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Report On

Application for Grant of Equipment Authorization of the
SMK Electronics Corp.
Luminette Bluetooth Window Curtain

FCC Part 15 Subpart C §15.247
IC RSS-Gen and RSS-210 Issue 8 December 2010

Report No. SD72100489A **March 2015**

REPORT ON	Radio Testing of the SMK Electronics Corp. Bluetooth Window Curtain
TEST REPORT NUMBER	SD72100489A
PREPARED FOR	SMK Electronics Corp. 1055 Tierra del Rey, Suite H Chula Vista, CA 91910
CONTACT PERSON	Nikolay Shtin RF Engineer (619) 216-6400 nshtin@smkusa.com
PREPARED BY	Alex Chang **Name** Authorized Signatory Title: EMC/Wireless Test Engineer
APPROVED BY	Juan Manuel Gonzalez **Name** Authorized Signatory Title: Commercial/Wireless Lab Manager
DATED	March 23, 2015

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

Revision History

SD72100489A SMK Electronics Corp. Luminette Bluetooth Window Curtain					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
03/23/2015	Initial Release				Juan M. Gonzalez

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SECTION 1

REPORT SUMMARY

Radio Testing of the
SMK Electronics Corp.
Bluetooth Window Curtain

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1.1 INTRODUCTION

The information contained in this report is intended to show verification of the SMK Electronics Corp. Bluetooth Window Curtain to the requirements of FCC Part 15 Subpart C §15.247 and IC RSS-Gen and RSS-210 Issue 8 December 2010.

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	SMK Electronics Corp.
Model Number(s)	1010512227
FCC ID Number	UXUSTRX1
IC Number	7316A-STRX1
Serial Number(s)	N/A
Number of Samples Tested	1
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.247 (October 1, 2014). • RSS-210 - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment (Issue 8, December 2010). • RSS-Gen - General Requirements and Information for the Certification of Radio Apparatus (Issue 3, December 2010). • 558074 D01 DTS Meas Guidance v03r02 (June 05, 2014) Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 • 412172 D01 Determining ERP and EIRP v01 (November 30, 2010) Guidelines for Determining the Effective Radiated Power (ERP) and Equivalent Isotropically Radiated Power (EIRP) of a RF Transmitting System
Start of Test	December 15, 2014
Finish of Test	December 22, 2014
Name of Engineer(s)	Alex Chang Kathy Mackenzie
Related Document(s)	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-210 A8.4 (4)	Peak Output Power	Compliant	
-	§15.207(a)	RSS-Gen 7.2.4	Conducted Emissions	N/A*	
2.2		RSS-Gen 4.6.1	99% Emission Bandwidth	Compliant	
2.3	§15.247(a)(2)	RSS-210 A8.2(a)	Minimum 6 dB RF Bandwidth	Compliant	
-	§15.247(d)	RSS-210 A8.5	Out-of-Band Emissions - Conducted	N/A**	
-	§15.247(d)	RSS-210 A8.5	Band-edge Compliance of RF Conducted Emissions	N/A***	
2.4	§15.247(d)	RSS-210 A8.5	Spurious Radiated Emissions	Compliant	
2.4		RSS-Gen 4.10	Receiver Spurious Emissions	Compliant	
2.5	§15.247(d)	RSS-210 A8.5	Radiated Band Edge Measurement and Immediate Restricted Bands	Compliant	
2.6	§15.247(e)	RSS-210 A8.2(b)	Power Spectral Density for Digitally Modulated Device	Compliant	

* *Not applicable. EUT is battery powered.*
** *Not applicable. EUT has an integral antenna. Conducted antenna port testing not available.*
*** *Not applicable. EUT has an integral antenna. Band-edge measurements performed by radiated method under Spurious Radiated Emissions.*

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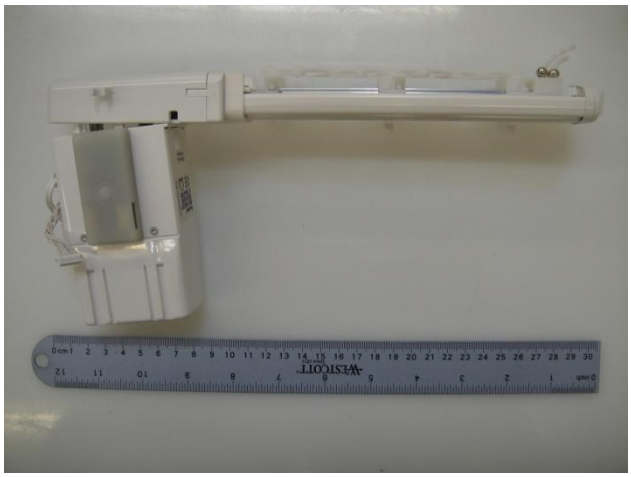
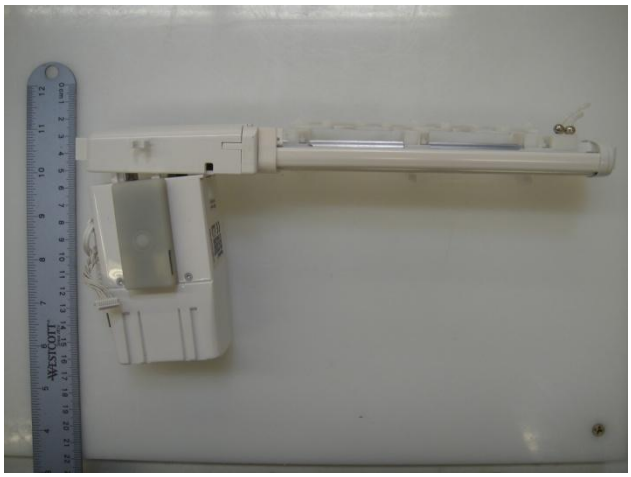
1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a SMK Electronics Corp. Bluetooth Window Curtain as shown in the photograph below. The EUT is a window curtain with Bluetooth LE technology that allow user to use the Bluetooth remote controller to operate the curtain. The EUT Bluetooth LE function was used and verified in this test report. The EUT is a battery operate device; although a support equipment AC-DC power supply adapter was also provided to supply 18VDC to the EUT and it is not part of this report evaluation.





Equipment Under Test

1.3.2 EUT General Description

EUT Description	Bluetooth Window Curtain
Model Name	Luminette
Model Number(s)	1010512227
Rated Voltage	18.0VDC (AA Lithium Ion batteries)
Output Power	3.34 dBm (EIRP – radiated)
Frequency Range	2402MHz to 2480 MHz in the 2400 MHz to 2483.5 MHz Band
Number of Operating Frequencies	40
Channels Verified	Low Channel 2402MHz Mid Channel 2440MHz High Channel 2480MHz
Antenna Type (used during evaluation)	Integral (Complies with Part 15.203 requirements)

1.3.3 Antenna Details

Manufacturer	SMK
Antenna Type	Inverted F
Antenna Gain	0 dBi

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1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configurations	Description
Default	Radiated only configuration. EUT transmitting through the integral antenna. The EUT was a standalone device and set on continuous transmission @ 100% duty cycle modulated in low, mid or high channel for evaluation.

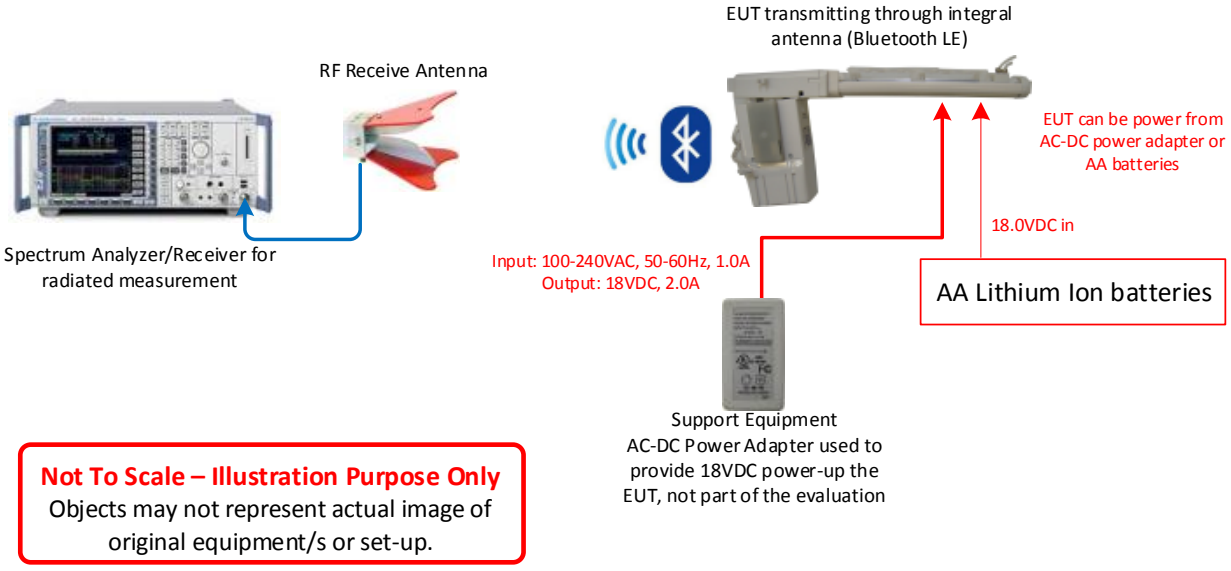
1.4.2 EUT Exercise Software

No special software used during evaluation. A firmware was loaded to the EUT which enable to change channels in Low, Mid and High @ 100% duty cycle (modulated) as well as normal operation and receive modes.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Outstanding Electronics	AC-DC Power Supply Adapter	Model: ADS0366-W180200 Alternative power source to provide output power 18VDC to the EUT

1.4.4 Simplified Test Configuration Diagram



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 C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.
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 C63.4-2009. 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)

Sony Electronics Inc., Building #8 16530 Via Esprillo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 942 5542 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 Industry Canada (IC) Registration No.: 3067A

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego) has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No. 3067A.

SECTION 2

TEST DETAILS

Radio Testing of the
SMK Electronics Corp.
Bluetooth Window Curtain

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)

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

December 18, 2014 / 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	20.1°C
Relative Humidity	48.4%
ATM Pressure	99.2 kPa

2.1.7 Additional Observations

- This is a radiated test. Fundamental field strength measurements are taken from test results presented under Section 2.4 (Spurious Radiated Emissions) of this test report.
- Methodology used for measuring maximum peak power is per Section 9.1.1 (RBW ≥ DTS bandwidth) of KDB 558074 (Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, June 05, 2014).
- The measured field strength levels are then converted to EIRP using the formula: E=EIRP-20log D + 104.8 (from Section 12.2.2 of KDB 558074).

2.1.8 Sample Computations

Using the formula: E=EIRP-20log D + 104.8 (from Section 12.2.2 of KDB 558074), compute for EIRP level:

- EIRP = 98.6+20log(3 meters) -104.8
- EIRP = 3.34 dBm

2.1.9 Test Results

Mode	Channel (MHz)	Peak Reading (dBµV/m @ 3.0 meters)	EIRP (dBm)	Limit (dBm)	Compliance
GFSK @ 1Mbps	2402	98.6	3.34	30	Complies
	2440	97.6	2.34	30	Complies
	2480	96.6	1.34	30	Complies

2.2 99% EMISSION BANDWIDTH

2.2.1 Specification Reference

RSS-Gen Clause 4.6.1

2.2.2 Standard Applicable

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 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 shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.
The trace data points are recovered and directly summed in linear 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. This frequency is recorded. The span between the two recorded frequencies is the 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

December 22, 2014 / KAM

2.2.5 Test Equipment Used

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

2.2.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.8°C
Relative Humidity	44.1%
ATM Pressure	99.1 kPa

