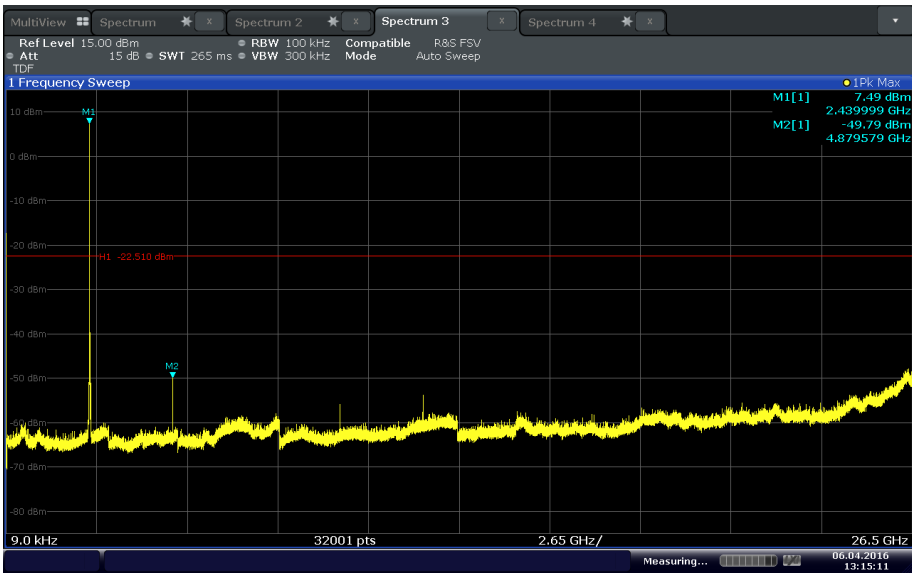
- This is a conducted test.
- TDF (Transducer Factor) was used to compensate for the external attenuator and cable used.
- RBW is 100kHz.VBW is 3X RBW.
- Sweep is auto. Detector is peak. Trace is max hold.
- Initial scan was performed to determine the highest level of the desired power within the band.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

2.5.8 Test Results Plots



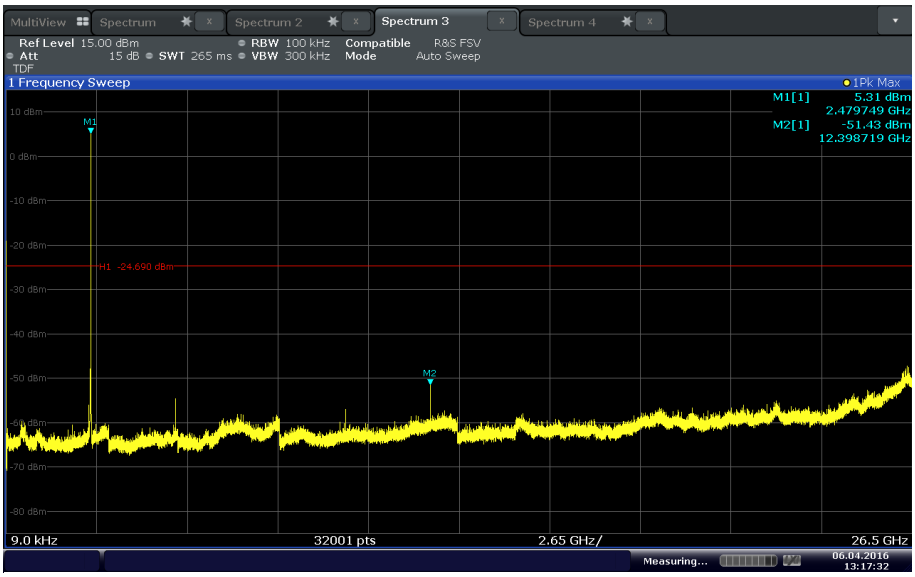
Date: 6.APR.2016 13:10:48

Bluetooth LE Low Channel



Date: 6.APR.2016 13:15:11

Bluetooth LE Mid Channel



Date: 6.APR.2016 13:17:32

Bluetooth LE High Channel

2.6 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

2.6.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(d)
FCC 47 CFR Part 15, Clause 15.205
RSS-247, Clause 5.5

2.6.2 Standard Applicable

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: 258602000335 (NU) / Default Test Configuration

