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Report On

Application for Grant of Equipment Authorization of the
Nextivity Inc.
Cel-Fi GO Smart Antenna 3G/4G/LTE Cellular Antenna

FCC Part 15 Subpart C §15.247
IC RSS-247 Issue 2 February 2017

Report No.SD72136978-0318B **March 2018**

REPORT ON	EMC Evaluation of the Nextivity Inc. Cel-Fi GO Smart Antenna 3G/4G/LTE Cellular Antenna
TEST REPORT NUMBER	SD72136978-0318B
TEST REPORT DATE	March 2018
PREPARED FOR	Nextivity Inc. 16550 West Bernardo Drive, Bldg 5, Suite 550 San Diego, CA 92127, USA
CONTACT PERSON	CK Li Sr. Principal Engineer, Regulatory CLi@NextivityInc.com (858) 485-9442
PREPARED BY	Xiaoying Zhang **Name** Authorized Signatory Title: EMC/Wireless Test Engineer
APPROVED BY	Ferdinand S. Custodio **Name** Authorized Signatory Title: EMC/Wireless Test Engineer
DATED	March 09, 2018

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

Revision History

SD72136978-0318B Nextivity Inc. Cel-Fi GO Smart Antenna 3G/4G/LTE Cellular Antenna					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
03/09/2018	Initial Release				Ferdinand Custodio

CONTENTS

SECTION 1

REPORT SUMMARY

Radio Testing of the
Nextivity Inc.
3G/4G/LTE Cellular Antenna

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Nextivity Inc. Cel-Fi 3G/4G/LTE Cellular Antenna to the requirements of FCC Part 15 Subpart C §15.247 and IC RSS-247 Issue 2 February 2017.

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.
EUT	3G/4G/LTE Cellular Antenna
Trade Name	Cel-Fi™
Model Name	GO Smart Antenna
FCC ID	YETA41-V32-100
IC Number	9298A-A41V32100
FCC Classification	Low power Communications device Transmitter (DTS)
Serial Number(s)	100750000272 (Conducted) 100750000333 (Radiated)
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.247 (October 1, 2017). • RSS-247–Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices (Issue 2, February 2017). • RSS-Gen - General Requirements for Compliance of Radio Apparatus (Issue 4, November 2014).
Start of Test	March 01, 2018
Finish of Test	March 02, 2018
Name of Engineer(s)	Xiaoying Zhang
Related Document(s)	• KDB 558074 D01 (DTS Meas Guidance v04, April 05, 2017). Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247. • Supporting documents for EUT certification are separate exhibits.

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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 2 February 2017 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(d)	Peak Output Power	Compliant	
2.2	§15.207(a)	RSS-Gen 8.8	Conducted Emissions	Compliant	
-	-	RSS-Gen 6.6	99% Emission Bandwidth	Compliant	
-	§15.247(a)(2)	RSS-247 5.2(a)	Minimum 6 dB RF Bandwidth	Compliant	
-	§15.247(d)	RSS-247 5.5	Out-of-Band Emissions - Conducted	Compliant	
-	§15.247(d)	RSS-247 5.5	Band-edge Compliance of RF Conducted Emissions	Compliant	
-	§15.247(d)	RSS-247 5.5	Radiated Spurious Emissions	Compliant	
-	-	RSS-Gen 7.1	Receiver Spurious Emissions	N/A	
2.3	§15.247(d)	RSS-247 5.5	Radiated Band Edge Measurements and Restricted Bands	Compliant	
-	§15.247(e)	RSS-247 5.2(b)	Power Spectral Density for Digitally Modulated Device	Compliant	

N/A Not required as per RSS-Gen 5.3. The EUT has no receiver stand-alone mode.

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) is a Nextivity Inc. Cel-Fi GO Smart Antenna 3G/4G/LTE Cellular Antenna. The EUT is a high-gain, low profile, magnetic-mounted wideband cellular antenna designed for mobile use on vehicles with the Cel-Fi GO Smart Signal Booster. The GO Smart Antenna includes Bluetooth LE functionality to communicate with the GO Smart Signal Booster. Only the BT Low Energy function of the EUT was verified in this test report.

1.3.2 EUT General Description

EUT Description	3G/4G/LTE Cellular Antenna
Trade Name	Cel-Fi™
Model Name	GO Smart Antenna
Rated Voltage	3.8 VDC from Cel-Fi GO NU port
Mode Verified	BT LE
Capability	BT LE
Primary Unit (EUT)	☒ Production
	☐ Pre-Production
	☐ Engineering
Manufacturer Declared Temperature Range	-20°C to 50°C
Antenna Type	PCB Monopole
Manufacturer	Nextivity
Antenna Model	-
Maximum Antenna Gain	6 dBi

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	3.43	2.2	4.56	2.86

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	The EUT is powered by Cel-Fi GO NU Port. The EUT is connected to a support laptop running Nextivity Integrated Programming Environment V4.05 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 Conducted tests, the antenna port was connected to the Spectrum Analyser or Power Meter when used with a conducted RF Cable. For Radiated tests, Cell Antenna is in rotation mode as the worst case.

1.4.2 EUT Exercise Software

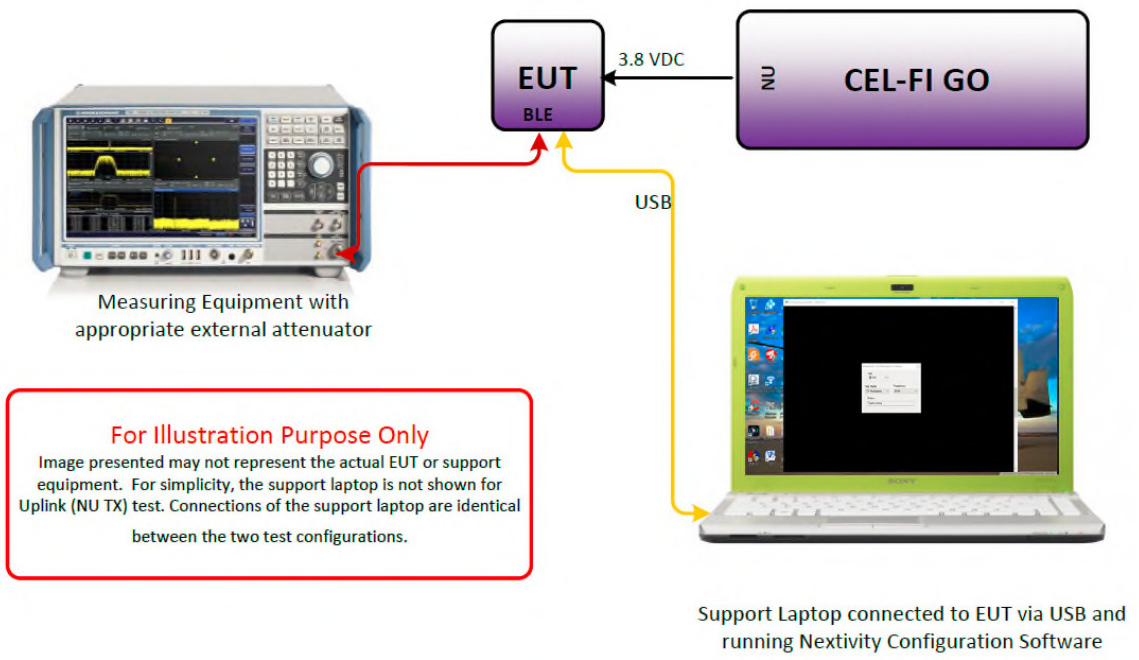
Manufacturer provided a configuration software (Integrated Programming Environment v4.05) running from a support laptop where EUT is connected via USB.

1.4.3 Support Equipment and I/O cables

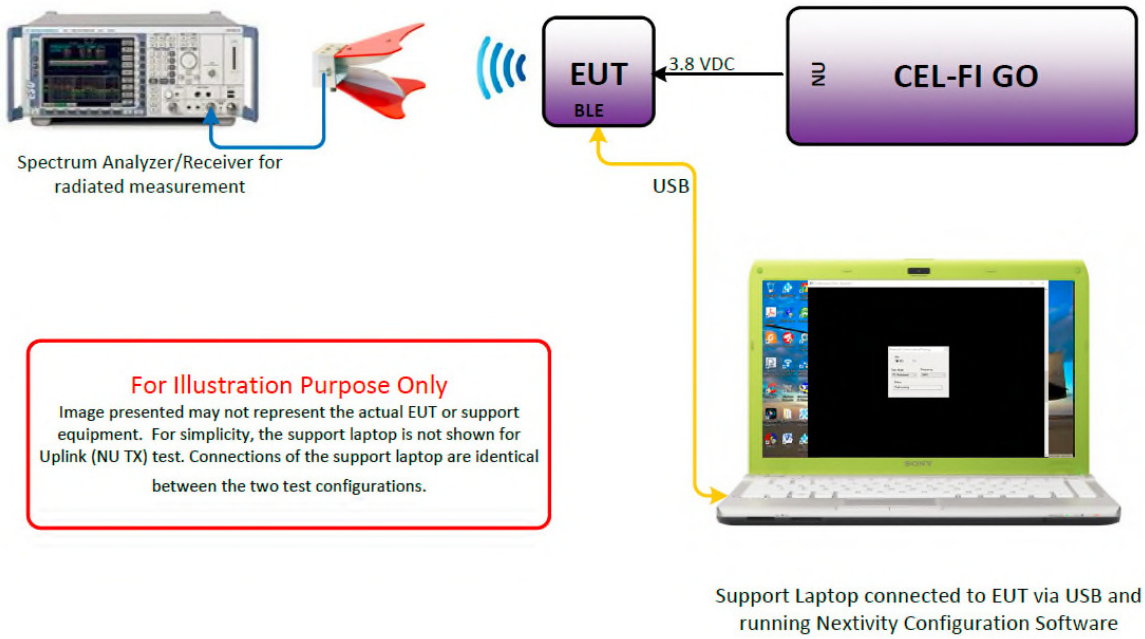
Manufacturer	Equipment/Cable	Description
DELL	Support Laptop	Model: Latitude D630 S/N: 5SBJBG1
HON-KWANG	I.T.E Power Supply	Model: HK-AY-150A160-US S/N: KH30000455 Input: 100-240V, 50/60Hz, 0.8A; Output: 15 VDC 1.6A
Nextivity	Cel-Fi GO	M/N: G32-2/4/5/12/13X S/N: 932744000001
-	RF Cable	3 meter RF Cable
Microchip	Pickit 3	M/N: BUR172073317

1.4.4 Simplified Test Configuration Diagram

Antenna Conducted Port Test Configuration



Radiated Test Configuration

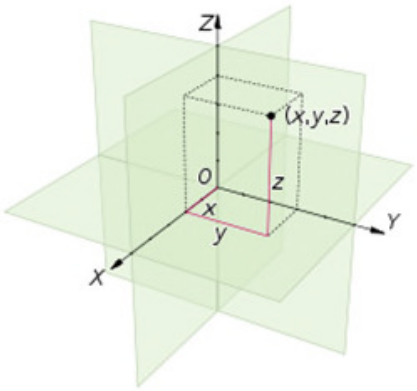


1.4.5 Worst Case Configuration

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 only at Y orientation. For radiated measurements verifications performed using "Y" 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: 100750000272 (conducted) and 100750000333 (radiated)		
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 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)

16936 Via Del Campo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 678-1400 Fax: 858 546 0364.

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Designation 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 Designation is US1146.