2.2.7 Additional Observations

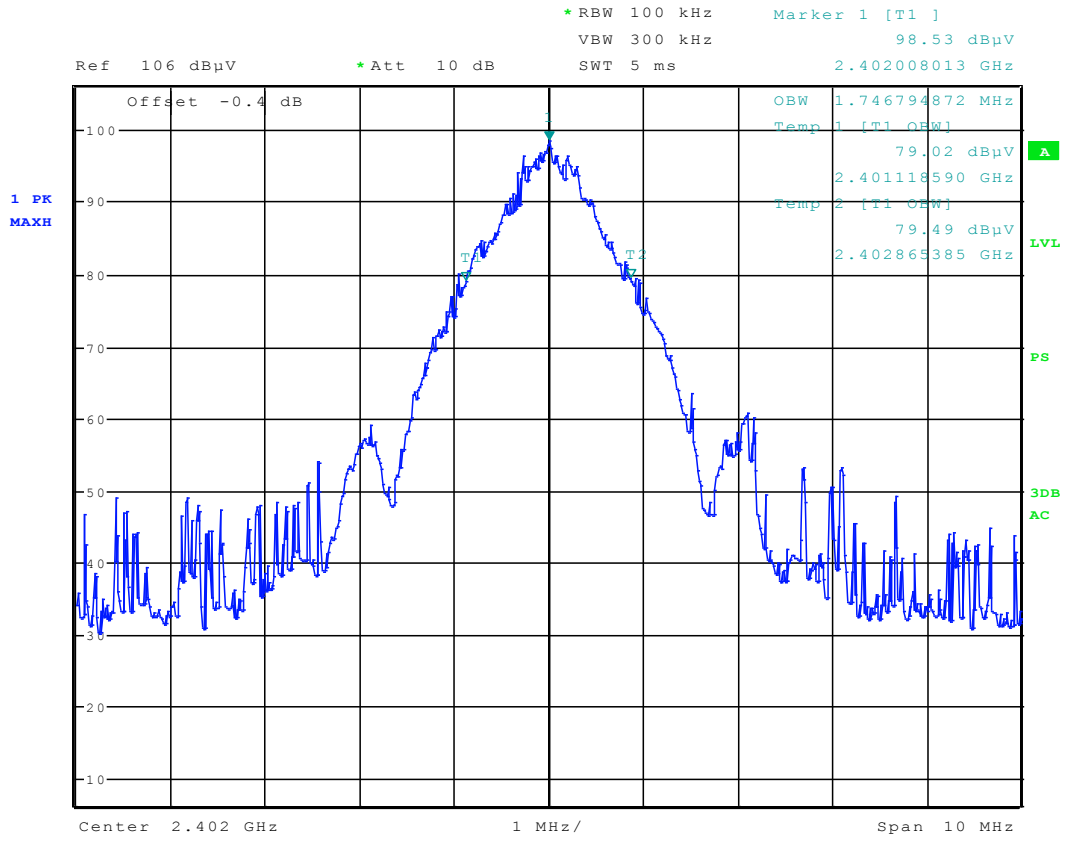
- This is a radiated test.
- Span is wide enough to capture the channel transmission.
- RBW is 1% of the span
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.

- 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.

2.2.8 Test Results

Modulation	Channel (MHz)	Measured 99% Bandwidth (MHz)
GFSK @ 1Mbps	2402	1.747
	2440	1.715
	2480	1.763

2.2.9 Test Results Plots



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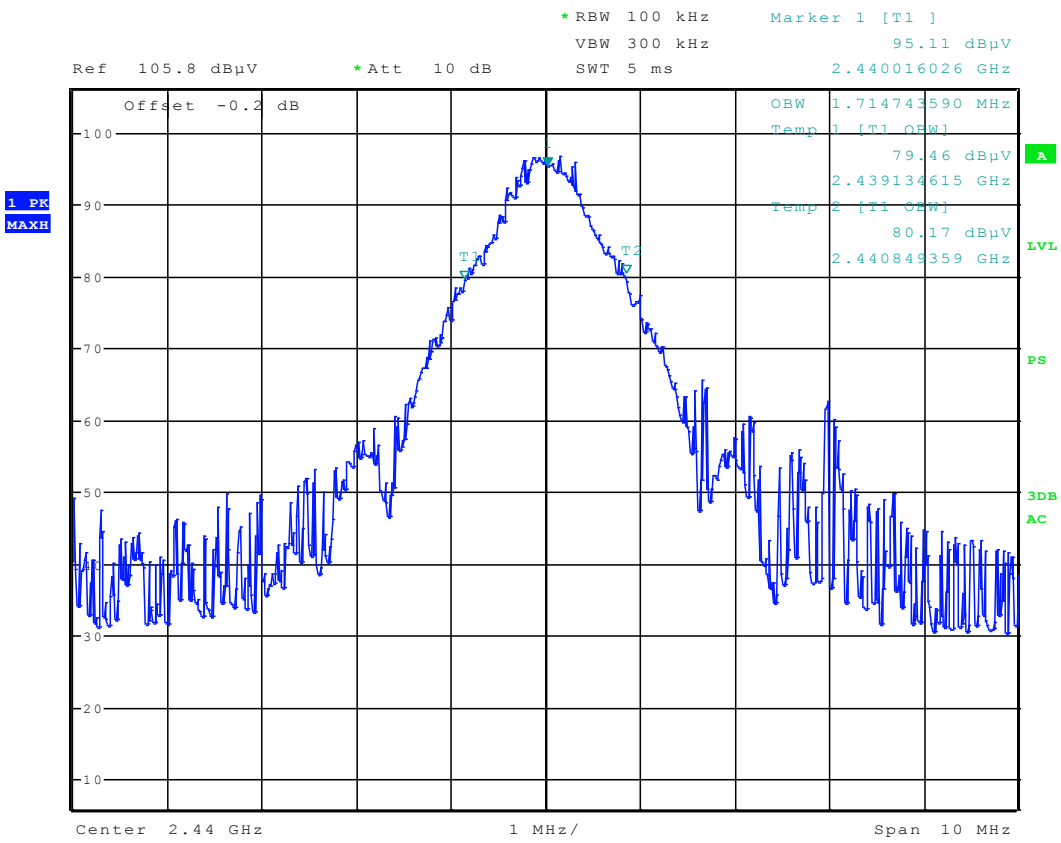
Low Channel – 2402 MHz



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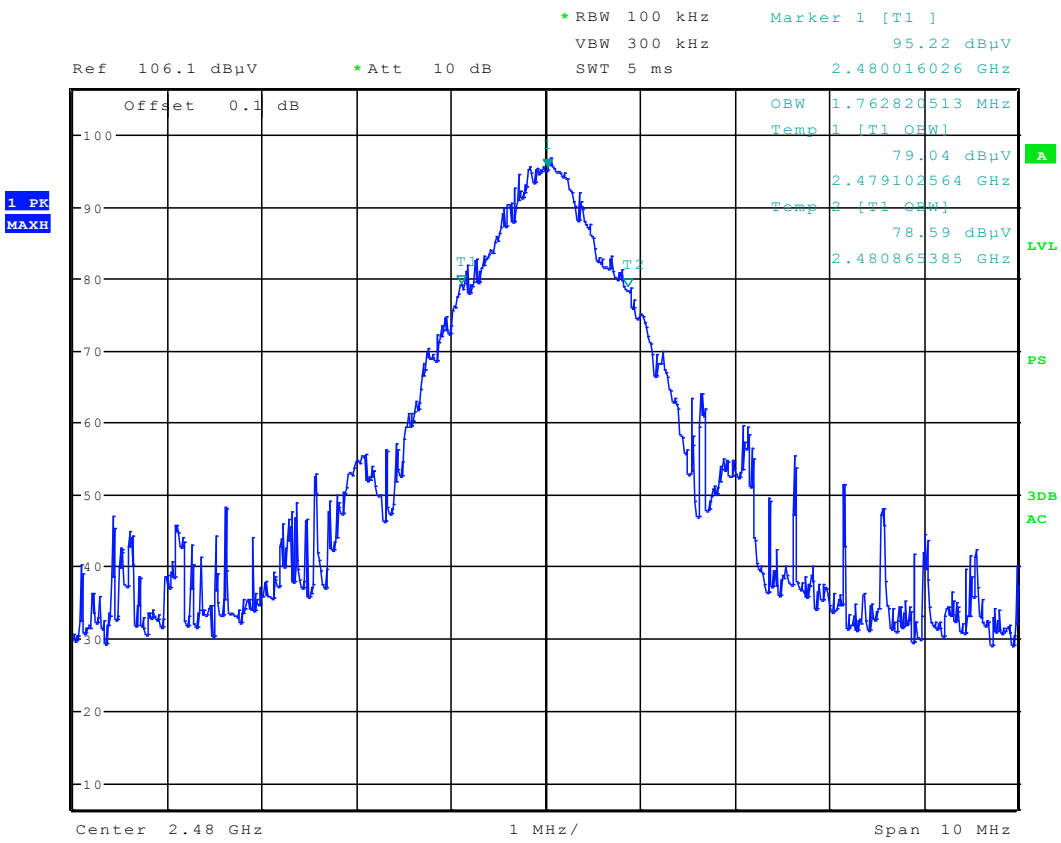
Mid Channel – 2440 MHz



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High Channel – 2480 MHz

2.3 MINIMUM 6 dB RF BANDWIDTH

2.3.1 Specification Reference

Part 15 Subpart C §15.247(a)(2)

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

December 22, 2014 / KAM

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 performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.8°C
Relative Humidity	44.1%
ATM Pressure	99.1 kPa

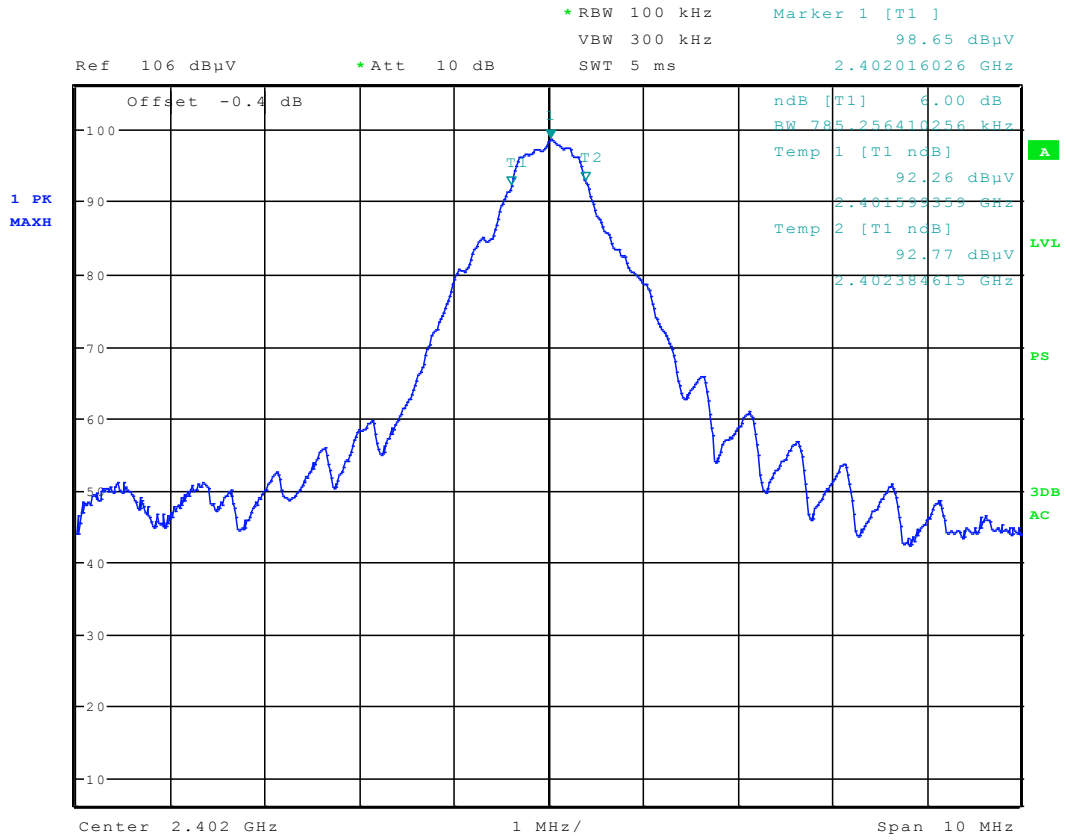
2.3.7 Additional Observations

- This is a radiated test as per DTS bandwidth 8.2 Option 2 guidance of KDB 558074 (Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, June 05, 2014).
- Automatic bandwidth function of the spectrum analyzer was used for this test.
- Span is wide enough to capture the channel transmission.
- RBW is set to 100 kHz.
- VBW is 3X RBW.
- Sweep is auto couple.
- Detector is peak.
- Trace is max hold.

