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Report On

Application for Grant of Equipment Authorization of the
SMK Electronics Corp.
Power View Scene Controller

FCC Part 15 Subpart C §15.247
IC RSS-Gen Issue 4 November 2014
IC RSS-210 Issue 8 December 2010

Report No. SD72105568A-0415 **May 2015**

REPORT ON	Radio Testing of the SMK Electronics Corp. Power View Scene Controller
TEST REPORT NUMBER	SD72105568A-0415
PREPARED FOR	SMK Electronics Corp. 1055 Tierra del Rey, Suite H Chula Vista, CA 91910
CONTACT PERSON	Nikolay Shtin RF Engineer (619) 216-6400 nshtin@smkusa.com
PREPARED BY	Alex Chang **Name** Authorized Signatory Title: EMC/Wireless Test Engineer
APPROVED BY	Juan Manuel Gonzalez **Name** Authorized Signatory Title: Commercial/Wireless EMC Lab Manager
DATED	May 21, 2015

Revision History

SD72105568A-0415 SMK Electronics Corp. Power View Scene Controller					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
05/21/2015	Initial Release				Juan M. Gonzalez

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SECTION 1

REPORT SUMMARY

Radio Testing of the
SMK Electronics Corp.
Power View Scene Controller

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the SMK Electronics Corp. Power View Scene Controller to the requirements of FCC Part 15 Subpart C §15.247, IC RSS-Gen Issue 4 November 2014 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)	1010512200
FCC ID Number	UXUSC4U1
IC Number	7316A-SC4U1
Serial Number(s)	Conducted antenna port testing sample, serial number not available. This is a PCB board only. Radiated testing sample, serial number not available. Proto type sample provided.
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.247 (October 1, 2014). • RSS-210 - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment (Issue 8, December 2010). • RSS-Gen - General Requirements for Compliance of Radio Apparatus (Issue 4, November 2014). • 558074 D01 DTS Meas Guidance v03r02, (June 05, 2014) Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.
Start of Test	May 04, 2015
Finish of Test	May 05, 2015
Name of Engineer(s)	Alex Chang
Related Document(s)	None. Supporting documents for EUT certification are separate exhibits.

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart C §15.247 with cross-reference to the corresponding IC RSS standard is shown below.

Section	§15.247 Spec Clause	RSS	Test Description	Result	Comments/ Base Standard
2.1	§15.247(b)(3)	RSS-210 A8.4 (4)	Peak Output Power	Compliant	
—	§15.207(a)	RSS-Gen 8.8	Conducted Emissions	N/A ***)**	
2.2		RSS-Gen 6.6	99% Emission Bandwidth	Compliant	
2.3	§15.247(a)(2)	RSS-210 A8.2(a)	Minimum 6 dB RF Bandwidth	Compliant	
2.4	§15.247(d)	RSS-210 A8.5	Out-of-Band Emissions - Conducted	Compliant	
2.5	§15.247(d)	RSS-210 A8.5	Band-edge Compliance of RF Conducted Emissions	Compliant	
2.6	§15.247(d)	RSS-210 A8.5	Spurious Radiated Emissions	Compliant	
2.7		RSS-Gen 7.1	Receiver Spurious Emissions	Compliant	
2.8	§15.247(d)	RSS-210 A8.5	Radiated Band Edge Measurements	Compliant	
2.9	§15.247(e)	RSS-210 A8.2(b)	Power Spectral Density for Digitally Modulated Device	Compliant	

***)** Not applicable. EUT is a battery operated device.

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) is a SMK Electronics Corp. Power View Scene Controller as shown in the photograph below.

Equipment Under Test

1.3.2 EUT General Description

EUT Description	Power View Scene Controller
Model Name	PV Scene Controller
Model Number(s)	1010512200
Rated Voltage	3.0VDC Coin Cell Battery (CR2032) x2 in parallel
Frequency Range	2407 MHz to 2480 MHz in the 2400 MHz to 2483.5 MHz Band
Number of Operating Frequencies	74
Channels Verified	Low Channel 2407MHz Mid Channel 2440MHz High Channel 2480MHz
Antenna Type (used during evaluation)	Integral (Complies with Part 15.203 requirements)

1.3.3 Antenna Details

Manufacturer	HunterDouglas
Antenna Type	Printed PCB Trace Antenna
Antenna Gain	-1.75 dBi

1.3.4 Maximum Conducted Output Power

Frequency Range (MHz)	Average Output Power (dBm)	Output Power (mW)
2407-2480	-5.03	0.31

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Conducted antenna port configuration. EUT was set on continuous transmission @ 100% duty cycle modulated in low, mid and high channels for evaluation via temporary antenna port provided by manufacturer.
B	Radiated emissions test configuration. EUT transmitting through the integral antenna. The EUT was a standalone device and set on continuous transmission @ 100% duty cycle modulated in low, mid or high channel for evaluation.

1.4.2 EUT Exercise Software

No special software used during evaluation. A firmware "Scene Selector FCC Code Rev 2" was loaded to the EUT which enable to change channels in Low, Mid and High @ 100% duty cycle (modulated) as well as normal operation and receive modes.

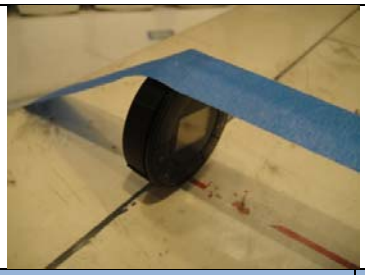
1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
—	—	—

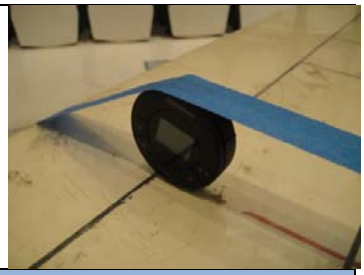
1.4.4 Worst Case Configuration

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

"X" Configuration



"Y" Configuration

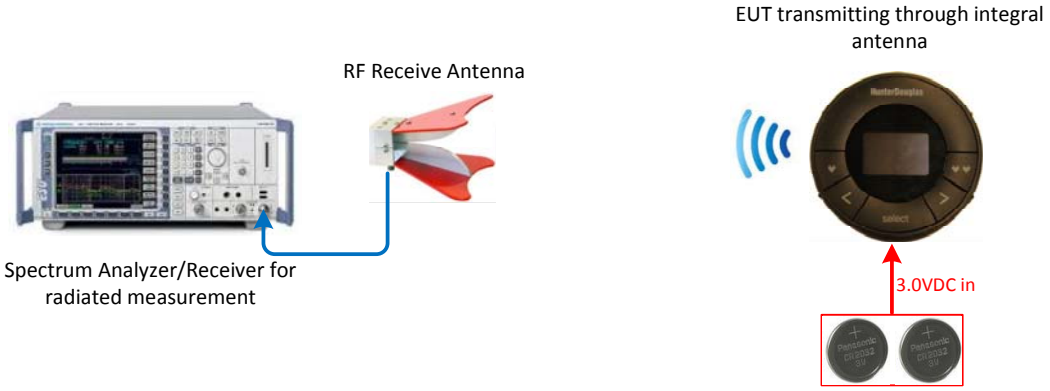


"Z" Configuration

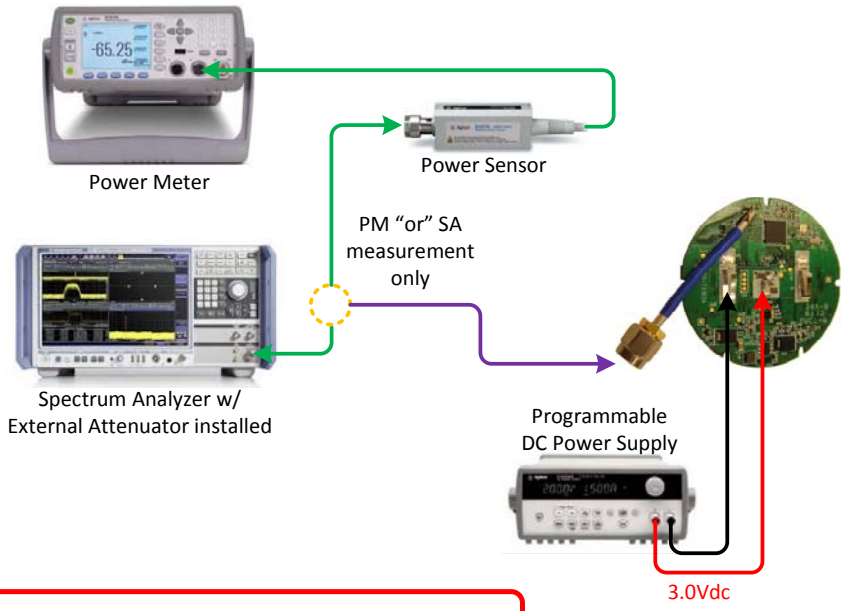
Worst case channel used is Low Channel (Channel 2407 MHz). This is based from Peak Output Power test results under Section 2.1 of this test report.

1.4.5 Simplified Test Configuration Diagram

Radiated Test Configuration



Conducted (Antenna Port) Test Configuration



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

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: Conducted antenna port testing sample, serial number not available. PCB board only. Radiated testing sample, serial number not available. Proto type sample provided.		
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 §2.948 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.

SECTION 2

TEST DETAILS

Radio Testing of the
SMK Electronics Corp.
Power View Scene Controller

2.1 PEAK OUTPUT POWER

2.1.1 Specification Reference

Part 15 Subpart C §15.247(b)(3)

2.1.2 Standard Applicable

(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

2.1.3 Equipment Under Test and Modification State

Serial No: PCB board sample / Test Configuration A

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

May 04, 2015 / AC

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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	18.0°C
Relative Humidity	30.0%
ATM Pressure	99.5 kPa

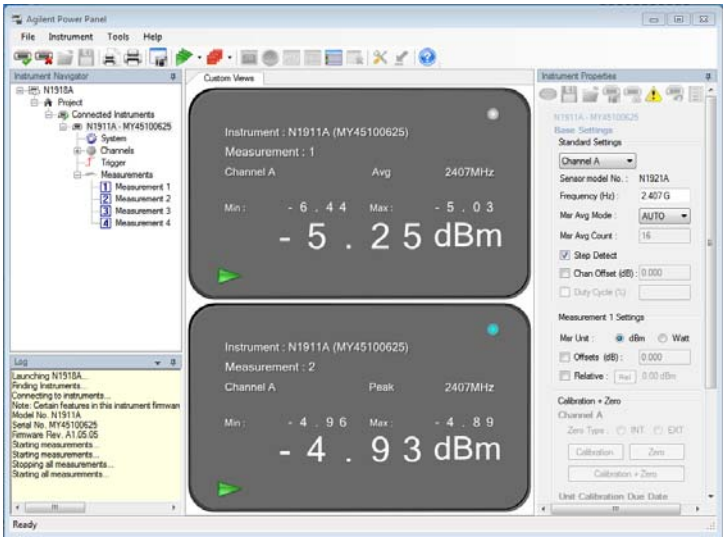
2.1.7 Additional Observations

- This is a conducted test (Maximum conducted [average] output power) using direct connection to a power meter.
- Test methodology is per Clause 9.2.3.1 of KDB 558074 D01 (DTS Meas Guidance v03r02, June 05, 2014). All conditions under this Clause were satisfied.
- Both Peak and Average measurements were recorded.

