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Report On

Application for Grant of Equipment Authorization of the
Blast Motion, Inc.
Blast B0113A Wireless Motion Sensor

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

Report No. SC1307983 **August 2013**

REPORT ON	Radio Testing of the Blast Motion, Inc. Wireless Motion Sensor
TEST REPORT NUMBER	SC1307983
PREPARED FOR	Blast Motion, Inc. 2281 Las Palmas Drive, Suite 101 Carlsbad, CA 92011
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APPROVED BY	Chip R. Fleury **Name** Authorized Signatory
DATED	August 21, 2013

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

Revision History

SC1307983 Blast Motion, Inc. Blast B0113A Wireless Motion Sensor					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
08/20/13	Initial Release				Ferdinand Custodio

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SECTION 1

REPORT SUMMARY

Radio Testing of the
Blast Motion, Inc.
Wireless Motion Sensor

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1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Blast Motion, Inc. Wireless Motion Sensor 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	Blast Motion, Inc.
Model Number(s)	B0113A
FCC ID Number	SN2-B0113A
IC Number	11003A-B0113A
Serial Number(s)	N/A
Number of Samples Tested	3
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.247 (October 1, 2012). • 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).
Start of Test	August 19, 2013
Finish of Test	August 20, 2013
Name of Engineer(s)	Ferdinand S. Custodio
Related Document(s)	• KDB 412172 Guidelines for Determining the Effective Radiated Power (ERP) and Equivalent Isotropically Radiated Power (EIRP) of a RF Transmitting System (November 30, 2010). • 558074 D01 DTS Meas Guidance v03r01 (Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, April 09, 2013) • ANSI C63.10-2009 (American National Standard for Testing Unlicensed Wireless Devices. • 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	
2.2	§15.207(a)	RSS-Gen 7.2.4	Conducted Emissions	N/A*	
2.3		RSS-Gen 4.6.1	99% Emission Bandwidth	Compliant	
2.4	§15.247(a)(2)	RSS-210 A8.2(a)	Minimum 6 dB RF Bandwidth	Compliant	
2.5	§15.247(d)	RSS-210 A8.5	Out-of-Band Emissions - Conducted	N/A**	
2.6	§15.247(d)	RSS-210 A8.5	Band-edge Compliance of RF Conducted Emissions	N/A***	
2.7	§15.247(d)	RSS-210 A8.5	Spurious Radiated Emissions	Compliant	
2.7		RSS-Gen 4.10	Receiver Spurious Emissions	Compliant	
2.8	§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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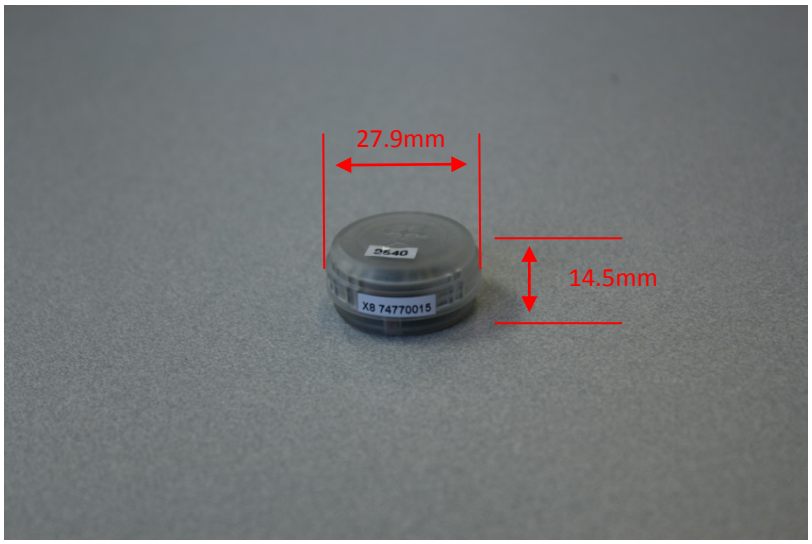
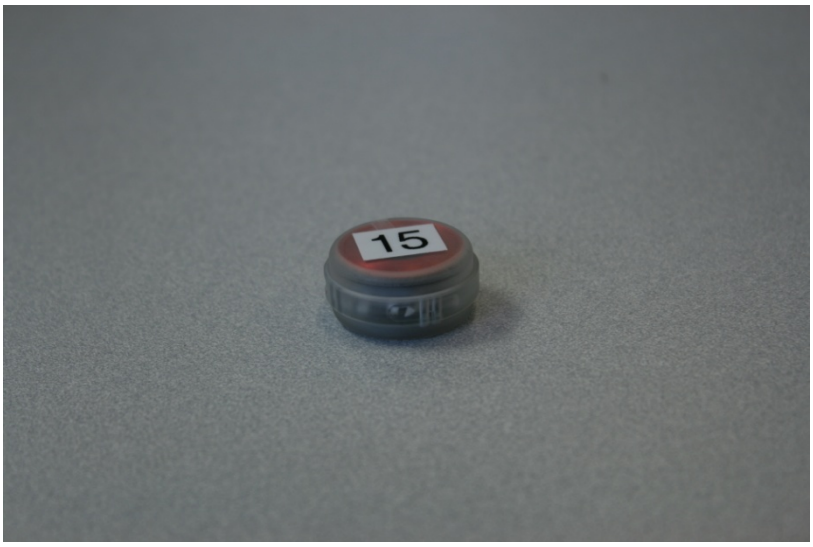
1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Blast Motion, Inc. Wireless Motion Sensor as shown in the photograph below. The EUT is a compact inertial sensor capable of tracking motion in three-dimensional space. The EUT typically communicate with a custom mobile app using Bluetooth LE technology.





Equipment Under Test

1.3.2 EUT General Description

EUT Description	Wireless Motion Sensor
Model Name	Blast
Model Number(s)	B0113A
Rated Voltage	2.8 – 4.2VDC (Rechargeable Lithium Ion Battery)
Output Power	3.42 dBm (2.2mW - maximum peak conducted output power)
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 (Advertising Channel) Mid Channel 2440MHz (Data Channel) High Channel 2480MHz (Advertising Channel)
Antenna Type (used during evaluation)	Integral (Complies with Part 15.203 requirements)

1.3.3 Antenna Details

Model	BT Antenna Part No. 1001312
Manufacturer	ethertronics®
Antenna Type	Embedded Bluetooth™ Ceramic Antenna
Antenna Gain	1.72 dBi
EUT Antenna Connector	N/A (surface mount).
Maximum Dimensions	2.0 x 1.2mm

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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 placed over the support wireless charging pad to sustain continuous transmission @ 100% duty cycle. This is to prevent the EUT from reaching the cut-off voltage of 2.8VDC.

1.4.2 EUT Exercise Software

A test firmware was loaded to the EUT which enable cycling of Low, Mid and High channels @ 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
LG	Wireless Charger	Model: WCP-300 SN: 304HYDT001690
Belkin	USB Extension	1.8 meters, shielded, Type A connector
Novatel Wireless	AC Power Supply (USB 5VDC)	Model: SSW-2423 SN: N/A

1.4.4 Worst Case Configuration

For radiated measurements X, Y and Z orientations were verified. For Z orientation, the EUT was rotated 90° from Y position. Identical result obtained between Y and Z orientations. Verification performed using Y or Z orientation.

"X" Configuration

"Y" Configuration

"Z" Configuration

Worst case channel used is Mid Channel (Channel 17 2440 MHz). This is based from Peak Output Power test results under Section 2.1 of this test report.

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1.4.5 Simplified Test Configuration Diagram

EUT placed over a support wireless charger during testing to ensure the internal battery can support the continuous transmission @ 100% duty cycle.

Support iPad Mini used to program the EUT using BT LE technology to transmit continuously @ 100% duty cycle (iPad removed during verification testing of the EUT) using custom test app.

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

1.8.1 FCC – Registration No.: US5296

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 §2.498 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US5296.

1.8.2 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
Blast Motion, Inc.
Wireless Motion Sensor

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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

August 20,2013/FSC

2.1.5 Test Equipment Used

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

2.1.6 Environmental Conditions

Ambient Temperature	25.8°C
Relative Humidity	48.5%
ATM Pressure	98.9 kPa

2.1.7 Additional Observations

- This is a radiated test. Fundamental field strength measurements are taken from test results presented under Section 2.7 (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, April 9, 2013).
- 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).
- The EIRP levels are converted to equivalent conducted output power using the formula: $EIRP=P_T + G_T - L_C$ (from Section 1.3.2 of KDB 412172 v01).