2.3.8 Test Results

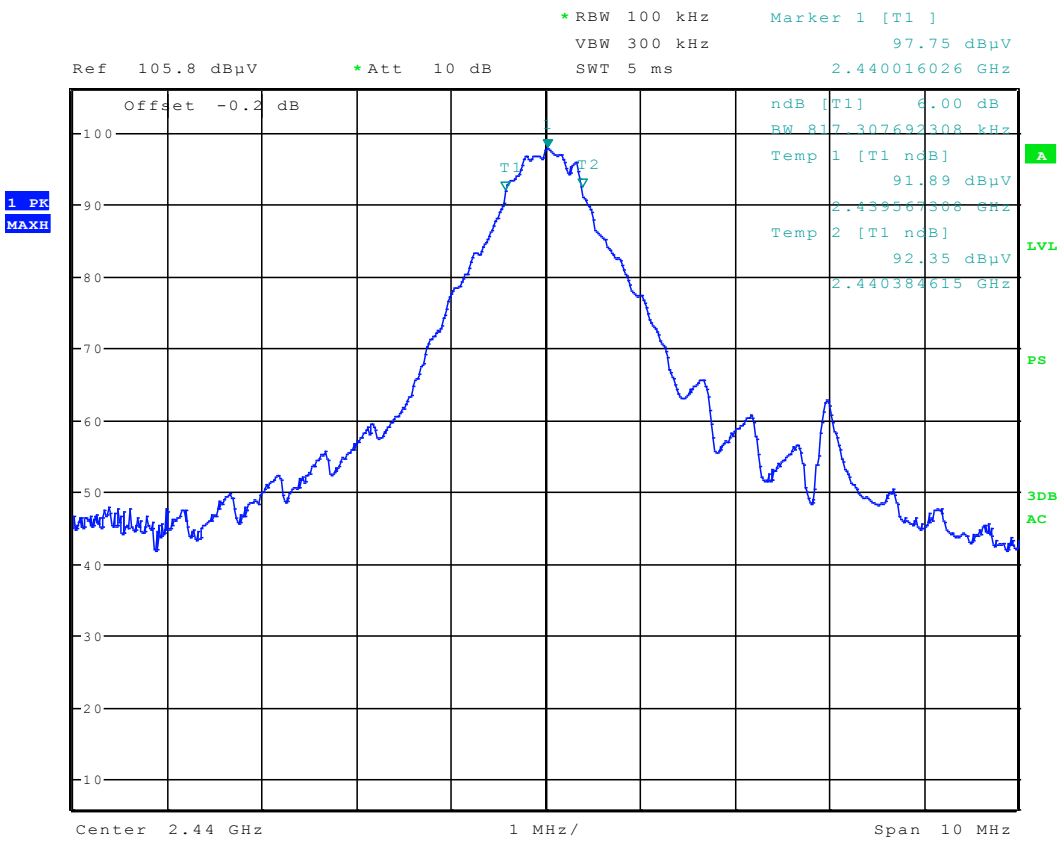
Modulation	Channel (MHz)	Measured 6dB Bandwidth (kHz)	Limit (kHz)
GFSK @ 1Mbps	2402	785.256	>500
	2440	817.308	
	2480	801.282	

2.3.9 Test Results Plots



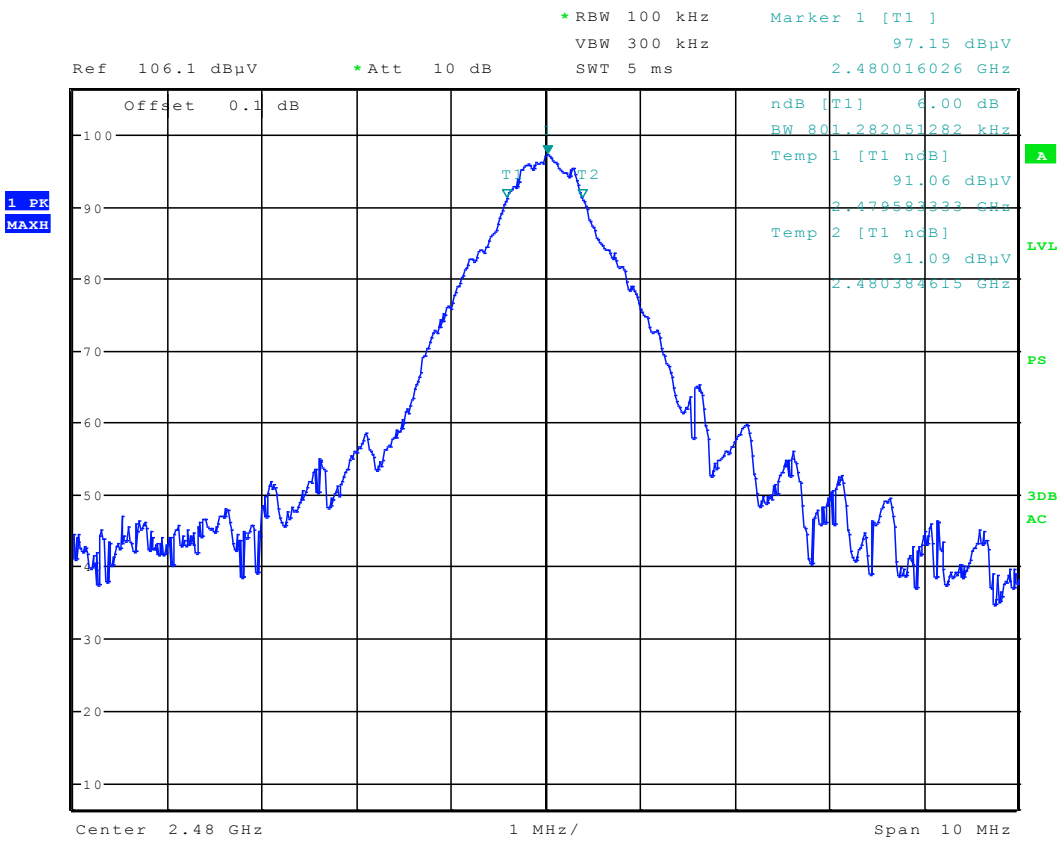
Date: 22.DEC.2014 15:19:27

Low Channel – 2402 MHz



Date: 22.DEC.2014 15:28:44

Mid Channel – 2440 MHz



High Channel – 2480 MHz

2.4 SPURIOUS RADIATED EMISSIONS

2.4.1 Specification Reference

Part 15 Subpart C §15.247(d) and RSS-Gen 4.10

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)).

The receiver shall be operated in the normal receive mode near the mid-point of the band in which the receiver is designed to operate.
Radiated emission measurements are to be performed on a test site registered with Industry Canada. As an alternative, the conducted measurement method may be used when the antenna is detachable. In such a case, the receiver spurious signal may be measured at the antenna port.
If the receiver is super-regenerative, stabilize it by coupling to it an unmodulated carrier on the receiver frequency (antenna conducted measurement) or by transmitting an unmodulated carrier on the receiver frequency from an antenna in the proximity of the receiver (radiated measurement). Taking care not to overload the receiver, vary the amplitude and frequency of the stabilizing signal to obtain the highest level of the spurious emissions from the receiver.
For either method, the search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is higher, to at least 3 times the highest tuneable or local oscillator frequency, whichever is higher, without exceeding 40 GHz.
For emissions below 1000 MHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector function properly adjusted for factors such as pulse desensitization as required, with an equal or greater measurement bandwidth relative to the applicable CISPR quasi-peak bandwidth.
Above 1000 MHz, measurements shall be performed using an average detector with a minimum resolution bandwidth of 1 MHz.

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

December 18, 2014 / 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 performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	20.1°C
Relative Humidity	48.4%
ATM Pressure	99.2 kPa

2.4.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic.
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d).
- There are no emissions 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.

2.4.8 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**

2.4.9 Test Results

See attached plots.

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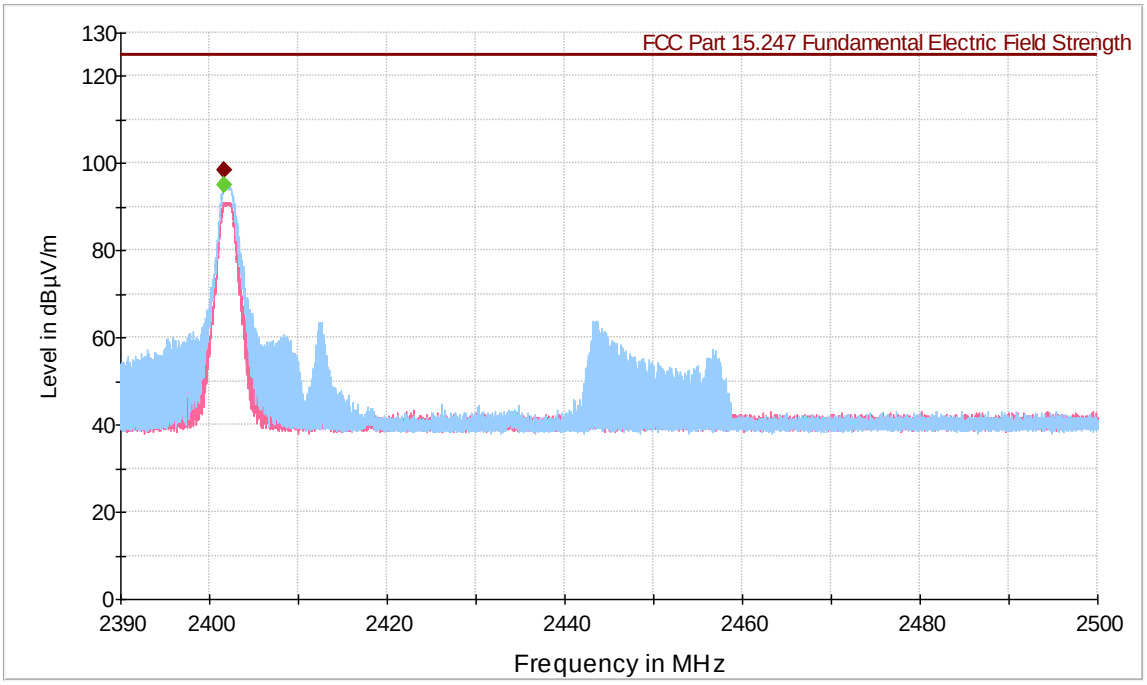
2.4.10 Test Results – Low Channel Fundamental Frequency



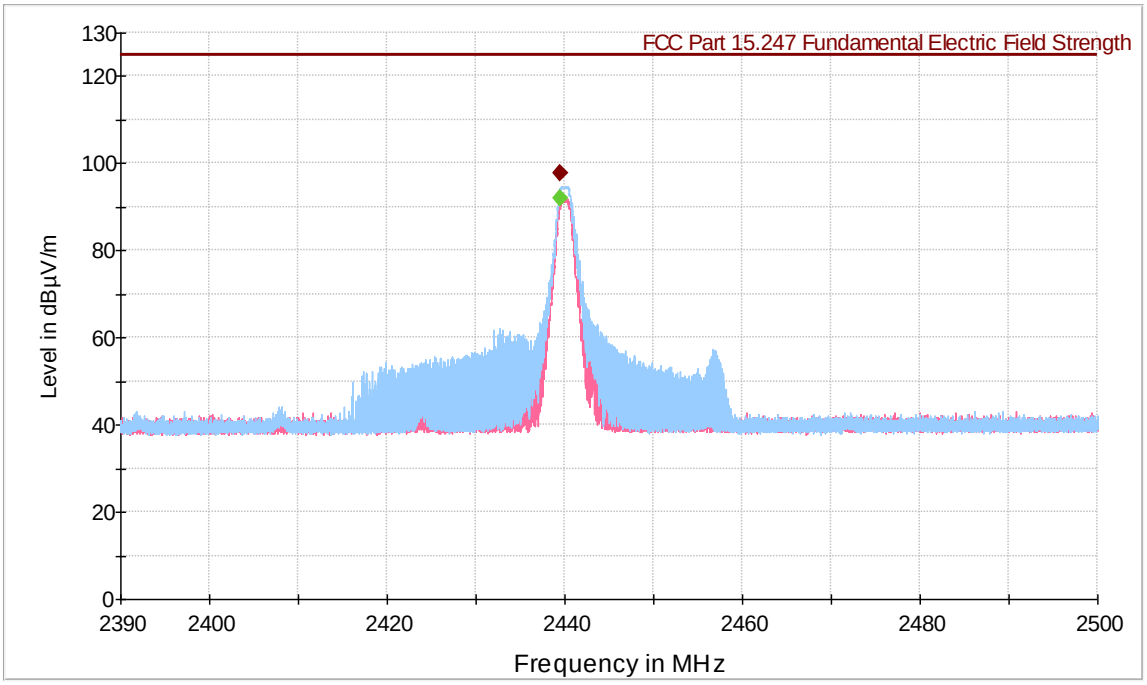
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2401.683333	98.6	1000.0	1000.000	404.0	H	316.0	-0.4	26.4	125.0

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2401.683333	94.9	1000.0	1000.000	404.0	H	316.0	-0.4	30.1	125.0