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

April 06, 2016/XYZ

2.6.5 Test Equipment Used

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

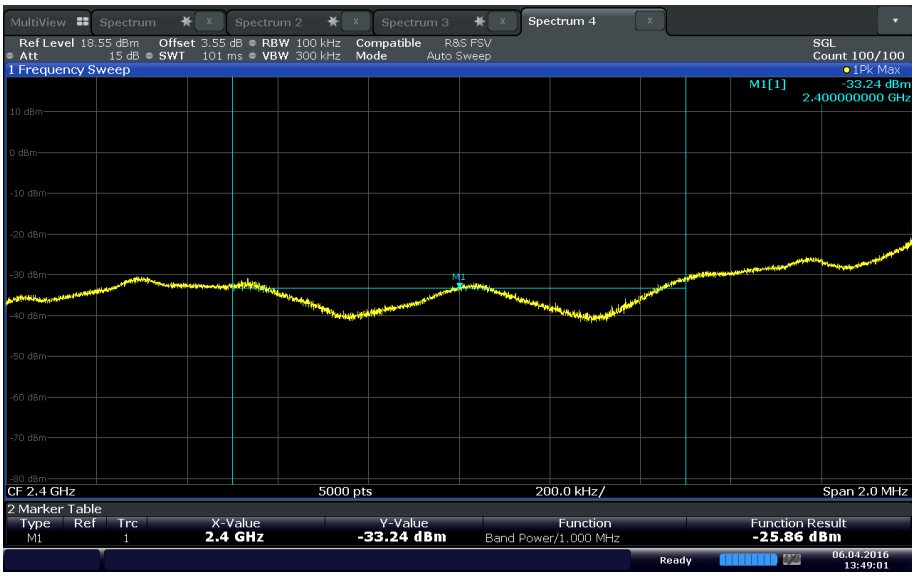
2.6.6 Environmental Conditions

Ambient Temperature	25.9°C
Relative Humidity	36.9%
ATM Pressure	99.2kPa

2.6.7 Additional Observations

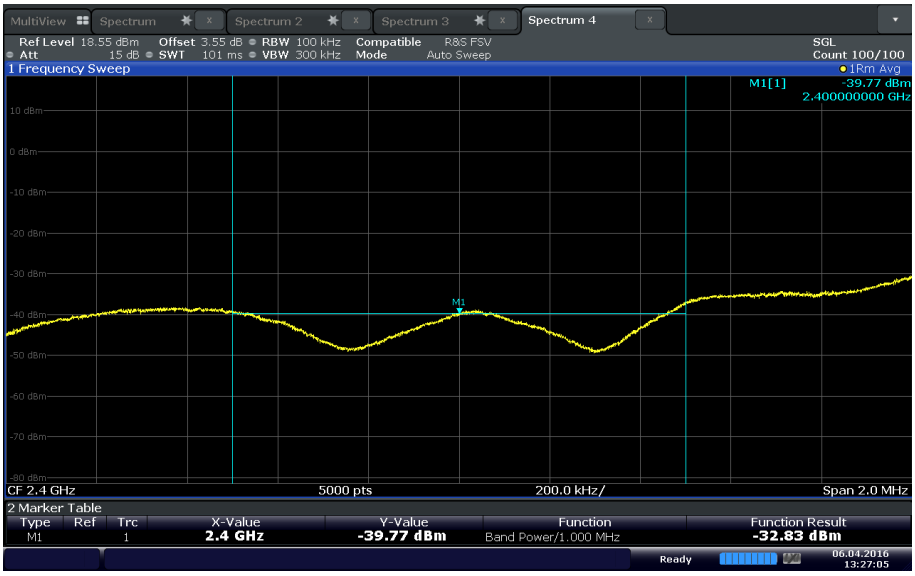
- Setup is identical to “Out-of-Band Emissions – Conducted” test (previous test).
- The path loss was measured and entered as a level offset
- Test methodology is per Clause 13.3.1 of KDB 558074 D01 (DTS Meas Guidance v03r04, January 07, 2016); trace averaging with continuous EUT transmission at full power.
- The highest level of the desired power in the 100 kHz bandwidth within the band were tested , Limits are 30dBc from the highest level of the desired power within the band.

2.6.8 Test Results



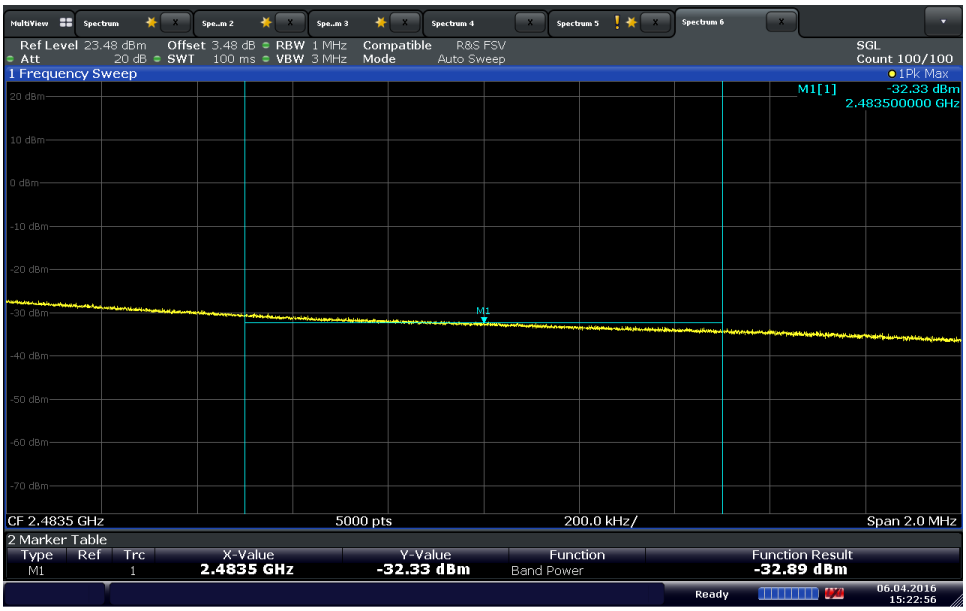
Date: 6.APR.2016 13:49:01

Bluetooth LE Low Band Edge 2400MHz (Peak Measurement) @ Ch 2402 MHz
(for reference only. not in the restricted band)



Date: 6.APR.2016 13:27:05

Bluetooth LE Low Channel (2402 MHz). Limit is -22.53dBm. Margin is -10.3dB.
(The highest level of the desired power in the 100 kHz bandwidth within the band is 7.47dBm)



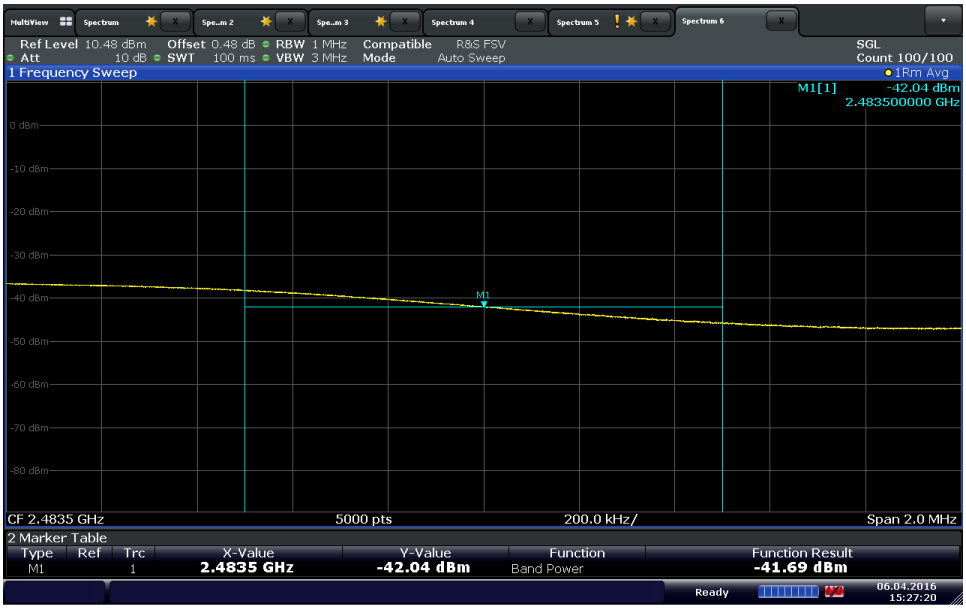
Date: 6.APR.2016 15:22:57

Bluetooth LE Upper Band Edge 2483.5MHz (Peak Measurement) @ Ch 2480 MHz

Upper band edge calculation (2483.5 MHz):

- 2483.5 MHz (in the restricted bands)
- Use the following formula as per Section Section G(2)D)(III) of KDB789033 D02 General UNII Test Procedures New Rules v01r01:

E(dBµV/m) = EIRP (dBm) + 95.2
= (-32.9 dBm + 0 dBi antenna gain) + 95.2
= 62.3 dBµV/m @ 3 meters (Complies with 74 dBµV/m limit)



Date: 6.APR.2016 15:27:20

Bluetooth LE High Channel (2480 MHz). Limit is -24.69dBm. Margin is -17.0dB.
(The highest level of the desired power in the 100 kHz bandwidth within the band is 5.31dBm)

