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Report On

Application for Grant of Equipment Authorization of the
Novatel Wireless Inc.

MiFi 6630 Wireless Hotspot Modem

FCC Part 15 Subpart E §15.407

IC RSS-210 Issue 8 December 2010

Report No. SD72101251C

March 2015



REPORT ON Radio Testing of the
Novatel Wireless Inc.
MiFi 6630 Wireless Hotspot Modem

TEST REPORT NUMBER SD72101251C

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DATED March 30, 2015



Revision History

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SECTION 1

REPORT SUMMARY

Radio Testing of the
Novatel Wireless Inc.
MiFi 6630 Wireless Hotspot Modem



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Novatel Wireless Inc. MiFi 6630 Wireless Hotspot Modem 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	Novatel Wireless Inc.
Model Number(s)	MIFI6630
FCC ID Number	PKRNVWMIFI6630
IC Number	3229A-MIFI6630
Serial Number(s)	SH181214900051
Number of Samples Tested	1
Test Specification/Issue/Date	<ul style="list-style-type: none">• FCC Part 15 Subpart E §15.407 (October 1, 2014).• RSS-210 - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment (Issue 8, December 2010).• RSS-Gen - General Requirements Compliance of Radio Apparatus (Issue 4, November 2014).• 789033 D02 General UNII Test Procedures New Rules v01 (Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E) June 06, 2014.
Start of Test	June 28, 2014
Finish of Test	July 03, 2014
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 E §15.407 with cross-reference to the corresponding IC RSS standard is shown below.

Operation in the U-NII 1 and U-NII 3 Bands (New Rules)					
Section	Spec Clause	RSS	Test Description	Result	Comments/Bas e Standard
2.1	§15.207(a)	RSS-Gen 7.2.4	Conducted Emissions	N/A*	
2.2	§15.407(a)(1)		26 dB Bandwidth	As Reported	
2.3		RSS-Gen 4.6.1	99% Emission Bandwidth	As Reported	
2.4	§15.407(a)(1)	RSS-210 A9.2(1)	Maximum Conducted Output Power	Compliant	
2.5	§15.407(a)(1)	RSS-210 A9.2(1)	Maximum Power Spectral Density (PSD)	Compliant	
2.6	§15.407(b)(1)/ 15.209	RSS-210 A9.2(1)	Unwanted Emissions Measurement	Compliant	
2.7	§15.407(b)(1)	RSS-210 A9.2(1)	Band-Edge Measurements	Compliant	
2.8	§15.407(a)(6)		Peak Excursion Ratio	Compliant	

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Novatel Wireless Inc. MiFi 6630 Wireless Hotspot Modem. The EUT creates a personal Wi-Fi cloud, capable of sharing high speed 4G LTE and 3G Mobile Broadband Internet connectivity with up to 15 Wi-Fi enable devices simultaneously. The EUT comes with an AC power adaptor Novatel Wireless, model: SSW-2597.

1.3.2 EUT General Description

EUT Description	Wireless Hotspot Modem
Model Name	MiFi 6630
Model Number(s)	MIFI6630
Frequency Range	5180 MHz to 5240 MHz in the 5150 MHz to 5350 MHz Band
Number of Operating Frequencies	4
Channels Verified (U-NII 1)	Low Channel 5180 MHz (Channel 36) Mid Channel 5200 MHz (Channel 40) Mid Channel 5220 MHz (Channel 44) High Channel 5240MHz (Channel 48)
Rated Voltage	Nominal 3.8VDC Li-ion Battery AC Power Adaptor: Input: 100-240VAC/0.3A/50-60Hz Output: 5.0VDC/2.0A
Mode Verified	802.11 a and n
Antenna Type	Ceramic Chip
Manufacturer	Novatel Wireless, Inc.
Antenna Model	NVTL 12023203
Antenna Gain (Tx0)	1.72 dBi
Antenna Gain (Tx1)	1.72 dBi

1.3.3 Maximum Conducted Output Power

Mode	Frequency Range (MHz)	Average Output Power (dBm)	Average Output Power (mW)
SISO 802.11a	5180-5240	7.98	6.28
MIMO 802.11n ht20	5180-5240	10.95	12.45

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Conducted antenna port measurement. EUT Tx at a max power and connected to a programmable DC power supply via dummy battery pack.
B	Raidated test setup. EUT Tx through integral antenna and connected to supplied AC-DC power adaptor.

1.4.2 EUT Exercise Software

Before each test, the EUT is configured using Qualcomm Radio Control Toolkit Version 3.0.28.0. The software allows configuration of channels, modes, data rate and power level. Power level is set according to manufacturer specification for each mode (802.11 a/n).

1.4.1 Support Equipment and I/O cables

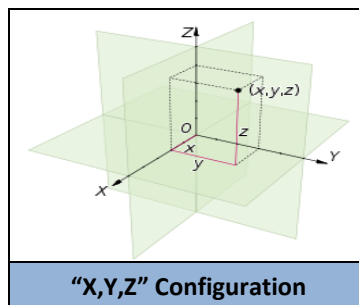
Manufacturer	Equipment/Cable	Description
Dell	Support Laptop	LATITUDE E6410, Model: PP27LA
Dell	Support Laptop Power Supply Adaptor	Model: DA130PE1-00
Novatel Wireless	USB Cable	Micro USB Type B to Standard USB Type B
Novatel Wireless	AC-DC Power Supply Unit for EUT	Model: SSW-2597, P/N: 40115132.01 Input: 100-240VAC 0.3A 50-60Hz Output: 5.0VDC 2.0A

1.4.2 Worst Case Configuration

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

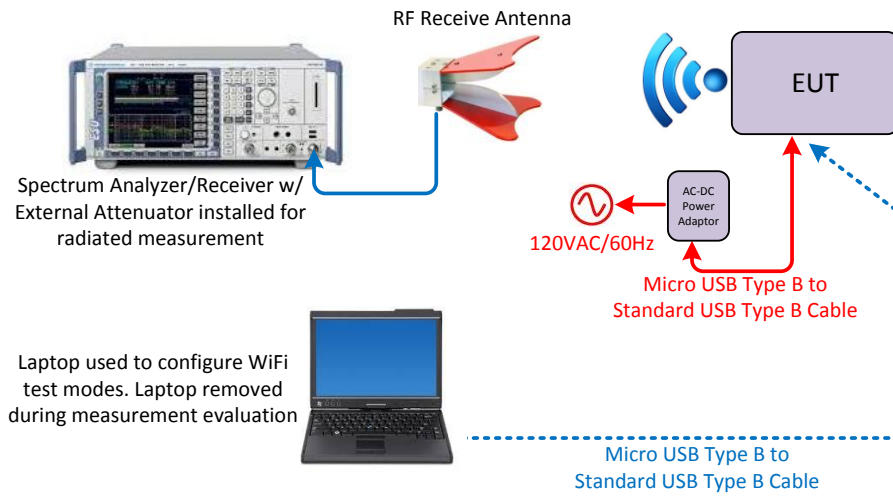
Mode	Channel	Data Rate
MIMO 802.11n ht20	Channel 48	6.5 Mbps

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

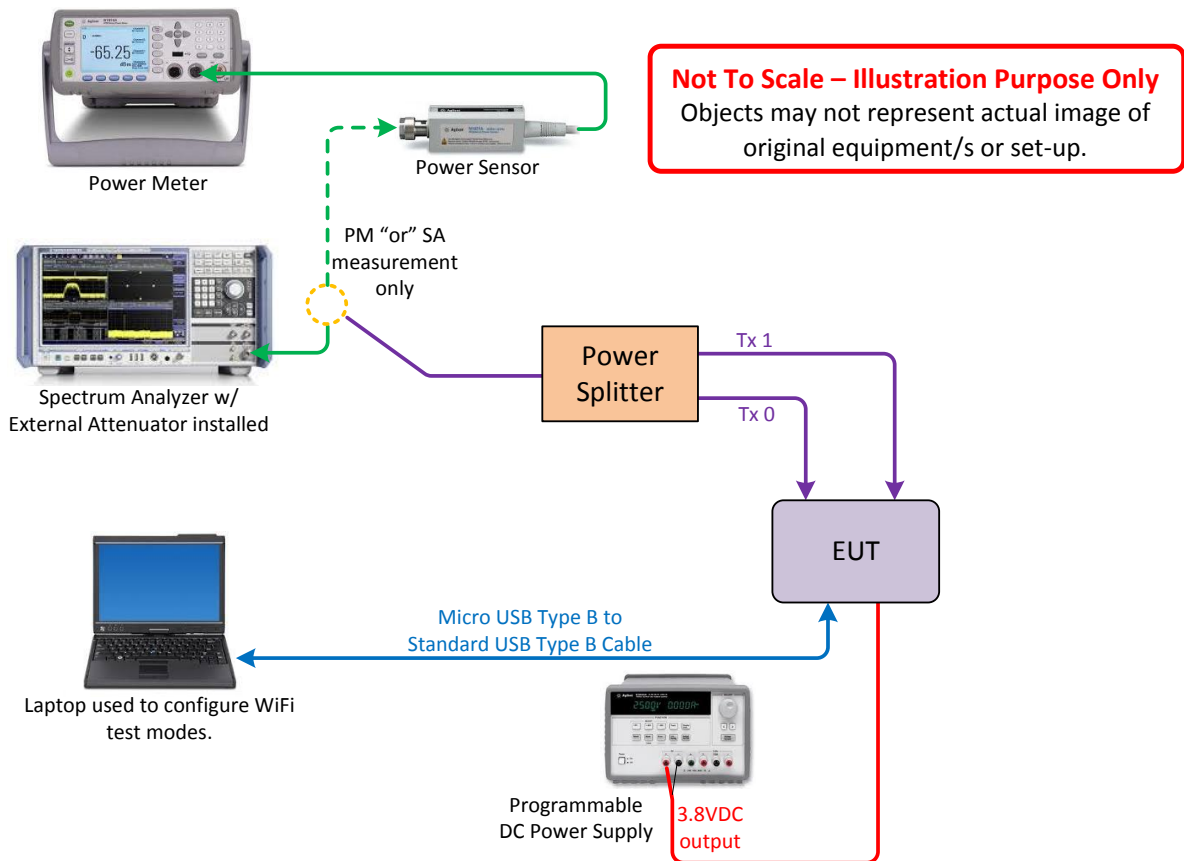


1.4.3 Simplified Test Configuration Diagram

Radiated/Conducted Emission Test Configuration via Conducted Port



Conducted (Antenna Port) Test Configuration



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
PCB No. SH181214900051		
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 KDB 789033 D02 General UNII Test Procedures New Rules v01 (Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E) June 06, 2014.

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 TÜV SÜD 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
Novatel Wireless Inc.
MiFi 6630 Wireless Hotspot Modem

2.1 CONDUCTED EMISSIONS

2.1.1 Specification Reference

Part 15 Subpart C §15.207(a) and RSS-Gen 7.2.4

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 μ H/50 ohms line impedance stabilization network (LISN).

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

2.1.3 Equipment Under Test and Modification State

Serial No: SH181214900051 / Test Configuration A

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

June 30, 2014 / 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 Location

Test performed at TUV SUD America Inc. Rancho Bernardo facility

Ambient Temperature 25.8°C
Relative Humidity 47.3%
ATM Pressure 98.7 kPa

2.1.7 Additional Observations

- 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 2.1.8 for sample computation.

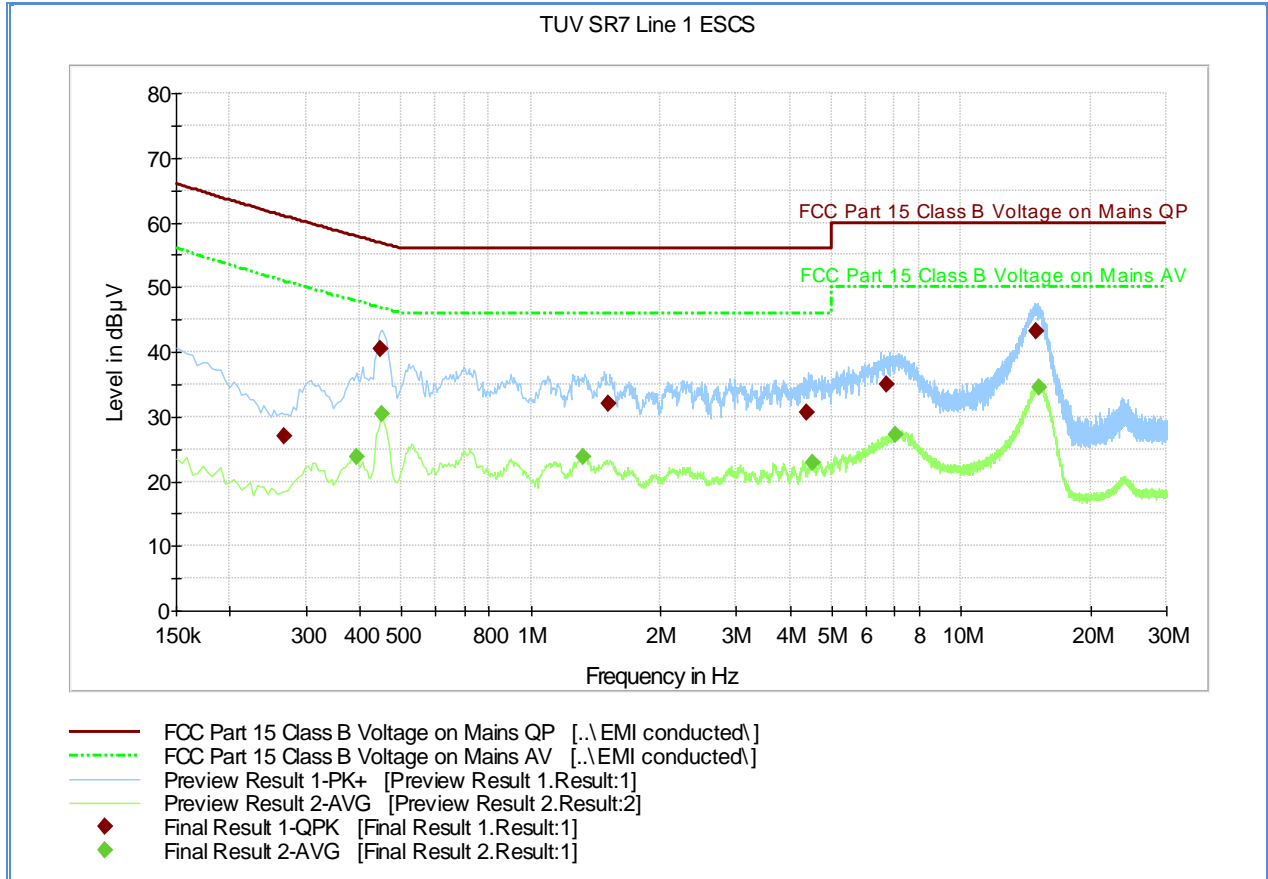
2.1.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (db μ V) @ 150kHz		5.5
Correction Factor (dB)	Asset# 8607 (20 dB attenuator)	19.9
	Asset# 1177 (cable)	0.15
	Asset# 1176 (cable)	0.35
	Asset# 7568 (LISN)	0.30
Reported QuasiPeak Final Measurement (db μ V) @ 150kHz		26.2

2.1.9 Test Results

Compliant. See attached plots and tables.