1.9.2 Innovation, Science and Economic Development Canada (IC) Registration No.: 3067A-1 & 22806-1

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego Rancho Bernardo) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 3067A-1.

The 3m Semi-anechoic chamber of TUV SUD America Inc. (San Diego Mira Mesa) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 22806-1.

1.9.3 BSMI – Laboratory Code: SL2-IN-E-028R (US0102)

TUV Product Service Inc. (San Diego) is a recognized EMC testing laboratory by the BSMI under the MRA (Mutual Recognition Arrangement) with the United States. Accreditation includes CNS 13438 up to 6GHz.

1.9.4 NCC (National Communications Commission - US0102)

TUV SUD America Inc. (San Diego) is listed as a Foreign Recognized Telecommunication Equipment Testing Laboratory and is accredited to ISO/IEC 17025 (A2LA Certificate No.2955.13) which under APEC TEL MRA Phase 1 was designated as a Conformity Assessment Body competent to perform testing of equipment subject to the Technical Regulations covered under its scope of accreditation including RTTE01, PLMN01 and PLMN08 for TTE type of testing and LP002 for Low-Power RF Device type of testing.

1.9.5 VCCI – Registration No. A-0280 and A-0281

TUV SUD America Inc. (San Diego) is a VCCI registered measurement facility which includes radiated field strength measurement, radiated field strength measurement above 1GHz, mains port interference measurement and telecommunication port interference measurement.

1.9.6 RRA – Identification No. US0102

TUV SUD America Inc. (San Diego) is National Radio Research Agency (RRA) recognized laboratory under Phase I of the APEC Tel MRA.

1.9.7 OFCA – U.S. Identification No. US0102

TUV SUD America Inc. (San Diego) is recognized by Office of the Communications Authority (OFCA) under Appendix B, Phase I of the APEC Tel MRA.

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SECTION 2

TEST DETAILS

Radio Testing of the
Nextivity Inc.
3G/4G/LTE Cellular Antenna

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 (d)

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: 100750000272 / Default Test Configuration

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

March 01, 2018/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	20.4°C
Relative Humidity	43.8%
ATM Pressure	99.6kPa

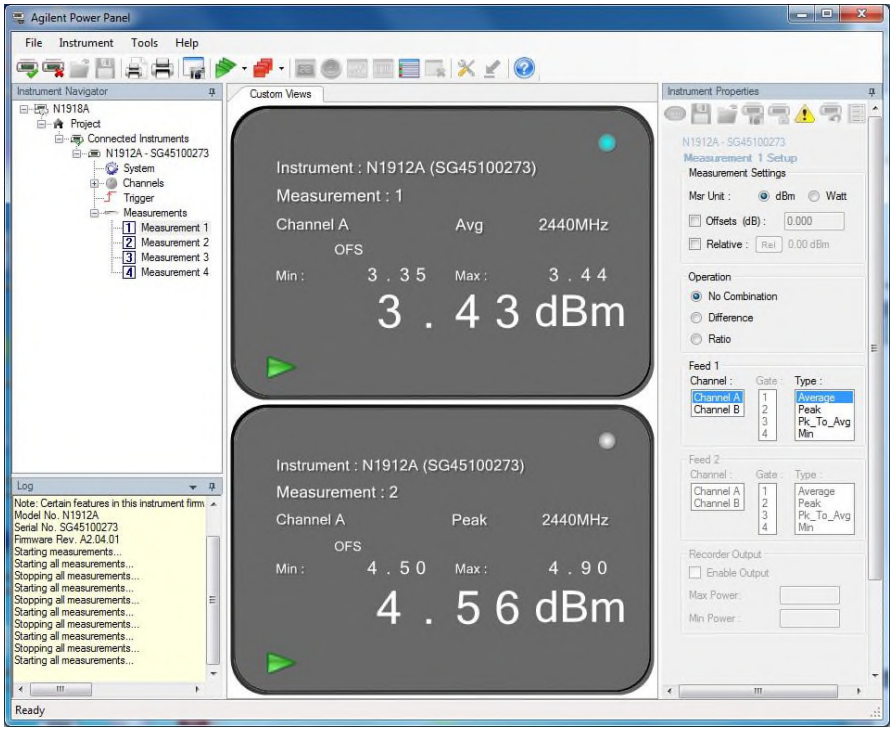
2.1.7 Additional Observations

- 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 v04, April 05, 2017). 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	2.00	3.56
	17 (2440 MHz)		**3.43**	**4.56**
	39 (2480 MHz)		0.86	2.84

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: 100750000333 / Default Test Configuration

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

March 02, 2018/XYZ

2.2.5 Test Equipment Used

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

2.2.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	20.4 °C
Relative Humidity	39.4 %
ATM Pressure	99.4 kPa

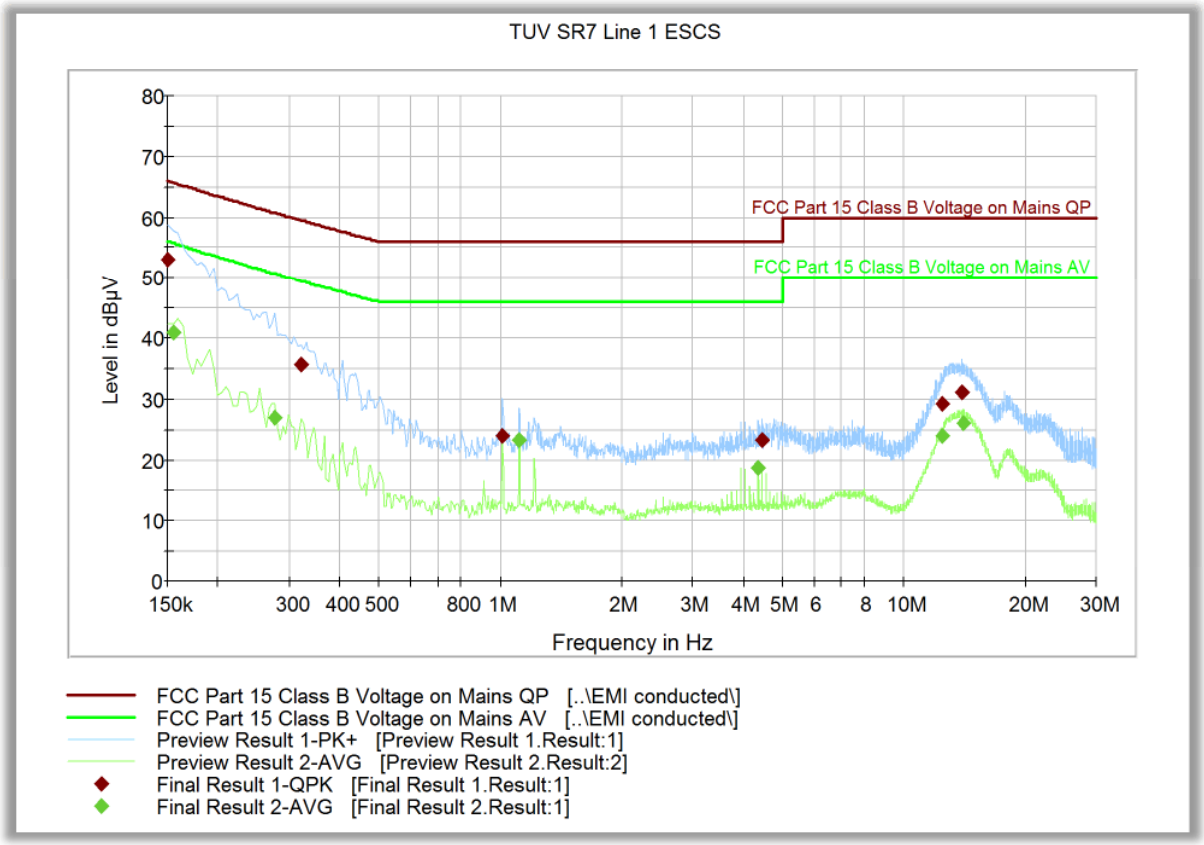
2.2.7 Additional Observations

- 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 - Conducted Emissions Line 1 – Hot



