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Report On

Application for Grant of Equipment Authorization of the
XY - The Findables Company
XYGPS Tracking Device

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

Report No. SD72124811-0217

May 2017




REPORT ON Radio Testing of the
XY - The Findables Company
Tracking Device

TEST REPORT NUMBER SD72124811-0217

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DATED May 03, 2017



Revision History

SD72124811-0217 XY - The Findables Company XYGPS Tracking Device					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
05/03/2017	Initial Release				Juan M. Gonzalez



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SECTION 1

REPORT SUMMARY

Radio Testing of the
XY - The Findables Company
XYGPS Tracking Device



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the XY - The Findables Company, model XYGPS Tracking Device 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	XY - The Findables Company
Model Number(s)	XYGPS
FCC ID Number	2ADLNXYGPS-01
IC Number	12506A-XYGPS01
Serial Number(s)	N/A
Number of Samples Tested	1
Test Specification/Issue/Date	<ul style="list-style-type: none">• 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 Issue 4 November 2014 – General Requirements for Compliance of Radio Apparatus.• 558074 D01 DTS Meas Guidance v03r05 (April 08, 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	March 06, 2017
Finish of Test	March 09, 2017
Name of Engineer(s)	Alex Chang
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(b)	Power Spectral Density for Digitally Modulated Device	Compliant	

N/A *Not applicable. EUT is a battery operated device.*



1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was an XY - The Findables Company XYGPS Tracking Device. The EUT uses the BLE to communicate with the phone and laptop to setup the unit for the customer application. The application is some form of location of the unit. There is two ways of locating the unit. If the unit is inside it uses a beacon from BLE to find the location. If the unit is outside, it uses the GPS to find the location. The location is then transmitted via the GSM. The BLE functionality is verified and evaluated only in this test report.



1.3.2 EUT General Description

EUT Description	Tracking Device
Model Name	XYGPS
Model Number(s)	XYGPS
Rated Voltage	2.0 – 3.6VDC (Lithium Ion Battery)
Mode Verified	Bluetooth Low Energy (BT LE)
Capability	GPS, GSM (850 MHz and 1900 MHz bands) and Bluetooth
Mode Verified	Bluetooth
Primary Unit (EUT)	<input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering
Antenna Type	Meandering
Antenna Manufacturer	SMK
Antenna Model Number	PCB Board Rev. D
Antenna Gain	-1 dBi

1.3.3 Maximum Peak Conducted Output Power

Mode	Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
Bluetooth LE	2402 – 2480	-3.45	0.45

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	EUT connected to a support laptop via a mini USB cable for programming in transmit mode. Tools and software were provided by the manufacturer and was used to configure RF parameter of the EUT. The power setting to the EUT was set as “5” during final evaluation.

1.4.2 EUT Exercise Software

None. No special software used to exercise the EUT. A software “uEnergy Test” version 2.2.1 was used to program the EUT in transmit mode with a power setting “5” during final evaluation.

1.4.3 Support Equipment and I/O cables

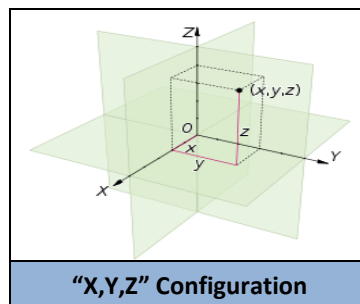
Manufacturer	Equipment/Cable	Description
Sony	Support Laptop	Support laptop used to configure EUT RF parameter setting
—	mini USB interface board	Interface communication board between EUT and support laptop

1.4.4 Worst Case Configuration

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

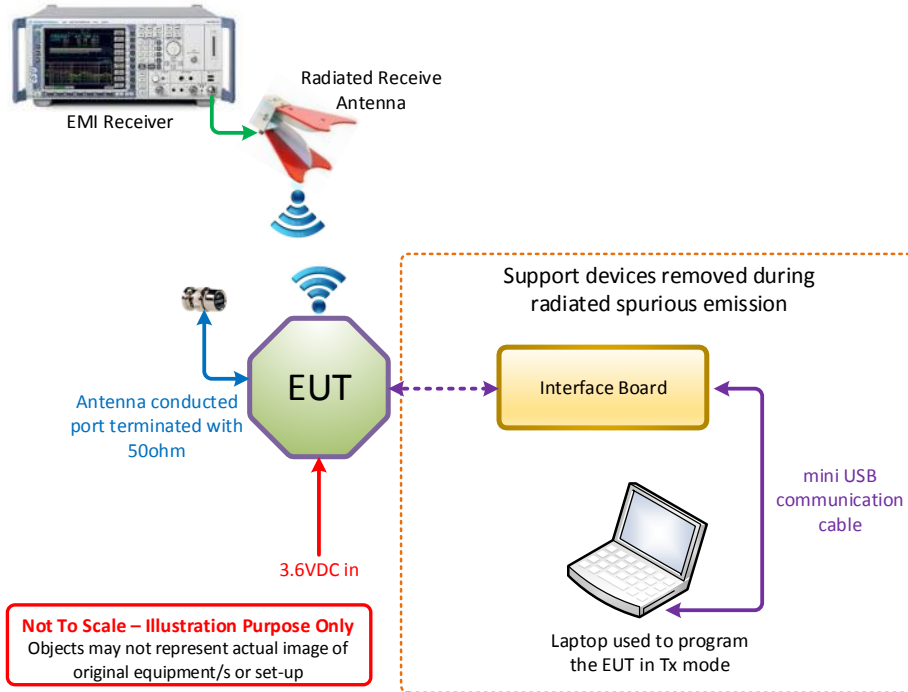
Mode	Channel	Data Rate
Bluetooth LE	2440 MHz (Mid Channel)	1Mbps

For radiated measurements X, Y and Z orientations were verified. Worst case position is “X”.

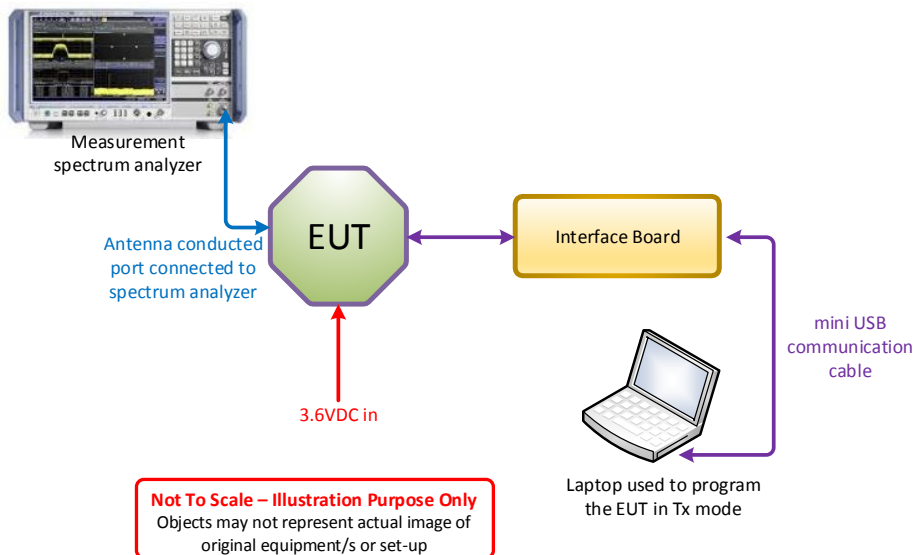


1.4.5 Simplified Test Configuration Diagram

Radiated Spurious Emission Measurement Setup



Temporary Antenna Port Measurement Setup





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		
None	—	—

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 (ISED) Registration No.: 3067A

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



SECTION 2

TEST DETAILS

Radio Testing of the
XY - The Findables Company
Tracking Device



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: N/A / Default Test Configuration

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

March 06, 2017 / AC

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	23.5 °C
Relative Humidity	34.5 %
ATM Pressure	997 kPa

2.1.7 Additional Observations

- This is a conducted test (Maximum peak conducted output power) using direct connection to a power meter.
- An offset of 21.3dB was added to compensate for the external attenuator and cable used from the antenna port to the power sensor.
- Test methodology is per Clause 9.1.2 of KDB 558074 D01 DTS Meas Guidance v03r05 (April 08, 2016) 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)
	2402 MHz	GFSK	-4.66	1.36
	2440 MHz		-3.45	1.52
	2480 MHz		-6.64	0.57

2.1.9 Test Plots

The screenshot displays the Agilent Power Panel software interface. The main display area shows two measurement views:

- Measurement 1:** Channel A, Avg, 2402MHz. Min: -19.26, Max: -4.66. Result: **-5.13 dBm**.
- Measurement 2:** Channel A, Peak, 2402MHz. Min: -2.55, Max: 1.36. Result: **-1.94 dBm**.

The right-hand side of the interface shows the Instrument Properties for N1912A - SG45100273, including Base Settings (Channel A, 2402 G, AUTO mode) and Measurement 1 Settings (dBm unit, 0.000 offsets).

Low Channel BT LE



The screenshot displays the Agilent Power Panel software interface. The main area is divided into two measurement displays. The top display, labeled 'Measurement 1', shows an average power of -4.01 dBm at 2440 MHz. The bottom display, labeled 'Measurement 2', shows a peak power of 1.07 dBm at 2440 MHz. Both displays indicate an offset (OFS) of 21.300 dB. The interface includes an Instrument Navigator on the left, a Log window at the bottom left, and an Instrument Properties panel on the right. The Instrument Properties panel shows settings for Channel A, including sensor model number, frequency, and measurement settings.

