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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 C §15.247: 2014
IC RSS-247 Issue 1 May 2015

Report No.SD72102282-0215A **June 2015**

REPORT ON	Radio Testing of the NantWorks HBox Access Point for Medical Devices
TEST REPORT NUMBER	SD72102282-0215A
PREPARED FOR	NantWorks 9920 Jefferson Blvd. Culver City, CA 90232
CONTACT PERSON	David Lu Principal Engineer (858) 735-6852 dlu@nantworks.com
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	June 18, 2015

Revision History

SD72102282-0215A NantWorks HBox Access Point for Medical Devices					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
06/18/2015	Initial Release				Juan M Gonzalez

CONTENTS

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

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 HBox Access Point for Medical Devices to the requirements of the following:
FCC Part 15 Subpart C §15.247 & 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 Name	HBox
Model Number(s)	200-HBV-PDL
FCC ID Number	IFU1001011
FCC Classification	Low power Communications device Transmitter (DTS)
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 - Sample #2)
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.247 (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	Aril 29, 2015
Finish of Test	May 30, 2015
Name of Engineer(s)	Xiaoying Zhang
Related Document(s)	• KDB 558074 D01 (DTS Meas Guidance v03r02, June 05, 2014). Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247. • KDB 662911 D01 Multiple Transmitter Output v02r01 (October 31, 2013) Emissions Testing of Transmitters with Multiple Outputs in the Same Band.

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1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart C §15.247 and IC RSS-247 Issue 1 May 2015 with cross-reference to the corresponding IC RSS standard is shown below.

Section	§15.247 Spec Clause	RSS	Test Description	Result	Comments/ Base Standard
2.1	§15.247(b)(3)	RSS-247 5.4(4)	Peak Output Power	Compliant	
2.2	§15.207(a)	RSS-Gen 8.8	Conducted Emissions	Compliant	
-		RSS-Gen 6.6	99% Emission Bandwidth	N/T*	See Note
-	§15.247(a)(2)	RSS-247 5.2(1)	Minimum 6 dB RF Bandwidth	N/T*	See Note
2.3	§15.247(d)	RSS-247 5.5	Out-of-Band Emissions - Conducted	Compliant	
2.4	§15.247(d)	RSS-247 5.5	Band-edge Compliance of RF Conducted Emissions	Compliant	
2.5	§15.247(d)	RSS-247 5.5	Radiated Spurious Emissions	Compliant	
—		RSS-Gen 7.1	Receiver Spurious Emissions	N/A**	See Note
2.6	§15.247(d)	RSS-247 5.5	Radiated Band Edge Measurements and Restricted Bands	Compliant	
2.7	§15.247(e)	RSS-247 5.2(2)	Power Spectral Density for Digitally Modulated Device	Compliant	

N/T: This is an updated product which uses the identical RF Module as the previous version. Only test cases related to power are verified in this report.*
*N/A**: Not applicable. EUT has no Stand-Alone receiver port.*

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a NantWorks HBox Access Point for Medical Devices as shown in the photograph below. The EUT can collect data through USB/BT/WIFI and send the data to server through ethernet/WIFI or Cellular network. The NFC function is for quick Bluetooth pairing by obtaining the device info when within NFC range of the EUT. Only the 802.11 b, g, n and Bluetooth LE functions verified in this test report.

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1.3.2 EUT General Description

EUT Description	Access Point for Medical Devices
Model Name	HBox
Model Number(s)	200-HBV-PDL
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 b/g/n and BT LE
Capability	CDMA2000 1xRTT, 1xEvDO Release A, 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)
MIMO Signal Type	Completely uncorrelated (Manufacturer declared)
Antenna Gain Ant #1 (Main, WiFi +BT)	2400MHz = 2.9dBi
Antenna Gain Ant #2 (MIMO 802.11 n ht20 2.4 GHz only)	2400MHz = 5.5dBi

1.3.3 Maximum Conducted Output Power

Mode	Frequency Range (MHz)	Avg Output Power (dBm)	Avg Output Power (mW)	Peak Output Power (dBm)	Peak Output Power (mW)
802.11b	2412-2462	12.29	16.94	14.45	27.86
802.11g	2412-2462	11.72	14.86	19.49	88.92
802.11 n (ht20)	2412-2462	11.62	14.52	19.38	86.70
802.11 n (ht40)	2422-2452	7.01	5.02	19.25	84.14
802.11 n (ht20 MIMO)	2412-2462	14.04	25.35	22.59	181.55
Bluetooth LE	2402-2480	9.77	9.48	9.96	9.91

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) except when in MIMO configuration where both antenna (Ant #1 and 2) were verified. MIMO function is limited to 802.11 n ht20 2.4GHz only. Antenna #1 is for both Wi-Fi and Bluetooth functions while Antenna #2 is for MIMO function only. 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

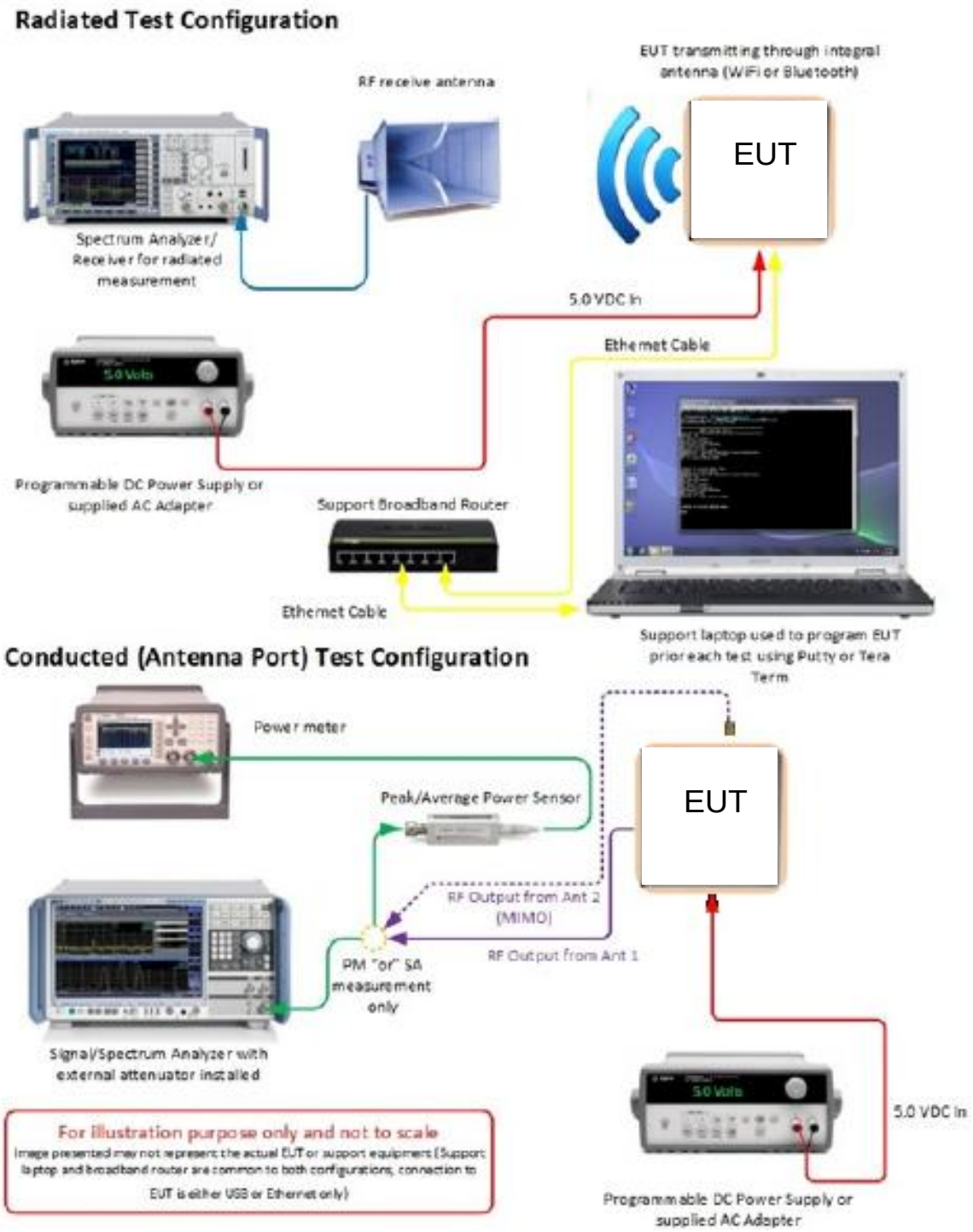
1.4.4 Worst Case Configuration

Worst-case configuration used in this test report as per Radiated Spurious Emission:

Mode	Channel	Data Rate
802.11b	11 (High Channel)	5.5Mbps
802.11g	11 (High Channel)	6Mbps
802.11 n 2.4G (ht20)	6 (Mid Channel)	6.5Mbps (mcs 0)
802.11 n (ht20 MIMO)	6 (Mid Channel)	13Mbps (mcs 8)
Bluetooth LE	37 (Low Channel)	1Mbps

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.
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 PEAK OUTPUT POWER

2.1.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(b)(3)
RSS-247, Clause 5.4 (4)

2.1.2 Standard Applicable

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

2.1.3 Equipment Under Test and Modification State

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

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

May 12, 2015/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	22.0°C
Relative Humidity	46.5%
ATM Pressure	99.5 kPa