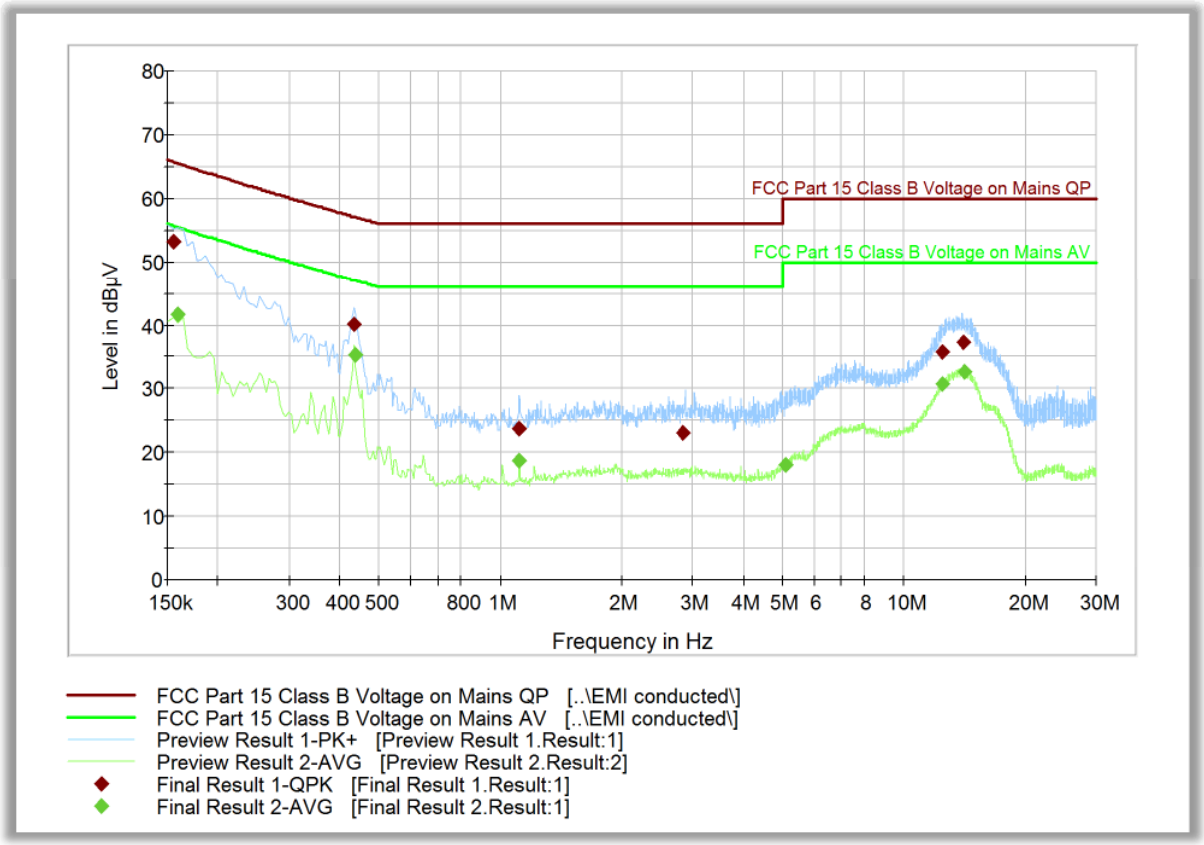
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150000	53.1	1000.0	9.000	Off	L1	20.0	12.9	66.0
0.321000	35.6	1000.0	9.000	Off	L1	20.1	23.9	59.5
1.009500	24.0	1000.0	9.000	Off	L1	19.9	32.0	56.0
4.461000	23.3	1000.0	9.000	Off	L1	20.3	32.7	56.0
12.489000	29.2	1000.0	9.000	Off	L1	20.6	30.8	60.0
13.911000	31.0	1000.0	9.000	Off	L1	20.7	29.0	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.154500	40.8	1000.0	9.000	Off	L1	20.0	14.9	55.7
0.276000	27.0	1000.0	9.000	Off	L1	20.0	23.7	50.7
1.113000	23.3	1000.0	9.000	Off	L1	20.0	22.7	46.0
4.357500	18.9	1000.0	9.000	Off	L1	20.2	27.1	46.0
12.475500	23.9	1000.0	9.000	Off	L1	20.6	26.1	50.0
14.073000	26.2	1000.0	9.000	Off	L1	20.7	23.8	50.0

2.2.10 Test Result - 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	53.2	1000.0	9.000	Off	N	20.0	12.5	65.7
0.433500	40.2	1000.0	9.000	Off	N	20.0	16.9	57.1
1.113000	23.7	1000.0	9.000	Off	N	20.0	32.3	56.0
2.827500	23.0	1000.0	9.000	Off	N	20.3	33.0	56.0
12.489000	35.7	1000.0	9.000	Off	N	20.6	24.3	60.0
13.996500	37.2	1000.0	9.000	Off	N	20.7	22.8	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.159000	41.7	1000.0	9.000	Off	N	20.0	13.7	55.5
0.438000	35.3	1000.0	9.000	Off	N	20.0	11.7	47.0
1.113000	18.8	1000.0	9.000	Off	N	20.0	27.2	46.0
5.073000	18.1	1000.0	9.000	Off	N	20.3	31.9	50.0
12.489000	30.8	1000.0	9.000	Off	N	20.6	19.2	50.0
14.095500	32.7	1000.0	9.000	Off	N	20.6	17.4	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: 100750000272 / Default Test Configuration

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

March 01, 2018/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

Ambient Temperature	20.4°C
Relative Humidity	43.8%
ATM Pressure	99.6kPa

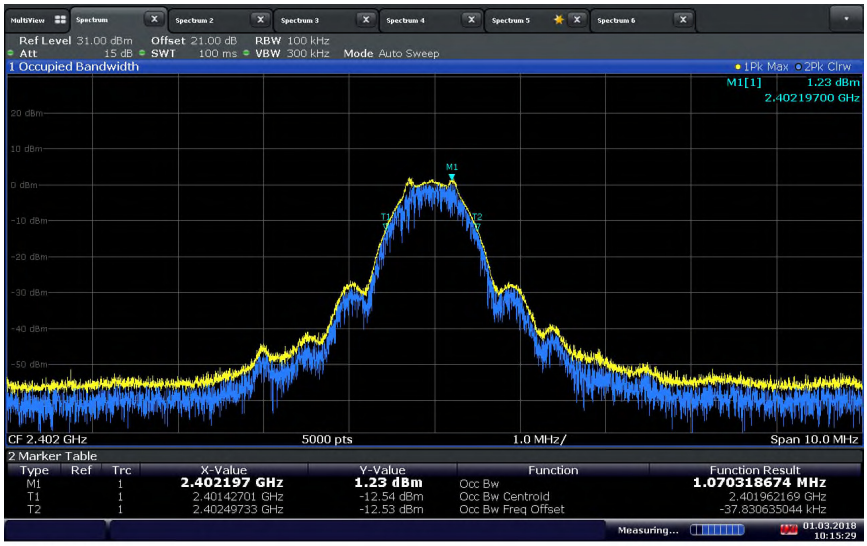
2.3.7 Additional Observations

- This is a conducted test.
- The path loss was measured and entered as a level offset.
- 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)	1.07
	17 (2440 MHz)	1.08
	39 (2480 MHz)	1.06

2.3.9 Test Results Plots



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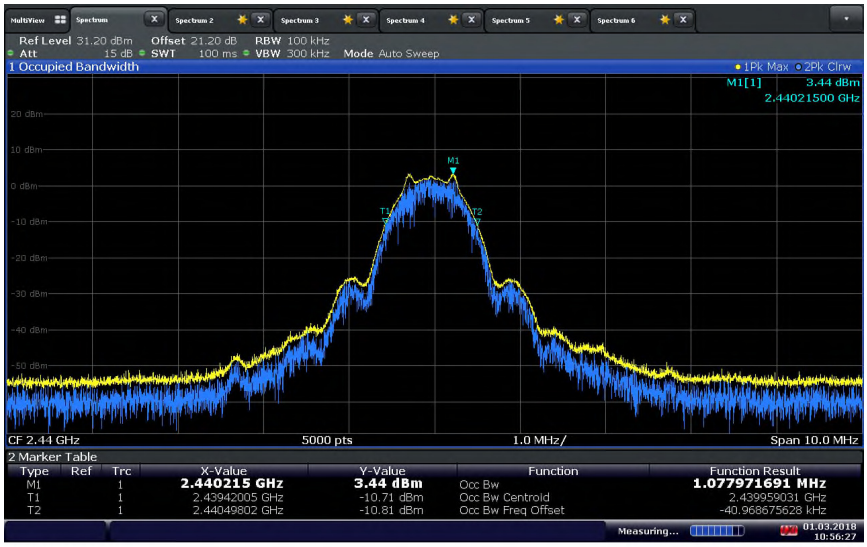
Bluetooth LE Low Channel



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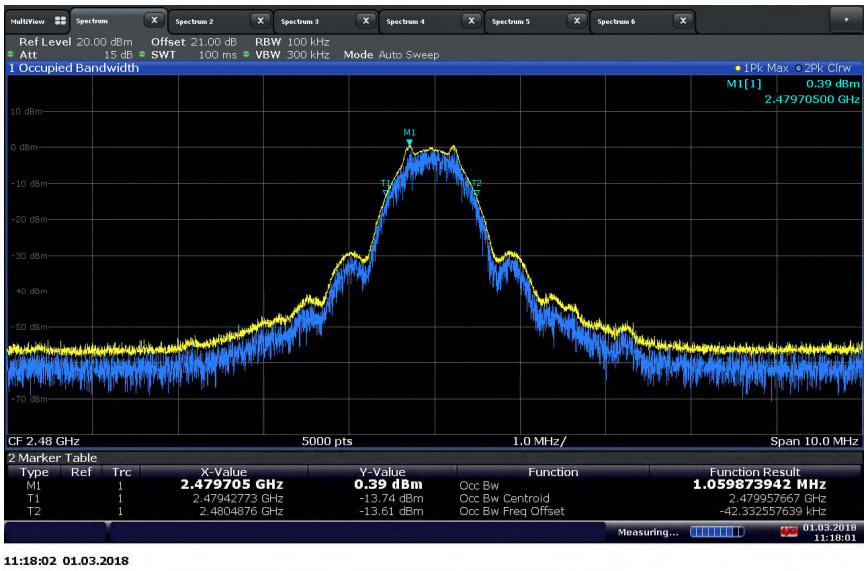
Bluetooth LE Mid Channel



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)
RSS-247, Clause 5.2 (a)

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: 100750000272 / Default Test Configuration

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

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

March 01, 2018/XYZ

2.4.6 Test Equipment Used

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

2.4.7 Environmental Conditions

Ambient Temperature	20.4°C
Relative Humidity	43.8%
ATM Pressure	99.6kPa

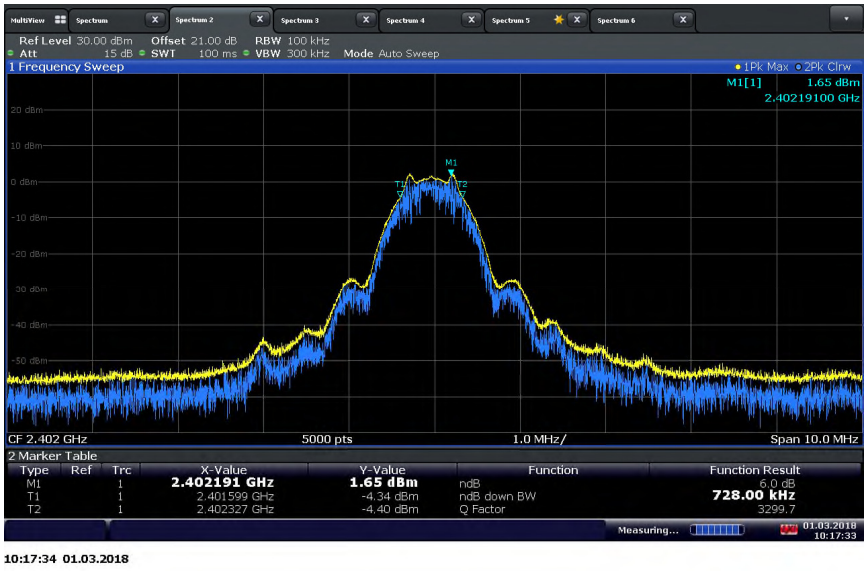
2.4.8 Additional Observations

- This is a conducted test.
- The path loss was measured and entered as a level offset.
- Span is wide enough to capture the channel transmission.
- RBW is set to 100 kHz.
- VBW is ≥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.

