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Report On

Application for Grant of Equipment Authorization of the
Nextivity Inc.

Cel-Fi DUOSmart Cellular Signal Booster

FCC Part 15 Subpart C §15.247

IC RSS-247 Issue 1 May 2015

Report No.SD72112726-0116A Rev1.0

June 2016



REPORT ON Radio Testing of the
Nextivity Inc.
Cel-Fi DUOSmart Cellular Signal Booster

TEST REPORT NUMBER SD72112726-0116A Rev1.0

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DATED June 02, 2016



Revision History

SD72112726-0116A Rev1.0 Nextivity Inc. M/N D32-2/13/66 Cel-Fi DUOSmart Cellular Signal Booster					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
04/22/2016	Initial Release				Juan M Gonzalez
06/02/2016	Initial Release	Rev1.0	Change 1.3.2 Capability to LTE (Band 2, 13 and 4)/UNII and BT LE		Juan M Gonzalez



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SECTION 1

REPORT SUMMARY

Radio Testing of the
Nextivity Inc.
Cel-Fi DUOSmart Cellular Signal Booster



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Nextivity Inc.Cel-Fi DUOSmart Cellular Signal Boosterto the requirements of the following:
 FCC Part 15 Subpart C §15.247&IC RSS-247 Issue 1 May 2015.

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Nextivity Inc.
Model Name	Cel-Fi DUO
Model Number(s)	D32-2/13/66
FCC ID	NU: YETD32-21366NU CU: YETD32-21366CU
FCC Classification	Low power Communications device Transmitter (DTS)
IC Number	N/A (Manufacturer not seeking IC Certification at the time of verification)
Serial Number(s)	921550000015
Number of Samples Tested	1
Test Specification/Issue/Date	<ul style="list-style-type: none"> • FCC Part 15 Subpart C §15.247 (October 1, 2015). • RSS-247–DigitalTransmission 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	January 05, 2016
Finish of Test	January 19, 2016
Name of Engineer(s)	Xiaoying Zhang
Related Document(s)	<ul style="list-style-type: none"> • KDB 558074 D01 (DTS Meas Guidance v03r03, June 09, 2015). 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 IC RSS-247 Issue 1 May 2015 with cross-reference to the corresponding IC RSS standard is shown below.

Section	§15.247 Spec Clause	RSS	Test Description	Result	Comments/ Base Standard
2.1	§15.247(b)(3)	RSS-247 5.4(4)	Peak Output Power	Compliant	
2.2	§15.207(a)	RSS-Gen 8.8	Conducted Emissions	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)	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	
-	-	RSS-Gen 7.1	Receiver Spurious Emissions	N/A*	See Note
2.8	§15.247(d)	RSS-247 5.5	Radiated Band Edge Measurements and Restricted Bands	Compliant	
2.9	§15.247(e)	RSS-247 5.2(2)	Power Spectral Density for Digitally Modulated Device	Compliant	

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



1.3 PRODUCT INFORMATION


1.3.1 Technical Description

The Equipment Under Test (EUT) was a Nextivity Inc. Cel-Fi DUOSmart Cellular Signal Booster. The EUT is a signal booster for indoor residential, small business and small enterprise use. It consists of two units: the Network Unit (NU), and the Coverage Unit (CU). NU and CU are shipped and sold as one unit. The NU transmits and receives Cellular signals from the base station and operates similar to a cellular handset. The CU transmits and receives signals with the cellular handset and operates on frequencies similar to the cellular base station. The NU and CU are connected wirelessly over a full-duplex wireless link in the UNII band using a mixed OFDM and muxed cellular signal over a 30 or 40 MHz channel in each direction. The CU also includes Bluetooth LE connectivity. With the use of smart phone application, it allows user to register the product, update software, capture/display details metrics of the system. NU does not support Bluetooth LE. Only the BT Low Energy function of the EUT Coverage Unit (CU) was verified in this test report.

1.3.2 EUT General Description

EUT Description	Smart Cellular Signal Booster
Model Name	Cel-Fi DUO
Model Number(s)	D32-2/13/66
Rated Voltage	12V DC viaexternal AC/DC adapter
Mode Verified	BT LE
Capability	LTE (Band 2, 13 and 4)/UNII and BT LE
Primary Unit (EUT)	<input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering
Manufacturer Declared Temperature Range	0°C to 40°C
Antenna Type	PCB Monopole
Manufacturer	Nextivity Inc.
Antenna Model	N/A
Antenna Gain	-3.0dBi

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	-4.24	0.38	-2.66	0.54



1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	<p>The EUT is connected to a support laptop running NextivityCel-Fi 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.</p> <p>For Antenna Conducted Port tests, the manufacturer provided a temporary antenna port disconnecting the integral antenna inside the EUT when used.</p> <p>Only the Coverage Unit (CU) was verified in this test report and verified in standalone configuration using the test files provided. The Network Unit (NU) does not have BT-LE capability.</p>

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

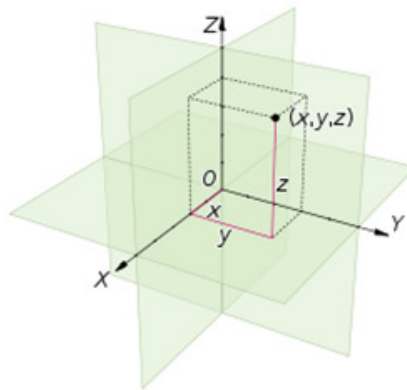
Manufacturer	Equipment/Cable	Description
Hon-Kwang	AC/DC Adapter (EUT)	M/N HK-AB-120A250-US P/N 290N025-001, 12VDC 2.5A
-	Support USB cable	1.75 meters, shielded Type A to Micro B connector
Sony	Support Laptop	M/N PCG-31311L S/N 27545534 3006488
Sony	Support Laptop AC Adapter	M/N PCGA-AC19V9 S/N 147839091 0023259

1.4.4 Worst Case Configuration

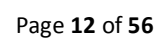
Worst-case configuration used in this test report as per Radiated Spurious Emission:

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 were verified. No major variation in emissions observed between the three (3) orientations. Verifications performed using "Z" configuration.



Antenna Conducted Port 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 Number921550000015		
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. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.10-2013. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY

1.8.1 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.

1.8.2 Industry Canada (IC) Registration No.: 3067A

The 10m Semi-anechoic chamber of TUV SUD 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
Nextivity Inc.
Cel-Fi DUOSmart Cellular Signal Booster



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: 921550000015 / Default Test Configuration

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

January 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	22.7°C
Relative Humidity	52.9%
ATM Pressure	98.8kPa

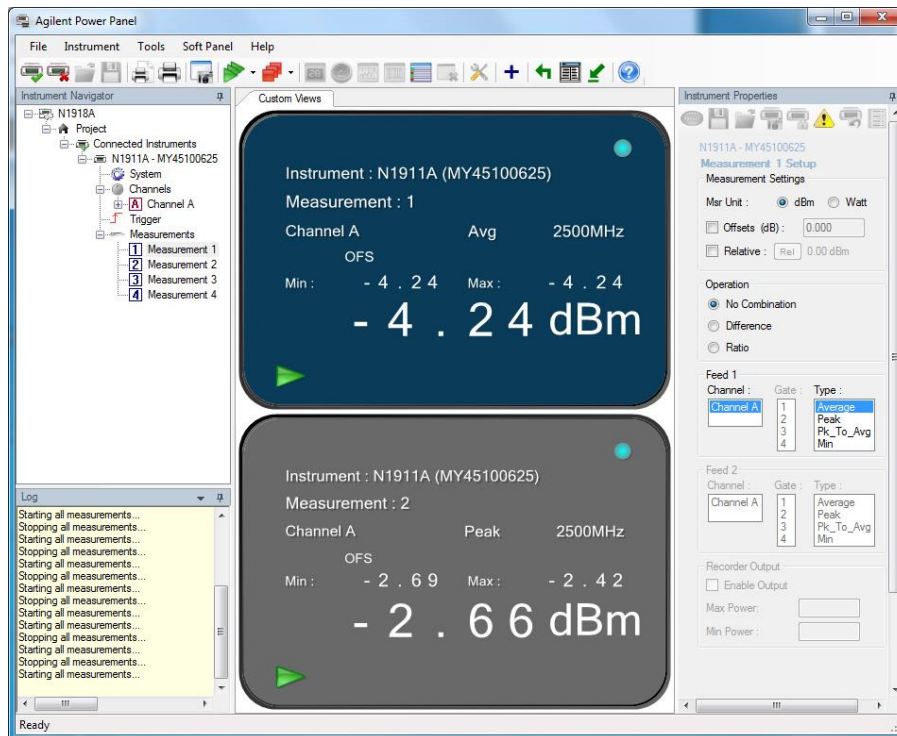
2.1.7 Additional Observations

- 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 v03r03, June 09, 2015). 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	-4.31	-2.71
	17 (2440 MHz)		-4.24	-2.66
	39 (2480 MHz)		-8.05	-5.62

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 μ H/50 ohms line impedance stabilization network (LISN).

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

**Decreases with the logarithm of the frequency.*

2.2.3 Equipment Under Test and Modification State

Serial No: 921550000015 / Default Test Configuration

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

January 18, 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 22.5°C
Relative Humidity 52.6.%
ATM Pressure 99.9kPa

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 normal operation mode observed is presented.

