America

Choose certainty.
Add value.

Report On

Radio Testing of the
SMK Electronics Corp.
50.0 UHF 2G Remote Control

FCC Part 15 Subpart C §15.249

Report No. SC1411276A December 2014

TÜV SÜD America Inc., 10040 Mesa Rim Road, San Diego, CA 92121
Tel: (858) 678-1400. Website: www.TUVamerica.com

REPORT ON	Radio Testing of the SMK Electronics Corp. Remote Control
TEST REPORT NUMBER	SC1411276A
PREPARED FOR	SMK Electronics Corp. 1055 Tierra del Rey, Suite H Chula Vista, CA 91910
CONTACT PERSON	Leon Gateno Sr. RF Engineer (619) 216-6425 lgateno@smkusa.com
PREPARED BY	Kathy MacKenzie **Name** Authorized Signatory Title: EMC/Wireless Test Technician
APPROVED BY	Chip R. Fleury **Name** Authorized Signatory Title: EMC West General Manager
DATED	December 9, 2014

TÜV SÜD America Inc., 10040 Mesa Rim Road, San Diego, CA 92121
Tel: (858) 678-1400. Website: www.TUVamerica.com

Revision History

SC1411276A SMK Electronics Corp. 50.0 UHF 2G Remote Control					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
12/09/14	Initial Release				Chip R. Fleury

CONTENTS

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

SECTION 1

REPORT SUMMARY

Radio Testing of the
SMK Electronics Corp.
Remote Control

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

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the SMK Electronics Corp. Remote Control to the requirements of FCC Part 15 Subpart C §15.249.

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.
FCC ID Number	QVE4SYDN
Serial Number(s)	N/A
Number of Samples Tested	1
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.249 (October 1, 2013).
Start of Test	December 1, 2014
Finish of Test	December 1, 2014
Name of Engineer(s)	Kathy MacKenzie
Related Document(s)	None. Supporting documents for EUT certification are separate exhibits.

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

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart C §15.249 is shown below.

Section	Spec Clause	Test Description	Result	Comments/Base Standard
2.1	§15.207(a)	Conducted Emissions	N/A	
2.2	§15.215(c)	20 dB Bandwidth	Compliant	
2.3	§15.249(a)	Field Strength Limits for Fundamental and Harmonics	Compliant	
2.4	§15.249(d)	Spurious Radiated Emissions	Compliant	

N/A *Not applicable, EUT is battery powered*

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

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a SMK Electronics Corp. Remote Control operating in the 2400MHz to 2483.5 MHz Band.

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

1.3.2 EUT General Description

EUT Description	Remote Control
Model Name	50.0 UHF 2G
Rated Voltage	3.0 VDC (Uses 2-AA Batteries)
Output Power	76.5 dBµV/m @ 3 meters
Frequency Range	2425MHz to 2475 MHz in the 2400 MHz to 2483.5 MHz Band
Number of Operating Frequencies	3
Channels Verified	Low Channel 2425MHz Mid Channel 2450MHz High Channel 2475MHz
Antenna Type (used during evaluation)	Integral (Complies with Part 15.203 requirements)

1.3.3 Antenna Details

Model	N/A (Trace)
Manufacturer	SMK
Antenna Type	Inverted F
Antenna Gain	0 dBi
EUT Antenna Connector	N/A (surface mount).
Maximum Dimensions	2.0 x 1.0mm

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

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 in continuous transmission @ 100% duty cycle.

1.4.2 EUT Exercise Software

LG-CC2650 Rev.1

1.4.3 Support Equipment and I/O cables

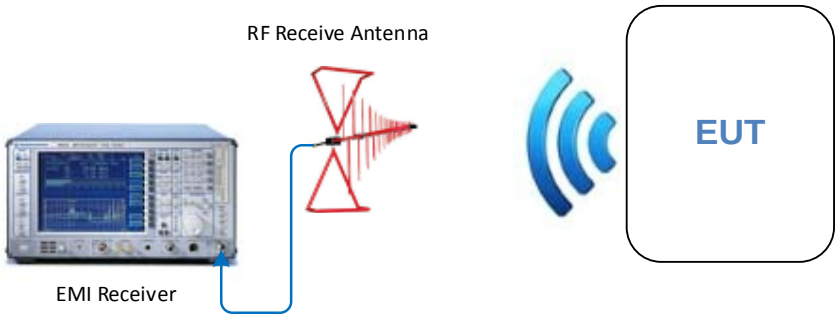
Manufacturer	Equipment/Cable	Description
	N/A	

1.4.4 Worst Case Configuration

For radiated measurements X, Y and Z orientations were verified. The worst case was determined to be X orientation, so verification was performed with the EUT in X orientation.
Worst case channel used is High Channel (Channel 25 2475 MHz). This is based from Peak Output Power test results under Section 2.4 of this test report.

1.4.5 Simplified Test Configuration Diagram

Radiated Emission Test Configuration



Not To Scale – Illustration Purpose Only
Objects may not represent actual image of original equipment/s or set-up.

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

1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number N/A		
N/A		

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.
For conducted and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.4-2009. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY LOCATION

1.8.1 TÜV SÜD America Inc. (Mira Mesa)

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

1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)

Sony Electronics Inc., Building #8 16530 Via Esprillo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 942 5542 FAX: 858-546 0364

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Registration No.: US1146

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.498 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US1146.

1.9.2 Industry Canada (IC) Registration No.: 3067A

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

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

SECTION 2

TEST DETAILS

Radio Testing of the
SMK Electronics Corp.
Remote Control

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

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

Not performed. EUT is battery operated only.

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 / Default Test Configuration

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

December 1, 2014/KAM

2.2.5 Test Equipment Used

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

2.2.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.4°C
Relative Humidity	44.5%
ATM Pressure	99.6 kPa

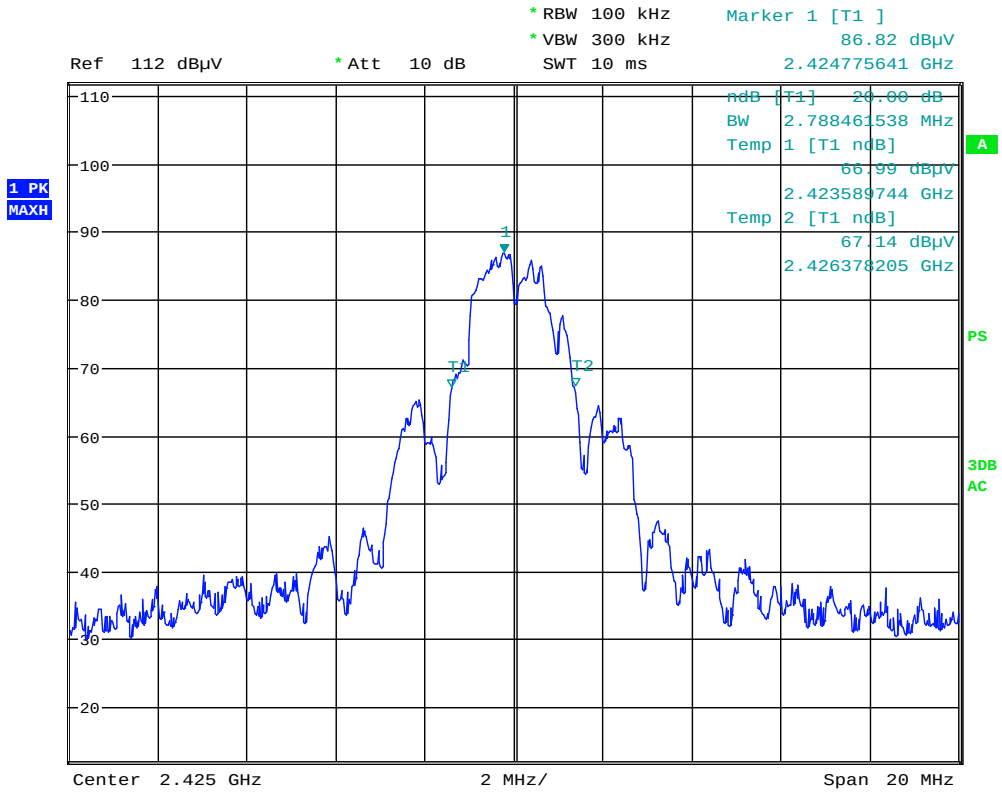
2.2.7 Additional Observations

- This is a radiated test.
- “n dB down” marker function of the Spectrum Analyzer used.
- 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.

