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Report On

Application for Grant of Equipment Authorization of the
Novatel Wireless Inc.
T1114 Wireless Router with Cellular Voice and Data Capabilities

FCC Part 15 Subpart E §15.407

Report No. SD72118007-0616B

August 2016



REPORT ON Radio Testing of the
Novatel Wireless Inc.
Wireless Router with Cellular Voice and Data Capabilities

TEST REPORT NUMBER SD72118007-0616B

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DATED August 10, 2016



Revision History

SD72118007-0616B Novatel Wireless Inc. T1114 Wireless Router with Cellular Voice and Data Capabilities					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
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SECTION 1

REPORT SUMMARY

Radio Testing of the
Novatel Wireless Inc.
T1114 Wireless Router with Cellular Voice and Data Capabilities



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Novatel Wireless Inc. T1114 Wireless Router with Cellular Voice and Data Capabilities 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)	T1114
FCC ID Number	PKRNVWT1114
IC Number	N/A
Serial Number(s)	IMEI 990000949644647
Number of Samples Tested	1
Test Specification/Issue/Date	FCC Part 15 Subpart E §15.407 (October 1, 2015).
Start of Test	June 21, 2016
Finish of Test	July 22, 2016
Name of Engineer(s)	Nikolay Shtin
Related Document(s)	- Supporting documents for EUT certification are separate exhibits. - SC1307899D FCC Part 15 Subpart E §15.407 Test Report for Novatel Wireless Inc. T1114 Wireless Router with Cellular Voice and Data Capabilities issued by TÜV SÜD America Inc.

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.

Operation in the U-NII 1 and U-NII 3 Bands (New Rules)				
Section	Spec Clause	Test Description	Result	Comments/Bas e Standard
2.1	§15.407(b)(6)	Conducted Emissions	N/A	
2.2	§15.407(e)	Indoor Operation Only	N/A	
2.3	§15.407(a)(1)	26 dB Bandwidth	As Reported	
2.4	§15.407(e)	Minimum 6dB Bandwidth	Compliant	
2.5	§15.407(a)(1)(IV) and §15.407(a)(3)	Maximum Conducted Output Power	Compliant	
2.6	§15.407(a)(1)(IV) and §15.407(a)(3)	Maximum Power Spectral Density (PSD)	Compliant	
2.7	§15.407(b)(1),(4)	Band-Edge Compliance of RF Conducted Emissions	Compliant	
2.8	§15.407(b)(1),(4) and (7) / 15.209	Spurious Radiated Emissions	Compliant	

N/A Not performed. Conducted emissions test results and Indoor Operation manufacturer declaration are applicable from Test Report: SC1307899D FCC Part 15 Subpart E §15.407 Test Report for Novatel Wireless Inc. T1114 Wireless Router with Cellular Voice and Data Capabilities issued by TÜV SÜD America Inc.



1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Novatel Wireless Inc. T1114 Wireless Router with Cellular Voice and Data Capabilities. The EUT is a wireless device that delivers Internet connectivity and telephone service, it uses LTE Band 4 and 13 / CDMA BC0 & BC1. The EUT can make a phone call, connect up to 10 devices via Wi-Fi (b/g/n 2.4GHz and a/n 5GHz UNII-1 and UNII-3) and connect up to 3 devices via Ethernet, simultaneously. The EUT is equipped with two optional antenna ports accessible to customers to improve the coverage range with custom design antenna "Sold separately". (See Exhibit PKRNVWT1114_Theory of Operation pages 24-28).

1.3.2 EUT General Description

EUT Description	Wireless Router with Cellular Voice and Data Capabilities
Model Number(s)	T1114
Rated Voltage	From AC-DC converter: 100-240VAC, 50/60Hz to 5.0VDC / 3.5A (Nominal voltage).
Mode Verified	802.11 a/n
Capability	CDMA BC0 (CELL) & BC1 (PCS), Band 4 (1.4, 5.0, 10, 15 and 20MHz BW) and Band 13 (5 and 10MHz BW) LTE, 802.11 b/g/n 2.4 GHz & 802.11 a/n 5 GHz.
Output Power	13.81 dBm/24.04 mW (conducted – Average)
Frequency Range	5180 MHz to 5240 MHz in the 5150 MHz to 5350 MHz Band 5745 MHz to 5825 MHz in the 5725 MHz to 5850 MHz Band
Number of Operating Frequencies	9
Channels Verified (802.11 a/n)	Low Channel 5180 MHz (U-NII-1) Mid Channel 5200MHz (U-NII-1) High Channel 5240MHz (U-NII-1) Low Channel 5745MHz (U-NII-3) Mid Channel 5785MHz (U-NII-3) High Channel 5825MHz (U-NII-3)
Primary Unit (EUT)	☐ Production ☒ Pre-Production ☐ Engineering
Modulation used	OFDM



1.3.3 Antenna Details

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

WWAN Antenna – CDMA

Manufacturer: Pulse
Part Number: DA-010190774
Type: PIFA
Antenna Gain:

- CDMA BC0 – 850MHz: -0.59dBi
- CDMA BC1 – 1880MHz: -0.82dBi

WWAN Antenna – LTE Band 13/4

Manufacturer: Pulse
Part Number: DA-01019775
Type: PIFA
Antenna Gain:

- LTE B13 – 700MHz: 1.21dBi
- LTE B4 – 1700MHz: 2.44dBi

WLAN – Antenna: 802.11 a/b/g/n

Manufacturer: Novatel
Type: CERAMIC CHIP
Antenna Gain:

- 802.11 b/g/n 2.4GHz: 3.0dBi
- 802.11 a/n 5GHz: 3.0dBi

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Configuration A	Antenna port conducted measurement. Manufacturer provided a coax test port for conducted measurements. Power setting used was 13 dBm.
Configuration B	Radiated emissions test configuration. The EUT connected to AC-DC power adapter transmitting through the integral antenna.

1.4.2 EUT Exercise Software

Before each test, the EUT is configured using Qualcomm Radio Control Toolkit version 3.0.54.0. The software allows configuration of operating channel, WLAN mode + data rate and power level. Power level is set according to manufacturer specification for each mode.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Dell	Support Laptop	Latitude E6410 (Novatel Wireless Test configuration Support Laptop)
	USB cable	Shielded, Type A to Micro USB USB Revision 2.0

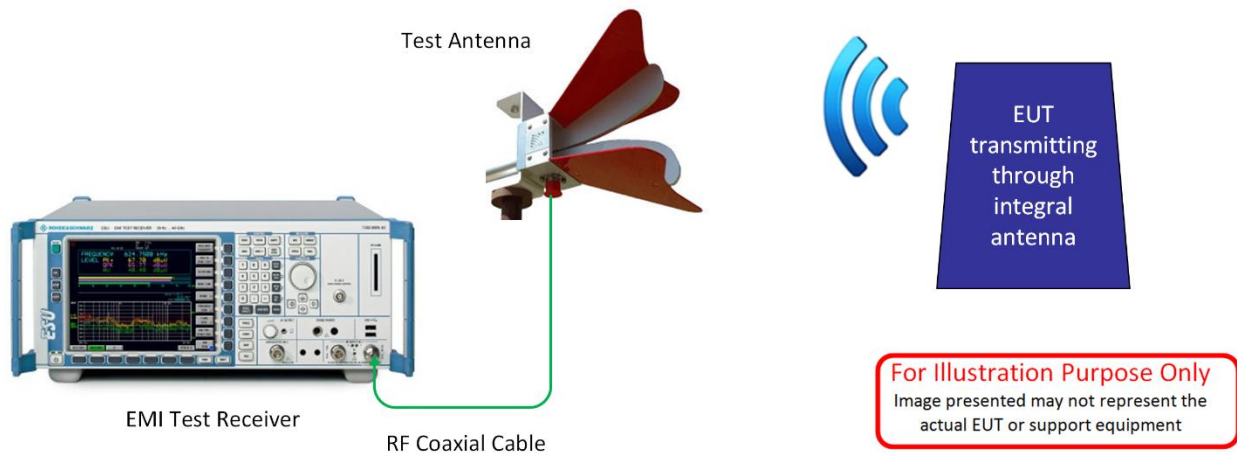
1.4.4 Worst Case Configuration

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

Mode	Channel	Data Rate
802.11 a (U-NII 1)	48 (High Channel)	24Mbps
802.11 n (U-NII 1)	36 (Low Channel)	58.5Mbps (MCS6)
802.11a (U-NII 3)	157 (Mid Channel)	18Mbps
802.11n (U-NII 3)	157 (Mid Channel)	26Mbps (MCS3)

EUT is designed for indoor use a table top operation, for radiated spurious measurement only default configuration was evaluated (See test setup picture exhibit).

1.4.5 SIMPLIFIED TEST CONFIGURATION DIAGRAM





1.5 DEVIATIONS FROM THE STANDARD

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

1.6 MODIFICATION RECORD

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

The table above details modifications made to the EUT during the test program. 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 C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

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)

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 Innovation, Science and Economic Development Canada Registration No.: 3067A

The 10m Semi-anechoic chamber of TÜV SÜD America Inc. (San Diego) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 3067A.



SECTION 2

TEST DETAILS

Radio Testing of the
Novatel Wireless Inc.
Wireless Router with Cellular Voice and Data Capabilities

2.1 CONDUCTED EMISSIONS

2.1.1 Specification Reference

Part 15 Subpart C §15.207(a)

2.1.2 Standard Applicable

An intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 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

Not performed. Conducted emissions test results from Report Number: SC1307899D FCC Part 15 Subpart E §15.407 Test Report for Novatel Wireless Inc. T1114 Wireless Router with Cellular Voice and Data Capabilities issued by TÜV SÜD America Inc.



2.2 INDOOR OPERATION ONLY

2.2.1 Specification Reference

Part 15 Subpart E §15.407(e)

2.2.2 Standard Applicable

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

2.2.3 State

Not performed. Manufacturer declaration from Report Number: SC1307899D FCC Part 15 Subpart E §15.407 Test Report for Novatel Wireless Inc. T1114 Wireless Router with Cellular Voice and Data Capabilities issued by TÜV SÜD America Inc.



2.3 26 dB BANDWIDTH

2.3.1 Specification Reference

Part 15 Subpart E §15.403(i)

2.3.2 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..

2.3.3 Test Methodology

Section II (C) (1) of 789033 D02 General UNII Test Procedures v01r02

2.3.4 Equipment Under Test and Modification State

Serial No: IMEI 990000949644647 / Test Configuration A

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

July 22, 2016/NS

2.3.6 Test Equipment Used

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

2.3.7 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	26.5°C
Relative Humidity	45.3%
ATM Pressure	99.2 kPa

2.3.8 Additional Observations

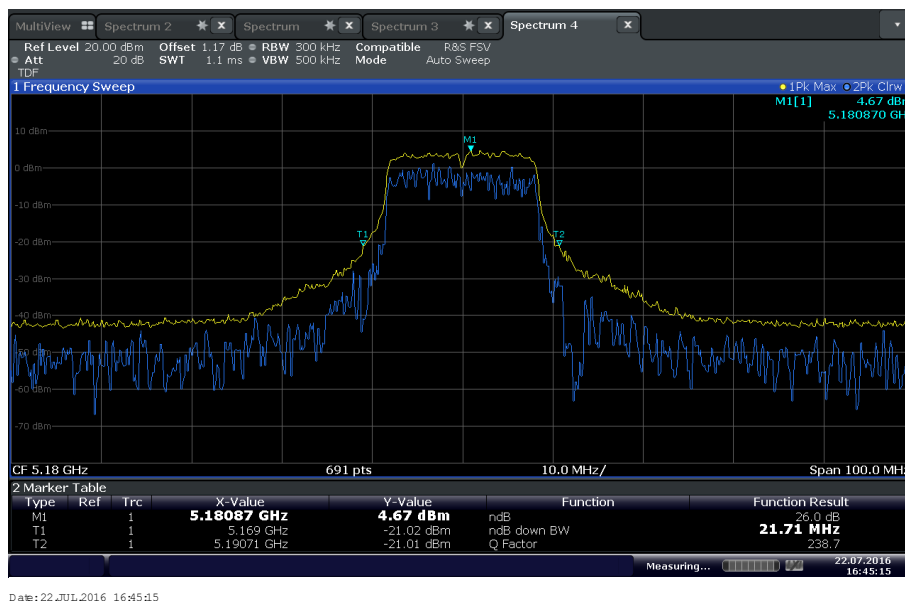
- This is a conducted test.
- Test methodology is per Section II (C) (1) of 789033 D02 General UNII Test Procedures v01r02 (April 08, 2016). All conditions under this Section were satisfied.
- Span is wide enough to capture the channel transmission.
- RBW is 1% initially set approx. to 1% of anticipated EBW.
- VBW > RBW.
- Trace is max hold.
- Detector is peak.

- Sweep time is set to Auto.
- “n dB down” (26dB) marker function of the spectrum analyzer was used for this test.
- RBW adjusted until RBW/EBW ratio is approximately 1% or as the SA setting permits (i.e next setting after 300kHz RBW is limited to 500kHz).

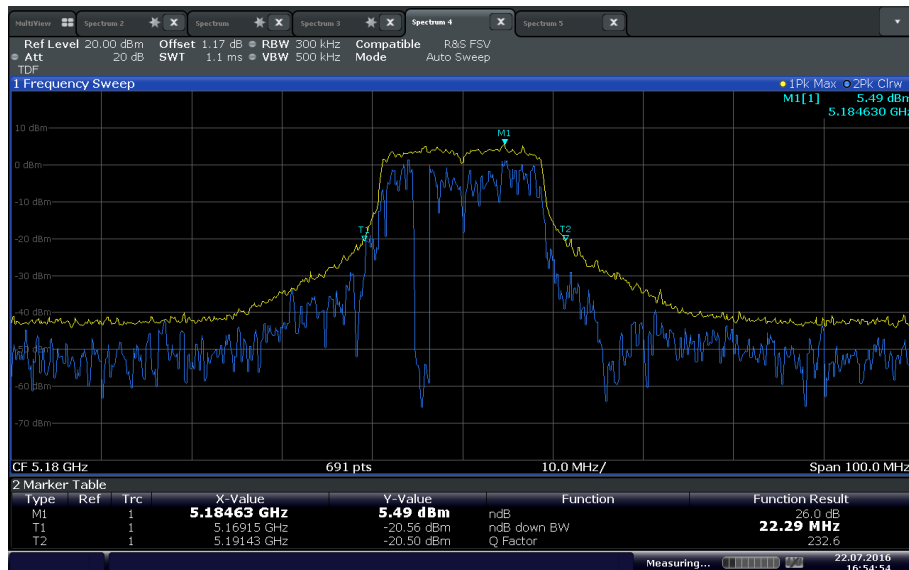
2.3.9 Summary Test Results (as reported)

26 dB Bandwidth			
WiFi Mode	Low Channel	Mid Channel	High Channel
802.11a U-NII 1	21.71 MHz	22.00 MHz	21.56 MHz
802.11n U-NII 1	22.29 MHz	22.58 MHz	22.14 MHz
802.11a U-NII 3	21.56 MHz	21.71 MHz	21.56 MHz
802.11n U-NII 3	22.43 MHz	22.43 MHz	23.44 MHz

2.3.10 Test Plots

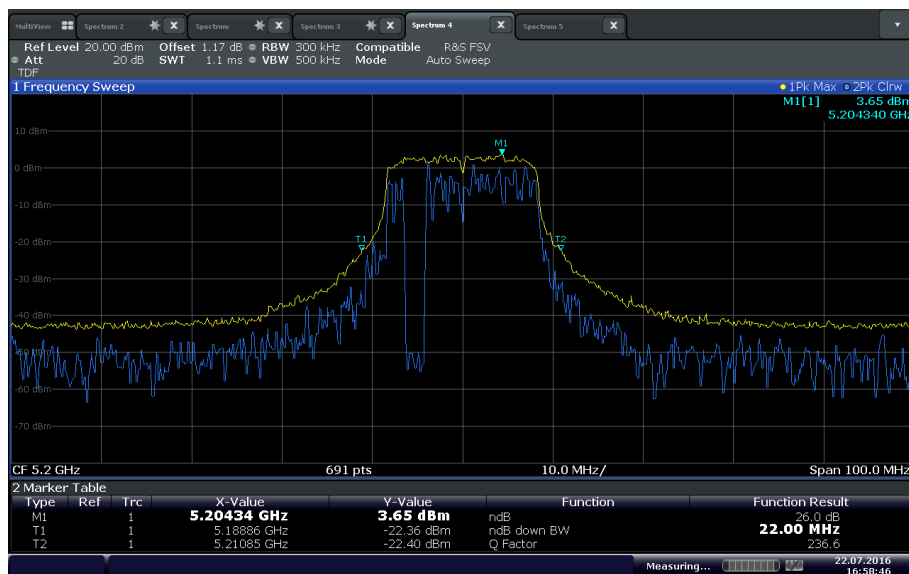


Low Channel U-NII 1 802.11a



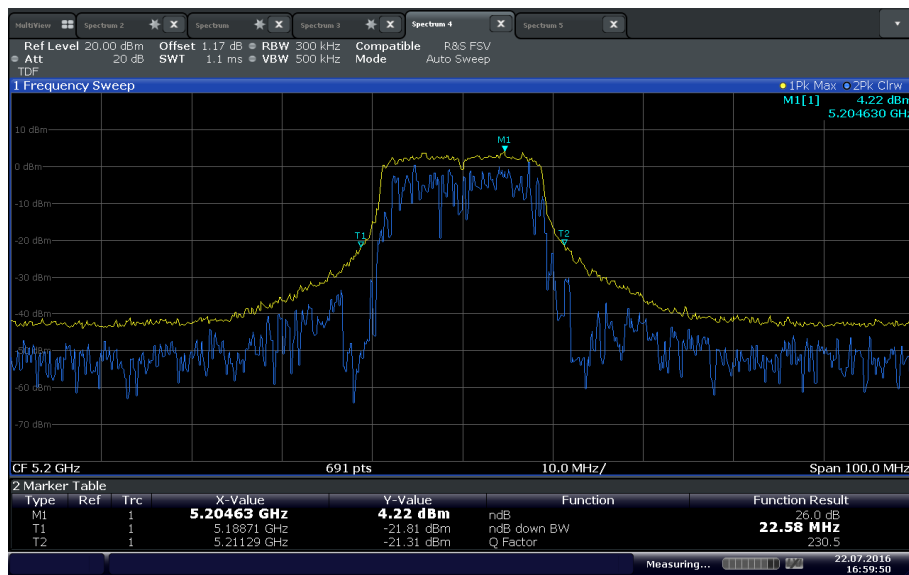
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Low Channel U-NII 1 802.11n



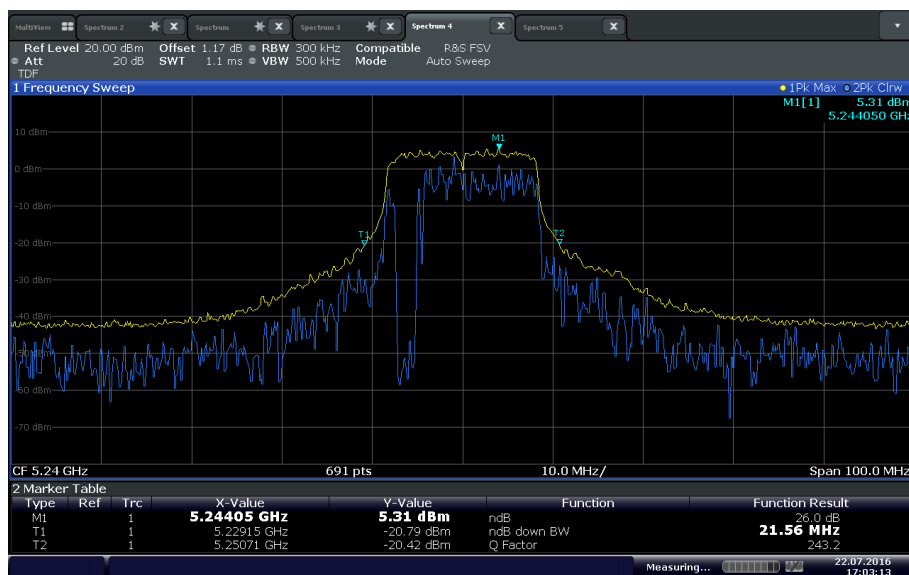
Date: 22 JUL 2016 16:58:47

Mid Channel U-NII 1 802.11a



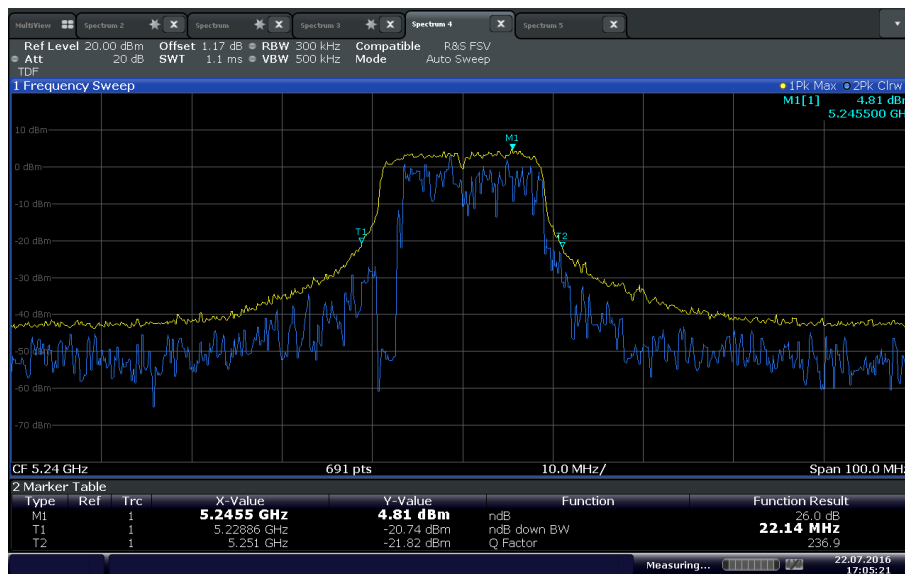
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Mid Channel U-NII 1 802.11n



