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## Report On

Application for Grant of Equipment Authorization of the  
SMK Electronics Corp  
RC03 RF Remote Control (with TDK antenna)

FCC Part 15 Subpart E §15.407  
IC RSS-210 Issue 8 December 2010

Report No. SC1304645A

May 2013

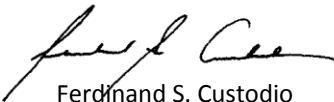



**REPORT ON** Radio Testing of the  
SMK Electronics Corp  
RF Remote Control (with TDK antenna)

**TEST REPORT NUMBER** SC1304645A

**PREPARED FOR** SMK Electronics Corp  
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**Name**  
Authorized Signatory

**DATED** May 17, 2013



**Revision History**

SC1304645A SMK Electronics Corp RC03 RF Remote Control (with TDK antenna)					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
05/17/13	Initial Release				Ferdinand Custodio



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## **SECTION 1**

### **REPORT SUMMARY**

Radio Testing of the  
SMK Electronics Corp  
RF Remote Control (with TDK antenna)



## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the SMK Electronics Corp RF Remote Control (with TDK antenna) to the requirements of FCC Part 15 Subpart E §15.407 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	SMK Electronics Corp
Model Number(s)	RC03
FCC ID Number	TC2-RCB3
IC Number	5959A-RCB3
Serial Number(s)	N/A
Number of Samples Tested	1
Test Specification/Issue/Date	<ul style="list-style-type: none"><li>• FCC Part 15 Subpart E §15.407 (October 1, 2011).</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 3, December 2010).</li></ul>
Start of Test	May 4, 2013
Finish of Test	May 16, 2013
Name of Engineer(s)	Ferdinand S. Custodio
Related Document(s)	<ul style="list-style-type: none"><li>• 789033 D01 General UNII Test Procedures v01r01 (Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E.</li><li>• Supporting documents for EUT certification are separate exhibits.</li></ul>



1.2 **BRIEF SUMMARY OF RESULTS**

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart E §15.407 with cross-reference to the corresponding IC RSS standard is shown below.

Operation in the 5.15 to 5.25GHz band					
Section	Spec Clause	RSS	Test Description	Result	Comments/ Base Standard
-	§15.207(a)	RSS-Gen 7.2.4	Conducted Emissions	N/A*	
2.1	§15.407(e)	RSS-210 A9.4(6)(i)	Indoor Operation Only	Client Declaration	
2.2	§15.407(a)(1)		26 dB Bandwidth	As Reported	
2.3	§15.407(a)(1)	RSS-210 A9.2(1)	Output Power	Compliant**	
2.4	§15.407(a)(1)		Power Spectral Density	Compliant**	
2.4		RSS-210 A9.4(2)	Power Spectral Density	Compliant**	
2.5-2.7	§15.407(b)(1) / 15.209	RSS-210 A9.2(1)	Out-Of-Band Emission Limits	Compliant**	
2.8	§15.407(a)(6)		Peak Excursion Ratio	Compliant**	

\* Not applicable. EUT is battery powered.

\*\* All Conducted port testing is from test report SC1208772 Rev 1 and is not being repeated as the device is using the same chip set with the same layout and the same conducted port.



**1.3 PRODUCT INFORMATION**

**1.3.1 Technical Description**

The Equipment Under Test (EUT) was a SMK Electronics Corp RF Remote Control (with TDK antenna) as shown in the photograph below. The EUT is a remote control for the Roku streaming player. The EUT operates using WLAN channels in the 2.4GHz and 5.0 GHz bands.

**1.3.2 EUT General Description**

EUT Description	RF Remote Control (with TDK antenna)
Model Number(s)	RC03
Rated Voltage	3.0VDC from 2 (two) AA alkaline batteries
Output Power	-11.1 dBm/78 $\mu$ W (conducted – Average) -5.92 dBm/256 $\mu$ W EIRP
Frequency Range	5180 MHz to 5240 MHz in the 5150 MHz to 5350 MHz Band
Number of Operating Frequencies	4
Channels Verified	Low Channel 5180 MHz Mid Channel 5200 MHz High Channel 5240MHz
Antenna Type (used during evaluation)	Integral (Complies with Part 15.203 requirements)
Modulation Used	OFDM

**1.3.3 Antenna Details**

Model	ANT016008LCD244MA1
Manufacturer	TDK
Antenna Type	Compact Dual-Band Chip Antenna
Antenna Gain (802.11 b/g)	2.27 dBi
Antenna Gain (802.11 a)	5.18 dBi
EUT Antenna Connector	N/A (small SMD chip antenna).



1.4 **EUT TEST CONFIGURATION**

1.4.1 **Test Configuration Description**

Test Configurations	Description
A	Antenna port conducted measurement. Manufacturer provided a SMA test port for conducted measurements. Power setting set to "SPW 1". (Originally measured in report SC1208772 and copied into this report)
B	Radiated emissions test configuration. EUT configured to transmit on either antenna #1 or antenna#2. Power setting set to "SPW 1".

1.4.2 **EUT Exercise Software**

Client provided a programming software (AT\_Cont131.exe) using Prolific USB-to-Serial adapter. The software allows the following channels: 1-14, 36,40,44,48,149,153,157 and 161. The following data rates are available: 1, 2, 5.5,11,6,9,12,18 and 24 Mbps.

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

Manufacturer	Equipment/Cable	Description
Ozmo	Debug Jig (USB-to-Serial programmer)	Interface to program EUT (Channel, Data Rate, Power and Antenna). Not part of the test setup, removed during radiated emissions test.

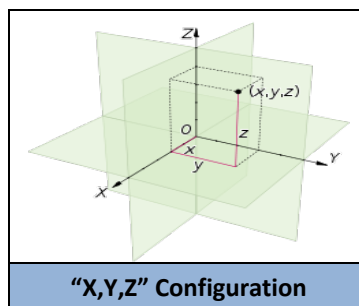
*Laptop used during programming is generic and can be different brand and model.*

1.4.4 **Worst Case Configuration**

Worst-case configuration used in this test report based from Peak Output Power measurements:

Mode	Channel	Data Rate
802.11a	36 (Low Channel)	6Mbps

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





**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 and 789033 D01 General UNII Test Procedures v01r01 (Federal Communications Commission Office of Engineering and Technology Laboratory Division Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E.

For conducted and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.4-2009. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

**1.8 TEST FACILITY**

**1.8.1 FCC – Registration No.: US5296**

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.498 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US5296.

**1.8.2 Industry Canada (IC) Registration No.: 3067A**

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



## **SECTION 2**

### **TEST DETAILS**

Radio Testing of the  
SMK Electronics Corp  
RF Remote Control (with TDK antenna)



## 2.1 INDOOR OPERATION ONLY

### 2.1.1 Specification Reference

Part 15 Subpart E §15.407(e) and RSS-210 A9.4(6)(i)

### 2.1.2 Standard Applicable

(e) Within the 5.15–5.25 GHz band, U-NII devices will be restricted to indoor operations to reduce any potential for harmful interference to co-channel MSS operations.

### 2.1.3 Manufacturer Declaration

See attached page from the user manual with a statement indicating compliance with this requirement.

## Legal Notices

### Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

IEEE 802.11b or 802.11g operation of this product in the U.S.A. is firmware-limited to channels 1 through 11.

#### Wireless Radio Use:

This device is restricted to indoor use when operating in the 5.15 to 5.25 GHz frequency band.

#### IMPORTANT NOTE:

##### FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

#### Note to US model owner:

To comply with US FCC regulation, the country selection function has been completely removed from all US models.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination. The firmware setting is not accessible by the end user.

### Industry Canada statement

This device complies with RSS-210 of the Industry Canada Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

#### French translation:

Ce dispositif est conforme à la norme CNR-210 d'Industrie Canada applicable aux appareils radio exempts de licence. Son fonctionnement est sujet aux deux conditions suivantes: (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.



2.2 **26 dB BANDWIDTH**

2.2.1 **Specification Reference**

Part 15 Subpart E §15.407(a)(1)

2.2.2 **Standard Applicable**

(1) For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

2.2.3 **Test Methodology**

Section D of 789033 D01 General UNII Test Procedures v01r01

2.2.4 **Equipment Under Test and Modification State**

Serial No: N/A / Default Test Configuration

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

August 24 and September 20, 2012/JMG and FSC

2.2.6 **Test Equipment Used**

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

2.2.7 **Environmental Conditions**

Ambient Temperature	22.2 to 24.3°C
Relative Humidity	43.2 to 47.2%
ATM Pressure	99.2 to 100.2kPa

2.2.8 **Additional Observations**

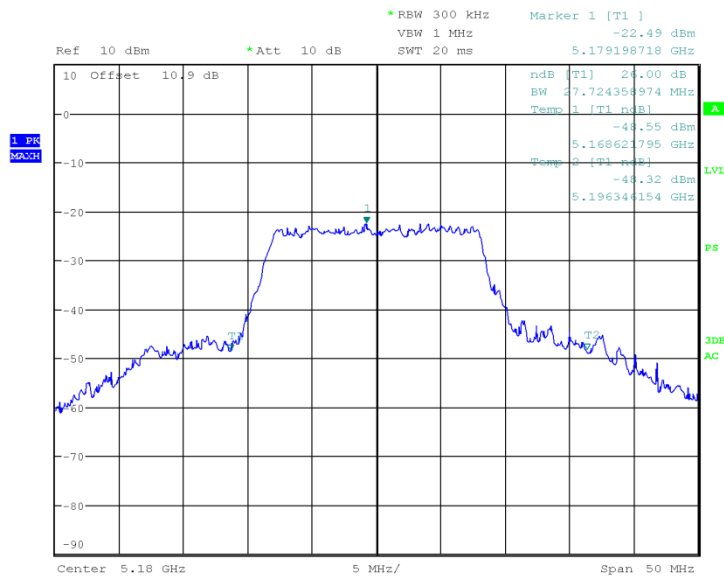
- This is a radiated test.
- Span is wide enough to capture the channel transmission.
- RBW is 1% of the span.
- VBW > RBW.
- Sweep is auto.
- Detector is peak.



- Trace is max hold.
- “n dB down” (26dB) marker function of the spectrum analyzer was used for this test.
- RBW adjusted until RBW/EBW ratio is approximately 1%.