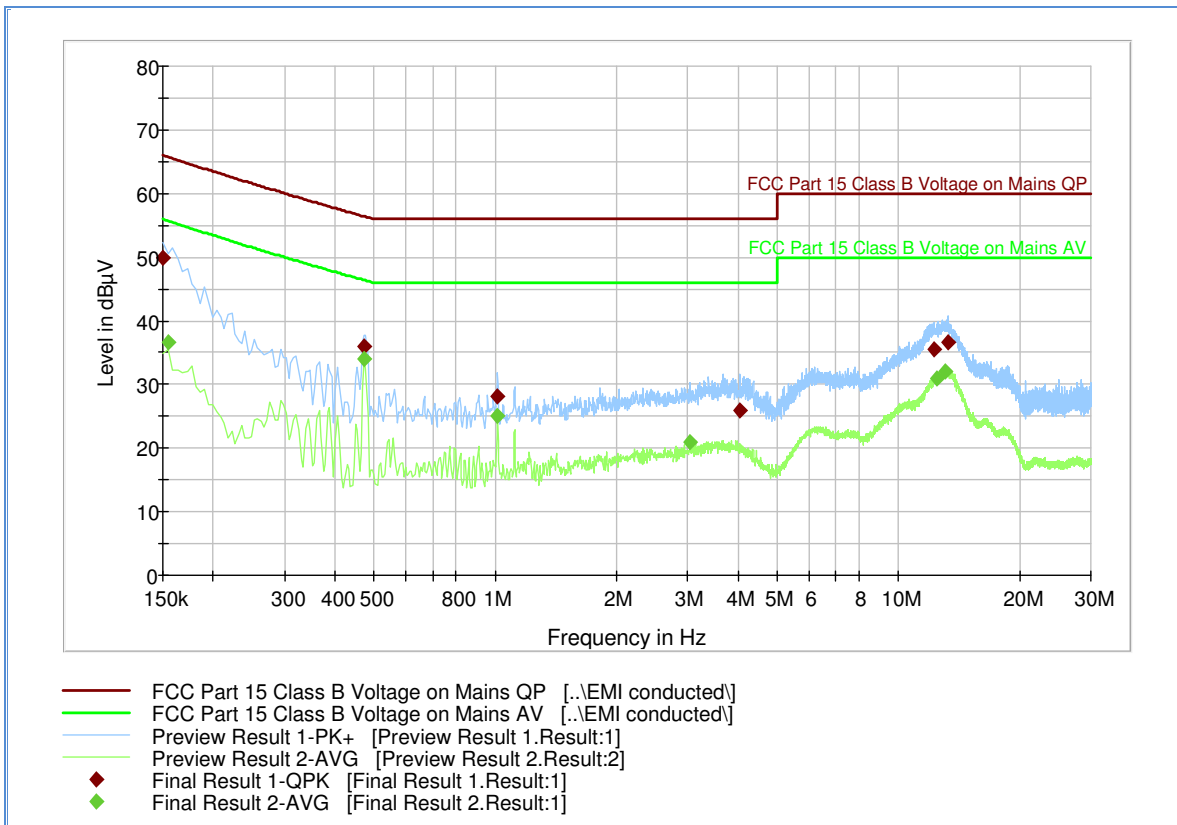


- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.2.8 for sample computation.

2.2.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (db μ V) @ 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 (db μ V) @ 150kHz			26.2

2.2.9 Test Results - Conducted Emissions Line 1 – Hot



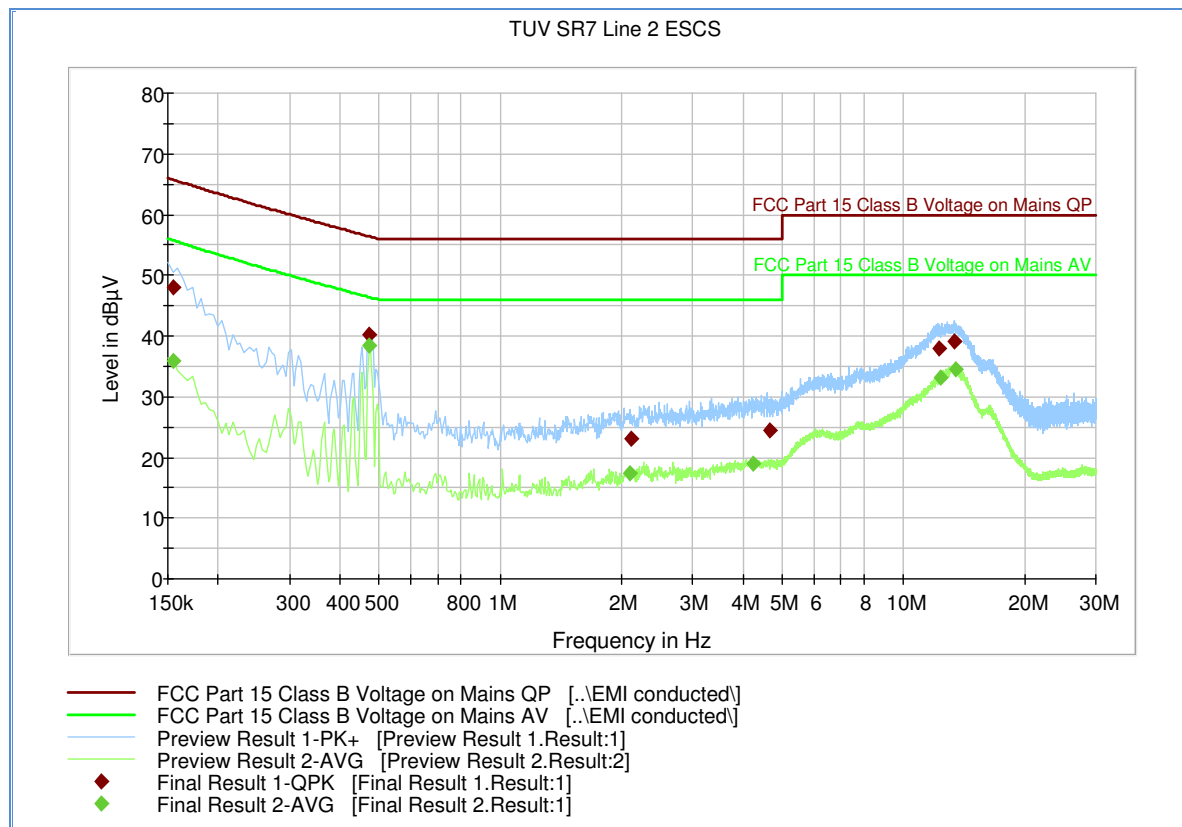
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150000	49.9	1000.0	9.000	Off	L1	20.1	16.1	66.0
0.474000	36.0	1000.0	9.000	Off	L1	20.1	20.4	56.4
1.014000	28.2	1000.0	9.000	Off	L1	20.2	27.8	56.0
4.056000	26.0	1000.0	9.000	Off	L1	20.4	30.0	56.0
12.214500	35.6	1000.0	9.000	Off	L1	20.6	24.4	60.0
13.299000	36.5	1000.0	9.000	Off	L1	20.6	23.5	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.154500	36.7	1000.0	9.000	Off	L1	20.0	19.1	55.7
0.474000	33.9	1000.0	9.000	Off	L1	20.1	12.5	46.4
1.014000	25.0	1000.0	9.000	Off	L1	20.2	21.0	46.0
3.043500	20.9	1000.0	9.000	Off	L1	20.4	25.1	46.0
12.430500	31.0	1000.0	9.000	Off	L1	20.6	19.0	50.0
13.105500	32.1	1000.0	9.000	Off	L1	20.6	17.9	50.0

2.2.10 FCC 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	48.0	1000.0	9.000	Off	N	20.0	17.7	65.7
0.474000	40.3	1000.0	9.000	Off	N	20.1	16.1	56.4
2.116500	23.1	1000.0	9.000	Off	N	20.3	32.9	56.0
4.672500	24.6	1000.0	9.000	Off	N	20.4	31.4	56.0
12.273000	37.8	1000.0	9.000	Off	N	20.7	22.2	60.0
13.362000	39.1	1000.0	9.000	Off	N	20.6	20.9	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.154500	35.8	1000.0	9.000	Off	N	20.0	19.9	55.7
0.474000	38.4	1000.0	9.000	Off	N	20.1	8.0	46.4
2.098500	17.4	1000.0	9.000	Off	N	20.2	28.6	46.0
4.258500	19.0	1000.0	9.000	Off	N	20.4	27.0	46.0
12.399000	33.2	1000.0	9.000	Off	N	20.7	16.8	50.0
13.434000	34.4	1000.0	9.000	Off	N	20.6	15.6	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: 921550000015 / Default Test Configuration

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

January 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 23.1°C
Relative Humidity 45.0%
ATM Pressure 99.3kPa

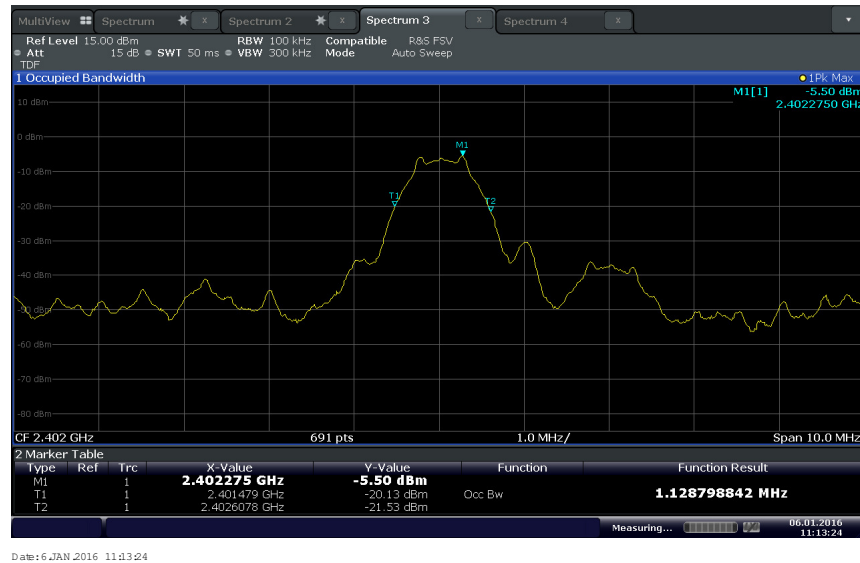
2.3.7 Additional Observations

- 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.