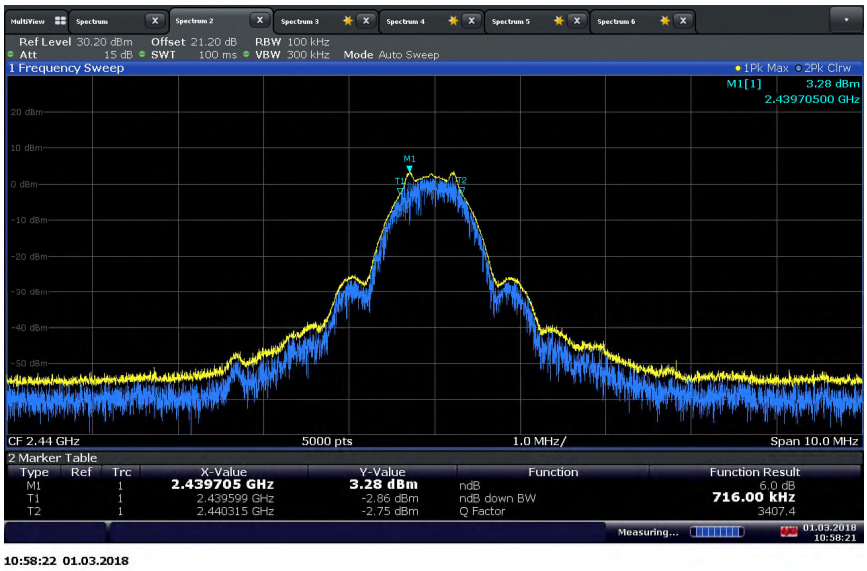
2.4.9 Test Results

Mode	Channel	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Compliance
Bluetooth LE	37 (2402 MHz)	0.728	0.500	Complies
	17 (2440 MHz)	0.716	0.500	Complies
	39 (2480 MHz)	0.706	0.500	Complies

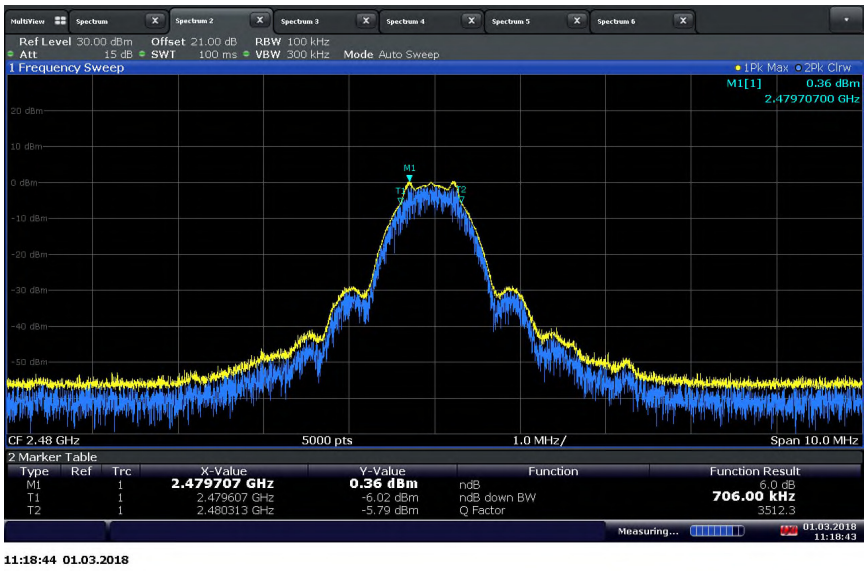
2.4.10 Test Results Plots



Bluetooth LE Low Channel



Bluetooth LE Mid Channel



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: 100750000272 / Default Test Configuration

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

March 01, 2018/XYZ

2.5.5 Test Equipment Used

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

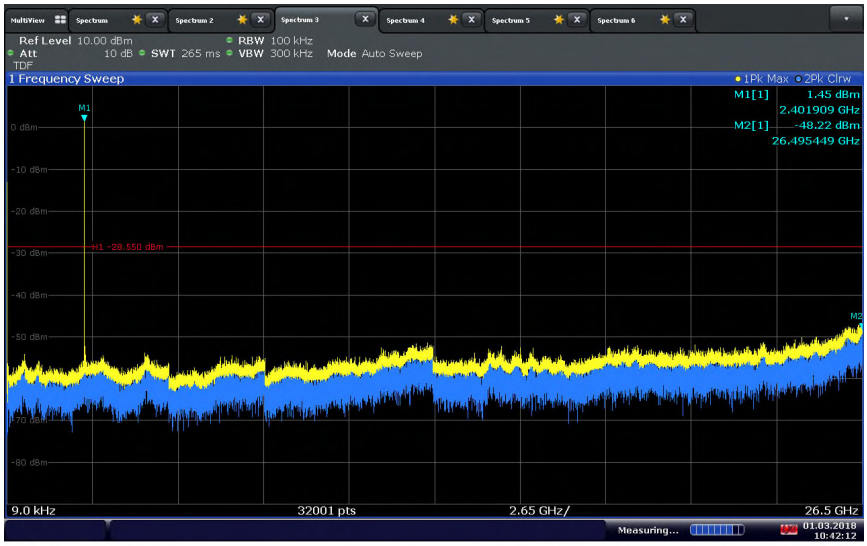
2.5.6 Environmental Conditions

Ambient Temperature	20.4°C
Relative Humidity	43.8%
ATM Pressure	99.6kPa

2.5.7 Additional Observations

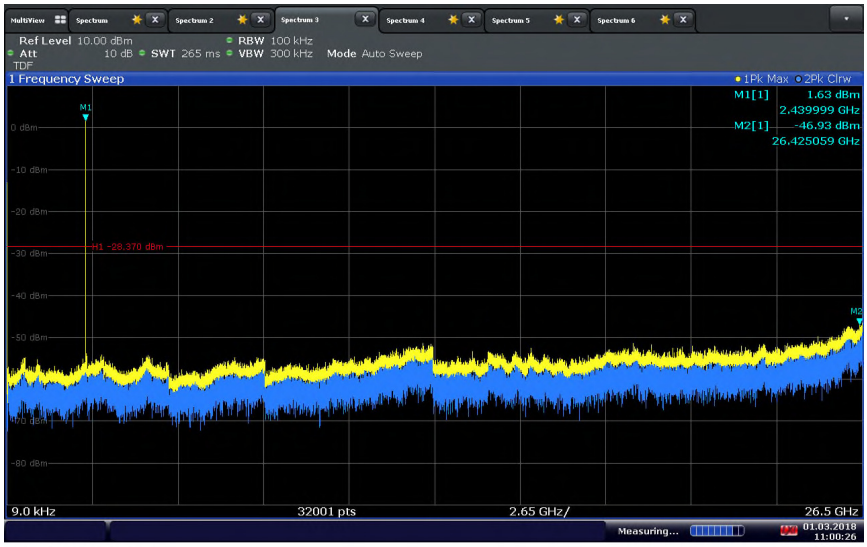
- This is a conducted test.
- TDF (Transducer Factor) was used to compensate for the external attenuator and cable used.
- RBW is 100kHz.VBW is 3X RBW.
- Sweep is auto. Detector is peak. Trace is max hold.
- Initial scan was performed to determine the highest level of the desired power within the band. 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



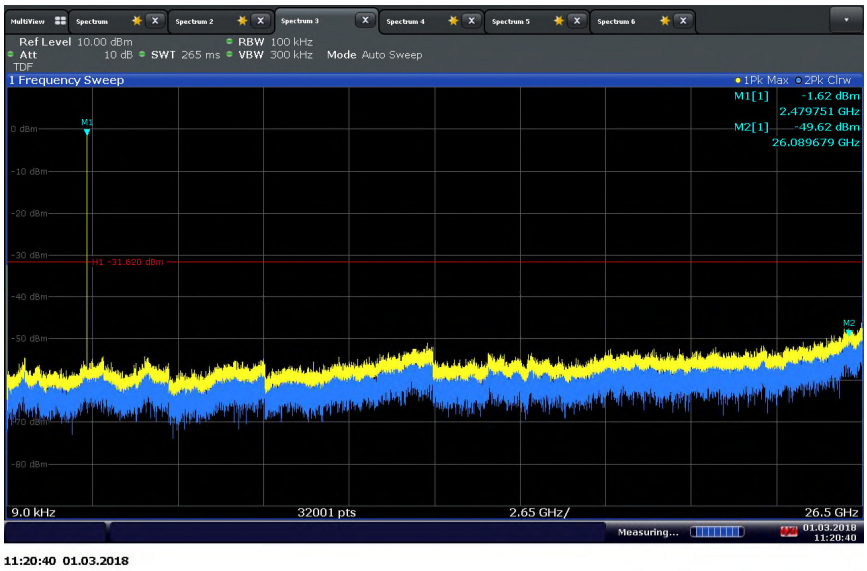
10:42:13 01.03.2018

Bluetooth LE Low Channel



11:00:26 01.03.2018

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)
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: 100750000272 / Default Test Configuration