2.1.7 Additional Observations

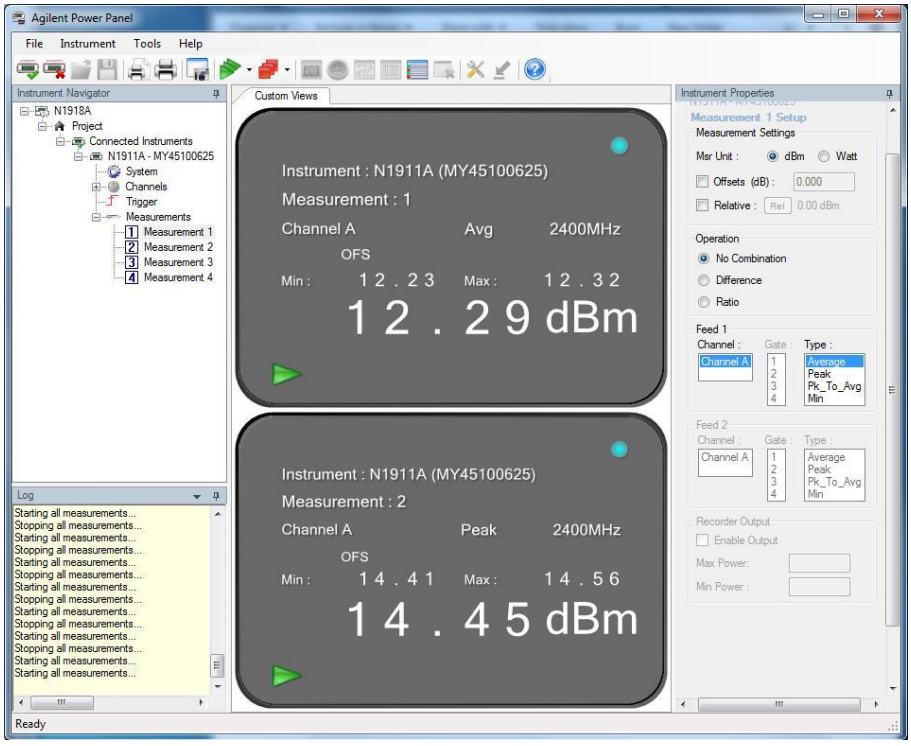
- This is a conducted test (Maximum conducted [average] output power) using direct connection to a power meter.
- The path loss for was measured and entered as a level offset.
- Test methodology is per Clause 9.2.3.1 of KDB 558074 D01 (DTS Meas Guidance v03r02, June 05, 2014). All conditions under this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

2.1.8 Test Results

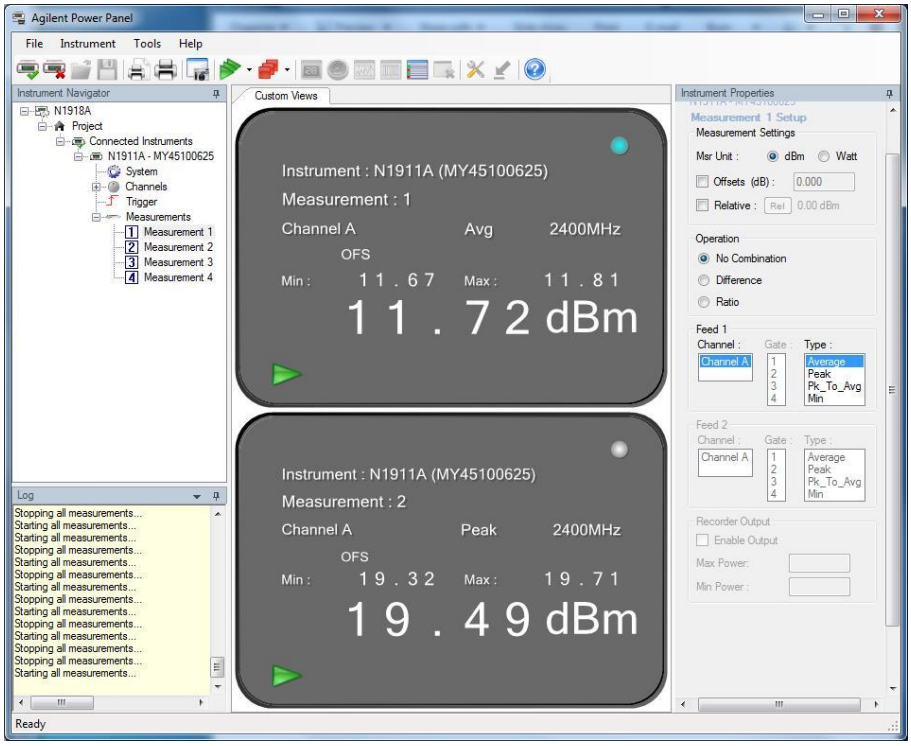
WLAN Mode	Channel	Data Rates (Mbps)	Measured Average Power (dBm)	Measured Peak Power (dBm)
802.11b	1 (2412 MHz)	5.5	11.67	13.78
	6 (2437 MHz)	**5.5**	**12.29**	**14.45**
	11 (2462 MHz)	5.5	12.12	14.24
802.11g	1 (2412 MHz)	6	10.96	18.90
	6 (2437 MHz)	**6**	**11.72**	**19.49**
	11 (2462 MHz)	6	10.81	18.80
802.11n (ht20)	1 (2412 MHz)	mcs 0 (6.50 Mbps)	10.84	18.81
	6 (2437 MHz)	**mcs 0 (6.50 Mbps)**	**11.62**	**19.38**
	11 (2462 MHz)	mcs 0 (6.50 Mbps)	11.44	19.52
802.11n (ht40)	3 (2422 MHz)	mcs 6 (121.50 Mbps)	6.61	18.86
	6 (2437 MHz)	**mcs 6 (121.50 Mbps)**	**7.01**	**19.25**
	9 (2452 MHz)	mcs 6 (121.50 Mbps)	6.96	19.47
802.11n (ht20 MIMO on antenna #1)	6 (2437 MHz)	mcs 8 (13.00 Mbps)	10.87	19.39
802.11n (ht20 MIMO on antenna #2)	6 (2437 MHz)	mcs 8 (13.00 Mbps)	11.19	19.76

Bluetooth Low Energy (LE)	Channel	Modulation	Measured Average Power (dBm)	Measured Peak Power (dBm)
	37 (2402 MHz)	GFSK @ 1Mbps	8.02	8.28
	17 (2440 MHz)		**9.77**	**9.96**
	39 (2480 MHz)		8.86	9.08

