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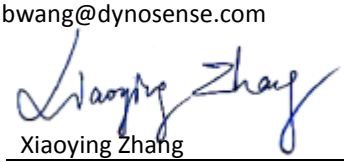
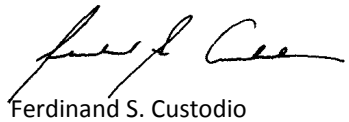
Report On

Application for Grant of Equipment Authorization of the
DynoSense Corp
Vital Sign Measuring System - DYNO 50

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

Report No. FB72129882-0717A **August 2017**

REPORT ON	Radio Testing of the DynoSense Corp Vital Sign Measuring System - DYNO 50
TEST REPORT NUMBER	FB72129882-0717A
PREPARED FOR	DynoSense Corp 100 Century Center Ct Ste 650 San Jose, CA 95112
CONTACT PERSON	Bruce Wang Chief Engineer (650) 397-6103 bwang@dynosense.com
PREPARED BY	 Xiaoying Zhang **Name** Authorized Signatory Title: EMC/Wireless Test Engineer
APPROVED BY	 Ferdinand S. Custodio **Name** Authorized Signatory Title: EMC/Senior Wireless Test Engineer
DATED	August 14, 2017

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

Revision History

FB72129882-0717A DynoSense Corp DYNO 50 Vital Sign Measuring System					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
08/14/2017	Initial Release				Ferdinand S. Custodio

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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
DynoSense Corp
Vital Sign Measuring System - DYNO 50

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the DynoSense Corp DYNO 50 Vital Sign Measuring System to the requirements of FCC Part 15 Subpart C §15.247 and 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	DynoSense Corp
Model Number(s)	999-00050-01
FCC ID Number	2AHYU-9990005001
IC Number	21382-9990005001
Serial Number(s)	9106010617000001 and 9106010517000041
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.247 (October 1, 2016). • RSS-247 Issue 2 February 2017 - Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices. • RSS-Gen - General Requirements for Compliance of Radio Apparatus (Issue 4, November 2014). • 558074 D01 DTS Meas Guidance v04, (April 5, 2017) Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247. • ANSI C63.10-2013. American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Start of Test	July 25, 2017
Finish of Test	July 27, 2017
Name of Engineer(s)	Xiaoying Zhang
Related Document(s)	None. Supporting documents for EUT certification are separate exhibits.

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart C §15.247 with cross-reference to the corresponding IC RSS standard is shown below.

Section	§15.247 Spec Clause	RSS	Test Description	Result	Comments/ Base Standard
2.1	§15.247(b)(3)	RSS-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 6.6	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-Gen 8.9 and 8.10	Spurious Radiated Emissions	Compliant	
2.8	§15.247(e)	RSS-247 5.2(2)	Power Spectral Density for Digitally Modulated Device	Compliant	

N/A Not performed. EUT is DC Powered.

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1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a DynoSense Corp DYNO 50 Vital Sign Measuring System as shown in the photograph below. DynoSense Vital Sign Measuring System is intended to record, transfer, store and display of single lead electrocardiography (ECG), heart rate (HR), functional oxygen saturation of arterial hemoglobin (SpO2), pulse rate (PR), respiration rate (RR), and oral body temperature (TEMP). The device uses Bluetooth Low Energy as the wireless link to enable data transmission and communication to a mobile device. Acquired data is wirelessly transmitted to the cloud using the mobile device. Only the Bluetooth LE function of the EUT was verified in this test report.

Equipment Under Test

Equipment Under Test with the charger

1.3.2 EUT General Description

EUT Description	Vital Sign Measuring System
Model Name	DYNO 50
Model Number(s)	999-00050-01
Rated Voltage	5VDC via USB
Mode Verified	Bluetooth Low Energy (BT LE)
Capability	Bluetooth Low Energy (BT LE)
Primary Unit (EUT)	☒ Production
	☐ Pre-Production
	☐ Engineering
Antenna Type	PCB IFA
Antenna Manufacturer	DynoSense Corp
Antenna Model Number	N/A
Antenna Gain	0 dBi (Max.)

1.3.3 Maximum Peak Conducted Output Power

Mode	Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
Bluetooth LE	2402-2480	-0.06	0.99

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Conducted test configuration. The manufacturer (client) provided a sample with temporary antenna connector. The EUT is programmed with Radio Test Firmware to work in different mode controlled by power cycle the device.
B	Radiated test configuration. The EUT is programmed with Radio Test Firmware to work in different mode controlled by power cycle the device.

1.4.2 EUT Exercise Software

None.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
HP	DC Power Supply	Model E3631A 0-6V, 5A/ 0 - ±25V, 1A Triple Output DC Power Supply

1.4.4 Worst Case Configuration

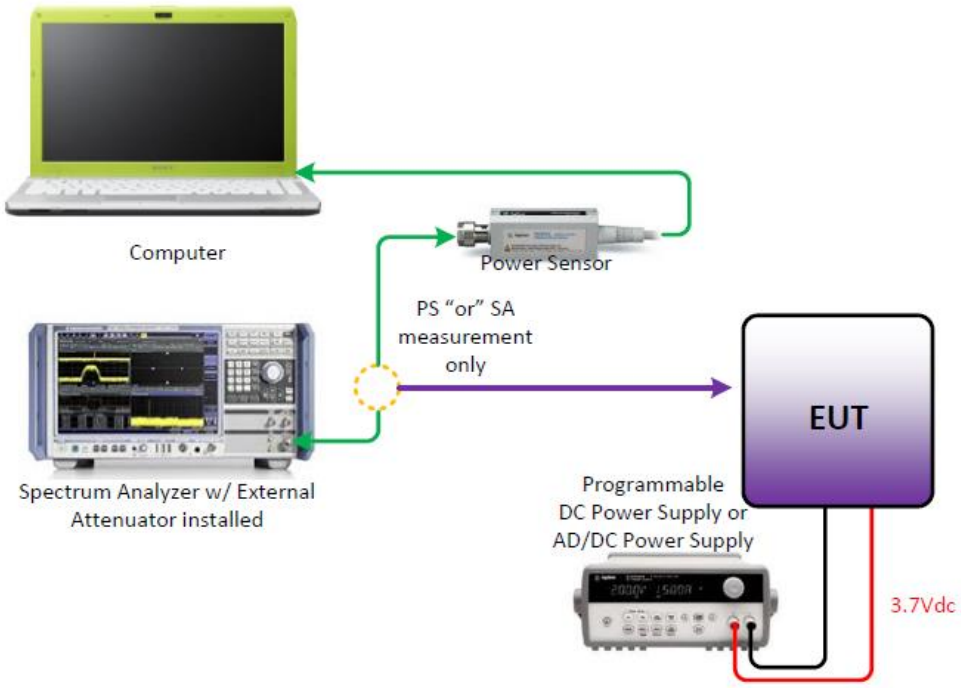
Worst-case configuration used in this test report as per maximum conducted output power measurements:

Mode	Channel	Data Rate
Bluetooth LE	39 (High Channel)	1Mbps

For radiated measurements, the EUT was verified using the worst case axis (“X”) (verified via prescan).

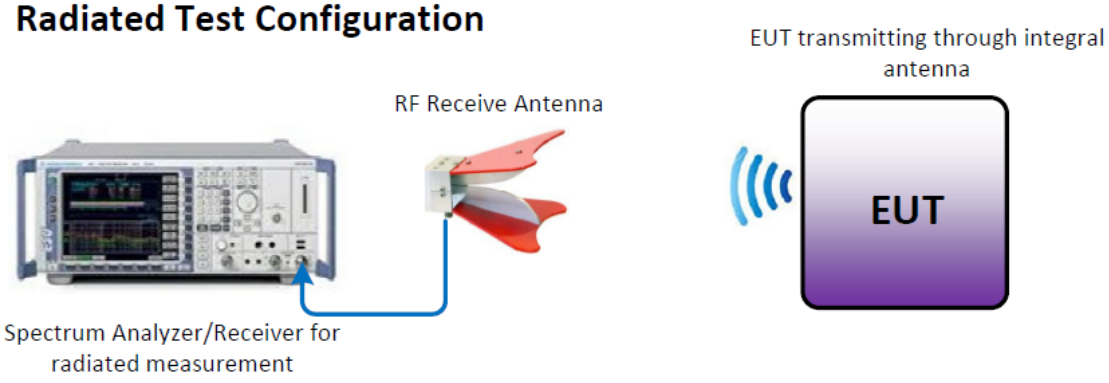
1.4.5 Simplified Test Configuration Diagram

Conducted (Antenna Port) Test Configuration



Not To Scale – Illustration Purpose Only
Objects may not represent actual image of original equipment/s or set-up.

Radiated Test Configuration



Not To Scale – Illustration Purpose Only
Objects may not represent actual image of original equipment/s or set-up.

1.5 DEVIATIONS FROM THE STANDARD

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

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number 9106010617000001 and 9106010517000041		
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 C63.4-2014. 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 – Registration No.: US1146

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.948 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US1146.

