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# Report On

Radio Testing of the  
SMK Electronics Corp.  
Bose Model 420129 RF Remote Control

FCC Part 15 Subpart C §15.249  
IC RSS-210 Issue 8 December 2010  
Telecom Technical Regulations Test Regulations LP0002

**Report No. SD72112151-1215D**

**March 2016**



**REPORT ON** Radio Testing of the  
SMK Electronics Corp.  
RF Remote Control

**TEST REPORT NUMBER** SD72112151-1215D

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**APPROVED BY** Juan Manuel Gonzalez  
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Title: Commercial/Wireless EMC Lab Manager

**DATED** March 21, 2016



**Revision History**

SD72112151-1215D SMK Electronics Corp. Bose Model 420129 RF Remote Control					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
03/21/2016	Initial Release				Juan M. Gonzalez



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## **SECTION 1**

### **REPORT SUMMARY**

Radio Testing of the  
SMK Electronics Corp.  
Bose Model 420129 RF Remote Control



## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the SMK Electronics Corp. RF Remote Control to the requirements of FCC Part 15 Subpart C §15.249, IC RSS-210 Issue 8 December 2010 and Telecom Technical Regulations Test Regulations LP0002.

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)	420129
FCC ID Number	A94420129
IC Number	3232A-420129
Serial Number(s)	N/A
Number of Samples Tested	2
Test Specification/Issue/Date	<ul style="list-style-type: none"><li>• FCC Part 15 Subpart C §15.249 (October 1, 2015).</li><li>• RSS-210 - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment (Issue 8, December 2010).</li><li>• RSS-Gen - General Requirements and Information for the Certification of Radio Apparatus (Issue 4, November 2014).</li><li>• Telecom Technical Regulations Test Regulations LP0002 Low-power Radio-frequency Devices Technical Regulations (28 June, 2011 revised)</li></ul>
Start of Test	December 10, 2015
Finish of Test	January 25, 2016
Name of Engineer(s)	Nikolay Shtin
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 §15.249 with cross-reference to the corresponding IC RSS and NCC LP0002 standards is shown below.

Section	Spec Clause	RSS	LP0002	Test Description	Result	Comments/Base Standard
-	§15.207(a)	RSS-Gen 8.8	2.3	Conducted Emissions	N/A*	See Note
2.1	§15.215(c)			20 dB Bandwidth	Compliant	
2.2		RSS-Gen 6.6		99% Emission Bandwidth	Compliant	
2.3	§15.249(a)	RSS-210 A2.9(a)	3.10.2(2)	Field Strength Limits for Fundamental and Harmonics	Compliant	
2.4	§15.249(d)	RSS-210 A2.9(b)	3.10.2(2)	Spurious Radiated Emissions	Compliant	
—		RSS-Gen 7.1		Receiver Spurious Emissions	N/A**	See Note

\* *Not applicable. EUT is battery powered.*

\*\* *Not applicable. EUT has no Stand-Alone receiver port*



### **1.3 PRODUCT INFORMATION**

#### **1.3.1 Technical Description**

The Equipment Under Test (EUT) was a SMK Electronics Corp. Bose Model 420129 RF Remote Control. The EUT is a battery powered, hand-held remote control with OLED display. It incorporates a low power radio operating in the 2400-2483.5 MHz ISM band.





**1.3.2 EUT General Description**

EUT Description	RF Remote Control
Model Number(s)	420129
Rated Voltage	6.0VDC from 4 (four) AA alkaline batteries
Output Power	102.08 dB $\mu$ V/m @ 3 meters (4.84 mW EIRP)
Frequency Range	2401.759 MHz to 2482.073 MHz in the 2400 MHz to 2483.5 MHz Band
Number of Operating Frequencies	21
Channels Verified	Low Channel 2401.759 MHz Mid Channel 2441.188 MHz High Channel 2482.073 MHz
Antenna Type (used during evaluation)	Integral PCB antenna (Complies with Part 15.203 requirements)
Modulation Used	GFSK



#### 1.4 EUT TEST CONFIGURATION

##### 1.4.1 Test Configuration Description

Test Configuration	Description
A	Conducted antenna port measurement. EUT transmitting at a max power on low, mid and high channels
B	Radiated test setup. EUT transmitting through integral antenna on low, mid and high channels

##### 1.4.2 EUT Exercise Software

The EUT was programmed with a firmware (FW version: BardeenRemoteManufacturing\_0.1.3.4124) enabling test mode. The radio control commands were sent via serial interface from a support Laptop.

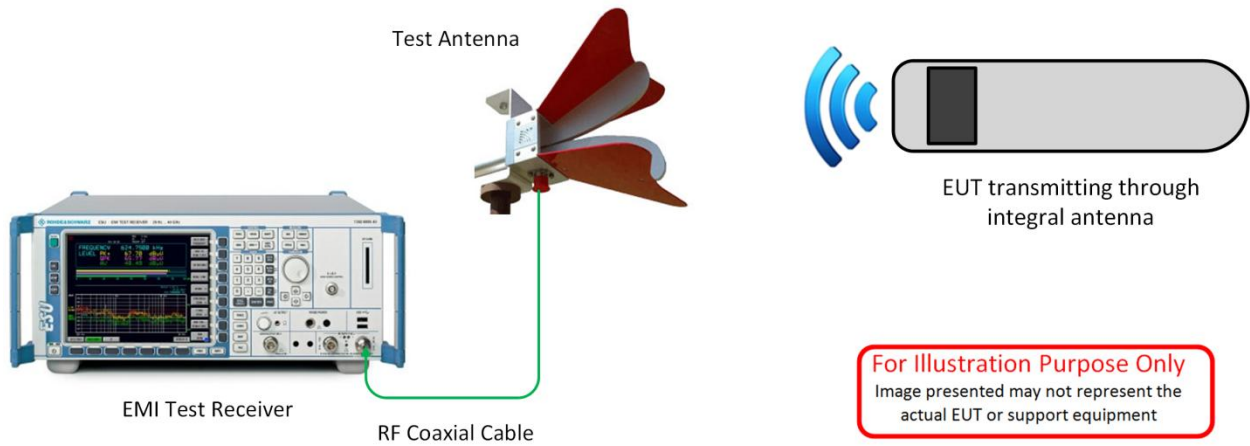
##### 1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Dell	Support Laptop	Model T2400 Inspiron S/N: CO00095

##### 1.4.4 Worst Case Configuration

EUT is a mobile device. For radiated measurements X, Y and Z orientations were verified. Worst case orientation is "Z".

### 1.4.5 Simplified Test Configuration Diagram



**Note:** Client also provided a sample with temporary antenna port for direct conducted port measurements.



**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 program. 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 C63.4-2014, 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 C63.4-2014. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

**1.8 TEST FACILITY LOCATION**

**1.8.1 TÜV SÜD America Inc. (Mira Mesa)**

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: 858 678 1400 FAX: 858-546 0364

**1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)**

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

**1.9 TEST FACILITY REGISTRATION**

**1.9.1 FCC – Registration No.: US1146**

TUV SUD America Inc. (San Diego), a \$2.498 listed test firm operates the EMC Laboratory registered under Sony Electronics Inc. Product Quality Division EMC. This laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is US1146.



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

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 for radio equipment testing with Registration No. 3067A.



## **SECTION 2**

### **TEST DETAILS**

Radio Testing of the  
SMK Electronics Corp.  
Bose Model 420129 RF Remote Control



## **2.1 20 DB BANDWIDTH**

### **2.1.1 Specification Reference**

Part 15 Subpart C §15.215(c)

### **2.1.2 Standard Applicable**

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

### **2.1.3 Equipment Under Test and Modification State**

Serial No: N/A / Test Configuration A

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

December 21 and 23, 2015/NS

### **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	22.2-25.6°C
Relative Humidity	36.2-43.2%
ATM Pressure	99.2-100.0 kPa

### **2.1.7 Additional Observations**

- This is a conducted test.
- A peak output reading was taken.
- 20dB bandwidth verified using ndB down BW function of 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.



- Trace is max hold.

