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Report On

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

MiFi 6620L Wireless Hotspot Modem

FCC Part 15 Subpart E §15.407

Report No. SC1403560E Rev.1

July 2014



REPORT ON Radio Testing of the
Novatel Wireless Inc.
MiFi 6620L Wireless Hotspot Modem


TEST REPORT NUMBER SC1403560E Rev.1

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DATED July 17, 2014



Revision History

SC1403560E Rev.1 Novatel Wireless Inc. MiFi 6620L Wireless Hotspot Modem					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
07/17/2014	Initial Release				Ferdinand Custodio
07/18/2014	Initial Release	Rev. 1	Model name change from MiFi6620L to MiFi 6620L	1,2,4,5,7 and 11	Ferdinand Custodio



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SECTION 1

REPORT SUMMARY

Radio Testing of the
Novatel Wireless Inc.
MiFi 6620L Wireless Hotspot Modem



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Novatel Wireless Inc. MiFi 6620L Wireless Hotspot Modem to the requirements of FCC Part 15 Subpart E §15.407

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)	MiFi 6620L
FCC ID Number	PKRNVWMIFI6620
IC Number	N/A
Serial Number(s)	SS220414800525
Number of Samples Tested	1
Start of Test	June 28, 2014
Finish of Test	July 08, 2014
Name of Engineer(s)	Alex Chang
Related Document(s)	<ul style="list-style-type: none">• RF Exposure Lab Certificate of Compliance SAR Evaluation Test Report Number: SAR.20140601 Revision D.• 789033 D01 General UNII Test Procedures Old Rules v01r04 June 06, 2014 (Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices- Part 15, Subpart E).• 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).• 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 is shown below.

Section	Spec Clause	Test Description	Result	Comments/Base Standard
2.1	§15.207(a)	Conducted Emissions	Compliant	
2.2	§15.407(a)(1)	26 dB Bandwidth	As Reported	
2.3	§15.407(a)(1)	Maximum Conducted Output Power	Compliant	
2.4	§15.407(a)(1)	Peak Power Spectral Density	Compliant	
2.5	§15.407(b)(1)/ 15.209	Unwanted Emissions Measurement	Compliant	
2.6	§15.407(b)(1)	Band-Edge Measurements	Compliant	
2.7	§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 6620L 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 Wirelss, model: SSW-2597.

1.3.2 EUT General Description

EUT Description	Wireless Hotspot Modem
Model Number(s)	MiFi 6620L
Rated Voltage	Nominal 3.8VDC Li-Ion Battery AC Power Adaptor: Input: 100-240VAC/0.3A/50-60Hz Output: 5.0 VDC/2.0A
Frequency Range	5180 MHz to 5240 MHz in the 5150 MHz to 5350 MHz Band
Number of Operating Frequencies	4
Channels Verified	Low Channel 5180 MHz Mid Channel (1) 5200 MHz Mid Channel (2) 5220 MHz High Channel 5240 MHz
Antenna Type (used during evaluation)	Integral (Complies with Part 15.203 requirements)



1.3.3 Antenna Details

Internal Antennas Details
(Client declaration, max. antenna gain covered under this test report)

WWAN Antenna – CDMA/GPRS/EDGE/WCDMA/LTE

Manufacturer: NVTL
Part Number: NVTL DA-01020345
Type: Monopole
Antenna Gain:

- CDMA BC0 – 850MHz: -3.46 dBi
- CDMA BC1 – 1900MHz: -0.97 dBi
- GSM850 – 850MHz: -2.0 dBi
- GSM1900 – 1900MHz: -1.64 dBi
- WCDMA Band 5 – 850MHz: -2.0 dBi
- WCDMA Band 2 – 1900MHz: -1.64 dBi
- LTE Band 2 – 1900MHz: -1.64 dBi
- LTE Band 4 – 1700MHz: 0.83 dBi
- LTE Band 13 – 700MHz: -1.09 dBi

WLAN – Antenna: 802.11 a/b/g/n

Manufacturer: NVTL
Part Number: NVTL 12023203
Type: CERAMIC CHIP
Antenna Tx0 Gain:

- 802.11 b/g/n 2.4MHz : -0.94 dBi
- 802.11 a/n 5GHz: 1.72 dBi

Antenna Tx1 Gain:

- 802.11 b/g/n 2.4MHz : -0.94 dBi
- 802.11 a/n 5GHz: 1.72 dBi

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).

1.4.3 Support Equipment and I/O cables

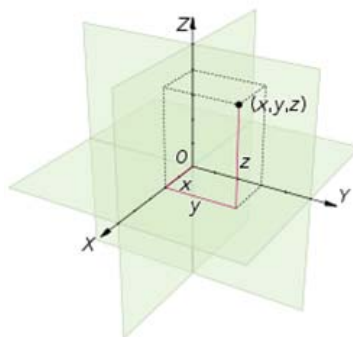
Manufacturer	Equipment/Cable	Description
Dell	Support Laptop	Support Laptop for WiFi Test configuration, Model: Latitude XT2
Dell	Support Laptop Power Supply Adaptor	Model: PA-1900-02D
Novatel Wireless	USB Cable	Micro USB Type B to Standard USB Type B

1.4.4 Worst Case Configuration

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

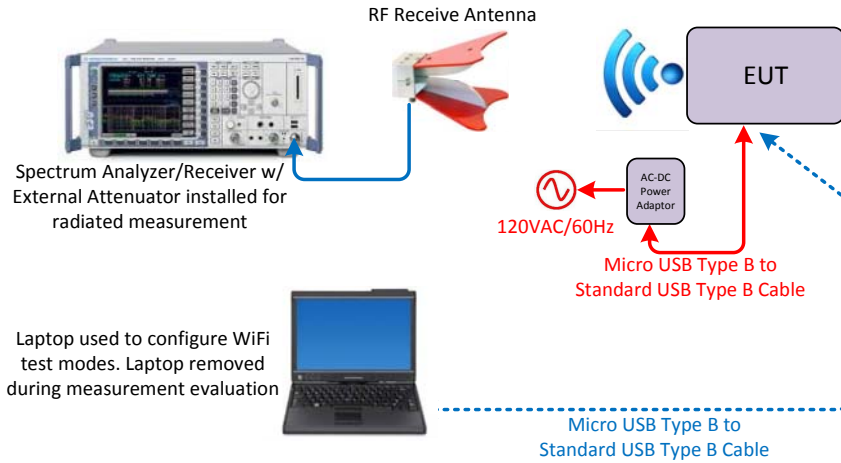
System Mode	Frequency Range (MHz)	Mode	Channel	Data Rate (Mbps)	Average Output Power (dBm)	Average Output Power (mW)
SISO	5180 - 5240	802.11a	44	6	7.98	6.28
MIMO	5180 - 5240	802.11n (HT20)	48	6.5	10.95	12.45

For radiated measurements X, Y, and Z orientations were verified. The verification was determined "Y" as worst case configuration.

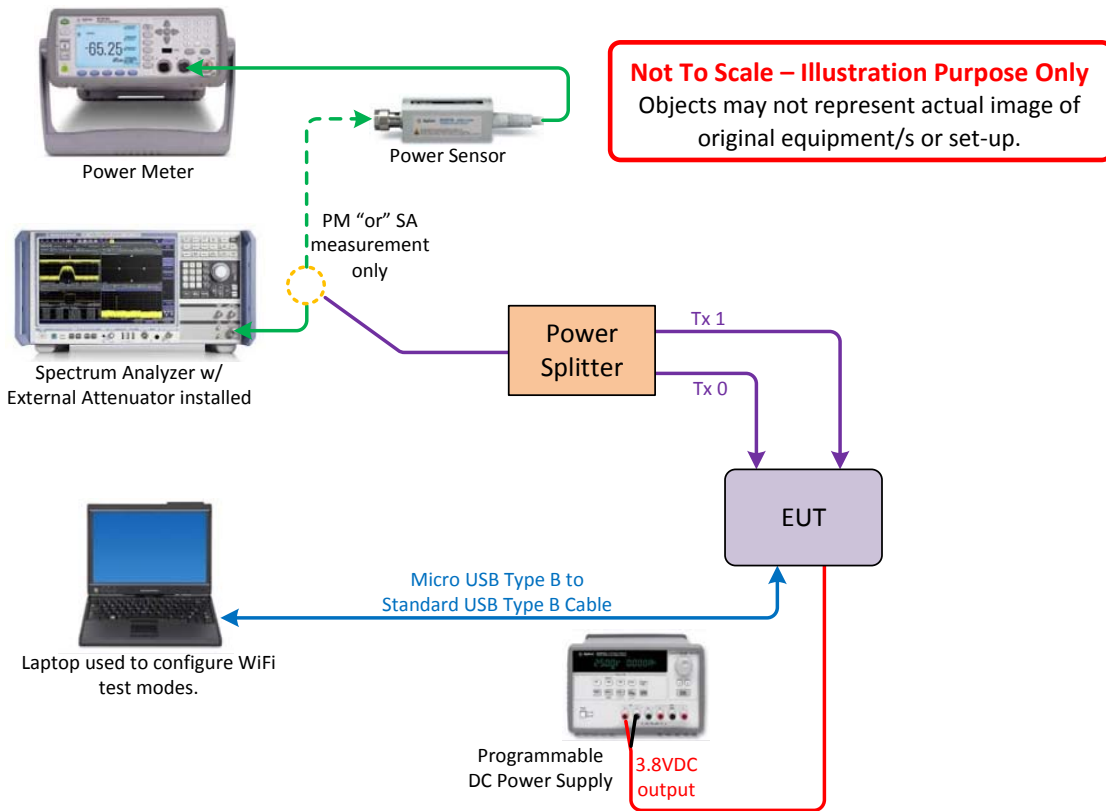


1.4.5 Simplified Test Configuration Diagram

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
Serial Number SS220414800525		
N/A	-	-

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

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz and 789033 D01 General UNII Test Procedures v01r01 (Federal Communications Commission Office of Engineering and Technology Laboratory Division Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E.

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

1.8 TEST FACILITY 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 6620L Wireless Hotspot Modem



2.1 CONDUCTED EMISSIONS

2.1.1 Specification Reference

Part 15 Subpart C §15.207(a)

2.1.2 Standard Applicable

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

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

**Decreases with the logarithm of the frequency.*

2.1.3 Equipment Under Test and Modification State

Serial No: SS220414800525 / 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)

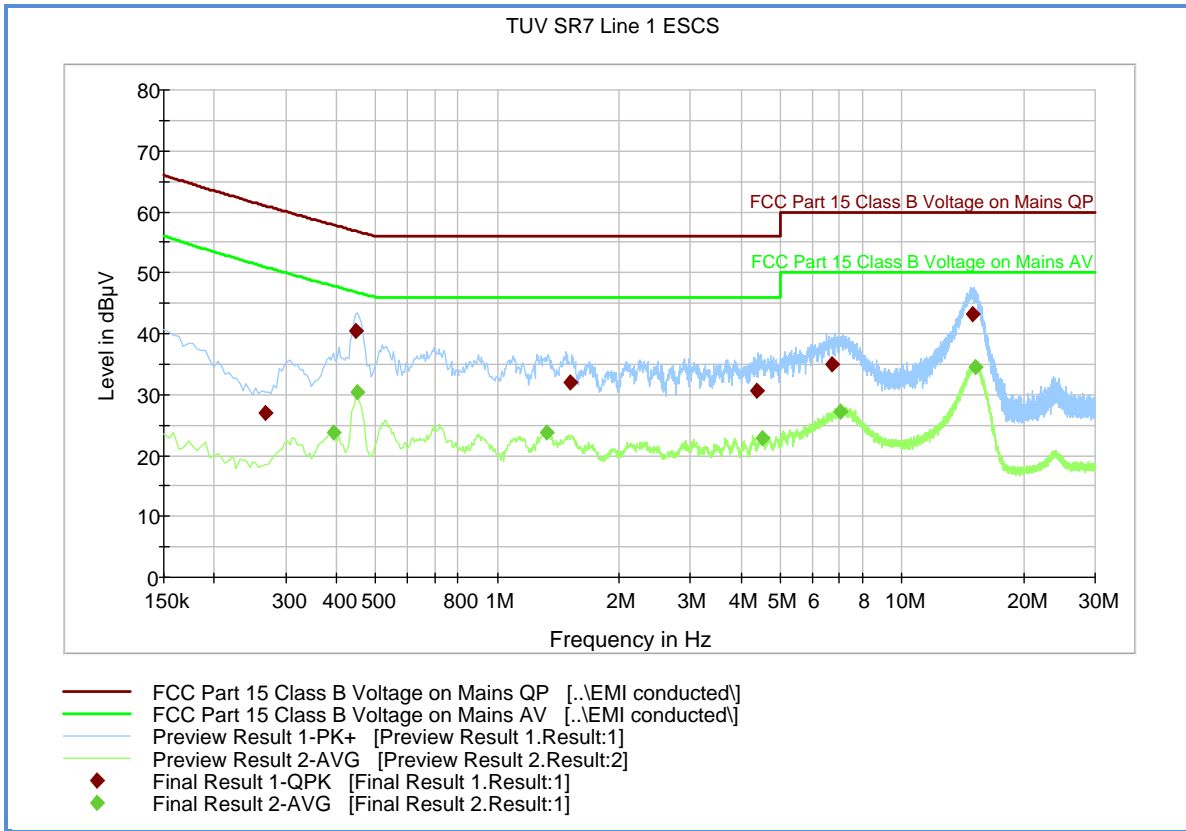
Measuring equipment raw measurement (db μ V) @ 150kHz		5.5
Correction Factor (dB)	Asset# 8607 (20 dB attenuator)	19.9
	Asset# 1177 (cable)	0.15
	Asset# 1176 (cable)	0.35
	Asset# 7568 (LISN)	0.30
Reported QuasiPeak Final Measurement (dbμV) @ 150kHz		26.2

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)_High Channel Transmit mode



Quasi Peak

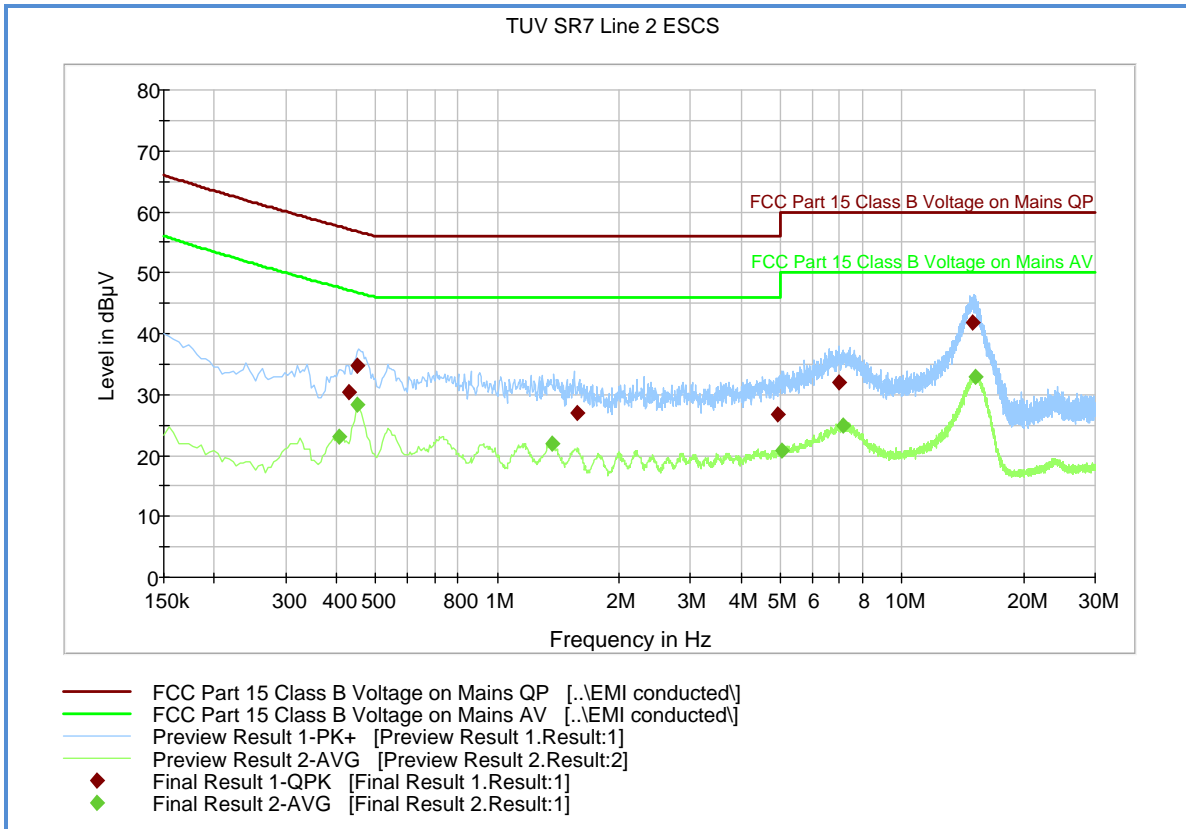
Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.267000	26.9	1000.0	9.000	Off	L1	20.1	34.1	61.0
0.447000	40.5	1000.0	9.000	Off	L1	20.0	16.4	56.9
1.518000	32.1	1000.0	9.000	Off	L1	20.0	23.9	56.0
4.375500	30.6	1000.0	9.000	Off	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)_High Channel 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 §15.407(a)(1)(iv)

2.2.2 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.