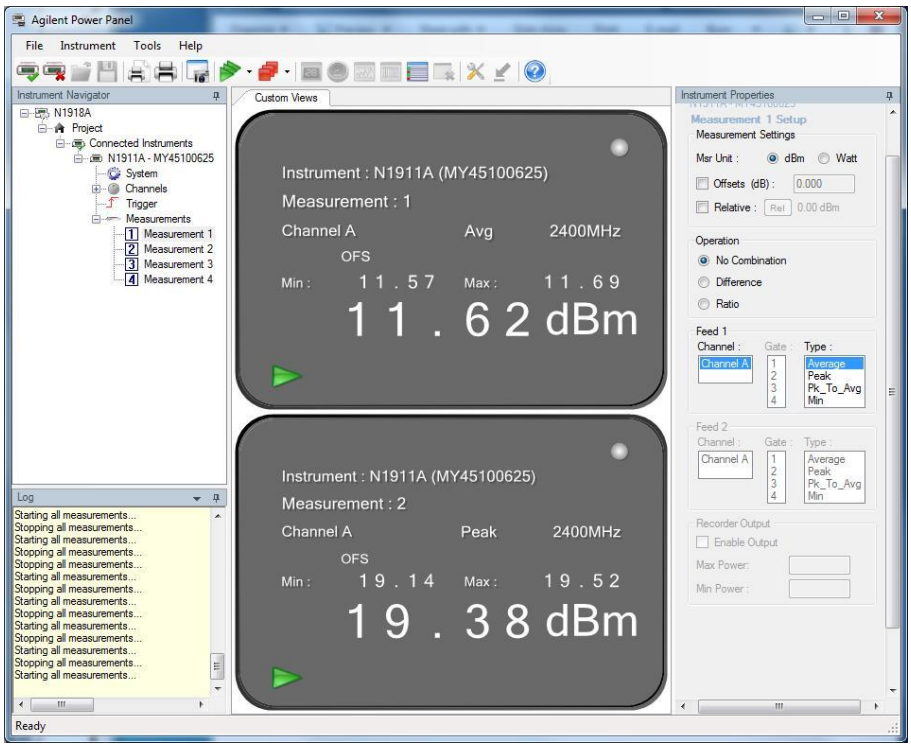
2.1.9 Sample Test Display



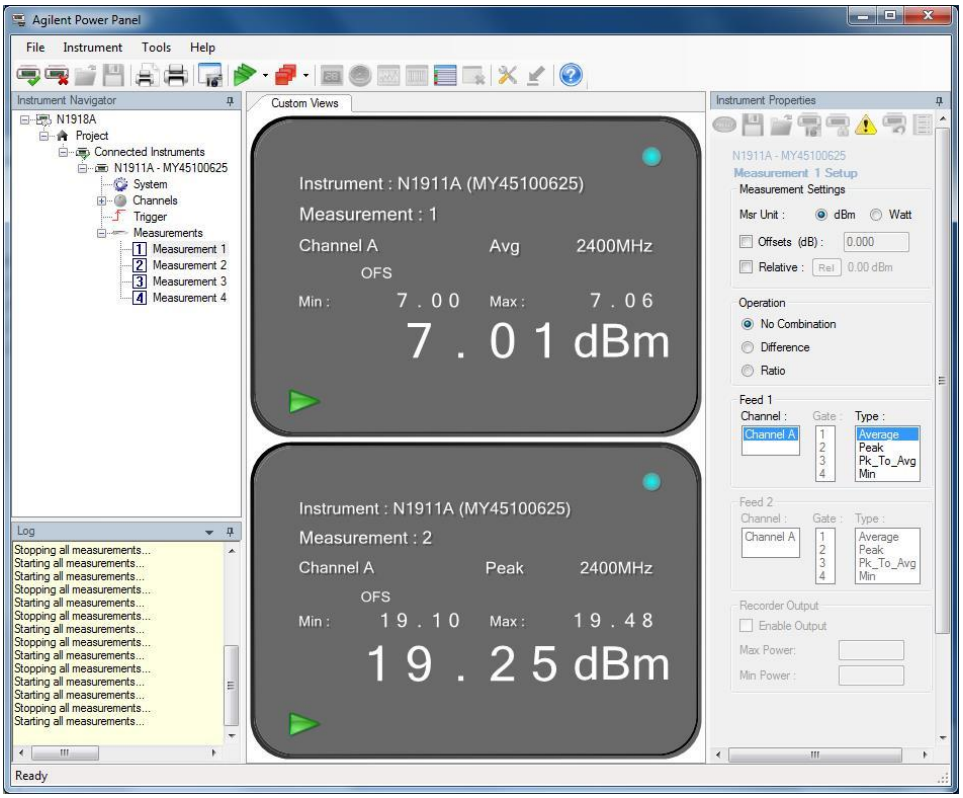
802.11 “b” mode. Mid Channel 5.5Mbps



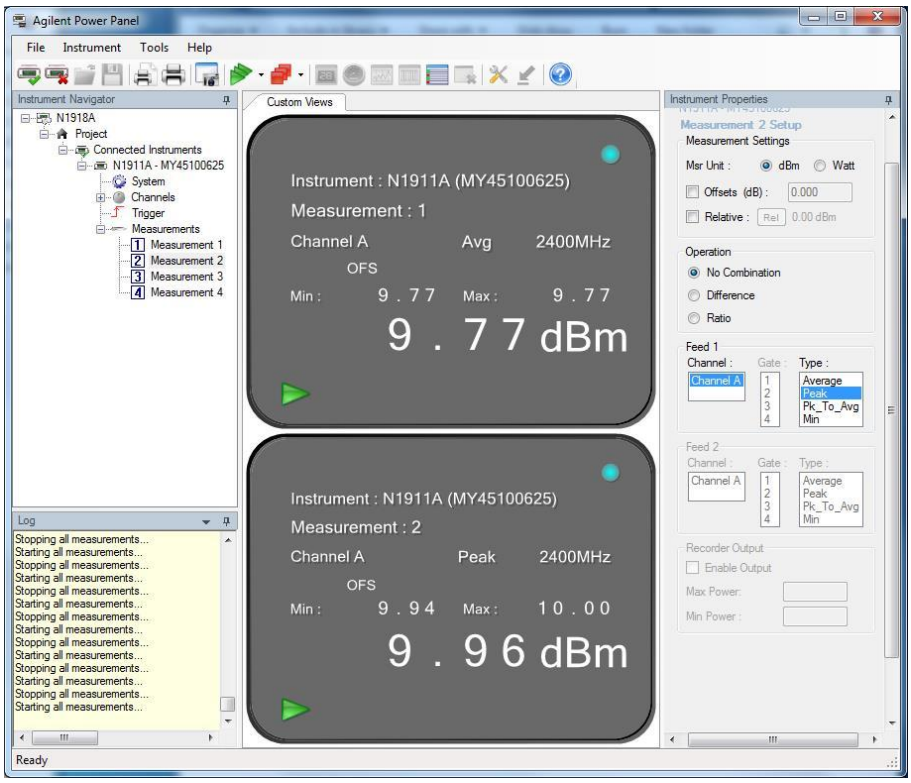
802.11 “g” mode. Mid Channel 6Mbps



802.11 “n” mode 2.4GHz ht20. Mid Channel 6.5Mbps



802.11 “n” mode 2.4GHz ht40. Mid Channel 121.5Mbps



Bluetooth LE. Mid Channel 1Mbps

2.2 CONDUCTED EMISSIONS

2.2.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.207(a)
RSS-GEN, Clause 8.8

2.2.2 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.*

2.2.3 Equipment Under Test and Modification State

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

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

April 28 and May 18, 2014/XYZ

2.2.5 Test Equipment Used

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

2.2.6 Environmental Conditions

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

2.2.7 Additional Observations

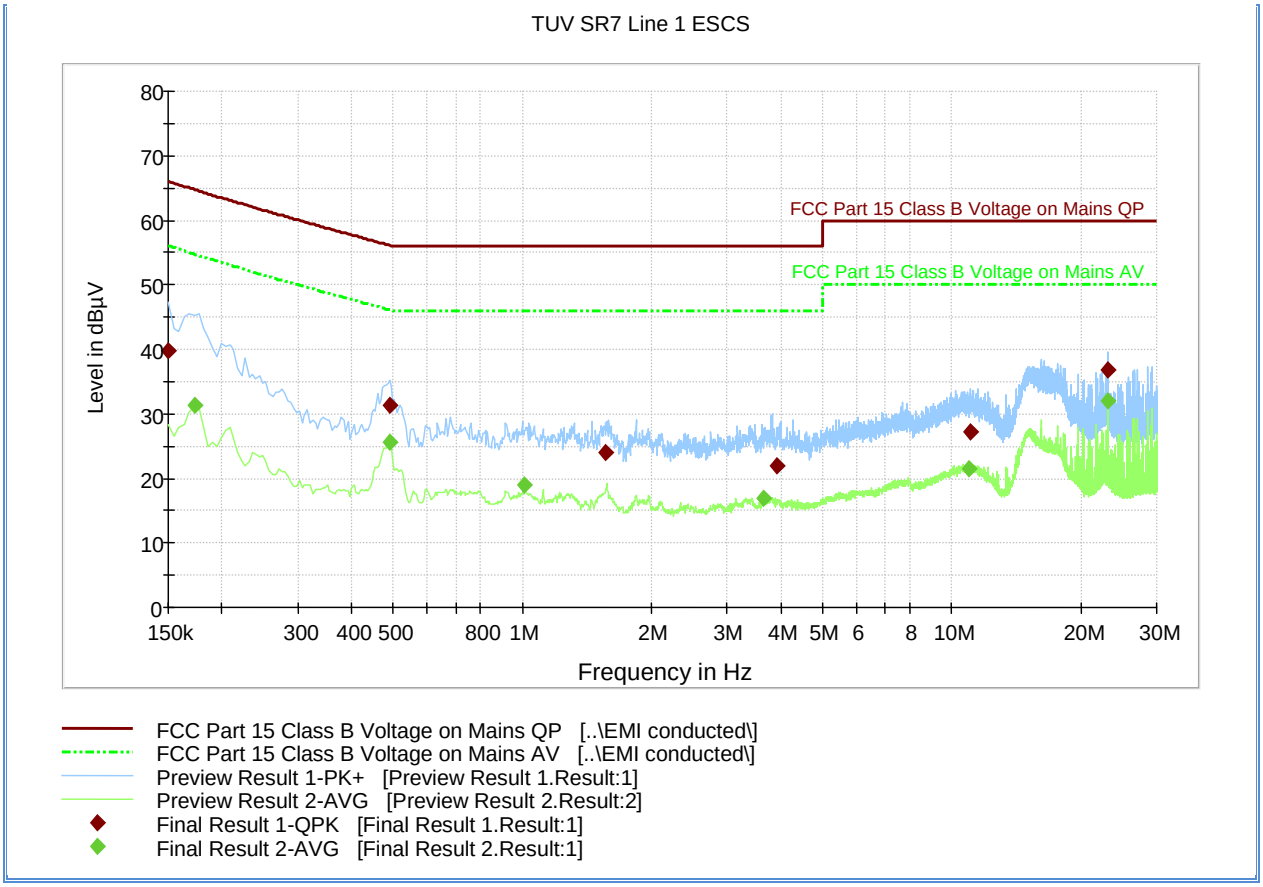
- The EUT was verified using AC adapter supplied by the manufacturer..
- EUT verified using input voltage of 120VAC 60Hz.
- There are no significant variations in test results between each operating modes. Only the worst case observed configuration is presented (802.11n HT20 MIMO mode).
- Receive mode 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 2.2.8 for sample computation.