2.4.11 Test Results – Mid Channel Fundamental Frequency



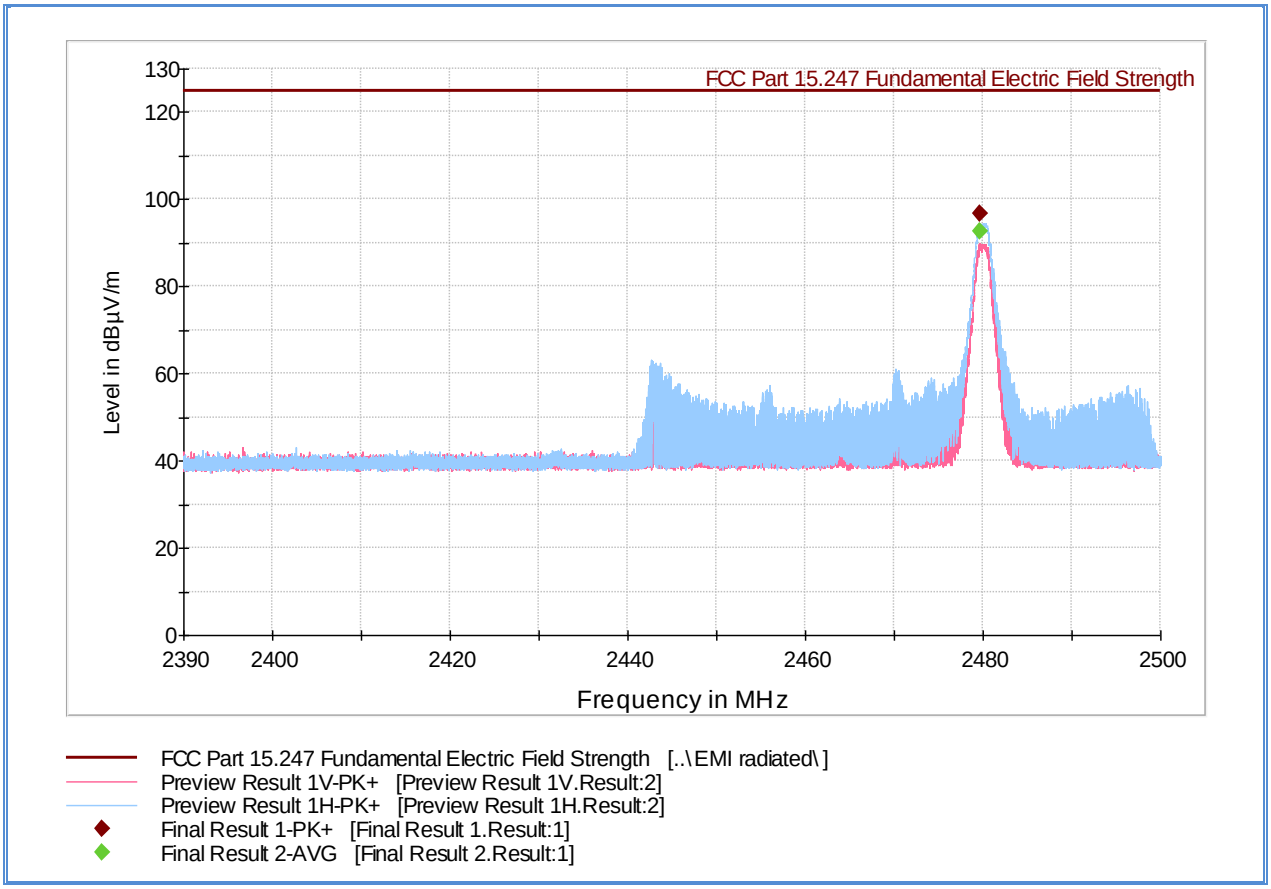
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2439.498000	97.6	1000.0	1000.000	300.0	H	300.0	-0.2	27.4	125.0

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2439.498000	91.9	1000.0	1000.000	300.0	H	300.0	-0.2	33.1	125.0

2.4.12 Test Results – High Channel Fundamental Frequency



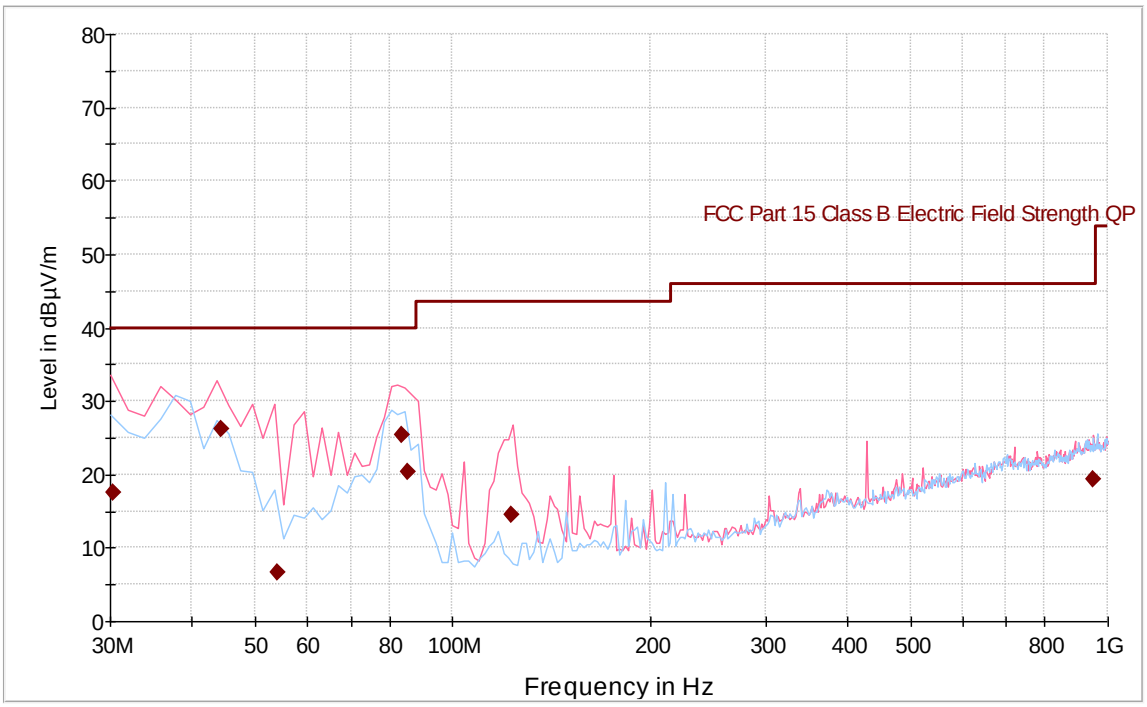
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2479.642667	96.6	1000.0	1000.000	265.0	H	328.0	0.1	28.4	125.0

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2479.642667	92.6	1000.0	1000.000	265.0	H	328.0	0.1	32.4	125.0

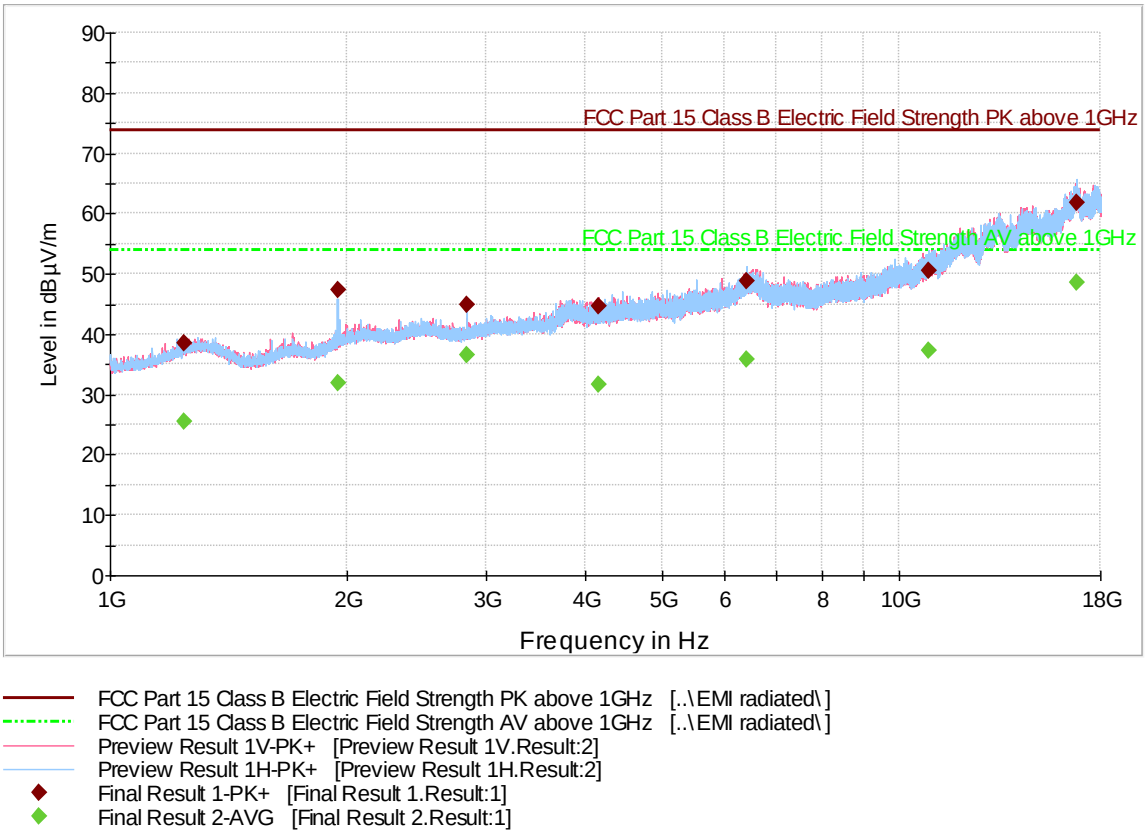
2.4.13 Test Results Below 1GHz (Receive Mode)



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.240000	17.6	1000.0	120.000	100.0	V	95.0	-11.4	22.4	40.0
44.287214	26.1	1000.0	120.000	100.0	V	167.0	-17.9	13.9	40.0
54.086653	6.7	1000.0	120.000	128.0	V	135.0	-20.5	33.3	40.0
83.604970	25.4	1000.0	120.000	100.0	V	102.0	-21.5	14.6	40.0
85.172745	20.3	1000.0	120.000	116.0	V	-3.0	-21.4	19.7	40.0
122.826613	14.4	1000.0	120.000	200.0	V	353.0	-20.3	29.1	43.5
951.762806	19.4	1000.0	120.000	105.0	V	332.0	1.5	26.6	46.0

2.4.14 Test Results Above 1GHz (Receive Mode)



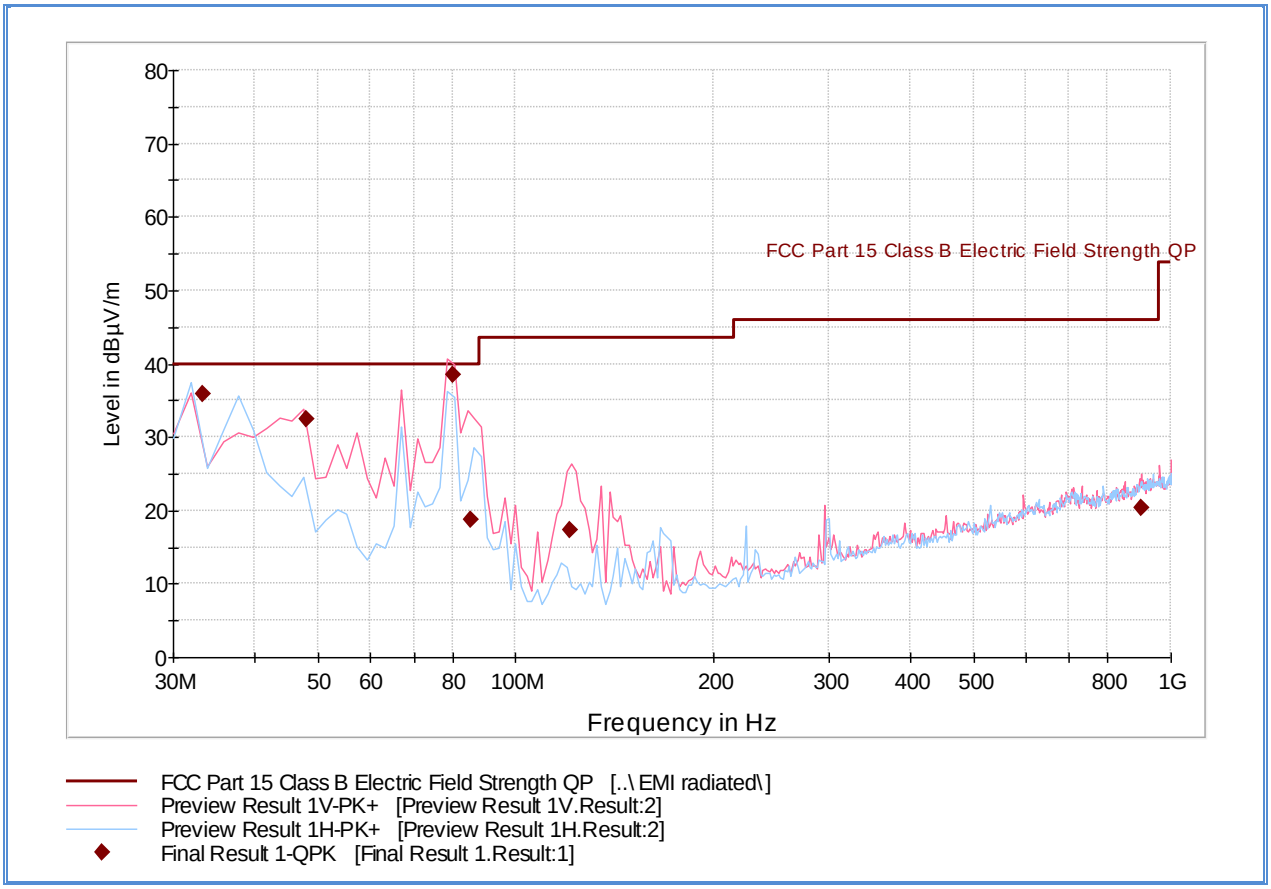
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1239.933333	38.4	1000.0	1000.000	137.0	H	20.0	-5.8	35.5	73.9
1941.066667	47.3	1000.0	1000.000	397.8	H	0.0	-1.8	26.6	73.9
2836.400000	44.8	1000.0	1000.000	400.0	H	253.0	0.4	29.1	73.9
4155.166667	44.5	1000.0	1000.000	406.9	V	335.0	5.2	29.4	73.9
6406.566667	48.8	1000.0	1000.000	400.0	H	57.0	11.5	25.1	73.9
10900.03333	50.4	1000.0	1000.000	164.0	H	17.0	15.3	23.5	73.9
16806.56666	61.9	1000.0	1000.000	392.0	H	135.0	26.4	12.0	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)
1239.933333	25.5	1000.0	1000.000	137.0	H	20.0	-5.8	28.4	53.9
1941.066667	31.8	1000.0	1000.000	397.8	H	0.0	-1.8	22.1	53.9
2836.400000	36.6	1000.0	1000.000	400.0	H	253.0	0.4	17.3	53.9
4155.166667	31.6	1000.0	1000.000	406.9	V	335.0	5.2	22.3	53.9
6406.566667	35.7	1000.0	1000.000	400.0	H	57.0	11.5	18.2	53.9
10900.03333	37.3	1000.0	1000.000	164.0	H	17.0	15.3	16.6	53.9
16806.56666	48.6	1000.0	1000.000	392.0	H	135.0	26.4	5.3	53.9