- Sample computations can be found under section 2.8.8 of this test report...

2.1.8 Test Results

Mode	Channel	Peak Reading (dBµV/m @ 3.0 meters)	EIRP (dBm)	Peak Output Power (dBm)	Limit (dBm)	Compliance
GFSK @ 1Mbps	37 (2402 MHz)	93.50	-1.76	-3.48	30	Complies
	17 (2440 MHz)	100.4	5.14	3.42	30	Complies
	39 (2480 MHz)	92.4	-2.86	-4.58	30	Complies

2.2 CONDUCTED EMISSIONS

2.2.1 Specification Reference

Part 15 Subpart C §15.207(a)

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 battery operated only.

2.3 99% EMISSION BANDWIDTH

2.3.1 Specification Reference

RSS-Gen Clause 4.6.1

2.3.2 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.

2.3.3 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

August 19,2013/FSC

2.3.5 Test Equipment Used

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

2.3.6 Environmental Conditions

Ambient Temperature	25.1°C
Relative Humidity	49.4%
ATM Pressure	98.8 kPa

2.3.7 Additional Observations

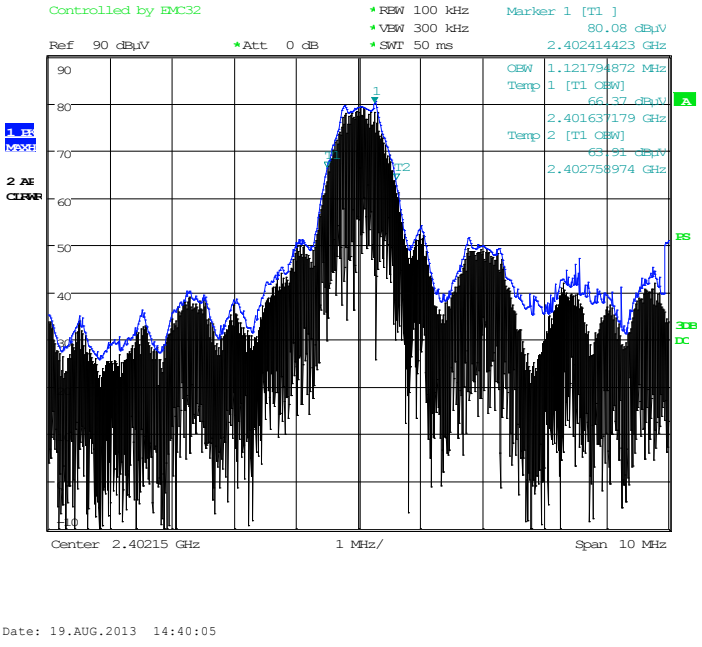
- This is a radiated test.
- Span is wide enough to capture the channel transmission.
- RBW is 1% of the span
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.

- 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.

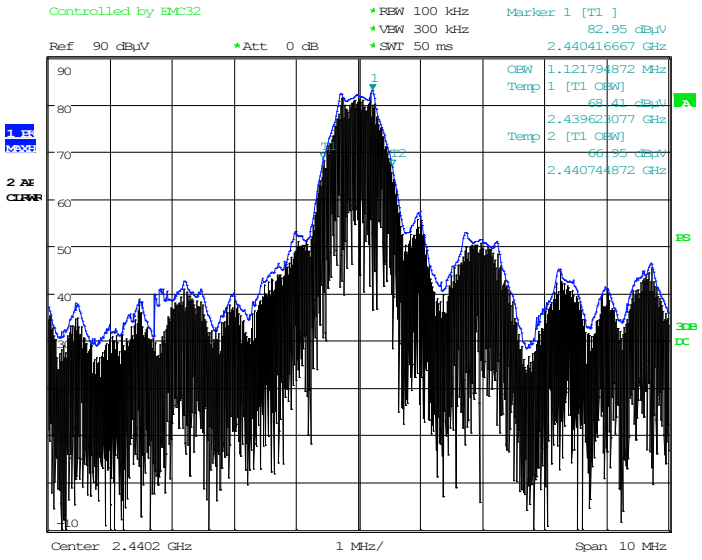
2.3.8 Test Results (For reporting purposes only)

Modulation	Channel	Measured 99% Bandwidth (MHz)
GFSK @ 1Mbps	37 (2402 MHz)	1.122
	17 (2440 MHz)	1.122
	39 (2480 MHz)	1.106

2.3.9 Test Results Plots



Low Channel



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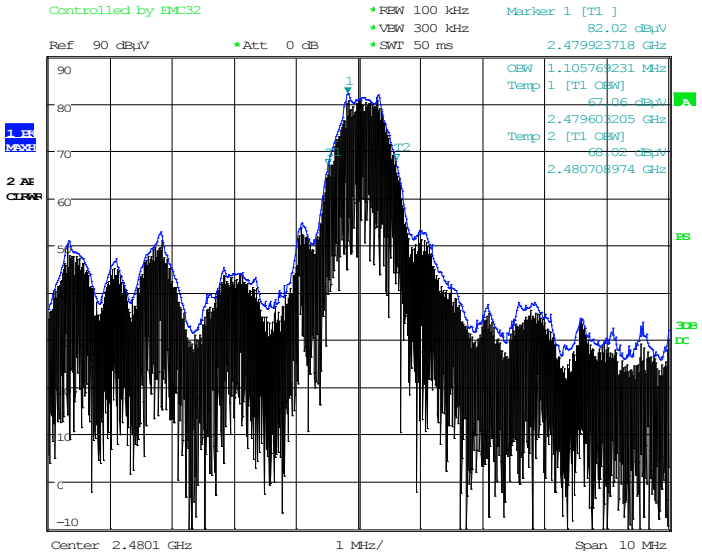
Mid Channel



Date: 19.AUG.2013 14:47:00

High Channel

2.4 MINIMUM 6 dB RF BANDWIDTH

2.4.1 Specification Reference

Part 15 Subpart C §15.247(a)(2)

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

August 19,2013/FSC

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

Ambient Temperature	25.1°C
Relative Humidity	49.4%
ATM Pressure	98.8 kPa

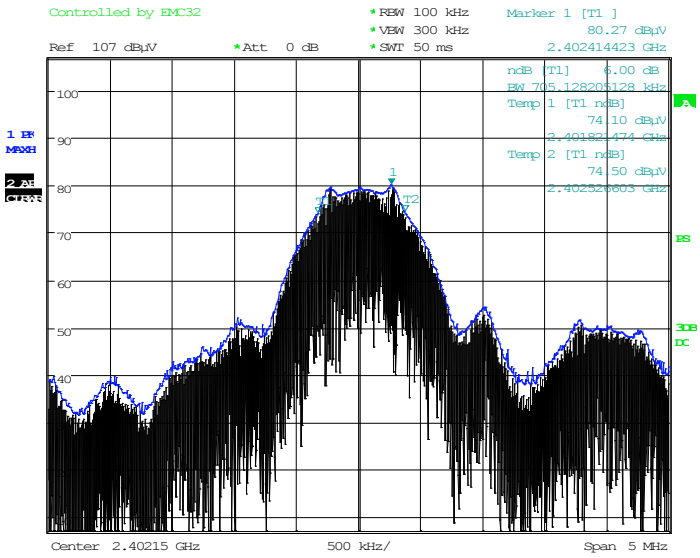
2.4.7 Additional Observations

- This is a radiated test as per DTS (6-dB) Bandwidth guidance of KDB 558074 (Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, April 9, 2013).
- 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.