2.2.8 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**

2.2.9 Test Results - Conducted Emissions Line 1 – Hot (Worst Case Transmit Mode - 802.11n 2.4G HT20 MIMO mode)



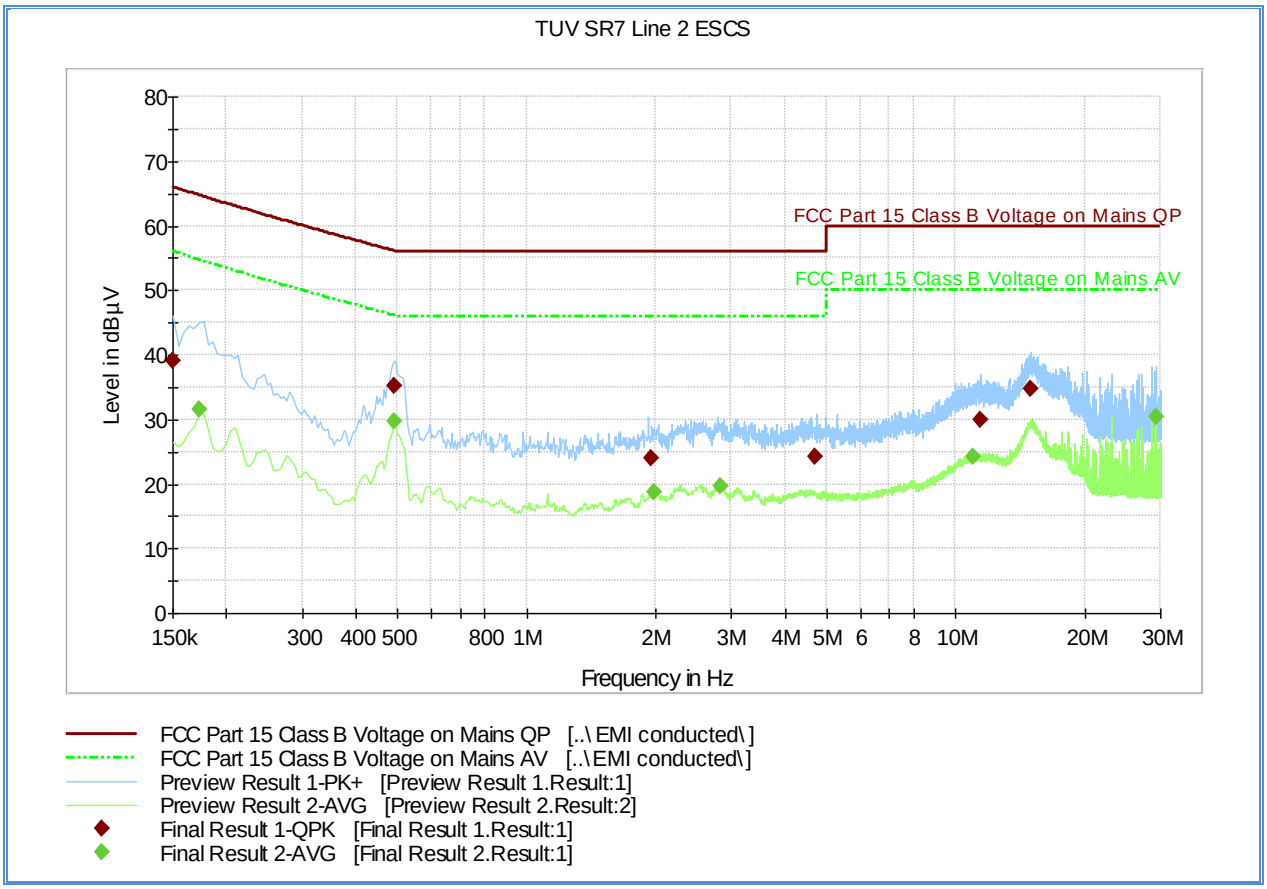
Quasi Peak

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	N	20.1	26.3	66.0
0.492000	31.3	1000.0	9.000	Off	N	20.1	24.9	56.1
1.563000	23.9	1000.0	9.000	Off	N	20.2	32.1	56.0
3.912000	22.0	1000.0	9.000	Off	N	20.5	34.0	56.0
11.022000	27.2	1000.0	9.000	Off	N	20.7	32.8	60.0
23.127000	36.7	1000.0	9.000	Off	N	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	N	20.1	23.4	54.7
0.492000	25.6	1000.0	9.000	Off	N	20.1	20.5	46.1
1.014000	19.1	1000.0	9.000	Off	N	20.2	26.9	46.0
3.655500	16.9	1000.0	9.000	Off	N	20.4	29.1	46.0
10.941000	21.5	1000.0	9.000	Off	N	20.7	28.5	50.0
23.127000	31.9	1000.0	9.000	Off	N	20.9	18.1	50.0