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

SECTION 2

TEST DETAILS

Radio Testing of the
DynoSense Corp
Vital Sign Measuring System - DYNO 50

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

2.1 PEAK OUTPUT POWER

2.1.1 Specification Reference

Part 15 Subpart C §15.247(b)(3) and RSS-247 5.4(d)

2.1.2 Standard Applicable

(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

2.1.3 Equipment Under Test and Modification State

Serial No: 9106010517000041 / Test Configuration A

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

July 25, 2017/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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	27.2 °C
Relative Humidity	46.8 %
ATM Pressure	99.0 kPa

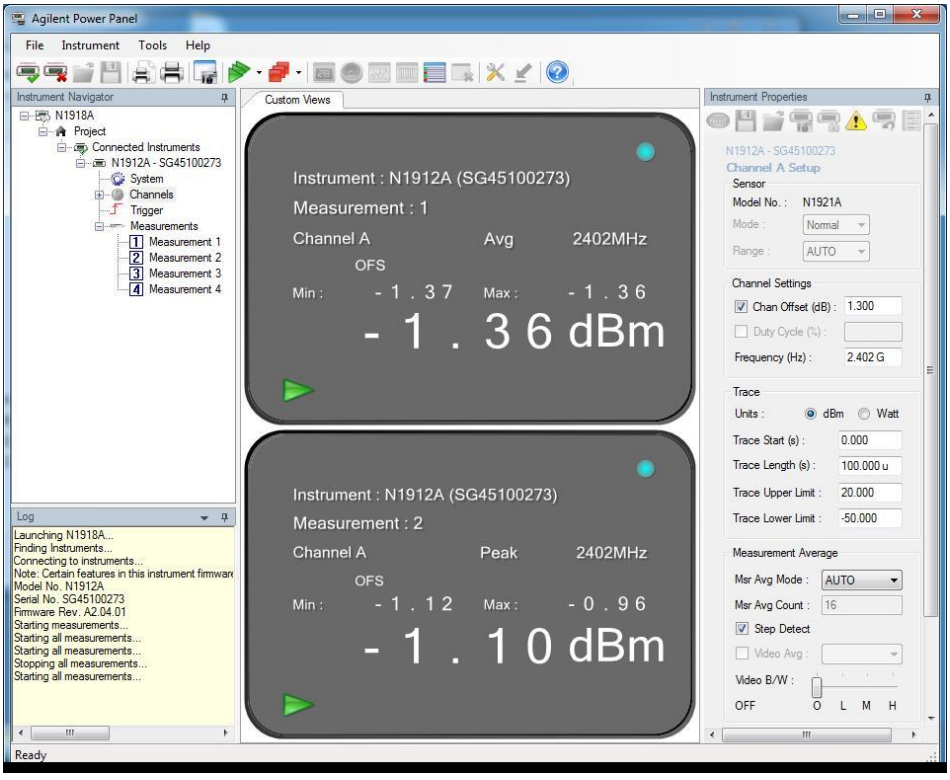
2.1.7 Additional Observations

- This is a conducted test (Maximum peak conducted output power) using direct connection to a broadband power meter with a video bandwidth greater than the DTS bandwidth.
- The cable loss was added to compensate for the external cable used from the antenna port to the power sensor.
- Test methodology is per Clause 9.1.3 of KDB 558074 D01 DTS Meas Guidance v04 (April 05, 2017) Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.
- Both Peak and Average measurements were recorded.

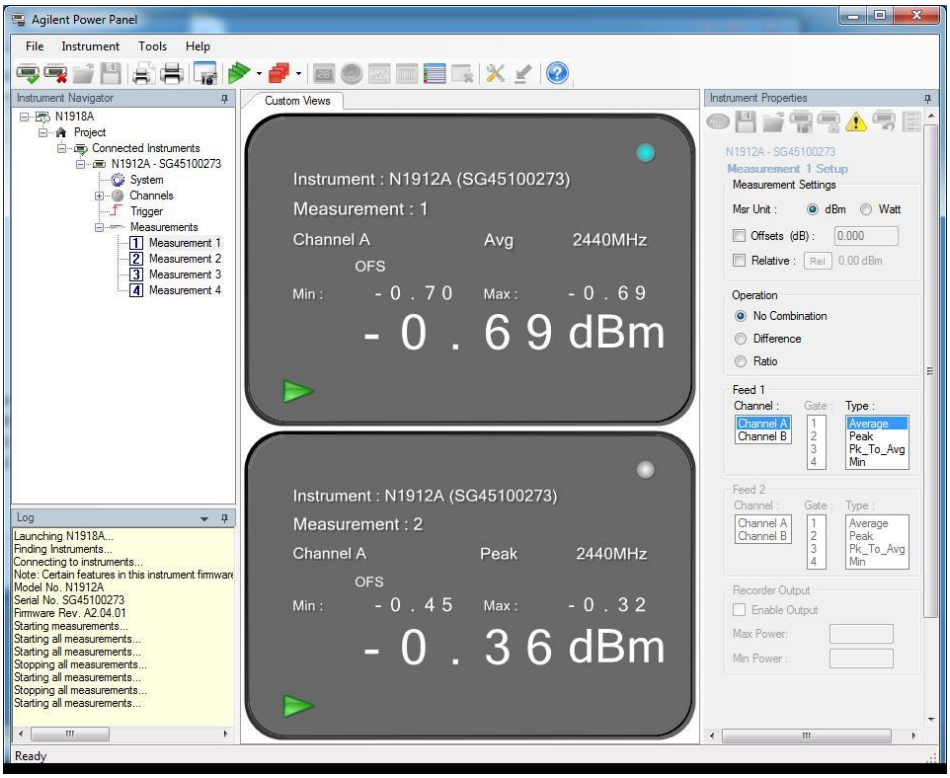
2.1.8 Test Results

Bluetooth Low Energy (LE)	Channel	Modulation	Measured Average Power (dBm)	Measured Peak Power (dBm)
	37 (2402 MHz)	GFSK	-1.36	-1.10
	17 (2440 MHz)		-0.69	-0.36
	39 (2480 MHz)		-0.19	-0.06

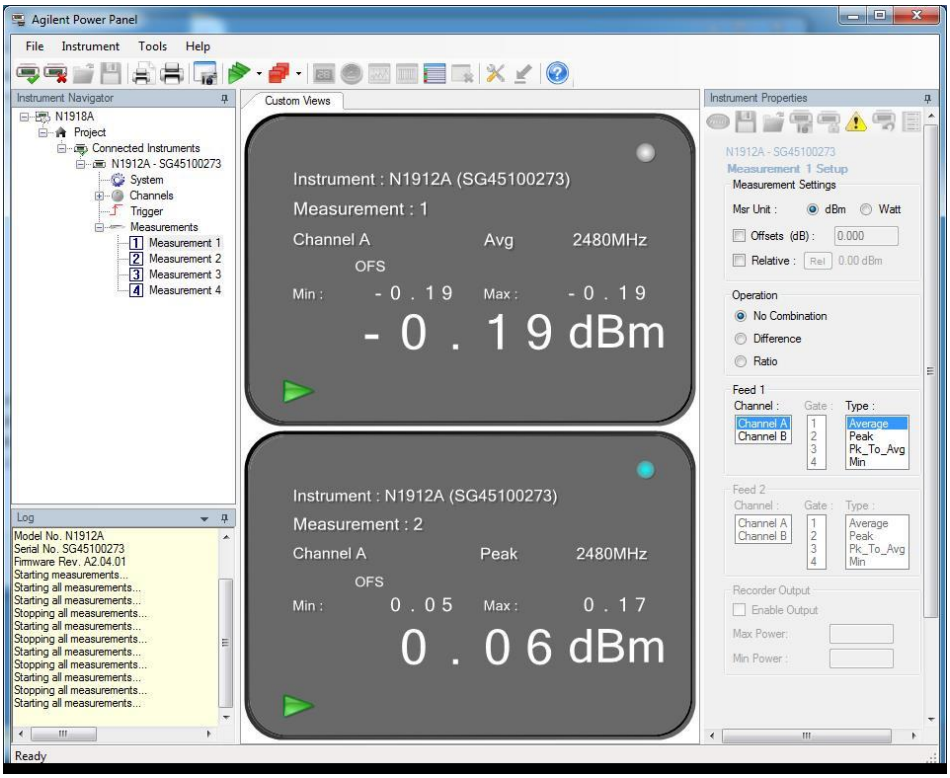
2.1.9 Test Plots



Low Channel BT LE



Mid Channel BT LE



High Channel BT LE

2.2 CONDUCTED EMISSIONS

2.2.1 Specification Reference

Part 15 Subpart C §15.207(a) and RSS-Gen 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

Not performed. EUT is a DC Powered.

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: 9106010517000041 / Default Test Configuration A

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

July 26, 2017/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	27.3 °C
Relative Humidity	47.4.%
ATM Pressure	99.1 kPa

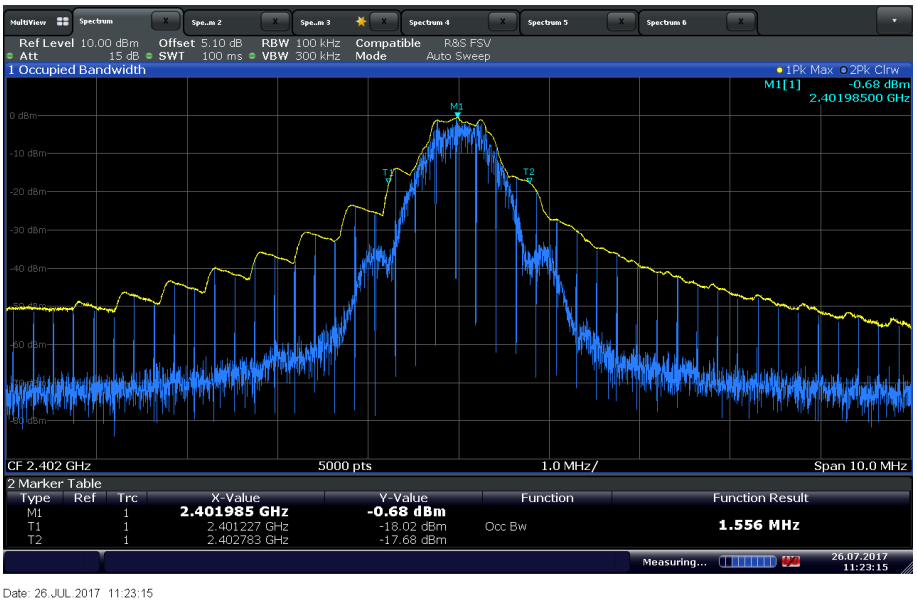
2.3.7 Additional Observations

- This is a conducted test.
- Span is wide enough to capture the channel transmission.
- RBW is 1% of the span.
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.
- The % Power Bandwidth setting in the spectrum analyzer was set to 99% (default).
- The Channel Bandwidth measurement function of the spectrum analyzer was used for this test.

