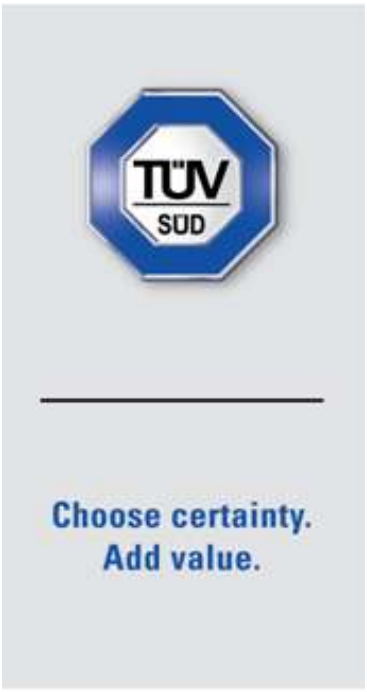

Report On

Application for Grant of Equipment Authorization of the
Dexcom Inc.
G6 Firefly CGM System
G6 Firefly Transmitter

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

Report No.72140726B **August 2018**

REPORT ON	Radio Testing of the Dexcom Inc. G6 Firefly CGM System Model 9445-18 G6 Firefly Transmitter
TEST REPORT NUMBER	72140726B
TEST REPORT DATE	August 2018
PREPARED FOR	Dexcom Inc. 6310 Sequence Dr. San Diego, CA 92121 USA
CONTACT PERSON	Gang Chen Staff Engineer Gang.Chen@dexcom.com (858) 529-4038
PREPARED BY	Ferdinand S. Custodio **Name** Authorized Signatory Title: Senior EMC Test Engineer / Wireless Team Lead
APPROVED BY	Alex Chang **Name** Authorized Signatory Title: Senior EMC/Wireless Test Engineer
DATED	August 27, 2018

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

Revision History

72140726B Dexcom Inc. G6 Firefly CGM System Model 9445-18 G6 Firefly Transmitter					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
08/27/2018	Initial Release				Ferdinand Custodio

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CONTENTS

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

SECTION 1

REPORT SUMMARY

Radio Testing of the
Dexcom Inc.
G6 Firefly Transmitter

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Dexcom Inc. G6 Firefly CGM System G6 Firefly Transmitter 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	Dexcom Inc.
EUT	G6 Firefly Transmitter
Trade Name	G6 Firefly CGM System
Model Name	9445-18
FCC ID	PH29688
IC Number	9290A-944518
FCC Classification	Low power Communications Device Transmitter (DTS)
Serial Number(s)	8G41SN (Conducted) 8G41UX (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 5, April 2018).
Start of Test	August 20, 2018
Finish of Test	August 24, 2018
Name of Engineer(s)	Ferdinand Custodio
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	N/A	
2.3	-	RSS-Gen 6.7	99% Emission Bandwidth	Compliant	
2.4	§15.247(a)(2)	RSS-247 5.2(a)	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 7.3 and 7.4	Receiver Spurious Emissions	N/A*	
2.8	§15.247(e)	RSS-247 5.2(b)	Power Spectral Density for Digitally Modulated Device	Compliant	

N/A The EUT only employ battery power for operation and do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines

N/A* Not required as per RSS-Gen 5.3 The EUT does not fall into any category defined as Receiver under RSS-Gen.

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1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) is a Dexcom Inc. G6 Firefly CGM System G6 Firefly Transmitter. The EUT is part of the G6 Continuous Glucose Monitor (CGM) system. The system consists of a sensor, a primary battery powered transmitter that is physically connected to the sensor and the Dexcom G6 Orion Receiver. The G6 CGM System may also include smart device that has a Dexcom G6 CGM App. In normal operation the G6 Firelfy transmitter will exchange data with the Receiver and/or the smart device once every 5 minutes over a Bluetooth Low Energy wireless link. The Receiver and smart device CGM App display (and record) glucose values and provide alerts and alarms. The Bluetooth LE function of the EUT was verified in this test report.

1.3.2 EUT General Description

EUT Description	G6 Firefly Transmitter
Trade Name	G6 Firefly CGM System
Model Name	9445-18
Rated Voltage	Internal 1.5 VDC from Silver oxide battery
Mode Verified	BT LE
Capability	BT LE
Primary Unit (EUT)	☐ Production
	☒ Pre-Production
	☐ Engineering
Manufacturer Declared Temperature Range	10°C to 42°C
Antenna Type	PCB trace (Monopole)
Manufacturer	Dexcom
Antenna Model	-
Maximum Antenna Gain	0 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	-0.19	0.957	2.96	1.98

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	EUT is configured to operate in test mode in which it can transmit continuously. A laptop with Dexcom software was used to manually set EUT to transmit at Low, Mid, and High frequency channels for evaluations.

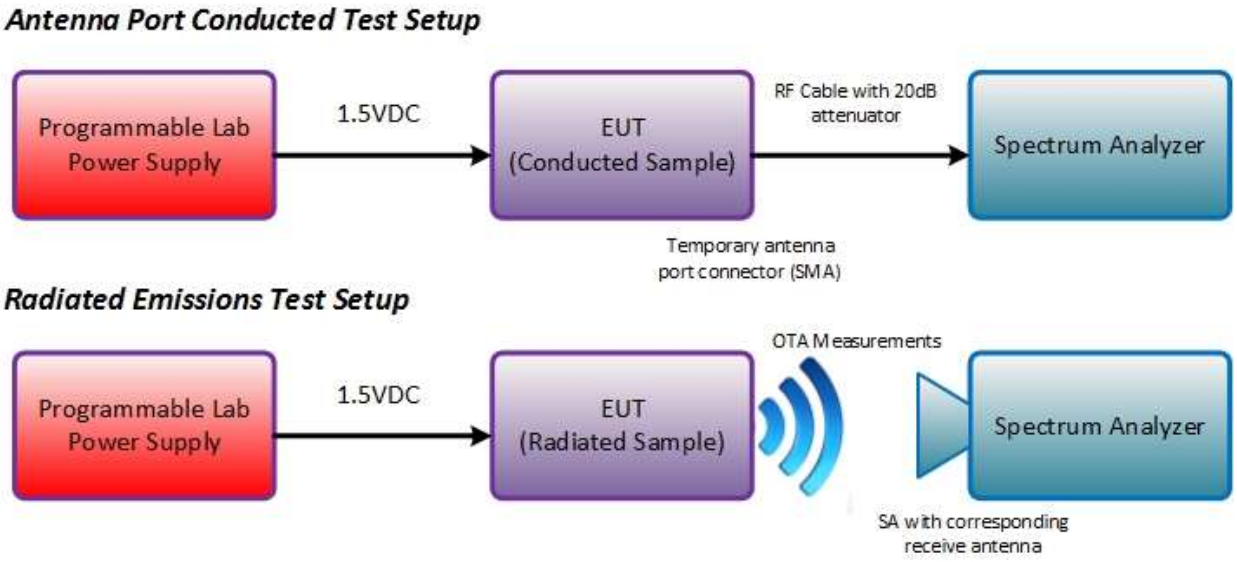
1.4.2 EUT Exercise Software

Manufacturer provided a configuration software (Pulsar Smart Transmitter Communication tool SW11629 V1.0.0.2) running from a support laptop where EUT is connected via BLE wireless link and configured into the test mode.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
DELL	Support Laptop	Model: Latitude E5440 Dexcom Asset # 06774 Service Tag # 14XCH12
Hewlett Packard	DC Power Supply	SDRB1072 E3610A S/N KR51311519

1.4.4 Simplified Test Configuration Diagram

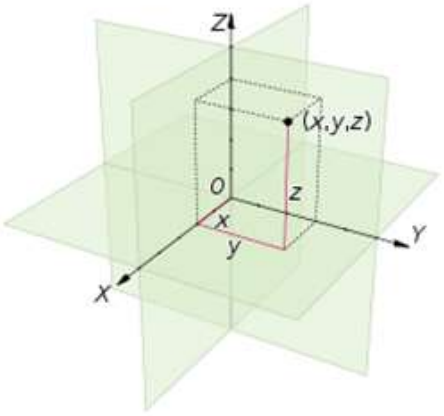


1.4.5 Worst Case Configuration

Worst-case configuration used in this test report as per Peak Output Power measurements:

Mode	Channel	Data Rate
Bluetooth LE	37 (Low Channel)	1Mbps

EUT is a mobile device. Final installation position is only at Y orientation. For radiated measurements verifications performed using "X" 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: 8G41SN (conducted) and 8G41UX (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
Dexcom Inc.
G6 Firefly Transmitter

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: 8G41SN / Default Test Configuration