2.2.10 FCC Conducted Emissions Line 2 – Neutral (Worst Case Transmit Mode - - 802.11n 2.4G HT20 MIMO mode)



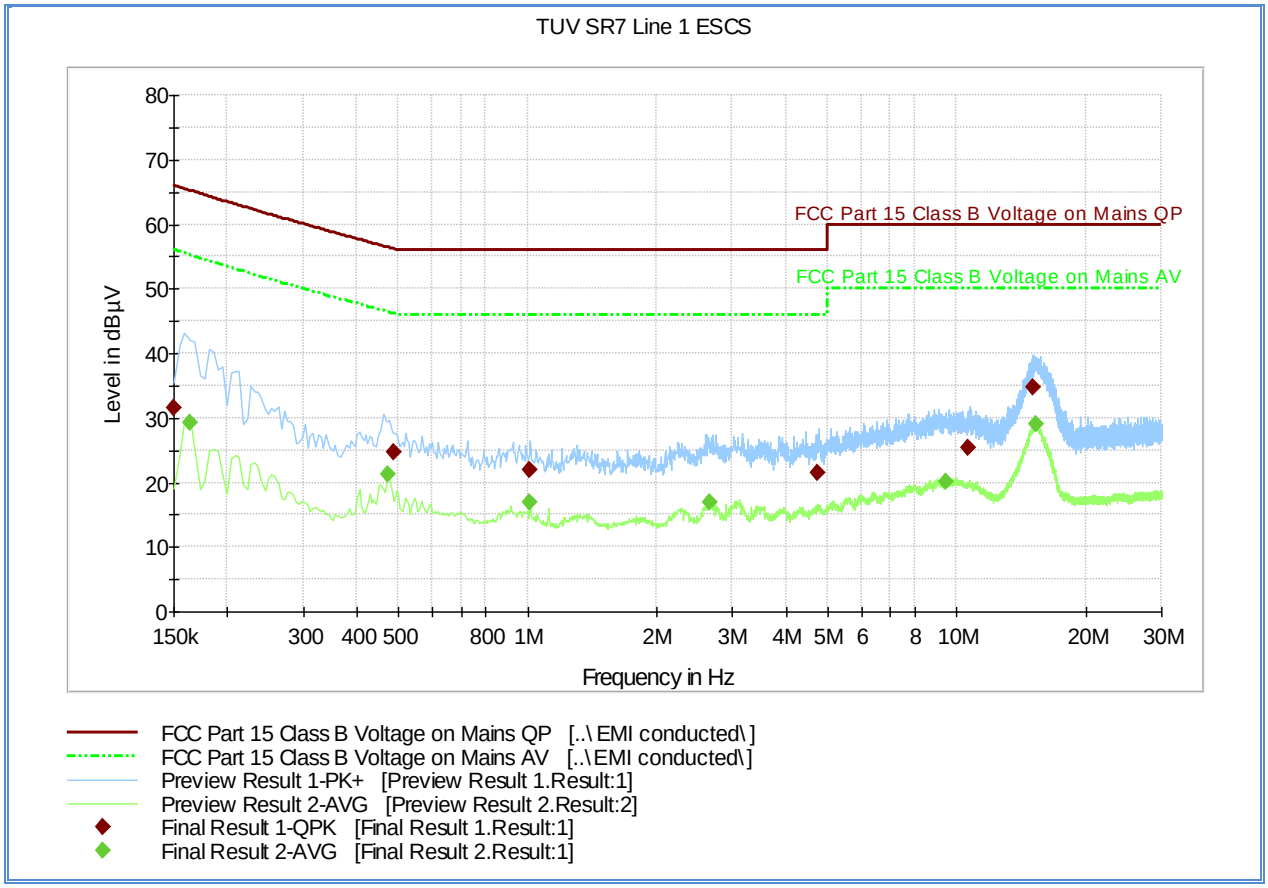
Quasi Peak

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

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



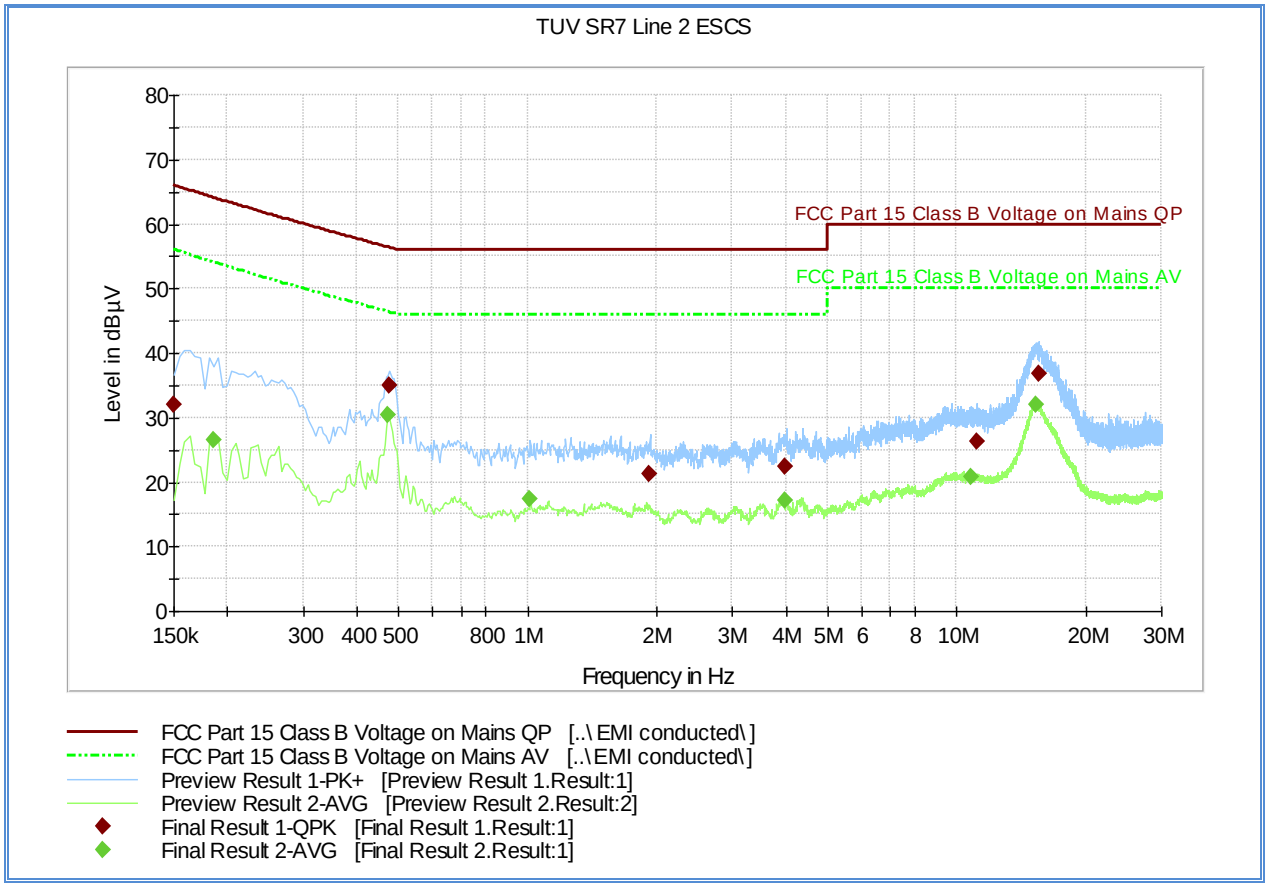
Quasi Peak

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

2.2.12 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

2.3 OUT-OF-BAND EMISSIONS - CONDUCTED

2.3.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(d)
RSS-247, Clause 5.5

2.3.2 Standard Applicable

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

2.3.3 Equipment Under Test and Modification State

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

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

May 13, 2015/XYZ

2.3.5 Test Equipment Used

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

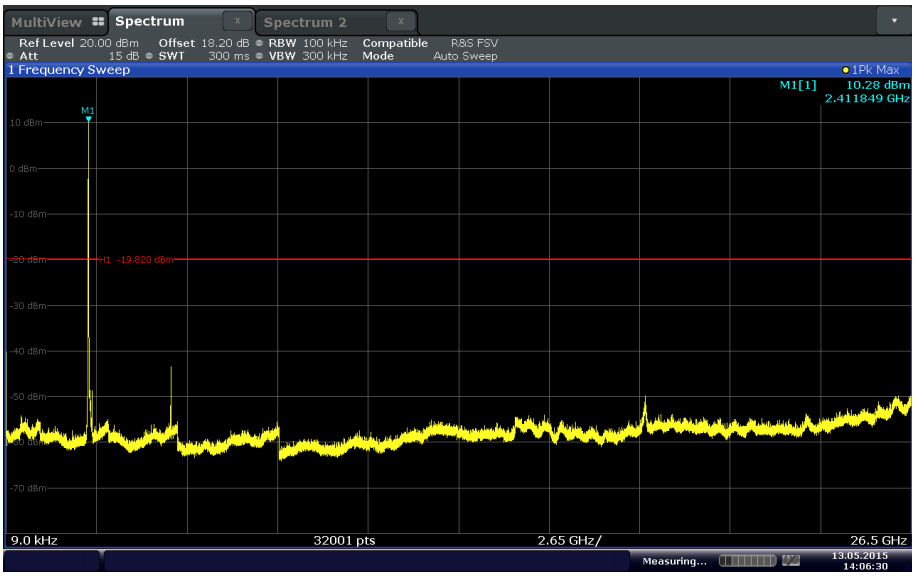
2.3.6 Environmental Conditions

Ambient Temperature	24.3°C
Relative Humidity	38.8%
ATM Pressure	98.9kPa

2.3.7 Additional Observations

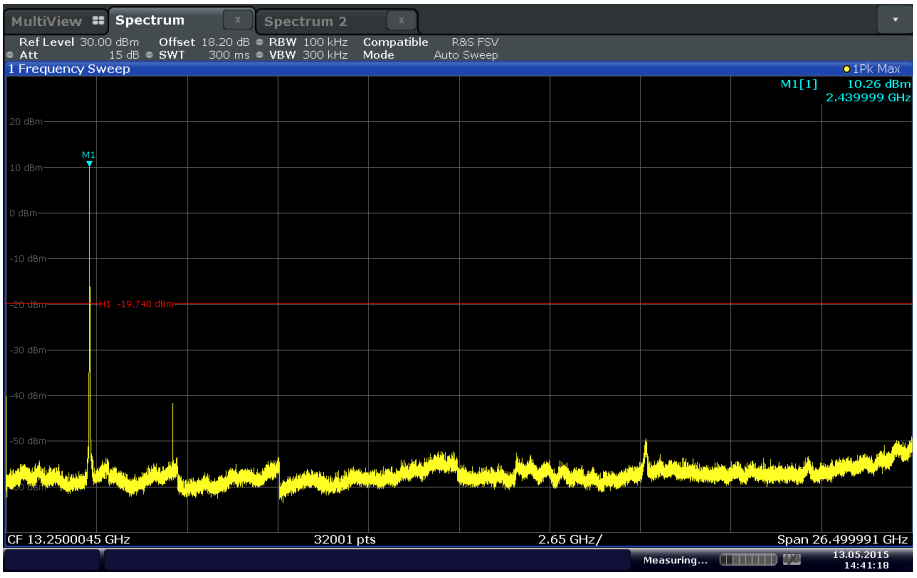
- This is a conducted test.
- The path loss was measured and entered as a level offset
- RBW is 100kHz.VBW is 3X RBW.
- Sweep is auto. Detector is peak. Trace is max hold.
- Initial scan was performed to determine the highest level of the desired power within the band. Limit (display line) was drawn 30dB below this level.
- Spectrum was searched from 9 kHz up to 26.5GHz and up to 40GHz for 5GHz 802.11 a and n.
- Only noise floor measurements observed from 26.5GHz up to 40GHz.