2.1.10 120VAC/60Hz, Line 1_Worst Case Configuration_802.11n 5GHz ht20_Channel 48 Transmit mode



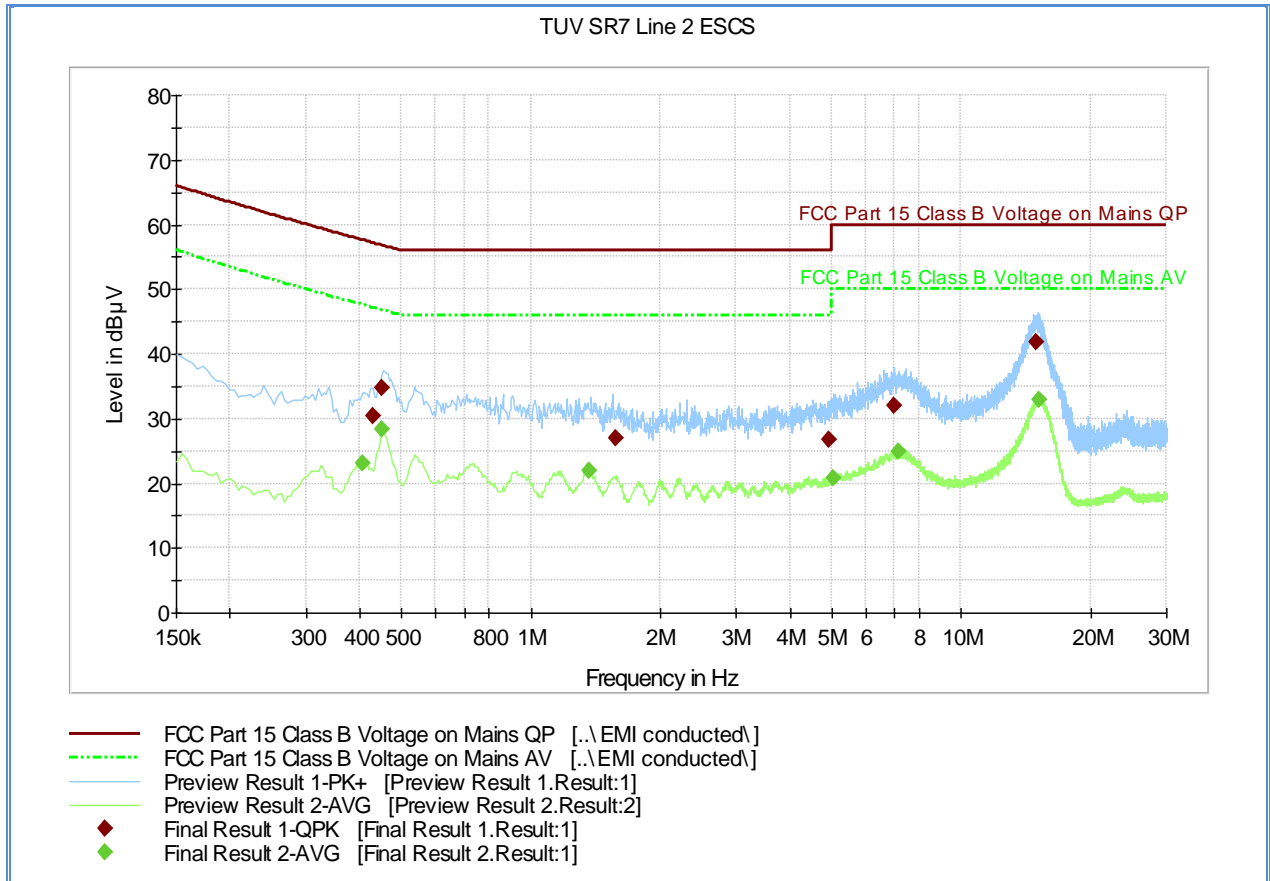
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.267000	26.9	1000.0	9.000	Off	L1	20.1	34.1	61.0
0.447000	40.5	1000.0	9.000	Off	L1	20.0	16.4	56.9
1.518000	32.1	1000.0	9.000	Off	L1	20.0	23.9	56.0
4.375500	30.6	1000.0	9.000	Off	L1	20.5	25.4	56.0
6.733500	35.0	1000.0	9.000	Off	L1	20.6	25.0	60.0
14.968500	43.1	1000.0	9.000	Off	L1	20.8	16.9	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.393000	23.7	1000.0	9.000	Off	L1	20.0	24.2	47.8
0.451500	30.4	1000.0	9.000	Off	L1	20.0	16.4	46.8
1.329000	23.8	1000.0	9.000	Off	L1	20.2	22.2	46.0
4.519500	22.8	1000.0	9.000	Off	L1	20.5	23.2	46.0
7.057500	27.2	1000.0	9.000	Off	L1	20.5	22.8	50.0
15.126000	34.5	1000.0	9.000	Off	L1	20.8	15.5	50.0

2.1.1 120VAC/60Hz, Line 2_Worst Case Configuration_802.11n 5GHz ht20_Channel 48 Transmit mode



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.429000	30.4	1000.0	9.000	Off	N	20.0	26.8	57.2
0.451500	34.8	1000.0	9.000	Off	N	20.0	22.0	56.8
1.576500	27.0	1000.0	9.000	Off	N	20.1	29.0	56.0
4.924500	26.8	1000.0	9.000	Off	N	20.4	29.2	56.0
7.012500	31.9	1000.0	9.000	Off	N	20.4	28.1	60.0
14.941500	41.8	1000.0	9.000	Off	N	20.7	18.2	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.406500	23.1	1000.0	9.000	Off	N	20.1	24.5	47.6
0.451500	28.2	1000.0	9.000	Off	N	20.0	18.5	46.8
1.365000	21.9	1000.0	9.000	Off	N	20.0	24.1	46.0
5.041500	20.9	1000.0	9.000	Off	N	20.4	29.1	50.0
7.147500	25.0	1000.0	9.000	Off	N	20.4	25.0	50.0
15.211500	32.9	1000.0	9.000	Off	N	20.8	17.1	50.0

2.2 26 DB BANDWIDTH

2.2.1 Specification Reference

Part 15 Subpart E §15.403(i)

2.2.2 Standard Applicable

(i) Emission bandwidth. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement..

2.2.3 Test Methodology

Section II (C) (1) of 789033 D02 General UNII Test Procedures v01

2.2.4 Equipment Under Test and Modification State

Serial No: SH181214900051 / Test Configuration A

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

July 03, 2014 /AC

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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.8°C
Relative Humidity	47.3%
ATM Pressure	98.7 kPa

2.2.8 Additional Observations

- This is a conducted test as per section C.2 of 789033 D02 General UNII Test Procedures New Rules v01 June 06, 2014 (Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E).
- Span is wide enough to capture the channel transmission.
- RBW is 1% of the span.
- VBW > RBW.
- Sweep is auto.
- Detector is peak.
- Conducted antenna port 0 and 1 were verified and found transmit port 1 was worst case scenario when in SISO mode. Therefore, only transmit port 1 was reported.

- Trace is max hold.
- The offset table below to the power meter was used for the power splitter, external attenuator and cable used.

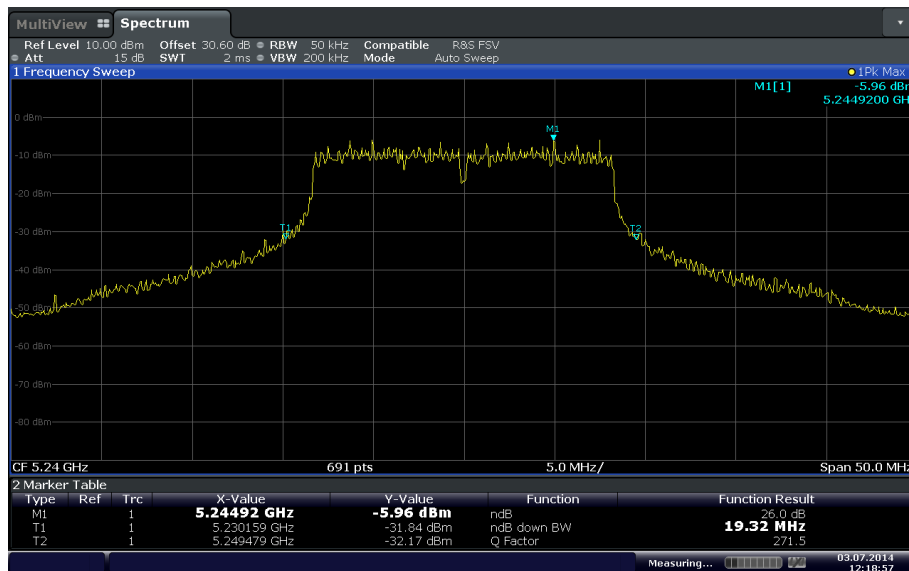
Channel (#)	Frequency (MHz)	Offset (dB)
36	5180	29.9
44	5220	30.3
48	5240	30.6

- 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 Summary Test Results (as reported)

26 dB Bandwidth			
WiFi Mode	Low Channel 36 (5180MHz)	Mid Channel 44 (5220MHz)	High Channel 48 (5240MHz)
SISO 802.11a U-NII 1	18.74 MHz	18.96 MHz	19.32 MHz
MIMO 802.11n ht20 U-NII 1	19.10 MHz	19.18 MHz	19.10 MHz
WiFi Mode	Low Channel 38 (5190MHz)	—	High Channel 46 (5230MHz)
MIMO 802.11n ht40 U-NII 1	38.49 MHz	—	38.64 MHz

2.2.10 Sample Test Plots



Date: 3 JUL 2014 12:18:58

802.11a U-NII 1 High Channel 48 (5240MHz)

2.3 99% EMISSION BANDWIDTH

2.3.1 Specification Reference

RSS-Gen Section 4.6.1

2.3.2 Standard Applicable

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.

The trace data points are recovered and directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

2.3.3 Equipment Under Test and Modification State

Serial No: SH181214900051 / Test Configuration A

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

March 30, 2015 / FSC

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 performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.8°C
Relative Humidity	47.3%
ATM Pressure	98.7 kPa

2.3.7 Additional Observations

- This is a conducted test.
- The offset table below to the power meter was used for the power splitter, external attenuator and cable used.

Channel (#)	Frequency (MHz)	Offset (dB)
36	5180	29.9
44	5220	30.3
48	5240	30.6

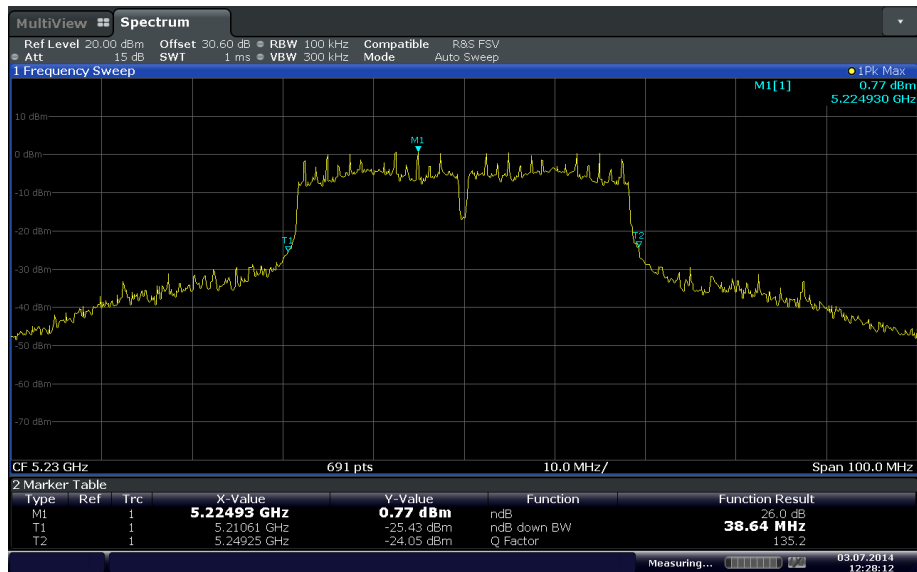
- Span is wide enough to capture the channel transmission.
- RBW is 1% of the span.

- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.
- The % Power Bandwidth setting in the spectrum analyzer was set to 99% (default).
- The Channel Bandwidth measurement function of the spectrum analyzer was used for this test.

2.3.8 Summary Test Results (as reported)

26 dB Bandwidth			
WiFi Mode	Low Channel 36 (5180MHz)	Mid Channel 44 (5220MHz)	High Channel 48 (5240MHz)
SISO 802.11a U-NII 1	17.2 MHz	17.6 MHz	17.2 MHz
MIMO 802.11n ht20 U-NII 1	18.3 MHz	18.1 MHz	18.1 MHz
WiFi Mode	Low Channel 38 (5190MHz)	—	High Channel 46 (5230MHz)
MIMO 802.11n ht40 U-NII 1	37.4 MHz	—	37.2 MHz

2.3.9 Sample Test Plots



802.11n ht 40 High Channel

2.4 MAXIMUM CONDUCTED OUTPUT POWER

2.4.1 Specification Reference

Part 15 Subpart E §15.407(a)(1)(IV) and §15.407(a)(3) and RSS-210 A9.2(1) and (4)

2.4.2 Standard Applicable

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

2.4.3 Test Methodology

Section II (E)(2)(d) Method SA-2 of 789033 D02 General UNII Test Procedures v01

2.4.4 Equipment Under Test and Modification State

Serial No: SH181214900051 / Test Configuration A

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

*June 28, 2014 / AC

*The tables presented on this test report are from SAR Evaluation Test Report Number: SAR.20140601 Revision D; TUV performed verification on random channels and worst case conditions and did not find any significant differences.

2.4.2 Test Equipment Used

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

2.4.3 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature 25.8°C
Relative Humidity 47.3%
ATM Pressure 98.7 kPa

2.4.4 Additional Observations

- These are the Conducted port measurement provided by the RF exposure SAR laboratory. The data was used and help in determining worst case testing conditions for the remainder of the report.
- This is a conducted test using a peak/average power meter.
- The test method was use per section E of 789033 D02 General UNII Test Procedures New Rules v01 June 06, 2014 (Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E).
- TUV performed verification checks and compared the measurements to the data provided by RF Exposure Labs (SAR.20140601 Revision D) and the results were found to be similar and are used to show compliance in this test report.
- The offset table below to the power meter was used for the power splitter, external attenuator and cable used.

Channel (#)	Frequency (MHz)	Offset (dB)
36	5180	29.9
44	5220	30.3
48	5240	30.6

- Conducted antenna port 0 and 1 were verified and found transmit port 1 was worst case scenario when in SISO mode. Therefore, only transmit port 1 was reported.
- All available modes and data rates were verified. The worst case data rate for each mode (marked bold and italic) will be verified for each test throughout this test report.

