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Report On

Radio Testing of the
Hunter Douglas Window Fashions
Platinum Repeater

FCC Part 15 Subpart C §15.249
IC RSS-210 Issue 8 December 2010

Report No. SC1206696C

July 2012



REPORT ON Radio Testing of the
Hunter Douglas Window Fashions
Repeater

TEST REPORT NUMBER SC1206696C

PREPARED FOR Hunter Douglas Window Fashions
One Duette Way,
Boomfield, CO 80020

CONTACT PERSON Leon Gateno
Senior RF Engineer
(619) 216-6425
lgateno@smkusa.com

PREPARED BY 
Kathy MacKenzie

Name

APPROVED BY 
Chip R. Fleury

Name
Authorized Signatory

DATED July 25, 2012



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SECTION 1

REPORT SUMMARY

Radio Testing of the
Hunter Douglas Window Fashions
Repeater



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Hunter Douglas Window Fashions Repeater to the requirements of FCC Part 15 Subpart C §15.249 and IC 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	Hunter Douglas Window Fashions
Model Number(s)	1010520088
FCC ID Number	UXUPR
IC Number	7316A-PR
Serial Number(s)	N/A
Number of Samples Tested	1
Test Specification/Issue/Date	<ul style="list-style-type: none">• FCC Part 15 Subpart C §15.249 (October 1, 2011).• 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	June 21, 2012
Finish of Test	July 25, 2012
Name of Engineer(s)	Juan Manuel Gonzalez Kathy MacKenzie Ferdie Custodio
Related Document(s)	SC1206696A_FCC Subpart B Class B Test Report. Other 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 standard is shown below.

Section	Spec Clause	RSS	Test Description	Result	Comments/Base Standard
2.1	§15.207(a)	RSS-Gen 7.2.4	Conducted Emissions	Compliant	
2.2	§15.215(c)	RSS-Gen 4.6.3	20 dB Bandwidth	Compliant	
2.3		RSS-Gen 4.6.1	99% Emission Bandwidth	Compliant	
2.4	§15.249(a)	RSS-210 A2.9(a)	Field Strength Limits for Fundamental and Harmonics	Compliant	
2.5	§15.249(d)	RSS-210 A2.9(b)	Spurious Radiated Emissions	Compliant	
2.6		RSS-Gen 4.10	Receiver Spurious Emissions	Compliant	

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Hunter Douglas Window Fashions Platinum Model No. 1010520088 Repeater as shown in the photograph below. The EUT is a two-way RF repeater operating in the 2.4 GHz ISM band designed to extend the coverage of a proprietary RF network.



Equipment Under Test



1.3.2 EUT General Description

EUT Description	Repeater
Model Name	Platinum
Model Number(s)	1010520088
Rated Voltage	5.0VDC from USB Port
Output Power	86.0dB μ V/m @ 3 meters (119.4 μ W EIRP)
Frequency Range	2433 MHz to 2471 MHz in the 2400 MHz to 2483.5 MHz Band
Number of Operating Frequencies	4
Channels Verified	Low Channel 2433 MHz Control Channel 2440MHz Mid Channel 2 2452MHz High Channel 2471MHz Note.-2440MHz used for short period handshake communication between Bridge and Repeater (Shock Burst) main RF Signal Tx performed with 2433MHz,2452MHz and 2471MHz.
Antenna Type	Integral, FRACTUS chip antenna FR05-S1-N-0-102 (Complies with Part 15.203 requirements)
Antenna Gain	1.7dBi
Modulation Used	GFSK

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	EUT transmitting sequentially between three channels. EUT powered by the provided USB AC adapter.
B	Test configuration as stated under SC1206696A, FCC Subpart B Class B Test Report

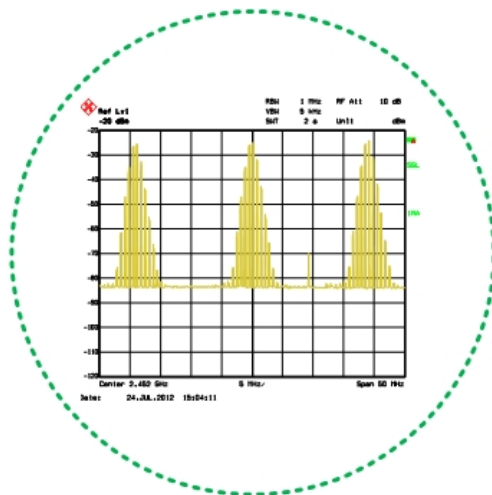
1.4.2 EUT Exercise Software

A test firmware was installed on the EUT during investigation. Cycling the power will cycle the EUT to transmit on all three channels, control channel, normal transmit mode (all three frequencies transmitting sequentially) and RF transmission off.

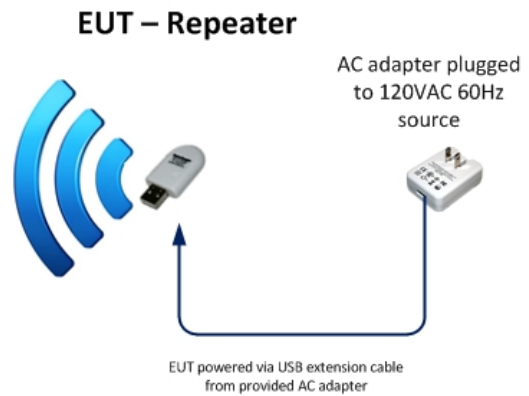
1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
lemrep.com	I.T.E Power Supply	Model GFP051-0505-1 100-240VAC 50/60Hz 0.2A. Output 5.0V 500mA

1.4.4 Simplified Test Configuration Diagram



Signal transmission as seen from a Spectrum Analyzer. EUT is transmitting sequentially between three channels.





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.: US5281

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 US5281.

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
Hunter Douglas Window Fashions
Repeater



2.1 CONDUCTED EMISSIONS

2.1.1 Specification Reference

Part 15 Subpart C §15.207(a)

2.1.2 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.*

2.1.3 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

July 24, 2012/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 23.1°C
 Relative Humidity 47.9%
 ATM Pressure 99.1 kPa

2.1.7 Additional Observations

- The EUT is a USB powered device.
- Verification was performed using the supplied USB AC adapter.
- 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 2.1.8 for sample computation.



2.1.8 Sample Computation (Conducted Emission – Quasi Peak)

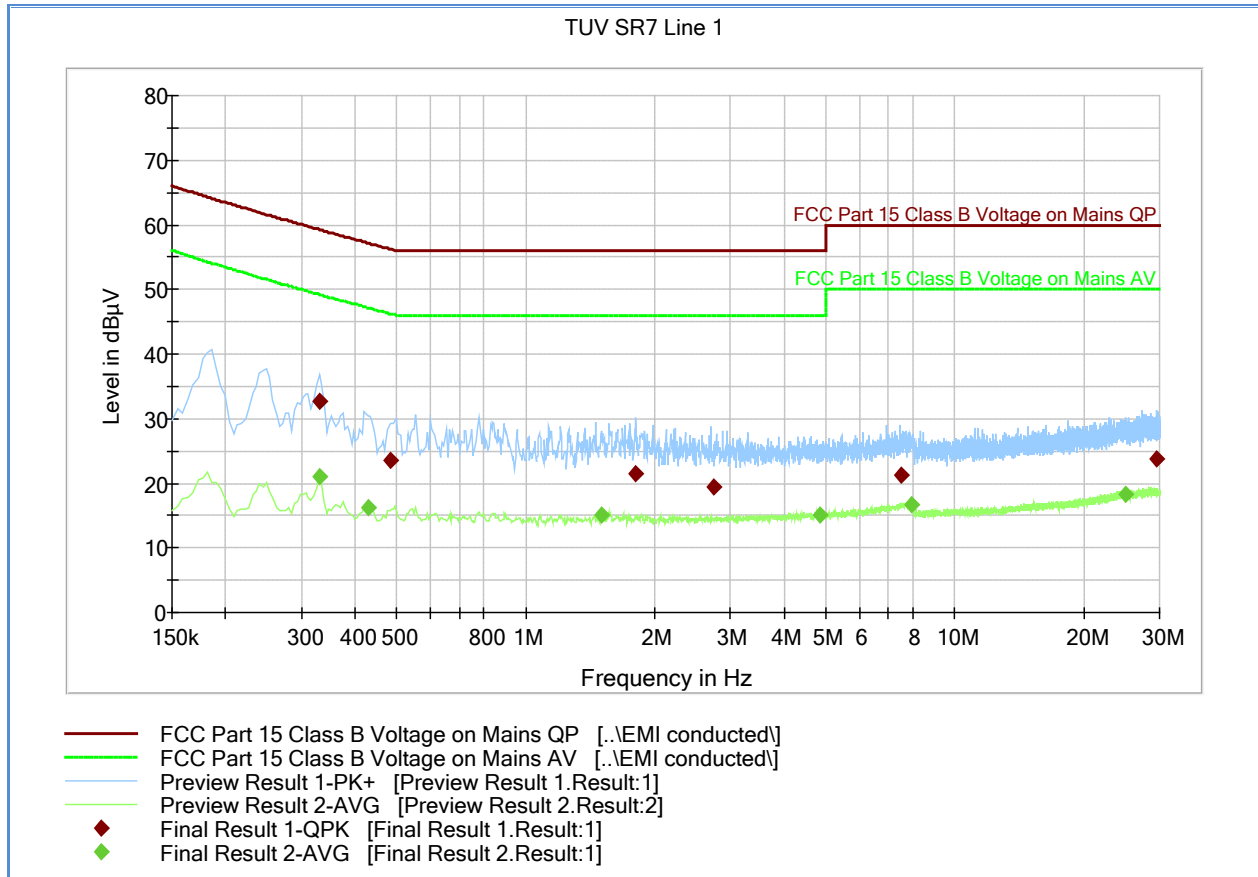
Measuring equipment raw measurement (db μ V) @ 150kHz		5.5
Correction Factor (dB)	Asset# 8607 (20 dB attenuator)	19.9
	Asset# 1177 (cable)	0.15
	Asset# 1176 (cable)	0.35
	Asset# 7567 (LISN)	0.30
Reported QuasiPeak Final Measurement (dbμV) @ 150kHz		26.2

2.1.9 Test Results

Compliant. See attached plots and tables.



