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Report On

Application for Grant of Equipment Authorization of the
NantWorks
HBox Access Point for Medical Devices

FCC Part 15 Subpart E §15.407: 2014
IC RSS-247 Issue 1 May 2015

Report No. SD72106517-0515D Rev.1 **July 2015**

REPORT ON	Radio Testing of the NantWorks HBox Access Point for Medical Devices
TEST REPORT NUMBER	SD72106517-0515D Rev.1
PREPARED FOR	NantWorks 9920 Jefferson Blvd. Culver City, CA 90232
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PREPARED BY	Xiaoying Zhang **Name** Authorized Signatory Title: EMC/Wireless Test Engineer
APPROVED BY	Juan M. Gonzalez **Name** Authorized Signatory Title: Commercial Wireless EMC Lab Manager
DATED	July 15, 2015

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

Revision History

SD72106517-0515D Rev.1 NantWorks 200-HBX-PDL rev 1 HBox Access Point for Medical Devices					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
06/24/2015	Initial Release				Juan M Gonzalez
07/15/2015		Rev.1	Model name correction	6 and 9	Alex Chang

CONTENTS

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SECTION 1

REPORT SUMMARY

Radio Testing of the
NantWorks
HBox Access Point for Medical Devices

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the NantWorks Access Point for Medical Devices to the requirements of the following:
FCC Part 15 Subpart E §15.407
IC RSS-247 Issue 1 May 2015.

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	NantWorks
Model Number(s)	200-HBX-PDL rev 1
FCC ID Number	IFU1001012
IC Number	N/A (Manufacturer not seeking IC Certification at the time of verification)
Serial Number(s)	N/A (Sample #2) Conducted antenna service port testing sample, serial number not available due to temporary addition of an antenna port for testing / (Sample #1) (Radiated testing)
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC Part 15 Subpart E §15.407 (October 1, 2014). • RSS-247 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices (Issue 1, May 2015). • RSS-Gen - General Requirements for Compliance of Radio Apparatus (Issue 4, November 2014). •
Start of Test	April 29, 2015
Finish of Test	June 17, 2015
Name of Engineer(s)	Xiaoying Zhang
Related Document(s)	KDB789033 D01 General UNII Test Procedures Old Rules v01 (Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E) June 06, 2014.

1.2 BRIEF SUMMARY OF RESULTS

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

Operation in the U-NII 1 and U-NII 3 Bands (New Rules)					
Section	**Spec Clause**	**RSS**	**Test Description**	**Result**	**Comments/ Base Standard**
2.1	§15.407(a)	RSS-Gen 8.8	Conducted Emissions	Compliant	
2.2	§15.403(i)		26 dB Bandwidth	As Reported	
-		RSS-Gen 6.6	99% Emission Bandwidth	N/T*	See Note
-	§15.407(e)	RSS-247 6.2.4(1)	Minimum 6dB Bandwidth	N/T*	See Note
2.3	§15.407(a)(1)(IV) and §15.407(a)(3)	RSS-247 6.2.4(1)	Maximum Conducted Output Power	Compliant	
2.4	§15.407(a)(1)(IV) and §15.407(a)(3)	RSS-247 6.2.3(1)	Maximum Power Spectral Density (PSD)	Compliant	
2.5	§15.407(b)(1),(4) and (7) / 15.209	RSS-247 6.2.4(2)	Unwanted Emissions Measurement	Compliant	
2.6	§15.407(b)(1),(4) and (7)	RSS-247 6.2.4(2)	Band-Edge Measurements	Compliant	
-	§15.407(g)	RSS-Gen 6.11	Frequency Stability	N/T*	
-		RSS-247 6.2.2(2)	Indoor Operation Only	Client Declaration	Same as the previous version

N/T: This is an updated product which uses the identical RF Module as the previous version (project SC1311091) . Only test cases related to power are verified in this report.*

Note: All verifications performed on model 200-HBV-PDL.The two models 200-HBV-PDL and HBox are identical except that 200-HBV-PDL has CDMA2000 and ISM900 RF modules and HBox unit does not have.

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a NantWorks HBox Access Point for Medical Devices. The EUT can connect to a network through Ethernet port or Wi-Fi. In normal operation, the EUT collects user data via USB, Bluetooth or Wi-Fi and upload the information back to a data server. The NFC function is for quick Bluetooth pairing by obtaining the device info when within NFC range of the EUT. Only the 802.11 ”a” and “n” (U-NII) functions verified in this test report.

1.3.2 EUT General Description

EUT Description	Access Point for Medical Devices
Model Name	HBox
Model Number(s)	200-HBX-PDL rev 1
Frequency Range	5180 MHz to 5240 MHz in the 5150 MHz to 5250 MHz Band (U-NII 1) and 5745 MHz to 5825 MHz in the 5725 MHz to 5850 MHz Band (U-NII 3)
Rated Voltage	Internal 3.7VDC Li-Ion Battery (GP Batteries 2501022), AC adapter/charger is Hon-Kwang Switching Power Supply Model: HK-AD-050A500-US, output is 5.0VDC 5.0A
Mode Verified	802.11 a and n (U-NII)
Capability	802.11 a/b/g/n WLAN (DTS/U-NII), Bluetooth 2.0 + EDR, Bluetooth 4.0 and NFC
Primary Unit (EUT)	☒ Production ☐ Pre-Production ☐ Engineering
Antenna Type	Integral PIFA type (Ant #1 and 2)
Antenna Gain Ant #1 (Main, WiFi +BT)	5000MHz = 2.3dBi. Ant #2 is not used for 5GHz application.
Modulation Used	OFDM

1.3.3 Channel Table

5150-5250 MHz band (U-NII 1)				
Mode	**Channel**	**Frequency (MHz)**	**Bandwidth (MHz)**	**Modulation Technology**
802.11 a	36	5180	20	OFDM
802.11 a	40	5200	20	OFDM
802.11 a	44	5220	20	OFDM
802.11 a	48	5240	20	OFDM
802.11 n	36	5180	20/40	OFDM
802.11 n	40	5200	20/40	OFDM
802.11 n	44	5220	20/40	OFDM
802.11 n	48	5240	20/40	OFDM
5725-5850 MHz band (U-NII 3)				
Mode	**Channel**	**Frequency (MHz)**	**Bandwidth (MHz)**	**Modulation Technology**
802.11 a	149	5745	20	OFDM
802.11 a	153	5765	20	OFDM
802.11 a	157	5785	20	OFDM
802.11 a	161	5805	20	OFDM
802.11 a	165	5825	20	OFDM
802.11 n	149	5745	20/40	OFDM
802.11 n	153	5765	20/40	OFDM
802.11 n	157	5785	20/40	OFDM
802.11 n	161	5805	20/40	OFDM
802.11 n	165	5825	20/40	OFDM

1.3.4 Maximum Conducted Output Power

Mode	Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
802.11a (U-NII 1)	5180-5240	11.64	14.6
802.11n 20MHz (U-NII 1)	5180-5240	11.43	13.9
802.11n 40MHz (U-NII 1)	5180-5240	11.02	12.6
802.11a (U-NII 3)	5745-5825	10.65	14.5
802.11n 20MHz (U-NII 3)	5745-5825	10.69	11.7
802.11n 40MHz (U-NII 3)	5745-5825	10.08	10.2

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Antenna conducted port test configuration. All measurements were performed on the main antenna (Ant.#1). Programmed using PuTTY SSH2 (Secure Shell) client software.
B	Radiated emissions test configuration. The EUT is programmed using PuTTY SSH2 (Secure Shell) client software. The EUT is connected to a support broadband router where the support laptop used to program the EUT is also connected. Client provided radio commands to modify modes, channel number and data rates. TX power is set to max power as a default setting.

1.4.2 EUT Exercise Software

HBOX Function Tester. This is built-in within the firmware. Radio commands are executed via Ethernet using Putty from a support PC.

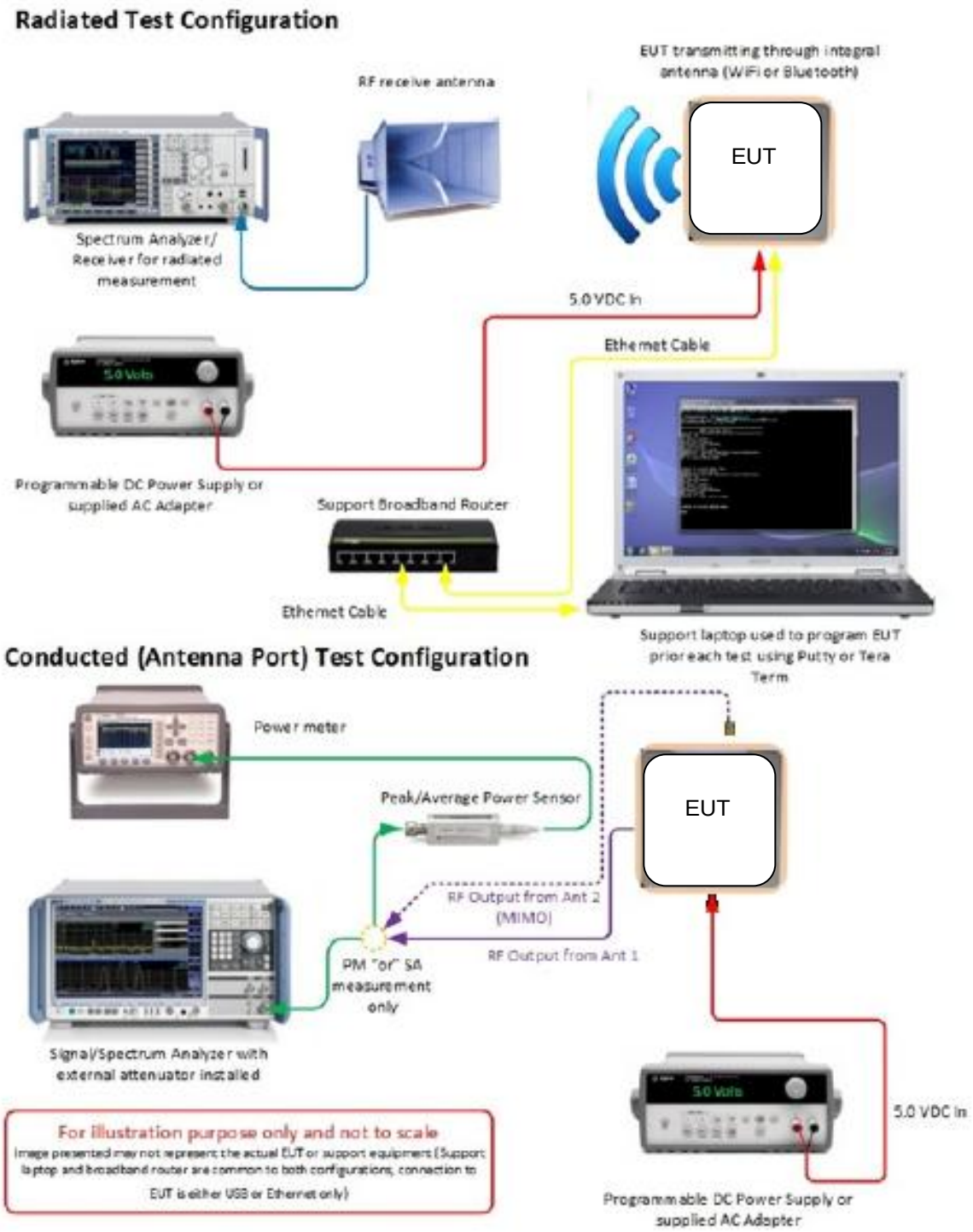
1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Model	Description
Sony	Personal Computer (Y Series Laptop)	PCG-31311L	-
Sony	AC Adapter	PCGA-AC19V9	S/N:147839091 0023259
HON-KWANG	Switching Power Supply (x2)	HK-AD-050A500-US	5VDC @ 5A
Trendnet	Broadband Router	TW100-S4W1CA,	S/N: RA1332S400789
Lorom	CAT5E Patch Cable (x2)	-	Unshielded, 1.5 meters Ethernet cables

1.4.4 Worst Case Configuration

EUT is a mobile device. For radiated measurements X, Y and Z orientations were verified. Worst case position is “X”.

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 (Sample #2) and (Sample #1)		
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 U-NII Test Procedures v01r03 (Federal Communications Commission Office of Engineering and Technology Laboratory Division Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E.
For conducted and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.4-2009. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY

1.8.1 FCC – Registration No.: 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.

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

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

SECTION 2

TEST DETAILS

Radio Testing of the
NantWorks
HBox Access Point for Medical Devices

2.1 CONDUCTED EMISSIONS

2.1.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.407(a)
RSS-GEN, Clause 8.8

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 µH/50 ohms line impedance stabilization network (LISN).

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: N/A (Sample #1) / Test Configuration B

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

April 28 and May 18, 2014/XYZ

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

Ambient Temperature	22.9 - 23.8 °C
Relative Humidity	45.2 - 47.1.%
ATM Pressure	99.2 - 99.9 kPa

2.1.7 Additional Observations

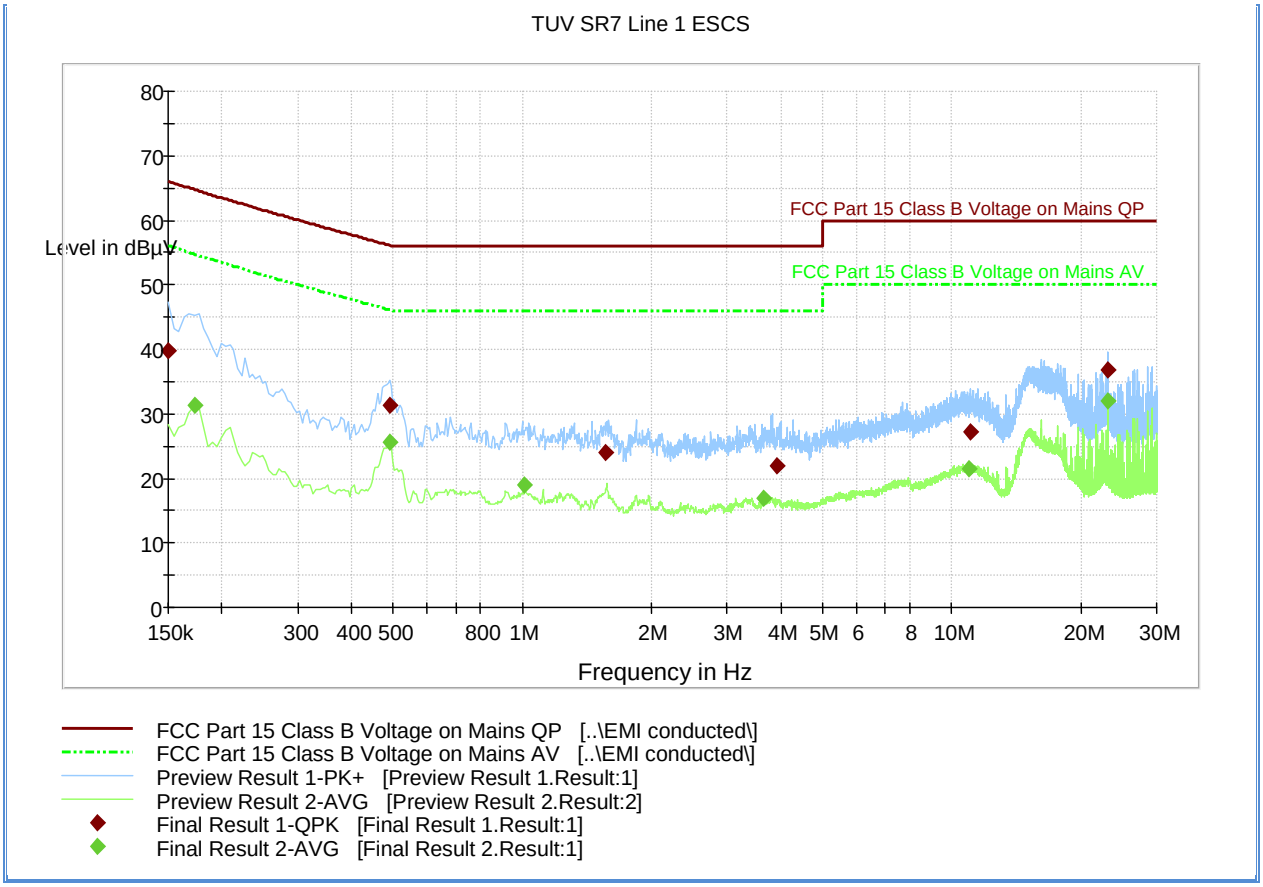
- The EUT was verified using AC adapter supplied by the manufacturer..
- EUT verified using input voltage of 120VAC 60Hz.
- There are no significant variations in test results between each operating modes. Only the worst case observed configuration is presented (802.11n HT20 MIMO mode).
- Receive mode is also presented for comparison.

- 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 2.1.8 for sample computation.

2.1.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (dbµV) @ 150kHz			5.5
Correction Factor (dB)	Asset# 8607 (20 dB attenuator)	19.9	20.7
	Asset# 1177 (cable)	0.15	
	Asset# 1176 (cable)	0.35	
	Asset# 7567 (LISN)	0.30	
Reported QuasiPeak Final Measurement (dbµV) @ 150kHz			**26.2**

2.1.9 Test Results - Conducted Emissions Line 1 – Hot (Worst Case Transmit)



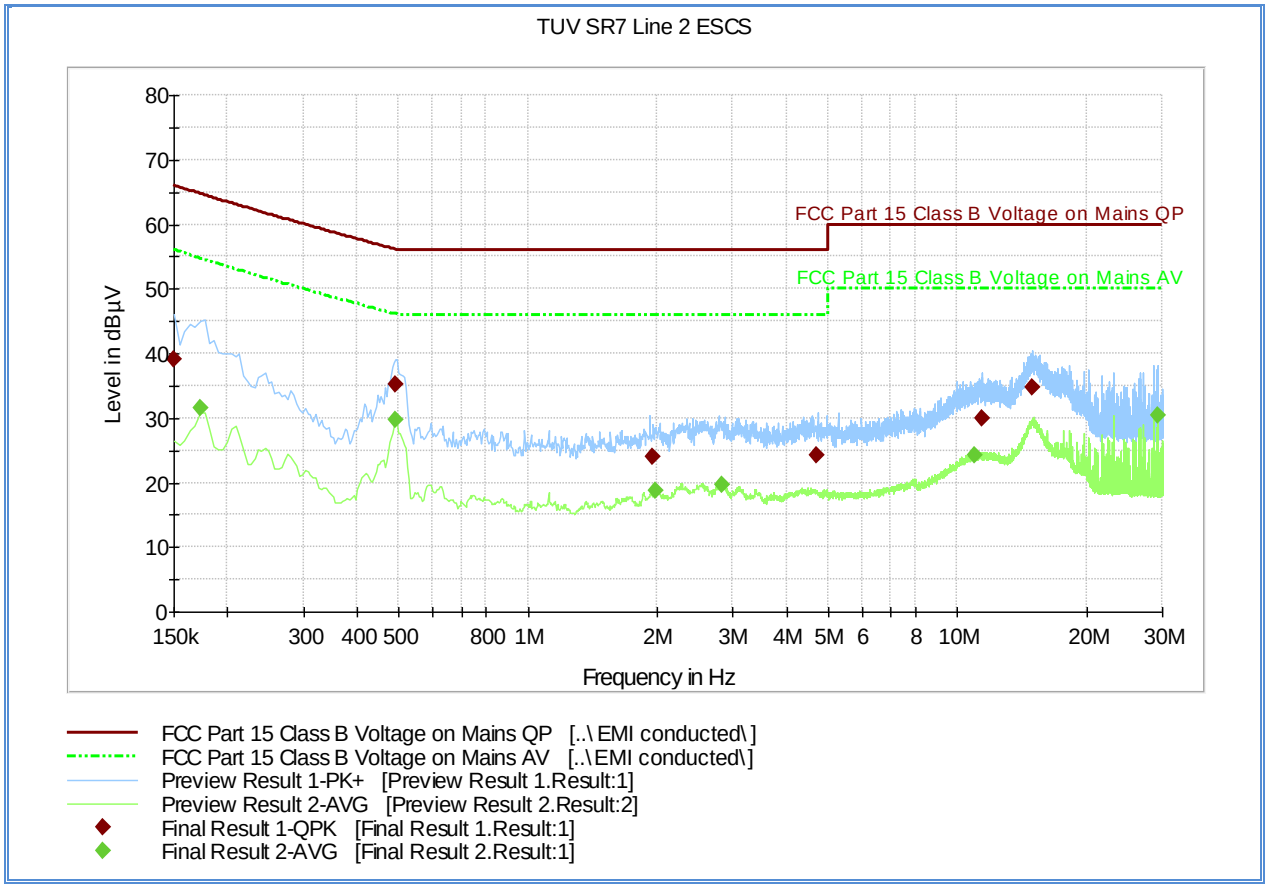
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150000	39.7	1000.0	9.000	Off	L1	20.1	26.3	66.0
0.492000	31.3	1000.0	9.000	Off	L1	20.1	24.9	56.1
1.563000	23.9	1000.0	9.000	Off	L1	20.2	32.1	56.0
3.912000	22.0	1000.0	9.000	Off	L1	20.5	34.0	56.0
11.022000	27.2	1000.0	9.000	Off	L1	20.7	32.8	60.0
23.127000	36.7	1000.0	9.000	Off	L1	20.9	23.3	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.172500	31.4	1000.0	9.000	Off	L1	20.1	23.4	54.7
0.492000	25.6	1000.0	9.000	Off	L1	20.1	20.5	46.1
1.014000	19.1	1000.0	9.000	Off	L1	20.2	26.9	46.0
3.655500	16.9	1000.0	9.000	Off	L1	20.4	29.1	46.0
10.941000	21.5	1000.0	9.000	Off	L1	20.7	28.5	50.0
23.127000	31.9	1000.0	9.000	Off	L1	20.9	18.1	50.0