**2.1.8 Test Results**

Low Channel (2401.759 MHz)	Mid Channel (2441.188 MHz)	High Channel (2482.073 MHz)
0.860 MHz	0.857 MHz	0.878 MHz

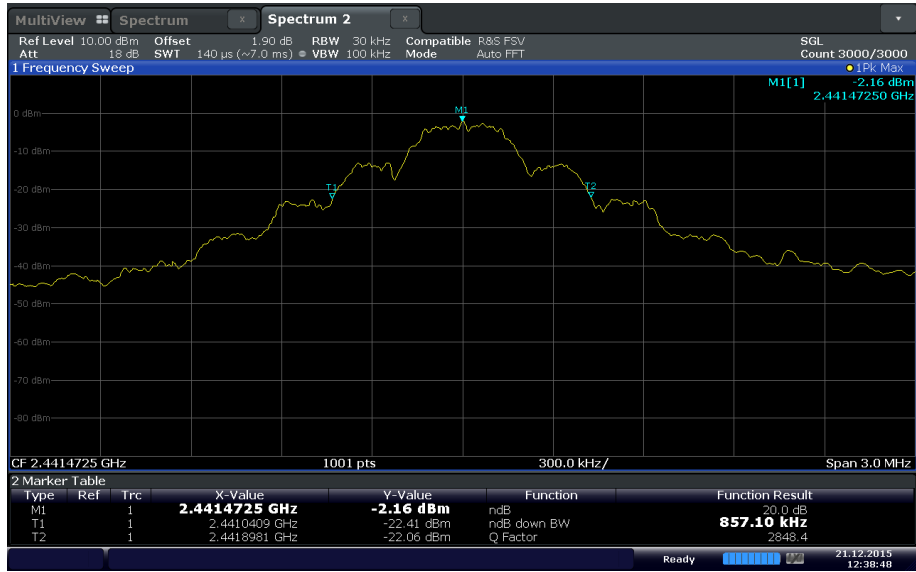
2401.759 MHz – (20dB BW/2) = 2401.329MHz (within the frequency band - **Compliant**)  
 2482.073 MHz + (20dB BW/2) = 2482.512 MHz (within the frequency band - **Compliant**)



Date: 23 DEC 2015 12:55:22

**Low Channel**





Date: 21.DEC.2015 12:38:49

Mid Channel



Date: 23.DEC.2015 13:07:18

High Channel



## **2.2 99% EMISSION BANDWIDTH**

### **2.2.1 Specification Reference**

RSS-Gen Clause 6.6

### **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 / Test Configuration A

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

December 21 and 23, 2015/NS

### **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**

Ambient Temperature	22.2-25.6°C
Relative Humidity	36.2-43.2%
ATM Pressure	99.2-100.0 kPa

### **2.2.7 Additional Observations**

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



- The % Power Bandwidth setting in the spectrum analyzer was set to 99% (default).
- The Channel Bandwidth measurement function of the spectrum analyzer was used for this test.

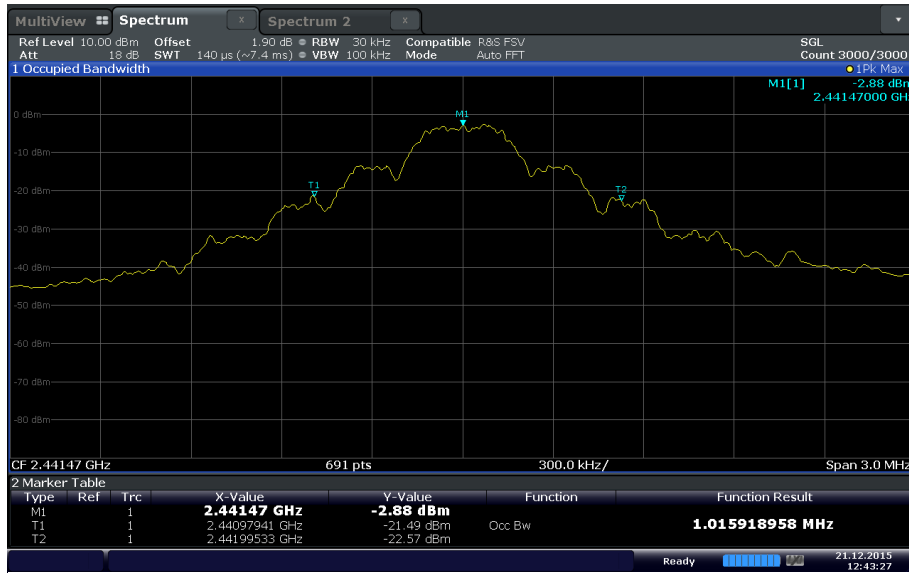
**2.2.8 Test Results**

Low Channel (2401.759 MHz)	Mid Channel (2441.188 MHz)	High Channel (2482.073 MHz)
1.059 MHz	1.016 MHz	1.081 MHz



Date: 23.DEC.2015 12:59:26

**Low Channel**



Date: 21.DEC.2015 12:43:27

### Mid Channel



Date: 23.DEC.2015 13:05:02

### High Channel



**2.3 FIELD STRENGTH LIMITS FOR FUNDAMENTAL AND HARMONICS**

**2.3.1 Specification Reference**

Part 15 Subpart C §15.249(a)

**2.3.2 Standard Applicable**

(a) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

**2.3.3 Equipment Under Test and Modification State**

Serial No: N/A / Test Configuration B

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

December 22, 2015 and January 25, 2016/NS

**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 22.9-23.1°C  
Relative Humidity 39.8-43.5%  
ATM Pressure 99.0-99.5 kPa

**2.3.7 Additional Observations**

- This is a radiated test. The spectrum was searched from 1GHz to the 10<sup>th</sup> harmonic (25GHz).
- Harmonics measurements were performed with a notch filter attenuating the fundamental frequency.
- Measurement was done using EMC32 V8.52 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 2.3.8 for sample computation.

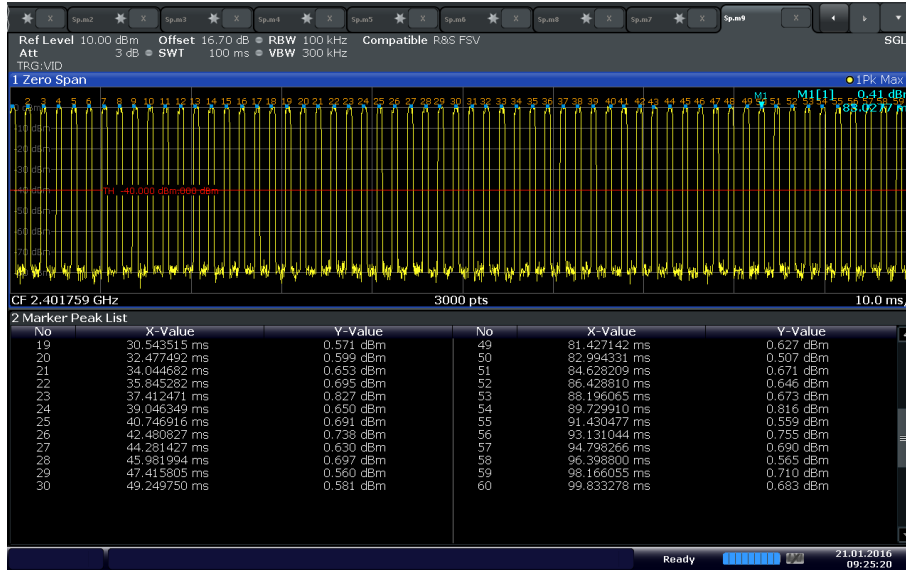


**2.3.8 Sample Computation (Radiated Emission)**

Measuring equipment raw measurement (db $\mu$ V) @ 2400 MHz		58.4
Correction Factor (dB)	Asset# 1153 (cable)	3.3
	Asset# 8628 (preamplifier)	-36.4
	Asset# 6669 (antenna)	28.3
<b>Reported Peak Final Measurement (db<math>\mu</math>V/m) @ 2400 MHz</b>		<b>53.6</b>