2.2.3 Equipment Under Test and Modification State

Serial No: SS220414800525 / Test Configuration A

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

July 03, 2014 / AC

Test Equipment Used

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

2.2.5 Environmental Conditions / Test Location

Test performed at TÜV SUD America Inc. Rancho Bernardo facility

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

2.2.6 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.

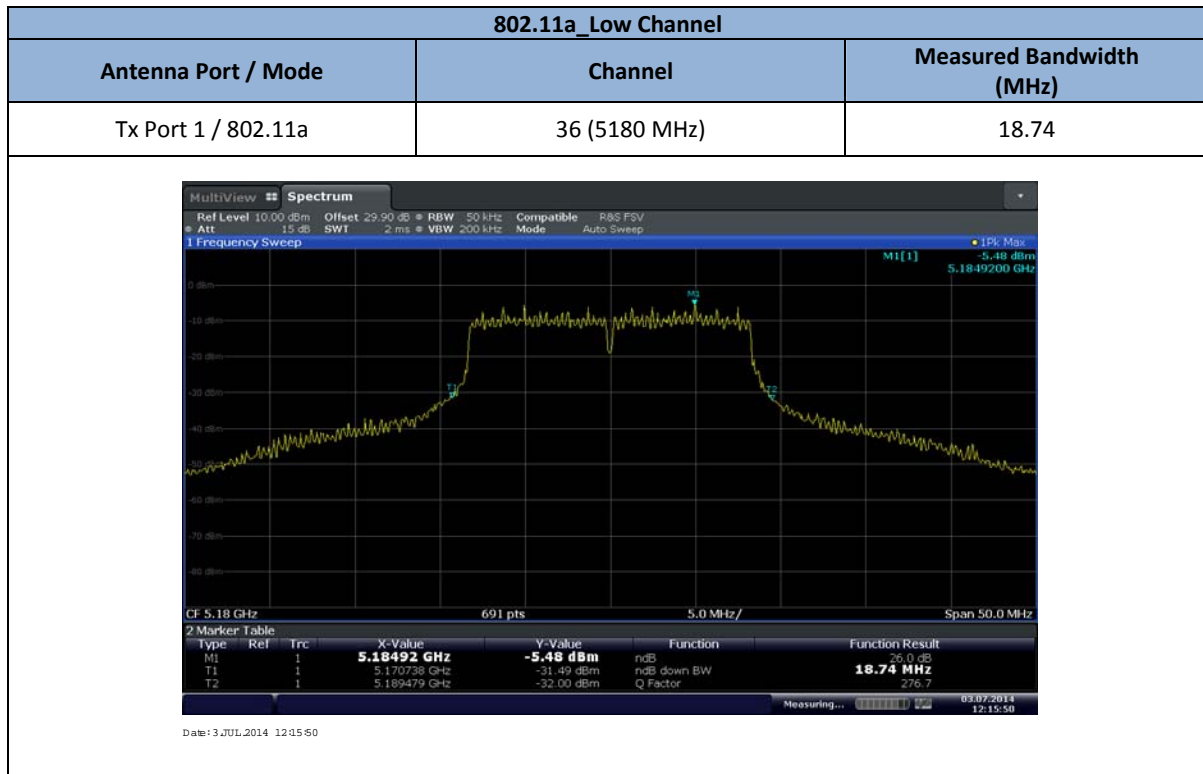


- Trace is max hold.
- The offset table below to the power meter was used for the power splitter, external attenuator and cable used.

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

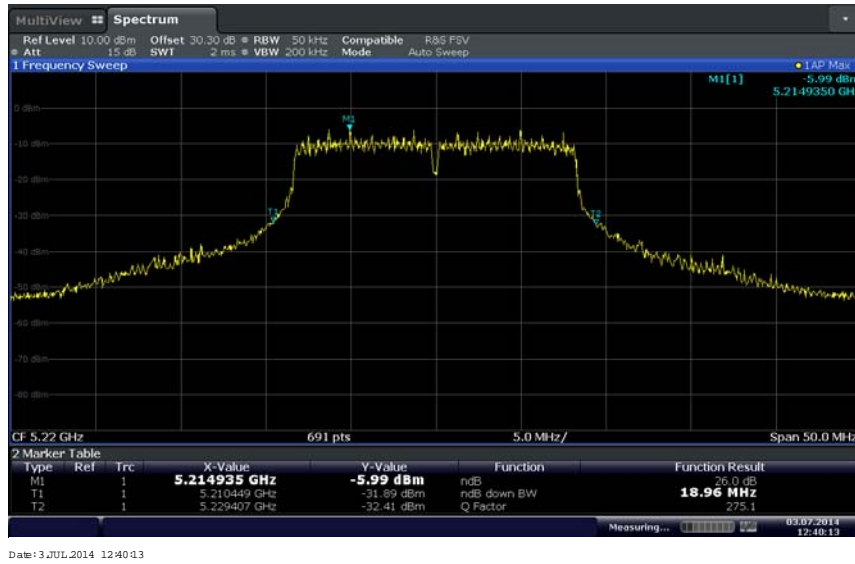
- n dB down" (26dB) marker function of the spectrum analyzer was used for this test.
- RBW adjusted until RBW/EBW ratio is approximately 1%.

2.2.7 Test Results (as reported)

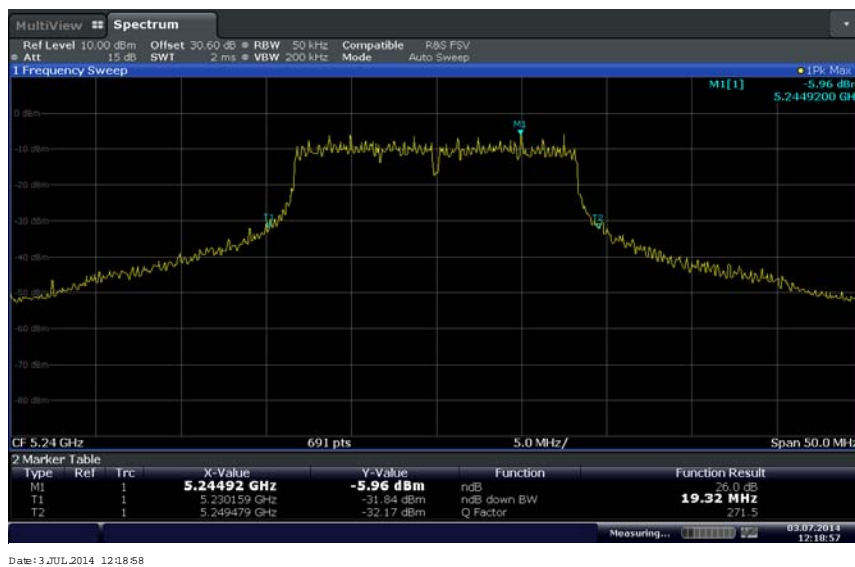




802.11a_Mid Channel		
Antenna Port / Mode	Channel	Measured Bandwidth (MHz)
Tx Port 1 / 802.11a	44 (5220 MHz)	18.96

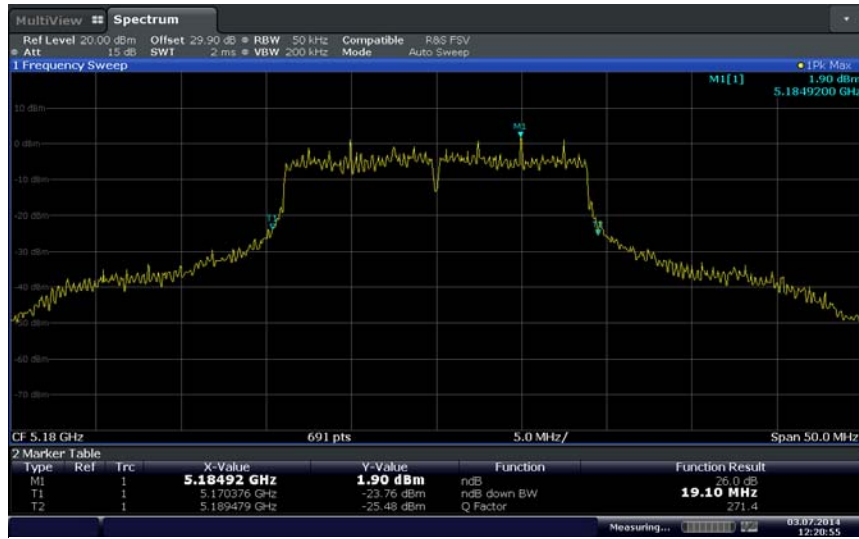


802.11a_High Channel		
Antenna Port / Mode	Channel	Measured Bandwidth (MHz)
Tx Port 1 / 802.11a	48 (5240 MHz)	19.32



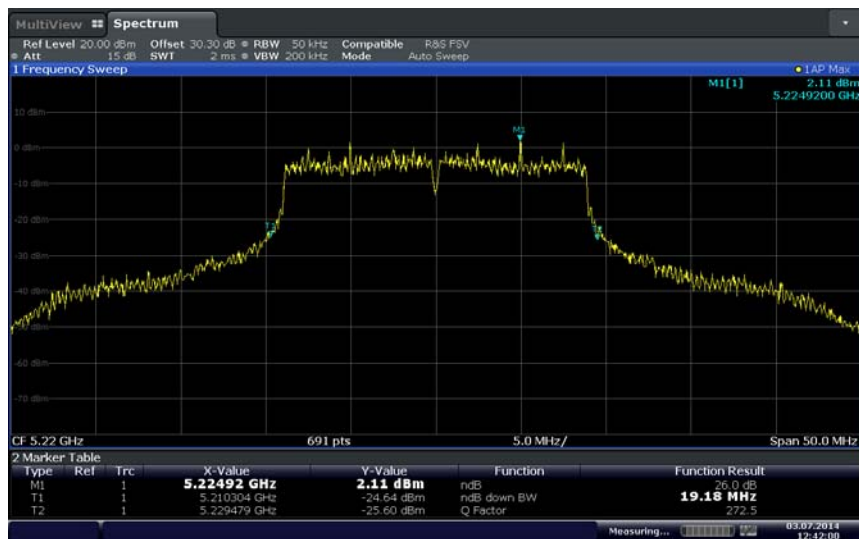


802.11n (HT20)_Low Channel		
Antenna Port / Mode	Channel	Measured Bandwidth (MHz)
MIMO / 802.11n (HT20)	36 (5180 MHz)	19.10



Date: 3 JUL 2014 12:20:55

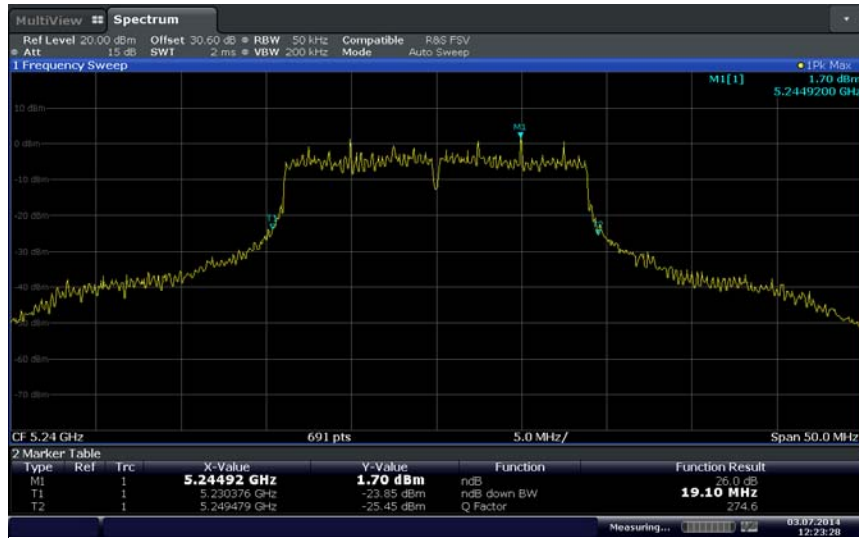
802.11n (HT20)_Mid Channel		
Antenna Port / Mode	Channel	Measured Bandwidth (MHz)
MIMO / 802.11n (HT20)	44 (5220 MHz)	19.18



Date: 3 JUL 2014 12:42:00

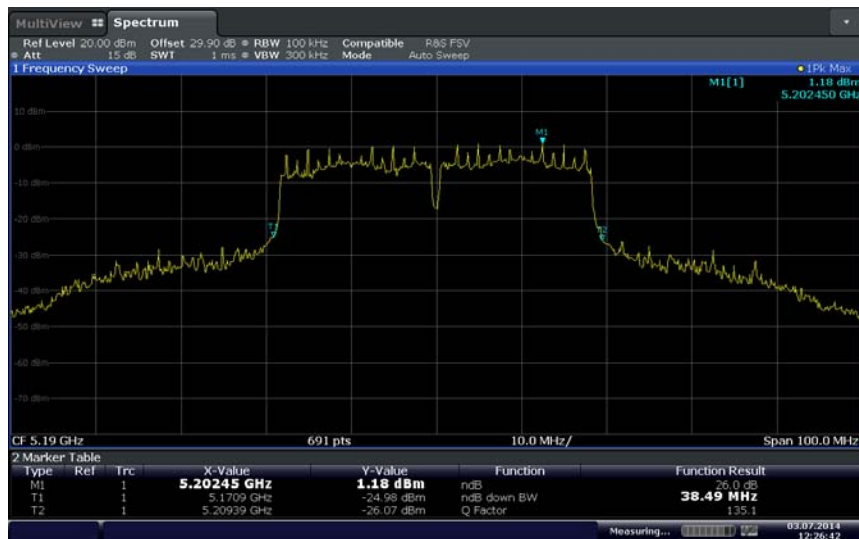


802.11n (HT20)_High Channel		
Antenna Port / Mode	Channel	Measured Bandwidth (MHz)
MIMO / 802.11n (HT20)	48 (5240 MHz)	19.10

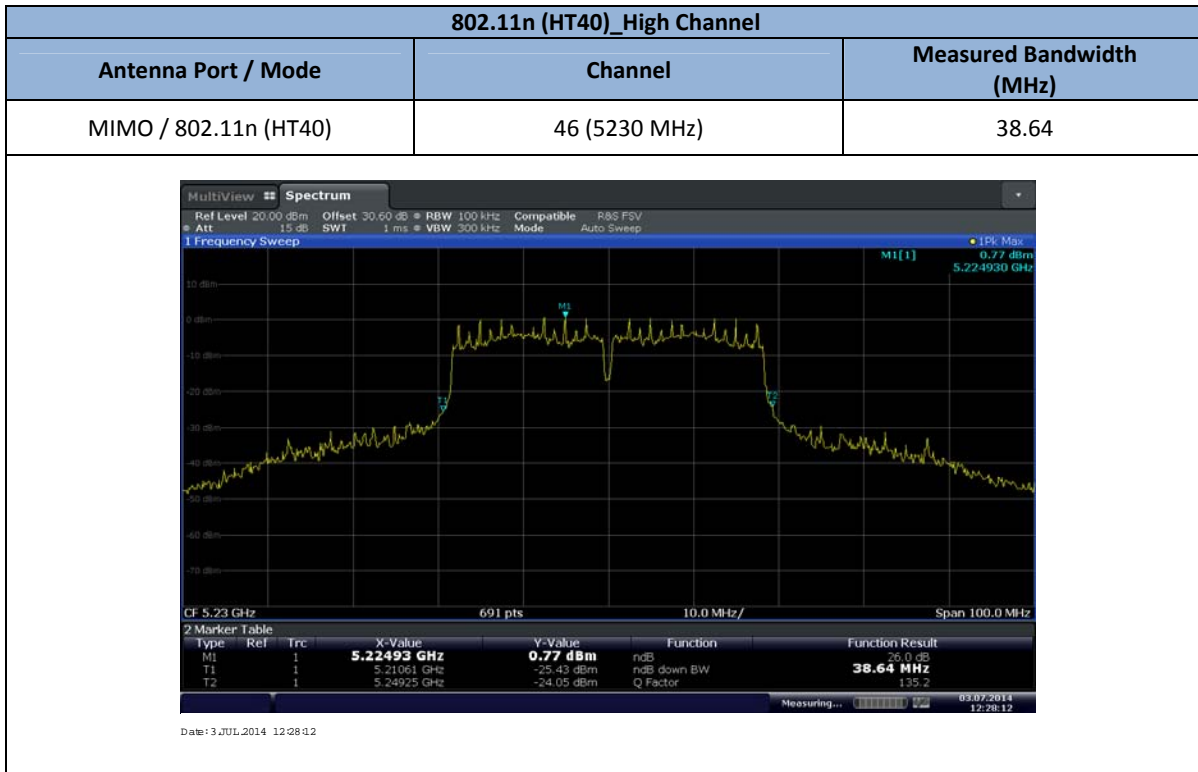


Date: 3 JUL 2014 12:23:28

802.11n (HT40)_High Channel		
Antenna Port / Mode	Channel	Measured Bandwidth (MHz)
MIMO / 802.11n (HT40)	38 (5190 MHz)	38.49



Date: 3 JUL 2014 12:26:42





2.3 MAXIMUM OUTPUT POWER

2.3.1 Specification Reference

Part 15 Subpart E §15.407(a)(1) (iv)

2.3.2 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.