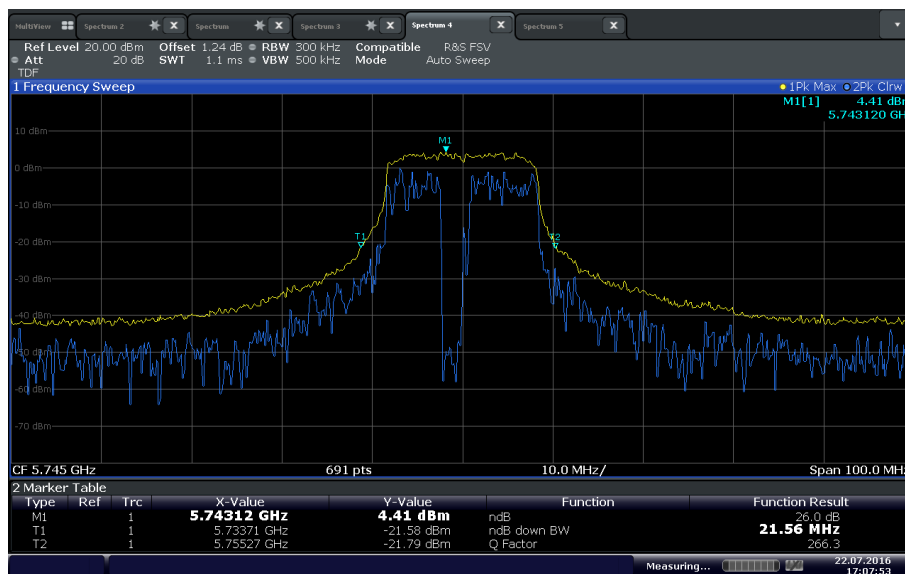
Date: 22.JUL.2016 17:03:13

High Channel U-NII 1 802.11a



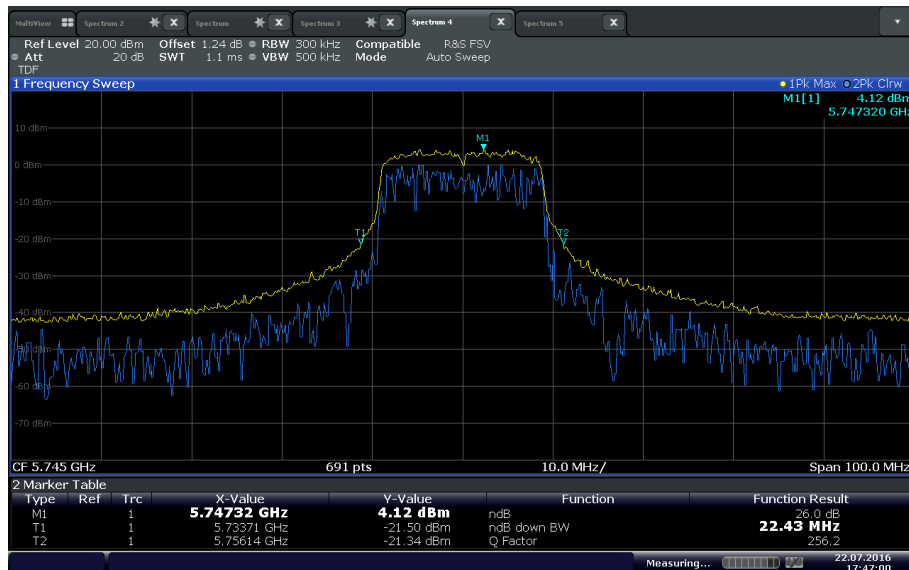
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High Channel U-NII 1 802.11n



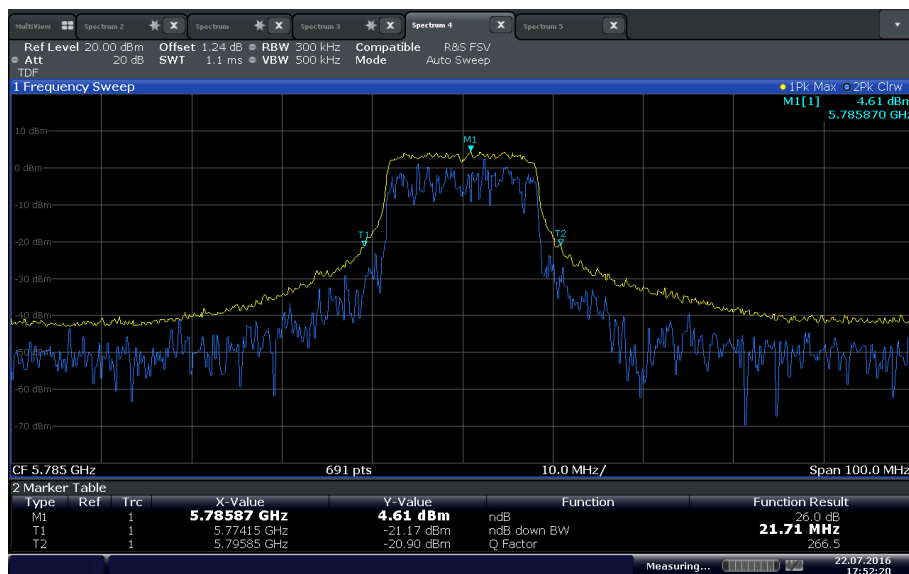
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Low Channel U-NII 3 802.11a



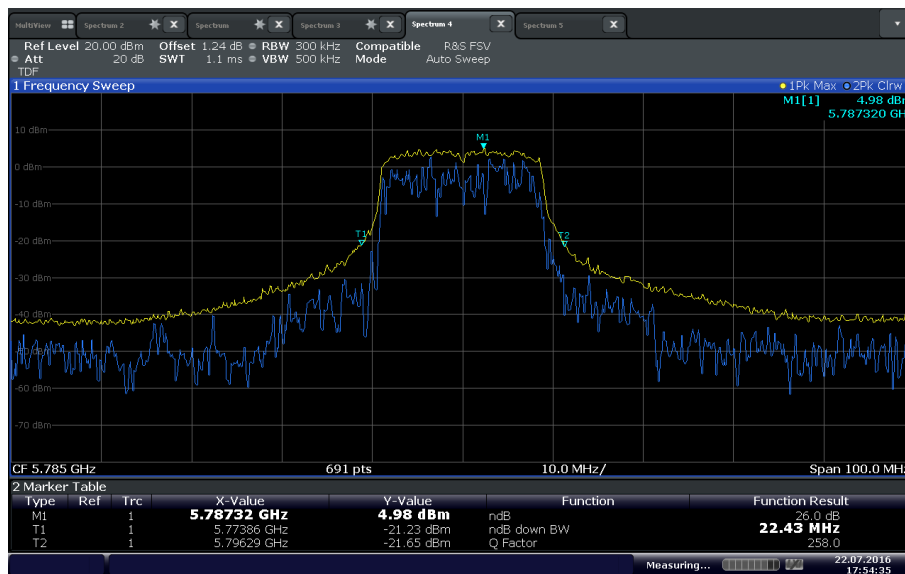
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Low Channel U-NII 3 802.11n



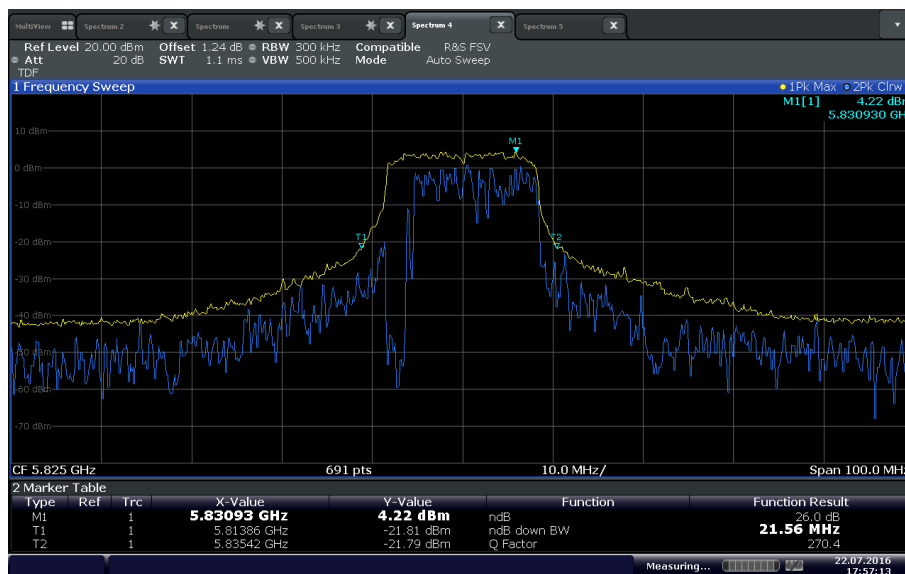
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Mid Channel U-NII 3 802.11a



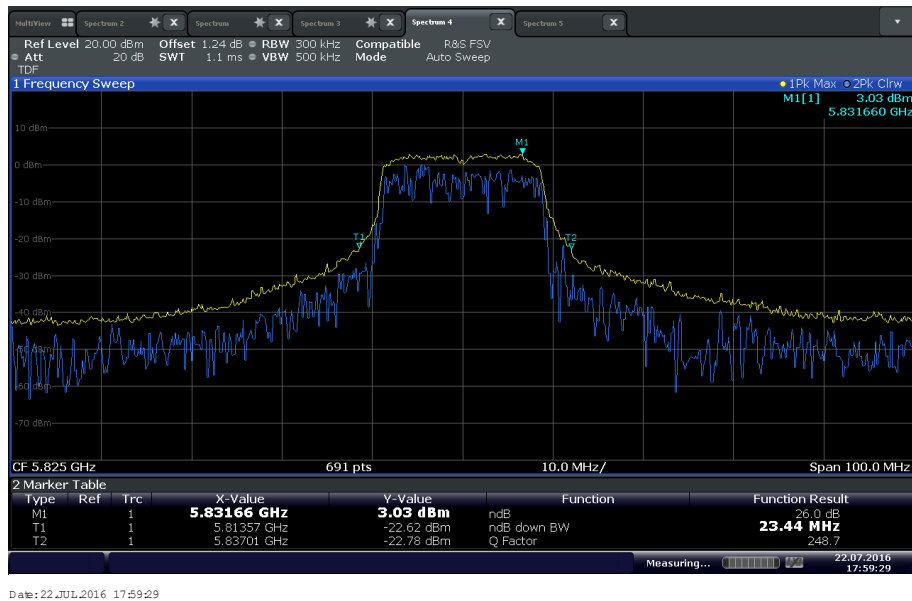
Date: 22 JUL 2016 17:54:34

Mid Channel U-NII 3 802.11n



Date: 22 JUL 2016 17:57:13

High Channel U-NII 3 802.11a



Date: 22 JUL 2016 17:59:29

High Channel U-NII 3 802.11n



2.4 MINIMUM 6dB BANDWIDTH

2.4.1 Specification Reference

Part 15 Subpart E §15.407(e)

2.4.2 Standard Applicable

(e) Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

2.4.3 Test Methodology

Section II (C) (2) of 789033 D02 General UNII Test Procedures v01r02

2.4.4 Equipment Under Test and Modification State

Serial No: IMEI 990000949644647 / Test Configuration A

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

July 22, 2016/NS

2.4.6 Test Equipment Used

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

2.4.7 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	26.5°C
Relative Humidity	45.3%
ATM Pressure	99.2 kPa

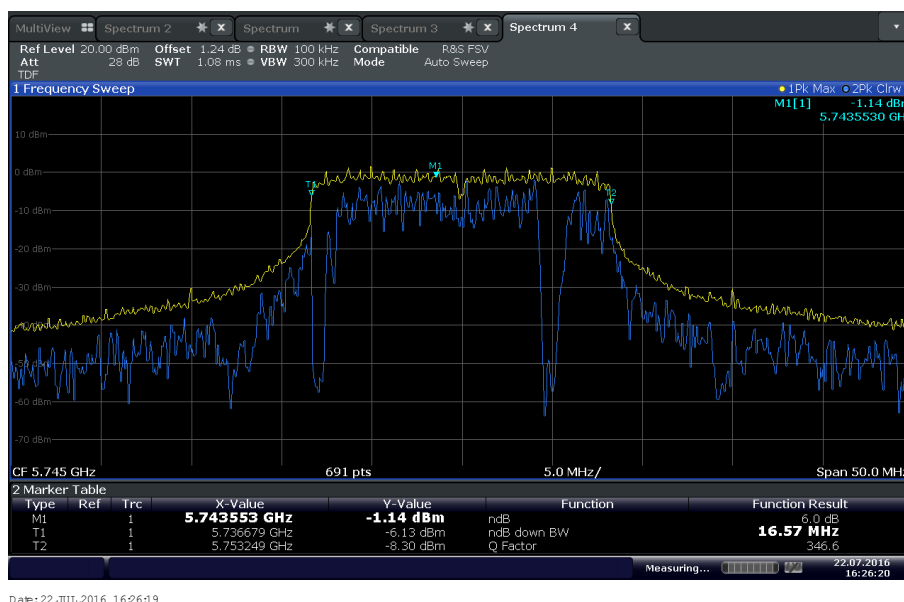
2.4.8 Additional Observations

- This is a conducted test.
- An offset of 1.17/1.24 dB and a Transducer Factor (TDF) were used to compensate for the signal loss in external attenuator and cable used.
- Span is wide enough to capture the channel transmission.
- RBW is 100kHz.
- VBW is 3X RBW.
- Sweep is auto.
- Detector is Peak.
- Trace mode is Max Hold
- "n dB down" (6dB) marker function of the spectrum analyzer was used for this test.

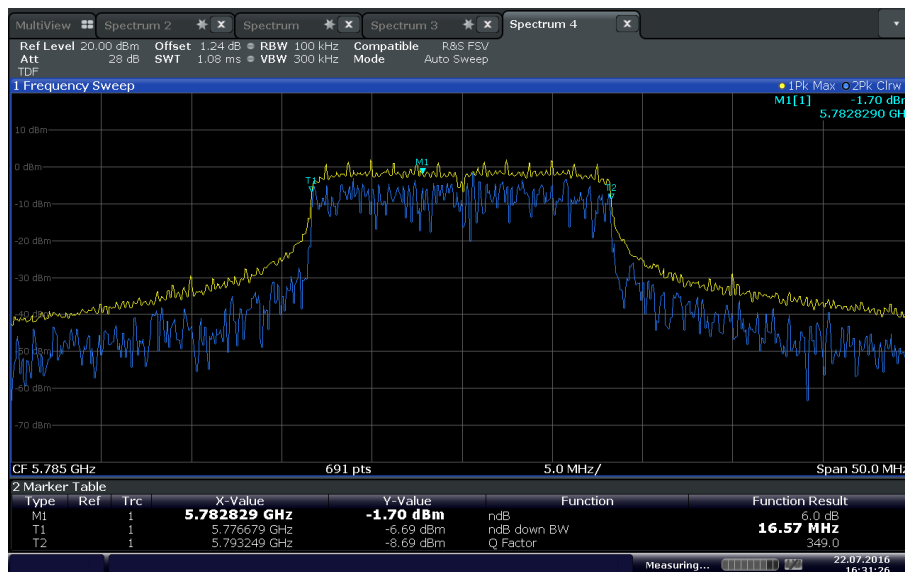
2.4.9 Summary Test Results (as reported)

Minimum 6 dB Bandwidth (>500kHz)			
WiFi Mode	Low Channel (5745 MHz)	Mid Channel (5785 MHz)	High Channel (5825 MHz)
802.11a U-NII 3	16.57 MHz	16.57 MHz	16.57 MHz
802.11n U-NII 3	17.80 MHz	17.80 MHz	17.80 MHz

2.4.10 Test Plots

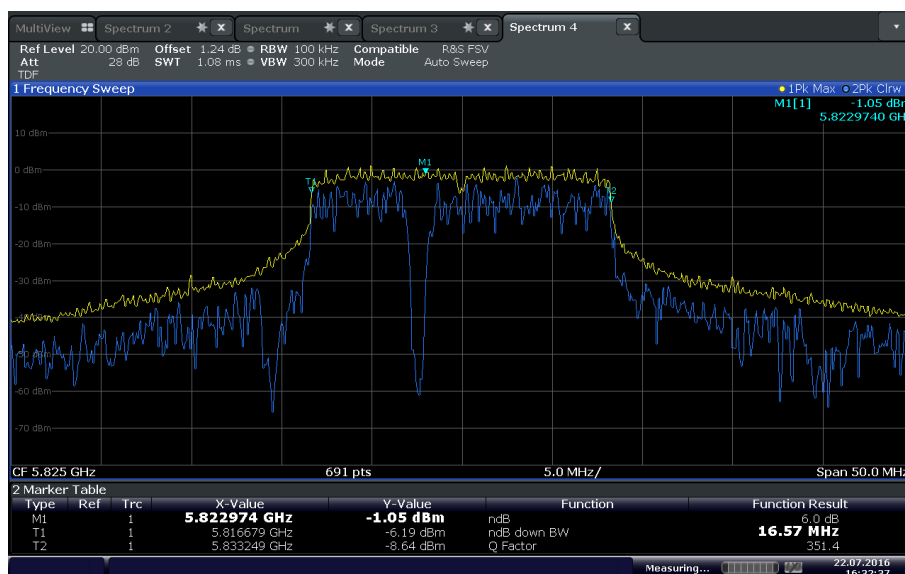


Low Channel U-NII 3 802.11a



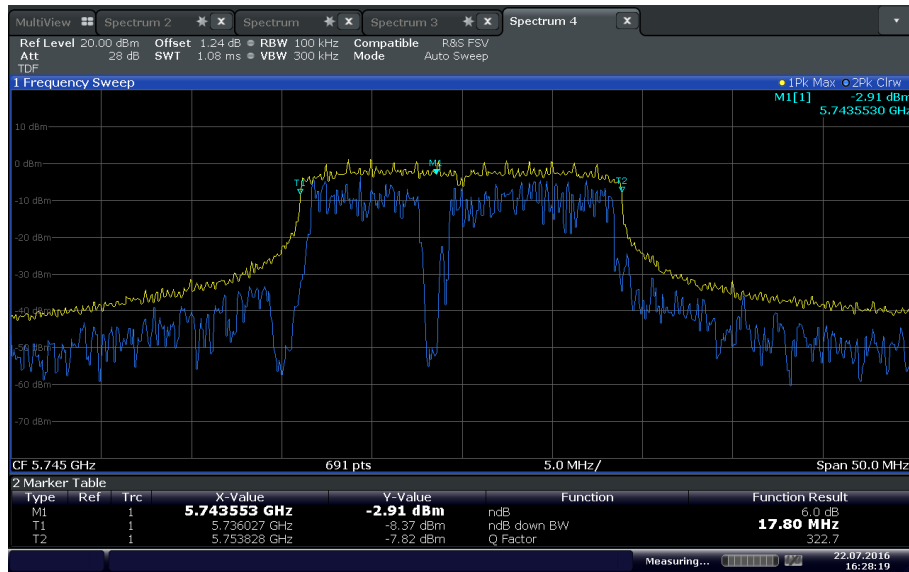
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Mid Channel U-NII 3 802.11a