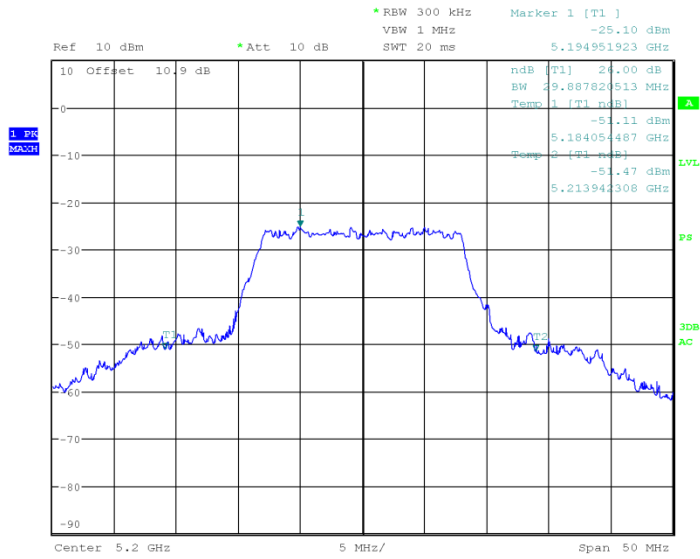
2.2.9 Test Results (as reported)

Low Channel (5180 MHz)	Mid Channel (5200 MHz)	High Channel (5240 MHz)
27.72 MHz	29.89 MHz	33.65 MHz



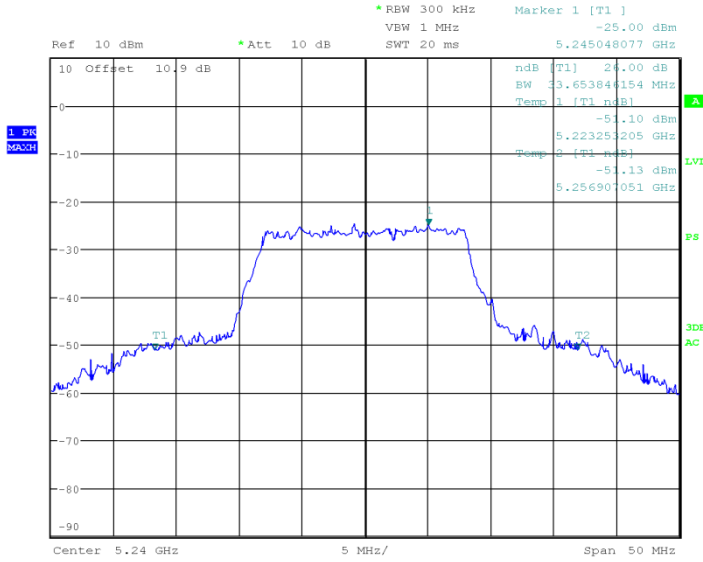
Date: 20.SEP.2012 08:37:36

Low Channel



Date: 20.SEP.2012 08:39:28

### Mid Channel



Date: 20.SEP.2012 08:42:50

### High Channel



## 2.3 OUTPUT POWER

### 2.3.1 Specification Reference

Part 15 Subpart E §15.407(a)(1) and RSS-210 A9.2(1)

### 2.3.2 Standard Applicable

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum e.i.r.p. shall not exceed 200 mW or  $10 + 10 \log_{10} B$ , dBm, whichever power is less. B is the 99% emission bandwidth in MHz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band

### 2.3.3 Test Methodology

Section A Method PM of 789033 D01 General UNII Test Procedures v01r01

### 2.3.4 Equipment Under Test and Modification State

Serial No: N/A / Test Configuration A

### 2.3.5 Date of Test/Initial of test personnel who performed the test

August 23 and September 8, 2012/FSC

### 2.3.6 Test Equipment Used

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

### 2.3.7 Environmental Conditions

Ambient Temperature	21.5 to 22.2°C
Relative Humidity	43.2 to 47.4%
ATM Pressure	99.2 to 100.1kPa

### 2.3.8 Additional Observations

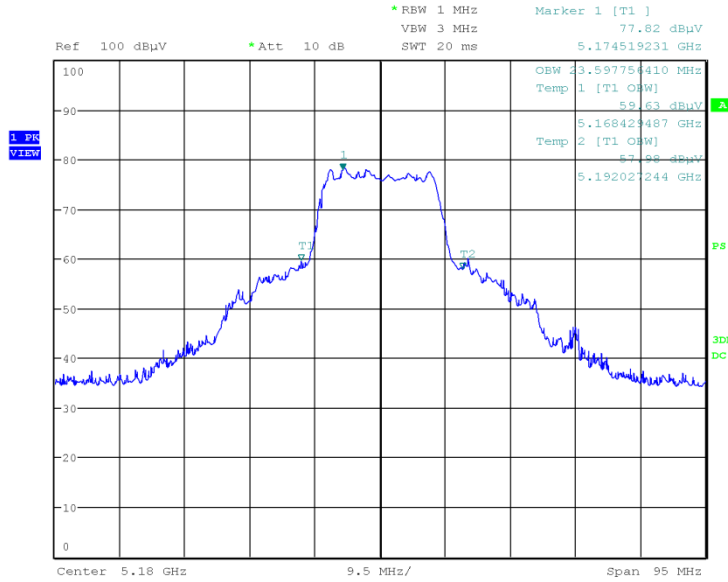
- This is a conducted test using a wideband RF power meter as an alternative to spectrum analyzer measurements.
- All available data rates were verified. The worst case data rate (marked bold and italic) will be verified for each test throughout this test report.





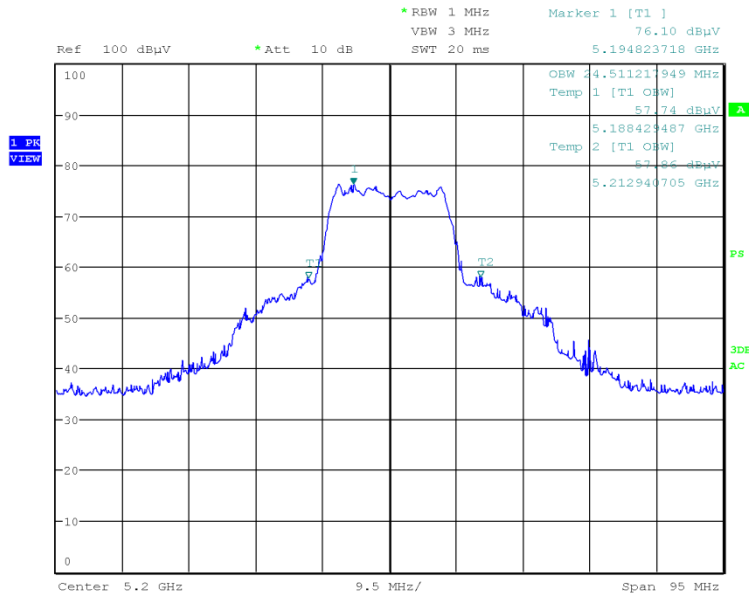
2.3.9 Test Results (99% BW)

Low Channel (5180 MHz)	Mid Channel (5200 MHz)	High Channel (5240 MHz)
23.6 MHz	24.51 MHz	25.72 MHz



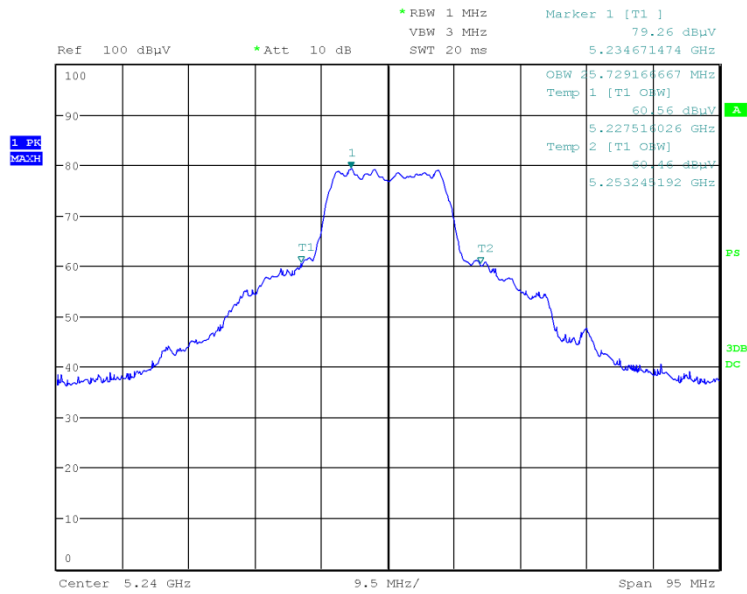
Date: 23.AUG.2012 16:34:57

Low Channel



Date: 28.AUG.2012 09:02:05

Mid Channel



Date: 23.AUG.2012 16:29:45

### High Channel

#### 2.3.10 Limit Consideration

FCC Limit = 50mW or 4 dBm + 10 log (26dB BW in MHz)  
 = 50mW or 4 dBm + 10 log (33.65MHz)  
 = 50mW or 19.27 dBm (84.52mW)  
 = since 50<84.52  
 = therefore use 50mW or 17dBm limit

IC Limit = 200 mW or 10 + 10 log<sub>10</sub> (99% BW in MHz)  
 = 200 mW or 10 + 10 log<sub>10</sub> (24.4MHz)  
 = 200mW or 23.87 dBm (244mW)  
 = since 200<244  
 = therefore use 200mW or 23dBm limit

Limit used is 50mW or 17dBm which satisfy both FCC and IC requirement for this test.



2.3.11 Test Results (Maximum Conducted Power)

802.11 a				
Channel	Frequency (MHz)	Data Rate (Mbps)	Average Power (dBm)	Peak Power (dBm)
<b>36</b>	<b>5180</b>	<b>6</b>	<b>-11.1</b>	<b>4.21</b>
<b>40</b>	<b>5200</b>	<b>6</b>	<b>-13.3</b>	<b>1.88</b>
<b>48</b>	<b>5240</b>	<b>6</b>	<b>-12.25</b>	<b>2.81</b>
36	5180	9	-12.5	3.98
40	5200	9	-14.77	1.52
48	5240	9	-13.7	2.83
36	5180	12	-13.6	3.76
40	5200	12	-15.82	1.24
48	5240	12	-14.78	2.79
36	5180	18	-14.9	3.66
40	5200	18	-17.11	1.17
48	5240	18	-16.04	2.25
36	5180	24	-15.98	3.76
40	5200	24	-18.11	1.77
48	5240	24	-17.11	2.81



## 2.4 POWER SPECTRAL DENSITY

### 2.4.1 Specification Reference

Part 15 Subpart E §15.407(a)(1) and RSS-210 A9.4(2)

### 2.4.2 Standard Applicable

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Within the emission bandwidth, when the peak spectral density per MHz over any continuous transmission exceeds the average (10 log<sub>10</sub> B) value by more than 3 dB, the permissible power spectral density shall be reduced by the excess amount.

A measurement resolution bandwidth narrower than 1.0 MHz is permitted provided that power integration over 1.0 MHz is performed. However, if the emission bandwidth of the signal is less than 1.0 MHz, the measurement bandwidth should be reduced to that of the emission bandwidth to obtain the proper power spectral density; alternatively, the measured value could be normalized to 1.0 MHz.

(Note: B has been defined above as the 99% emission bandwidth).