2.1.10 Line 1 (Hot)



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.330000	32.7	1000.0	9.000	Off	L1	20.2	26.5	59.3
0.483000	23.6	1000.0	9.000	Off	L1	20.2	32.7	56.3
1.801500	21.5	1000.0	9.000	Off	L1	20.1	34.5	56.0
2.742000	19.5	1000.0	9.000	Off	L1	20.1	36.5	56.0
7.494000	21.3	1000.0	9.000	Off	L1	20.3	38.7	60.0
29.503500	23.8	1000.0	9.000	Off	L1	21.3	36.2	60.0

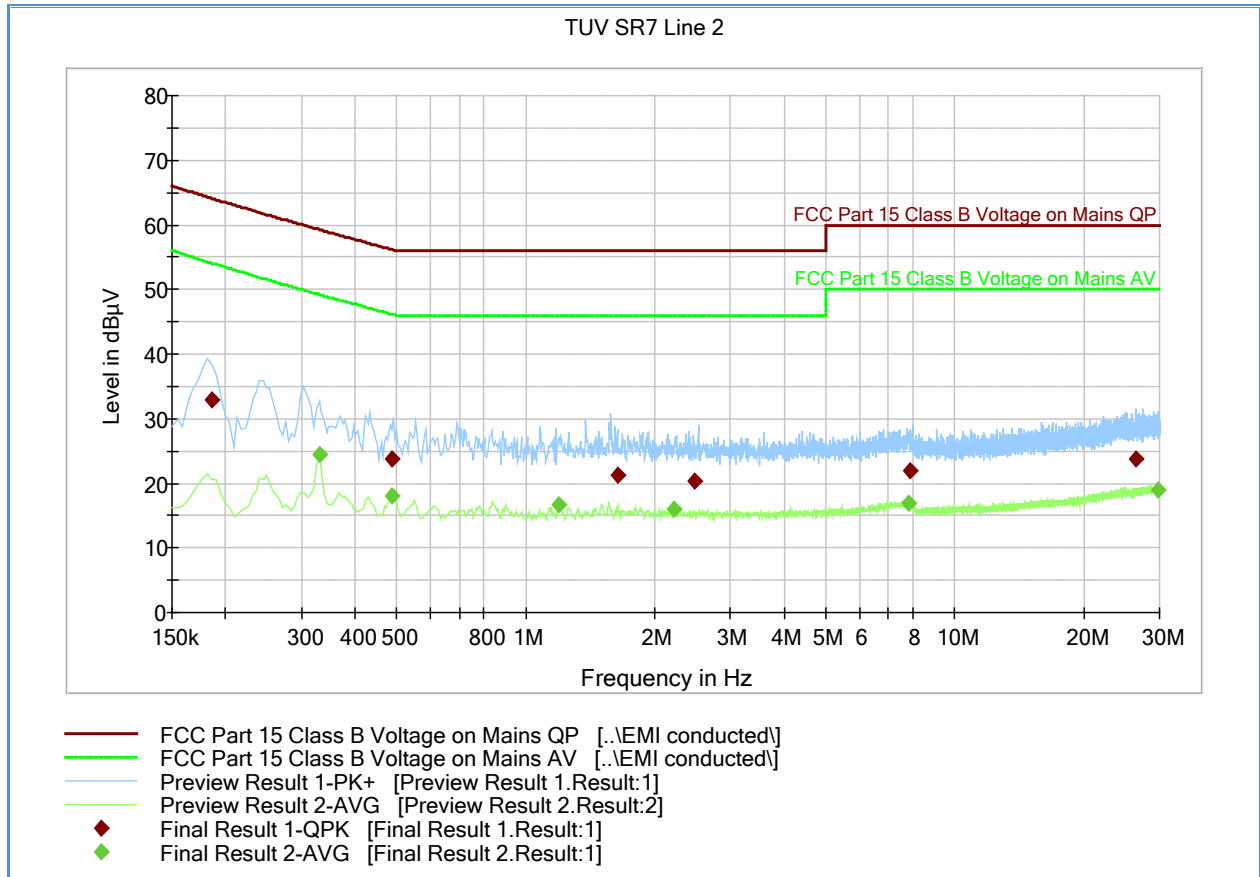
Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.330000	21.0	1000.0	9.000	Off	L1	20.2	28.3	49.2
0.429000	16.2	1000.0	9.000	Off	L1	20.2	31.0	47.2
1.504500	15.0	1000.0	9.000	Off	L1	20.1	31.0	46.0
4.870500	15.0	1000.0	9.000	Off	L1	20.3	31.0	46.0
7.926000	16.6	1000.0	9.000	Off	L1	20.3	33.4	50.0
24.990000	18.4	1000.0	9.000	Off	L1	21.1	31.6	50.0



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2.1.11 Line 2 (Neutral)



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.186000	32.9	1000.0	9.000	Off	N	20.9	31.2	64.1
0.487500	23.7	1000.0	9.000	Off	N	20.6	32.5	56.2
1.635000	21.4	1000.0	9.000	Off	N	20.5	34.6	56.0
2.467500	20.3	1000.0	9.000	Off	N	20.5	35.7	56.0
7.881000	21.9	1000.0	9.000	Off	N	20.7	38.1	60.0
26.434500	23.7	1000.0	9.000	Off	N	21.6	36.3	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.330000	24.4	1000.0	9.000	Off	N	20.6	24.8	49.2
0.487500	18.0	1000.0	9.000	Off	N	20.6	28.2	46.2
1.198500	16.6	1000.0	9.000	Off	N	20.5	29.4	46.0
2.220000	16.0	1000.0	9.000	Off	N	20.5	30.0	46.0
7.804500	16.9	1000.0	9.000	Off	N	20.7	33.1	50.0
29.683500	18.9	1000.0	9.000	Off	N	21.7	31.1	50.0



2.2 20 dB BANDWIDTH

2.2.1 Specification Reference

Part 15 Subpart C §15.215(c)

2.2.2 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.

2.2.3 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

July 24, 2012/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

Ambient Temperature	23.1°C
Relative Humidity	47.9%
ATM Pressure	99.1 kPa

2.2.7 Additional Observations

- This is a radiated test.
- A peak output reading was taken. A display line was drawn 20dB below the peak level.
- 20dB bandwidth verified using delta-marker measurements from the line drawn.
- 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.

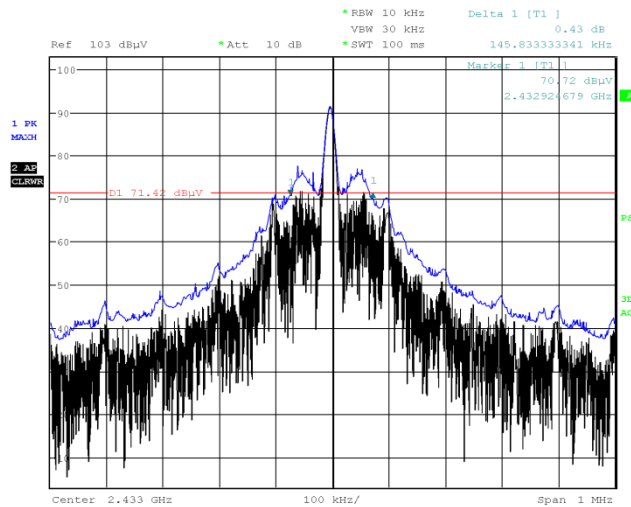


- Trace is max hold.

2.2.8 Test Results

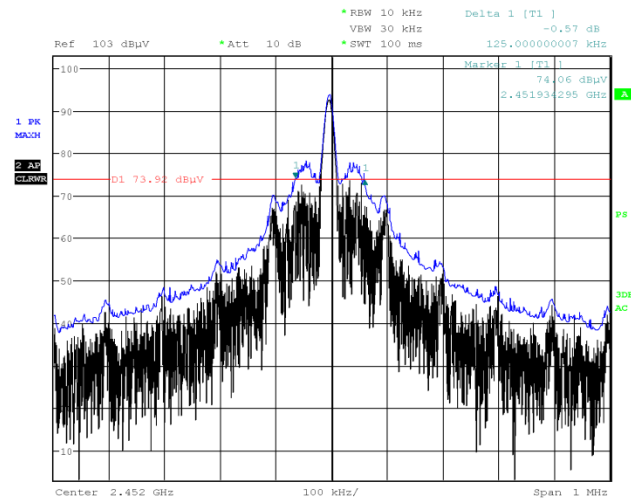
Low Channel (2433 MHz)	Mid Channel (2452MHz)	High Channel (2471MHz)	Control Channel (2440MHz)
145.83 kHz	125.0 kHz	102.56 kHz	141.03 kHz

2433.00 MHz – (20dB BW/2) = 2432.93MHz (within the frequency band - **Compliant**)
 2471.00MHz + (20dB BW/2) = 2471.05 MHz (within the frequency band - **Compliant**)



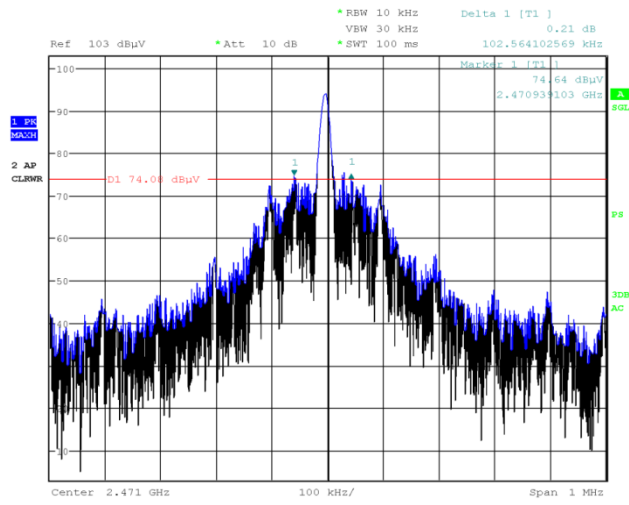
Date: 24.JUL.2012 16:38:04

Low Channel



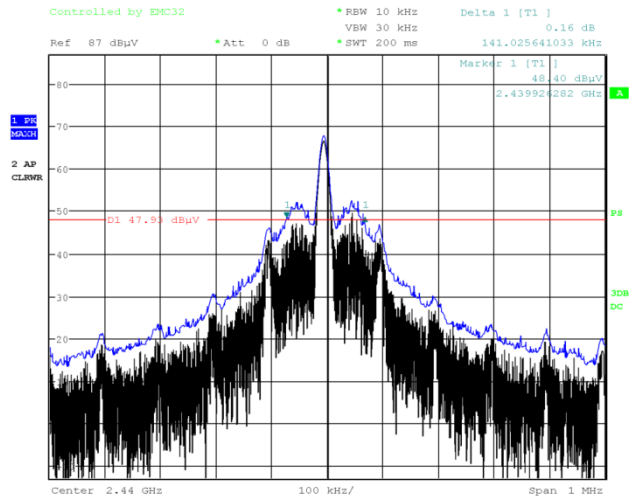
Date: 24.JUL.2012 16:40:19

Mid Channel



Date: 24.JUL.2012 16:51:45

High Channel



Date: 25.JUL.2012 09:09:05

Control Channel



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 / Test Configuration A

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

July 25, 2012/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

Ambient Temperature	23.0°C
Relative Humidity	48.8%
ATM Pressure	99.0 kPa

2.3.7 Additional Observations

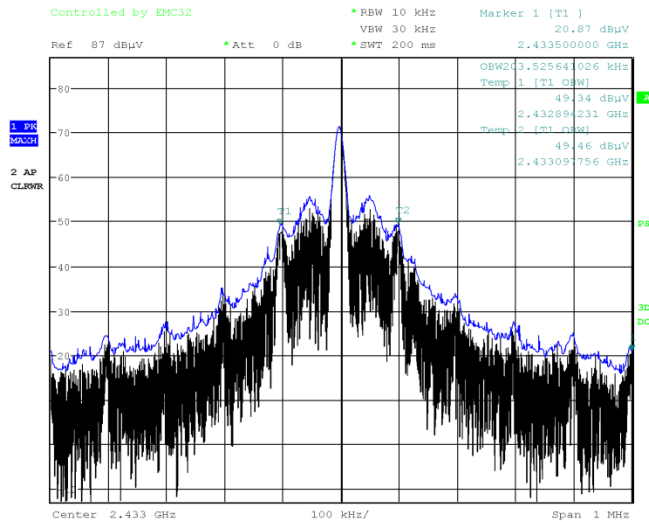
- This is a radiated test.
- Span is wide enough to capture the channel transmission.
- RBW is 1% of the span.
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.