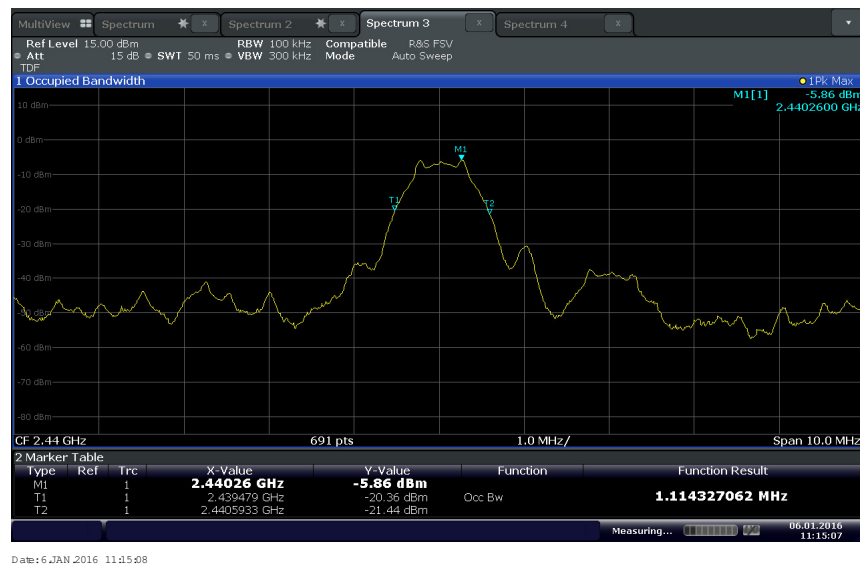
2.3.8 Test Results (For reporting purposes only)

Mode	Channel	Measured 99% Bandwidth (MHz)
Bluetooth LE	37 (2402 MHz)	1.129
	17 (2440 MHz)	1.115
	39 (2480 MHz)	1.158

2.3.9 Test Results Plots



Bluetooth LE Low Channel



Bluetooth LE Mid Channel



Date: 6 JAN 2016 11:18:07

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: 921550000015 / Default Test Configuration

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

January 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	23.1°C
Relative Humidity	45.0%
ATM Pressure	99.3kPa

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 $\geq 3X$ 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.

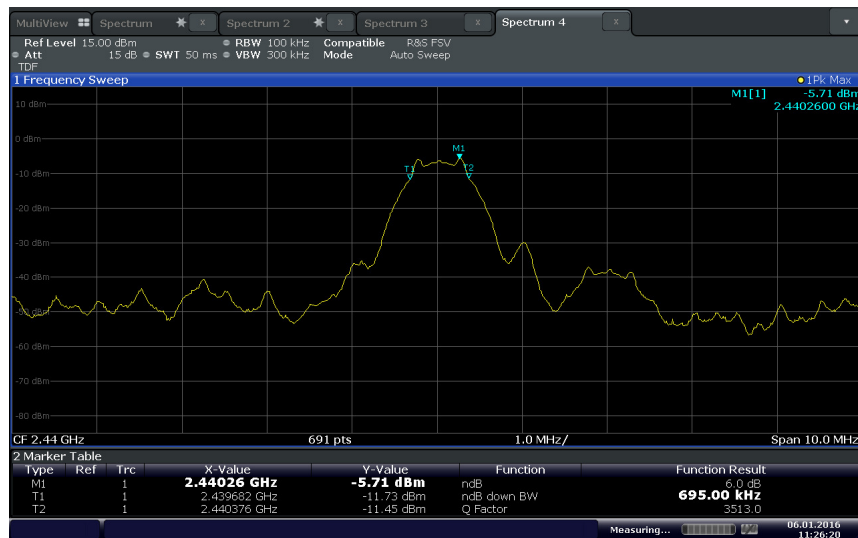
2.4.8 Test Results

Mode	Channel	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Compliance
Bluetooth LE	37 (2402 MHz)	0.695	0.500	Complies
	17 (2440 MHz)	0.695	0.500	Complies
	39 (2480 MHz)	0.695	0.500	Complies

2.4.9 Test Results Plots

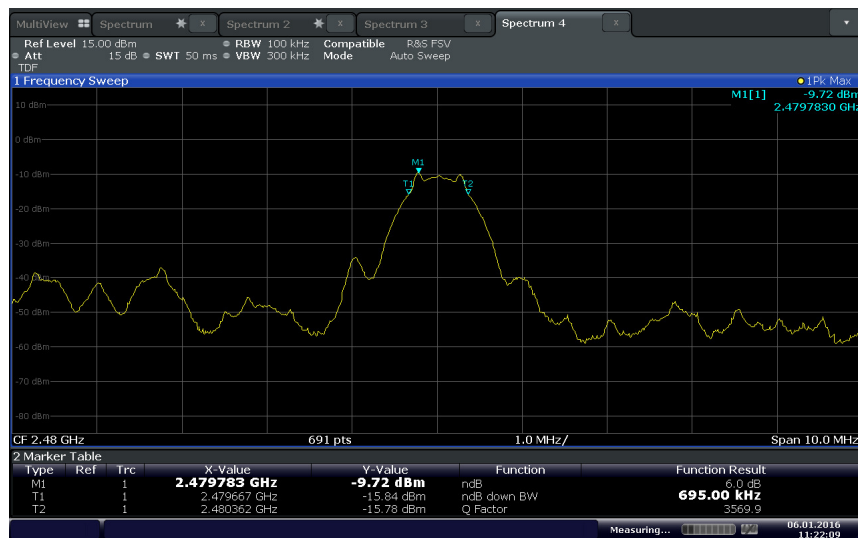


Bluetooth LE Low Channel



Date: 6 JAN 2016 11:26:20

Bluetooth LE Mid Channel



Date: 6 JAN 2016 11:22:09

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: 921550000015 / Default Test Configuration

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

January 05, 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.

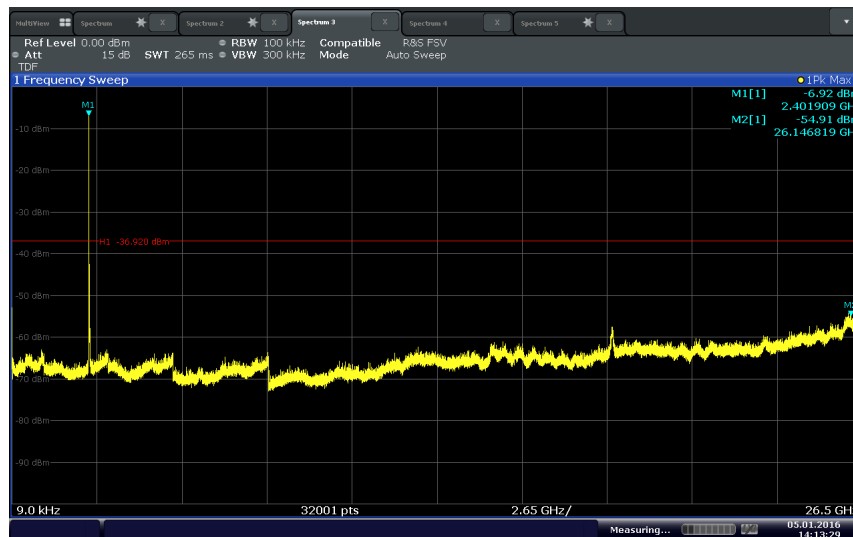
2.5.6 Environmental Conditions

Ambient Temperature	22.7°C
Relative Humidity	52.9%
ATM Pressure	98.8kPa

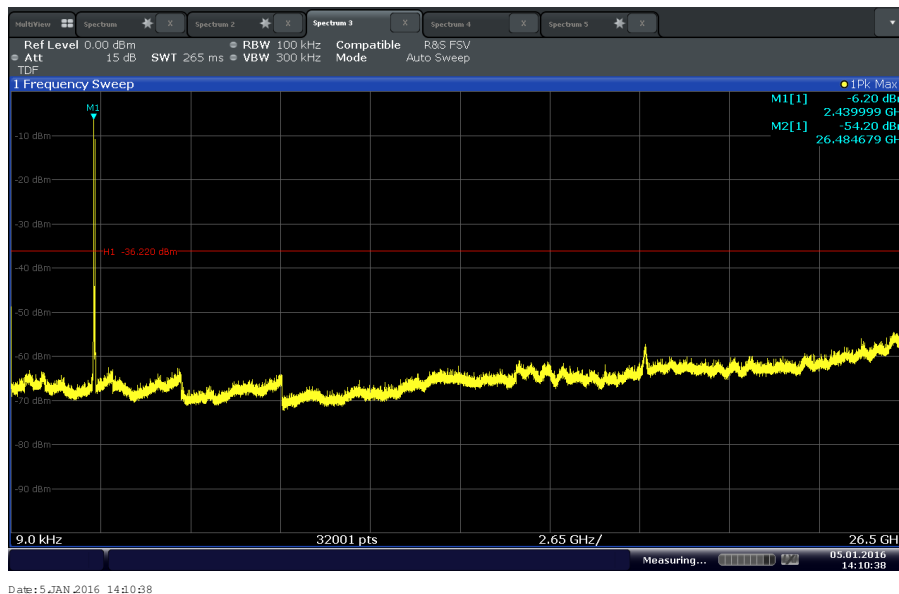
2.5.7 Additional Observations

- This is a conducted test.
- The path loss was measured and entered as a level offset
- RBW is 100kHz.VBW is 3X RBW.
- Sweep is auto. Detector is peak. Trace is max hold.
- Initial scan was performed to determine the highest level of the desired power within the band. Limit (display line) was drawn 30dB below this level.
- Spectrum was searched from 9 kHz up to 26.5GHz.