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

August 22, 2018/FSC

2.1.5 Test Equipment Used

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

2.1.6 Environmental Conditions

Ambient Temperature	26.2°C
Relative Humidity	54.9%
ATM Pressure	99.1kPa

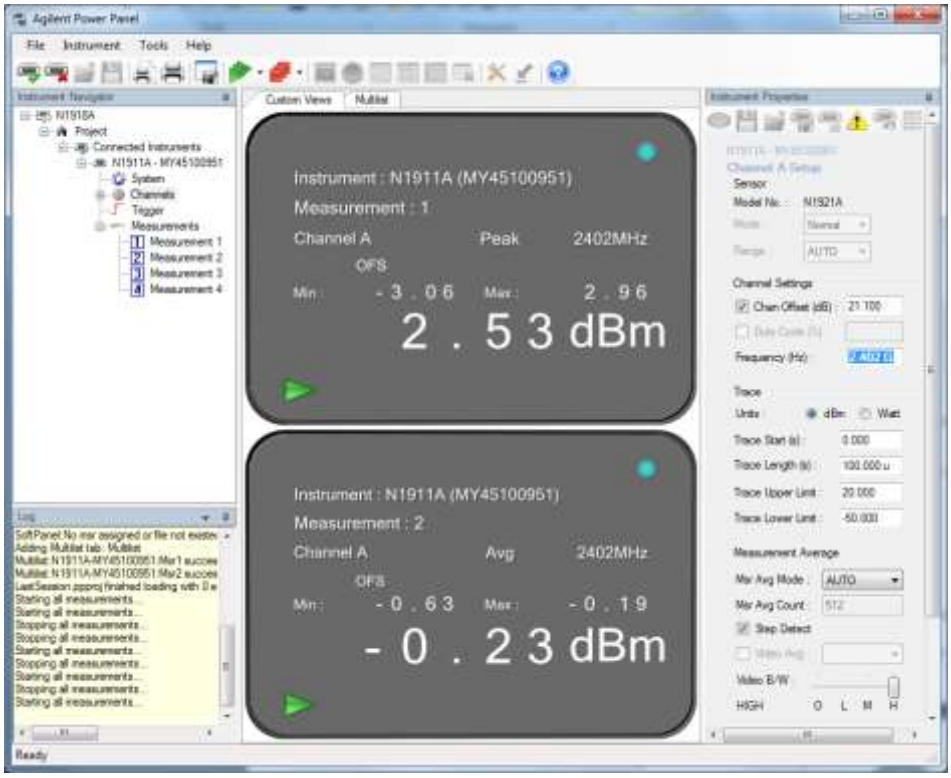
2.1.7 Additional Observations

- 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 TDF (Transducer Factor).
- 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.

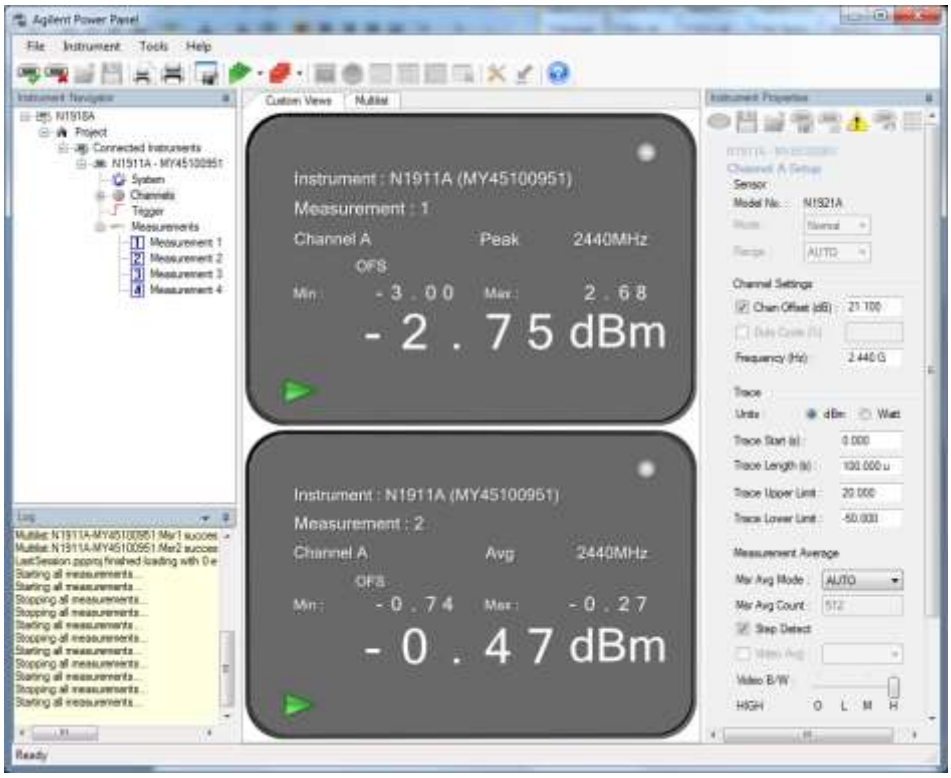
2.1.8 Test Results

Bluetooth Low Energy (LE)	Channel	Modulation	Measured Average Power (dBm)	Measured Peak Power (dBm)
	37 (2402 MHz)	GFSK @ 1Mbps	**-0.19**	**2.96**
	17 (2440 MHz)		-0.27	2.68
	39 (2480 MHz)		-0.37	2.83

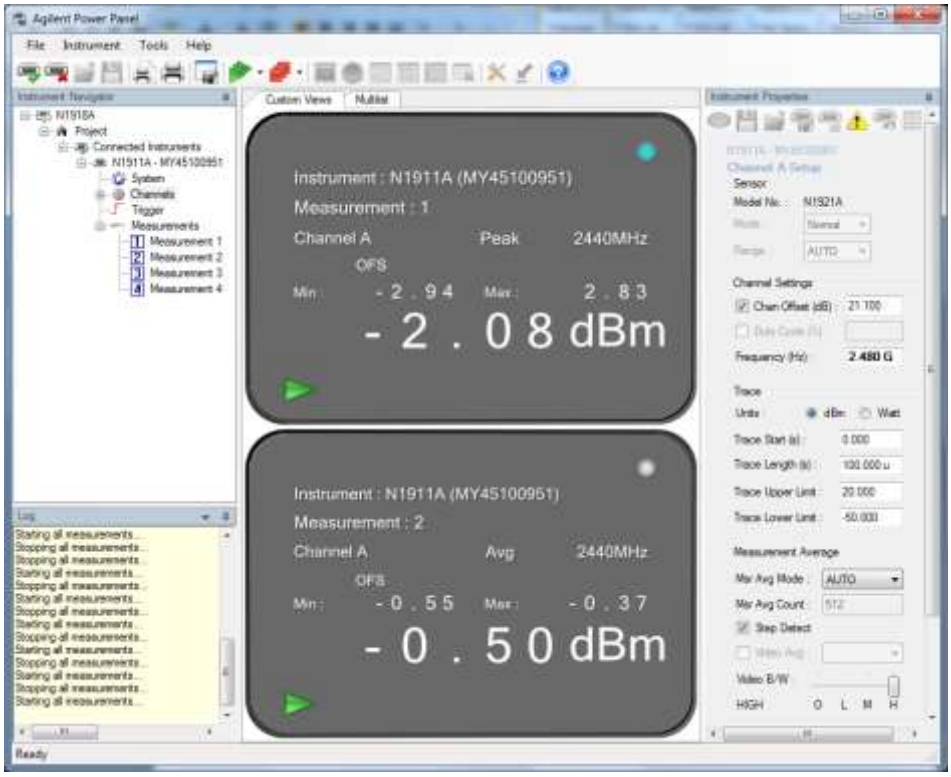
2.1.9 Test Plots



Bluetooth LE. Low Channel 1Mbps



Bluetooth LE. Mid Channel 1Mbps



Bluetooth LE. High 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: 8G41UX

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

N/A. The EUT only employ battery power for operation and do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

2.3 99% EMISSION BANDWIDTH

2.3.1 Specification Reference

RSS-Gen Clause 6.7

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: 8G41SN / Default Test Configuration

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

August 22, 2018/FSC

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	26.2°C
Relative Humidity	54.9%
ATM Pressure	99.1kPa

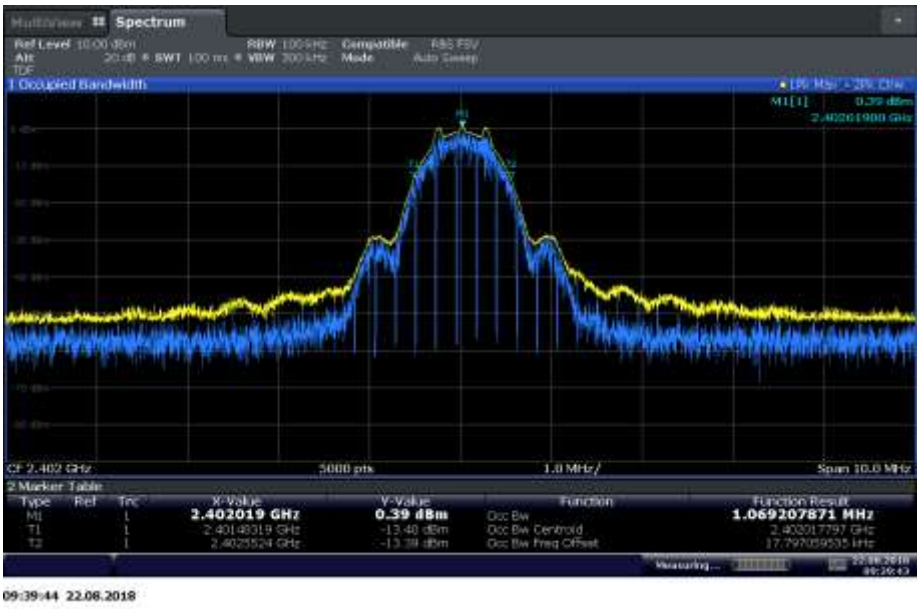
2.3.7 Additional Observations

- This is a conducted test.
- The path loss was measured and entered as a TDF (Transducer Factor).
- 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.