- 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.

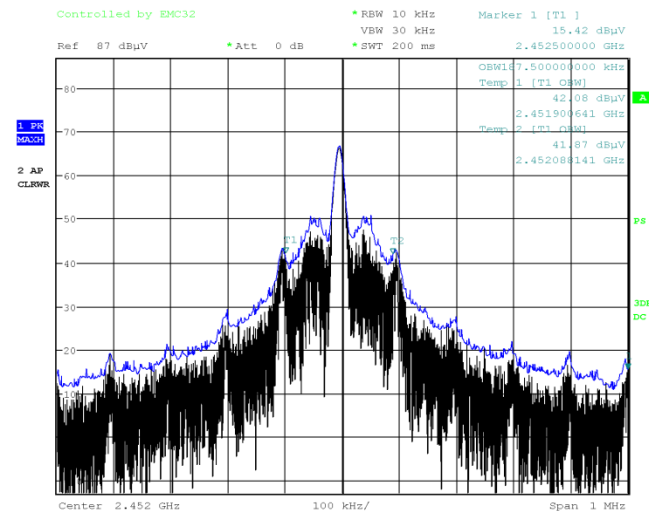
2.3.8 Test Results

Low Channel (2433 MHz)	Mid Channel (2452MHz)	High Channel (2471MHz)	Control Channel (2440MHz)
203.53 kHz	187.5 kHz	152.31 kHz	200.32 kHz



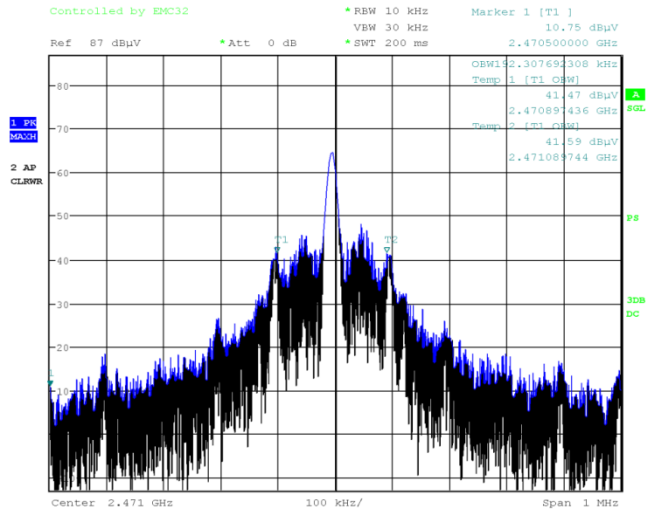
Date: 25.JUL.2012 09:03:25

Low Channel



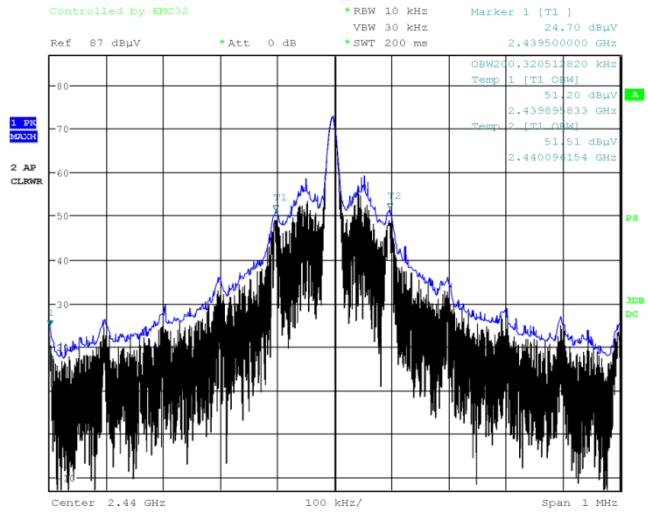
Date: 25.JUL.2012 09:05:29

Mid Channel



Date: 25.JUL.2012 09:07:16

High Channel



Date: 25.JUL.2012 09:04:21

Control Channel



2.4 FIELD STRENGTH LIMITS FOR FUNDAMENTAL AND HARMONICS

2.4.1 Specification Reference

Part 15 Subpart C §15.249(a)

2.4.2 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

2.4.3 Equipment Under Test and Modification State

Serial No: N/A / Test Configuration A

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

July 12 and 24, 2012/KAM, 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 23.1°C, 22.8°C
 Relative Humidity 47.9%, 46.2%
 ATM Pressure 99.1 kPa

2.4.7 Additional Observations

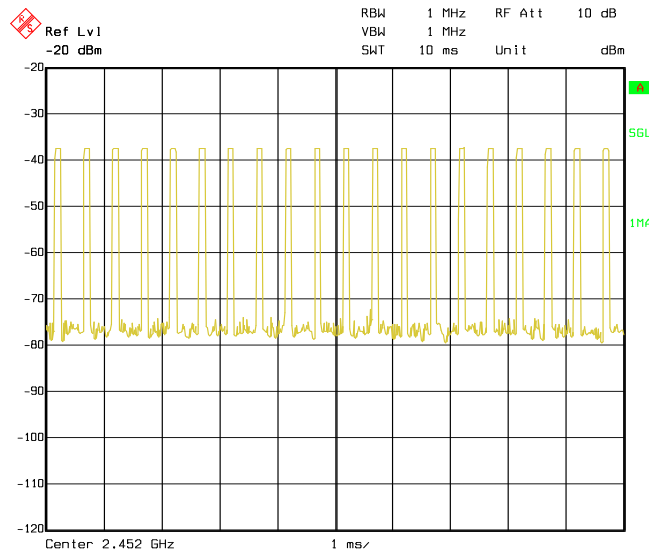
- This is a radiated test. The spectrum was searched from 1GHz to the 10th harmonic (25GHz).
- During fundamental measurements, harmonics scanned during the sweep are ignored. A separate harmonics measurements were performed with a notch filter installed attenuating the fundamental frequencies.
- Measurement 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.



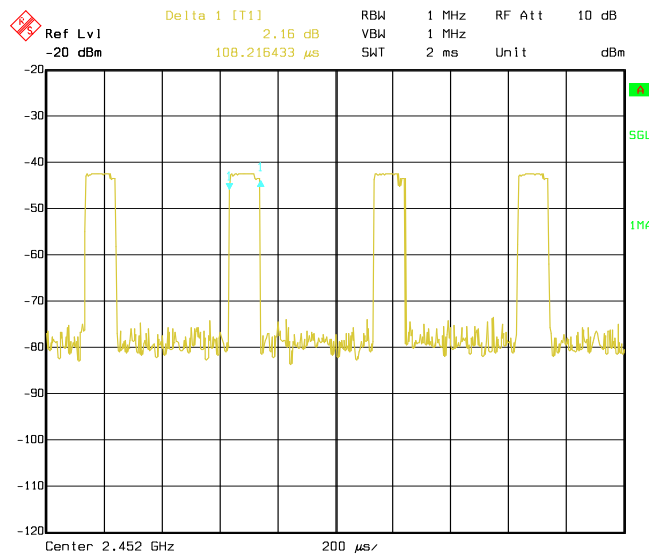
2.4.8 Sample Computation (Radiated Emission)

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# 1051 (antenna)	28.3	
Reported Peak Final Measurement (dbμV/m) @ 2400 MHz			53.6

2.4.9 Duty Cycle Correction Factor Calculation



10ms sweep (representative channel)



2ms sweep (representative channel)



Duty Cycle Calculation: = 20x "on" time per 10ms
= 200x "on" time per 100ms (20 x 10ms)
= 0.108 ms x 200
= 21.6 ms "On" time per 100 ms sweep

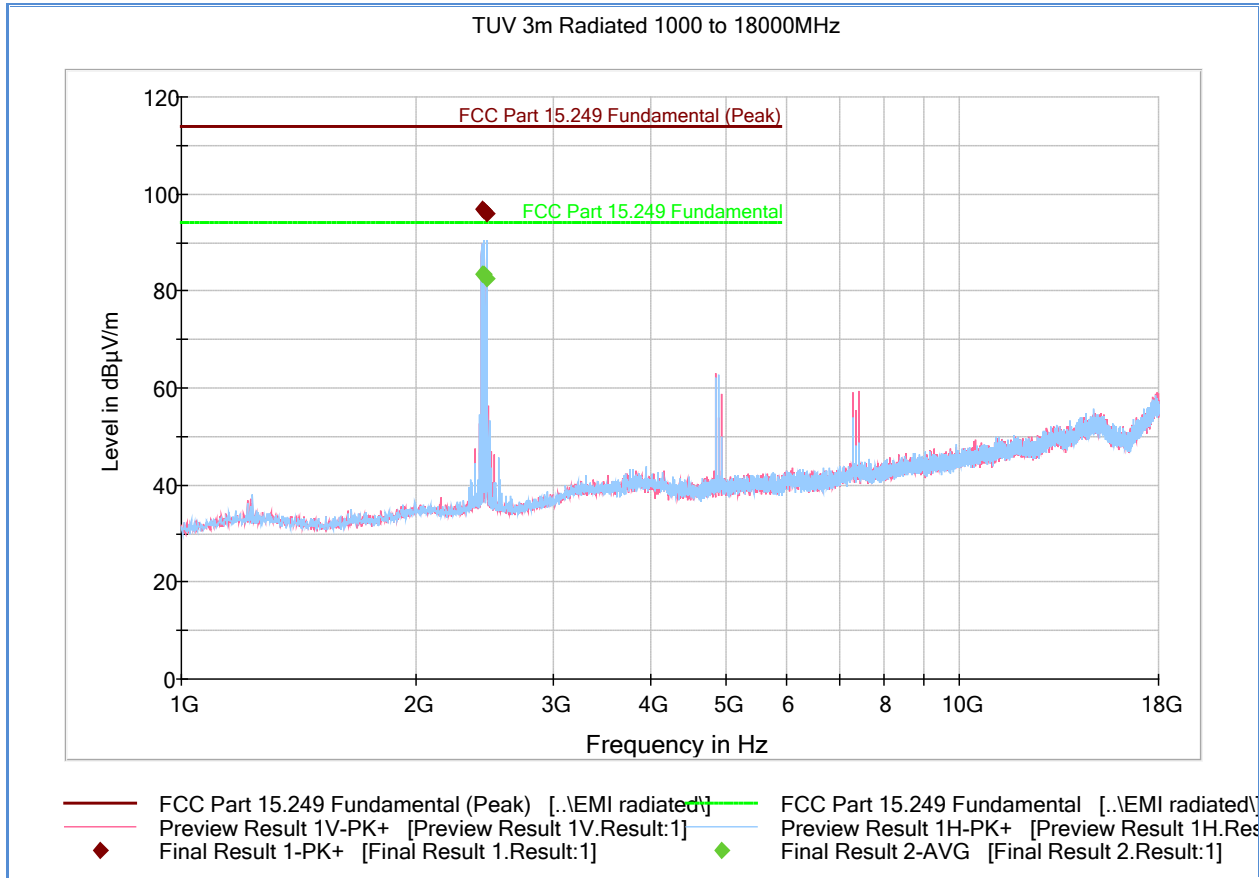
Duty Cycle Correction Factor = 20 log (0.216)
= **-13.31dB**

2.4.10 Test Results

See attached plots.