2.3.8 Test Results (For reporting purposes only)

Mode	Channel	Measured 99% Bandwidth (MHz)
Bluetooth LE	37 (2402 MHz)	1.556
	17 (2440 MHz)	1.91
	39 (2480 MHz)	1.26

2.3.9 Test Results Plots



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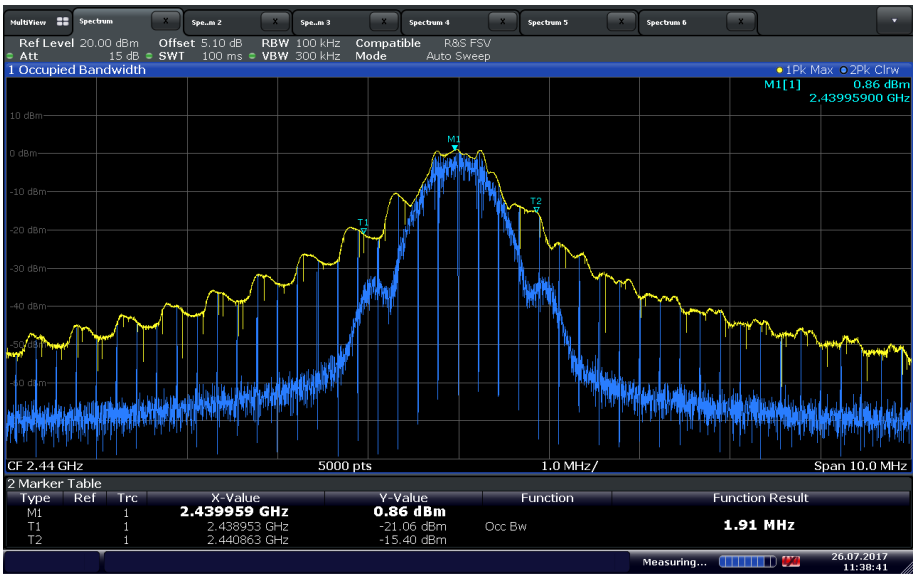
Bluetooth LE Low Channel



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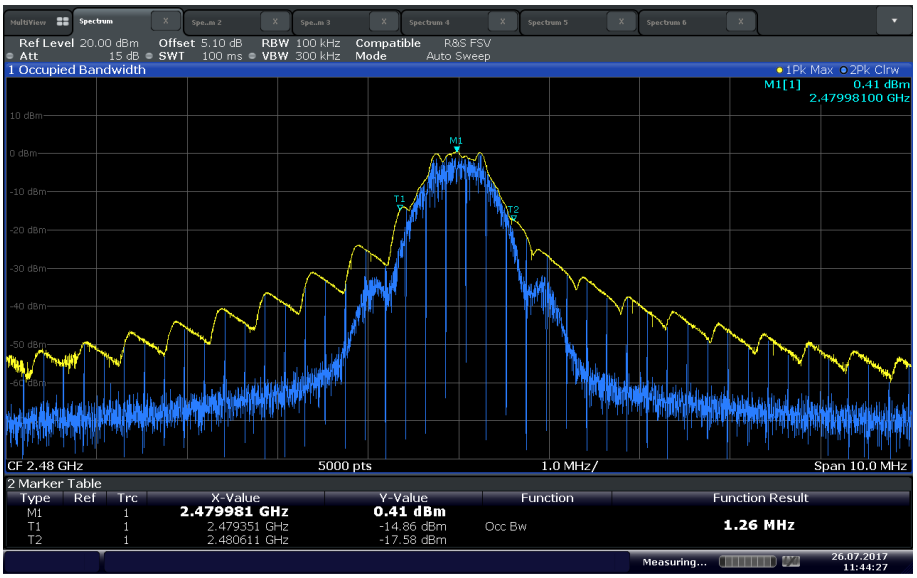
Bluetooth LE Mid Channel



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Bluetooth LE High Channel

2.4 MINIMUM 6 dB RF BANDWIDTH

2.4.1 Specification Reference

Part 15 Subpart C §15.247(a)(2) and RSS-247 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: 9106010517000041 / Test Configuration A

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

July 26, 2017/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	27.3 °C
Relative Humidity	47.4.%
ATM Pressure	99.1 kPa

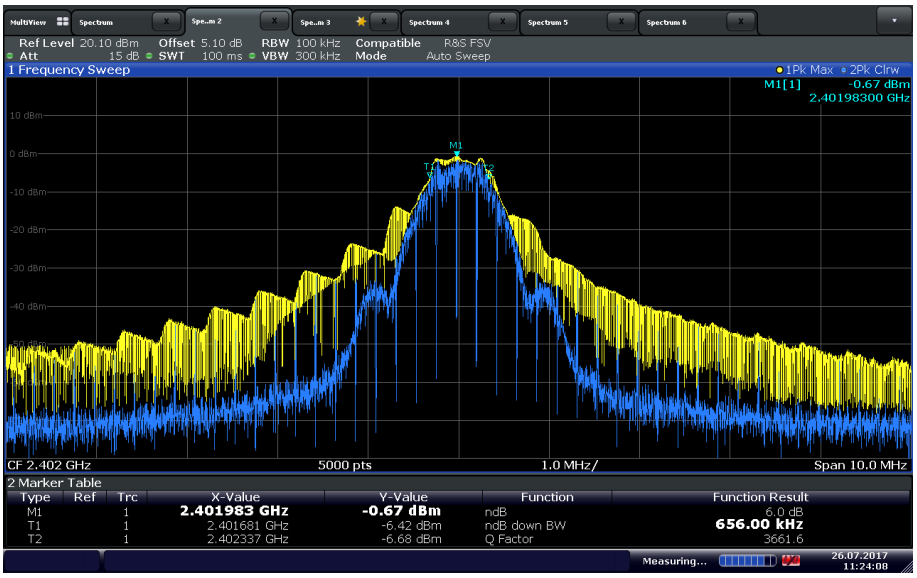
2.4.7 Additional Observations

- This is a conducted test.
- Span is wide enough to capture the channel transmission.
- RBW was set to 100 kHz while VBW is ≥3X RBW.
- Sweep is auto while Detector used is peak with maximum hold.
- 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)	0.656	0.500	Complies
	17 (2440 MHz)	0.648	0.500	Complies
	39 (2480 MHz)	0.656	0.500	Complies

2.4.9 Test Results Plots



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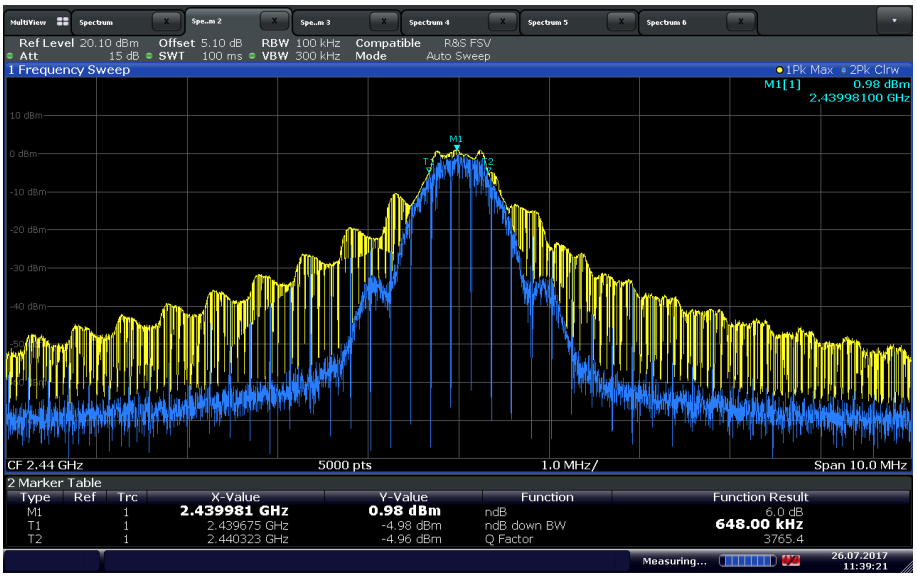
Bluetooth LE Low Channel



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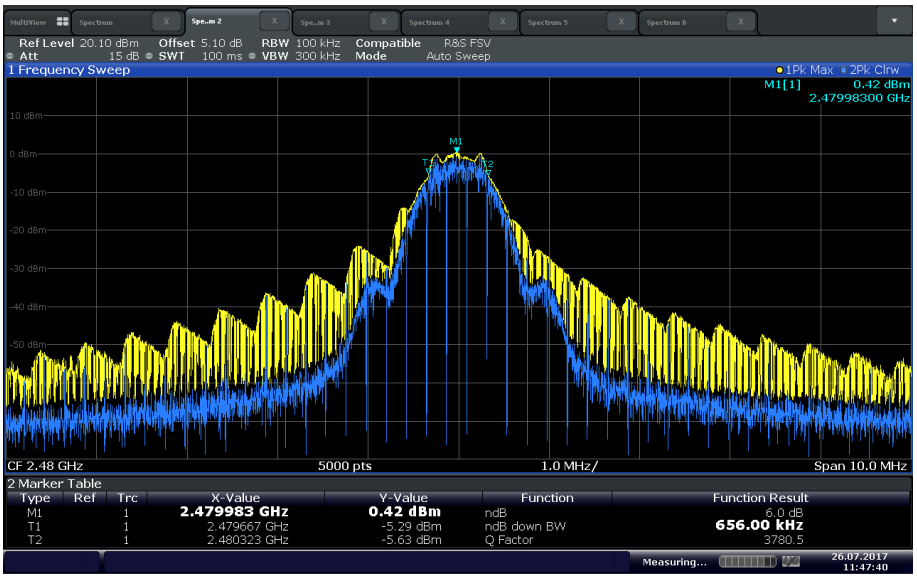
Bluetooth LE Mid Channel



Date: 26 JUL 2017 11:47:40

Bluetooth LE High Channel

2.5 OUT-OF-BAND EMISSIONS - CONDUCTED

2.5.1 Specification Reference

Part 15 Subpart C §15.247(d) and RSS-247 5.5

2.5.2 Standard Applicable

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

2.5.3 Equipment Under Test and Modification State

Serial No: 9106010517000041 / Test Configuration A

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

July 26, 2017/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/ Test Location

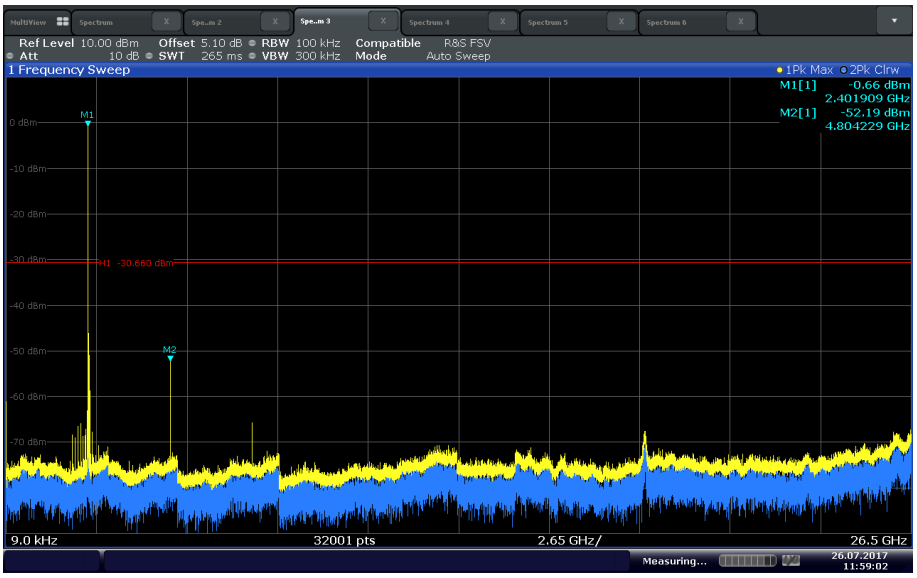
Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	27.3 °C
Relative Humidity	47.4.%
ATM Pressure	99.1 kPa

2.5.7 Additional Observations

- This is a conducted test.
- 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 (worst case).
- Spectrum was searched from 9 kHz up to 26.5GHz.