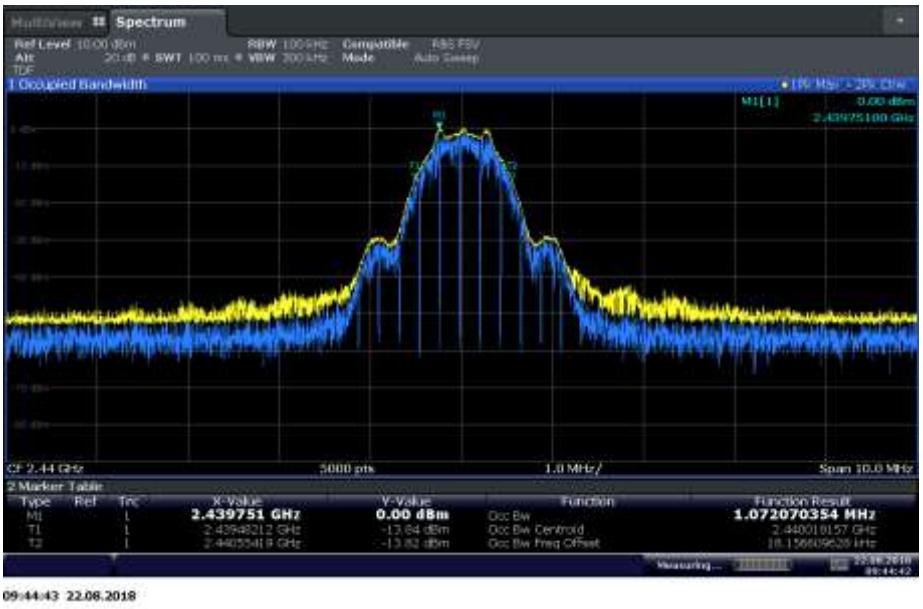
2.3.8 Test Results (For reporting purposes only)

Mode	Channel	Measured 99% Bandwidth (MHz)
Bluetooth LE	37 (2402 MHz)	1.06
	17 (2440 MHz)	1.07
	39 (2480 MHz)	1.07

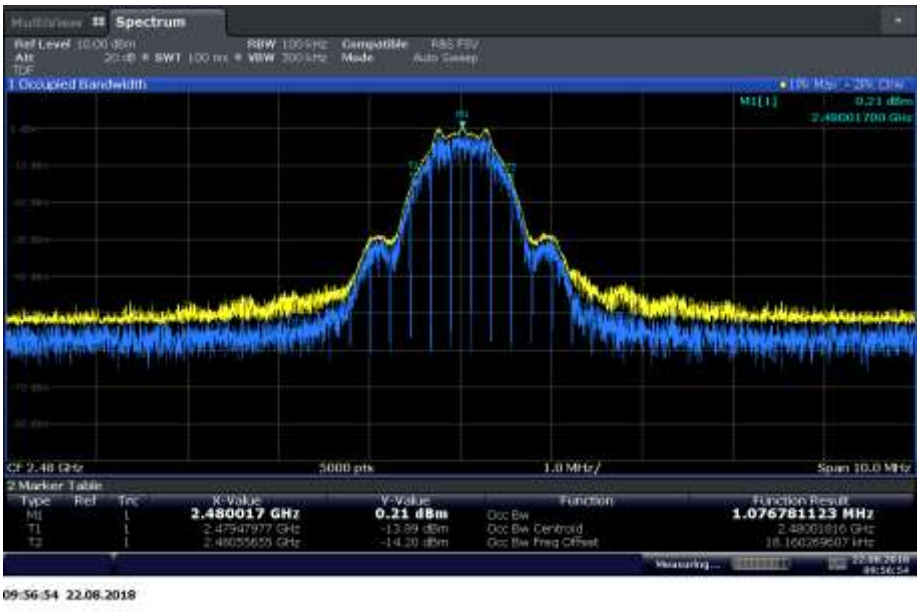
2.3.9 Test Results Plots



Bluetooth LE Low Channel



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: 8G41SN / 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

August 22, 2018/FSC

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	26.2°C
Relative Humidity	54.9%
ATM Pressure	99.1kPa

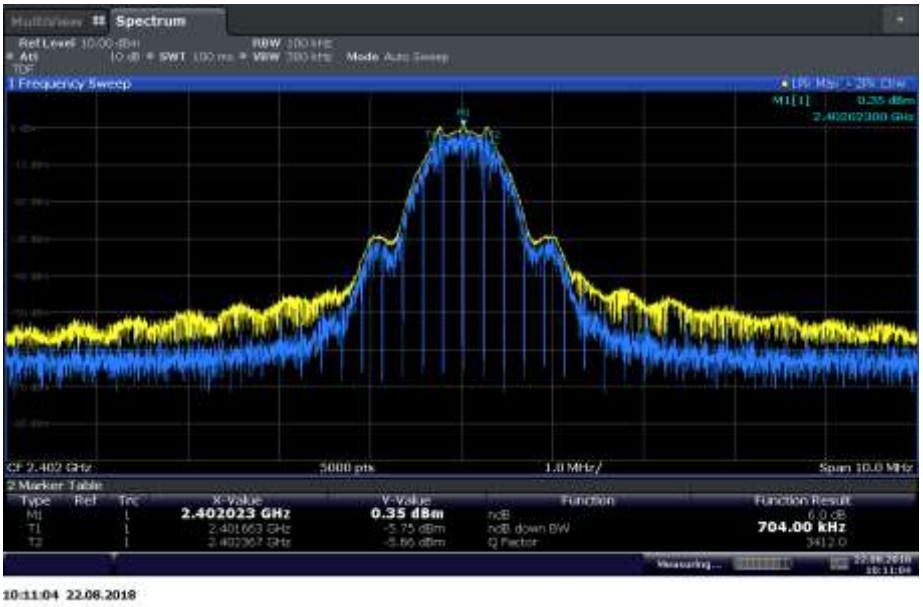
2.4.8 Additional Observations

- 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.

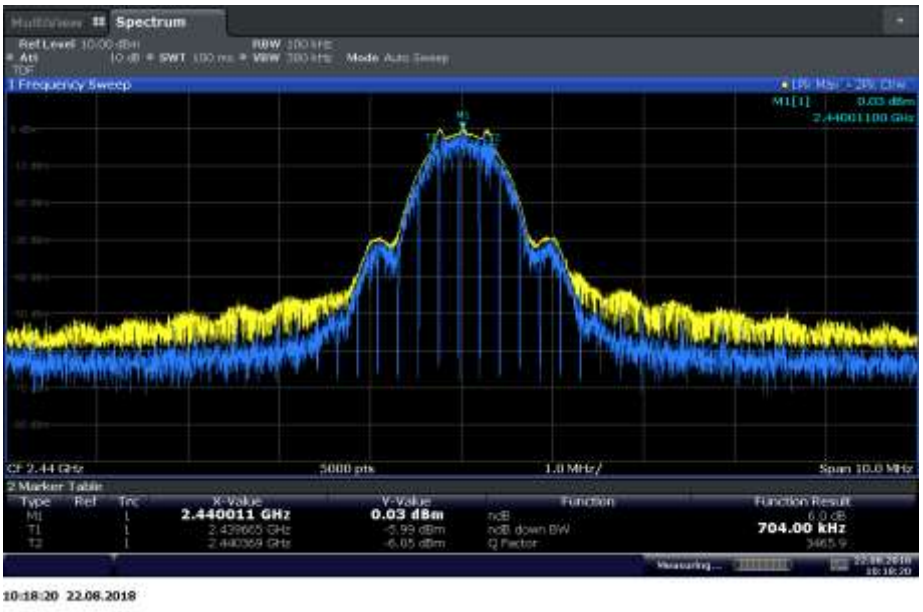
2.4.9 Test Results

Mode	Channel	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Compliance
Bluetooth LE	37 (2402 MHz)	0.704	0.500	Complies
	17 (2440 MHz)	0.704	0.500	Complies
	39 (2480 MHz)	0.718	0.500	Complies

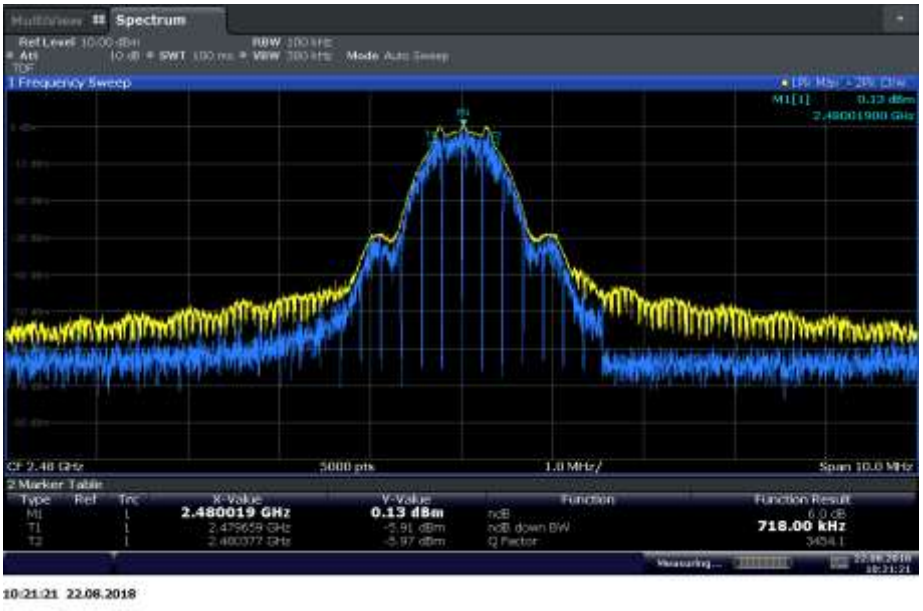
2.4.10 Test Results Plots



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: 8G41SN / Default Test Configuration