Measurement	Instrument	Channel	Mode	Frequency	Power
1	N1912A (SG45100273)	Channel A	Avg	2440MHz	-4.01 dBm
2	N1912A (SG45100273)	Channel A	Peak	2440MHz	1.07 dBm

Mid Channel BT LE



The screenshot displays the Agilent Power Panel software interface. The main display area is divided into two measurement panels. The top panel shows Measurement 1 with an average power of -6.74 dBm at 2480 MHz. The bottom panel shows Measurement 2 with a peak power of 0.29 dBm at 2480 MHz. The right-hand side contains the Instrument Properties panel, which includes Base Settings (Channel A, Sensor model No. N1921A, Frequency 2.480 G, Msr Avg Mode AUTO, Msr Avg Count 512) and Measurement 1 Settings (Msr Unit dBm, Offsets 0.000, Relative Rel 0.00 dBm). The bottom status bar indicates 'Ready'.

Measurement	Instrument	Channel	Mode	Frequency	Power
1	N1912A (SG45100273)	Channel A	Avg	2480MHz	-6.74 dBm
2	N1912A (SG45100273)	Channel A	Peak	2480MHz	0.29 dBm

High Channel BT LE



2.2 99% EMISSION BANDWIDTH

2.2.1 Specification Reference

RSS-Gen Clause 6.6

2.2.2 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.

2.2.3 Equipment Under Test and Modification State

Serial No: N/A / Default Test Configuration

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

March 06, 2017 / AC

2.2.5 Test Equipment Used

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



2.2.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature 23.5 °C
Relative Humidity 34.5.%
ATM Pressure 99.7 kPa

2.2.7 Additional Observations

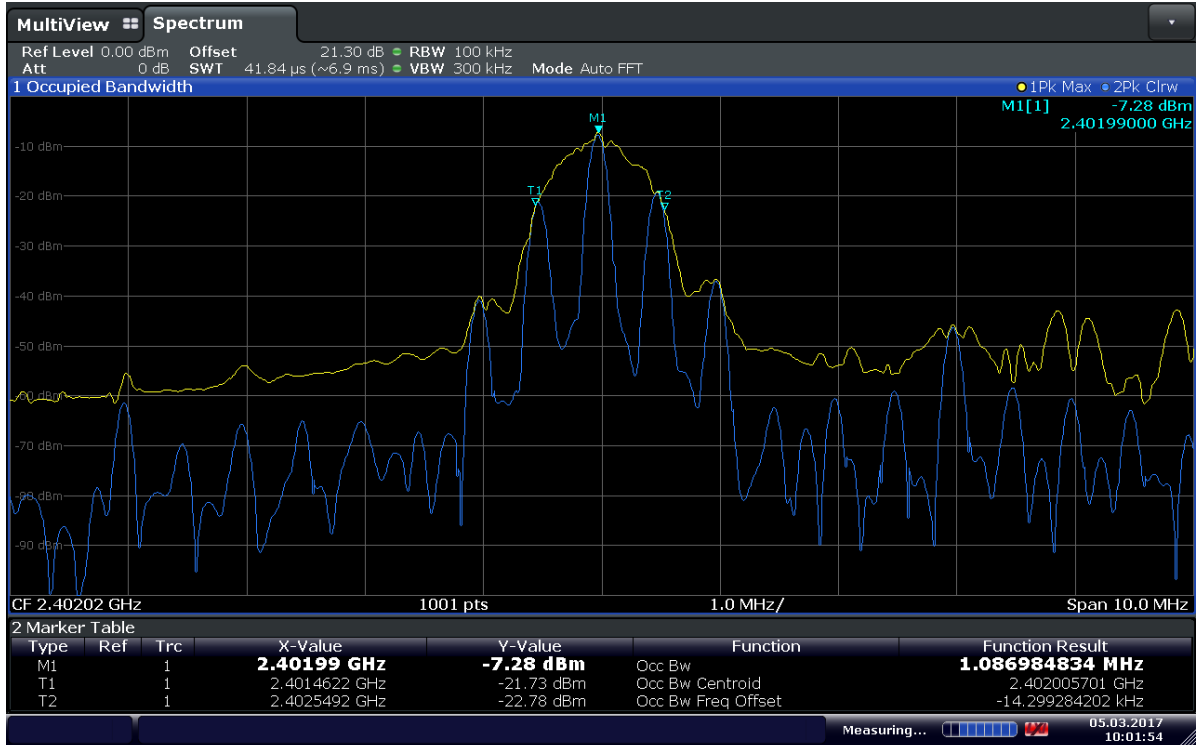
- This is a conducted test.
- An offset of 21.3dB was added to compensate for the external attenuator and cable used from the antenna port to the spectrum analyzer.
- Span is wide enough to capture the channel transmission.
- RBW is 1% of the span.
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.
- 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.

2.2.8 Test Results (For reporting purposes only)

Mode	Channel	Measured 99% Bandwidth (MHz)
Bluetooth LE	2402 MHz	1.087
	2440 MHz	1.082
	2480 MHz	1.078

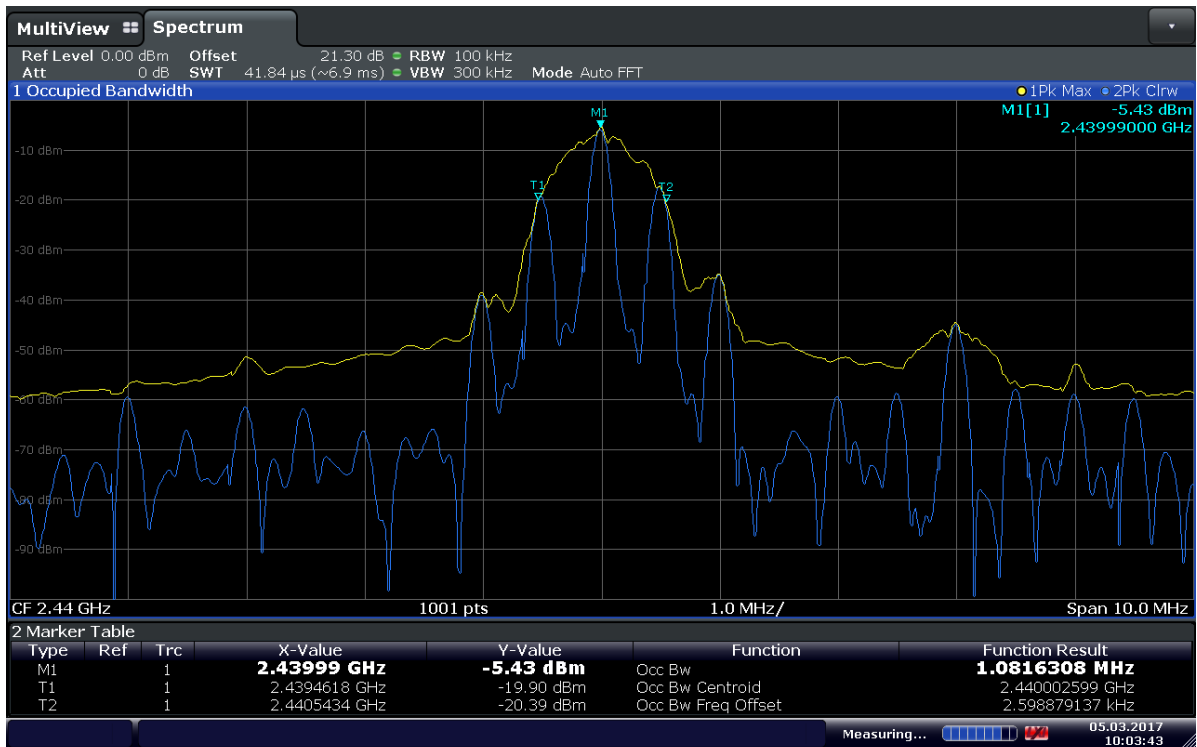


2.2.9 Test Results Plots



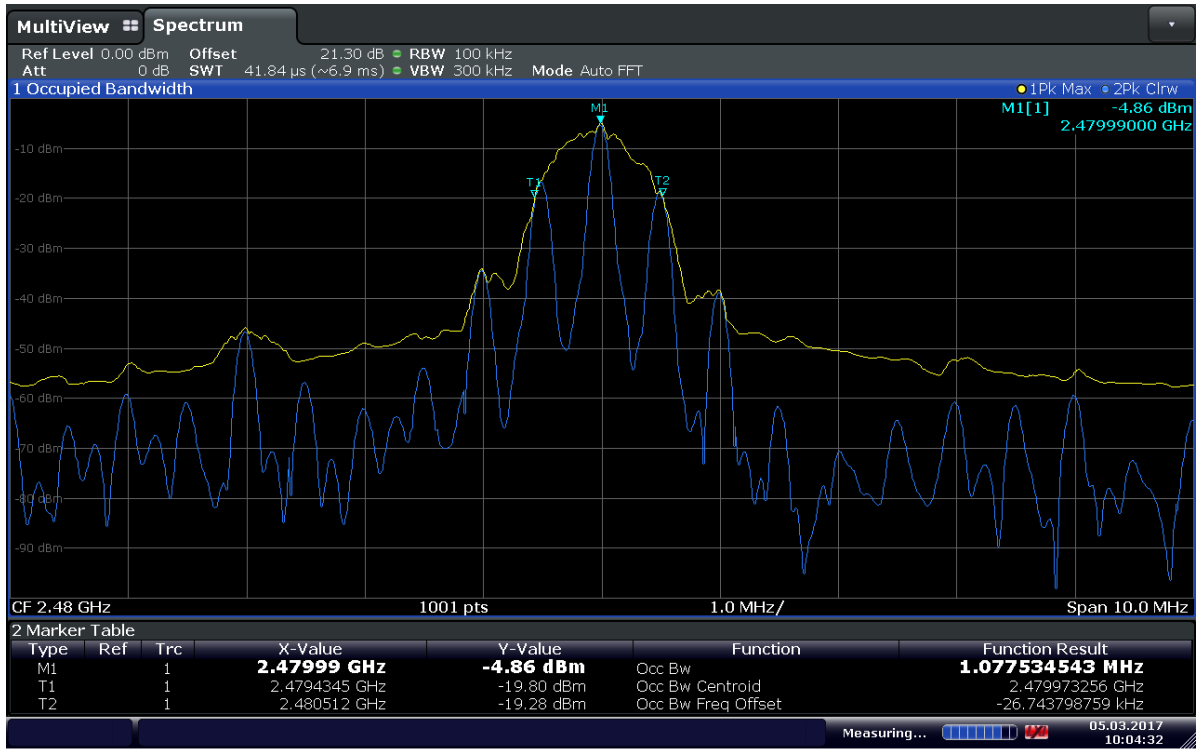
10:01:55 05.03.2017

Low Channel BT LE



10:03:43 05.03.2017

Mid Channel BT LE



10:04:32 05.03.2017

High Channel BT LE



2.3 MINIMUM 6 dB RF BANDWIDTH

2.3.1 Specification Reference

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

2.3.2 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.