2.1.8 Test Results

Channel (MHz)	Modulation	Measured Average Power (dBm)
2407	GFSK @ 1Mbps	-5.03
2440		-5.06
2480		-5.64

2.1.9 Sample Test Display



Low Channel

2.2 99% EMISSION BANDWIDTH

2.2.1 Specification Reference

RSS-Gen Clause 6.6

2.2.2 Standard Applicable

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth.
When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 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 (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

Note: Video averaging is not permitted.
A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.
The trace data points are recovered and are directly summed in linear power level 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 (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.
The difference between the two recorded frequencies is the 99% occupied bandwidth.

2.2.3 Equipment Under Test and Modification State

Serial No: PCB board sample / Test Configuration A

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

May 04, 2015 / AC

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	18.0°C
Relative Humidity	30.0%
ATM Pressure	99.5 kPa

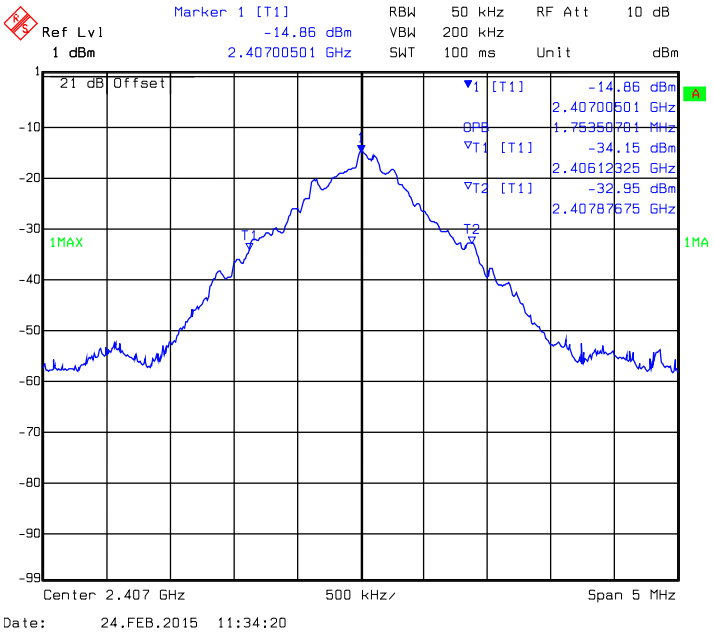
2.2.7 Additional Observations

- This is a conducted test.
- An offset 21dB was used to compensate for the external attenuator and cable 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.
- The % Power Bandwidth setting in the spectrum analyzer was set to 99% (default).

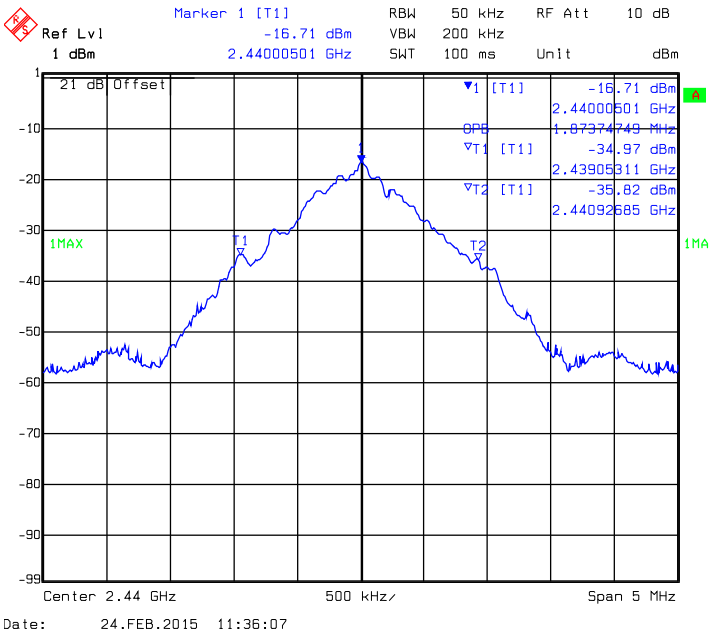
2.2.8 Test Results

Channel (MHz)	Measured 99% Bandwidth (MHz)
2407	1.754
2440	1.874
2480	1.814

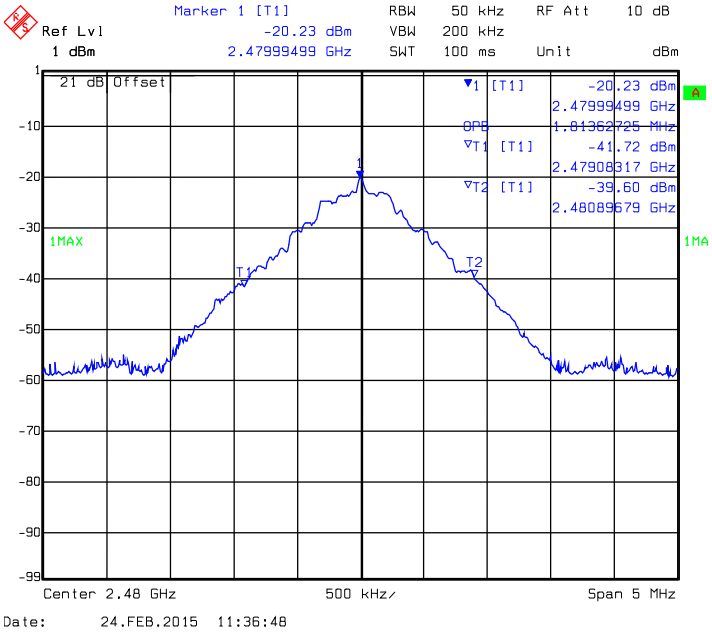
2.2.9 Test Results Plots



Low Channel



Mid Channel



High Channel

2.3 MINIMUM 6 dB RF BANDWIDTH

2.3.1 Specification Reference

Part 15 Subpart C §15.247(a)(2)

2.3.2 Standard Applicable

(2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

2.3.3 Equipment Under Test and Modification State

Serial No: PCB board sample / Test Configuration A

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

May 04, 2015 / AC

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	18.0°C
Relative Humidity	30.0%
ATM Pressure	99.5 kPa

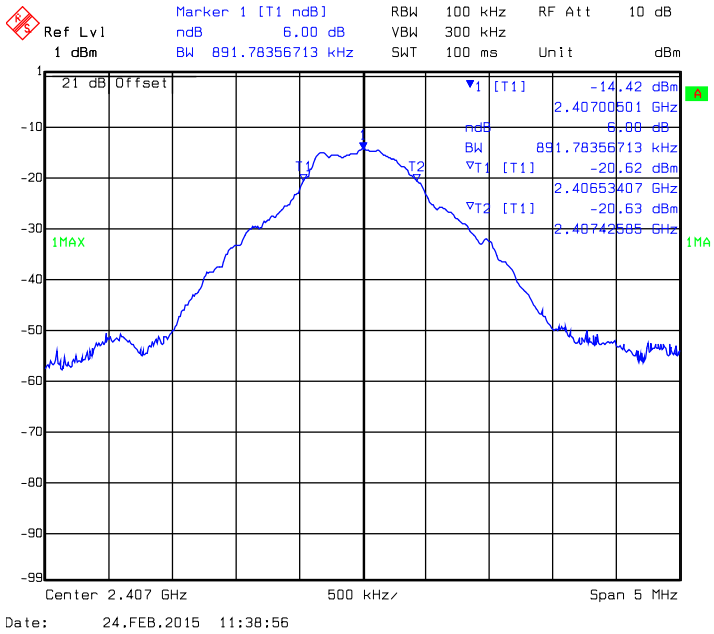
2.3.7 Additional Observations

- This is a conducted test.
- An offset 21dB was used to compensate for the external attenuator and cable used.
- Span is wide enough to capture the channel transmission.
- RBW is set to either 100 kHz or 1% of the span (802.11 b, g and n).
- VBW is ≥3X RBW.
- Sweep is auto.
- Detector is peak.
- The “n” dB down marker function of the spectrum analyzer was used for this test.

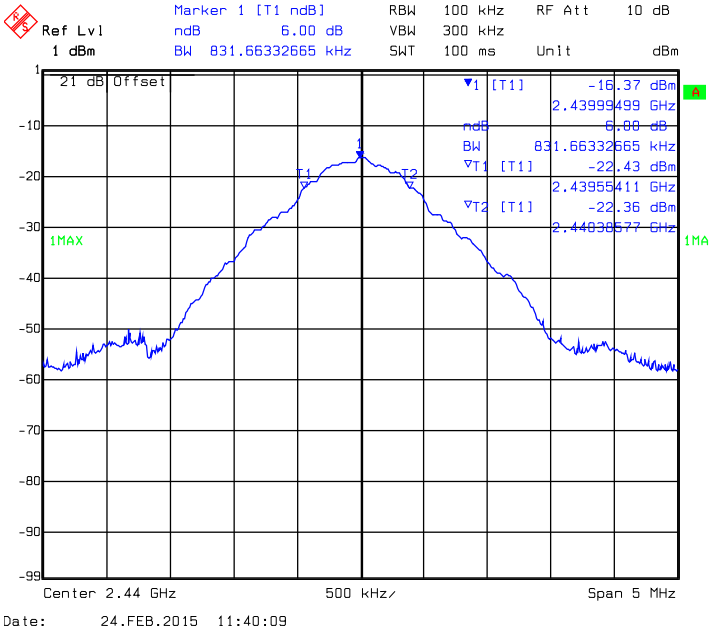
2.3.8 Test Results

Channel (MHz)	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Compliance
2407	0.892	0.500	Complies
2440	0.832	0.500	Complies
2480	0.832	0.500	Complies

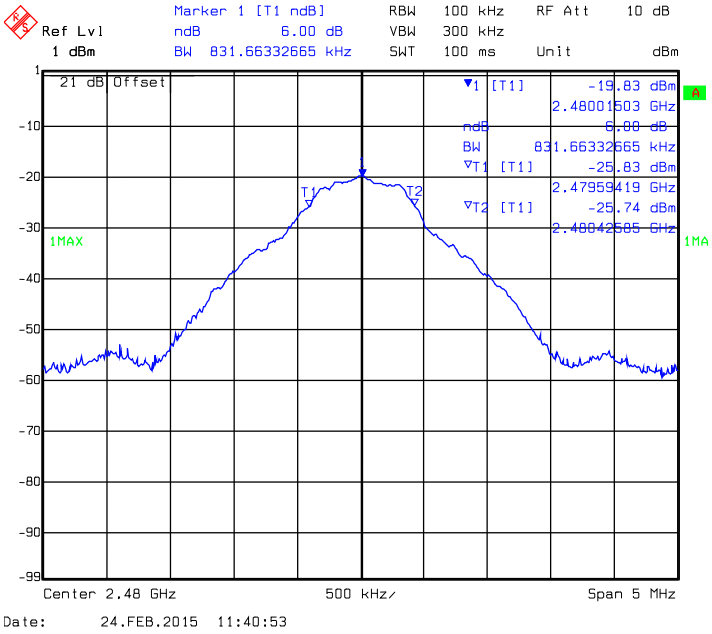
2.3.9 Test Results Plots



Low Channel



Mid Channel



High Channel

2.4 OUT-OF-BAND EMISSIONS - CONDUCTED

2.4.1 Specification Reference

Part 15 Subpart C §15.247(d)