2.4.11 Test Results Fundamental ("X" axis configuration)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2433.00000	96.8	1000.0	1000.000	100.0	H	221.0	-4.7	17.2	114.0
2452.00000	96.6	1000.0	1000.000	100.0	H	220.0	-4.7	17.4	114.0
2471.00000	95.9	1000.0	1000.000	100.0	V	93.0	-4.6	18.0	114.0

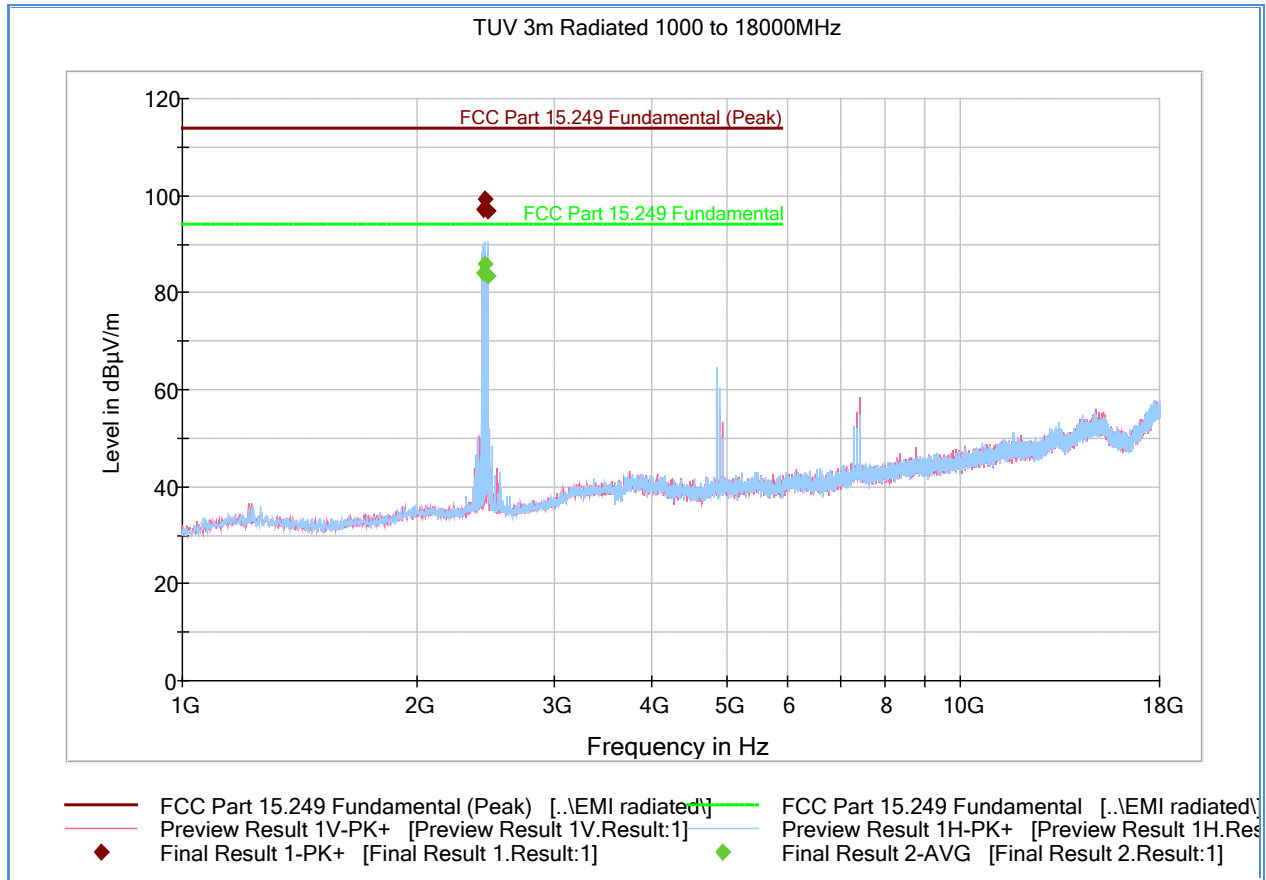
Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2433.00000	83.5							10.5	94.0
2452.00000	83.3							10.7	94.0
2471.00000	82.6							11.4	94.0

Test Notes: Average data are from Peak data with Duty Cycle correction factor applied. Sample computation:
 2433.0 MHz (Low Channel) = 96.8 dBµV/m (Peak)
 = 96.8 dBµV/m + (-13.31 dB DCCF)
 = 83.49 dBµV/m (Average)



2.4.12 Test Results Fundamental ("Y" axis configuration)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2433.00000	97.3	1000.0	1000.000	120.0	H	91.0	-4.7	16.7	114.0
2452.00000	99.2	1000.0	1000.000	100.0	H	276.0	-4.7	14.7	114.0
2471.00000	96.8	1000.0	1000.000	100.0	H	88.0	-4.6	17.2	114.0

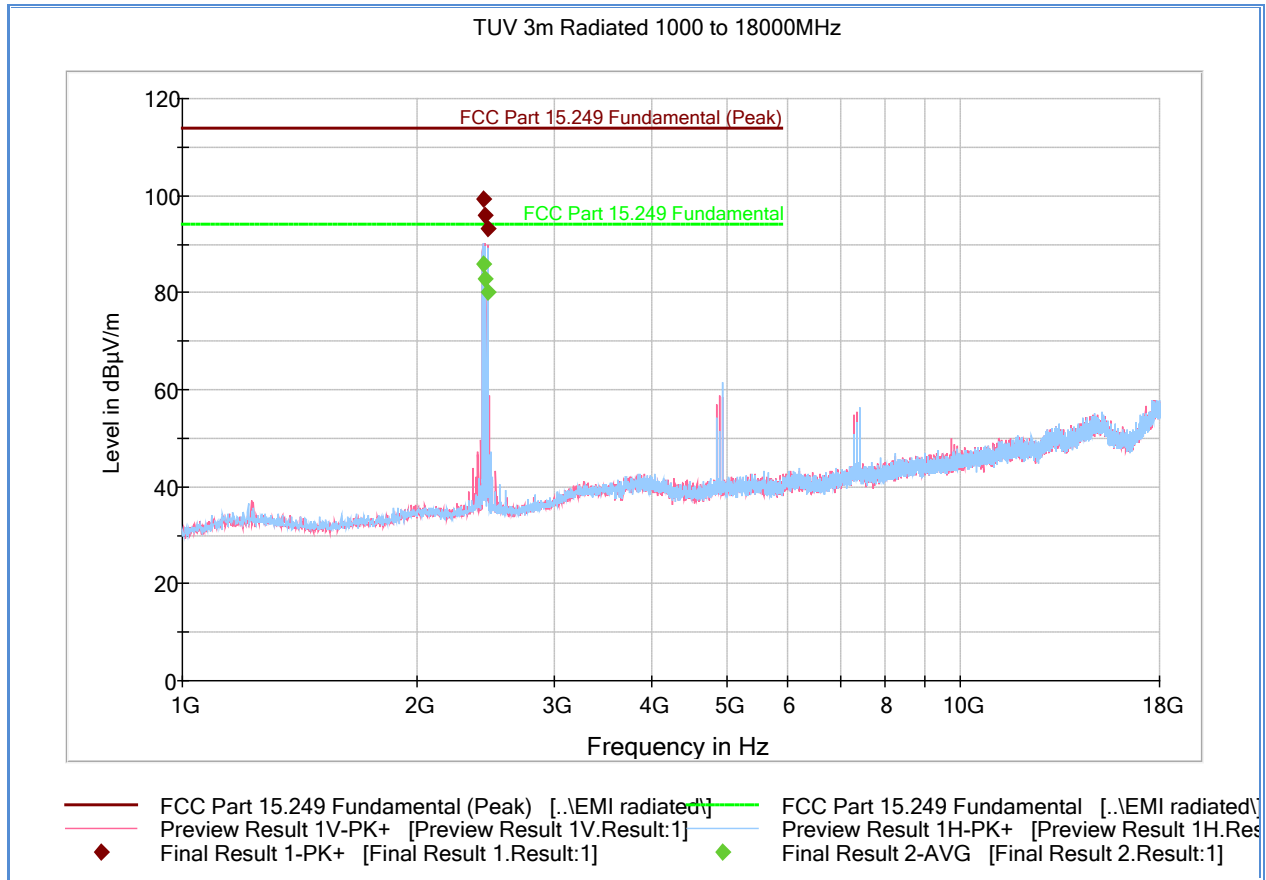
Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2433.00000	84.0							10.0	94.0
2452.00000	85.9							8.1	94.0
2471.00000	83.5							10.5	94.0

Test Notes: Average data are from Peak data with Duty Cycle correction factor applied. Sample computation:
 2433.0 MHz (Low Channel) = 97.3 dBµV/m (Peak)
 = 97.3 dBµV/m + (-13.31 dB DCCF)
 = 83.99 dBµV/m (Average)



2.4.13 Test Results Fundamental ("Z" axis configuration)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2433.00000	99.3	1000.0	1000.000	110.0	H	216.0	-4.7	14.7	114.0
2452.00000	96.0	1000.0	1000.000	128.0	V	128.0	-4.7	18.0	114.0
2471.00000	93.3	1000.0	1000.000	165.0	V	348.0	-4.6	20.7	114.0

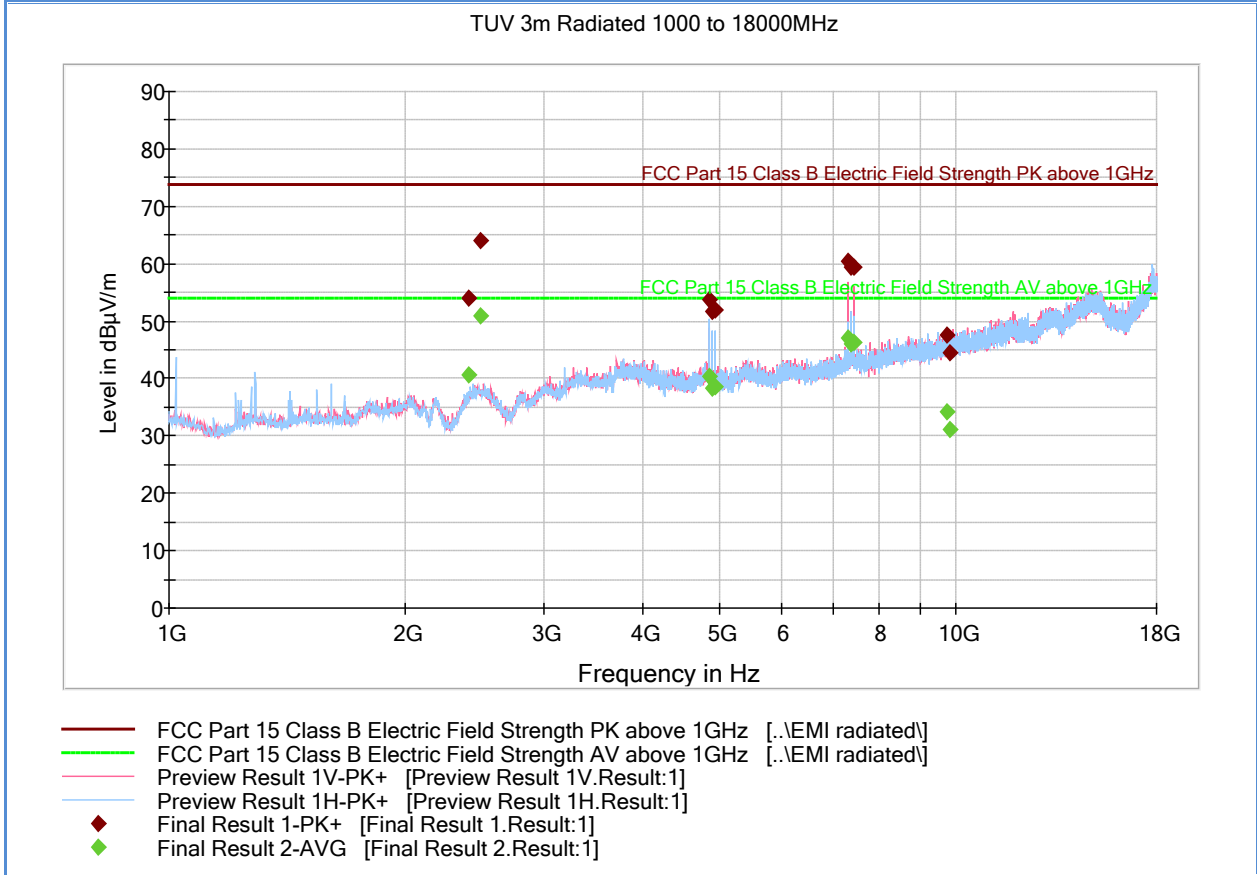
Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2433.00000	86.0							8.0	94.0
2452.00000	82.7							11.3	94.0
2471.00000	80.0							14.0	94.0