2.1.10 FCC Conducted Emissions Line 2 – Neutral (Worst Case Transmit)



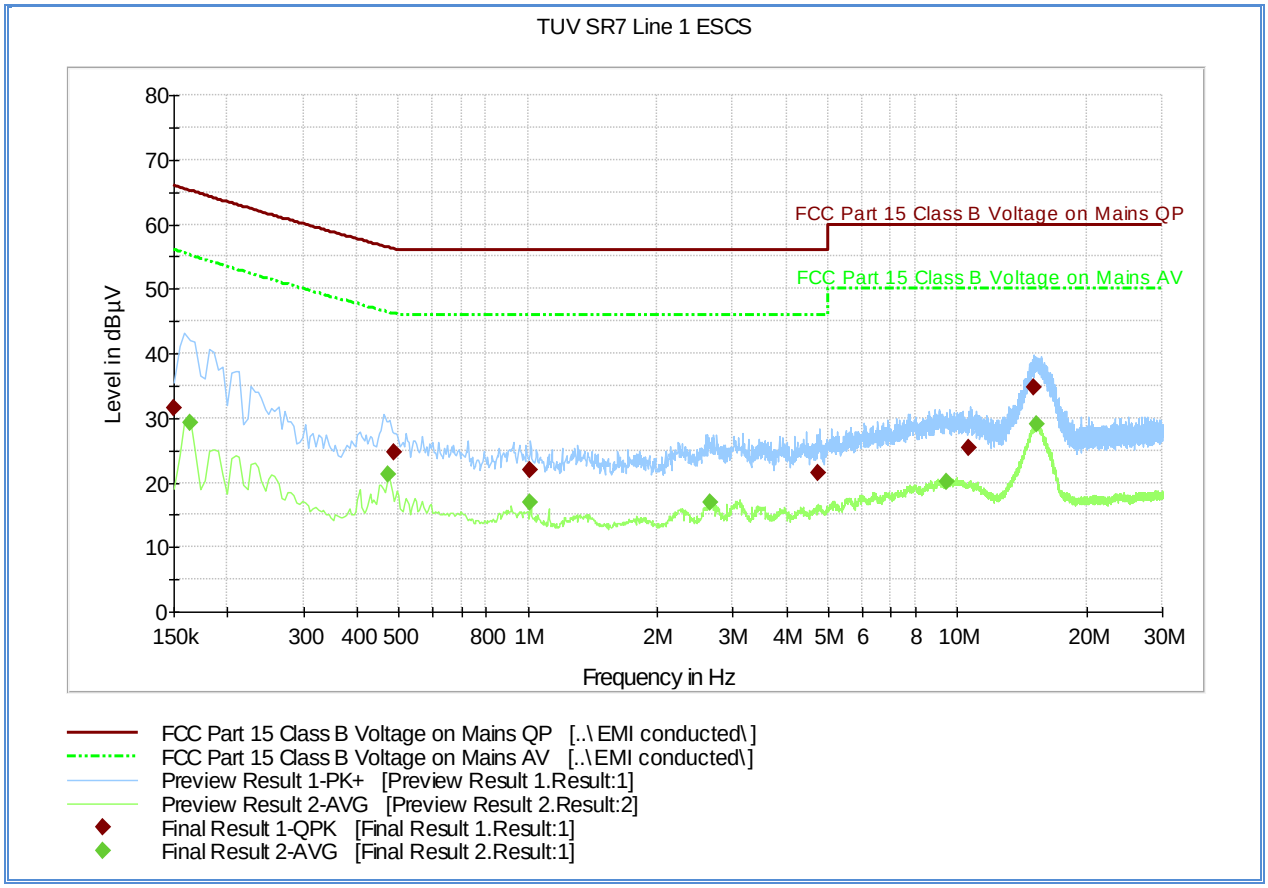
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150000	39.1	1000.0	9.000	Off	N	20.1	26.9	66.0
0.492000	35.1	1000.0	9.000	Off	N	20.1	21.0	56.1
1.950000	24.1	1000.0	9.000	Off	N	20.1	31.9	56.0
4.717500	24.2	1000.0	9.000	Off	N	20.4	31.8	56.0
11.377500	29.9	1000.0	9.000	Off	N	20.7	30.1	60.0
14.928000	34.7	1000.0	9.000	Off	N	20.7	25.3	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.172500	31.5	1000.0	9.000	Off	N	20.1	23.2	54.7
0.492000	29.8	1000.0	9.000	Off	N	20.1	16.3	46.1
1.981500	18.7	1000.0	9.000	Off	N	20.2	27.3	46.0
2.827500	19.7	1000.0	9.000	Off	N	20.5	26.3	46.0
10.986000	24.2	1000.0	9.000	Off	N	20.7	25.8	50.0
29.233500	30.3	1000.0	9.000	Off	N	21.0	19.7	50.0

2.1.11 FCC Conducted Emissions Line 1 – Hot (Receive Mode)



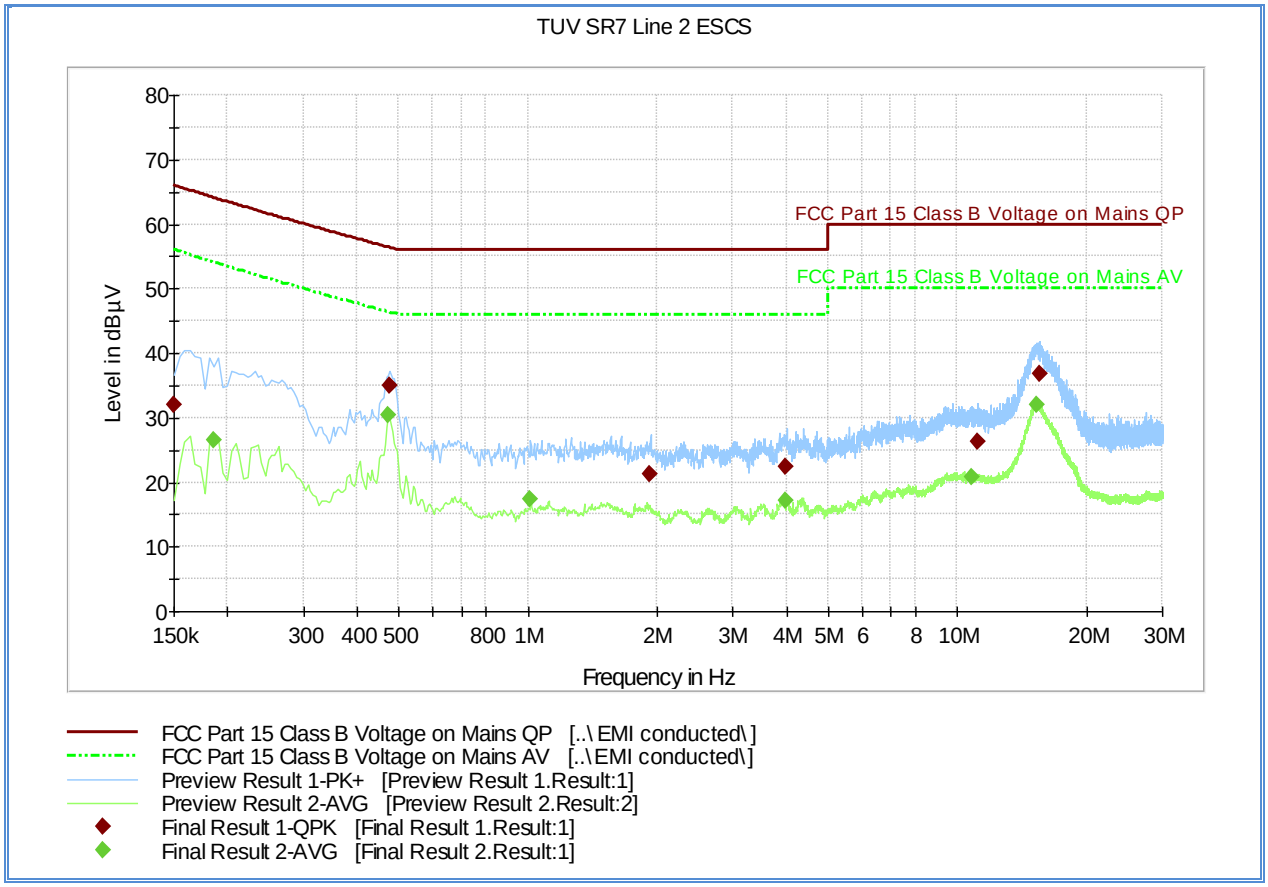
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150000	31.6	1000.0	9.000	Off	L1	20.1	34.4	66.0
0.487500	24.7	1000.0	9.000	Off	L1	20.1	31.5	56.2
1.014000	21.9	1000.0	9.000	Off	L1	20.2	34.1	56.0
4.722000	21.6	1000.0	9.000	Off	L1	20.6	34.4	56.0
10.671000	25.4	1000.0	9.000	Off	L1	20.7	34.6	60.0
15.076500	34.8	1000.0	9.000	Off	L1	20.9	25.2	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.163500	29.3	1000.0	9.000	Off	L1	20.1	25.9	55.2
0.474000	21.2	1000.0	9.000	Off	L1	20.1	25.2	46.4
1.014000	17.0	1000.0	9.000	Off	L1	20.2	29.0	46.0
2.661000	16.9	1000.0	9.000	Off	L1	20.5	29.1	46.0
9.433500	20.1	1000.0	9.000	Off	L1	20.7	29.9	50.0
15.310500	28.9	1000.0	9.000	Off	L1	20.9	21.1	50.0

2.1.12 FCC Conducted Emissions Line 2 – Neutral (Receive Mode)



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150000	32.1	1000.0	9.000	Off	N	20.1	33.9	66.0
0.478500	35.0	1000.0	9.000	Off	N	20.1	21.4	56.3
1.927500	21.1	1000.0	9.000	Off	N	20.1	34.9	56.0
3.975000	22.3	1000.0	9.000	Off	N	20.5	33.7	56.0
11.134500	26.3	1000.0	9.000	Off	N	20.7	33.7	60.0
15.513000	36.9	1000.0	9.000	Off	N	20.7	23.1	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.186000	26.4	1000.0	9.000	Off	N	20.1	27.6	54.1
0.474000	30.4	1000.0	9.000	Off	N	20.1	16.0	46.4
1.014000	17.3	1000.0	9.000	Off	N	20.2	28.7	46.0
3.966000	17.1	1000.0	9.000	Off	N	20.5	28.9	46.0
10.770000	20.8	1000.0	9.000	Off	N	20.6	29.2	50.0
15.310500	32.0	1000.0	9.000	Off	N	20.7	18.0	50.0

2.2 26 dB BANDWIDTH

2.2.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.403(i)

2.2.2 Standard Applicable

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

2.2.3 Test Methodology

Section (C) of 789033 D01 General UNII Test Procedures Old Rules v01

2.2.4 Equipment Under Test and Modification State

Serial No: N/A (Sample #2) / Test Configuration A

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

June 11, 2015/XYZ

2.2.6 Test Equipment Used

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

2.2.7 Environmental Conditions

Ambient Temperature	22.3 °C
Relative Humidity	49.2 %
ATM Pressure	98.4 kPa

2.2.8 Additional Observations

- This is a conducted test.
- Test methodology is per Section (C) of 789033 D01 General UNII Test Procedures Old Rules v01. 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.

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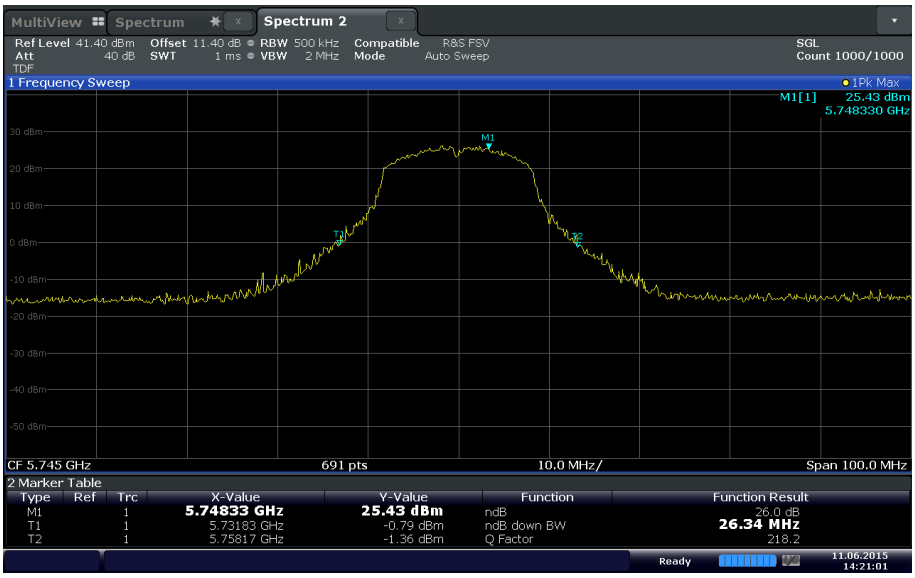
- Sweep time is set to Auto.
- "n dB down" (26dB) marker function of the spectrum analyzer was used for this test.
- RBW adjusted until RBW/EBW ratio is approximately 1% or as the SA setting permits (i.e next setting after 300kHz RBW is limited to 500kHz).

2.2.9 Summary Test Results (as reported)

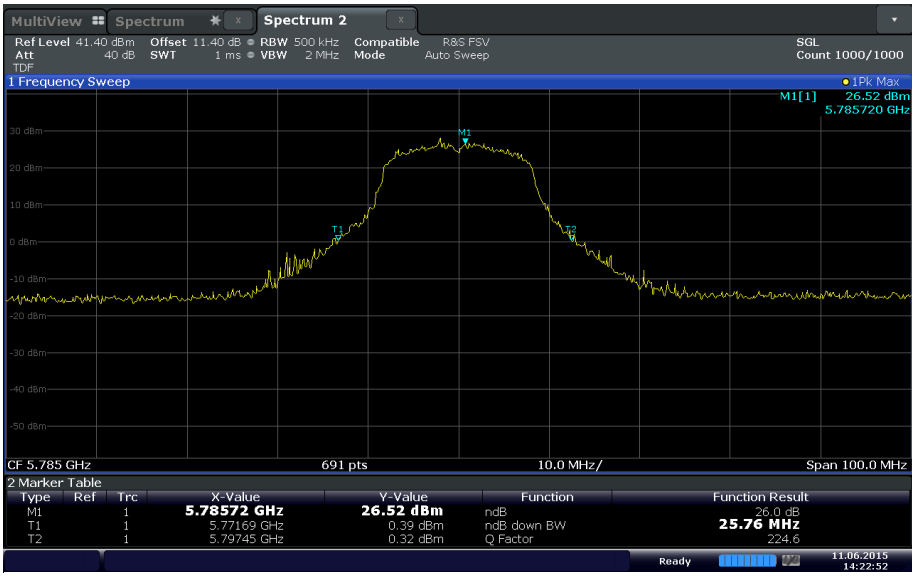
26 dB Bandwidth 802.11n			
WiFi Mode	**Low Channel (Channel No./ BW in MHz)**	**Mid Channel (Channel No./ BW in MHz)**	**High Channel (Channel No./ BW in MHz)**
U-NII 1 802.11a	36/28.51 MHz	44/28.58 MHz	48/28.22MHz
U-NII 1 802.11n 20 MHz BW	36/24.10 MHz	44/24.31 MHz	48/22.58 MHz
U-NII 1 802.11n 40 MHz BW	36/43.85 MHz	44/44.28 MHz	48/44.14 MHz
U-NII 3 802.11a	149/26.34 MHz	157/25.76 MHz	165/24.46 MHz
U-NII 3 802.11n 20 MHz BW	149/27.50 MHz	157/27.21 MHz	165/27.79 MHz
U-NII 3 802.11n 40 MHz BW	149/48.19 MHz	157/47.03 MHz	165/47.47 MHz

2.2.10 Sample Test Plots



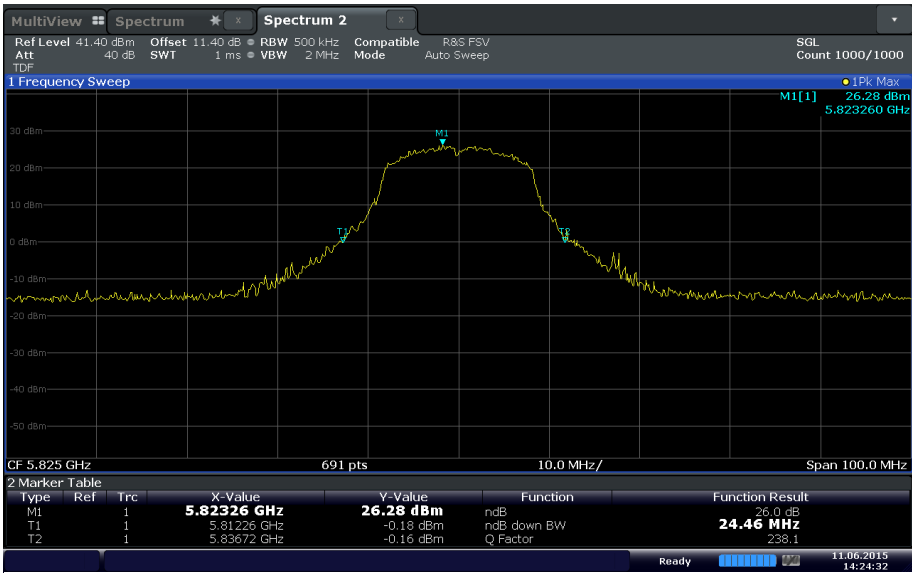
Date: 11.JUN.2015 14:21:02

U-NII 3 802.11a Channel 149



Date: 11.JUN.2015 14:22:52

U-NII 3 802.11a Channel 157



U-NII 3 802.11a Channel 165

2.3 MAXIMUM CONDUCTED OUTPUT POWER

2.3.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.407(a)(1)(IV) and (a)(3)
RSS-247, Clause 6.2.4(1)

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.
(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.