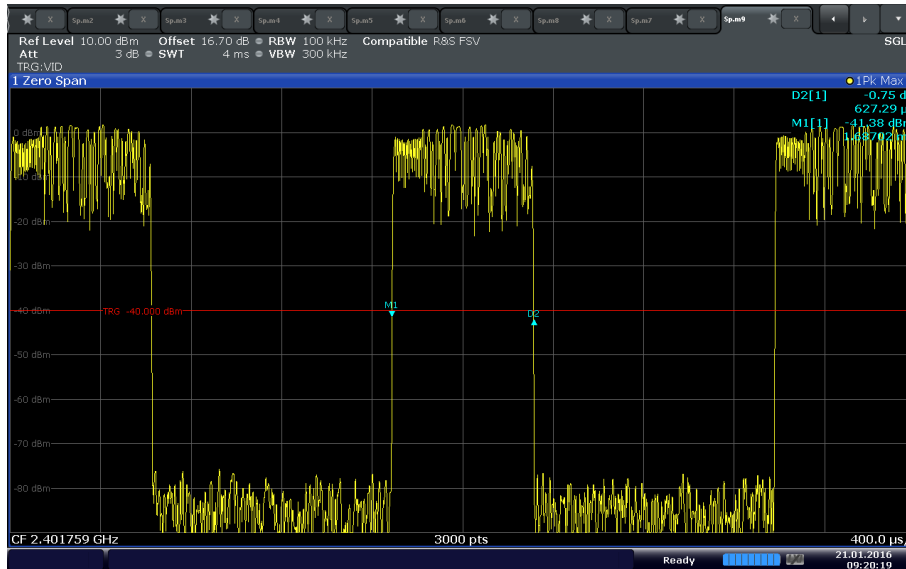


**2.3.9 Duty Cycle Correction Factor Calculation**



Date: 21 JAN 2016 09:25:20

**100ms sweep (representative channel)**



Date: 21 JAN 2016 09:20:19

**4ms sweep (representative channel)**

**Duty Cycle Calculation:** = 0.627 ms "On" time per 100 ms sweep  
 = 0.627 ms x 60 / 100

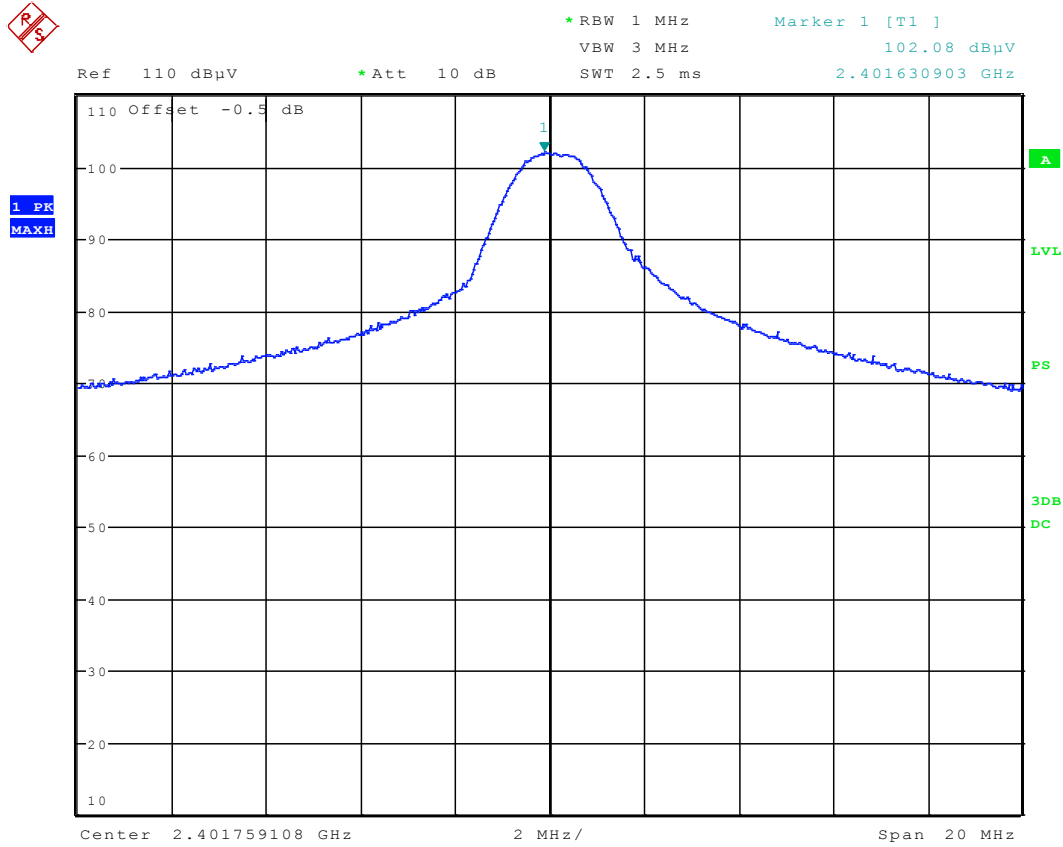
**Duty Cycle Correction Factor** = 20 log (0.3762)  
 = **-8.49 dB**



**2.3.10 Test Results**

See attached plots.

**2.3.11 Test Results Fundamental (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)
2401.6309	102.08	1000.0	1000.000	152.7	H	20.0	-0.5	11.92	114.0

**Average Data**

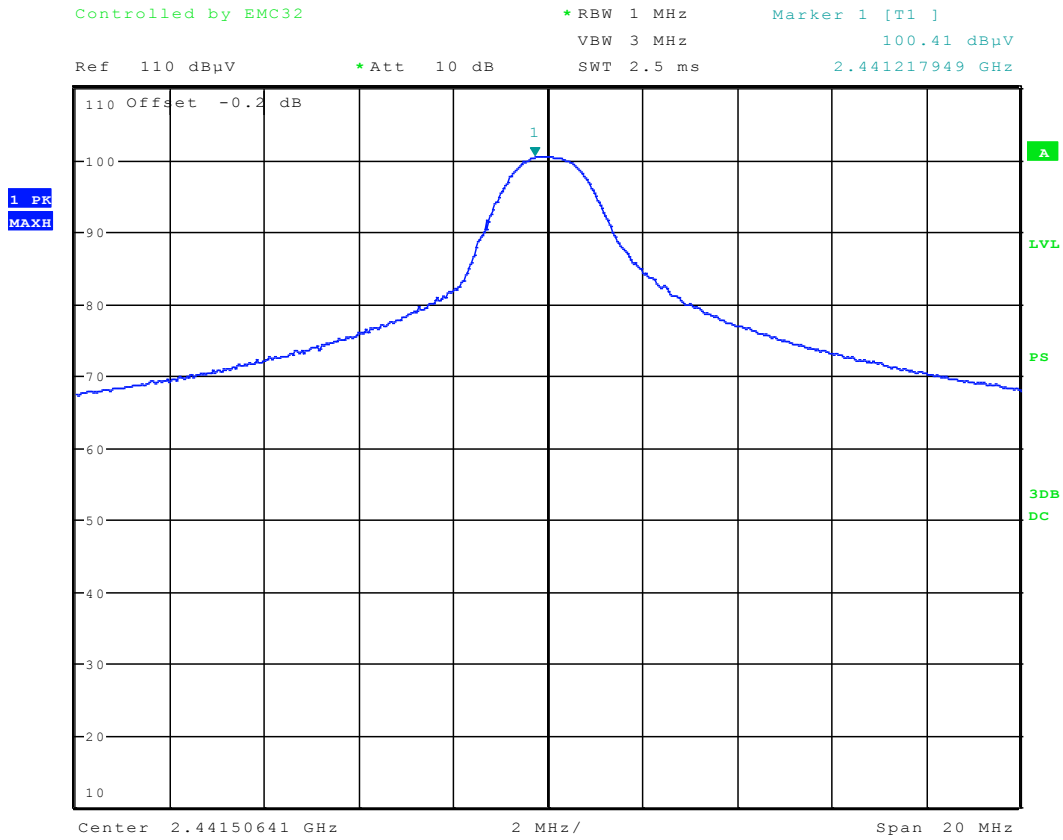
Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2401.6309	93.59							0.41	94.0

**Test Notes:** Average data are from Peak data with Duty Cycle correction factor applied. Sample computation:  
 2401.6309 MHz (Low Channel) = 102.08 dBμV/m (Peak)  
 = 102.08 dBμV/m - 8.49 (DCCF)  
 = 93.59 (Average)





**2.3.12 Test Results Fundamental (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)
2441.21795	100.41	1000.0	1000.000	129.8	H	14.0	-0.2	13.59	114.0

