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Report On

Application for Grant of Equipment Authorization of the
Privoro LLC
M0002 SafeCase

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

Report No. 72138836 D **July 2018**

REPORT ON	Radio Testing of the Privoro LLC SafeCase
TEST REPORT NUMBER	72138836 D
PREPARED FOR	Privoro LLC 3100 W. Ray Road, #201 Chandler, AZ 85226 USA
CONTACT PERSON	Leslie Kelly Program Manager (602) 316 9500 Leslie.Kelly@privoro.com
PREPARED BY	Joel Rivera Name Authorized Signatory Title: EMC/Senior Wireless Test Engineer
APPROVED BY	Ferdinand S. Custodio **Name** Authorized Signatory Title: EMC/Senior Wireless Test Engineer
DATED	July 11, 2018

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

Revision History

72138836 D Privoro LLC M0002 SafeCase					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
08/17/18	Initial Release				Ferdie Custodio

CONTENTS

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SECTION 1

REPORT SUMMARY

Radio Testing of the
Privoro LLC
M0002 SafeCase

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Privoro LLC SafeCase SafeCase 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. Module has been already pre-approved see Related documents. FCC ID Z64-WL1835MOD
Manufacturer	Privoro LLC
Model Number(s)	M0002
FCC ID Number	2APWV PM02SC
IC Number	23953-PM02SC
Serial Number(s)	N/A
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.247 (October 1, 2017). • 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 5, April 2018). • 558074 D01 DTS Meas Guidance v03r04, (January 07, 2016) 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	June 11, 2018
Finish of Test	June 29, 2018
Name of Engineer(s)	Joel Rivera
Related Document(s)	Privoro SafeCase EMC Test Critieria.docx Provoro SafeCase Compliance Block Diagram R2.pptx Sporton International INC. FCC RF Test Report, Report No. FR383067B

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	N/A*	
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 - Radiated	Compliant	
2.6	§15.247(d)	RSS-247 5.5	Band-edge Compliance and Immediate Restricted Band	Compliant	
2.8	§15.247(e)	RSS-247 5.2(2)	Power Spectral Density for Digitally Modulated Device	N/A**	

N/A Not performed as per manufacturer test plan. RF module is already pre-approved (FCC ID Z64-WL1835MOD)*

*N/A** Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines*

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) were Privoro LLC M0002 SafeCase as shown in the photograph below. The EUT is an iPhone case that serves several functions, all targeted toward user security and privacy: (1) video protection: a hood on the SafeCase covers the iPhone camera; (2) audio protection: small speakers drive noise into the iPhone microphones to prevent eavesdropping; (3) secure wireless communications (Bluetooth, Bluetooth Low Energy, WiFi, NFC); (4) accelerometer and magnetometer; (5) GPS; (6) RF power detector. Technologies include Bluetooth LE and WIFI 802.11a, b,g,n, and NFC at 13.56MHz. BLE was verified in this test report.

Equipment Under Test

Equipment Under Test

1.3.2 EUT General Description

EUT Description	SafeCase
Model Name	SafeCase
Model Number(s)	M0002
Rated Voltage	Battery Operated 3.7V 900 mAh Lithium Ion Model :GSP423255 LiCo02/C(Li-polymer cell)
Mode Verified	Bluetooth Low Energy (BT LE)
Capability	WIFI a,b,g,n, BT LE, and NFC
Primary Unit (EUT)	☐ Production ☒ Pre-Production ☐ Engineering
Antenna Type	Multilayer Antenna (Dual Band type)
Antenna Manufacturer	TDK
Antenna Model Number	ANT016008LCD2442MA1
Antenna Dimensions	8mm x 5mm x 0.4mm
Antenna Gain	-0.2 dBi (Peak)

1.3.3 Maximum Peak Conducted Output Power

Mode	Frequency Range (MHz)	EIRP Output Power (dBm)	EIRP (mW)
Bluetooth LE	2402-2480	8.44	7.0

**Module is already pre-approved.* Sporton International INC. FCC RF Test Report, Report No. FR383067B

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	Mode: Battery LED reflects current mode in frequency combination per chart below. Power Button controls BLE and WIFI. Front Push To Talk Button cycles NFC mode. Pushing LED Power button cycles WIFI and BT LE channels **Mode : Battery Led reflects current mode in binary** Corner Led : Green = NFC in CW mode Corner Led : Red = WL18xx in TX mode Corner Led : Yellow = NFC & WL18xx in TX mode **"PTT Button" controls NFC Mode for PN7120** On - NFC in CW mode Off - NFC dormant **"Power Button" controls main FCC Mode for WL18xx** 0) Power up - normal. BLE is advertising. All leds off 1) All transmitters off 2) BLE at 2.402 MHz. Corner led Red/Green 3) BLE at 2.442 MHz. Corner led Red/Green 4) BLE at 2.480 MHz. Corner led Red/Green 5) Wifi at 2.412 MHz. Corner led Red/Green 6) Wifi at 2.442 MHz. Corner led Red/Green 7) Wifi at 2.484 MHz. Corner led Red/Green NFC can be toggled ON/OFF in any of the above FCC modes.

1.4.2 EUT Exercise Software

The EUTs were exercised using Privoro Test App PRIVORO PLATFORM Version 1.0.0 Build 10

1.4.3 Support Equipment and I/O cables

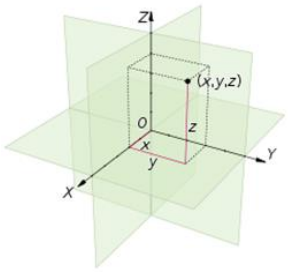
Manufacturer	Equipment/Cable	Description
Apple	iPhone 7	Model A1660; Privoro.Test6
Apple	iPhone 8	Privoro.Test5
Generic	AC/DC Adaptor	Model: L1265
Apple	AC/DC Adaptor	Model: A1385
USB Meter	USB Male/USB Female	Model AVHzY-UM24C
Privoro	USB to Micro USB/Lightning Cable	3 foot from AC adaptor to EUT

Worst Case Configuration

Worst-case configuration used in this test report as per Sporton International INC. FCC RF Test Report, Report No. FR383067B

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

EUT is a portable device. For radiated measurements, all three axes were verified to determine worst case axis to be used during testing. “Z” axis was verified to be the worst axis for radiated emissions.



1.4.4 Simplified Test Configuration Diagram

Not required. EUT was verified on a stand-alone test configuration.

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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 N/A		
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)

16530 Via Esprillo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 678 1400 Fax: 858 546 0364.

1.9 TEST FACILITY REGISTRATION

1.10 FCC – DESIGNATION NO.: US1146

TÜV SÜD 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.

1.10.1 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.

1.10.2 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.

1.10.3 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.

1.10.4 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.

1.10.5 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.

1.10.6 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
Privoro LLC
M0002 SafeCase

2.1 PEAK OUTPUT POWER

2.1.1 Specification Reference

Part 15 Subpart C §15.247(b)(3) and RSS-247 5.4(4)

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: N/A

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

Not Performed. See Section 1.2 for details

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 battery powered device. See Section 2.1 for Details.