2.4.2 Standard Applicable

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

2.4.3 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

May 05, 2015 / AC

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

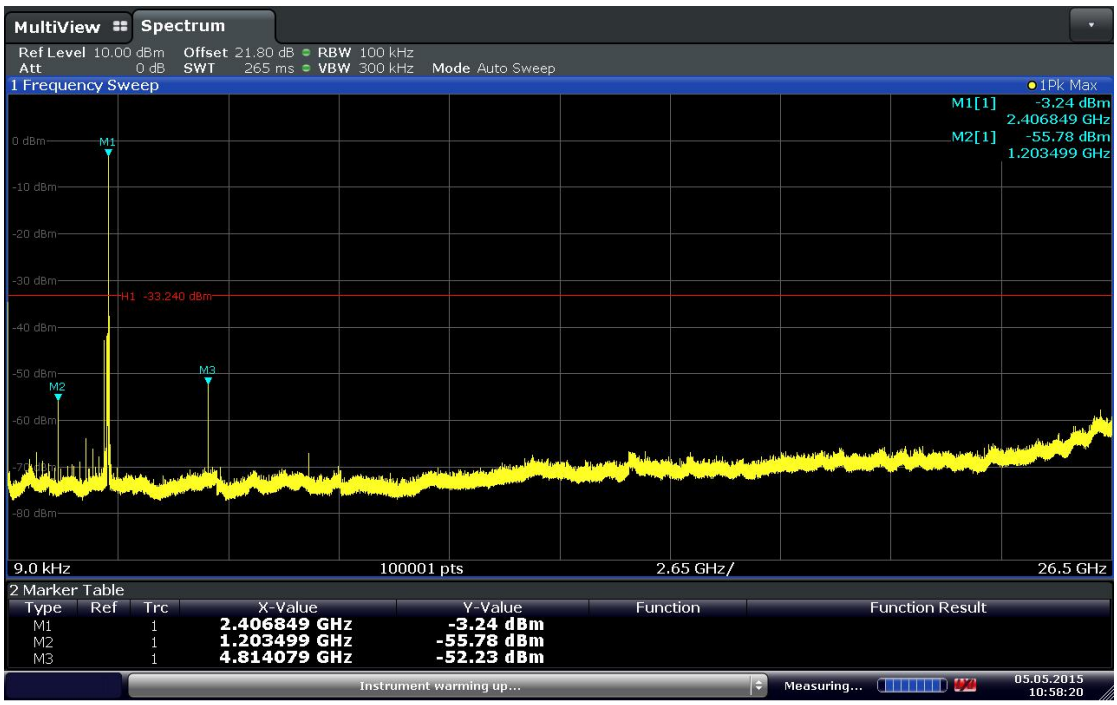
Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	18.0 °C
Relative Humidity	30.0.%
ATM Pressure	99.5 kPa

2.4.7 Additional Observations

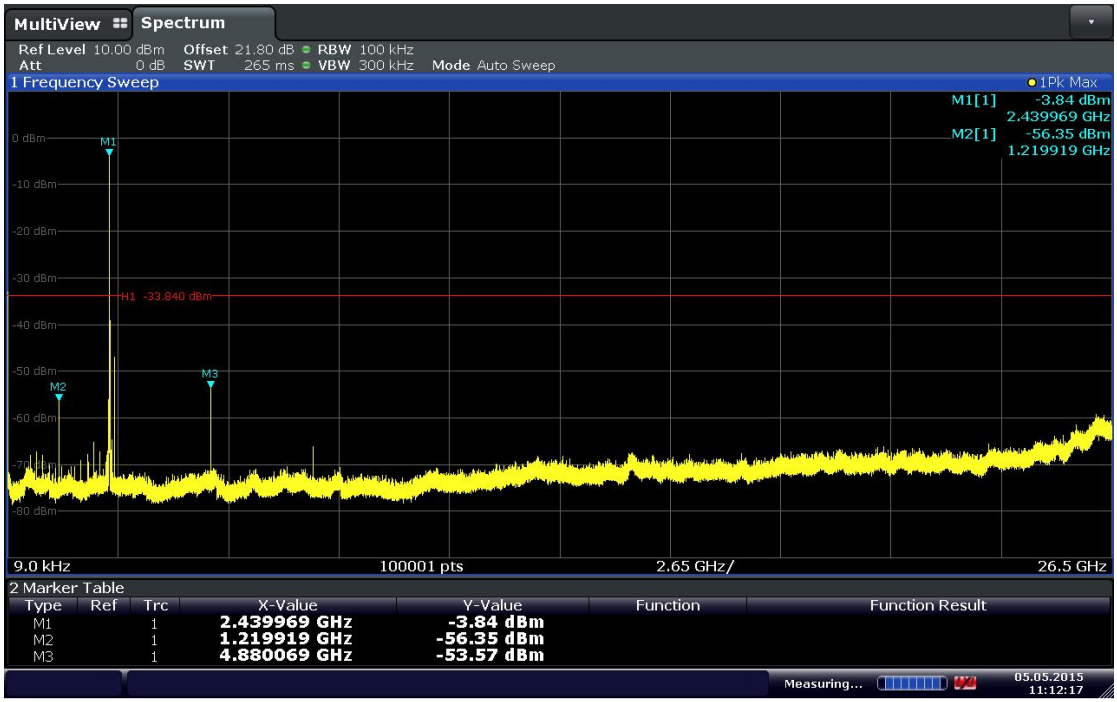
- This is a conducted test.
- An offset 21.8dB was used to compensate for the external cable used.
- RBW is 100kHz.VBW is 3X RBW.
- Sweep is auto. Detector is peak. Trace is max hold.
- Initial scan was performed to determine the highest level of the desired power within the band. Limit (display line) was drawn 30dB below this level.
- Spectrum was searched from 9 kHz up to 26.5GHz.

2.4.8 Test Results Plots



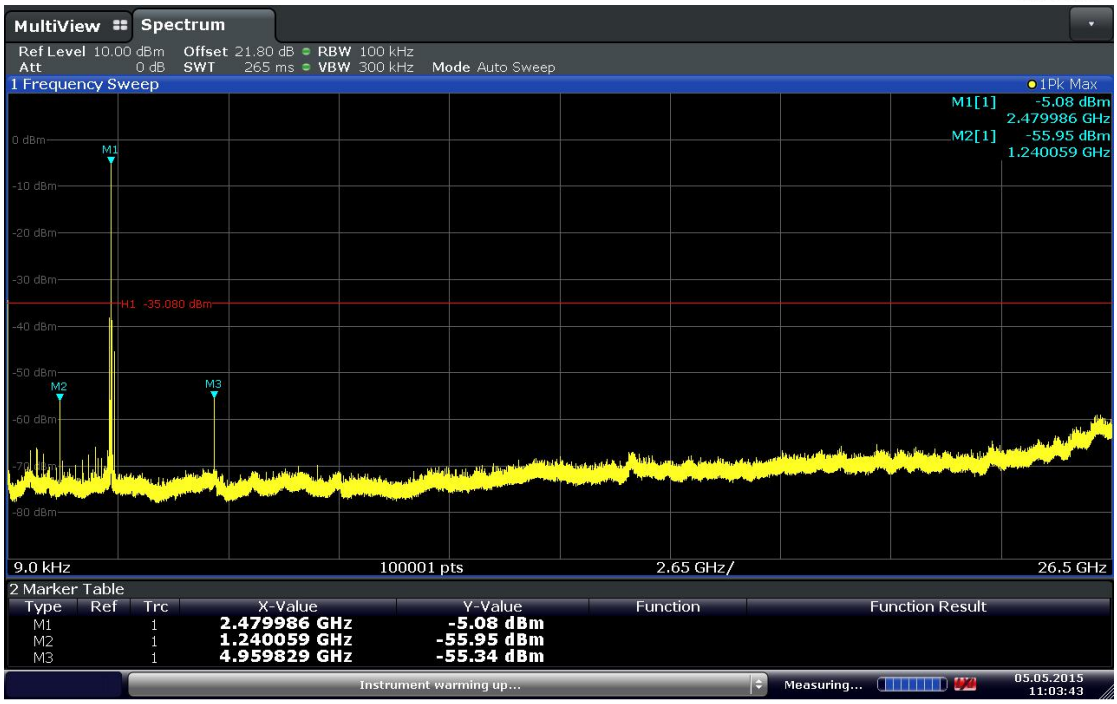
Date: 5.MAY.2015 10:58:20

Low Channel



Date: 5.MAY.2015 11:12:17

Mid Channel



Date: 5.MAY.2015 11:03:44

High Channel

2.5 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

2.5.1 Specification Reference

Part 15 Subpart C §15.247(d)

2.5.2 Standard Applicable

See previous test.

2.5.3 Equipment Under Test and Modification State

Serial No: PCB board sample / Test Configuration A

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

May 05, 2015 / AC

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/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

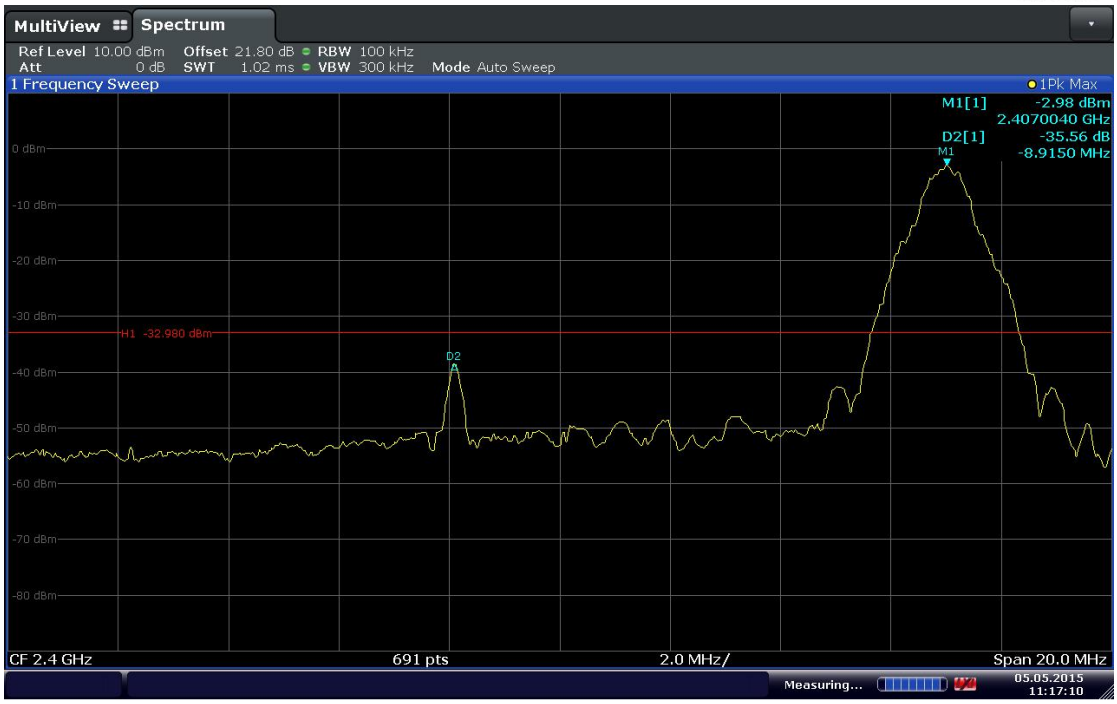
Ambient Temperature	18.0 °C
Relative Humidity	30.0%
ATM Pressure	99.5 kPa

2.5.7 Additional Observations

- This is a conducted test.
- An offset 21.8dB was used to compensate for the external cable used.
- RBW is 100kHz.VBW is 3X RBW.
- Sweep is auto. Detector is peak. Trace is max hold.
- Trace was centred on the band-edge frequency.
- Span was set to encompass the band-edge frequency and the peak of the emission.
- Using Marker function, peak of the emission was determined and the delta to the band-edge frequency measured.