### 2.4.3 Test Methodology

Section E of 789033 D01 General UNII Test Procedures v01r01

### 2.4.4 Equipment Under Test and Modification State

Serial No: N/A / Test Configuration A

### 2.4.5 Date of Test/Initial of test personnel who performed the test

September 10, 2012/FSC

### 2.4.6 Test Equipment Used

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

### 2.4.7 Environmental Conditions

Ambient Temperature	23.1°C
Relative Humidity	43.5%
ATM Pressure	99.0 kPa

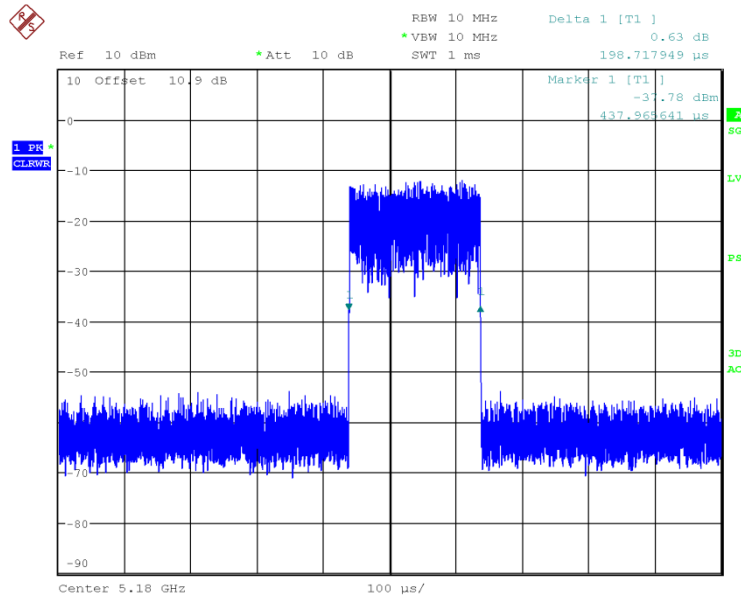


2.4.8 **Additional Observations**

- This is a conducted test as per Section E (PPSD) of 789033 D01 General UNII Test Procedures v01r01.
- Average power spectrum method used is SA-2 (trace averaging across on and off times of the EUT transmissions)

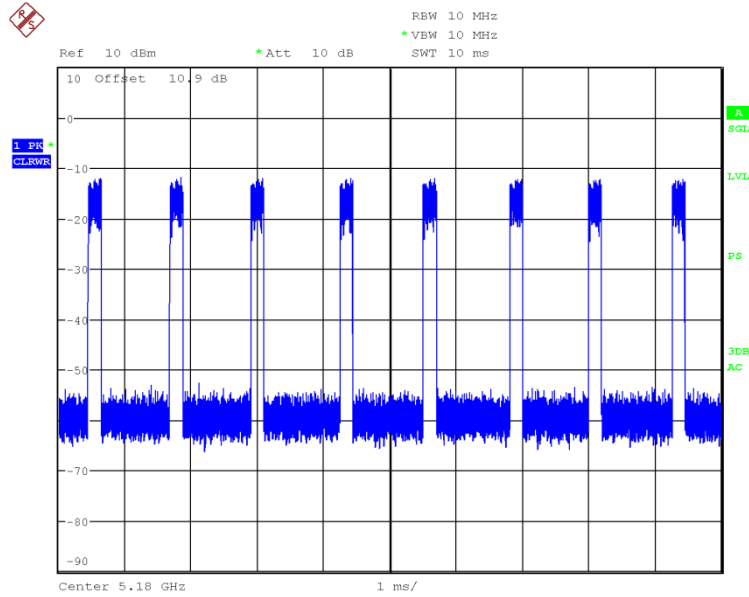
2.4.9 **Test Results (Duty Cycle “X” and Transmission Duration “T”)**

- Test methodology is per Section B of 789033 D01 General UNII Test Procedures v01r01.
- Since the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal, the zero-span mode on the spectrum analyzer is used.
- Since  $T=198.72\mu s$ . Therefore  $50/T$  is less than 10MHz RBW/VBW used.
- Sweep points setting is 25000/ms, therefore sweep points across duration  $T = 4967$  (complies with 100 requirement).
- Duty Cycle (x) =  $198.72\mu s \times 8$  (8 transmissions in 10ms sweep)/10000  $\mu s$   
 =  $1589.76 \mu s/10000 \mu s$   
 = 0.159



Date: 9.SEP.2012 16:34:36

**T = 198.72  $\mu s$**



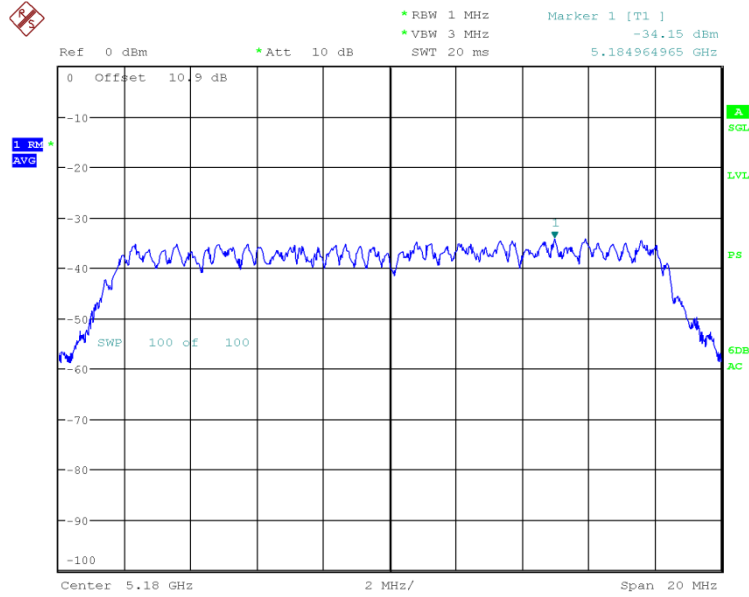
Date: 9.SEP.2012 16:45:41

**Sweep showing eight (8) transmissions in 10ms sweep**

**2.4.10 Test Results (PPSD)**

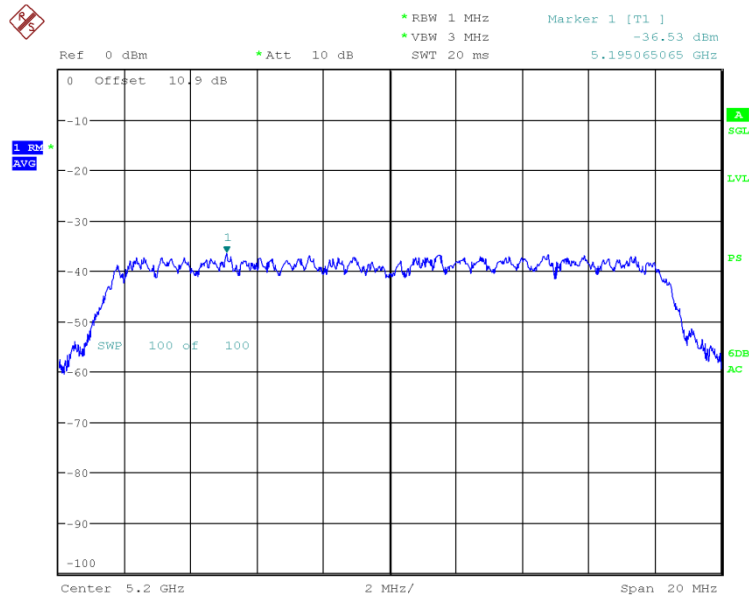
See attached plots and table.

Channel	Frequency (MHz)	Peak of average power spectrum (dBm)	Duty Cycle 10log(1/x)	PPSD (dBm)	Limit (dBm)	Margin (dB)
36	5180	-34.15	7.99	-26.16	4	30.16
40	5200	-36.53	7.99	-28.54	4	32.54
48	5240	-35.53	7.99	-27.54	4	31.54



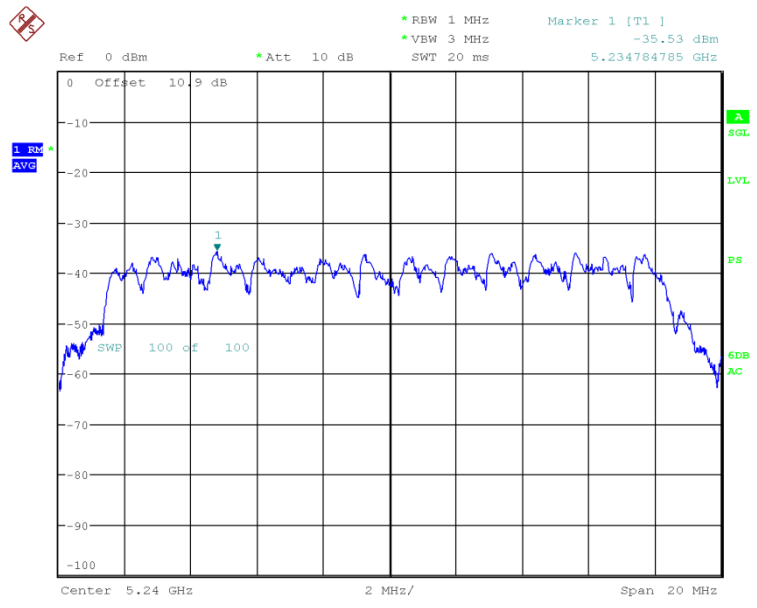
Date: 10.SEP.2012 07:29:40

**Low Channel (802.11 a)**



Date: 10.SEP.2012 07:30:37

**Mid Channel (802.11 a)**



Date: 10.SEP.2012 07:31:46

### High Channel (802.11 a)





## 2.5 OUT-OF-BAND EMISSION LIMITS

### 2.5.1 Specification Reference

Part 15 Subpart E §15.407(b)(1) and RSS-210 A9.2(1)

### 2.5.2 Standard Applicable

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.

Emissions outside the band 5150-5250 MHz shall not exceed -27 dBm/MHz e.i.r.p.

### 2.5.3 Test Methodology

Section G of 789033 D01 General UNII Test Procedures v01r01

### 2.5.4 Equipment Under Test and Modification State

Serial No: N/A / Test Configuration A

### 2.5.5 Date of Test/Initial of test personnel who performed the test

September 10, 2012/FSC

### 2.5.6 Test Equipment Used

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

### 2.5.7 Environmental Conditions

Ambient Temperature	23.1°C
Relative Humidity	43.5%
ATM Pressure	99.0 kPa

### 2.5.8 Additional Observations

- This is a conducted test as per Section G of 789033 D01 General UNII Test Procedures v01r01 .
- There are no emissions observed within 20dB of the limit.