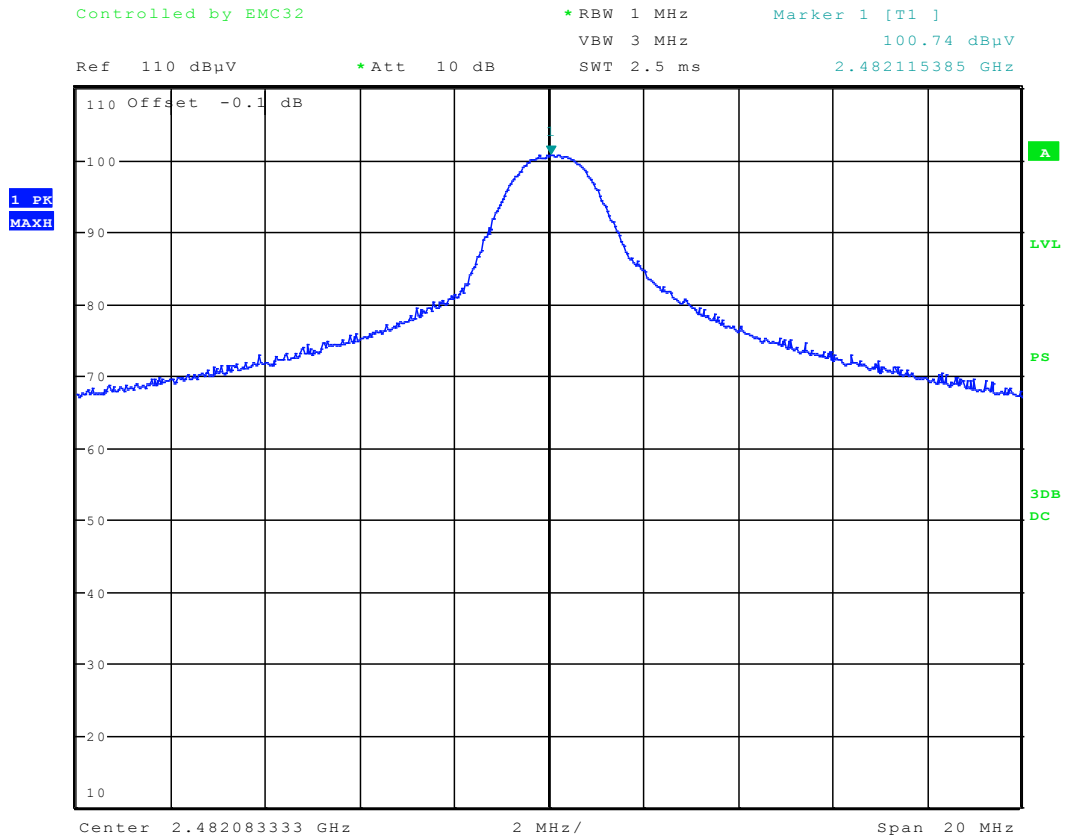
**Average Data**

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2441.21795	91.92							2.08	94.0

**Test Notes:** Average data are from Peak data with Duty Cycle correction factor applied. Sample computation:  
 2441.21795 MHz (Mid Channel) = 100.41 dBμV/m (Peak)  
 = 100.41 dBμV/m - 8.49 (DCCF)  
 = 91.92 (Average)



**2.3.13 Test Results Fundamental (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)
2482.11538	100.74	1000.0	1000.000	147.4	H	14.0	-0.1	13.26	114.0

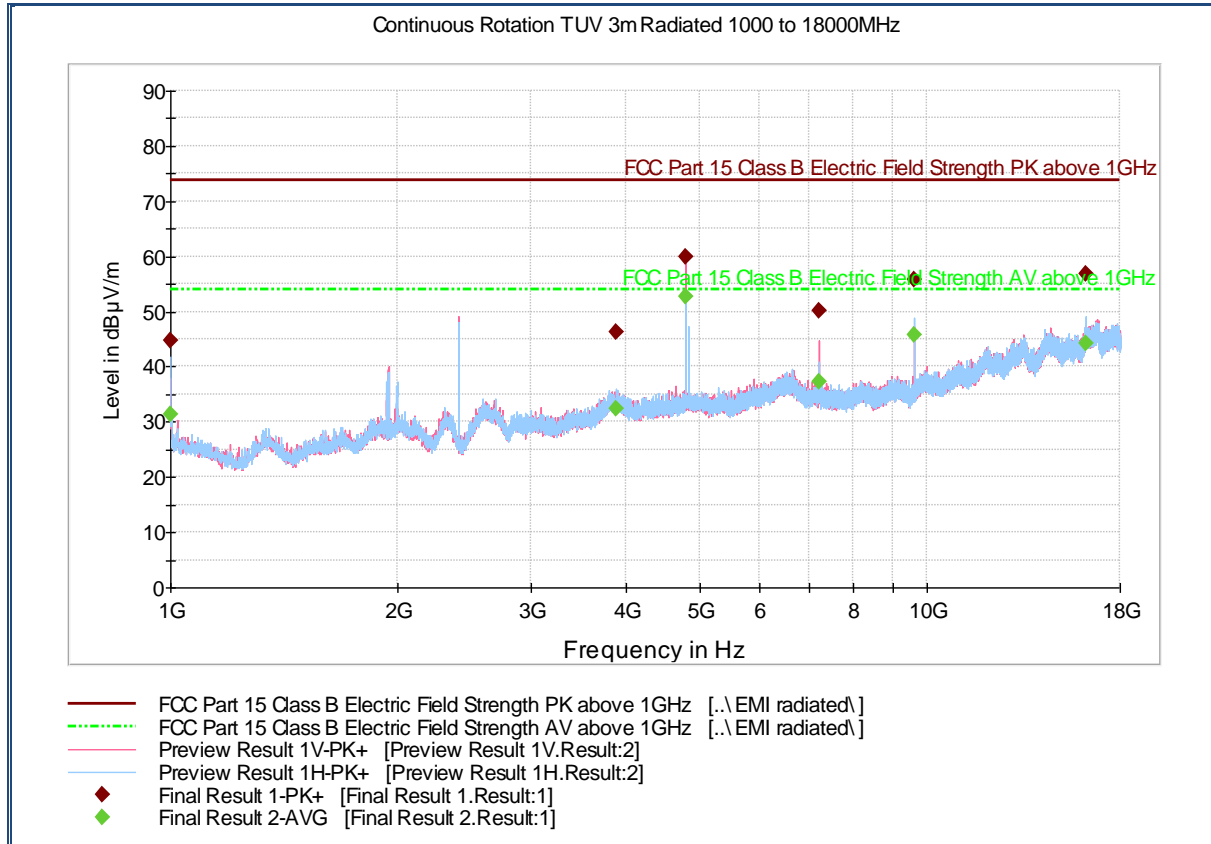
**Average Data**

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2482.11538	92.25							1.75	94.0

**Test Notes:** Average data are from Peak data with Duty Cycle correction factor applied. Sample computation:  
 2482.1153 MHz (High Channel) = 100.74 dBμV/m (Peak)  
 = 100.74 dBμV/m - 8.49 (DCCF)  
 = 92.25 (Average)



**2.3.14 Test Results Harmonics (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	44.7	1000.0	1000.000	239.4	H	129.0	-7.2	29.2	73.9
3883.200000	46.2	1000.0	1000.000	103.7	H	351.0	5.1	27.7	73.9
4803.866667	59.9	1000.0	1000.000	151.6	V	29.0	5.8	14.0	73.9
7206.000000	50.1	1000.0	1000.000	206.5	V	1.0	10.0	23.8	73.9
9607.066667	55.7	1000.0	1000.000	269.3	H	336.0	12.3	18.2	73.9
16257.300000	56.7	1000.0	1000.000	304.2	H	111.0	23.1	17.2	73.9