2.3.8 Test Results Plots



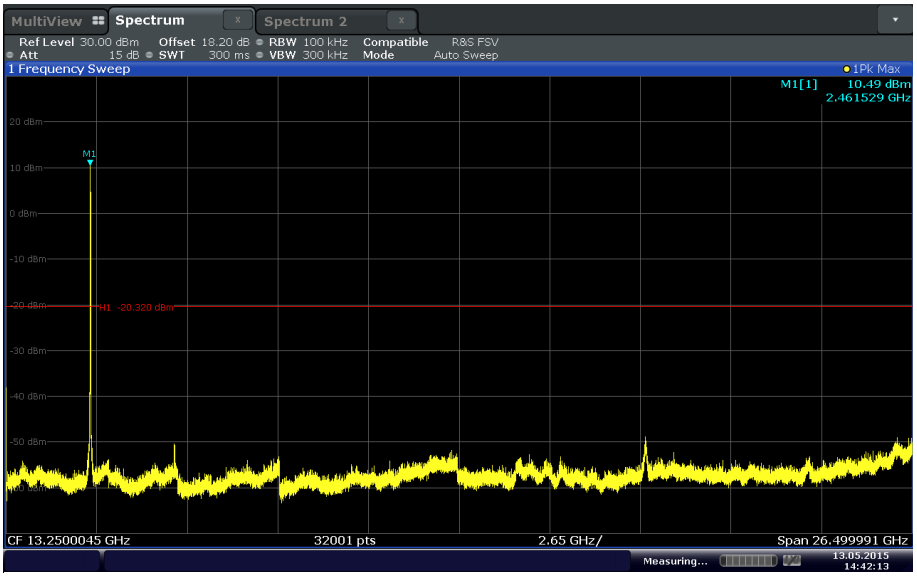
Date: 13.MAY.2015 14:06:30

802.11b Low Channel



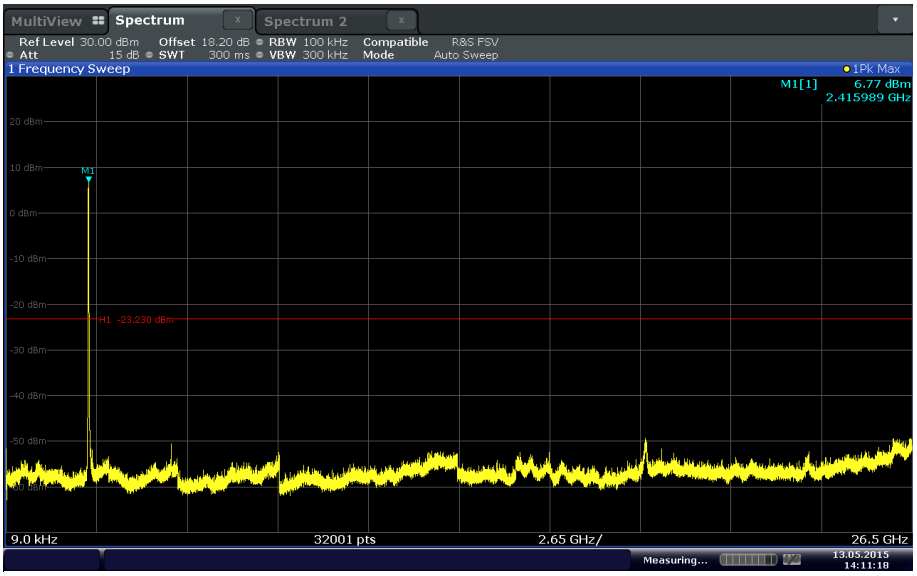
Date: 13.MAY.2015 14:41:19

802.11b Mid Channel



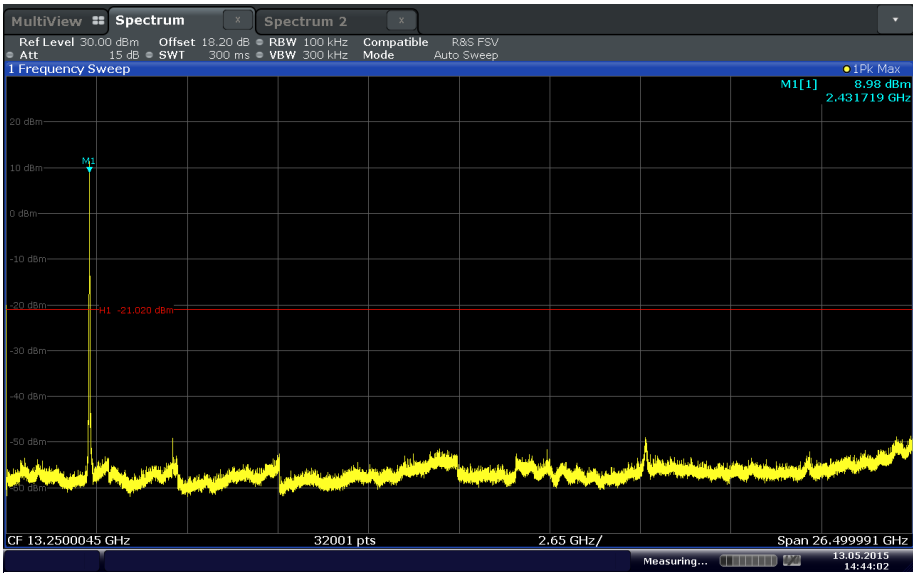
Date: 13.MAY.2015 14:42:13

802.11b High Channel



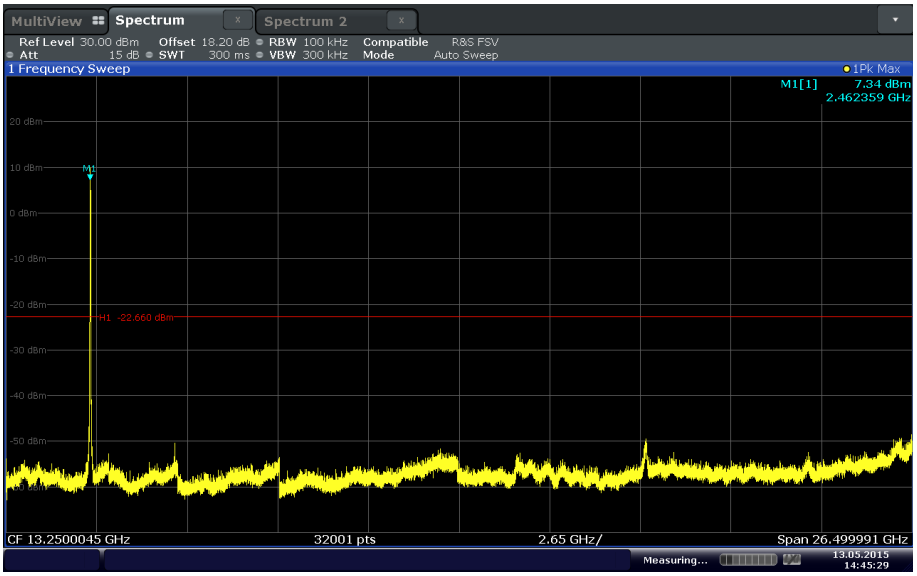
Date: 13.MAY.2015 14:11:19

802.11g Low Channel



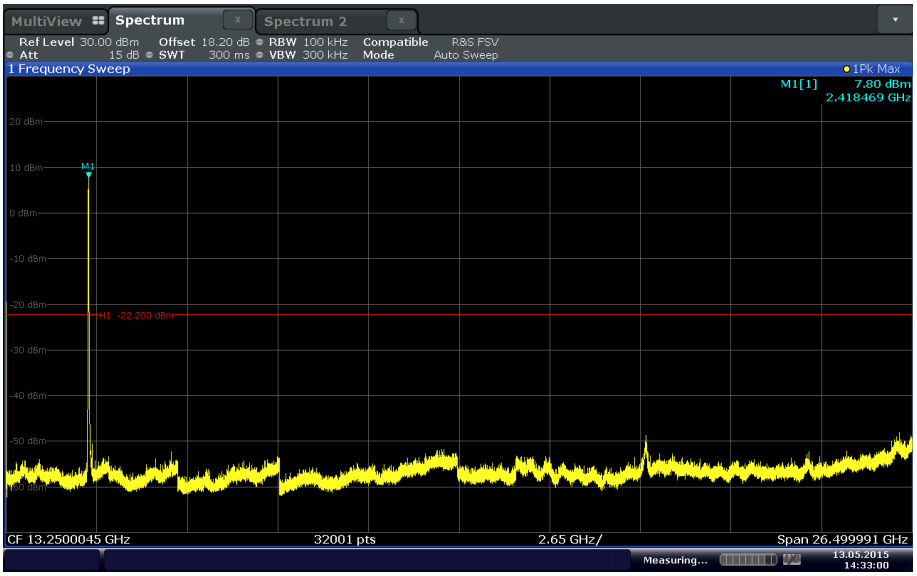
Date: 13.MAY.2015 14:44:01

802.11g Mid Channel



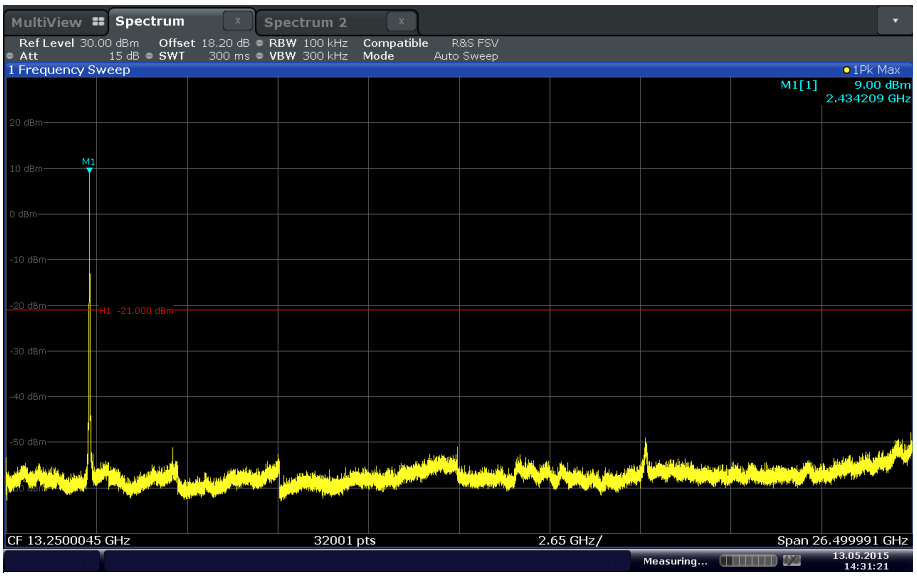
Date: 13.MAY.2015 14:45:29

802.11g High Channel



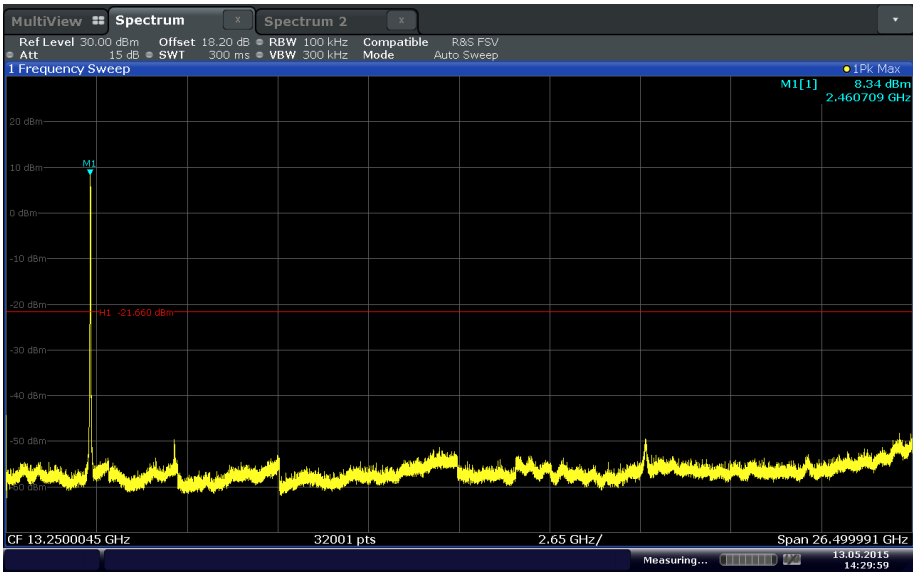
Date: 13.MAY.2015 14:33:01

802.11n 2.4G HT20 Low Channel



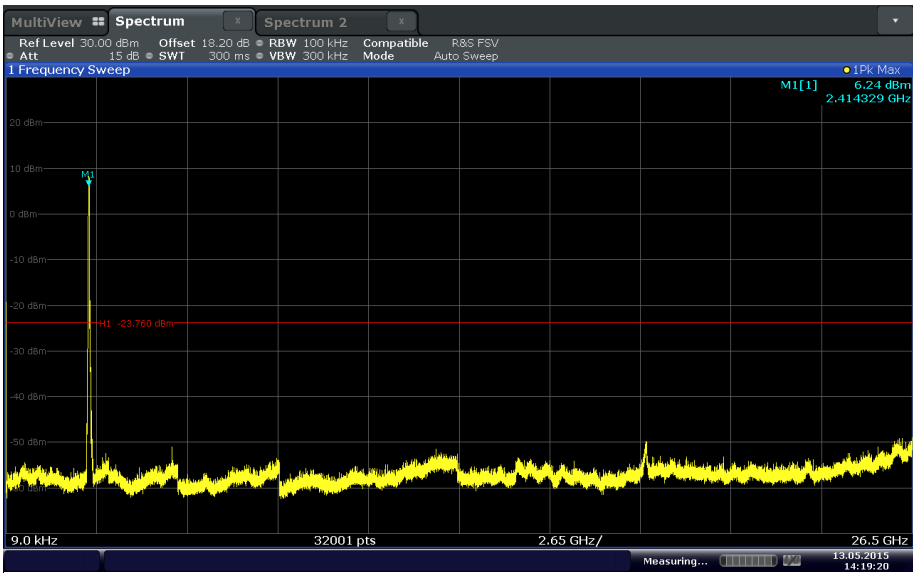
Date: 13.MAY.2015 14:31:22

802.11n 2.4G HT20 Mid Channel



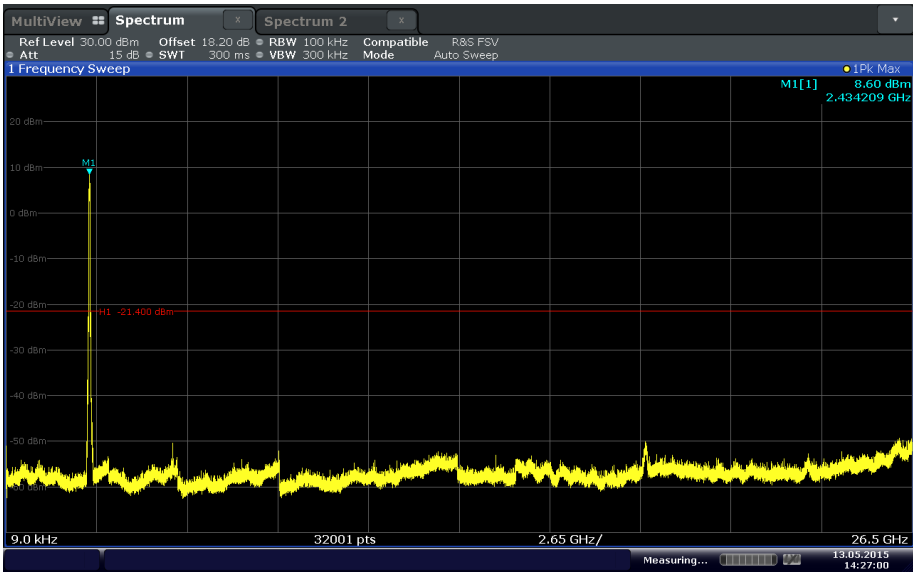
Date:13.MAY.2015 14:29:59

802.11n 2.4G HT20 High Channel



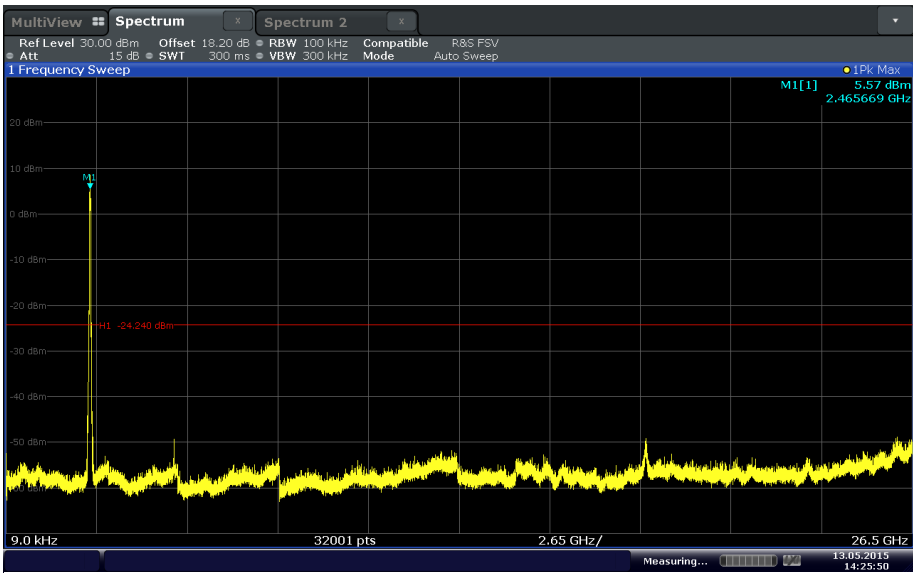
Date:13.MAY.2015 14:19:21

802.11n 2.4G HT40 Low Channel



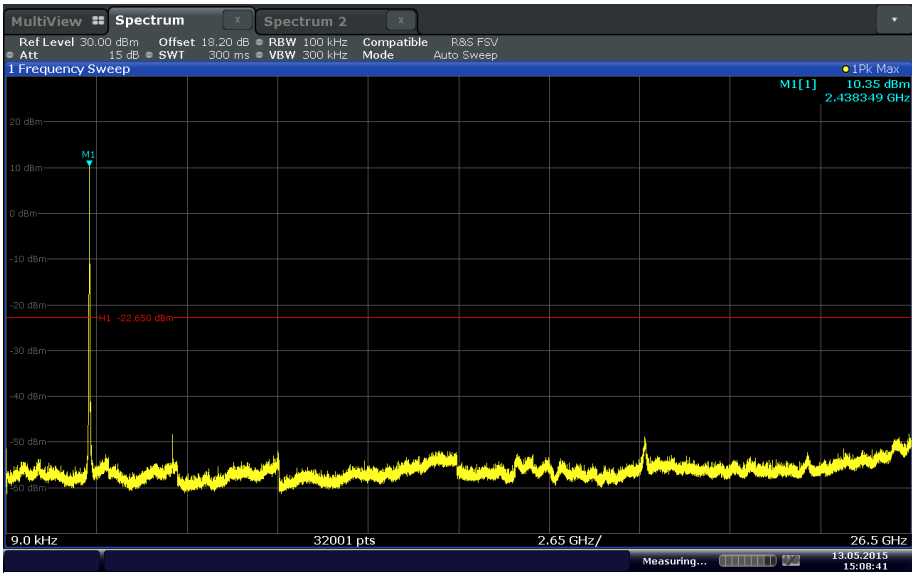
Date:13.MAY.2015 14:27:01

802.11n 2.4G HT40 Mid Channel



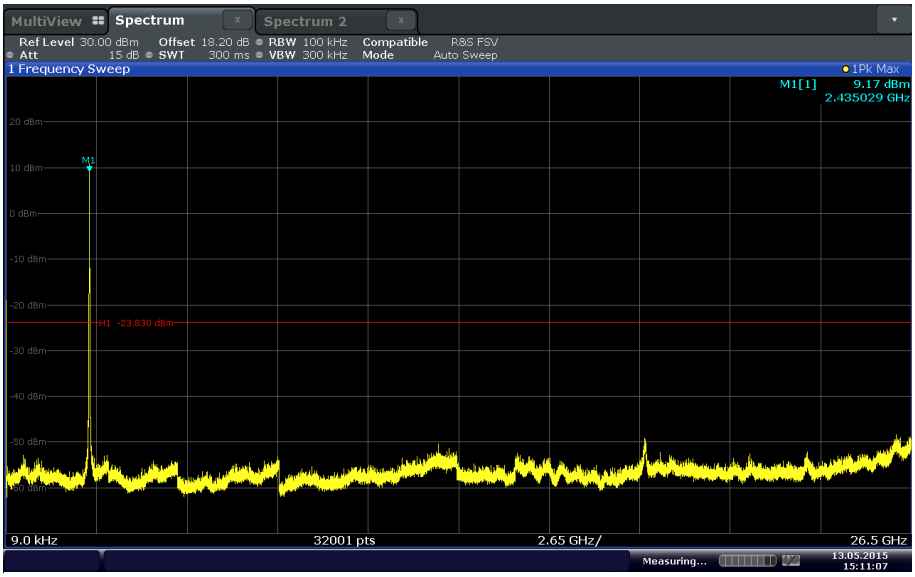