2.3.3 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

March 06, 2017 / AC

2.3.5 Test Equipment Used

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

2.3.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.5 °C
Relative Humidity	34.5.%
ATM Pressure	99.7 kPa

2.3.7 Additional Observations

- This is a conducted test.
- An offset 21.3dB was added to compensate for the external attenuator and cable used from the antenna port to the spectrum analyser.
- Span is wide enough to capture the channel transmission.
- RBW was set to 100 kHz while VBW is $\geq 3X$ RBW.
- Sweep is auto while Detector used is peak.
- The “n” dB down marker function of the spectrum analyzer was used for this test.



2.3.8 Test Results

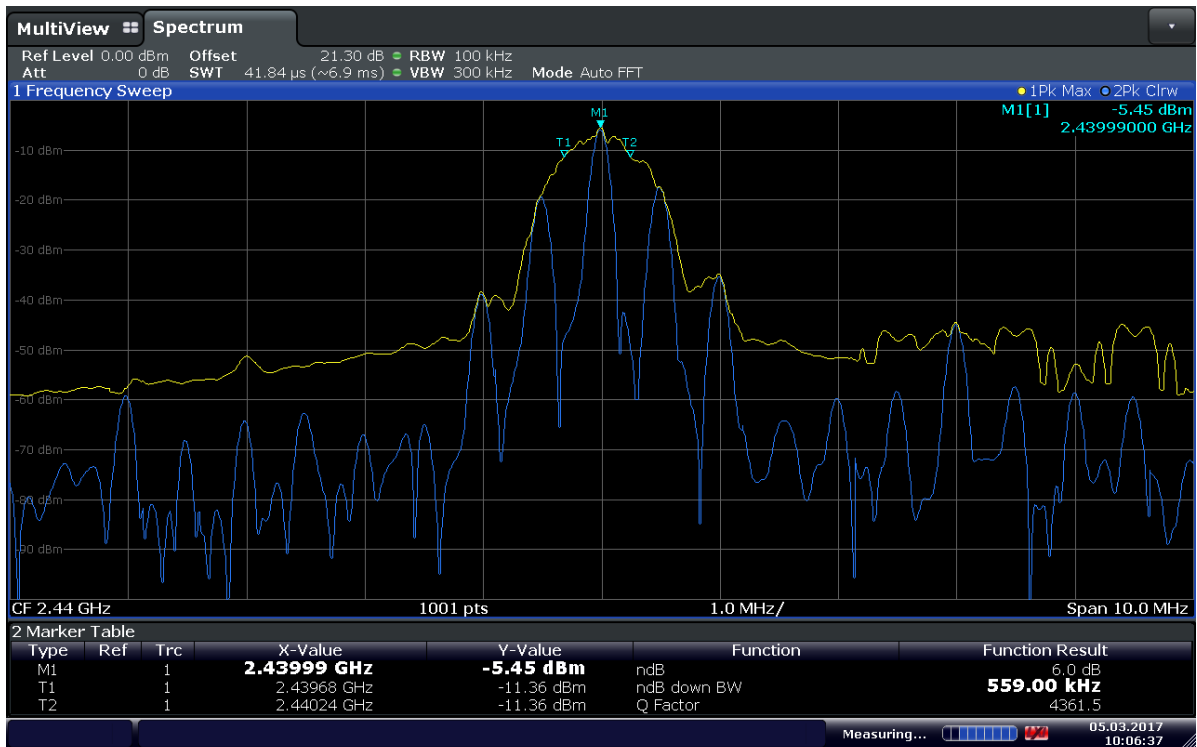
Mode	Channel	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Compliance
Bluetooth LE	2402 MHz	0.569	0.500	Complies
	2440 MHz	0.559	0.500	Complies
	2480 MHz	0.599	0.500	Complies

2.3.9 Test Results Plots



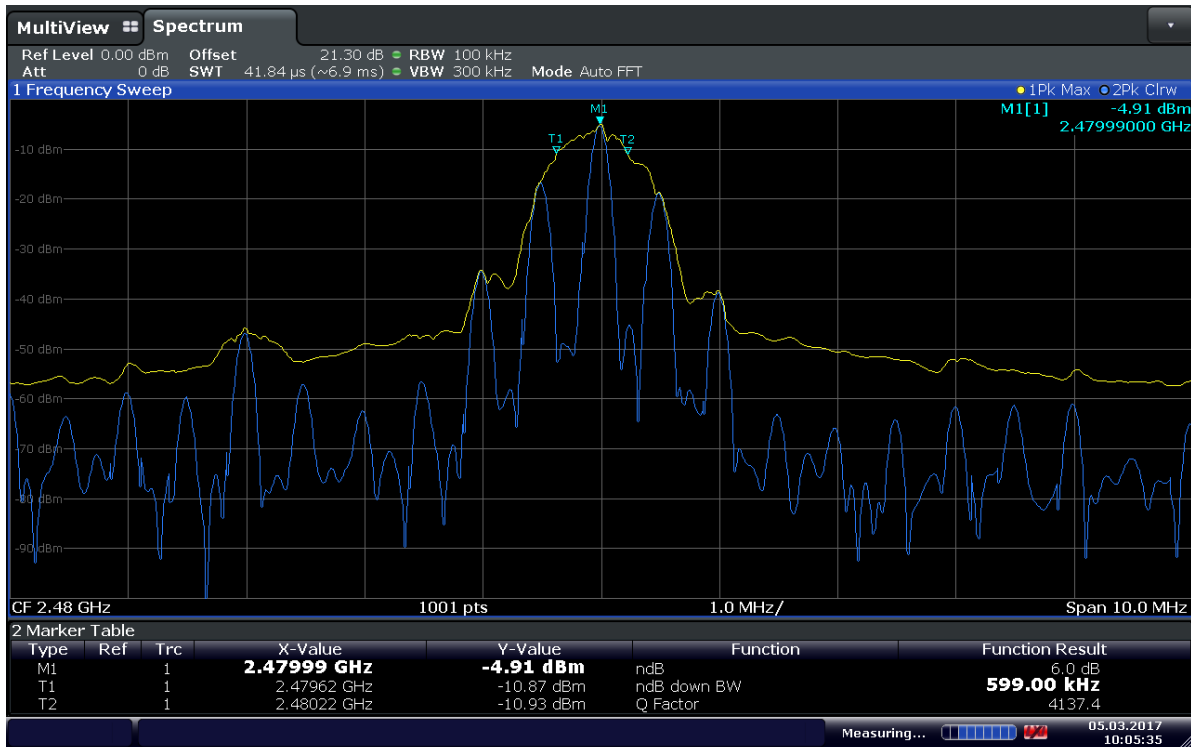
10:07:37 05.03.2017

Low Channel BT LE



10:06:37 05.03.2017

Mid Channel BT LE



10:05:35 05.03.2017

High Channel BT LE



2.4 OUT-OF-BAND EMISSIONS - CONDUCTED

2.4.1 Specification Reference

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

2.4.2 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)).

2.4.3 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

March 06, 2017 / AC

2.4.5 Test Equipment Used

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

2.4.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

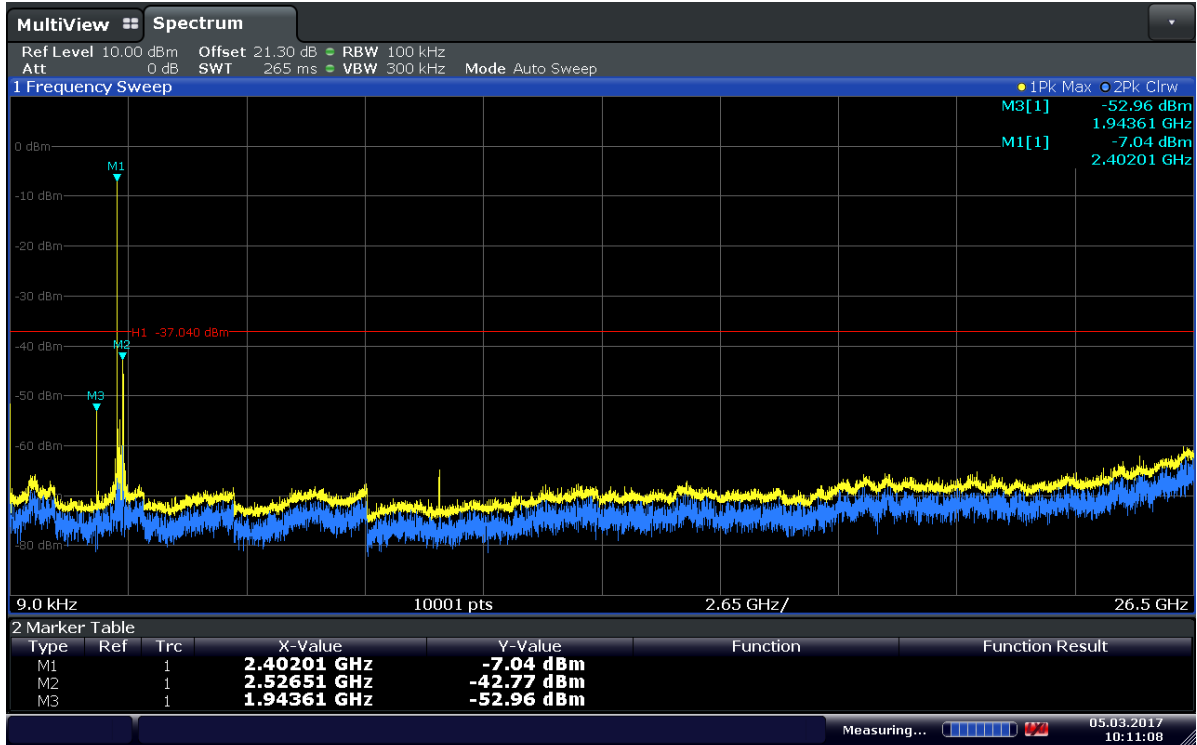
Ambient Temperature	23.5 °C
Relative Humidity	34.5.%
ATM Pressure	99.7 kPa

2.4.7 Additional Observations

- This is a conducted test.
- An offset of 21.3dB was added to compensate for the external attenuator and cable used from the antenna port to the spectrum analyzer.
- 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.