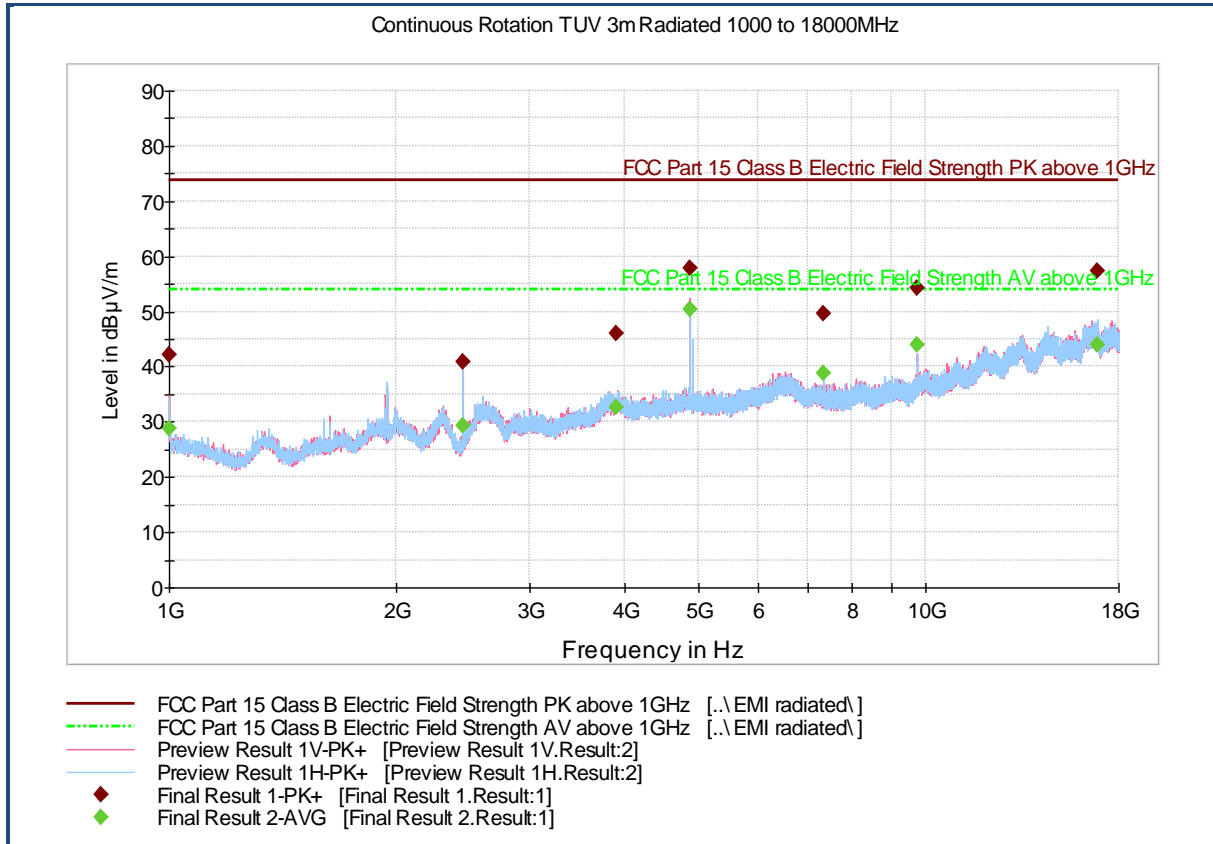
**Average Data**

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	31.4	1000.0	1000.000	239.4	H	129.0	-7.2	22.5	53.9
3883.200000	32.5	1000.0	1000.000	103.7	H	351.0	5.1	21.4	53.9
4803.866667	52.7	1000.0	1000.000	151.6	V	29.0	5.8	1.2	53.9
7206.000000	37.2	1000.0	1000.000	206.5	V	1.0	10.0	16.7	53.9
9607.066667	45.7	1000.0	1000.000	269.3	H	336.0	12.3	8.2	53.9
16257.300000	44.3	1000.0	1000.000	304.2	H	111.0	23.1	9.6	53.9

**Test Notes 1:** Measurement was performed with a 2.4GHz notch filter.



**2.3.15 Test Results Harmonics (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	42.0	1000.0	1000.000	124.0	V	337.0	-7.2	31.9	73.9
2441.633333	40.8	1000.0	1000.000	259.0	V	87.0	-0.2	Fundamental	
3908.100000	46.1	1000.0	1000.000	100.0	V	344.0	5.2	27.8	73.9
4883.200000	57.9	1000.0	1000.000	178.0	V	24.0	6.1	16.0	73.9
7324.366667	49.7	1000.0	1000.000	205.0	H	78.0	9.8	24.3	73.9
9766.133333	54.3	1000.0	1000.000	176.0	V	106.0	12.6	19.6	73.9
16878.366667	57.4	1000.0	1000.000	200.0	H	111.0	23.7	16.5	73.9

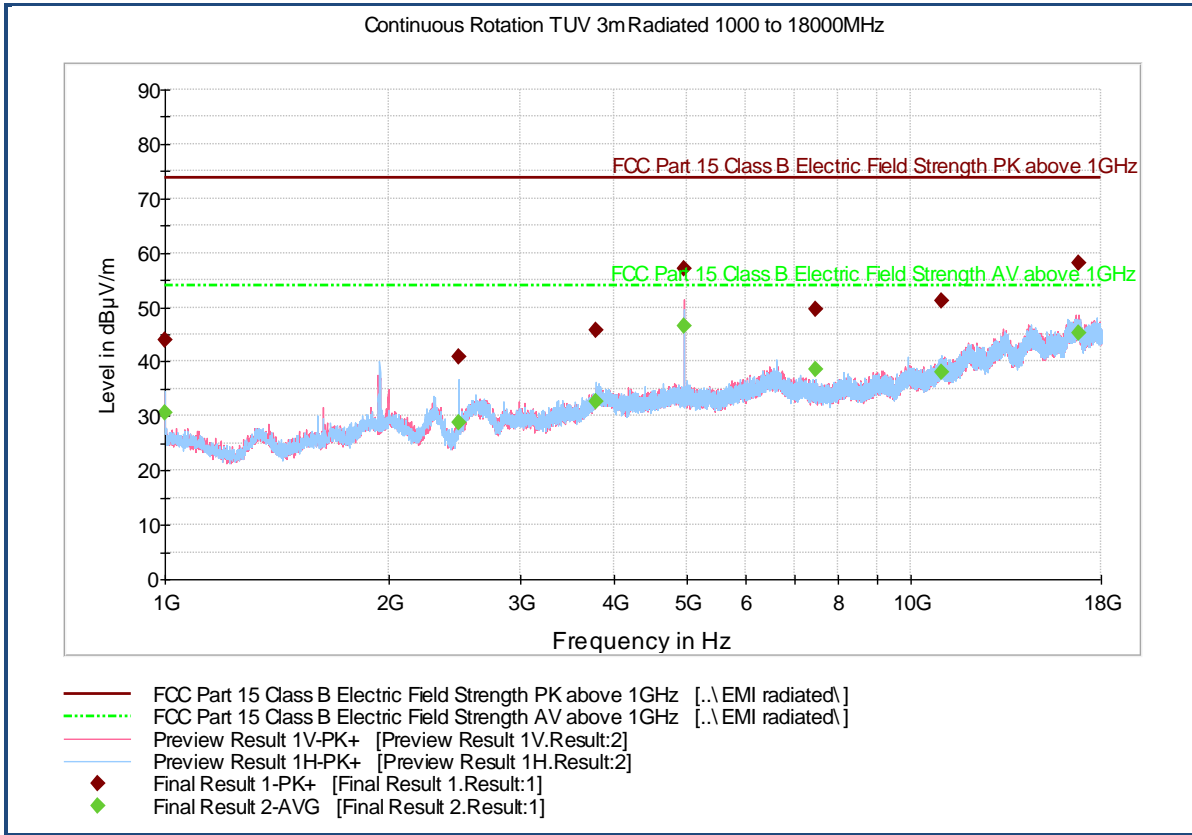
**Average Data**

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	28.7	1000.0	1000.000	124.0	V	337.0	-7.2	25.2	53.9
2441.633333	29.4	1000.0	1000.000	259.0	V	87.0	-0.2	Fundamental	
3908.100000	32.6	1000.0	1000.000	100.0	V	344.0	5.2	21.3	53.9
4883.200000	50.5	1000.0	1000.000	178.0	V	24.0	6.1	3.4	53.9
7324.366667	38.7	1000.0	1000.000	205.0	H	78.0	9.8	15.2	53.9
9766.133333	44.0	1000.0	1000.000	176.0	V	106.0	12.6	9.9	53.9
16878.366667	44.1	1000.0	1000.000	200.0	H	111.0	23.7	9.8	53.9

**Test Notes 1:** Measurement was performed with a 2.4GHz notch filter. No EUT emissions other than the second and third harmonics were observed.