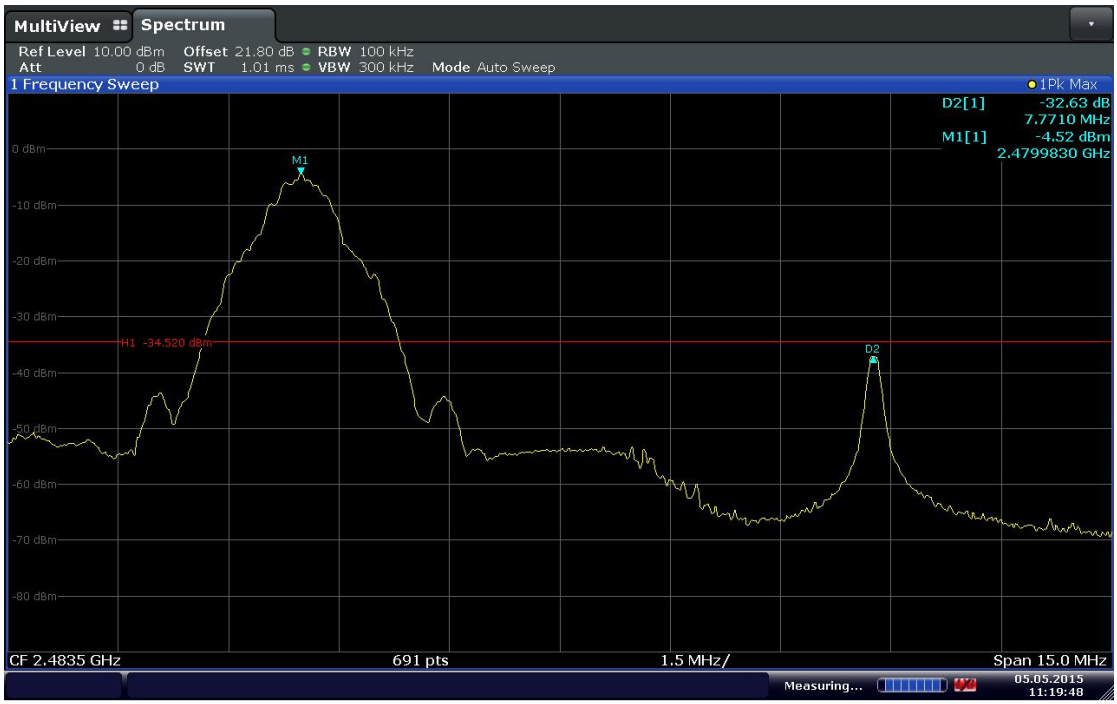
2.5.8 Test Results

Complies. See attached plots.



Date: 5.MAY.2015 11:17:10

Low Channel (2407 MHz)



Date: 5.MAY.2015 11:19:48

High Channel (2480 MHz)

2.6 SPURIOUS RADIATED EMISSIONS

2.6.1 Specification Reference

Part 15 Subpart C §15.247(d)

2.6.2 Standard Applicable

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

2.6.3 Equipment Under Test and Modification State

Serial No: N/A. Proto type simple / Test Configuration B

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

May 04, 2015 / AC

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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	20.0°C
Relative Humidity	38.0%
ATM Pressure	99.5 kPa

2.6.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic.
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d).
- Only the considered worst case channel (Mid Channel 2440MHz) presented for radiated emissions below 1GHz. There are no significant differences in emissions between all modes below 1GHz.
- Only noise floor measurements observed above 18GHz.

- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.6.8 for sample computation.

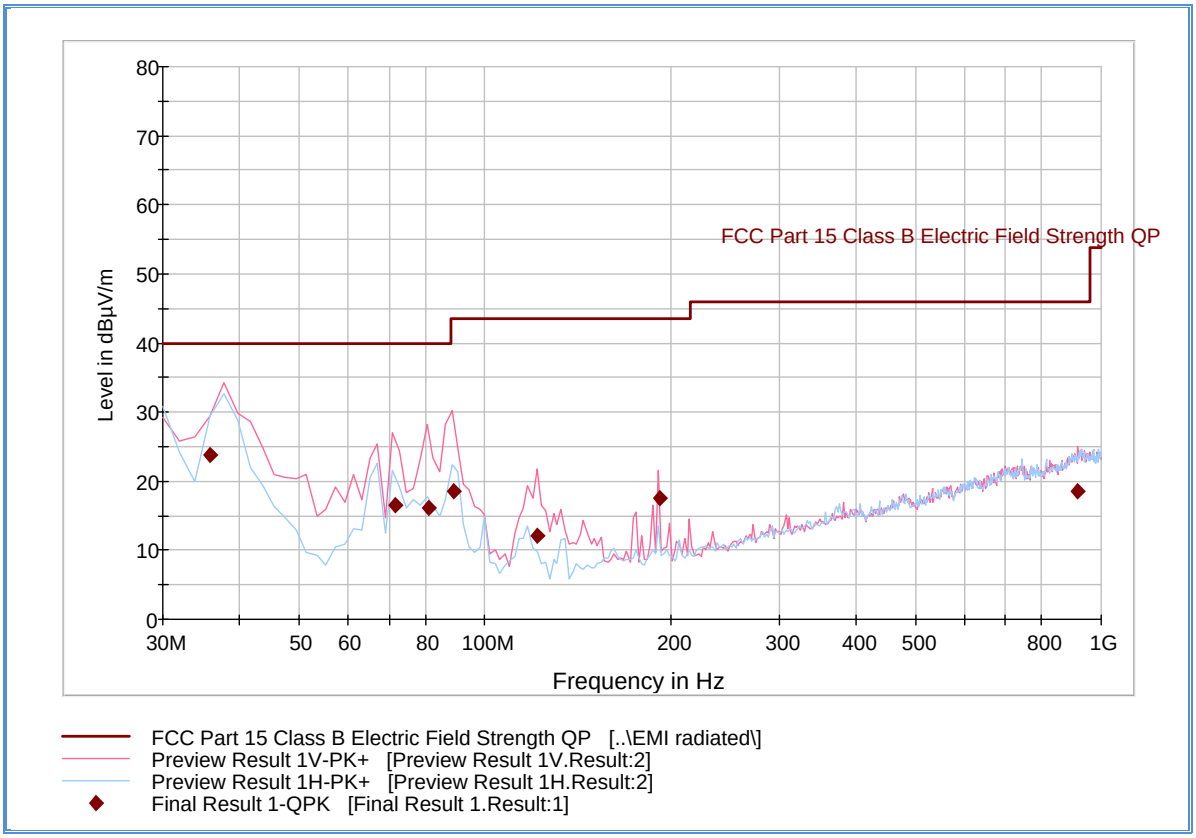
2.6.8 Sample Computation (Radiated Emission)

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

2.6.9 Test Results

See attached plots.

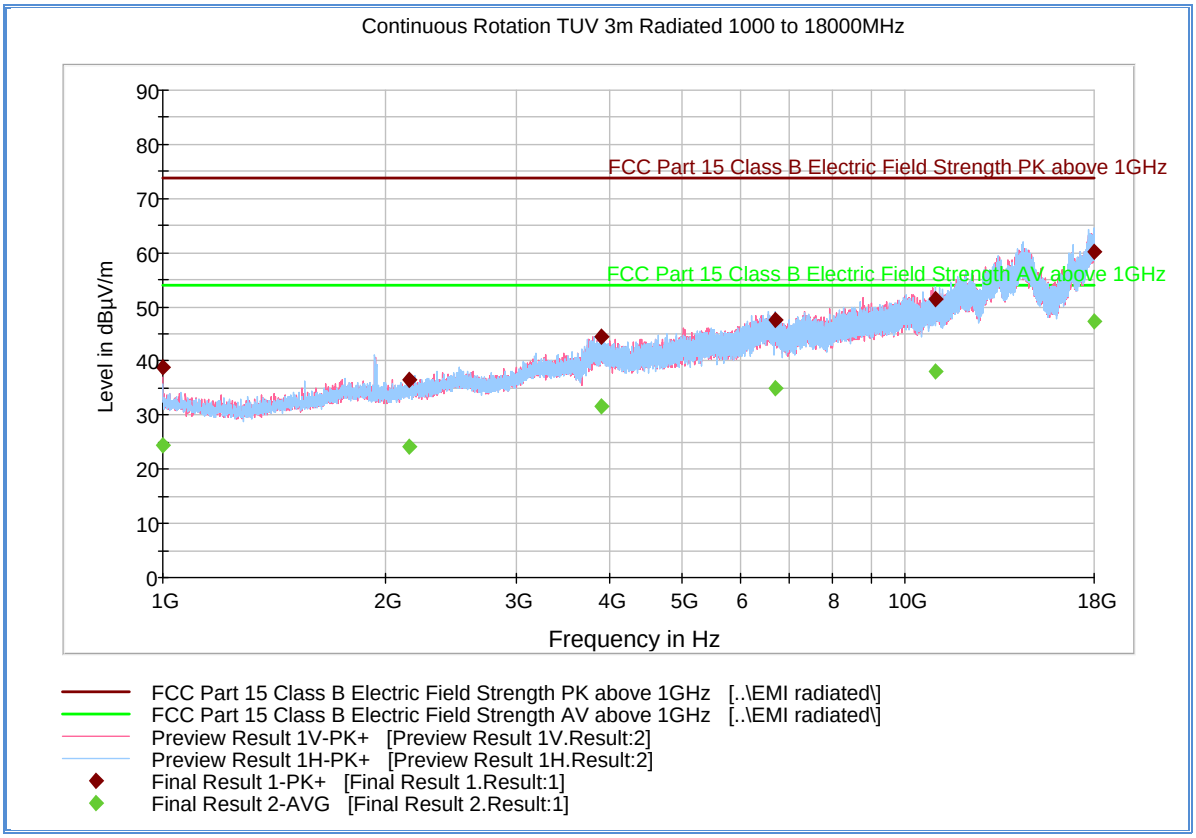
2.6.10 Test Results Below 1GHz (Receive Mode)