2.5.8 Test Results Plots



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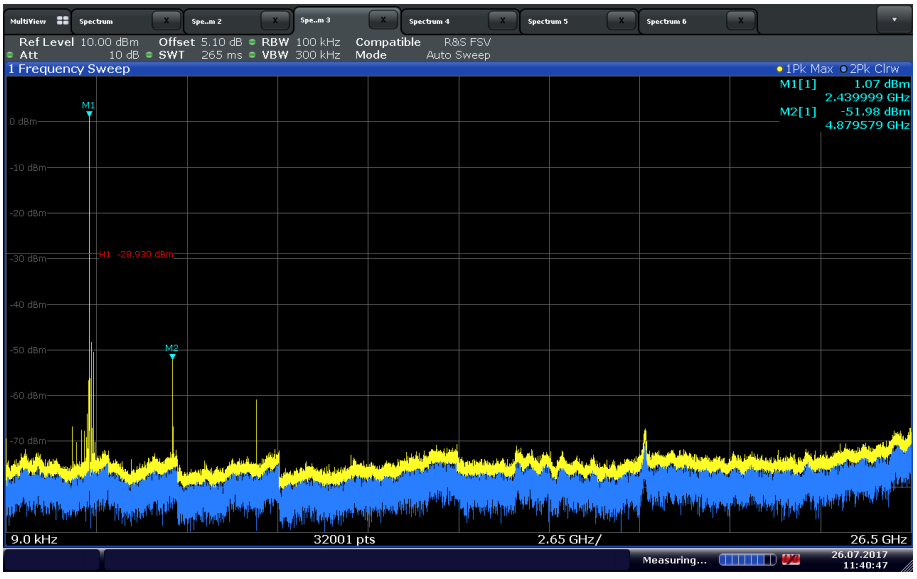
Bluetooth LE Low Channel



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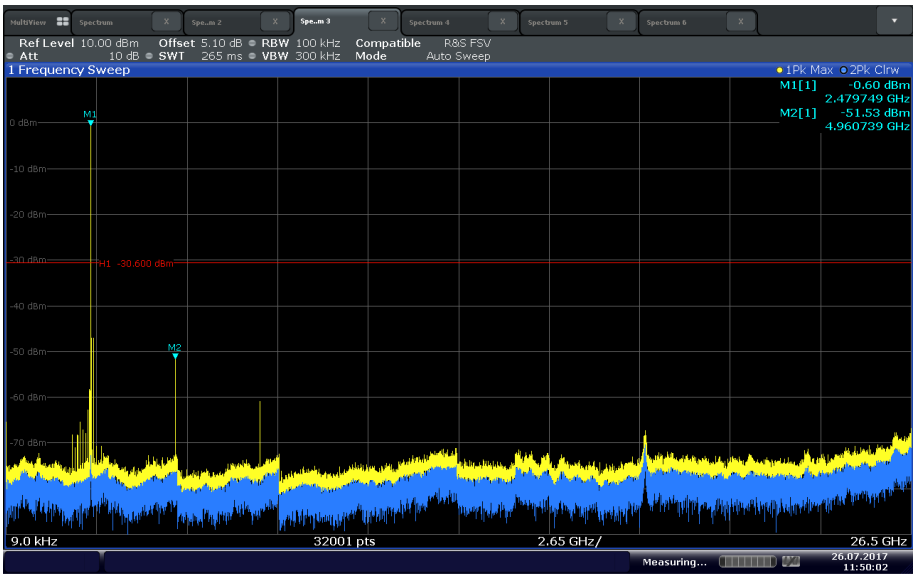
Bluetooth LE Mid Channel



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Bluetooth LE High Channel

2.6 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

2.6.1 Specification Reference

Part 15 Subpart C §15.247(d) and RSS-247 5.5

2.6.2 Standard Applicable

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

2.6.3 Equipment Under Test and Modification State

Serial No: 9106010517000041 / Test Configuration A

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

July 26, 2017/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/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

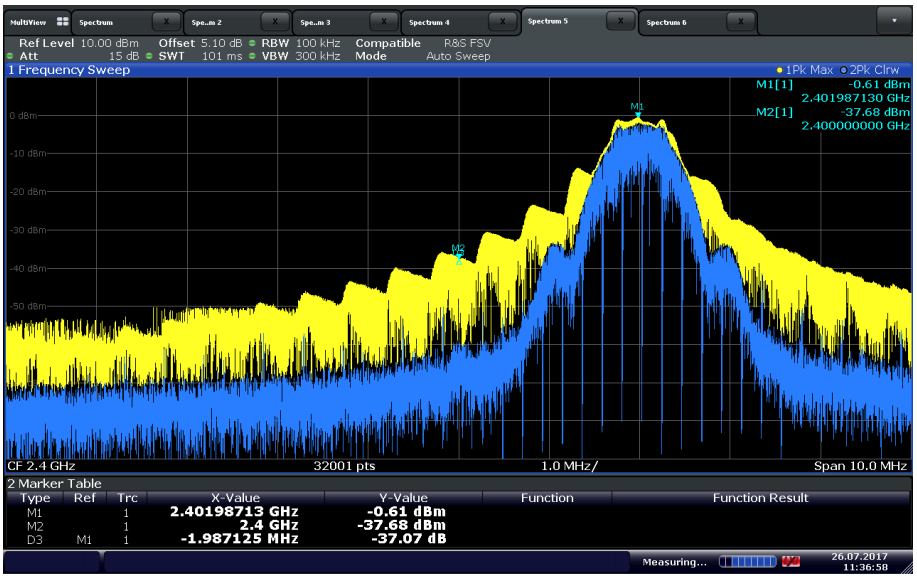
Ambient Temperature	27.3 °C
Relative Humidity	47.4.%
ATM Pressure	99.1 kPa

2.6.7 Additional Observations

- This is a conducted test.
- RBW is 100kHz.VBW is 3X RBW.
- Sweep is auto. Detector is peak. Trace is max hold.
- Trace was centered on the band-edge frequency.
- Span was set to encompass the band-edge frequency and the peak of the emission.
- Using Marker function, peak of the emission was determined and the delta to the band-edge frequency measured (for EUT OBW edge not within 2MHz of the authorized band edge).

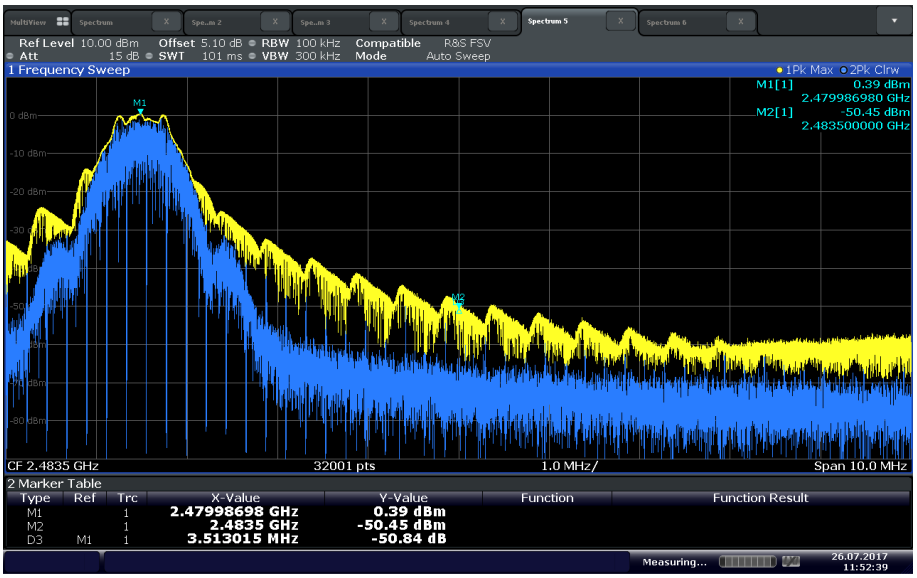
2.6.8 Test Results

Complies. See attached plots.