Upper band edge calculation (2483.5 MHz):

- 2483.5 MHz (in the restricted bands)
- Use the following formula as per Section Section G(2)D)(III) of KDB789033 D02 General UNII Test Procedures New Rules v01r01:

E(dBµV/m) = EIRP (dBm) + 95.2
= (-41.69 dBm + 0 dBi antenna gain) + 95.2
= 53.51 dBµV/m @ 3 meters (Complies with 54 dBµV/m limit)

2.7 RADIATED SPURIOUS EMISSIONS

2.7.1 Specification Reference

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

2.7.2 Standard Applicable

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: 258602000335 (NU) and 25955100346 (CU) / Default Test Configuration

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

April 06 and 18, 2016/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

Ambient Temperature	25.9 - 27.1°C
Relative Humidity	23.8 - 36.9%
ATM Pressure	99.2 - 99.3kPa

2.7.7 Additional Observations

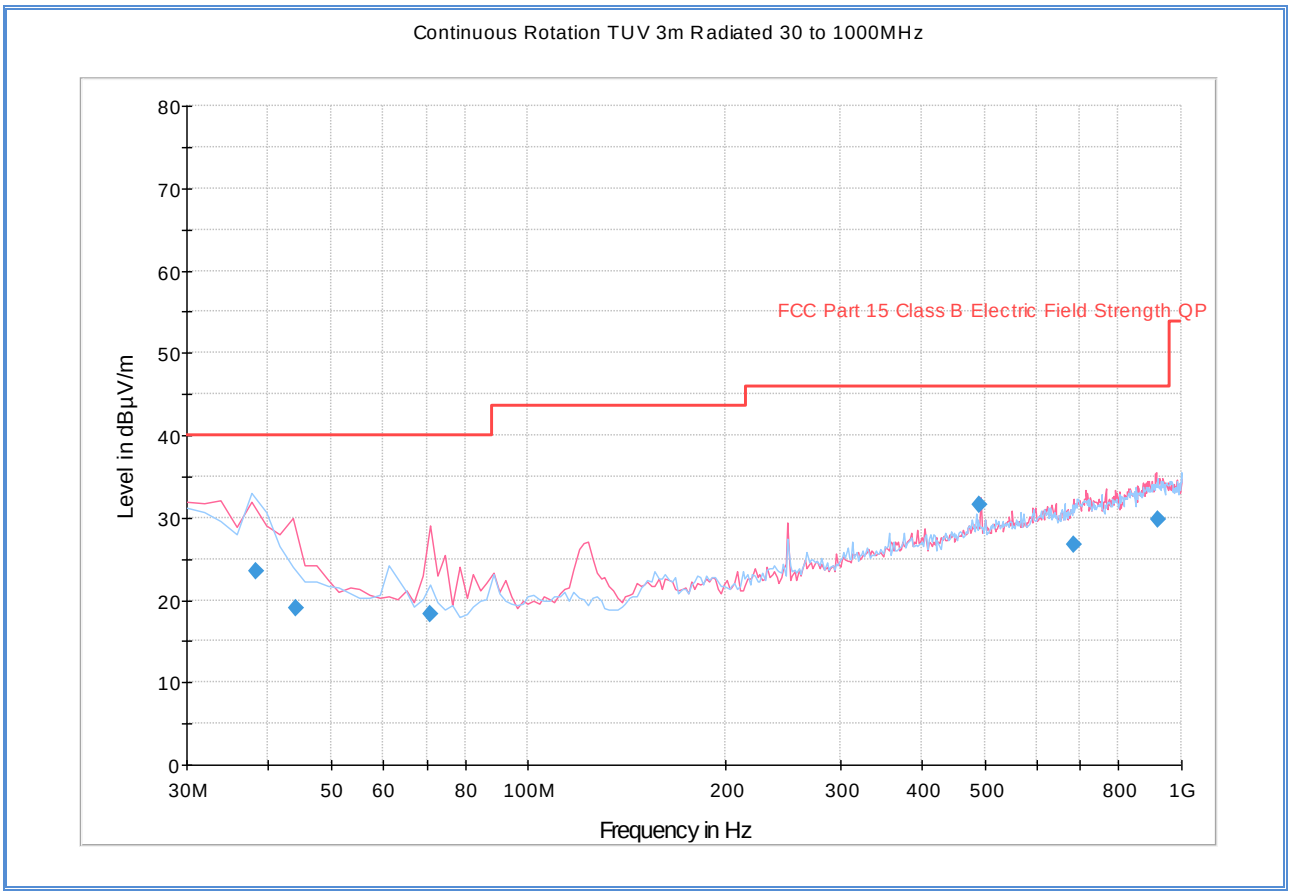
- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic.
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d).
- Only the worst case BLE (Middle Channel) presented. There are no significant differences in emissions between all channels.

- Only noise floor measurements observed above 18GHz.
- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.7.8 for sample computation.

2.7.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (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**