2.4.5 Limit Consideration for FCC

FCC Limit = 250mW or 23.98 dBm

Worst case for this test was=10.95 dBm
10.95dBm<23.98dBm → **Compliant**

2.4.6 Test Results (Maximum Conducted Power)

802.11a (5GHz)					
System Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Average Power (dBm)	Peak Power (dBm)
SISO	36	5180	6	7.92	12.53
			9	7.94	12.54
			12	7.90	12.49
			18	7.93	12.42
			24	7.89	12.40
			36	7.82	12.37
			48	7.80	12.45
			54	7.79	12.42
	40	5200	6	7.96	12.49
			9	7.91	12.42
			12	7.88	12.47
			18	7.86	12.38
			24	7.90	12.39
			36	7.85	12.45
			48	7.82	12.46
			54	7.77	12.32
	44	5220	6	7.98	12.48
			9	7.95	12.42
			12	7.94	12.43
			18	7.90	12.48
			24	7.88	12.40
			36	7.87	12.38
			48	7.89	12.39
			54	7.83	12.35
	48	5240	6	7.92	12.47
			9	7.95	12.49
			12	7.90	12.43
			18	7.87	12.44
			24	7.85	12.37
			36	7.86	12.35
			48	7.82	12.32
			54	7.84	12.30

802.11n (HT20) (5GHz)					
System Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Average Power (dBm)	Peak Power (dBm)
SISO	36	5180	MCS0_6.5	7.92	12.44
			MCS1_13	7.90	12.41
			MCS2_19.5	7.88	12.46
			MCS3_26	7.87	12.35
			MCS4_39	7.85	12.38
			MCS5_52	7.86	12.39
			MCS6_58.5	7.82	12.30
	MCS7_65	7.81	12.34		
	40	5200	MCS0_6.5	7.94	12.46
			MCS1_13	7.89	12.40
			MCS2_19.5	7.84	12.38
			MCS3_26	7.81	12.34
			MCS4_39	7.83	12.36
			MCS5_52	7.78	12.37
			MCS6_58.5	7.79	12.30
	MCS7_65	7.77	12.33		
	44	5220	MCS0_6.5	7.94	12.39
			MCS1_13	7.92	12.37
			MCS2_19.5	7.85	12.38
			MCS3_26	7.89	12.41
			MCS4_39	7.81	12.35
			MCS5_52	7.76	12.36
			MCS6_58.5	7.79	12.37
	MCS7_65	7.72	12.35		
	48	5240	MCS0_6.5	7.94	12.46
			MCS1_13	7.93	12.40
			MCS2_19.5	7.90	12.35
			MCS3_26	7.87	12.39
			MCS4_39	7.84	12.30
			MCS5_52	7.82	12.32
			MCS6_58.5	7.80	12.44
			MCS7_65	7.75	12.39

802.11n (HT40) (5GHz)					
System Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Average Power (dBm)	Peak Power (dBm)
SISO	38	5190	MCS0_13.5	7.87	12.22
			MCS1_27	7.81	12.19
			MCS2_40.5	7.83	12.18
			MCS3_54	7.78	12.20
			MCS4_81	7.82	12.23
			MCS5_108	7.71	12.14
			MCS6_121.5	7.76	12.17
			MCS7_135	7.68	12.19
	46	5230	MCS0_13.5	7.74	12.26
			MCS1_27	7.72	12.21
			MCS2_40.5	7.69	12.23
			MCS3_54	7.65	12.17
			MCS4_81	7.67	12.15
			MCS5_108	7.60	12.13
			MCS6_121.5	7.63	12.10
			MCS7_135	7.59	12.11

802.11n (HT20) (5GHz)					
System Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Average Power (dBm)	Peak Power (dBm)
MIMO	36	5180	MCS0_6.5	10.93	15.45
			MCS1_13	10.91	15.42
			MCS2_19.5	10.89	15.47
			MCS3_26	10.88	15.36
			MCS4_39	10.86	15.39
			MCS5_52	10.87	15.40
			MCS6_58.5	10.83	15.31
			MCS7_65	10.82	15.35
	40	5200	MCS0_6.5	10.95	15.47
			MCS1_13	10.90	15.41
			MCS2_19.5	10.85	15.39
			MCS3_26	10.82	15.35
			MCS4_39	10.84	15.37
			MCS5_52	10.79	15.38
			MCS6_58.5	10.80	15.31
			MCS7_65	10.78	15.34
	44	5220	MCS0_6.5	10.95	15.40
			MCS1_13	10.93	15.38
			MCS2_19.5	10.86	15.39
			MCS3_26	10.90	15.42
			MCS4_39	10.82	15.36
			MCS5_52	10.77	15.37
			MCS6_58.5	10.80	15.38
			MCS7_65	10.73	15.36
	48	5240	MCS0_6.5	10.95	15.47
			MCS1_13	10.94	15.41
			MCS2_19.5	10.91	15.36
			MCS3_26	10.88	15.40
			MCS4_39	10.85	15.31
			MCS5_52	10.83	15.33
			MCS6_58.5	10.81	15.45
			MCS7_65	10.76	15.40

802.11n (HT40) (5GHz)					
System Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Average Power (dBm)	Peak Power (dBm)
MIMO	38	5910	MCS0_13.5	10.88	15.23
			MCS1_27	10.82	15.20
			MCS2_40.5	10.84	15.19
			MCS3_54	10.79	15.21
			MCS4_81	10.83	15.24
			MCS5_108	10.72	15.15
			MCS6_121.5	10.77	15.18
			MCS7_135	10.69	15.20
	46	5230	MCS0_13.5	10.75	15.27
			MCS1_27	10.73	15.22
			MCS2_40.5	10.70	15.24
			MCS3_54	10.66	15.18
			MCS4_81	10.68	15.16
			MCS5_108	10.61	15.14
			MCS6_121.5	10.64	15.11
		MCS7_135	10.60	15.12	

2.5 MAXIMUM POWER SPECTRAL DENSITY (PSD)

2.5.1 Specification Reference

Part 15 Subpart E §15.407(a)(1)(IV) and §15.407(a)(3) and RSS-210 A9.2(1) and (4)

2.5.2 Standard Applicable

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

2.5.3 Test Methodology

Section II (F) PSD of 789033 D02 General UNII Test Procedures v01

2.5.4 Equipment Under Test and Modification State

Serial No: SH181214900051 / Test Configuration A

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

July 03, 2014 / AC

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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature 25.8°C
 Relative Humidity 47.3%
 ATM Pressure 98.7 kPa

2.5.8 Additional Observations

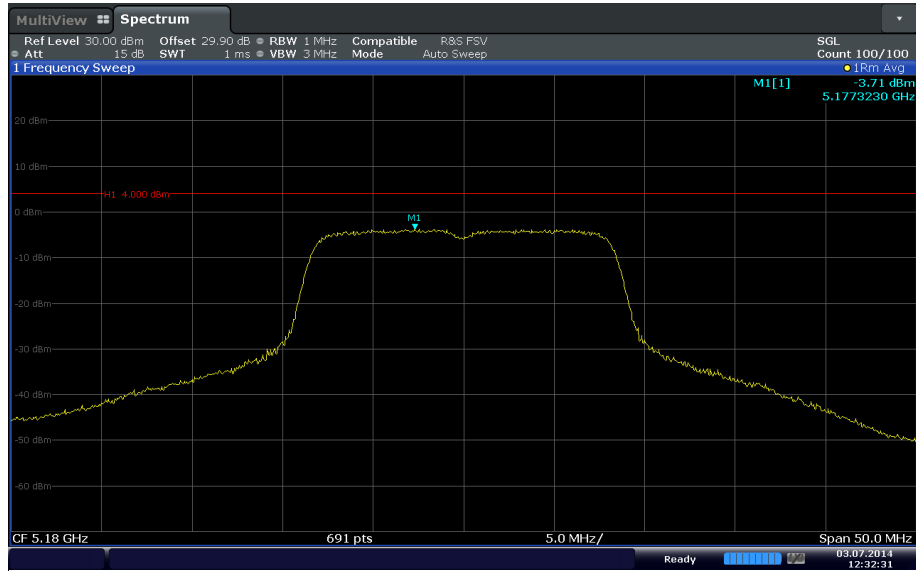
- This is a conducted test as per Section F of 789033 D02 General UNII Test Procedures New Rules v01 June 06, 2014 (Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E).
- Conducted antenna port 0 and 1 were verified and found transmit port 1 was worst case scenario when in SISO mode. Therefore, only transmit port 1 was reported.
- The offset table below is for the power meter, power splitter, external attenuator and cable used.

Channel (#)	Frequency (MHz)	Offset (dB)
36	5180	29.9
44	5220	30.3
48	5240	30.6

2.5.9 Test Results

PSD			
WiFi Mode	PSD (dBm)	Limit (dBm)	Margin (dB)
SISO 802.11a			
Low Channel 36 (5180MHz)	-3.71	11	7.29
Mid Channel 44 (5220MHz)	-4.05	11	6.95
High Channel 48 (5240MHz)	-3.62	11	7.38
WiFi Mode MIMO 802.11n ht20			
Low Channel 36 (5180MHz)	-1.28	11	12.28
Mid Channel 44 (5220MHz)	-0.24	11	11.24
High Channel 48 (5240MHz)	-0.88	11	11.88
WiFi Mode MIMO 802.11n ht40			
Low Channel 38 (5190MHz)	-3.17	11	14.17
Mid Channel 46 (5230MHz)	-3.60	11	14.60

2.5.10 Sample Test Plots



Date: 3 JUL 2014 12:32:30

802.11a SISO mode Channel 36 (5180MHz)

2.6 UNWANTED EMISSIONS MEASUREMENT

2.6.1 Specification Reference

Part 15 Subpart E §15.407(b)(1),(4) and (7) / 15.209 and RSS-210 A9.2(1) and (4)

2.6.2 Standard Applicable

(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) 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 e.i.r.p. of -27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.

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

2.6.3 Test Methodology

Section II (G) Unwanted Emission Measurement of 789033 D02 General UNII Test Procedures v01

2.6.4 Equipment Under Test and Modification State

Serial No: SH181214900051 / Test Configuration B and A

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

Julu 03, 2014 / AC

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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.8°C
Relative Humidity	47.3%
ATM Pressure	98.7 kPa

2.6.8 Additional Observations

- These are radiated tests (cabinet emissions measurements) to supplement conducted measurements performed.
- 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.
- For any emission falling outside the restricted band, the limit of -27dBm/MHz was converted to field strength using the formula under section G(2)(iii) of 789033 D02 General UNII Test Procedures New Rules v01 June 06, 2014 (Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E):

$$\begin{aligned}
 E(\text{dB}\mu\text{V}/\text{m}) &= 95.2\text{-EIRP (dBm) @ 3 meters using 1MHz RBW} \\
 &= 95.2\text{-27 dBm} \\
 &= 68.2 \text{ dB}\mu\text{V}/\text{m}
 \end{aligned}$$

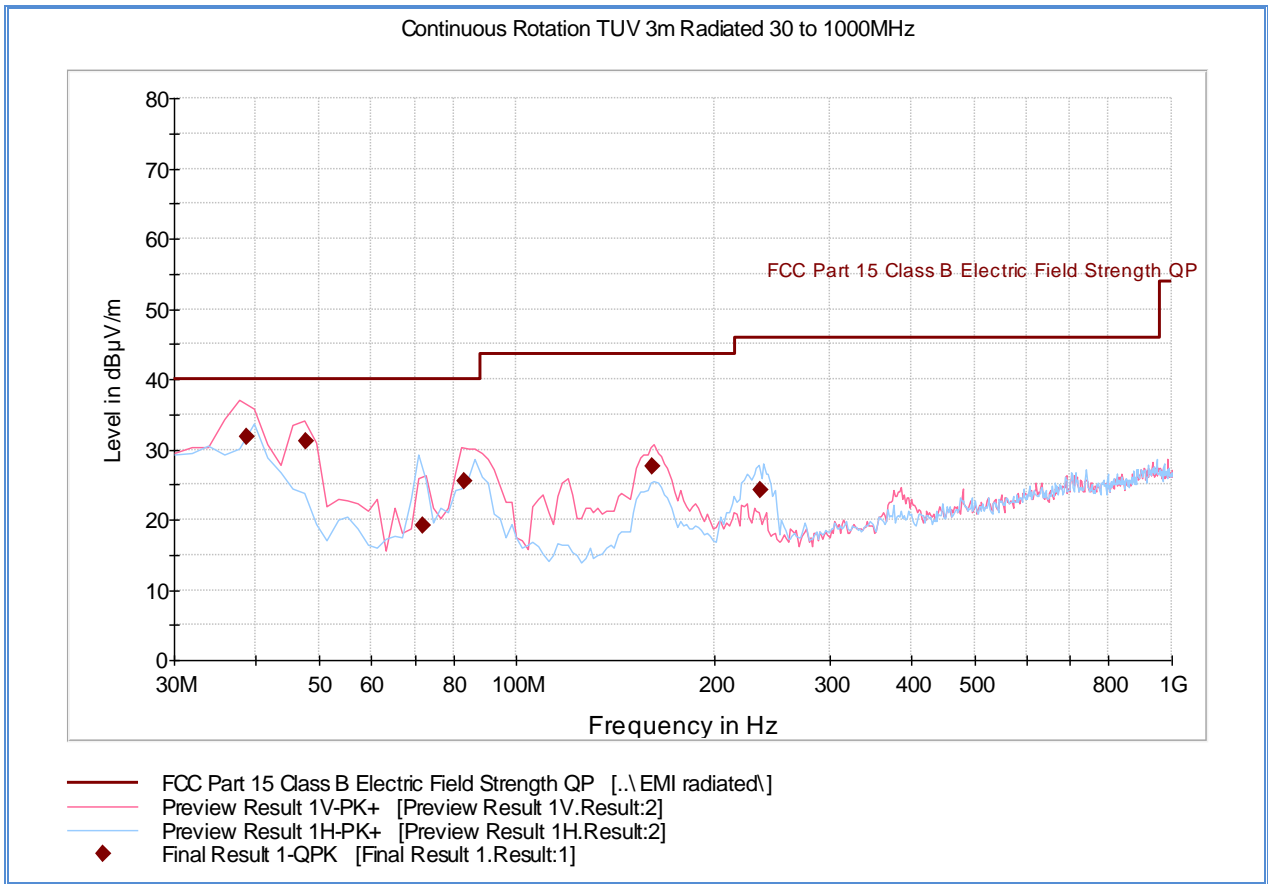
2.6.9 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (db μ 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
Reported QuasiPeak Final Measurement (dbμV/m) @ 30MHz		11.8

2.6.10 Test Results

See attached plots.

**2.6.11 Test Results Below 1GHz (Tx – SISO Mode)_Worst Case Configuration
802.11a 5GHz_Mid(44) Channel (5220MHz)_6Mbps Data Rate**

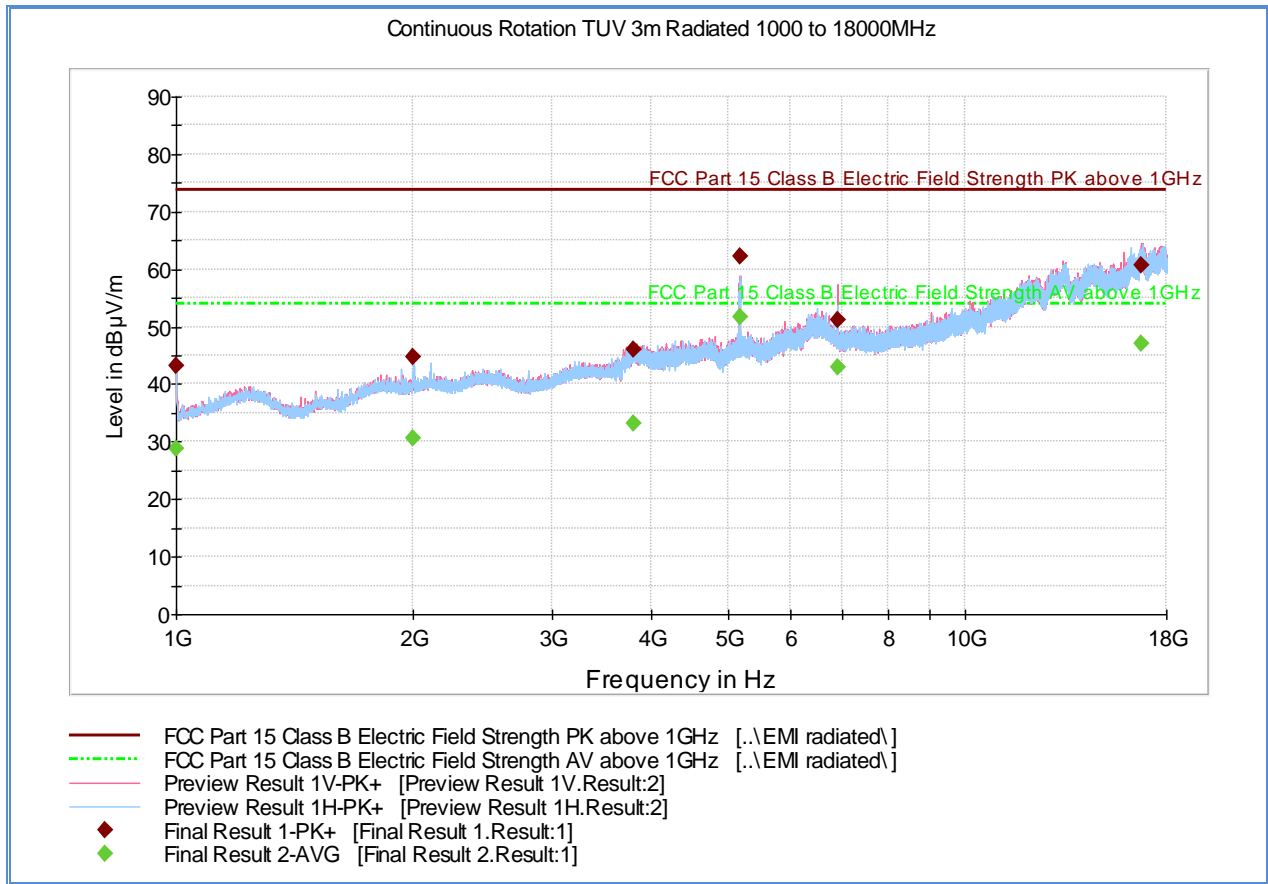


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
38.735551	31.8	1000.0	120.000	100.0	V	72.0	-15.1	8.2	40.0
47.574990	31.1	1000.0	120.000	100.0	V	135.0	-18.2	8.9	40.0
71.741643	19.2	1000.0	120.000	200.0	H	-15.0	-21.4	20.8	40.0
83.164970	25.4	1000.0	120.000	109.0	V	73.0	-20.8	14.6	40.0
161.384369	27.5	1000.0	120.000	100.0	V	89.0	-17.3	16.0	43.5
234.995992	24.3	1000.0	120.000	109.0	H	144.0	-13.5	21.7	46.0