Test Notes: Average data are from Peak data with Duty Cycle correction factor applied. Sample computation:
 2433.0 MHz (Low Channel) = 99.3 dBµV/m (Peak)
 = 99.3 dBµV/m + (-13.31 dB DCCF)
 = 85.99 dBµV/m (Average)



2.4.14 Test Results Harmonics ("X" axis configuration)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2400.460000	54.0	100.0	1000.000	149.0	H	150.0	4.7	19.9	73.9
2483.080000	64.1	100.0	1000.000	100.0	H	95.0	5.6	9.8	73.9
4865.980000	53.7	1000.0	1000.000	131.0	H	63.0	2.2	20.2	73.9
4903.980000	51.7	1000.0	1000.000	100.0	H	110.0	2.2	22.2	73.9
4942.000000	51.8	1000.0	1000.000	150.0	V	154.0	2.3	22.1	73.9
7299.000000	60.3	1000.0	1000.000	107.0	V	352.0	7.0	13.6	73.9
7356.000000	59.3	1000.0	1000.000	112.0	V	168.0	7.2	14.6	73.9
7412.980000	59.5	1000.0	1000.000	136.0	V	168.0	7.2	14.4	73.9
9731.980000	47.6	1000.0	1000.000	243.0	V	45.0	9.5	26.3	73.9
9812.900000	44.5	1000.0	1000.000	268.0	V	116.0	9.7	29.4	73.9



Average Data

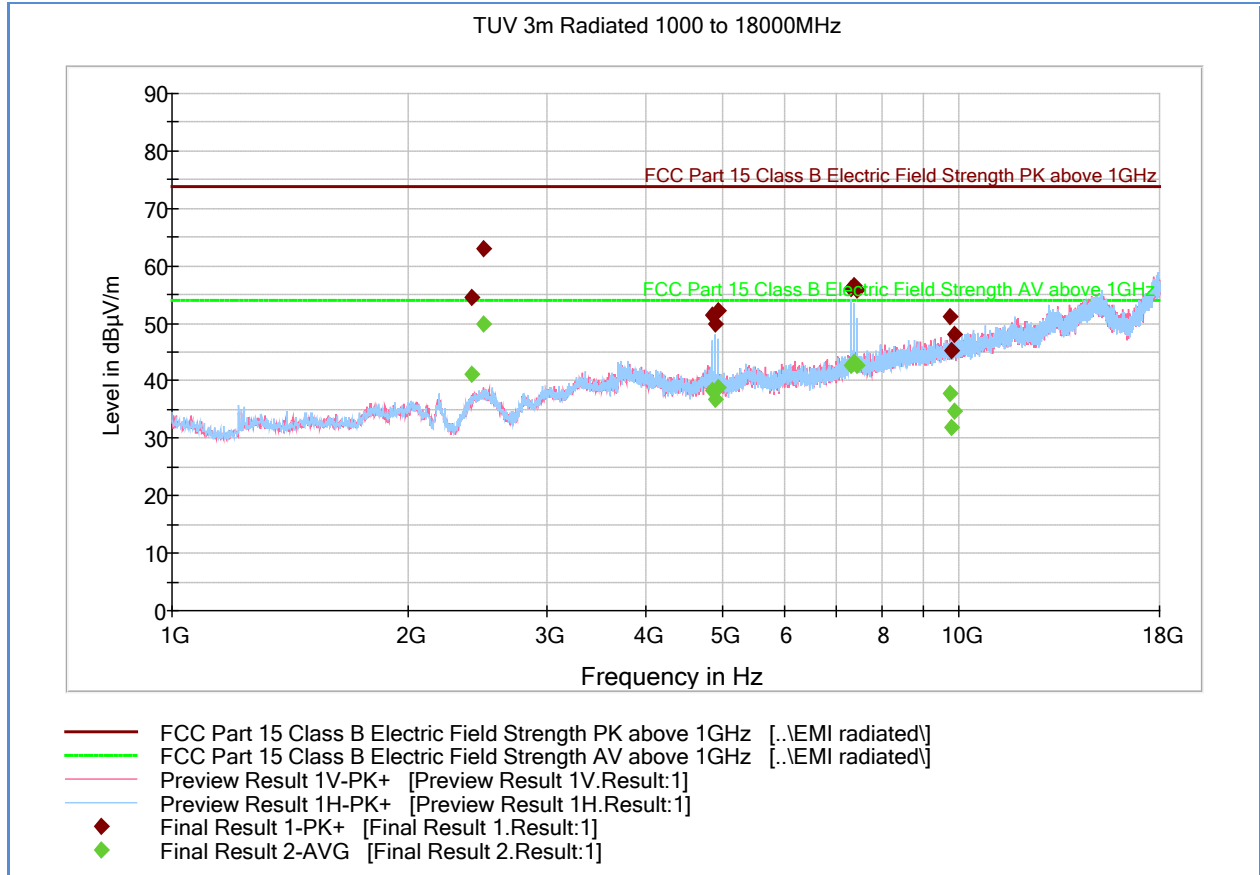
Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2400.460000	40.7							13.2	53.9
2483.080000	50.8							3.1	53.9
4865.980000	40.4							13.5	53.9
4903.980000	38.4							15.5	53.9
4942.000000	38.5							15.4	53.9
7299.000000	47							6.9	53.9
7356.000000	46							7.9	53.9
7412.980000	46.2							7.7	53.9
9731.980000	34.3							19.6	53.9
9812.900000	31.2							22.7	53.9

Test Notes 1: Measurement was performed with a 2.4GHz notch filter. Band edge measurements were performed with the notch filter removed. Worst band edge measurements presented.

Test Notes 2: Average data are from Peak data with Duty Cycle correction factor applied. Sample computation:
 4865.98 MHz = 53.7 dBµV/m (Peak)
 = 53.7 dBµV/m + (-13.31 dB DCCF)
 = 40.4 dBµV/m (Average)



2.4.15 Test Results Harmonics (“Y” axis configuration)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2400.500000	54.5	100.0	1000.000	100.0	H	172.0	4.7	19.4	73.9
2483.000000	63.1	100.0	1000.000	100.0	H	87.0	5.6	10.8	73.9
4865.980000	51.5	1000.0	1000.000	100.0	H	66.0	2.2	22.4	73.9
4903.980000	50.0	1000.0	1000.000	100.0	H	67.0	2.2	23.9	73.9
4942.000000	52.1	1000.0	1000.000	115.0	H	267.0	2.3	21.8	73.9
7299.000000	56.1	1000.0	1000.000	154.0	H	8.0	7.0	17.8	73.9
7356.000000	56.5	1000.0	1000.000	141.0	H	5.0	7.2	17.4	73.9
7412.980000	55.9	1000.0	1000.000	171.0	H	304.0	7.2	18.0	73.9
9732.000000	51.1	1000.0	1000.000	128.0	V	181.0	9.5	22.8	73.9
9803.680000	45.1	1000.0	1000.000	123.0	H	27.0	9.7	28.8	73.9
9883.980000	48.1	1000.0	1000.000	144.0	V	85.0	9.9	25.8	73.9



Average Data

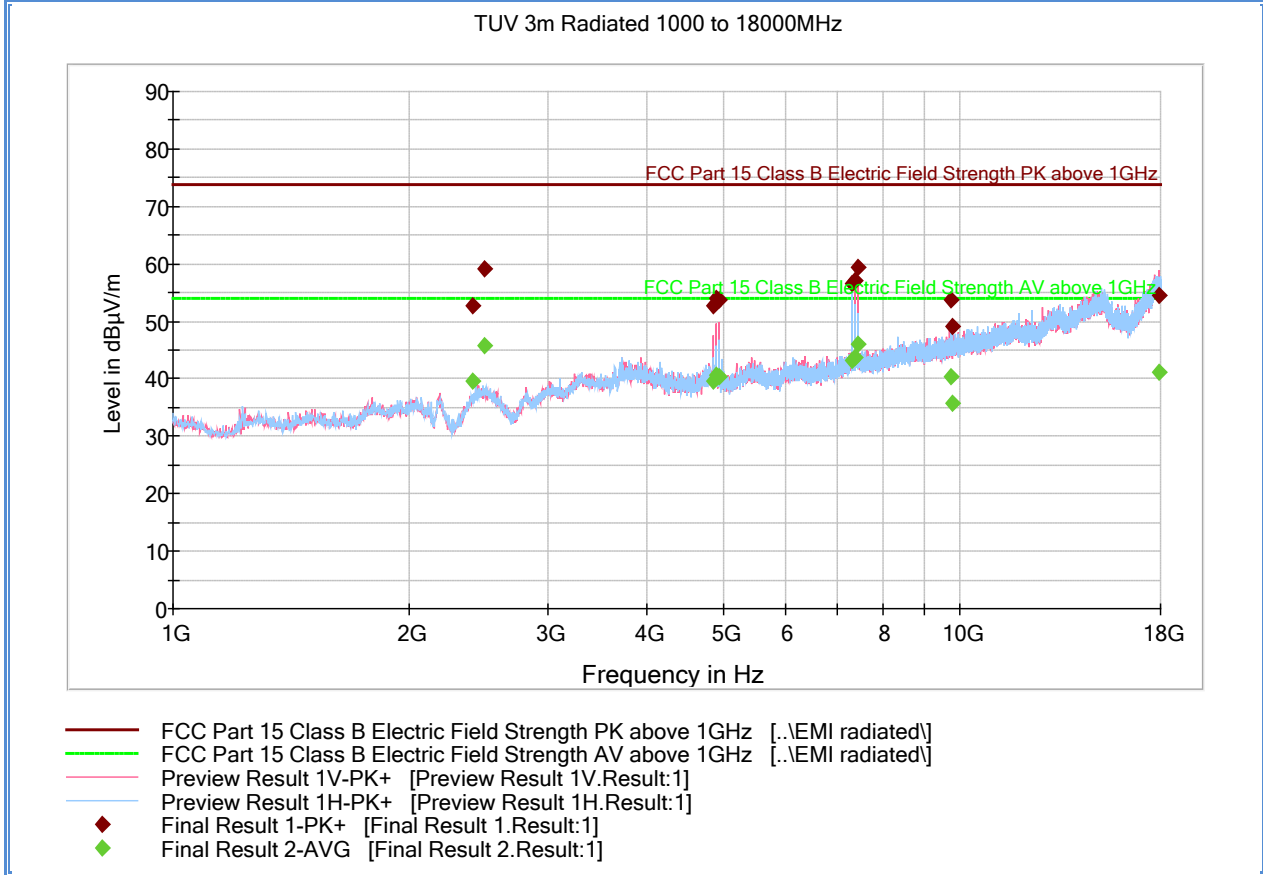
Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2400.500000	41.2							12.7	53.9
2483.000000	49.8							4.1	53.9
4865.980000	38.2							15.7	53.9
4903.980000	36.7							17.2	53.9
4942.000000	38.8							15.1	53.9
7299.000000	42.8							11.1	53.9
7356.000000	43.2							10.7	53.9
7412.980000	42.6							11.3	53.9
9732.000000	37.8							16.1	53.9
9803.680000	31.8							22.1	53.9
9883.980000	34.8							19.1	53.9