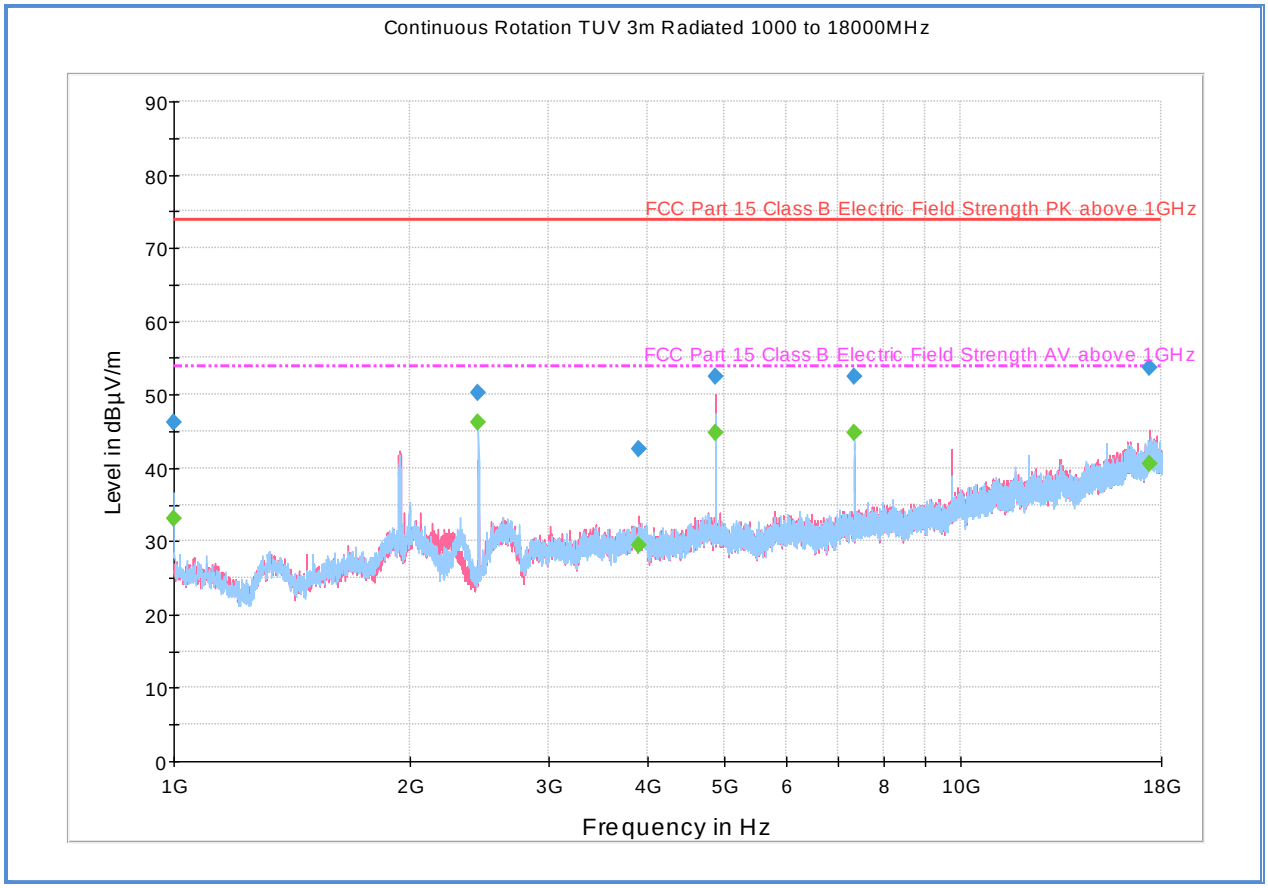
2.7.9 Test Results - Below 1GHz (NU) - Middle Channel



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)
38.215551	23.5	1000.0	120.000	383.0	H	15.0	-10.2	16.6	40.0
44.127214	19.1	1000.0	120.000	120.0	V	-15.0	-12.7	20.9	40.0
70.821643	18.4	1000.0	120.000	100.0	V	254.0	-16.8	21.6	40.0
491.525291	31.6	1000.0	120.000	100.0	V	13.0	-1.8	14.4	46.0
683.306293	26.7	1000.0	120.000	250.0	V	184.0	2.3	19.3	46.0
917.868938	29.7	1000.0	120.000	150.0	V	111.0	6.4	16.3	46.0

2.7.10 Test Results - Above 1GHz (NU) - Middle Channel



Peak Data

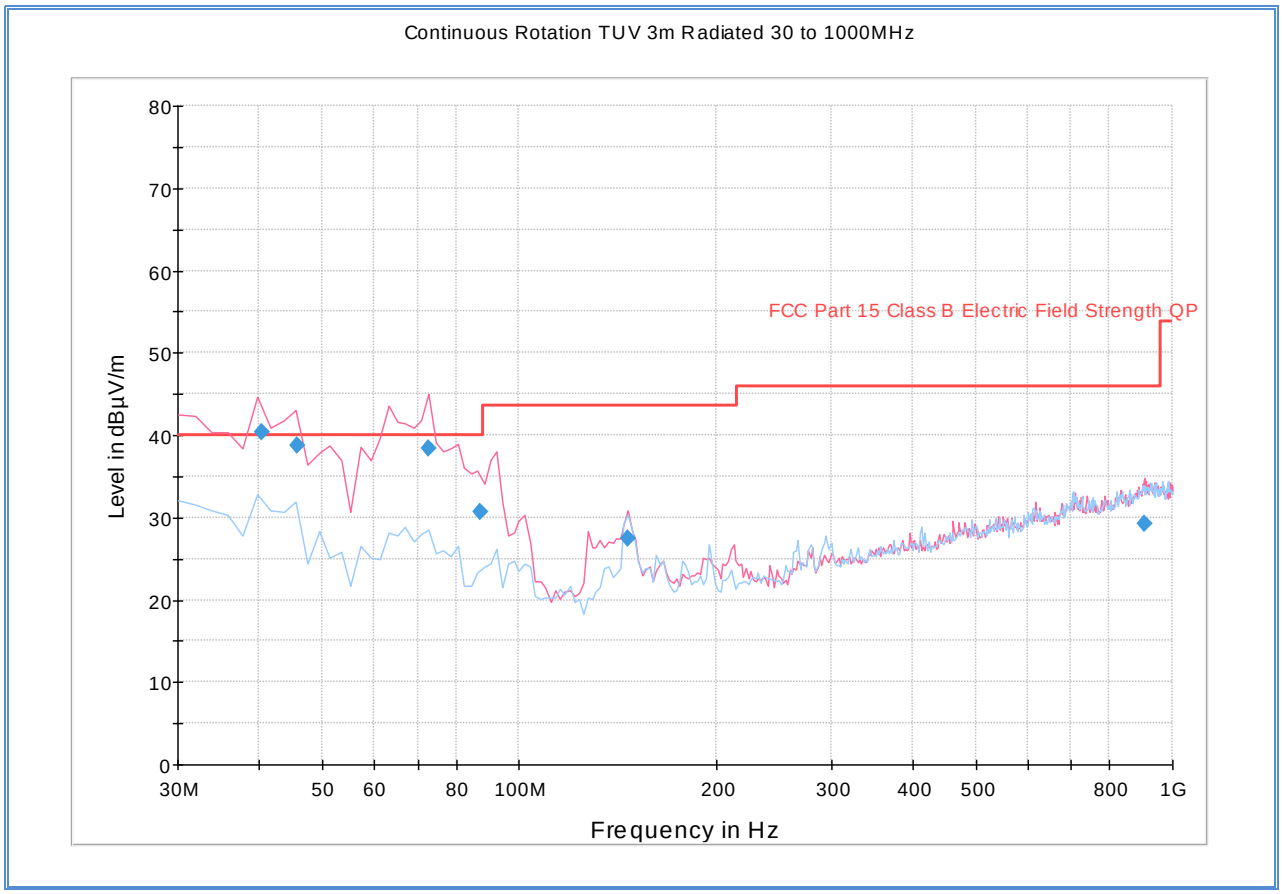
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	46.2	1000.0	1000.000	303.0	H	16.0	-7.8	27.7	73.9
2440.300000	50.2	1000.0	1000.000	100.0	H	73.0	-0.9	23.7	73.9
3907.933333	42.5	1000.0	1000.000	304.0	V	154.0	2.2	31.4	73.9
4879.600000	52.5	1000.0	1000.000	192.0	V	51.0	3.5	21.4	73.9
7320.600000	52.5	1000.0	1000.000	137.0	H	98.0	7.4	21.4	73.9
17399.33333	53.6	1000.0	1000.000	139.0	V	196.0	20.2	20.3	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	33.1	1000.0	1000.000	303.0	H	16.0	-7.8	20.8	53.9
2440.300000	46.1	1000.0	1000.000	100.0	H	73.0	-0.9	7.8	53.9
3907.933333	29.4	1000.0	1000.000	304.0	V	154.0	2.2	24.5	53.9
4879.600000	44.8	1000.0	1000.000	192.0	V	51.0	3.5	9.1	53.9
7320.600000	44.8	1000.0	1000.000	137.0	H	98.0	7.4	9.1	53.9
17399.33333	40.6	1000.0	1000.000	139.0	V	196.0	20.2	13.3	53.9