2.3.3 Equipment Under Test and Modification State

Serial No: SS220414800525 / Test Configuration A

2.3.4 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; TÜV performed verification on random channels and worst case conditions and did not find any significant differences.

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 SUD America Inc. Rancho Bernardo facility

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

2.3.7 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.

2.3.8 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**



2.3.9 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			



2.4 POWER SPECTRAL DENSITY

2.4.1 Specification Reference

Part 15 Subpart E §15.407(a)(1) (iv)

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.

2.4.3 Equipment Under Test and Modification State

Serial No: SS220414800525 / Test Configuration A

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

July 03, 2014 / 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	25.8°C
Relative Humidity	47.3%
ATM Pressure	98.7 kPa

2.4.7 Additional Observations

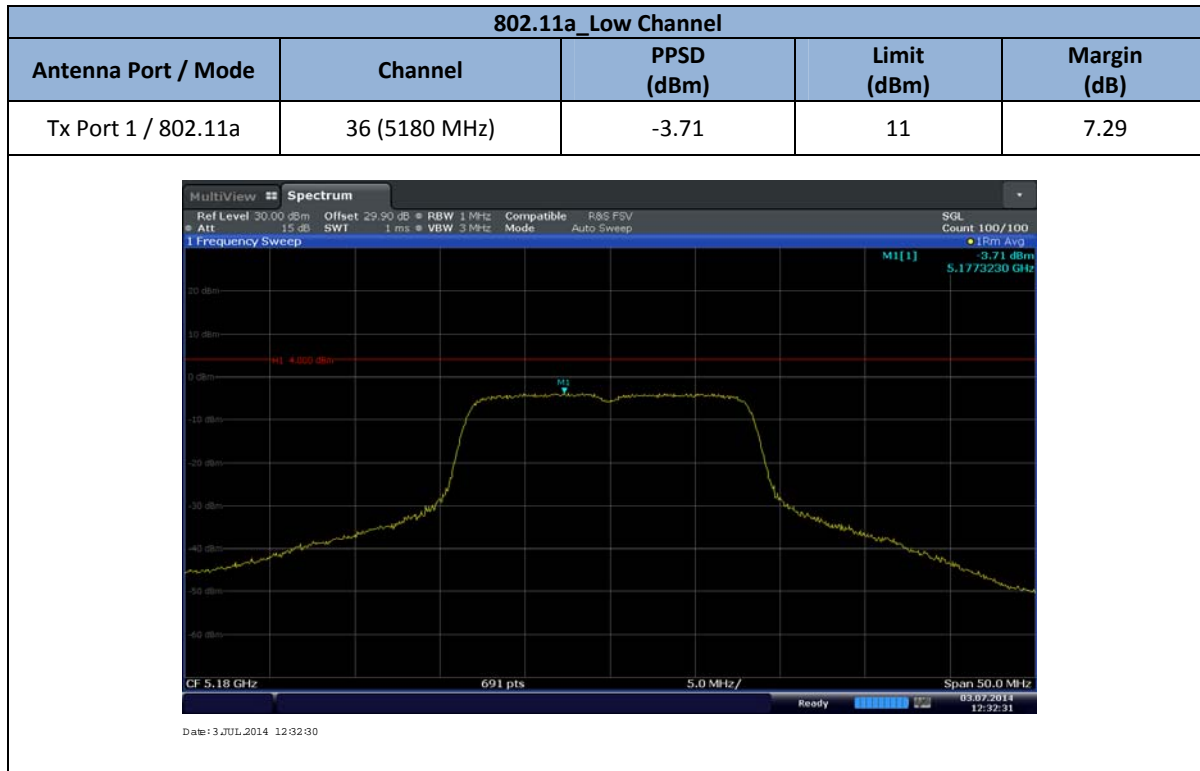
- This is a conducted test as per Section F of 789033 D02 General UNII Test Procedures New Rules v01 June 06, 2014 (Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E).
- Conducted antenna port 0 and 1 were verified and found transmit 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

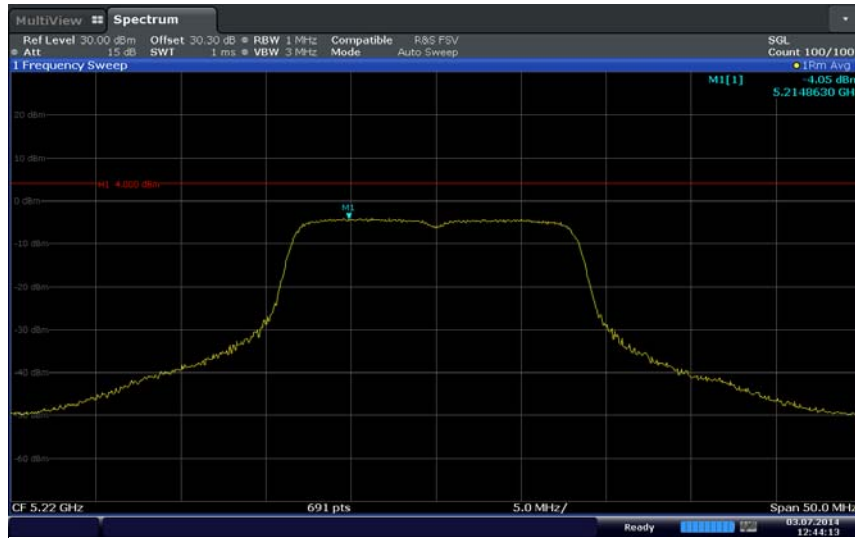
2.4.8 Test Results (PPSD)

See attached plots and table.

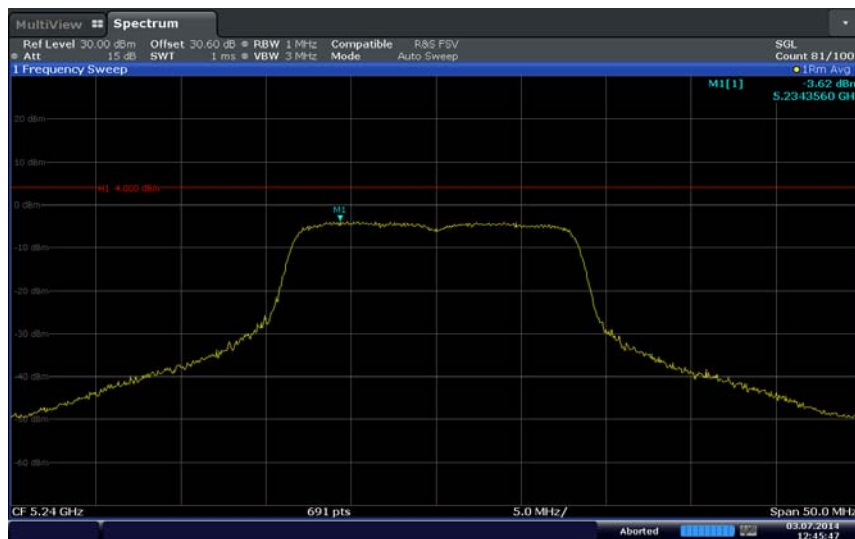




802.11a_Mid Channel				
Antenna Port / Mode	Channel	PPSD (dBm)	Limit (dBm)	Margin (dB)
Tx Port 1 / 802.11a	44 (5220 MHz)	-4.05	11	6.95

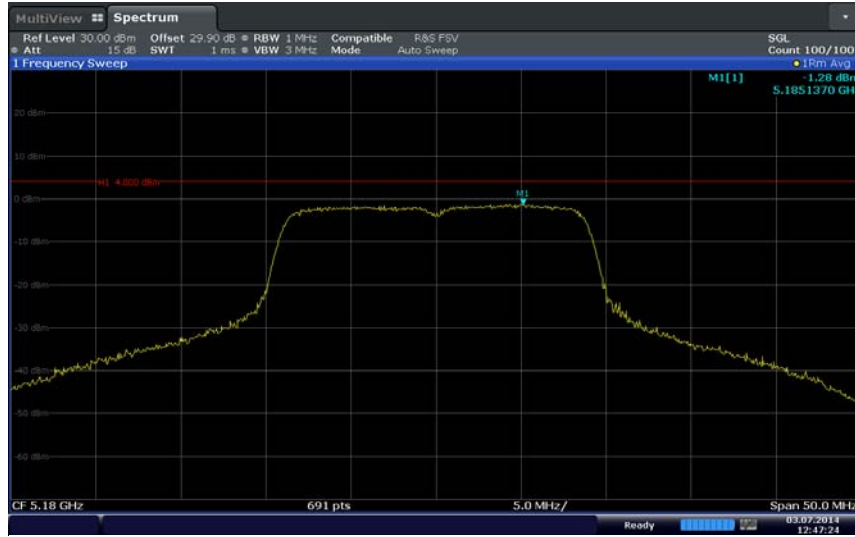


802.11a_High Channel				
Antenna Port / Mode	Channel	PPSD (dBm)	Limit (dBm)	Margin (dB)
Tx Port 1 / 802.11a	48 (5240 MHz)	-3.62	11	7.38



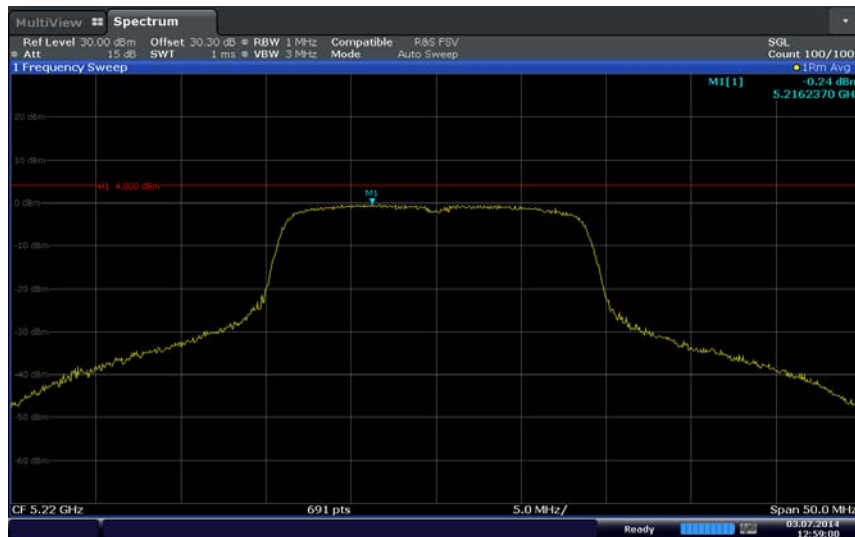


802.11n (HT20)_Low Channel				
Antenna Port / Mode	Channel	PPSD (dBm)	Limit (dBm)	Margin (dB)
MIMO / 802.11n (HT20)	36 (5180 MHz)	-1.28	11	12.28



Date: 3 JUL 2014 12:47:24

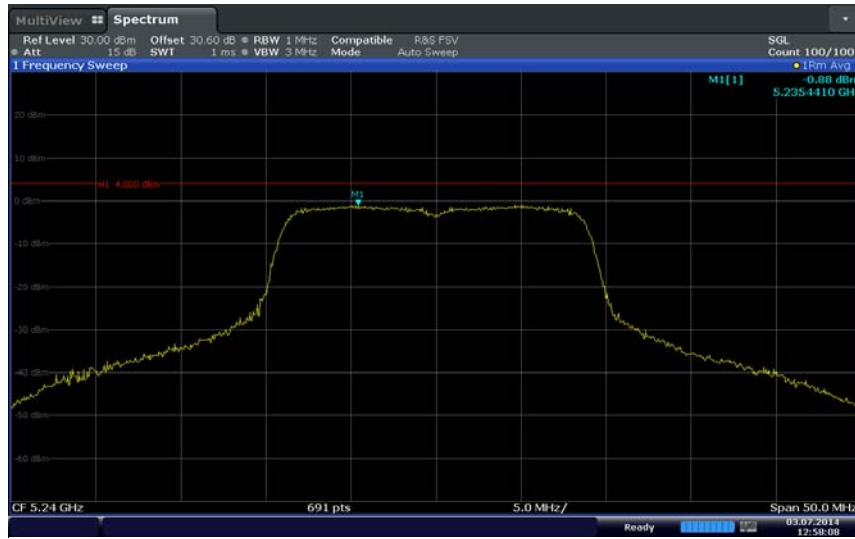
802.11n (HT20)_Mid Channel				
Antenna Port / Mode	Channel	PPSD (dBm)	Limit (dBm)	Margin (dB)
MIMO / 802.11n (HT20)	44 (5220 MHz)	-0.24	11	11.24



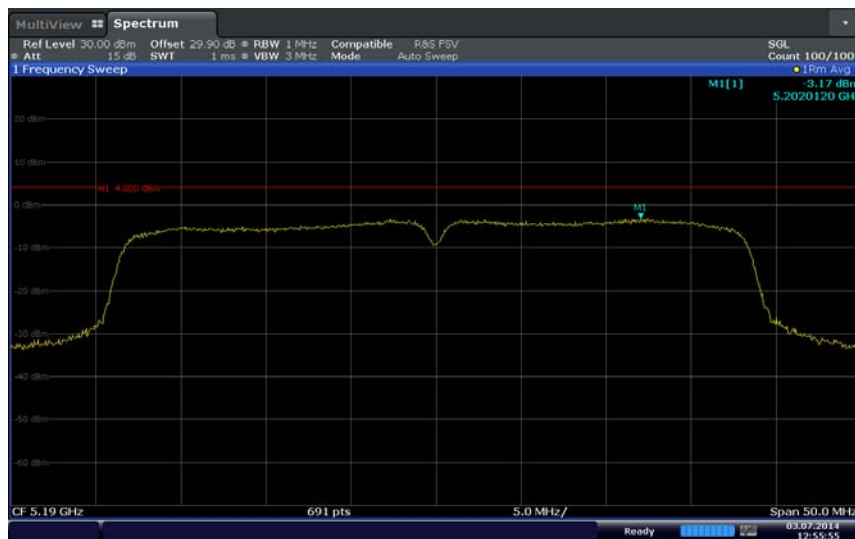
Date: 3 JUL 2014 12:59:00



802.11n (HT20)_High Channel				
Antenna Port / Mode	Channel	PPSD (dBm)	Limit (dBm)	Margin (dB)
MIMO / 802.11n (HT20)	48 (5240 MHz)	-0.88	11	11.88

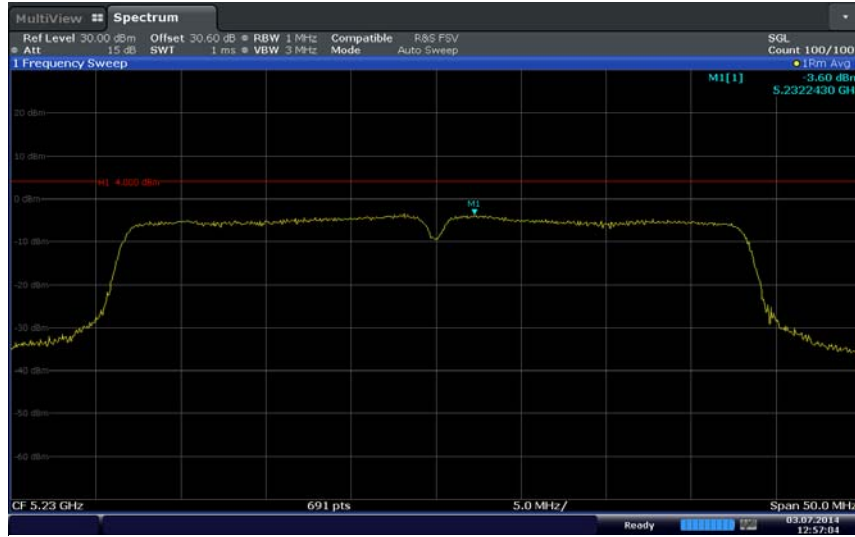


802.11n (HT40)_Low Channel				
Antenna Port / Mode	Channel	PPSD (dBm)	Limit (dBm)	Margin (dB)
MIMO / 802.11n (HT40)	38 (5190 MHz)	-3.17	11	14.17





802.11n (HT40)_High Channel				
Antenna Port / Mode	Channel	PPSD (dBm)	Limit (dBm)	Margin (dB)
MIMO / 802.11n (HT40)	46 (5230 MHz)	-3.60	11 (8 for MIMO)	14.60



Date: 3 JUL 2014 12:57:04



2.5 BAND-EDGE MEASUREMENTS (CONDUCTED)

2.5.1 Specification Reference

Part 15 Subpart E §15.407(b)(1) and (7)

2.5.2 Standard Applicable

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

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

2.5.3 Equipment Under Test and Modification State

Serial No: SS220414800525 / Test Configuration A

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

Jul 03, 2014 / 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 SUD America Inc. Rancho Bernardo facility

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

2.5.7 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.