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

March 01, 2018/XYZ

2.6.5 Test Equipment Used

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

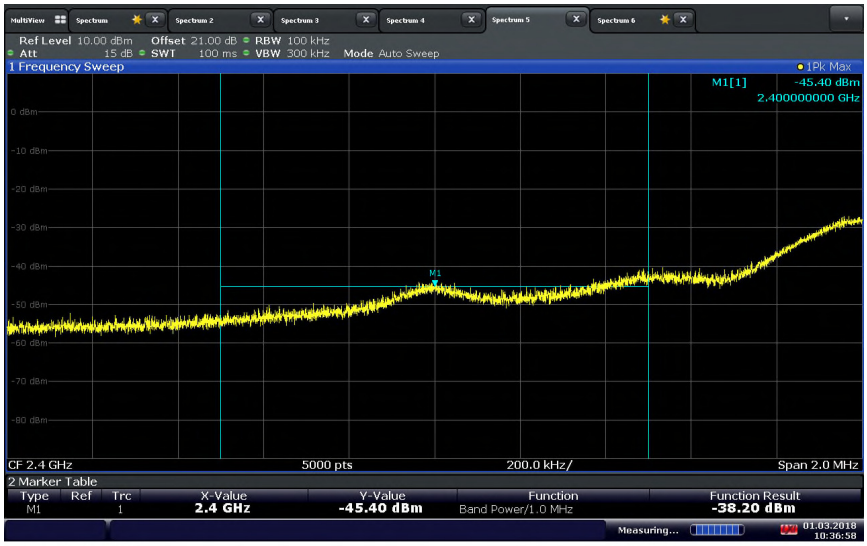
2.6.6 Environmental Conditions

Ambient Temperature	20.4°C
Relative Humidity	43.8%
ATM Pressure	99.6kPa

2.6.7 Additional Observations

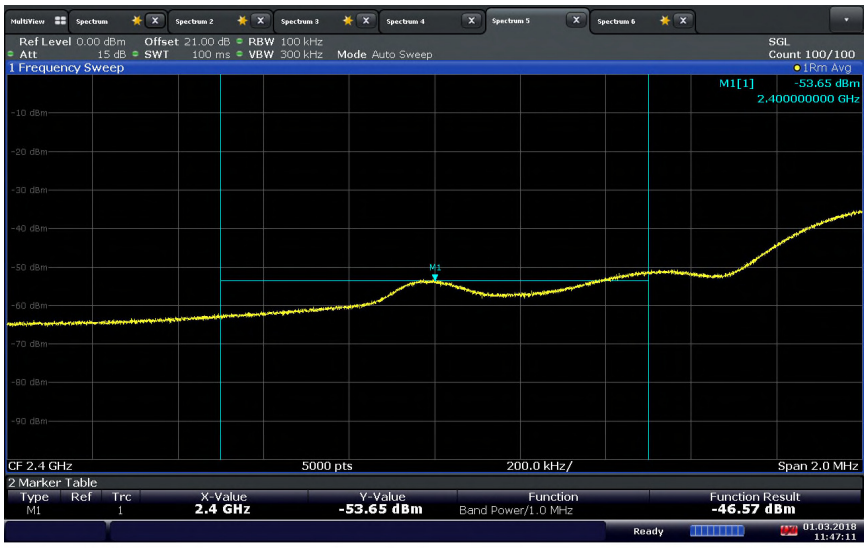
- Setup is identical to “Out-of-Band Emissions – Conducted” test (previous test).
- The path loss was measured and entered as a level offset
- Test methodology is per Clause 13.3.1 of KDB 558074 D01 (DTS Meas Guidance v04, April 05, 2017); trace averaging with continuous EUT transmission at full power.
- 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



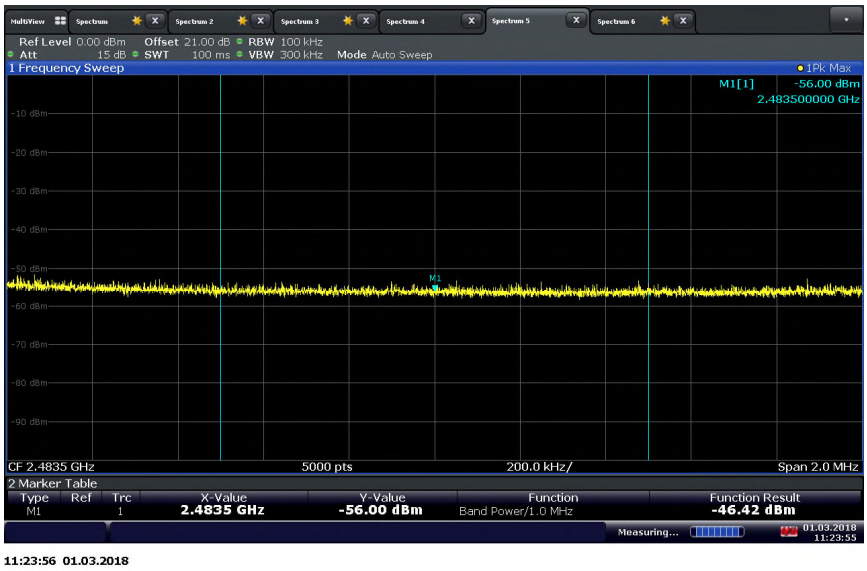
10:36:59 01.03.2018

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



11:47:11 01.03.2018

Bluetooth LE Low Channel (2402 MHz). Limit is -28.55 dBm. Margin is -18.02 dB.
(The highest level of the desired power in the 100 kHz bandwidth within the band is 1.45dBm)

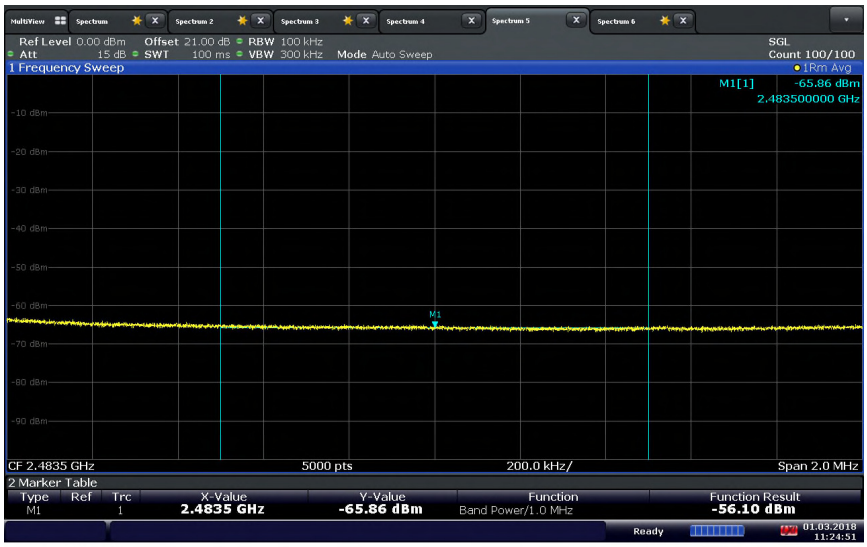


Bluetooth LE Upper Band Edge 2483.5MHz (Peak Measurement) @ Ch 2480 MHz

Upper band edge calculation (2483.5 MHz):

- 2483.5 MHz (in the restricted bands)
- Use the following formula as per Section 12.2.2 (b) in KDB 558074 D01 (DTS Meas Guidance v04, April 05, 2017):

E(dBµV/m) = EIRP (dBm) + 95.26
= (-46.42 dBm + 6 dBi antenna gain) + 95.26
= 54.84 dBµV/m @ 3 meters (Complies with 74 dBµV/m limit)



11:24:52 01.03.2018

Bluetooth LE High Channel (2480 MHz). Limit is -31.62 dBm. Margin is -24.48 dB.
(The highest level of the desired power in the 100 kHz bandwidth within the band is -1.62 dBm)

Upper band edge calculation (2483.5 MHz):

- 2483.5 MHz (in the restricted bands)
- Use the following formula as per Section 12.2.2 (b) in KDB 558074 D01 (DTS Meas Guidance v04, April 05, 2017):

E(dBµV/m) = EIRP (dBm) + 95.26
= (-56.1 dBm + 6 dBi antenna gain) + 95.26
= 39.16 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: 100750000333 / Default Test Configuration

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

March 01 and 02, 2018/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	25.4 °C
Relative Humidity	39.4 - 43.8 %
ATM Pressure	99.4 - 99.6 kPa

2.7.7 Additional Observations

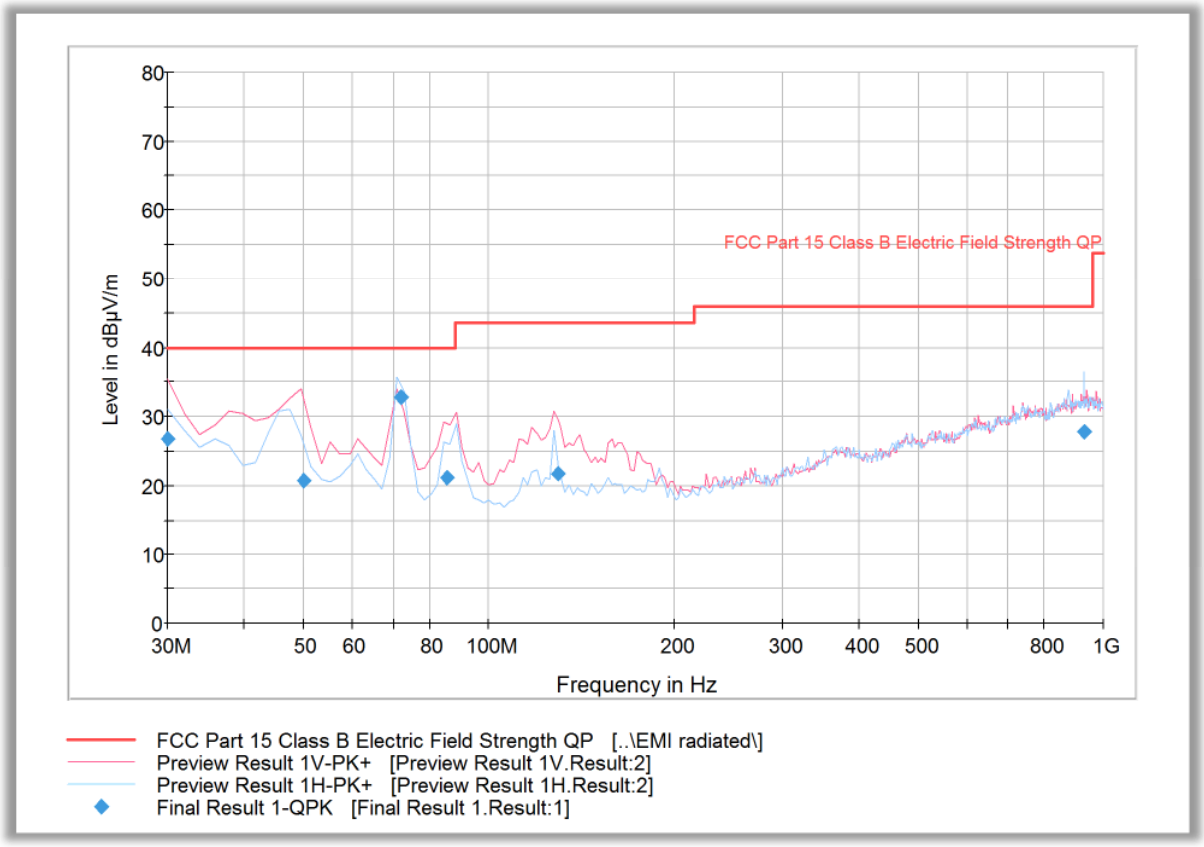
- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic.
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d).
- Only the worst case BLE (Middle Channel) presented for below 1GHz. There are no 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**