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

2.7.11 Test Results - Below 1GHz (CU) - Middle Channel

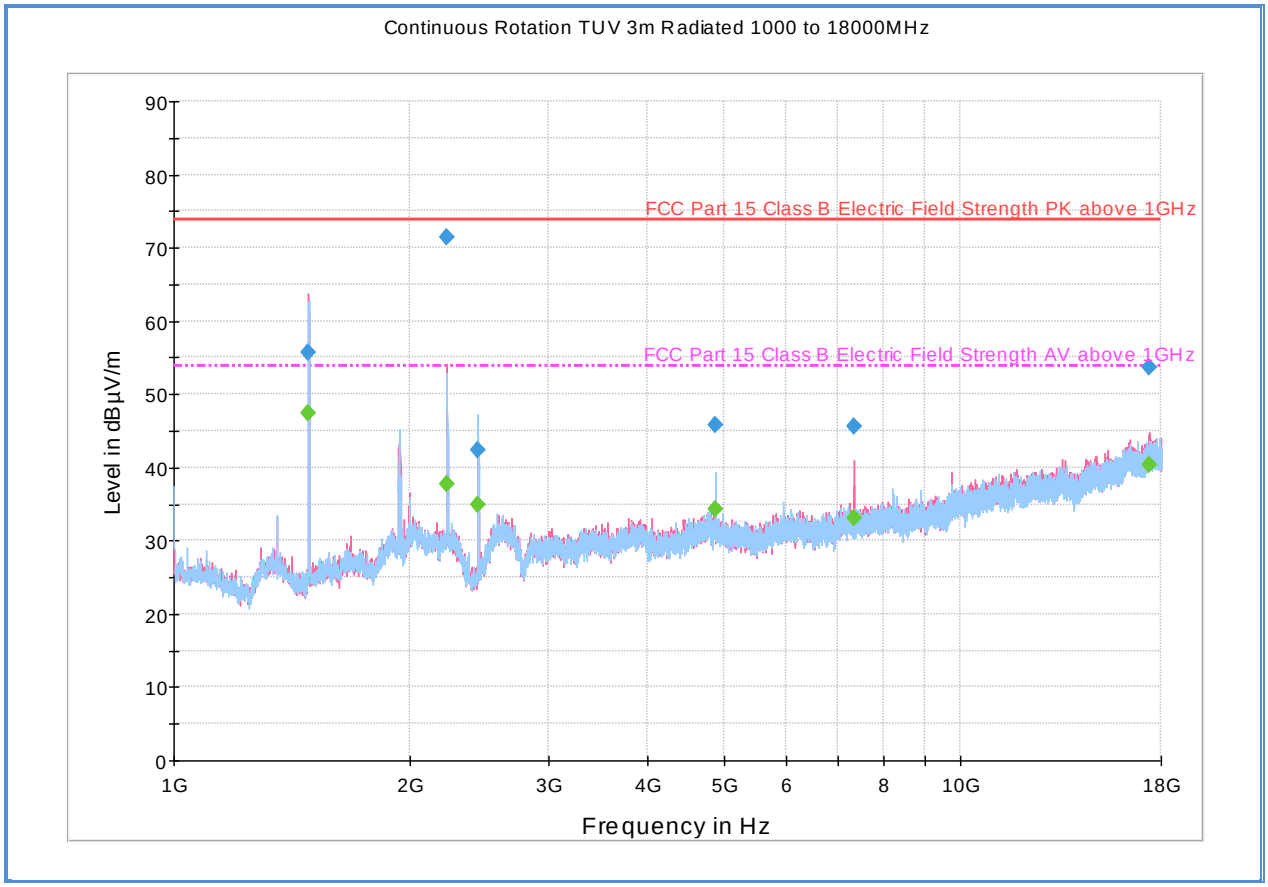


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
40.279439	40.4	1000.0	120.000	100.0	V	40.0	-11.3	-0.4*	40.0
45.671102	38.8	1000.0	120.000	100.0	V	55.0	-13.2	1.2	40.0
72.765531	38.4	1000.0	120.000	100.0	V	65.0	-16.8	1.6	40.0
87.332745	30.8	1000.0	120.000	105.0	V	336.0	-15.8	9.2	40.0
146.673267	27.4	1000.0	120.000	100.0	V	277.0	-13.7	16.1	43.5
905.909499	29.2	1000.0	120.000	150.0	V	16.0	6.1	16.8	46.0

Test Note *: Frequency 40.2794MHz is not within the restricted band. It complies with Part 15.247(d).

2.7.12 Test Results - Above 1GHz (CU) - Middle 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)
1484.700000	55.7	1000.0	1000.000	278.3	V	181.0	-5.9	18.2	73.9
2226.633333	71.4	1000.0	1000.000	310.2	V	9.0	-1.7	2.5	73.9
2439.733333	42.3	1000.0	1000.000	140.7	H	121.0	-0.9	31.6	73.9
4880.333333	45.8	1000.0	1000.000	102.8	H	10.0	3.5	28.1	73.9
7320.066667	45.7	1000.0	1000.000	157.6	V	292.0	7.4	28.2	73.9
17367.600000	53.6	1000.0	1000.000	259.3	V	282.0	20.0	20.3	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)
1484.700000	47.4	1000.0	1000.000	278.3	V	181.0	-5.9	6.5	53.9
2226.633333	37.7	1000.0	1000.000	310.2	V	9.0	-1.7	16.2	53.9
2439.733333	35.0	1000.0	1000.000	140.7	H	121.0	-0.9	18.9	53.9
4880.333333	34.2	1000.0	1000.000	102.8	H	10.0	3.5	19.7	53.9
7320.066667	33.1	1000.0	1000.000	157.6	V	292.0	7.4	20.8	53.9
17367.600000	40.4	1000.0	1000.000	259.3	V	282.0	20.0	13.5	53.9