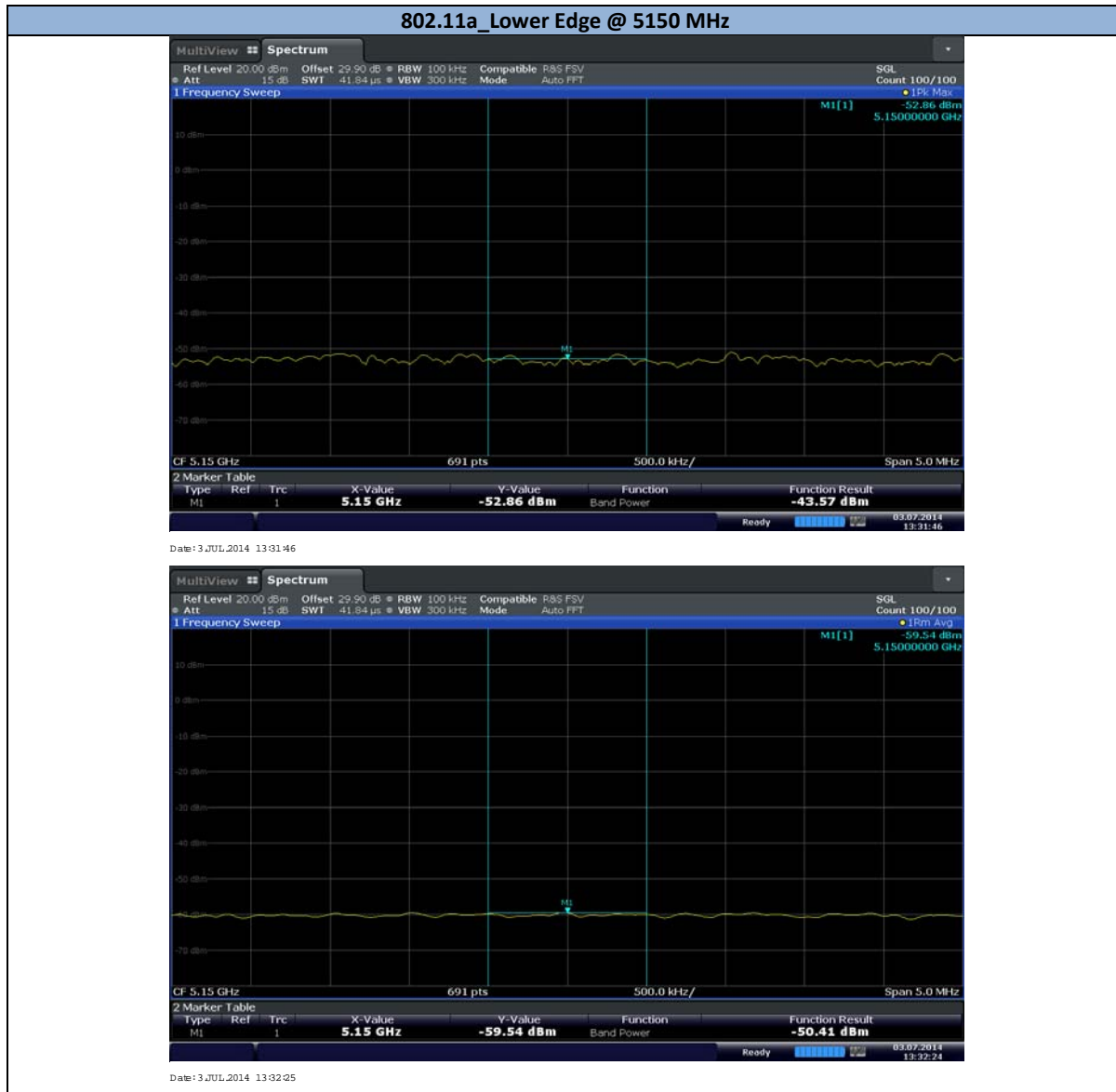
Channel (#)	Frequency (MHz)	Offset (dB)
36	5180	29.9
44	5220	30.3
48	5240	30.6



- 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.

2.5.8 Test Results

Complies. See attached plots and calculations.



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:

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

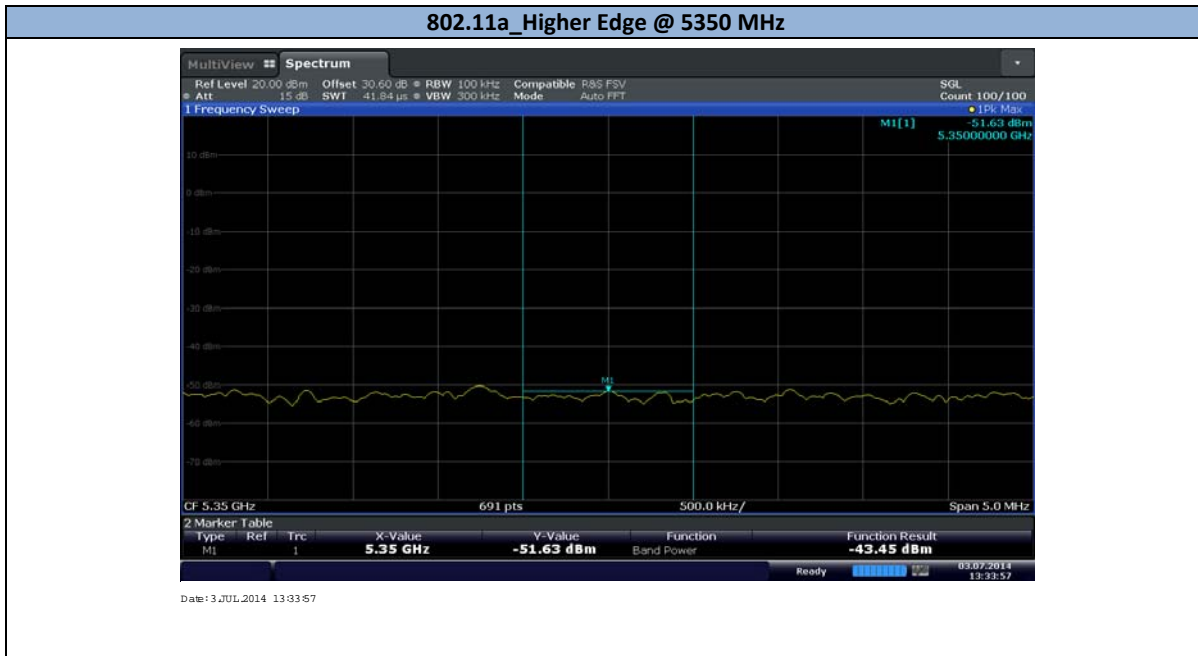
$$= (-52.86 \text{ dBm} + 1.72\text{dBi antenna gain}) + 95.2$$

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

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

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

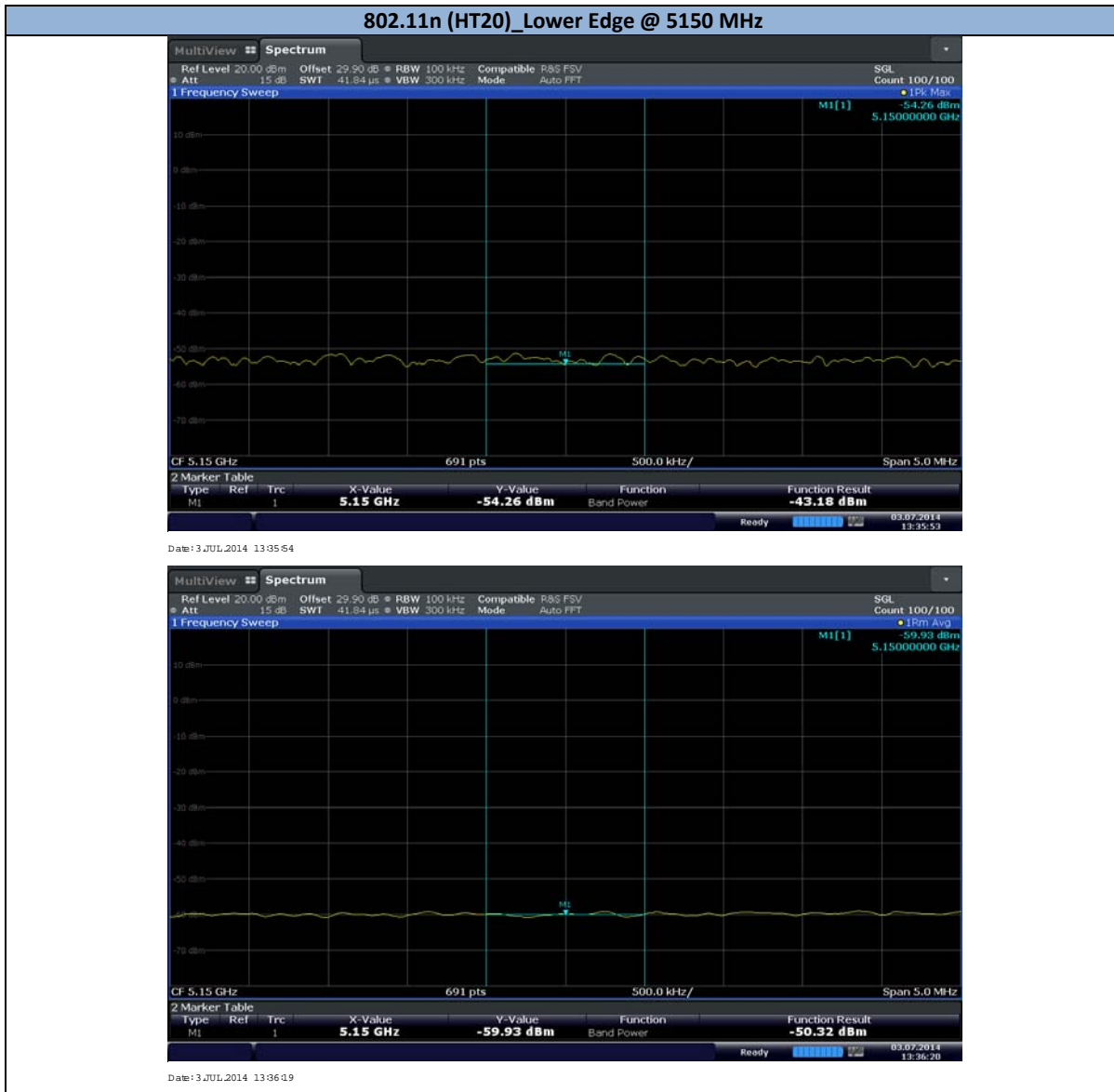
$$= 37.38 \text{ dB}\mu\text{V}/\text{m} @ 3 \text{ meters (Calculating for Average)}$$
- 44.06 dBμV/m (Peak) @ 3 meters (complies with 74 dBμV/m limit)
- 37.38 dBμV/m (Average) @ 3 meters (complies with 54 dBμV/m limit)



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:

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

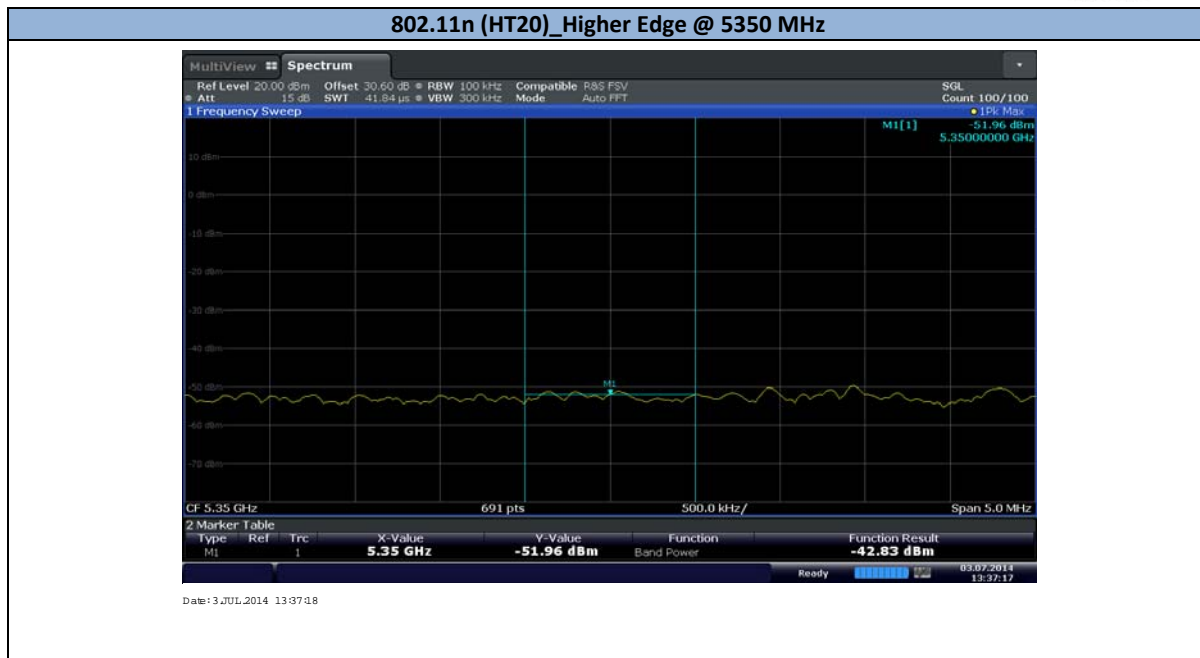
$$= (-54.26 \text{ dBm} + 1.72\text{dBi antenna gain}) + 95.2$$

$$= 42.66 \text{ dB}\mu\text{V}/\text{m} @ 3 \text{ meters (Calculating for Peak)}$$