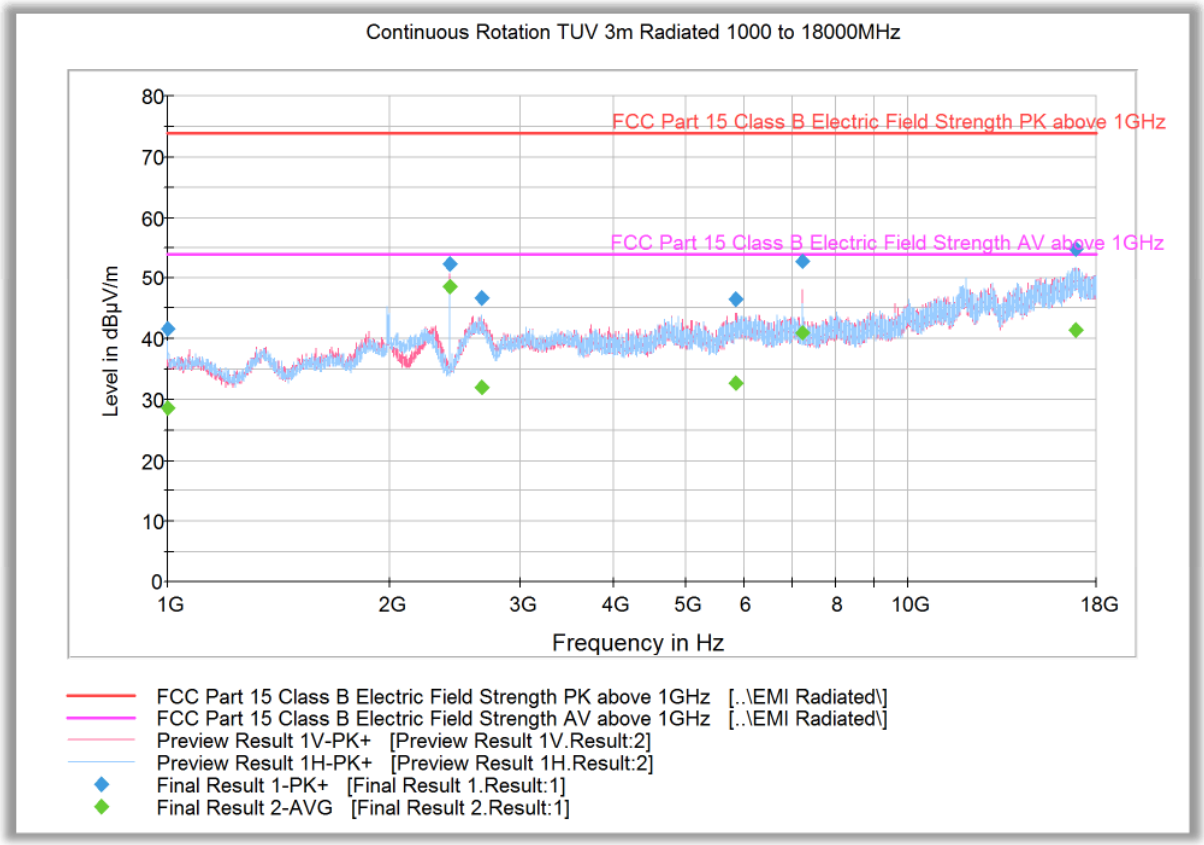
2.7.9 Worst case Test Results for Below 1GHz – Middle Channel



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)
30.000000	26.9	1000.0	120.000	144.0	V	-12.0	-5.2	13.1	40.0
50.038878	20.8	1000.0	120.000	100.0	V	158.0	-13.7	19.2	40.0
72.021643	32.9	1000.0	120.000	294.0	H	176.0	-16.1	7.1	40.0
85.332745	21.2	1000.0	120.000	100.0	V	178.0	-16.0	18.8	40.0
129.274389	21.8	1000.0	120.000	100.0	V	-5.0	-15.3	21.7	43.5
929.660040	27.8	1000.0	120.000	239.0	H	37.0	6.9	18.2	46.0

2.7.10 Test Results for Above 1GHz - Low Channel



Peak Data

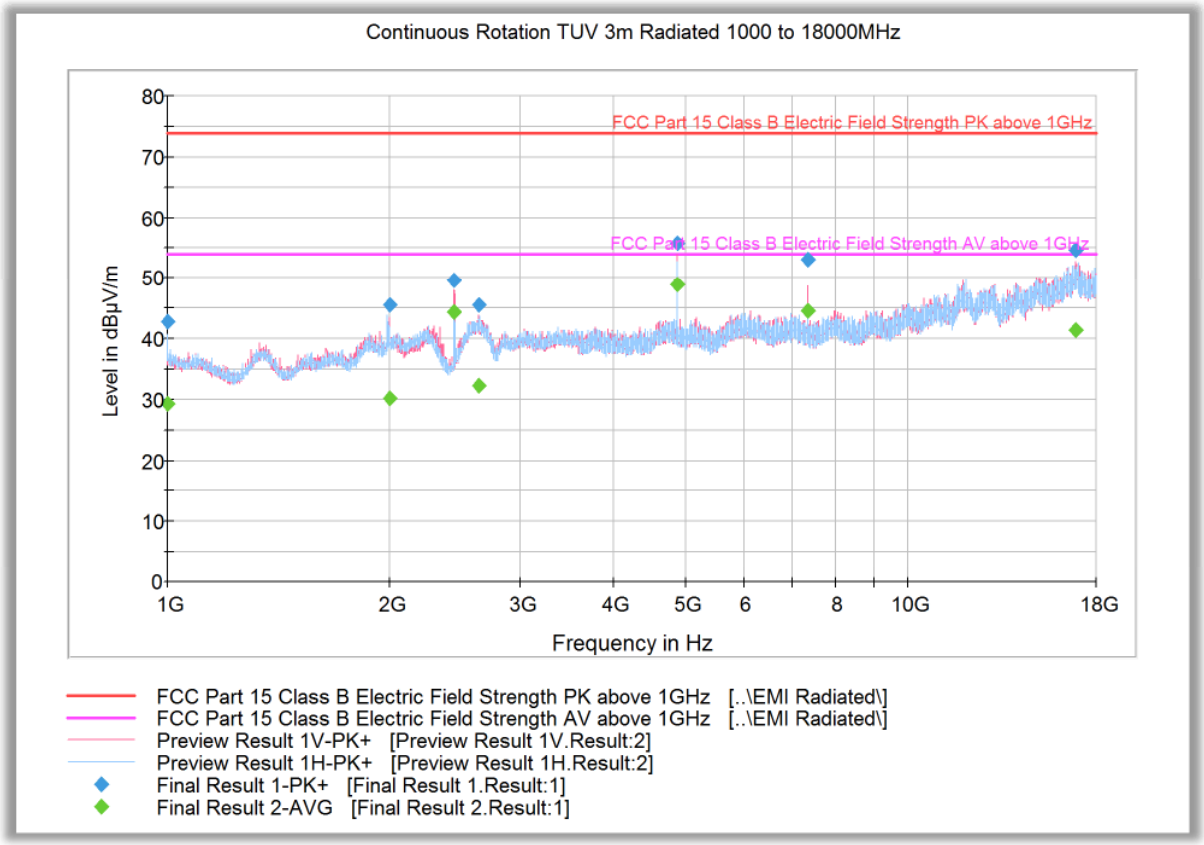
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	41.7	1000.0	1000.000	170.6	H	100.0	-7.1	32.2	73.9
2401.766667	52.3	1000.0	1000.000	194.5	V	188.0	-0.8	21.6	73.9
2654.900000	46.7	1000.0	1000.000	103.7	H	352.0	-0.1	27.2	73.9
5844.666667	46.3	1000.0	1000.000	301.2	V	290.0	5.8	27.6	73.9
7205.200000	52.8	1000.0	1000.000	328.2	V	216.0	7.0	21.1	73.9
16853.43333	54.8	1000.0	1000.000	113.7	V	321.0	19.2	19.1	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)
1000.000000	28.7	1000.0	1000.000	170.6	H	100.0	-7.1	25.2	53.9
2401.766667	48.4	1000.0	1000.000	194.5	V	188.0	-0.8	5.5	53.9
2654.900000	32.1	1000.0	1000.000	103.7	H	352.0	-0.1	21.8	53.9
5844.666667	32.8	1000.0	1000.000	301.2	V	290.0	5.8	21.1	53.9
7205.200000	40.9	1000.0	1000.000	328.2	V	216.0	7.0	13.0	53.9
16853.43333	41.3	1000.0	1000.000	113.7	V	321.0	19.2	12.6	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 for Above 1GHz - Middle Channel