2.3.3 Test Methodology

Section (E)(3) Method PM (Measurement using an RF average power meter) of 789033 D01 General UNII Test Procedures Old Rules v01.

2.3.4 Equipment Under Test and Modification State

Serial No: N/A (Sample #2) / Test Configuration A

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

June 11, 2015/XYZ

2.3.6 Test Equipment Used

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

2.3.7 Environmental Conditions

Ambient Temperature	22.3 °C
Relative Humidity	49.2 %
ATM Pressure	98.4 kPa

2.3.8 Additional Observations

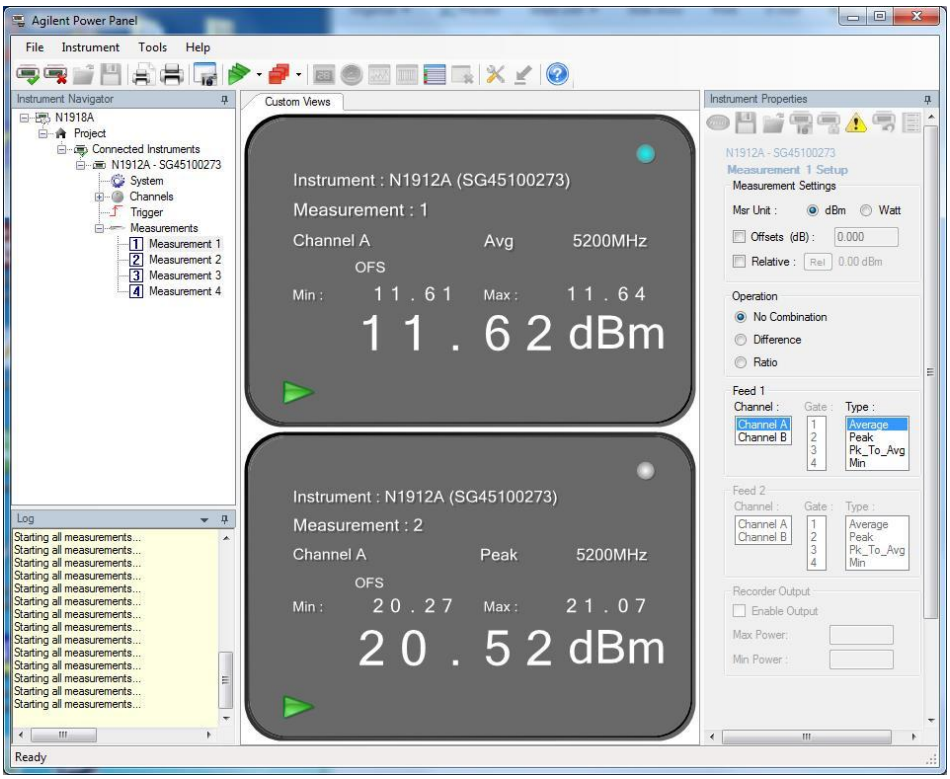
- This is a conducted test.
- Test methodology is per Section (E)(3) Method PM (Measurement using an RF average power meter) of 789033 D01 General UNII Test Procedures Old Rules v01. All conditions under this Section were satisfied.
- The path loss was measured and entered as a level offset

2.3.9 Test Results (Maximum Conducted Power)

U-NII 1 802.11 a				
Channel	**Frequency (MHz)**	**Data Rate (Mbps)**	**Average Power (dBm)**	**Margin from 24dBm limit (dB)**
36	5180	6	**11.64**	**12.36**
44	5220	6	11.19	12.81
48	5240	6	11.62	12.38
U-NII 1 802.11 n HT20				
Channel	**Frequency (MHz)**	**Data Rate (Mbps)**	**Average Power (dBm)**	**Margin from 24dBm limit (dB)**
36	5180	mcs 0 (6.50 Mbps)	**11.43**	**12.57**
44	5220	mcs 0 (6.50 Mbps)	11.40	12.6
48	5240	mcs 0 (6.50 Mbps)	11.41	12.59
U-NII 1 802.11 n HT40				
Channel	**Frequency (MHz)**	**Data Rate (Mbps)**	**Average Power (dBm)**	**Margin from 24dBm limit (dB)**
36	5180	mcs 0 (6.50 Mbps)	10.92	12.57
44	5220	mcs 0 (6.50 Mbps)	10.56	12.6
48	5240	mcs 0 (6.50 Mbps)	**11.02**	**12.59**

U-NII 3 802.11 a				
Channel	**Frequency (MHz)**	**Data Rate (Mbps)**	**Average Power (dBm)**	**Margin from 30dBm limit (dB)**
149	5745	6	10.37	19.63
147	5785	6	10.18	19.82
165	5825	6	**10.65**	**19.35**
U-NII 3 802.11 n HT20				
Channel	**Frequency (MHz)**	**Data Rate (Mbps)**	**Average Power (dBm)**	**Margin from 30dBm limit (dB)**
149	5745	mcs 0 (6.50 Mbps)	10.56	19.44
147	5785	mcs 0 (6.50 Mbps)	10.29	19.71
165	5825	mcs 0 (6.50 Mbps)	**10.69**	**19.31**
U-NII 3 802.11 n HT40				
Channel	**Frequency (MHz)**	**Data Rate (Mbps)**	**Average Power (dBm)**	**Margin from 30dBm limit (dB)**
149	5745	mcs 0 (6.50 Mbps)	9.57	20.43
147	5785	mcs 0 (6.50 Mbps)	9.69	20.31
165	5825	mcs 7 (65.0 Mbps)	**10.08**	**19.92**

2.3.10 Sample Test Display



U-NII 1 802.11a Worst Case Channel

2.4 PEAK POWER SPECTRAL DENSITY

2.4.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.407(a)(1)(IV) and (a)(3)
RSS-247, Clause 6.2.3(1)

2.4.2 Standard Applicable

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

2.4.3 Test Methodology

Section (F) PSD of 789033 D01 General UNII Test Procedures Old Rules v01

2.4.4 Equipment Under Test and Modification State

Serial No: N/A (Sample #2) / Test Configuration A

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

June 11, 2015/XYZ

2.4.6 Test Equipment Used

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

2.4.7 Environmental Conditions

Ambient Temperature	22.3 °C
Relative Humidity	49.2 %
ATM Pressure	98.4 kPa

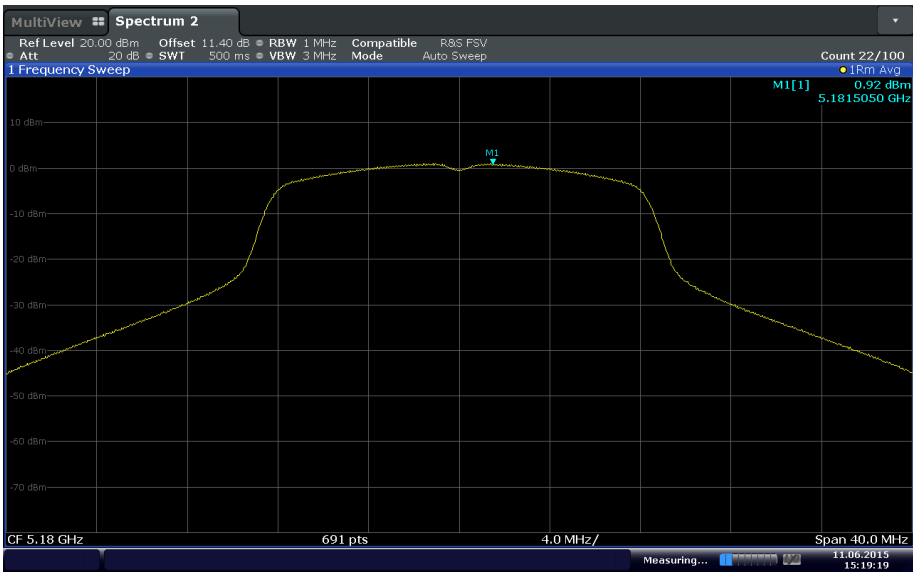
2.4.8 Additional Observations

- This is a conducted test as per Section (F) PSD of 789033 D01 General UNII Test Procedures Old Rules v01.
- Method SA-2 of Section II (E) was used for SA configuration.
- The path loss was measured and entered as a level offset.
- Only the worst case channel and data rate for each mode presented.
- RBW for U-NII 1 is 1MHz while 500 kHz for U-NII 3.

2.4.9 Test Results

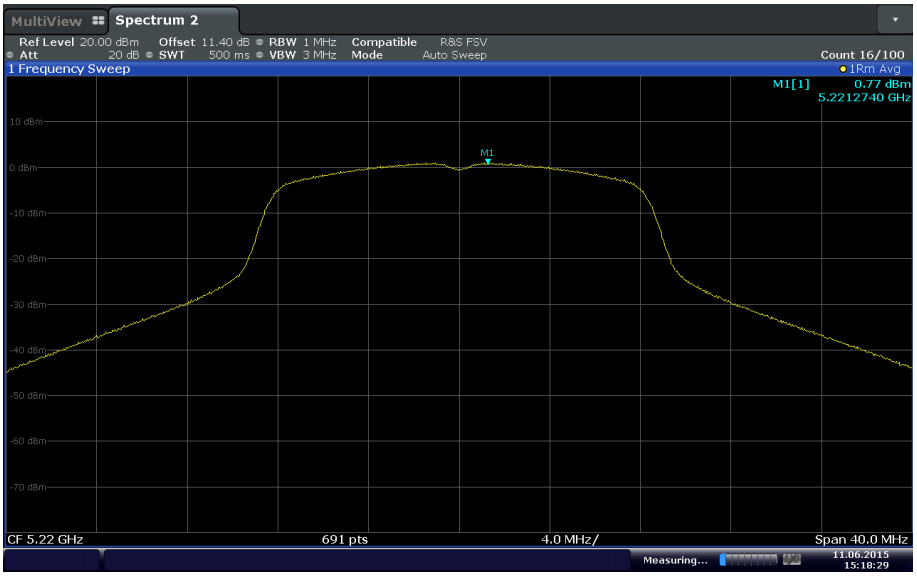
Mode	Channel	PPSD (dBm)	Limit (dBm / MHz)	Margin (dB)
U-NII 1 802.11a	36 (5180 MHz)	0.92	11	10.08
	44 (5220 MHz)	0.77	11	10.23
	48 (5240 MHz)	1.09	11	9.91
U-NII 1 802.11n HT20	**36 (5180 MHz)**	**1.69**	**11**	**9.31**
	44 (5220 MHz)	1.67	11	10.08
	48 (5240 MHz)	1.90	11	9.10
U-NII 1 802.11n HT40	36 (5180 MHz)	-3.29	11	10.08
	44 (5220 MHz)	-2.25	11	13.25
	48 (5240 MHz)	-2.90	11	13.90
U-NII 3 802.11a	149 (5745 MHz)	-3.08	30	33.08
	157 (5785 MHz)	-2.32	30	32.32
	165 (5825 MHz)	-2.99	30	32.99
U-NII 3 802.11n HT20	149 (5745 MHz)	-2.86	30	32.86
	157 (5785 MHz)	-2.61	30	32.61
	165 (5825 MHz)	-3.23	30	33.23
U-NII 3 802.11n HT40	149 (5745 MHz)	-7.44	30	37.44
	157 (5785 MHz)	-6.51	30	36.51
	165 (5825 MHz)	-6.81	30	36.81