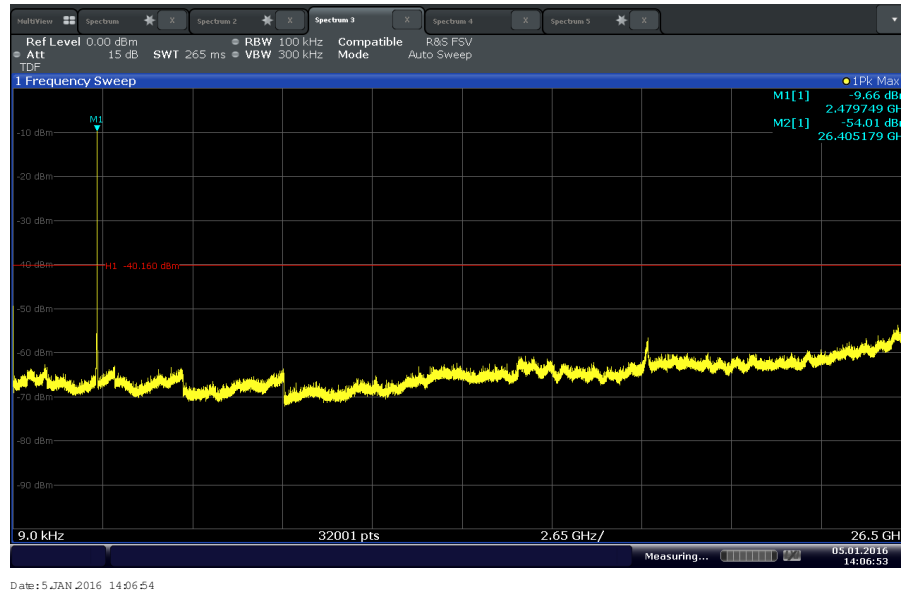
2.5.8 Test Results Plots



Bluetooth LE Low Channel



Bluetooth LE Mid Channel



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)
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: 921550000015 / Default Test Configuration

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

January 05, 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.

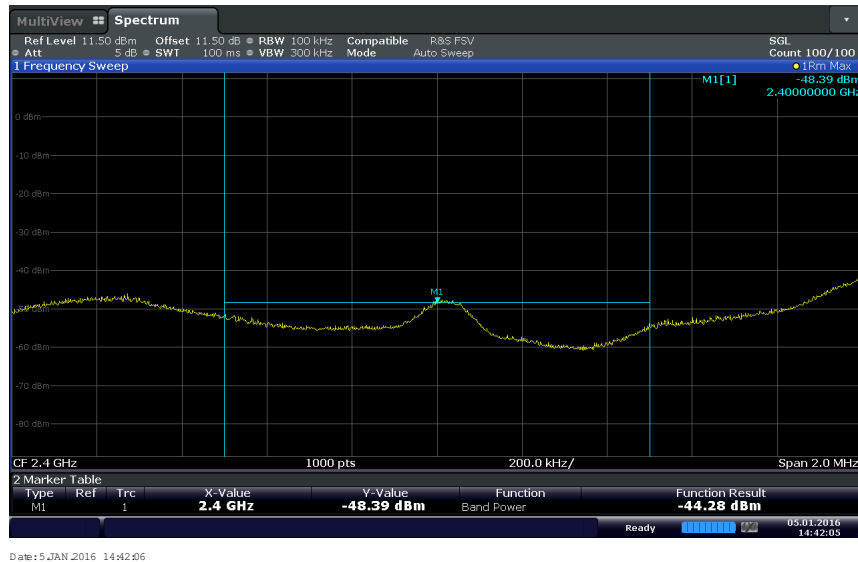
2.6.6 Environmental Conditions

Ambient Temperature	22.7°C
Relative Humidity	52.9%
ATM Pressure	98.8kPa

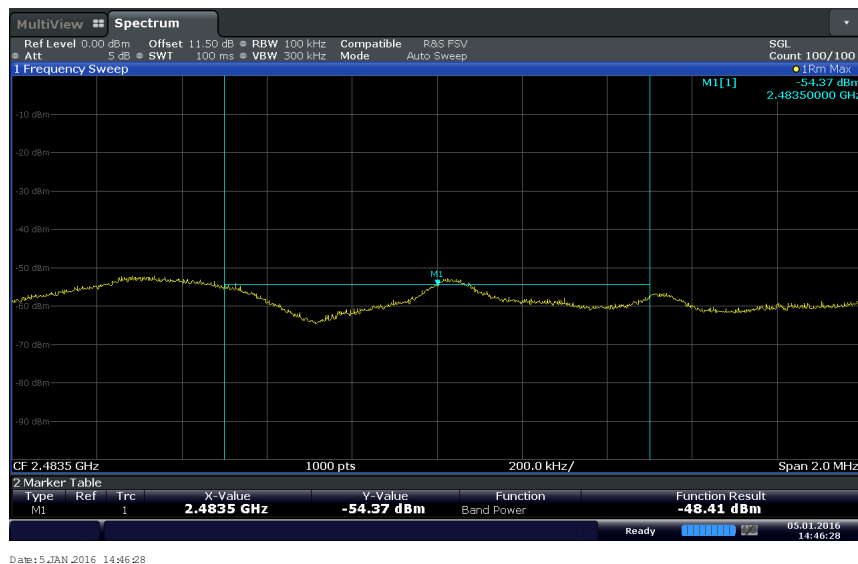
2.6.7 Additional Observations

- 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 v03r03, June 09, 2015); 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



Bluetooth LE Low Channel (2402 MHz). Limit is -36.92dBm. Margin is -7.36dB.
 (The highest level of the desired power in the 100 kHz bandwidth within the band is -6.92dBm)



Bluetooth LE High Channel (2480 MHz). Limit is -39.66dBm. Margin is -8.75dB.
 (The highest level of the desired power in the 100 kHz bandwidth within the band is -9.66dBm)

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: 921550000015 / Default Test Configuration

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

January 15 and 19, 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	22.8 - 23.1 °C
Relative Humidity	34.5 - 46.6 %
ATM Pressure	99.2 - 99.8kPa

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 for radiated emissions below 1GHz. There are no significant differences in emissions between all channels below 1GHz.

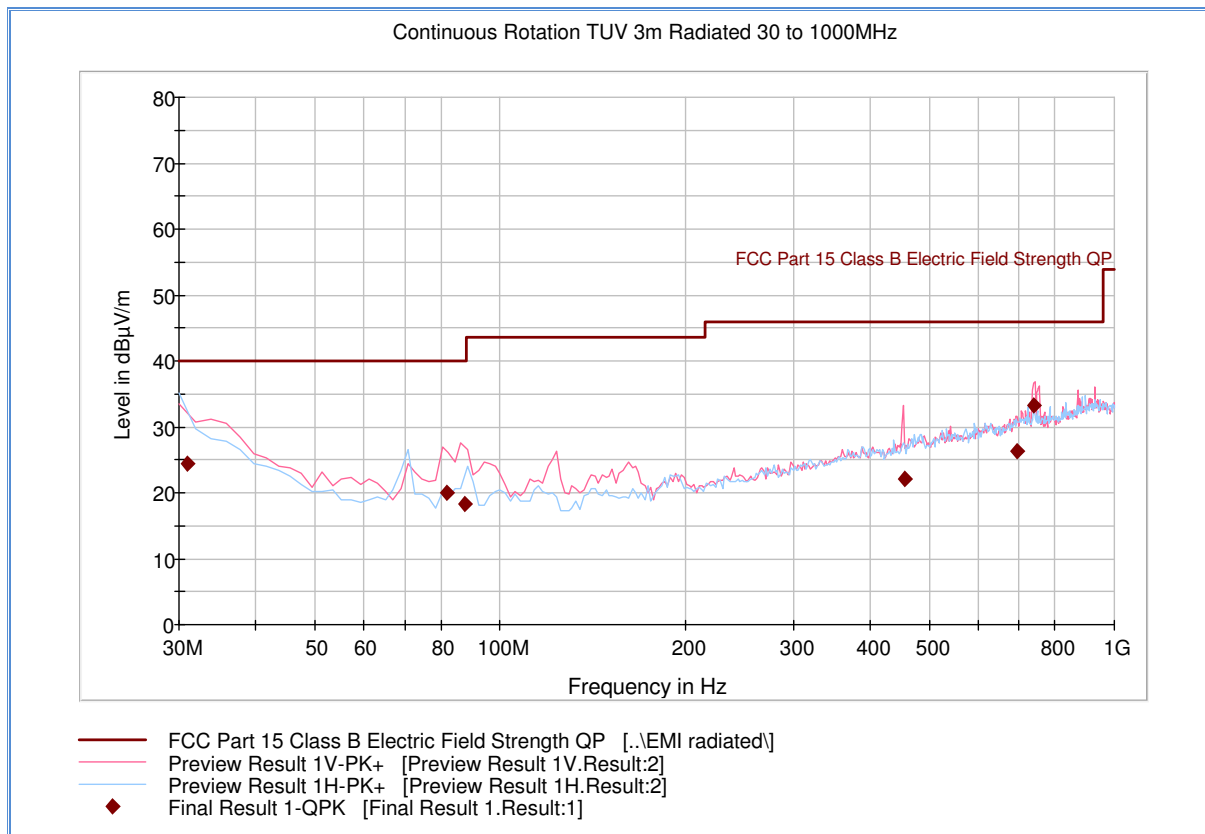


- Only noise floor measurements observed above 18GHz.
- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.7.8 for sample computation.