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

**2.6.12 Test Results Above 1GHz (Tx - SISO Mode)_Worst Case Configuration
802.11a 5GHz_Low(36) Channel (5180MHz)_18Mbps Data Rate**



Peak Data

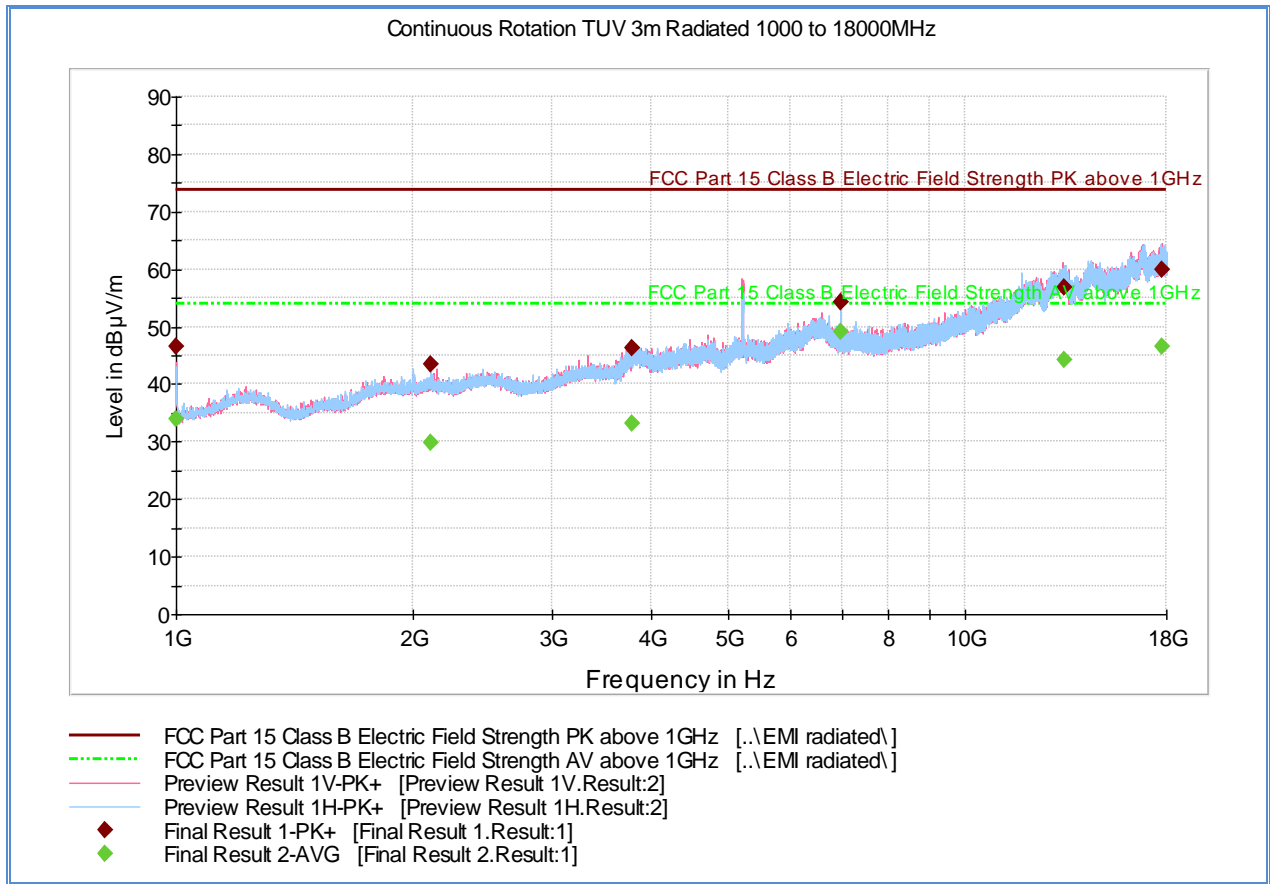
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.500000	43.2	1000.0	1000.000	190.5	V	357.0	-7.0	30.7	73.9
1999.566667	44.8	1000.0	1000.000	299.2	H	310.0	-1.0	29.1	73.9
3799.133333	46.0	1000.0	1000.000	131.7	V	20.0	6.0	27.9	73.9
5182.933333	62.3	1000.0	1000.000	279.3	V	51.0		Fundamental	
6906.566667	51.1	1000.0	1000.000	208.5	V	65.0	10.9	22.8	73.9
16753.700000	60.7	1000.0	1000.000	288.2	V	16.0	25.9	13.2	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)
1000.500000	28.9	1000.0	1000.000	190.5	V	357.0	-7.0	25.0	53.9
1999.566667	30.7	1000.0	1000.000	299.2	H	310.0	-1.0	23.2	53.9
3799.133333	33.3	1000.0	1000.000	131.7	V	20.0	6.0	20.6	53.9
5182.933333	51.8	1000.0	1000.000	279.3	V	51.0		Fundamental	
6906.566667	43.0	1000.0	1000.000	208.5	V	65.0	10.9	10.9	53.9
16753.700000	47.0	1000.0	1000.000	288.2	V	16.0	25.9	6.9	53.9

Test Notes: Measurement was performed with a 5GHz notch filter. No significant emissions observed above 8GHz. Measurement above 8GHz are noise floor figures. There are no emissions observed that does not comply with the 68.2 dBµV/m calculated limit for non-restricted bands.

**2.6.13 Test Results Above 1GHz (Tx - SISO Mode)_Worst Case Configuration
802.11a 5GHz_Mid(44) Channel (5220MHz)_6Mbps Data Rate**



Peak Data

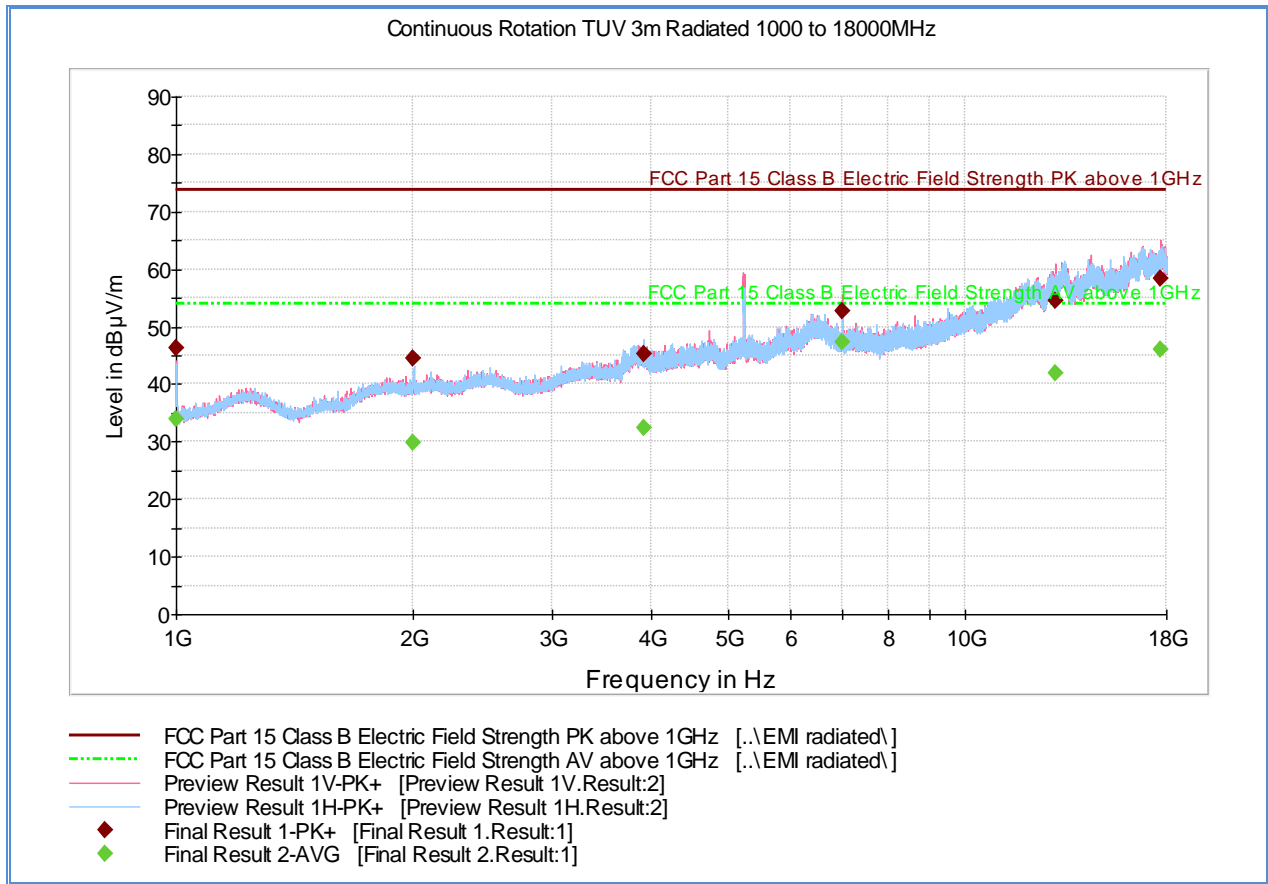
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	46.5	1000.0	1000.000	189.5	V	298.0	-7.0	27.4	73.9
2098.766667	43.5	1000.0	1000.000	278.3	H	54.0	-1.0	30.4	73.9
3790.700000	46.2	1000.0	1000.000	201.3	H	20.0	5.8	27.7	73.9
6959.833333	54.1	1000.0	1000.000	275.3	V	80.0	10.7	19.8	73.9
13374.133333	56.7	1000.0	1000.000	112.7	H	298.0	22.2	17.2	73.9
17734.200000	60.0	1000.0	1000.000	101.7	V	275.0	25.7	13.9	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)
1000.000000	34.1	1000.0	1000.000	189.5	V	298.0	-7.0	19.8	53.9
2098.766667	29.9	1000.0	1000.000	278.3	H	54.0	-1.0	24.0	53.9
3790.700000	33.1	1000.0	1000.000	201.3	H	20.0	5.8	20.8	53.9
6959.833333	49.2	1000.0	1000.000	275.3	V	80.0	10.7	4.7	53.9
13374.133333	44.1	1000.0	1000.000	112.7	H	298.0	22.2	9.8	53.9
17734.200000	46.4	1000.0	1000.000	101.7	V	275.0	25.7	7.5	53.9

Test Notes: Measurement was performed with a 5GHz notch filter. No significant emissions observed above 8GHz. Measurement above 8GHz are noise floor figures. There are no emissions observed that does not comply with the 68.2 dBµV/m calculated limit for non-restricted bands.

**2.6.14 Test Results Above 1GHz (Tx - SISO Mode)_Worst Case Configuration
802.11a 5GHz_High(48) Channel (5240MHz)_9Mbps Data Rate**



Peak Data

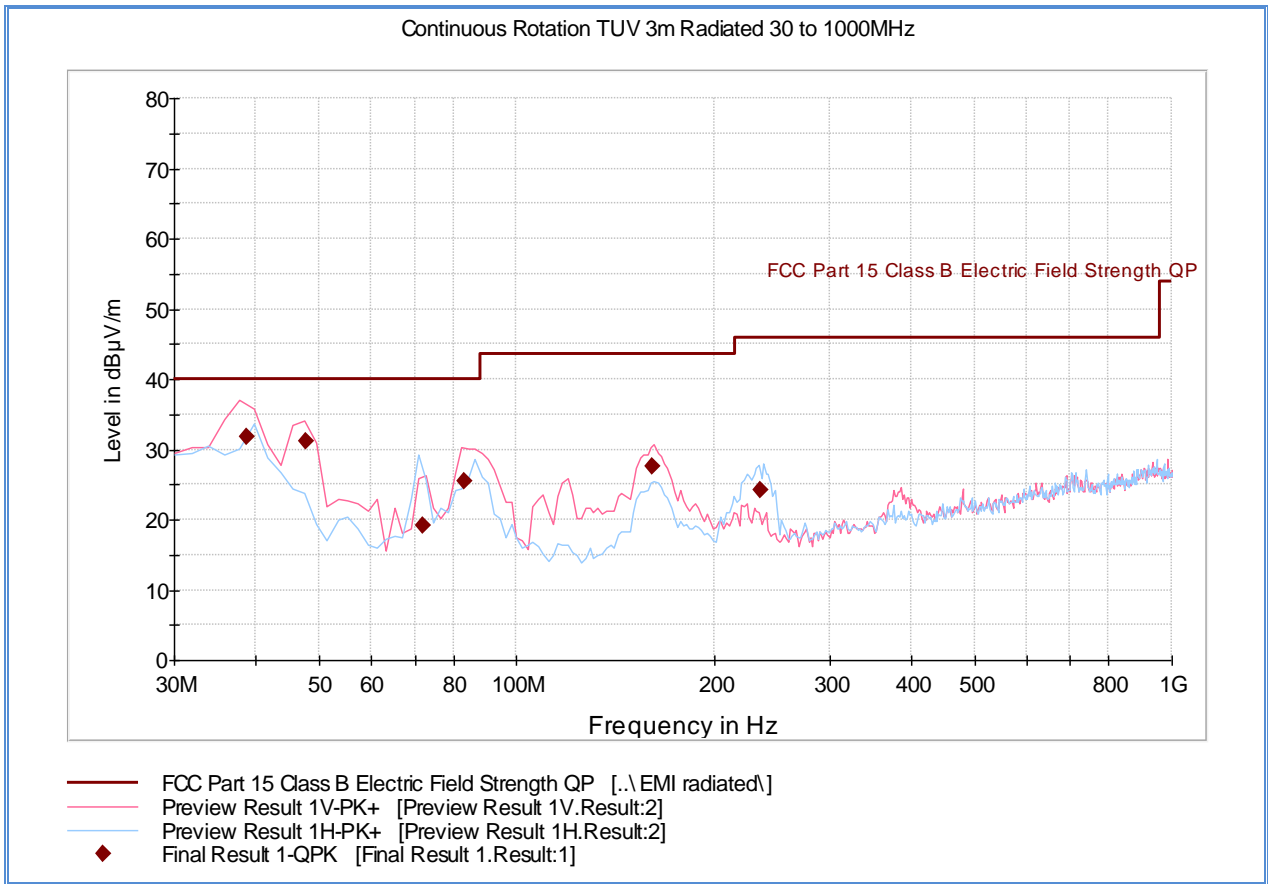
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	46.2	1000.0	1000.000	188.5	V	25.0	-7.0	27.7	73.9
2000.533333	44.4	1000.0	1000.000	301.2	H	329.0	-1.0	29.5	73.9
3920.000000	45.2	1000.0	1000.000	404.2	H	345.0	6.0	28.7	73.9
6986.466667	52.7	1000.0	1000.000	190.5	V	60.0	10.6	21.2	73.9
12995.633333	54.5	1000.0	1000.000	404.1	V	265.0	20.6	19.4	73.9
17680.033333	58.5	1000.0	1000.000	103.7	V	107.0	25.4	15.4	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	33.9	1000.0	1000.000	188.5	V	25.0	-7.0	20.0	53.9
2000.533333	30.0	1000.0	1000.000	301.2	H	329.0	-1.0	23.9	53.9
3920.000000	32.5	1000.0	1000.000	404.2	H	345.0	6.0	21.4	53.9
6986.466667	47.2	1000.0	1000.000	190.5	V	60.0	10.6	6.7	53.9
12995.633333	41.9	1000.0	1000.000	404.1	V	265.0	20.6	12.0	53.9
17680.033333	46.1	1000.0	1000.000	103.7	V	107.0	25.4	7.8	53.9

Test Notes: Measurement was performed with a 5GHz notch filter. No significant emissions observed above 8GHz. Measurement above 8GHz are noise floor figures. There are no emissions observed that does not comply with the 68.2 dBµV/m calculated limit for non-restricted bands.