Peak Data

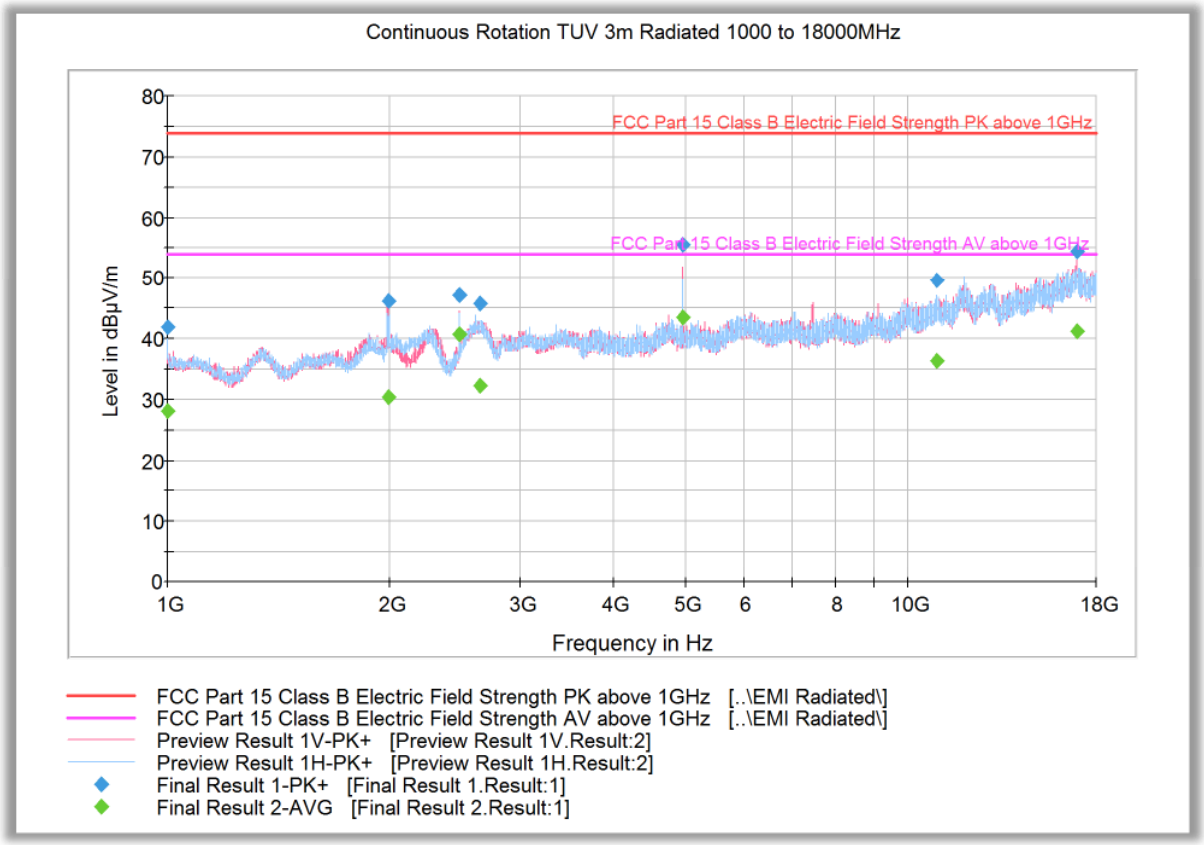
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	42.7	1000.0	1000.000	191.5	H	335.0	-7.1	31.2	73.9
1992.600000	45.5	1000.0	1000.000	213.5	V	68.0	-2.0	28.4	73.9
2440.300000	49.7	1000.0	1000.000	252.4	V	167.0	-0.5	24.2	73.9
2627.266667	45.5	1000.0	1000.000	123.7	V	94.0	-0.1	28.4	73.9
4880.200000	55.9	1000.0	1000.000	321.2	V	137.0	3.6	18.0	73.9
7319.466667	53.0	1000.0	1000.000	211.5	V	322.0	7.1	20.9	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	29.3	1000.0	1000.000	191.5	H	335.0	-7.1	24.6	53.9
1992.600000	30.2	1000.0	1000.000	213.5	V	68.0	-2.0	23.7	53.9
2440.300000	44.4	1000.0	1000.000	252.4	V	167.0	-0.5	9.5	53.9
2627.266667	32.3	1000.0	1000.000	123.7	V	94.0	-0.1	21.6	53.9
4880.200000	49.0	1000.0	1000.000	321.2	V	137.0	3.6	4.9	53.9
7319.466667	44.7	1000.0	1000.000	211.5	V	322.0	7.1	9.2	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 for 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)
1000.400000	41.8	1000.0	1000.000	127.7	H	138.0	-7.1	32.2	73.9
1991.500000	46.1	1000.0	1000.000	303.2	V	20.0	-2.0	27.8	73.9
2480.000000	47.0	1000.0	1000.000	250.5	V	178.0	-0.3	26.9	73.9
2644.333333	45.6	1000.0	1000.000	120.7	V	41.0	-0.1	28.3	73.9
4959.133333	55.5	1000.0	1000.000	241.4	V	229.0	3.7	18.4	73.9
10935.90000	49.7	1000.0	1000.000	228.4	H	140.0	12.1	24.2	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.400000	28.2	1000.0	1000.000	127.7	H	138.0	-7.1	25.7	53.9
1991.500000	30.3	1000.0	1000.000	303.2	V	20.0	-2.0	23.6	53.9
2480.000000	40.7	1000.0	1000.000	250.5	V	178.0	-0.3	13.2	53.9
2644.333333	32.3	1000.0	1000.000	120.7	V	41.0	-0.1	21.6	53.9
4959.133333	43.3	1000.0	1000.000	241.4	V	229.0	3.7	10.6	53.9
10935.90000	36.3	1000.0	1000.000	228.4	H	140.0	12.1	17.6	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: 100750000272 / Default Test Configuration

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

March 01, 2018/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	20.4°C
Relative Humidity	43.8%
ATM Pressure	99.6kPa

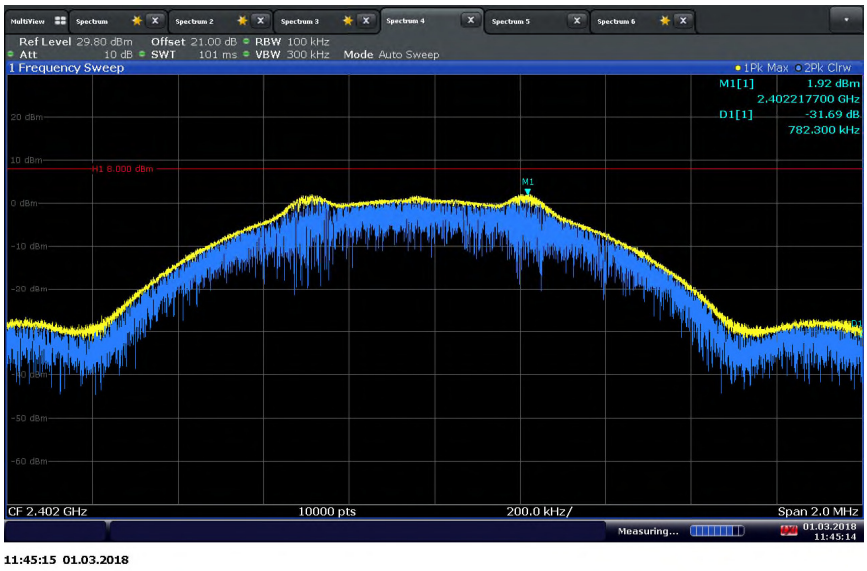
2.8.7 Additional Observations

- This is a conducted test.
- Test procedure is per Section 10.3 of KDB 558074 D01 (DTS Meas Guidance v04, April 05, 2017).
- 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.

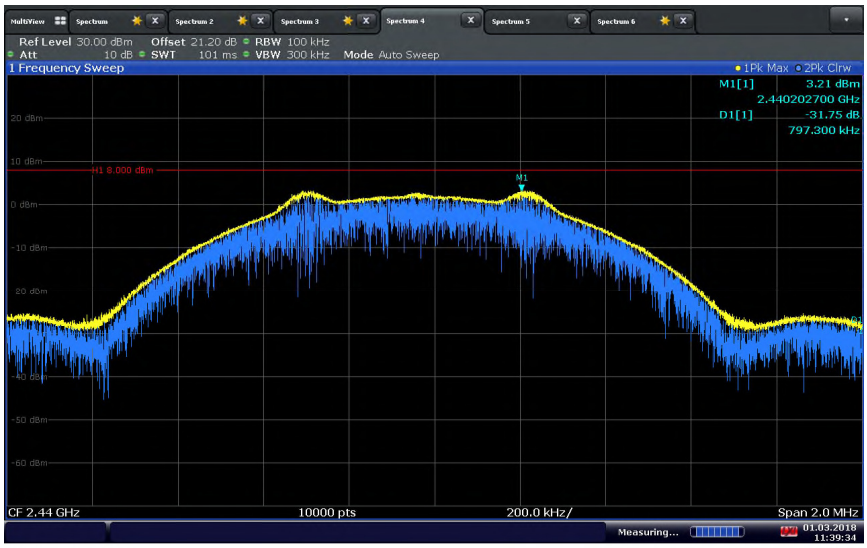
2.8.8 Test Results Summary

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	1.92	8	6.08	Complies
	17 (2440 MHz)	GFSK @ 1Mbps	3.21	8	4.79	Complies
	39 (2480 MHz)	GFSK @ 1Mbps	0.45	8	7.55	Complies

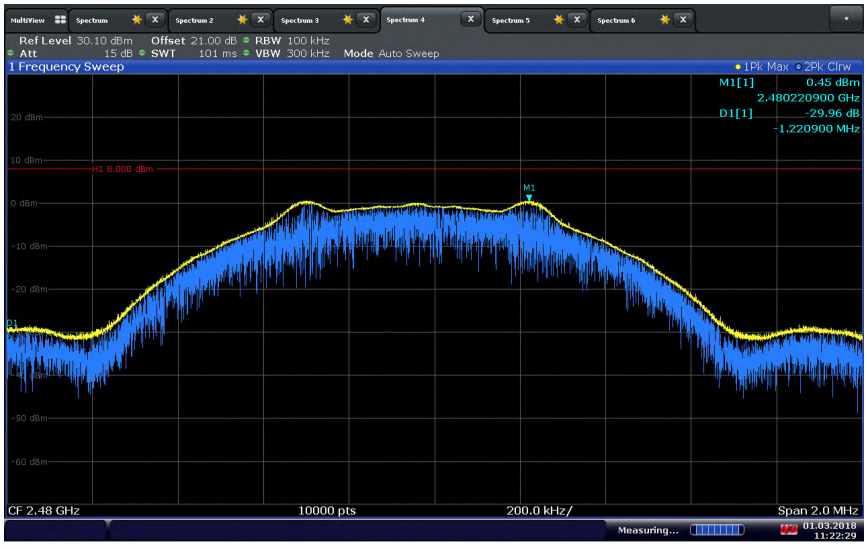
2.8.9 Test Results Plots



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						
7604	P-Series Power Meter	N1912A	SG45100273	Agilent	08/14/17	08/14/18
7605	50MHz-18GHz Wideband Power Sensor	N1921A	MY51100054	Agilent	05/19/17	05/19/18
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/19/17	09/19/19
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	12/14/17	12/14/18
8871	20dB Attenuator	18N10W-20dB	-	INMET	Verified by 7604, 7605 and 7608	
Conducted Emissions						
1024	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	09/15/17	09/15/18
6837	LISN	FCC-LISN-50-25-2	5025	Fischer Custom Comm.	05/30/17	05/30/18
8822	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	Verified by 7611 and 7608	
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	Verified by 7611 and 7608	
7611	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	04/25/17	04/25/18
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/19/17	09/19/19
Radiated Emission						
7611	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	04/25/17	04/25/18
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/19/17	09/19/19
1033	Bilog Antenna	3142C	00044556	EMCO	10/11/16	10/11/18
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	06/01/17	06/01/18
1151	Pre-amplifier	TS-PR26	100026	Rhode & Schwarz	Verified by 7611 and 7608	
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	Verified by 7611 and 7608	
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	Verified by 7611 and 7608	
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	10/25/17	10/25/18
7620	EMI Test Receiver	ESU40	100399	Rhode & Schwarz	10/17/17	10/17/18
1016	Pre-amplifier	PAM-0202	187	PAM	02/06/18	02/06/19
Miscellaneous						
6708	Multimeter	34401A	US36086974	Hewlett Packard	07/05/17	07/05/18
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	Sper Scientific	02/26/28	02/26/19
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

3.1 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.1.1 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

3.1.2 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	3.52	1.44	2.07
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	1.68
				Coverage Factor (k):	2
				Expanded Uncertainty:	3.36

3.1.3 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	3.00	1.22	1.50
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	1.49
				Coverage Factor (k):	2
				Expanded Uncertainty:	2.99