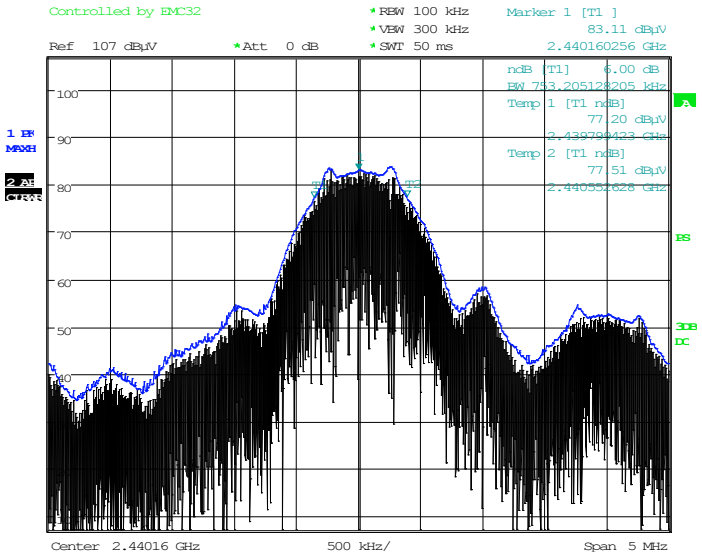
2.4.8 Test Results

Modulation	Channel	Measured 6dB Bandwidth (kHz)	Limit (kHz)
GFSK @ 1Mbps	37 (2402 MHz)	705.128	>500
	17 (2440 MHz)	753.253	
	39 (2480 MHz)	705.128	

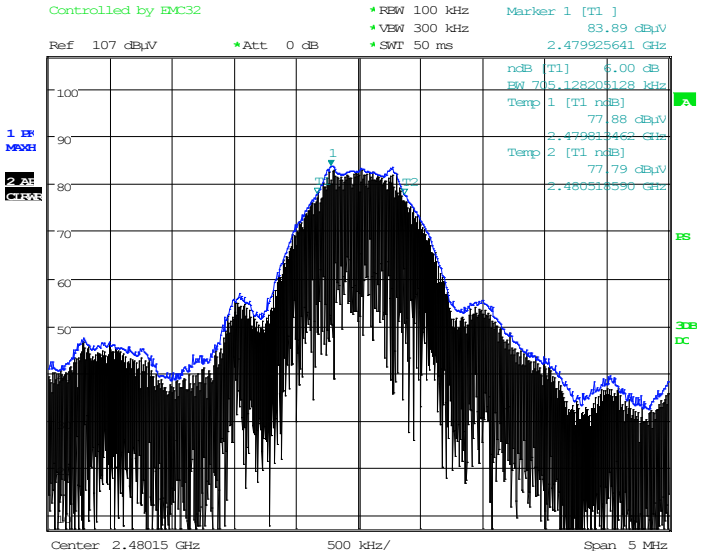
2.4.9 Test Results Plots



Low Channel



Mid Channel



High Channel

2.5 OUT-OF-BAND EMISSIONS - CONDUCTED

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

Not performed. Spurious emissions verifications performed under Section 2.7 of this test report.

2.6 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

2.6.1 Specification Reference

Part 15 Subpart C §15.247(d)

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

Not performed. Band-edges verifications performed under Section 2.7 of this test report.

2.7 SPURIOUS RADIATED EMISSIONS

2.7.1 Specification Reference

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

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)).

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.

2.7.3 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

August 20,2013/FSC

2.7.5 Test Equipment Used

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

2.7.6 Environmental Conditions

Ambient Temperature	25.8°C
Relative Humidity	48.5%
ATM Pressure	98.9 kPa

2.7.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic.
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d).
- Test procedure is consistent with those specified under C63.10.
- 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.

2.7.8 Sample Computation (Radiated Emission)

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

2.7.9 Test Results

See attached plots.

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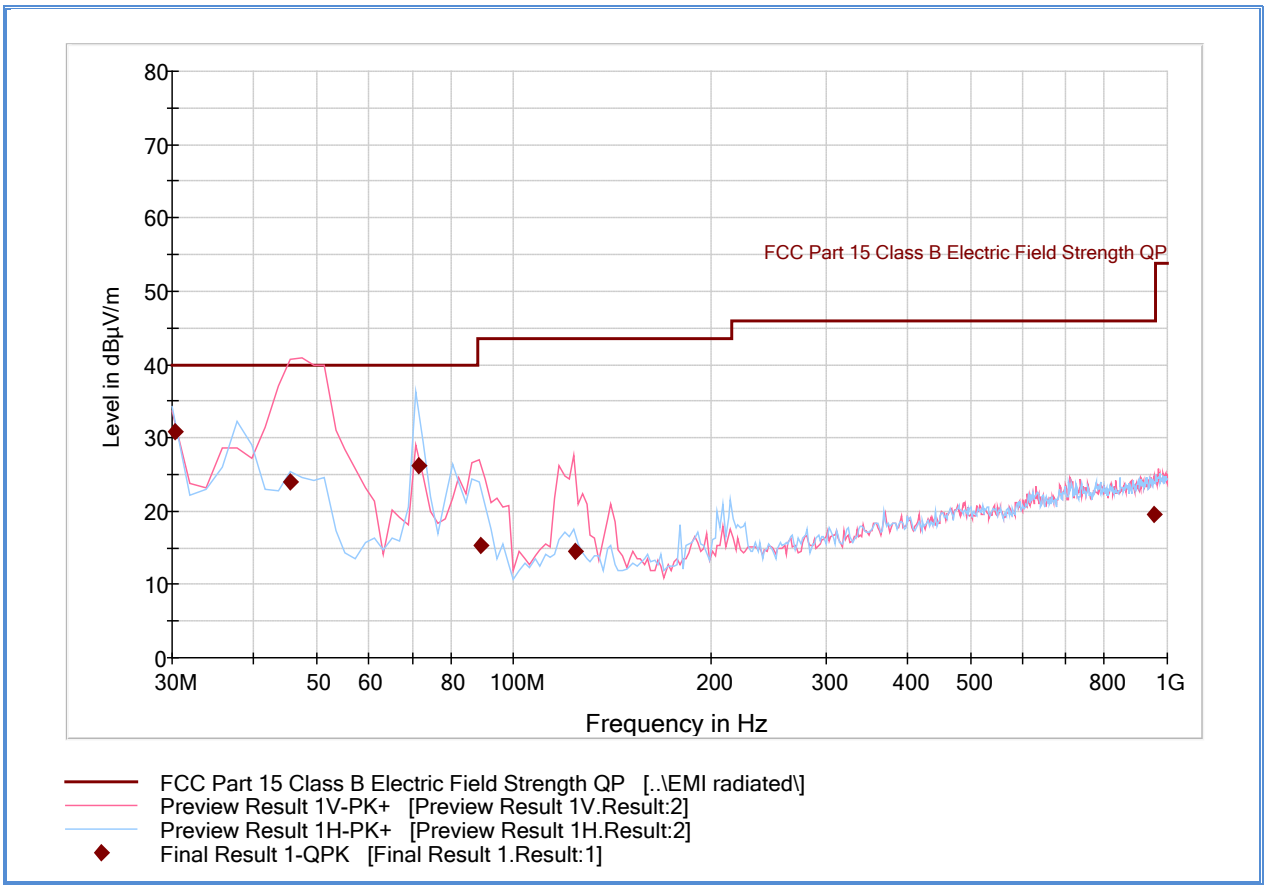
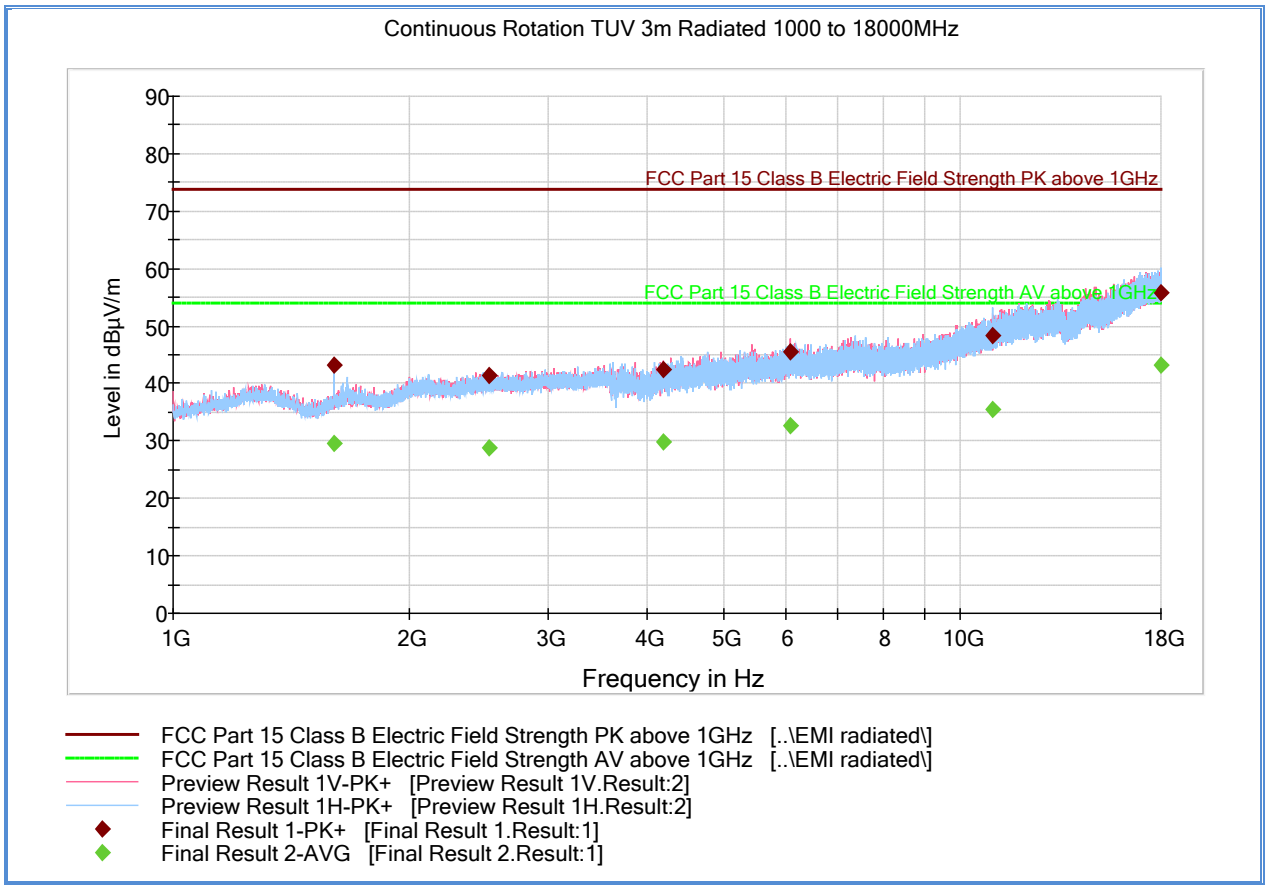
2.7.10 Test Results Below 1GHz (Receive Mode)