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

August 20, 2018/FSC

2.5.5 Test Equipment Used

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

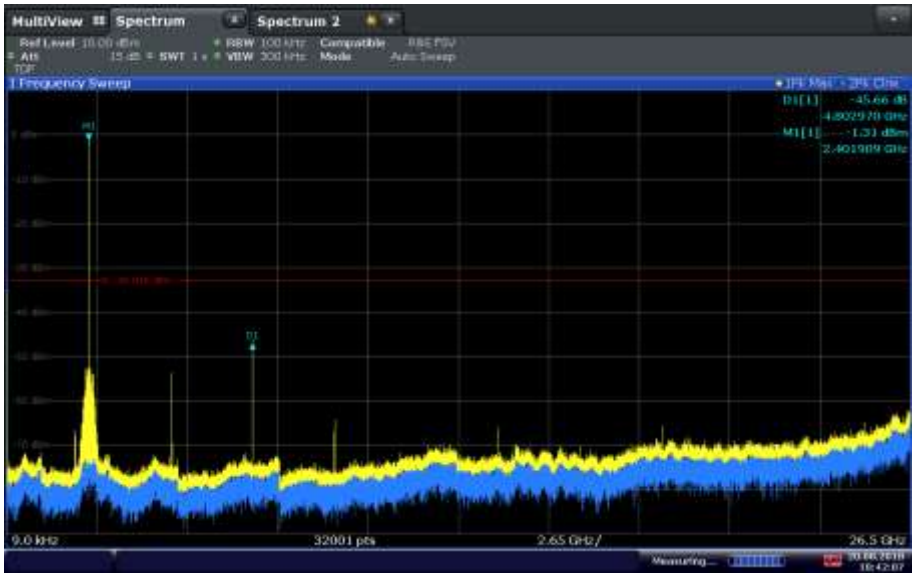
2.5.6 Environmental Conditions

Ambient Temperature	26.7°C
Relative Humidity	53.1%
ATM Pressure	98.8kPa

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



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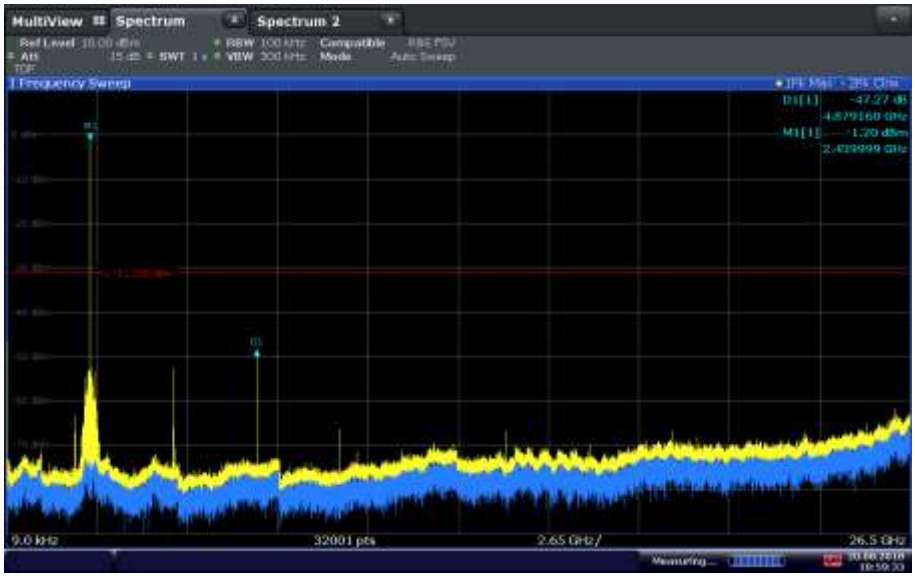
Bluetooth LE Low Channel



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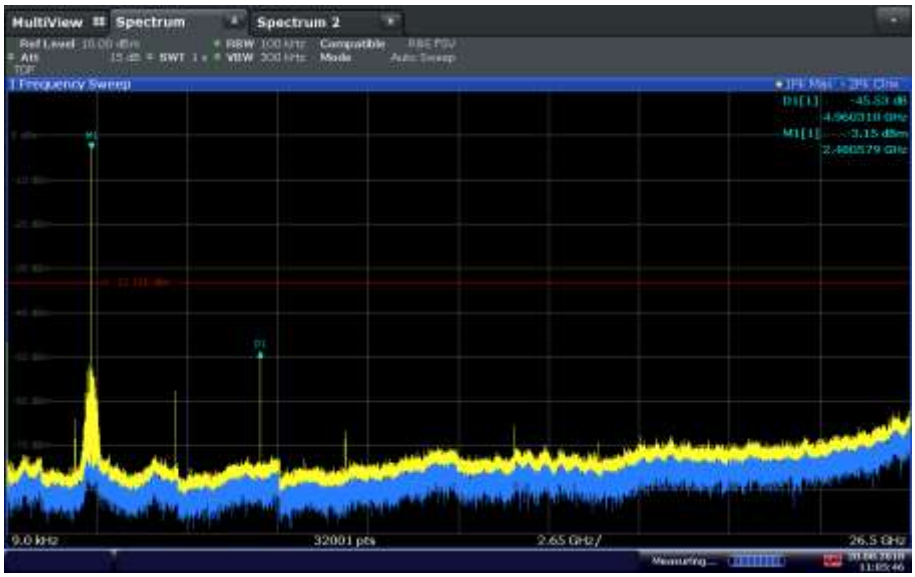
Bluetooth LE Mid Channel



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: 8G41SN / Default Test Configuration

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

August 22, 2018/FSC

2.6.5 Test Equipment Used

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

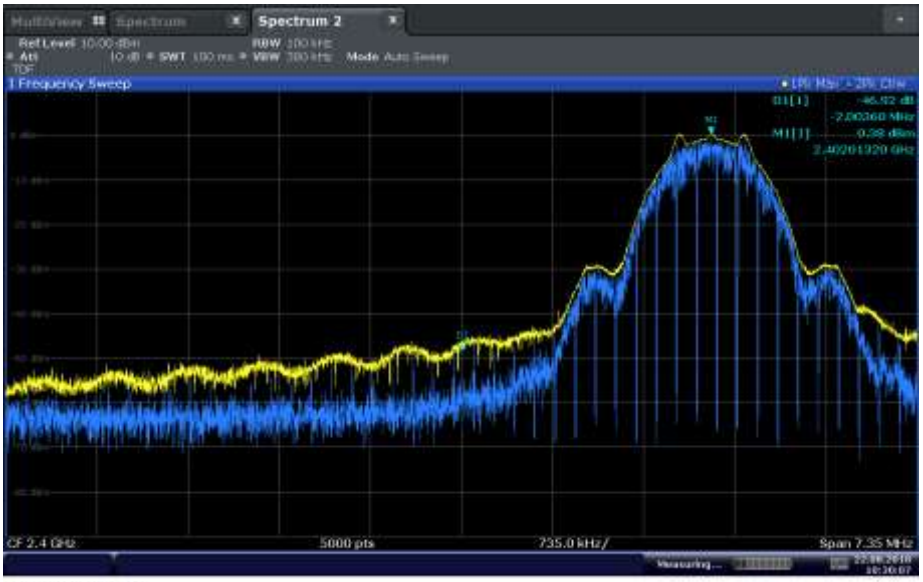
2.6.6 Environmental Conditions

Ambient Temperature	26.2°C
Relative Humidity	54.9%
ATM Pressure	99.1kPa

2.6.7 Additional Observations

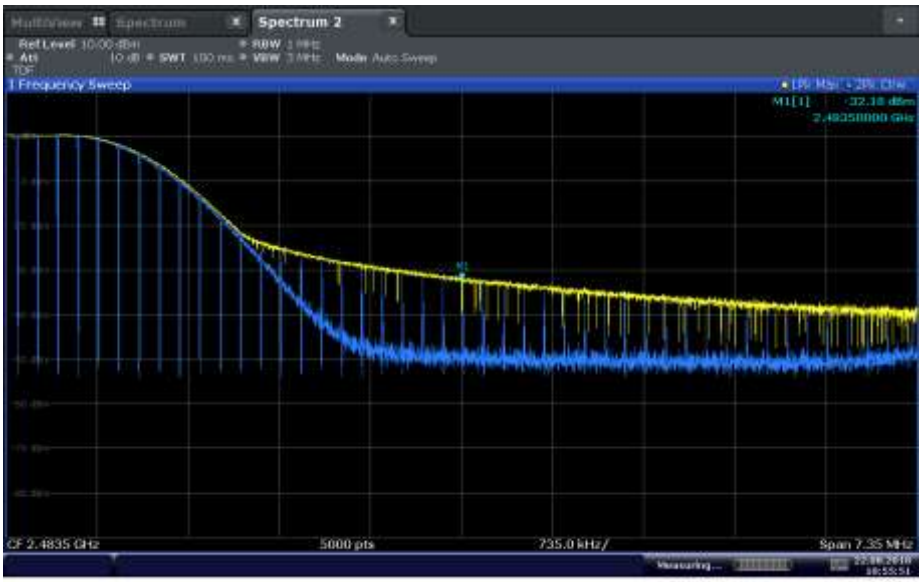
- Setup is identical to “Out-of-Band Emissions – Conducted” test (previous test).
- The path loss was measured and entered as a Transducer factor (TDF)
- For lower band edge, the highest level of the desired power in the 100 kHz bandwidth within the band were tested , Limits are 30dBc from the highest level of the desired power within the band.
- For upper band edge, Section 13.3.2 of KDB 558074 D01 (DTS Meas Guidance v04, April 05, 2017) was used.