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: N/A / Default Test Configuration

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

June 27, 2018/JR

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	25.3 °C
Relative Humidity	34.0.%
ATM Pressure	99.6 kPa

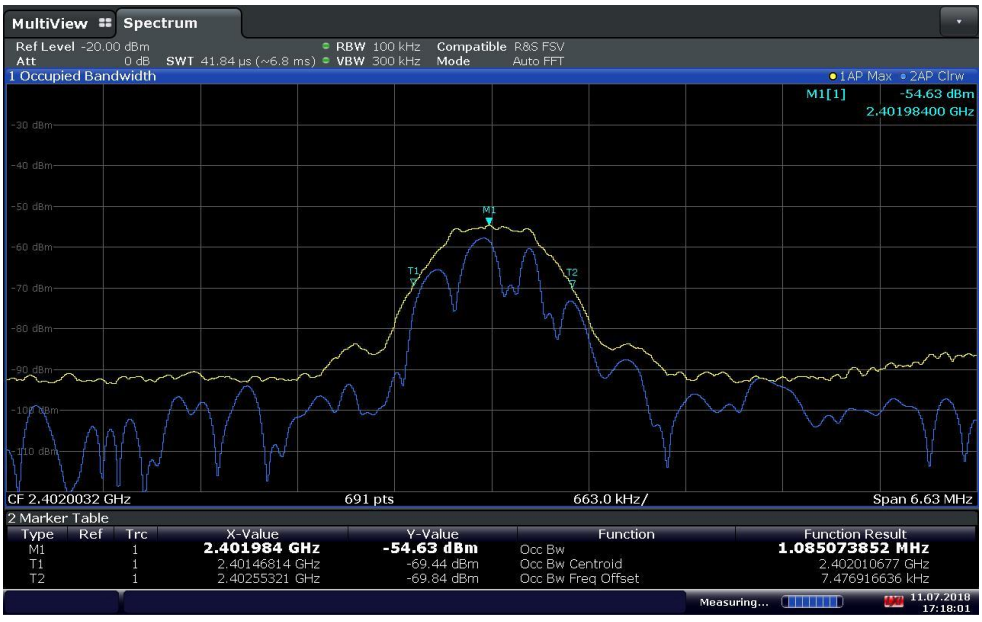
2.3.7 Additional Observations

- This is a radiated 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	Low (2442 MHz)	1.085
	Mid (2442 MHz)	1.097
	High (2480 MHz)	1.091

2.3.9 Test Results Plots



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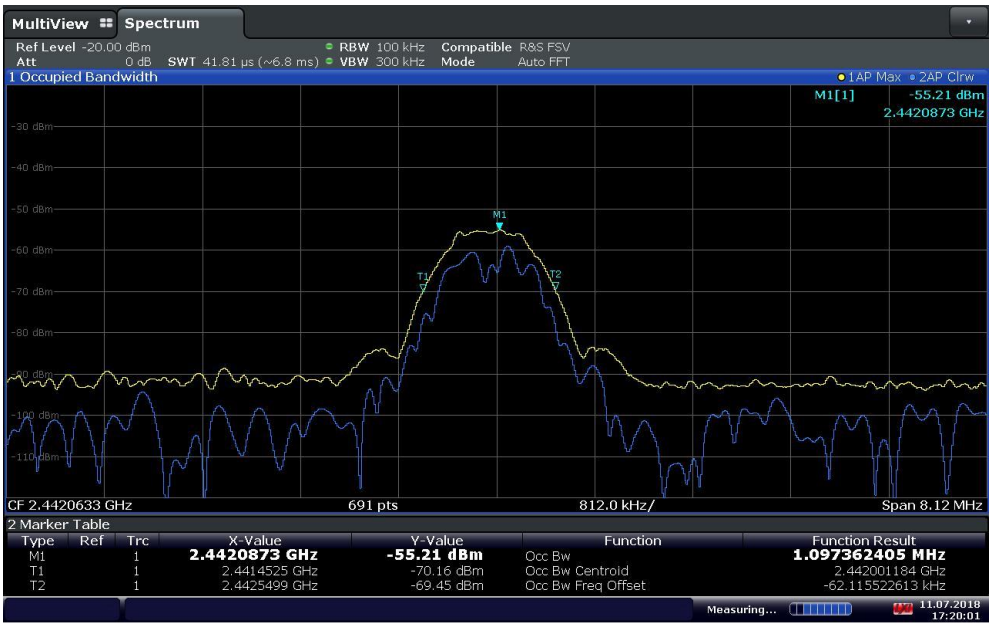
Bluetooth LE Low Channel



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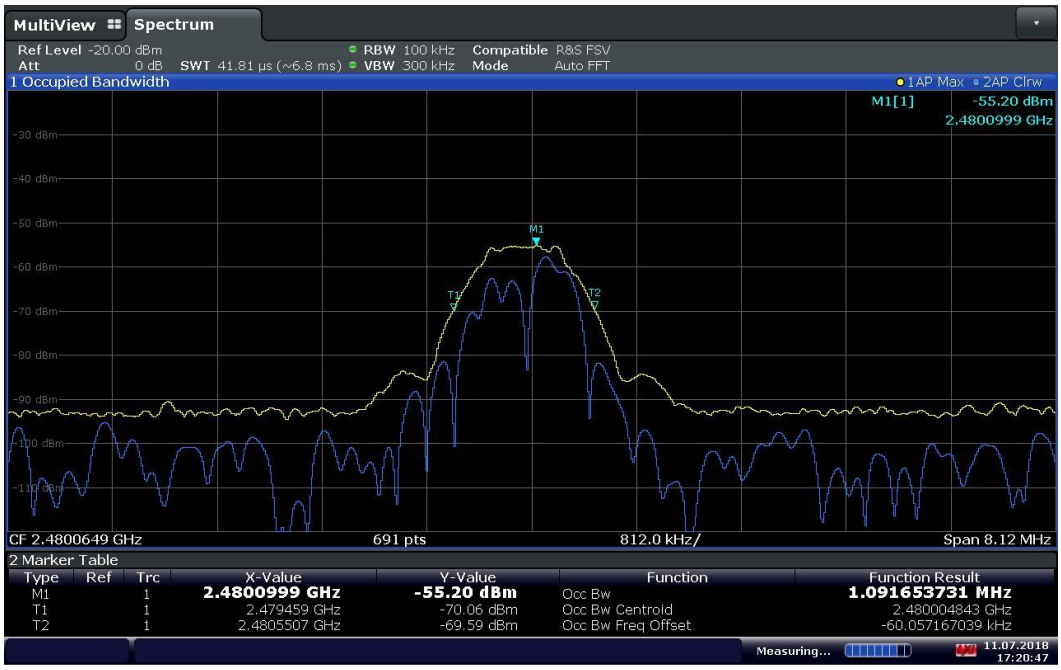
Bluetooth LE Mid Channel



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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(1)

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: N/A / Default Test Configuration

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

July 11, 2018/JR

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	25.3 °C
Relative Humidity	34.0.%
ATM Pressure	99.6 kPa