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	30.8	1000.0	120.000	128.0	H	140.0	-10.9	9.2	40.0
45.494990	23.9	1000.0	120.000	100.0	V	134.0	-18.1	16.1	40.0
71.541643	26.3	1000.0	120.000	200.0	H	-5.0	-21.7	13.7	40.0
88.932745	15.4	1000.0	120.000	400.0	V	339.0	-20.2	28.1	43.5
124.466613	14.5	1000.0	120.000	100.0	V	-6.0	-19.6	29.0	43.5
953.266693	19.6	1000.0	120.000	172.0	V	346.0	0.8	26.4	46.0

2.7.11 Test Results Above 1GHz (Receive Mode)



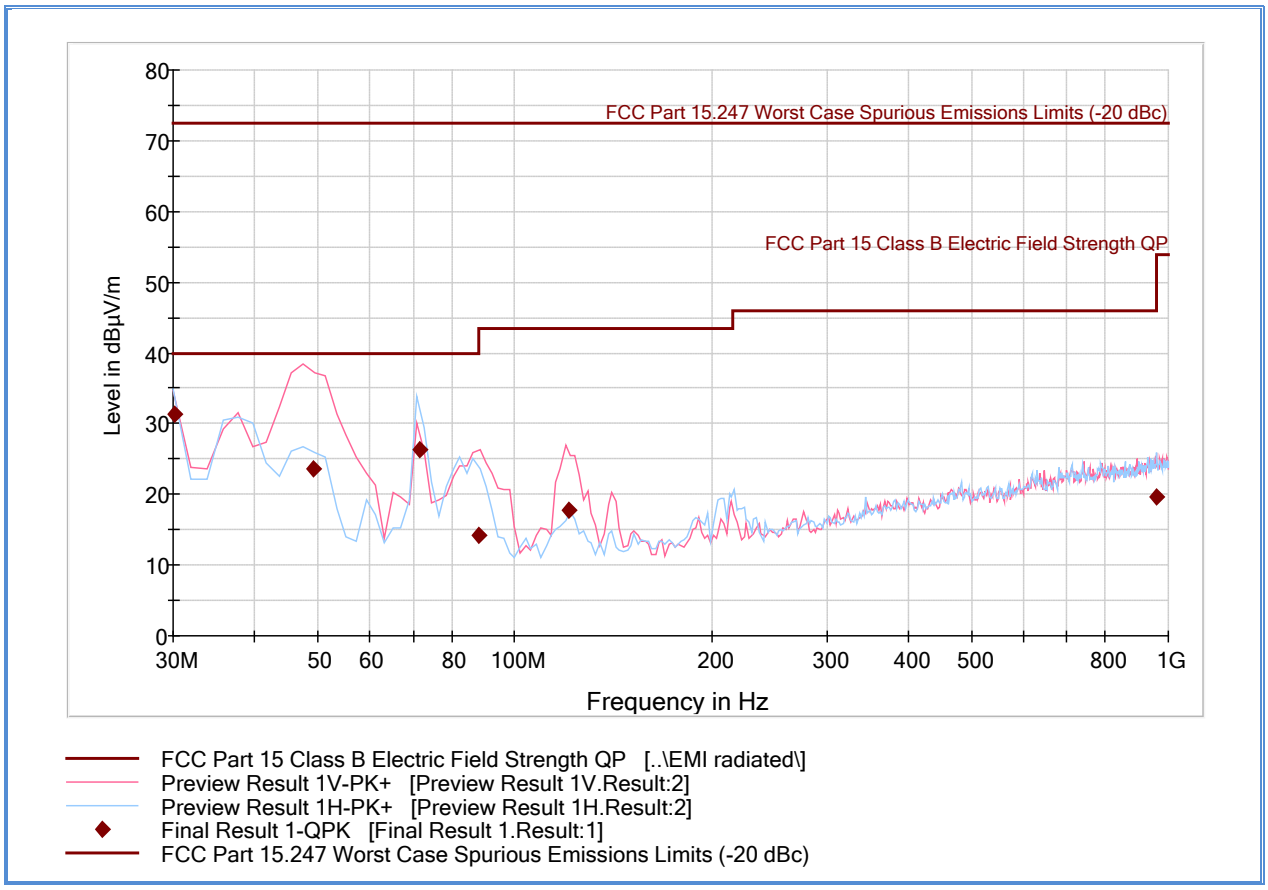
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1599.733333	43.3	1000.0	1000.000	293.2	H	20.0	-4.3	30.6	73.9
2525.100000	41.5	1000.0	1000.000	186.4	V	9.0	0.0	32.4	73.9
4199.633333	42.5	1000.0	1000.000	149.5	V	3.0	3.8	31.4	73.9
6088.633333	45.5	1000.0	1000.000	300.6	V	4.0	8.0	28.4	73.9
10982.53333	48.3	1000.0	1000.000	280.2	H	17.0	14.5	25.6	73.9
17970.33333	55.7	1000.0	1000.000	117.6	H	16.0	22.6	18.2	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)
1599.733333	29.6	1000.0	1000.000	293.2	H	20.0	-4.3	24.3	53.9
2525.100000	28.9	1000.0	1000.000	186.4	V	9.0	0.0	25.0	53.9
4199.633333	29.7	1000.0	1000.000	149.5	V	3.0	3.8	24.2	53.9
6088.633333	32.6	1000.0	1000.000	300.6	V	4.0	8.0	21.3	53.9
10982.53333	35.5	1000.0	1000.000	280.2	H	17.0	14.5	18.4	53.9
17970.33333	43.2	1000.0	1000.000	117.6	H	16.0	22.6	10.7	53.9