**2.3.16 Test Results Harmonics (High Channel)**



**Peak Data**

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	44.1	1000.0	1000.000	178.0	H	0.0	-7.2	29.8	73.9
2480.733333	40.9	1000.0	1000.000	245.0	H	10.0	-0.1	33.0	73.9
3782.900000	45.8	1000.0	1000.000	373.0	H	24.0	4.9	28.1	73.9
4960.433333	57.1	1000.0	1000.000	200.0	V	215.0	6.5	16.8	73.9
7441.500000	49.5	1000.0	1000.000	178.0	H	262.0	9.6	24.4	73.9
10993.600000	51.1	1000.0	1000.000	400.0	H	249.0	15.6	22.8	73.9
16785.633333	58.1	1000.0	1000.000	224.0	V	134.0	24.7	15.8	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	30.6	1000.0	1000.000	178.0	H	0.0	-7.2	23.3	53.9
2480.733333	28.7	1000.0	1000.000	245.0	H	10.0	-0.1	25.2	53.9
3782.900000	32.6	1000.0	1000.000	373.0	H	24.0	4.9	21.3	53.9
4960.433333	46.5	1000.0	1000.000	200.0	V	215.0	6.5	7.4	53.9
7441.500000	38.6	1000.0	1000.000	178.0	H	262.0	9.6	15.3	53.9
10993.600000	38.1	1000.0	1000.000	400.0	H	249.0	15.6	15.8	53.9
16785.633333	45.3	1000.0	1000.000	224.0	V	134.0	24.7	8.6	53.9

**Test Notes 1:** Measurement was performed with a 2.4GHz notch filter. No EUT emissions other than the second and third harmonics were observed.



**2.4 SPURIOUS RADIATED EMISSIONS**

**2.4.1 Specification Reference**

Part 15 Subpart C §15.249(d)

**2.4.2 Standard Applicable**

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

**2.4.3 Equipment Under Test and Modification State**

Serial No: N/A / Test Configuration B

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

December 22, 2015/NS

**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	23.1°C
Relative Humidity	43.5%
ATM Pressure	99.0 kPa

**2.4.7 Additional Observations**

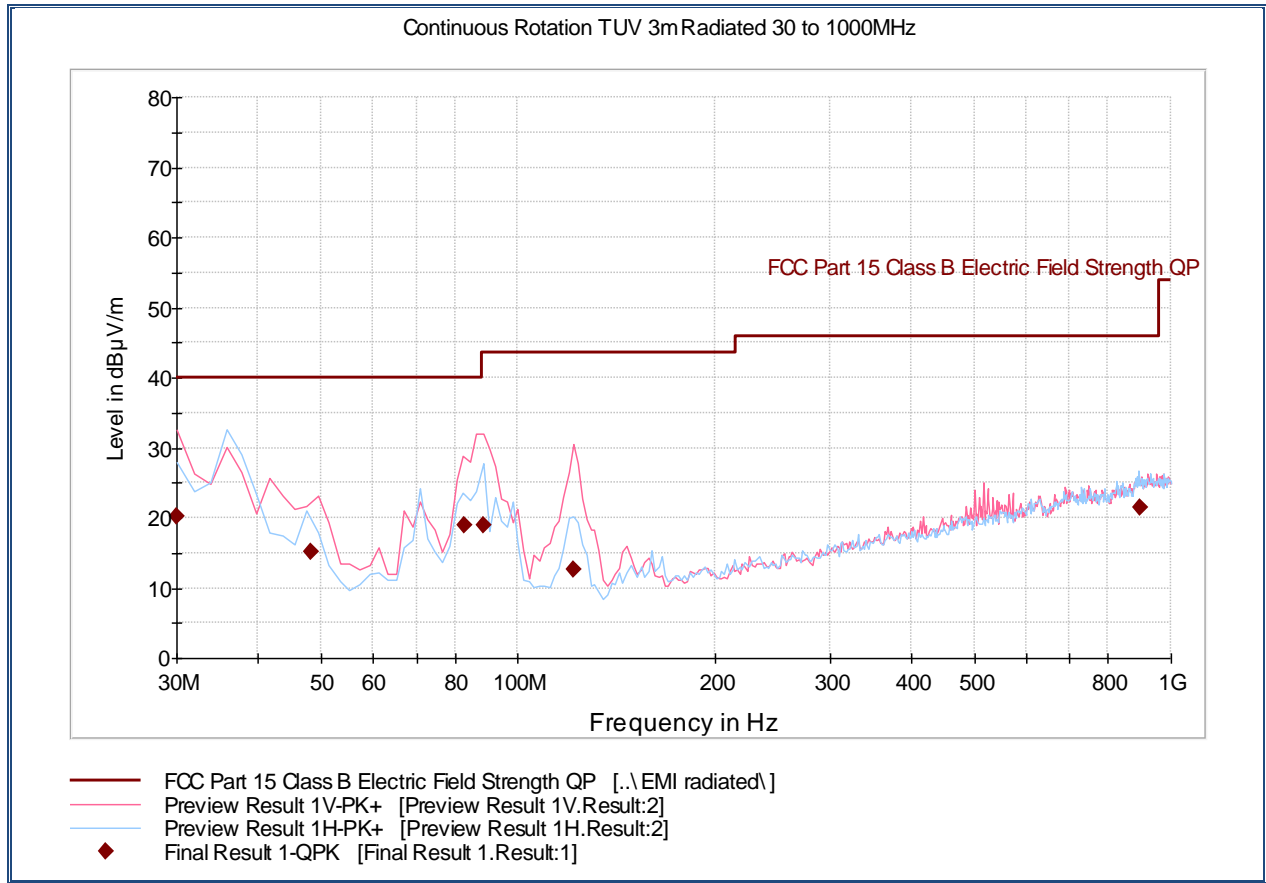
- This is a radiated test. The spectrum was searched from 30MHz to the 10<sup>th</sup> harmonic (25GHz). There are no emissions observed beyond 18GHz.
- No significant emission observed below 1GHz. Data presented is from worst configuration based on fundamental/harmonics verification ("Z" axis configuration).
- Above 1GHz measurement results are identical to test results presented under Section 2.3.14 up to Section 2.3.16 of this test report. No other spurious emissions observed other than harmonics of the fundamental frequency.
- Measurement was done using EMC32 V8.52 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 2.4.8 for sample computation.

**2.4.8 Sample Computation (Radiated Emission)**

Measuring equipment raw measurement (dbµV) @ 2400 MHz			58.4
Correction Factor (dB)	Asset# 1153 (cable)	3.3	-4.8
	Asset# 8628 (preamplifier)	-36.4	
	Asset# 6669 (antenna)	28.3	
Reported Peak Final Measurement (dbµV/m) @ 2400 MHz			53.6