Date: 26.JUL.2017 11:36:58

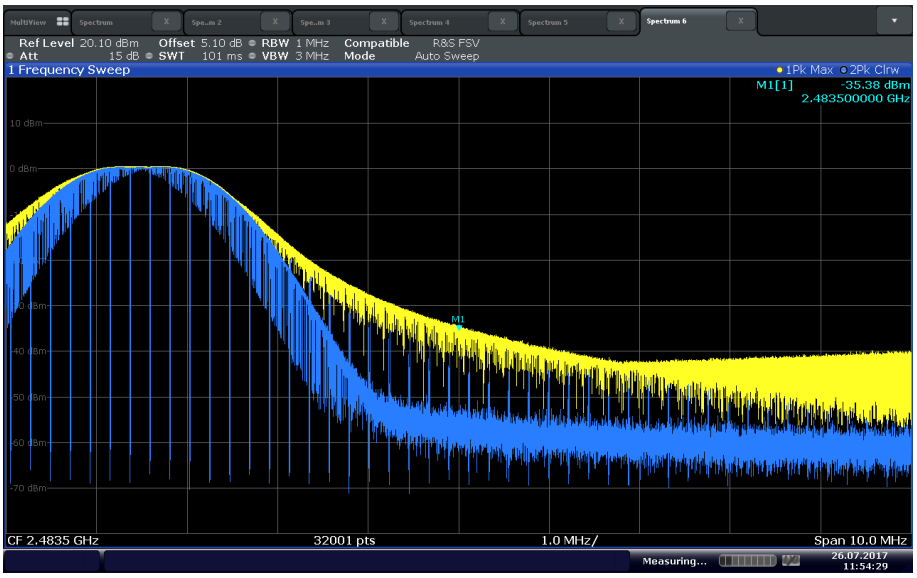
Bluetooth LE Low Channel (2402 MHz)



Date: 26.JUL.2017 11:52:39

Bluetooth LE High Channel (2480 MHz)

2.6.9 Band Edge Verification in the Restricted Band (Conducted Method)



Date: 26.JUL.2017 11:54:29

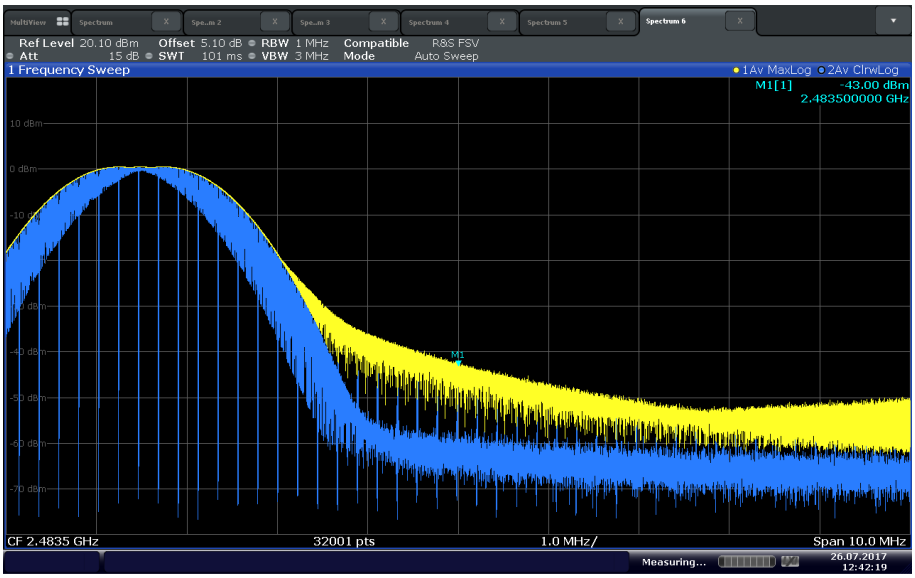
Upper Band Edge (in Restricted Band) measurement using Peak Power measurement procedure as per Clause 12.2.4 of KDB558074

Measured Peak = -35.38 dBm, since antenna gain is 0dBi then EIRP is the same. Using the formula:

$$E = EIRP - 20\log D + 104.8$$

Where: E = electric field strength in dBµV/m
EIRP = equivalent isotropic radiated power in dBm
D = specific measurement distance in meters

E is therefore = -35.38 dBm – (20log 3 meters) + 104.8
= 59.87 dBµV/m @ 3 meters (complies with the peak limit (74 dBµV/m))



Date: 26.JUL.2017 12:42:19

Upper Band Edge (in Restricted Band) measurement using Average Power measurement procedure as per Clause 12.2.4 of KDB558074

Measured Average = -43.0 dBm, since antenna gain is 0dBi then EIRP is the same. Using the formula:

$$E = EIRP - 20\log D + 104.8$$

Where:
- E = electric field strength in dBµV/m
- EIRP = equivalent isotropic radiated power in dBm
- D = specific measurement distance in meters

E is therefore = -43.0 dBm – (20log 3 meters) + 104.8
= 52.26 dBµV/m @ 3 meters (complies with the average limit (54 dBµV/m))

EUT complies restricted band @ 2483.5 MHz.

2.7 SPURIOUS RADIATED EMISSIONS

2.7.1 Specification Reference

Part 15 Subpart C §15.247(d) and RSS-Gen 8.9 and 8.10

2.7.2 Standard Applicable

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

2.7.3 Equipment Under Test and Modification State

Serial No: 9106010617000001 / Test Configuration B

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

July 27, 2017/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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	26.8 °C
Relative Humidity	50.1 %
ATM Pressure	99.0 kPa

2.7.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic.
- Test Methodology is per Clause 12.2.7 of KDB558074 D01 DTS Meas Guidance v04.
- 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 channel presented. EUT has an integrated antenna and can't be terminated for this test (cabinet spurious emissions).

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

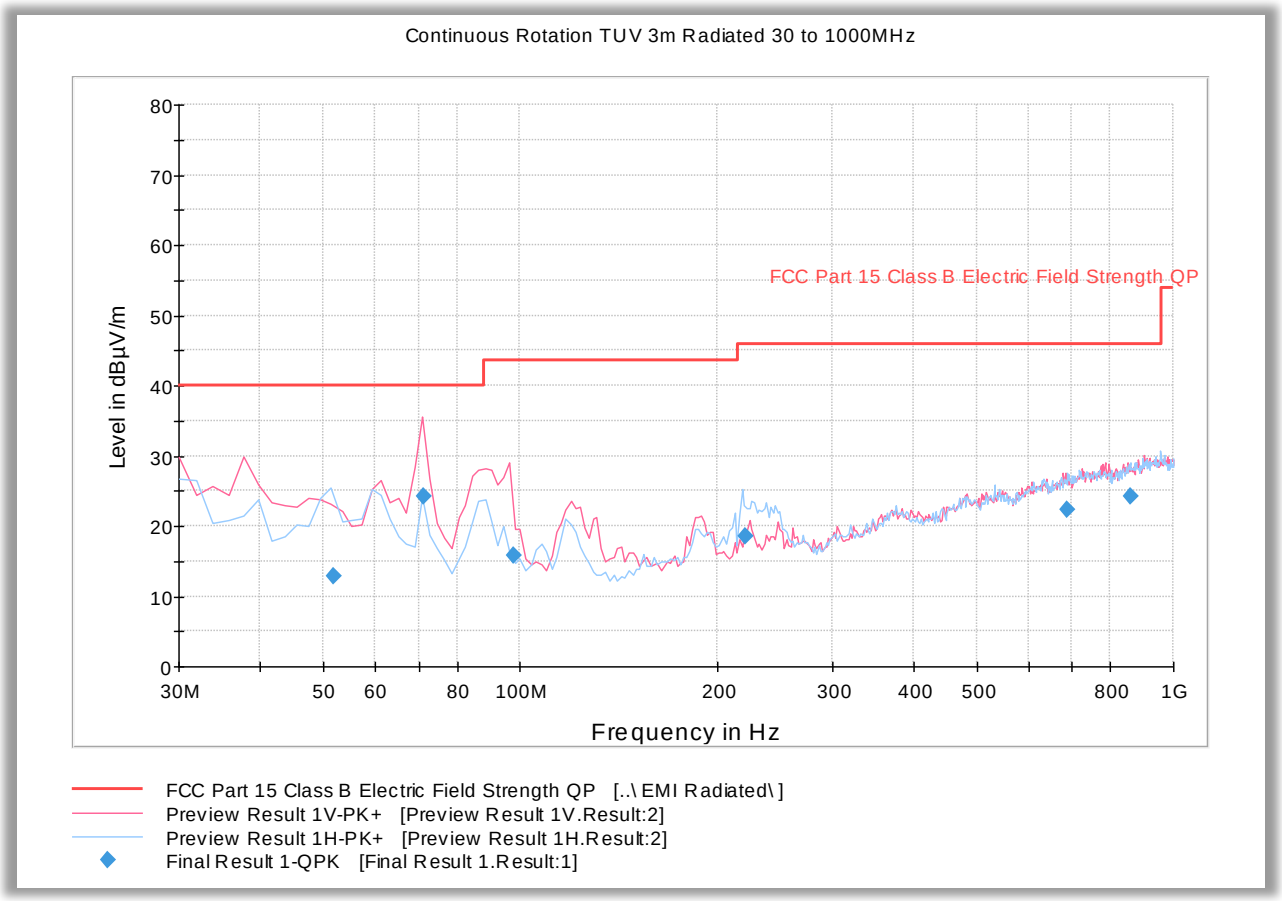
2.7.8 Sample Computation (Radiated Emission)

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

2.7.9 Test Results

See attached plots.