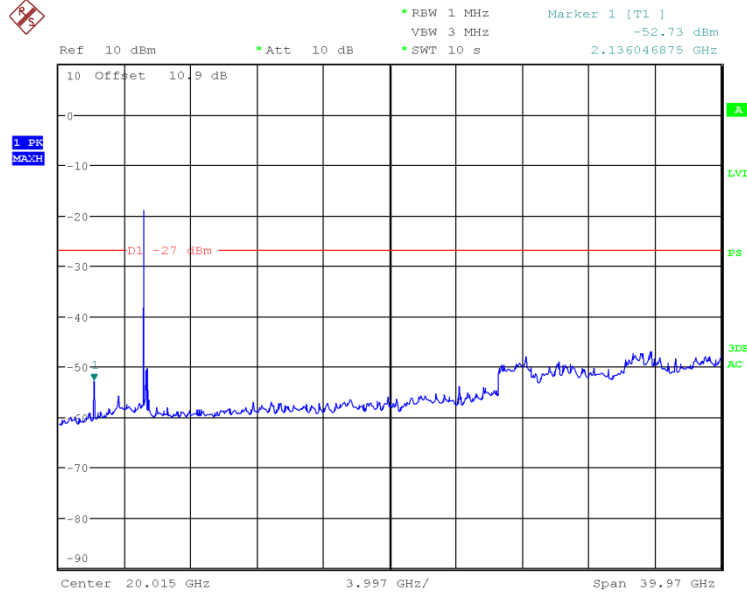
### 2.5.9 Sample Computations

- Highest out-of-band emission observed = -52.31 dBm @ 2.1360GHz (High Channel)
- EIRP(dBm) = -52.31 + 4.9 dBi (antenna gain)
- EIRP(dBm) = -57.21 dBm



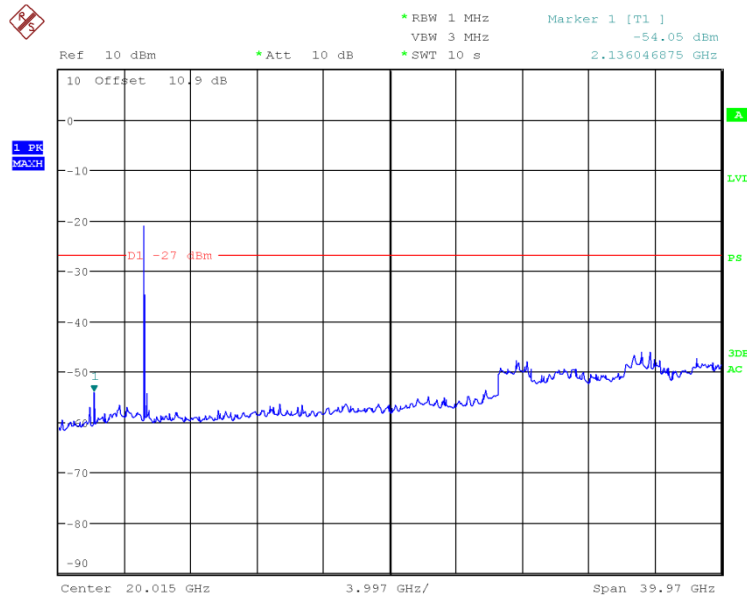
2.5.10 Test Results

Complies. See attached plots.



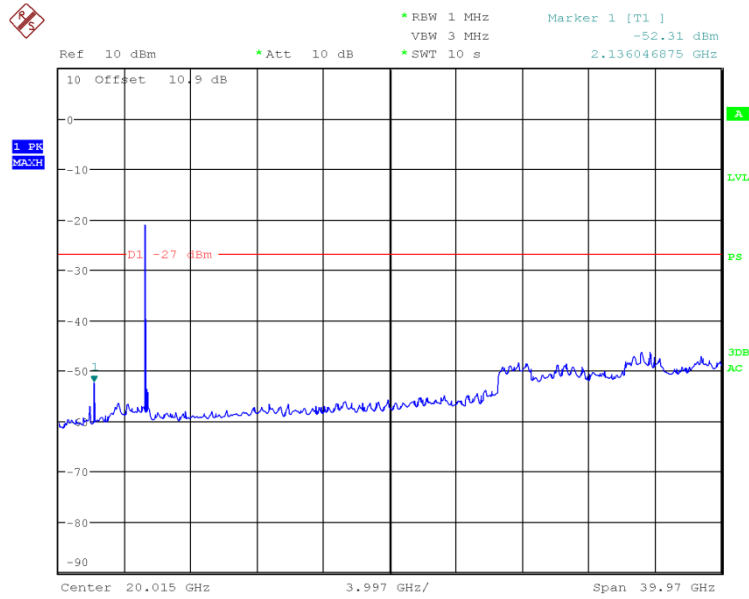
Date: 10.SEP.2012 08:28:20

Low Channel (5180 MHz)



Date: 10.SEP.2012 08:27:06

Mid Channel (5200 MHz)



Date: 10.SEP.2012 08:25:21

### High Channel (5240 MHz)



## 2.6 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

### 2.6.1 Specification Reference

Part 15 Subpart E §15.407(b)(1)/(7) and RSS-210 A9.2(1)

### 2.6.2 Standard Applicable

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.

The provisions of §15.205 apply to intentional radiators operating under this section.

Emissions outside the band 5150-5250 MHz shall not exceed -27 dBm/MHz e.i.r.p.

### 2.6.3 Test Methodology

Section G of 789033 D01 General UNII Test Procedures v01r01

### 2.6.4 Equipment Under Test and Modification State

Serial No: N/A / Test Configuration A

### 2.6.5 Date of Test/Initial of test personnel who performed the test

September 10, 2012/FSC

### 2.6.6 Test Equipment Used

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

### 2.6.7 Environmental Conditions

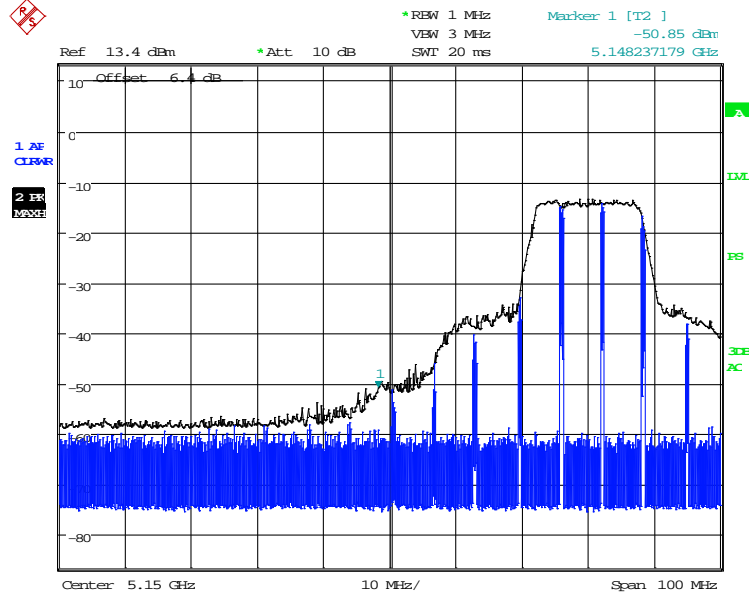
Ambient Temperature	23.1°C
Relative Humidity	43.5%
ATM Pressure	99.0 kPa

### 2.6.8 Additional Observations

- This is a conducted test as per Section G of 789033 D01 General UNII Test Procedures v01r01 .
- RBW=1MHz/VBW=3MHz
- Detector = Peak
- Sweep time=Auto
- Trace Mode=max hold
- Sweep allowed to continue until the trace stabilized.

2.6.9 Test Results

Complies. See attached plots and calculations.



Date: 16.MAY.2013 17:43:41

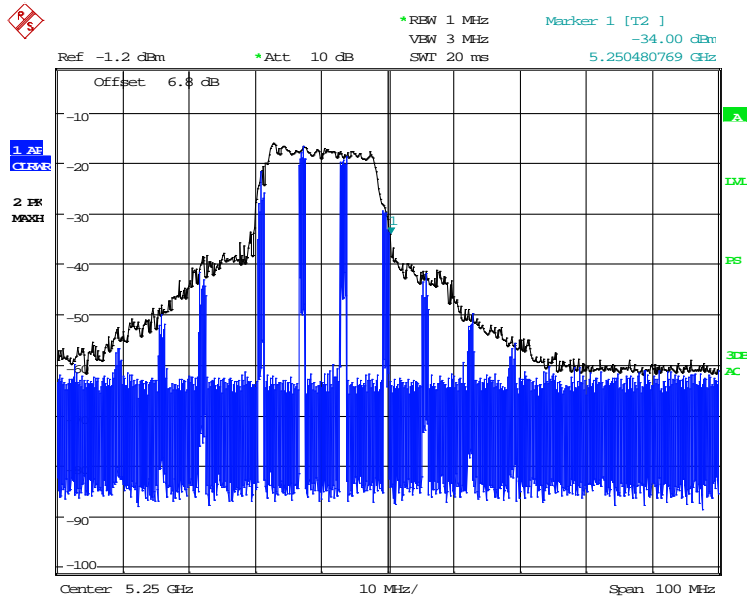
Low Channel (5180 MHz)

Lower band edge calculation:

- 5150 MHz (in the restricted band)
- Use the following formula as per Section G(1)(ii) of 789033 D01 General UNII Test Procedures v01r01:
 
$$E(\text{dB}\mu\text{V}/\text{m}) = \text{EIRP}(\text{dBm}) + 95.2$$

$$= (-50.85 \text{ dBm} + 4.9\text{dBi antenna gain}) + 95.2$$

$$= 49.25 \text{ dB}\mu\text{V}/\text{m} @ 3 \text{ meters}$$
- Since 49.25 dBμV/m (Peak) is less than than the 54 dBμV/m Average limit of 15.209, then average measurement is not required.



Date: 16.MAY.2013 17:57:04

### High Channel (5240 MHz)

#### Upper band edge calculation:

- 5250 MHz (not in the restricted bands)
- Limit is -27dBm EIRP
- Calculation @ 5250 MHz:
 

Peak measurement @ 5250 MHz	= -34 dBm
EIRP @ 5250 MHz	= -34 + 4.9 dBi (antenna gain)
	= -29.10 dBm
Margin of compliance	= 2.1 dB



**2.7 SPURIOUS RADIATED EMISSIONS**

**2.7.1 Specification Reference**

Part 15 Subpart E §15.407(b)(1)/(7)and RSS-210 A9.2(1)

**2.7.2 Standard Applicable**

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.

The provisions of §15.205 apply to intentional radiators operating under this section.

Emissions outside the band 5150-5250 MHz shall not exceed -27 dBm/MHz e.i.r.p.

**2.7.3 Test Methodology**

Section G of 789033 D01 General UNII Test Procedures v01r01

**2.7.4 Equipment Under Test and Modification State**

Serial No: N/A / Test Configuration B

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

May 04 and May 16, 2013/FSC,JMG,LS

**2.7.6 Test Equipment Used**

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

**2.7.7 Environmental Conditions**

Ambient Temperature	24.5 to 25.2°C
Relative Humidity	46.5 to 49.7%
ATM Pressure	99.2 to 99.8 kPa

**2.7.8 Additional Observations**

- These are radiated tests (cabinet emissions measurements) to supplement conducted measurements performed.
- Limit used is the more stringent §15.209 limits.
- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.7.9 for sample computation.