Test Notes 1: Measurement was performed with a 2.4GHz notch filter. Band edge measurements were performed with the notch filter removed. Worst band edge measurements presented.

Test Notes 2: Average data are from Peak data with Duty Cycle correction factor applied. Sample computation:
 4865.98 MHz = 51.5 dBµV/m (Peak)
 = 51.5 dBµV/m + (-13.31 dB DCCF)
 = 38.2 dBµV/m (Average)



2.4.16 Test Results Harmonics ("Z" axis configuration)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2400.300000	52.8	100.0	1000.000	100.0	H	84.0	4.7	21.1	73.9
2483.000000	59.2	100.0	1000.000	100.0	H	92.0	5.6	14.7	73.9
4865.980000	52.8	1000.0	1000.000	154.0	V	186.0	2.2	21.1	73.9
4903.980000	54.0	1000.0	1000.000	167.0	V	180.0	2.2	19.9	73.9
4942.000000	53.7	1000.0	1000.000	165.0	V	154.0	2.3	20.2	73.9
7299.000000	56.6	1000.0	1000.000	191.0	V	212.0	7.0	17.3	73.9
7356.000000	57.0	1000.0	1000.000	144.0	V	233.0	7.2	16.9	73.9
7412.980000	59.4	1000.0	1000.000	150.0	V	242.0	7.2	14.5	73.9
9731.980000	53.6	1000.0	1000.000	115.0	V	40.0	9.5	20.3	73.9
9807.960000	49.0	1000.0	1000.000	115.0	V	75.0	9.7	24.9	73.9
17953.720000	54.4	1000.0	1000.000	357.0	V	256.0	21.1	19.5	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)
2400.300000	39.5							14.4	53.9
2483.000000	45.9							8	53.9
4865.980000	39.5							14.4	53.9
4903.980000	40.7							13.2	53.9
4942.000000	40.4							13.5	53.9
7299.000000	43.3							10.6	53.9
7356.000000	43.7							10.2	53.9
7412.980000	46.1							7.8	53.9
9731.980000	40.3							13.6	53.9
9807.960000	35.7							18.2	53.9
17953.720000	41.1							12.8	53.9

Test Notes 1: Measurement was performed with a 2.4GHz notch filter. Band edge measurements were performed with the notch filter removed. Worst band edge measurements presented.

Test Notes 2: Average data are from Peak data with Duty Cycle correction factor applied. Sample computation:
 4865.98 MHz = 52.8 dBµV/m (Peak)
 = 52.8 dBµV/m + (-13.31 dB DCCF)
 = 39.5 dBµV/m (Average)



2.5 SPURIOUS RADIATED EMISSIONS

2.5.1 Specification Reference

Part 15 Subpart C §15.249(d)

2.5.2 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.

2.5.3 Equipment Under Test and Modification State

Serial No: N/A / Test Configuration A

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

July 12 & 25, 2012/KAM

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

Ambient Temperature	23.1°C
Relative Humidity	47.9%
ATM Pressure	99.1 kPa

2.5.7 Additional Observations

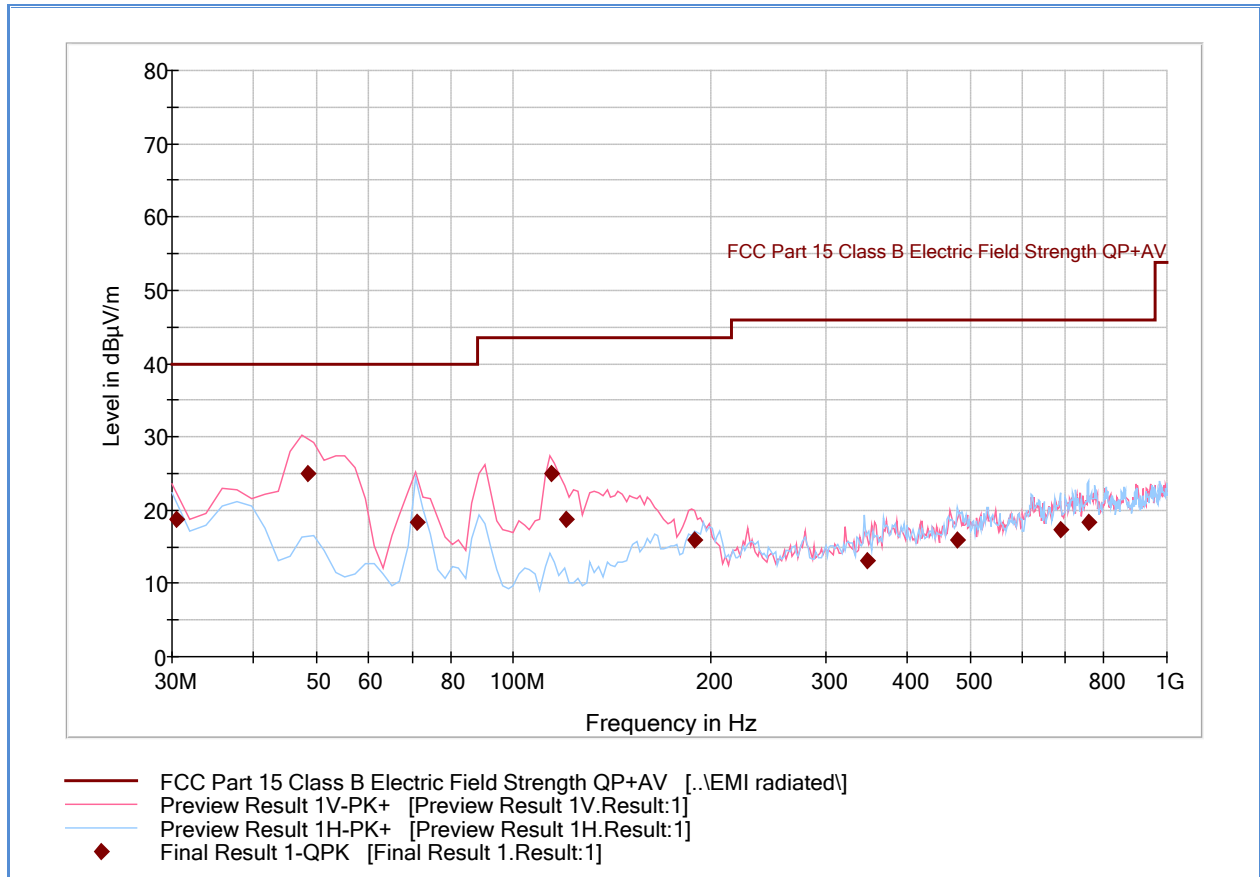
- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic (25GHz). There are no emissions observed beyond 18GHz.
- No significant emission observed below 1GHz. Data presented is from worst configuration based from fundamental/harmonics verification ("Y" axis configuration).
- Above 1GHz measurement results are identical to test results presented under Section 2.4.13 up to Section 2.4.15 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 2.5.8 for sample computation.

2.5.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dbµV) @ 2400 MHz		58.4
Correction Factor (dB)	Asset# 1153 (cable)	3.3
	Asset# 8628 (preamplifier)	-36.4
	Asset# 1051 (antenna)	28.3
Reported Peak Final Measurement (dbµV/m) @ 2400 MHz		53.6



2.5.9 Test Results Below 1GHz (“Y” Configuration)



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)
30.440000	18.8	1000.0	120.000	362.0	V	172.0	-12.4	21.2	40.0
48.374990	25.0	1000.0	120.000	100.0	V	7.0	-20.2	15.0	40.0
71.221643	18.3	1000.0	120.000	168.0	V	232.0	-22.2	21.7	40.0
114.027174	25.0	1000.0	120.000	100.0	V	180.0	-20.7	18.5	43.5
120.026613	18.7	1000.0	120.000	100.0	V	197.0	-20.9	24.8	43.5
188.734910	15.9	1000.0	120.000	100.0	V	214.0	-16.6	27.6	43.5
347.349820	13.0	1000.0	120.000	235.0	H	82.0	-10.5	33.0	46.0
478.734188	15.8	1000.0	120.000	142.0	H	97.0	-6.7	30.2	46.0
686.594068	17.4	1000.0	120.000	382.0	H	348.0	-3.4	28.6	46.0
758.837916	18.2	1000.0	120.000	238.0	H	3.0	-1.8	27.8	46.0



2.6 RECEIVER SPURIOUS EMISSIONS

2.6.1 Specification Reference

RSS-Gen 4.10

2.6.2 Standard Applicable

The receiver shall be operated in the normal receive mode near the mid-point of the band over which the receiver is designed to operate. Spurious Emission Limits for Receivers

Fundamental frequency	Field strength of harmonics (microvolts/m at 3meters)
30–88 MHz	100
88–216 MHz	150
216–960 MHz	200
Above 960 MHz	500