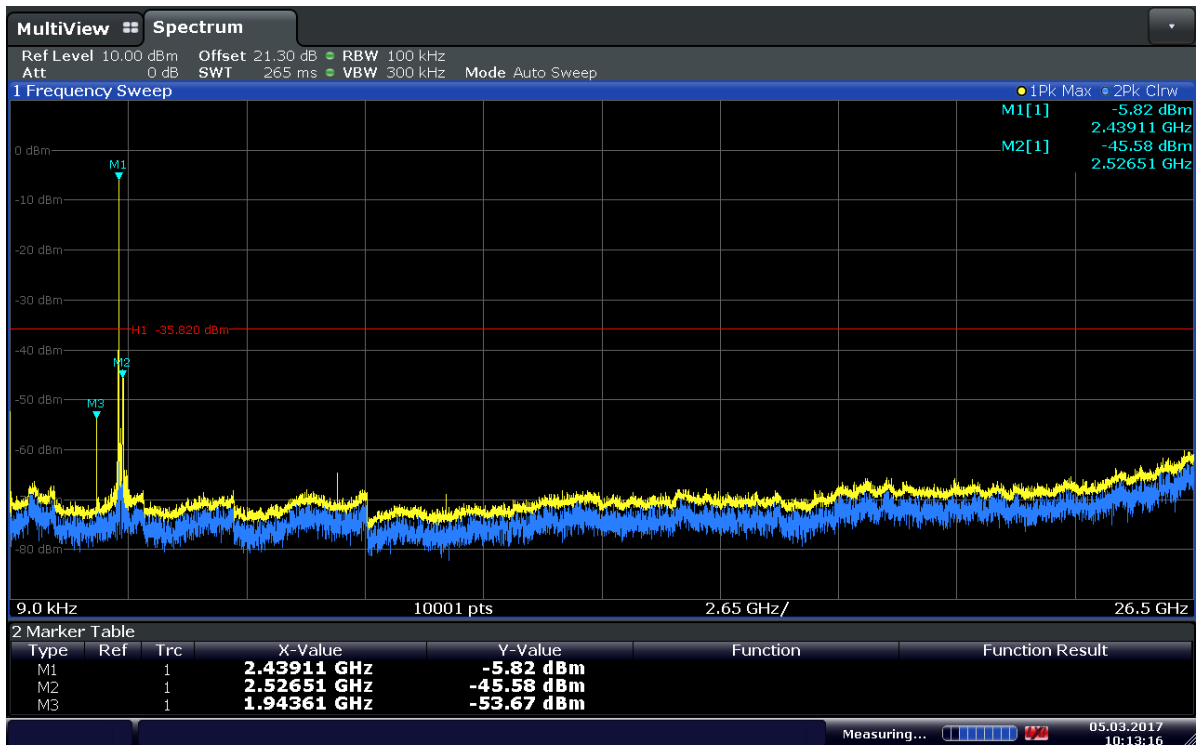


2.4.8 Test Results Plots



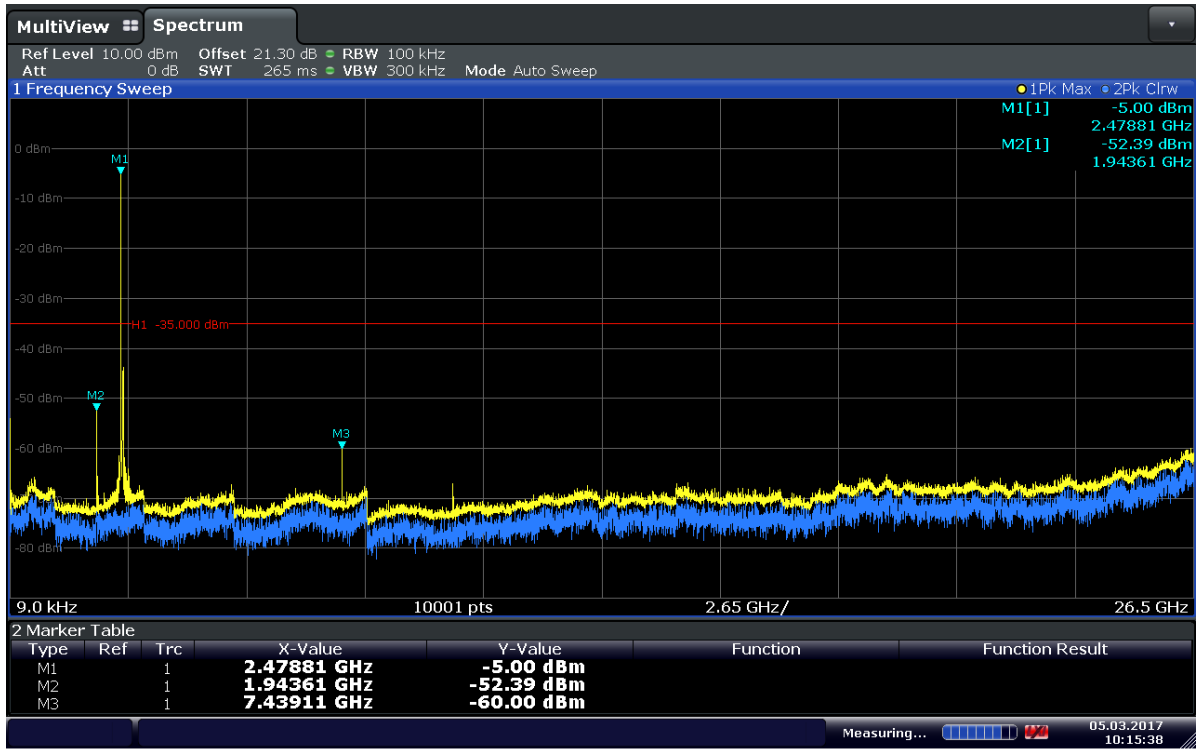
10:11:09 05.03.2017

Low Channel BT LE



10:13:16 05.03.2017

Mid Channel BT LE



10:15:38 05.03.2017

High Channel BT LE



2.5 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

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

March 06, 2017 / AC

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	23.5 °C
Relative Humidity	34.5.%
ATM Pressure	99.7 kPa

2.5.7 Additional Observations

- This is a conducted test.
- An offset of 21.3dB was added to compensate for the external attenuator and cable used from the antenna port to the spectrum analyzer
- 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.

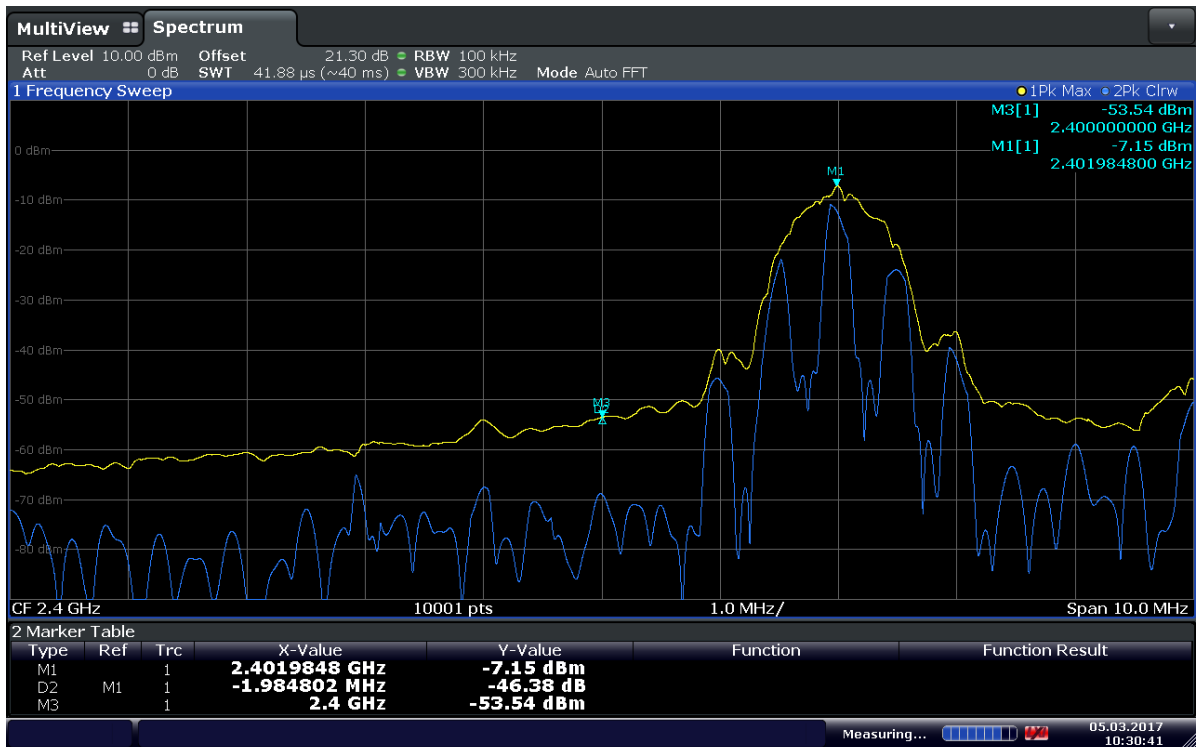


America

- 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).