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
35.775551	23.7	1000.0	120.000	100.0	V	15.0	-14.6	16.3	40.0
71.701643	16.6	1000.0	120.000	100.0	V	234.0	-22.3	23.4	40.0
81.181082	16.1	1000.0	120.000	100.0	V	15.0	-22.0	23.9	40.0
88.996633	18.4	1000.0	120.000	100.0	V	15.0	-21.0	25.1	43.5
121.842725	12.1	1000.0	120.000	150.0	V	12.0	-20.5	31.4	43.5
191.742685	17.5	1000.0	120.000	100.0	V	189.0	-16.6	26.0	43.5
914.732826	18.5	1000.0	120.000	145.0	V	179.0	1.1	27.5	46.0

2.6.11 Test Results Above 1GHz (Receive Mode)



Peak Data

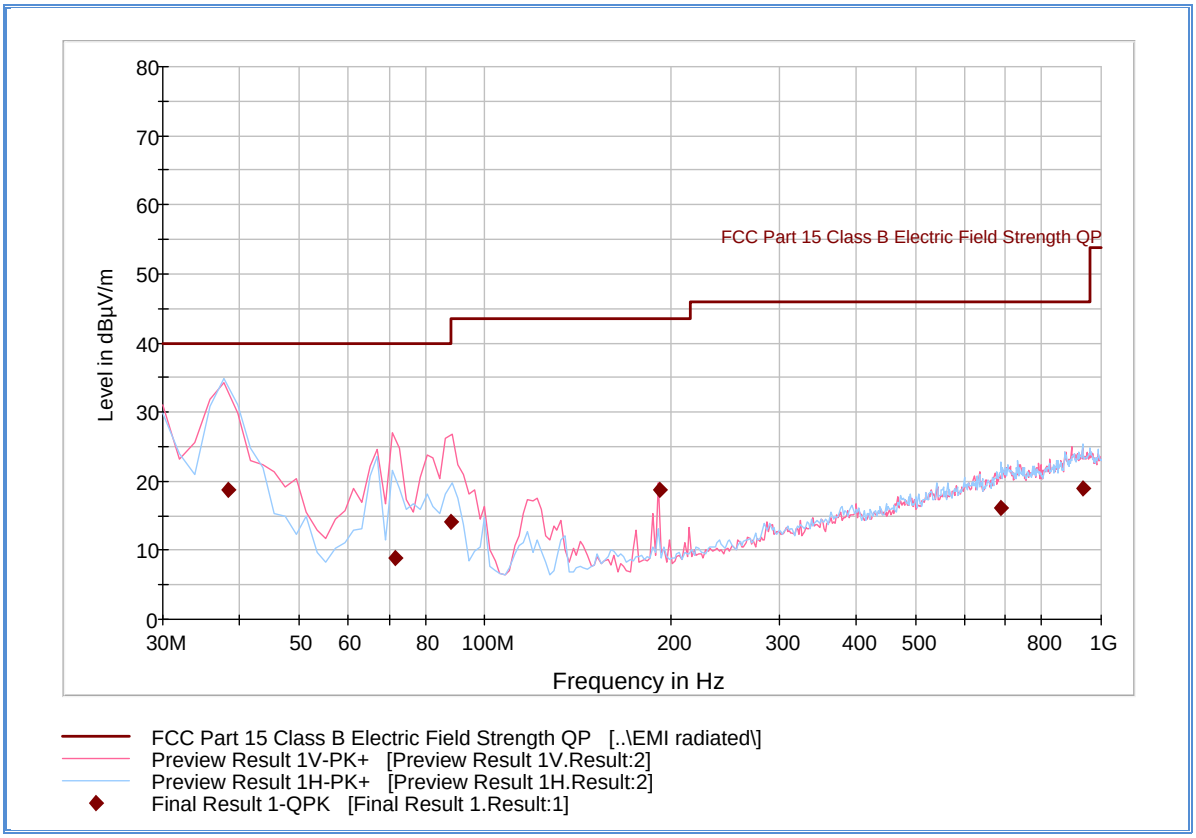
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.500000	38.9	1000.0	1000.000	300.6	V	21.0	-10.5	35.0	73.9
2144.333333	36.5	1000.0	1000.000	132.7	V	12.0	-5.5	37.4	73.9
3893.933333	44.5	1000.0	1000.000	202.3	V	1.0	4.0	29.4	73.9
6681.800000	47.6	1000.0	1000.000	180.6	H	1.0	9.9	26.3	73.9
11007.76666	51.4	1000.0	1000.000	344.1	H	5.0	15.1	22.5	73.9
17964.50000	60.2	1000.0	1000.000	198.5	H	21.0	26.6	13.7	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)
1000.500000	24.5	1000.0	1000.000	300.6	V	21.0	-10.5	29.4	53.9
2144.333333	24.0	1000.0	1000.000	132.7	V	12.0	-5.5	29.9	53.9
3893.933333	31.7	1000.0	1000.000	202.3	V	1.0	4.0	22.2	53.9
6681.800000	34.9	1000.0	1000.000	180.6	H	1.0	9.9	19.0	53.9
11007.76666	38.2	1000.0	1000.000	344.1	H	5.0	15.1	15.7	53.9
17964.50000	47.4	1000.0	1000.000	198.5	H	21.0	26.6	6.5	53.9

Test Notes: No significant emissions observed above 1GHz.

2.6.12 Test Results Below 1GHz (Mid Channel – 2440MHz)

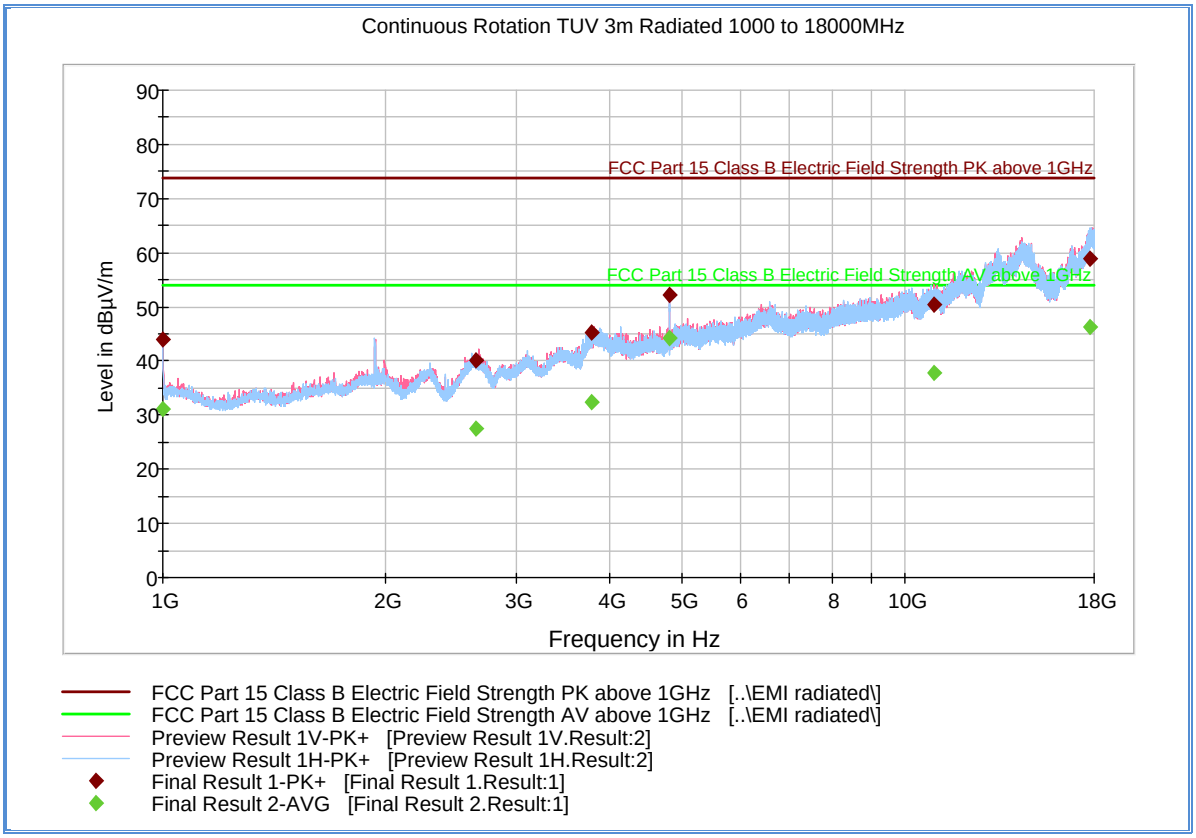


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
38.295551	18.8	1000.0	120.000	250.0	H	11.0	-15.9	21.2	40.0
71.701643	8.9	1000.0	120.000	200.0	V	265.0	-22.3	31.1	40.0
88.172745	14.2	1000.0	120.000	300.0	V	6.0	-21.2	29.3	43.5
191.742685	18.7	1000.0	120.000	100.0	V	158.0	-16.6	24.8	43.5
688.777956	16.1	1000.0	120.000	350.0	H	4.0	-2.2	29.9	46.0
934.307816	18.9	1000.0	120.000	266.0	H	244.0	1.4	27.1	46.0