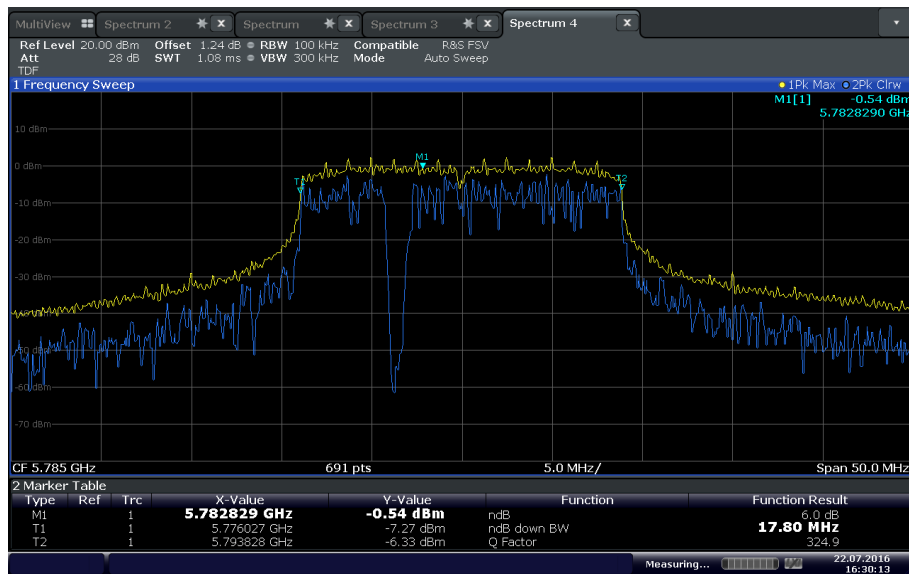
Date: 22 JUL 2016 16:32:36

High Channel U-NII 3 802.11a



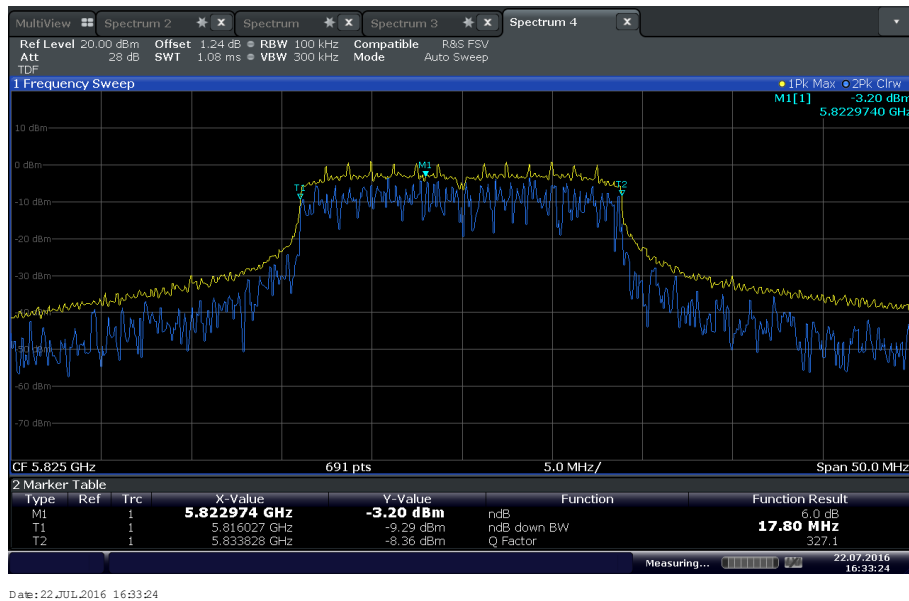
Date: 22 JUL 2016 16:28:19

Low Channel U-NII 3 802.11n



Date: 22 JUL 2016 16:30:13

Mid Channel U-NII 3 802.11n



Date: 22 JUL 2016 16:33:24

High Channel U-NII 3 802.11n



2.5 MAXIMUM CONDUCTED OUTPUT POWER

2.5.1 Specification Reference

Part 15 Subpart E §15.407(a)(1)(IV) and §15.407(a)(3)

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 (E)(2)(d) Method PM (Measurement using Spectrum Analyzer or EMI Receiver) of 789033 D02 General UNII Test Procedures New Rules v01r02.

2.5.4 Equipment Under Test and Modification State

Serial No: IMEI 990000949644647 / Test Configuration A

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

July 21, 2016 / NS

2.5.2 Test Equipment Used

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

2.5.3 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature 26.6°C
Relative Humidity 45.0%
ATM Pressure 98.9 kPa

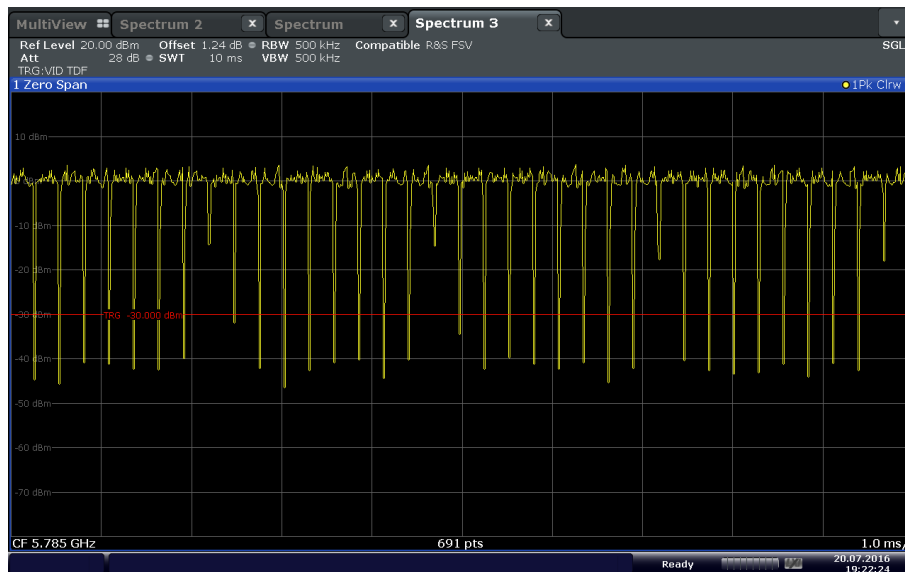
2.5.4 Additional Observations

- This is a conducted test.
- Test methodology is per Section II (E)(2)(d) Method PM (Measurement using Spectrum Analyzer or EMI Receiver) of 789033 D02 General UNII Test Procedures New Rules v01r02. All conditions under this Section were satisfied.
- Duty Cycle was measured and calculated according to Section II(B)(2)(b) of 789033 D02 General UNII Test Procedures New Rules v01r02.
- An offset of 1.17/1.24 dB and a Transducer Factor (TDF) were used to compensate for the signal loss in attenuator and cable used.
- Calculated Average Power is the sum of the measured average power and the corresponding duty cycle correction factor.

2.5.5 Duty Cycle Calculations

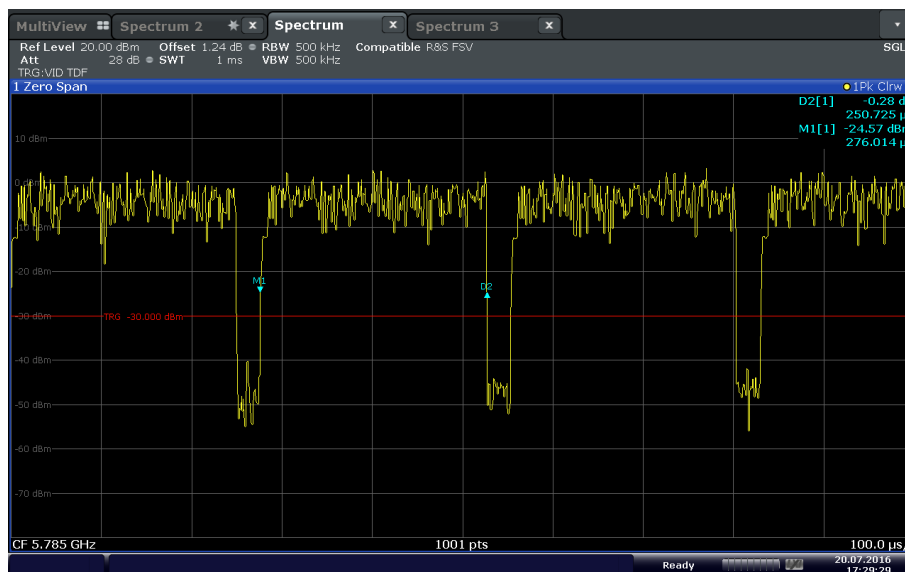
Duty Cycle Calculations					
WLAN Mode	Data rate (Mbps)	No. of transmissions/10 ms	Length of each packet (μs)	Total transmission time/100 ms (ms)	Duty Cycle Correction Factor (dB)
802.11a	6	4.8	2070.72	99.39	0.03
	9	7.1	1385.72	98.39	0.07
	12	9.3	1045.72	97.25	0.12
	18	13.7	706.99	96.86	0.14
	24	17.8	534.99	95.23	0.21
	36	25.5	366.99	93.58	0.29
	48	33.0	278.986	92.06	0.36
	54	26.0	250.725	90.26	0.45
802.11n	6.5 (MCS0)	5.2	1918.990	99.79	0.01
	13 (MCS1)	9.9	979.990	97.02	0.13
	19.5 (MCS2)	14.5	665.990	96.57	0.15
	26 (MCS3)	18.7	507.990	94.99	0.22
	39 (MCS4)	26.2	353.986	94.16	0.26
	52 (MCS5)	33.3	272.986	90.90	0.41
	58.5 (MCS6)	36.1	250.986	90.60	0.43
	65 (MCS7)	39.0	229.986	89.69	0.47

2.5.6 Sample Duty Cycle Calculations



Date: 20 JUL 2016 19:22:24

36 Transmissions in 10ms window (zero span) using HT20 54Mbps

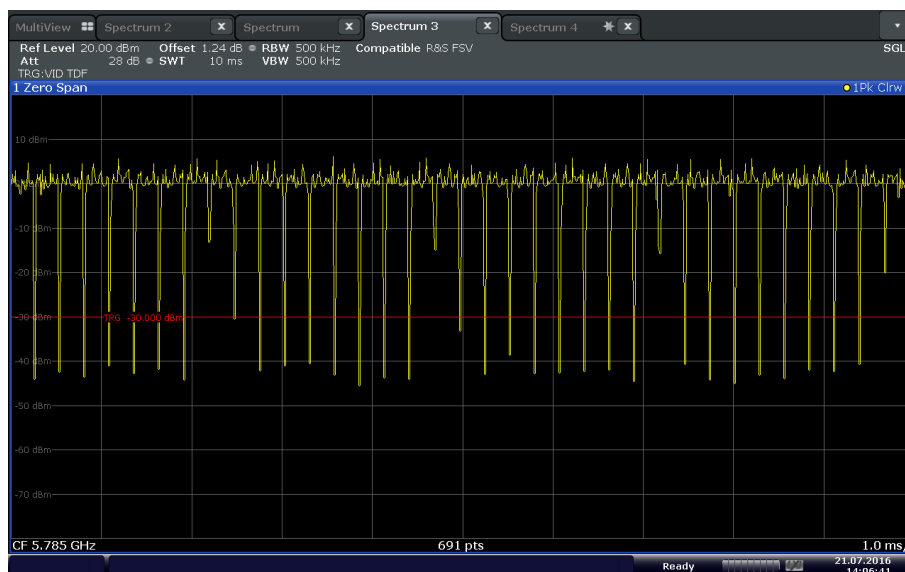


Date: 20 JUL 2016 17:29:29

250.725 μs per transmission (T , maximum transmission duration)

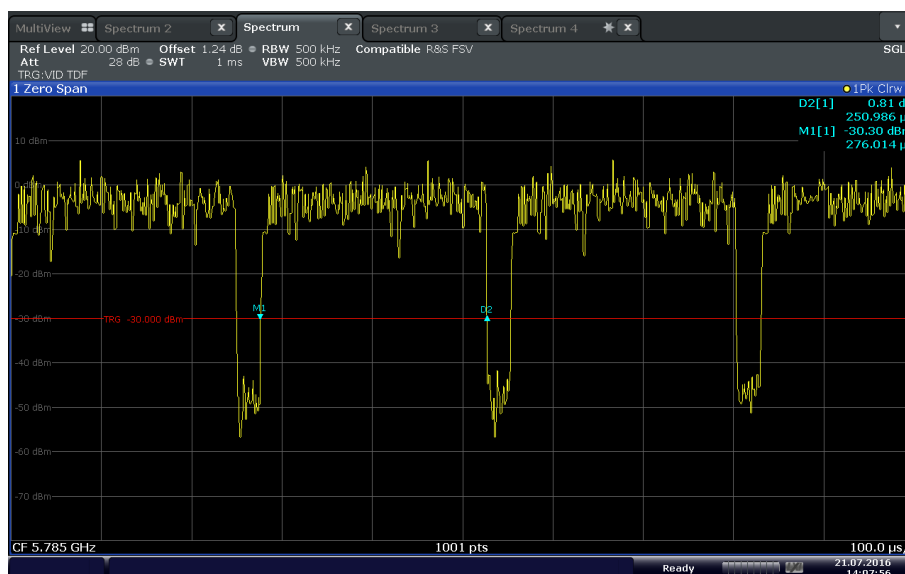
Calculated Duty Cycle (X)= $0.250725\text{ms} (36)(10)/100\text{ms}$
 $44.6082 \text{ ms}/100\text{ms}$
 $0.9026\text{or } 90.26\%$

Duty Cycle Correction Factor= $10 \log (1/X)$
 $10 \log (1/0.9026)$
 $0.45 \text{ dB for HT20 54 Mbps}$



Date: 21 JUL 2016 14:06:41

36.1 Transmissions in 10ms window (zero span) using HT20 MCS6 58.5Mbps



Date: 21 JUL 2016 14:07:56

250.986 us per transmission (T, maximum transmission duration)

Calculated Duty Cycle (X)= $0.250986\text{ms} (36.1)(10)/100\text{ms}$
 $90.6060\text{ ms}/100\text{ms}$
 0.9060 or 90.60%

Duty Cycle Correction Factor= $10 \log (1/X)$
 $10 \log (1/0.9060)$
 0.43 dB for HT20 MCS6 58.5 Mbps

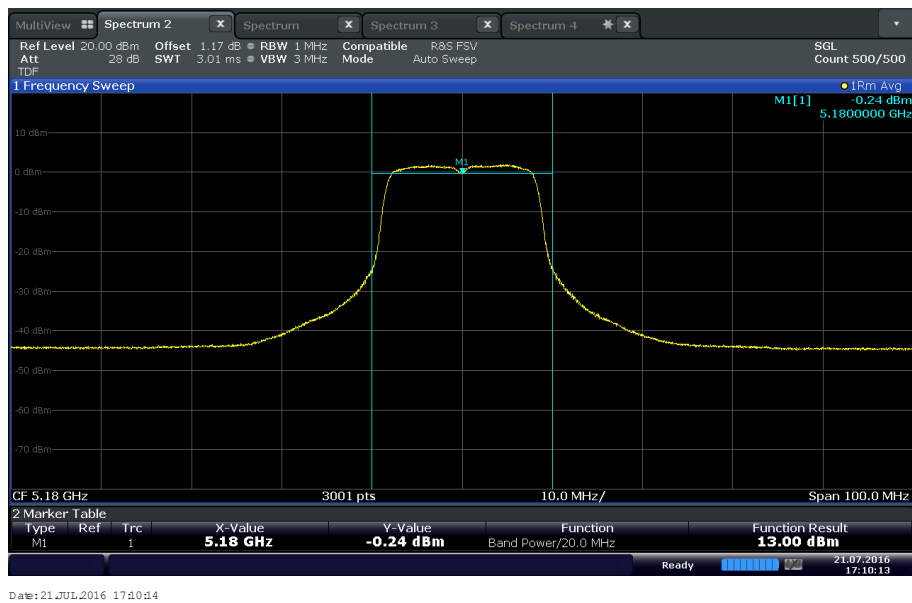
2.5.7 Test Results

802.11a					
WLAN Mode	Channel	Data rate (Mbps)	Measured Average Power (dBm)	Duty Cycle Correction Factor (dB)	Calculated Average Power (dBm)
802.11a U-NII 1 (5150 MHz to 5250 MHz). Limit is 24 dBm	36 (5180 MHz)	6	13.10	0.03	13.13
		9	13.03	0.07	13.10
		12	12.98	0.12	13.10
		18	13.00	0.14	13.14
		24	12.79	0.21	13.00
		36	12.68	0.29	12.97
		48	12.65	0.36	13.01
		54	12.53	0.45	12.98
802.11a U-NII 1 (5150 MHz to 5250 MHz). Limit is 24 dBm	40 (5200 MHz)	6	11.62	0.03	11.65
		9	11.55	0.07	11.62
		12	11.50	0.12	11.62
		18	11.50	0.14	11.64
		24	11.34	0.21	11.55
		36	11.22	0.29	11.51
		48	11.67	0.36	12.03
		54	11.64	0.45	12.09
	48 (5240 MHz)	6	12.79	0.03	12.82
		9	12.75	0.07	12.82
		12	12.68	0.12	12.80
		18	12.72	0.14	12.86
		24	13.05	0.21	13.26
		36	12.94	0.29	13.23
		48	12.58	0.36	12.94
		54	12.45	0.45	12.90
802.11a U-NII 3 (5725 MHz to 5850 MHz). Limit is 30 dBm	149 (5745 MHz)	6	12.23	0.03	12.26
		9	12.19	0.07	12.26
		12	12.21	0.12	12.33
		18	12.07	0.14	12.21
		24	11.62	0.21	11.83
		36	11.55	0.29	11.84
		48	12.12	0.36	12.48

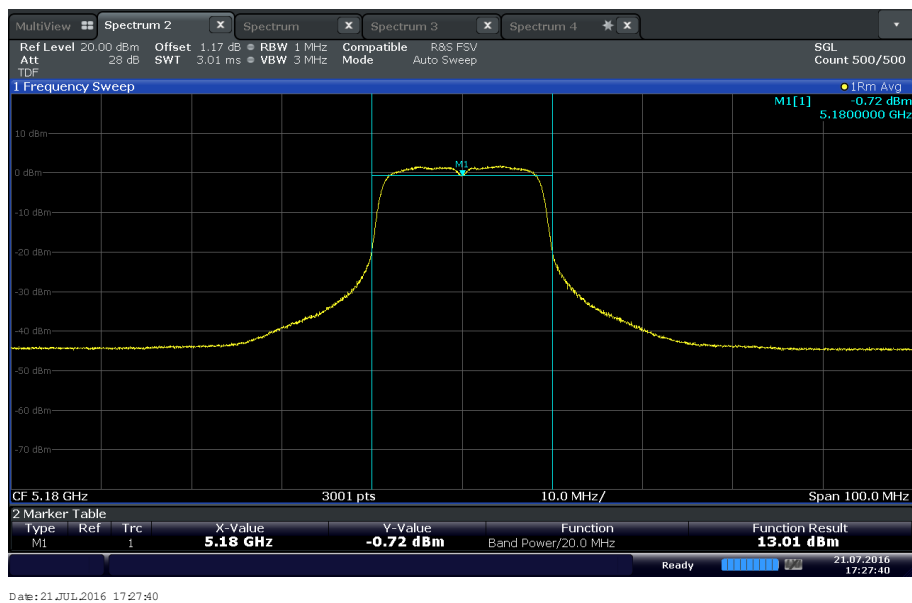
		54	12.05	0.45	12.50
	157 (5785 MHz)	6	13.03	0.03	13.06
		9	13.23	0.07	13.30
		12	13.21	0.12	13.33
		18	13.26	0.14	13.40
		24	13.15	0.21	13.36
		36	12.95	0.29	13.24
		48	12.53	0.36	12.89
		54	12.52	0.45	12.97
		802.11a U-NII 3 (5725 MHz to 5850 MHz). Limit is 30 dBm	165 (5825 MHz)	6	12.14
9	12.11			0.07	12.18
12	12.10			0.12	12.22
18	12.14			0.14	12.28
24	12.02			0.21	12.23
36	11.92			0.29	12.21
48	11.97			0.36	12.33
54	11.91			0.45	12.36
802.11n					
WLAN Mode	Channel	MCS	Measured Average Power (dBm)	Duty Cycle Correction Factor (dB)	Calculated Average Power (dBm)
802.11n U-NII 1 (5150 MHz to 5250 MHz). Limit is 24 dBm	36 (5180 MHz)	0	12.76	0.01	12.77
		1	12.63	0.13	12.76
		2	12.67	0.15	12.82
		3	13.11	0.22	13.33
		4	13.15	0.26	13.41
		5	12.94	0.41	13.35
		6	13.01	0.43	13.44
		7	12.96	0.47	13.43
	40 (5200 MHz)	0	11.78	0.01	11.79
		1	11.66	0.13	11.79
		2	11.71	0.15	11.85
		3	12.17	0.22	12.39
		4	12.14	0.26	12.40
		5	12.02	0.41	12.43
		6	12.03	0.43	12.46