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

2.8 POWER SPECTRAL DENSITY

2.8.1 Specification Reference

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

2.8.2 Standard Applicable

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: 258602000335 (NU) / Default Test Configuration

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

April 05, 2016/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

Ambient Temperature	26.1°C
Relative Humidity	35.2%
ATM Pressure	99.4kPa

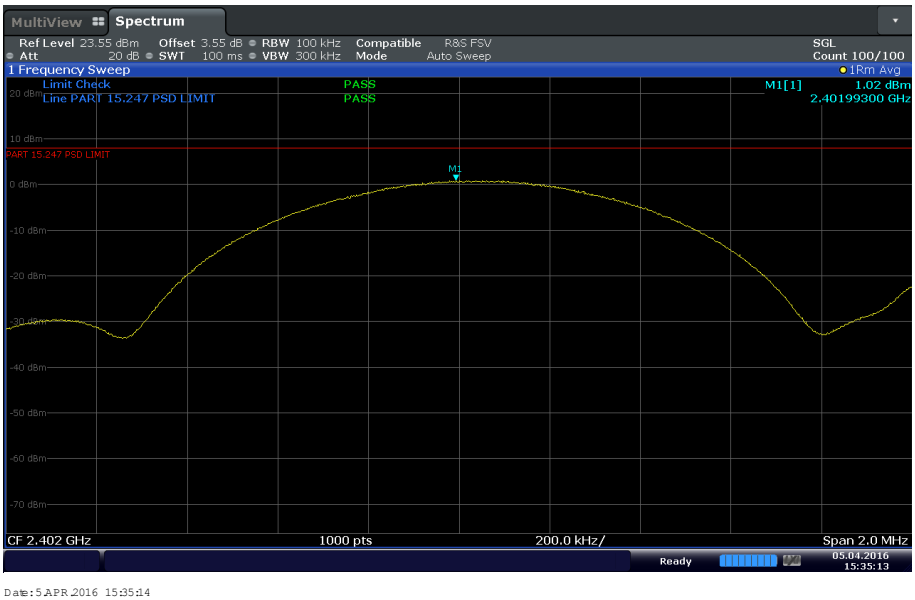
2.8.7 Additional Observations

- This is a conducted test.
- Test procedure is per Section 10.3 of KDB 558074 D01 (DTS Meas Guidance v03r04, January 07, 2016).
- The path loss for was measured and entered as a level offset
- Detector is RMS power averaging.
- Trace averaging mode over 100 traces.
- Sweep time is Auto.
- EUT complies with 100 kHz RBW.

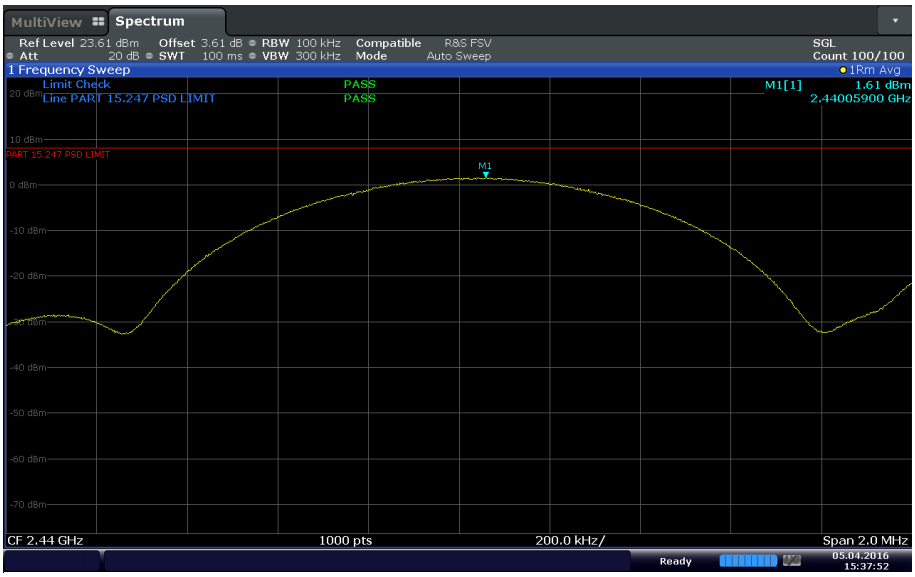
2.8.8 Test Results Summary

Mode	Channel	Data Rates (Mbps)	Marker Reading using 100 kHz RBW (dBm)	PSD Limit (dBm)	Margin (dB)	Compliance
Bluetooth LE	37 (2402 MHz)	GFSK @ 1Mbps	1.02	8	6.98	Complies
	17 (2440 MHz)	GFSK @ 1Mbps	1.61	8	6.39	Complies
	39 (2480 MHz)	GFSK @ 1Mbps	-1.26	8	9.26	Complies