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

2.6.13 Test Results Above 1GHz (Low Channel)



Peak Data

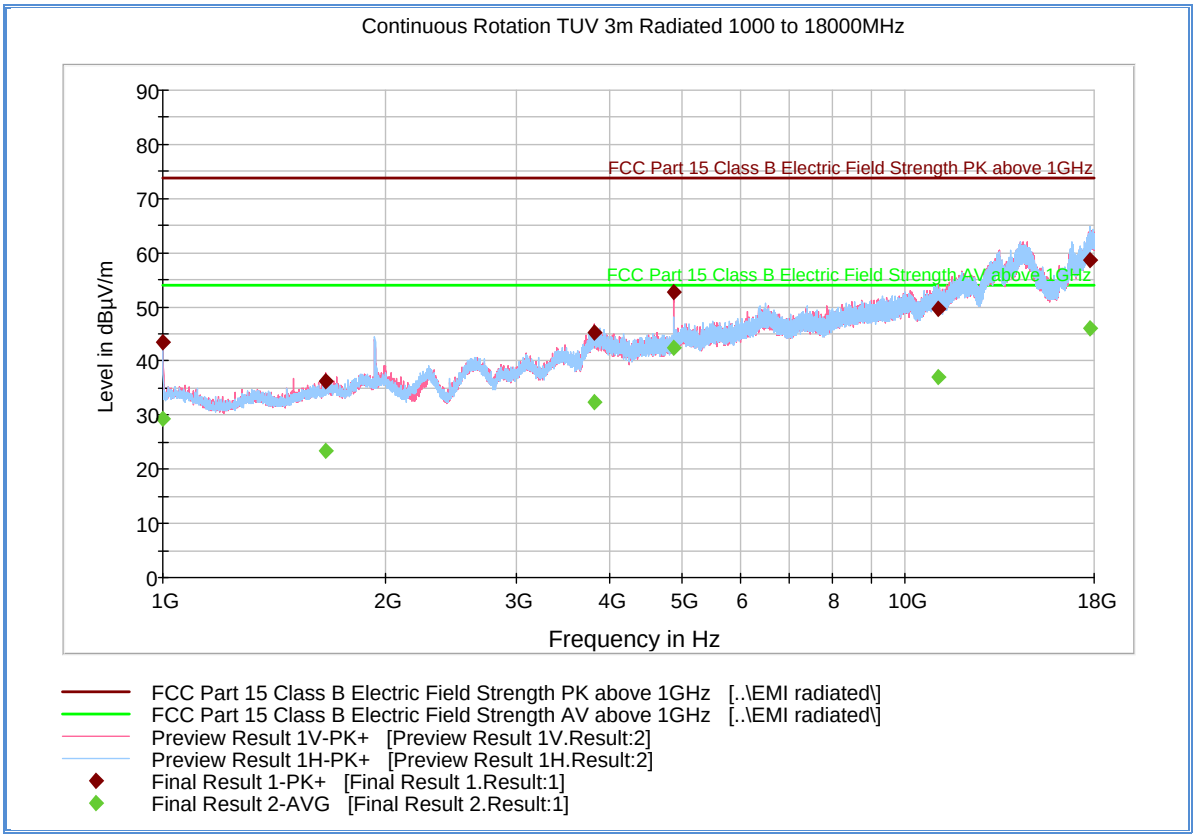
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	44.0	1000.0	1000.000	302.5	V	306.0	-10.5	29.9	73.9
2642.433333	40.2	1000.0	1000.000	171.6	H	31.0	-3.8	33.7	73.9
3788.800000	45.2	1000.0	1000.000	331.2	H	336.0	3.8	28.7	73.9
4814.433333	52.3	1000.0	1000.000	278.3	V	26.0	4.3	21.6	73.9
10947.666667	50.4	1000.0	1000.000	228.4	V	301.0	14.9	23.5	73.9
17800.933333	58.9	1000.0	1000.000	386.1	H	172.0	26.1	15.0	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	31.2	1000.0	1000.000	302.5	V	306.0	-10.5	22.7	53.9
2642.433333	27.6	1000.0	1000.000	171.6	H	31.0	-3.8	26.3	53.9
3788.800000	32.3	1000.0	1000.000	331.2	H	336.0	3.8	21.6	53.9
4814.433333	44.3	1000.0	1000.000	278.3	V	26.0	4.3	9.6	53.9
10947.666667	37.7	1000.0	1000.000	228.4	V	301.0	14.9	16.2	53.9
17800.933333	46.2	1000.0	1000.000	386.1	H	172.0	26.1	7.7	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz were noise floor figures.

2.6.14 Test Results Above 1GHz (Mid Channel)



Peak Data

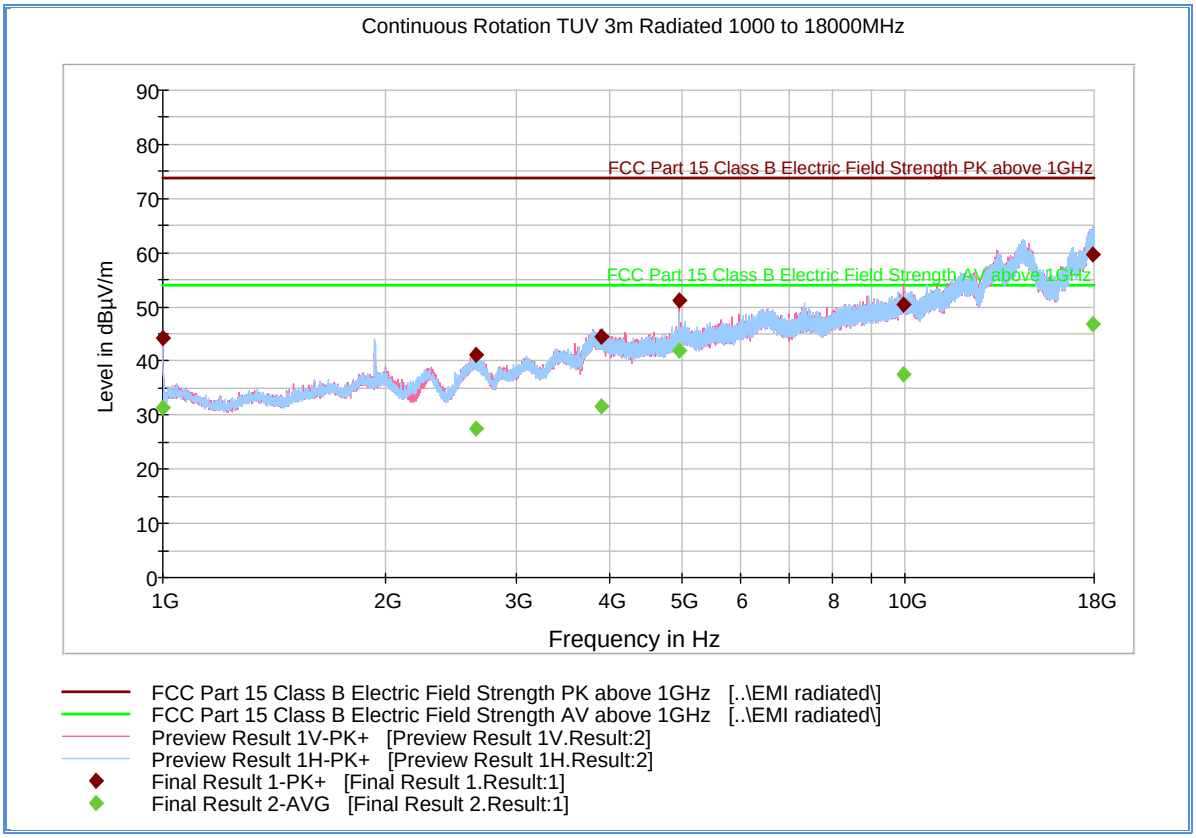
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.400000	43.4	1000.0	1000.000	296.3	V	108.0	-10.5	30.5	73.9
1659.966667	36.3	1000.0	1000.000	355.1	V	192.0	-7.9	37.6	73.9
3811.100000	45.3	1000.0	1000.000	367.1	V	265.0	3.9	28.6	73.9
4879.233333	52.8	1000.0	1000.000	299.2	V	333.0	4.8	21.1	73.9
11083.666667	49.5	1000.0	1000.000	103.7	V	211.0	14.8	24.4	73.9
17806.433333	58.7	1000.0	1000.000	202.5	H	137.0	26.1	15.2	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)
1000.400000	29.3	1000.0	1000.000	296.3	V	108.0	-10.5	24.6	53.9
1659.966667	23.5	1000.0	1000.000	355.1	V	192.0	-7.9	30.4	53.9
3811.100000	32.5	1000.0	1000.000	367.1	V	265.0	3.9	21.4	53.9
4879.233333	42.4	1000.0	1000.000	299.2	V	333.0	4.8	11.5	53.9
11083.666667	37.0	1000.0	1000.000	103.7	V	211.0	14.8	16.9	53.9
17806.433333	46.1	1000.0	1000.000	202.5	H	137.0	26.1	7.8	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz were noise floor figures.

2.6.15 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)
1000.000000	44.3	1000.0	1000.000	235.4	V	351.0	-10.5	29.6	73.9
2642.566667	41.0	1000.0	1000.000	265.3	V	311.0	-3.8	32.9	73.9
3908.100000	44.4	1000.0	1000.000	103.7	H	80.0	4.0	29.5	73.9
4959.533333	51.3	1000.0	1000.000	128.7	V	38.0	5.2	22.6	73.9
9952.066667	50.4	1000.0	1000.000	403.9	V	178.0	13.5	23.5	73.9
17920.066667	59.5	1000.0	1000.000	390.1	H	0.0	26.4	14.4	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)
1000.000000	31.3	1000.0	1000.000	235.4	V	351.0	-10.5	22.6	53.9
2642.566667	27.4	1000.0	1000.000	265.3	V	311.0	-3.8	26.5	53.9
3908.100000	31.7	1000.0	1000.000	103.7	H	80.0	4.0	22.2	53.9
4959.533333	41.8	1000.0	1000.000	128.7	V	38.0	5.2	12.1	53.9
9952.066667	37.5	1000.0	1000.000	403.9	V	178.0	13.5	16.4	53.9
17920.066667	46.7	1000.0	1000.000	390.1	H	0.0	26.4	7.2	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 5GHz. Measurements above 5GHz were noise floor figures.

2.7 RADIATED BAND EDGE MEASUREMENTS AND IMMEDIATE RESTRICTED BANDS

2.7.1 Specification Reference

Part 15 Subpart C §15.247(d)

2.7.2 Standard Applicable

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

2.7.3 Equipment Under Test and Modification State

Serial No: N/A. Proto type simple / Test Configuration B

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

May 04, 2015 / AC

2.7.5 Test Equipment Used

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

2.7.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	20.0 °C
Relative Humidity	38.0%
ATM Pressure	99.5 kPa

2.7.7 Additional Observations

- This is a radiated test. The spectrum was searched from 2310MHz to 2390MHz for lower immediate restricted band and 2483.5MHz to 2500MHz for the upper immediate restricted band.
- There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.
- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.7.8 for sample computation.