2.7.8 Sample Computation (Radiated Emission)

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

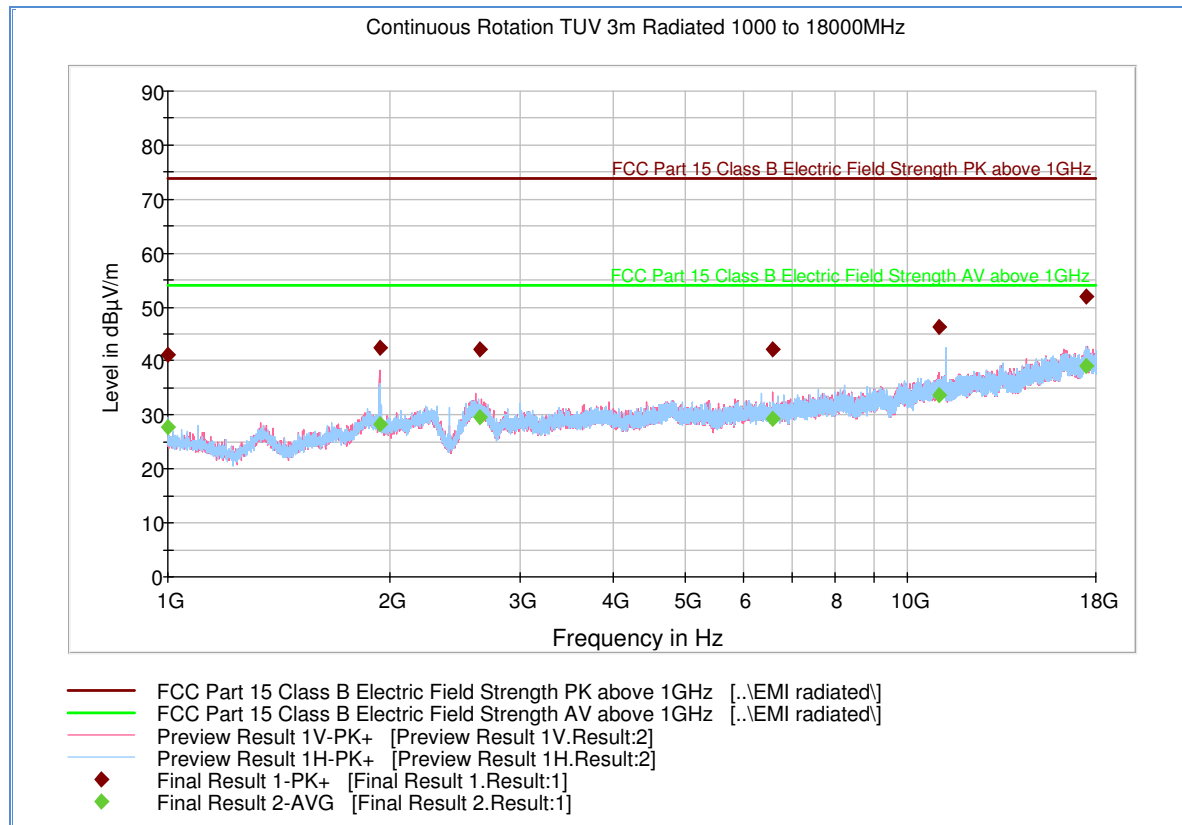
2.7.9 Test Results - Below 1GHz (Middle Channel)



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)
30.920000	24.4	1000.0	120.000	256.0	H	11.0	-6.1	15.6	40.0
81.781082	19.9	1000.0	120.000	103.0	V	-5.0	-16.2	20.1	40.0
87.452745	18.3	1000.0	120.000	103.0	V	18.0	-15.6	21.7	40.0
455.167535	22.1	1000.0	120.000	250.0	V	193.0	-2.6	23.9	46.0
693.009619	26.2	1000.0	120.000	150.0	V	110.0	2.9	19.8	46.0
741.022926	33.2	1000.0	120.000	400.0	V	328.0	3.3	12.8	46.0

2.7.10 Test Results Above 1GHz (Low Channel)



Peak Data

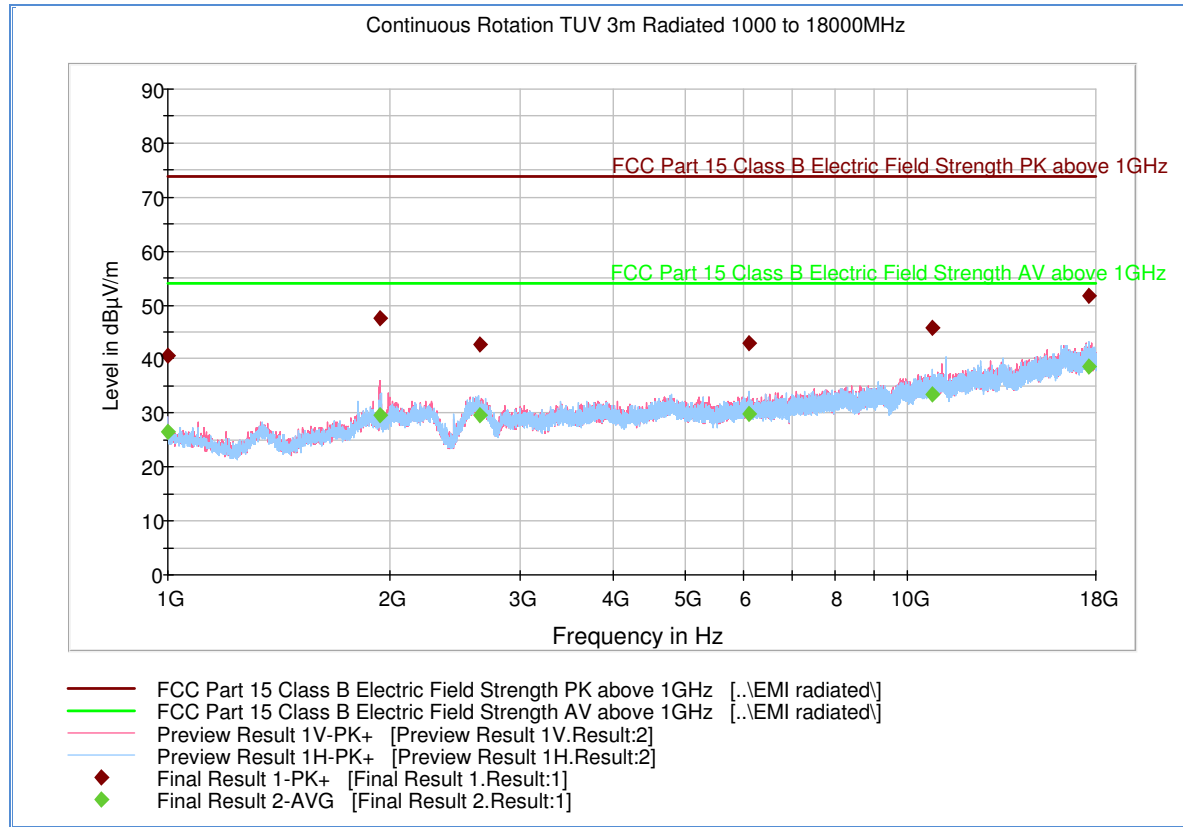
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	41.1	1000.0	1000.000	164.6	H	20.0	-7.9	32.8	73.9
1932.933333	42.6	1000.0	1000.000	229.4	V	249.0	-1.6	31.3	73.9
2637.900000	42.3	1000.0	1000.000	201.3	H	228.0	-0.9	31.6	73.9
6581.233333	42.1	1000.0	1000.000	103.7	V	340.0	5.1	31.8	73.9
11039.10000	46.3	1000.0	1000.000	116.7	V	66.0	11.7	27.6	73.9
17475.40000	52.1	1000.0	1000.000	333.1	H	217.0	18.0	21.8	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	27.8	1000.0	1000.000	164.6	H	20.0	-7.9	26.1	53.9
1932.933333	28.3	1000.0	1000.000	229.4	V	249.0	-1.6	25.6	53.9
2637.900000	29.6	1000.0	1000.000	201.3	H	228.0	-0.9	24.3	53.9
6581.233333	29.4	1000.0	1000.000	103.7	V	340.0	5.1	24.5	53.9
11039.10000	33.7	1000.0	1000.000	116.7	V	66.0	11.7	20.2	53.9
17475.40000	39.1	1000.0	1000.000	333.1	H	217.0	18.0	14.8	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 Above 1GHz (Middle Channel)



Peak Data

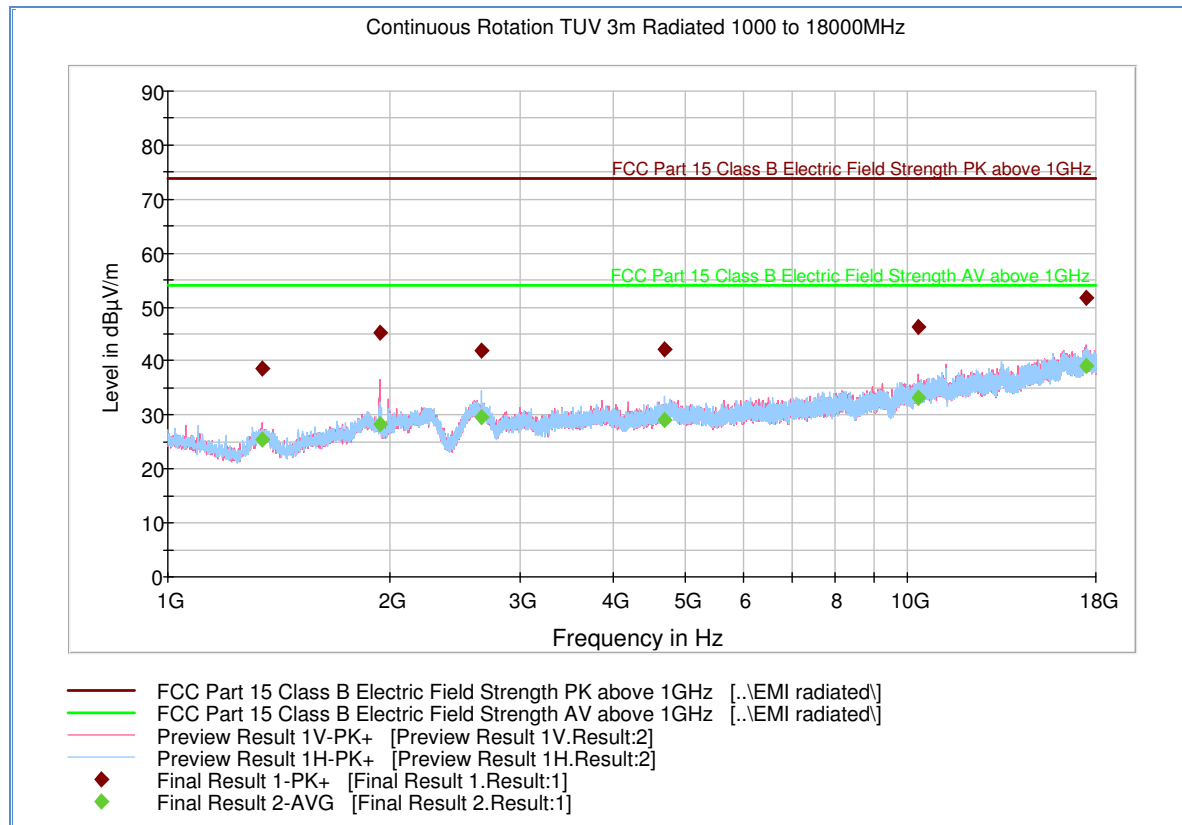
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.500000	40.6	1000.0	1000.000	177.6	H	232.0	-7.9	33.3	73.9
1937.466667	47.6	1000.0	1000.000	403.5	V	304.0	-1.5	26.3	73.9
2637.900000	42.6	1000.0	1000.000	403.5	H	175.0	-0.9	31.3	73.9
6104.533333	42.8	1000.0	1000.000	139.7	H	20.0	4.8	31.1	73.9
10825.100000	45.8	1000.0	1000.000	140.7	H	231.0	11.6	28.1	73.9
17649.233333	51.6	1000.0	1000.000	103.7	H	207.0	18.0	22.3	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.500000	26.4	1000.0	1000.000	177.6	H	232.0	-7.9	27.5	53.9
1937.466667	29.5	1000.0	1000.000	403.5	V	304.0	-1.5	24.4	53.9
2637.900000	29.7	1000.0	1000.000	403.5	H	175.0	-0.9	24.2	53.9
6104.533333	29.8	1000.0	1000.000	139.7	H	20.0	4.8	24.1	53.9
10825.100000	33.4	1000.0	1000.000	140.7	H	231.0	11.6	20.5	53.9
17649.233333	38.6	1000.0	1000.000	103.7	H	207.0	18.0	15.3	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.