2.6.8 Test Results for Lower Band Edge (not in restricted bands)



Bluetooth LE Low Band Edge 2400MHz (Peak Measurement) @ Ch 2402 MHz showing a delta of 46.92dB at the edge

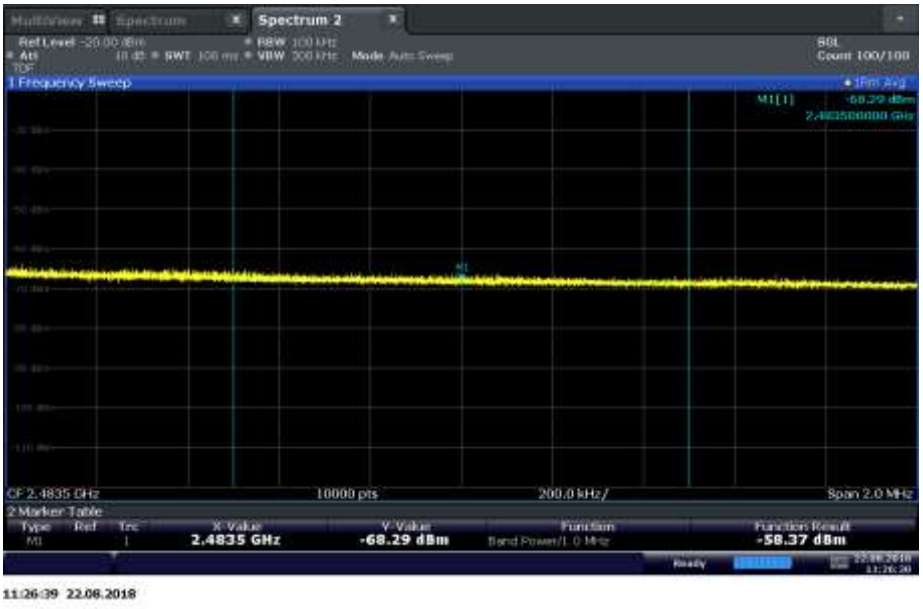
2.6.9 Test Results for Upper Band Edge (within the restricted bands)



Upper band edge calculation for Peak requirement (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
= (-32.18 dBm + 0 dBi antenna gain) + 95.26
= 63.07 dBµV/m @ 3 meters (Complies with 74 dBµV/m Peak limit)



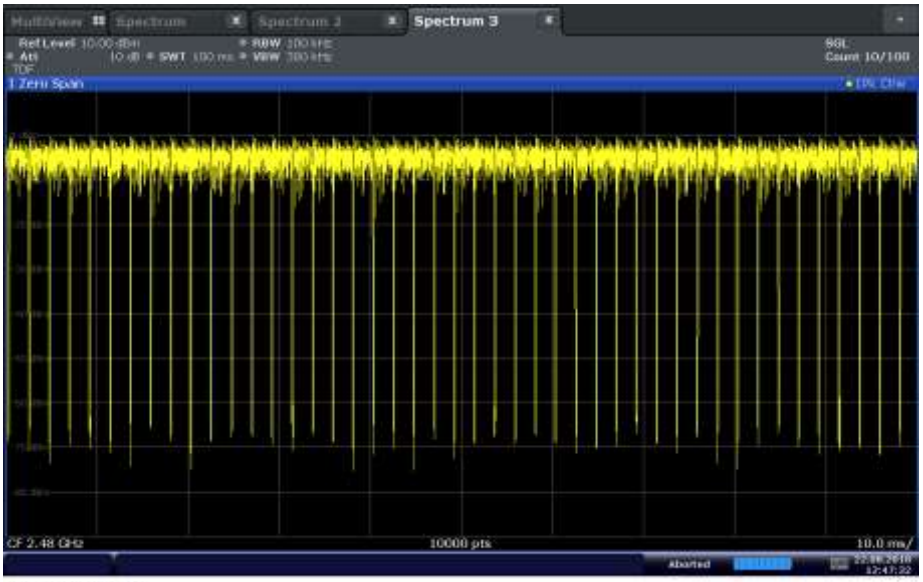
Upper band edge calculation for Average requirement (2483.5 MHz):

- 2483.5 MHz (in the restricted bands)
- Procedure is per Section 13.3.2 of KDB 558074 D01 (DTS Meas Guidance v04, April 05, 2017).
- See Duty Cycle (x) calculation on the following page.
- Use the following formula as per Section 12.2.2 (b) of KDB 558074 D01:

E(dBµV/m) = EIRP (dBm) + 95.26 + (10log(1/x)
= (-58.37 dBm + 0 dBi antenna gain) + 95.26 + (10log(1/0.9468))
= 37.12dBµV/m @ 3 meters (Complies with 54 dBµV/m Average limit)

Duty Cycle Calculation:

2.104ms per Packet



45 TX per 100ms

Duty Cycle (X)	=	On Time / On Time + Off Time
	=	(2.104 ms x 45) / 100 ms
	=	0.9468

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: 8G41UX / Default Test Configuration

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

August 21, 2018/FSC

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	43.8 %
ATM Pressure	99.8 kPa

2.7.7 Additional Observations

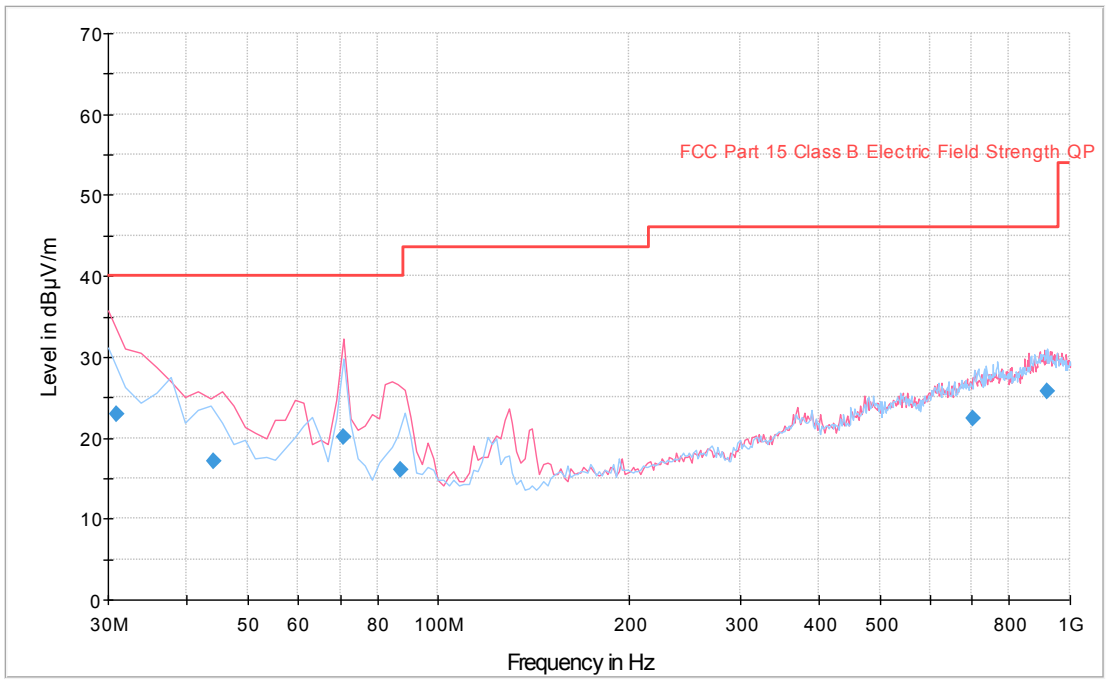
- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic.
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d).
- Only the worst case BLE (Low Channel) presented for below 1GHz. There are no significant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