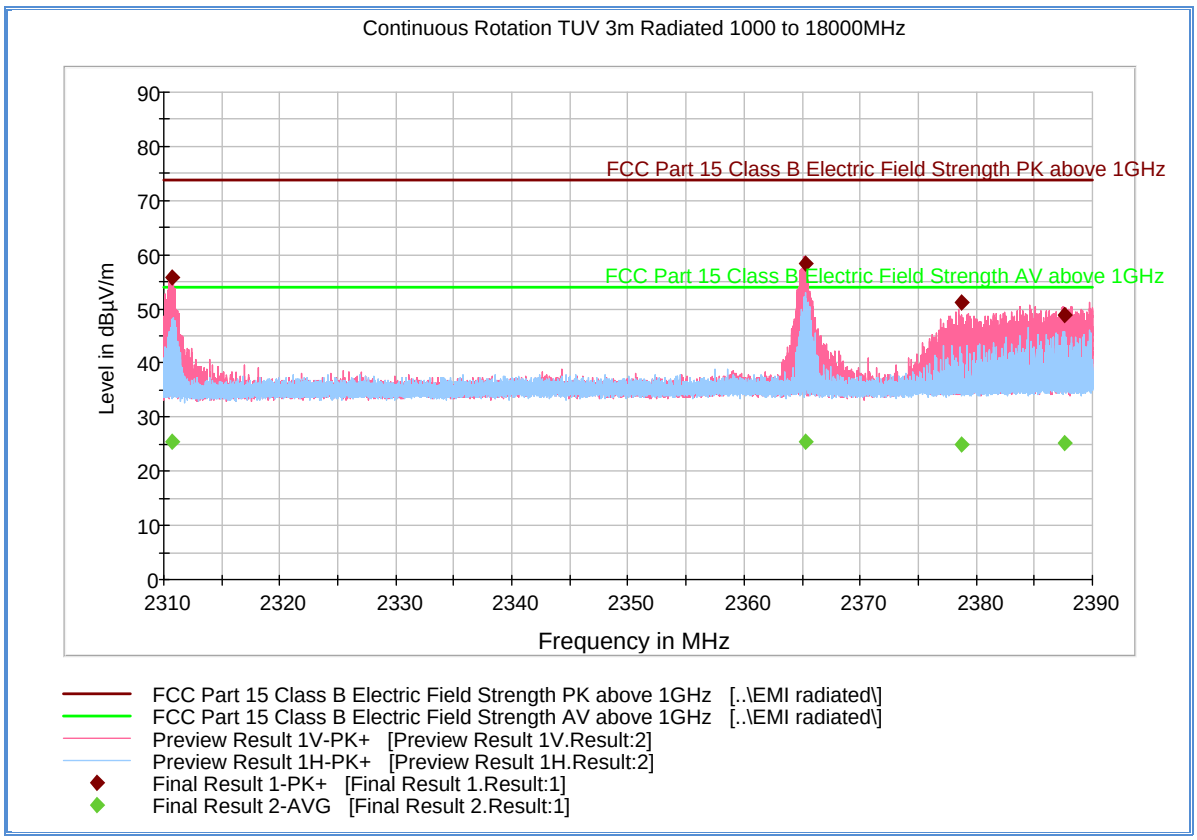
2.7.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dBµV) @ 2400 MHz			53.9
Correction Factor (dB)	Asset# 1153 (cable)	3.4	-0.4
	Asset# 8628(preamplifier)	-36.5	
	Asset#7575 (antenna)	32.7	
Reported Max Peak Final Measurement (dBµV/m) @ 2400 MHz			**53.5**

2.7.9 Test Results

See attached plots.

2.7.10 Test Results Restricted Band 2310MHz to 2390MHz (Low Channel)



Peak Data

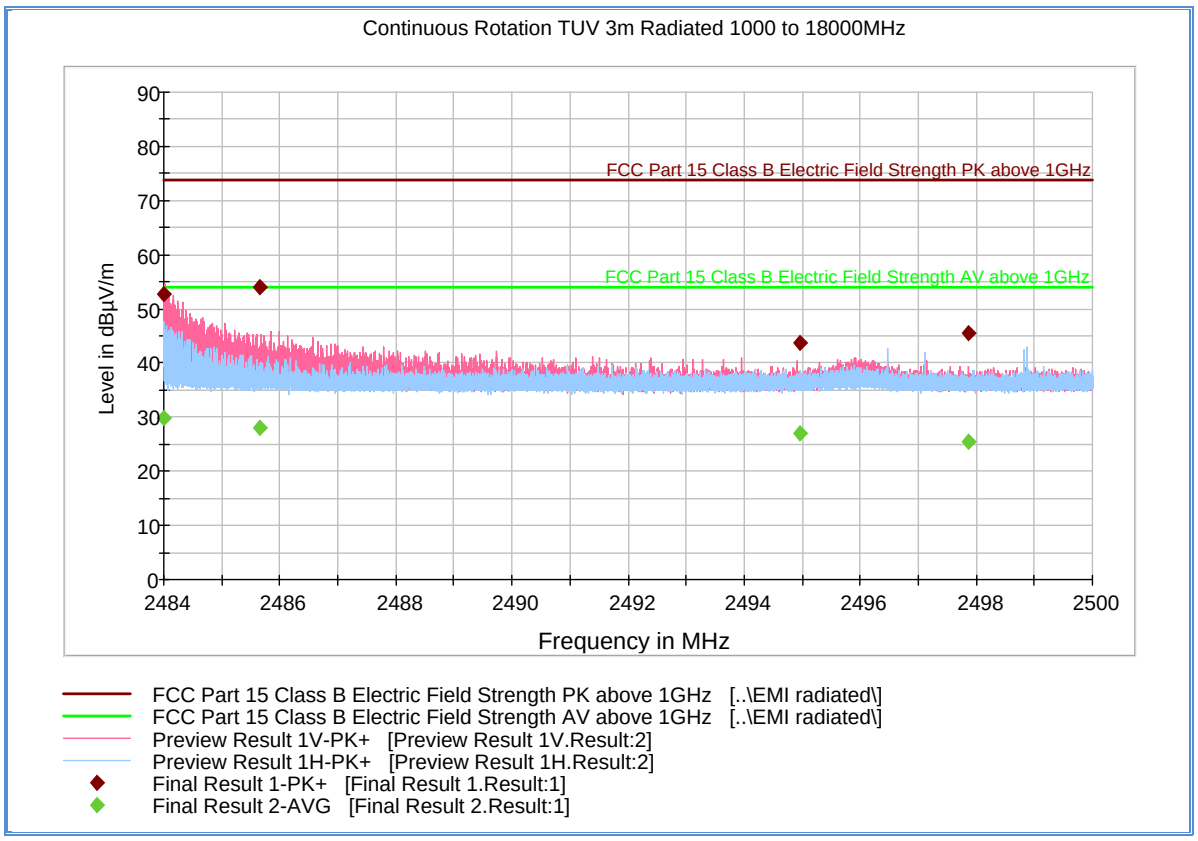
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2310.700000	55.9	1000.0	1000.000	131.7	V	190.0	-4.9	18.0	73.9
2365.344000	58.4	1000.0	1000.000	132.7	V	283.0	-4.7	15.5	73.9
2378.709333	51.3	1000.0	1000.000	208.5	V	263.0	-4.6	22.6	73.9
2387.560000	48.9	1000.0	1000.000	171.6	V	268.0	-4.6	25.0	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)
2310.700000	25.4	1000.0	1000.000	131.7	V	190.0	-4.9	28.5	53.9
2365.344000	25.5	1000.0	1000.000	132.7	V	283.0	-4.7	28.4	53.9
2378.709333	25.0	1000.0	1000.000	208.5	V	263.0	-4.6	28.9	53.9
2387.560000	25.2	1000.0	1000.000	171.6	V	268.0	-4.6	28.7	53.9

Test Notes: 2.4GHz notch filter removed for this test.

2.7.11 Test Results Restricted Band 2483.5MHz to 2500MHz (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)
2484.000000	52.7	1000.0	1000.000	197.5	V	216.0	-4.2	21.2	73.9
2485.665067	54.1	1000.0	1000.000	196.5	V	216.0	-4.2	19.8	73.9
2494.953600	43.8	1000.0	1000.000	197.5	V	216.0	-4.2	30.1	73.9
2497.874667	45.4	1000.0	1000.000	216.4	H	129.0	-4.2	28.5	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)
2484.000000	29.8	1000.0	1000.000	197.5	V	216.0	-4.2	24.1	53.9
2485.665067	28.0	1000.0	1000.000	196.5	V	216.0	-4.2	25.9	53.9
2494.953600	26.9	1000.0	1000.000	197.5	V	216.0	-4.2	27.0	53.9
2497.874667	25.6	1000.0	1000.000	216.4	H	129.0	-4.2	28.3	53.9

Test Notes: 2.4GHz notch filter removed for this test.

2.8 POWER SPECTRAL DENSITY

2.8.1 Specification Reference

Part 15 Subpart C §15.247(e)

2.8.2 Standard Applicable

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

2.8.3 Equipment Under Test and Modification State

Serial No: PCB board sample / Test Configuration A

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

May 04, 2015 / AC

2.8.5 Test Equipment Used

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

2.8.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	18.0°C
Relative Humidity	30.2%
ATM Pressure	99.5 kPa

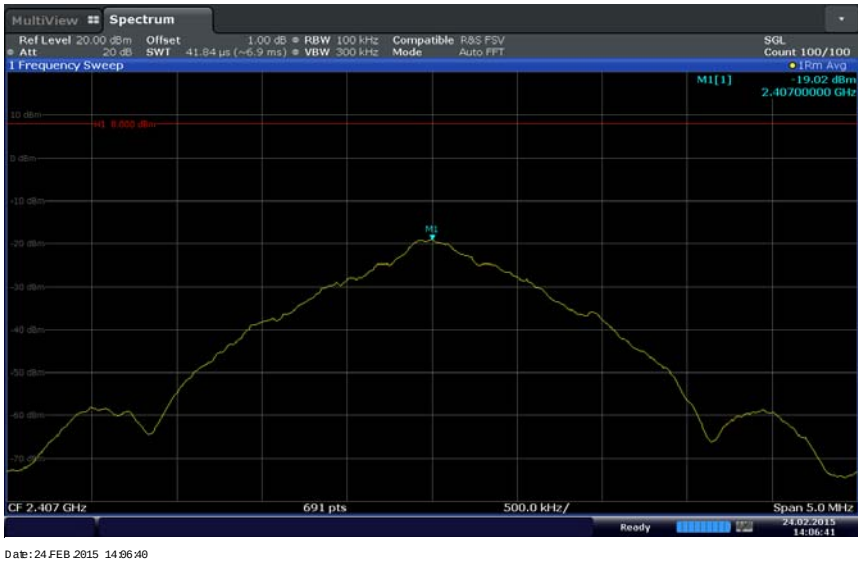
2.8.7 Additional Observations

- This is a conducted test.
- Test procedure is per Section 10.3 of KDB 558074 (June 05, 2014).
- An offset 1dB was used to compensate for the external cable used.
- Detector is RMS power averaging.
- Trace averaging mode over 100 traces.
- Sweep time is Auto Couple.
- EUT complies with 100 kHz RBW.