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

$$= (-59.93 \text{ dBm} + 1.72\text{dBi antenna gain}) + 95.2$$

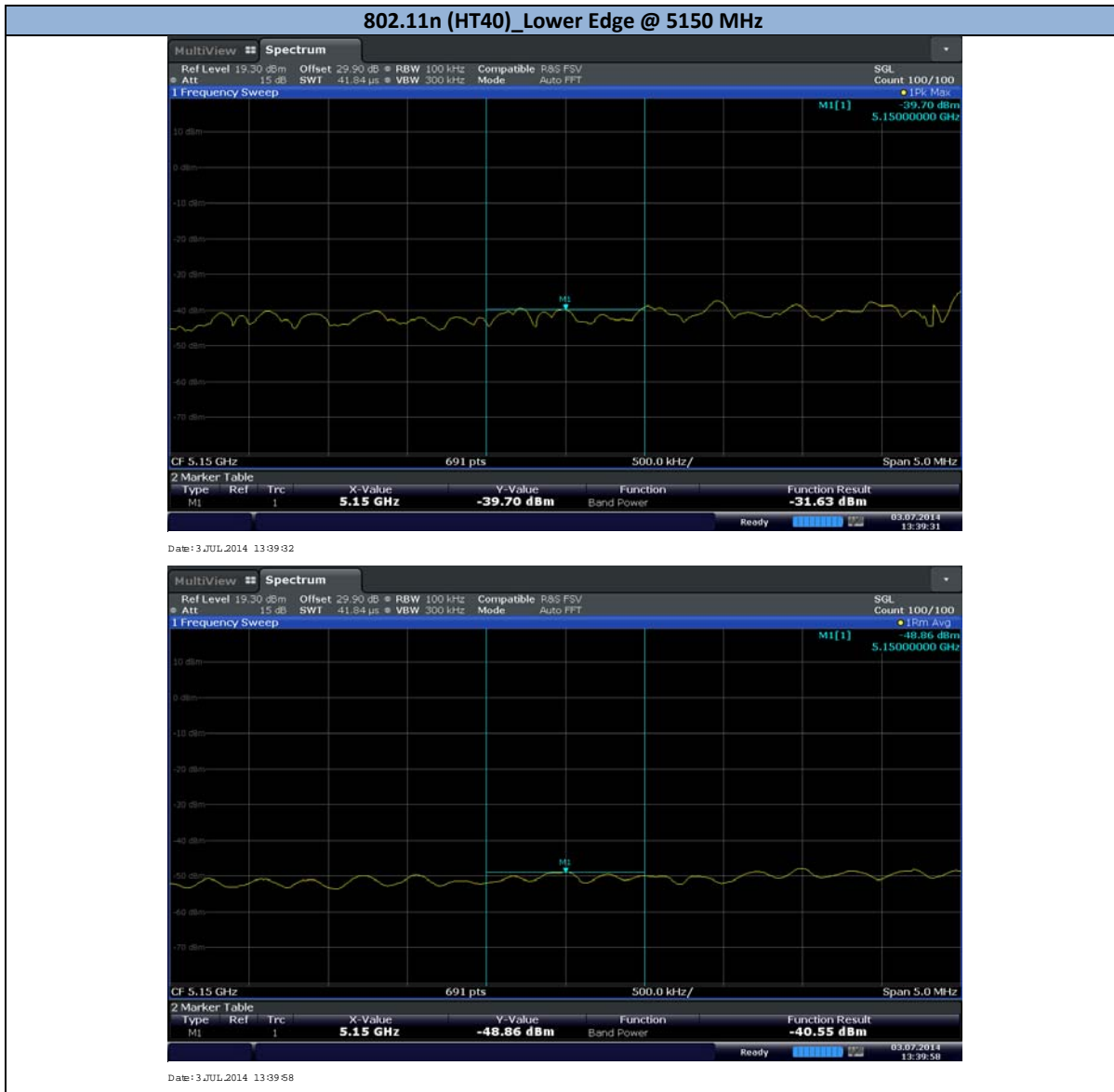
$$= 36.99 \text{ dB}\mu\text{V}/\text{m} @ 3 \text{ meters (Calculating for Average)}$$
- 42.66 dBμV/m (Peak) @ 3 meters (complies with 74 dBμV/m limit)
- 36.99 dBμV/m (Average) @ 3 meters (complies with 54 dBμV/m limit)



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:

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

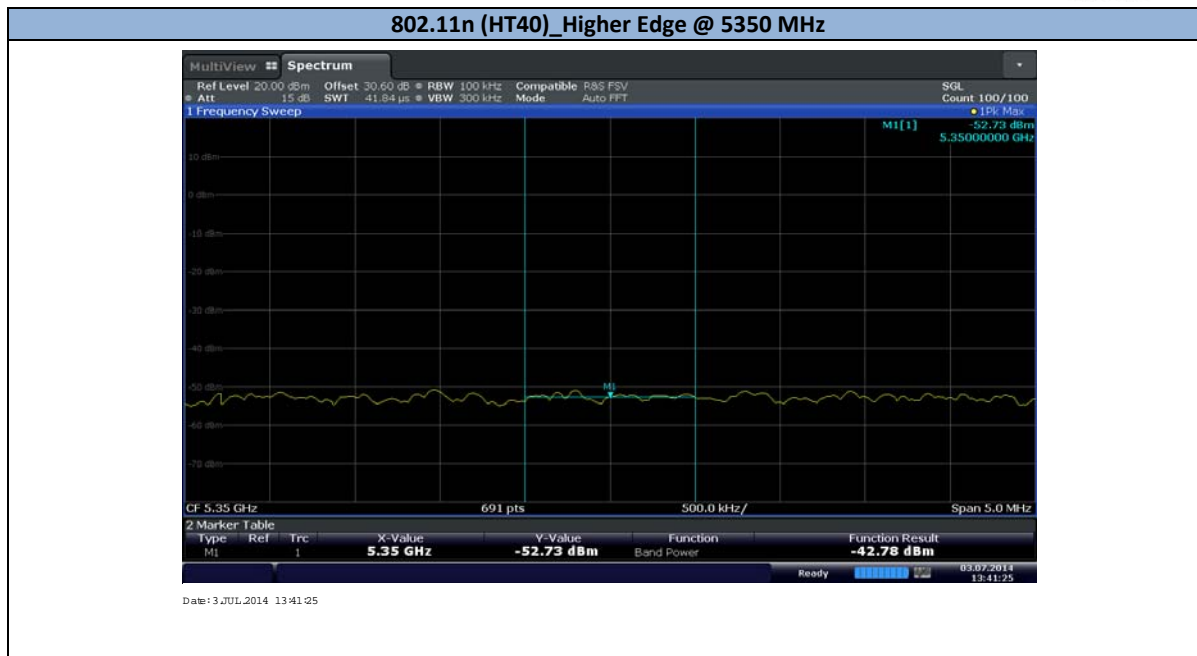
$$= (-39.70 \text{ dBm} + 1.72\text{dBi antenna gain}) + 95.2$$

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

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

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

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



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



2.6 SPURIOUS RADIATED EMISSIONS

2.6.1 Specification Reference

Part 15 Subpart E §15.407(b)(1)

2.6.2 Standard Applicable

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

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

2.6.3 Equipment Under Test and Modification State

Serial No: SS220414800525 / Test Configuration B

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

June 26 and 27, 2014 / 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 Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

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

2.6.7 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):
E(dBμV/m) = 95.2-EIRP (dBm) @ 3 meters using 1MHz RBW
= 95.2-27 dBm
= 68.2 dBμV/m



2.6.8 Sample Computation (Radiated Emission)

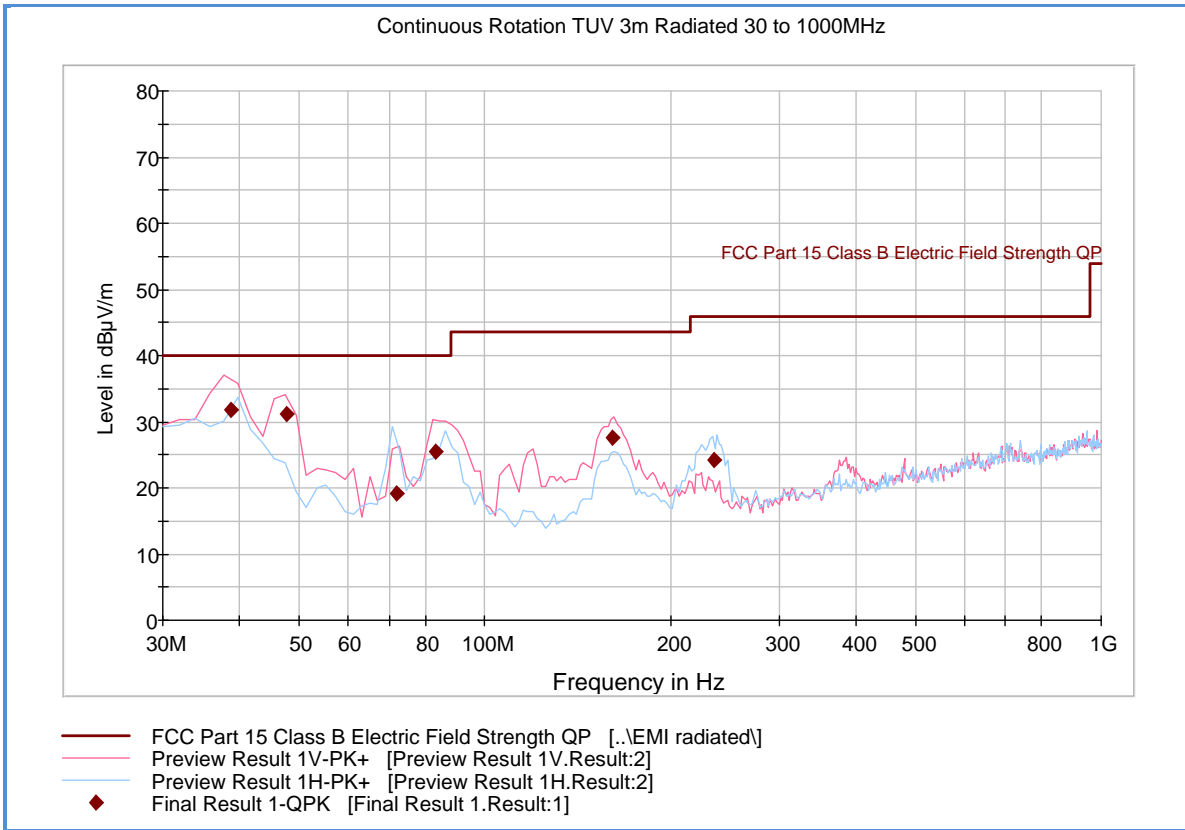
Measuring equipment raw measurement (db μ V) @ 30 MHz			24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3	-12.6
	Asset# 1172 (cable)	0.3	
	Asset# 1016 (preamplifier)	-30.7	
	Asset# 1175(cable)	0.3	
	Asset# 1002 (antenna)	17.2	
Reported QuasiPeak Final Measurement (db μ V/m) @ 30MHz			11.8

2.6.9 Test Results

See attached plots.



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



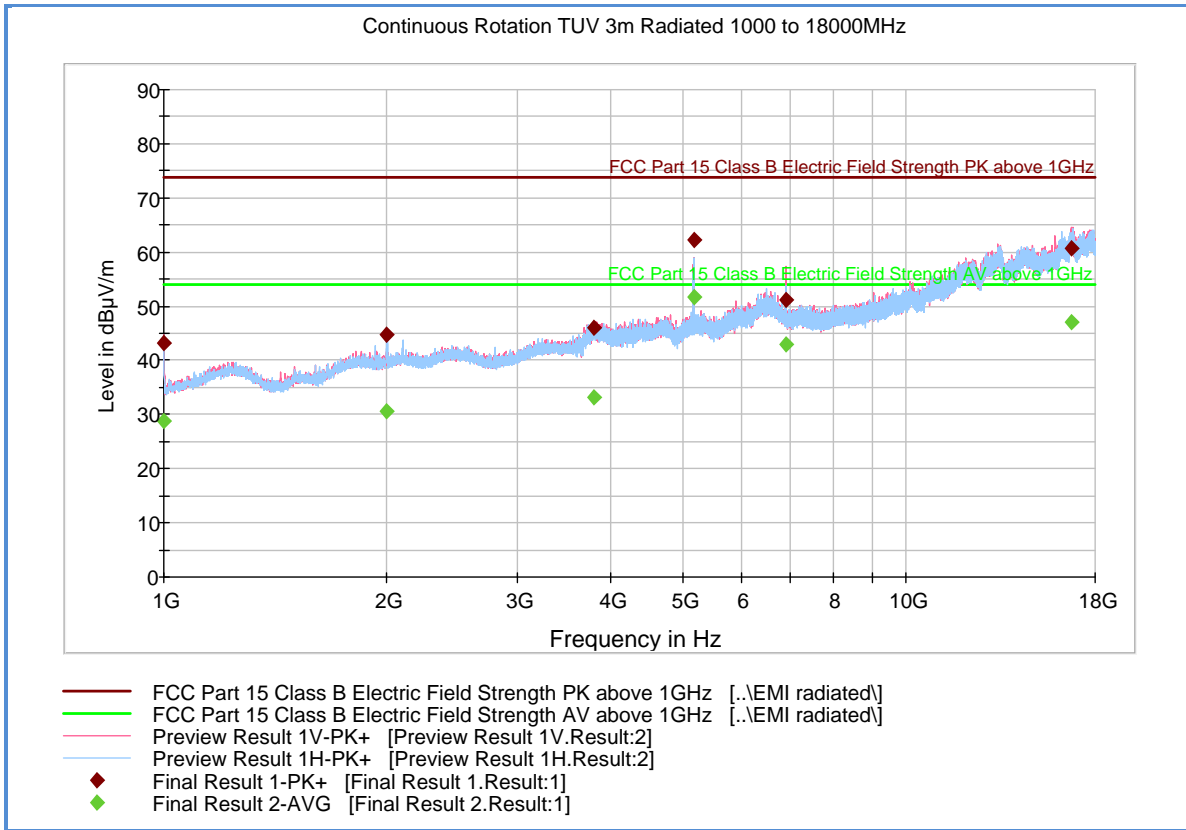
Quasi Peak Data

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.



2.6.11 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

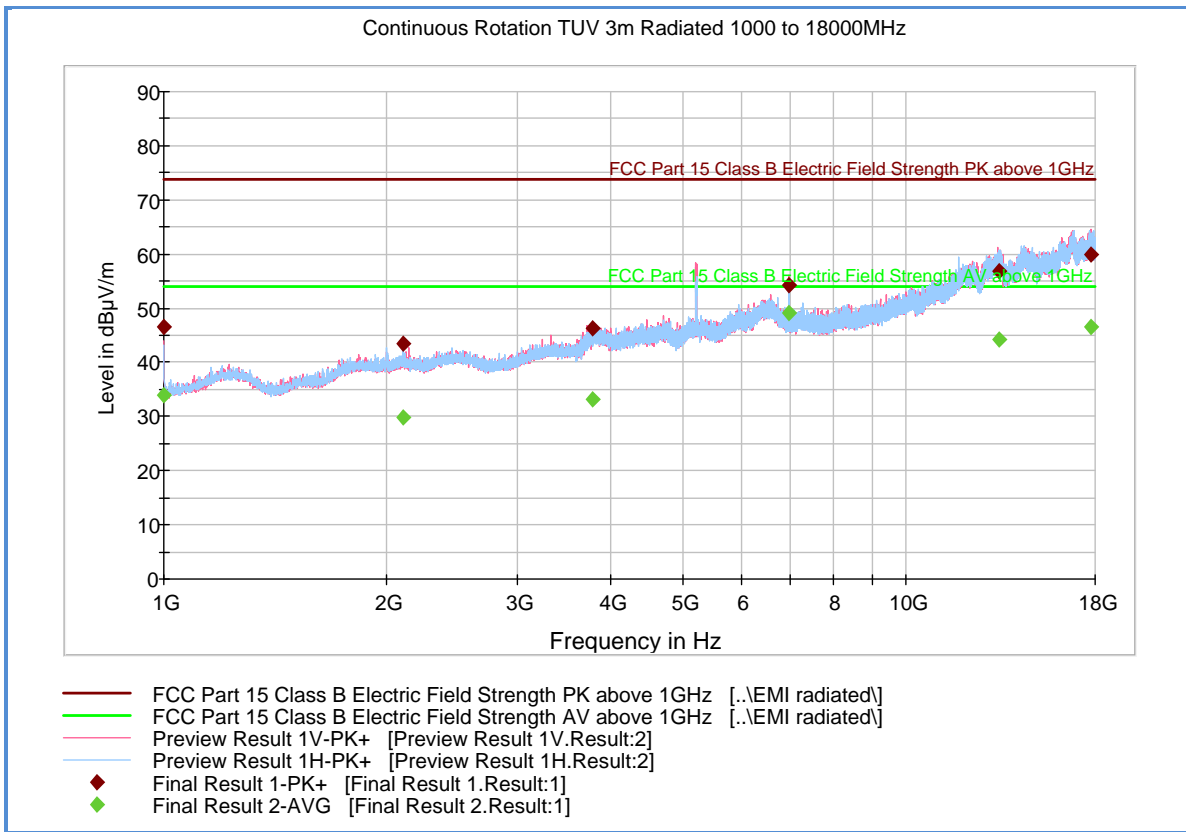
Average Data

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.