2.7.12 Test Results Below 1GHz (Mid Channel)

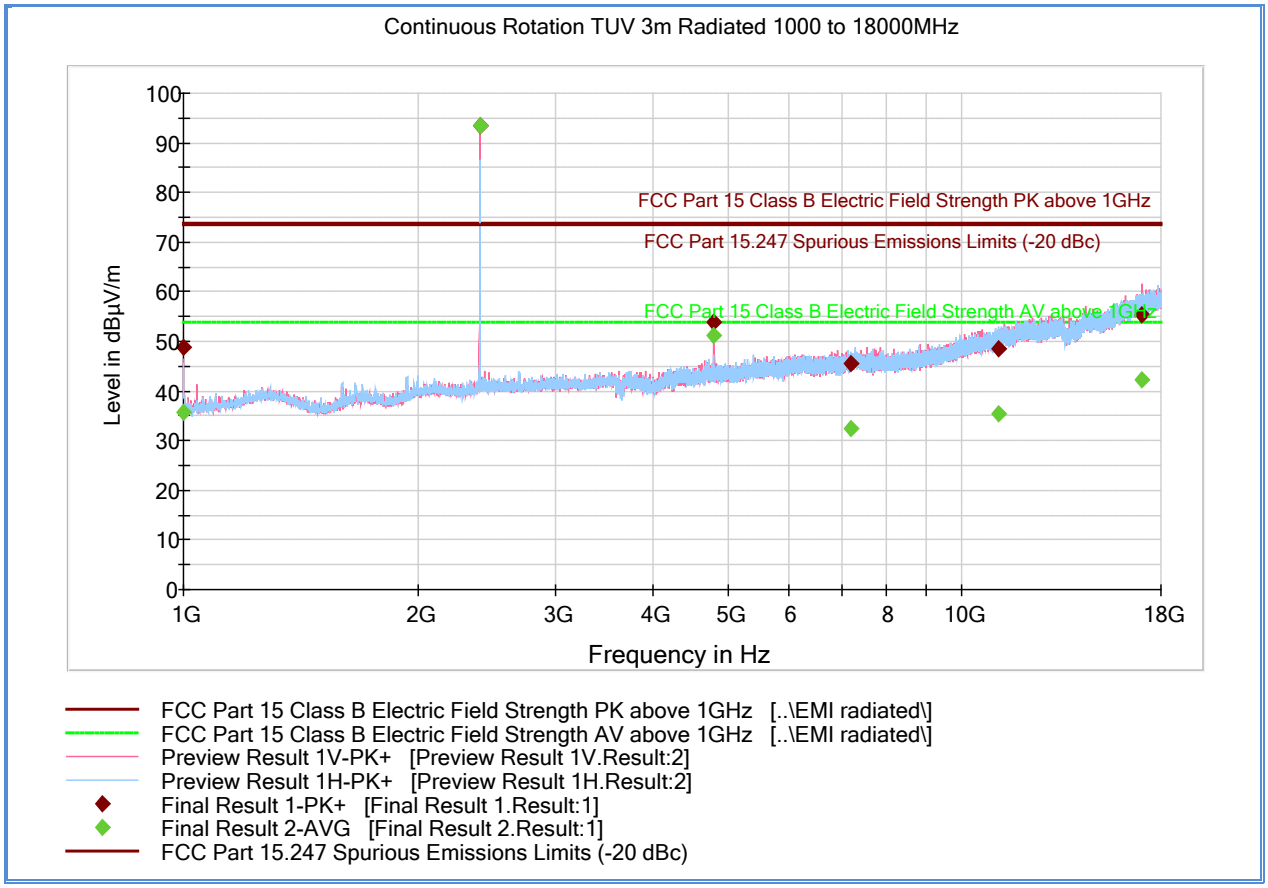


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.200000	31.4	1000.0	120.000	150.0	H	-15.0	-10.9	8.6	40.0
49.214990	23.6	1000.0	120.000	150.0	V	225.0	-19.0	16.4	40.0
71.541643	26.2	1000.0	120.000	200.0	H	-7.0	-21.7	13.8	40.0
87.932745	14.1	1000.0	120.000	400.0	V	342.0	-20.4	25.9	40.0
120.666613	17.8	1000.0	120.000	100.0	V	6.0	-19.4	25.7	43.5
958.098357	19.7	1000.0	120.000	100.0	H	126.0	0.9	26.3	46.0

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

2.7.13 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	48.9	1000.0	1000.000	198.4	V	331.0	-6.3	25.0	73.9
2402.133333	93.5	1000.0	1000.000	104.6	V	111.0	-0.4	-19.6	73.9
4804.233333	53.8	1000.0	1000.000	103.6	V	106.0	5.4	20.1	73.9
7206.333333	45.6	1000.0	1000.000	271.2	H	47.0	9.5	28.3	73.9
11116.333333	48.6	1000.0	1000.000	353.1	H	136.0	14.6	25.3	73.9
16990.966667	55.4	1000.0	1000.000	342.1	V	20.0	22.0	18.5	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	35.6	1000.0	1000.000	198.4	V	331.0	-6.3	18.3	53.9
2402.133333	93.5	1000.0	1000.000	104.6	V	111.0	-0.4	-39.6	53.9
4804.233333	51.2	1000.0	1000.000	103.6	V	106.0	5.4	2.7	53.9
7206.333333	32.5	1000.0	1000.000	271.2	H	47.0	9.5	21.4	53.9
11116.333333	35.4	1000.0	1000.000	353.1	H	136.0	14.6	18.5	53.9
16990.966667	42.4	1000.0	1000.000	342.1	V	20.0	22.0	11.5	53.9

Test Notes: 2402.0 MHz is part of fundamental measurement and not subjected to 15.209 and 15.205 limits. There are no emissions observed above 10GHz (noise floor measurements).

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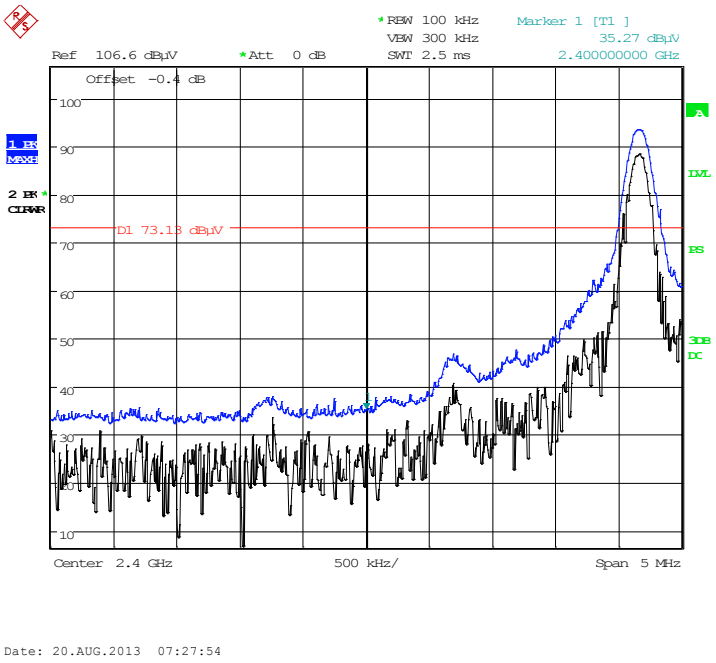
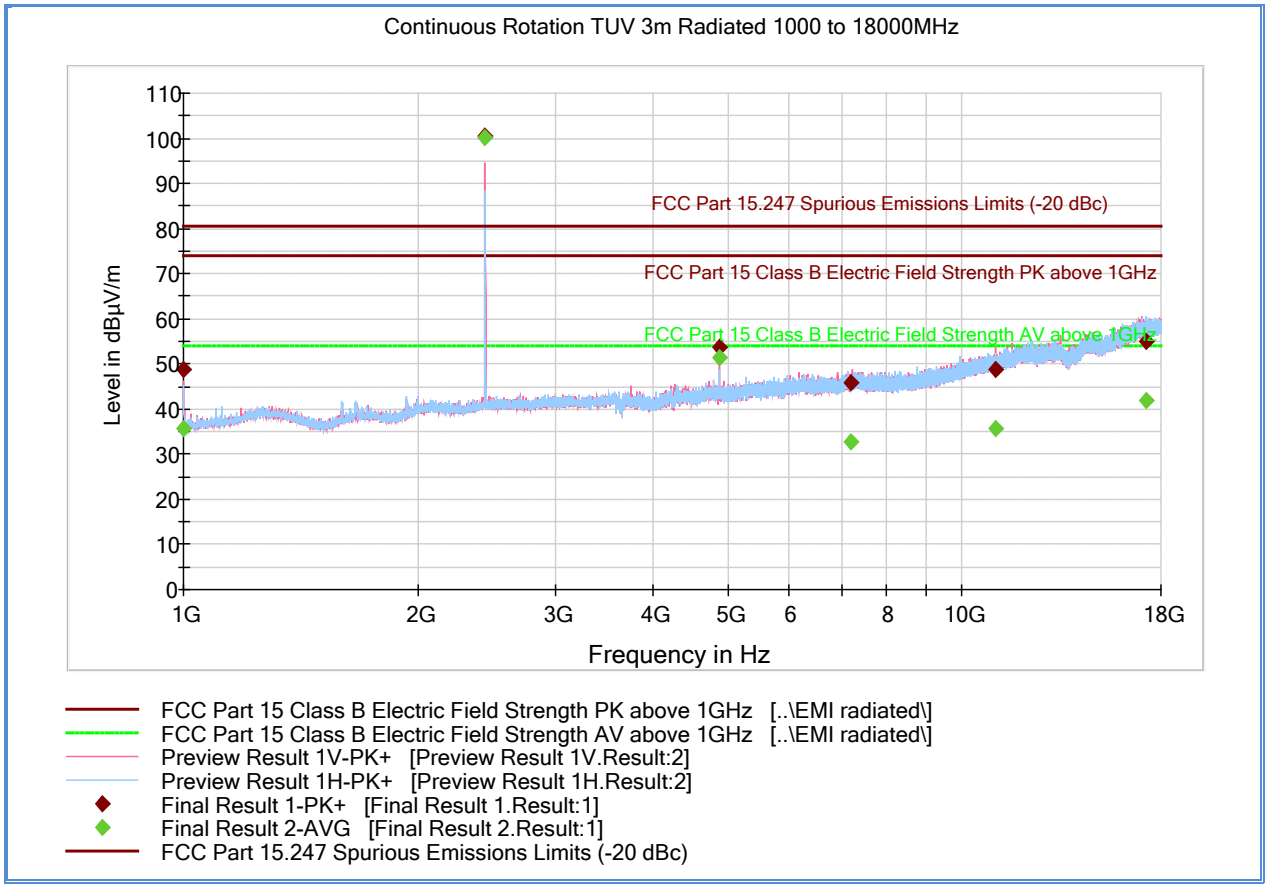
2.7.14 Test Results Lower Band Edge (Radiated - Low Channel using 100 kHz RBW)