2.4.15 Test Results Below 1GHz (Low Channel)

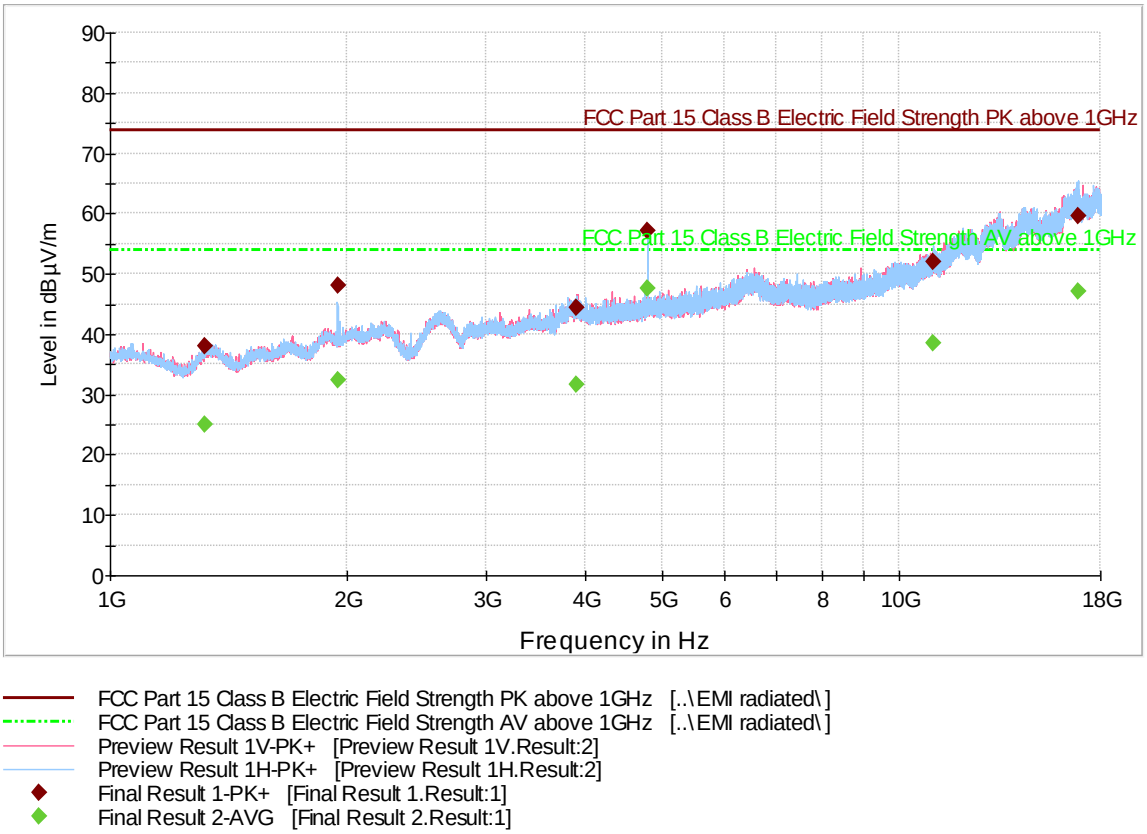


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
33.360000	35.8	1000.0	120.000	150.0	H	197.0	-12.8	4.2	40.0
47.974990	32.3	1000.0	120.000	109.0	V	262.0	-19.1	7.7	40.0
79.997194	38.6	1000.0	120.000	100.0	V	85.0	-21.7	1.4	40.0
85.572745	18.8	1000.0	120.000	150.0	V	11.0	-21.3	21.2	40.0
120.866613	17.3	1000.0	120.000	100.0	V	-12.0	-20.0	26.2	43.5
899.941723	20.3	1000.0	120.000	183.0	V	35.0	1.1	25.7	46.0

Test Notes: Only worst case channel presented for spurious emissions below 1GHz.

2.4.16 Test Results Above 1GHz (Low Channel)



Peak Data

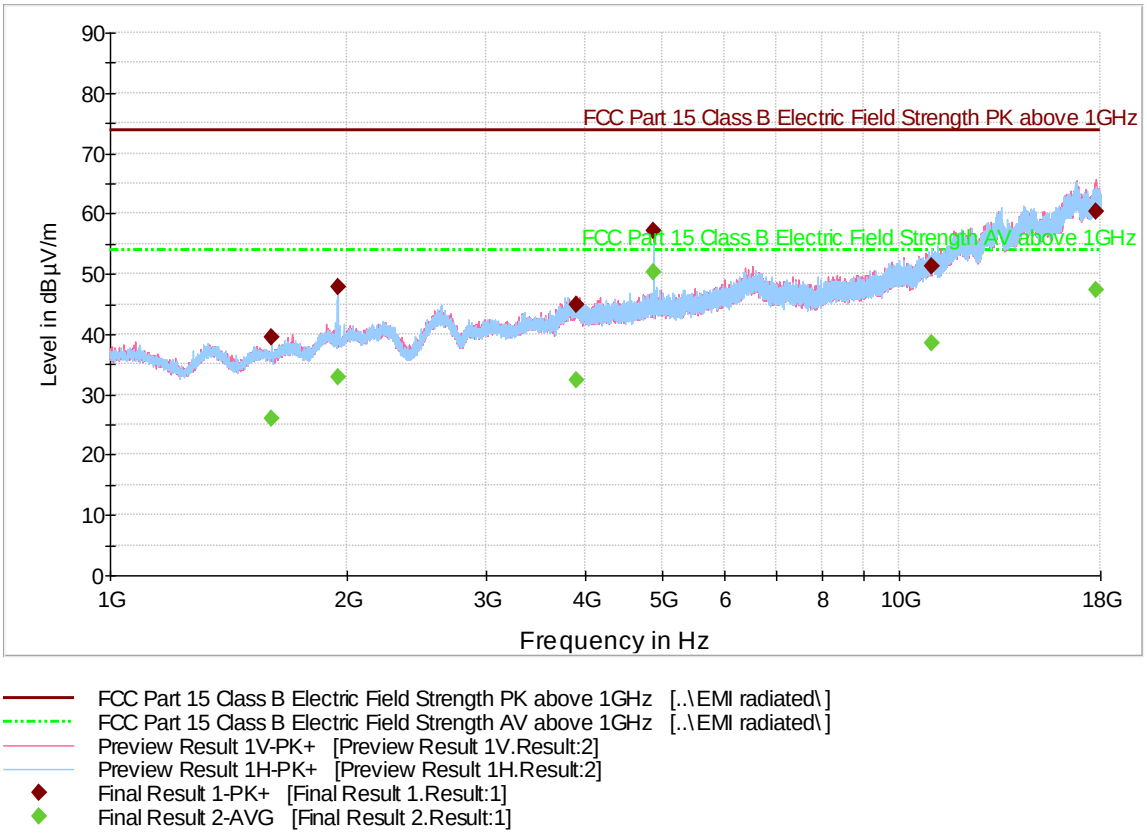
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1318.266667	38.1	1000.0	1000.000	324.0	H	140.0	-5.4	35.8	73.9
1941.466667	48.0	1000.0	1000.000	410.0	H	0.0	-1.8	25.9	73.9
3899.433333	44.4	1000.0	1000.000	200.0	V	256.0	5.2	29.5	73.9
4803.266667	57.0	1000.0	1000.000	300.0	V	153.0	5.8	16.9	73.9
11029.800000	51.9	1000.0	1000.000	370.0	H	329.0	15.5	22.0	73.9
16860.800000	59.6	1000.0	1000.000	244.0	H	347.0	25.8	14.3	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)
1318.266667	25.1	1000.0	1000.000	324.0	H	140.0	-5.4	28.8	53.9
1941.466667	32.4	1000.0	1000.000	410.0	H	0.0	-1.8	21.5	53.9
3899.433333	31.7	1000.0	1000.000	200.0	V	256.0	5.2	22.2	53.9
4803.266667	47.5	1000.0	1000.000	300.0	V	153.0	5.8	6.4	53.9
11029.800000	38.4	1000.0	1000.000	370.0	H	329.0	15.5	15.5	53.9
16860.800000	47.1	1000.0	1000.000	244.0	H	347.0	25.8	6.8	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz are noise floor figures.

2.4.17 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)
1599.933333	39.5	1000.0	1000.000	219.0	H	250.0	-5.4	34.4	73.9
1941.033333	47.8	1000.0	1000.000	392.0	H	80.0	-1.8	26.1	73.9
3907.933333	45.0	1000.0	1000.000	406.9	V	35.0	5.2	28.9	73.9
4879.600000	57.2	1000.0	1000.000	300.0	V	171.0	6.1	16.7	73.9
10987.333333	51.3	1000.0	1000.000	392.0	H	9.0	15.6	22.6	73.9
17754.633333	60.2	1000.0	1000.000	300.0	V	31.0	25.9	13.7	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)
1599.933333	26.1	1000.0	1000.000	219.0	H	250.0	-5.4	27.8	53.9
1941.033333	32.8	1000.0	1000.000	392.0	H	80.0	-1.8	21.1	53.9
3907.933333	32.5	1000.0	1000.000	406.9	V	35.0	5.2	21.4	53.9
4879.600000	50.3	1000.0	1000.000	300.0	V	171.0	6.1	3.6	53.9
10987.333333	38.6	1000.0	1000.000	392.0	H	9.0	15.6	15.3	53.9
17754.633333	47.2	1000.0	1000.000	300.0	V	31.0	25.9	6.7	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz are noise floor figures.