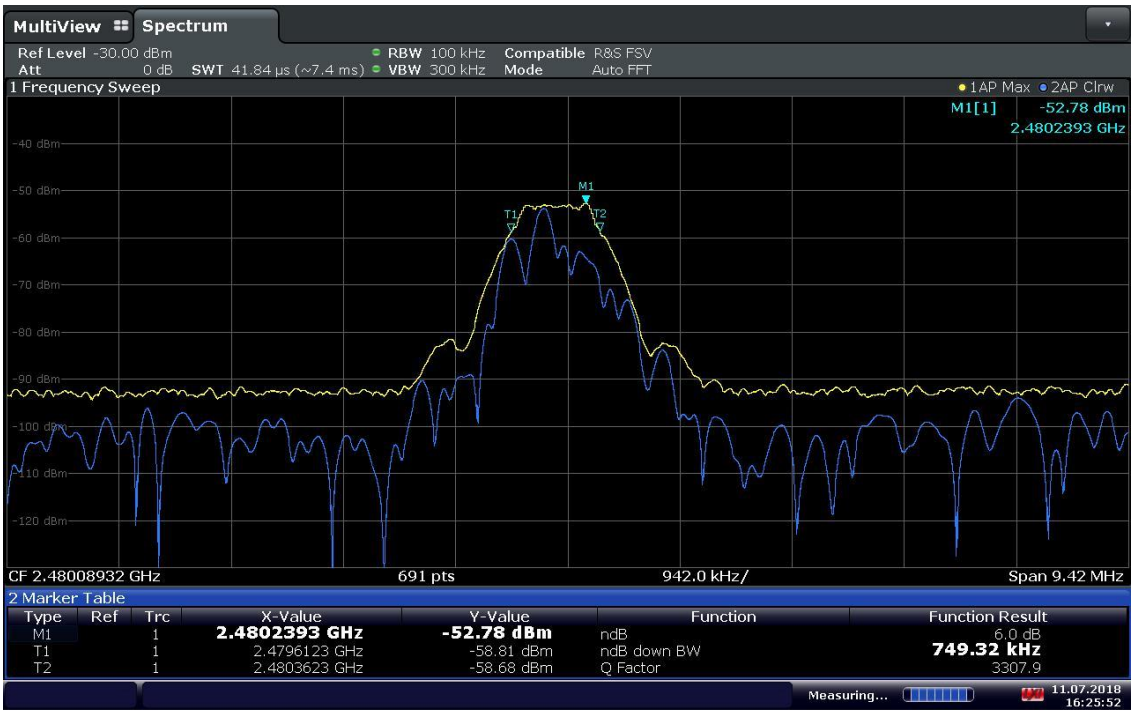
2.4.7 Additional Observations

- This is a radiated 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.
- 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	Low (2442 MHz)	0.755	0.500	Complies
	Mid (2461 MHz)	0.695	0.500	Complies
	High (2480 MHz)	0.749	0.500	Complies

2.4.9 Sample Test Plot



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Bluetooth LE High Channel

2.5 OUT-OF-BAND EMISSIONS - RADIATED

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: N/A / Default Test Configuration

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

June 25, 2018/JR

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 performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.2 °C
Relative Humidity	40.9 %
ATM Pressure	99.5 kPa

2.5.7 Additional Observations

- This is a radiated test.
- Data presented is per§15.209(a) and §15.205(c). Test results are considered worst case compared to the 20dBc limit.
- It was verified however that all emissions measured complies with the 20dBc limit.
- 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 2.5.8 for sample computation.

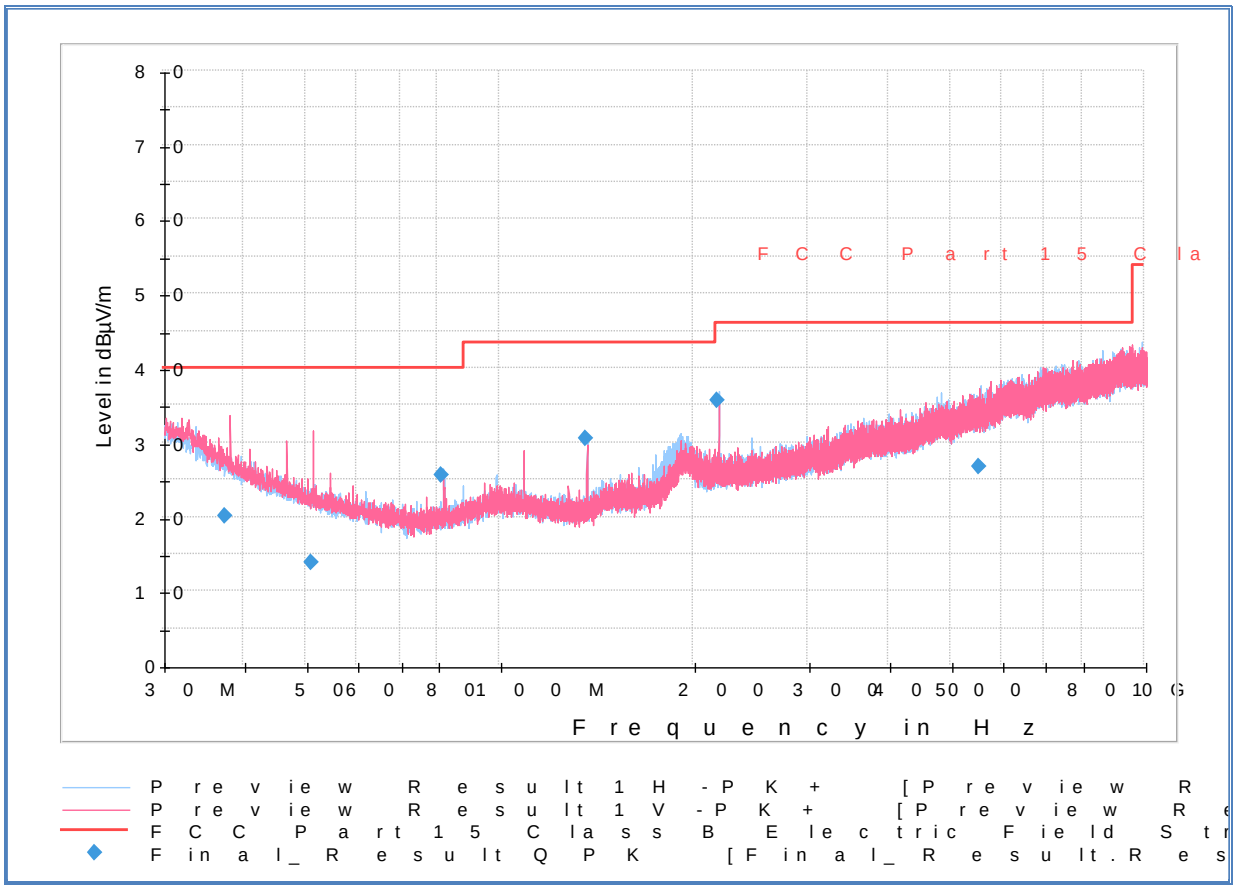
2.5.8 Sample Computation (Radiated Emission)

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**

2.5.9 Test Results

See attached plots.