	48 (5240 MHz)	7	11.98	0.47	12.45
		0	12.60	0.01	12.61
		1	12.52	0.13	12.65
		2	12.60	0.15	12.75
		3	12.59	0.22	12.81
		4	12.54	0.26	12.80
		5	12.47	0.41	12.88
		6	12.42	0.43	12.85
		7	12.38	0.47	12.85
802.11n U-NII 3 (5725 MHz to 5850 MHz). Limit is 30 dBm	149 (5745 MHz)	0	12.49	0.01	12.50
		1	12.41	0.13	12.54
		2	12.42	0.15	12.57
		3	12.39	0.22	12.61
		4	11.99	0.26	12.25
		5	11.96	0.41	12.37
		6	11.98	0.43	12.41
		7	11.94	0.47	12.41
	157 (5785 MHz)	0	13.04	0.01	13.05
		1	13.06	0.13	13.19
		2	13.12	0.15	13.27
		3	13.59	0.22	13.81
		4	13.53	0.26	13.79
		5	13.06	0.41	13.47
		6	13.11	0.43	13.54
		7	13.01	0.47	13.48
	165 (5825 MHz)	0	12.40	0.01	12.41
		1	12.31	0.13	12.44
		2	12.25	0.15	12.40
		3	12.11	0.22	12.33
		4	12.01	0.26	12.27
		5	11.92	0.41	12.33
		6	11.94	0.43	12.37
		7	11.92	0.47	12.39

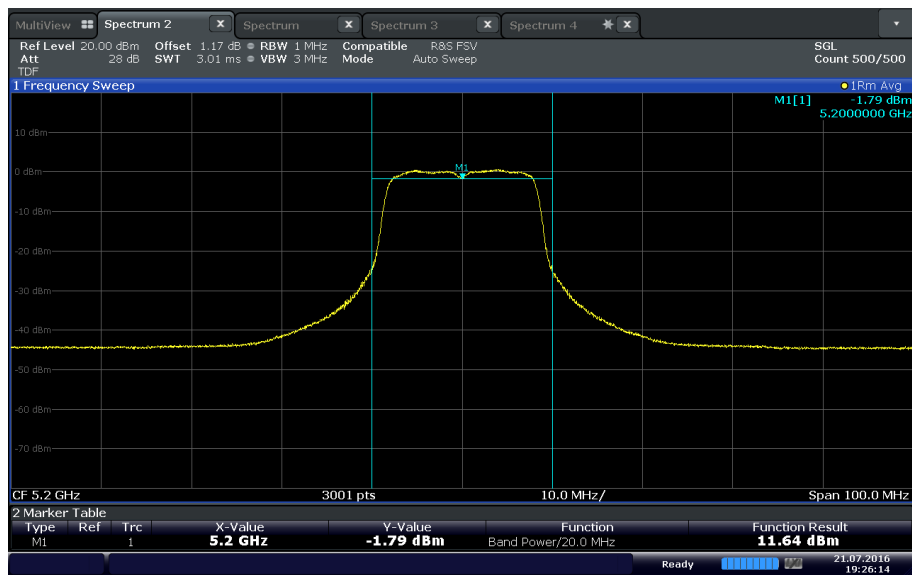
2.5.8 Sample Test Plots



Low Channel, 802.11a U-NII 1 HT20 18 Mbps

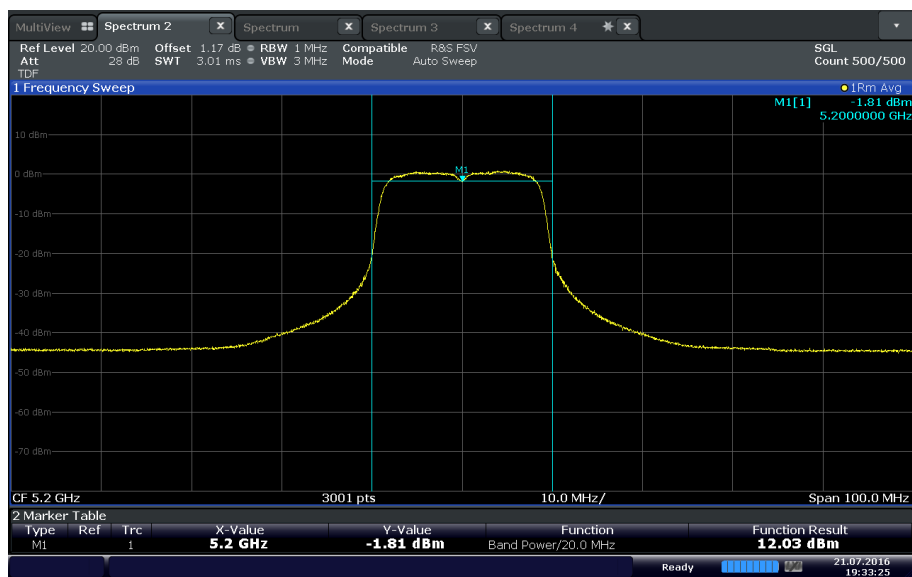


Low Channel, 802.11n U-NII 1 HT20 MCS6 58.5 Mbps



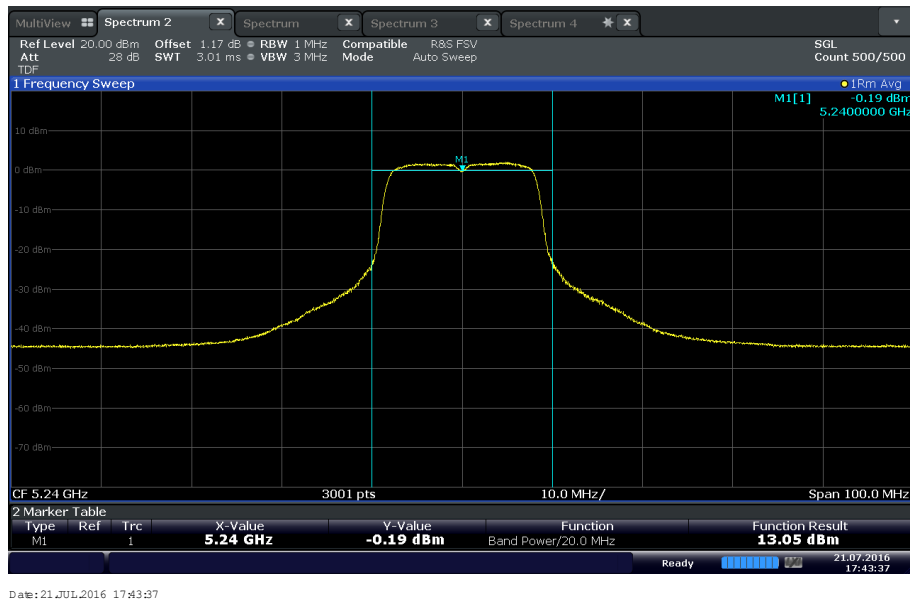
Date: 21 JUL 2016 19:26:14

Mid Channel, 802.11a U-NII 1 HT20 54 Mbps



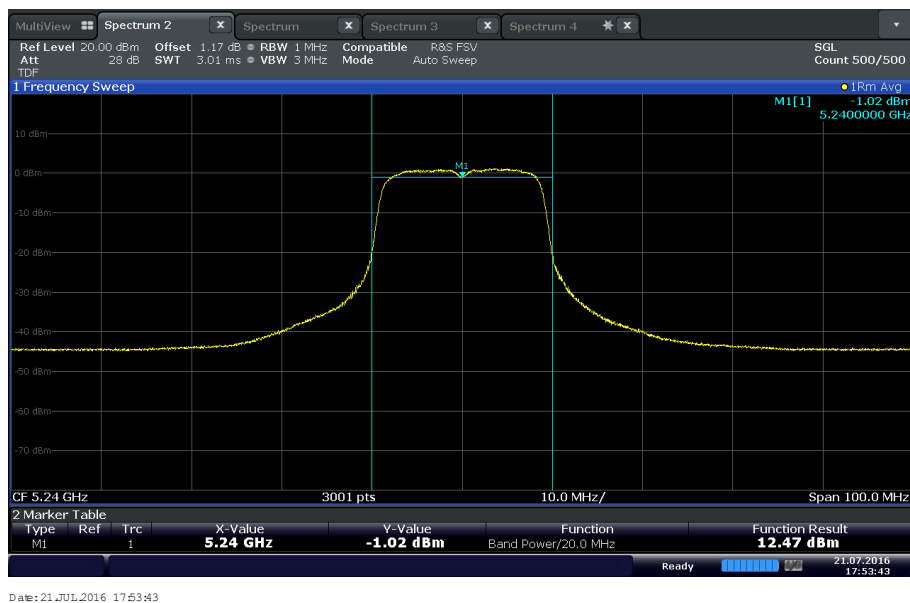
Date: 21 JUL 2016 19:33:25

Mid Channel, 802.11n U-NII 1 HT20 MCS6 58.5 Mbps



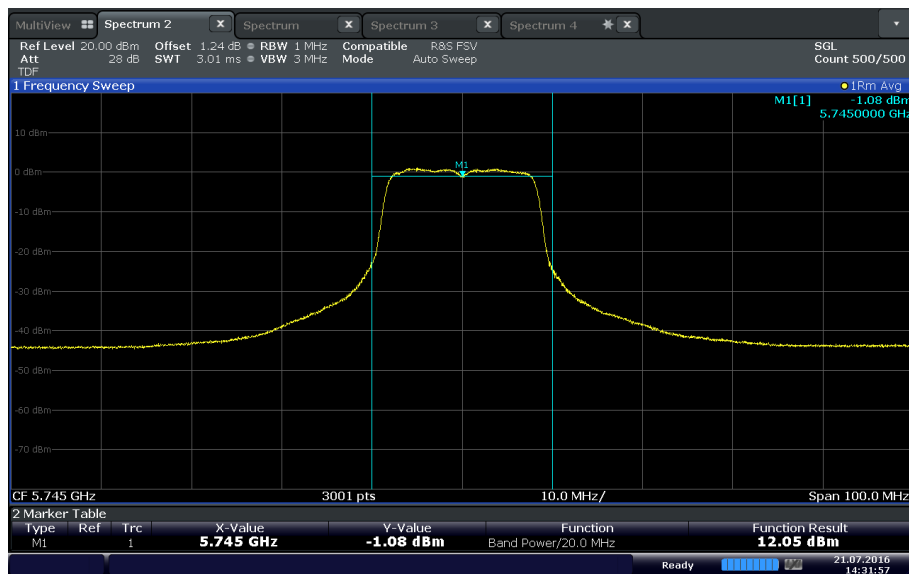
Date: 21 JUL 2016 17:43:37

High Channel, 802.11a U-NII 1 HT20 24 Mbps



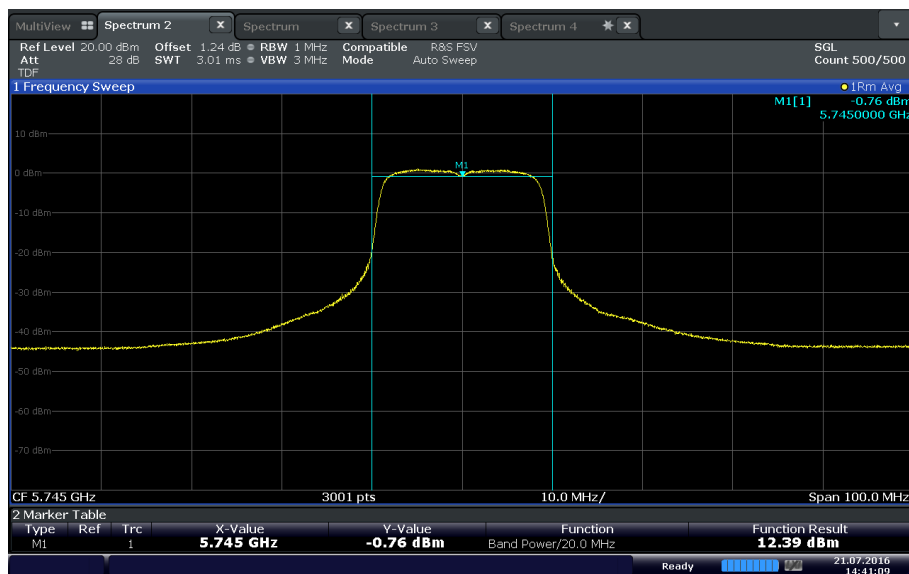
Date: 21 JUL 2016 17:53:43

High Channel, 802.11n U-NII 1 HT20 MCS5 52 Mbps



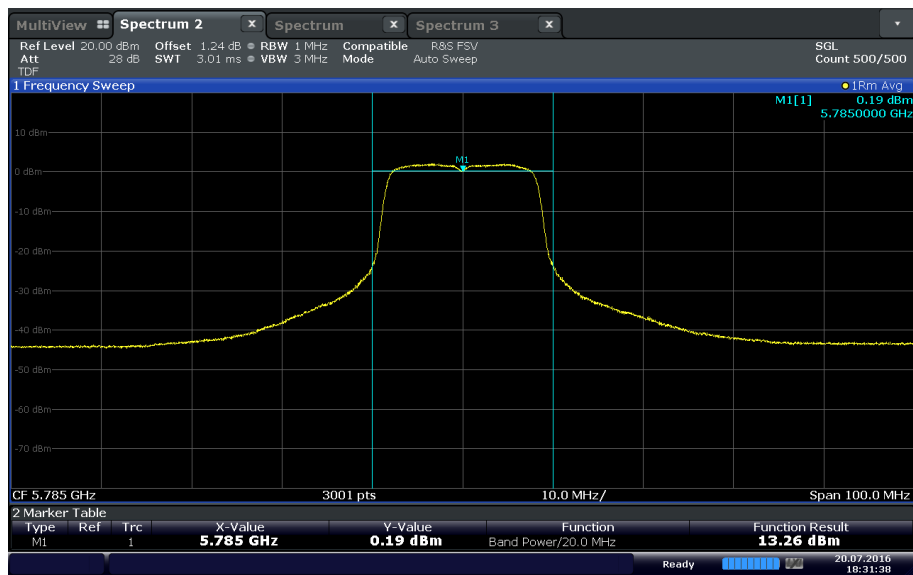
Date: 21 JUL 2016 14:31:57

Low Channel, 802.11a U-NII 3 HT20 54 Mbps



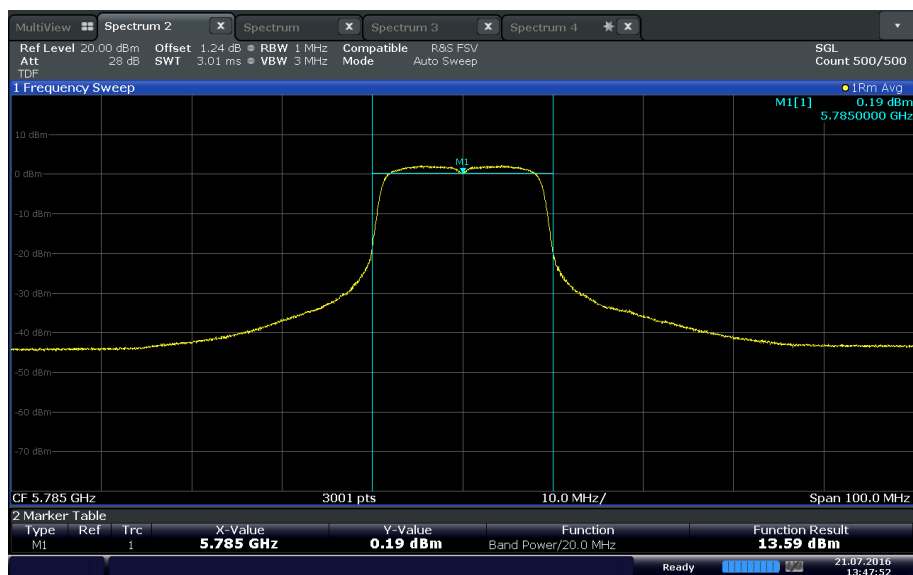
Date: 21 JUL 2016 14:41:09

Low Channel, 802.11n U-NII 3 HT20 MCS3 26Mbps



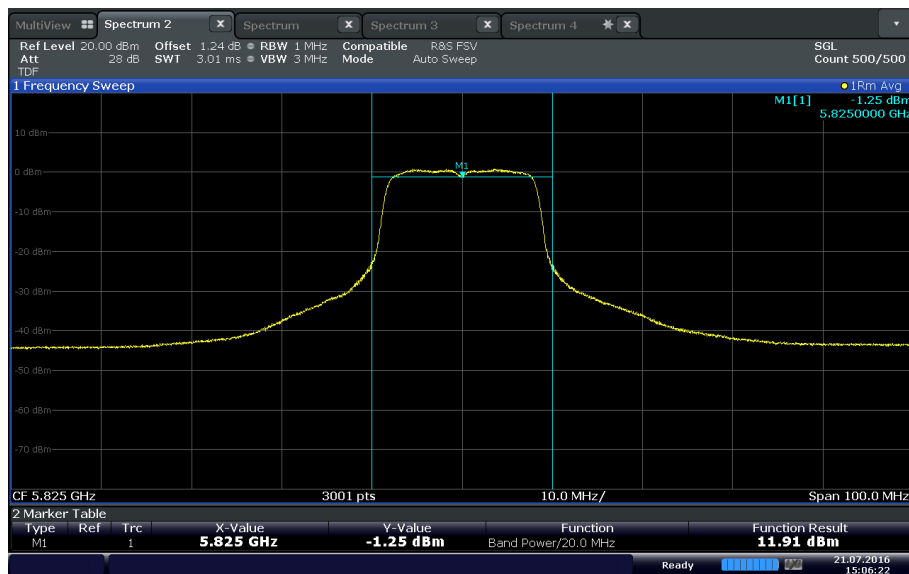
Date: 20 JUL 2016 18:31:39

Mid Channel, 802.11a U-NII 3 HT20 18 Mbps



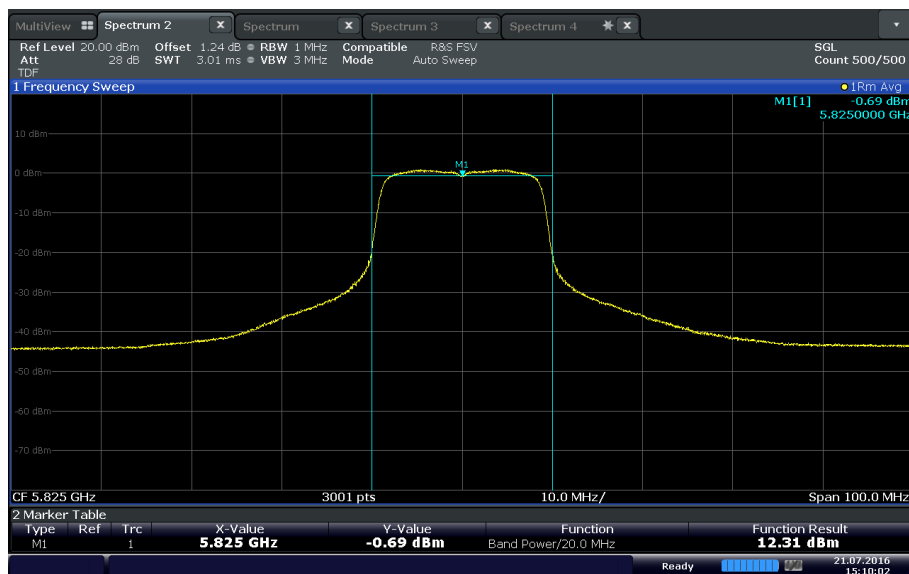
Date: 21 JUL 2016 13:47:52

Mid Channel, 802.11n U-NII 3 HT20 MCS3 26Mbps



Date: 21 JUL 2016 15:06:22

High Channel, 802.11a U-NII 3 HT20 54 Mbps



Date: 21 JUL 2016 15:10:02

High Channel, 802.11n U-NII 3 HT20 MCS1 13Mbps



2.6 MAXIMUM POWER SPECTRAL DENSITY (PSD)

2.6.1 Specification Reference

Part 15 Subpart E §15.407(a)(1)(IV) and §15.407(a)(3)

2.6.2 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.