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

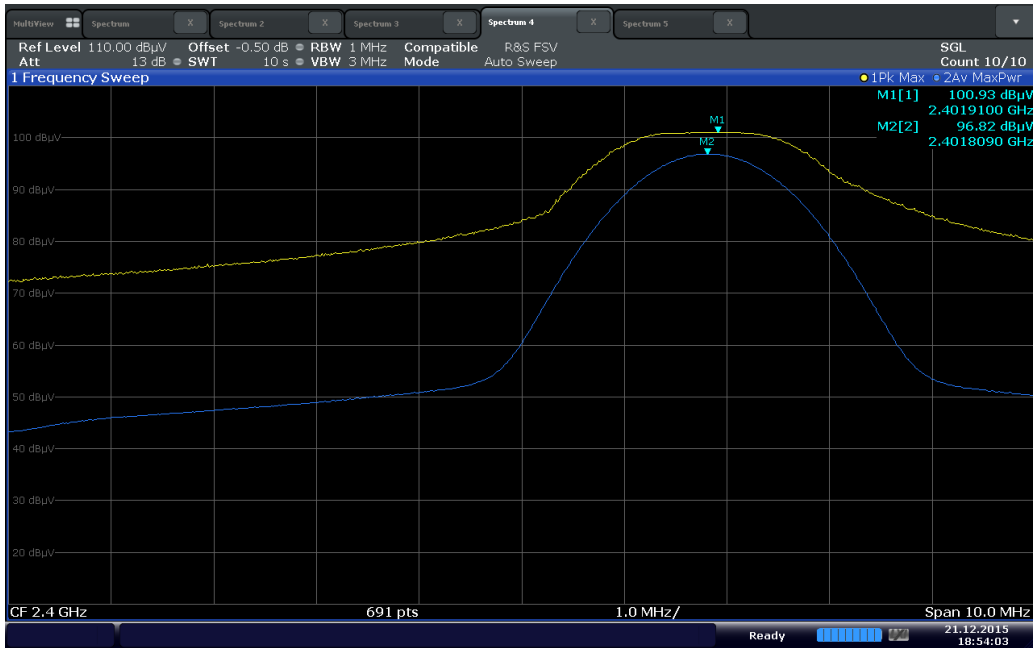


Quasi Peak Data

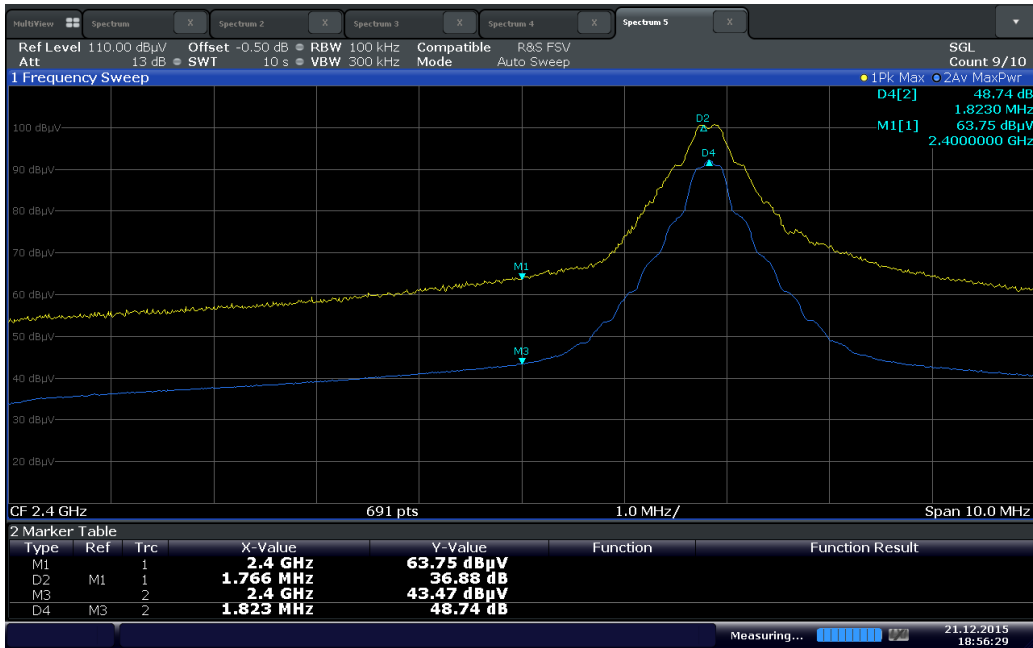
Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.000000	20.3	1000.0	120.000	150.0	V	342.0	-11.5	19.7	40.0
48.198878	15.1	1000.0	120.000	116.0	V	15.0	-19.3	24.9	40.0
82.684970	18.9	1000.0	120.000	165.0	V	343.0	-21.7	21.1	40.0
88.532745	18.9	1000.0	120.000	100.0	V	-2.0	-21.1	24.6	43.5
121.706613	12.7	1000.0	120.000	200.0	V	342.0	-20.4	30.8	43.5
896.046172	21.4	1000.0	120.000	102.0	H	55.0	1.2	24.6	46.0



2.4.10 Test Results of Lower Band Edge measurement (Marker-delta method)



Date: 21 DEC 2015 18:54:04



Date: 21 DEC 2015 18:56:29

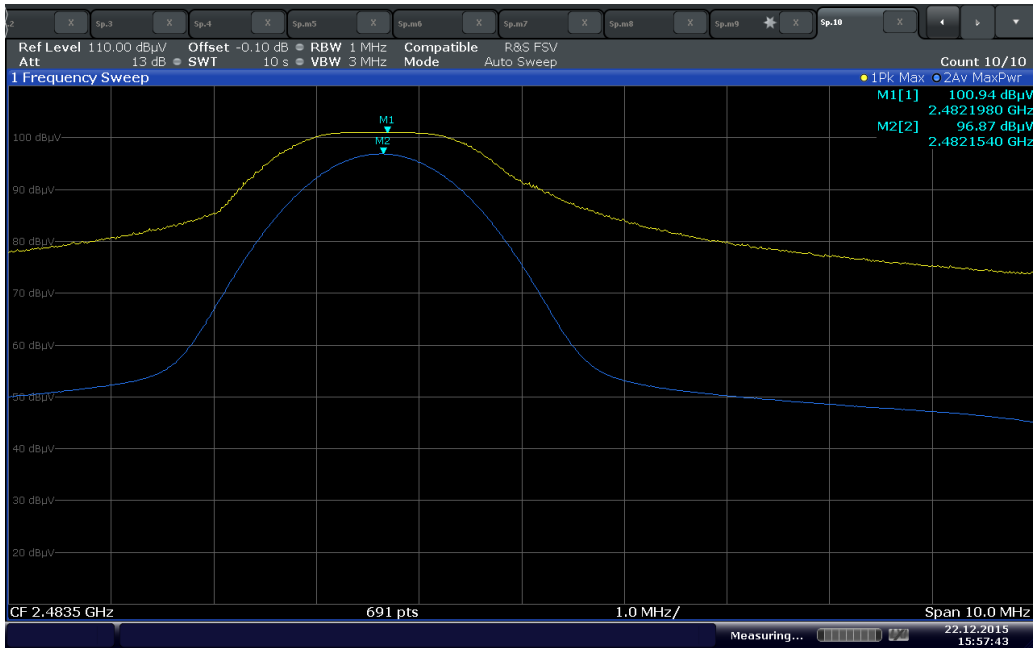
Band edge calculation:

Average value:  $96.82 - 48.74 = 48.08$  dBµV/m. Limit is 54. EUT **Complies**.  
 Peak value:  $100.93 - 36.88 = 64.05$  dBµV/m. Limit is 74. EUT **Complies**.

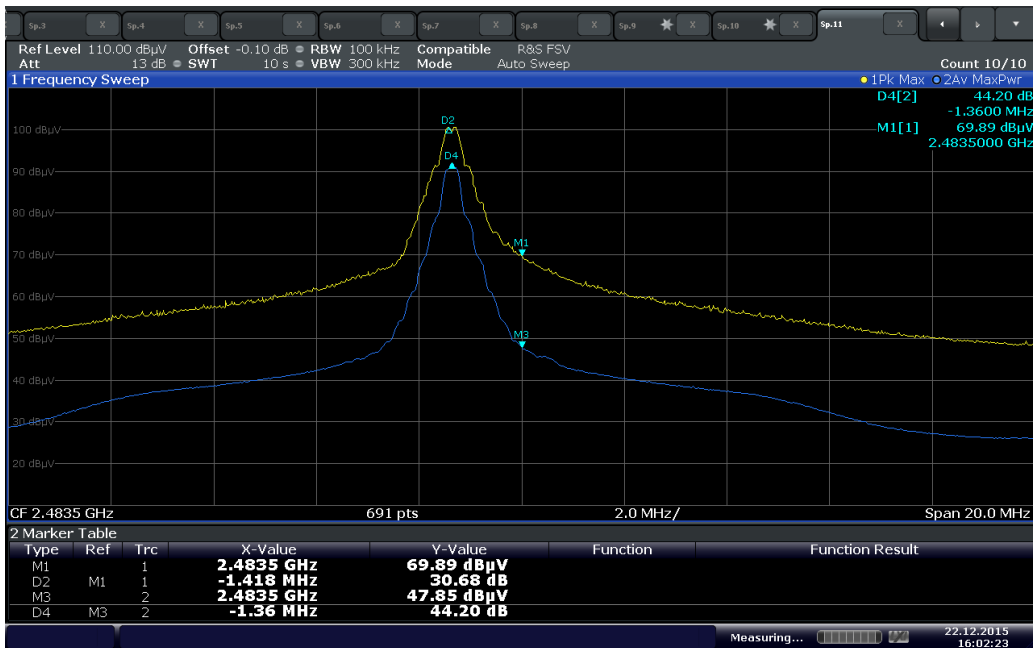




2.4.11 Test Results of Upper Band Edge measurement (Marker-delta method)



Date:22.DEC.2015 15:57:43



Date:22.DEC.2015 16:02:23

Band edge calculation:

Average value:  $96.87 - 44.20 = 52.67 \text{ dB}\mu\text{V/m}$ . Limit is 54. EUT **Complies**.  
 Peak value:  $100.94 - 30.68 = 70.26 \text{ dB}\mu\text{V/m}$ . Limit is 74. EUT **Complies**.