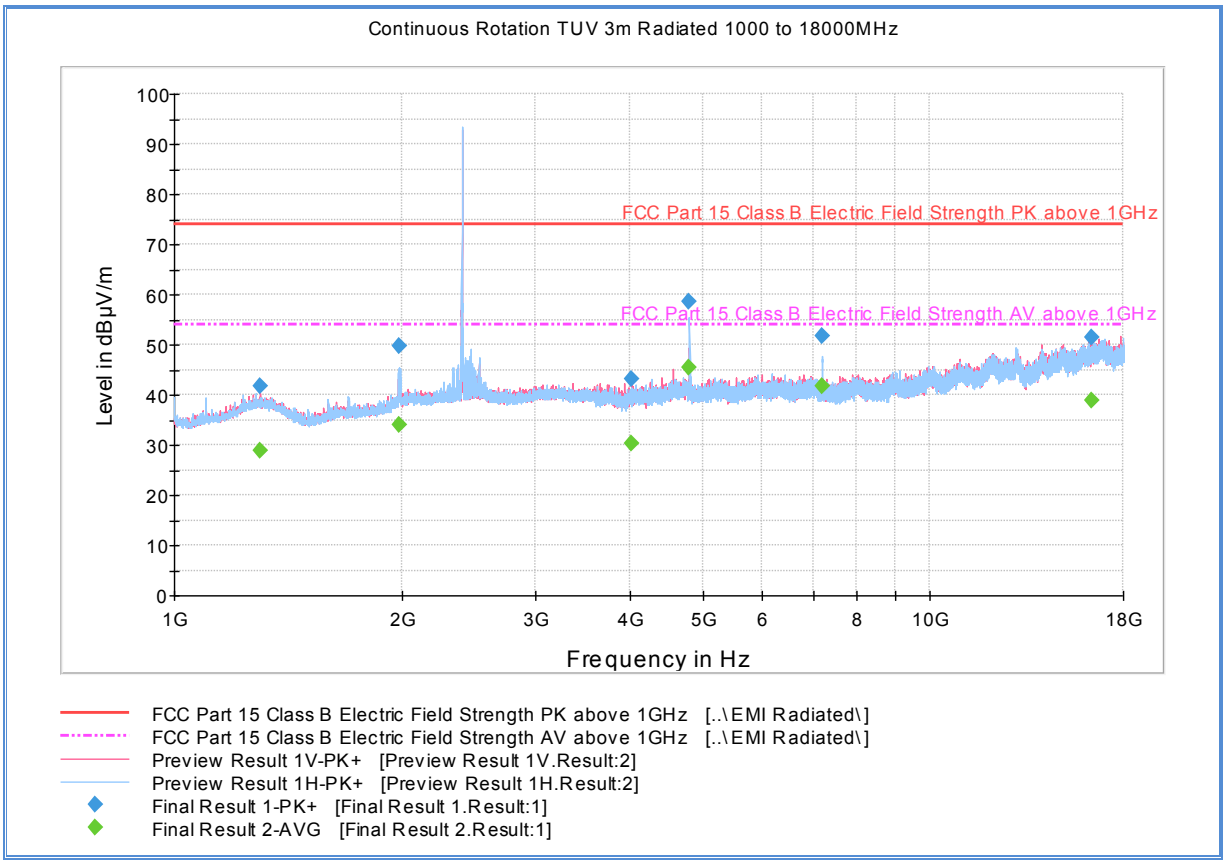
2.7.9 Worst case Test Results for Below 1GHz – Low Channel



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)
30.960000	22.9	1000.0	120.000	115.0	V	119.0	-7.1	17.1	40.0
44.031102	17.1	1000.0	120.000	100.0	V	183.0	-13.8	22.9	40.0
70.781643	20.1	1000.0	120.000	300.0	V	-12.0	-17.2	19.9	40.0
87.372745	16.1	1000.0	120.000	300.0	V	18.0	-16.6	23.9	40.0
702.641283	22.4	1000.0	120.000	340.0	V	84.0	3.0	23.6	46.0
921.244489	25.8	1000.0	120.000	250.0	H	92.0	6.7	20.2	46.0

2.7.10 Test Results for Above 1GHz - Low Channel



Peak Data

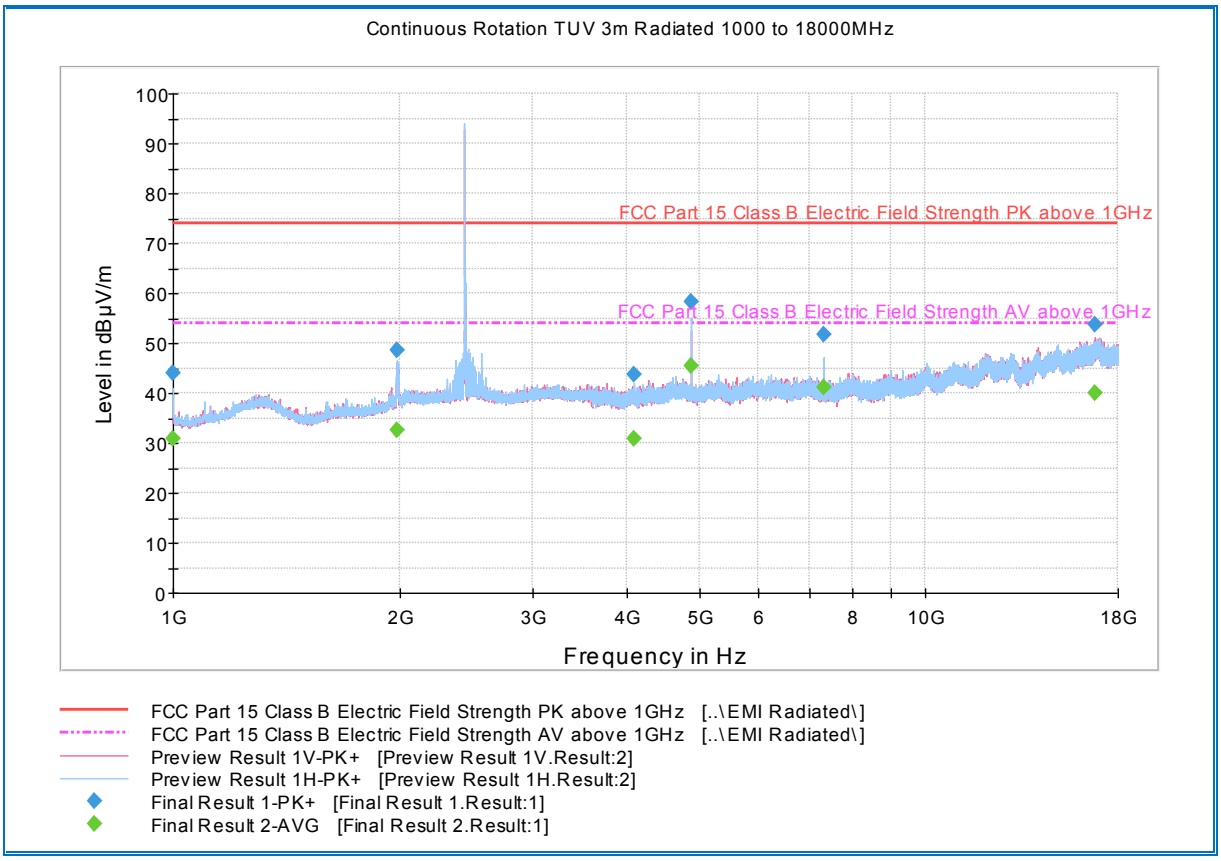
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1300.333333	41.7	1000.0	1000.000	239.0	V	108.0	-5.2	32.2	73.9
1981.133333	49.6	1000.0	1000.000	299.0	H	-19.0	-2.3	24.3	73.9
4031.700000	43.2	1000.0	1000.000	273.0	V	147.0	2.3	30.7	73.9
4804.033333	58.7	1000.0	1000.000	350.0	H	148.0	3.5	15.2	73.9
7205.400000	51.7	1000.0	1000.000	350.0	H	178.0	6.5	22.2	73.9
16316.26666	51.4	1000.0	1000.000	180.0	V	246.0	17.0	22.5	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1300.333333	28.8	1000.0	1000.000	239.0	V	108.0	-5.2	25.1	53.9
1981.133333	34.0	1000.0	1000.000	299.0	H	-19.0	-2.3	19.9	53.9
4031.700000	30.4	1000.0	1000.000	273.0	V	147.0	2.3	23.5	53.9
4804.033333	45.5	1000.0	1000.000	350.0	H	148.0	3.5	8.4	53.9
7205.400000	41.7	1000.0	1000.000	350.0	H	178.0	6.5	12.2	53.9
16316.26666	38.7	1000.0	1000.000	180.0	V	246.0	17.0	15.2	53.9

Test Notes: Measurement was performed without a 2.4GHz notch filter. Fundamental will be ignored for this test. 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