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.

2.7.15 Test Results Above 1GHz (Mid Channel)



Peak Data

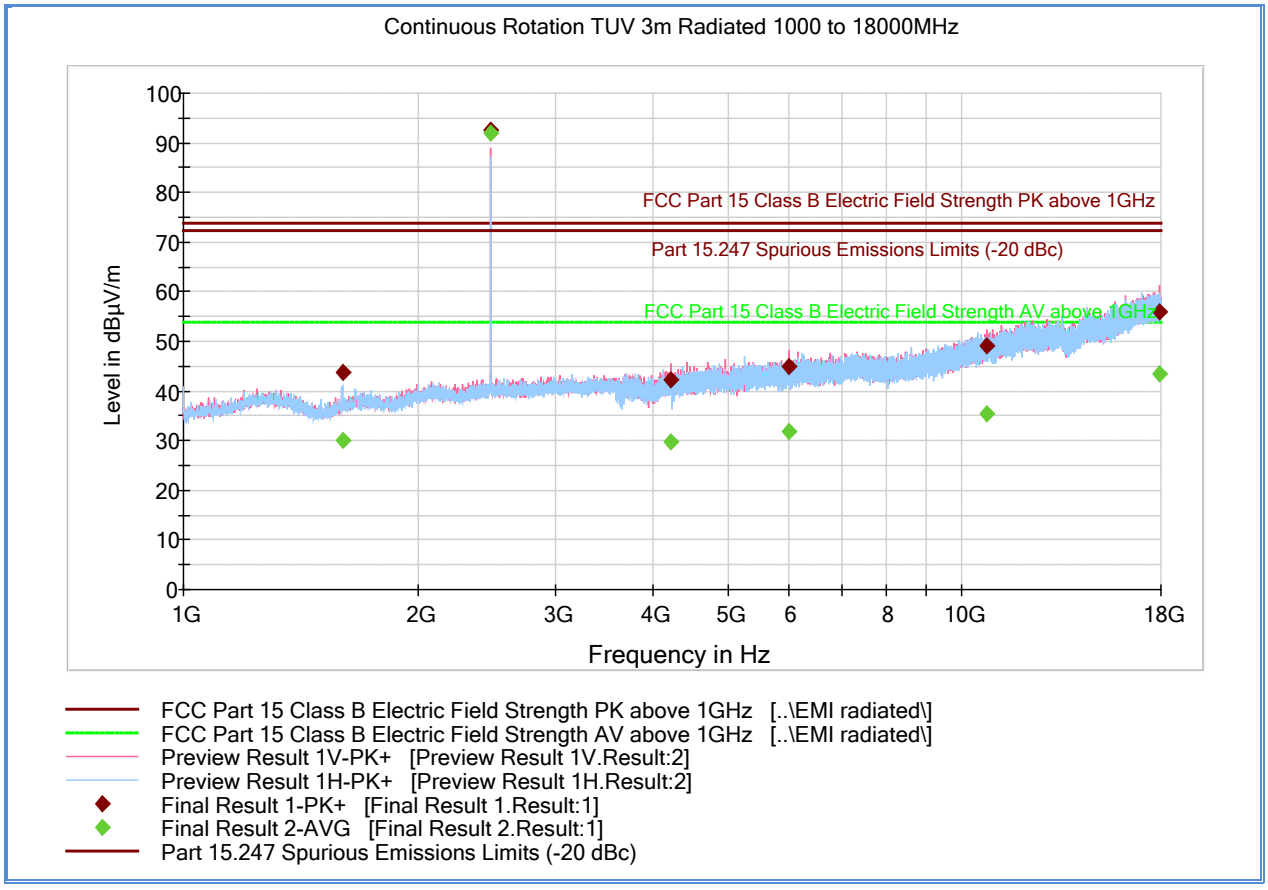
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	48.9	1000.	1000.000	198.4	V	55.0	-6.3	25.0	73.9
2440.100000	100.4	1000.	1000.000	103.6	V	105.0	-0.3	-26.5	73.9
4880.166667	53.8	1000.	1000.000	99.6	V	105.0	5.2	20.1	73.9
7207.500000	45.9	1000.	1000.000	217.4	V	253.0	9.5	28.0	73.9
11061.16666	48.8	1000.	1000.000	180.5	V	110.0	14.6	25.1	73.9
17216.13333	55.1	1000.	1000.000	115.6	H	124.0	21.6	18.8	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	35.8	1000.	1000.000	198.4	V	55.0	-6.3	18.1	53.9
2440.100000	100.2	1000.	1000.000	103.6	V	105.0	-0.3	-46.3	53.9
4880.166667	51.5	1000.	1000.000	99.6	V	105.0	5.2	2.4	53.9
7207.500000	32.8	1000.	1000.000	217.4	V	253.0	9.5	21.1	53.9
11061.166667	35.6	1000.	1000.000	180.5	V	110.0	14.6	18.3	53.9
17216.133333	42.0	1000.	1000.000	115.6	H	124.0	21.6	11.9	53.9

Test Notes: 2440MHz is part of fundamental measurement and not subjected to 15.209 and 15.205 limits. There are no emissions observed above 10GHz (noise floor measurements).

2.7.16 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)
1599.533333	43.7	1000.0	1000.000	304.2	H	344.0	-4.3	30.2	73.9
2480.333333	92.4	1000.0	1000.000	175.5	V	60.0	-0.2	-18.5	73.9
4227.533333	42.4	1000.0	1000.000	114.6	V	344.0	3.9	31.5	73.9
5993.500000	44.9	1000.0	1000.000	399.0	V	358.0	7.7	29.0	73.9
10760.066667	49.2	1000.0	1000.000	353.1	V	20.0	13.8	24.7	73.9
17896.733333	56.1	1000.0	1000.000	399.0	V	0.0	22.4	17.8	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)
1599.533333	30.0	1000.0	1000.000	304.2	H	344.0	-4.3	23.9	53.9
2480.333333	92.1	1000.0	1000.000	175.5	V	60.0	-0.2	-38.2	53.9
4227.533333	29.7	1000.0	1000.000	114.6	V	344.0	3.9	24.2	53.9
5993.500000	31.9	1000.0	1000.000	399.0	V	358.0	7.7	22.0	53.9
10760.066667	35.5	1000.0	1000.000	353.1	V	20.0	13.8	18.4	53.9
17896.733333	43.3	1000.0	1000.000	399.0	V	0.0	22.4	10.6	53.9

Test Notes: 2480 MHz is part of fundamental measurement and not subjected to 15.209 and 15.205 limits. There are no emissions observed above 10GHz (noise floor measurements).