2.7.9 **Sample Computation (Radiated Emission)**

Measuring equipment raw measurement (db $\mu$ V) @ 30 MHz		24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3
	Asset# 1172 (cable)	0.3
	Asset# 1016 (preamplifier)	-30.7
	Asset# 1175(cable)	0.3
	Asset# 1002 (antenna)	17.2
<b>Reported QuasiPeak Final Measurement (db<math>\mu</math>V/m) @ 30MHz</b>		<b>11.8</b>

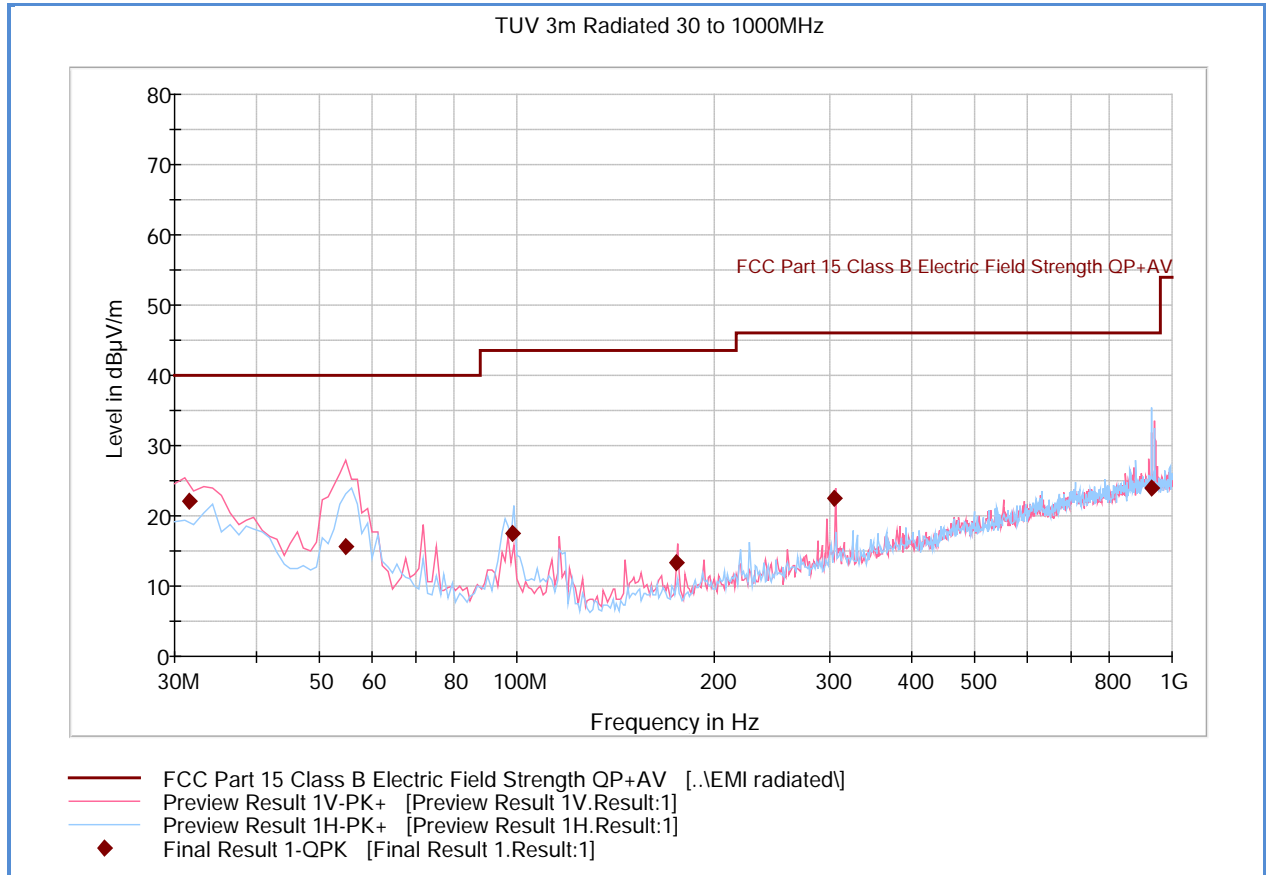
2.7.10 **Test Results**

See attached plots.





2.7.11 Test Results Below 1GHz (Receive Mode)

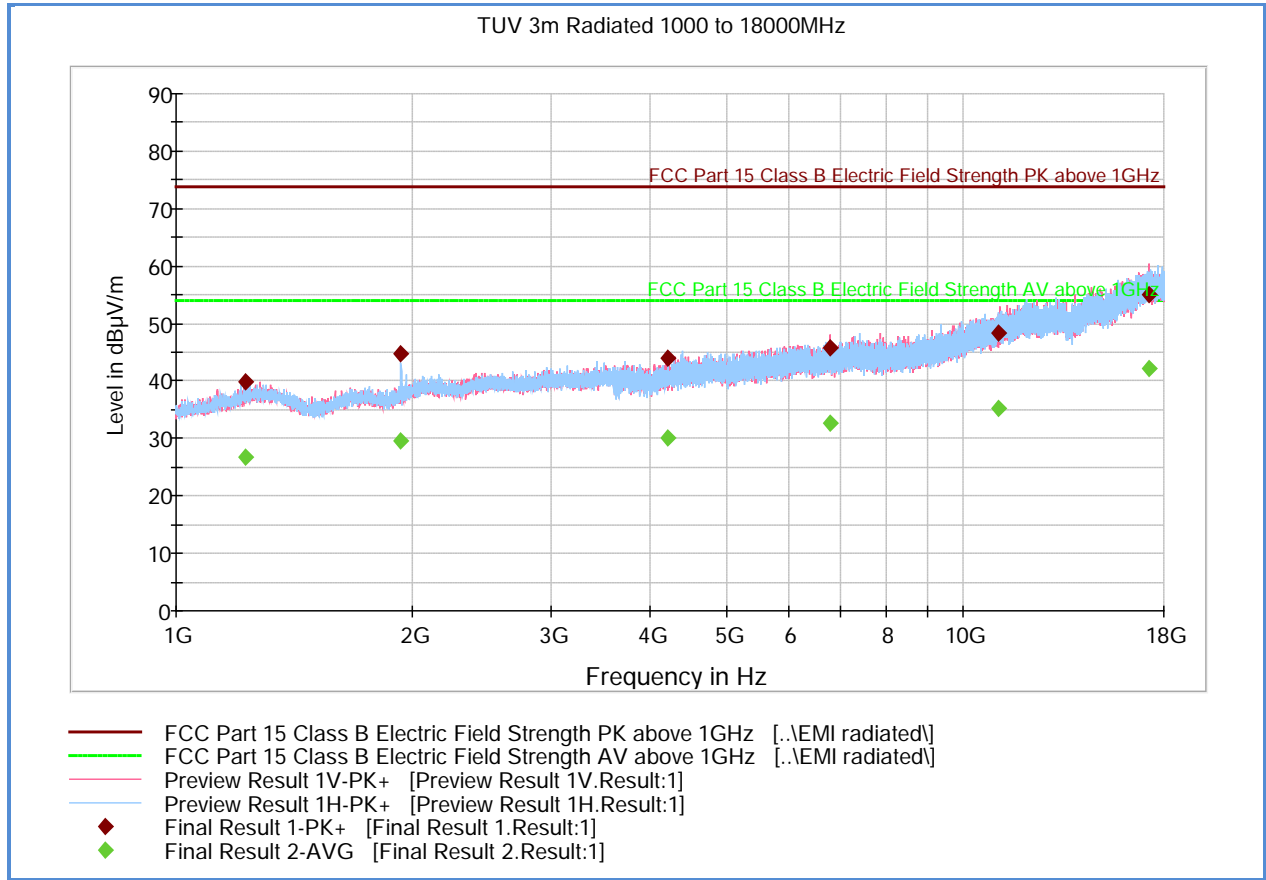


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
31.520000	22.1	1000.0	120.000	100.0	V	84.0	-13.5	18.0	40.0
54.788889	15.7	1000.0	120.000	100.0	V	28.0	-22.5	24.3	40.0
98.457778	17.5	1000.0	120.000	103.0	H	-1.0	-22.1	26.0	43.5
175.260000	13.4	1000.0	120.000	100.0	V	180.0	-21.3	30.1	43.5
305.428889	22.6	1000.0	120.000	100.0	V	45.0	-16.1	23.4	46.0
929.622222	24.0	1000.0	120.000	103.0	H	181.0	-5.2	22.0	46.0



2.7.12 Test Results Above 1GHz (Receive Mode)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1223.526667	39.9	1000.0	1000.000	173.7	H	52.0	-4.9	34.0	73.9
1932.546667	44.7	1000.0	1000.000	135.8	H	296.0	-2.0	29.2	73.9
4219.420000	43.9	1000.0	1000.000	390.4	V	96.0	3.9	30.0	73.9
6785.073333	45.9	1000.0	1000.000	390.4	V	330.0	8.7	28.0	73.9
11096.16000	48.3	1000.0	1000.000	390.4	H	84.0	14.6	25.6	73.9
17229.84000	55.0	1000.0	1000.000	235.4	V	298.0	21.6	18.9	73.9

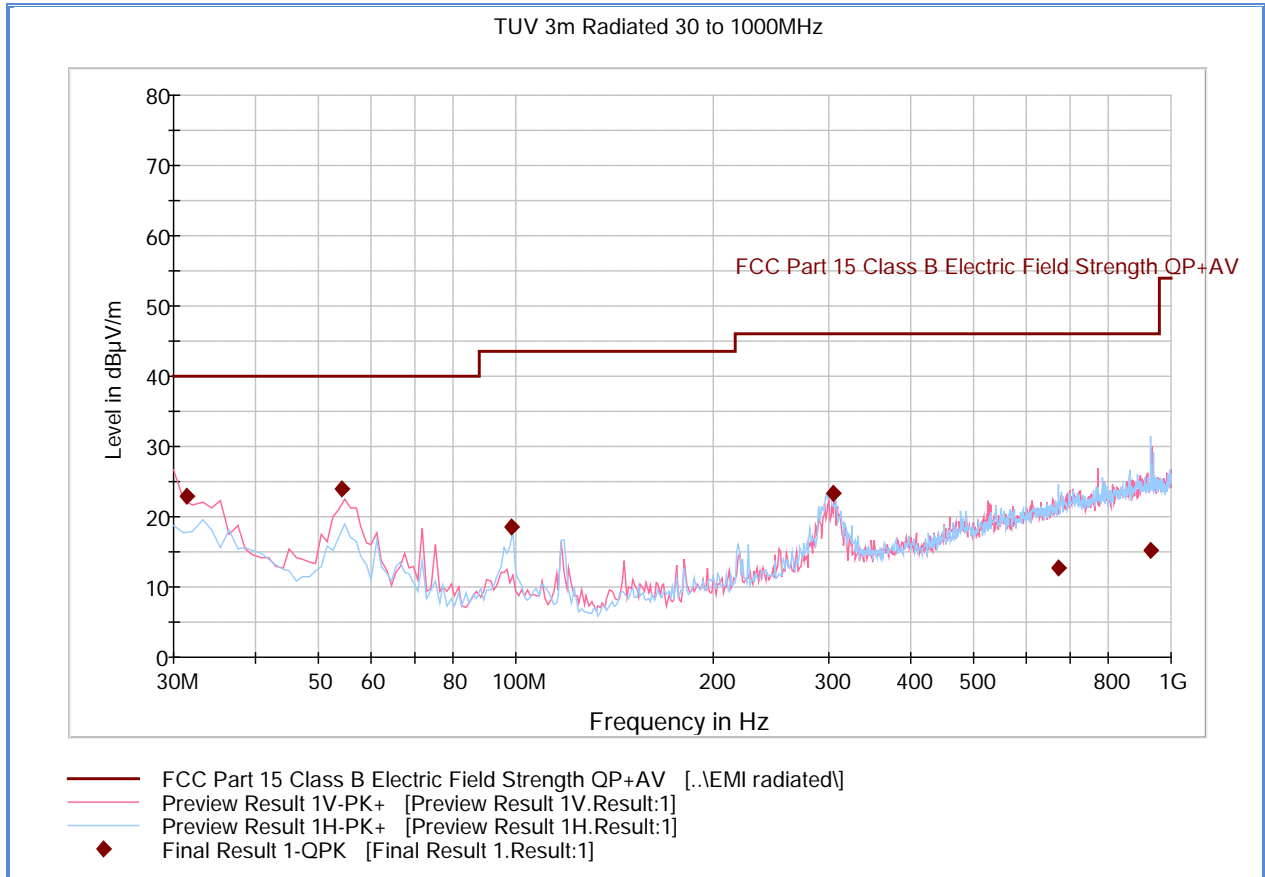
Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1223.526667	26.7	1000.0	1000.000	173.7	H	52.0	-4.9	27.2	53.9
1932.546667	29.6	1000.0	1000.000	135.8	H	296.0	-2.0	24.3	53.9
4219.420000	30.0	1000.0	1000.000	390.4	V	96.0	3.9	23.9	53.9
6785.073333	32.6	1000.0	1000.000	390.4	V	330.0	8.7	21.3	53.9
11096.16000	35.3	1000.0	1000.000	390.4	H	84.0	14.6	18.6	53.9
17229.84000	42.1	1000.0	1000.000	235.4	V	298.0	21.6	11.8	53.9