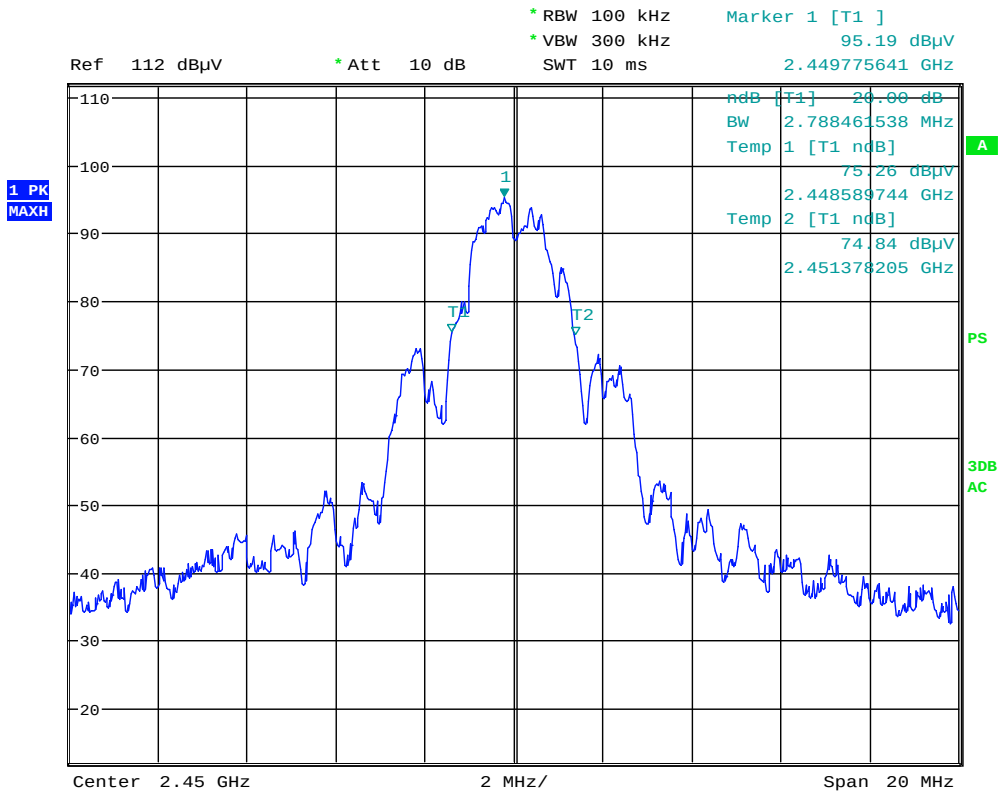
2.2.8 Test Results

Low Channel (2402 MHz)	Mid Channel (2440MHz)	High Channel (2480MHz)
2.788 MHz	2.788 MHz	2.788 MHz

2425.00 MHz – (20dB BW/2) = 2423.606MHz (within the frequency band - **Compliant**)
2475.00MHz + (20dB BW/2) = 2476.394MHz (within the frequency band - **Compliant**)

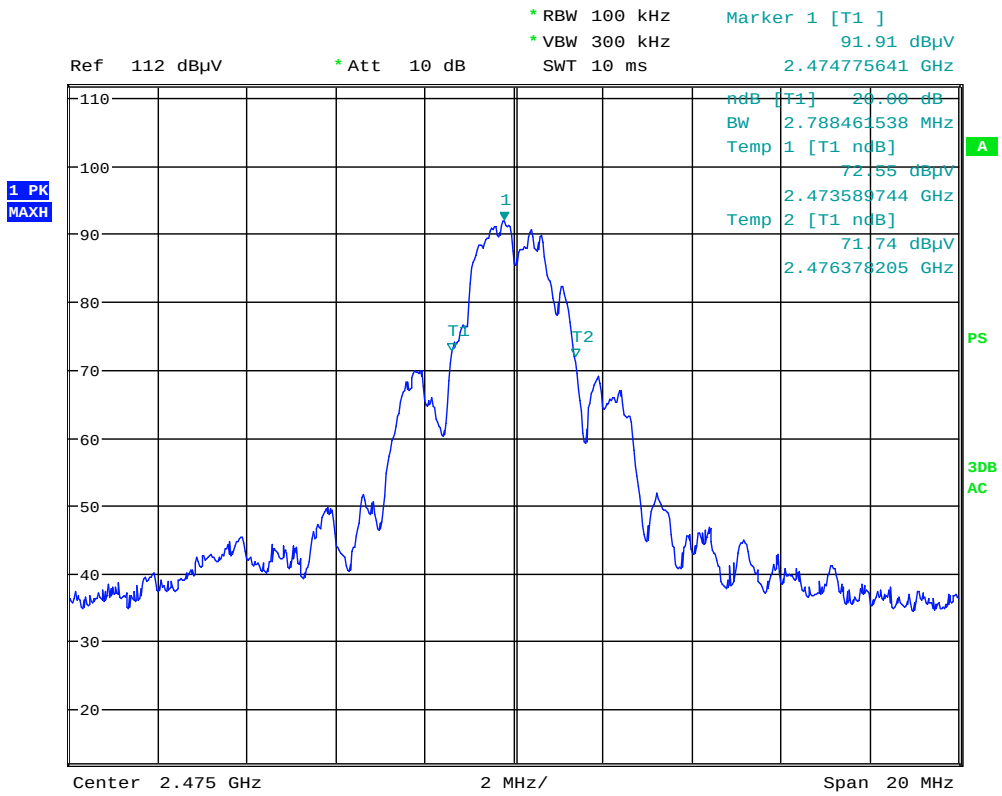


Low Channel



Date: 1.DEC.2014 16:13:18

Mid Channel



Date: 1.DEC.2014 16:08:45

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 / Default Test Configuration

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

December 1, 2014/KAM

2.3.5 Test Equipment Used

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

2.3.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.4°C
Relative Humidity	44.5%
ATM Pressure	99.6 kPa

2.3.7 Additional Observations

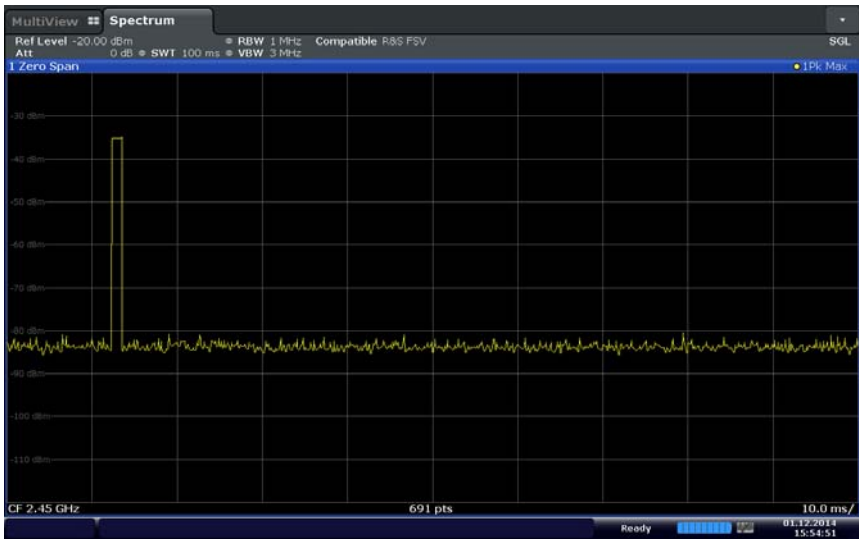
- This is a radiated test. The spectrum was searched from 1GHz to the 10th harmonic (25GHz).
- There are no emissions observed above 10GHz.
- When calculating Duty Cycle, the EUT was configured to normal operation (actual duty cycle vs. 100% duty cycle when in test mode).
- Both the Fundamental and the Harmonic measurements corrected for DCCF, all other emissions complies with the general radiated emission limits of §15.209 even at 100% duty cycle (test mode).

- Measurement was done using EMC32 V8.53 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.
- A 2.4GHz to 2.5GHz Notch filter was used for harmonic emissions measurements.