2.4.10 Example Test Plots



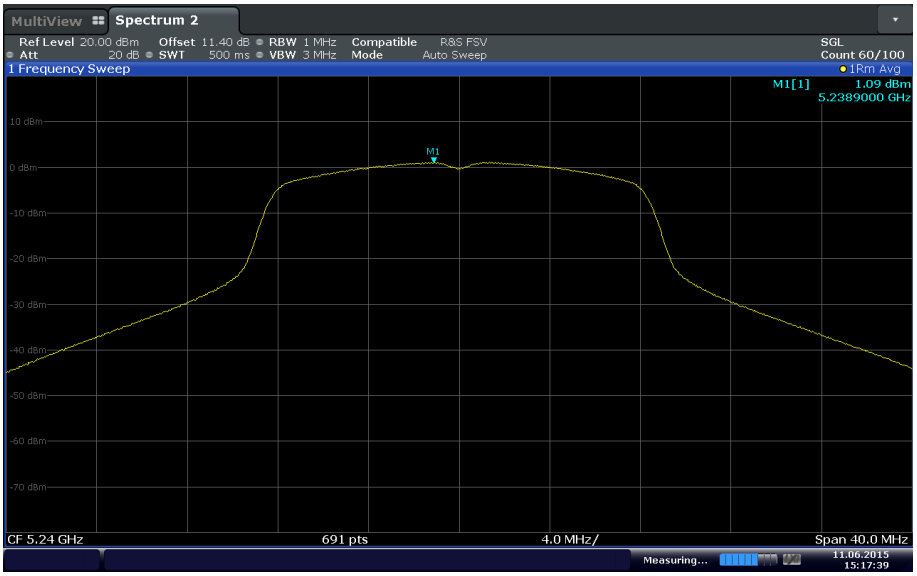
Date: 11.JUN.2015 15:19:18

U-NII 1 802.11a Low Channel



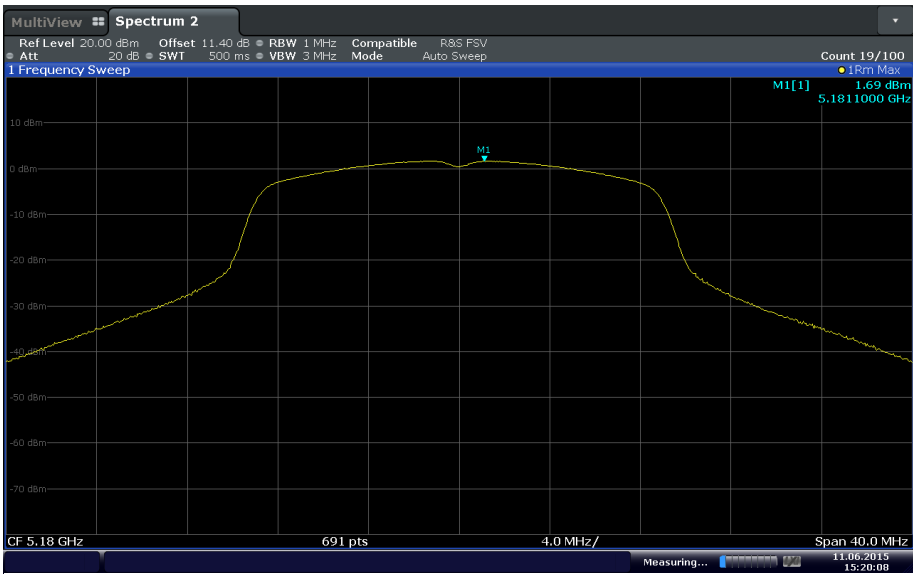
Date: 11.JUN.2015 15:18:29

U-NII 1 802.11a Mid Channel



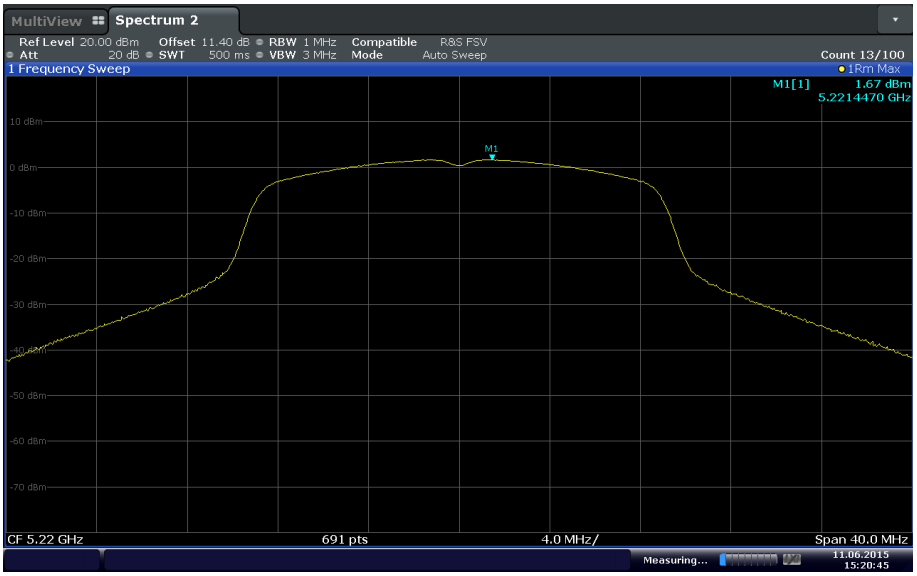
Date: 11.JUN.2015 15:17:40

U-NII 1 802.11a High Channel



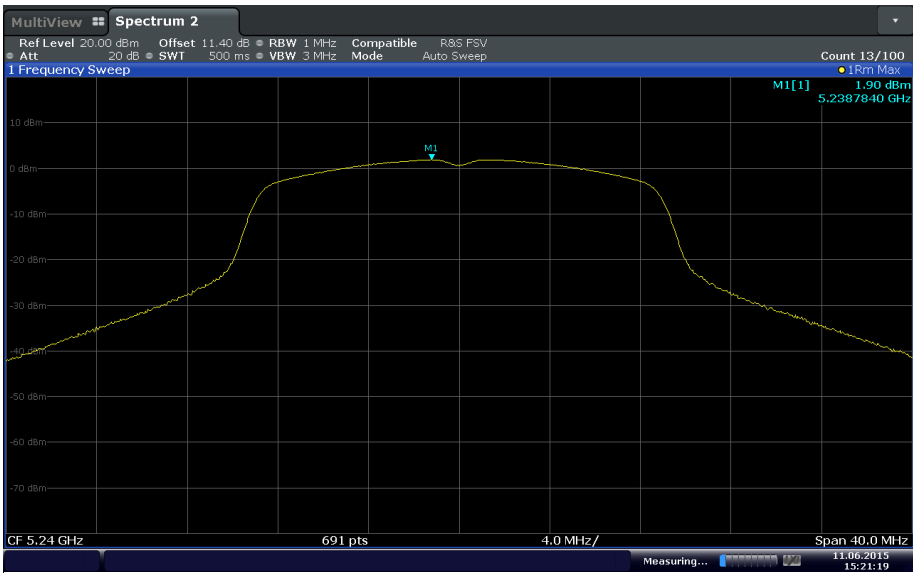
Date: 11.JUN.2015 15:20:08

U-NII 1 802.11n HT20 Low Channel



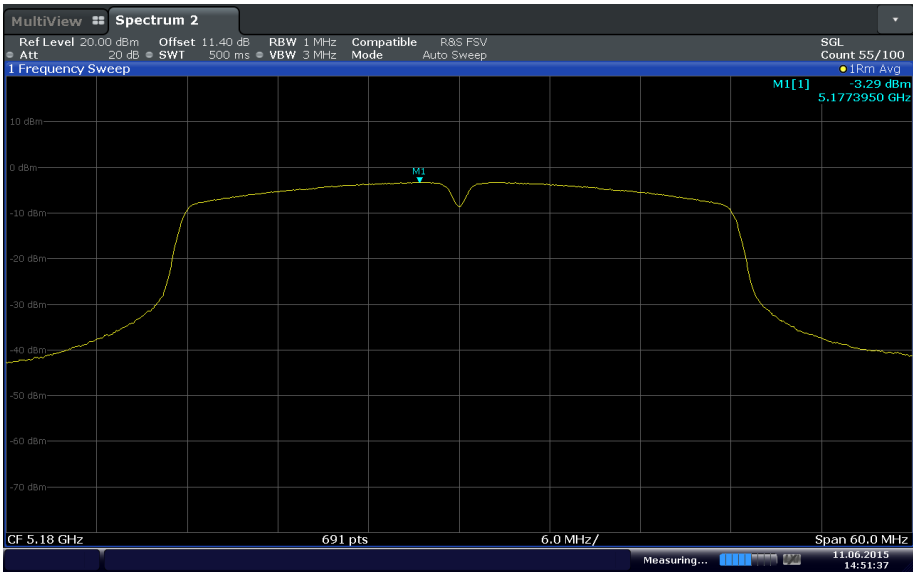
Date: 11.JUN.2015 15:20:45

U-NII 1 802.11n HT20 Mid Channel

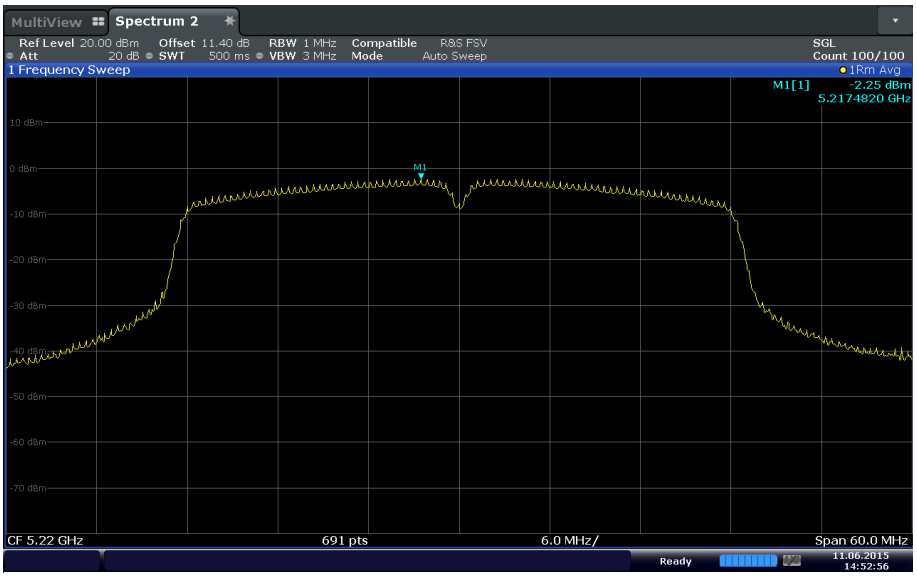


Date: 11.JUN.2015 15:21:19

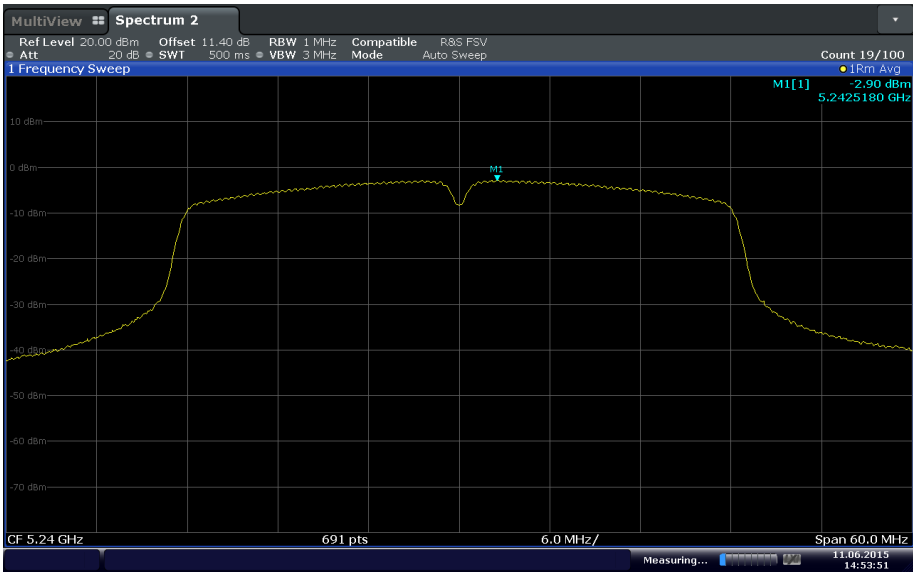
U-NII 1 802.11n HT20 High Channel



U-NII 1 802.11n HT40 Low Channel



U-NII 1 802.11n HT40 Mid Channel



U-NII 1 802.11n HT40 High Channel

2.5 UNWANTED EMISSIONS MEASUREMENT

2.5.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.407(b)(1),(4) and (7)
FCC 47 CFR Part 15, Clause 15.209
RSS-210, Clause A9.2(1) and (4)

2.5.2 Standard Applicable

(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:
(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.
(7) The provisions of §15.205 apply to intentional radiators operating under this section.

2.5.3 Test Methodology

Section II (G) Unwanted Emission Measurement of 789033 D01 General UNII Test Procedures Old Rules v01

2.5.4 Equipment Under Test and Modification State

Serial No: N/A (Sample #2) and (Sample #1) / Test Configuration A and B

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

May 1 and June 17, 2015/XYZ

2.5.6 Test Equipment Used

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

2.5.7 Environmental Conditions

Ambient Temperature	22.3 - 24.3°C
Relative Humidity	31.2 - 49.2 %
ATM Pressure	98.4 - 99.5kPa

2.5.8 Additional Observations

- This is an antenna-port conducted measurement test plus radiated cabinet emissions measurements.
- Sweep time is set to auto.
- The path loss was measured and entered as a level offset
- There were no unwanted emissions observed that falls in the Restricted Bands.
- Any emissions that is not in the restricted band will be evaluated to -27dBm/MHz (U-NII 1) and -17dBm/MHz (U-NII 3) limit.
- For any emissions falling outside the restricted band, the limit of -27dBm/MHz was converted to field strength using the formula under Section H(2)(d)(i) of 789033 D01 General UNII Test Procedures v01r03:

  E(dBµV/m) = 95.2-EIRP (dBm) @ 3 meters using 1MHz RBW
  = 95.2-27 dBm
  = 68.2 dBµV/m
- Radiated 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 2.5.9 for sample computation.
- Only the worst case data rate presented for both 802.11n covering all available bandwidths.

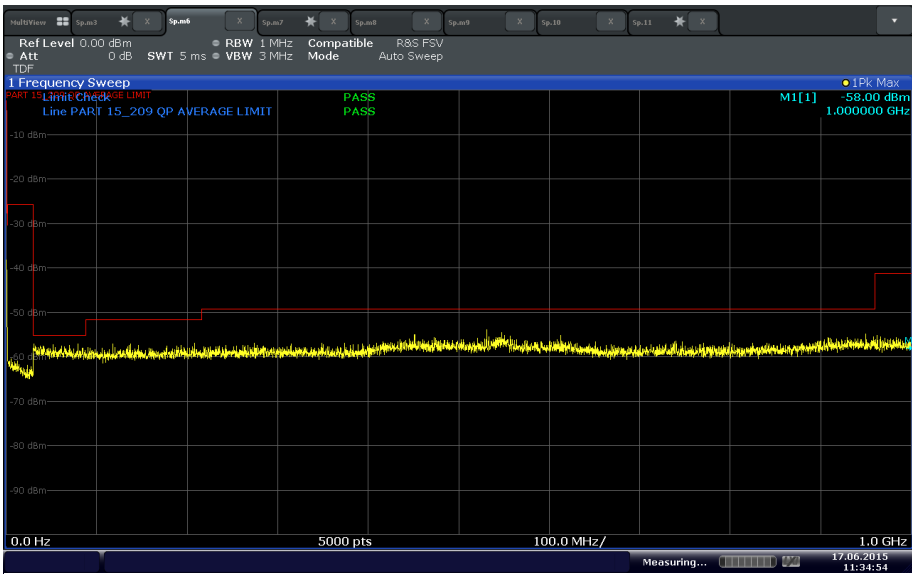
2.5.9 Sample Computation (Radiated Emission)

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

2.5.10 Test Results

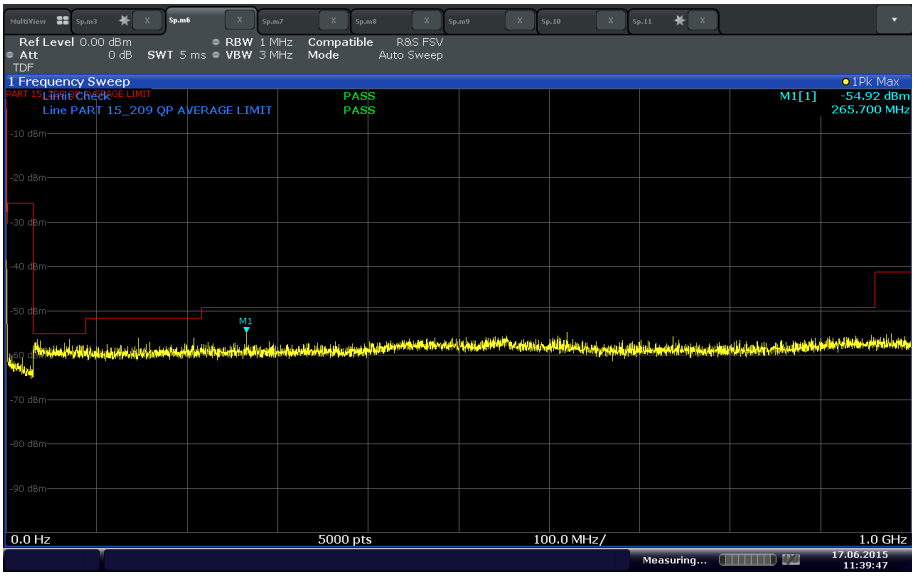
See attached plots.

2.5.11 Test Plots



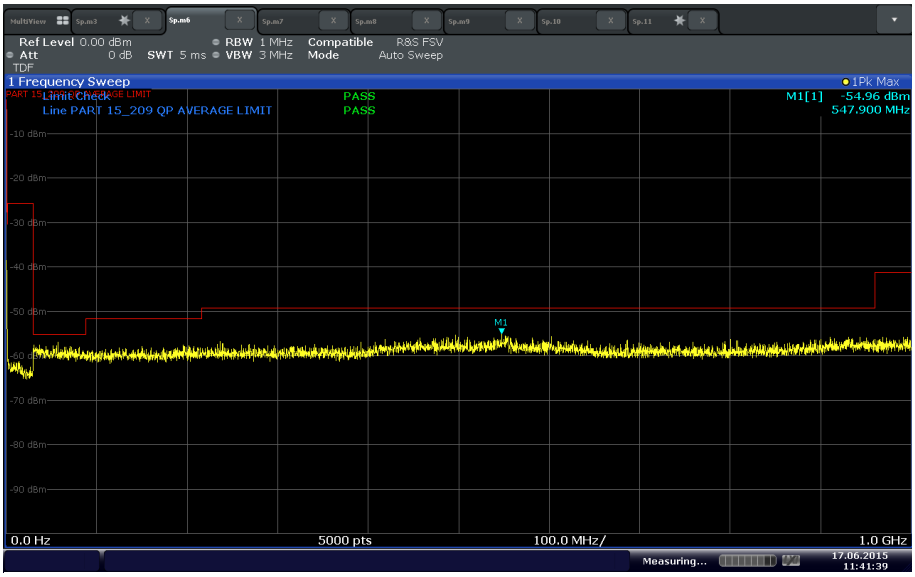
Date: 17.JUN.2015 11:34:54

U-NII 1 802.11 n Low Channel below 1GHz (20 MHz BW)



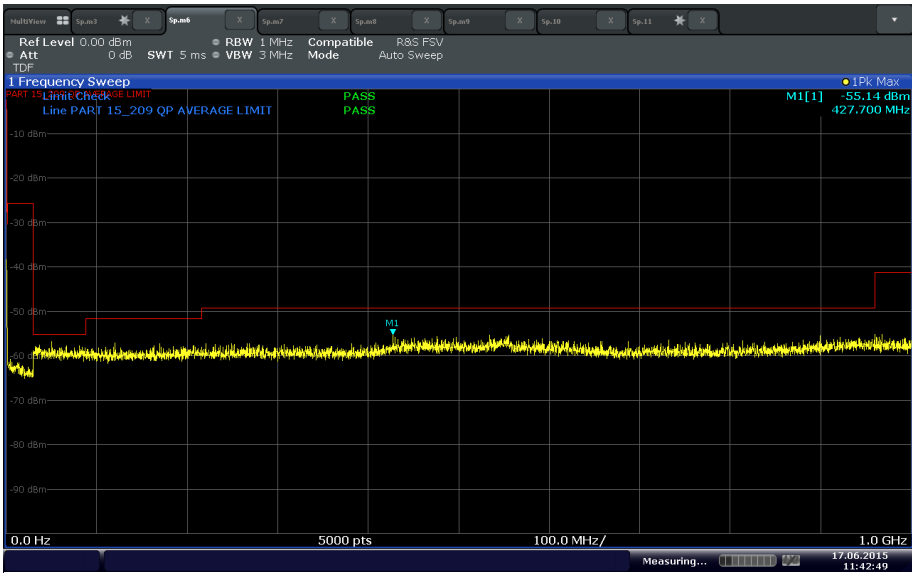
Date: 17.JUN.2015 11:39:47

U-NII 1 802.11 n Mid Channel below 1GHz (20 MHz BW)



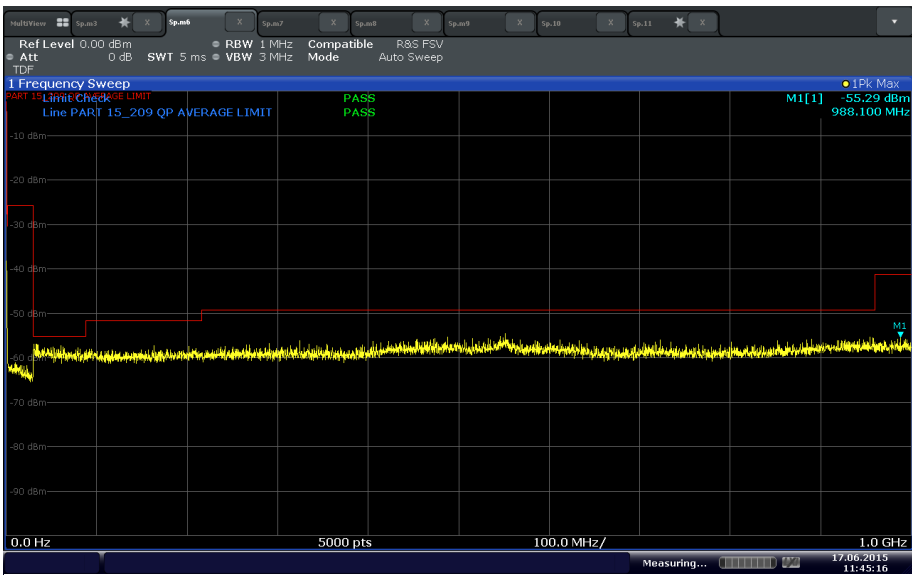
Date: 17.JUN.2015 11:41:39

U-NII 1 802.11 n Top Channel below 1GHz (20 MHz BW)



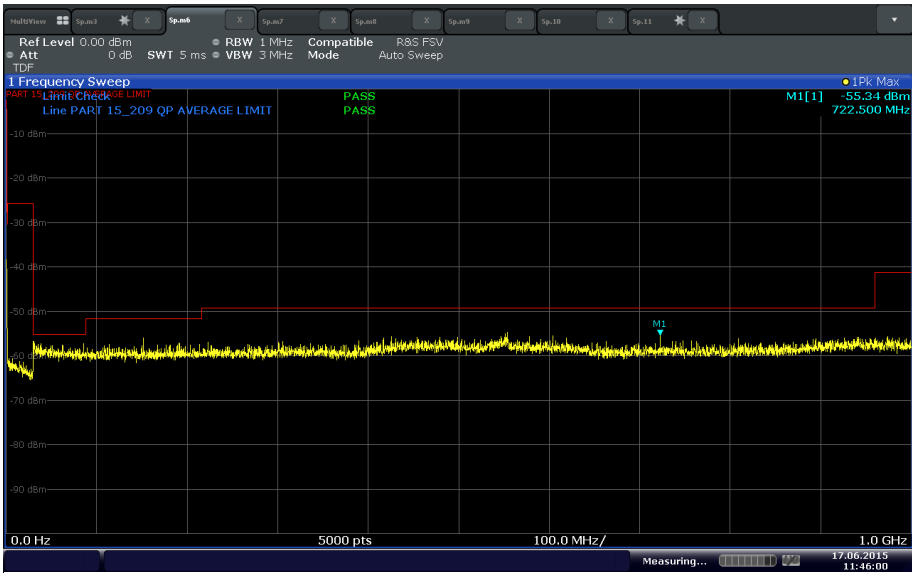
Date: 17.JUN.2015 11:42:50

U-NII 1 802.11 n Low Channel below 1GHz (40 MHz BW)



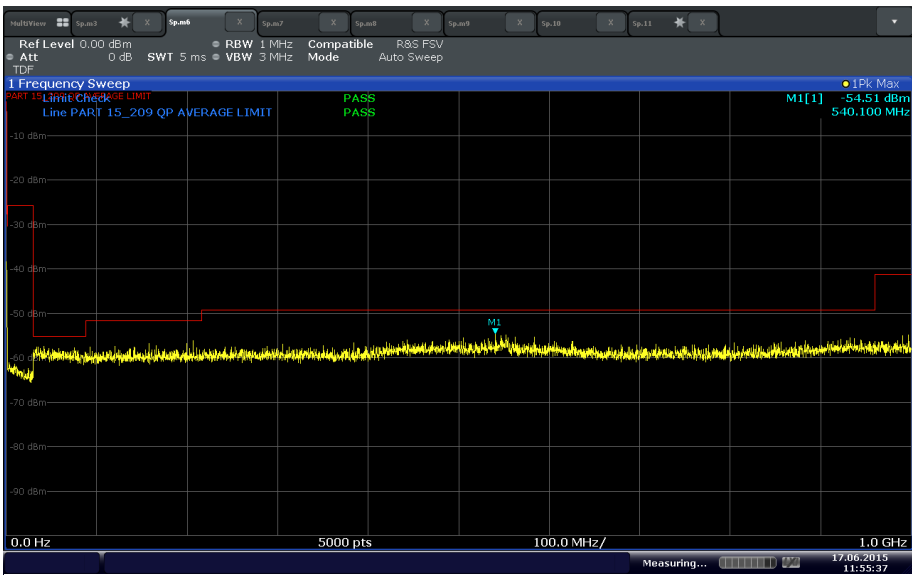
Date: 17.JUN.2015 11:45:17

U-NII 1 802.11 n Mid Channel below 1GHz (40 MHz BW)



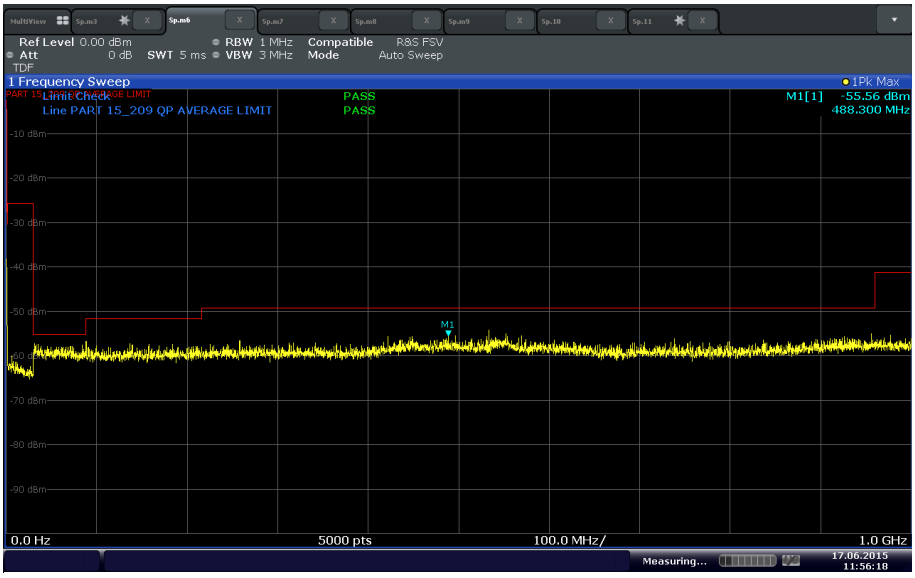
Date: 17.JUN.2015 11:46:00

U-NII 1 802.11 n Top Channel below 1GHz (40 MHz BW)