2.7.10 Test Results Below 1GHz (Worst Case Channel – High Channel)

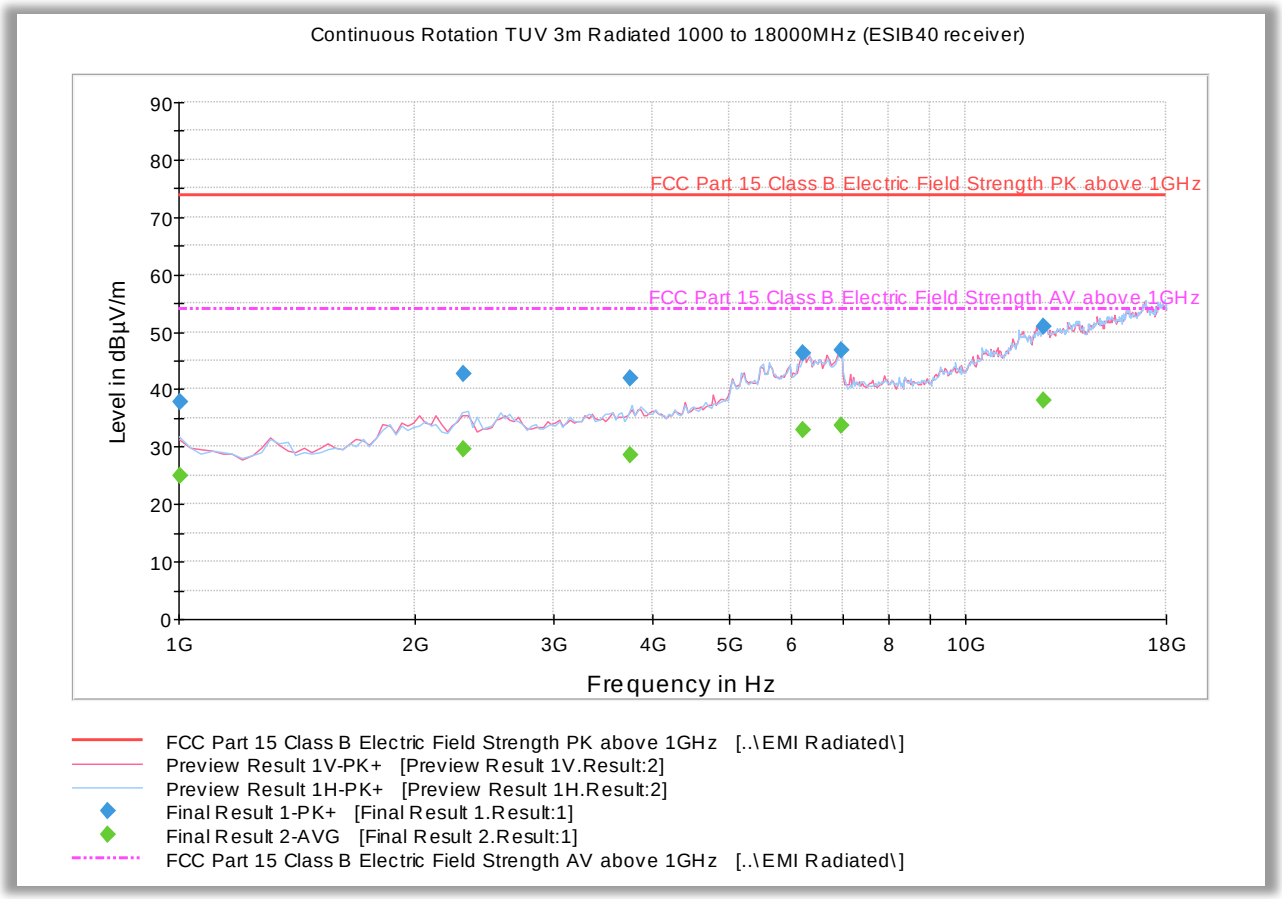


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
51.702766	12.9	1000.0	120.000	200.0	H	4.0	-14.8	27.1	40.0
71.101643	24.3	1000.0	120.000	200.0	V	352.0	-16.9	15.7	40.0
97.972184	15.9	1000.0	120.000	135.0	V	1.0	-14.7	27.6	43.5
221.317114	18.5	1000.0	120.000	115.0	H	49.0	-10.5	27.5	46.0
687.177956	22.3	1000.0	120.000	250.0	H	319.0	2.6	23.7	46.0
860.456192	24.2	1000.0	120.000	302.0	H	63.0	5.1	21.8	46.0

Test Notes: Only worst case channel presented for cabinet spurious emissions.

2.7.11 Test Results Above 1GHz (Worst Case Channel – Low Channel)



Peak Data

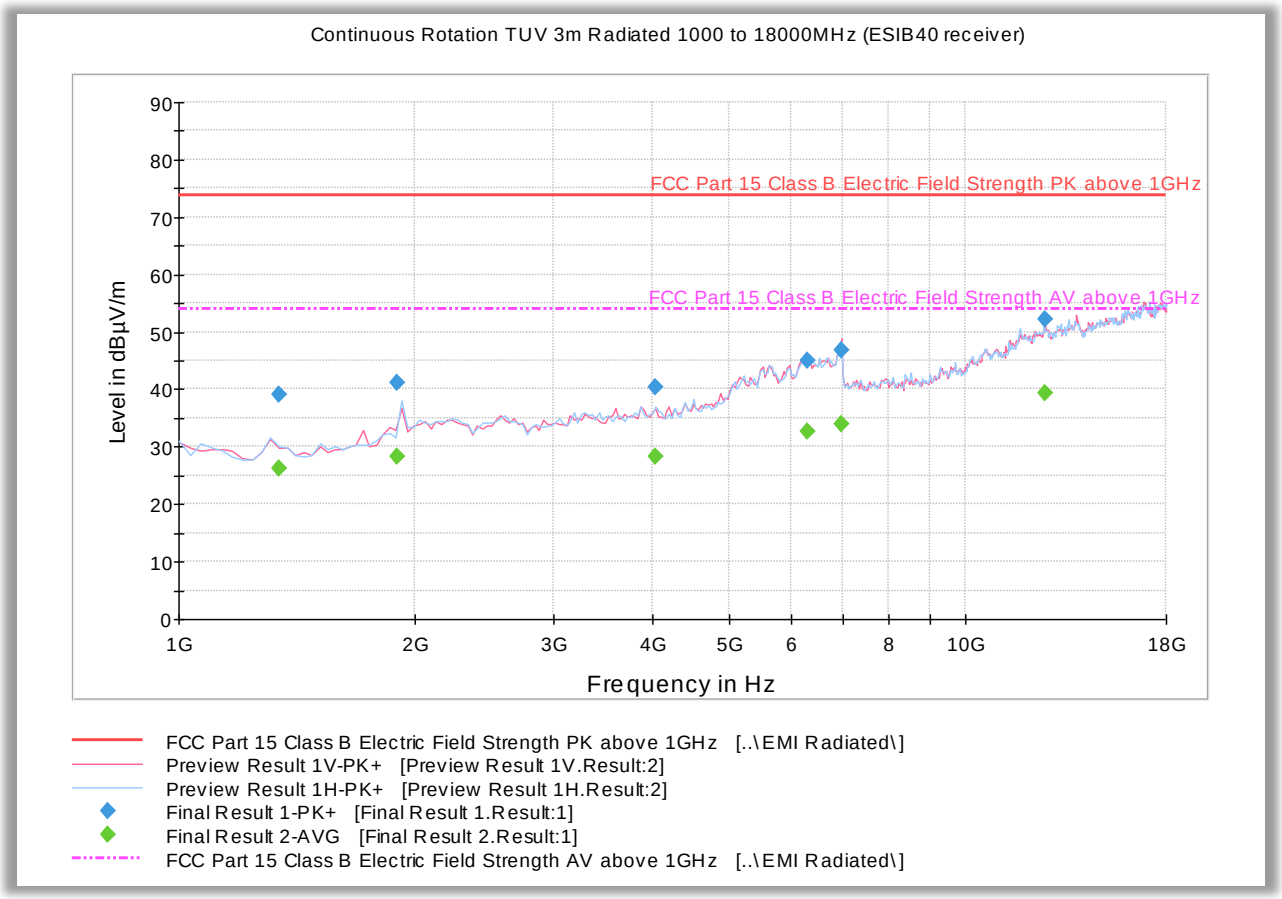
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1006.400000	37.8	1000.0	1000.000	152.2	H	72.0	-7.3	36.1	73.9
2303.457315	42.7	1000.0	1000.000	352.1	H	39.0	-1.2	31.2	73.9
3749.519038	41.8	1000.0	1000.000	351.6	H	217.0	1.9	32.1	73.9
6214.492986	46.2	1000.0	1000.000	312.2	H	100.0	6.8	27.7	73.9
6953.123848	46.7	1000.0	1000.000	210.4	H	278.0	7.8	27.2	73.9
12548.766333	50.8	1000.0	1000.000	351.6	H	185.0	16.8	23.1	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)
1006.400000	25.0	1000.0	1000.000	152.2	H	72.0	-7.3	28.9	53.9
2303.457315	29.5	1000.0	1000.000	352.1	H	39.0	-1.2	24.4	53.9
3749.519038	28.5	1000.0	1000.000	351.6	H	217.0	1.9	25.4	53.9
6214.492986	33.0	1000.0	1000.000	312.2	H	100.0	6.8	20.9	53.9
6953.123848	33.7	1000.0	1000.000	210.4	H	278.0	7.8	20.2	53.9
12548.766333	38.1	1000.0	1000.000	351.6	H	185.0	16.8	15.8	53.9

Test Notes: A 2.4GHz Notch is used when testing. No significant emissions observed above 18GHz. Measurements above 18GHz were noise floor figures.