2.5.10 Test Results Below 1GHz (Worst Case Channel – Low Channel)

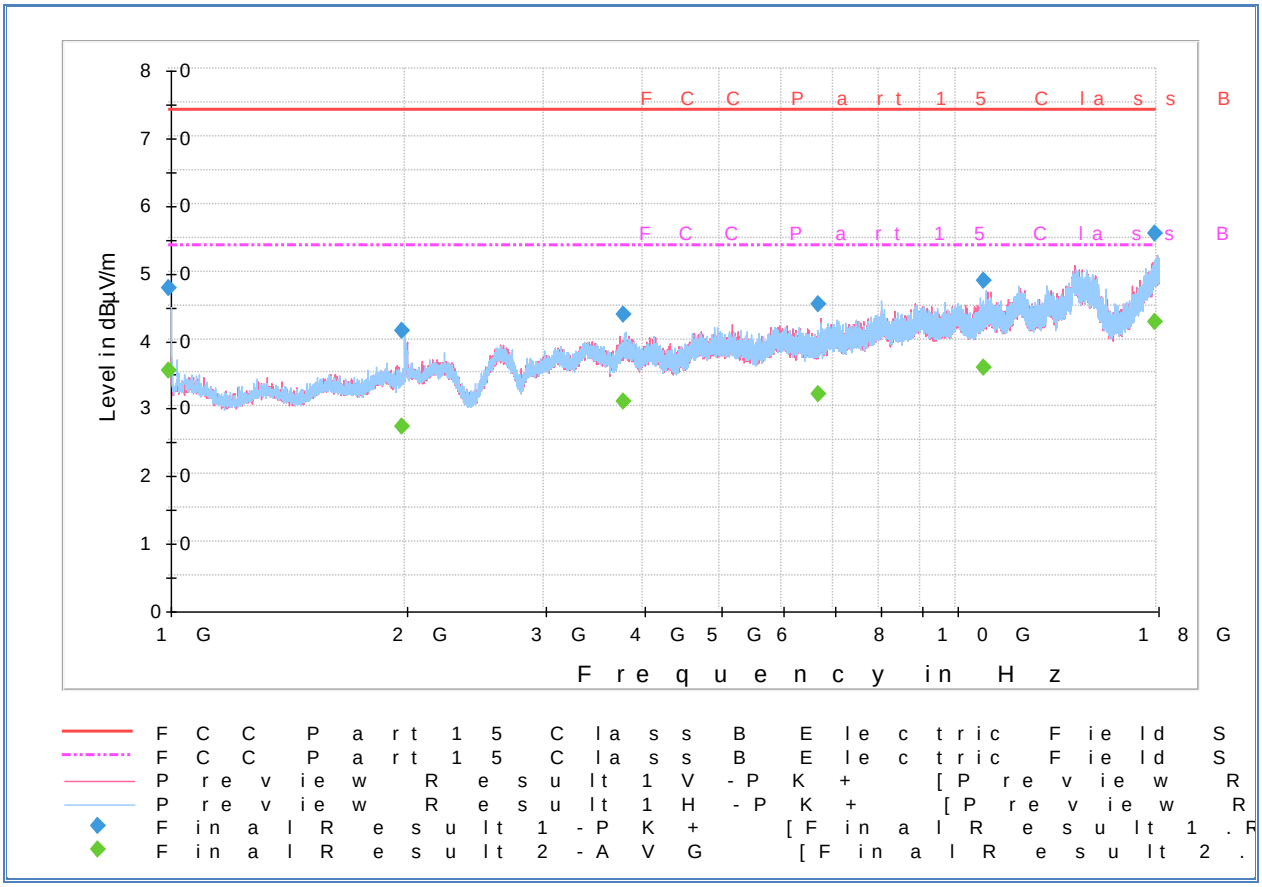


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
37.481667	20.10	1000.0	120.000	125.3	V	108.0	20.9	19.90	40.00
50.984333	13.84	1000.0	120.000	125.1	V	158.0	16.3	26.16	40.00
81.345333	25.57	1000.0	120.000	204.6	H	26.0	14.1	14.43	40.00
135.600667	30.54	1000.0	120.000	125.2	H	-10.0	15.1	12.96	43.50
216.951333	35.66	1000.0	120.000	104.0	H	133.0	19.7	10.34	46.00
553.018667	26.79	1000.0	120.000	325.1	H	-13.0	28.5	19.21	46.00

Test Notes:

2.5.11 Test Results Above 1GHz (Low Channel)



Peak Data

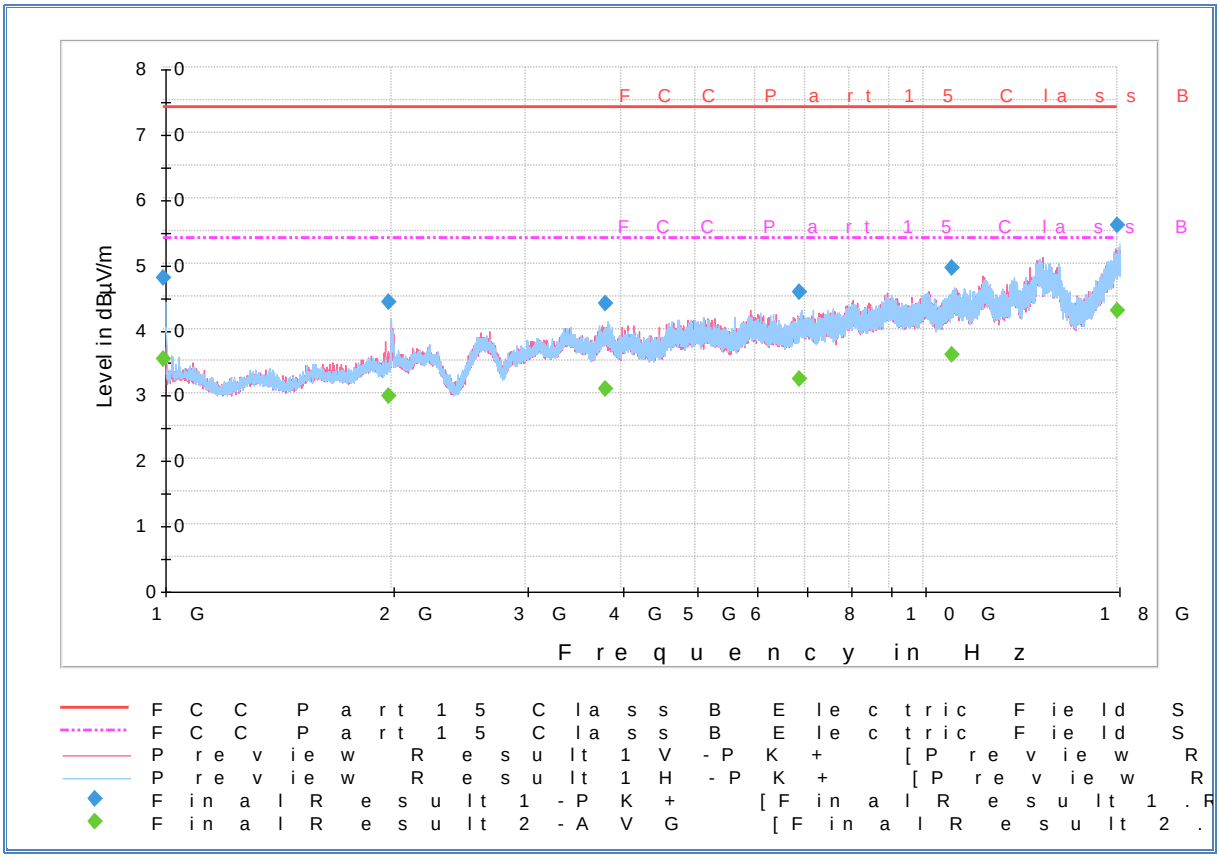
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	47.6	1000.0	1000.000	103.7	H	273.0	-10.7	26.3	73.9
1980.733333	41.2	1000.0	1000.000	151.2	H	-15.0	-6.1	32.7	73.9
3775.733333	43.5	1000.0	1000.000	352.1	H	127.0	1.0	30.4	73.9
6702.900000	45.1	1000.0	1000.000	352.0	V	269.0	5.4	28.8	73.9
10834.866667	48.6	1000.0	1000.000	352.1	H	132.0	11.7	25.3	73.9
17890.033333	55.5	1000.0	1000.000	103.7	V	6.0	21.2	18.4	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	35.3	1000.0	1000.000	103.7	H	273.0	-10.7	18.6	53.9
1980.733333	27.1	1000.0	1000.000	151.2	H	-15.0	-6.1	26.8	53.9
3775.733333	30.7	1000.0	1000.000	352.1	H	127.0	1.0	23.2	53.9
6702.900000	31.8	1000.0	1000.000	352.0	V	269.0	5.4	22.1	53.9
10834.866667	35.8	1000.0	1000.000	352.1	H	132.0	11.7	18.1	53.9
17890.033333	42.4	1000.0	1000.000	103.7	V	6.0	21.2	11.5	53.9