**Test Notes:** No significant emissions observed above 2GHz. All measurements presented above 2GHz are noise floor figures.



2.7.13 Test Results Below 1GHz (Low Channel)



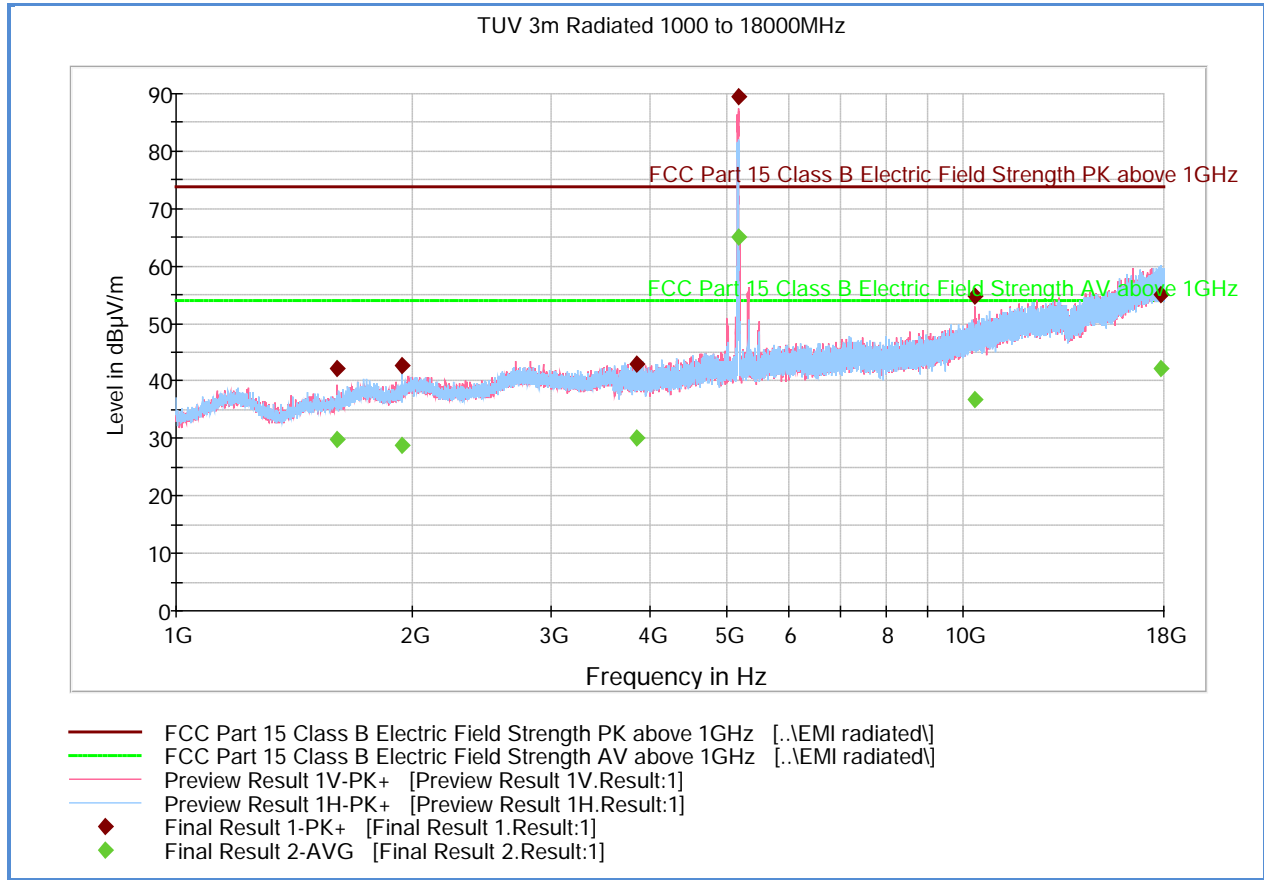
Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
31.480000	23.0	1000.0	120.000	100.0	V	20.0	-13.5	17.0	40.0
54.148889	24.0	1000.0	120.000	100.0	V	119.0	-22.3	16.0	40.0
98.497778	18.5	1000.0	120.000	103.0	H	38.0	-22.1	25.0	43.5
305.428889	23.4	1000.0	120.000	100.0	V	89.0	-16.1	22.6	46.0
672.513333	12.6	1000.0	120.000	103.0	H	133.0	-8.5	33.4	46.0
931.182222	15.2	1000.0	120.000	103.0	H	3.0	-5.2	30.8	46.0

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



2.7.14 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)
1599.993333	42.2	1000.0	1000.000	140.8	V	241.0	-4.3	31.7	73.9
1937.933333	42.7	1000.0	1000.000	301.3	H	36.0	-2.0	31.2	73.9
3846.626667	42.9	1000.0	1000.000	132.8	V	196.0	3.1	31.0	73.9
5187.520000	89.6	1000.0	1000.000	139.8	V	5.0	6.5	-15.7	73.9
10358.79333	54.7	1000.0	1000.000	118.8	V	217.0	13.4	19.2	73.9
17824.80000	55.1	1000.0	1000.000	356.1	H	199.0	22.3	18.8	73.9

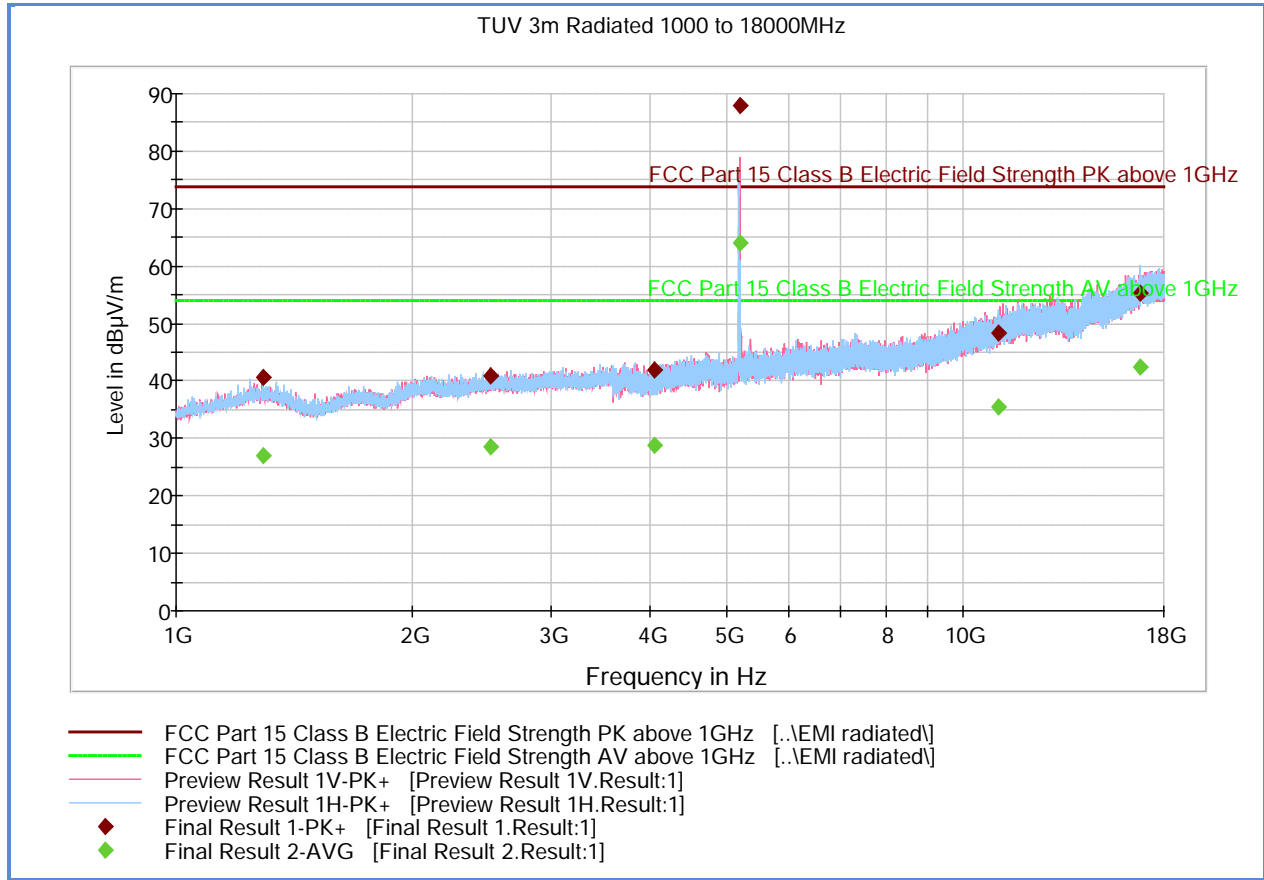
Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1599.993333	29.9	1000.0	1000.000	140.8	V	241.0	-4.3	24.0	53.9
1937.933333	28.8	1000.0	1000.000	301.3	H	36.0	-2.0	25.1	53.9
3846.626667	30.0	1000.0	1000.000	132.8	V	196.0	3.1	23.9	53.9
5187.520000	65.1	1000.0	1000.000	139.8	V	5.0	6.5	-11.2	53.9
10358.79333	36.8	1000.0	1000.000	118.8	V	217.0	13.4	17.1	53.9
17824.80000	42.3	1000.0	1000.000	356.1	H	199.0	22.3	11.6	53.9

**Test Notes:** 5187.52MHz is part of fundamental measurement and not subjected to 15.209 and 15.205 limits. There are no emissions observed above 12GHz (noise floor measurements).