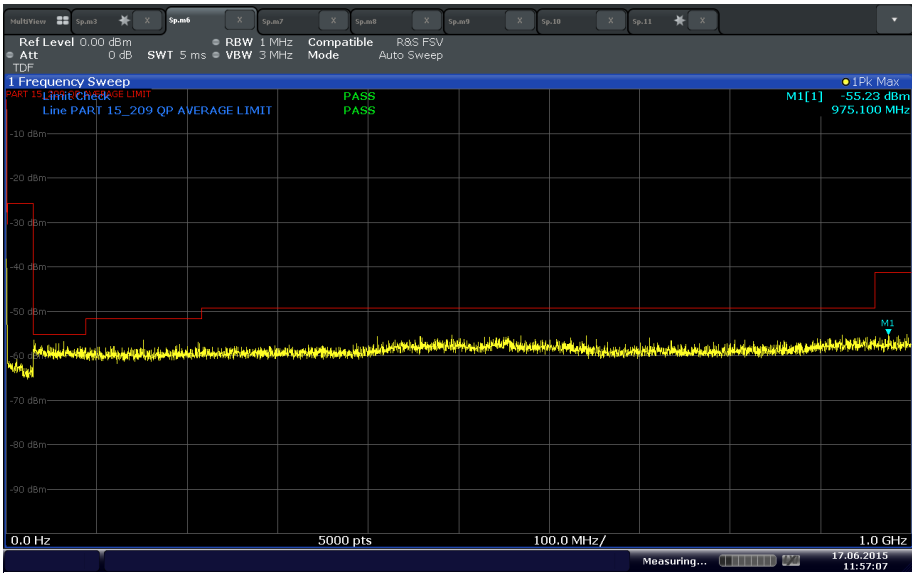
Date: 17.JUN.2015 11:55:37

U-NII 3 802.11 n Low Channel below 1GHz (20 MHz BW)



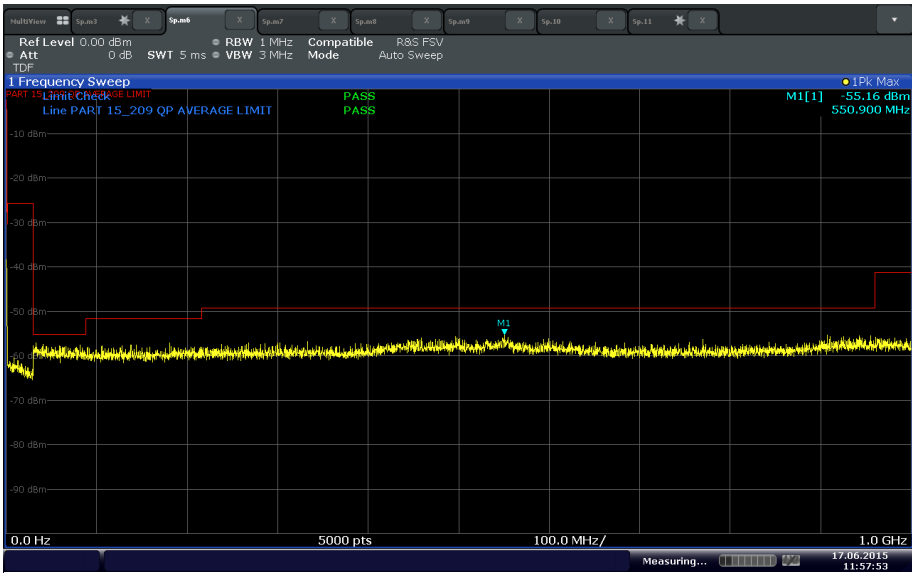
Date: 17.JUN.2015 11:56:18

U-NII 3 802.11 n Mid Channel below 1GHz (20 MHz BW)



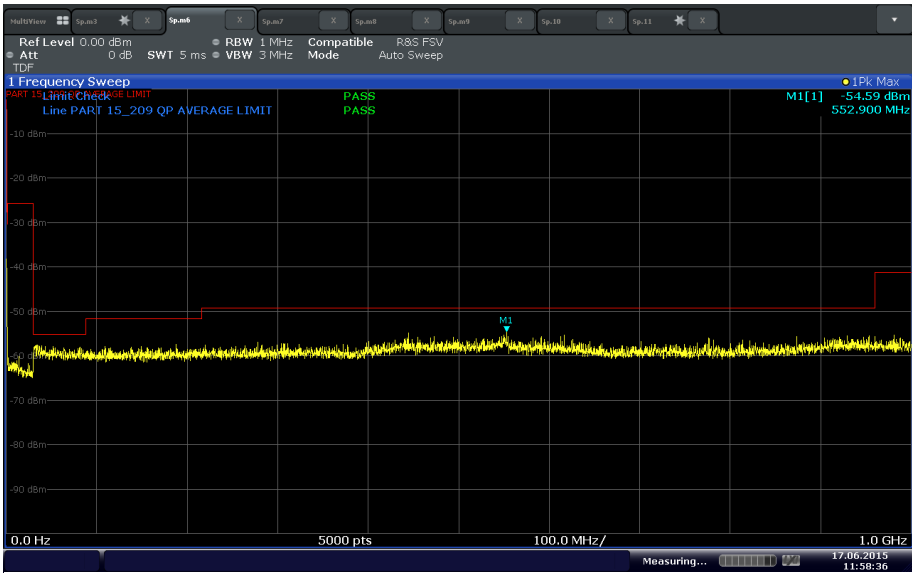
Date: 17.JUN.2015 11:57:07

U-NII 3 802.11 n Top Channel below 1GHz (20 MHz BW)



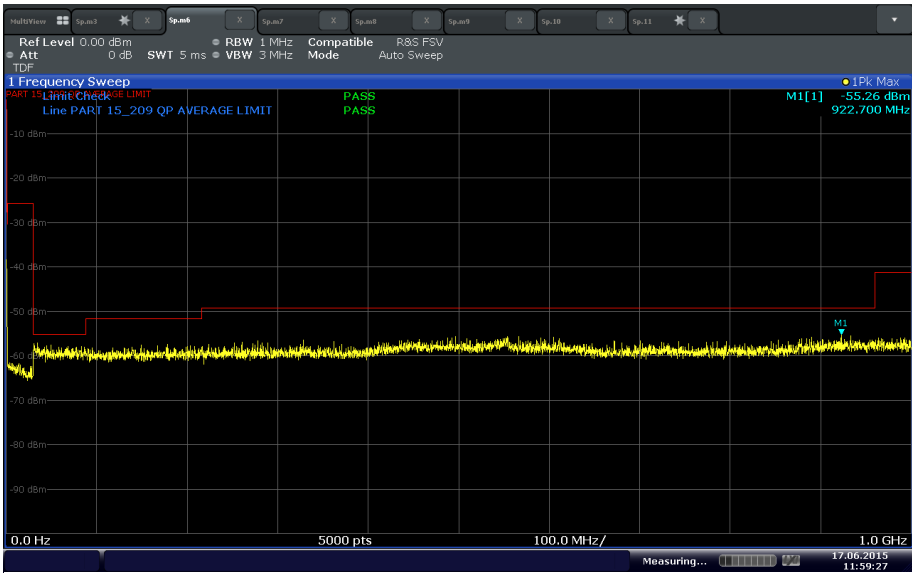
Date: 17.JUN.2015 11:57:53

U-NII 3 802.11 n Low Channel below 1GHz (40 MHz BW)



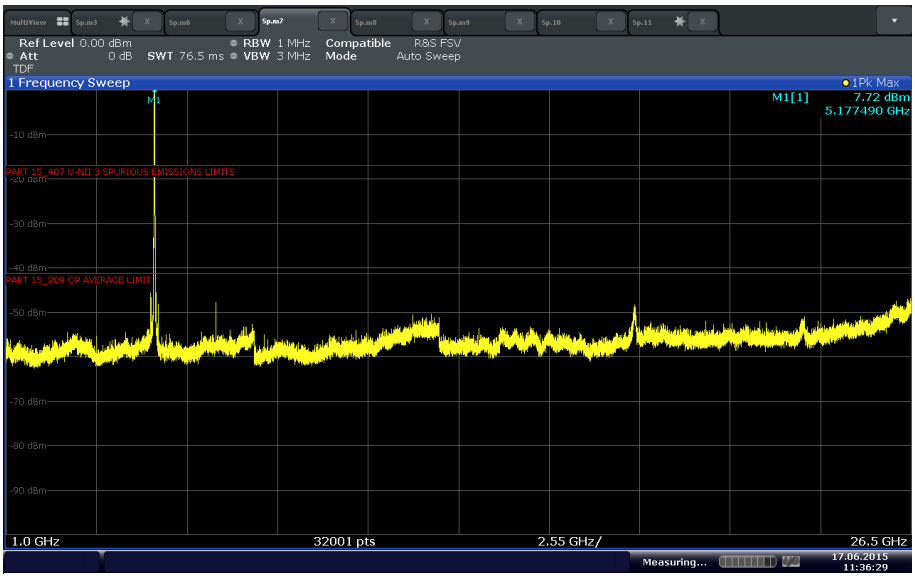
Date: 17.JUN.2015 11:58:37

U-NII 3 802.11 n Mid Channel below 1GHz (40 MHz BW)



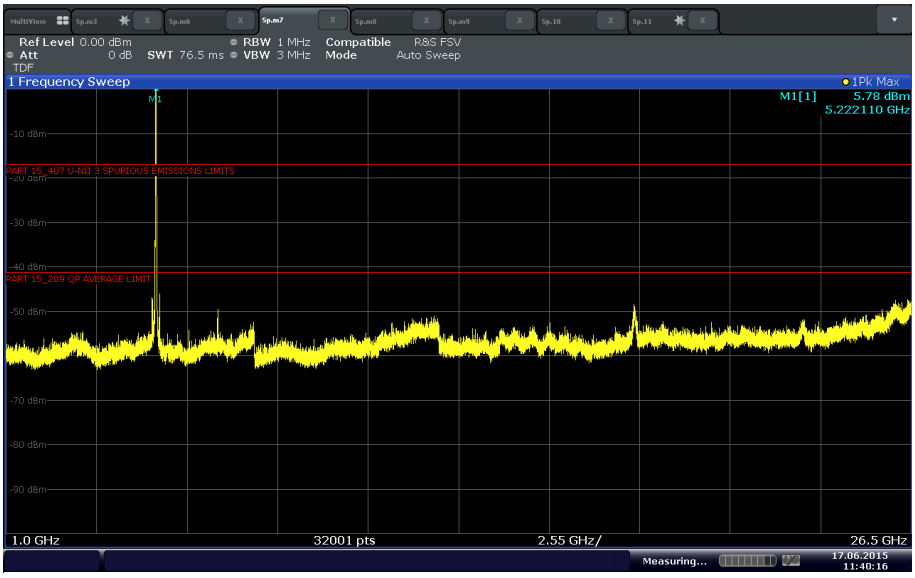
Date: 17.JUN.2015 11:59:27

U-NII 3 802.11 n Top Channel below 1GHz (40 MHz BW)



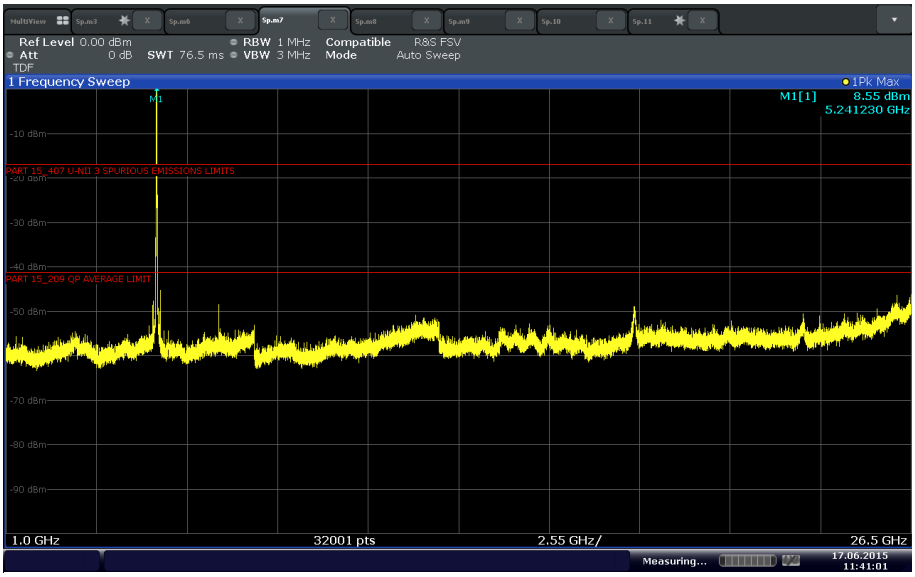
Date:17.JUN.2015 11:36:29

U-NII 1 802.11 n Low Channel above 1GHz (20 MHz BW)



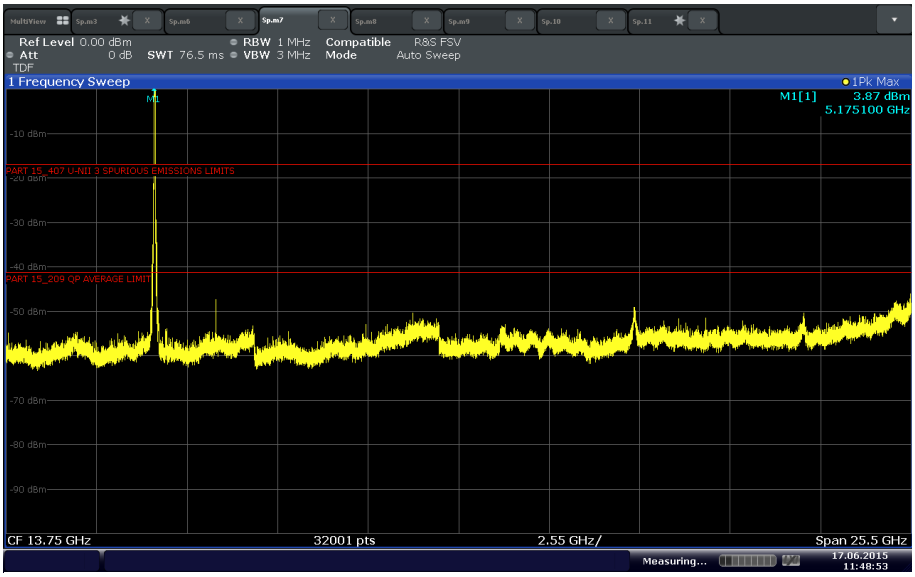
Date:17.JUN.2015 11:40:17

U-NII 1 802.11 n Mid Channel above 1GHz (20 MHz BW)



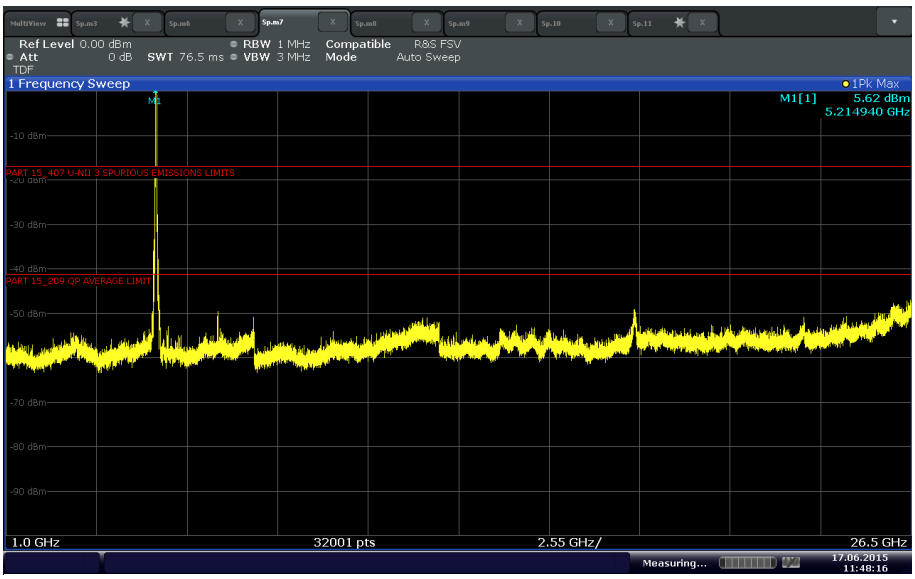
Date: 17.JUN.2015 11:41:01

U-NII 1 802.11 n Top Channel above 1GHz (20 MHz BW)



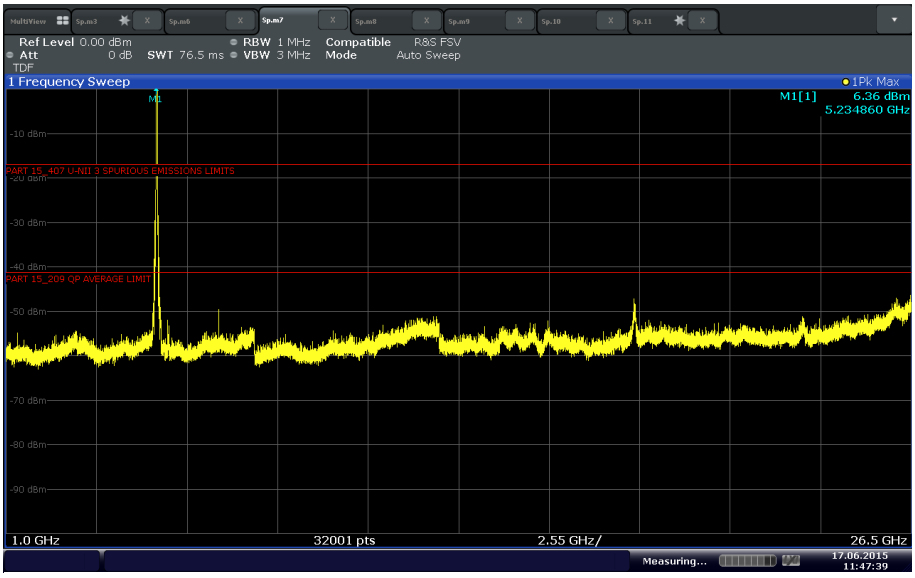
Date: 17.JUN.2015 11:48:53

U-NII 1 802.11 n Low Channel above 1GHz (40 MHz BW)



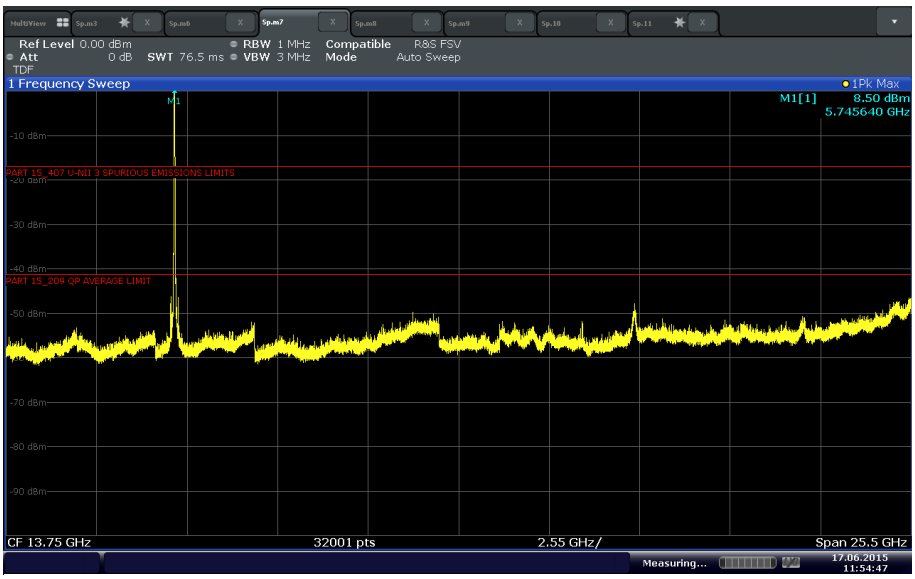
Date: 17.JUN.2015 11:48:16

U-NII 1 802.11 n Mid Channel above 1GHz (40 MHz BW)