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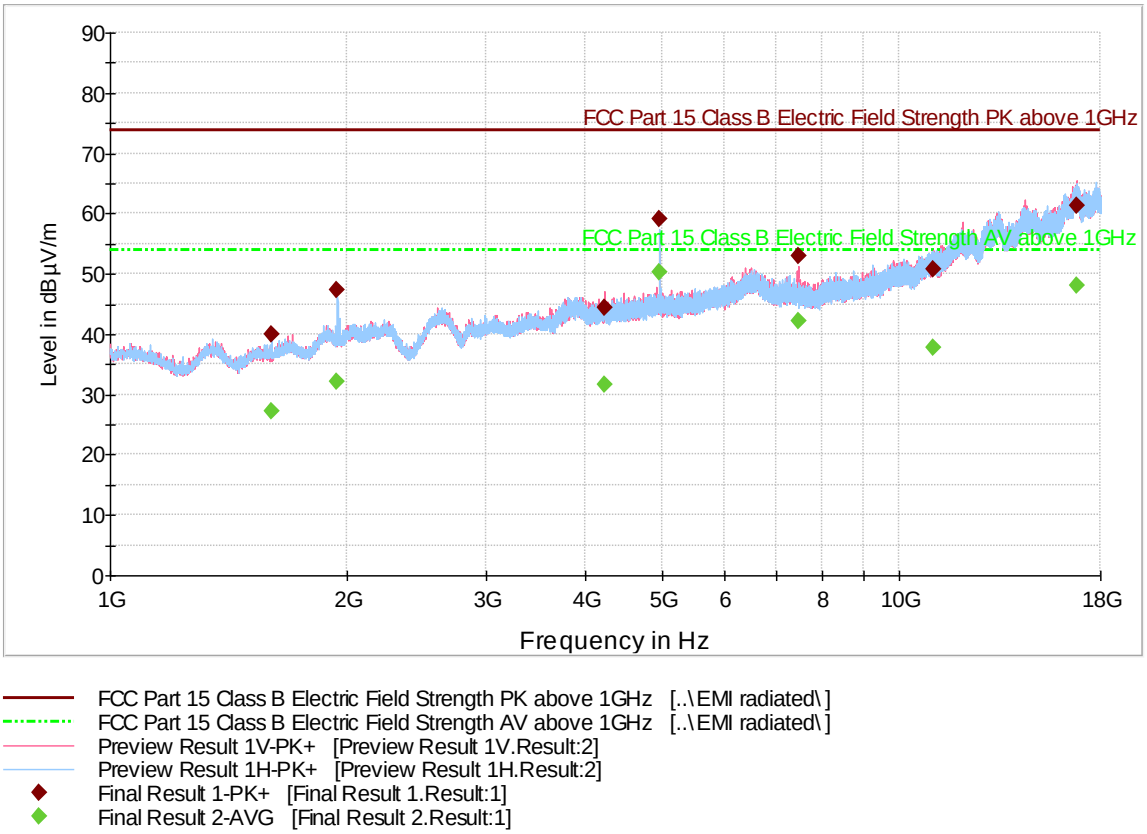
2.4.18 Test Results Above 1GHz (High Channel)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1599.933333	40.0	1000.0	1000.000	206.0	H	174.0	-5.4	33.9	73.9
1940.866667	47.3	1000.0	1000.000	410.0	H	166.0	-1.8	26.6	73.9
4240.000000	44.5	1000.0	1000.000	372.0	V	306.0	5.2	29.4	73.9
4960.633333	59.1	1000.0	1000.000	124.0	H	93.0	6.4	14.8	73.9
7440.933333	52.9	1000.0	1000.000	245.0	V	138.0	9.6	21.0	73.9
11057.000000	50.8	1000.0	1000.000	270.0	V	-20.0	15.3	23.1	73.9
16808.666667	61.3	1000.0	1000.000	150.0	V	115.0	26.4	12.6	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)
1599.933333	27.2	1000.0	1000.000	206.0	H	174.0	-5.4	26.7	53.9
1940.866667	32.1	1000.0	1000.000	410.0	H	166.0	-1.8	21.8	53.9
4240.000000	31.7	1000.0	1000.000	372.0	V	306.0	5.2	22.2	53.9
4960.633333	50.3	1000.0	1000.000	124.0	H	93.0	6.4	3.6	53.9
7440.933333	42.2	1000.0	1000.000	245.0	V	138.0	9.6	11.7	53.9
11057.000000	37.8	1000.0	1000.000	270.0	V	-20.0	15.3	16.1	53.9
16808.666667	48.2	1000.0	1000.000	150.0	V	115.0	26.4	5.7	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 8GHz. Measurements above 8GHz are noise floor figures.

2.5 RADATED BAND EGDE MEASURMENTS AND IMMEDIATE RESTRICTED BANDS

2.5.1 Specification Reference

Part 15 Subpart C §15.247(d)

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

December 18, 2014 / 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 performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	20.1°C
Relative Humidity	48.4%
ATM Pressure	99.2 kPa

2.5.7 Additional Observations

- This is a radiated test. The spectrum was searched from 2310MHz to 2390MHz for lower immediate restricted band and 2483.5MHz to 2500MHz for upper immediate restricted band.
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205.
- 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.

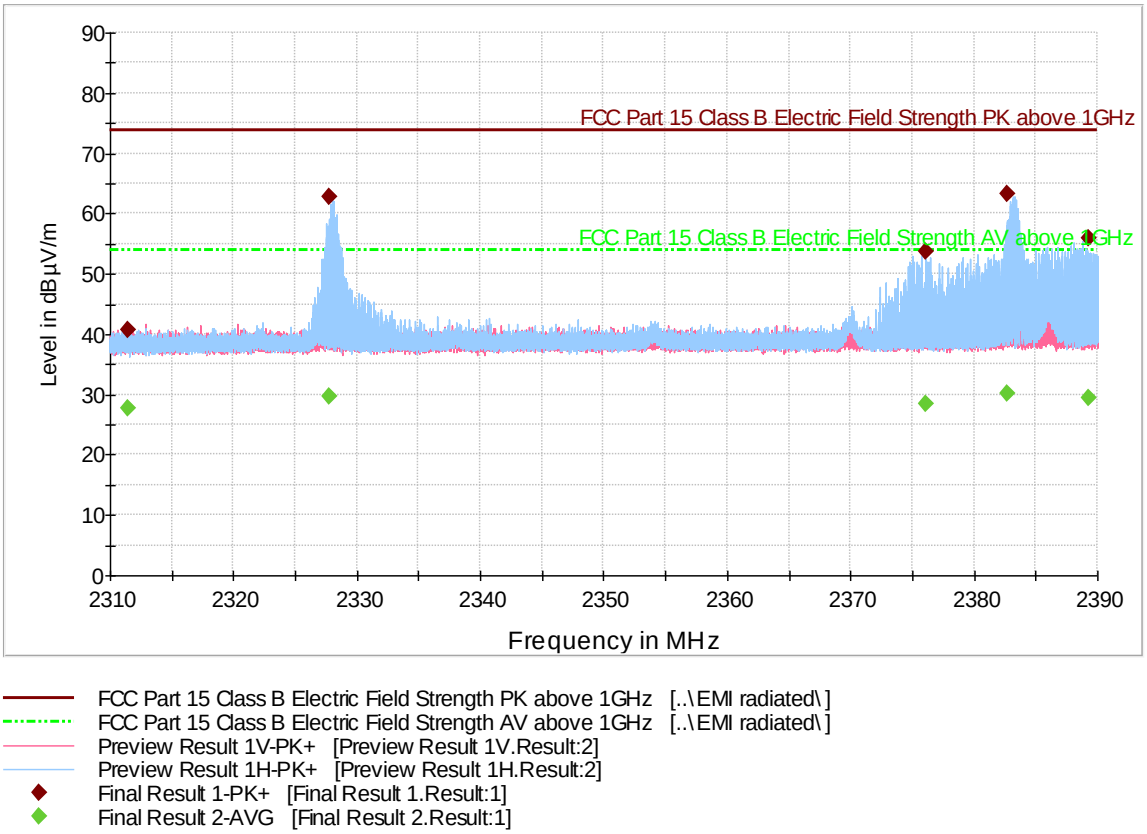
2.5.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dBµV) @ 2400 MHz			53.9
Correction Factor (dB)	Asset# 1153 (cable)	0.3	-0.4
	Asset# 8628 (preamplifier)	-36.5	
	Asset# 7575 (antenna)	32.7	
Reported Max Peak Final Measurement (dBµV/m) @ 2400 MHz			**53.5**

2.5.9 Test Results

See attached plots.

2.5.10 Test Results Restricted Band 2310MHz to 2390MHz (Bluetooth LE Low Channel)



Peak Data

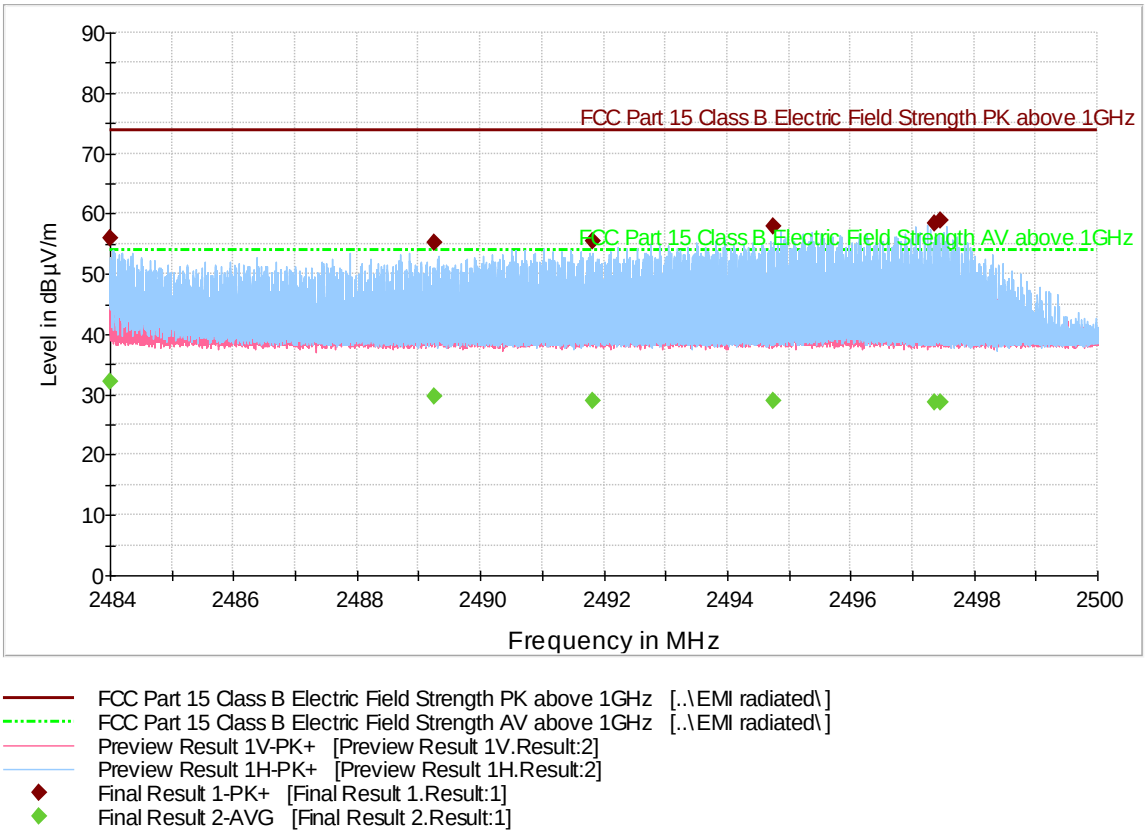
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2311.456000	40.8	1000.0	1000.000	398.0	V	281.0	-0.9	33.1	73.9
2327.752000	62.8	1000.0	1000.000	410.0	H	306.0	-0.8	11.1	73.9
2376.032000	53.7	1000.0	1000.000	400.0	H	300.0	-0.5	20.2	73.9
2382.698667	63.3	1000.0	1000.000	400.0	H	295.0	-0.5	10.6	73.9
2389.269333	55.9	1000.0	1000.000	400.0	H	294.0	-0.4	18.0	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)
2311.456000	27.7	1000.0	1000.000	398.0	V	281.0	-0.9	26.2	53.9
2327.752000	29.8	1000.0	1000.000	410.0	H	306.0	-0.8	24.1	53.9
2376.032000	28.4	1000.0	1000.000	400.0	H	300.0	-0.5	25.5	53.9
2382.698667	30.2	1000.0	1000.000	400.0	H	295.0	-0.5	23.7	53.9
2389.269333	29.5	1000.0	1000.000	400.0	H	294.0	-0.4	24.4	53.9

Test Notes: 2.4GHz notch filter removed for this test.