**2.6.12 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

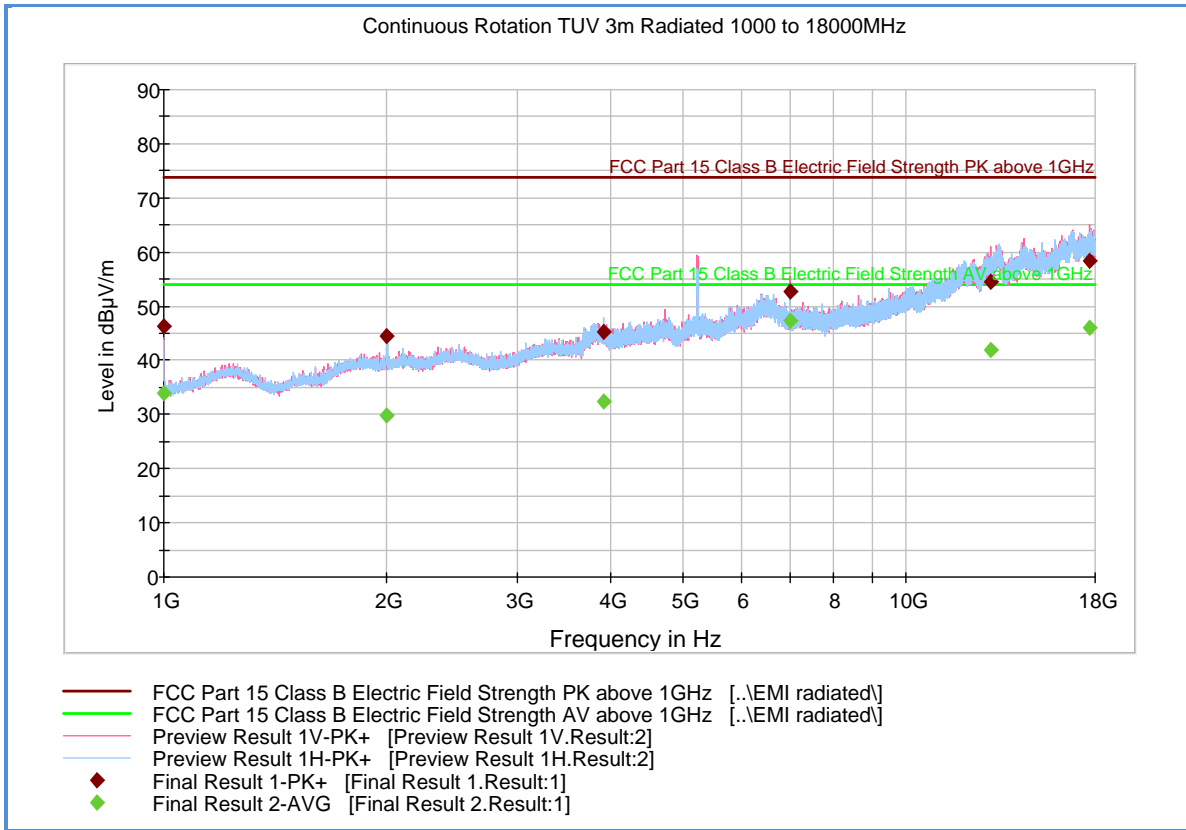
Average Data

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.



2.6.13 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

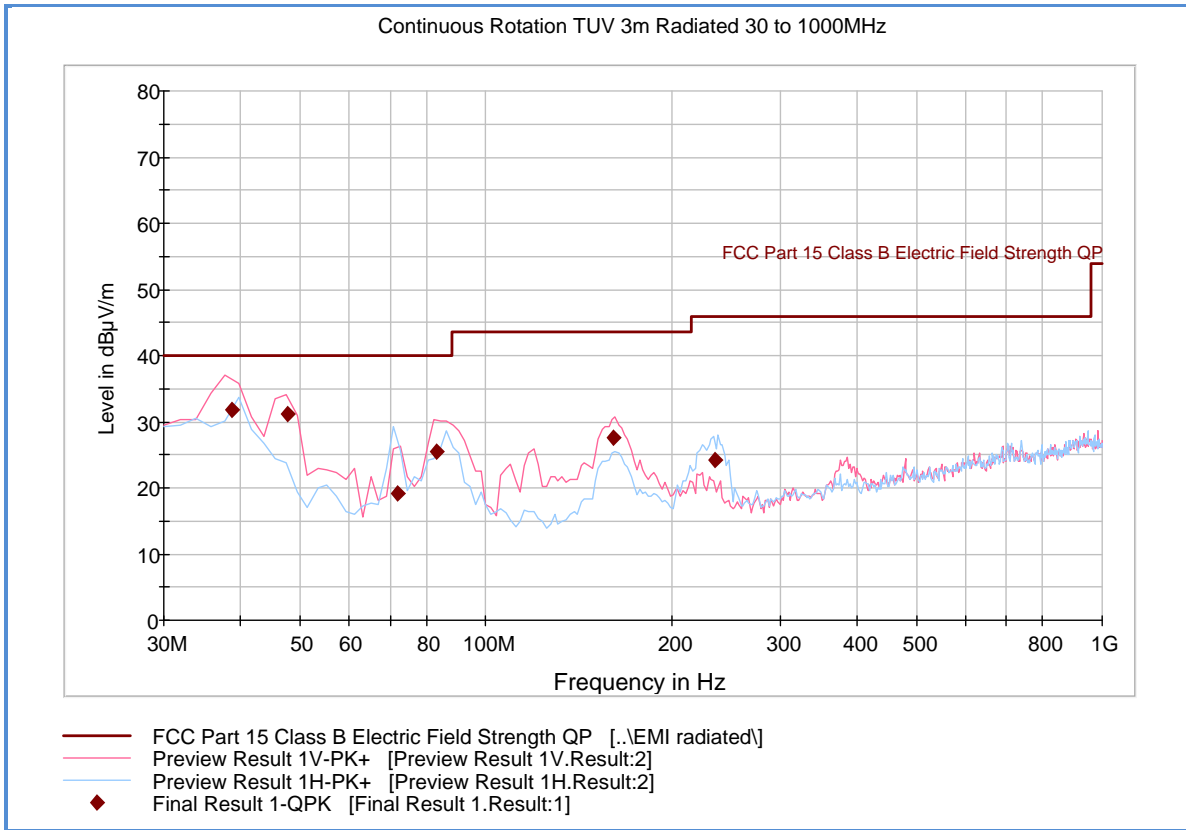
Average Data

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.



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



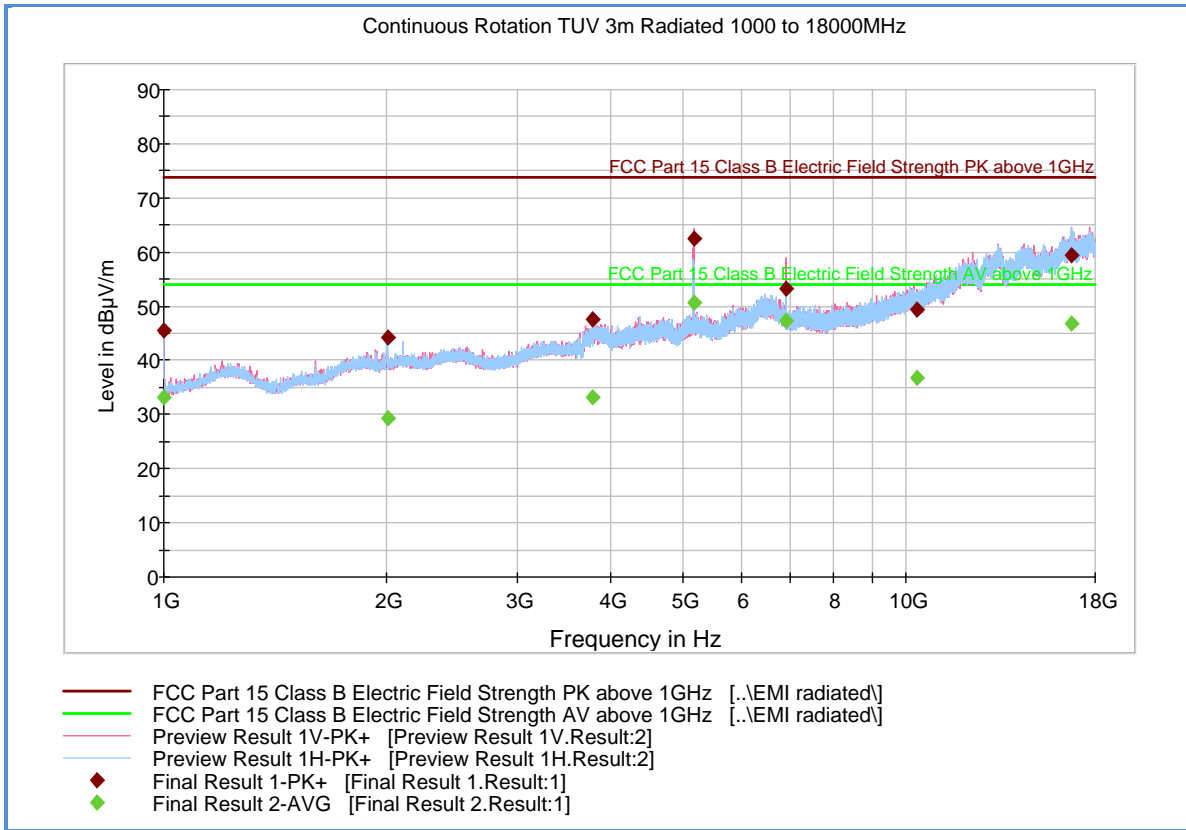
Quasi Peak Data

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.



**2.6.15 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

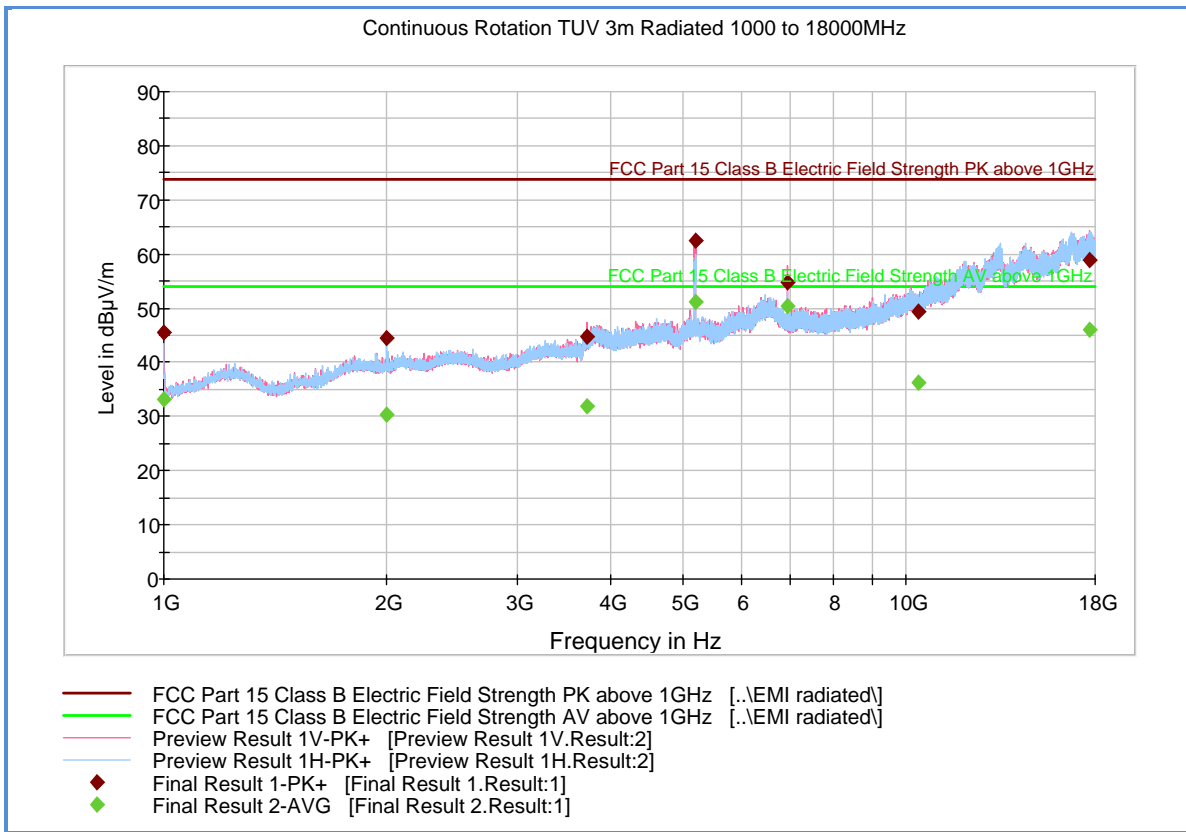
Average Data

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.



**2.6.16 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

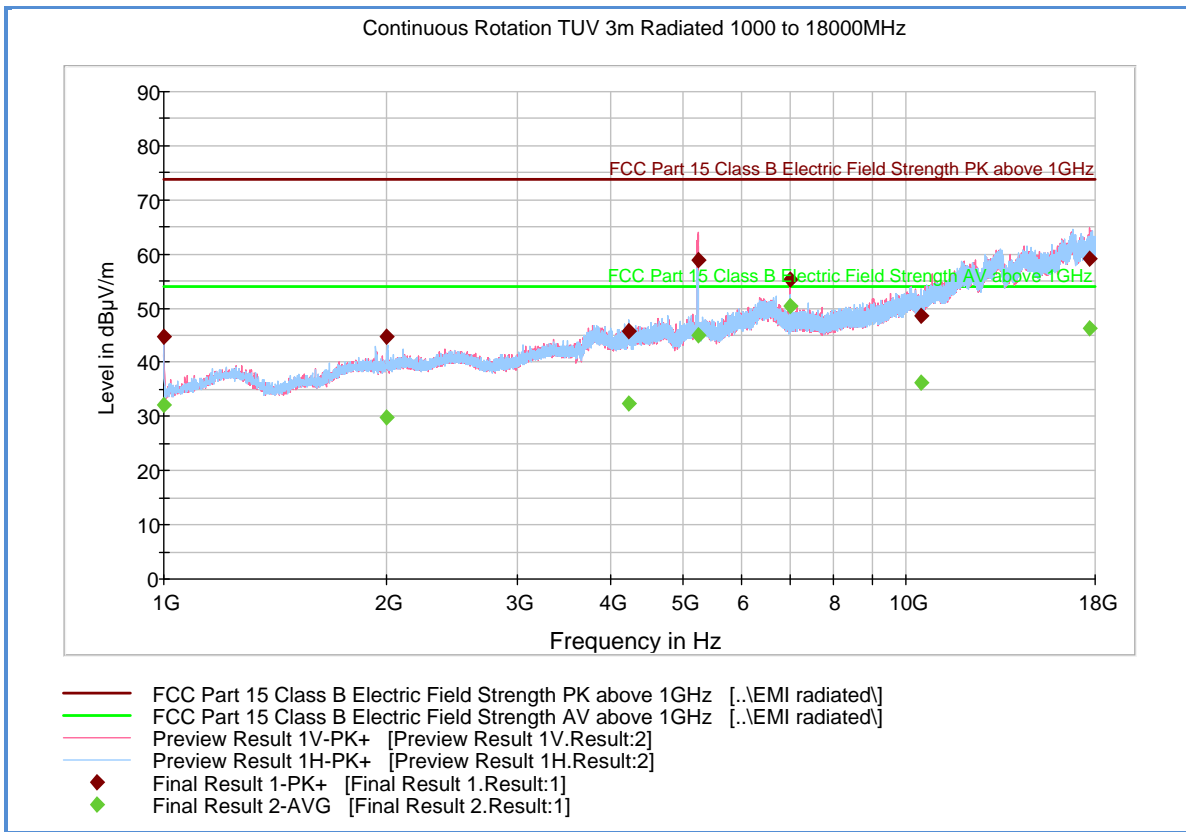
Average Data

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.