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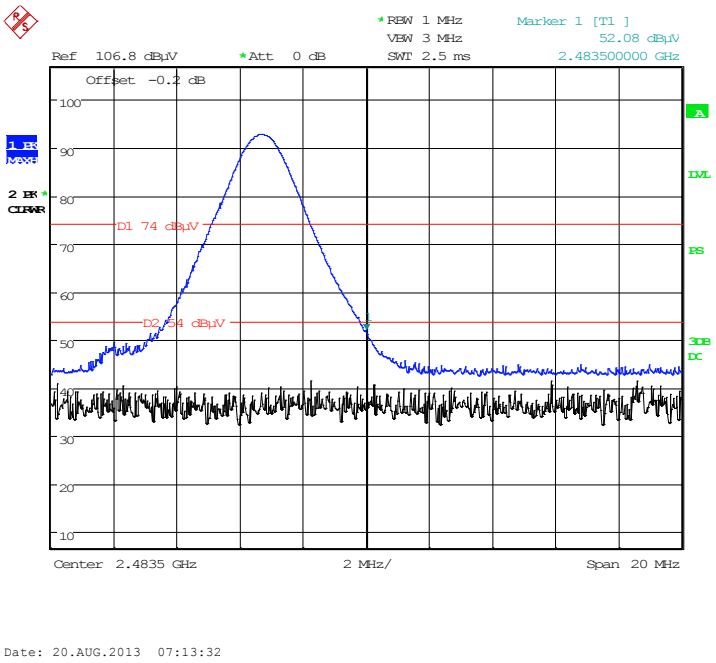
2.7.17 Test Results Upper Band Edge (Radiated – High Channel in Restricted Band)



Test Notes: Carrier frequency (High Channel) was maximized for this test. Correction factor of -0.2dB is from the cable, antenna and preamp used. Peak complies with Average limit therefore no Average measurement performed.

2.8 POWER SPECTRAL DENSITY

2.8.1 Specification Reference

Part 15 Subpart C §15.247(e)

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 / Default Test Configuration

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

August 20,2013/FSC

2.8.5 Test Equipment Used

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

2.8.6 Environmental Conditions

Ambient Temperature	25.8°C
Relative Humidity	48.5%
ATM Pressure	98.9 kPa

2.8.7 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 v03r01 (April 2013).
- 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.

2.8.8 Sample Computations

Using the formula: E=EIRP-20log D + 104.8 (from Section 12.2.2 of KDB 558074 v03r01), compute for EIRP level:

- EIRP = 93.79+20log(3 meters) -104.8
- EIRP = -1.47 dBm

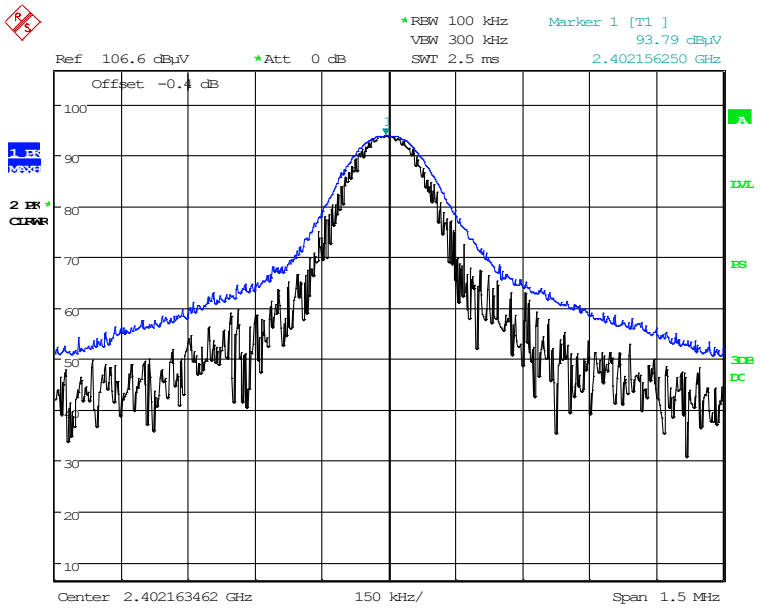
Using the formula: EIRP=P_T + G_T - L_C (from Section 1.3.2 of KDB 412172 v01), compute for P_T:

- P_T= -1.47-1.72dBi (antenna gain) + 0 (signal attenuation between antenna and transmitter)
  P_T= -3.19 dBm (compared to 8 dBm PSD limit)

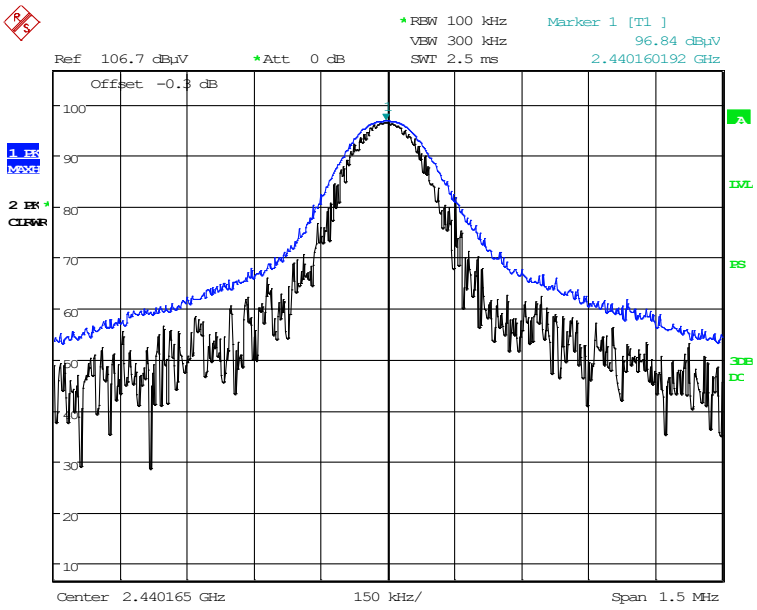
2.8.9 Test Results Summary

Mode	Channel	Marker Reading (dBµV/m @ 3.0 meters)	EIRP (dBm)	Peak PSD Level (dBm)	Limit (dBm)	Compliance
GFSK @ 1Mbps	37 (2402 MHz)	93.79	-1.47	-3.19	8	Complies
	17 (2440 MHz)	96.84	1.58	-0.18	8	Complies
	39 (2480 MHz)	95.01	-0.25	-1.97	8	Complies

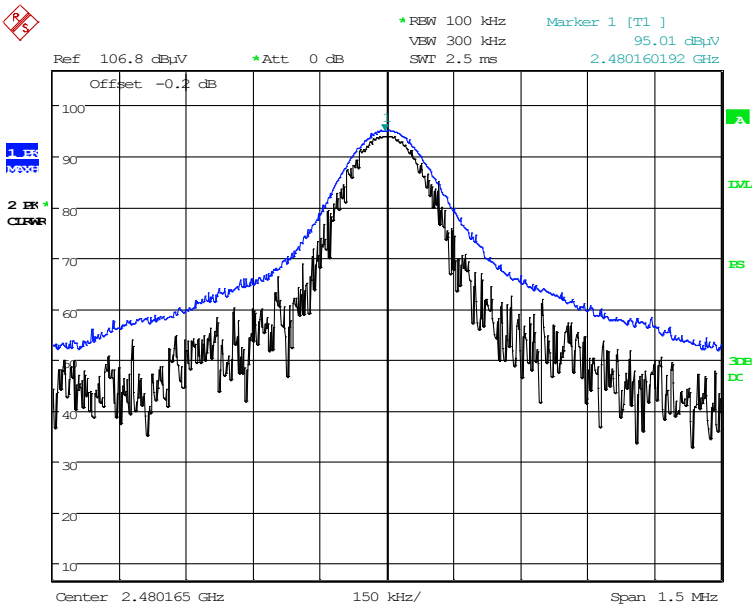
2.8.10 Test Results Plots



Low Channel



Mid Channel



High Channel

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

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

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Radiated Test Setup						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/21/13	01/21/14
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	03/25/13	03/25/14
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	09/21/12	09/21/13
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	09/21/12	09/21/13
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	09/21/12	09/21/13
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	07/31/13	07/31/14
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	07/24/13	07/24/14
1016	Pre-amplifier	PAM-0202	187	PAM	09/24/12	09/24/13
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	05/02/14
Miscellaneous						
6452	Multimeter	3478A	2911A52177	Hewlett Packard	08/02/13	
6452	Multimeter	3478A	2911A52177	Hewlett Packard	08/02/13	08/02/14
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	11/12/12	11/12/13
7560	Barometer/Temperature /Humidity Transmitter	iBTHX-W	1240476	Omega	11/19/12	11/19/13
	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