2.8.9 Test Results Plots

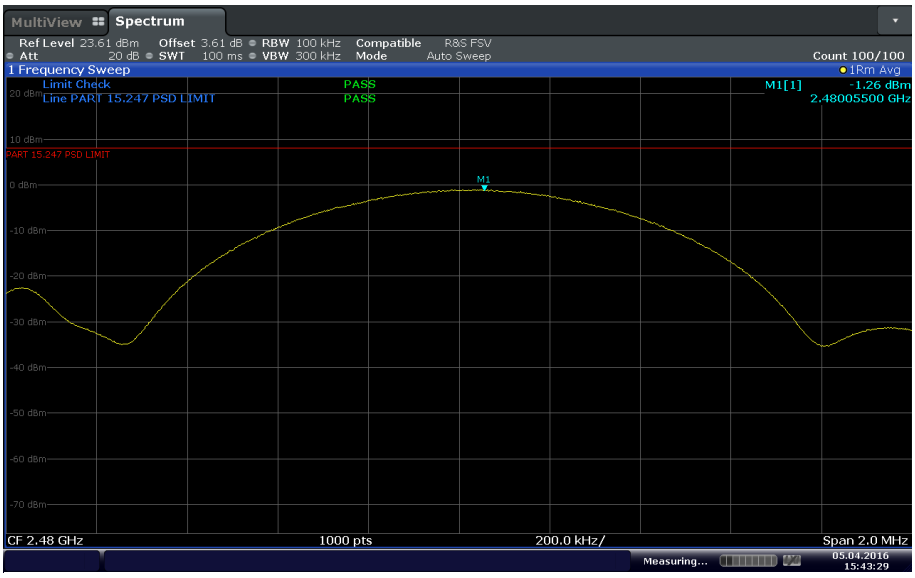


Bluetooth LE Low Channel



Date: 5.APR.2016 15:37:52

Bluetooth LE Middle Channel



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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	10/05/15	10/05/16
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	07/29/15	07/29/16
7569	Series Power Meter	N1911A P-	MY45100625	Agilent	06/19/15	06/19/16
7605	50MHz-18GHz Wideband Power Sensor	N1921A	MY51100054	Agilent	04/10/15	04/10/16
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	02/29/16	02/28/17
8772	10dB Attenuator	606-06-1F4/DR	-	MECA	Verified by 7608 and 7569	
-	3dB Attenuator	PE7010-6	-	PASTERNACK	Verified by 7608 and 7569	
Conducted Emissions						
7620	EMI Test Receiver	ESU40	100399	Rhode & Schwarz	09/03/15	09/03/16
7567	LISN	FCC-LISN-50-25-2-10	120304	Fischer Custom Comm.	07/14/15	07/14/16
7568	LISN	FCC-LISN-50-25-2-10	120305	Fischer Custom Comm.	10/28/15	10/28/16
8822	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	02/29/16	02/28/17
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	02/29/16	02/28/17
Radiated Emissions						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	11/06/15	11/06/17
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	09/29/15	09/29/16
1016	Pre-amplifier	PAM-0202	187	PAM	12/15/15	12/15/16
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	04/27/15	04/27/16
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/11/16	03/11/17
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	03/20/16	03/20/17
Miscellaneous						
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/14/15	08/14/16
7560	Barometer/Temperature/Humidity Transmitter	iBTHX-W	1240476	Omega	10/19/15	10/19/16
	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 Conducted Measurements

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.36	0.21	0.04
2	Cables	Rectangular	0.50	0.29	0.08
3	LISN	Rectangular	0.66	0.38	0.15
4	Attenuator	Rectangular	0.30	0.17	0.03
5	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	0.80
				Coverage Factor (k):	2
				Expanded Uncertainty:	1.59

3.2.2 Radiated Measurements (Below 1GHz)

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

3.2.3 Radiated Emission Measurements (Above 1GHz)

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

3.2.4 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

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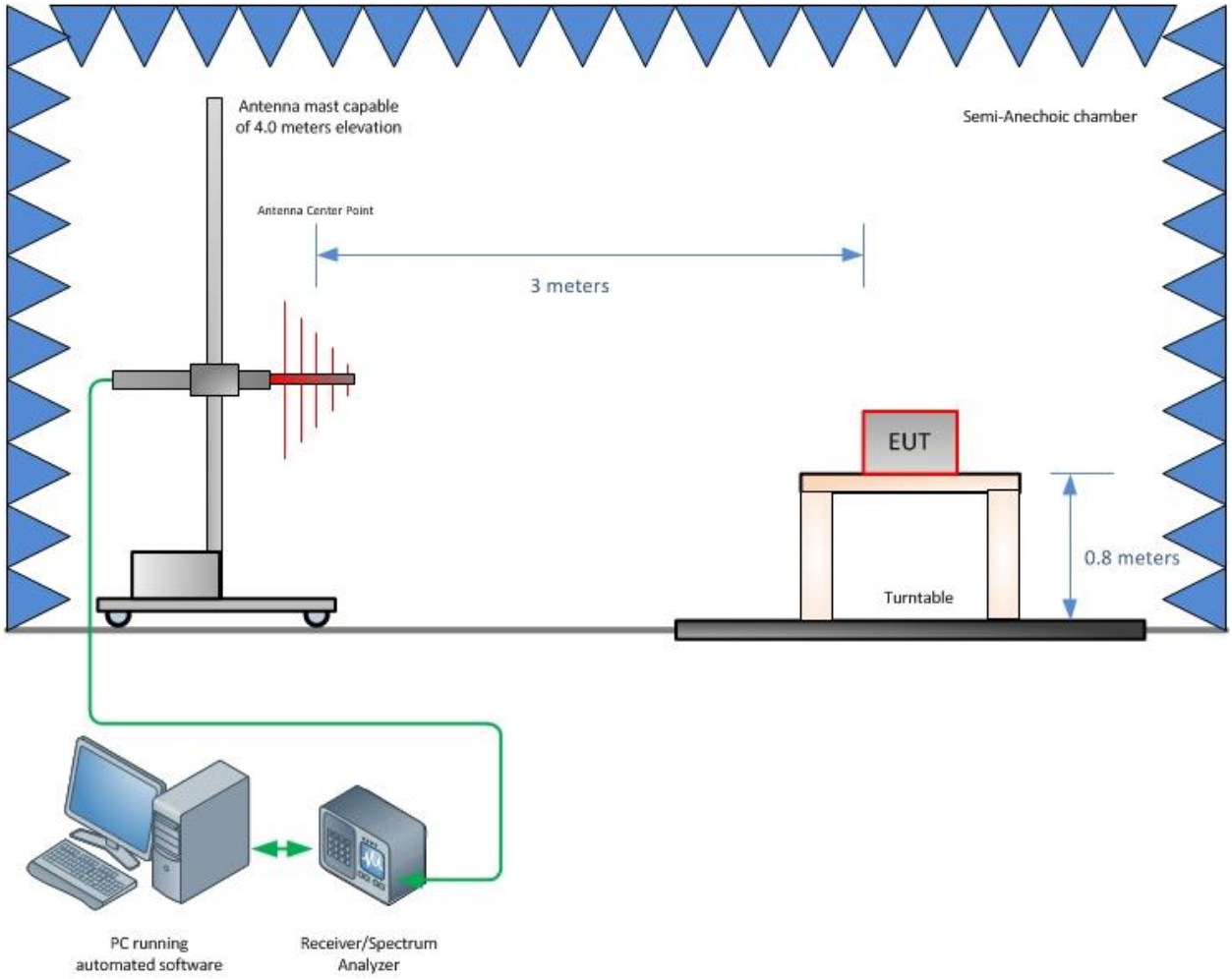
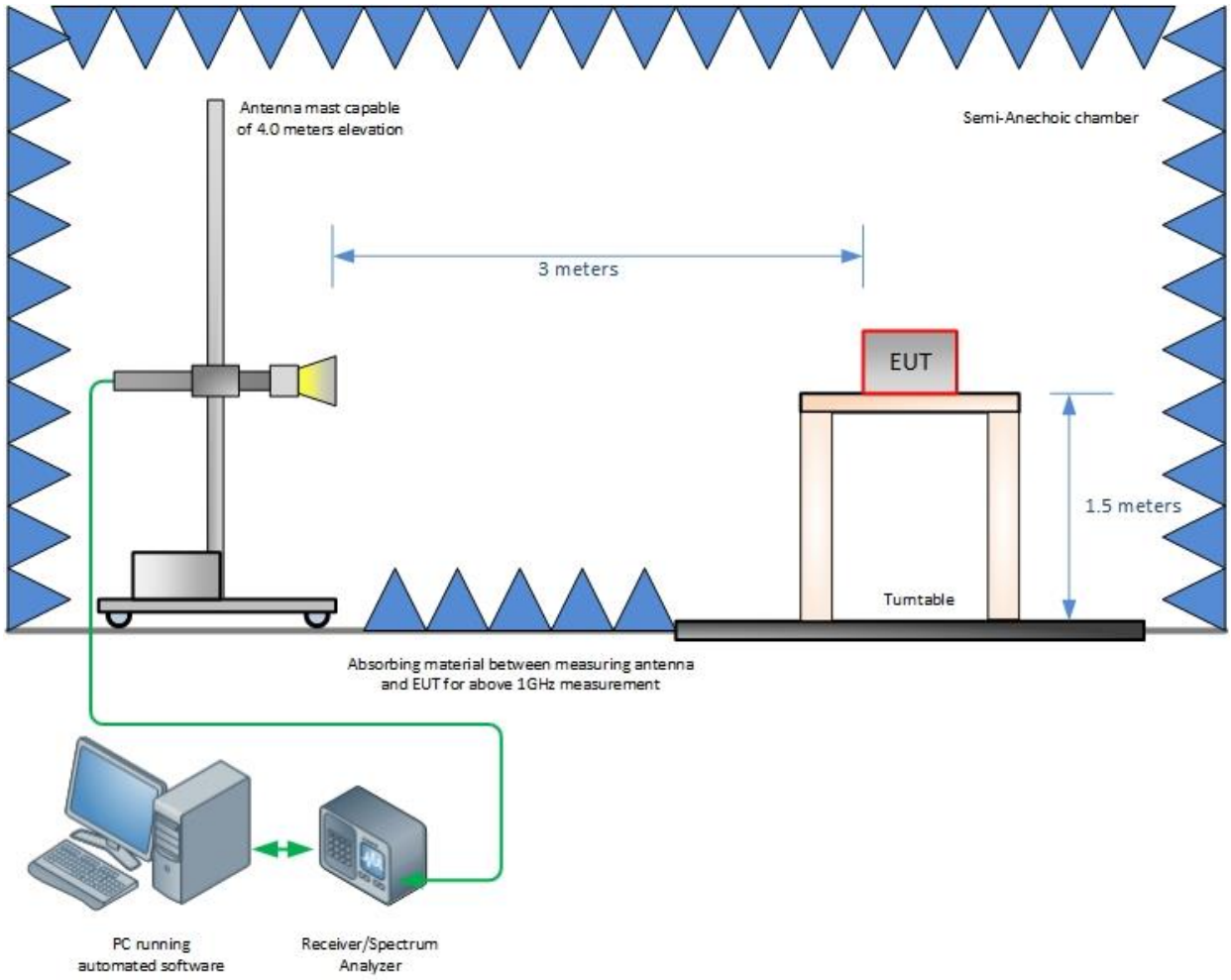
SECTION 4