### **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
Conducted Port Setup						
7611	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	03/25/15	03/25/16
8773	10dB Attenuator	606-10-1F4/DR	N/A	Meca	Verified by 1003 and 7611	
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	04/29/15	04/29/16
Radiated Emissions						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/30/14	01/30/16
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	03/20/15	03/20/16
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	09/03/15	09/03/16
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	09/29/15	09/29/16
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/11/15	03/11/16
1016	Pre-amplifier	PAM-0202	187	PAM	12/10/14	12/10/15
6815	2.4GHz Band Notch Filter	BRM50702	008	Micro-Tronics	Verified by 1003 and 7611	
Miscellaneous						
7619	Barometer/Temperature /Humidity Transmitter	iBTHX-W	15250268	Omega	10/19/15	10/19/16
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/14/15	08/14/16
1072	DC Power Supply	E3610A	KR51311519	Hewlett Packard	Verified by 6792	
	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**

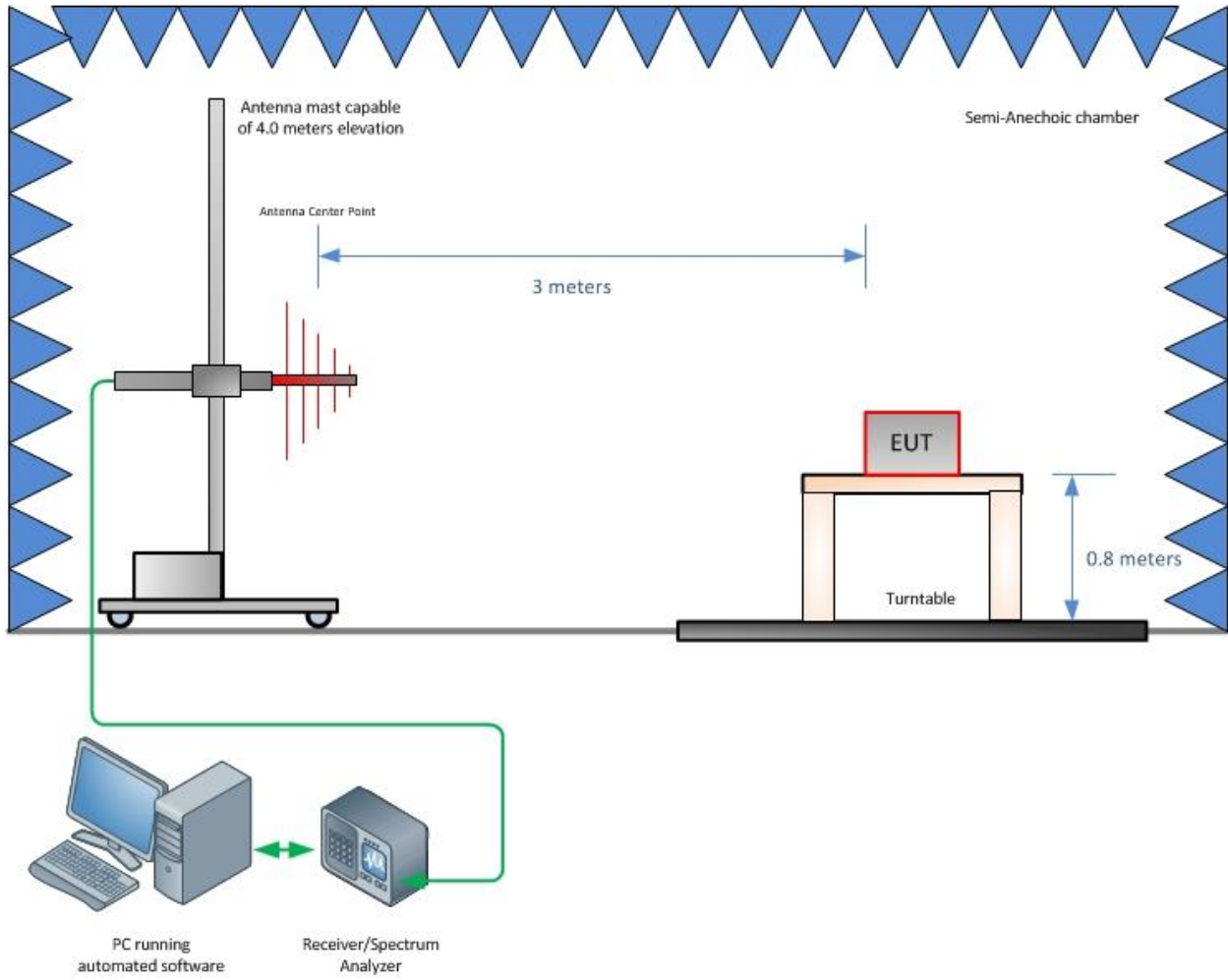
Contribution		Probability Distribution Type	Probability Distribution $x_i$	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.50	0.29	0.08
3	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty ( $u_c$ ):					0.72
Coverage Factor (k):					2
Expanded Uncertainty:					1.45



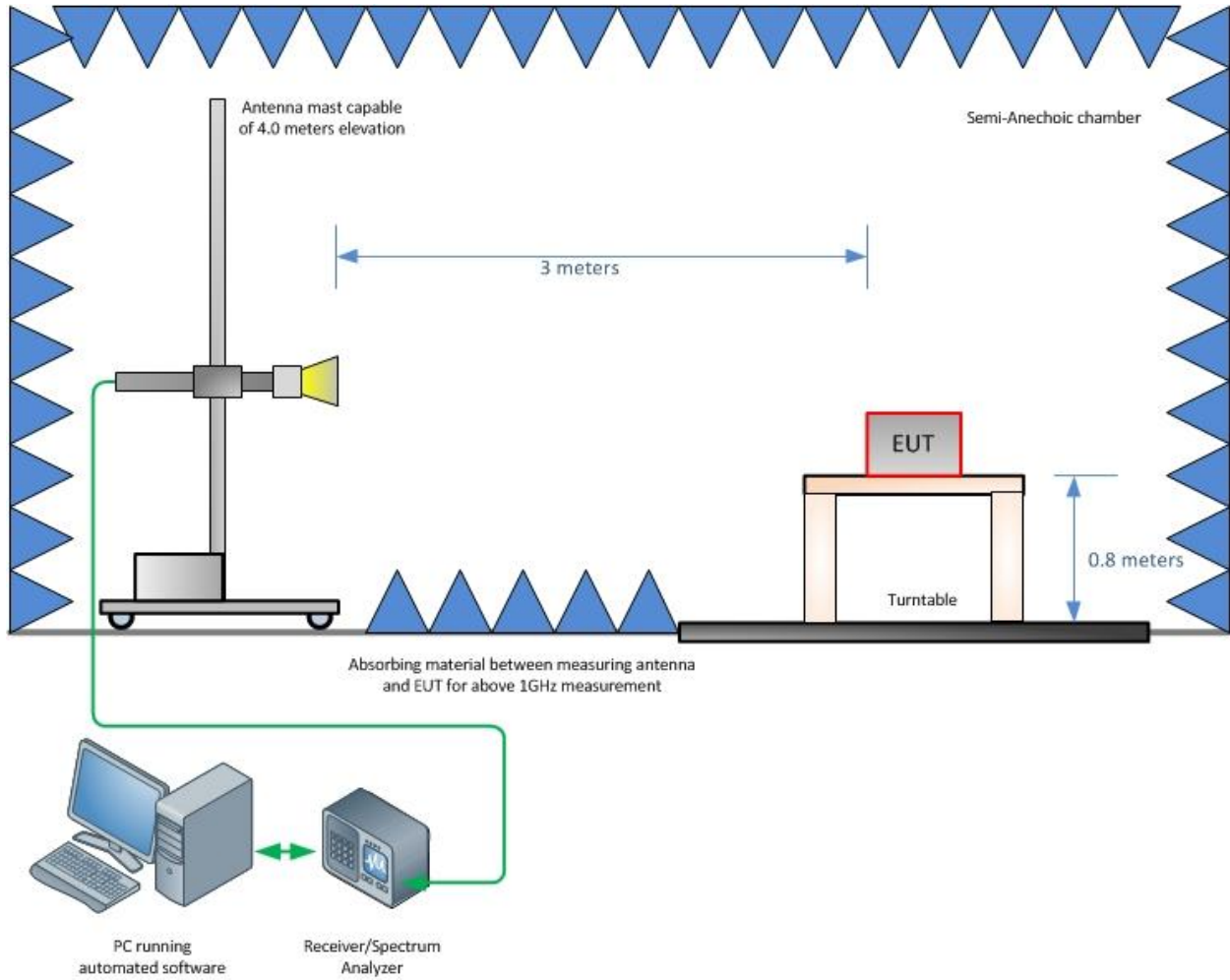
## SECTION 4

### 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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