2.6.3 Test Methodology

Section II (F) PSD of 789033 D02 General UNII Test Procedures v01r02

2.6.4 Equipment Under Test and Modification State

Serial No: IMEI 990000949644647 / Test Configuration A

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

July 22, 2016/NS

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 26.5°C
Relative Humidity 45.3%
ATM Pressure 99.2 kPa

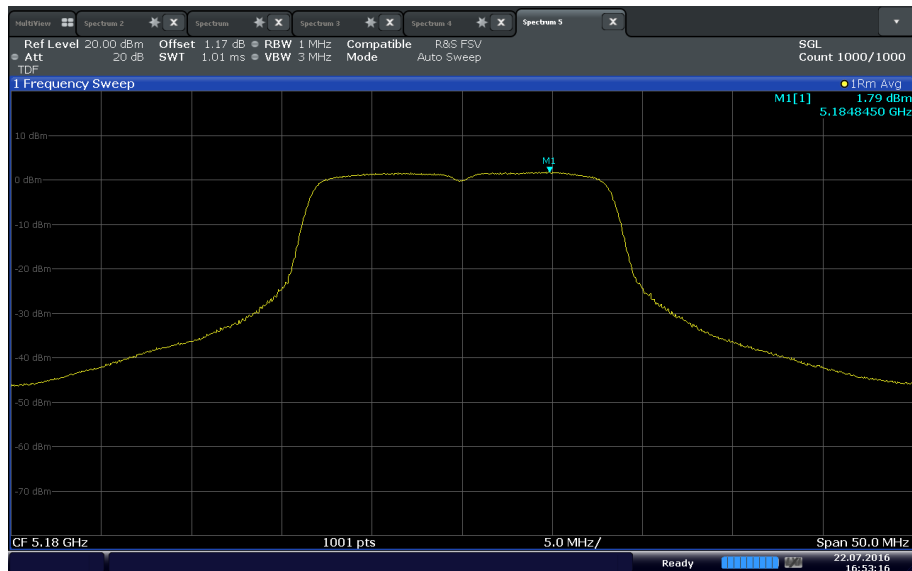
2.6.8 Additional Observations

- This is a conducted test as per Section II (F) PSD of 789033 D02 General UNII Test Procedures v01r02 (April 08, 2016). All conditions under this Section were satisfied.
- An offset of 1.17/1.24dB and a Transducer Factor (TDF) were used to compensate for the signal loss in external attenuator and cable used.
- Only the worst case data rates are presented.
- RBW for U-NII 1 is 1MHz and 500 kHz for U-NII 3.

2.6.9 Test Results

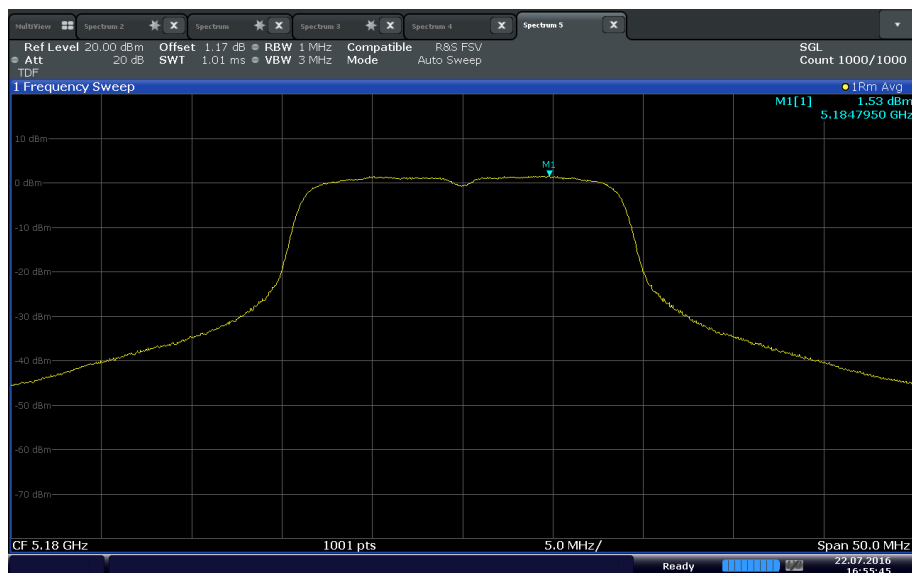
WLAN Mode	Channel	Peak of the Spectrum (dBm)	Duty Cycle Correction Factor (dB)	Calculated Maximum PSD (dBm)	Limit (dBm)
802.11a U-NII 1 (5150 MHz to 5250 MHz)	36 (5180 MHz)	1.79	0.14	1.93	11 dBm/1 MHz
	40 (5200 MHz)	-0.04	0.45	0.41	
	48 (5240 MHz)	1.69	0.21	1.90	
802.11n U-NII 1 (5150 MHz to 5250 MHz)	36 (5180 MHz)	1.53	0.43	1.96	
	40 (5200 MHz)	0.30	0.43	0.73	
	48 (5240 MHz)	0.72	0.41	1.13	
802.11a U-NII 3 (5725 MHz to 5850 MHz).	149 (5745 MHz)	-2.06	0.45	-1.61	30 dBm/500 kHz
	157 (5785 MHz)	-1.49	0.14	-1.35	
	165 (5825 MHz)	-2.05	0.45	-1.60	
802.11n U-NII 3 (5725 MHz to 5850 MHz).	149 (5745 MHz)	-2.26	0.22	-2.04	
	157 (5785 MHz)	-1.22	0.22	-1.00	
	165 (5825 MHz)	-2.64	0.13	-2.51	

2.6.10 Test Plots



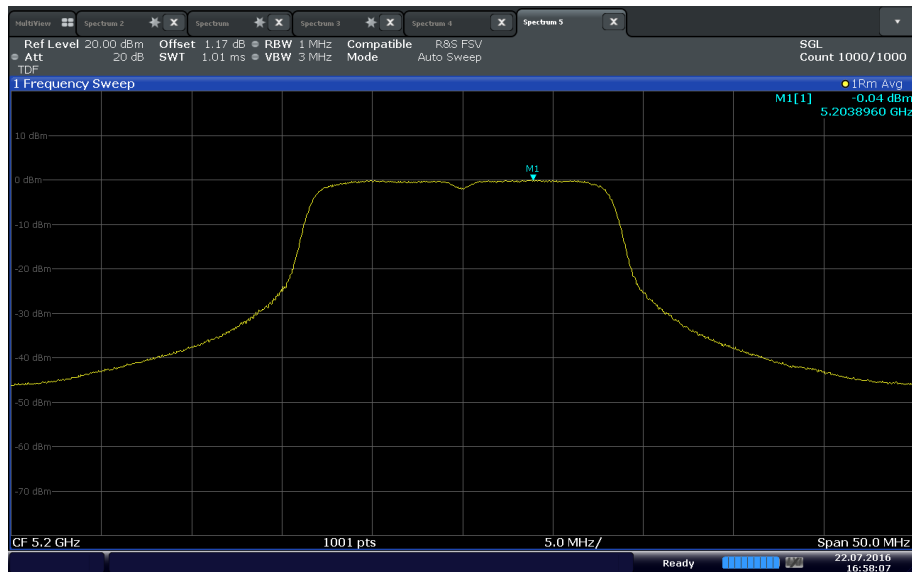
Date: 22 JUL 2016 16:53:16

Low Channel U-NII 1 802.11a



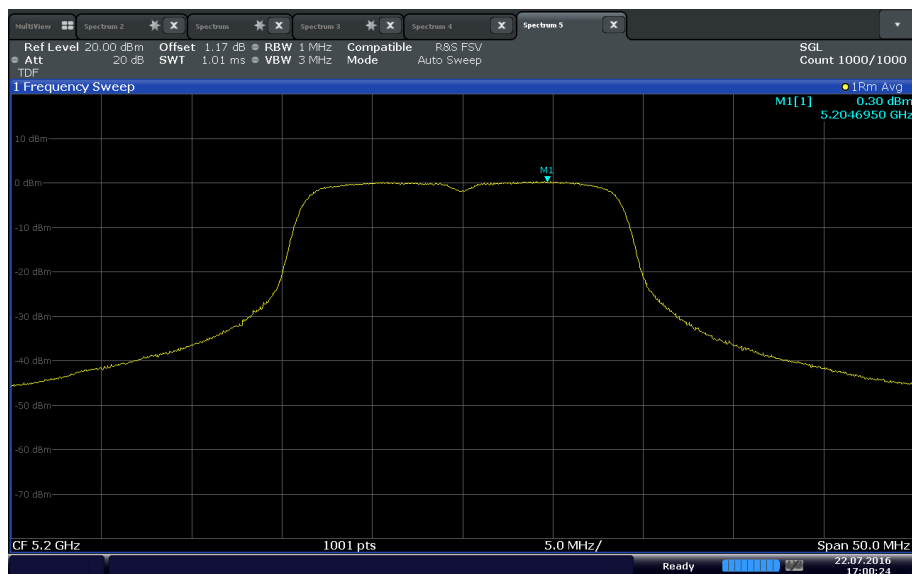
Date: 22 JUL 2016 16:55:46

Low Channel U-NII 1 802.11n



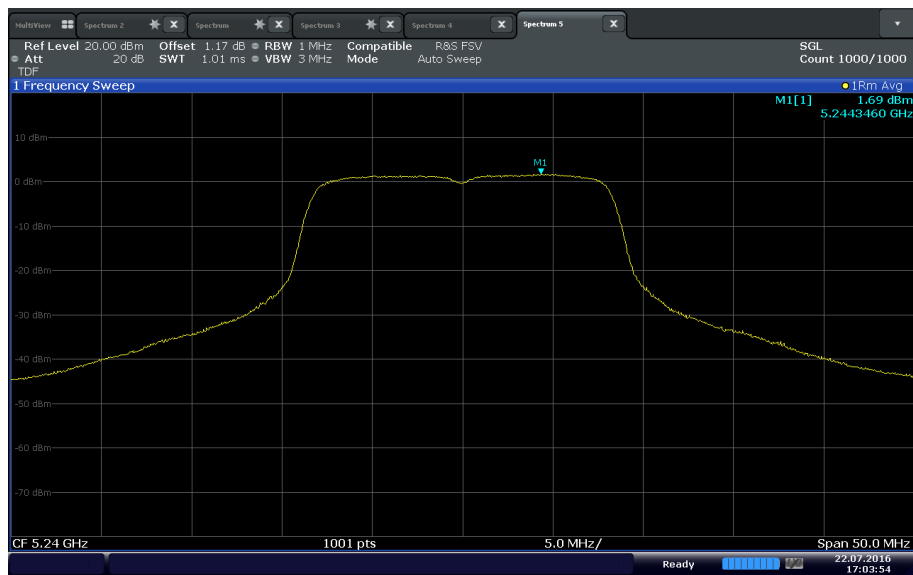
Date: 22 JUL 2016 16:58:07

Mid Channel U-NII 1 802.11a



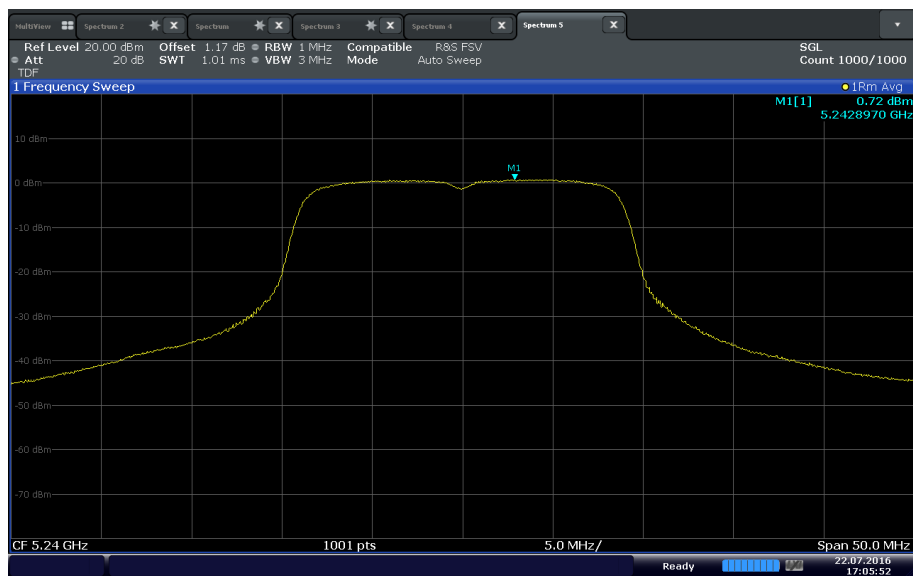
Date: 22 JUL 2016 17:00:23

Mid Channel U-NII 1 802.11n



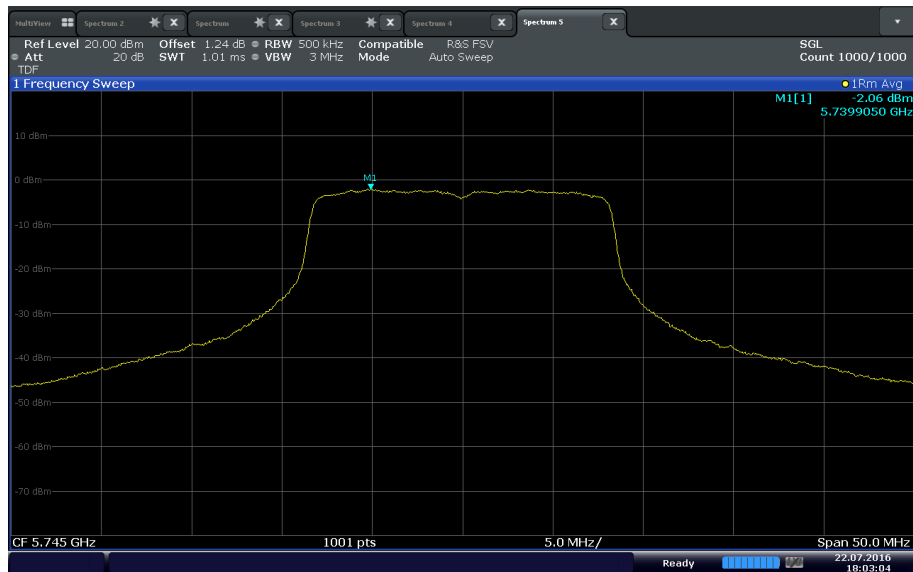
Date: 22 JUL 2016 17:03:53

High Channel U-NII 1 802.11a



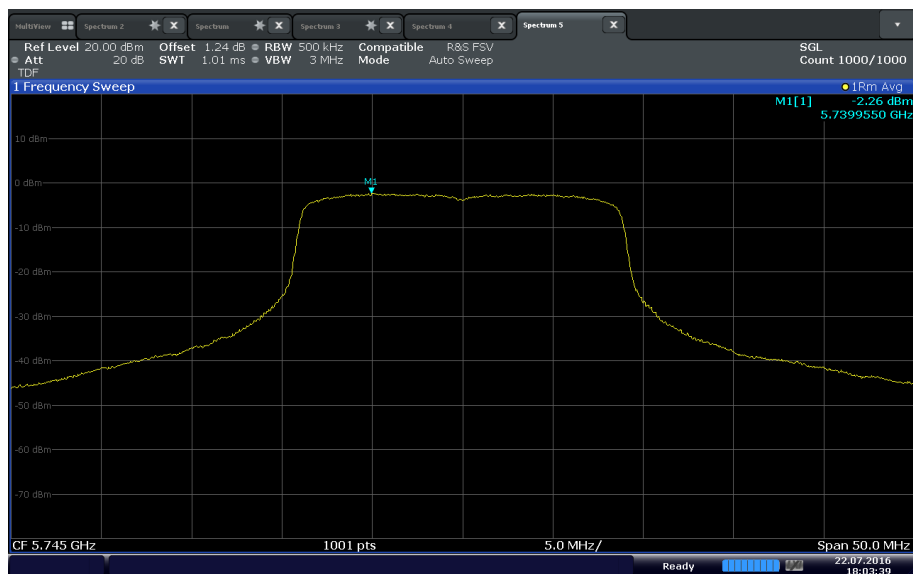
Date: 22 JUL 2016 17:05:53

High Channel U-NII 1 802.11n



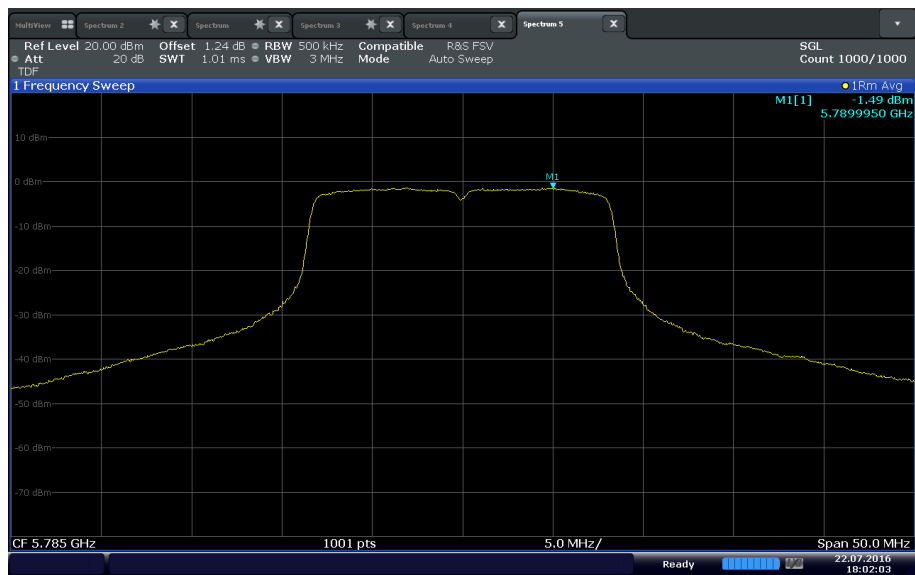
Date: 22 JUL 2016 18:03:04

Low Channel U-NII 3 802.11a



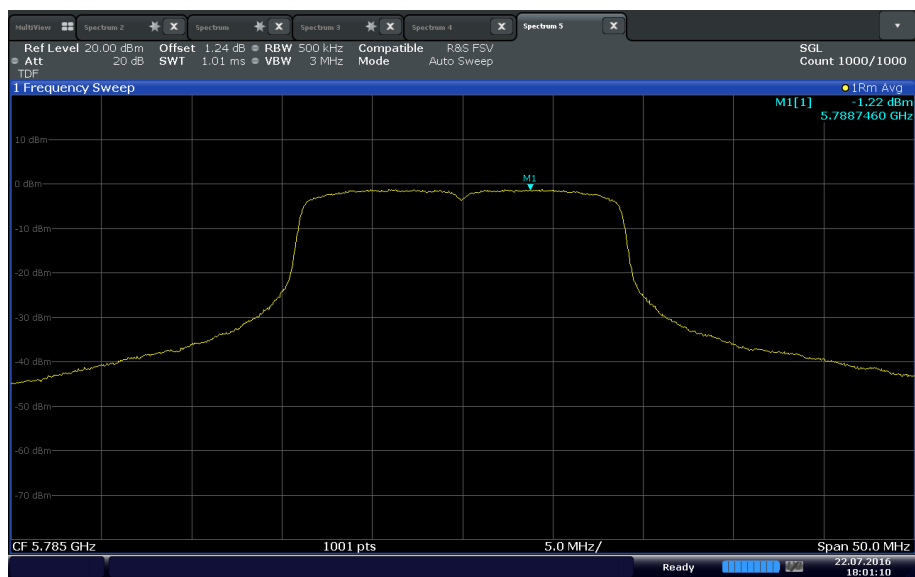
Date: 22 JUL 2016 18:03:39

Low Channel U-NII 3 802.11n



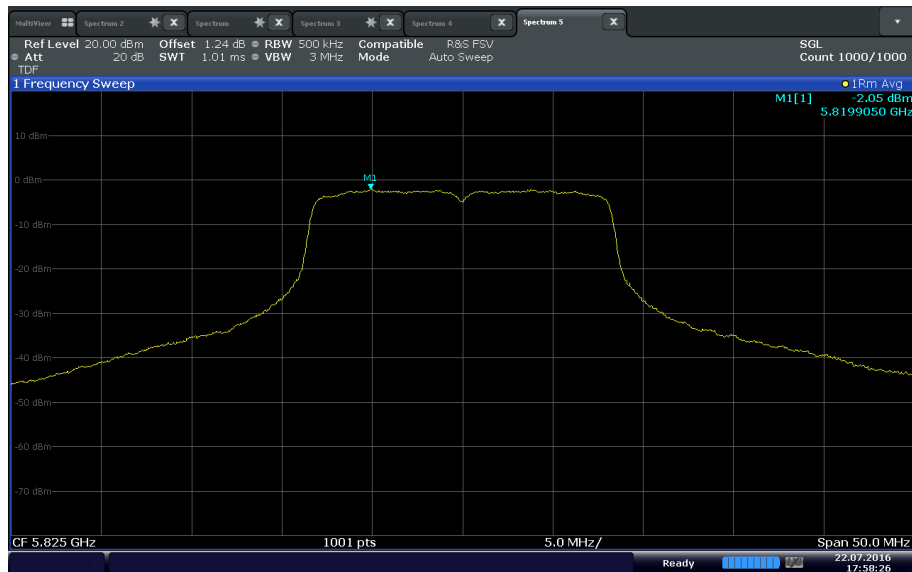
Date: 22 JUL 2016 18:02:03

Mid Channel U-NII 3 802.11a



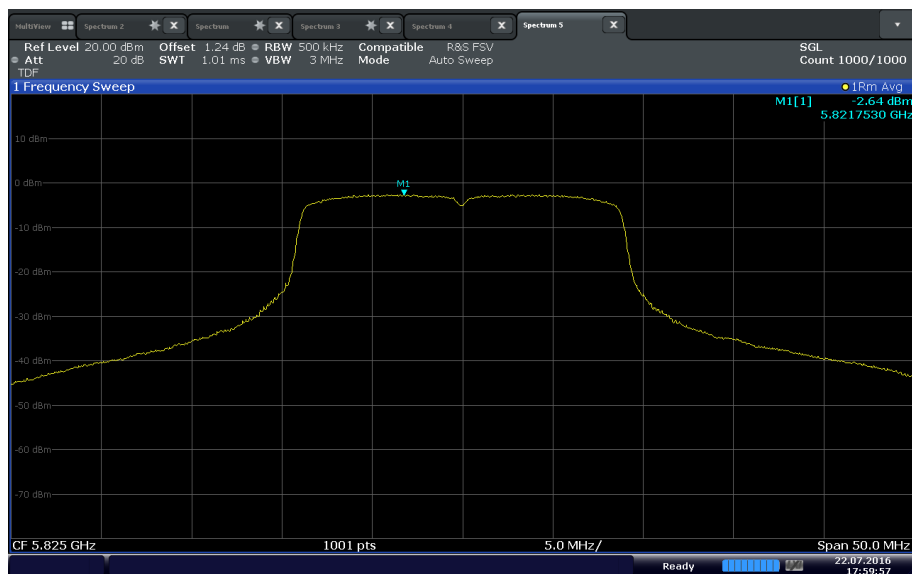
Date: 22 JUL 2016 18:01:11

Mid Channel U-NII 3 802.11n



Date: 22 JUL 2016 17:58:26

High Channel U-NII 3 802.11a



Date: 22 JUL 2016 17:59:57

High Channel U-NII 3 802.11n



2.7 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

2.7.1 Specification Reference

Part 15 Subpart E §15.407(b)(1),(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.