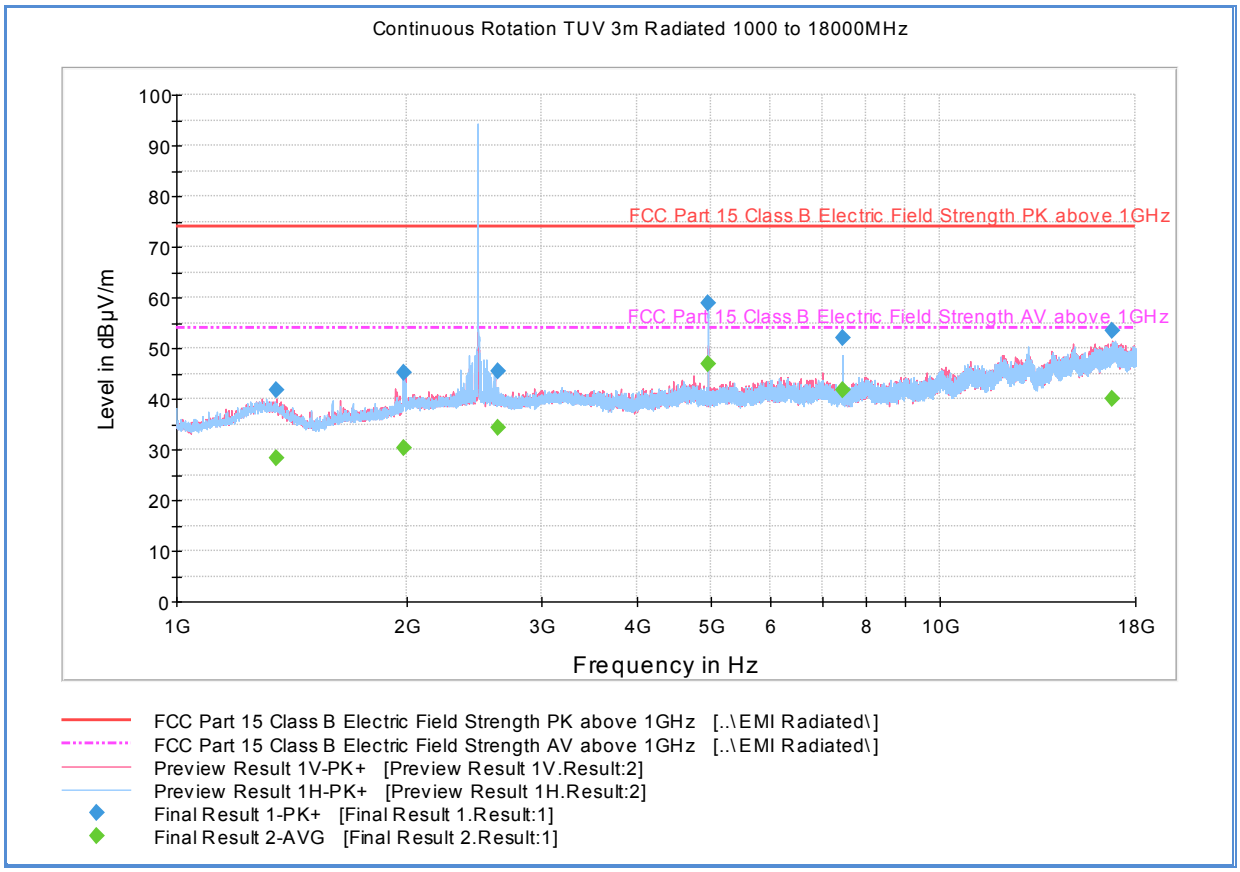
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	44.1	1000.0	1000.000	100.0	H	237.0	-7.0	29.8	73.9
1986.966667	48.5	1000.0	1000.000	350.0	H	74.0	-2.3	25.4	73.9
4092.133333	43.8	1000.0	1000.000	380.0	H	303.0	2.5	30.1	73.9
4880.400000	58.2	1000.0	1000.000	250.0	H	148.0	3.5	15.7	73.9
7320.800000	51.8	1000.0	1000.000	319.0	H	204.0	6.6	22.1	73.9
16799.03333	53.8	1000.0	1000.000	400.0	V	173.0	17.8	20.1	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	30.9	1000.0	1000.000	100.0	H	237.0	-7.0	23.0	53.9
1986.966667	32.5	1000.0	1000.000	350.0	H	74.0	-2.3	21.4	53.9
4092.133333	30.7	1000.0	1000.000	380.0	H	303.0	2.5	23.2	53.9
4880.400000	45.4	1000.0	1000.000	250.0	H	148.0	3.5	8.5	53.9
7320.800000	41.2	1000.0	1000.000	319.0	H	204.0	6.6	12.7	53.9
16799.03333	40.1	1000.0	1000.000	400.0	V	173.0	17.8	13.8	53.9

Test Notes: Measurement was performed without a 2.4GHz notch filter. Fundamental will be ignored for this test. 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)
1350.333333	41.6	1000.0	1000.000	150.0	V	312.0	-5.1	32.3	73.9
1980.733333	45.1	1000.0	1000.000	293.0	H	260.0	-2.3	28.8	73.9
2640.133333	45.5	1000.0	1000.000	173.0	H	139.0	-0.3	28.4	73.9
4960.633333	58.8	1000.0	1000.000	100.0	H	149.0	3.5	15.1	73.9
7439.233333	52.0	1000.0	1000.000	200.0	H	177.0	6.6	21.9	73.9
16799.60000	53.4	1000.0	1000.000	100.0	V	253.0	17.8	20.5	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1350.333333	28.3	1000.0	1000.000	150.0	V	312.0	-5.1	25.6	53.9
1980.733333	30.4	1000.0	1000.000	293.0	H	260.0	-2.3	23.5	53.9
2640.133333	34.2	1000.0	1000.000	173.0	H	139.0	-0.3	19.7	53.9
4960.633333	46.9	1000.0	1000.000	100.0	H	149.0	3.5	7.0	53.9
7439.233333	41.7	1000.0	1000.000	200.0	H	177.0	6.6	12.2	53.9
16799.60000	40.1	1000.0	1000.000	100.0	V	253.0	17.8	13.8	53.9

Test Notes: Measurement was performed without a 2.4GHz notch filter. Fundamental will be ignored for this test. 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: 8G41SN / Default Test Configuration

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

August 22, 2018/FSC

2.8.5 Test Equipment Used

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

2.8.6 Environmental Conditions

Ambient Temperature	26.2°C
Relative Humidity	54.9%
ATM Pressure	99.1kPa

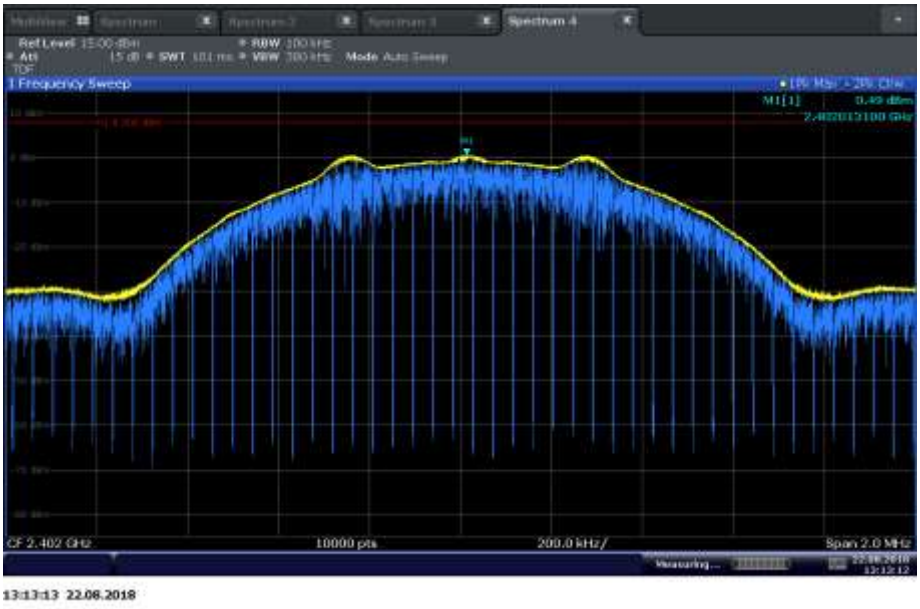
2.8.7 Additional Observations

- 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 was measured and entered as a Transducer factor (TDF)
- Detector is RMS power averaging.
- Trace averaging mode over 100 traces.
- Sweep time is Auto.
- EUT complies with 100 kHz RBW.

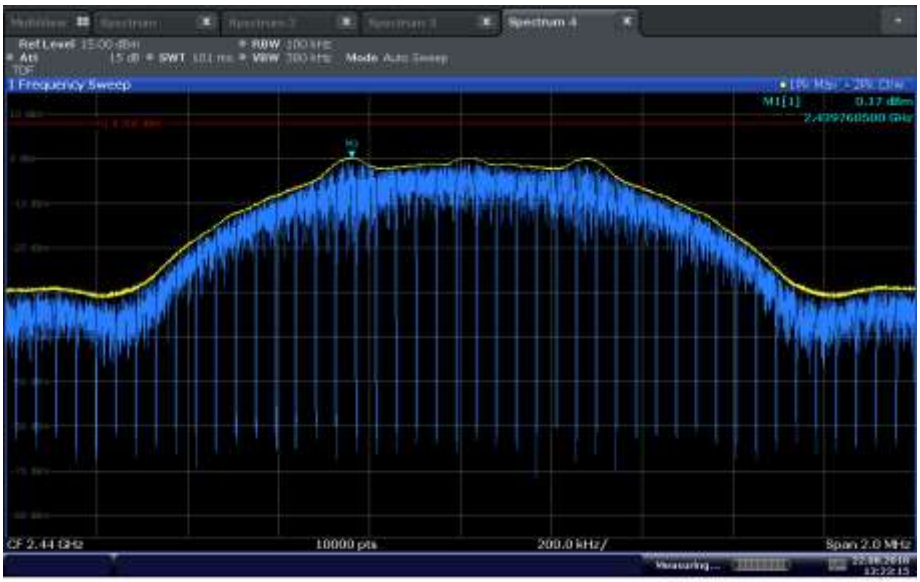
2.8.8 Test Results Summary

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	0.49	8	7.51	Complies
	17 (2440 MHz)	GFSK @ 1Mbps	0.17	8	7.83	Complies
	39 (2480 MHz)	GFSK @ 1Mbps	0.21	8	7.79	Complies