2.6.3 Equipment Under Test and Modification State

Serial No: N/A / Test configuration B

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

July 24, 2012/JMG

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

Ambient Temperature 27.8°C
Relative Humidity 48.8%
ATM Pressure 98.9 kPa

2.6.7 Additional Observations

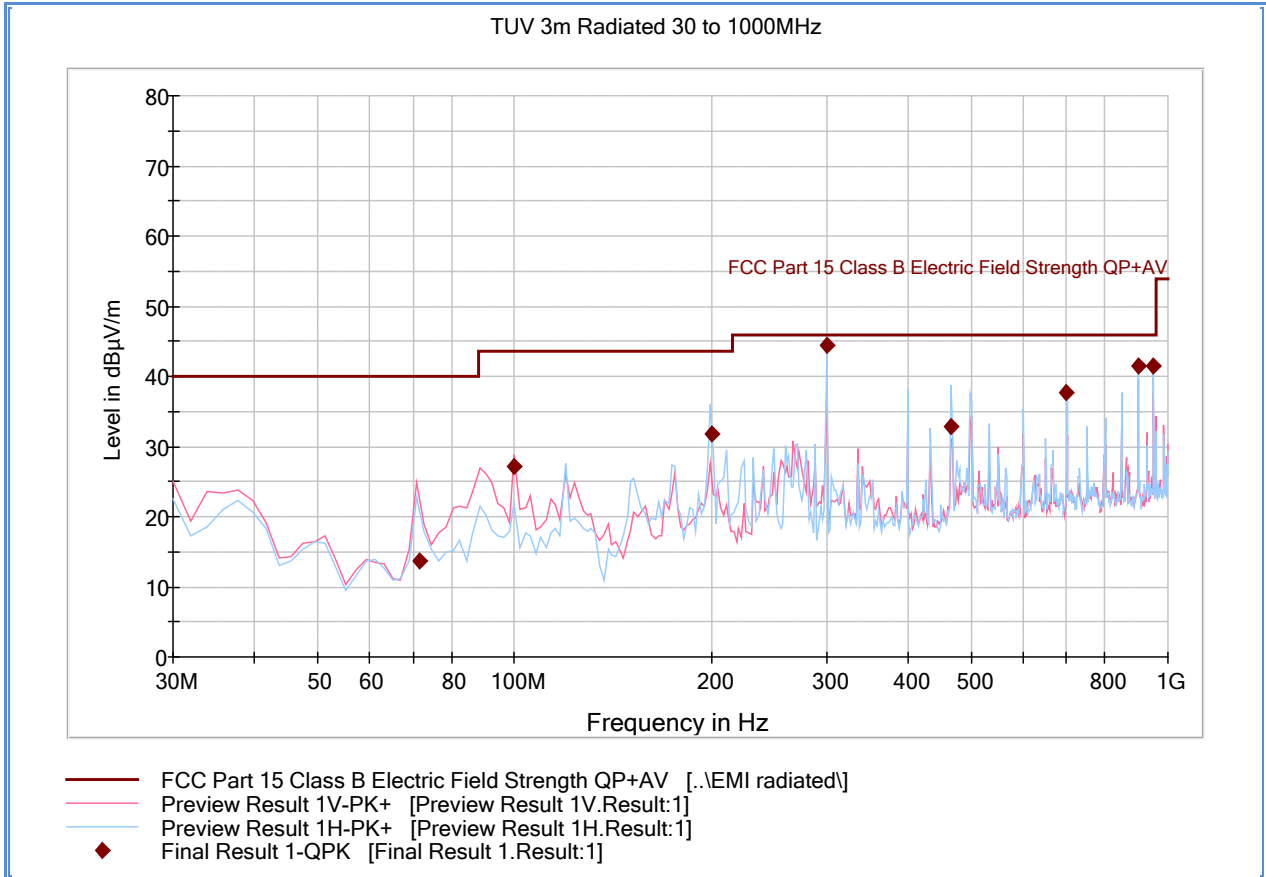
- This is a radiated test. The spectrum was searched from 30MHz to the 18GHz (6GHz as per requirement).
- Limit used is from FCC §15.209 which is identical to RSS-Gen limits.
- All emissions within 10dB of the limit were verified coming from the support equipment and not the EUT.
- Measurement was done 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.



2.6.8 Test Results

See attached plots.

2.6.9 Test Results Below 1GHz

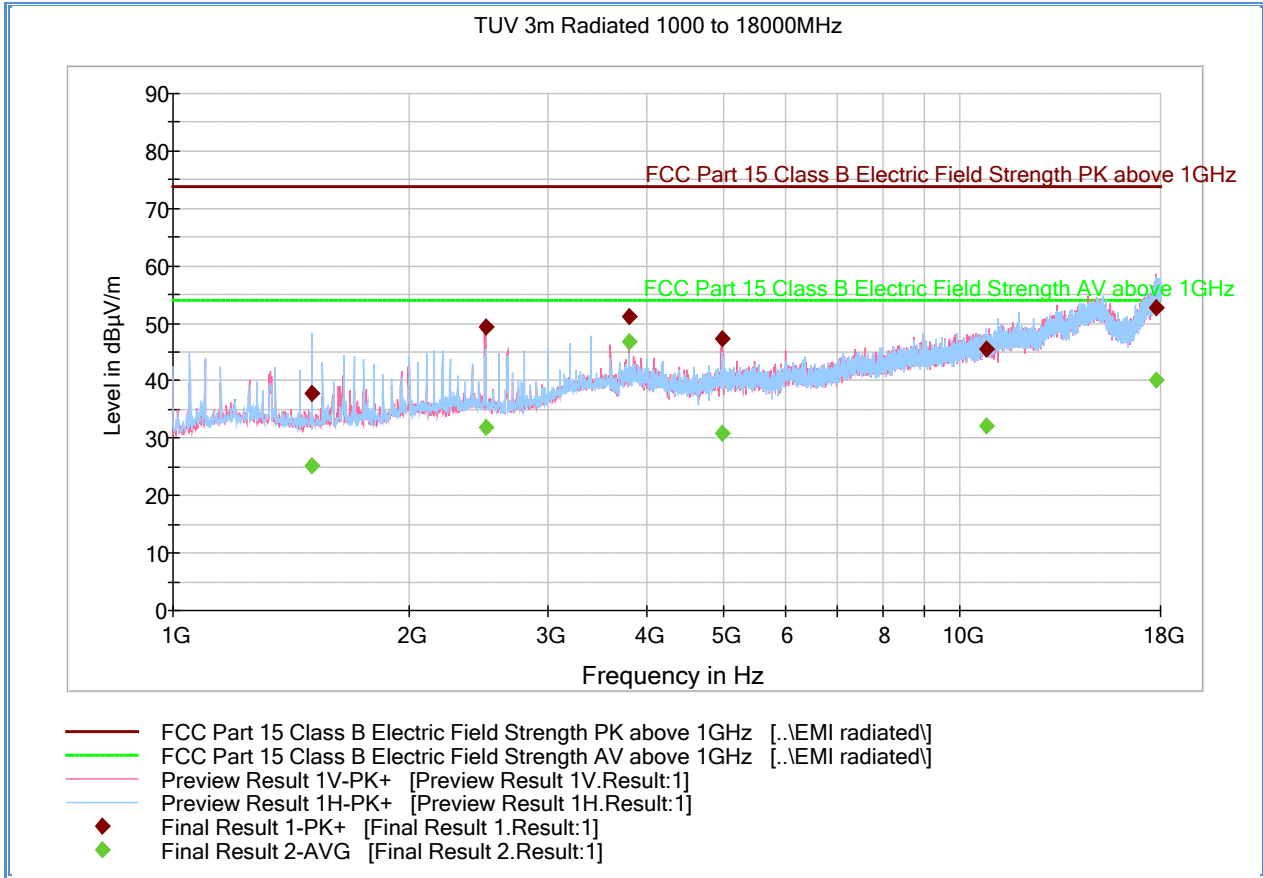


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
71.581643	13.7	1000.0	120.000	100.0	V	262.0	-22.2	26.3	40.0
100.019960	27.1	1000.0	120.000	106.0	V	74.0	-20.3	16.4	43.5
200.038236	31.7	1000.0	120.000	146.0	H	350.0	-16.5	11.8	43.5
300.000401	44.5	1000.0	120.000	100.0	H	72.0	-13.1	1.5	46.0
466.590862	32.8	1000.0	120.000	184.0	H	236.0	-7.5	13.2	46.0
700.001283	37.7	1000.0	120.000	100.0	H	262.0	-3.7	8.3	46.0
900.021723	41.5	1000.0	120.000	100.0	H	46.0	-0.2	4.5	46.0
950.042806	41.5	1000.0	120.000	100.0	H	42.0	-0.3	4.5	46.0



2.6.10 Test Results Above 1GHz



Peak Data

Frequency (MHz)	Max Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.020000	37.9	1000.0	1000.000	100.0	H	268.0	-9.0	36.0	73.9
2495.460000	49.3	1000.0	1000.000	100.0	V	88.0	-4.6	24.6	73.9
3800.120000	51.1	1000.0	1000.000	100.0	V	31.0	3.1	22.8	73.9
4988.460000	47.2	1000.0	1000.000	158.0	V	309.0	2.4	26.7	73.9
10793.480000	45.5	1000.0	1000.000	239.0	H	229.0	11.2	28.4	73.9
17773.600000	52.8	1000.0	1000.000	173.0	V	342.0	20.8	21.1	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)
1500.020000	25.2	1000.0	1000.000	100.0	H	268.0	-9.0	28.8	53.9
2495.460000	31.9	1000.0	1000.000	100.0	V	88.0	-4.6	22.0	53.9
3800.120000	46.7	1000.0	1000.000	100.0	V	31.0	3.1	7.2	53.9
4988.460000	31.0	1000.0	1000.000	158.0	V	309.0	2.4	22.9	53.9
10793.480000	32.3	1000.0	1000.000	239.0	H	229.0	11.2	21.6	53.9
17773.600000	40.2	1000.0	1000.000	173.0	V	342.0	20.8	13.7	53.9



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
1033	Bilog Antenna	3142C	00058717	EMCO	12/06/11	12/06/12
1024	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	02/29/12	02/28/13
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	08/10/11	08/10/12
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	06/13/12	06/13/13
6815	2.4GHz Band Notch Filter	BRM50702	008	Micro-Tronics	Verified by 1040	
1051	Double-ridged waveguide horn antenna	3115	9412-4364	EMCO	11/07/11	11/07/12
1016	Pre-amplifier	PAM-0202	187	PAM	08/17/11	08/17/12
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	10/13/11	10/13/12
1150	Horn antenna	RA42-K-F-4B-C	012054-004	CMT	Verified by 1003 and 1049	
1151	Pre-amplifier	TS-PR26	100026	Rhode & Schwarz	Verified by 1003 and 1049	
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	08/17/11	08/17/12
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	08/17/11	08/17/12
1173	Low-loss coaxial cable	Nokia Kabel RG213	N/A	Chase London	04/15/12	04/15/13
8607	20dB Attenuator	CAT-20	N/A	MCL HAT-20	07/29/11	07/29/12
8609	20dB Attenuator	CAT-20	N/A	MCL HAT-20	07/29/11	07/29/12
7567	LISN	FCC-LISN-50-25-2-10	120304	Fischer Custom Comm.	05/24/12	05/24/13
7568	LISN	FCC-LISN-50-25-2-10	120305	Fischer Custom Comm.	05/24/12	05/24/13
1123	DC Power Supply	E3631A	N/A	Hewlett Packard	Verified by 7514	
7514	Multimeter	34410A	MY45002624	Agilent	08/01/11	08/01/12
	Test Software	EMC32	V8.52	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	3.55	2.05	4.20
6 EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):				2.23
Coverage Factor (k):				2
Expanded Uncertainty:				4.45

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	3.55	2.05	4.20
6 EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):				2.22
Coverage Factor (k):				2
Expanded Uncertainty:				4.44