2.7.12 Test Results Above 1GHz (High Channel)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1341.500000	38.4	1000.0	1000.000	403.5	V	18.0	-5.5	35.5	73.9
1937.066667	45.2	1000.0	1000.000	403.5	V	321.0	-1.5	28.7	73.9
2651.966667	41.8	1000.0	1000.000	288.2	H	155.0	-1.1	32.1	73.9
4696.933333	42.1	1000.0	1000.000	322.2	H	178.0	2.8	31.8	73.9
10372.700000	46.2	1000.0	1000.000	390.1	V	10.0	10.5	27.7	73.9
17432.566667	51.8	1000.0	1000.000	403.5	V	9.0	18.1	22.1	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)
1341.500000	38.4	1000.0	1000.000	403.5	V	18.0	-5.5	35.5	73.9
1937.066667	45.2	1000.0	1000.000	403.5	V	321.0	-1.5	28.7	73.9
2651.966667	41.8	1000.0	1000.000	288.2	H	155.0	-1.1	32.1	73.9
4696.933333	42.1	1000.0	1000.000	322.2	H	178.0	2.8	31.8	73.9
10372.700000	46.2	1000.0	1000.000	390.1	V	10.0	10.5	27.7	73.9
17432.566667	51.8	1000.0	1000.000	403.5	V	9.0	18.1	22.1	73.9

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 RADIATED BAND EDGE MEASUREMENTS AND IMMEDIATE RESTRICTED BANDS

2.8.1 Specification Reference

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

2.8.2 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)).

2.8.3 Equipment Under Test and Modification State

Serial No: 921550000015 / Default Test Configuration

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

January 15, 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	23.1°C
Relative Humidity	34.5 %
ATM Pressure	99.2kPa

2.8.7 Additional Observations

- This is a radiated test. The spectrum was searched from 2310MHz to 2390MHz for lower immediate restricted band and 2483.5MHz to 2500MHz for the upper immediate restricted band.
- There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.

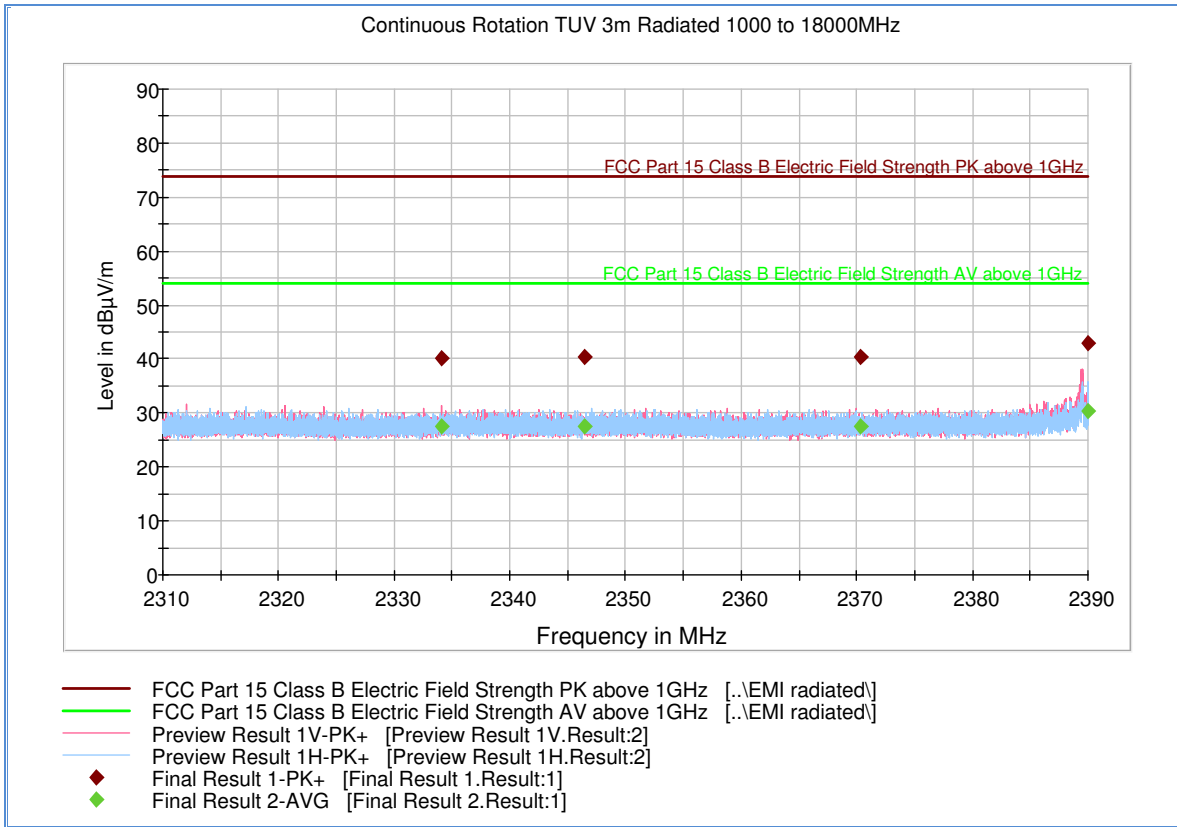


- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.8.8 for sample computation.

2.8.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (db 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

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



Peak Data

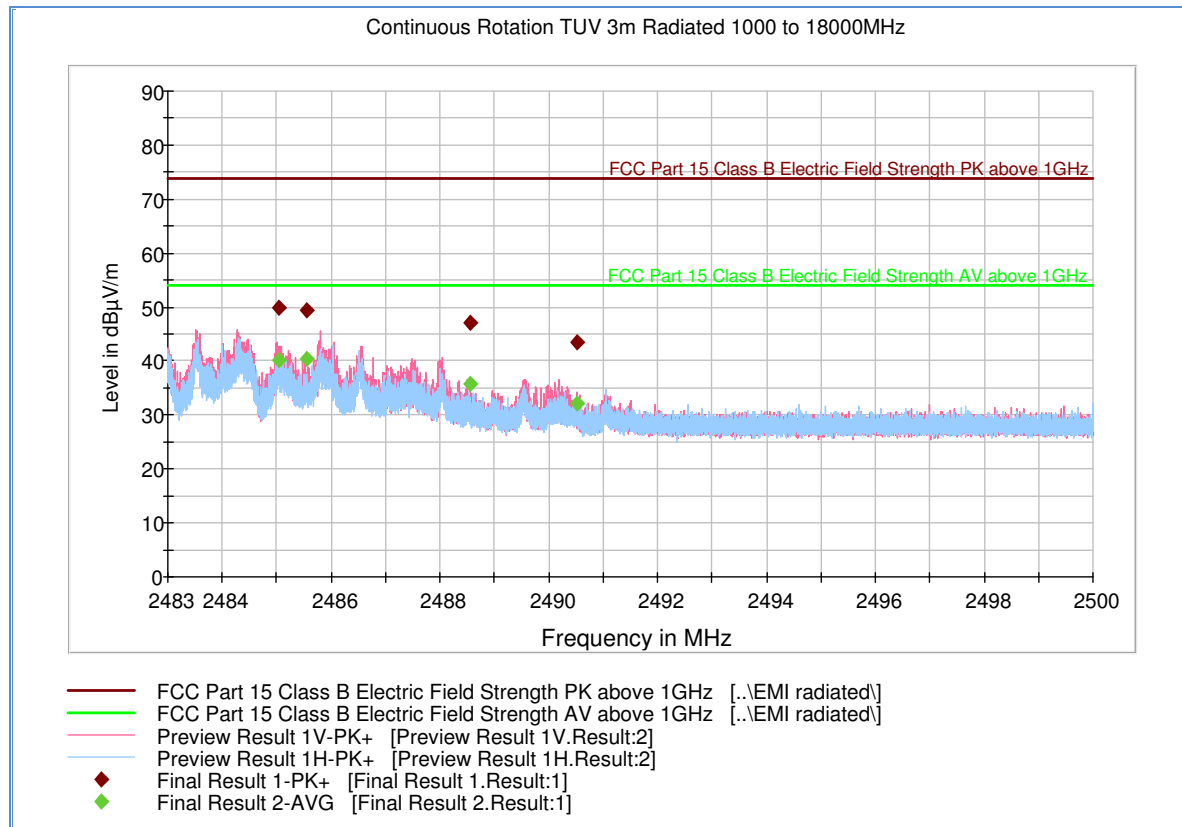
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2334.088000	40.0	1000.0	1000.000	355.1	V	39.0	-1.3	33.9	73.9
2346.517333	40.4	1000.0	1000.000	322.2	H	101.0	-1.4	33.5	73.9
2370.352000	40.4	1000.0	1000.000	268.3	V	52.0	-1.4	33.5	73.9
2390.000000	43.0	1000.0	1000.000	191.5	V	284.0	-1.3	30.9	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)
2334.088000	27.6	1000.0	1000.000	355.1	V	39.0	-1.3	26.3	53.9
2346.517333	27.6	1000.0	1000.000	322.2	H	101.0	-1.4	26.3	53.9
2370.352000	27.6	1000.0	1000.000	268.3	V	52.0	-1.4	26.3	53.9
2390.000000	30.2	1000.0	1000.000	191.5	V	284.0	-1.3	23.7	53.9