Test Notes: No significant emissions observed above 18GHz. Measurements above 18GHz were noise floor figures.

2.5.12 Test Results Above 1GHz (Mid Channel)



Peak Data

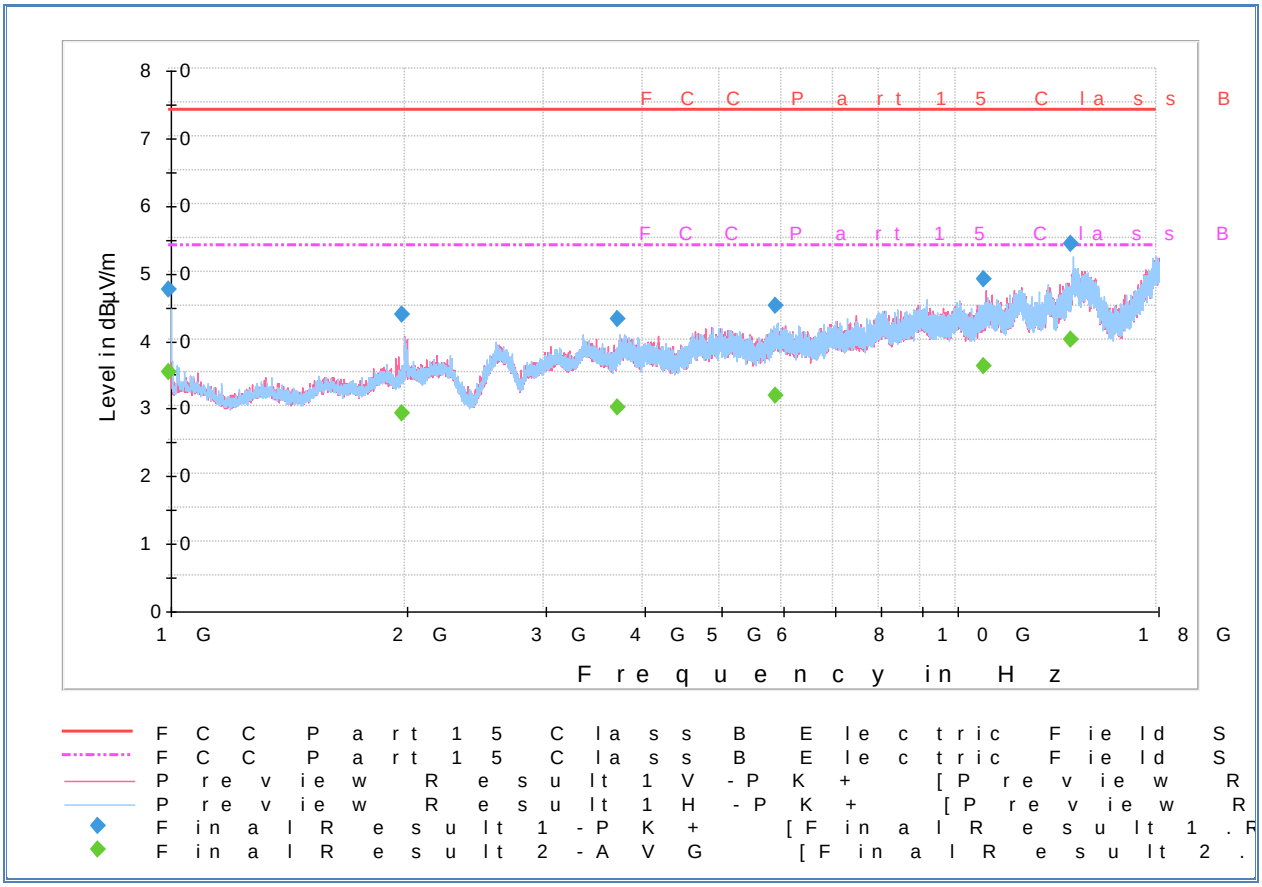
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	47.7	1000.0	1000.000	103.7	H	162.0	-10.7	26.2	73.9
1980.900000	44.0	1000.0	1000.000	339.1	H	156.0	-6.1	29.9	73.9
3815.566667	43.8	1000.0	1000.000	146.7	H	12.0	1.1	30.1	73.9
6859.000000	45.5	1000.0	1000.000	191.5	H	273.0	5.7	28.4	73.9
10893.100000	49.3	1000.0	1000.000	352.0	H	261.0	11.8	24.6	73.9
17999.500000	55.8	1000.0	1000.000	128.7	H	166.0	21.4	18.1	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	35.4	1000.0	1000.000	103.7	H	162.0	-10.7	18.5	53.9
1980.900000	29.7	1000.0	1000.000	339.1	H	156.0	-6.1	24.2	53.9
3815.566667	30.8	1000.0	1000.000	146.7	H	12.0	1.1	23.1	53.9
6859.000000	32.3	1000.0	1000.000	191.5	H	273.0	5.7	21.6	53.9
10893.100000	36.0	1000.0	1000.000	352.0	H	261.0	11.8	17.9	53.9
17999.500000	42.7	1000.0	1000.000	128.7	H	166.0	21.4	11.2	53.9

Test Notes: No significant emissions observed above 18GHz. Measurements above 18GHz were noise floor figures.