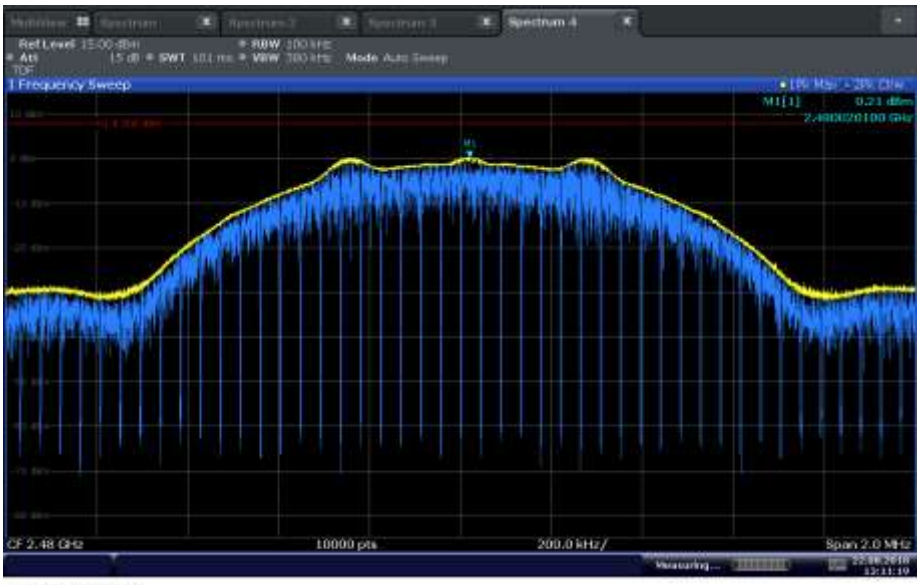
2.8.9 Test Results Plots



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						
7662	P-Series Power Meter	N1911A	MY45100951	Agilent	06/15/18	06/15/19
7661	50MHz-18GHz Wideband Power Sensor	N1921A	MY45241383	Agilent	06/15/18	06/15/19
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/19/17	09/19/19
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	06/08/18	06/08/19
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	12/14/17	12/14/18
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 7582, 1003 and 7608	
Radiated Emission						
7611	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	05/09/18	05/09/19
1033	Bilog Antenna	3142C	00044556	EMCO	10/11/16	10/11/18
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	06/16/18	06/01/20
1151	Pre-amplifier	TS-PR26	100026	Rhode & Schwarz	Verified by 7611 and 1003	
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	Verified by 7611 and 1003	
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	Verified by 7611 and 1003	
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	07/18/18	07/18/19
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	Sper Scientific	02/26/18	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 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

3.1.2 Radiated Emission Measurements (Above 1GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Rectangular	3.00	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

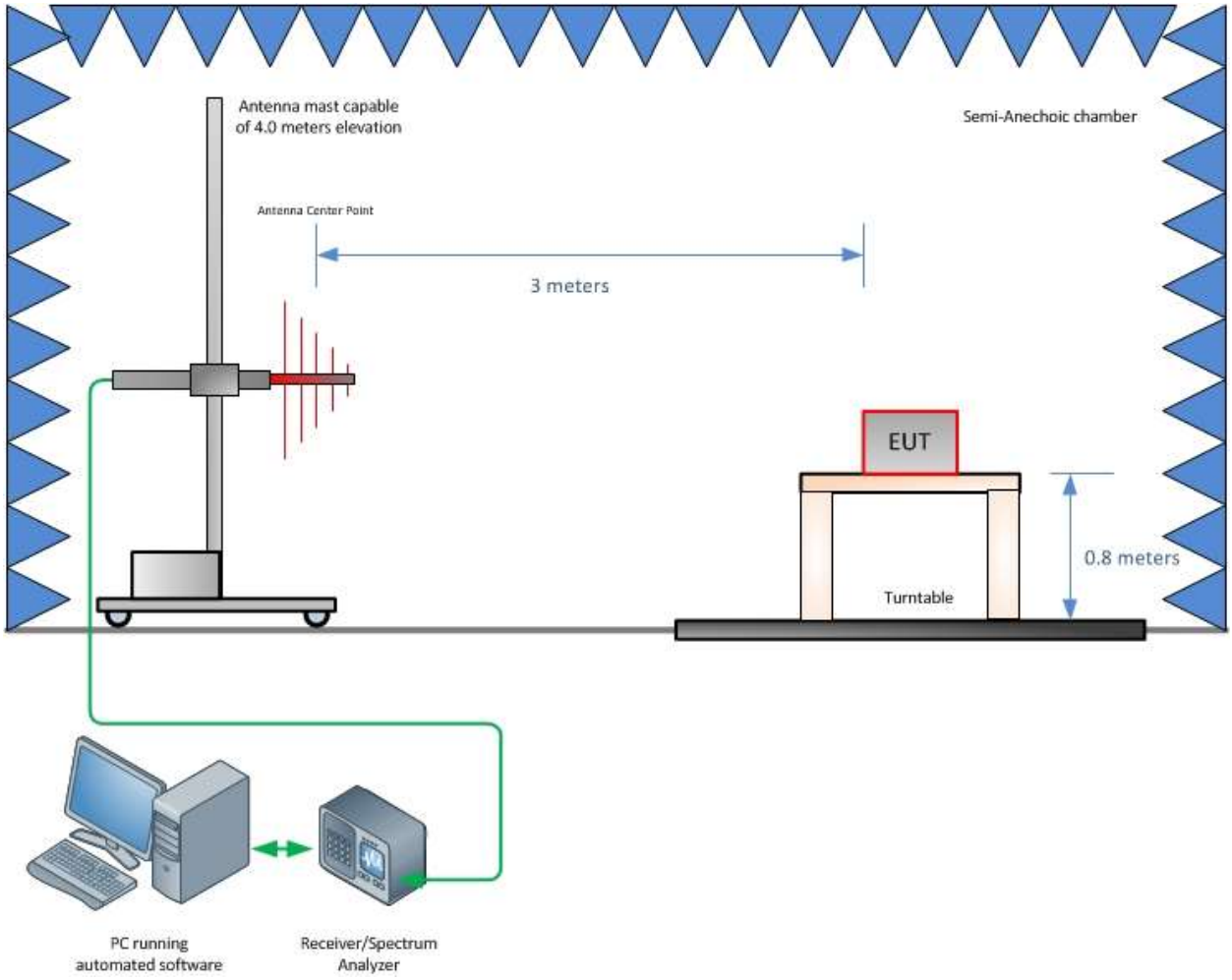
3.1.3 Conducted Antenna Port Measurement

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.08	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

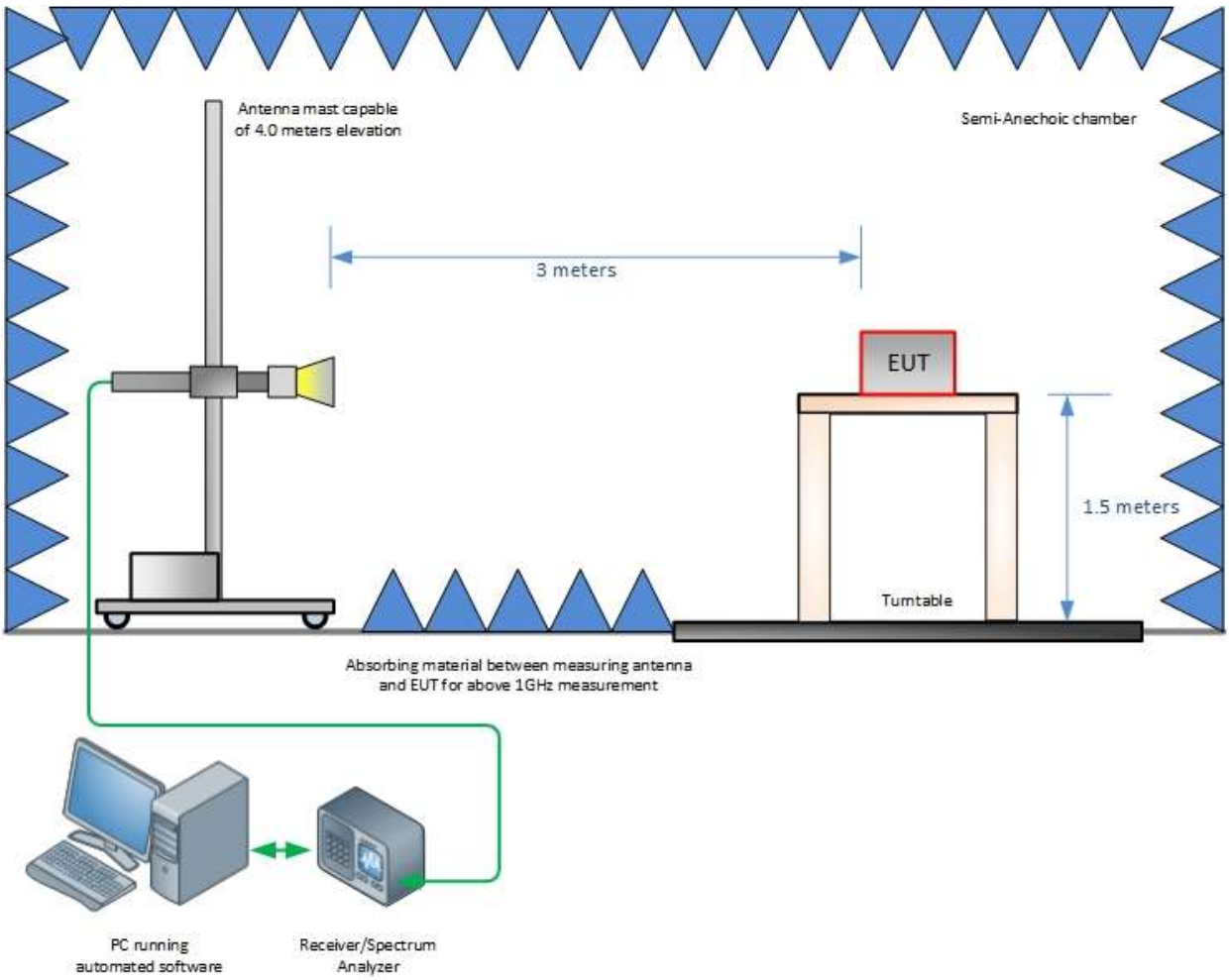
SECTION 4

DIAGRAM OF TEST SETUP

4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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