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

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



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2485.050367	49.9	1000.0	1000.000	190.5	V	289.0	-0.9	24.0	73.9
2485.550367	49.3	1000.0	1000.000	101.7	V	290.0	-0.9	24.6	73.9
2488.547833	47.1	1000.0	1000.000	102.7	V	285.0	-0.8	26.8	73.9
2490.510767	43.3	1000.0	1000.000	191.5	V	285.0	-0.8	30.6	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)
2485.050367	40.1	1000.0	1000.000	190.5	V	289.0	-0.9	13.8	53.9
2485.550367	40.4	1000.0	1000.000	101.7	V	290.0	-0.9	13.5	53.9
2488.547833	35.6	1000.0	1000.000	102.7	V	285.0	-0.8	18.3	53.9
2490.510767	32.1	1000.0	1000.000	191.5	V	285.0	-0.8	21.8	53.9

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

2.9 POWER SPECTRAL DENSITY

2.9.1 Specification Reference

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

2.9.2 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.

2.9.3 Equipment Under Test and Modification State

Serial No: 921550000015 / Default Test Configuration

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

January 05, 2016/XYZ

2.9.5 Test Equipment Used

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

2.9.6 Environmental Conditions

Ambient Temperature	22.7°C
Relative Humidity	52.9%
ATM Pressure	98.8kPa

2.9.7 Additional Observations

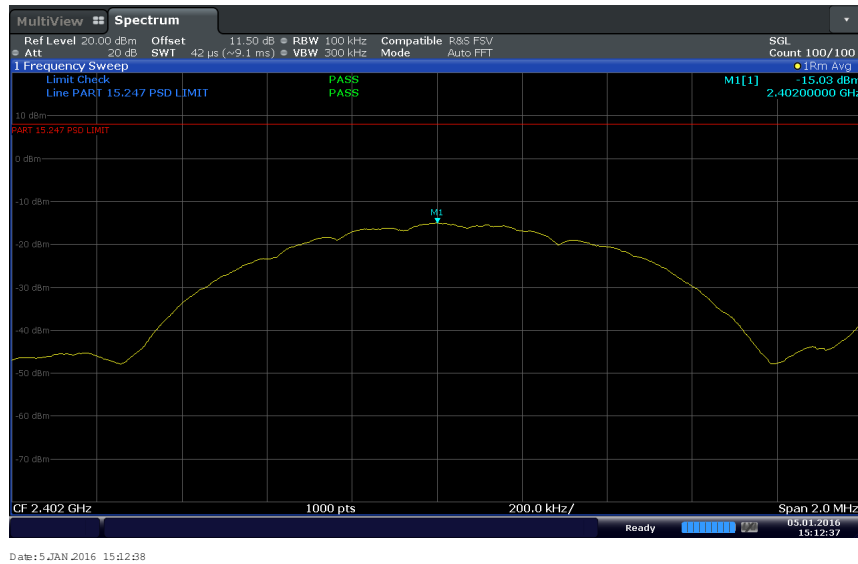
- This is a conducted test.
- Test procedure is per Section 10.3 of KDB 558074 D01 (DTS Meas Guidance v03r03, June 09, 2015).
- The path loss for was measured and entered as a level offset
- Detector is RMS power averaging.
- Trace averaging mode over 100 traces.
- Sweep time is Auto.
- EUT complies with 100 kHz RBW.



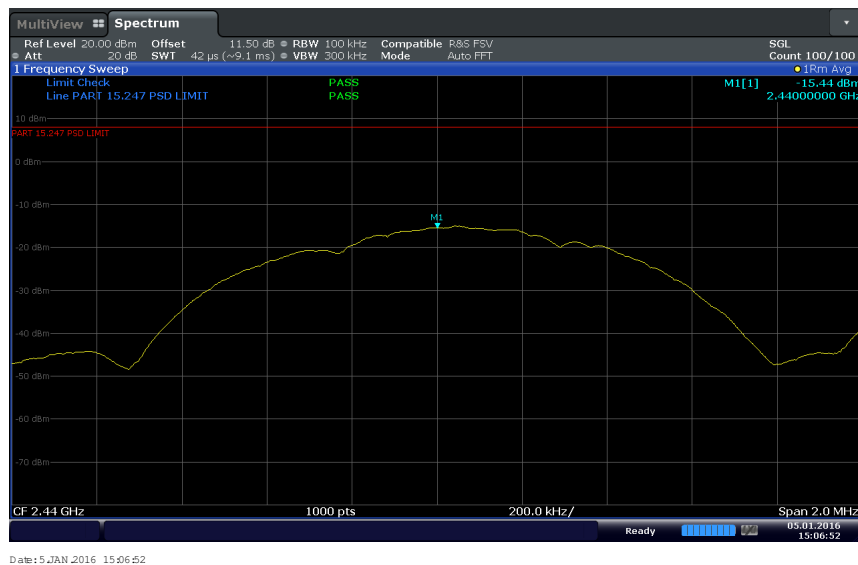
2.9.8 Test Results Summary

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	-15.03	8	23.03	Complies
	17 (2440 MHz)	GFSK @ 1Mbps	-15.44	8	23.44	Complies
	39 (2480 MHz)	GFSK @ 1Mbps	-19.41	8	27.41	Complies

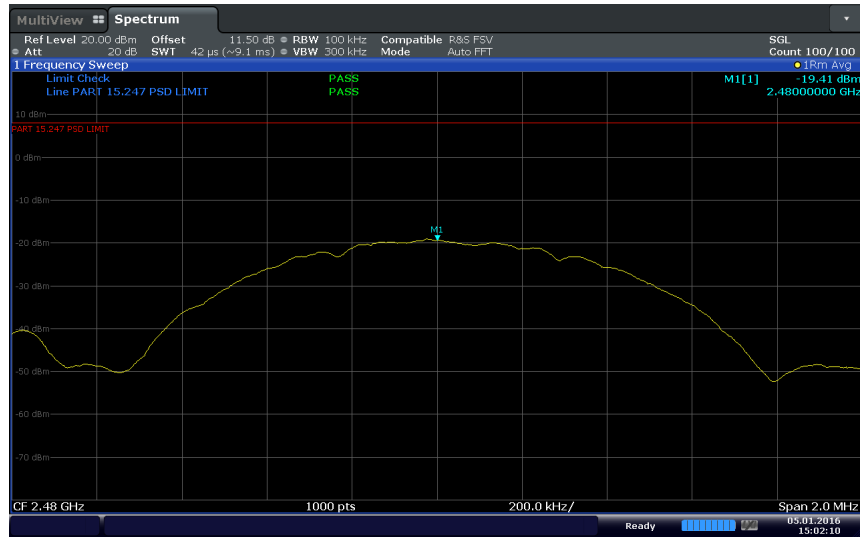
2.9.9 Test Results Plots



Bluetooth LE Low Channel



Bluetooth LE Middle Channel



Bluetooth LE High Channel



SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

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

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Conducted Port Setup						
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	10/05/15	10/05/16
7608	Vector Signal Generator	SMBV100 A	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
8772	10dB Attenuator	606-06-1F4/DR	-	MECA	Verified by 7608 and 7569	
Radiated Test Setup						
1033	Bilog Antenna	3142C	00044556	EMCO	09/25/15	09/25/16
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	04/27/15	04/27/16
8628	Pre-amplifier	QU 01182835 -JO	8986002	QuinStar Technologies Inc.	03/20/15	03/20/16
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	09/29/15	09/29/16
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/11/15	03/11/16
1016	Pre-amplifier	PAM-0202	187	PAM	12/15/15	12/15/16
8816	2.4GHz to 2.5GHz Notch Filter	BRM5070 2	133	MICRO-TRONICS	N/A	
Conducted Emissions						
1024	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	04/10/15	04/10/16
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	02/20/15	02/20/16
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	02/20/15	02/20/16
Miscellaneous						
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	
1072	DC Power Supply	E3610A	KR51311519	Hewlett Packard	Verified by 6752	
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/14/15	08/14/16
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	Sper Scientific	04/09/15	04/09/16

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 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

3.2.3 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	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