2.7.12 Test Results Above 1GHz (Worst Case Channel – Mid Channel)



Peak Data

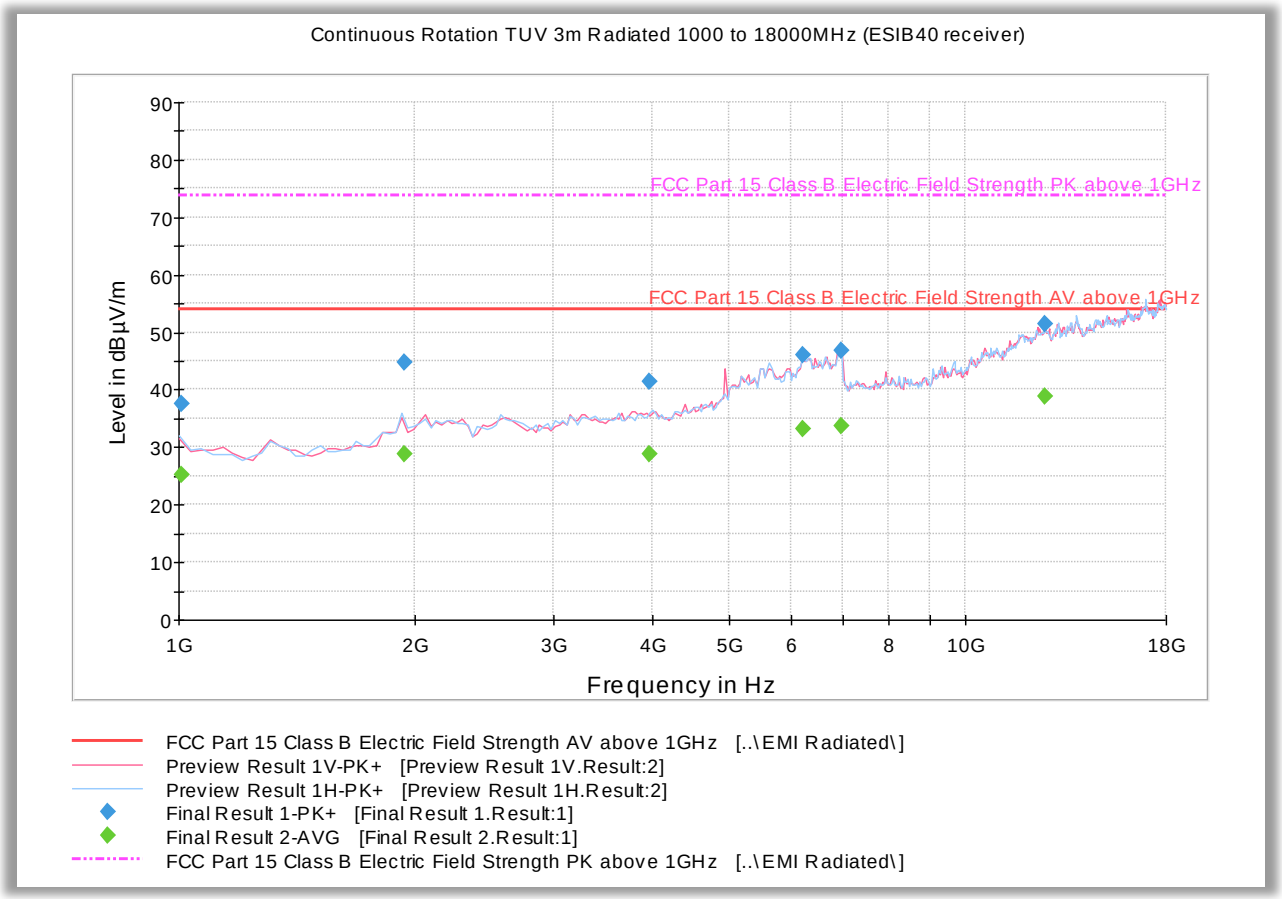
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1340.613226	39.0	1000.0	1000.000	335.2	H	0.0	-5.1	34.9	73.9
1895.439679	41.0	1000.0	1000.000	222.4	H	289.0	-2.2	32.9	73.9
4031.664128	40.5	1000.0	1000.000	403.1	H	218.0	3.3	33.4	73.9
6303.429259	44.9	1000.0	1000.000	152.2	H	1.0	6.6	29.0	73.9
6962.723848	46.9	1000.0	1000.000	167.6	V	181.0	7.8	27.0	73.9
12631.634469	52.3	1000.0	1000.000	395.1	V	126.0	17.4	21.6	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)
1340.613226	26.1	1000.0	1000.000	335.2	H	0.0	-5.1	27.8	53.9
1895.439679	28.2	1000.0	1000.000	222.4	H	289.0	-2.2	25.7	53.9
4031.664128	28.2	1000.0	1000.000	403.1	H	218.0	3.3	25.7	53.9
6303.429259	32.8	1000.0	1000.000	152.2	H	1.0	6.6	21.1	53.9
6962.723848	33.9	1000.0	1000.000	167.6	V	181.0	7.8	20.0	53.9
12631.634469	39.4	1000.0	1000.000	395.1	V	126.0	17.4	14.5	53.9

Test Notes: A 2.4GHz Notch is used when testing. No significant emissions observed above 18GHz. Measurements above 18GHz were noise floor figures.

2.7.13 Test Results Above 1GHz (Worst Case Channel – 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)
1010.000000	37.5	1000.	1000.000	250.5	H	278.0	-7.4	36.4	73.9
1938.239679	44.7	1000.	1000.000	410.7	H	278.0	-2.3	29.2	73.9
3967.995992	41.4	1000.	1000.000	269.3	H	80.0	2.6	32.5	73.9
6222.024850	46.0	1000.	1000.000	250.5	V	325.0	6.7	27.9	73.9
6966.323848	46.9	1000.	1000.000	103.7	H	298.0	7.8	27.0	73.9
12646.83446	51.4	1000.	1000.000	210.4	H	4.0	17.5	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)
1010.000000	25.2	1000.0	1000.000	250.5	H	278.0	-7.4	28.7	53.9
1938.239679	28.9	1000.0	1000.000	410.7	H	278.0	-2.3	25.0	53.9
3967.995992	28.9	1000.0	1000.000	269.3	H	80.0	2.6	25.0	53.9
6222.024850	33.1	1000.0	1000.000	250.5	V	325.0	6.7	20.8	53.9
6966.323848	33.6	1000.0	1000.000	103.7	H	298.0	7.8	20.3	53.9
12646.834469	38.8	1000.0	1000.000	210.4	H	4.0	17.5	15.1	53.9

Test Notes: A 2.4GHz Notch is used when testing. No significant emissions observed above 18GHz. Measurements above 18GHz were noise floor figures.

2.8 POWER SPECTRAL DENSITY

2.8.1 Specification Reference

Part 15 Subpart C §15.247(e) and RSS-247 5.2(2)

2.8.2 Standard Applicable

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

2.8.3 Equipment Under Test and Modification State

Serial No: 9106010517000041 / Configuration A

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

July 26, 2017/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/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	27.3 °C
Relative Humidity	47.4.%
ATM Pressure	99.1 kPa

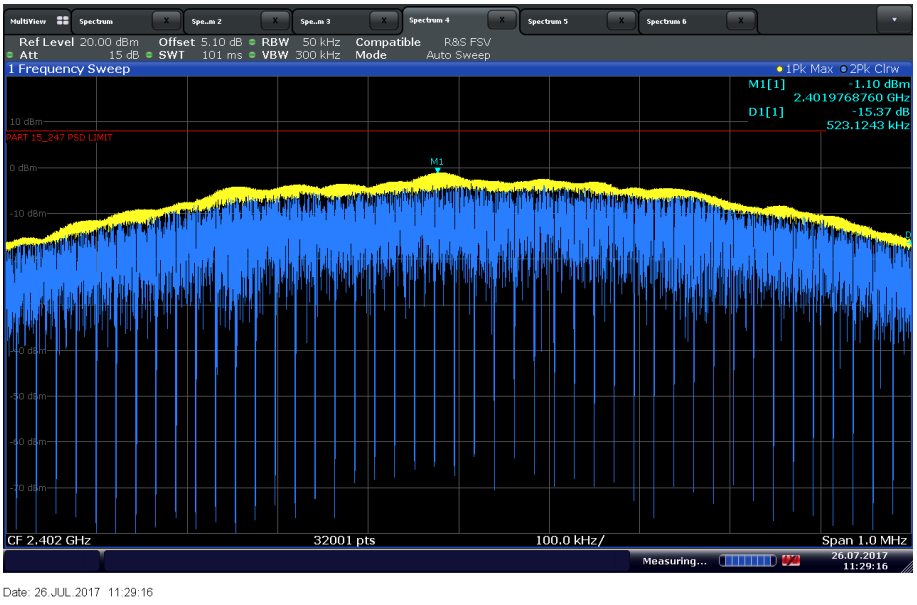
2.8.7 Additional Observations

- This is a conducted test.
- Test procedure is per Section 10.2 of KDB 558074 (April 05, 2017).
- Span is 1.5 times the DTS bandwidth.
- Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz
- Set the VBW ≥ 3 x RBW
- Detector is Peak
- Sweep time is Auto Couple.
- Trace mode is max hold
- Trace allowed to fully stabilize.
- EUT complies with 50 kHz RBW.

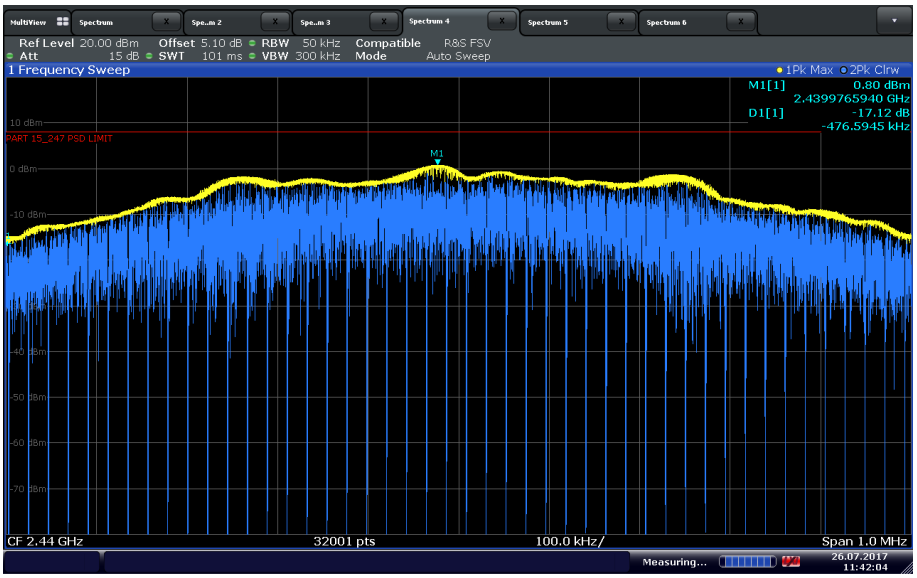
2.8.8 Test Results Summary

Mode	Channel	Marker Reading using 50 kHz RBW (dBm)	PSD Limit (dBm)	Margin (dB)	Compliance
Bluetooth LE	37 (2402 MHz)	-1.1	8	9.1	Complies
	17 (2440 MHz)	0.8	8	7.2	Complies
	39 (2480 MHz)	0.35	8	7.65	Complies

2.8.9 Test Results Plots



Bluetooth LE Low Channel



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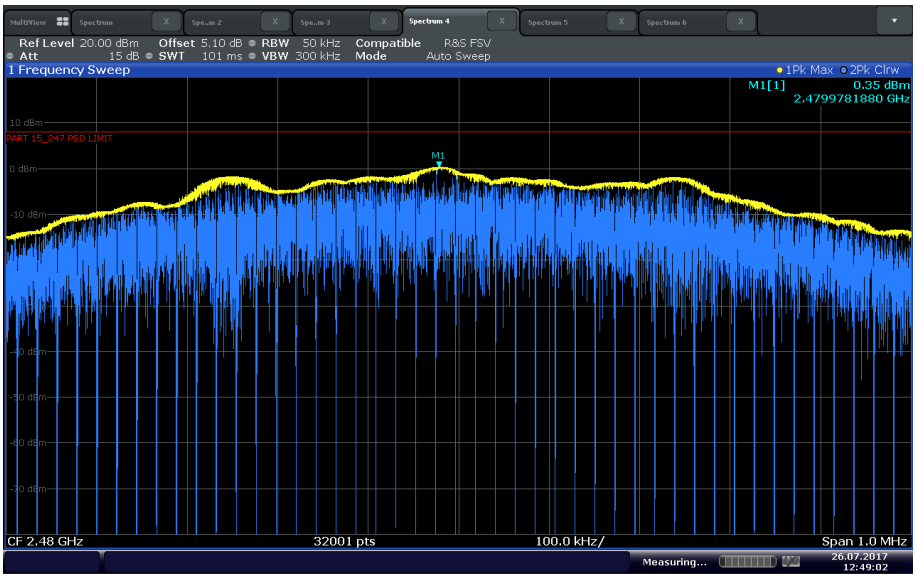
Bluetooth LE Mid Channel