2.7.15 Test Results Above 1GHz (Mid Channel)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1292.700000	40.7	1000.0	1000.000	140.8	H	318.0	-4.8	33.2	73.9
2509.380000	40.9	1000.0	1000.000	387.0	V	37.0	-0.1	33.0	73.9
4047.233333	41.9	1000.0	1000.000	387.0	V	197.0	3.6	32.0	73.9
5206.306667	87.9	1000.0	1000.000	119.8	V	215.0	6.6	-14.0	73.9
11078.22000	48.5	1000.0	1000.000	197.6	H	239.0	14.6	25.4	73.9
16827.50666	55.4	1000.0	1000.000	253.4	H	25.0	21.6	18.5	73.9

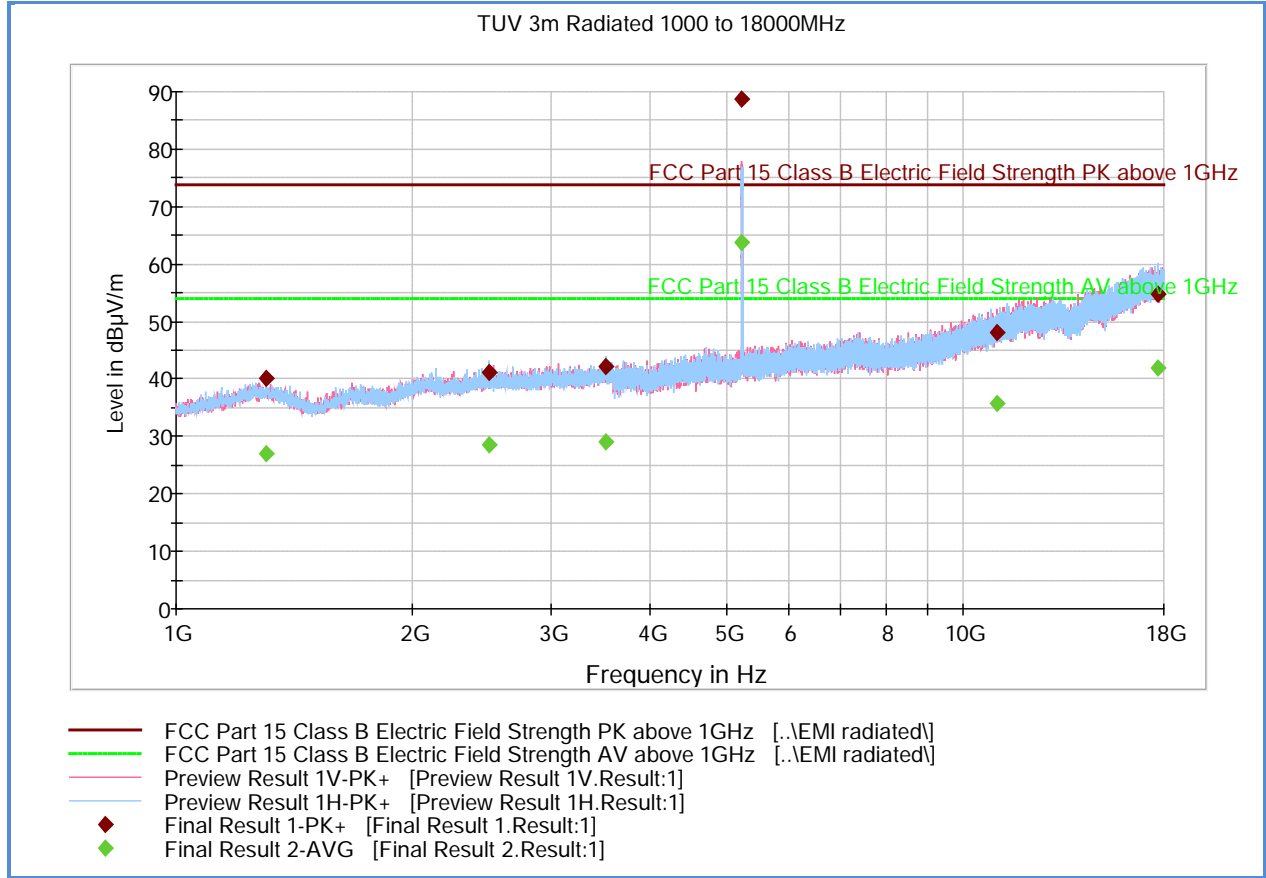
Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1292.700000	27.0	1000.0	1000.000	140.8	H	318.0	-4.8	26.9	53.9
2509.380000	28.5	1000.0	1000.000	387.0	V	37.0	-0.1	25.4	53.9
4047.233333	28.7	1000.0	1000.000	387.0	V	197.0	3.6	25.2	53.9
5206.306667	64.0	1000.0	1000.000	119.8	V	215.0	6.6	-10.1	53.9
11078.22000	35.5	1000.0	1000.000	197.6	H	239.0	14.6	18.4	53.9
16827.50666	42.5	1000.0	1000.000	253.4	H	25.0	21.6	11.4	53.9

**Test Notes:** 5206.31MHz is part of fundamental measurement and not subjected to 15.209 and 15.205 limits. There are no emissions observed above 6GHz (noise floor measurements).



2.7.16 Test Results Above 1GHz (High Channel)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1300.233333	40.2	1000.0	1000.000	271.3	V	48.0	-4.8	33.7	73.9
2499.700000	41.1	1000.0	1000.000	387.0	H	198.0	-0.1	32.8	73.9
3515.573333	42.2	1000.0	1000.000	205.6	H	89.0	2.2	31.7	73.9
5232.526667	88.7	1000.0	1000.000	133.8	V	224.0	6.8	-14.8	73.9
11052.48666	48.2	1000.0	1000.000	148.7	V	321.0	14.6	25.7	73.9
17715.31333	54.8	1000.0	1000.000	260.4	H	0.0	22.1	19.1	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)
1300.233333	27.1	1000.0	1000.000	271.3	V	48.0	-4.8	26.8	53.9
2499.700000	28.4	1000.0	1000.000	387.0	H	198.0	-0.1	25.5	53.9
3515.573333	29.1	1000.0	1000.000	205.6	H	89.0	2.2	24.8	53.9
5232.526667	63.7	1000.0	1000.000	133.8	V	224.0	6.8	-9.8	53.9
11052.48666	35.7	1000.0	1000.000	148.7	V	321.0	14.6	18.2	53.9
17715.31333	42.0	1000.0	1000.000	260.4	H	0.0	22.1	11.9	53.9

**Test Notes:** 5232.5MHz is part of fundamental measurement and not subjected to 15.209 and 15.205 limits. There are no emissions observed above 6GHz (noise floor measurements).



2.8 **PEAK EXCURSION RATIO**

2.8.1 **Specification Reference**

Part 15 Subpart E §15.407(a)(6)

2.8.2 **Standard Applicable**

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

2.8.3 **Test Methodology**

Section F of 789033 D01 General UNII Test Procedures v01r01

2.8.4 **Test Methodology**

Section E of 789033 D01 General UNII Test Procedures v01r01

2.8.5 **Equipment Under Test and Modification State**

Serial No: N/A / Test Configuration A

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

September 10, 2012/FSC

2.8.7 **Test Equipment Used**

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

2.8.8 **Environmental Conditions**

Ambient Temperature	23.1°C
Relative Humidity	43.5%
ATM Pressure	99.0 kPa

2.8.9 **Additional Observations**

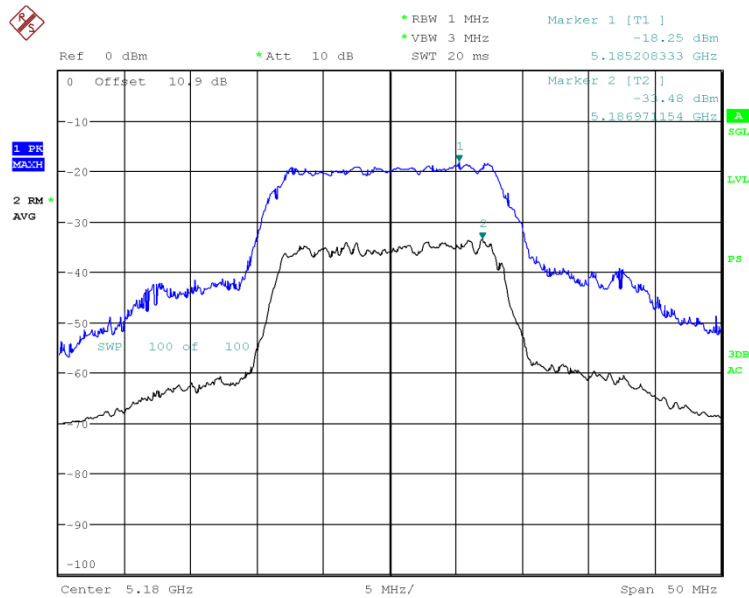
- This is a conducted test as per Section F of 789033 D01 General UNII Test Procedures v01r01.
- The ratio of the peak-max-hold spectrum with PPSD measurement was verified not to exceed 13 dB.
- Duty Cycle (x) calculation is from Section 2.4.9 of this test report.
- PPSD test procedure is detailed under Section 2.4 of this test report.



2.8.10 Test Results

See attached plots and table.