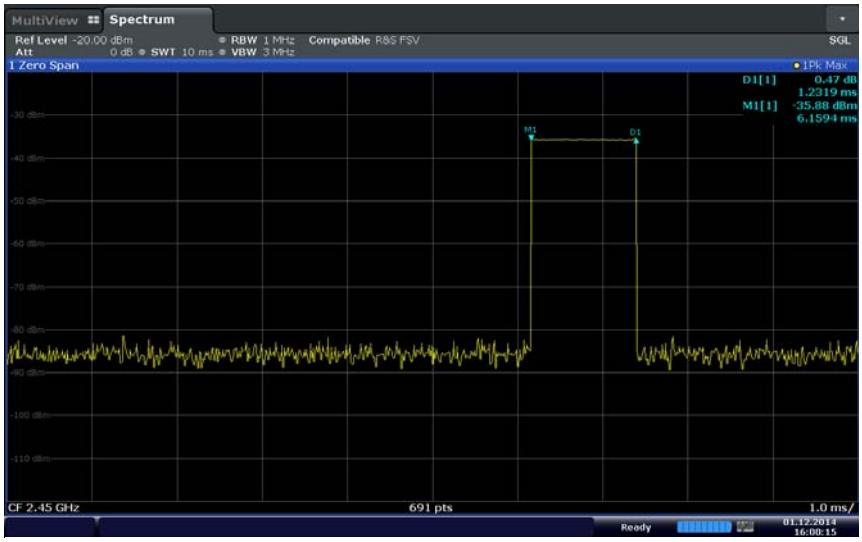
2.3.8 Sample Computation (Radiated Emission)

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**

2.3.9 Duty Cycle Correction Factor Calculation



100ms sweep (representative channel)



10ms sweep (representative channel)

Duty Cycle Calculation: = 1.2319 ms "On" time per100 ms sweep
Duty Cycle Correction Factor = 20 log (0.012319)
= **-38.1885(Limited to -20dB)**

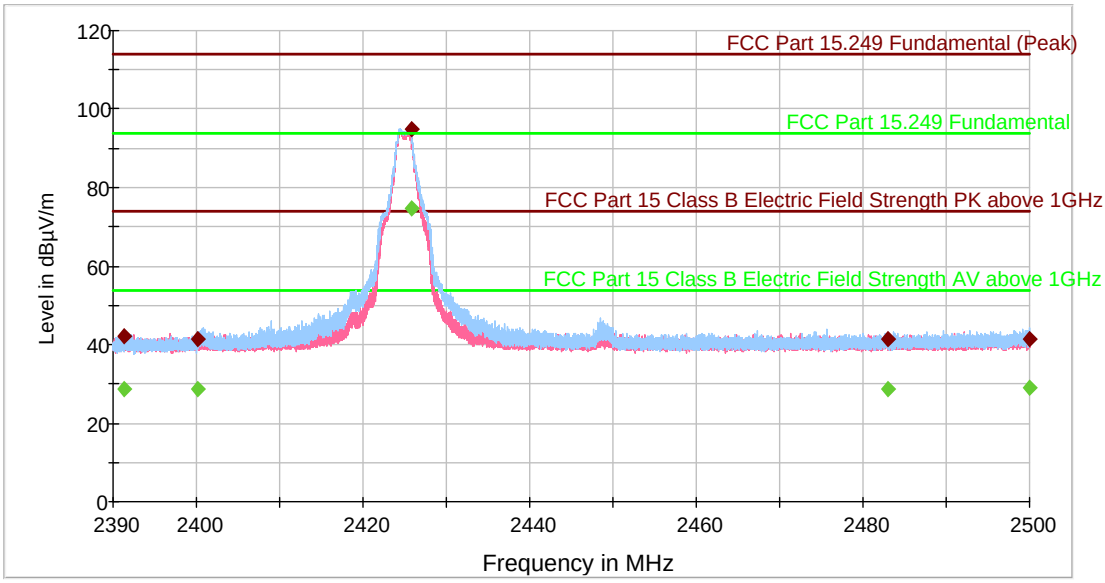
Sample Calculation for High Channel (96.5dBµV/m Peak @ 3 meters):
= 96.5dBµV/m – 20dB
=76.5 dBµV/m Average @ 3 meters

Duty Cycle correction factor verification was performed when the EUT is in normal operating mode. For actual measurements, the EUT was placed in test mode (100% Duty cycle)

2.3.10 Test Results

See attached plots.

2.3.11 Test Results for Low Channel (Fundamental and Band Edges)



FCC Part 15 Class B Electric Field Strength PK above 1GHz [..\EMI radiated\]
FCC Part 15 Class B Electric Field Strength AV above 1GHz [..\EMI radiated\]
Preview Result 1V-PK+ [Preview Result 1V.Result:2]
Preview Result 1H-PK+ [Preview Result 1H.Result:2]
Final Result 1-PK+ [Final Result 1.Result:1]
Final Result 2-AVG [Final Result 2.Result:1]
FCC Part 15.249 Fundamental (Peak) [..\EMI radiated\]
FCC Part 15.249 Fundamental [..\EMI radiated\]

Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2391.36466	42.0	1000.0	1000.000	332.1	H	329.0	-0.2	31.9	73.9
2400.13300	41.5	1000.0	1000.000	322.2	V	345.0	-0.2	32.4	73.9
2425.90066	94.7	1000.0	1000.000	132.7	H	325.0	0.0	19.3	114.0
2483.50000	41.5	1000.0	1000.000	332.1	V	206.0	0.1	32.4	73.9
2500.00000	41.5	1000.0	1000.000	273.3	H	166.0	0.2	32.4	73.9

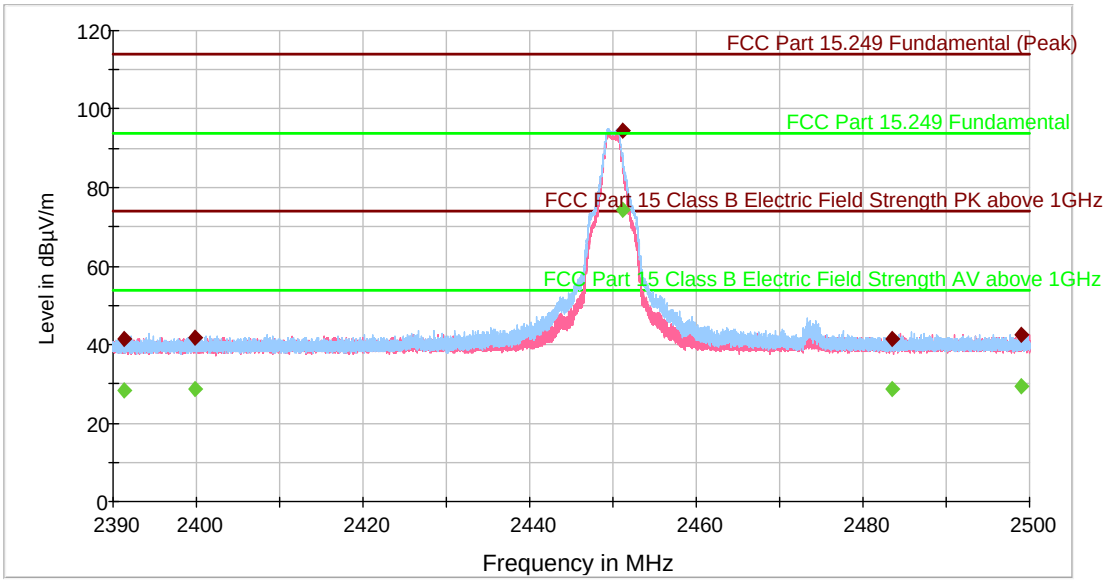
Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2391.36466	28.8	1000.0	1000.000	332.1	H	329.0	-0.2	25.1	53.9
2400.13300	28.5	1000.0	1000.000	322.2	V	345.0	-0.2	25.4	53.9
2483.50000	28.6	1000.0	1000.000	332.1	V	206.0	0.1	25.3	53.9
2500.00000	28.9	1000.0	1000.000	273.3	H	166.0	0.2	25.0	53.9

Average Data using Duty Cycle correction factor (Fundamental Frequency)

Frequency (MHz)	MaxPeak (dBµV/m)	Duty Cycle Correction (dB)	Calculated Average (dBµV/m)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2425.900667	94.7	-20	74.7	0.1	19.3	94.0

2.3.12 Test Results for Mid Channel (Fundamental and Band Edges)



FCC Part 15 Class B Electric Field Strength PK above 1GHz [..\EMI radiated\]
FCC Part 15 Class B Electric Field Strength AV above 1GHz [..\EMI radiated\]
Preview Result 1V-PK+ [Preview Result 1V.Result:2]
Preview Result 1H-PK+ [Preview Result 1H.Result:2]
Final Result 1-PK+ [Final Result 1.Result:1]
Final Result 2-AVG [Final Result 2.Result:1]
FCC Part 15.249 Fundamental (Peak) [..\EMI radiated\]
FCC Part 15.249 Fundamental [..\EMI radiated\]

Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2391.30000	41.5	1000.0	1000.000	180.6	V	98.0	-0.2	32.4	73.9
2399.76066	41.7	1000.0	1000.000	284.2	H	240.0	-0.2	32.2	73.9
2451.11466	94.5	1000.0	1000.000	138.7	H	158.0	0.1	19.5	114.0
2483.43766	41.6	1000.0	1000.000	332.1	V	319.0	0.1	32.3	73.9
2499.07733	42.3	1000.0	1000.000	237.4	H	340.0	0.2	31.6	73.9

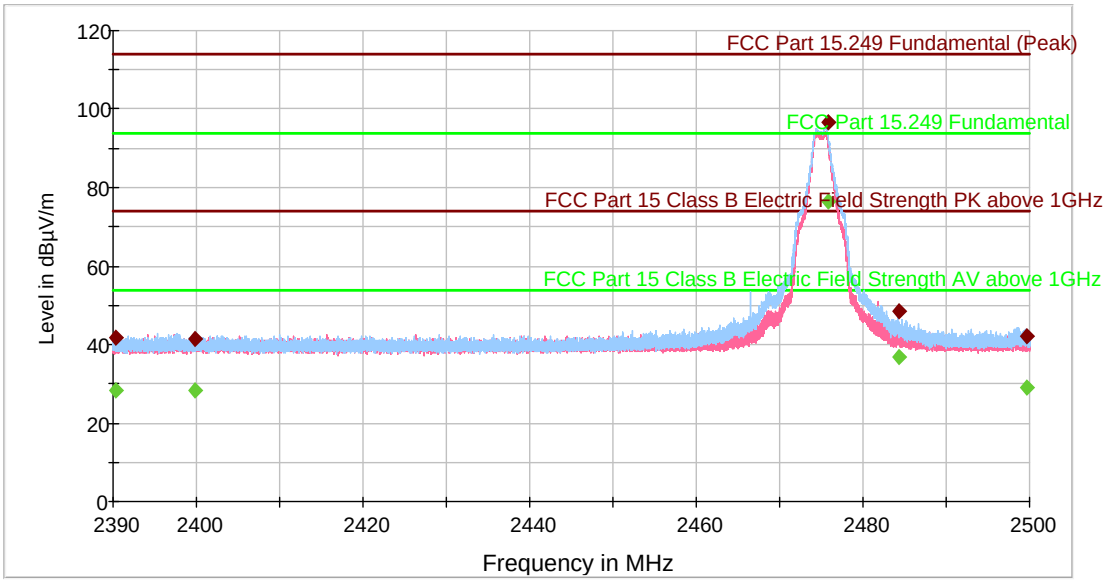
Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2391.30000	28.5	1000.0	1000.000	180.6	V	98.0	-0.2	25.4	53.9
2399.76066	28.7	1000.0	1000.000	284.2	H	240.0	-0.2	25.2	53.9
2483.43766	28.6	1000.0	1000.000	332.1	V	319.0	0.1	25.3	53.9
2499.07733	29.3	1000.0	1000.000	237.4	H	340.0	0.2	24.6	53.9

Average Data using Duty Cycle correction factor (Fundamental Frequency)

Frequency (MHz)	MaxPeak (dBµV/m)	Duty Cycle Correction (dB)	Calculated Average (dBµV/m)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2451.114667	94.5	-20	74.5	0.1	19.5	94.0

2.3.13 Test Results for High Channel (Fundamental and Band Edges)



FCC Part 15 Class B Electric Field Strength PK above 1GHz [..\EMI radiated\]
FCC Part 15 Class B Electric Field Strength AV above 1GHz [..\EMI radiated\]
Preview Result 1V-PK+ [Preview Result 1V.Result:2]
Preview Result 1H-PK+ [Preview Result 1H.Result:2]
Final Result 1-PK+ [Final Result 1.Result:1]
Final Result 2-AVG [Final Result 2.Result:1]
FCC Part 15.249 Fundamental (Peak) [..\EMI radiated\]
FCC Part 15.249 Fundamental [..\EMI radiated\]

Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.40000	41.6	1000.0	1000.000	164.6	V	161.0	-0.2	32.3	73.9
2399.86533	41.3	1000.0	1000.000	179.5	V	263.0	-0.2	32.6	73.9
2475.89200	96.5	1000.0	1000.000	138.7	H	131.0	0.1	17.5	114.0
2483.50000	48.4	1000.0	1000.000	132.7	H	164.0	0.2	25.5	73.9
2499.64966	42.0	1000.0	1000.000	190.5	V	43.0	0.2	31.9	73.9

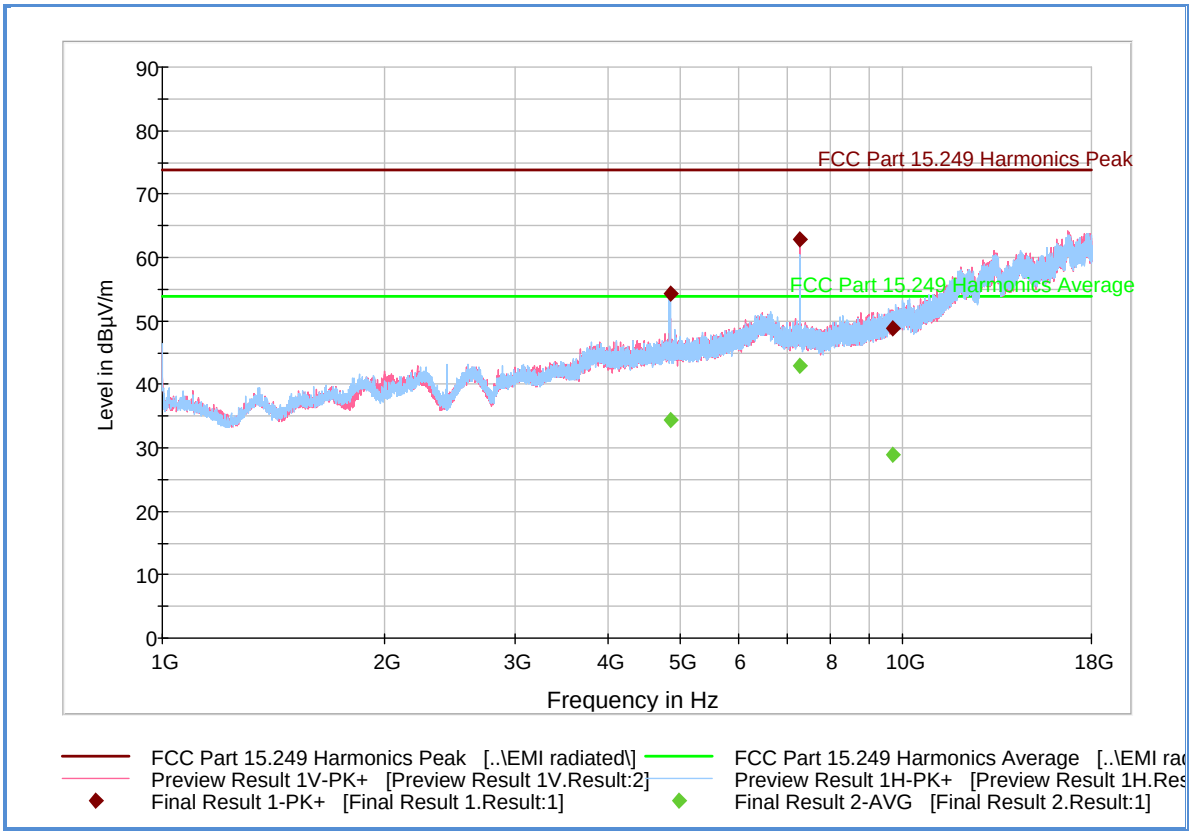
Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.40000	28.5	1000.0	1000.000	164.6	V	161.0	-0.2	25.4	53.9
2399.86533	28.5	1000.0	1000.000	179.5	V	263.0	-0.2	25.4	53.9
2483.50000	36.9	1000.0	1000.000	132.7	H	164.0	0.2	17.0	53.9
2499.64966	28.9	1000.0	1000.000	190.5	V	43.0	0.2	25.0	53.9

Average Data using Duty Cycle correction factor (Fundamental Frequency)

Frequency (MHz)	MaxPeak (dBµV/m)	Duty Cycle Correction (dB)	Calculated Average (dBµV/m)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2475.892000	96.5	-20	76.5	0.1	17.5	94.0