**2.6.17 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

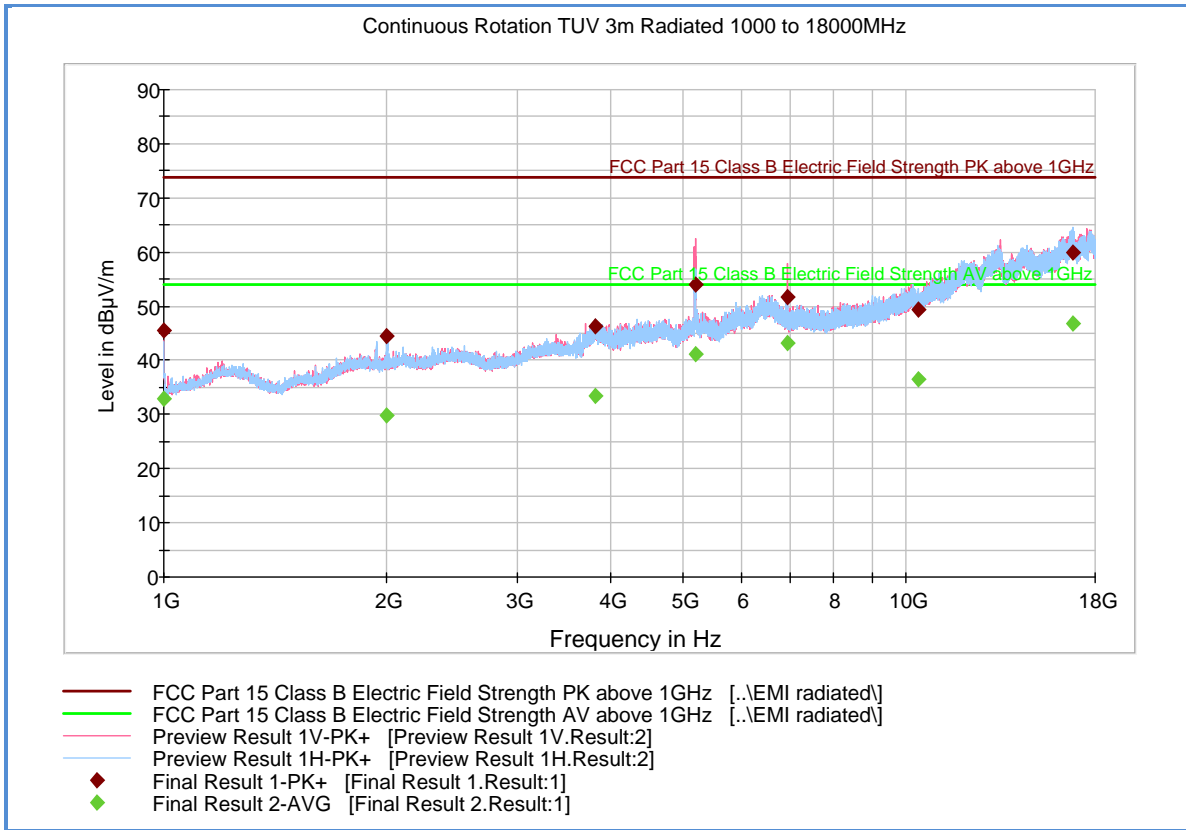
Average Data

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.



**2.6.18 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

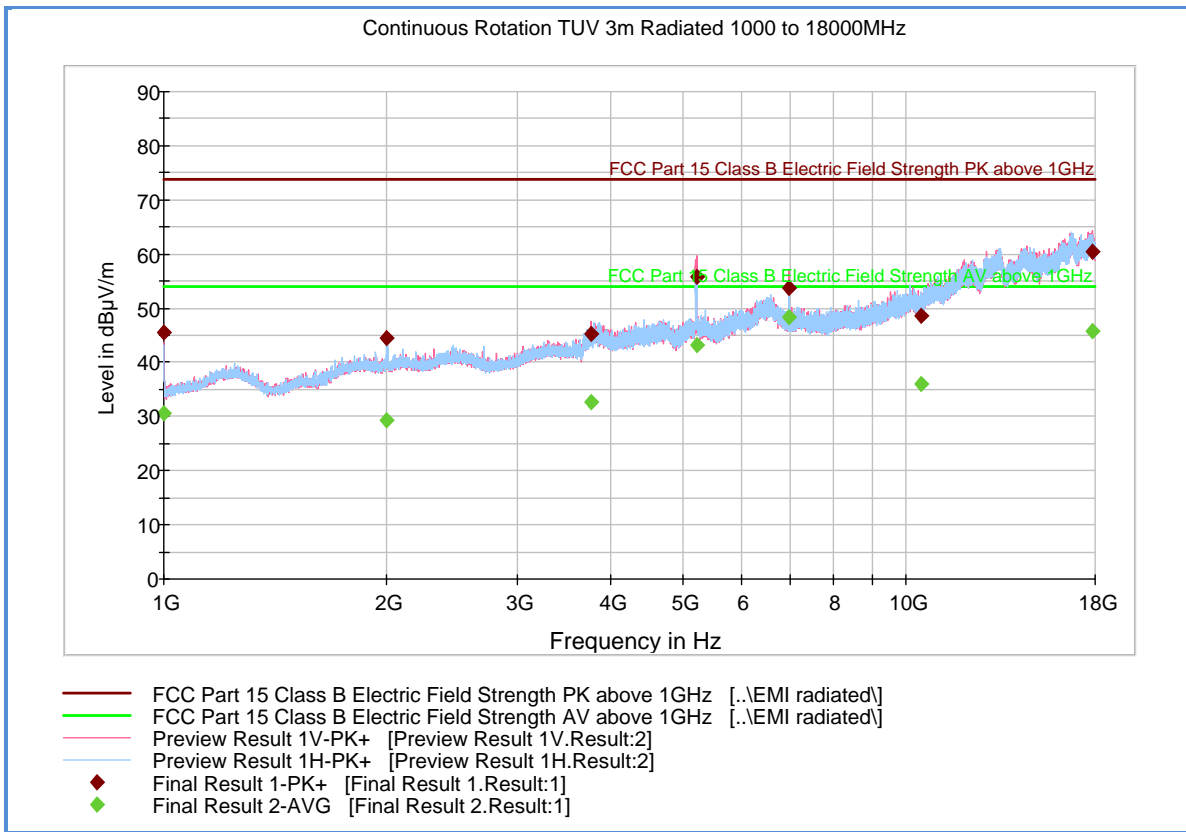
Average Data

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.



**2.6.19 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 PEAK EXCURSION RATIO

2.7.1 Specification Reference

Part 15 Subpart E §15.407(a)(6)

2.7.2 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.

2.7.3 Equipment Under Test and Modification State

Serial No: SS220414800525 / Test Configuration A

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

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

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

2.7.7 Additional Observations

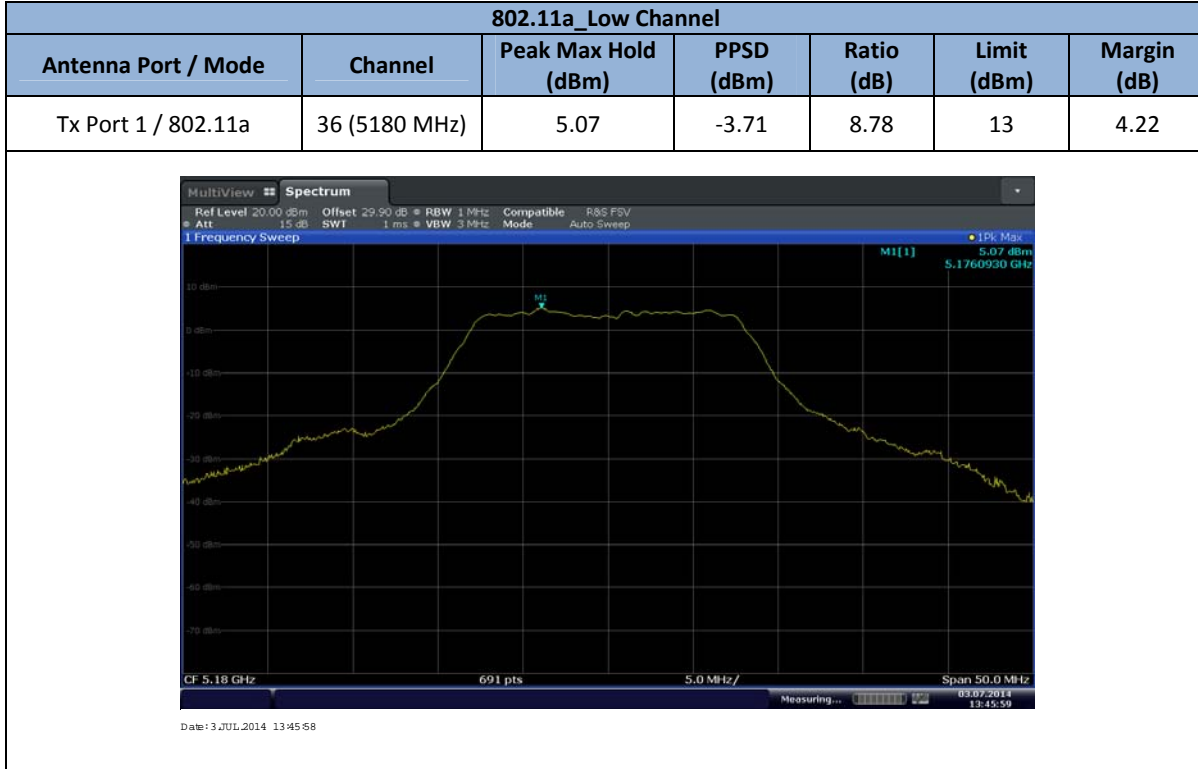
- This is a conducted test as per Section G of 789033 D01 General UNII Test Procedures v01r04 (Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E (June 06, 2014)).
- The ratio of the peak-max-hold spectrum was verified not to exceed 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



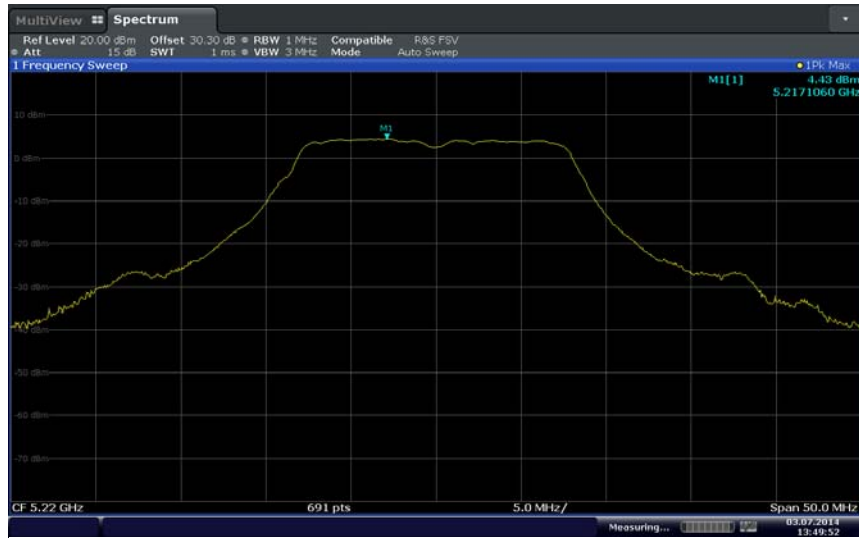
2.7.8 Test Results

See attached plots and table.



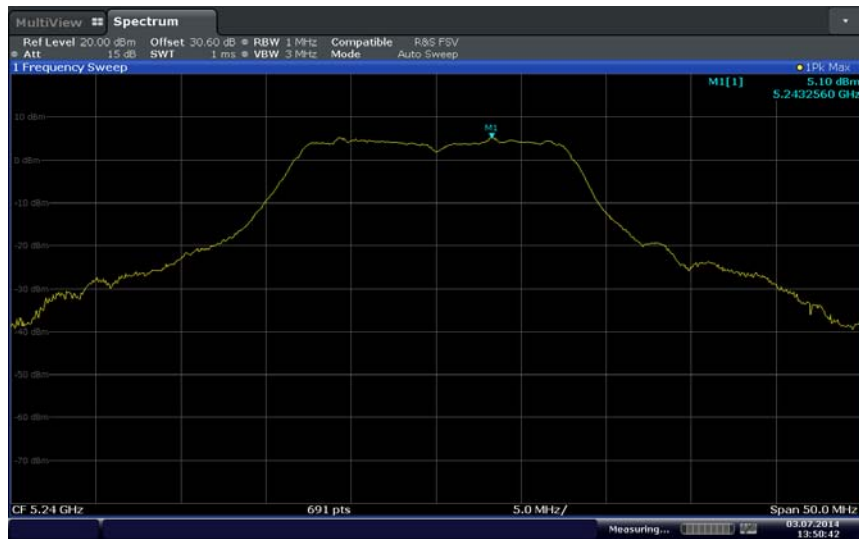


802.11a_Mid Channel						
Antenna Port / Mode	Channel	Peak Max Hold (dBm)	PPSD (dBm)	Ratio (dB)	Limit (dBm)	Margin (dB)
Tx Port 1 / 802.11a	44 (5220 MHz)	4.43	-4.05	8.48	13	4.52



Date: 3 JUL 2014 13:49:52

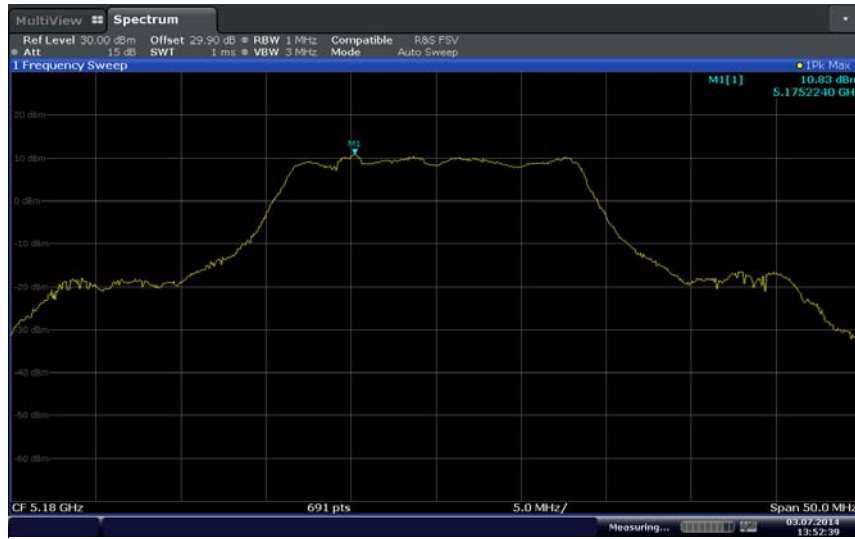
802.11a_High Channel						
Antenna Port / Mode	Channel	Peak Max Hold (dBm)	PPSD (dBm)	Ratio (dB)	Limit (dBm)	Margin (dB)
Tx Port 1 / 802.11a	48 (5240 MHz)	5.10	-3.62	8.72	13	4.28



Date: 3 JUL 2014 13:50:42

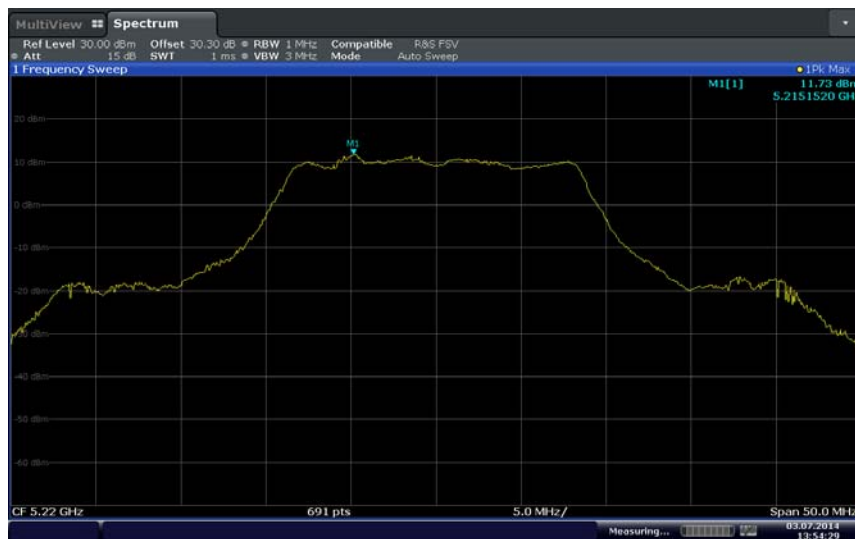


802.11n (HT20)_Low Channel						
Antenna Port / Mode	Channel	Peak Max Hold (dBm)	PPSD (dBm)	Ratio (dB)	Limit (dBm)	Margin (dB)
MIMO / 802.11n (HT20)	36 (5180 MHz)	10.83	-1.28	12.11	13	0.89