**2.6.15 Test Results Below 1GHz (Tx – MIMO Mode)_Worst Case Configuration
802.11n 5GHz(HT20)_High(48) Channel (5240MHz)_6.5Mbps Data Rate**

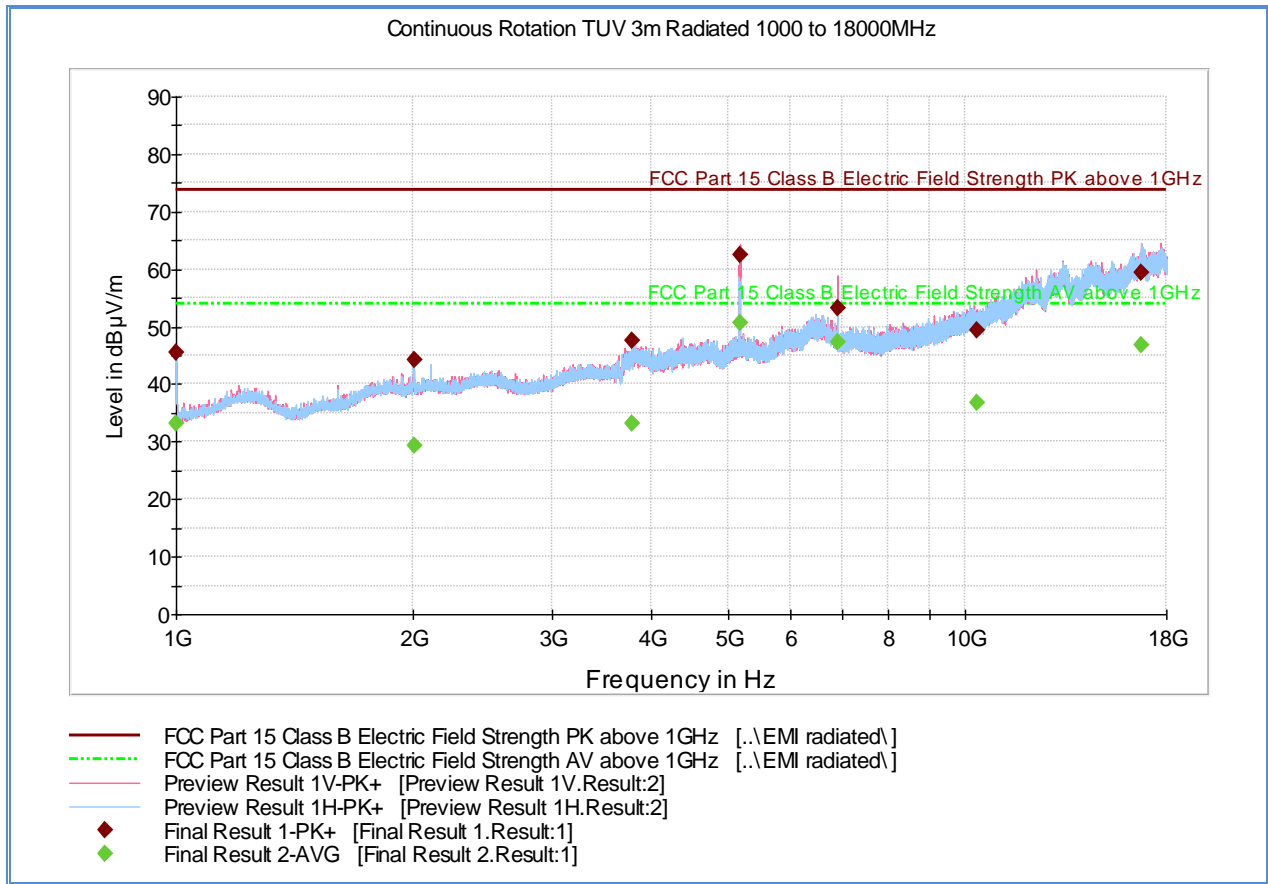


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
38.735551	31.8	1000.0	120.000	100.0	V	72.0	-15.1	8.2	40.0
47.574990	31.1	1000.0	120.000	100.0	V	135.0	-18.2	8.9	40.0
71.741643	19.2	1000.0	120.000	200.0	H	-15.0	-21.4	20.8	40.0
83.164970	25.4	1000.0	120.000	109.0	V	73.0	-20.8	14.6	40.0
161.384369	27.5	1000.0	120.000	100.0	V	89.0	-17.3	16.0	43.5
234.995992	24.3	1000.0	120.000	109.0	H	144.0	-13.5	21.7	46.0

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

**2.6.16 Test Results Above 1GHz (Tx - MIMO Mode)_Worst Case Configuration
802.11a 5GHz(HT20)_Low(36) Channel (5180MHz)_6.5Mbps Data Rate**



Peak Data

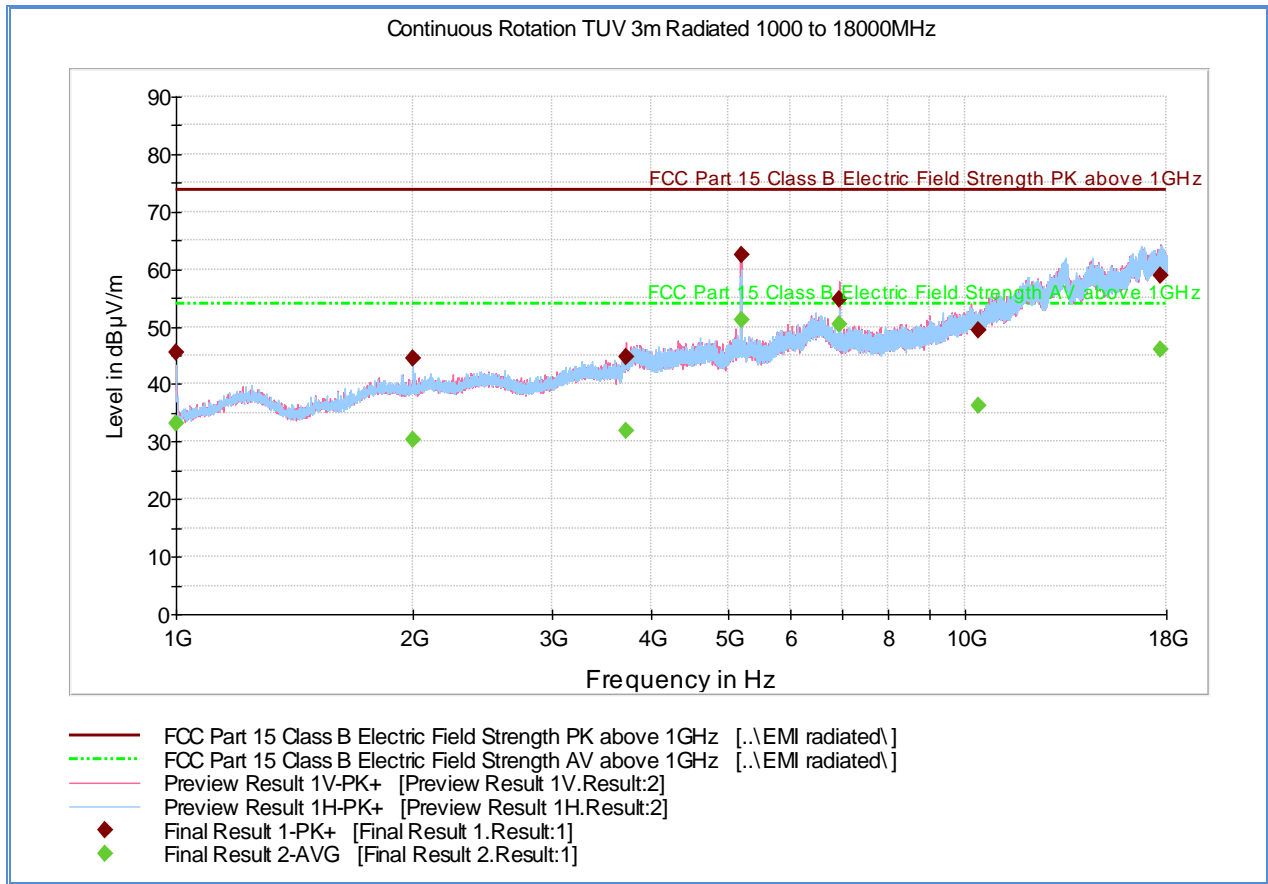
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	45.6	1000.0	1000.000	189.5	V	166.0	-7.0	28.3	73.9
2000.966667	44.2	1000.0	1000.000	237.4	H	327.0	-1.0	29.7	73.9
3789.166667	47.6	1000.0	1000.000	301.6	H	156.0	5.8	26.3	73.9
5182.233333	62.6	1000.0	1000.000	120.7	V	51.0		Fundamental	
6906.566667	53.2	1000.0	1000.000	179.5	V	73.0	10.9	20.7	73.9
10355.333333	49.4	1000.0	1000.000	404.2	V	3.0	14.1	24.5	73.9
16728.600000	59.5	1000.0	1000.000	206.5	H	242.0	25.9	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	33.1	1000.0	1000.000	189.5	V	166.0	-7.0	20.8	53.9
2000.966667	29.4	1000.0	1000.000	237.4	H	327.0	-1.0	24.5	53.9
3789.166667	33.2	1000.0	1000.000	301.6	H	156.0	5.8	20.7	53.9
5182.233333	50.6	1000.0	1000.000	120.7	V	51.0		Fundamental	
6906.566667	47.3	1000.0	1000.000	179.5	V	73.0	10.9	6.6	53.9
10355.333333	36.8	1000.0	1000.000	404.2	V	3.0	14.1	17.1	53.9
16728.600000	46.8	1000.0	1000.000	206.5	H	242.0	25.9	7.1	53.9

Test Notes: Measurement was performed with a 5GHz notch filter. No significant emissions observed above 8GHz. Measurement above 8GHz are noise floor figures. There are no emissions observed that does not comply with the 68.2 dBµV/m calculated limit for non-restricted bands.

**2.6.17 Test Results Above 1GHz (Tx - MIMO Mode)_Worst Case Configuration
802.11a 5GHz(HT20)_Mid(40) Channel (5200MHz)_6.5Mbps Data Rate**



Peak Data

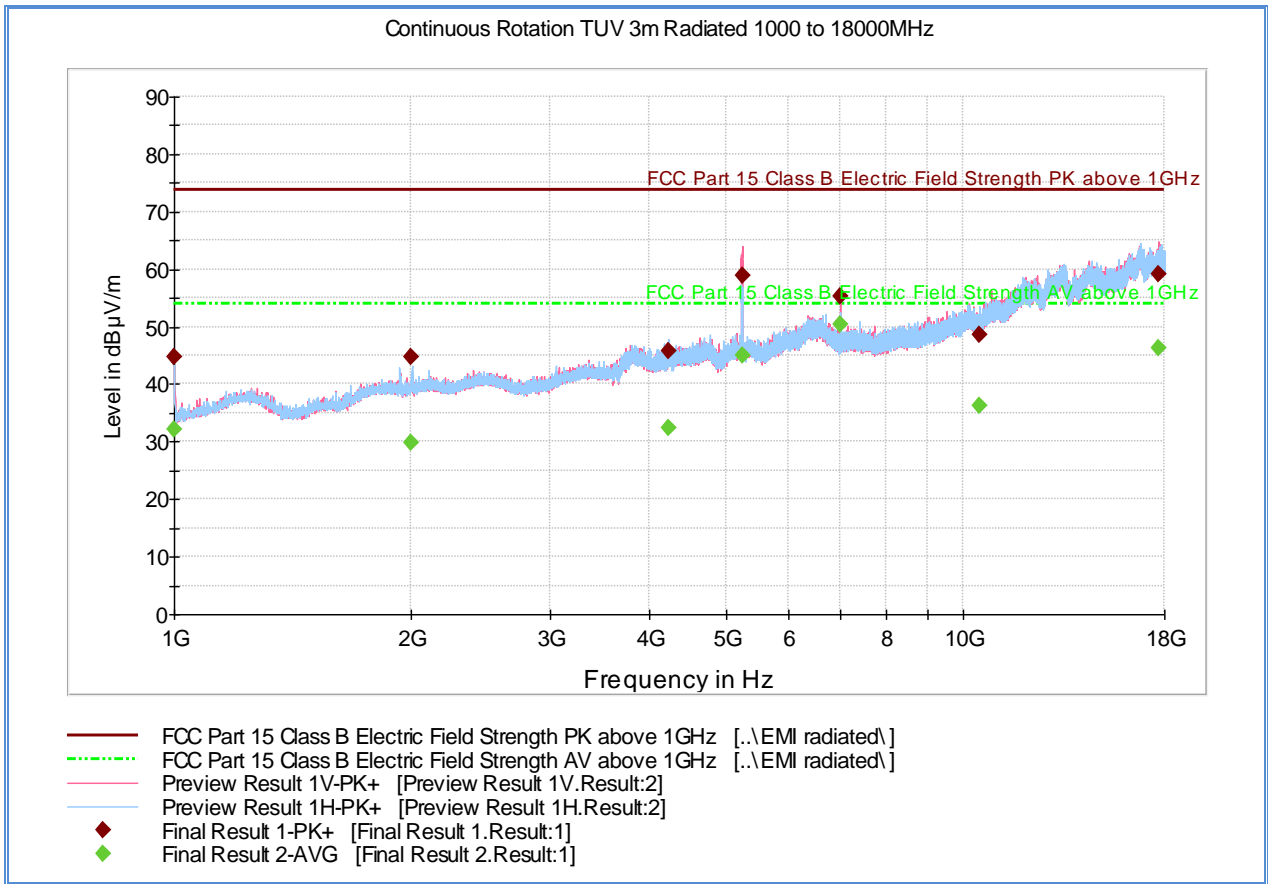
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	45.6	1000.0	1000.000	189.5	V	166.0	-7.0	28.3	73.9
1999.833333	44.4	1000.0	1000.000	320.2	H	122.0	-1.0	29.5	73.9
3719.833333	44.8	1000.0	1000.000	333.1	V	90.0	4.9	29.1	73.9
5205.766667	62.4	1000.0	1000.000	128.7	V	81.0		Fundamental	
6933.200000	54.7	1000.0	1000.000	194.5	V	78.0	10.8	19.2	73.9
10402.000000	49.4	1000.0	1000.000	402.7	V	285.0	14.0	24.5	73.9
17690.466667	58.8	1000.0	1000.000	404.3	V	110.0	25.5	15.1	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)
1000.000000	33.1	1000.0	1000.000	189.5	V	166.0	-7.0	20.8	53.9
1999.833333	30.3	1000.0	1000.000	320.2	H	122.0	-1.0	23.6	53.9
3719.833333	31.9	1000.0	1000.000	333.1	V	90.0	4.9	22.0	53.9
5205.766667	51.1	1000.0	1000.000	128.7	V	81.0		Fundamental	
6933.200000	50.3	1000.0	1000.000	194.5	V	78.0	10.8	3.6	53.9
10402.000000	36.2	1000.0	1000.000	402.7	V	285.0	14.0	17.7	53.9
17690.466667	46.1	1000.0	1000.000	404.3	V	110.0	25.5	7.8	53.9

Test Notes: Measurement was performed with a 5GHz notch filter. No significant emissions observed above 8GHz. Measurement above 8GHz are noise floor figures. There are no emissions observed that does not comply with the 68.2 dBµV/m calculated limit for non-restricted bands.