Date:13.MAY.2015 14:25:50

802.11n 2.4G HT40 High Channel



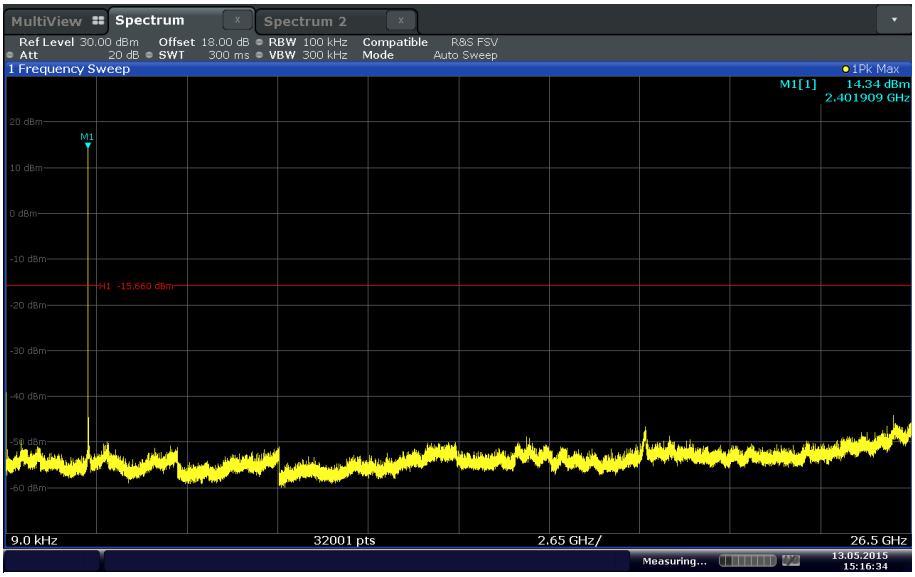
Date: 13.MAY.2015 15:08:41

802.11n MIMO HT20 Worse Case Channel on Antenna #1



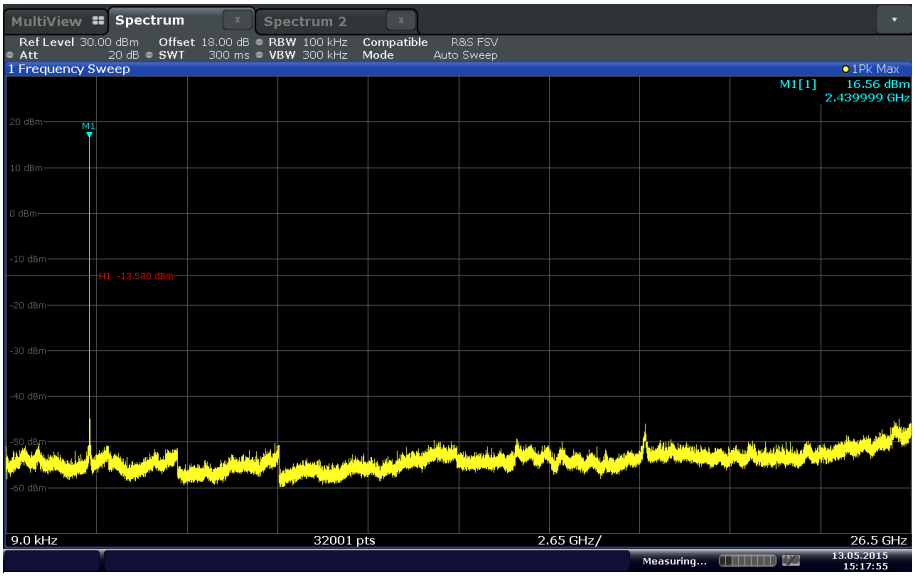
Date: 13.MAY.2015 15:11:08

802.11n MIMO HT20 Worse Case Channel on Antenna #2



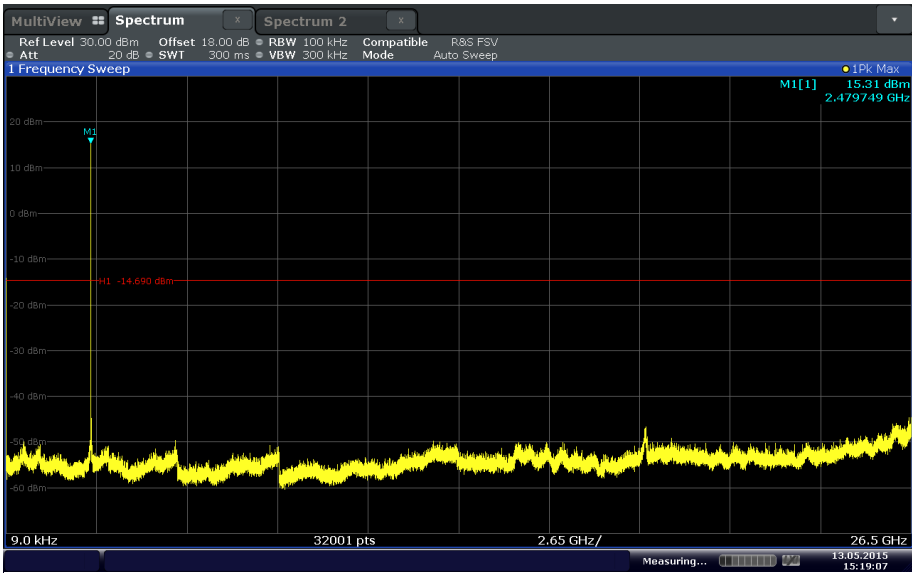
Date: 13.MAY.2015 15:16:34

Bluetooth LE Low Channel



Date: 13.MAY.2015 15:17:55

Bluetooth LE Mid Channel



Bluetooth LE High Channel

2.4 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

2.4.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(d)
RSS-247, Clause 5.5

2.4.2 Standard Applicable

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

2.4.3 Equipment Under Test and Modification State

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

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

May 14, 2015/XYZ

2.4.5 Test Equipment Used

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

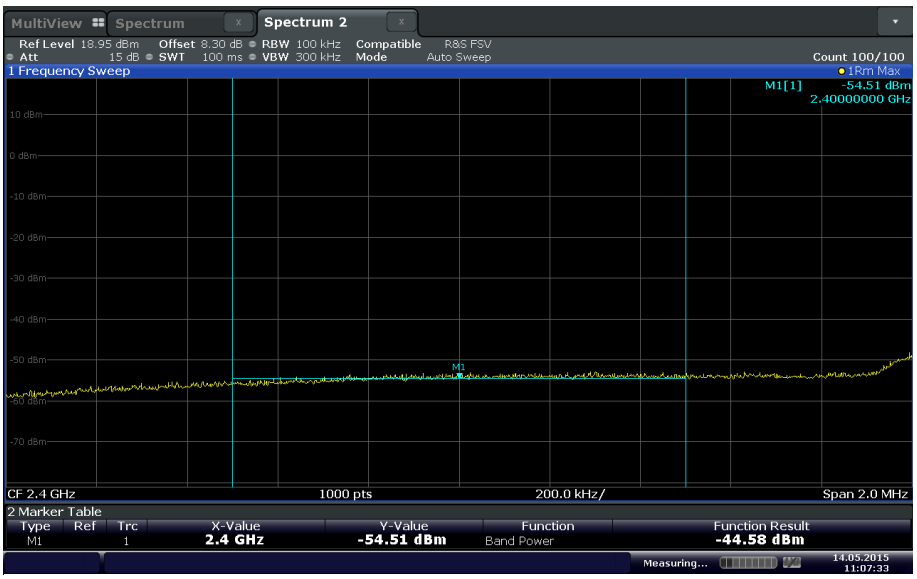
2.4.6 Environmental Conditions

Ambient Temperature	25.5°C
Relative Humidity	36.8%
ATM Pressure	98.8kPa

2.4.7 Additional Observations