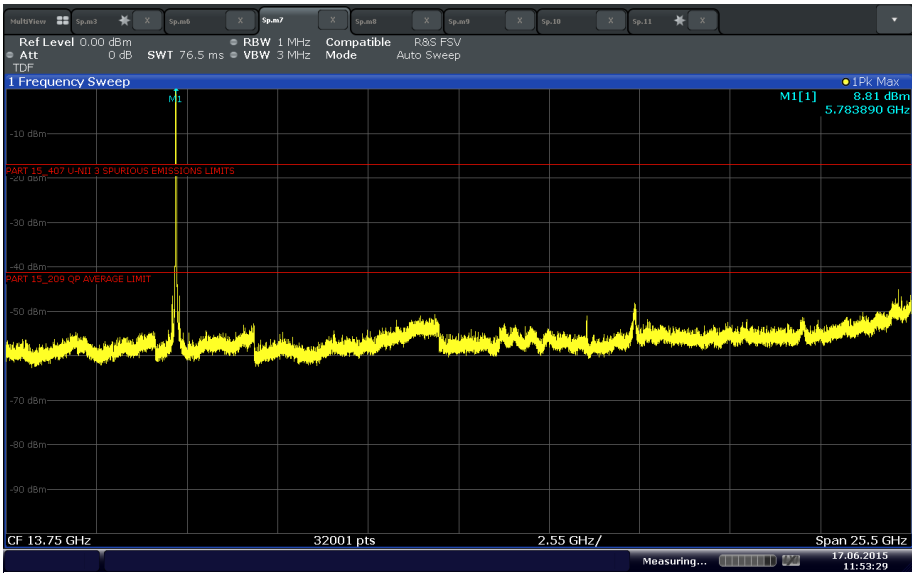
Date: 17.JUN.2015 11:47:40

U-NII 1 802.11 n Top Channel above 1GHz (40 MHz BW)



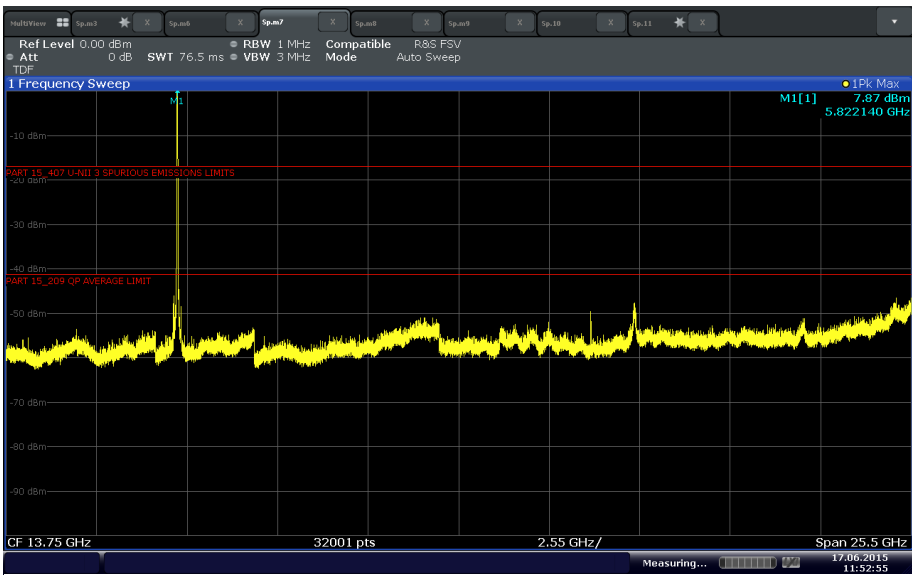
Date: 17.JUN.2015 11:54:48

U-NII 3 802.11 n Low Channel above 1GHz (20 MHz BW)

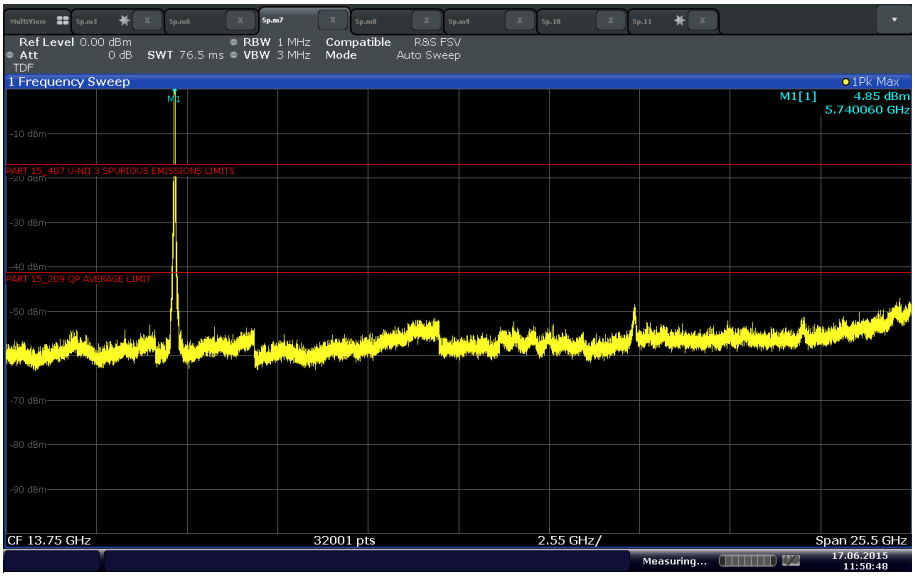


Date: 17.JUN.2015 11:53:29

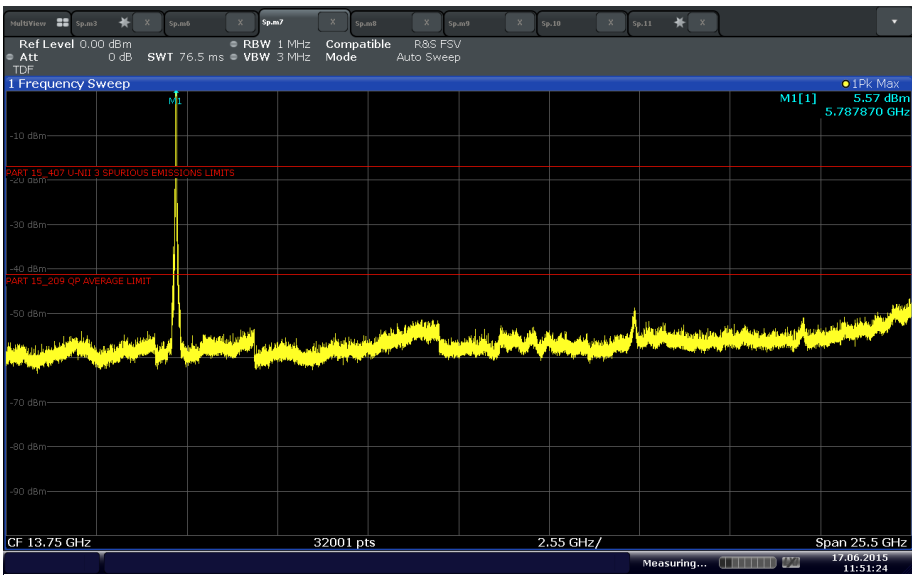
U-NII 3 802.11 n Mid Channel above 1GHz (20 MHz BW)



U-NII 3 802.11 n Top Channel above 1GHz (20 MHz BW)

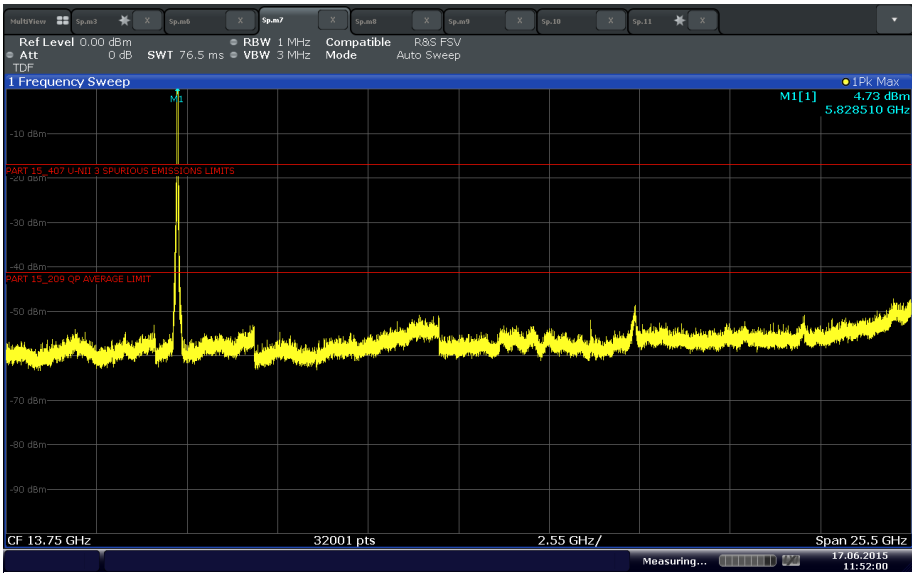


U-NII 3 802.11 n Low Channel above 1GHz (40 MHz BW)



Date: 17.JUN.2015 11:51:24

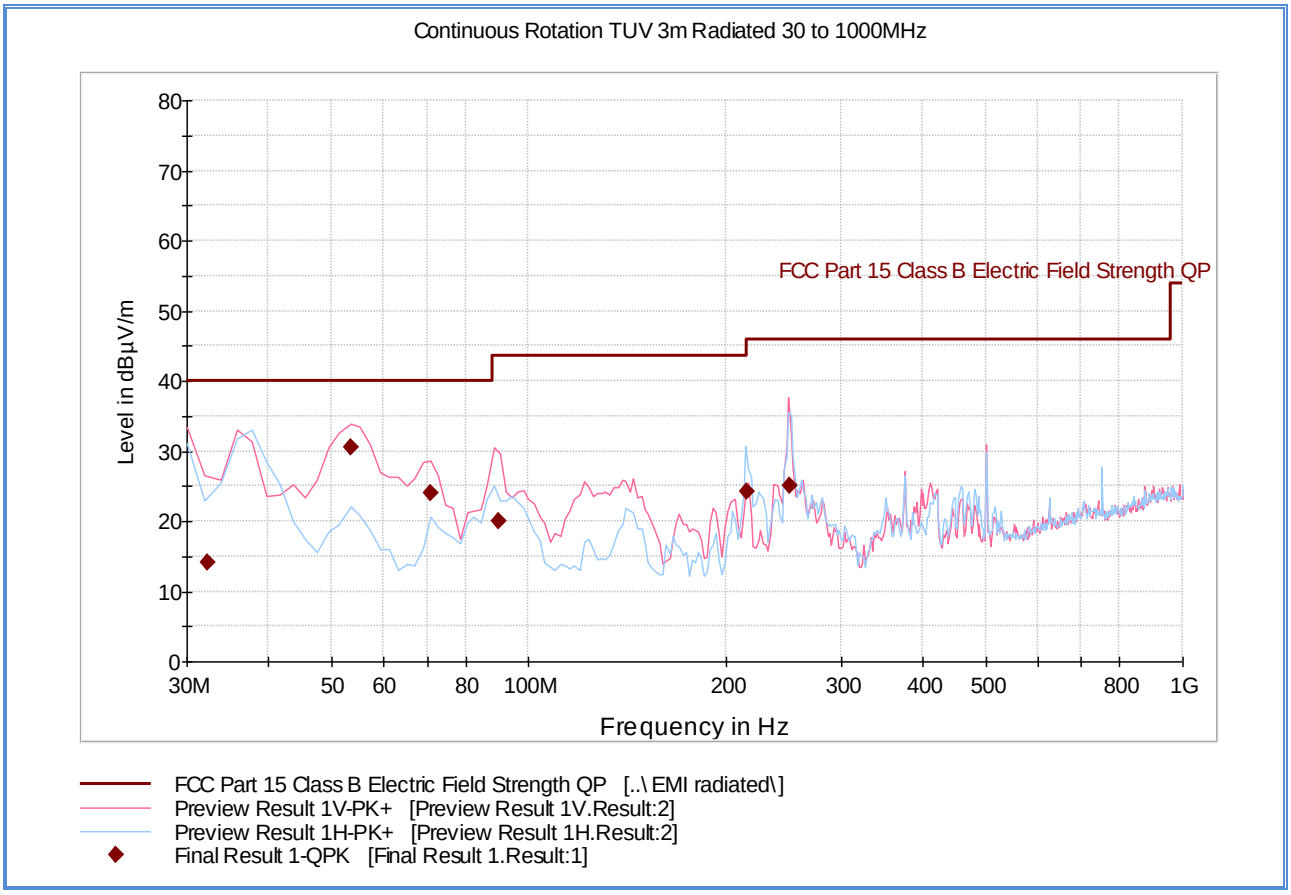
U-NII 3 802.11 n Mid Channel above 1GHz (40 MHz BW)



Date: 17.JUN.2015 11:52:00

U-NII 3 802.11 n Top Channel above 1GHz (40 MHz BW)

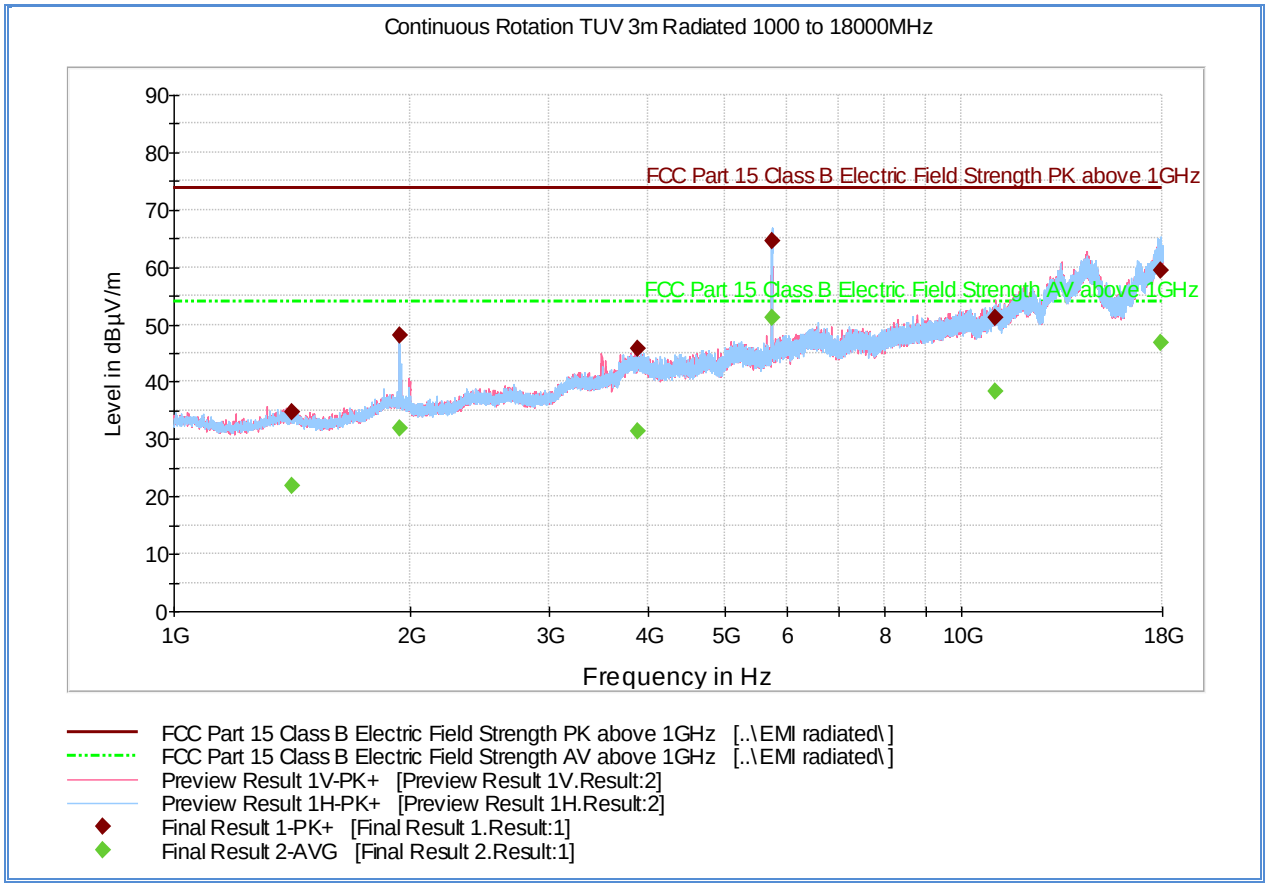
2.5.12 Test Results Below 1GHz (Representative Cabinet Spurious Emissions)



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)
32.280000	14.2	1000.0	120.000	155.0	V	12.0	-12.7	25.8	40.0
53.366653	30.5	1000.0	120.000	100.0	V	65.0	-20.6	9.5	40.0
70.781643	24.0	1000.0	120.000	111.0	V	135.0	-22.4	16.0	40.0
89.756633	20.0	1000.0	120.000	100.0	V	6.0	-20.9	23.5	43.5
215.869339	24.2	1000.0	120.000	129.0	H	244.0	-15.9	19.3	43.5
250.539319	25.1	1000.0	120.000	159.0	V	234.0	-14.5	20.9	46.0

2.5.13 Test Results Above 1GHz (Representative Cabinet Spurious Emissions)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1414.233333	34.6	1000.0	1000.000	218.4	V	98.0	-8.9	39.3	73.9
1932.766667	48.1	1000.0	1000.000	403.5	V	192.0	-5.9	25.8	73.9
3884.933333	45.7	1000.0	1000.000	248.3	V	116.0	4.0	28.2	73.9
5746.600000	64.5	1000.0	1000.000	378.1	H	279.0	7.3	9.4	73.9
11029.80000	51.2	1000.0	1000.000	116.7	V	122.0	15.0	22.7	73.9
17929.73333	59.3	1000.0	1000.000	378.1	H	264.0	26.4	14.6	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)
1414.233333	22.0	1000.0	1000.000	218.4	V	98.0	-8.9	31.9	53.9
1932.766667	31.9	1000.0	1000.000	403.5	V	192.0	-5.9	22.0	53.9
3884.933333	31.4	1000.0	1000.000	248.3	V	116.0	4.0	22.5	53.9
5746.600000	51.1	1000.0	1000.000	378.1	H	279.0	7.3	2.8	53.9
11029.80000	38.2	1000.0	1000.000	116.7	V	122.0	15.0	15.7	53.9
17929.73333	46.7	1000.0	1000.000	378.1	H	264.0	26.4	7.2	53.9

Test Notes:. Measurement was performed with a 5GHz notch filter No significant emissions observed above 18GHz.