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Bluetooth LE High Channel

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

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

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Antenna Conducted Port Setup						
7604	P-Series Power Meter	N1912A	SG45100273	Agilent	07/27/16	07/27/17
7605	50MHz-18GHz Wideband Power Sensor	N1921A	MY51100054	Agilent	05/19/17	05/19/18
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	10/26/15	10/26/17
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/02/16	09/02/17
8769	3dB Attenuator	606-03-1F4/DR	N/A	Meca	Verified by 7608 and 7582	
Radiated Test Setup						
1033	Bilog Antenna	3142C	00044556	EMCO	10/11/16	10/11/18
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	10/07/16	10/07/17
1016	Pre-amplifier	PAM-0202	187	PAM	02/09/17	02/09/18
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	06/01/17	06/01/18
9001	Horn Antenna (18-26GHz)	H042S	101	Custom Microwave	08/23/16	08/23/17
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	02/09/17	02/09/18
8893	Pre-amplifier (18-40 GHz)	SLKKa-30-6	15G27	Spacek Labs	09/04/16	09/04/17
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/02/16	09/02/17
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	10/26/15	10/26/17
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	Verified by 7608 and 7582	
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	Verified by 7608 and 7582	
6815	2.4GHz Band Notch Filter	BRM50702	008	Micro-Tronics	Verified by 1040	
Miscellaneous						
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/29/16	08/29/17
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	Sper Scientific	08/22/16	08/22/17
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

3.2 MEASUREMENT UNCERTAINTY

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

3.2.1 Conducted Antenna Port Measurement

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

3.2.2 AC Conducted Emissions

	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

3.2.3 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	Triangular	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

3.2.4 Radiated 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	Triangular	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

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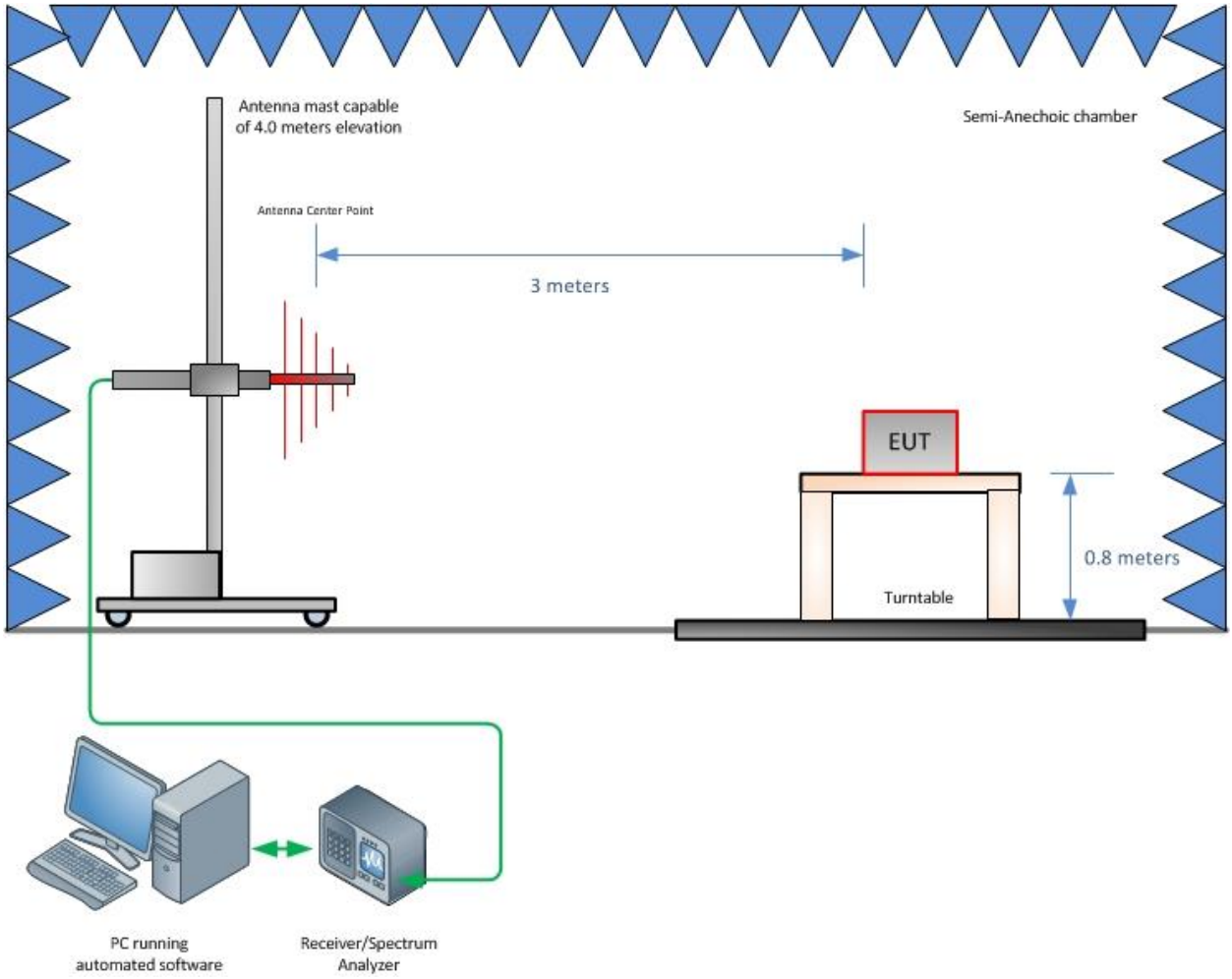
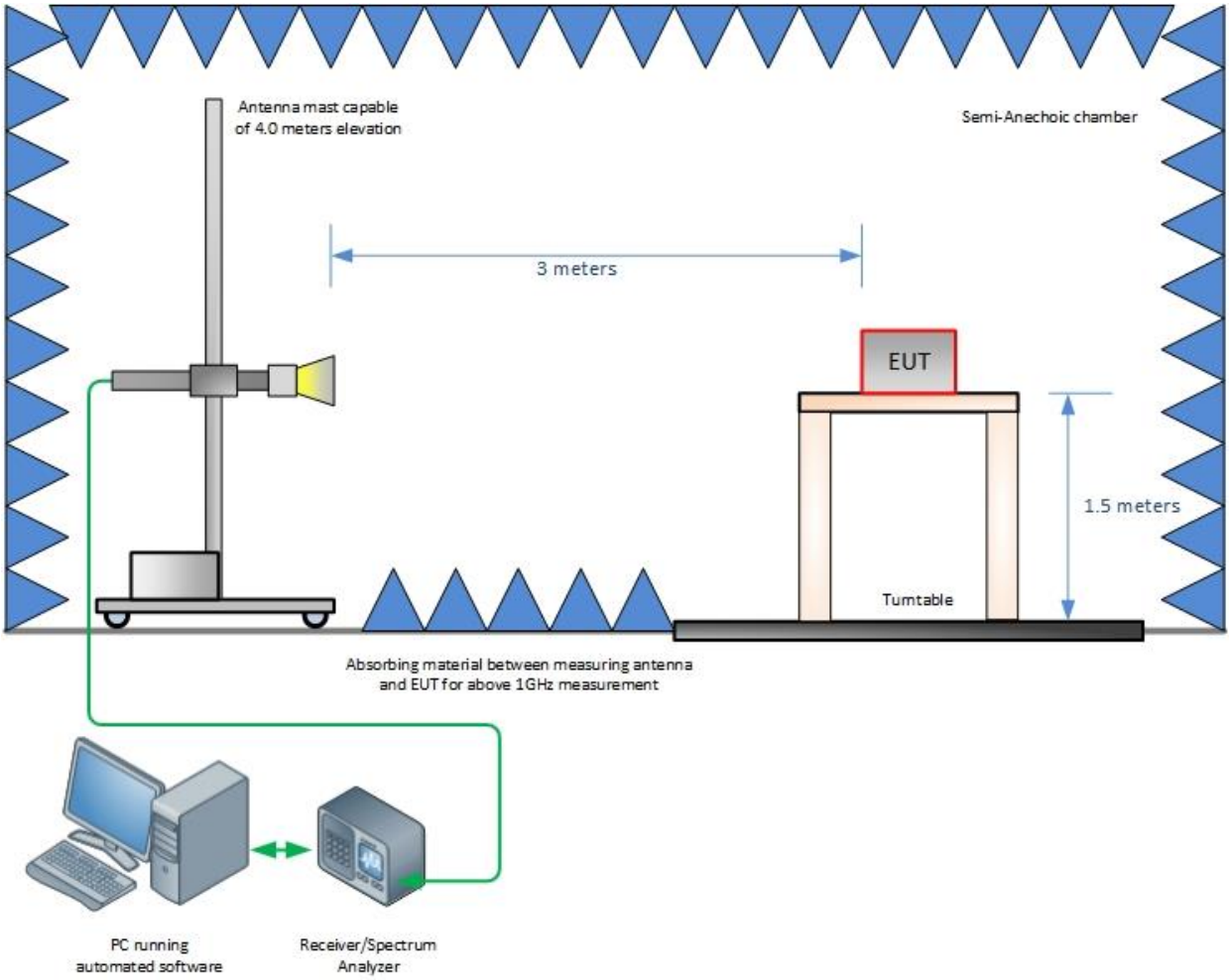
SECTION 4

DIAGRAM OF TEST SETUP

4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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