**2.6.18 Test Results Above 1GHz (Tx - MIMO Mode)_Worst Case Configuration
802.11a 5GHz(HT20)_High(48) Channel (5240MHz)_6.5Mbps Data Rate**



Peak Data

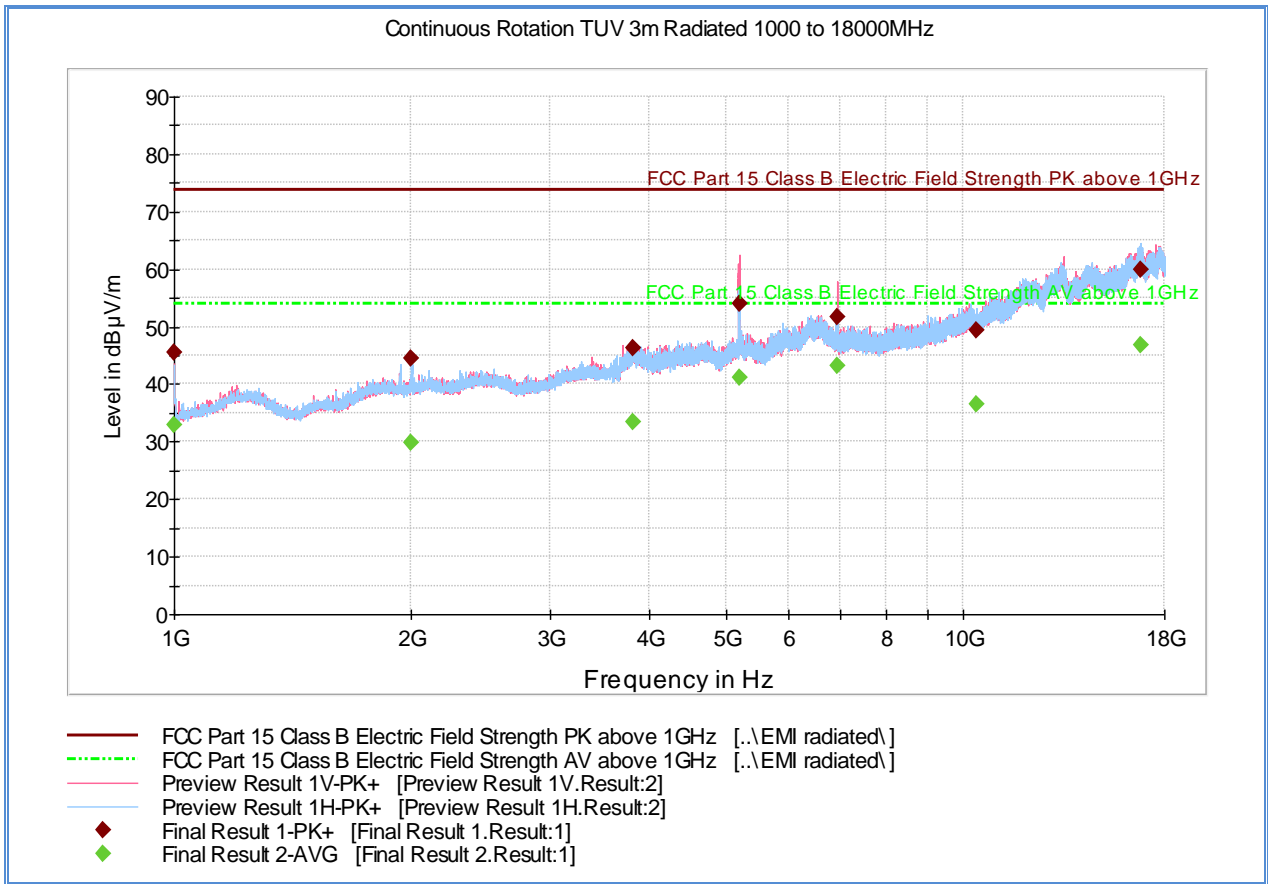
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	44.6	1000.0	1000.000	278.3	H	-16.0	-7.0	29.3	73.9
2000.533333	44.6	1000.0	1000.000	310.2	H	184.0	-1.0	29.3	73.9
4231.100000	45.7	1000.0	1000.000	201.3	H	-3.0	6.2	28.2	73.9
5243.400000	58.8	1000.0	1000.000	146.7	V	74.0		Fundamental	
6986.666667	55.2	1000.0	1000.000	189.5	V	84.0	10.6	18.7	73.9
10482.000000	48.7	1000.0	1000.000	169.6	V	132.0	14.5	25.2	73.9
17715.766667	59.1	1000.0	1000.000	103.7	V	182.0	25.6	14.8	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	32.1	1000.0	1000.000	278.3	H	-16.0	-7.0	21.8	53.9
2000.533333	29.9	1000.0	1000.000	310.2	H	184.0	-1.0	24.0	53.9
4231.100000	32.4	1000.0	1000.000	201.3	H	-3.0	6.2	21.5	53.9
5243.400000	45.1	1000.0	1000.000	146.7	V	74.0		Fundamental	
6986.666667	50.3	1000.0	1000.000	189.5	V	84.0	10.6	3.6	53.9
10482.000000	36.2	1000.0	1000.000	169.6	V	132.0	14.5	17.7	53.9
17715.766667	46.4	1000.0	1000.000	103.7	V	182.0	25.6	7.5	53.9

Test Notes: Measurement was performed with a 5GHz notch filter. No significant emissions observed above 8GHz. Measurement above 8GHz are noise floor figures. There are no emissions observed that does not comply with the 68.2 dBµV/m calculated limit for non-restricted bands.

**2.6.19 Test Results Above 1GHz (Tx - MIMO Mode)_Worst Case Configuration
802.11a 5GHz(HT40)_Low(38) Channel (5190MHz)_13.5Mbps Data Rate**



Peak Data

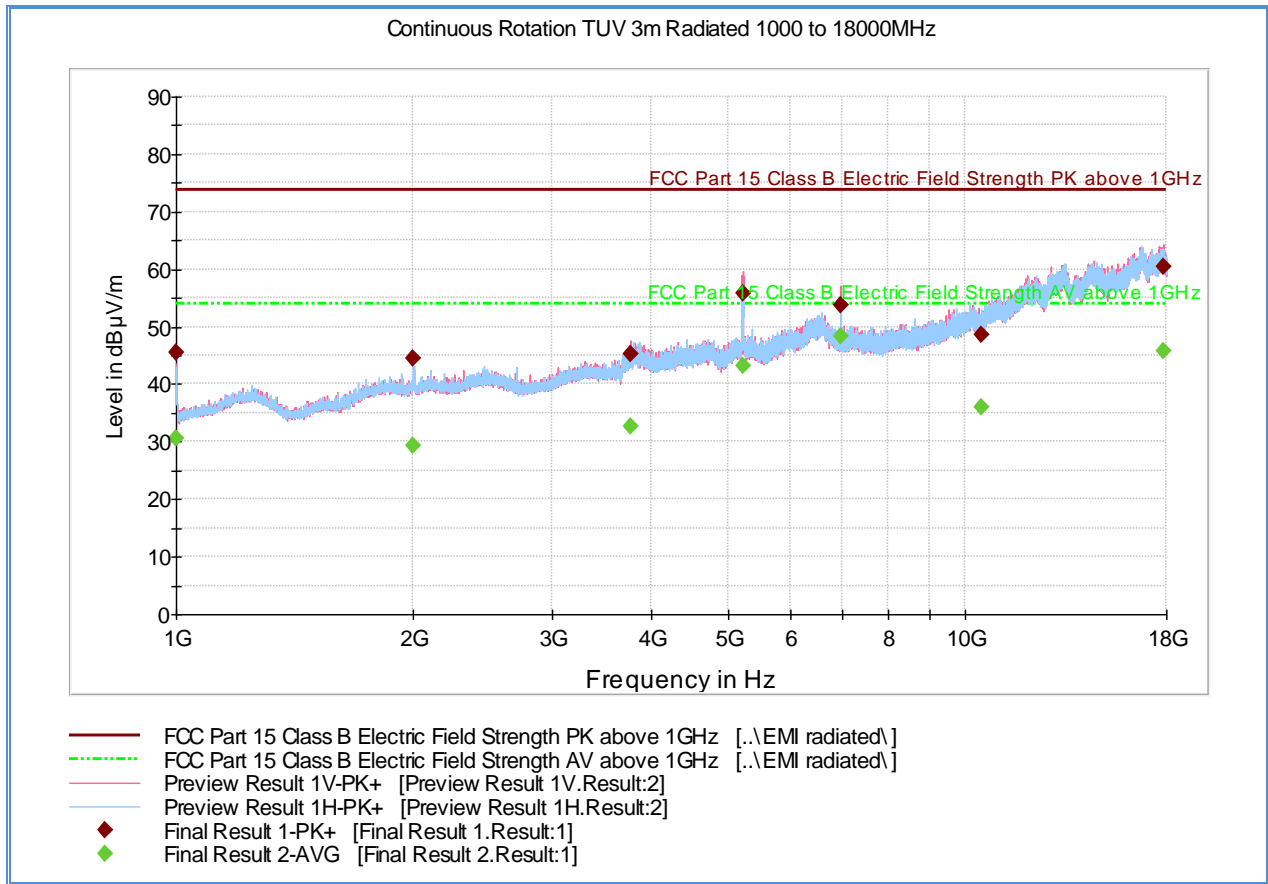
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	45.4	1000.0	1000.000	180.6	V	344.0	-7.0	28.5	73.9
2000.200000	44.4	1000.0	1000.000	248.3	H	248.0	-1.0	29.5	73.9
3815.400000	46.3	1000.0	1000.000	169.6	H	62.0	6.0	27.6	73.9
5212.166667	53.9	1000.0	1000.000	177.6	V	78.0		Fundamental	
6933.000000	51.7	1000.0	1000.000	146.7	V	65.0	10.8	22.2	73.9
10386.633333	49.2	1000.0	1000.000	201.3	H	135.0	14.0	24.7	73.9
16801.733333	59.8	1000.0	1000.000	153.7	H	42.0	25.8	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)
1000.000000	32.8	1000.0	1000.000	180.6	V	344.0	-7.0	21.1	53.9
2000.200000	29.8	1000.0	1000.000	248.3	H	248.0	-1.0	24.1	53.9
3815.400000	33.4	1000.0	1000.000	169.6	H	62.0	6.0	20.5	53.9
5212.166667	41.1	1000.0	1000.000	177.6	V	78.0		Fundamental	
6933.000000	43.2	1000.0	1000.000	146.7	V	65.0	10.8	10.7	53.9
10386.633333	36.4	1000.0	1000.000	201.3	H	135.0	14.0	17.5	53.9
16801.733333	46.9	1000.0	1000.000	153.7	H	42.0	25.8	7.0	53.9

Test Notes: Measurement was performed with a 5GHz notch filter. No significant emissions observed above 8GHz. Measurement above 8GHz are noise floor figures. There are no emissions observed that does not comply with the 68.2 dBµV/m calculated limit for non-restricted bands.

**2.6.20 Test Results Above 1GHz (Tx - MIMO Mode)_Worst Case Configuration
802.11a 5GHz(HT40)_High(46) Channel (5230MHz)_13.5Mbps Data Rate**



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	45.4	1000.0	1000.000	189.5	V	61.0	-7.0	28.5	73.9
1998.866667	44.5	1000.0	1000.000	248.3	H	179.0	-1.0	29.4	73.9
3769.266667	45.3	1000.0	1000.000	161.6	V	355.0	5.5	28.6	73.9
5221.466667	55.8	1000.0	1000.000	131.7	V	82.0		Fundamental	
6960.000000	53.7	1000.0	1000.000	180.6	V	79.0	10.7	20.2	73.9
10466.300000	48.6	1000.0	1000.000	144.7	H	100.0	14.4	25.3	73.9
17843.800000	60.5	1000.0	1000.000	200.5	V	131.0	25.6	13.4	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)
1000.500000	30.5	1000.0	1000.000	189.5	V	61.0	-7.0	23.4	53.9
1998.866667	29.3	1000.0	1000.000	248.3	H	179.0	-1.0	24.6	53.9
3769.266667	32.7	1000.0	1000.000	161.6	V	355.0	5.5	21.2	53.9
5221.466667	43.3	1000.0	1000.000	131.7	V	82.0		Fundamental	
6960.000000	48.4	1000.0	1000.000	180.6	V	79.0	10.7	5.5	53.9
10466.300000	36.1	1000.0	1000.000	144.7	H	100.0	14.4	17.8	53.9
17843.800000	45.9	1000.0	1000.000	200.5	V	131.0	25.6	8.0	53.9

Test Notes: Measurement was performed with a 5GHz notch filter. No significant emissions observed above 8GHz. Measurement above 8GHz are noise floor figures. There are no emissions observed that does not comply with the 68.2 dBµV/m calculated limit for non-restricted bands.

2.7 BAND-EDGE MEASUREMENTS

2.7.1 Specification Reference

Part 15 Subpart E §15.407(b)(1),(4) and (7) / 15.209 and RSS-210 A9.2(1) and (4)

2.7.2 Standard Applicable

(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) 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 e.i.r.p. of -27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.

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

2.7.3 Test Methodology

Section II (G)(3)(d)(ii) Band Edge Measurement of 789033 D02 General UNII Test Procedures v01

2.7.4 Equipment Under Test and Modification State

Serial No: SH181214900051 / Test Configuration A

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

Julu 03, 2014 / AC

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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.8°C
Relative Humidity	47.3%
ATM Pressure	98.7 kPa

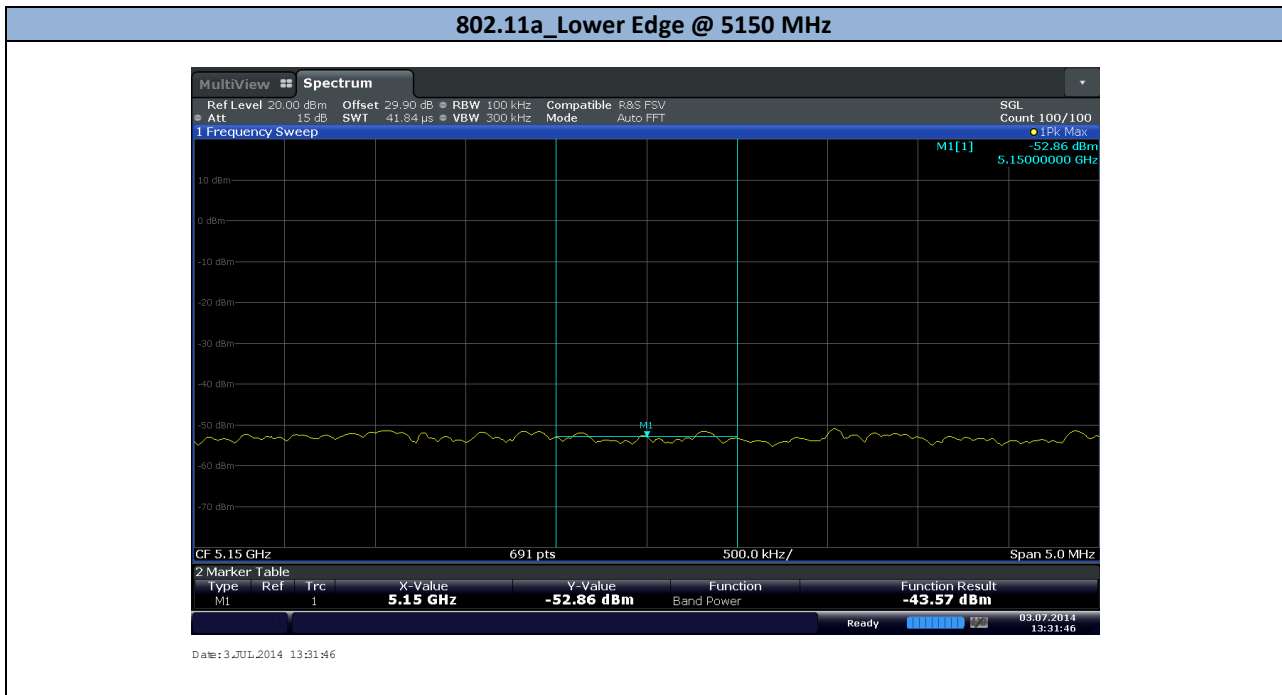
2.7.8 Additional Observations

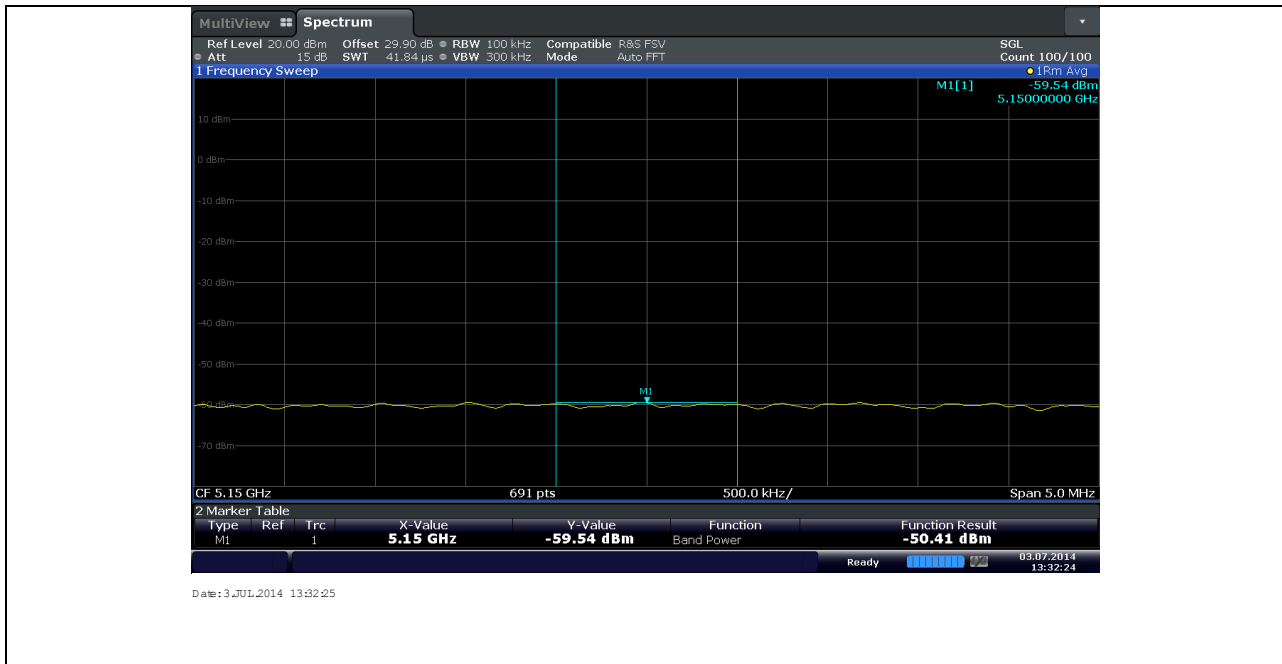
- This is a conducted test as per section G.3 of 789033 D02 General UNII Test Procedures New Rules v01 June 06, 2014 (Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E).
- RBW=1MHz/VBW=3MHz
- Detector = Peak
- Sweep time=Auto
- Trace Mode=max hold
- Sweep allowed to continue until the trace stabilized.
- The offset table below to the power meter was used for the power splitter, external attenuator and cable used.