2.7.3 Test Methodology

Section II (G)(3)(d)(ii) Band Edge Measurement of 789033 D02 General UNII Test Procedures v01r02

2.7.4 Equipment Under Test and Modification State

Serial No: IMEI 990000949644647 / Test Configuration A

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

July 22, 2016/NS

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

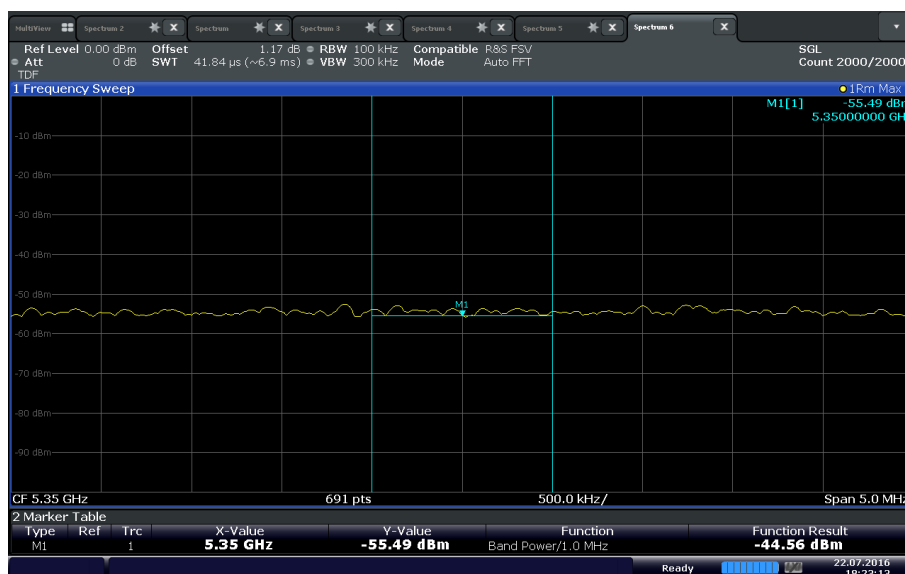
Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	26.5°C
Relative Humidity	45.3%
ATM Pressure	99.2 kPa

2.7.8 Additional Observations

- This is a conducted test using Integration Method as per Section II (G)(3)(d)(ii) Band Edge Measurement of 789033 D02 General UNII Test Procedures v01r02.
- RBW=100 kHz
- VBW=300 kHz
- Sweep time=Auto
- Trace Mode=max hold
- Sweep time is set to auto.
- An offset of 1.17/1.24dB and a Transducer Factor (TDF) were used to compensate for the signal loss in external attenuator and cable used.
- Integration performed across 1MHz bandwidth.

2.7.9 Test Results



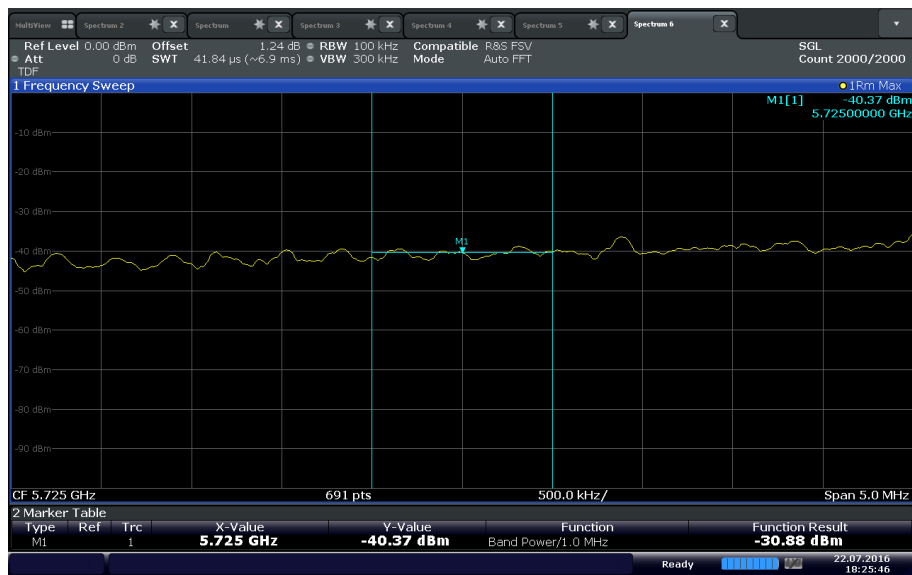
Date: 22 JUL 2016 18:23:13

U-NII 1 Upper Band Edge (Average Measurement) @ 5350 MHz

Upper band edge calculation (5350 MHz):

- Limit is -27dBm EIRP
- Calculation @ 5350 MHz:

Integrated average measurement @ 5350 MHz	= -44.56 dBm
EIRP @ 5350 MHz	= -44.56 + 0.41 (DCF)+3.0 dBi (antenna gain)
	= -41.15 dBm
Margin of compliance	= -14.15 dB (Compliant)

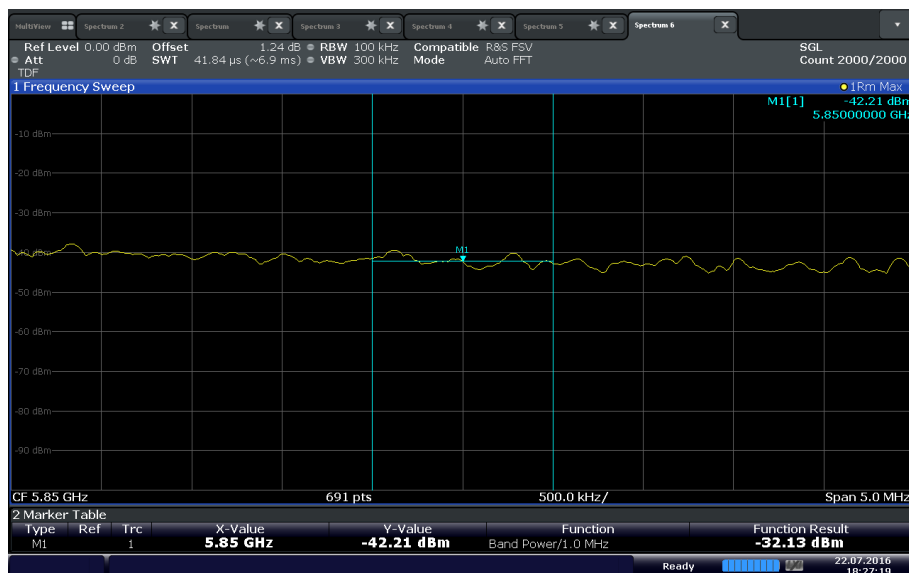


Date: 22 JUL 2016 18:25:46

U-NII 3 Lower Band Edge (Average Measurement) @ 5725 MHz

Lower band edge calculation:

- 5725 MHz (not in the restricted bands)
- Limit is -17dBm EIRP
- Calculation @ 5725 MHz:
 - Integrated average measurement @ 5725 MHz = -30.88 dBm
 - EIRP @ 5725 MHz = -30.88 + 0.22 dB (DCF) + 3.0 dBi (antenna gain)
 - = -27.66 dBm
 - Margin of compliance = -10.64dB (Compliant)



Date: 22 JUL 2016 18:27:19

U-NII 3 Upper Band Edge (Average Measurement) @ 5850 MHz

Lower band edge calculation:

- 5850 MHz (not in the restricted bands)
- Limit is -17dBm EIRP
- Calculation @ 5850 MHz:
 - Integrated average measurement @ 5850 MHz = -32.13 dBm
 - EIRP @ 5850 MHz = -32.13 + 0.13 dB (DCF) + 3.0 dBi (antenna gain)
 - = -29.00 dBm
 - Margin of compliance = -12.00 dB (Compliant)



2.8 SPURIOUS RADIATED EMISSIONS

2.8.1 Specification Reference

Part 15 Subpart E §15.407(b)(1),(4) and (7)

2.8.2 Standard Applicable

(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 EIRP of –27 dBm/MHz.

(4) For transmitters operating in the 5.725–5.825 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 EIRP of –17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of –27 dBm/MHz.

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

2.8.3 Equipment Under Test and Modification State

Serial No: IMEI 990000949644647/ Test Configuration B

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

June 21 and June 24, 2016/NS

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 performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.7-27.0°C
Relative Humidity	40.1-47.9%
ATM Pressure	98.8-98.9 kPa

2.8.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to 40GHz.
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.407(b).
- Only the considered worst case configurations presented. There are no significant differences in radiated emissions between the evaluated modulations and data rates.



- 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 2.8.8 for sample computation.

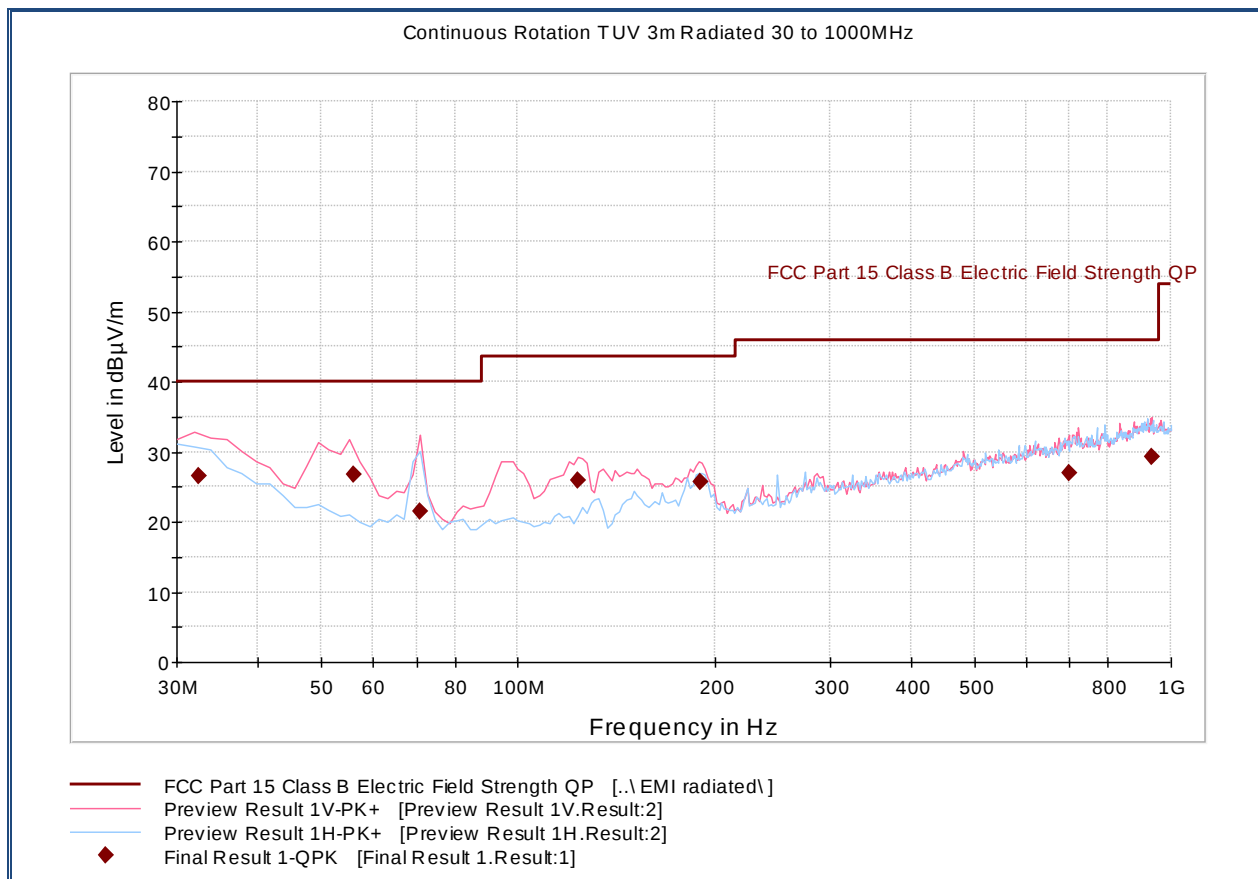
2.8.8 Sample Computation (Radiated Emission)

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

2.8.9 Test Results

See attached plots.

2.8.10 Test Results Below 1GHz (Ch157 802.11n MCS3 – worst case configuration)

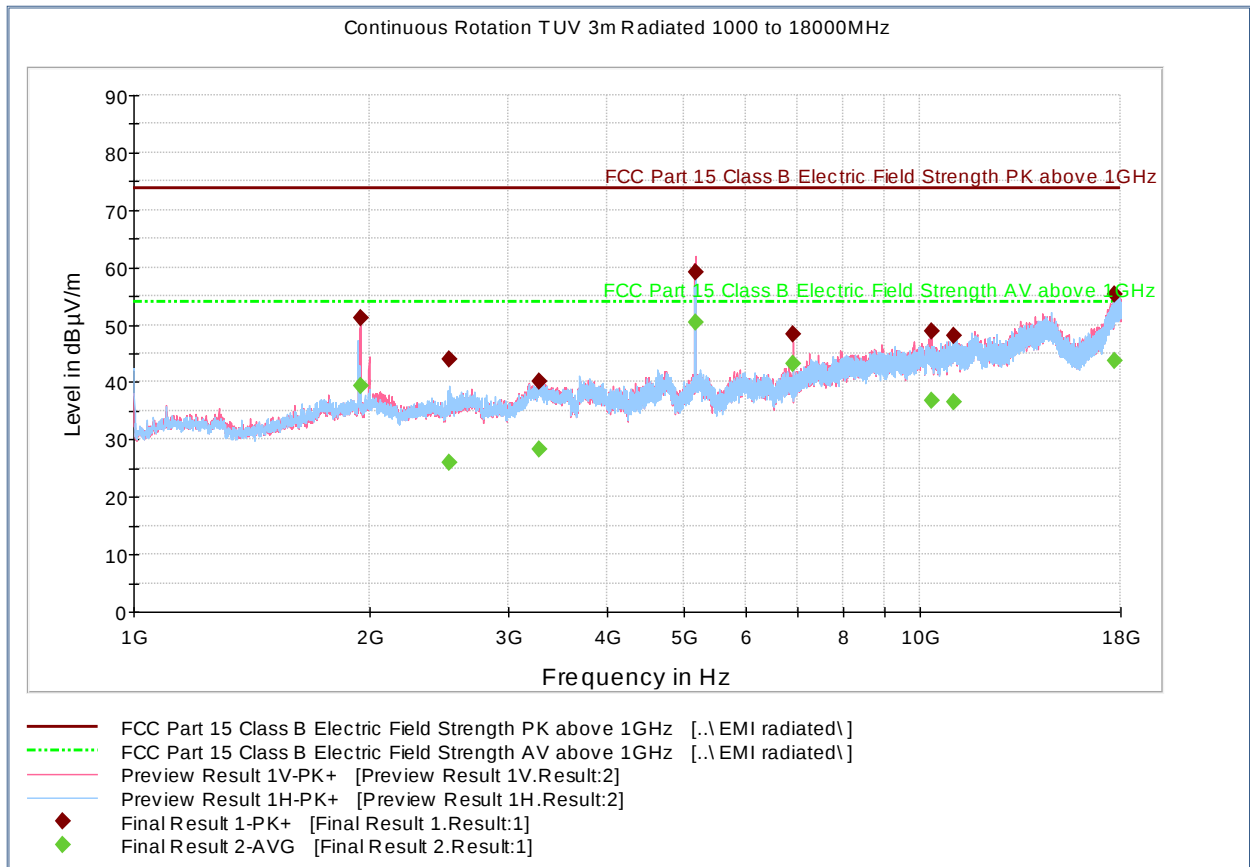


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
32.360000	26.6	1000.0	120.000	115.0	V	324.0	-7.2	13.4	40.0
55.990541	26.8	1000.0	120.000	100.0	V	240.0	-15.5	13.2	40.0
70.621643	21.5	1000.0	120.000	100.0	V	-10.0	-16.8	18.5	40.0
123.706613	25.9	1000.0	120.000	100.0	V	119.0	-15.4	17.6	43.5
190.222685	25.7	1000.0	120.000	100.0	V	184.0	-11.0	17.8	43.5
697.873507	27.0	1000.0	120.000	350.0	V	47.0	2.8	19.0	46.0
934.987816	29.4	1000.0	120.000	150.0	V	246.0	6.3	16.6	46.0

Test Notes:

2.8.11 Test Results above 1GHz Low Channel (36) (802.11a 18Mbps worst-case data rate)



Peak Data

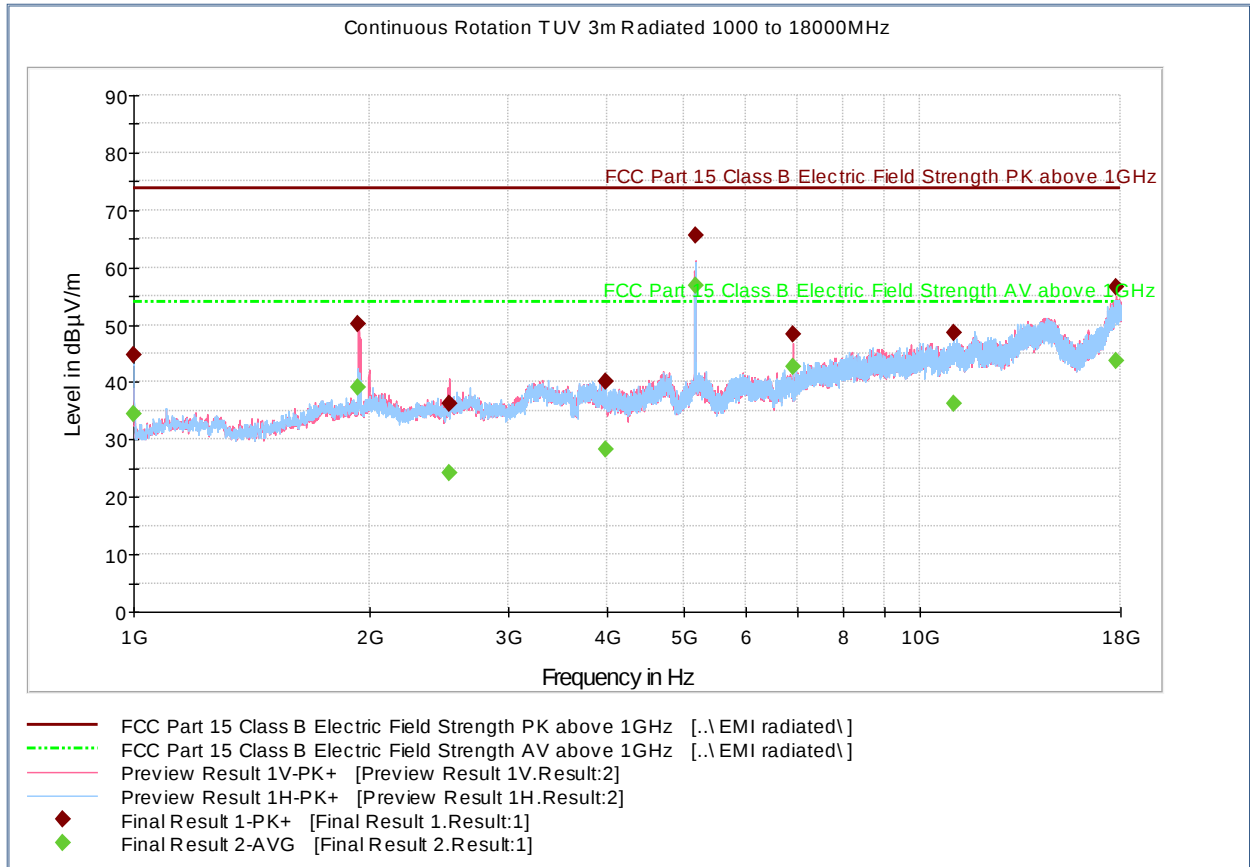
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1941.033333	51.3	1000.0	1000.000	309.1	V	304.0	-4.6	22.7	73.9
2522.833333	44.1	1000.0	1000.000	403.9	H	335.0	-4.9	29.8	73.9
3284.833333	40.2	1000.0	1000.000	264.3	V	-19.0	-1.1	33.7	73.9
5182.000000	59.1	1000.0	1000.000	136.6	V	315.0	2.7	Fundamental	
6906.566667	48.3	1000.0	1000.000	202.3	V	-4.0	5.8	25.6	73.9
10363.400000	49.0	1000.0	1000.000	126.7	V	37.0	12.1	24.9	73.9
11048.333333	48.1	1000.0	1000.000	326.1	V	342.0	13.1	25.8	73.9
17692.500000	55.2	1000.0	1000.000	214.4	V	273.0	22.7	18.7	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1941.033333	39.3	1000.0	1000.000	309.1	V	304.0	-4.6	14.6	53.9
2522.833333	25.9	1000.0	1000.000	403.9	H	335.0	-4.9	28.0	53.9
3284.833333	28.2	1000.0	1000.000	264.3	V	-19.0	-1.1	25.7	53.9
5182.000000	50.3	1000.0	1000.000	136.6	V	315.0	2.7	Fundamental	
6906.566667	43.2	1000.0	1000.000	202.3	V	-4.0	5.8	10.7	53.9
10363.400000	36.9	1000.0	1000.000	126.7	V	37.0	12.1	17.0	53.9
11048.333333	36.5	1000.0	1000.000	326.1	V	342.0	13.1	17.4	53.9
17692.500000	43.7	1000.0	1000.000	214.4	V	273.0	22.7	10.2	53.9

Test Notes: Measurement was performed with a 5.15-5.88 GHz notch filter. No significant emissions observed above 8GHz. Measurements above 8GHz are noise floor figures.

2.8.12 Test Results above 1GHz Low Channel (36) (802.11n MCS6 worst-case data rate)



Peak Data

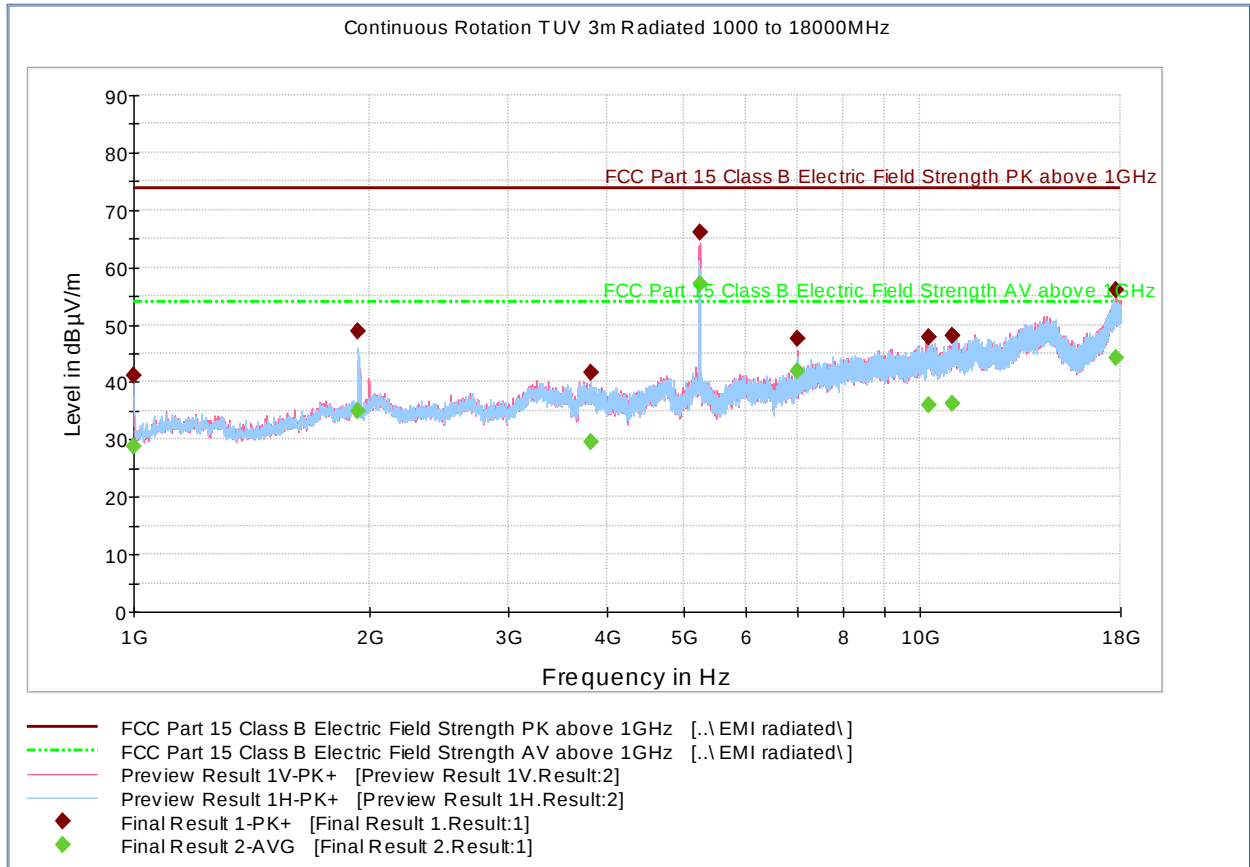
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	44.8	1000.0	1000.000	112.7	H	228.0	-11.2	29.1	73.9
1932.366667	50.2	1000.0	1000.000	305.1	V	281.0	-4.6	23.7	73.9
2519.433333	36.3	1000.0	1000.000	196.5	V	256.0	-4.9	37.6	73.9
3978.266667	40.0	1000.0	1000.000	401.7	H	101.0	1.3	33.9	73.9
5183.000000	65.5	1000.0	1000.000	167.6	V	59.0	2.7	Fundamental	
6906.566667	48.4	1000.0	1000.000	202.3	V	-1.0	5.8	25.5	73.9
11062.666667	48.6	1000.0	1000.000	176.6	V	310.0	13.2	25.3	73.9
17748.633333	56.5	1000.0	1000.000	228.4	V	298.0	23.1	17.4	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	34.4	1000.0	1000.000	112.7	H	228.0	-11.2	19.5	53.9
1932.366667	39.1	1000.0	1000.000	305.1	V	281.0	-4.6	14.8	53.9
2519.433333	24.1	1000.0	1000.000	196.5	V	256.0	-4.9	29.8	53.9
3978.266667	28.3	1000.0	1000.000	401.7	H	101.0	1.3	25.6	53.9
5183.000000	56.7	1000.0	1000.000	167.6	V	59.0	2.7	Fundamental	
6906.566667	42.7	1000.0	1000.000	202.3	V	-1.0	5.8	11.2	53.9
11062.666667	36.3	1000.0	1000.000	176.6	V	310.0	13.2	17.6	53.9
17748.633333	43.8	1000.0	1000.000	228.4	V	298.0	23.1	10.1	53.9

Test Notes: Measurement was performed with a 5.15-5.88 GHz notch filter. No significant emissions observed above 8GHz. Measurements above 8GHz are noise floor figures.

2.8.13 Test Results above 1GHz High Channel (48) (802.11a 24Mbps worst-case data rate)



Peak Data

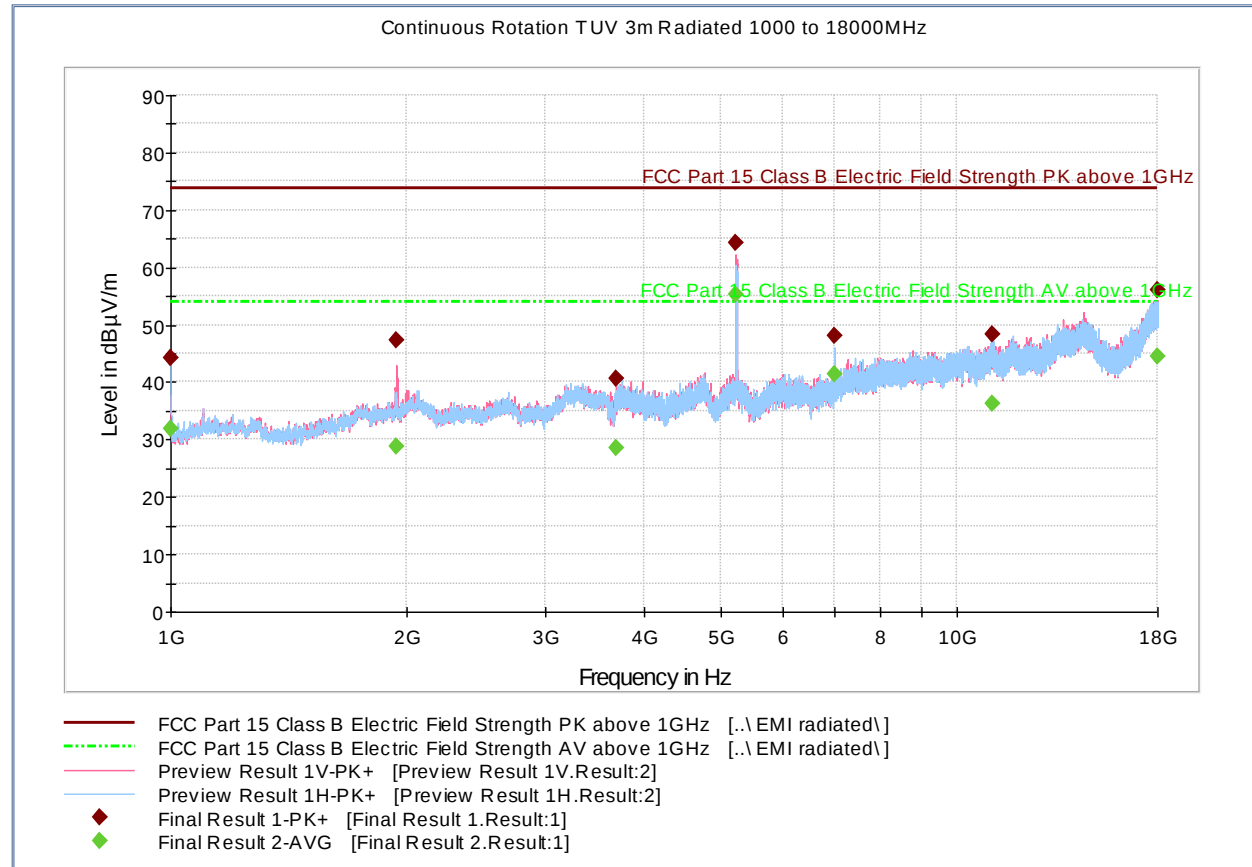
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.400000	41.1	1000.0	1000.000	165.6	H	159.0	-11.2	32.8	73.9
1932.200000	48.8	1000.0	1000.000	403.9	H	211.0	-4.6	25.1	73.9
3820.100000	41.7	1000.0	1000.000	403.8	H	130.0	0.9	32.2	73.9
5245.300000	66.2	1000.0	1000.000	156.6	V	78.0	3.0	Fundamental	
6986.866667	47.7	1000.0	1000.000	301.2	V	85.0	6.1	26.2	73.9
10285.766667	47.7	1000.0	1000.000	138.7	V	247.0	12.0	26.2	73.9
11001.466667	48.0	1000.0	1000.000	390.0	H	277.0	13.0	25.9	73.9
17734.033333	56.1	1000.0	1000.000	149.6	V	20.0	23.0	17.8	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)
1000.400000	28.7	1000.0	1000.000	165.6	H	159.0	-11.2	25.2	53.9
1932.200000	35.1	1000.0	1000.000	403.9	H	211.0	-4.6	18.8	53.9
3820.100000	29.6	1000.0	1000.000	403.8	H	130.0	0.9	24.3	53.9
5245.300000	57.1	1000.0	1000.000	156.6	V	78.0	3.0	Fundamental	
6986.866667	41.9	1000.0	1000.000	301.2	V	85.0	6.1	12.0	53.9
10285.766667	35.9	1000.0	1000.000	138.7	V	247.0	12.0	18.0	53.9
11001.466667	36.4	1000.0	1000.000	390.0	H	277.0	13.0	17.5	53.9
17734.033333	44.1	1000.0	1000.000	149.6	V	20.0	23.0	9.8	53.9

Test Notes: Measurement was performed with a 5.15-5.88 GHz notch filter. No significant emissions observed above 8GHz. Measurements above 8GHz are noise floor figures.

2.8.14 Test Results above 1GHz High Channel (48) (802.11n MCS5 worst-case data rate)



Peak Data

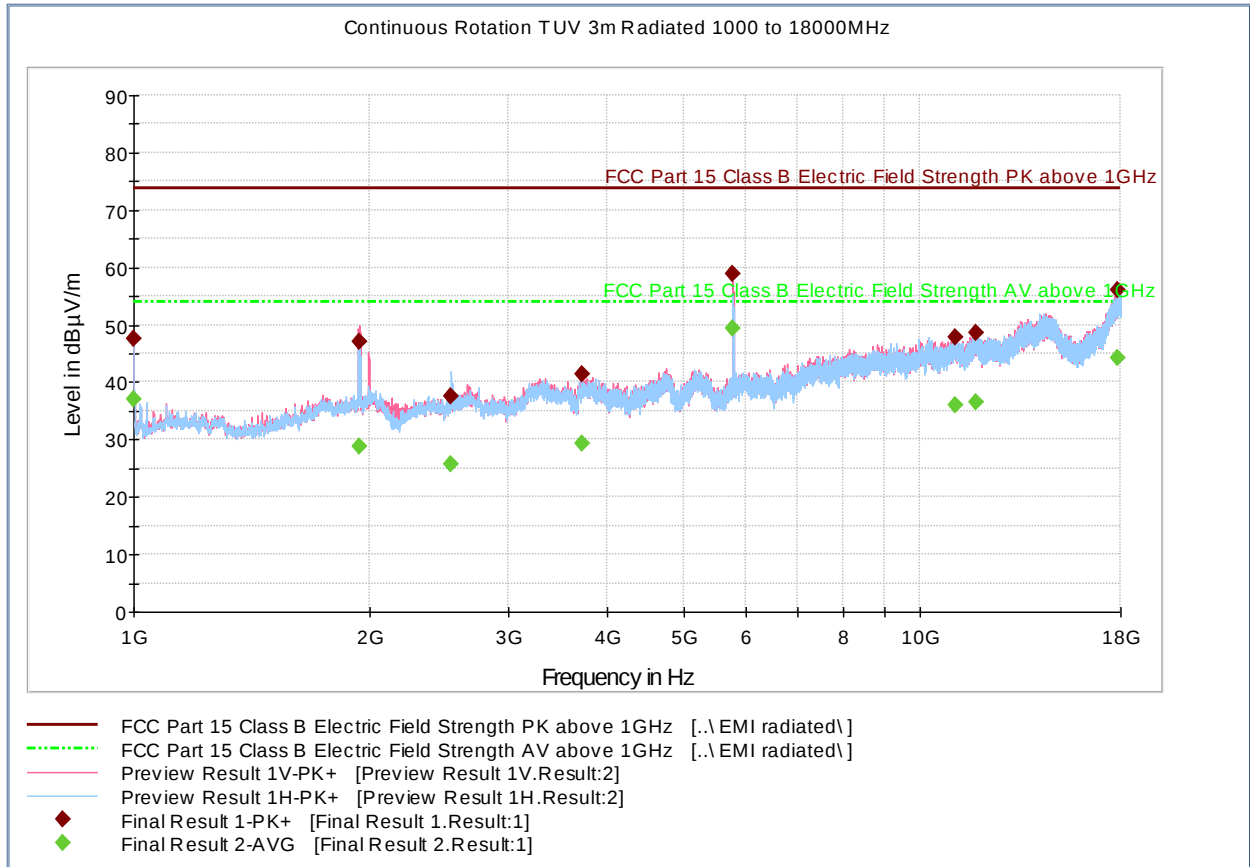
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.400000	44.2	1000.0	1000.000	113.7	H	5.0	-11.2	29.7	73.9
1936.100000	47.3	1000.0	1000.000	223.4	V	12.0	-4.6	26.6	73.9
3681.133333	40.6	1000.0	1000.000	192.5	V	315.0	-0.4	33.3	73.9
5235.800000	64.3	1000.0	1000.000	103.7	V	49.0	3.0	Fundamental	
6986.466667	48.0	1000.0	1000.000	102.7	H	-16.0	6.1	25.9	73.9
11094.433333	48.3	1000.0	1000.000	164.6	H	171.0	13.2	25.6	73.9
17982.100000	55.9	1000.0	1000.000	271.2	V	130.0	24.3	18.0	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.400000	32.0	1000.0	1000.000	113.7	H	5.0	-11.2	22.0	53.9
1936.100000	28.7	1000.0	1000.000	223.4	V	12.0	-4.6	25.2	53.9
3681.133333	28.6	1000.0	1000.000	192.5	V	315.0	-0.4	25.3	53.9
5235.800000	55.3	1000.0	1000.000	103.7	V	49.0	3.0	Fundamental	
6986.466667	41.5	1000.0	1000.000	102.7	H	-16.0	6.1	12.4	53.9
11094.433333	36.3	1000.0	1000.000	164.6	H	171.0	13.2	17.6	53.9
17982.100000	44.5	1000.0	1000.000	271.2	V	130.0	24.3	9.4	53.9

Test Notes: Measurement was performed with a 5.15-5.88 GHz notch filter. No significant emissions observed above 8GHz. Measurements above 8GHz are noise floor figures.