2.6 BAND-EDGE MEASUREMENTS (CONDUCTED)

2.6.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.407(b)(1),(4) and (7) / 15.209
RSS-210, Clause A9.2(1) and (4)

2.6.2 Standard Applicable

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

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

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

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

2.6.3 Test Methodology

Section II (G)(3)(d)(ii) Band Edge Measurement of 789033 D01 General UNII Test Procedures Old Rules v01

2.6.4 Equipment Under Test and Modification State

Serial No: N/A (Sample #2) and (Sample #1) / Test Configuration A and B

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

June 11 and 17, 2015/XYZ

2.6.6 Test Equipment Used

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

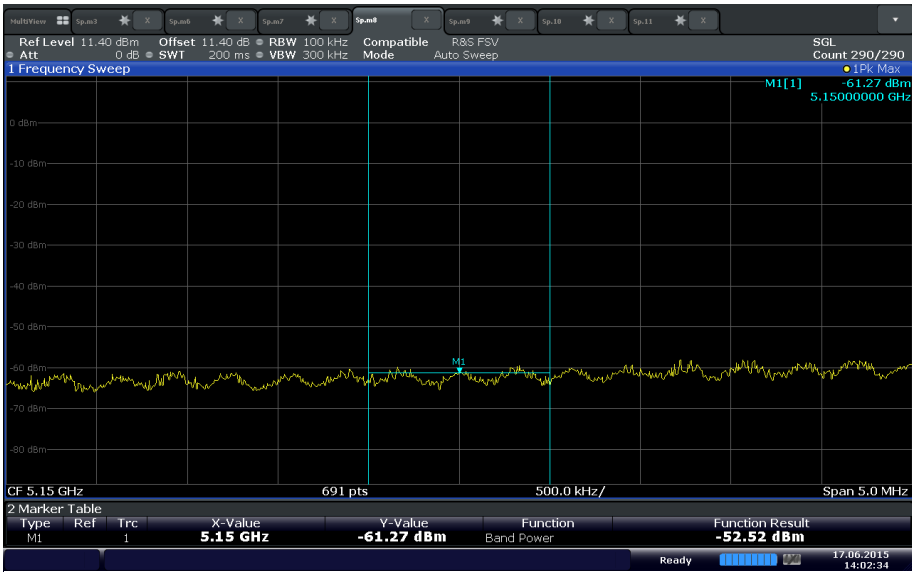
2.6.7 Environmental Conditions

Ambient Temperature	22.3 - 22.5°C
Relative Humidity	45.6 - 49.2 %
ATM Pressure	98.4 - 98.7kPa

2.6.8 Additional Observations

- This is a conducted test using Integration Method as per Section (H)(3)(d)(ii) Band Edge Measurement of 789033 D01 General UNII Test Procedures Old Rules v01.
- RBW=100 kHz
- VBW=300 kHz
- Sweep time=Auto
- Trace Mode=max hold (Peak); trace averaging (Average)
- Detector is Peak for Peak measurements and RMS for Average measurements.
- Sweep time is set to auto.
- The path loss was measured and entered as a level offset.
- Integration performed across 1MHz bandwidth.
- Only the worst case bandwidth and data rate presented.

2.6.9 Test Results

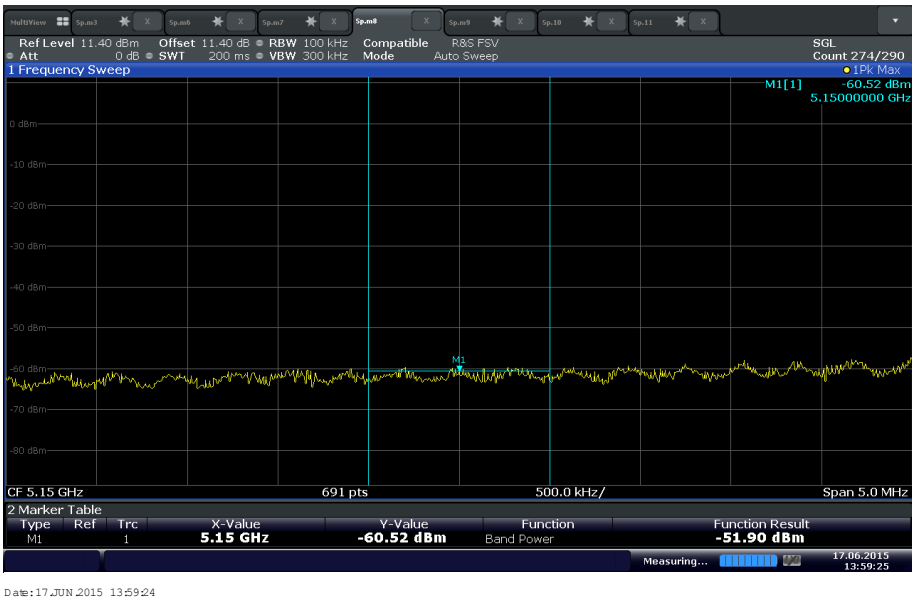


802.11a U-NII 1 Low Channel (Ch 36) Band Edge (Peak Measurement) @ 5150 MHz

Lower band edge calculation:

- 5150 MHz (in the restricted band)
- Use the following formula as per Section H(2)(d)(i) of 789033 D01 General U-NII Test Procedures v01r03:

  E(dBµV/m) = EIRP (dBm) + 95.2
  = (-52.52 dBm + 2.3dBi antenna gain) + 95.2
  = 44.98 dBµV/m @ 3 meters
- Since 44.98 dBµV/m (Peak) is less than than the 54 dBµV/m Average limit of §15.209, then average measurement is not required.

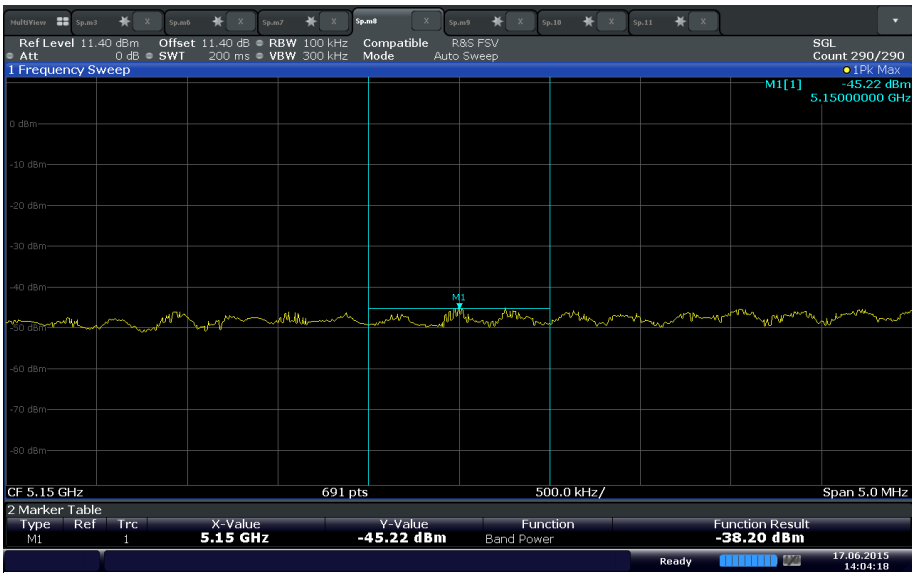


802.11n U-NII 1 HT20 Low Channel (Ch 36) Band Edge (Peak Measurement) @ 5150 MHz

Lower band edge calculation:

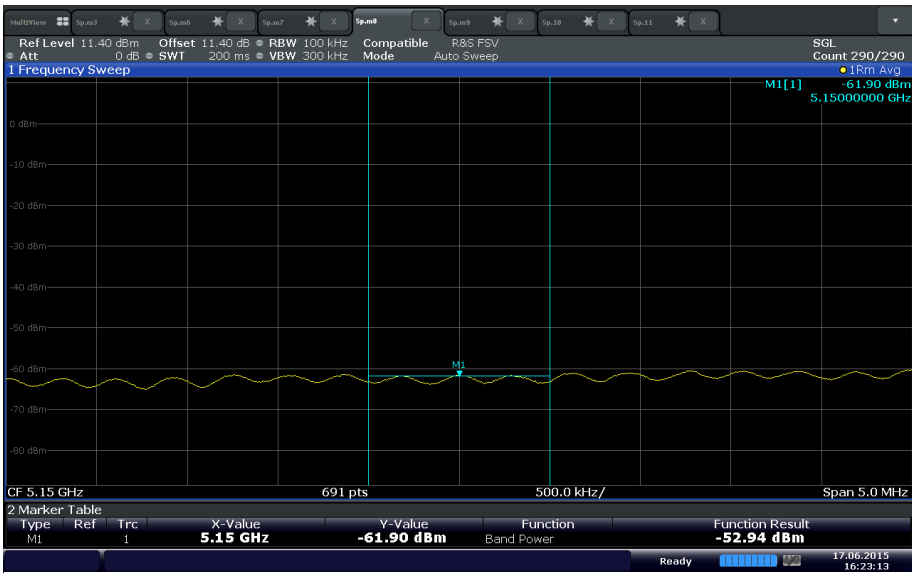
- 5150 MHz (in the restricted band)
- Use the following formula as per Section H(2)(d)(i) of 789033 D01 General U-NII Test Procedures v01r03:

  E(dBµV/m) = EIRP (dBm) + 95.2
  = (-51.90 dBm + 2.3dBi antenna gain) + 95.2
  = 45.6 dBµV/m @ 3 meters
- Since 45.6 dBµV/m (Peak) is less than than the 54 dBµV/m Average limit of §15.209, then average measurement is not required.



Date:17.JUN.2015 14:04:18

802.11n HT40 U-NII 1 Low Channel (Peak) (Ch 36) Band Edge (Peak Measurement) @ 5150 MHz



Date:17.JUN.2015 16:23:13

802.11n HT40 U-NII 1 Low Channel (Peak) (Ch 36) Band Edge (Average Measurement) @ 5150 MHz

Lower band edge calculation:

- 5150 MHz (in the restricted band)
- Use the following formula as per Section H(2)(d)(i) of 789033 D01 General U-NII Test Procedures v01r03:

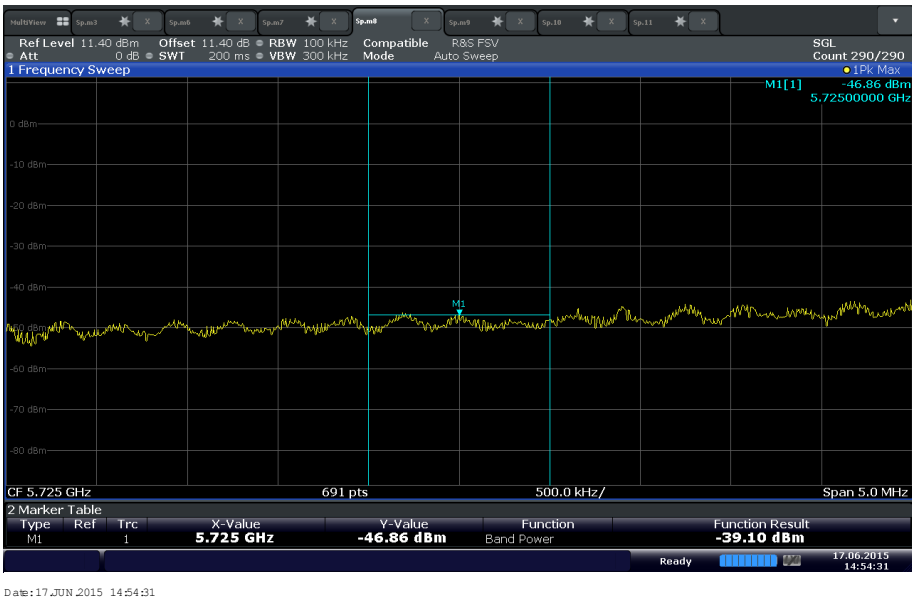
E(dBµV/m) = EIRP (dBm) + 95.2 (Peak Caculation)
= (-38.20 dBm + 2.3dBi antenna gain) + 95.2
= 59.3 dBµV/m @ 3 meters (Peak, complies with 74 dBµV/m limit)
= EIRP (dBm) + 95.2 (Average Caculation)
= (-52.94 dBm + 2.3dBi antenna gain) + 95.2
= 44.56 dBµV/m @ 3 meters (Average, complies with 54 dBµV/m limit)

802.11a U-NII 3 Low Channel (Ch 149) Band Edge (Peak 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	= -40.24 dBm
EIRP @ 5725 MHz	= -40.24 + 2.3 dBi (antenna gain)
	= -37.94 dBm
Margin of compliance	= -20.94dB



802.11n HT20 U-NII 3 Low Channel (Ch 149) Band Edge (Peak Measurement) @ 5725 MHz

Lower band edge calculation:

- 5725 MHz (not in the restricted bands)
- Limit is -17dBm EIRP
- Calculation @ 5725 MHz:

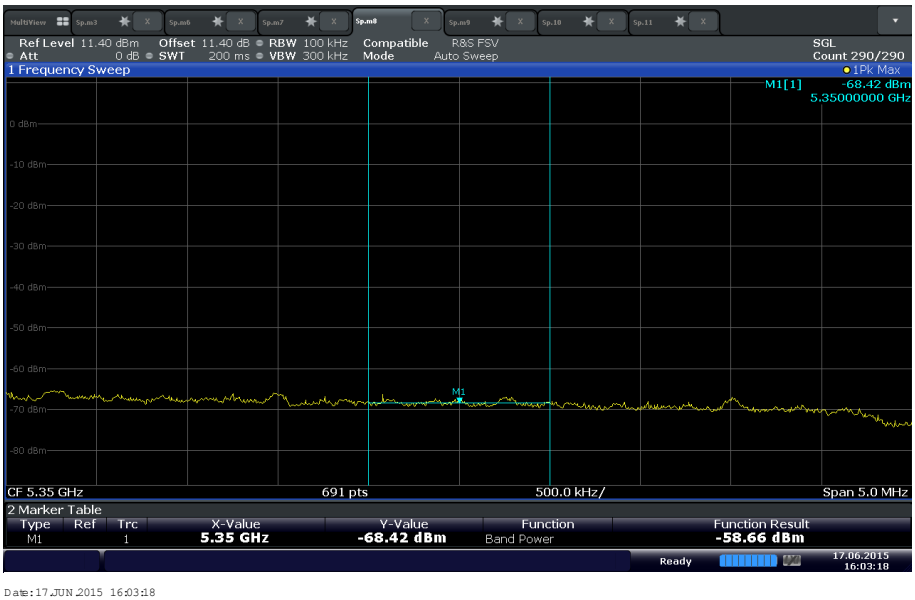
Integrated average measurement @ 5725 MHz	= -39.1 dBm
EIRP @ 5725 MHz	= -39.1 + 2.3 dBi (antenna gain)
	= -36.8 dBm
Margin of compliance	= -19.8dB

802.11n HT40 U-NII 3 Low Channel (Peak) (Ch 149) Band Edge (Peak 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	= -28.85 dBm
EIRP @ 5725 MHz	= -28.85 + 2.3 dBi (antenna gain)
	= -26.55 dBm
Margin of compliance	= -9.55 dB

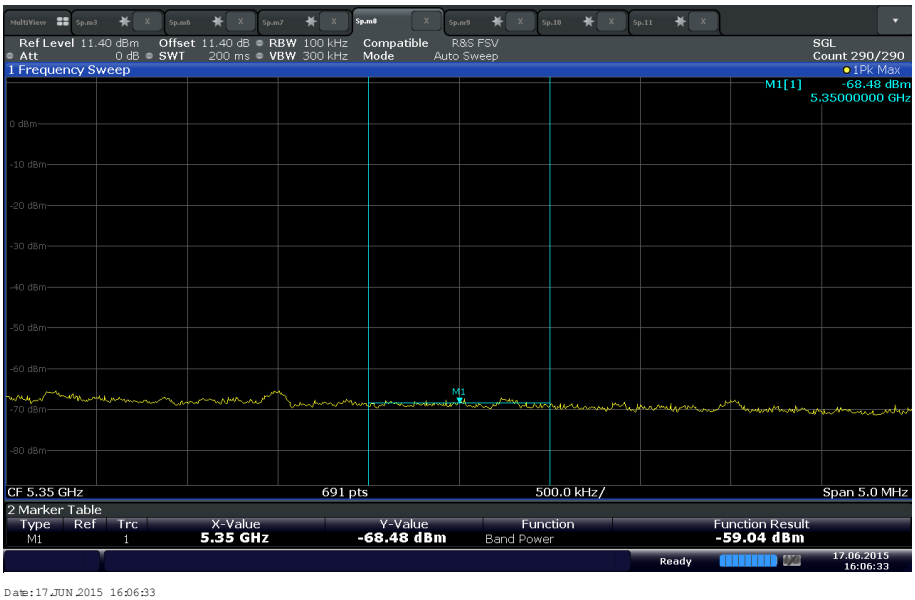


802.11a U-NII 1 High Channel (Ch 48) Band Edge (Peak Measurement) @ 5350 MHz

Upper band edge calculation (5350 MHz):

- 5350 MHz (in the restricted band)
- Use the following formula as per Section H(2)(d)(i) of 789033 D01 General U-NII Test Procedures v01r03:

E(dBµV/m) = EIRP (dBm) + 95.2
= (-58.66 dBm + 2.3dBi antenna gain) + 95.2
=38.84 dBµV/m @ 3 meters (Peak, complies with 74 dBµV/m limit)

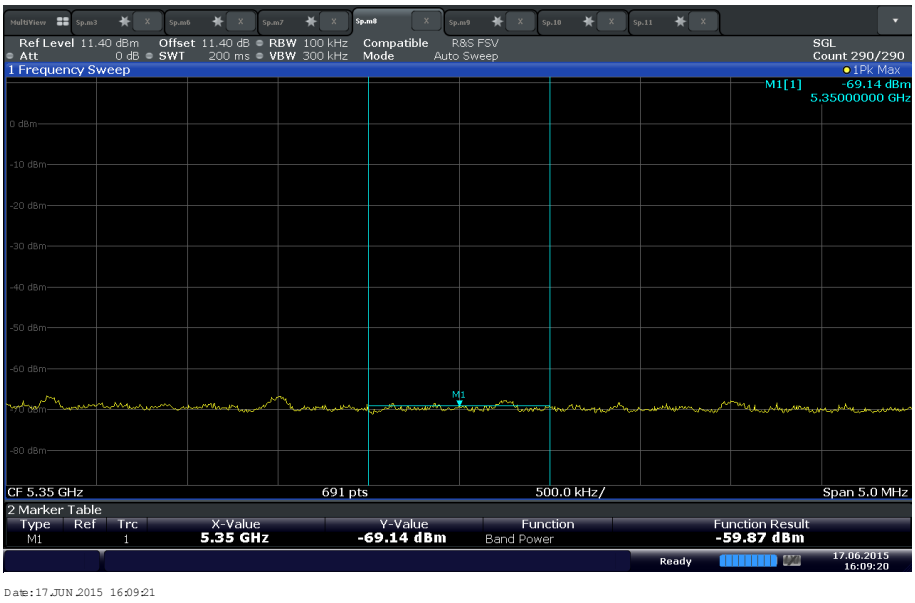


802.11n HT20 U-NII 1 High Channel (Ch 48) Band Edge (Peak Measurement) @ 5350 MHz

Upper band edge calculation (5350 MHz):

- 5350 MHz (in the restricted band)
- Use the following formula as per Section H(2)(d)(i) of 789033 D01 General U-NII Test Procedures v01r03:

E(dBµV/m) = EIRP (dBm) + 95.2
= (-59.04 dBm + 2.3dBi antenna gain) + 95.2
= 38.46 dBµV/m @ 3 meters (Peak, complies with 74 dBµV/m limit)