2.5.11 Test Results Restricted Band 2483.5MHz to 2500MHz (Bluetooth LE High Channel)



Peak Data

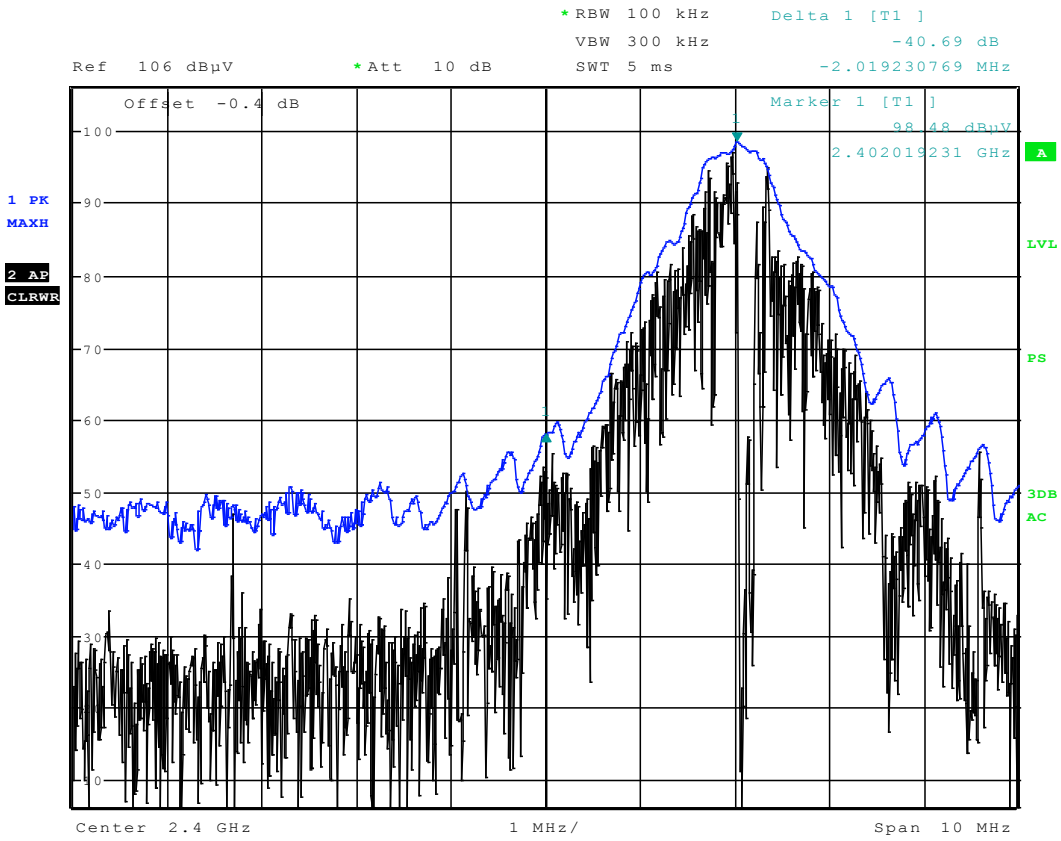
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2484.000000	55.8	1000.0	1000.000	378.0	H	323.0	0.1	18.1	73.9
2489.242667	55.1	1000.0	1000.000	364.0	H	324.0	0.1	18.8	73.9
2491.817067	55.4	1000.0	1000.000	324.0	H	320.0	0.1	18.5	73.9
2494.753067	57.9	1000.0	1000.000	323.0	H	320.0	0.2	16.0	73.9
2497.349333	58.3	1000.0	1000.000	324.0	H	324.0	0.2	15.6	73.9
2497.448000	58.8	1000.0	1000.000	366.0	H	324.0	0.2	15.1	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)
2484.000000	32.2	1000.0	1000.000	378.0	H	323.0	0.1	21.7	53.9
2489.242667	29.6	1000.0	1000.000	364.0	H	324.0	0.1	24.3	53.9
2491.817067	28.9	1000.0	1000.000	324.0	H	320.0	0.1	25.0	53.9
2494.753067	29.0	1000.0	1000.000	323.0	H	320.0	0.2	24.9	53.9
2497.349333	28.6	1000.0	1000.000	324.0	H	324.0	0.2	25.3	53.9
2497.448000	28.8	1000.0	1000.000	366.0	H	324.0	0.2	25.1	53.9

Test Notes: 2.4GHz notch filter removed for this test.

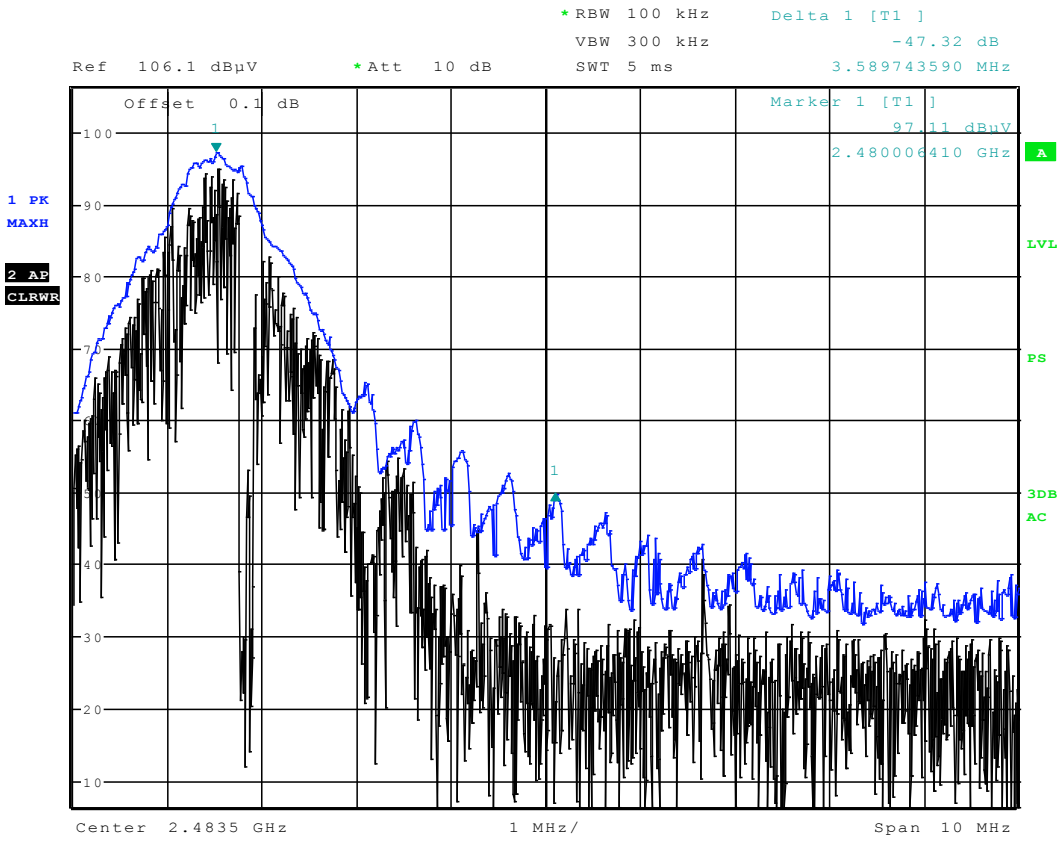
2.5.12 Test Results Lower Band Edge (Radiated - Low Channel using 100 kHz RBW)



Date: 22.DEC.2014 15:12:49

Test Notes: Carrier frequency (Low Channel) was maximized for this test. Correction factor of -0.4dB is from the cable, antenna and preamp used. Limit for this test is 20dBc.

2.5.13 Test Results Upper Band Edge (Radiated – High Channel in Restricted Band)



Date: 22.DEC.2014 15:42:51

Test Notes: Carrier frequency (High Channel) was maximized for this test. Correction factor of 0.1dB is from the cable, antenna and preamp used. Limit for this test is 20dBc.

2.6 POWER SPECTRAL DENSITY

2.6.1 Specification Reference

Part 15 Subpart C §15.247(e)

2.6.2 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.

2.6.3 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

December 22, 2015 / KAM

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	24.8°C
Relative Humidity	44.1%
ATM Pressure	99.1 kPa

2.6.7 Additional Observations

- This is a radiated test using PKPSD (peak PSD method).
- Test procedure is per Section 10.2 of KDB 558074 DO1 DTS Meas Guidance v03r02 (June 05, 2014).
- Offset used is the correction factor for the radiated hardware set-up (antenna correction factor, pre-amp gain and cable losses).
- Detector is Peak.
- Trace mode is Max Hold.
- Sweep time is Auto Couple.
- Span is wide enough to capture the channel transmission or 1.5 times the DTS bandwidth.
- EUT complies using 100 kHz RBW.

2.6.8 Sample Computations

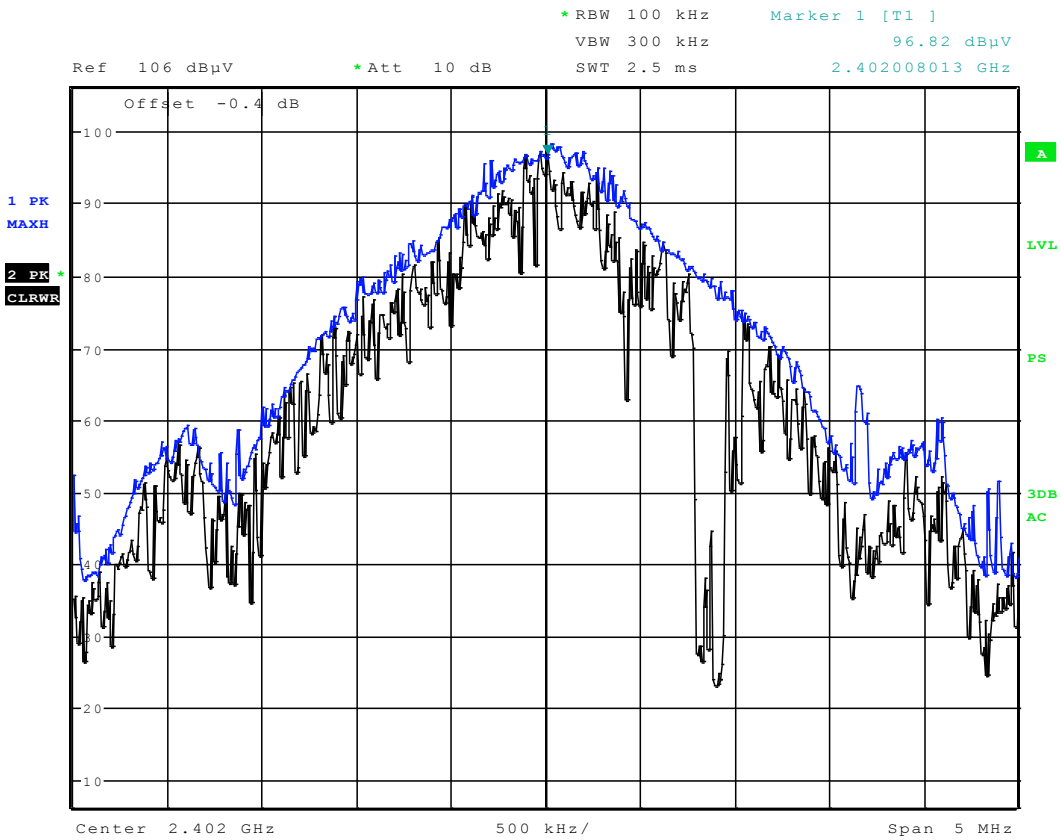
Using the formula: E=EIRP-20log D + 104.8 (from Section 12.2.2 of KDB 558074), compute for EIRP level:

- EIRP = 97.80+20log(3 meters) -104.8
- EIRP = 2.54 dBm

2.6.9 Test Results Summary

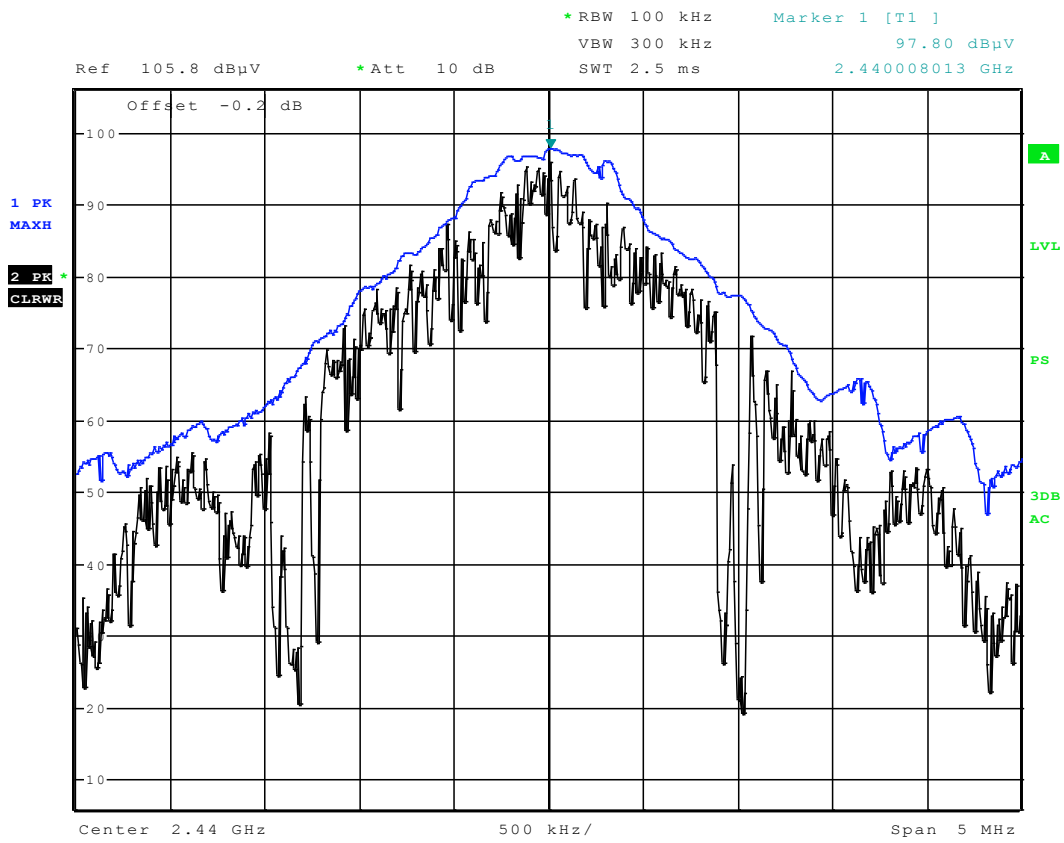
Mode	Channel (MHz)	Marker Reading (dBµV/m @ 3.0 meters)	EIRP (dBm)	Limit (dBm)	Compliance
GFSK @ 1Mbps	2402	96.82	1.56	8	Complies
	2440	97.80	2.54	8	Complies
	2480	97.13	1.87	8	Complies