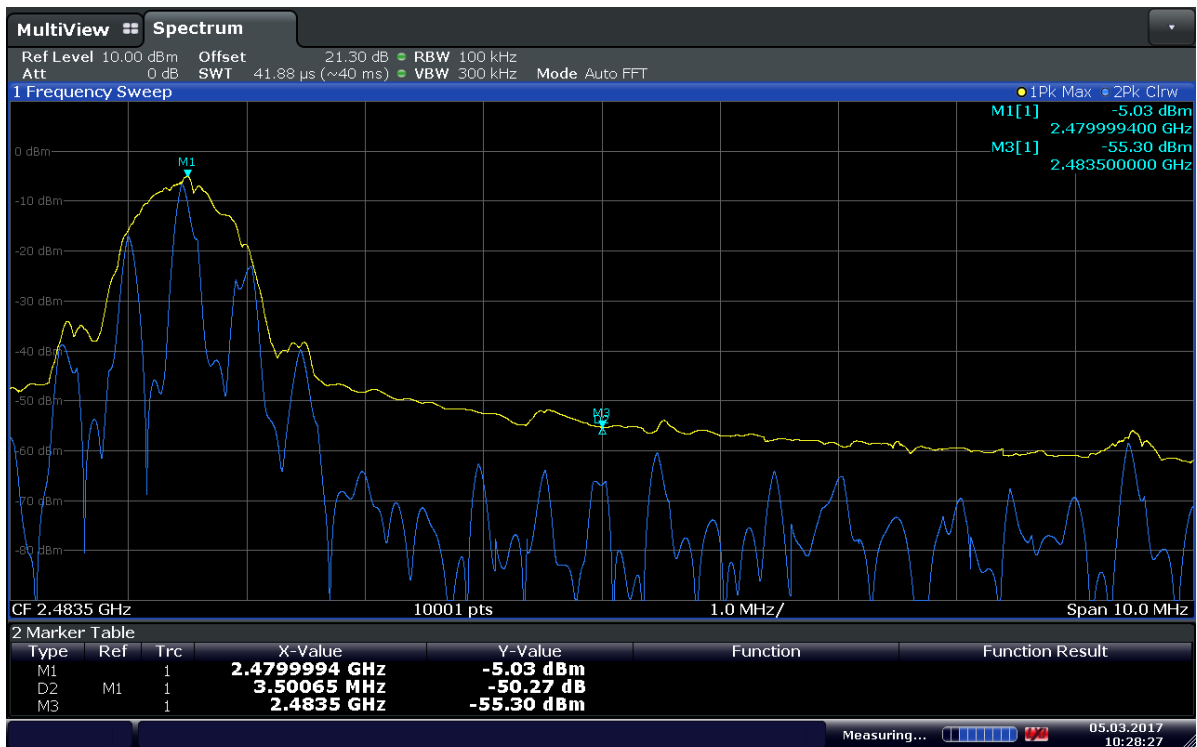
2.5.8 Test Results

Complies. See attached plots.



10:30:42 05.03.2017

Low Channel BT LE (2402 MHz)

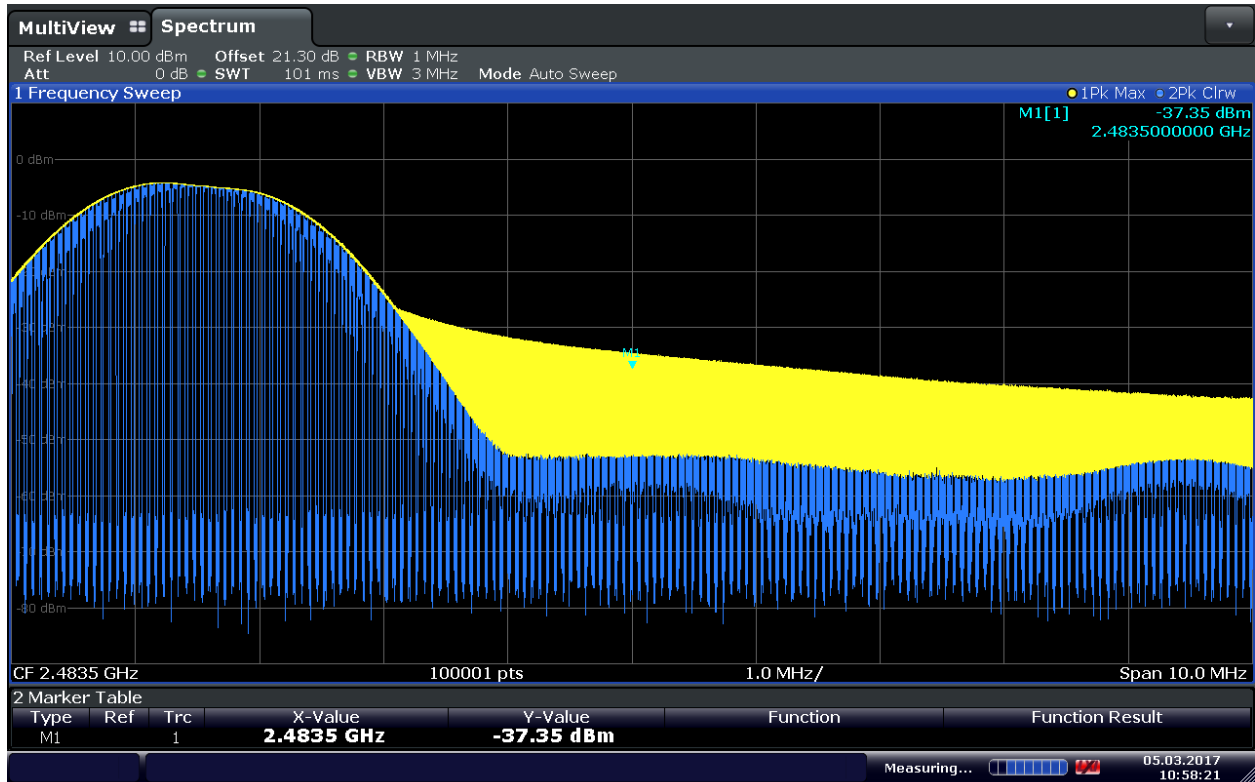


10:28:27 05.03.2017

Low Channel BT LE (2480 MHz)



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



10:58:22 05.03.2017

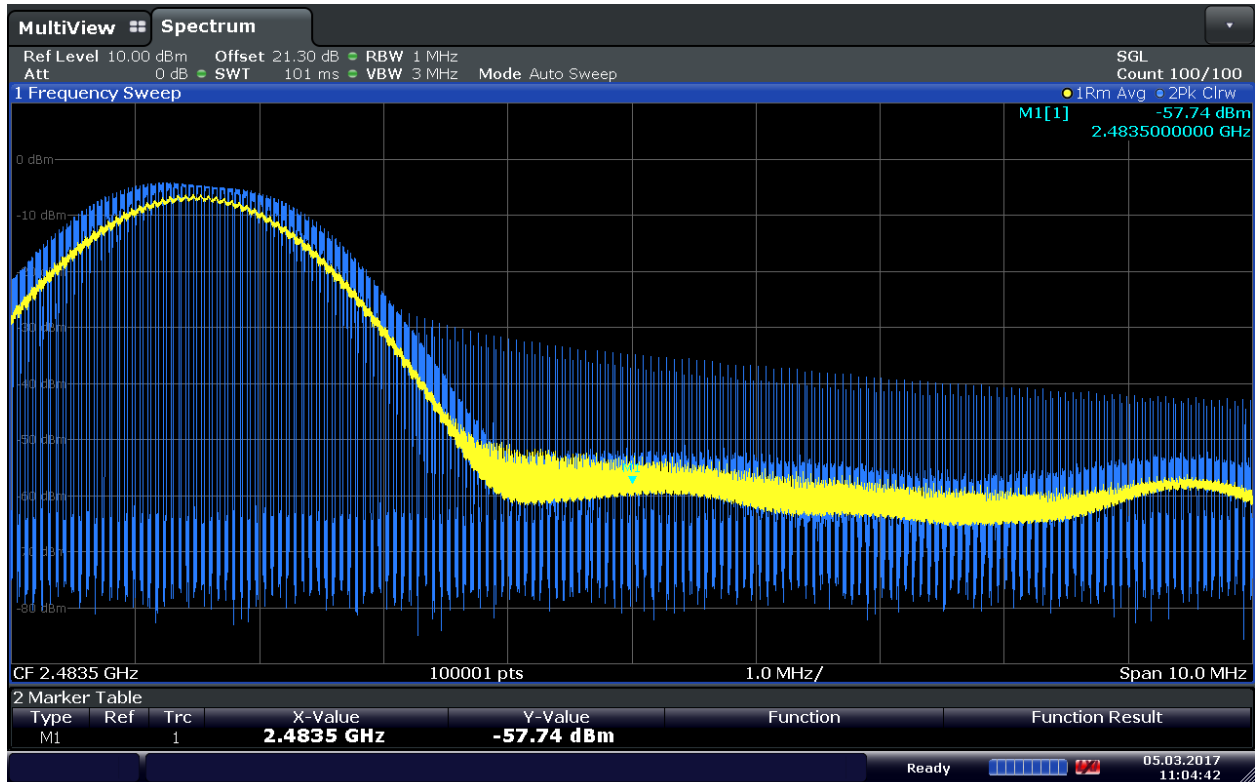
Upper Band Edge (in Restricted Band) measurement using Peak Power measurement procedure as per Clause 12.2.4 of KDB 558074

Measured Peak = -37.35 dBm, since antenna gain is 0dBi then EIRP is the same. Using the formula:

$$E = \text{EIRP} - 20\log D + 104.8$$

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

E is therefore = -37.35 dBm - (20log 3 meters) + 104.8
 = 57.91 dBμV/m @ 3 meters (Peak measurement complies with the limit of 74 dBμV/m)



11:04:42 05.03.2017

Upper Band Edge (in Restricted Band) measurement using Average Power measurement procedure as per Clause 12.2.5 of KDB 558074

Measured Peak = -57.74 dBm, since antenna gain is 0dBi then EIRP is the same. Using the formula:

$$E = \text{EIRP} - 20\log D + 104.8$$

Where:

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

E is therefore = -57.74 dBm – (20log 3 meters) + 104.8
 = 37.52 dBμV/m @ 3 meters (Peak measurement complies with the limit of 54 dBμV/m)



2.6 SPURIOUS RADIATED EMISSIONS

2.6.1 Specification Reference

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

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: N/A / Default Test Configuration

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

March 09, 2017 / AC

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	25.8 °C
Relative Humidity	33.0 %
ATM Pressure	99.3 kPa

2.6.7 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 v03r05.
- 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. Conducted port sample was presented for radiated emission test and the antenna port was terminated with 50ohm termination during evaluation for 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 2.6.8 for sample computation.