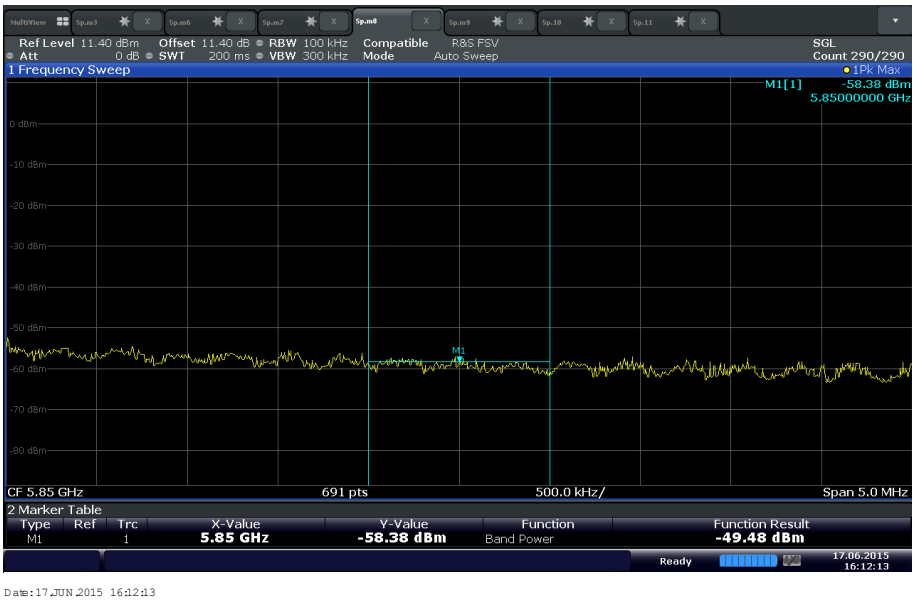


802.11n HT40 U-NII 1 High Channel (Ch 48) Band Edge (Peak Measurement) @ 5350 MHz

Upper band edge calculation (5350 MHz):

- 5350 MHz (in the restricted band)
- Use the following formula as per Section H(2)(d)(i) of 789033 D01 General U-NII Test Procedures v01r03:

E(dBµV/m) = EIRP (dBm) + 95.2
= (-59.87 dBm + 2.3dBi antenna gain) + 95.2
= 37.63 dBµV/m @ 3 meters (Peak, complies with 74 dBµV/m limit)

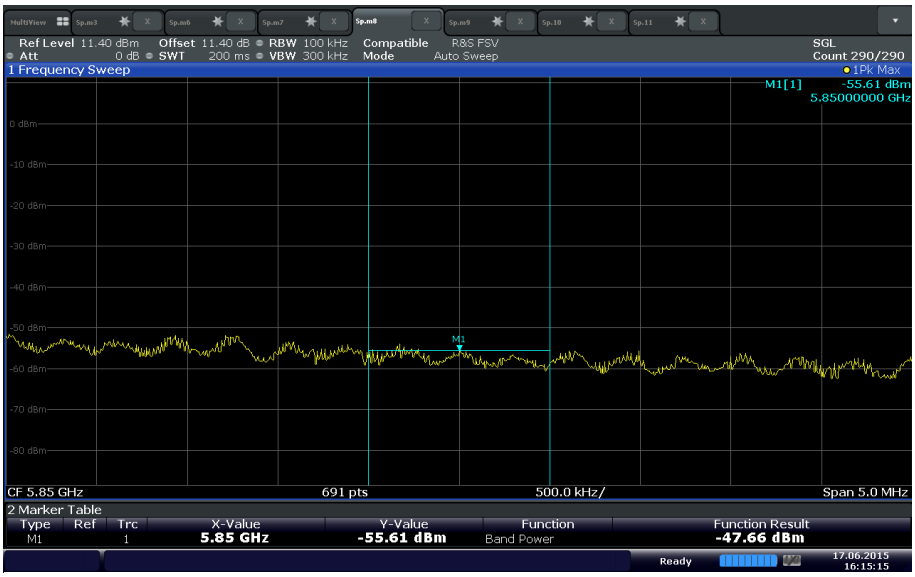


802.11a U-NII 3 High Channel (Ch 165) Band Edge (Peak Measurement) @ 5850 MHz

Upper band edge calculation (5850 MHz):

- 5850 MHz (not in the restricted bands)
- Limit is -17dBm EIRP
- Calculation @ 5850 MHz:

Integrated average measurement @ 5850 MHz	= -49.48 dBm
EIRP @ 5850 MHz	= -49.48 + 2.3 dBi (antenna gain)
	= -47.18 dBm
Margin of compliance	= -30.18 dB

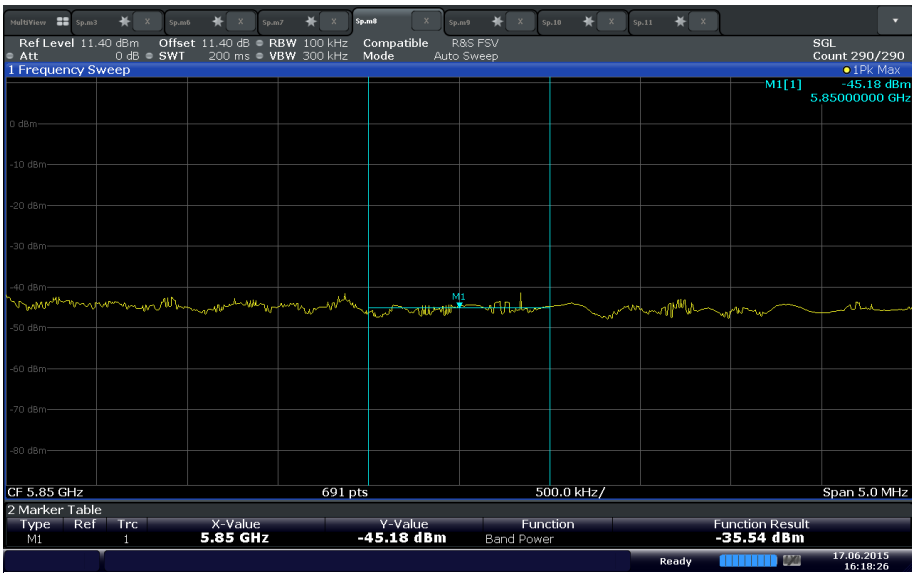


802.11n HT20 U-NII 3 High Channel (Ch 165) Band Edge (Peak Measurement) @ 5850 MHz

Upper band edge calculation (5850 MHz):

- 5850 MHz (not in the restricted bands)
- Limit is -17dBm EIRP
- Calculation @ 5850 MHz:

Integrated average measurement @ 5850 MHz	= -47.66 dBm
EIRP @ 5850 MHz	= -47.66 +2.3 dBi (antenna gain)
	= -45.36 dBm
Margin of compliance	= -28.36 dB



802.11n HT40 U-NII 3 High Channel (Ch 165) Band Edge (Peak Measurement) @ 5850 MHz

Upper band edge calculation (5850 MHz):

- 5850 MHz (not in the restricted bands)
- Limit is -17dBm EIRP
- Calculation @ 5850 MHz:

Integrated average measurement @ 5850 MHz	= -35.54 dBm
EIRP @ 5850 MHz	= -35.54 + 2.3 dBi (antenna gain)
	= -33.24 dBm
Margin of compliance	= -16.24 dB

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						
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	12/22/14	12/22/15
1003	Signal Generator	SMR 40	1104.0002.40	Rhode & Schwarz	04/29/15	04/29/16
7604	Series Power Meter	N1912A	SG45100273	Agilent	05/27/15	05/27/16
7605	50MHz-18GHz Wideband Power Sensor	N1921A	MY51100054	Agilent	04/10/15	04/10/16
-	6dB Attenuator	606-06-1F4/DR	-	MECA	Verified by 7604 and 1003	
-	10dB Attenuator	PE7010-10	3	PASTERNACK	Verified by 7604 and 1003	
Radiated Test Setup						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/30/14	01/30/16
1051	Double-ridged waveguide horn antenna	3115	9408-4329	EMCO	02/28/14	02/28/16
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	03/20/15	03/20/16
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	09/29/14	09/29/15
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/11/15	03/11/16
1016	Pre-amplifier	PAM-0202	187	PAM	12/10/14	12/10/15
8818	5.15GHz to 5.88GHz Notch Filter	BRM50716	015	MICRO-TRONICS	N/A	
Conducted Emissions						
1024	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	04/10/15	04/10/16
7567	LISN	FCC-LISN-50-25-2-10	120304	Fischer Custom Comm.	07/01/14	07/01/15
7568	LISN	FCC-LISN-50-25-2-10	120305	Fischer Custom Comm.	09/02/14	09/02/15
8822	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	02/20/15	02/20/16
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	02/20/15	02/20/16
Miscellaneous						
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	
1072	DC Power Supply	E3610A	KR51311519	Hewlett Packard	Verified by 6792	
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/12/14	08/12/15
7579	Temperature Chamber	115	151617	TestQuity	07/21/14	07/21/15
7554	Barometer/Temperature/Humidity Transmitter	iBTHX-W	1240476	Omega	01/30/14	01/30/16

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

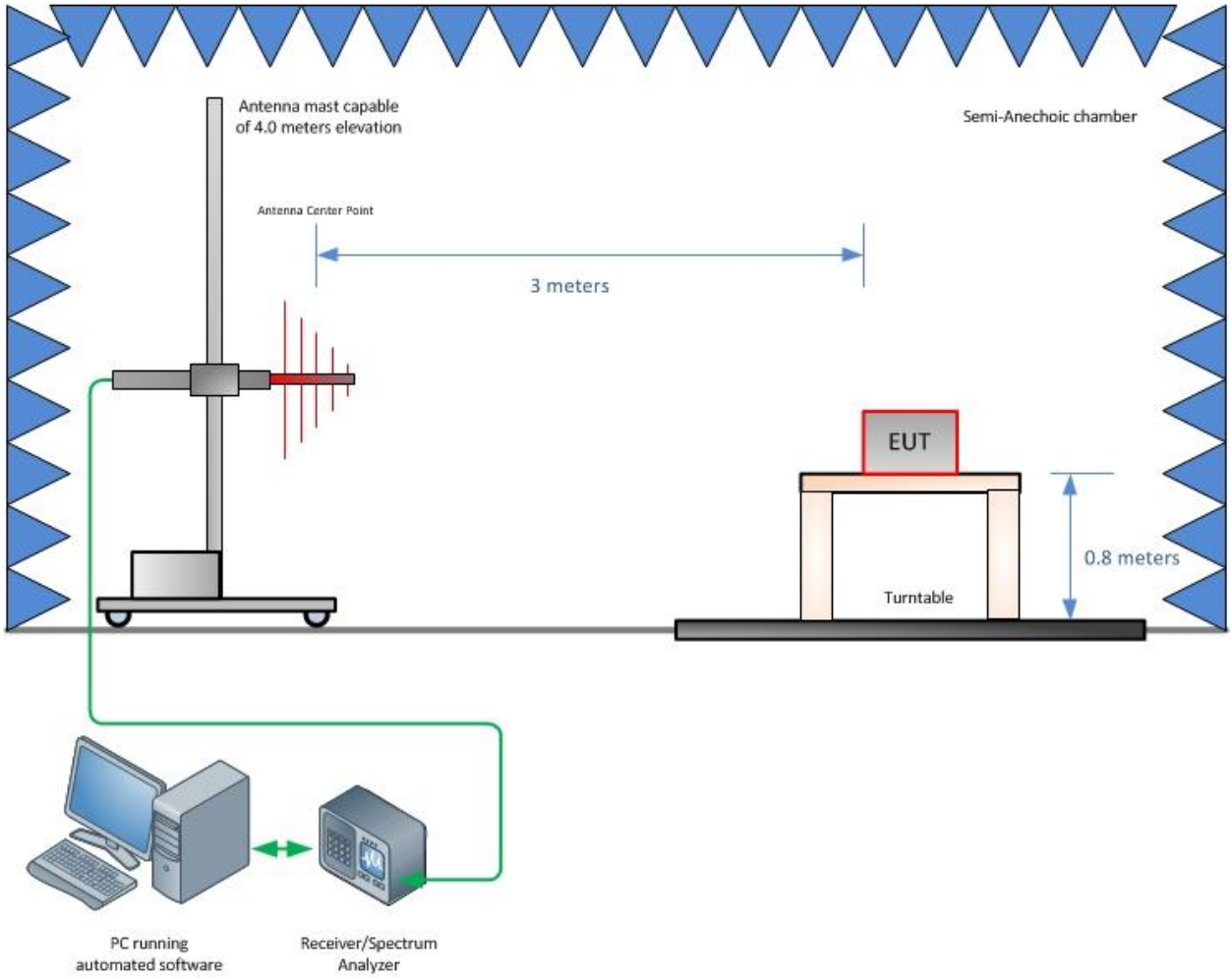
3.2.3 Conducted Antenna Port Measurement

	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

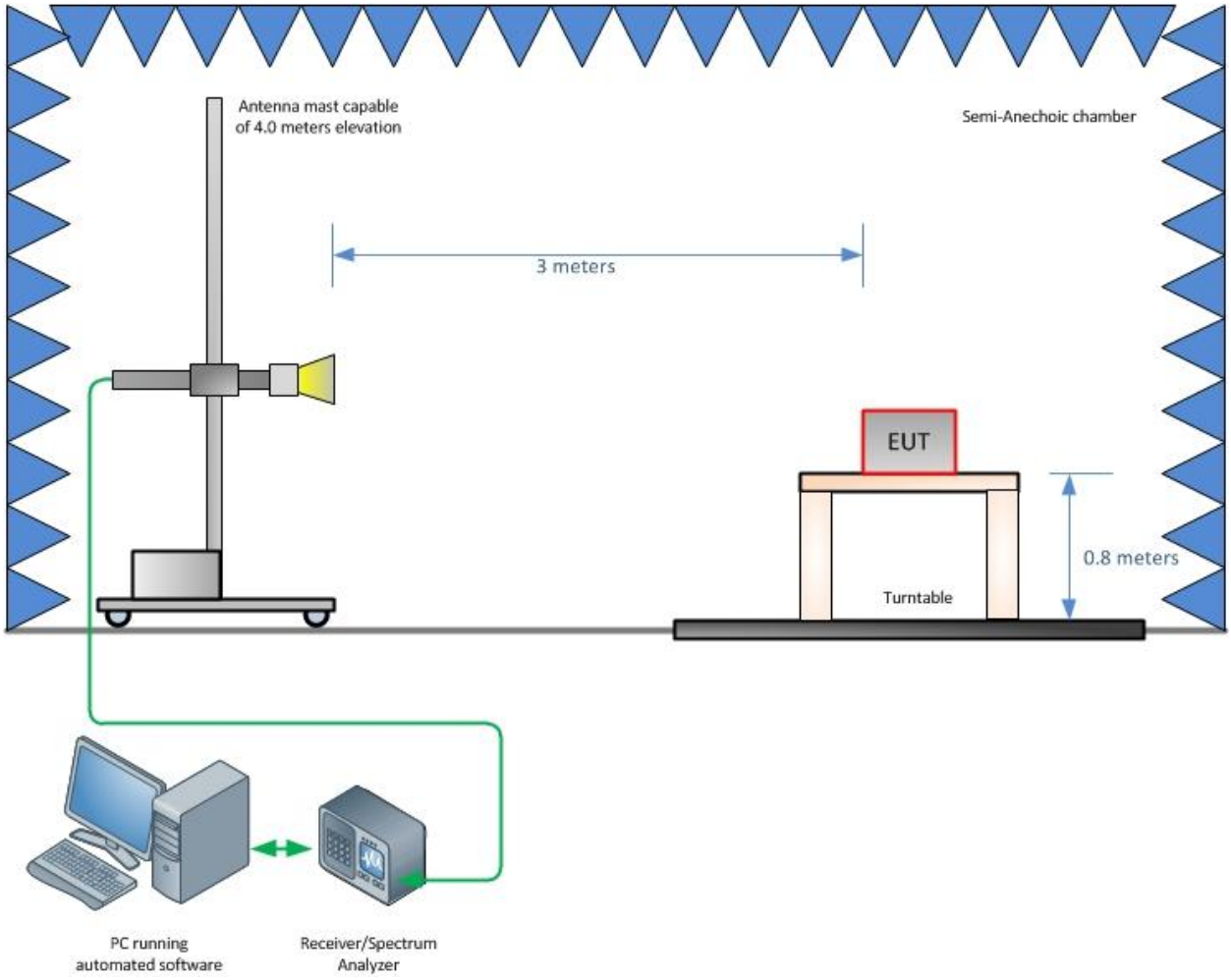
SECTION 4

DIAGRAM OF TEST SETUP

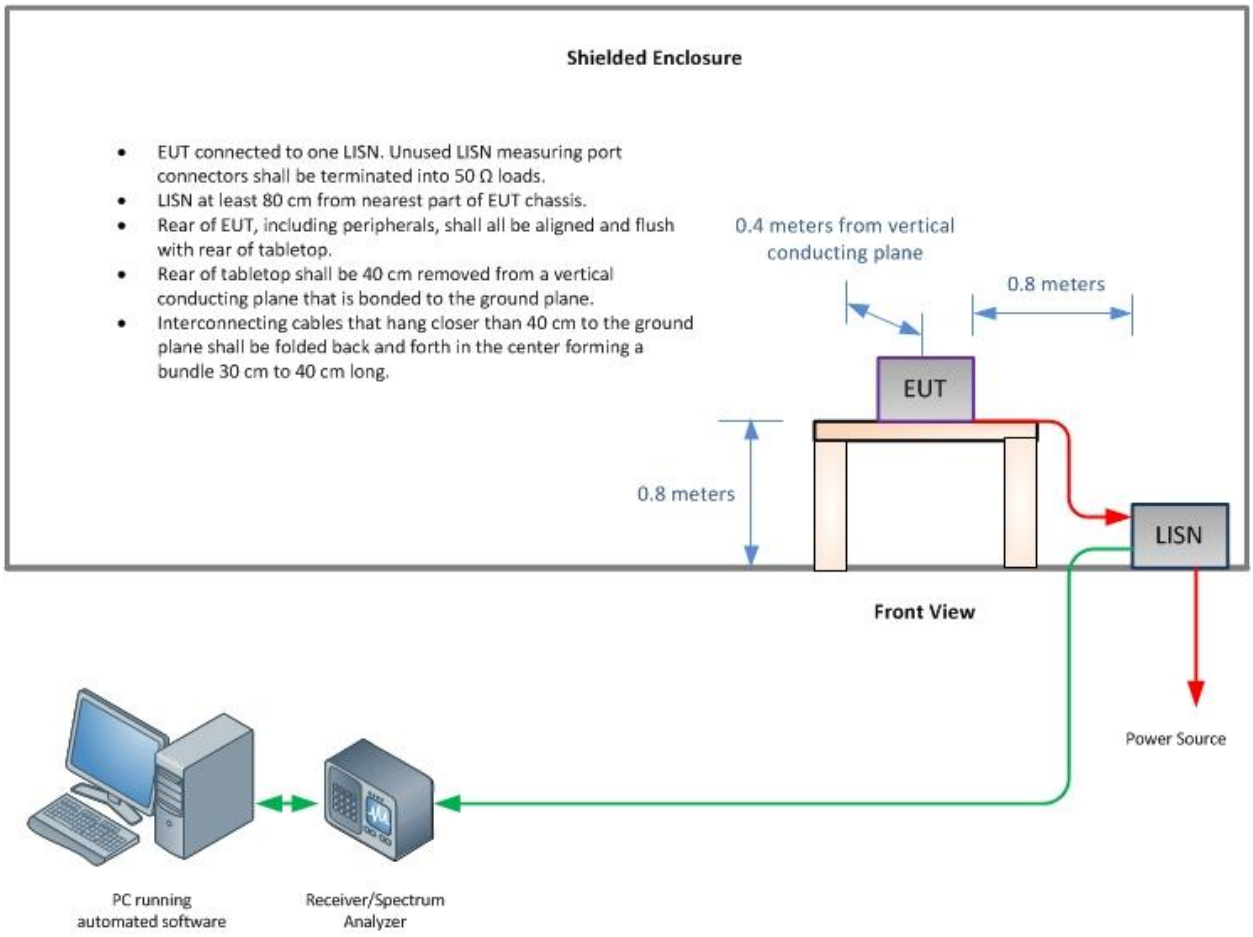
4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)



Conducted Emission Test Setup

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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