Channel (#)	Frequency (MHz)	Offset (dB)
36	5180	29.9
44	5220	30.3
48	5240	30.6

- Conducted antenna port 0 and 1 were verified and found transmit port 1 was worst case scenario when in SISO mode. Therefore, only transmit port 1 was reported.

2.7.9 Test Plots





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:

$$E(\text{dB}\mu\text{V}/\text{m}) = \text{EIRP}(\text{dBm}) + 95.2$$

$$= (-52.86 \text{ dBm} + 1.72 \text{ dBi antenna gain}) + 95.2$$

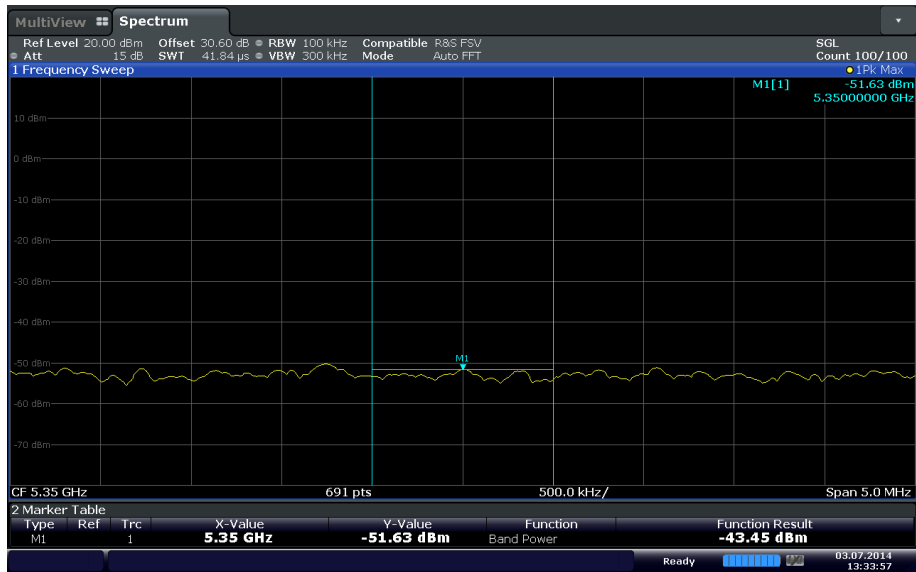
$$= 44.06 \text{ dB}\mu\text{V}/\text{m} @ 3 \text{ meters (Calculating for Peak)}$$

$$\text{EIRP}(\text{dBm}) + 95.2$$

$$= (-59.54 \text{ dBm} + 1.72 \text{ dBi antenna gain}) + 95.2$$

$$= 37.38 \text{ dB}\mu\text{V}/\text{m} @ 3 \text{ meters (Calculating for Average)}$$
- 44.06 dBμV/m (Peak) @ 3 meters (complies with 74 dBμV/m limit)
- 37.38 dBμV/m (Average) @ 3 meters (complies with 54 dBμV/m limit)

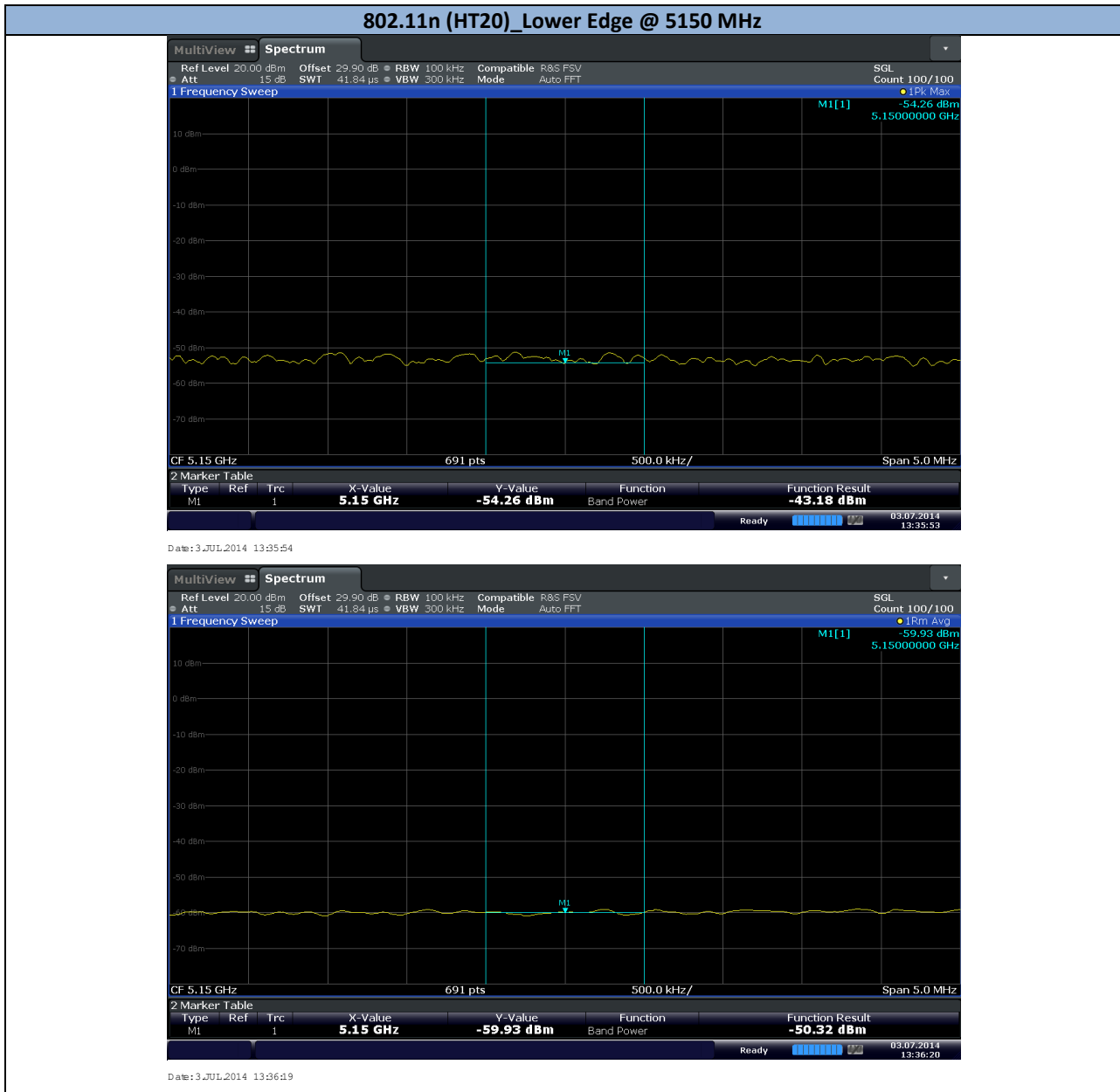
802.11a_Higher Edge @ 5350 MHz



High Channel (5240 MHz)

Upper band edge calculation:

- 5350 MHz (not in the restricted bands)
- Limit is -27dBm EIRP
- Calculation @ 5350 MHz:
 - Peak measurement @ 5350 MHz = -51.63 dBm
 - EIRP @ 5350 MHz = -51.63 + 1.72 dBi (antenna gain)
 - = -49.91 dBm
 - Margin of compliance = -22.91 dB



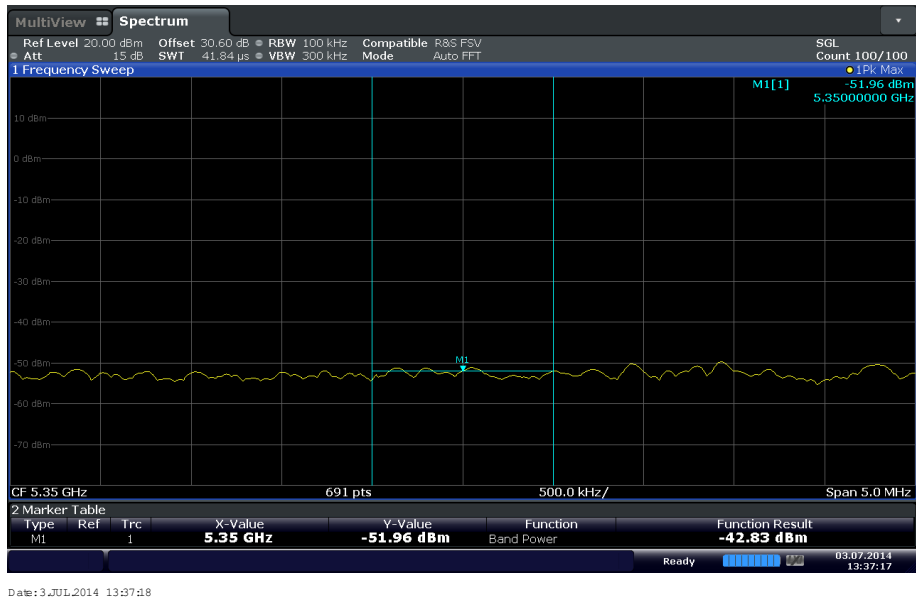
Low Channel (5180 MHz)

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:

$$\begin{aligned}
 E(\text{dB}\mu\text{V}/\text{m}) &= \text{EIRP (dBm)} + 95.2 \\
 &= (-54.26 \text{ dBm} + 1.72\text{dBi antenna gain}) + 95.2 \\
 &= 42.66 \text{ dB}\mu\text{V}/\text{m} @ 3 \text{ meters (Calculating for Peak)} \\
 \text{EIRP (dBm)} + 95.2 & \\
 &= (-59.93 \text{ dBm} + 1.72\text{dBi antenna gain}) + 95.2 \\
 &= 36.99 \text{ dB}\mu\text{V}/\text{m} @ 3 \text{ meters (Calculating for Average)}
 \end{aligned}$$
- 42.66 dBμV/m (Peak) @ 3 meters (complies with 74 dBμV/m limit)
- 36.99 dBμV/m (Average) @ 3 meters (complies with 54 dBμV/m limit)

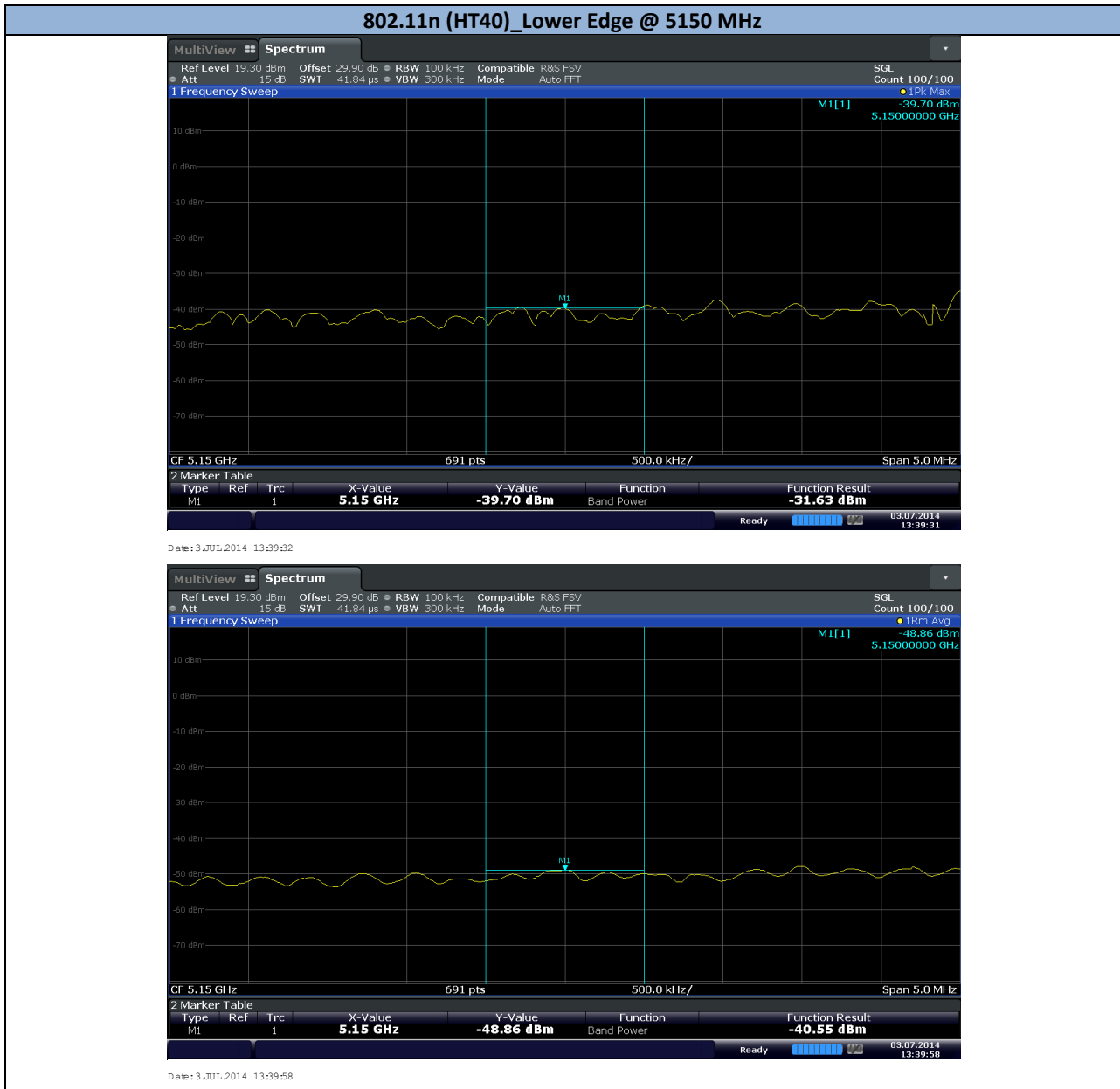
802.11n (HT20)_Higher Edge @ 5350 MHz



High Channel (5240 MHz)

Upper band edge calculation:

- 5350 MHz (not in the restricted bands)
- Limit is -27dBm EIRP
- Calculation @ 5350 MHz:
 - Peak measurement @ 5350 MHz = -51.96 dBm
 - EIRP @ 5350 MHz = -51.96 + 1.72 dBi (antenna gain)
 - = -50.24 dBm
 - Margin of compliance = -23.24 dB



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:

$$E(\text{dB}\mu\text{V}/\text{m}) = \text{EIRP (dBm)} + 95.2$$

$$= (-39.70 \text{ dBm} + 1.72\text{dBi antenna gain}) + 95.2$$

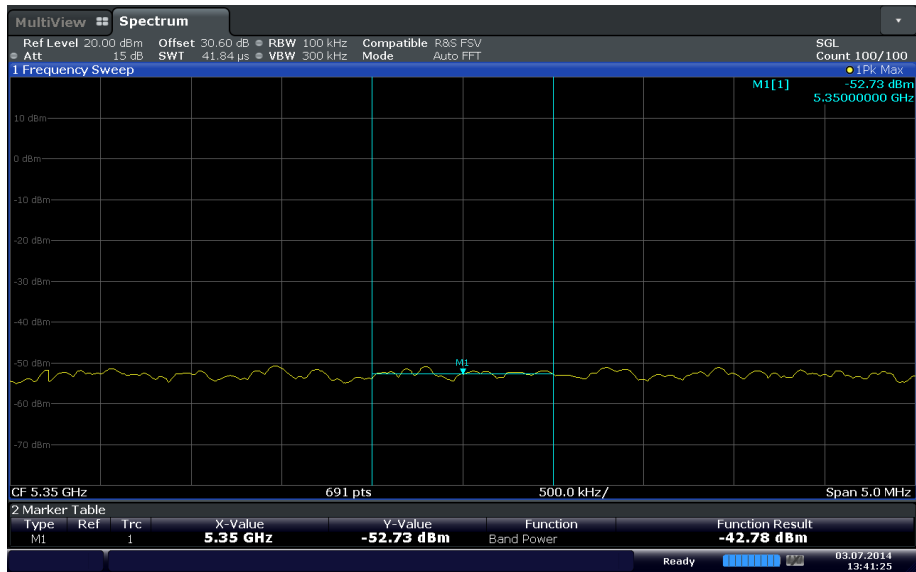
$$= 57.22 \text{ dB}\mu\text{V}/\text{m} @ 3 \text{ meters (Calculating for Peak)}$$

$$\text{EIRP (dBm)} + 95.2$$

$$= (-48.86 \text{ dBm} + 1.72\text{dBi antenna gain}) + 95.2$$

$$= 48.06 \text{ dB}\mu\text{V}/\text{m} @ 3 \text{ meters (Calculating for Average)}$$
- 57.22 dB μ V/m (Peak) @ 3 meters (complies with 74 dB μ V/m limit)
- 48.06 dB μ V/m (Average) @ 3 meters (complies with 54 dB μ V/m limit)

802.11n (HT40)_Higher Edge @ 5350 MHz



High Channel (5240 MHz)

Upper band edge calculation:

- 5350 MHz (not in the restricted bands)
- Limit is -27dBm EIRP
- Calculation @ 5350 MHz:
 - Peak measurement @ 5350 MHz = -52.73 dBm
 - EIRP @ 5350 MHz = -52.73 + 1.72 dBi (antenna gain)
 - = -51.01 dBm
 - Margin of compliance = -24.01 dB

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 Equipment Under Test and Modification State

Serial No: SH181214900051 / Test Configuration A

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

July 03, 2014 / 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 TUV SUD America Inc. Rancho Bernardo facility

Ambient Temperature 25.8°C
Relative Humidity 47.3%
ATM Pressure 98.7 kPa

2.8.7 Additional Observations

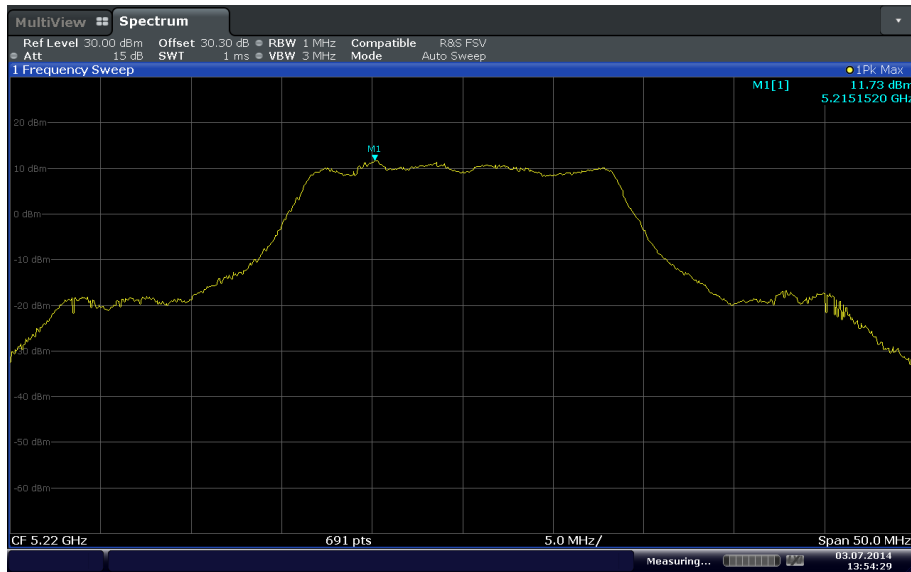
- This is a conducted test as per Section G of 789033 D01 General UNII Test Procedures v01r04 (Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E (June 06, 2014)).
- The ratio of the peak-max-hold spectrum was verified not to exceed 13 dB.
- Conducted antenna port 0 and 1 were verified and found transmit port 1 was worst case scenario when in SISO mode. Therefore, only transmit port 1 was reported.
- The offset table below to the power meter was used for the power splitter, external attenuator and cable used.

Channel (#)	Frequency (MHz)	Offset (dB)
36	5180	29.9
44	5220	30.3
48	5240	30.6

2.8.8 Test Results

See attached summary table and sample plot.

Antenna Port / Mode	Channel	Peak Max Hold (dBm)	PSD (dBm)	Ratio (dB)	Limit (dBm)	Margin (dB)
Tx Port 1 / 802.11a	36 (5180MHz)	5.07	-3.71	8.78	13	4.22
	44 (5220MHz)	4.43	-4.05	8.48	13	4.52
	48 (5240MHz)	5.10	-3.62	8.72	13	4.28
MIMO / 802.11n ht20	36 (5180MHz)	10.83	-1.28	12.11	13	0.89
	44 (5220MHz)	11.73	-0.24	11.97	13	1.03
	48 (5240MHz)	11.16	-0.88	12.04	13	0.96
MIMO / 802.11n ht40	38 (5190MHz)	9.21	-3.17	12.38	13	0.62
	46 (5230MHz)	8.40	-3.60	12	13	1.0



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MIMO / 802.11n ht20 Channel 44 (5220MHz)

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

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

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Conducted Port Setup						
7570	50MHz-18GHz Wideband Power Sensor	N1921A	MY45240588	Agilent	04/09/14	04/09/15
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	11/19/13	11/19/14
7569	Series Power Meter	N1911A P-	MY45100625	Agilent	04/22/14	04/22/15
Radiated Test Setup						
1051	Double-ridged waveguide horn antenna	3115	9408-4329	EMCO	02/28/14	02/28/16
1150	Horn antenna	3160-09	012054-004	ETS	04/26/13	04/26/15
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	07/31/13	07/31/14
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/30/14	01/30/16
1016	Pre-amplifier	PAM-0202	187	PAM	10/08/13	10/08/14
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/17/14	03/17/15
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
Conducted Emissions						
1024	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	04/05/14	04/05/15
7568	LISN	FCC-LISN-50-25-2-10	120305	Fischer Custom Comm.	07/10/13	07/10/14
8822	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	01/30/14	01/30/15
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	01/30/14	01/30/15
Miscellaneous						
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	
1072	DC Power Supply	E3610A	KR51311519	Hewlett Packard	Verified by 6452	
6452	Multimeter	3478A	2911A52177	Hewlett Packard	08/02/13	08/02/14
7562	Wideband Radio Communication Tester	CMW 500	1201.0002k50/103829	Rhode & Schwarz	10/09/13	10/09/15
7579	Temperature Chamber	115	151617	TestQuity	07/16/13	07/16/14
7560	Barometer/Temperature /Humidity Transmitter	iBTHX-W	1240476	Omega	01/30/14	01/30/15

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

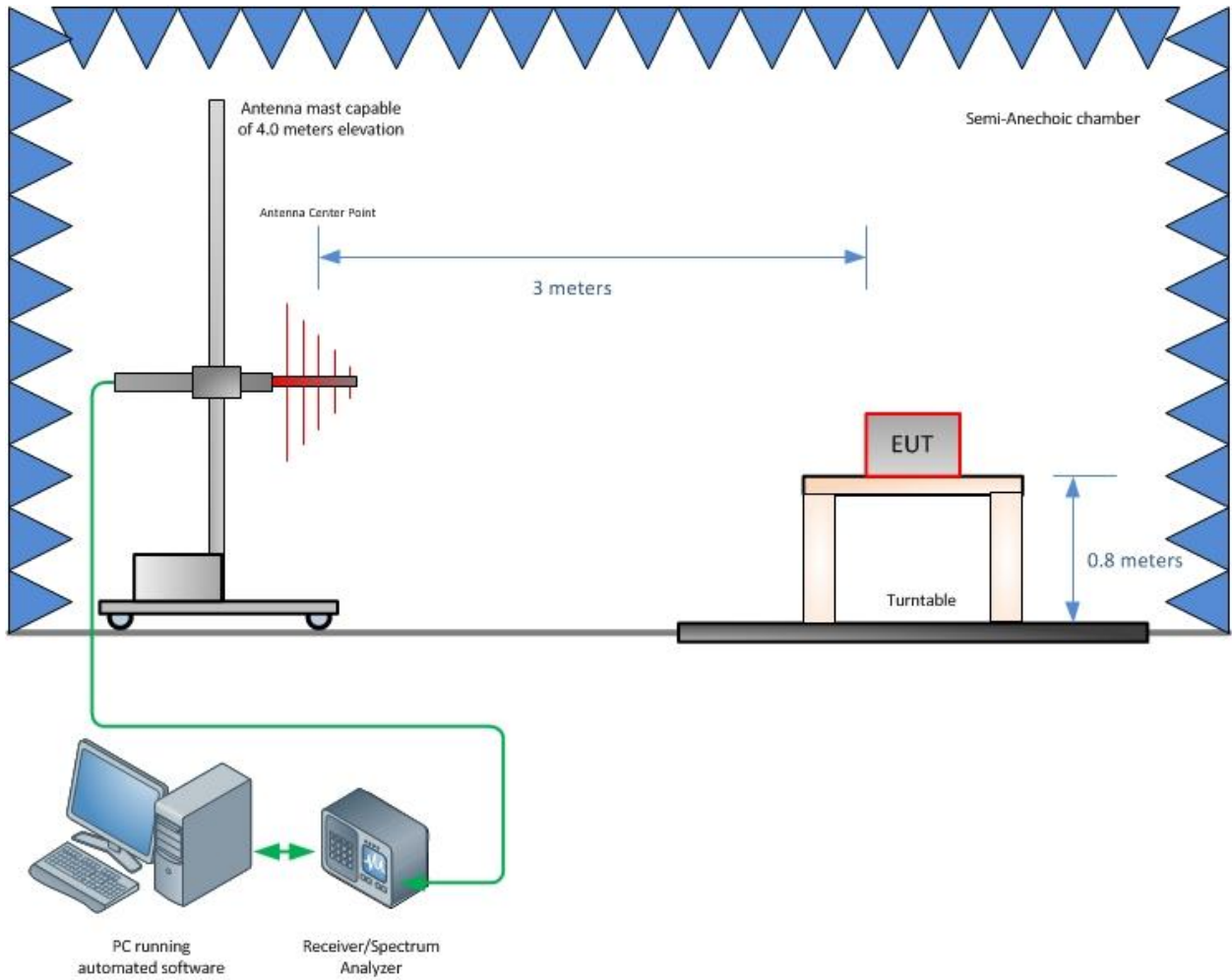
3.2.4 Conducted Emission Measurements

Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.36	0.21	0.04
2	Cables	Rectangular	0.50	0.29	0.08
3	LISN	Rectangular	0.66	0.38	0.15
4	Attenuator	Rectangular	0.30	0.17	0.03
5	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					0.80
Coverage Factor (k):					2
Expanded Uncertainty:					1.59

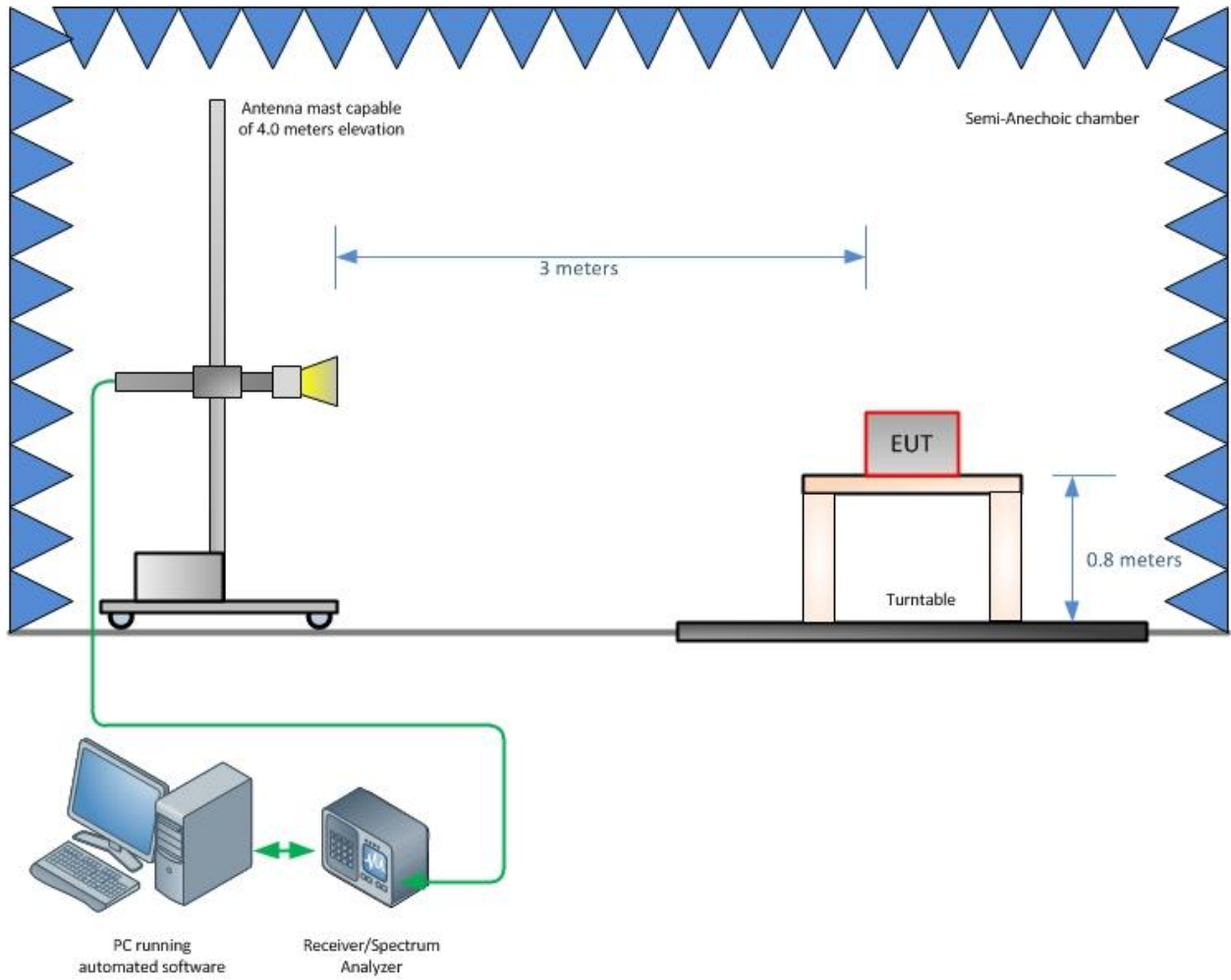
SECTION 4

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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