Date: 3 JUL 2014 13:52:39

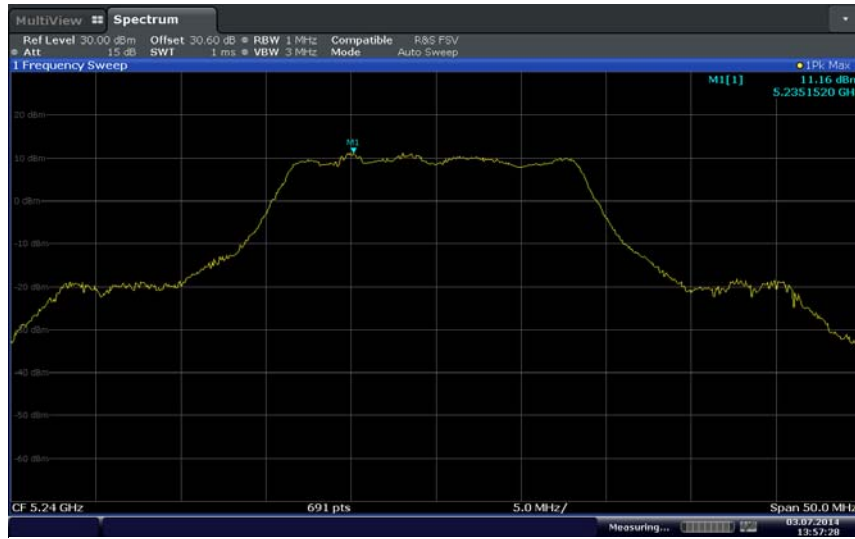
802.11n (HT20)_Mid Channel						
Antenna Port / Mode	Channel	Peak Max Hold (dBm)	PPSD (dBm)	Ratio (dB)	Limit (dBm)	Margin (dB)
MIMO / 802.11n (HT20)	44 (5220 MHz)	11.73	-0.24	11.97	13	1.03



Date: 3 JUL 2014 13:54:29

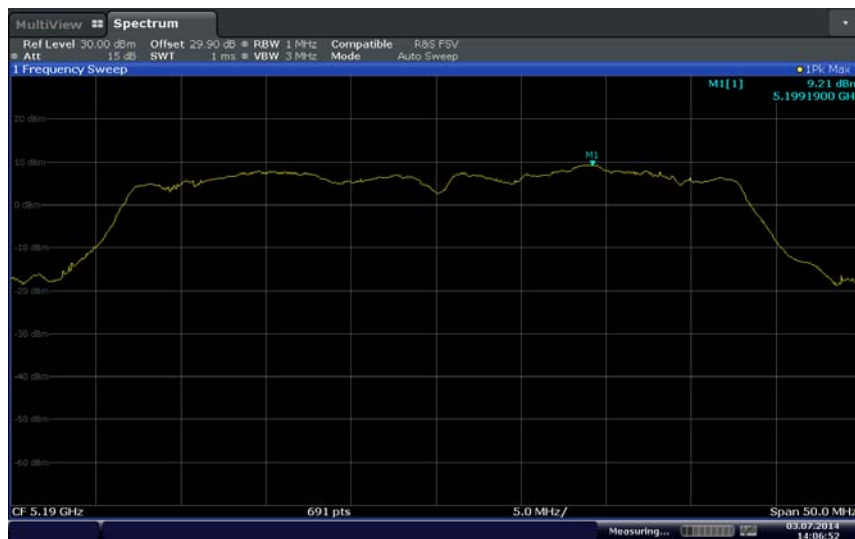


802.11n (HT20)_High Channel						
Antenna Port / Mode	Channel	Peak Max Hold (dBm)	PPSD (dBm)	Ratio (dB)	Limit (dBm)	Margin (dB)
MIMO / 802.11n (HT20)	48 (5240 MHz)	11.16	-0.88	12.04	13	0.96



Date: 3 JUL 2014 13:57:28

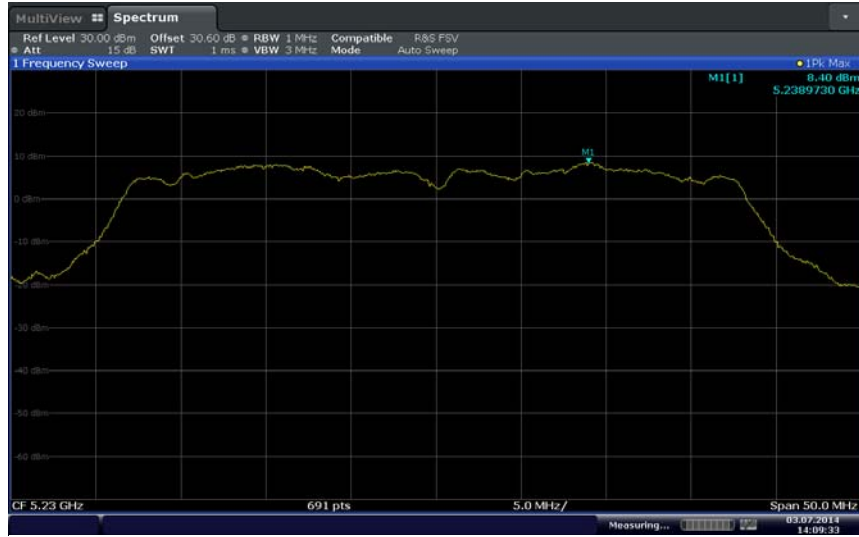
802.11n (HT40)_Low Channel						
Antenna Port / Mode	Channel	Peak Max Hold (dBm)	PPSD (dBm)	Ratio (dB)	Limit (dBm)	Margin (dB)
MIMO / 802.11n (HT40)	38 (5190 MHz)	9.21	-3.17	12.38	13	0.62



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802.11n (HT40)_High Channel						
Antenna Port / Mode	Channel	Peak Max Hold (dBm)	PPSD (dBm)	Ratio (dB)	Limit (dBm)	Margin (dB)
MIMO / 802.11n (HT40)	46 (5230 MHz)	8.40	-3.60	12	13	1.0





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

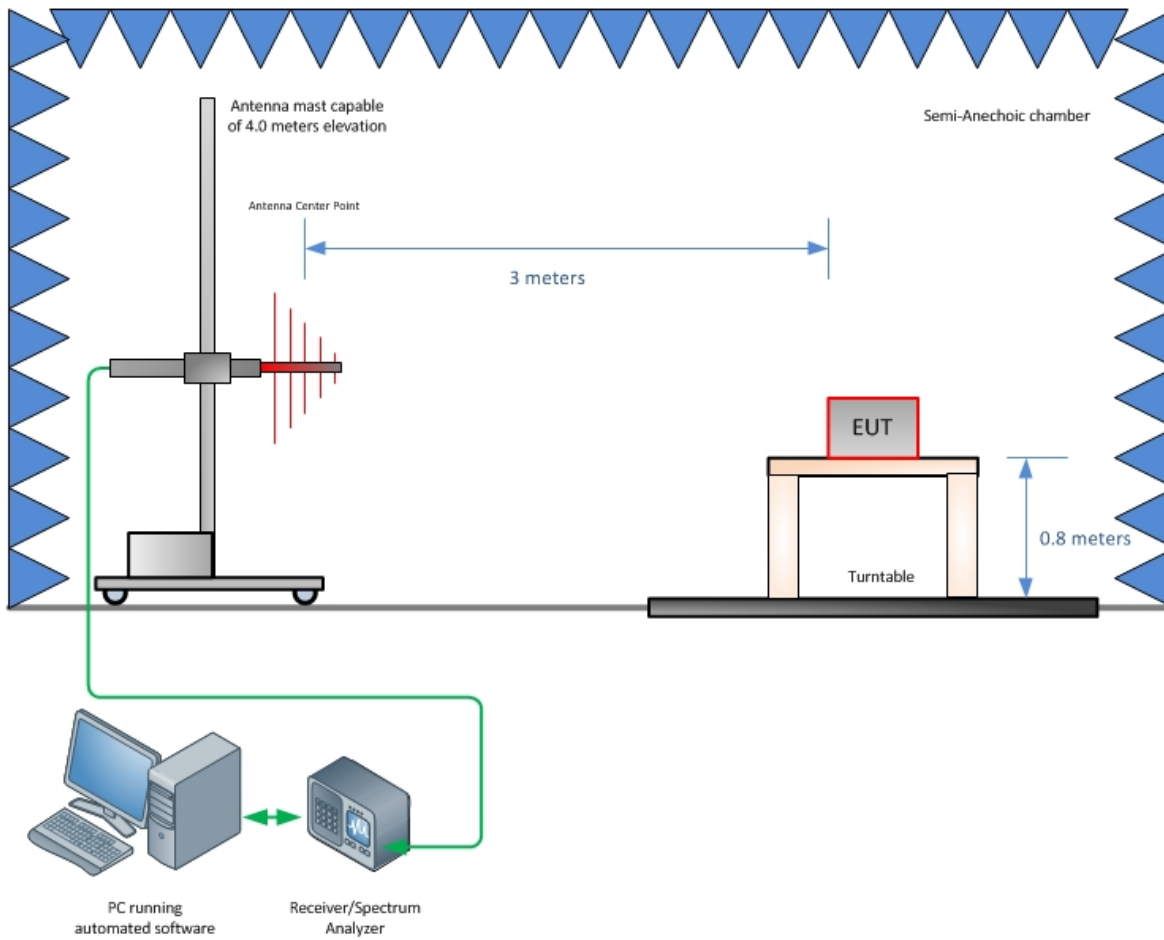
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.50	0.29	0.08
3	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					0.72
Coverage Factor (k):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



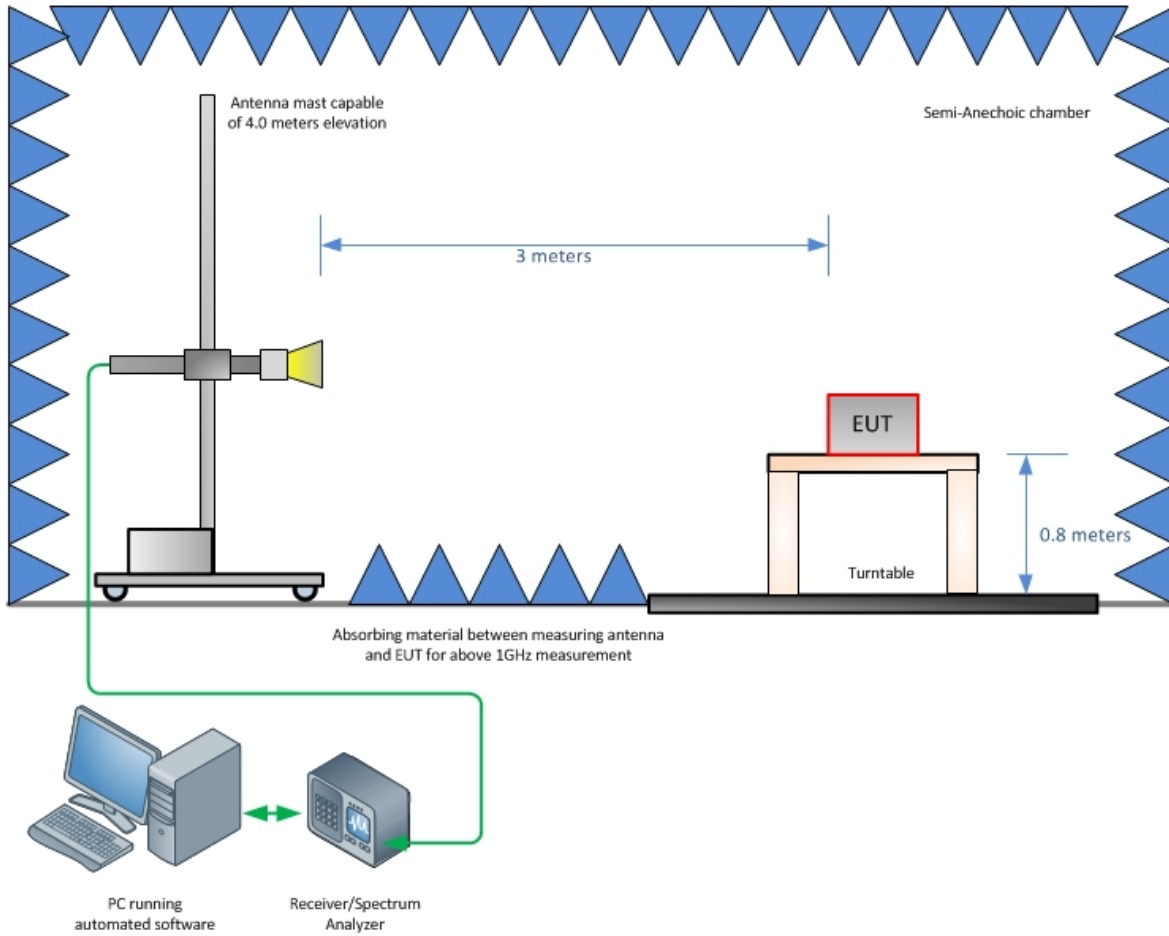
SECTION 4

DIAGRAM OF TEST SETUP

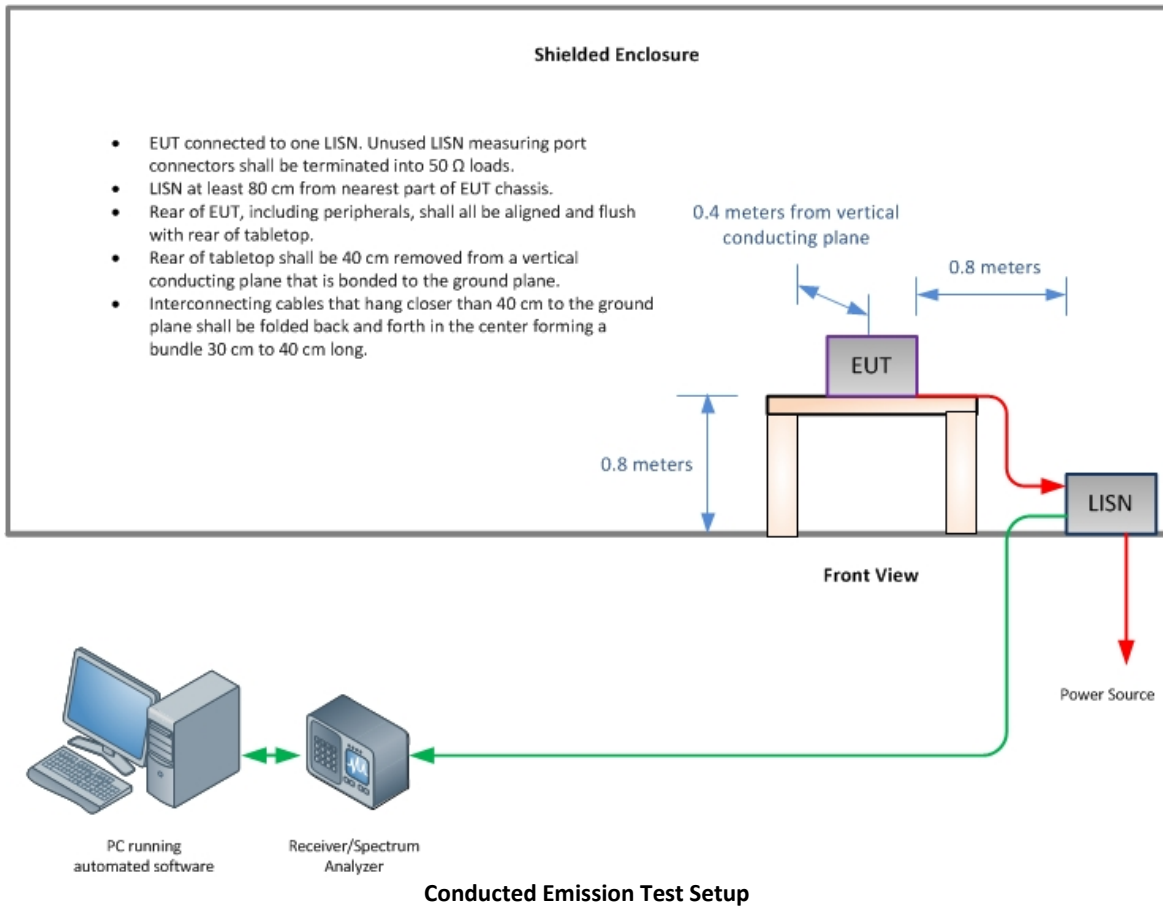
4.1 TEST SETUP DIAGRAM



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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