3.2.3 Conducted Antenna Port Measurement

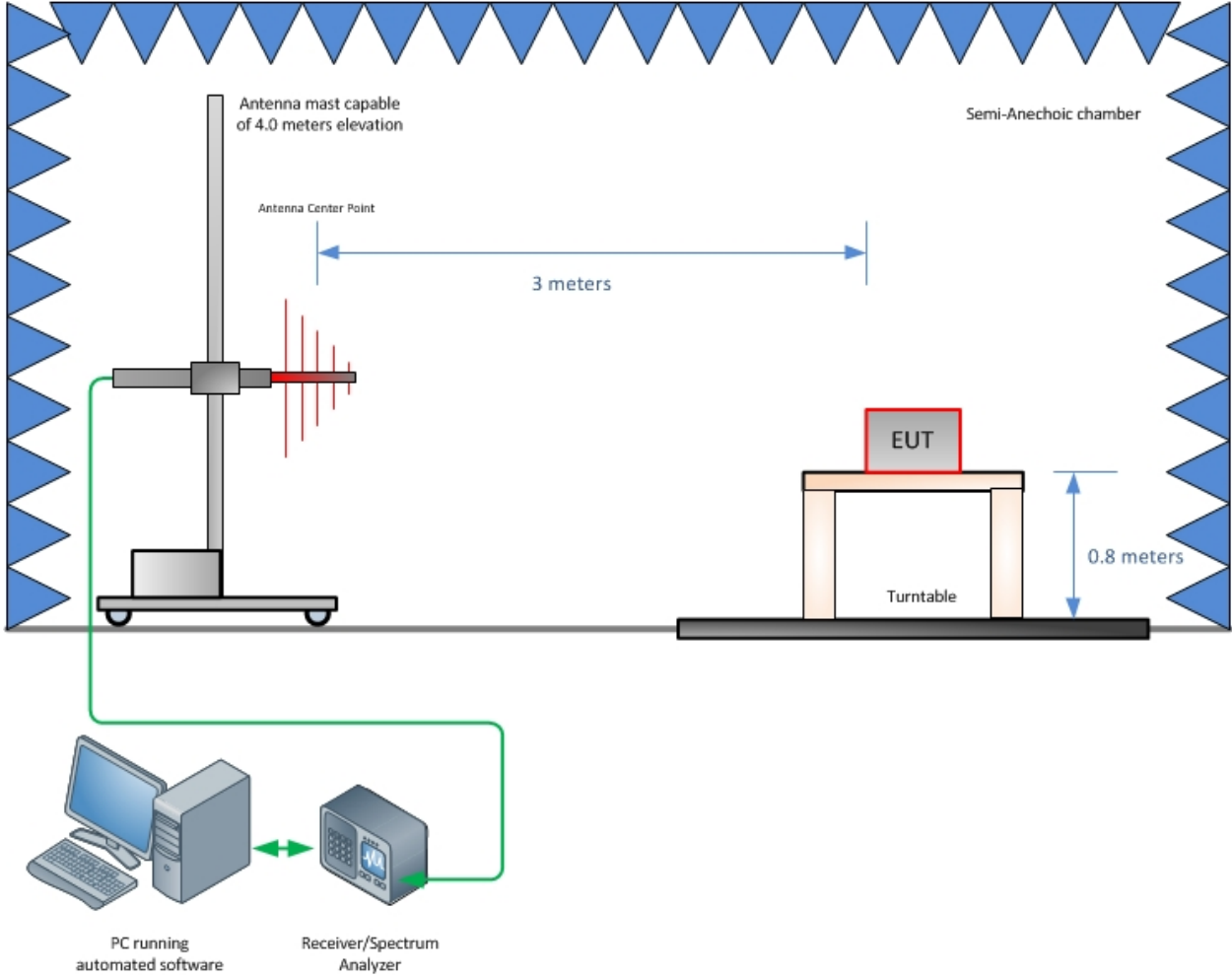
Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1 Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2 Cables	Rectangular	0.50	0.29	0.08
3 EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):				0.72
Coverage Factor (k):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



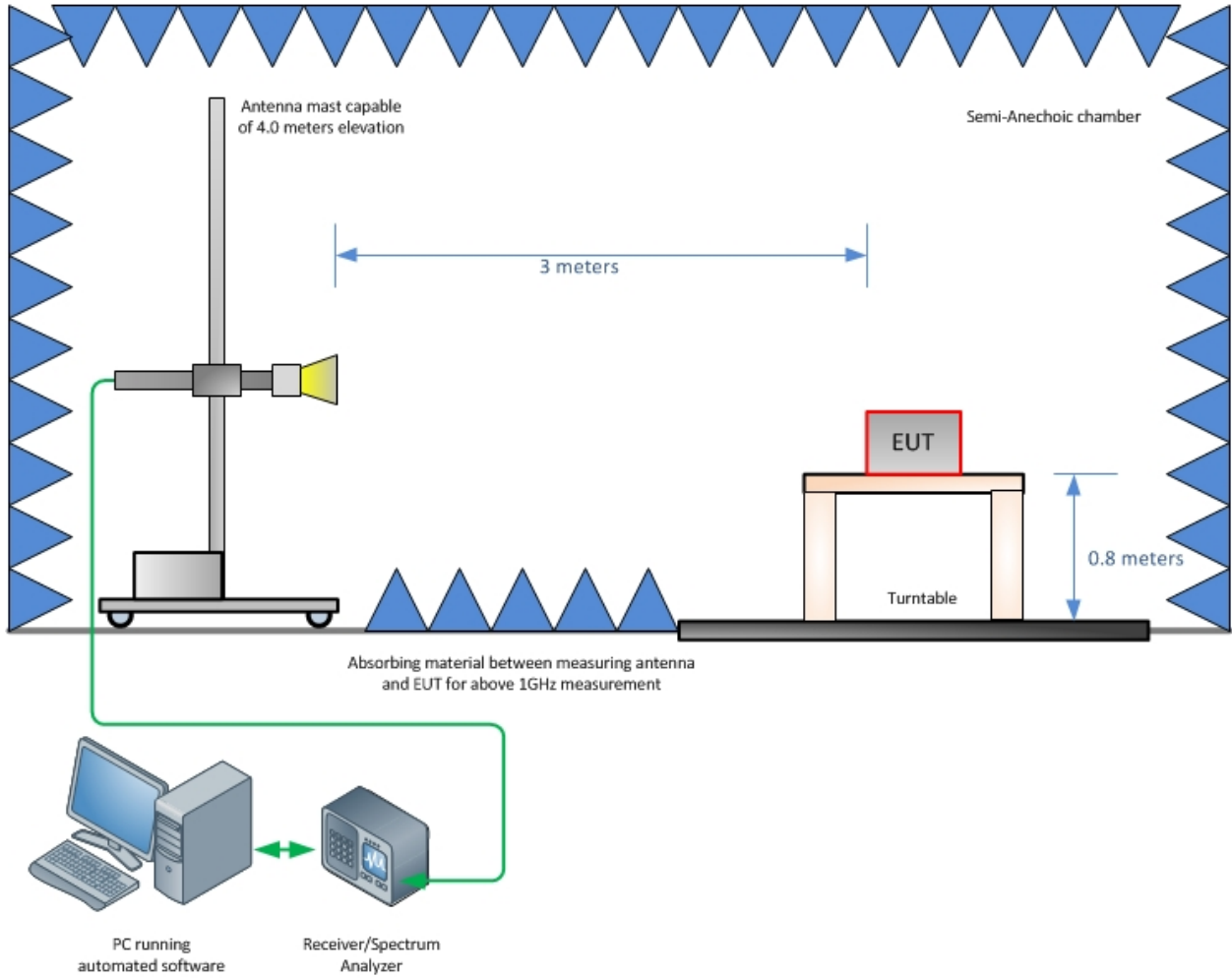
SECTION 4

DIAGRAM OF TEST SETUP

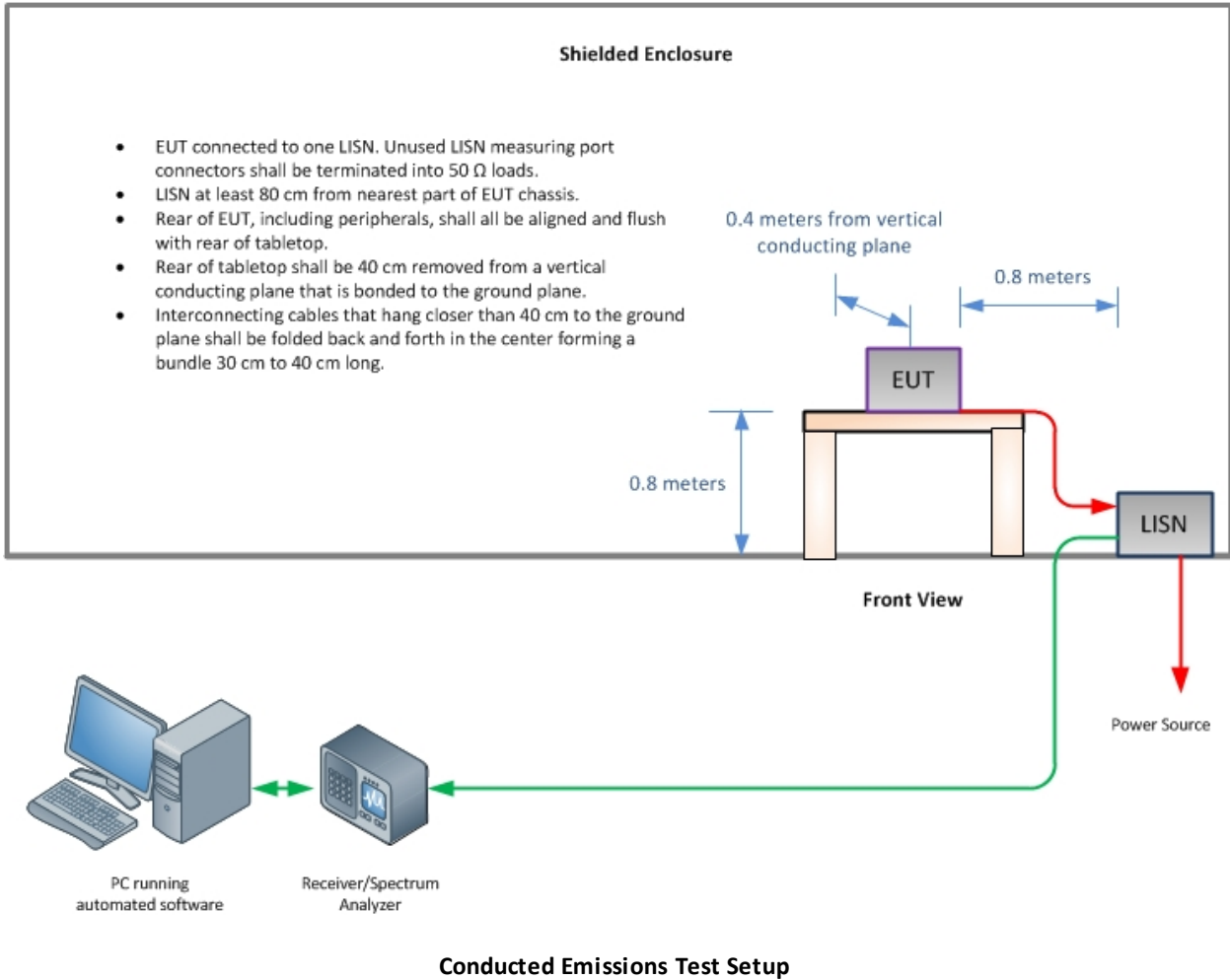
4.1 TEST SETUP DIAGRAM



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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