2.5.13 Test Results Above 1GHz (High Channel)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	47.3	1000.0	1000.000	103.7	H	336.0	-10.7	26.6	73.9
1981.100000	43.5	1000.0	1000.000	252.3	V	161.0	-6.1	30.4	73.9
3725.466667	42.9	1000.0	1000.000	170.6	H	267.0	0.5	31.0	73.9
5909.566667	44.8	1000.0	1000.000	367.1	H	279.0	4.3	29.1	73.9
10869.633333	48.8	1000.0	1000.000	140.6	V	175.0	11.8	25.1	73.9
14034.266667	54.1	1000.0	1000.000	170.6	H	224.0	16.8	19.8	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	35.1	1000.0	1000.000	103.7	H	336.0	-10.7	18.8	53.9
1981.100000	28.9	1000.0	1000.000	252.3	V	161.0	-6.1	25.0	53.9
3725.466667	29.9	1000.0	1000.000	170.6	H	267.0	0.5	24.0	53.9
5909.566667	31.7	1000.0	1000.000	367.1	H	279.0	4.3	22.2	53.9
10869.633333	36.1	1000.0	1000.000	140.6	V	175.0	11.8	17.8	53.9
14034.266667	40.0	1000.0	1000.000	170.6	H	224.0	16.8	13.9	53.9

Test Notes: No significant emissions observed above 18GHz. Measurements above 18GHz were noise floor figures.

2.6 BAND-EDGE COMPLIANCE AND IMMEDIATE RESTRICTED BAND

2.6.1 Specification Reference

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

2.6.2 Standard Applicable

See previous test.

2.6.3 Equipment Under Test and Modification State

Serial No: N/A / Default Test Configuration

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

June 27, 2018/JR

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 performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.2 °C
Relative Humidity	40.9 %
ATM Pressure	99.5 kPa

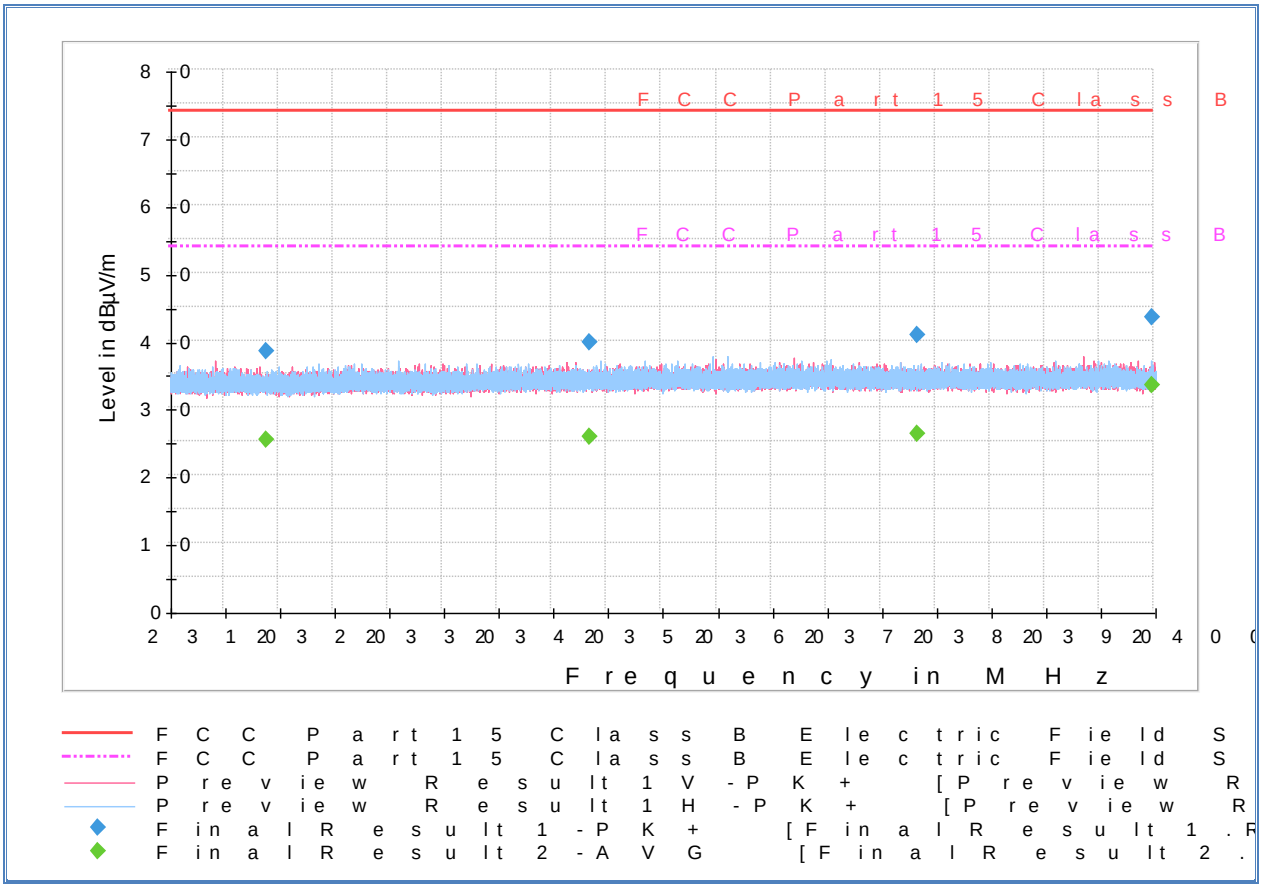
2.6.7 Additional Observations

- This is a radiated test.
- Verification performed to show compliance with immediate restricted band adjacent to 2.4GHz band.
- Lower and Upper band edges were also verified in this test since spurious emissions verification performed under Section 2.5 of this test report were done using a 2.4GHz notch filter.
- All measurement performed using Peak and Average detector at 100% duty cycle.
- Lower band edge, even not in restricted band was verified using §15.205(c) test methodology.

2.6.8 Test Results

Complies. See attached plots.