2.6.8 Sample Computation (Radiated Emission)

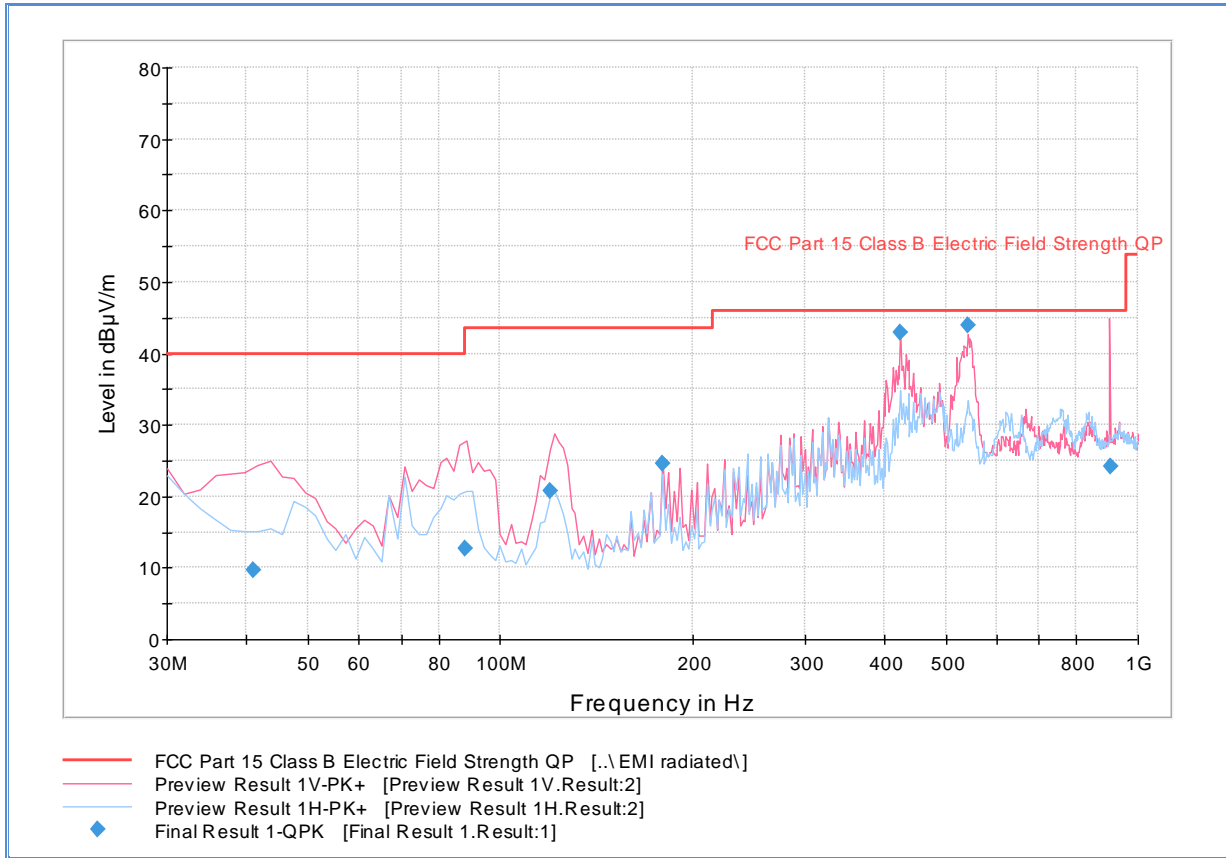
Measuring equipment raw measurement (dB μ V) @ 30 MHz		24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3
	Asset# 1172 (cable)	0.3
	Asset# 1016 (preamplifier)	-30.7
	Asset# 1175(cable)	0.3
	Asset# 1002 (antenna)	17.2
Reported Quasi Peak Final Measurement (dBμV/m) @ 30MHz		11.8

2.6.9 Test Results

See attached plots.



2.6.10 Test Results Below 1GHz (Worst Case Channel – Mid Channel)



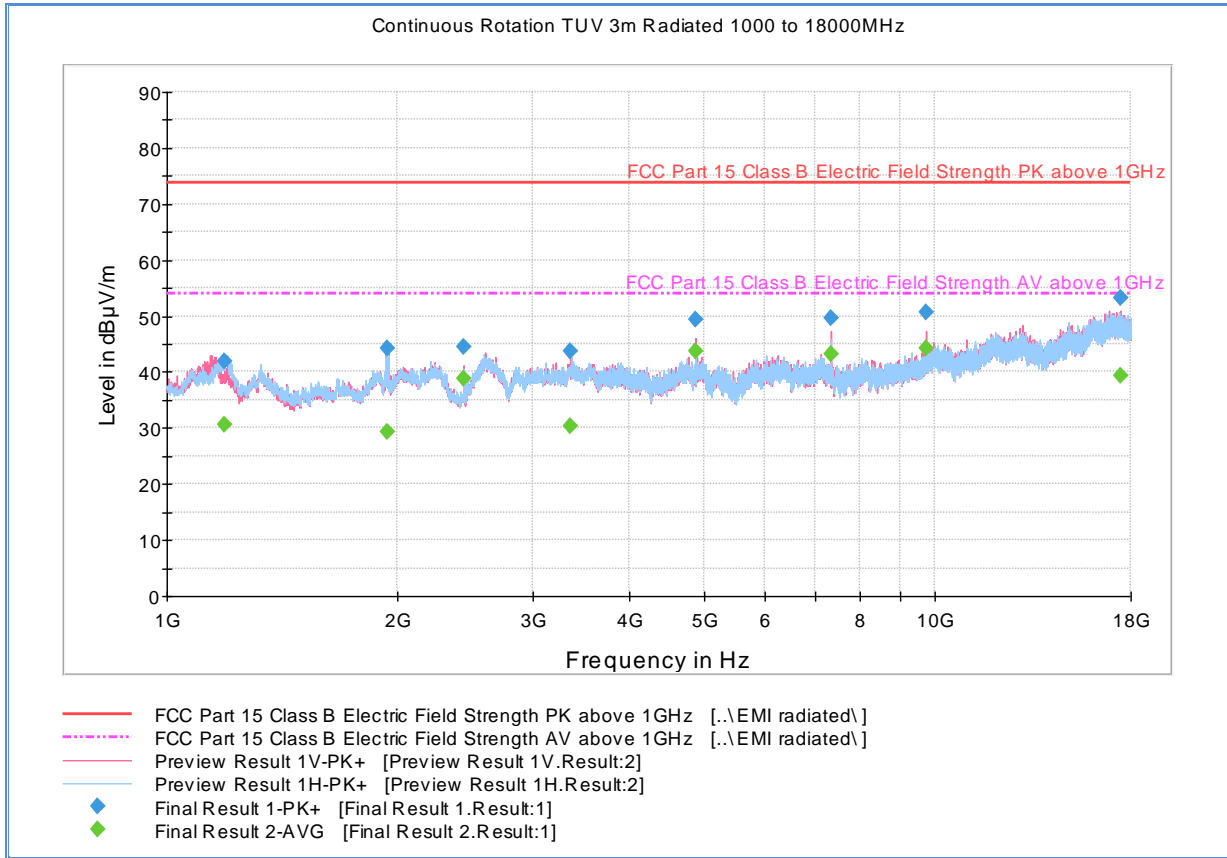
Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
41.007214	9.6	1000.0	120.000	139.0	V	98.0	-13.4	30.4	40.0
87.956633	12.7	1000.0	120.000	105.0	V	305.0	-17.1	27.3	40.0
119.962725	20.7	1000.0	120.000	100.0	V	-4.0	-16.6	22.8	43.5
179.999359	24.6	1000.0	120.000	100.0	V	303.0	-12.9	18.9	43.5
423.969218	42.9	1000.0	120.000	128.0	V	84.0	-4.7	3.1	46.0
539.962485	43.9	1000.0	120.000	100.0	V	100.0	-0.9	2.1	46.0
903.965611	24.1	1000.0	120.000	109.0	V	4.0	5.6	21.9	46.0

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



2.6.11 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)
1189.666667	41.9	1000.0	1000.000	166.6	H	185.0	-6.9	32.0	73.9
1932.966667	44.1	1000.0	1000.000	243.3	V	42.0	-2.2	29.8	73.9
2440.133333	44.6	1000.0	1000.000	103.7	V	18.0	-0.8	29.3	73.9
3350.500000	43.7	1000.0	1000.000	276.2	V	297.0	1.0	30.2	73.9
4880.166667	49.3	1000.0	1000.000	293.2	V	-13.0	3.6	24.6	73.9
7320.233333	49.5	1000.0	1000.000	203.4	V	83.0	6.7	24.4	73.9
9759.900000	50.6	1000.0	1000.000	167.6	V	294.0	9.4	23.3	73.9
17494.400000	53.3	1000.0	1000.000	401.9	V	186.0	19.7	20.6	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)
1189.666667	30.5	1000.0	1000.000	166.6	H	185.0	-6.9	23.4	53.9
1932.966667	29.2	1000.0	1000.000	243.3	V	42.0	-2.2	24.7	53.9
2440.133333	38.7	1000.0	1000.000	103.7	V	18.0	-0.8	15.2	53.9
3350.500000	30.3	1000.0	1000.000	276.2	V	297.0	1.0	23.6	53.9
4880.166667	43.7	1000.0	1000.000	293.2	V	-13.0	3.6	10.2	53.9
7320.233333	43.3	1000.0	1000.000	203.4	V	83.0	6.7	10.6	53.9
9759.900000	44.2	1000.0	1000.000	167.6	V	294.0	9.4	9.7	53.9
17494.400000	39.3	1000.0	1000.000	401.9	V	186.0	19.7	14.6	53.9

Test Notes: Measurement was performed with 2.4GHz notch filter. No significant emissions observed above 10GHz. Measurements above 10GHz were noise floor figures.