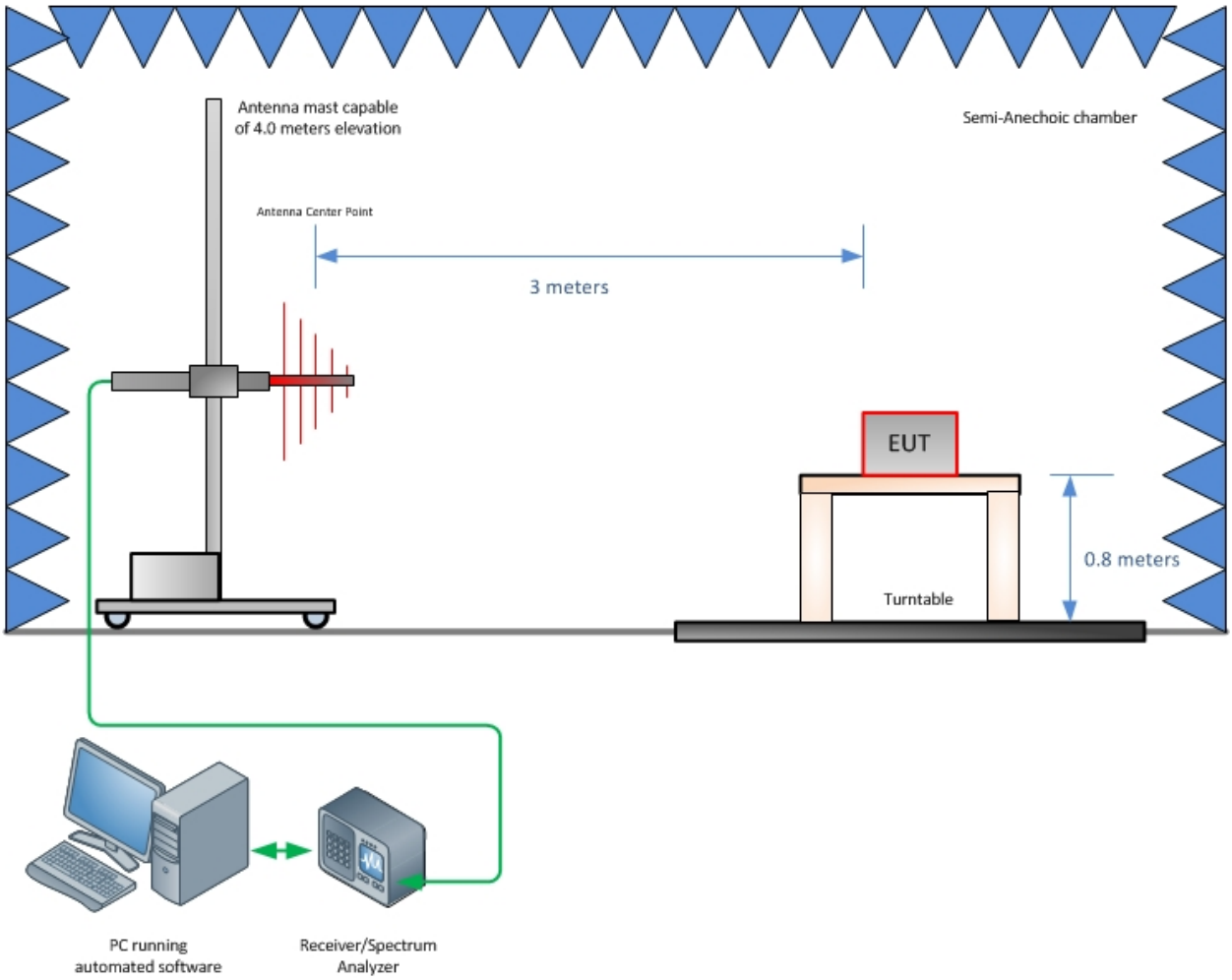
3.2.2 Radiated Emission Measurements (Above 1GHz)

	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

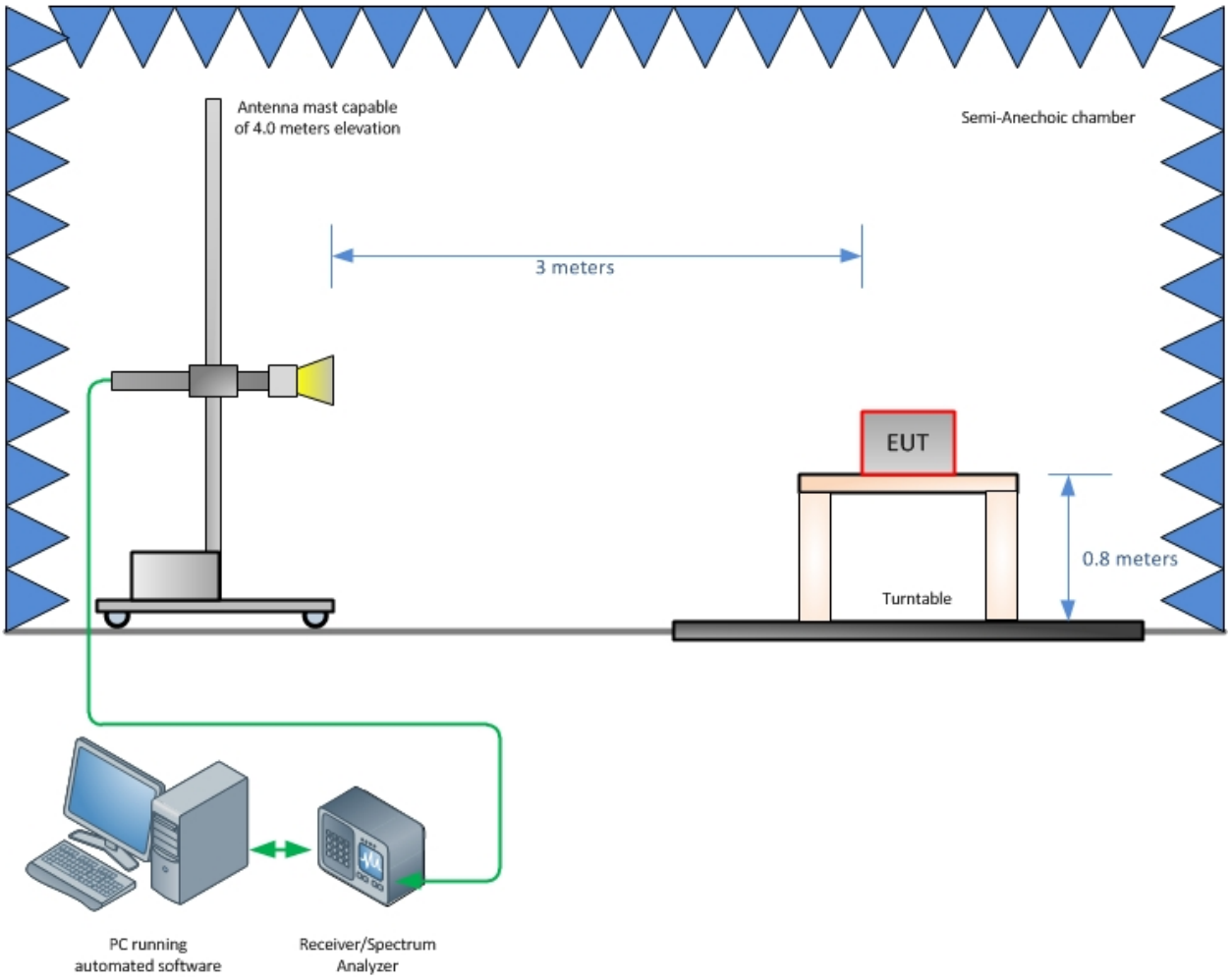
SECTION 4

DIAGRAM OF TEST SETUP

4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)

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SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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