2.6.9 Test Results (Lower Immediate Restricted Band (2310MHz to 2390MHz) + Band Edge)



Peak Data

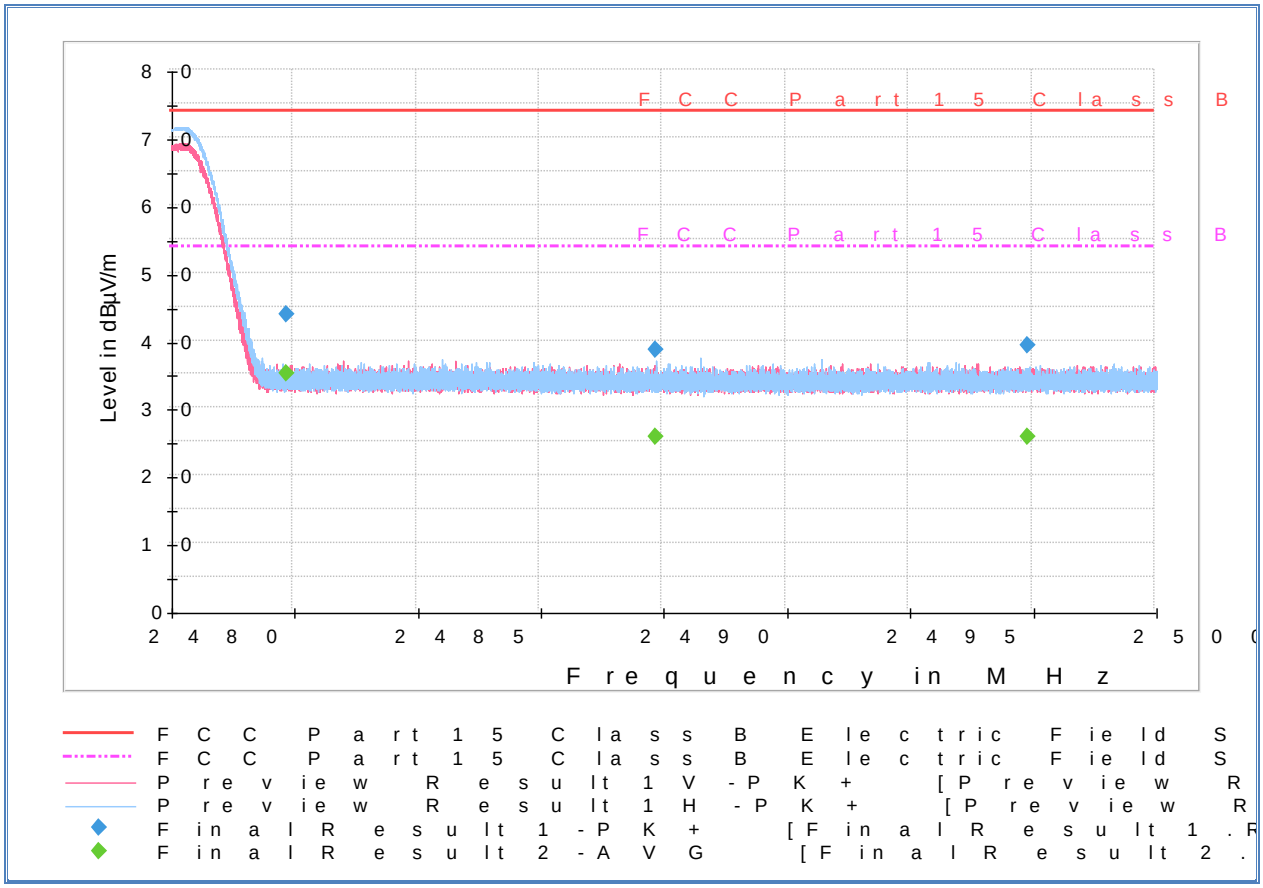
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2318.909000	38.4	1000.0	1000.000	154.2	V	50.0	-5.4	35.5	73.9
2348.449000	39.6	1000.0	1000.000	174.6	V	237.0	-5.1	34.3	73.9
2378.478000	40.8	1000.0	1000.000	367.1	H	129.0	-4.9	33.1	73.9
2399.800000	43.4	1000.0	1000.000	154.2	V	311.0	-4.8	30.6	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2318.909000	25.3	1000.0	1000.000	154.2	V	50.0	-5.4	28.6	53.9
2348.449000	25.8	1000.0	1000.000	174.6	V	237.0	-5.1	28.1	53.9
2378.478000	26.1	1000.0	1000.000	367.1	H	129.0	-4.9	27.8	53.9
2399.800000	33.4	1000.0	1000.000	154.2	V	311.0	-4.8	20.5	53.9

Test Notes: Lower band edge measurement performed using §15.205(c) requirement.

2.6.10 Test Results (Upper Immediate Restricted Band (2483.5MHz to 2500MHz) + Band Edge)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2482.355333	43.9	1000.0	1000.000	143.7	V	302.0	-4.7	30.0	73.9
2489.873333	38.5	1000.0	1000.000	151.6	H	153.0	-4.7	35.4	73.9
2497.411333	39.3	1000.0	1000.000	239.4	V	138.0	-4.6	34.6	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)
2482.355333	35.1	1000.0	1000.000	143.7	V	302.0	-4.7	18.8	53.9
2489.873333	25.7	1000.0	1000.000	151.6	H	153.0	-4.7	28.2	53.9
2497.411333	25.7	1000.0	1000.000	239.4	V	138.0	-4.6	28.2	53.9

Test Notes: Upper band edge complies with §15.205(c) requirement.

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: N/A / Default Test Configuration

Not performed. The EUT is deemed to comply with this requirement (Clause 12.2.7 of KDB558074 D01 DTS Meas Guidance v03r04) by virtue of Section 2.5 test results.

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: N/A

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

Not Tested . See Section 2.1 for details

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
Radiated Emission						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	11/20/18	11/06/19
1051	Horn Antenna	3115	9408-4329	EMCO	07/17/17	0717/18
1003	Signal Generator	SMR40	100443	Rhode & Schwarz	06/08/18	06/08/19
6628	Loop Antenna	HFH2-Z2335.4711.52	121086	TUV	05/02/18	05/02/19
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	10/07/16	10/07/17
8628	Pre-amplifier	QLJ-01182835-JO	187	Quinstar	03/06/18	02/06/19
1051	Double-ridged waveguide horn antenna	3115	9408-4329	EMCO	03/21/16	03/21/17
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/17/16	03/17/17
1193	Pre-amplifier	PAM-0202	185	A.H.Systems.	04/11/18	04/11/19
7582	Signal/Spectrum Analyzer	FSW26	102853	Rhode & Schwarz	12/14/17	12/14/18
7620	Signal/Spectrum Analyzer	FSW26	103026	Rhode & Schwarz	10/17/17	10/17/18
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	Verified by 1003 and 7582	
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	Verified by 1003 and 7582	
Miscellaneous						
7579	Temperature Chamber	115	151617	TestQuity	08/25/16	08/25/17
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/29/16	08/29/17
8816	Notch filter	BRM50702	008	Micro-Tronics	Verified by 1003 and 7582	
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 Radiated Measurements (Below 1GHz)