2.7 POWER SPECTRAL DENSITY

2.7.1 Specification Reference

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

2.7.2 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.

2.7.3 Equipment Under Test and Modification State

Serial No: N/A / Default Test Configuration

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

March 06, 2017 / AC

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 Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.5 °C
Relative Humidity	34.5.%
ATM Pressure	99.7 kPa

2.7.7 Additional Observations

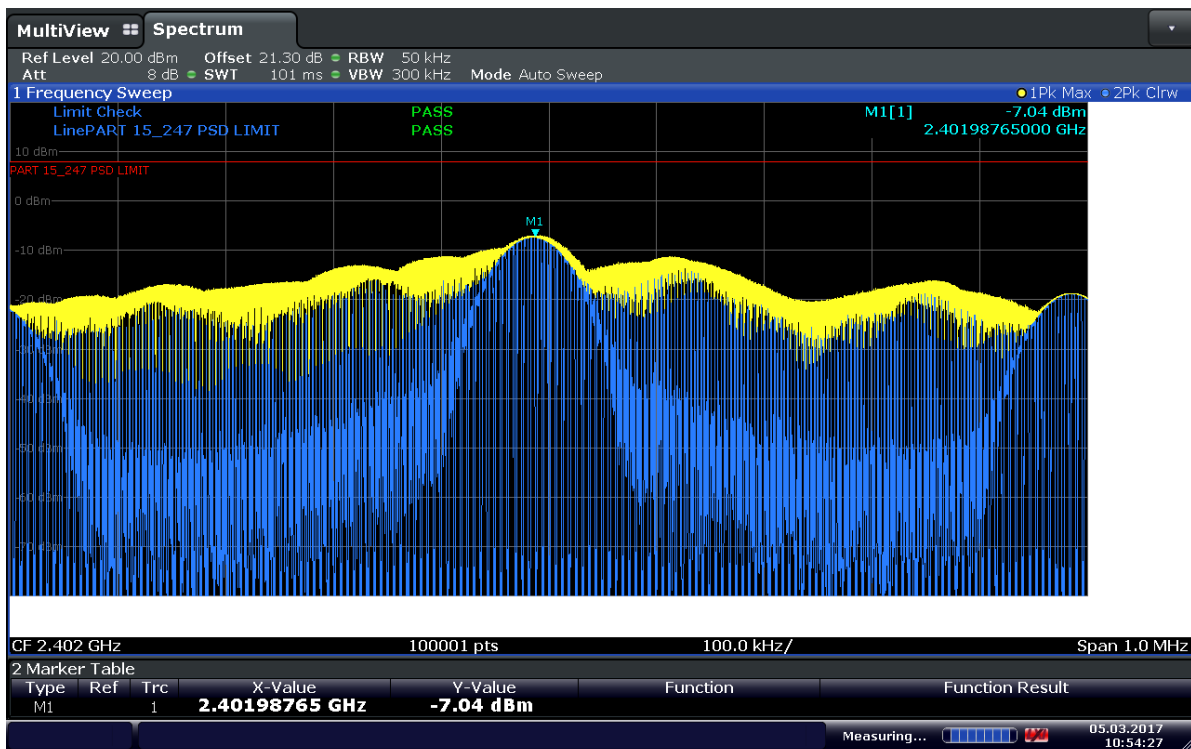
- This is a conducted test.
- Test procedure is per Section 10.2 of KDB 558074.
- Span is 1.5 times the DTS bandwidth.
- An offset of 21.3dB was added to compensate for the external attenuator and cable used from the antenna port to the spectrum analyzer.
- Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
- Set the VBW $\geq 3 \times \text{RBW}$
- Detector is Peak
- Sweep time is Auto Couple.
- Trace mode is max hold
- Trace allowed to fully stabilize.
- EUT complies with 50 kHz RBW.



2.7.8 Test Results Summary

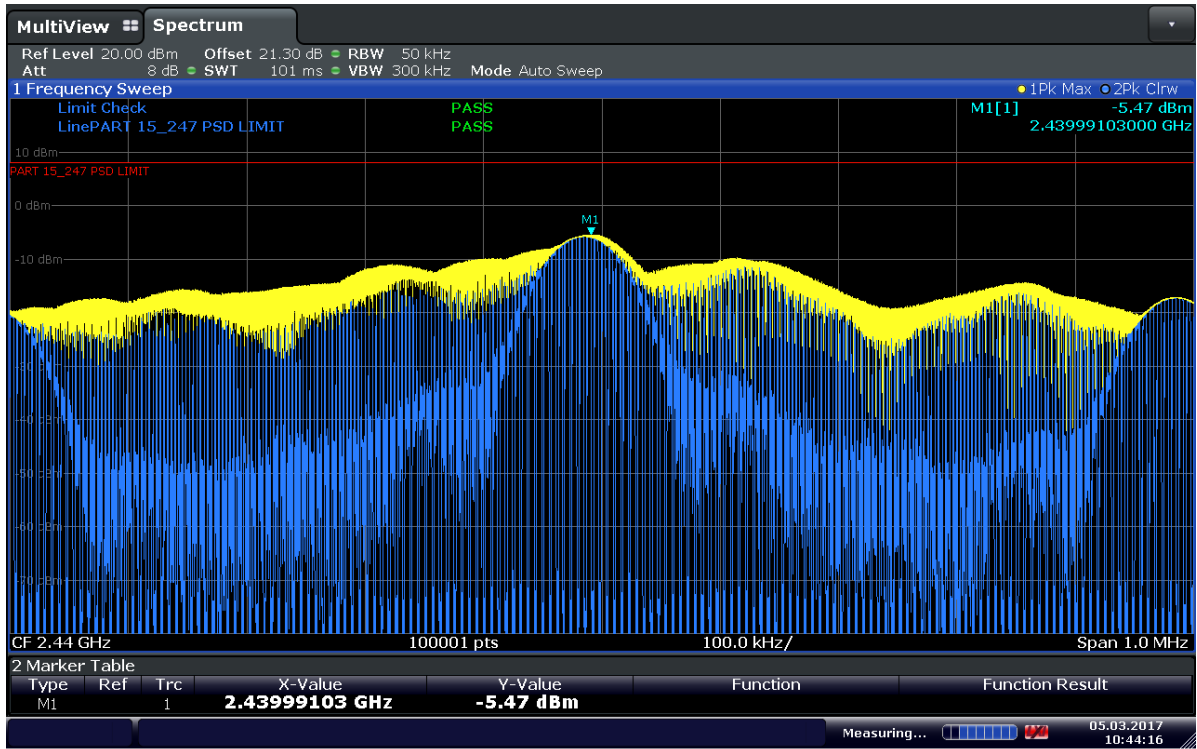
Mode	Channel	Marker Reading using 50 kHz RBW (dBm)	PSD Limit (dBm)	Margin (dB)	Compliance
Bluetooth LE	2402 MHz	-7.04	8	15.04	Complies
	2440 MHz	-5.47	8	13.47	Complies
	2480 MHz	-4.84	8	12.84	Complies