2.6.10 Test Results Plots



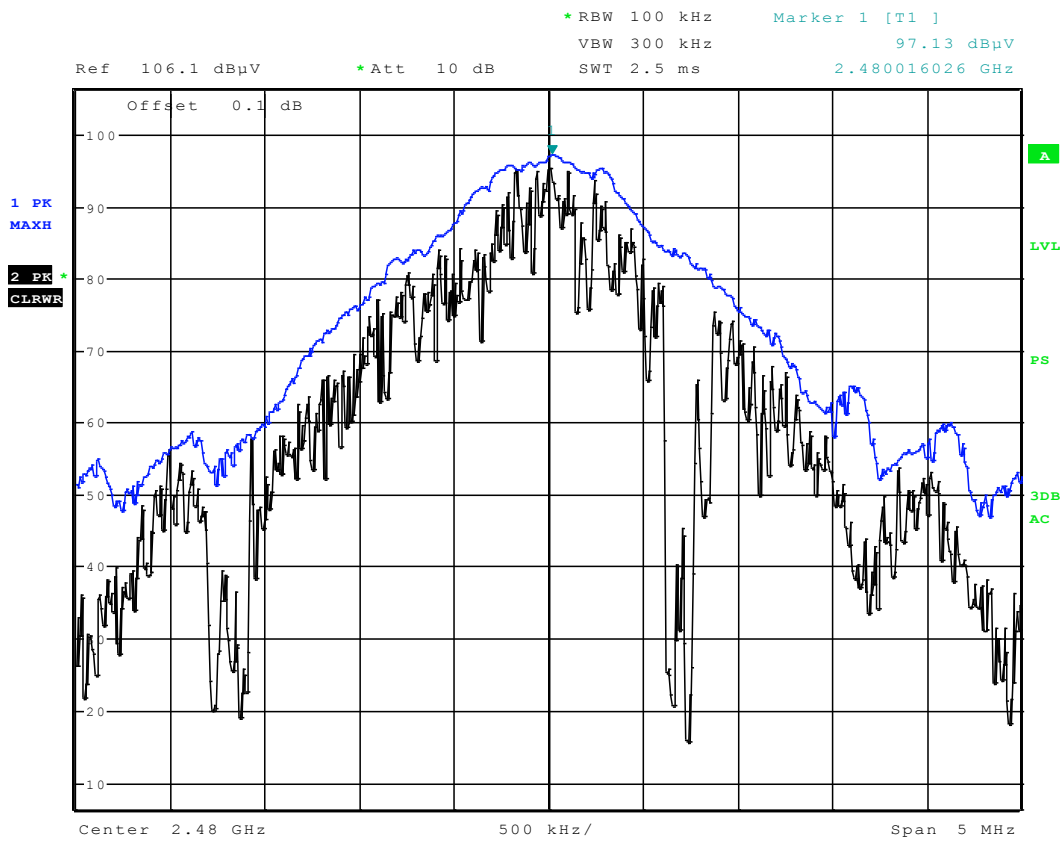
Date: 22.DEC.2014 15:22:12

Low Channel – 2402 MHz



Date: 22.DEC.2014 15:30:40

Mid Channel – 2440 MHz



High Channel – 2480 MHz

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 Test Setup						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/30/14	01/30/16
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	04/08/14	04/08/15
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	04/03/14	04/03/15
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	08/29/14	08/29/15
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/17/14	03/17/15
1016	Pre-amplifier	PAM-0202	187	PAM	12/10/14	12/10/15
1150	Horn antenna	3160-09	012054-004	ETS	04/26/13	04/26/15
1151	Pre-amplifier	TS-PR26	100026	Rhode & Schwarz	05/02/13	05/02/15
Miscellaneous						
7560	Barometer/Temperature /Humidity Transmitter	iBTHX-W	1240476	Omega	01/30/14	01/30/15
	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 Emission Measurements (Below 1GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2	Cables	Rectangular	0.50	0.29	0.08
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.75	0.43	0.19
5	Site	Rectangular	3.89	2.25	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	2.41
				Coverage Factor (k):	2
				Expanded Uncertainty:	4.82

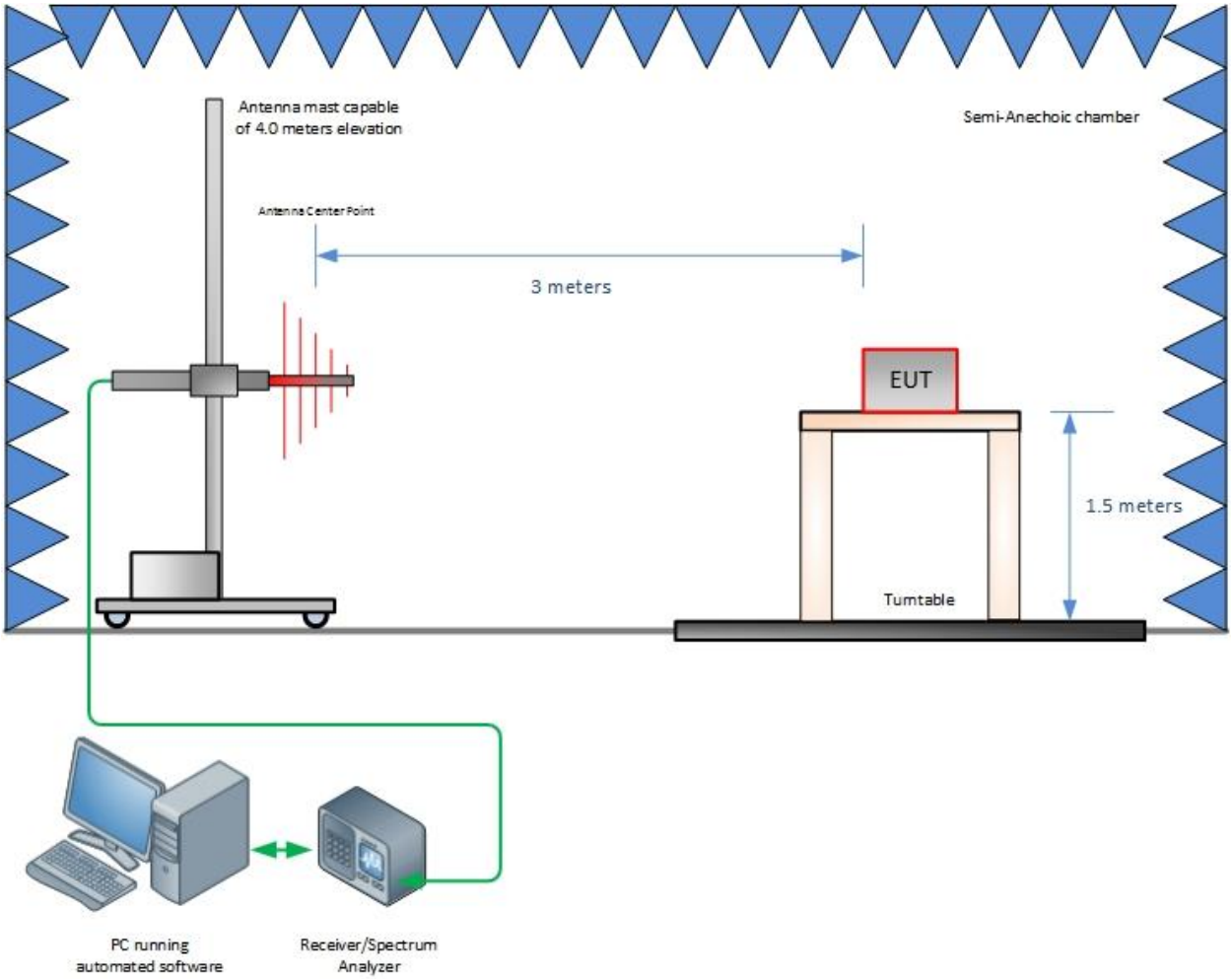
3.2.2 Radiated Emission Measurements (Above 1GHz)

	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	3.89	2.25	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	2.40
				Coverage Factor (k):	2
				Expanded Uncertainty:	4.81

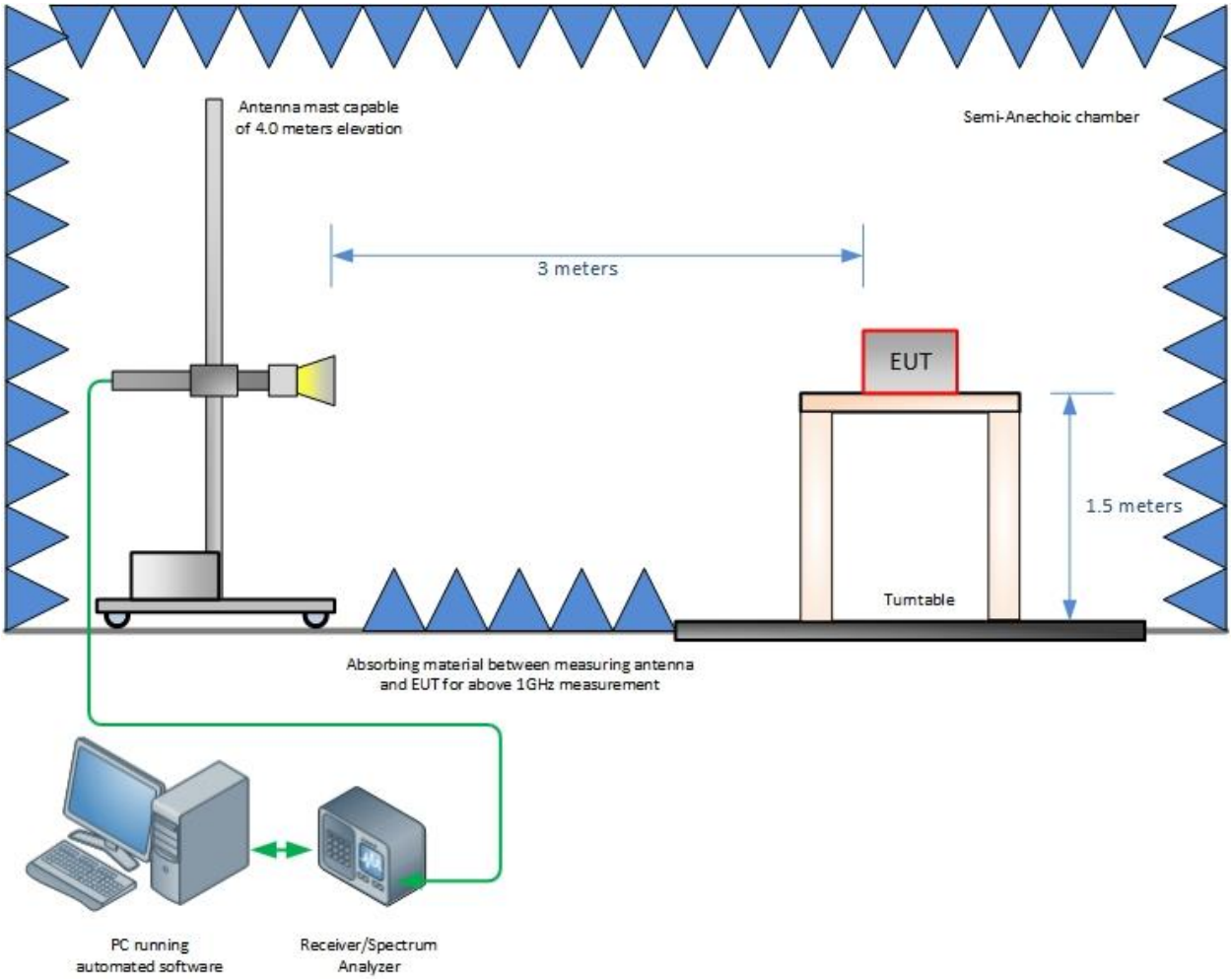
SECTION 4

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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