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

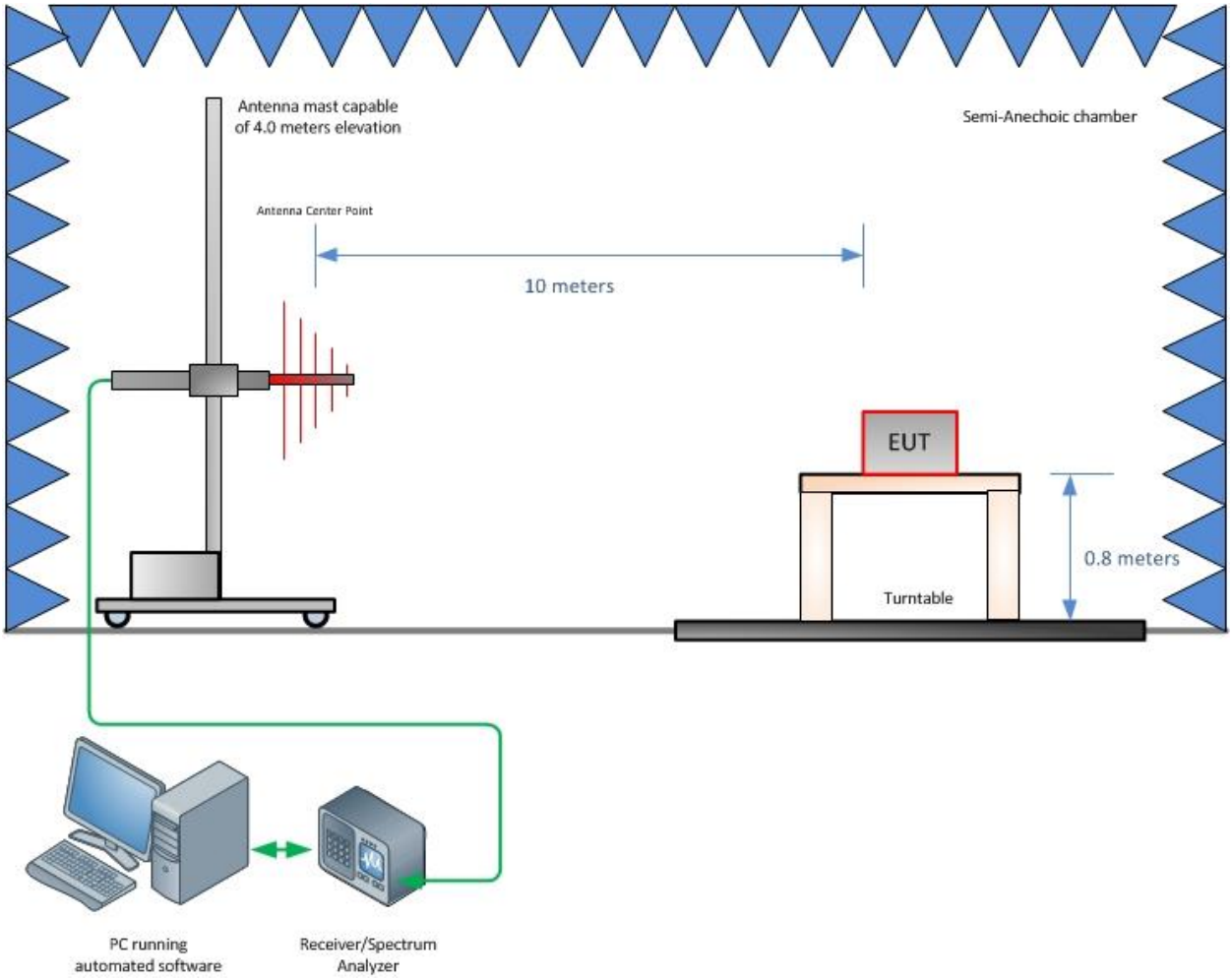
3.2.2 Radiated Emission Measurements (Above 1GHz)

	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	2.70	1.56	2.43
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	1.78
				Coverage Factor (k):	2
				Expanded Uncertainty:	3.56

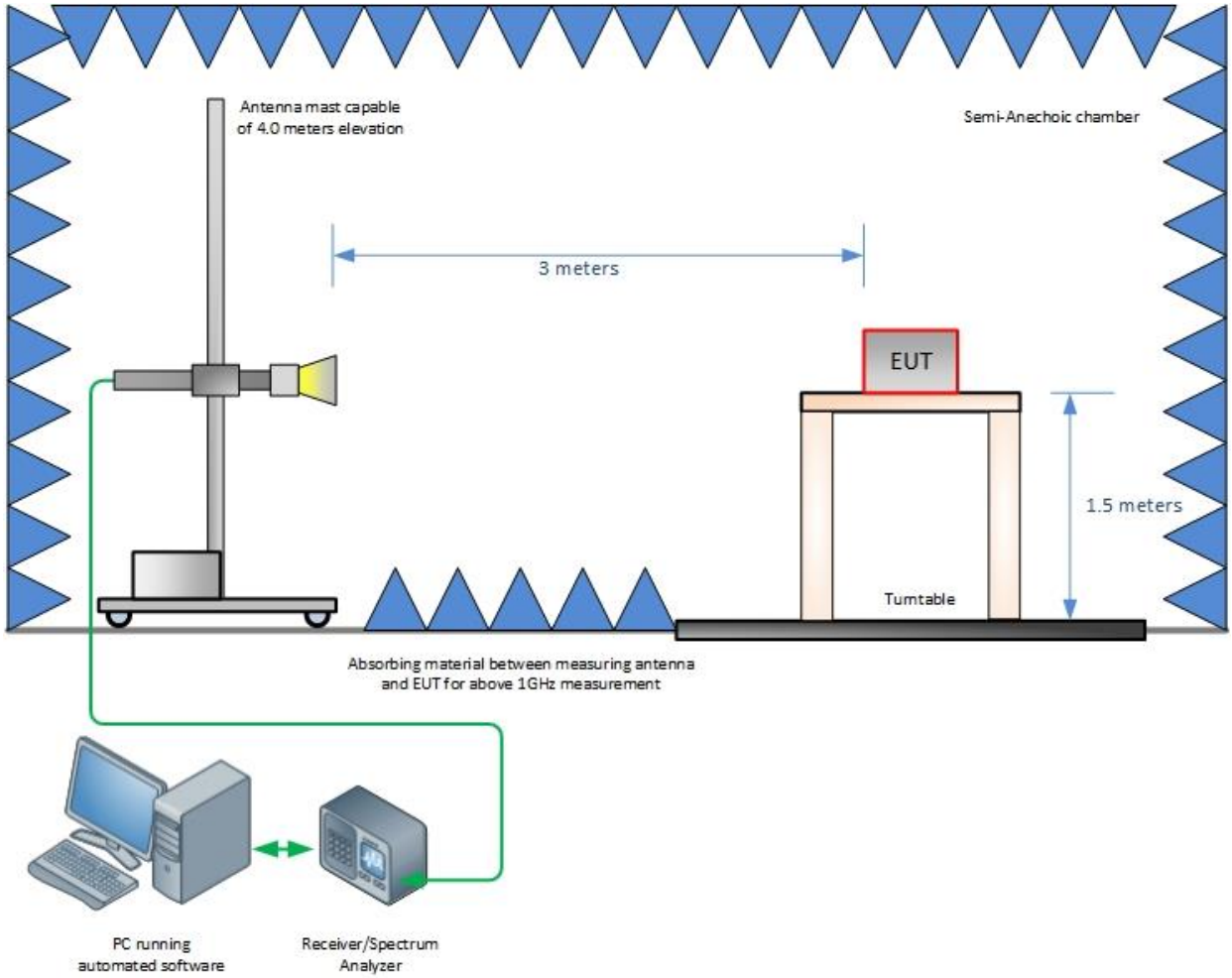
SECTION 4

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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