DIAGRAM OF TEST SETUP

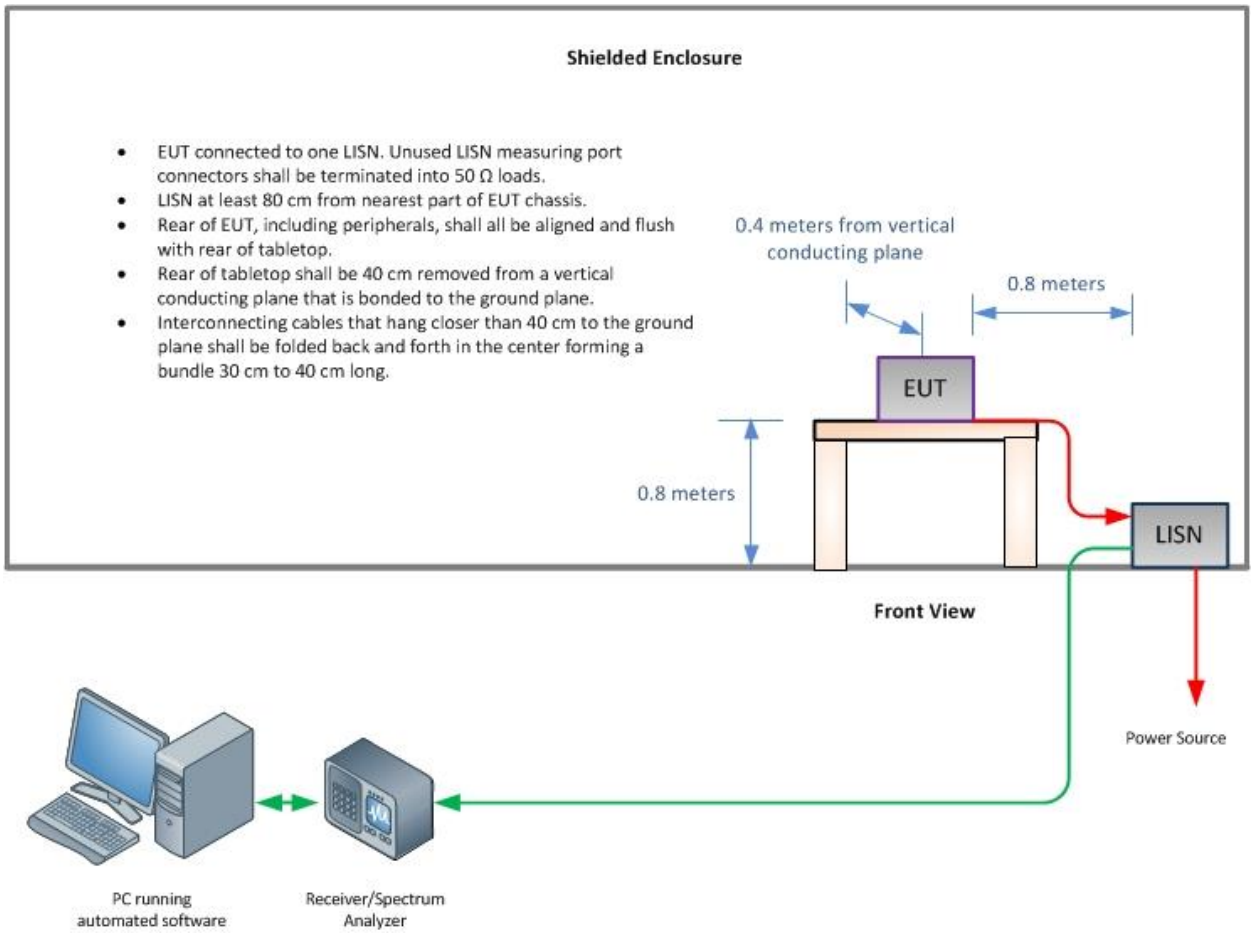
4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)



Conducted Emission Test Setup

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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