2.8.15 Test Results above 1GHz Mid Channel (157) (802.11a 18Mbps worst-case data rate)



Peak Data

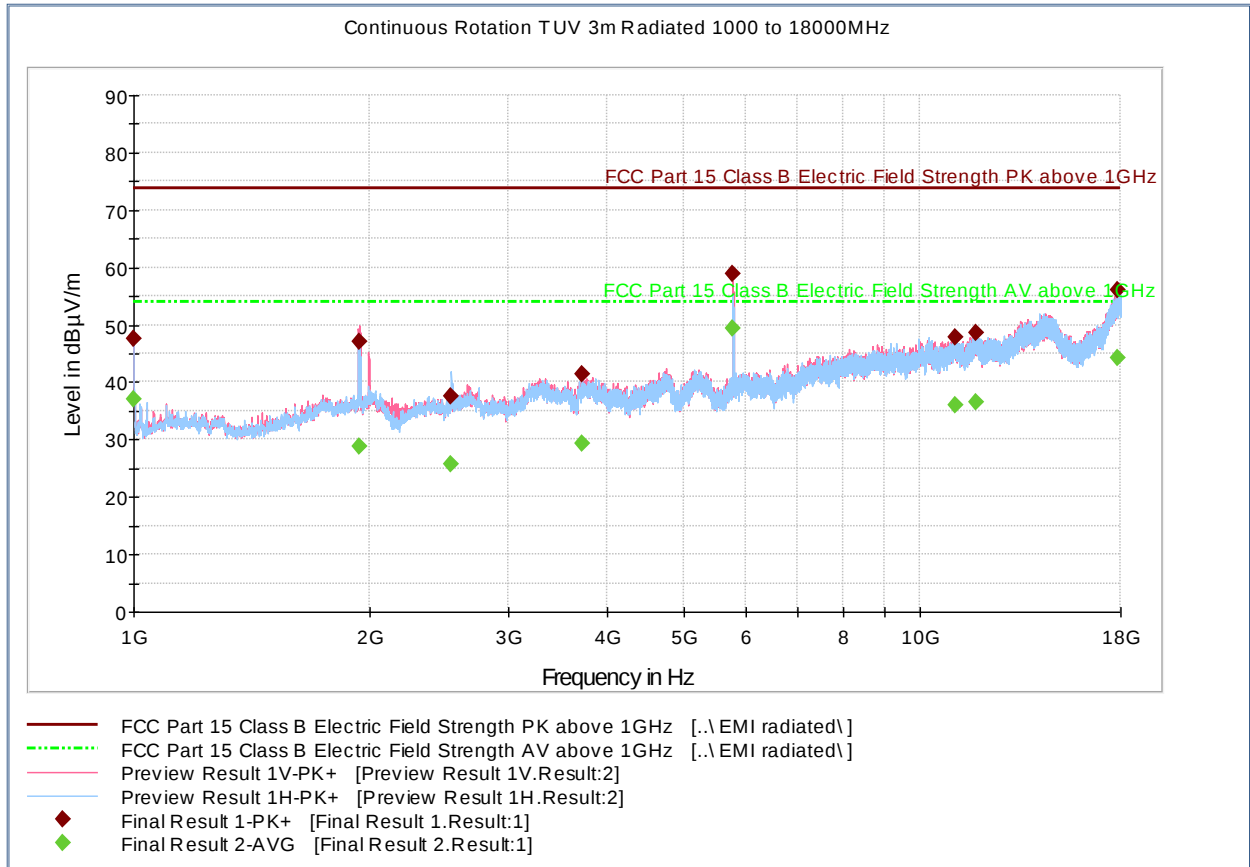
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	47.7	1000.0	1000.000	103.7	H	116.0	-11.2	26.2	73.9
1937.833333	47.0	1000.0	1000.000	361.1	V	98.0	-4.6	26.9	73.9
2536.600000	37.6	1000.0	1000.000	246.3	H	54.0	-4.8	36.3	73.9
3723.200000	41.3	1000.0	1000.000	403.9	V	196.0	0.1	32.6	73.9
5779.966667	58.8	1000.0	1000.000	403.8	V	333.0	3.7	Fundamental	
11103.500000	47.8	1000.0	1000.000	403.9	H	203.0	13.2	26.1	73.9
11806.900000	48.6	1000.0	1000.000	271.3	V	121.0	14.4	25.3	73.9
17807.866667	56.0	1000.0	1000.000	120.7	V	149.0	23.5	17.9	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	37.1	1000.0	1000.000	103.7	H	116.0	-11.2	16.8	53.9
1937.833333	28.8	1000.0	1000.000	361.1	V	98.0	-4.6	25.1	53.9
2536.600000	25.6	1000.0	1000.000	246.3	H	54.0	-4.8	28.3	53.9
3723.200000	29.4	1000.0	1000.000	403.9	V	196.0	0.1	24.5	53.9
5779.966667	49.4	1000.0	1000.000	403.8	V	333.0	3.7	Fundamental	
11103.500000	36.0	1000.0	1000.000	403.9	H	203.0	13.2	17.9	53.9
11806.900000	36.6	1000.0	1000.000	271.3	V	121.0	14.4	17.3	53.9
17807.866667	44.3	1000.0	1000.000	120.7	V	149.0	23.5	9.6	53.9

Test Notes: Measurement was performed with a 5.15-5.88 GHz notch filter. No significant emissions observed above 8GHz. Measurements above 8GHz are noise floor figures.

2.8.16 Test Results above 1GHz Mid Channel (157) (802.11n MCS3 worst-case data rate)



Peak Data

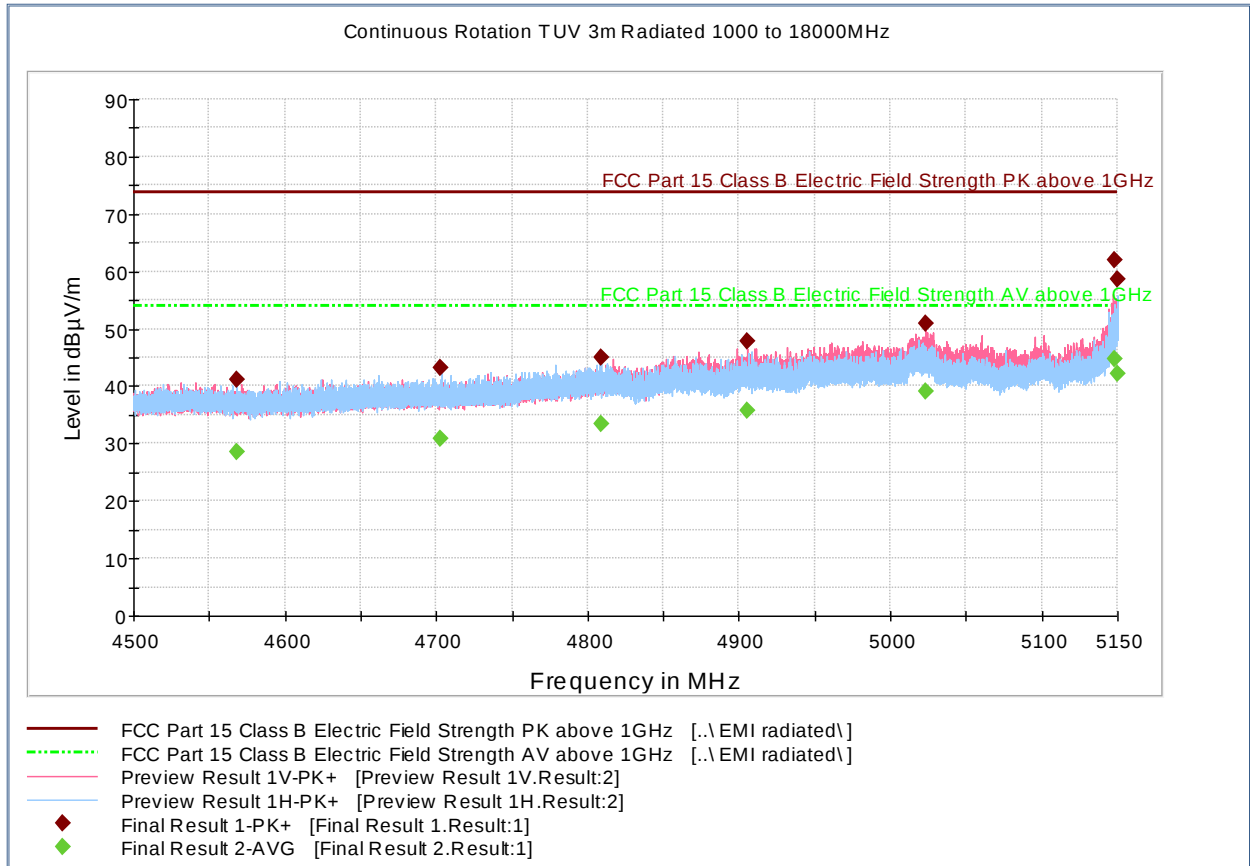
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	47.7	1000.0	1000.000	103.7	H	116.0	-11.2	26.2	73.9
1937.833333	47.0	1000.0	1000.000	361.1	V	98.0	-4.6	26.9	73.9
2536.600000	37.6	1000.0	1000.000	246.3	H	54.0	-4.8	36.3	73.9
3723.200000	41.3	1000.0	1000.000	403.9	V	196.0	0.1	32.6	73.9
5779.966667	58.8	1000.0	1000.000	403.8	V	333.0	3.7	Fundamental	
11103.500000	47.8	1000.0	1000.000	403.9	H	203.0	13.2	26.1	73.9
11806.900000	48.6	1000.0	1000.000	271.3	V	121.0	14.4	25.3	73.9
17807.866667	56.0	1000.0	1000.000	120.7	V	149.0	23.5	17.9	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	37.1	1000.0	1000.000	103.7	H	116.0	-11.2	16.8	53.9
1937.833333	28.8	1000.0	1000.000	361.1	V	98.0	-4.6	25.1	53.9
2536.600000	25.6	1000.0	1000.000	246.3	H	54.0	-4.8	28.3	53.9
3723.200000	29.4	1000.0	1000.000	403.9	V	196.0	0.1	24.5	53.9
5779.966667	49.4	1000.0	1000.000	403.8	V	333.0	3.7	Fundamental	
11103.500000	36.0	1000.0	1000.000	403.9	H	203.0	13.2	17.9	53.9
11806.900000	36.6	1000.0	1000.000	271.3	V	121.0	14.4	17.3	53.9
17807.866667	44.3	1000.0	1000.000	120.7	V	149.0	23.5	9.6	53.9

Test Notes: Test Notes: Measurement was performed with a 5.15-5.88 GHz notch filter. No significant emissions observed above 8GHz. Measurements above 8GHz are noise floor figures.

2.8.17 Test Results Lower Restricted Band (Ch36 802.11n MCS6 - worst-case configuration)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4567.881667	41.1	1000.0	1000.000	156.6	H	102.0	1.0	32.8	73.9
4702.363333	43.2	1000.0	1000.000	119.7	H	267.0	1.5	30.7	73.9
4808.620000	45.0	1000.0	1000.000	201.3	H	282.0	2.0	28.9	73.9
4905.816667	47.8	1000.0	1000.000	197.5	V	308.0	2.3	26.1	73.9
5023.011667	50.9	1000.0	1000.000	197.5	V	282.0	2.2	23.0	73.9
5148.335000	61.9	1000.0	1000.000	222.4	V	-1.0	2.6	12.0	73.9
5149.961667	58.5	1000.0	1000.000	111.7	H	48.0	2.6	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)
4567.881667	28.6	1000.0	1000.000	156.6	H	102.0	1.0	25.3	53.9
4702.363333	30.9	1000.0	1000.000	119.7	H	267.0	1.5	23.0	53.9
4808.620000	33.4	1000.0	1000.000	201.3	H	282.0	2.0	20.5	53.9
4905.816667	35.7	1000.0	1000.000	197.5	V	308.0	2.3	18.2	53.9
5023.011667	39.2	1000.0	1000.000	197.5	V	282.0	2.2	14.7	53.9
5148.335000	44.7	1000.0	1000.000	222.4	V	-1.0	2.6	9.2	53.9
5149.961667	42.2	1000.0	1000.000	111.7	H	48.0	2.6	11.7	53.9

Test Notes:



SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

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

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Antenna Conducted Port Setup						
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	05/16/16	05/16/17
7582	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	02/01/16	02/01/17
	20dB Attenuator	768-20-SP	2247	Narda	Verified by 7582 and 1003	
Radiated Test Setup						
1033	Bilog Antenna	3142C	00044556	EMCO	09/25/14	09/25/16
1051	Double-ridged waveguide horn antenna	3115	9408-4329	EMCO	03/21/16	03/21/17
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	01/11/16	01/11/17
1054	Horn antenna (18-40 GHz)	3116	9407-2233	EMCO	12/22/15	12/22/17
8893	Pre-amplifier (18-40 GHz)	SLKka-30-6	15G27	Spacek Labs	Verified by 1003 and 1049	
8850	High-frequency cable	N/A	N/A	N/A	12/17/15	12/17/16
8549	High-frequency cable	SAC-26G-6.1	363	A.H.Systems	03/17/16	03/17/17
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	09/29/15	09/29/16
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/17/16	03/17/17
8818	5.15-5.88GHz Notch Filter	BRM50716	015	Micro-Tronics	Verified by 1003 and 1049	
1016	Pre-amplifier	PAM-0202	187	PAM	12/15/15	12/15/16
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	05/16/16	05/16/17
Miscellaneous						
7619	Barometer/Temperature/ Humidity Transmitter	iBTHX-W	15250268	Omega	10/19/15	10/19/16
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

3.2 MEASUREMENT UNCERTAINTY

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

3.2.1 Radiated Emission Measurements (Below 1GHz)

Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2	Cables	Rectangular	0.50	0.29	0.08
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.75	0.43	0.19
5	Site	Rectangular	2.70	1.56	2.43
6	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					1.78
Coverage Factor (k):					2
Expanded Uncertainty:					3.57

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	2.70	1.56	2.43
6	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					1.78
Coverage Factor (k):					2
Expanded Uncertainty:					3.56

3.2.3 Conducted Antenna Port Measurement

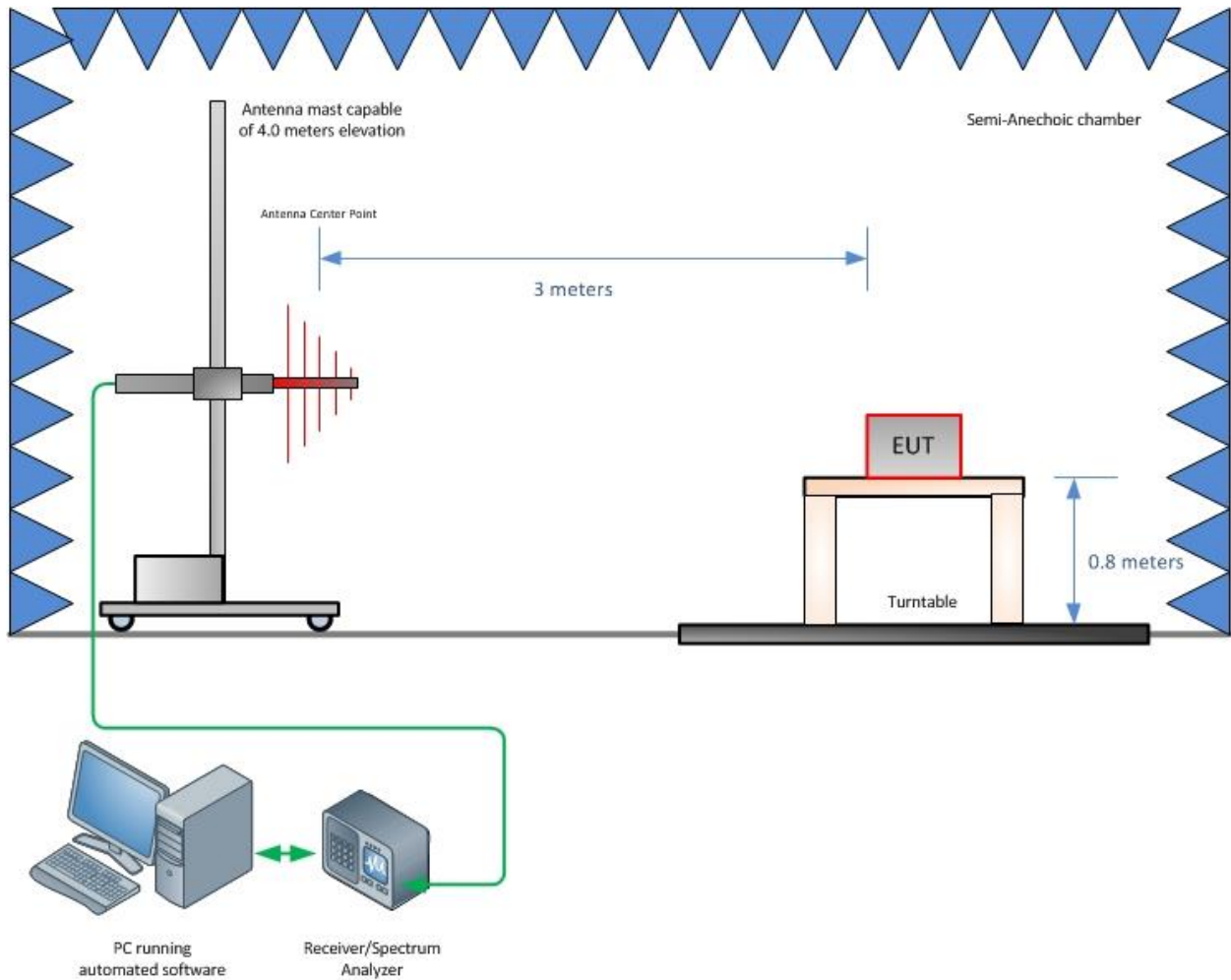
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.34	0.20	0.04
2	Cables	Rectangular	1.00	0.58	0.33
3	EUT Setup	Rectangular	0.50	0.29	0.08
Combined Uncertainty (u_c):					0.67
Coverage Factor (k):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



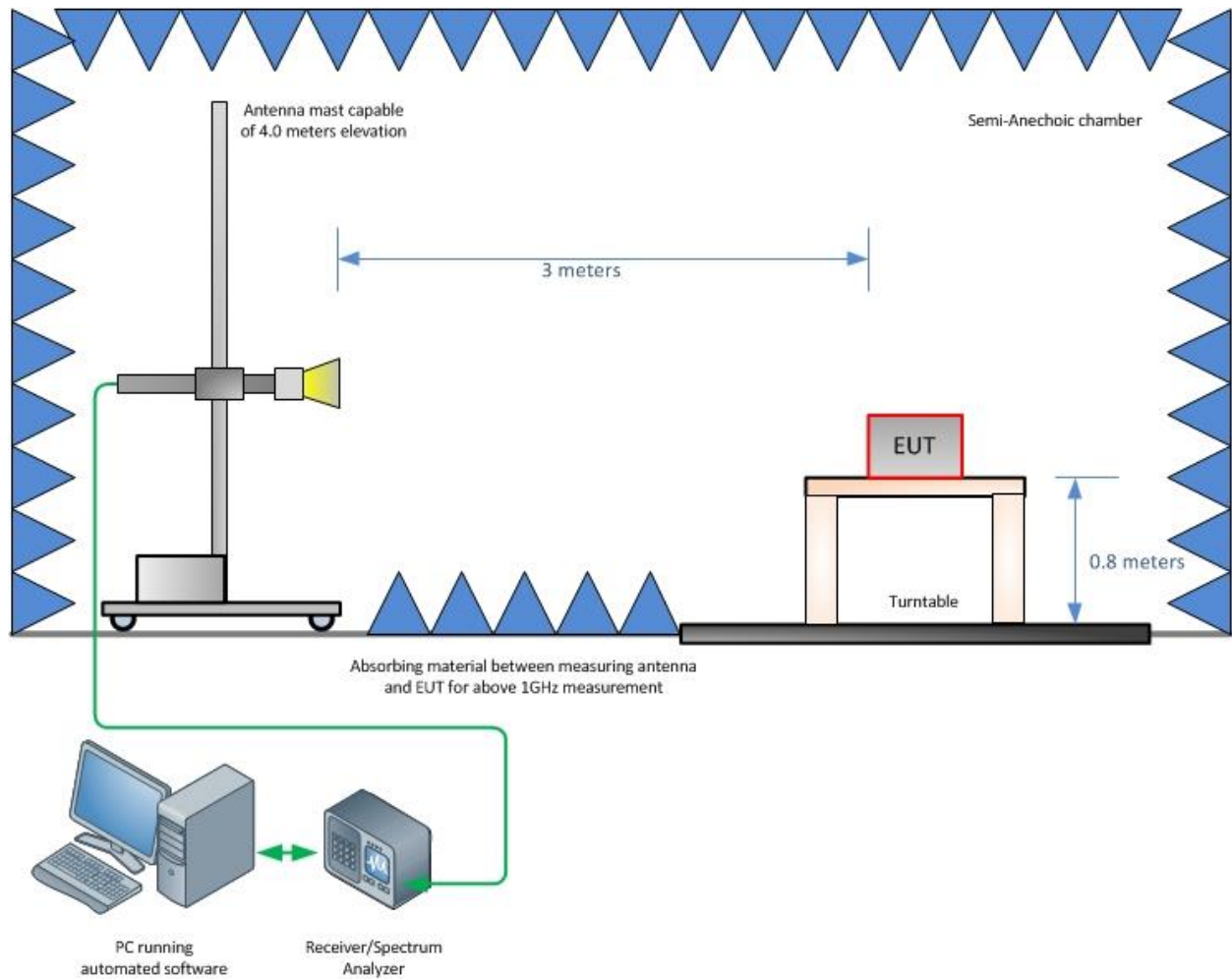
SECTION 4

DIAGRAM OF TEST SETUP

4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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