2.3.14 Test Results for Low Channel (Harmonics)



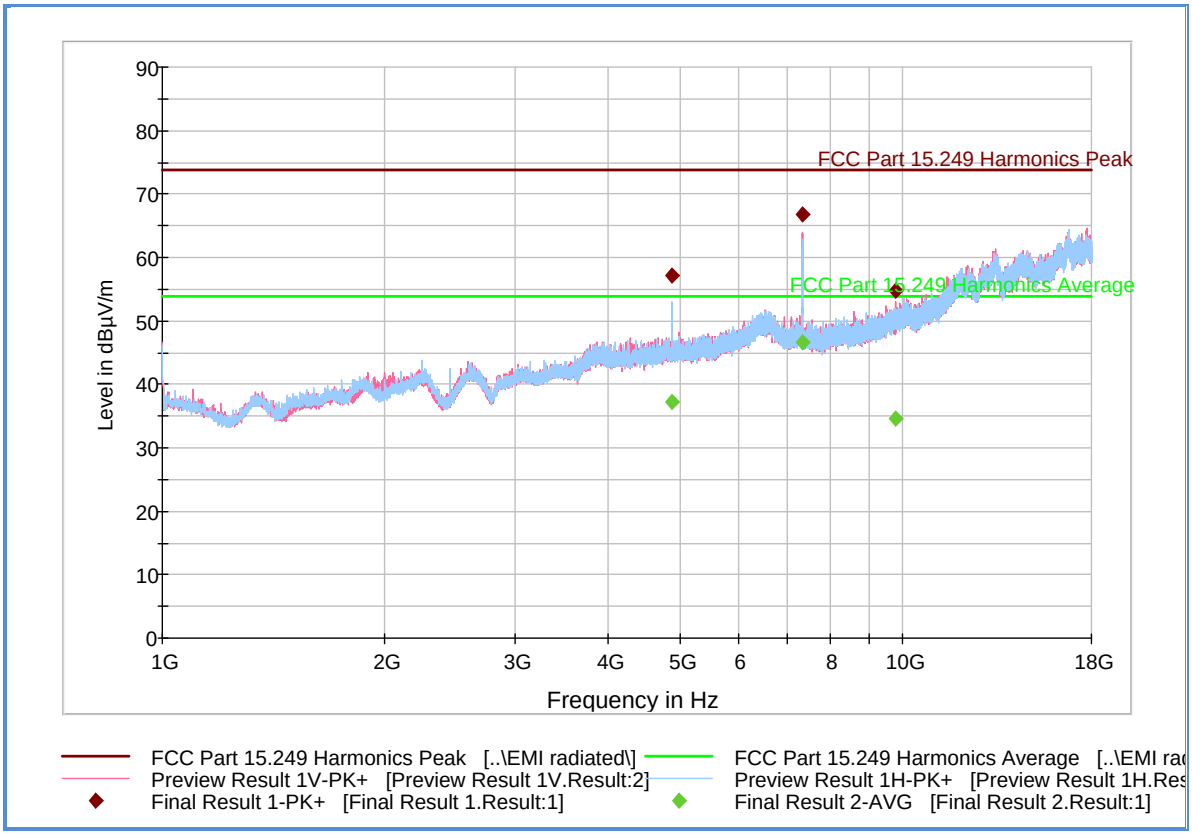
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4850.90000	54.4	1000.0	1000.000	148.7	H	86.0	7.0	19.5	73.9
7276.60000	62.9	1000.0	1000.000	378.1	V	82.0	11.2	11.0	73.9
9700.00000	48.8	1000.0	1000.000	269.3	V	144.0	13.7	25.1	73.9

Average Data using Duty Cycle correction factor

Frequency (MHz)	MaxPeak (dBµV/m)	Duty Cycle Correction (dB)	Calculated Average (dBµV/m)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4850.900000	54.4	-20	34.4	7.0	19.5	53.9
7276.600000	62.9	-20	42.9	11.2	11.0	53.9
9700.000000	48.8	-20	28.8	13.7	25.1	53.9

2.3.15 Test Results for Mid Channel (Harmonics)



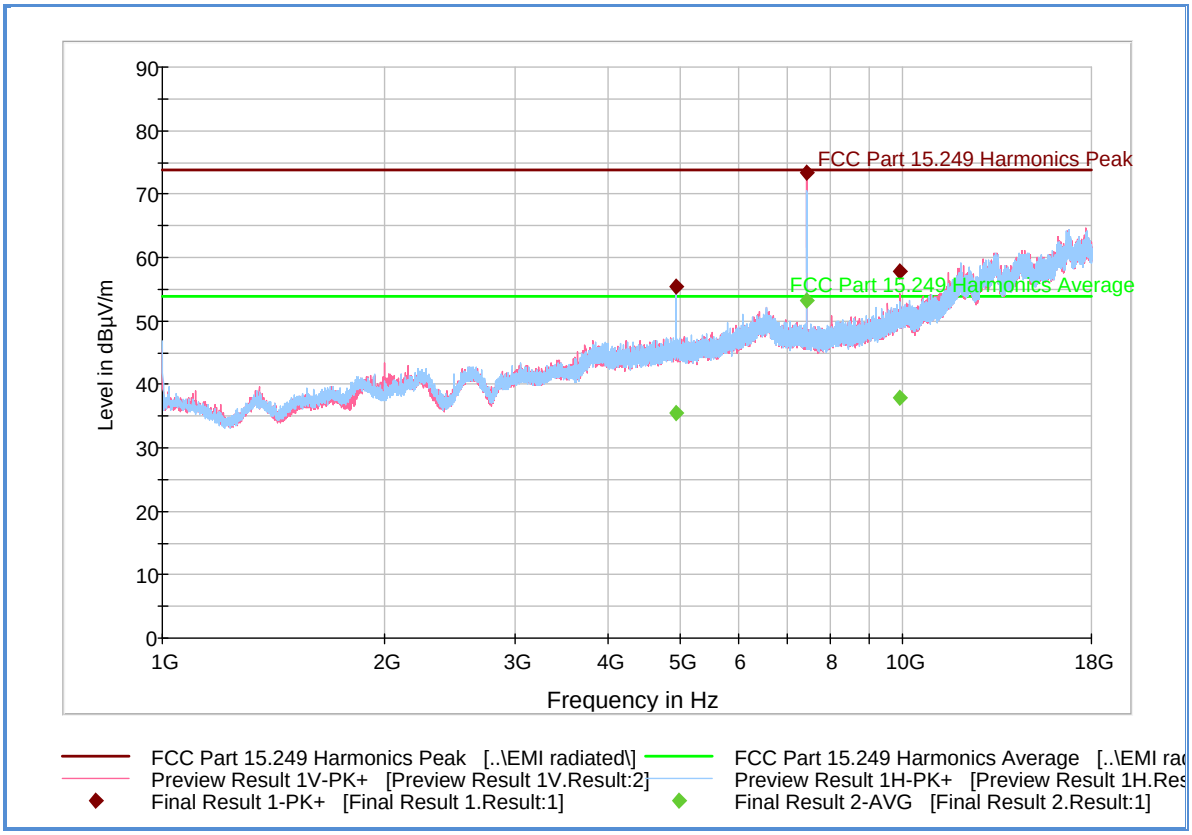
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4888.83333	57.2	1000.0	1000.000	115.7	H	78.0	7.2	16.7	73.9
7333.43333	66.7	1000.0	1000.000	171.6	V	271.0	11.0	7.2	73.9
9778.03333	54.7	1000.0	1000.000	200.5	V	-16.0	13.7	19.2	73.9

Average Data using Duty Cycle correction factor

Frequency (MHz)	MaxPeak (dBµV/m)	Duty Cycle Correction (dB)	Calculated Average (dBµV/m)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4888.833333	57.2	-20	37.2	7.0	16.7	53.9
7333.433333	66.7	-20	46.7	11.2	7.2	53.9
9778.033333	54.7	-20	34.7	13.7	19.2	53.9

2.3.16 Test Results for High Channel (Harmonics)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4948.73333	55.4	1000.0	1000.000	116.7	H	82.0	7.4	18.5	73.9
7426.36666	73.3	1000.0	1000.000	187.5	V	190.0	10.8	0.6	73.9
9901.96666	57.9	1000.0	1000.000	218.4	V	342.0	14.2	16.0	73.9

Average Data using Duty Cycle correction factor

Frequency (MHz)	MaxPeak (dBµV/m)	Duty Cycle Correction (dB)	Calculated Average (dBµV/m)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4948.733333	55.4	-20	35.4	7.0	18.5	53.9
7426.366667	73.3	-20	53.3	11.2	0.6	53.9
9901.966667	57.9	-20	37.9	13.7	16.0	53.9

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 / Default Test Configuration

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

December 1, 2014/KAM

2.4.5 Test Equipment Used

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

2.4.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.4°C
Relative Humidity	44.5%
ATM Pressure	99.6 kPa

2.4.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic (25GHz). There are no significant emissions observed beyond 18GHz.
- No significant emission difference between the three channels observed below 1GHz. Data presented is from worst configuration based from fundamental/harmonics verification (“Y” axis configuration).
- No significant spurious emissions observed other than harmonics of the fundamental frequency.
- Measurement was done using EMC32 V8.53 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 2.5.1 for sample computation.
- A 2.4GHz to 2.5GHz Notch filter was used for spurious emission measurements above 1GHz.