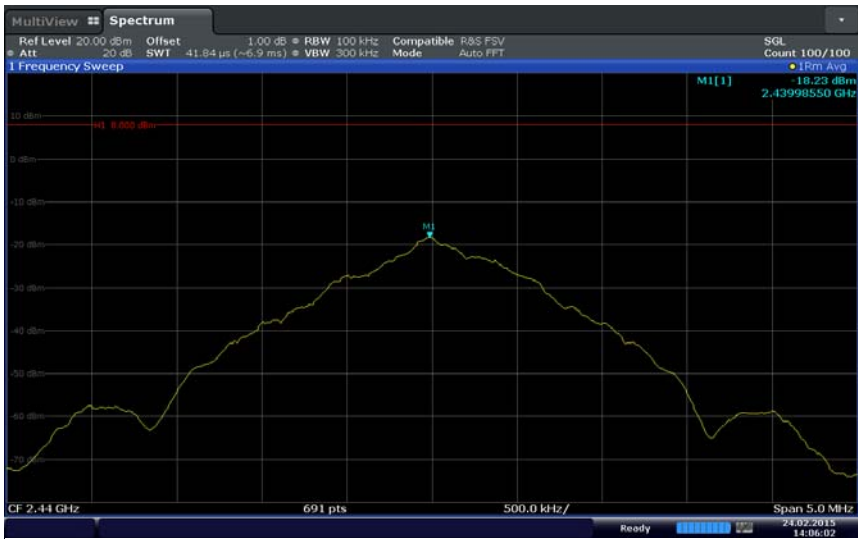
2.8.8 Test Results Summary

Channel (MHz)	Marker Reading using 100 kHz RBW (dBm)	PSD Limit (dBm)	Margin (dB)	Compliance
2407	-19.02	8	27.02	Complies
2440	-18.23	8	26.23	Complies
2480	-16.53	8	24.53	Complies

2.8.9 Test Results Plots

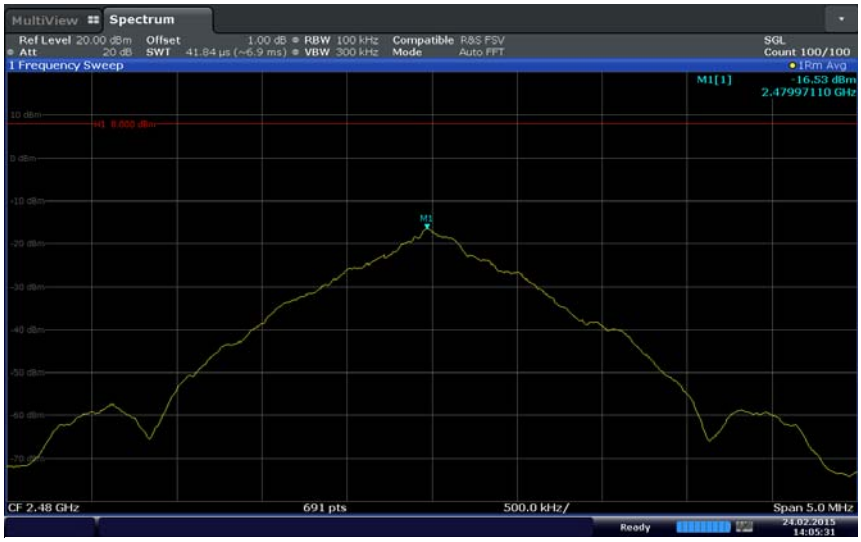


Low Channel



Date: 24.FEB.2015 14:06:03

Mid Channel



Date: 24.FEB.2015 14:05:31

High Channel

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

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

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Antenna Conducted Port Setup						
7611	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	03/25/15	03/25/16
1188	Signal Generator	2024	112282/488	Marconi	10/20/14	10/20/15
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 1188 and 7611	
Radiated Test Setup						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/30/14	01/30/16
1051	Double-ridged waveguide horn antenna	3115	9408-4329	EMCO	02/28/14	02/28/16
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	03/20/15	03/20/16
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	08/29/14	08/29/15
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/11/15	03/11/16
6815	2.4GHz Band Notch Filter	BRM50702	008	Micro-Tronics	Verified by 1049	
1016	Pre-amplifier	PAM-0202	187	PAM	12/10/14	12/10/15
Miscellaneous						
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/12/14	08/12/15
1072	DC Power Supply	E3610A	KR51311519	Hewlett Packard	Verified by 6452	
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 Radiated Emission Measurements (Below 1GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2	Cables	Rectangular	0.50	0.29	0.08
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.75	0.43	0.19
5	Site	Rectangular	3.89	2.25	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	2.41
				Coverage Factor (k):	2
				Expanded Uncertainty:	4.82

3.2.2 Radiated Emission Measurements (Above 1GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Rectangular	3.89	2.25	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	2.40
				Coverage Factor (k):	2
				Expanded Uncertainty:	4.81

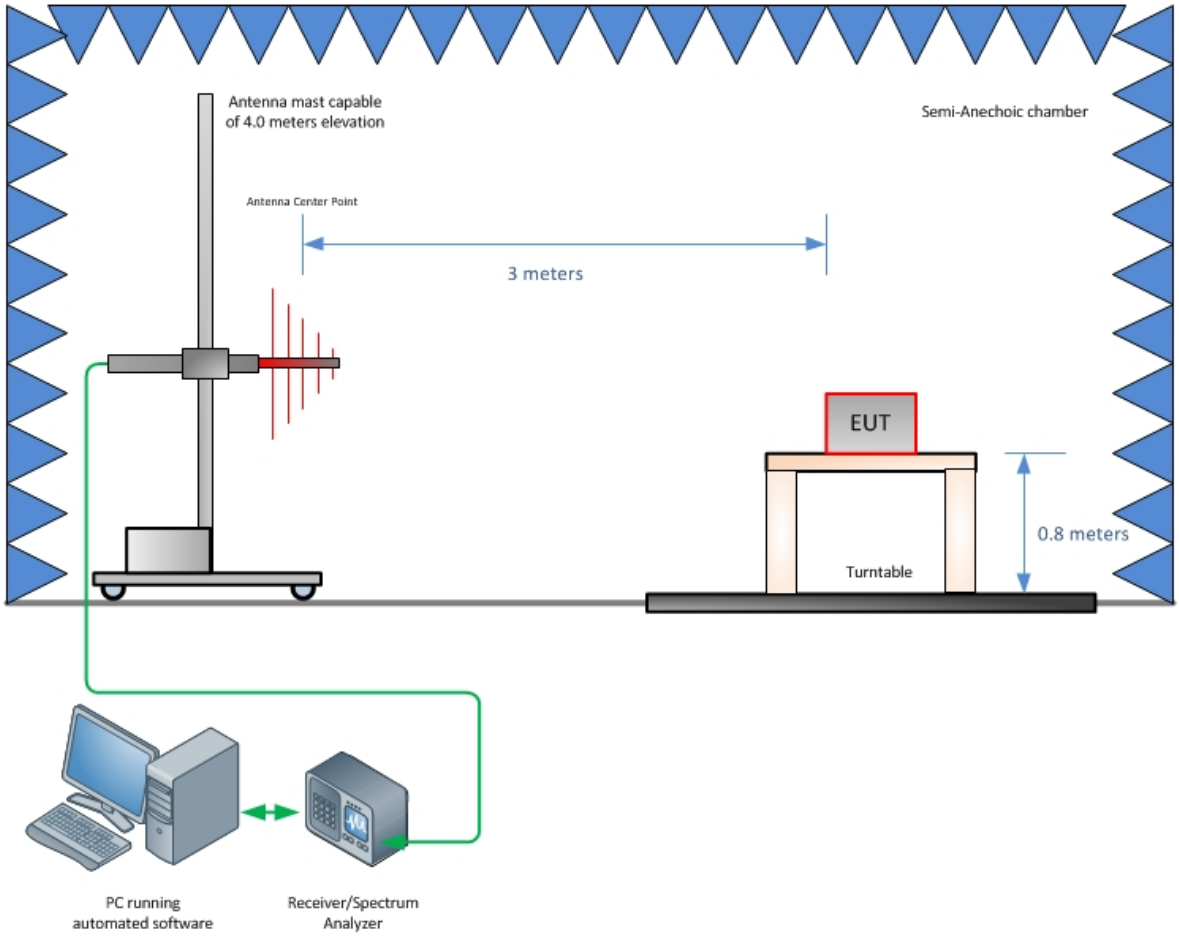
3.2.3 Conducted Antenna Port Measurement

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.34	0.20	0.04
2	Cables	Rectangular	1.00	0.58	0.33
3	EUT Setup	Rectangular	0.50	0.29	0.08
				Combined Uncertainty (u_c):	0.67
				Coverage Factor (k):	1.96
				Expanded Uncertainty:	1.32

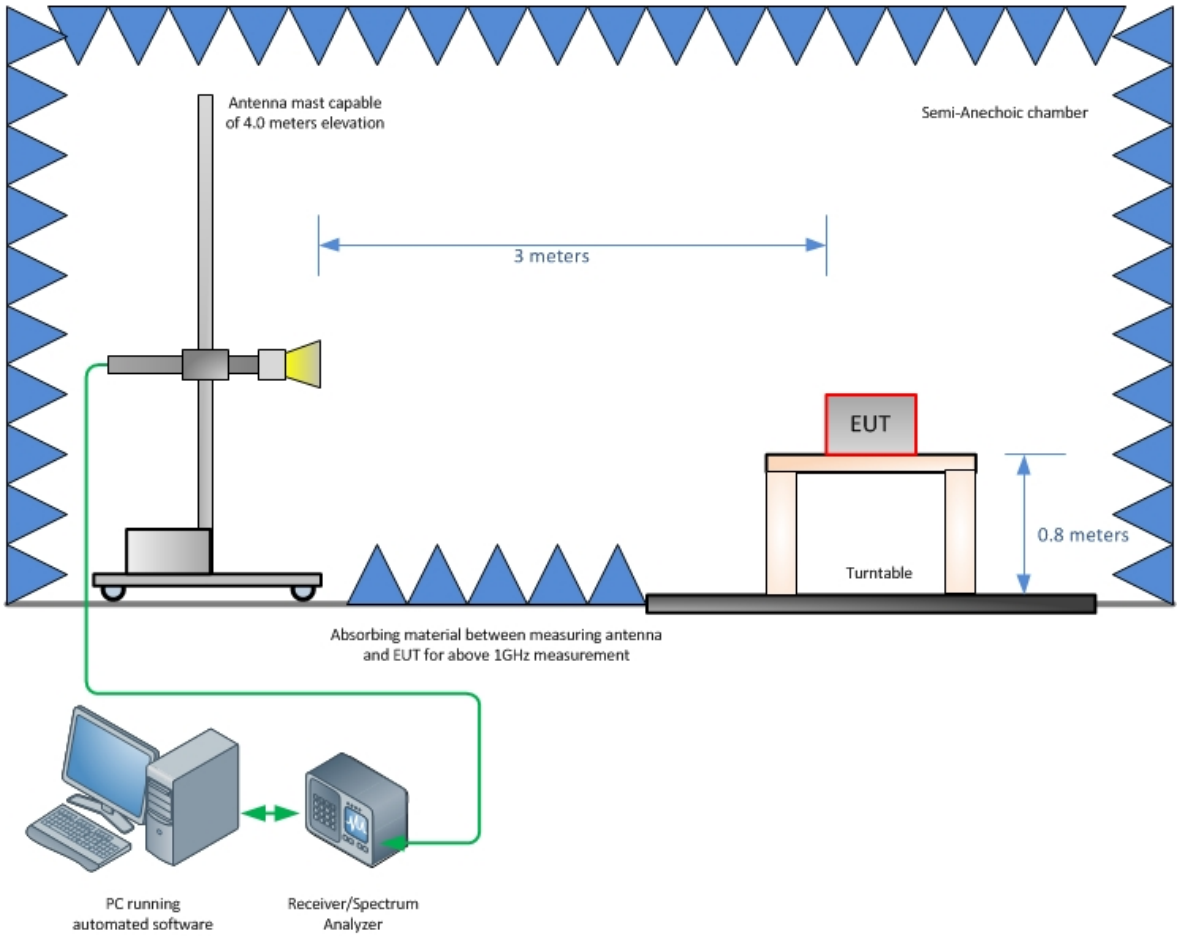
SECTION 4

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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