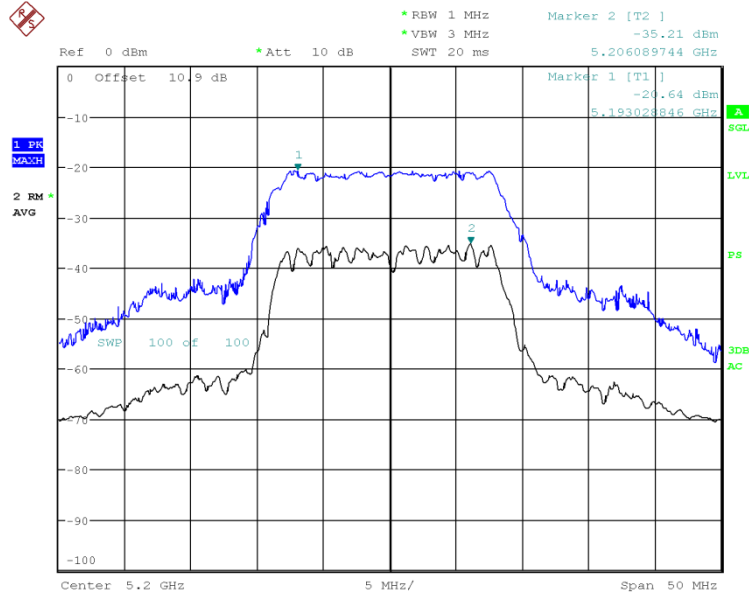
Channel	Frequency (MHz)	Peak of average power spectrum (dBm)	Duty Cycle 10log(1/x)	PPSD (dBm)	Peak Max Hold (dBm)	Ratio (dB)
36	5180	-33.48	7.99	-25.49	-18.25	7.24
40	5200	-35.21	7.99	-27.22	-20.64	6.58
48	5240	-35.62	7.99	-27.63	-20.30	7.33



Date: 10.SEP.2012 12:04:26

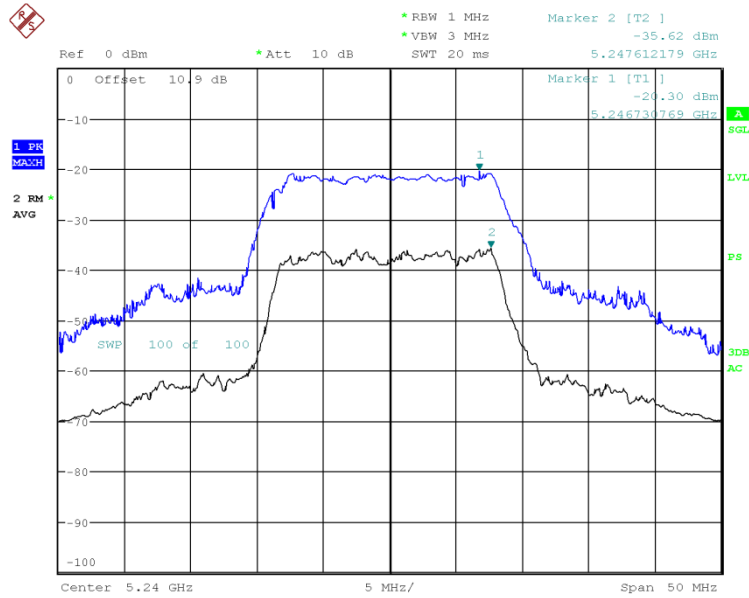
Low Channel (802.11 a)





Date: 10.SEP.2012 11:38:16

**Mid Channel (802.11 a)**



Date: 10.SEP.2012 11:39:46

**High Channel (802.11 a)**



### **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
<b>Conducted Port Setup</b>						
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	06/13/12	06/13/13
7569	Series Power Meter	N1911A P-	MY45100625	Agilent	02/24/12	02/24/14
7570	50MHz-18GHz Wideband Power Sensor	N1921A	MY45240588	Agilent	02/14/12	02/24/13
<b>Radiated Test Setup</b>						
1033	Bilog Antenna	3142C	00044556	EMCO	05/23/12	05/23/13
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	03/25/13	03/25/14
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	09/21/12	09/21/13
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	09/21/12	09/21/13
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	09/21/12	09/21/13
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	08/10/12	08/10/13
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	06/13/12	06/13/13
1016	Pre-amplifier	PAM-0202	187	PAM	08/17/12	08/17/13
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	
<b>Miscellaneous</b>						
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	11/12/12	11/12/13
6452	Multimeter	3478A	2911A52177	Hewlett Packard	07/16/12	07/16/13
7560	Barometer/Temperature /Humidity Transmitter	iBTHX-W	1240476	Omega	11/19/12	11/19/13
7539	DC Power Supply	6434B	1140A01866	Hewlett Packard	Verified by 6452	



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

3.2.3 Conducted Antenna Port Measurement

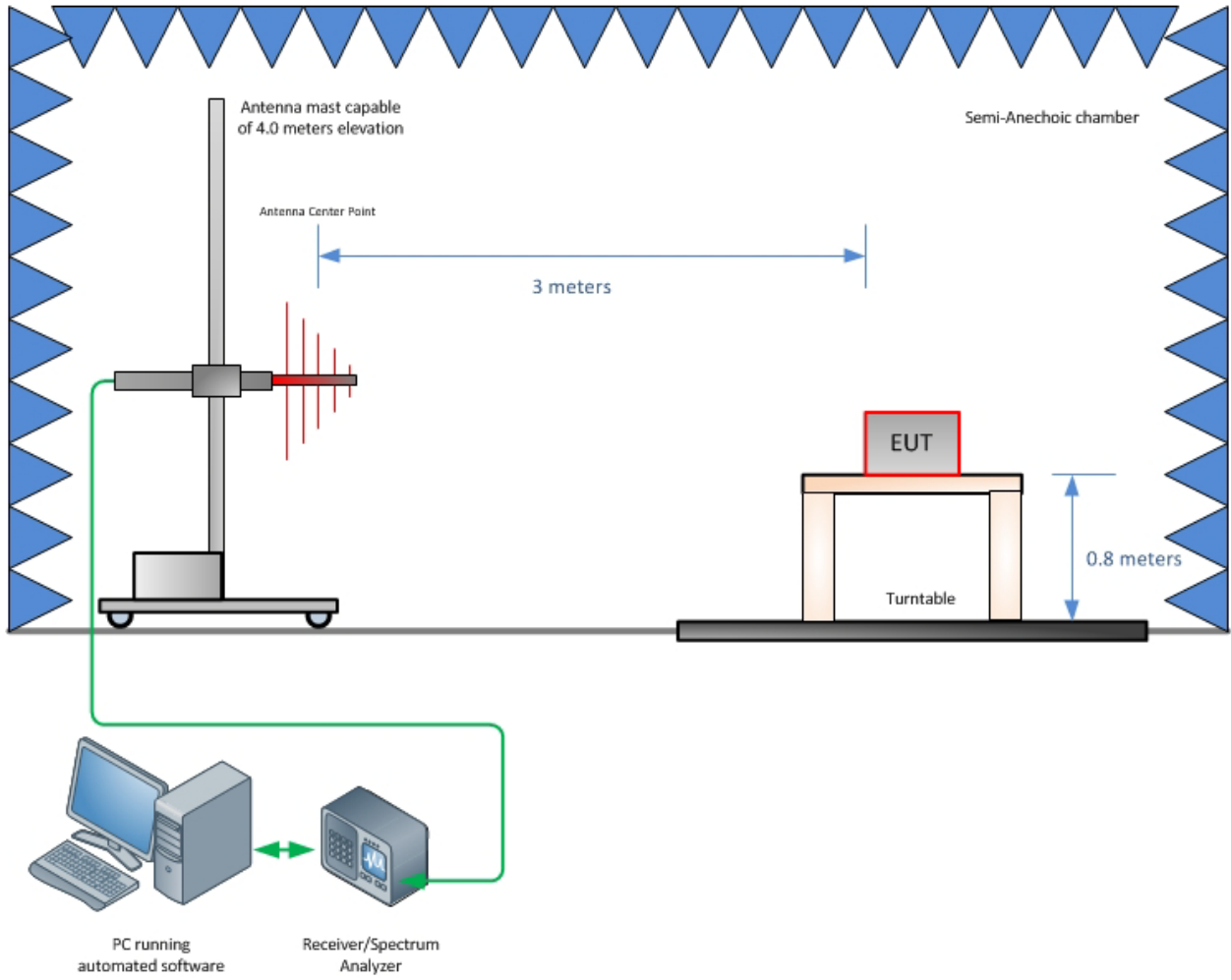
Contribution		Probability Distribution Type	Probability Distribution $x_i$	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.50	0.29	0.08
3	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty ( $u_c$ ):					0.72
Coverage Factor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



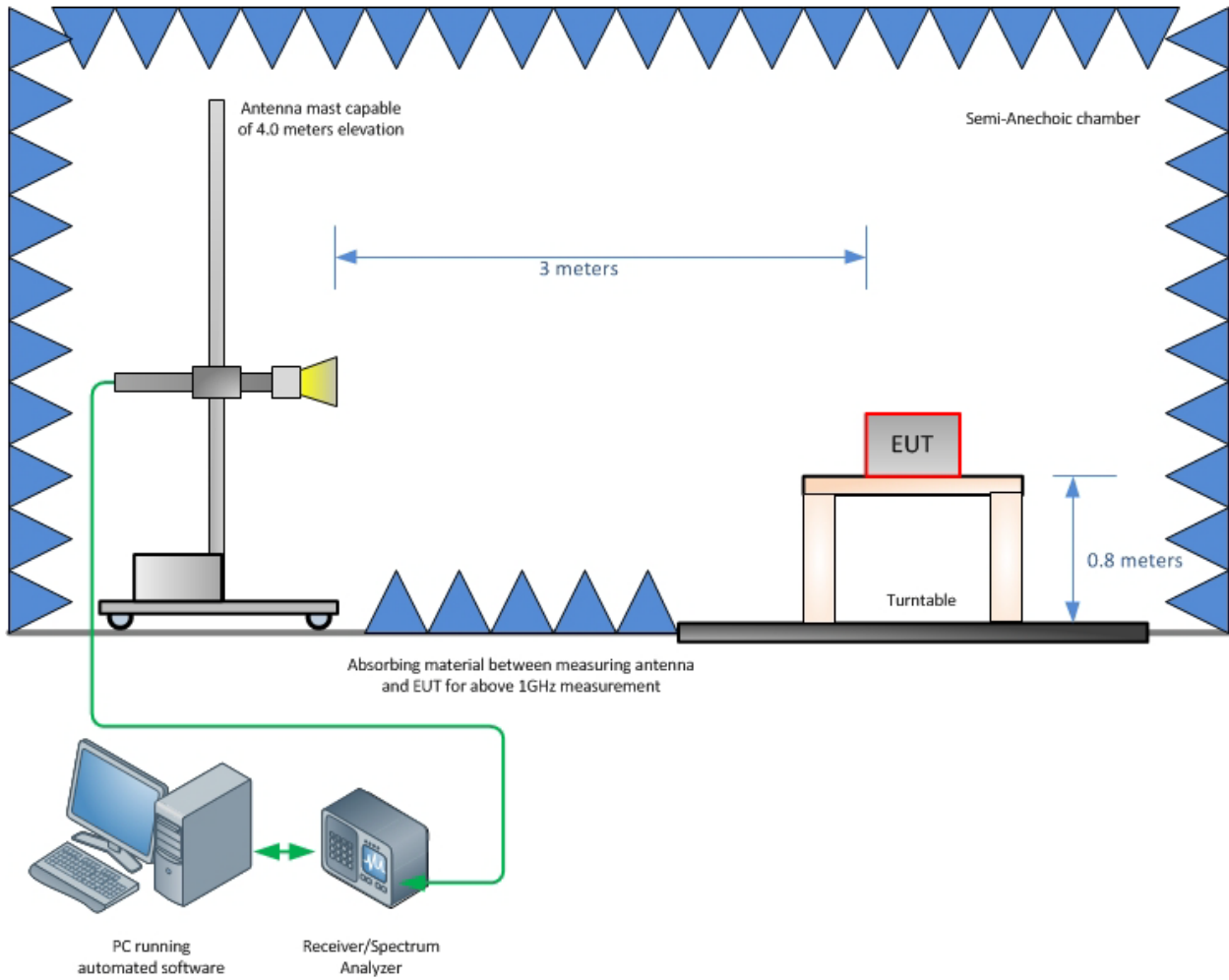
## SECTION 4

### 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





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