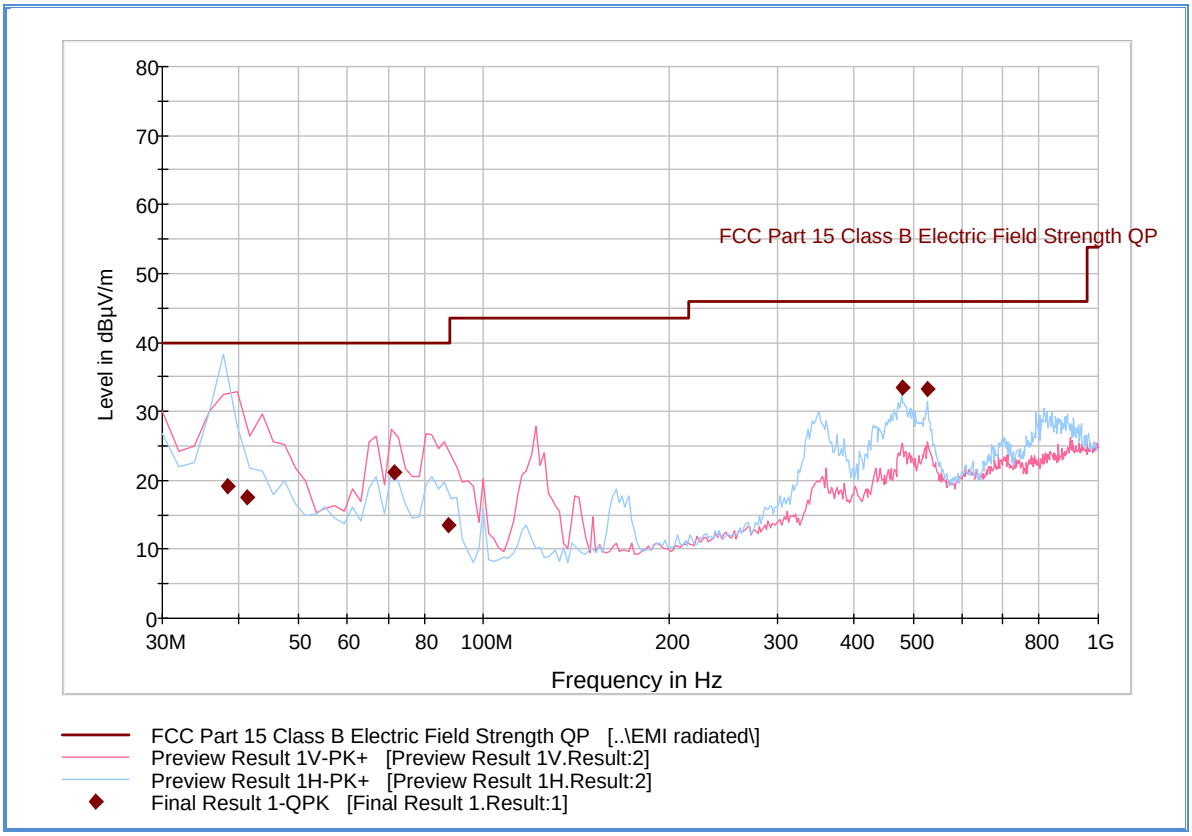
2.4.1 Sample Computation (Radiated Emission)

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

2.4.2 Test Results

See attached plots.

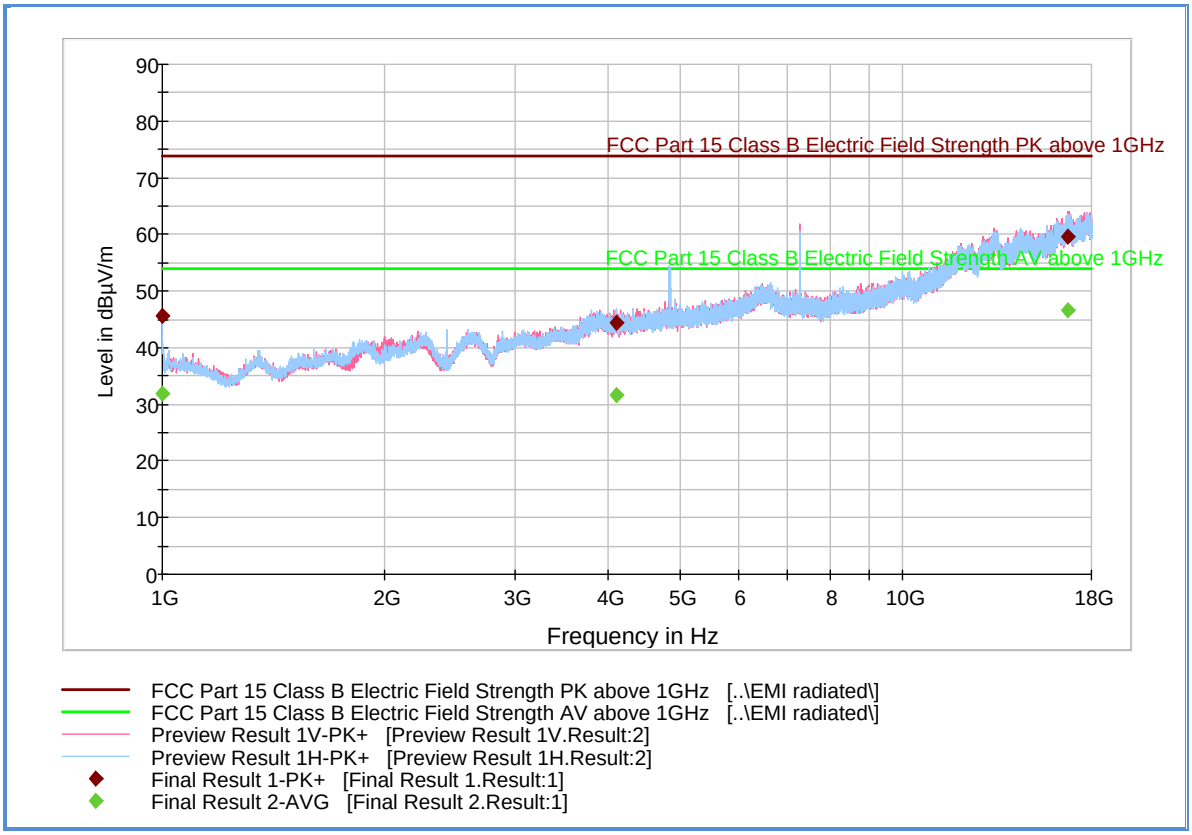
2.4.3 Test Results Below 1GHz (High Channel – Worst Case Configuration)



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)
38.375551	19.1	1000.0	120.000	250.0	H	312.0	-14.9	20.9	40.0
41.127214	17.4	1000.0	120.000	100.0	V	262.0	-16.3	22.6	40.0
71.621643	21.1	1000.0	120.000	109.0	V	186.0	-21.4	18.9	40.0
87.812745	13.6	1000.0	120.000	110.0	V	4.0	-20.3	26.4	40.0
478.958076	33.4	1000.0	120.000	178.0	H	49.0	-5.7	12.6	46.0
526.915271	33.3	1000.0	120.000	150.0	H	56.0	-4.9	12.7	46.0