2.7.9 Test Results Plots



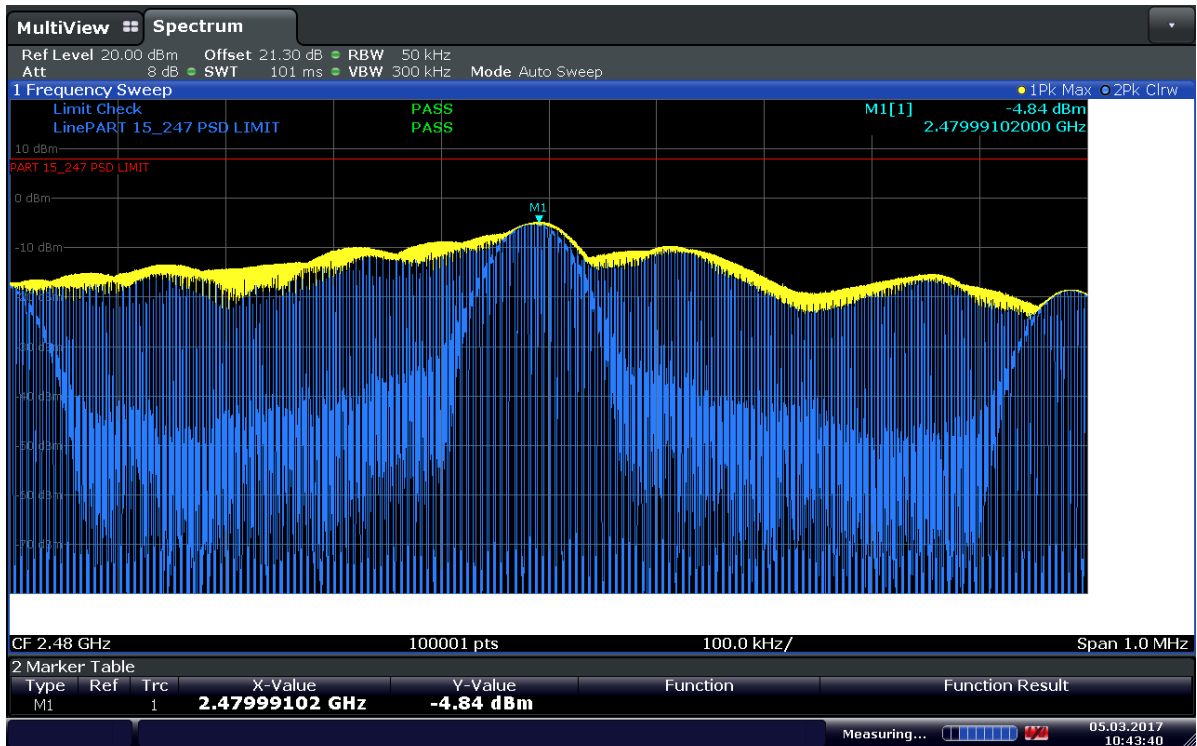
10:54:28 05.03.2017

Low Channel BT LE



10:44:17 05.03.2017

Mid Channel BT LE



10:43:41 05.03.2017

High Channel BT LE



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	04/19/16	04/19/17
7611	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	06/29/16	06/29/17
8607	20dB Attenuator	CAT-20	N/A	MCL HAT-20	10/10/16	10/10/17
Radiated Test Setup						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	11/06/15	11/06/17
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
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
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	02/09/17	02/09/18
6815	2.4GHz Band Notch Filter	BRM50702	008	Micro-Tronics	Verified by 1049	
Miscellaneous						
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/29/16	08/29/17
7560	Barometer/Temperature/Humidity Transmitter	iBTHX-W	1240476	Omega	01/17/17	01/17/18
	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

3.2.3 Conducted Antenna Port Measurement

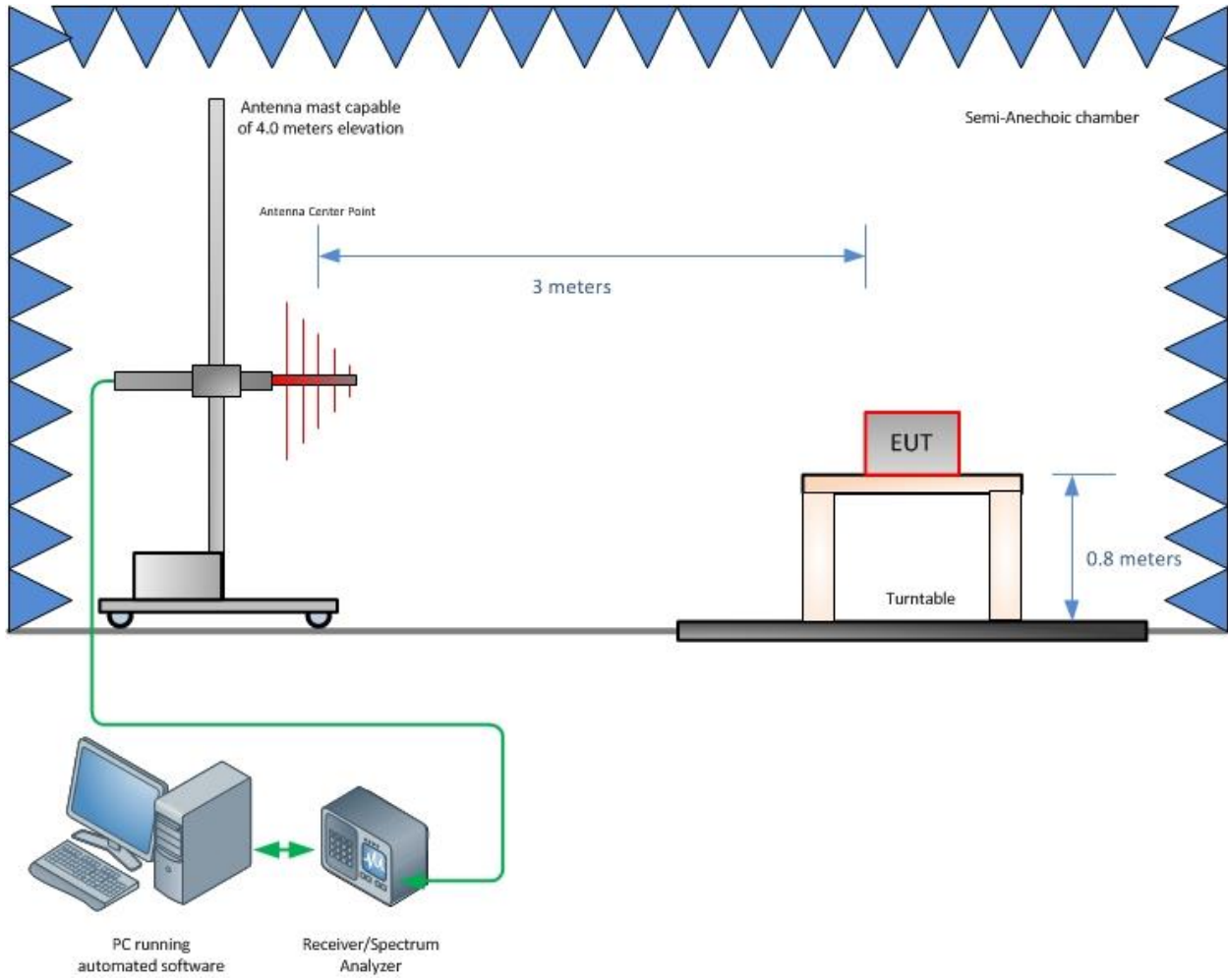
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.34	0.20	0.04
2	Cables	Rectangular	0.30	0.17	0.03
3	EUT Setup	Rectangular	0.50	0.29	0.08
Combined Uncertainty (u_c):					0.39
Coverage Factor (k):					1.96
Expanded Uncertainty:					0.76



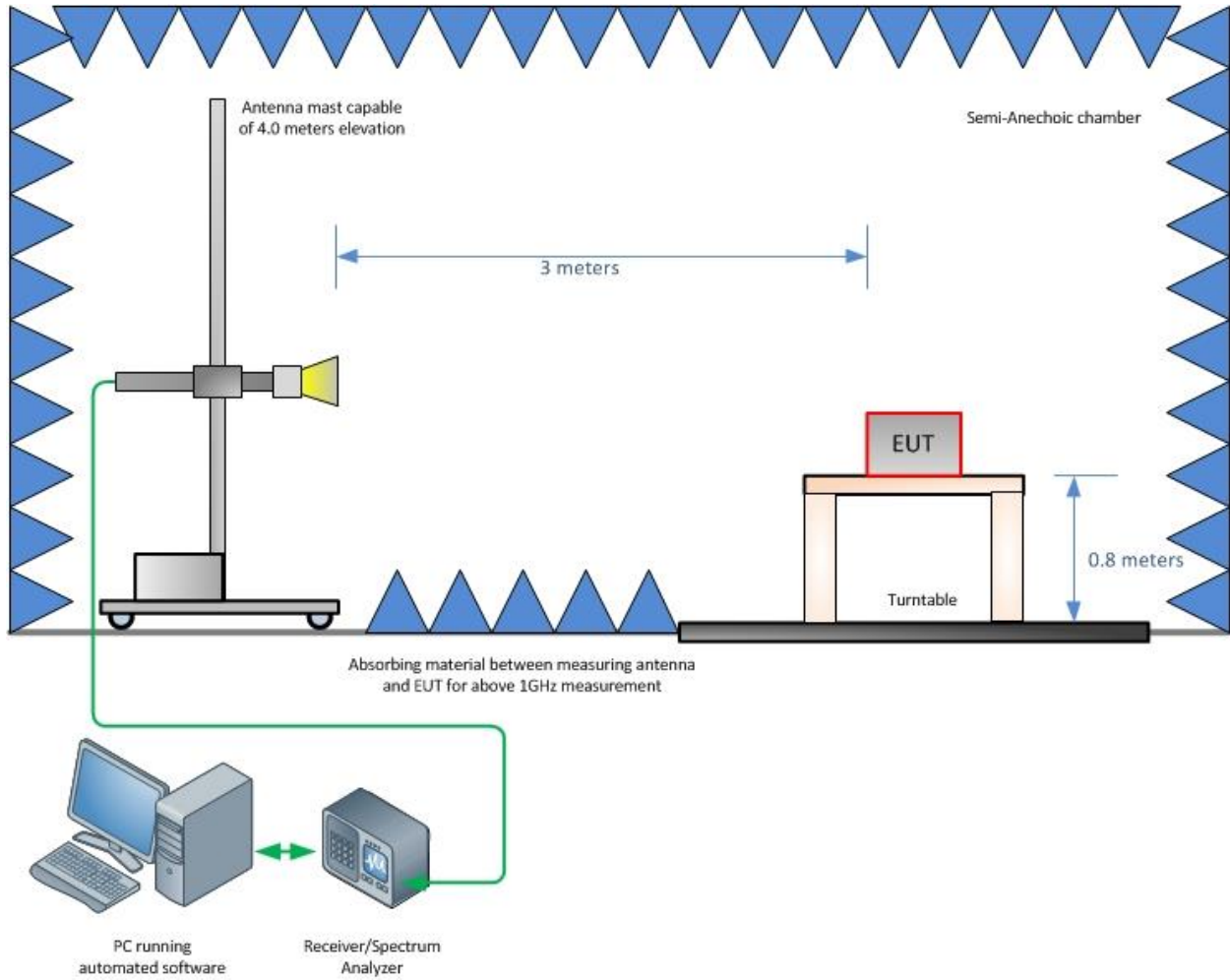
SECTION 4

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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