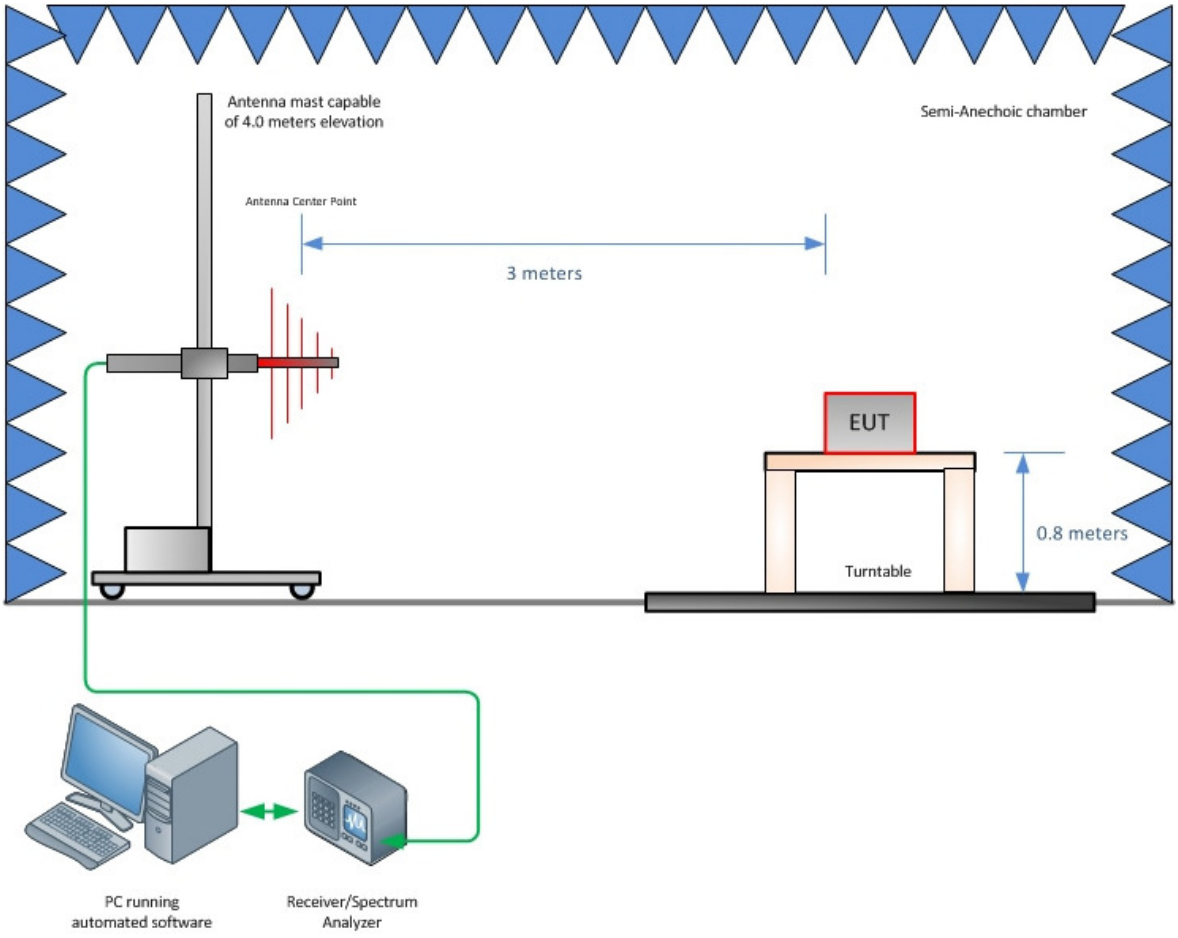
3.1.4 Conducted Antenna Port Measurement

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.08	0.05	0.00
2	Cables	Rectangular	0.30	0.17	0.03
3	EUT Setup	Rectangular	0.50	0.29	0.08
				Combined Uncertainty (u_c):	0.34
				Coverage Factor (k):	1.96
				Expanded Uncertainty:	0.67

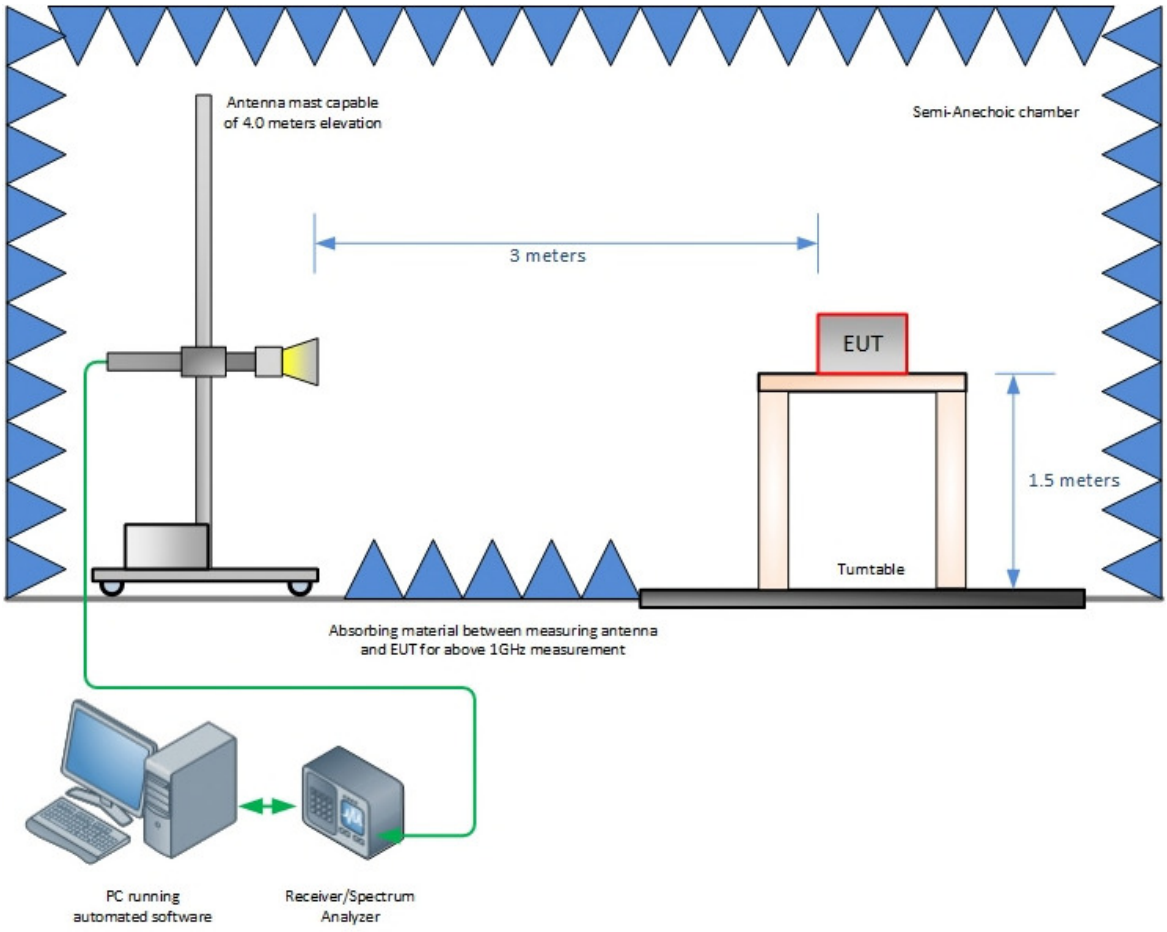
SECTION 4

DIAGRAM OF TEST SETUP

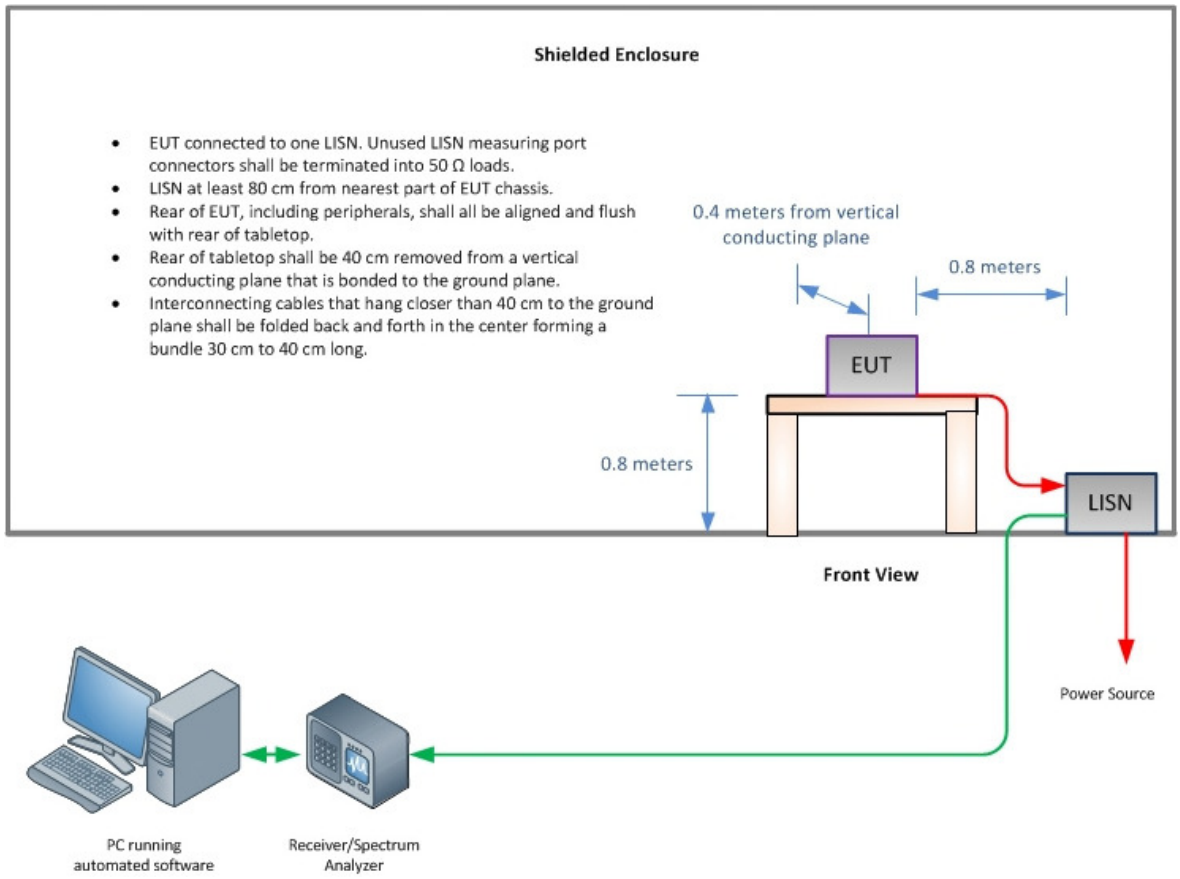
4.1 TEST SETUP DIAGRAM



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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