2.4.4 Test Results Above 1GHz (Low Channel)



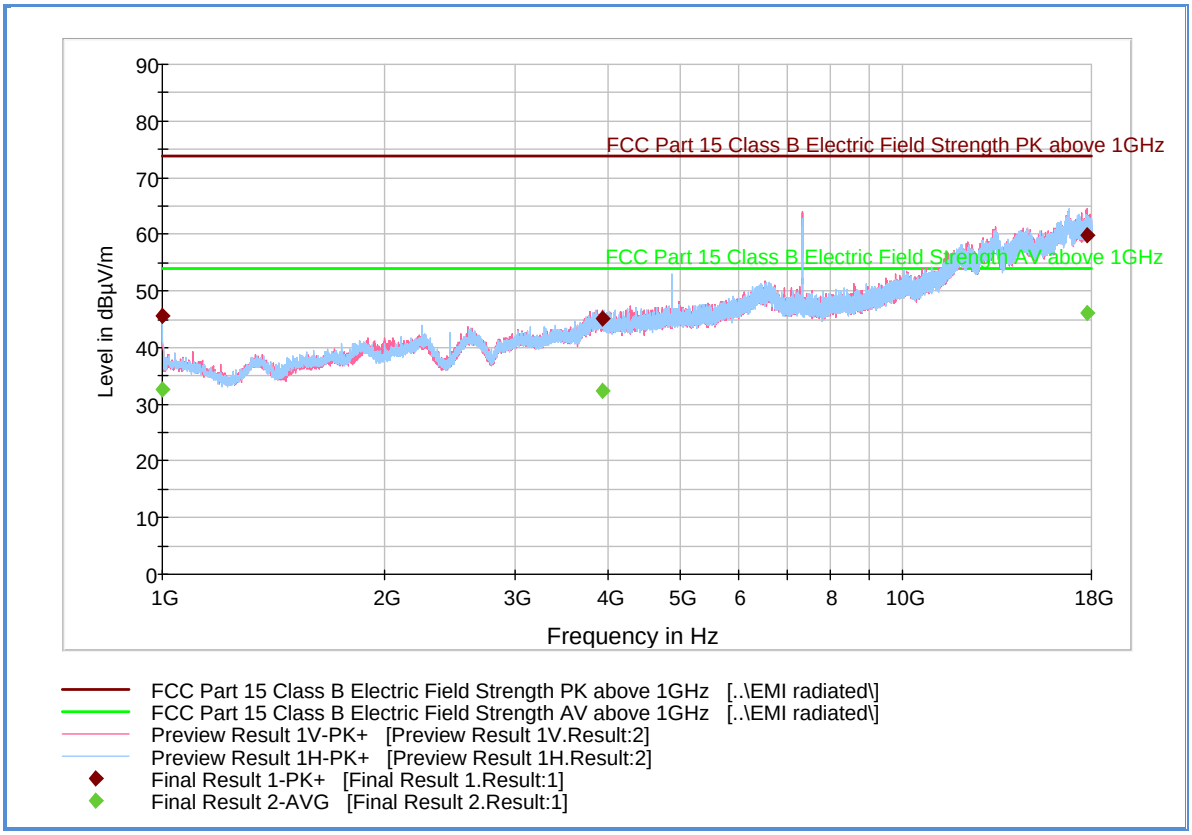
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.40000	45.7	1000.0	1000.000	237.4	H	78.0	-7.0	28.2	73.9
9700.00000	48.8	1000.0	1000.000	269.3	V	144.0	13.7	25.1	73.9
16756.5666	59.6	1000.0	1000.000	401.1	V	162.0	25.9	14.3	73.9

Spurious Average Data

Frequency (MHz)	Spurious Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.40000	31.8	1000.0	1000.000	237.4	H	78.0	-7.0	22.1	53.9
4099.90000	31.7	1000.0	1000.000	299.2	H	289.0	6.2	22.2	53.9
16756.5666	46.6	1000.0	1000.000	401.1	V	162.0	25.9	7.3	53.9

2.4.5 Test Results Above 1GHz (Mid Channel)



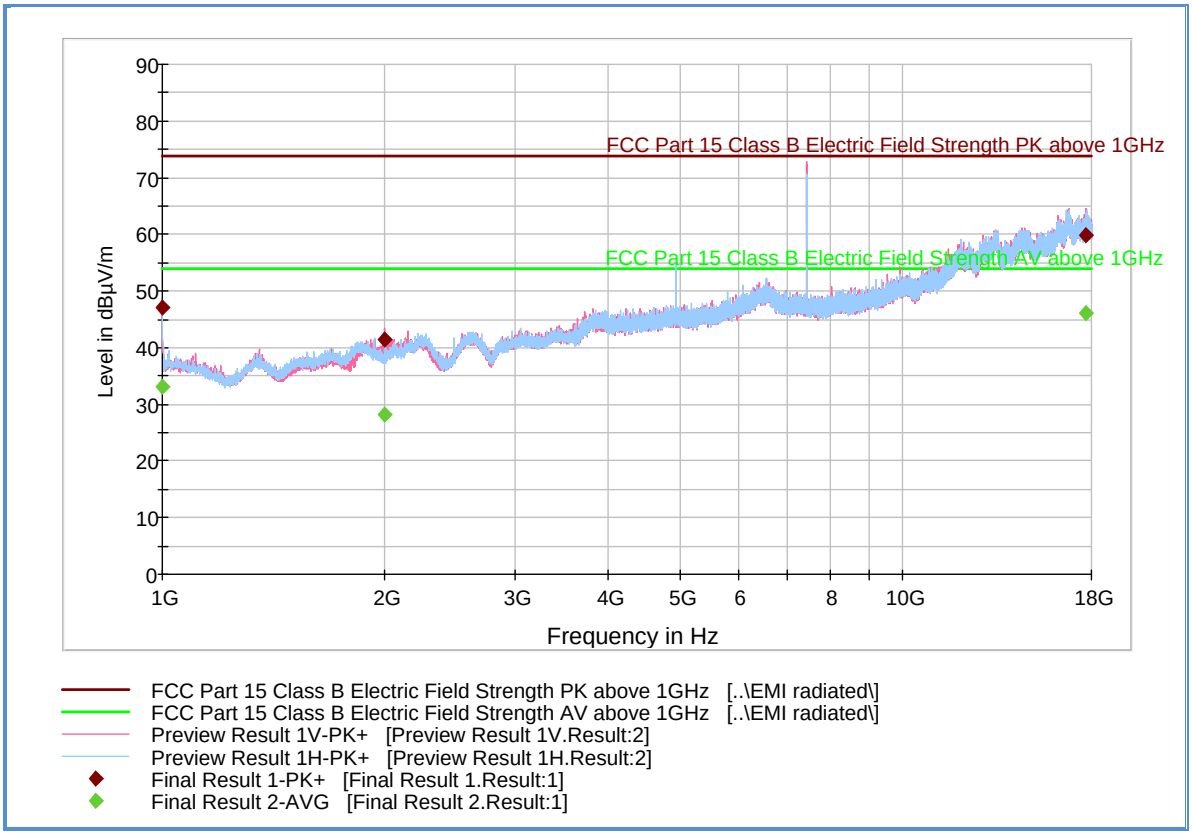
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.00000	45.6	1000.0	1000.000	235.4	V	204.0	-7.0	28.3	73.9
3938.93333	45.2	1000.0	1000.000	406.7	V	207.0	6.0	28.7	73.9
17735.7333	59.7	1000.0	1000.000	300.2	V	334.0	25.7	14.2	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)
1000.00000	32.5	1000.0	1000.000	235.4	V	204.0	-7.0	21.4	53.9
3938.93333	32.4	1000.0	1000.000	406.7	V	207.0	6.0	21.4	53.9
17735.7333	46.2	1000.0	1000.000	300.2	V	334.0	25.7	7.7	53.9

2.4.6 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)
1000.40000	47.1	1000.0	1000.000	247.3	H	66.0	-7.0	26.8	73.9
1992.93333	41.4	1000.0	1000.000	183.5	V	50.0	-1.0	32.5	73.9
17718.0000	59.8	1000.0	1000.000	355.1	V	253.0	25.6	14.1	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)
1000.40000	33.1	1000.0	1000.000	247.3	H	66.0	-7.0	20.8	53.9
1992.93333	28.3	1000.0	1000.000	183.5	V	50.0	-1.0	25.5	53.9
17718.0000	46.0	1000.0	1000.000	355.1	V	253.0	25.6	7.8	53.9

SECTION 3

TEST EQUIPMENT USED

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

3.1 TEST EQUIPMENT USED

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

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Radiated Test Setup						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/30/14	01/30/16
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	04/08/14	04/08/15
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	04/03/14	04/03/15
1150	Horn antenna	3160-09	012054-004	ETS	04/26/13	04/26/15
1151	Pre-amplifier	TS-PR26	100026	Rhode & Schwarz	05/02/13	05/02/15
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	04/03/14	04/03/15
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	08/29/14	08/29/15
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/17/14	03/17/15
6815	2.4GHz Band Notch Filter	BRM50702	008	Micro-Tronics	Verified by 1189 and 7582	
1016	Pre-amplifier	PAM-0202	187	PAM	05/05/14	05/05/15
Miscellaneous						
7560	Barometer/Temperature /Humidity Transmitter	iBTHX-W	1240476	Omega	01/30/14	01/30/15
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