3.2.4 Conducted Antenna Port Measurement

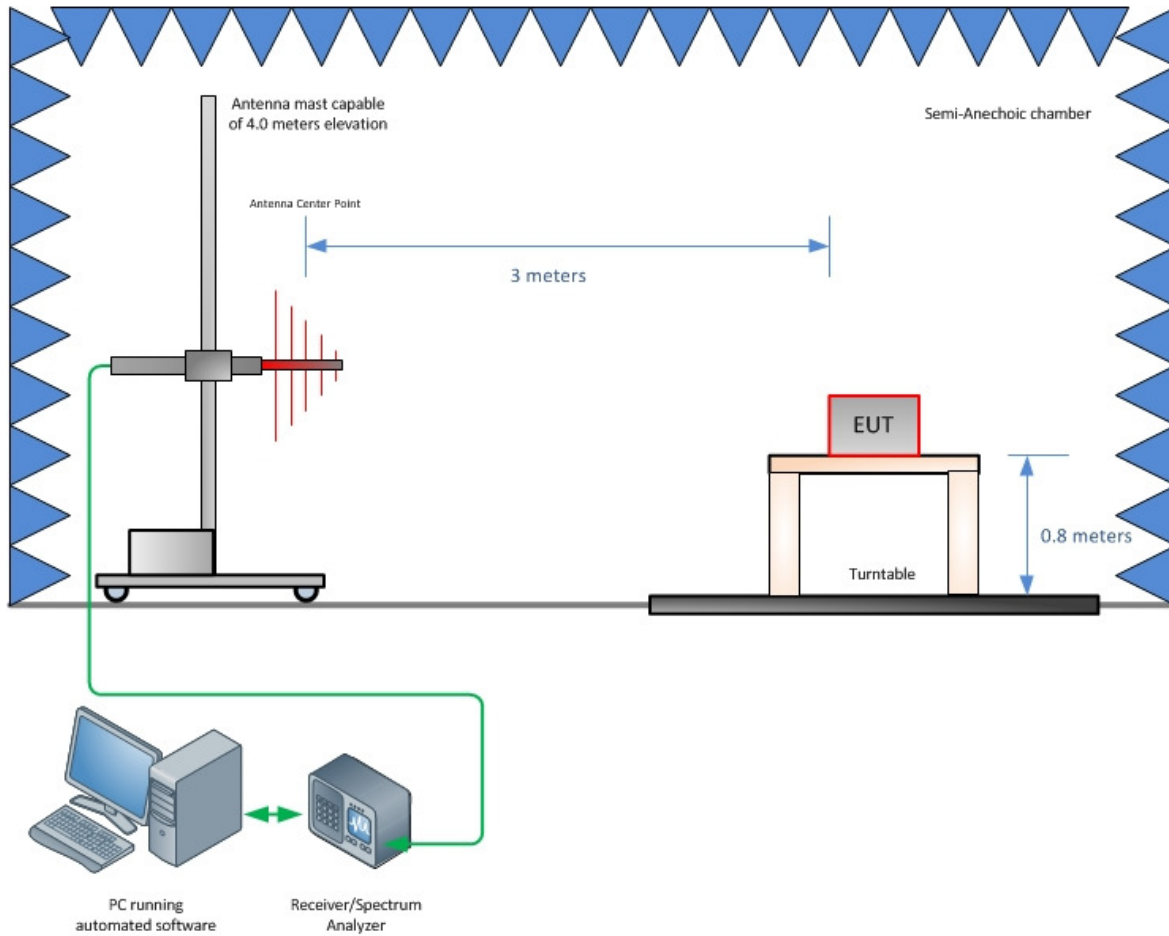
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.50	0.29	0.08
3	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					0.72
Coverage Factor (k):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



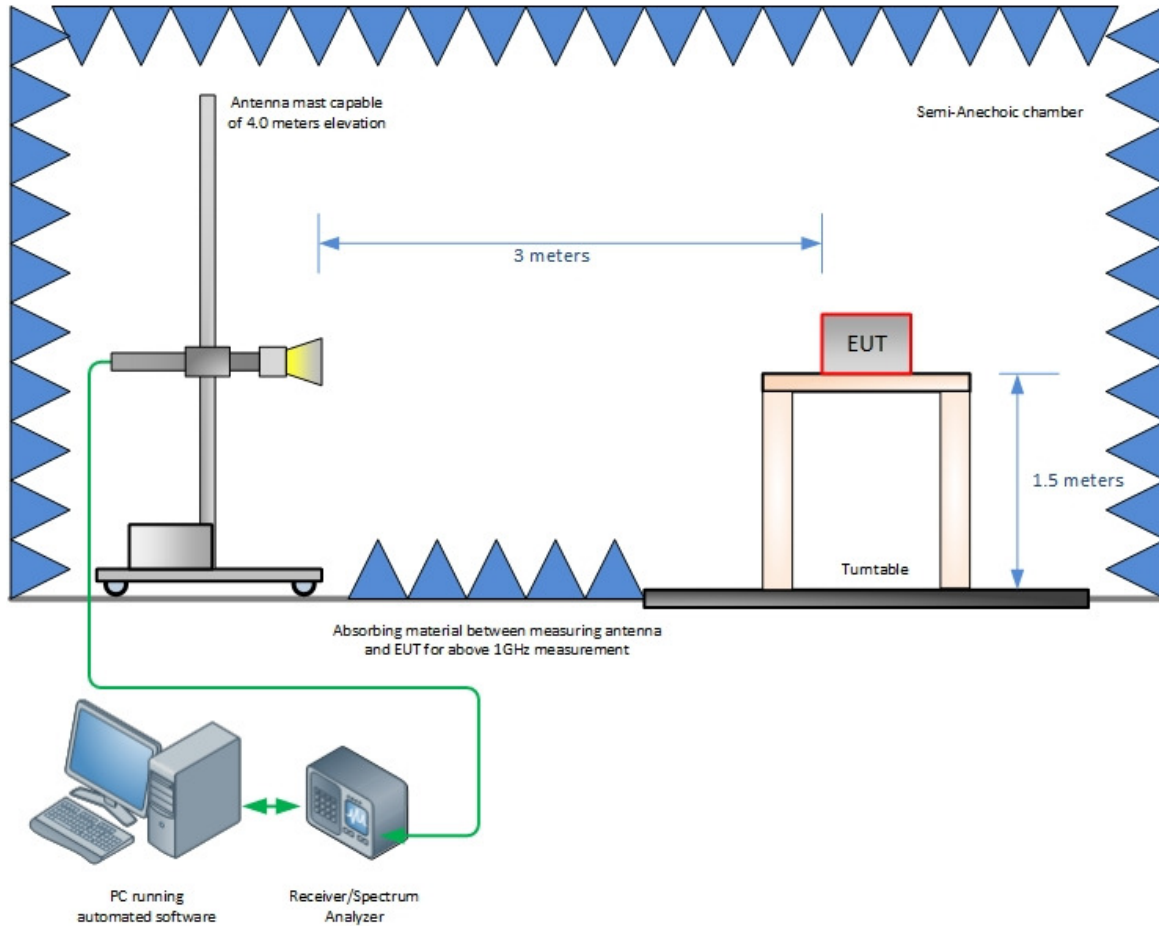
SECTION 4

DIAGRAM OF TEST SETUP

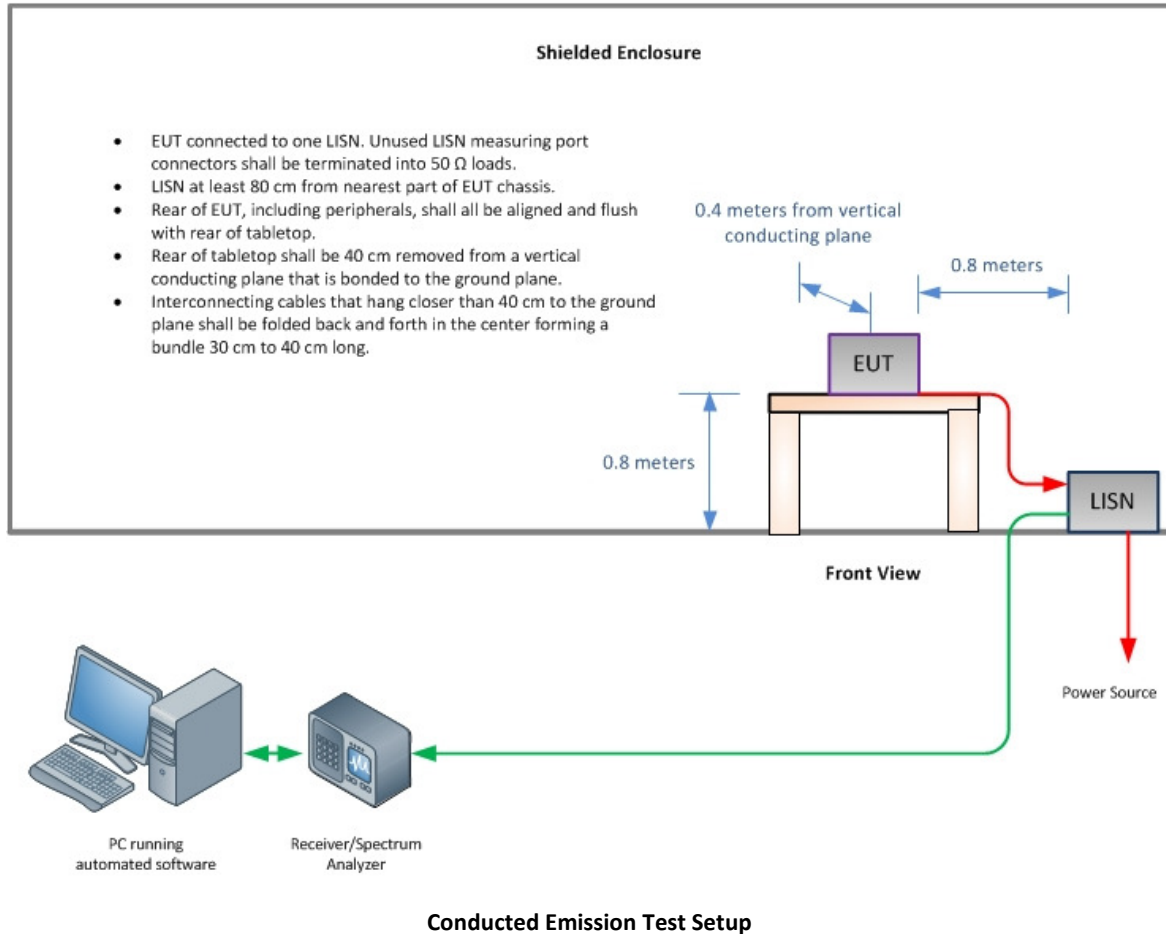
4.1 TEST SETUP DIAGRAM



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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