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

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

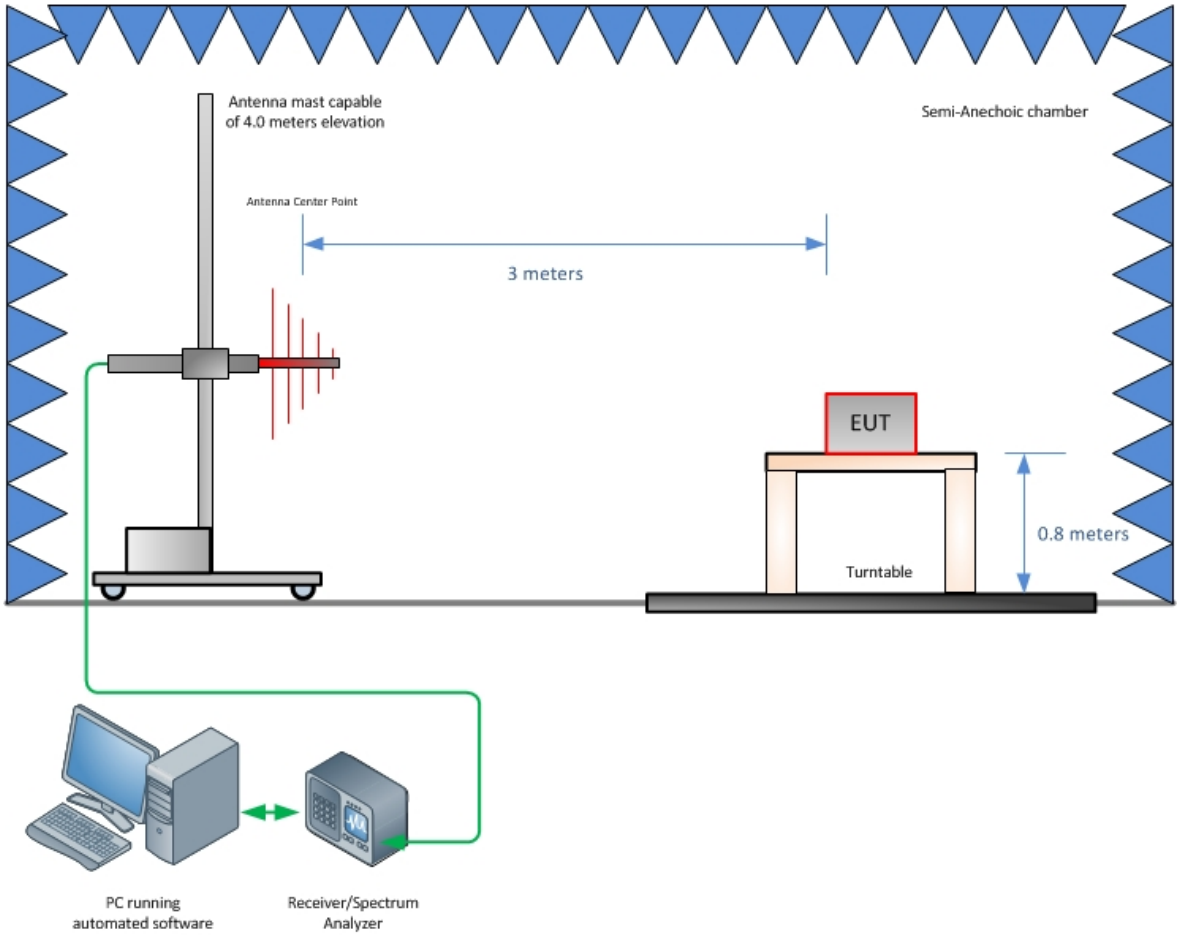
3.2.2 Radiated Emission Measurements (Above 1GHz)

	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

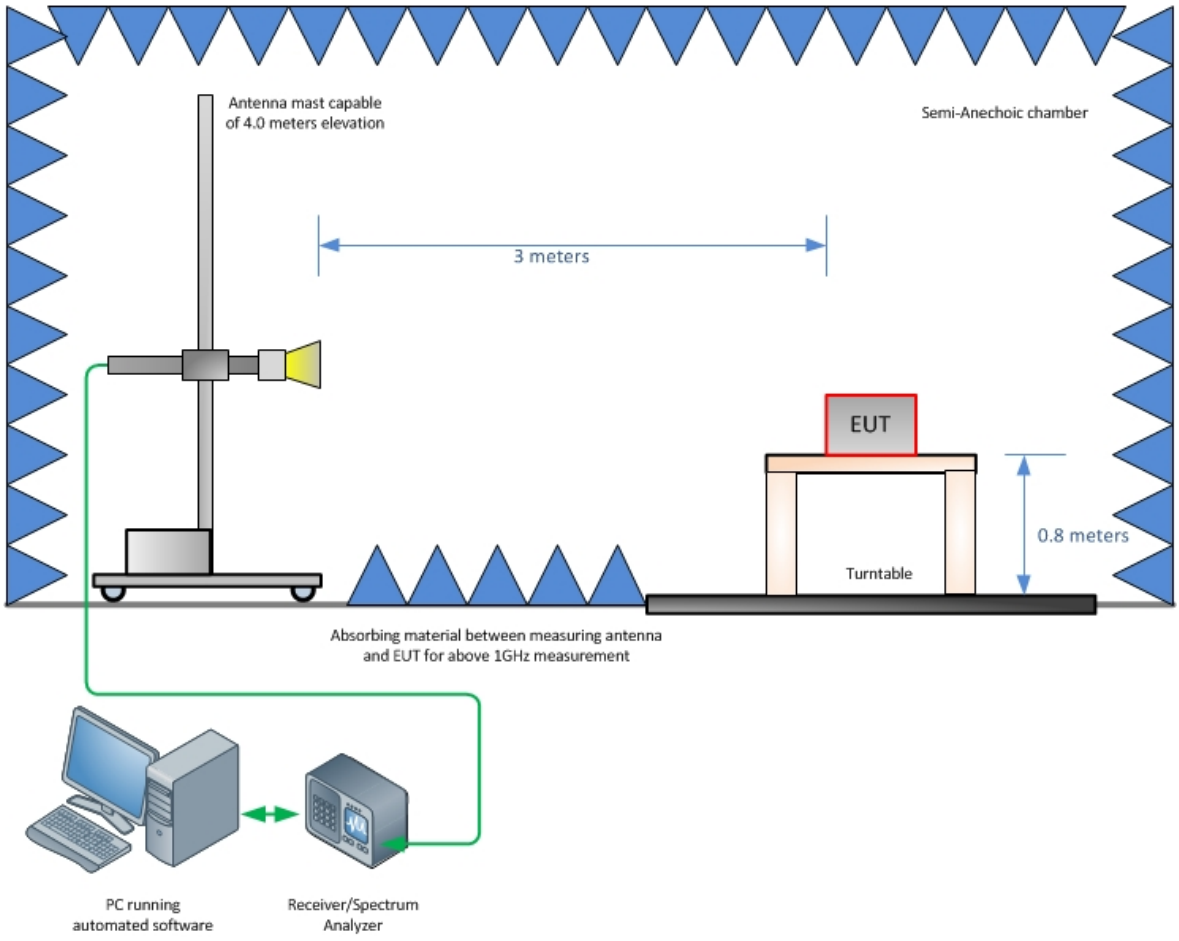
SECTION 4

DIAGRAM OF TEST SETUP

4.1 RADIATED EMISSION TEST SETUP (BELOW 1GHZ)



4.2 RADIATED EMISSION TEST SETUP (ABOVE 1GHZ)



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

TÜV SÜD America Inc.'s reports apply only to the specific sample tested under stated test conditions. It is the manufacturer's responsibility to assure the continued compliance of production units of this model. TÜV SÜD America, Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD America, Inc.'s issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and TÜV SÜD America, Inc., extracts from the test report shall not be reproduced, except in full without TÜV SÜD America, Inc.'s written approval.

This report must not be used to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the federal government.

TÜV SÜD America, Inc. and its professional staff hold government
and professional organization certifications for
AAMI, ACIL, AEA, ANSI, IEEE, A2LA, NIST and VCCI.

A2LA Cert. No. 2955.13

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