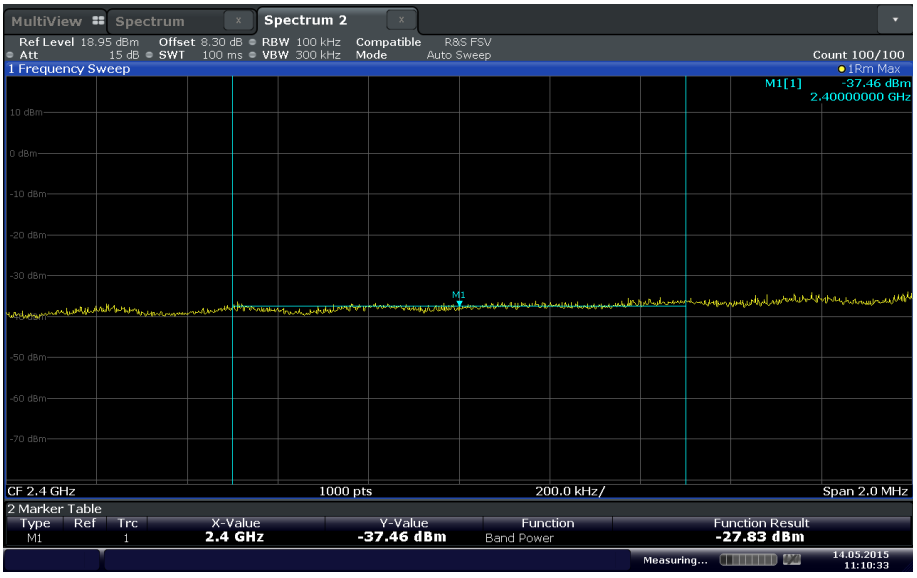
- Setup is identical to “Out-of-Band Emissions – Conducted“ test (previous test).
- The path loss was measured and entered as a level offset
- Both 2.4GHZ band-edge (2400MHz and 2483.5MHz) and 5GHz band-edge (5725MHz and 5850MHz) emissions were verified in this test.
- Test methodology is per Clause 13.3.1 of KDB 558074 D01 (DTS Meas Guidance v03r02, June 05, 2014); trace averaging with continuous EUT transmission at full power.
- The highest level of the desired power in the 100 kHz bandwidth within the band were tested , Limits are 30dBc from the highest level of the desired power within the band.

2.4.8 Test Results



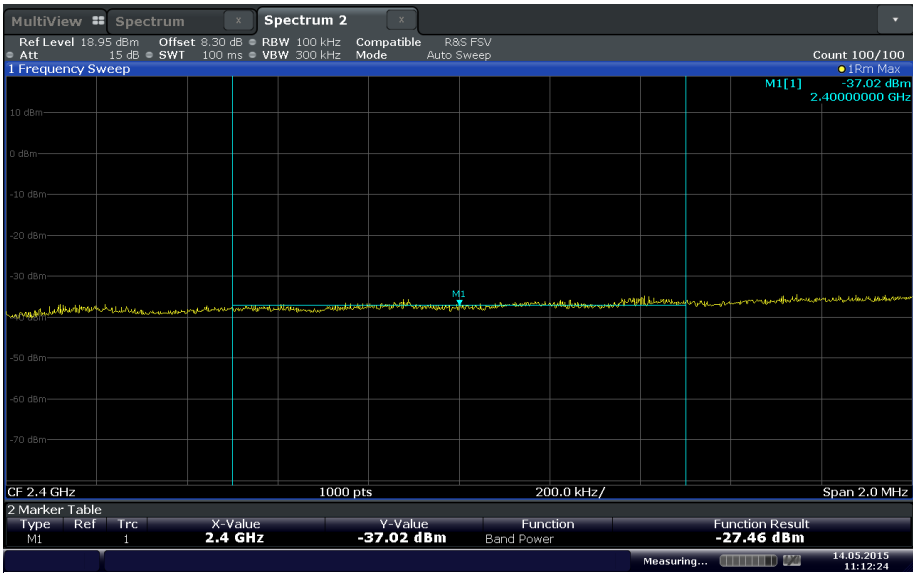
Date: 14.MAY.2015 11:07:32

802.11b Low Channel (2412 MHz). Limit is -29.31 dBm. Margin is -25.2 dB.
(The highest level of the desired power in the 100 kHz bandwidth within the band is 0.69dBm)



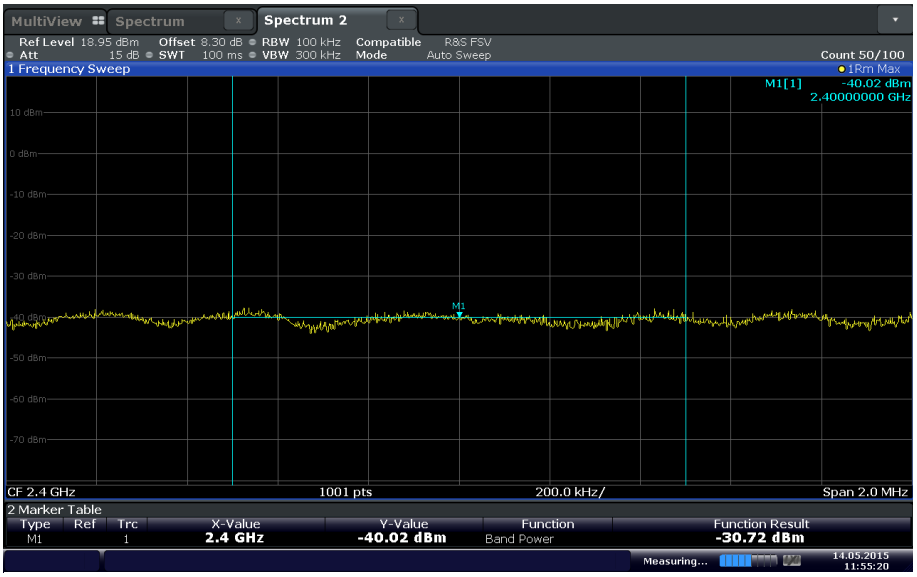
Date: 14.MAY.2015 11:10:33

802.11g Low Channel (2412 MHz). Limit is -30.5 dBm. Margin is -6.96 dB.
(The highest level of the desired power in the 100 kHz bandwidth within the band is -0.5dBm)



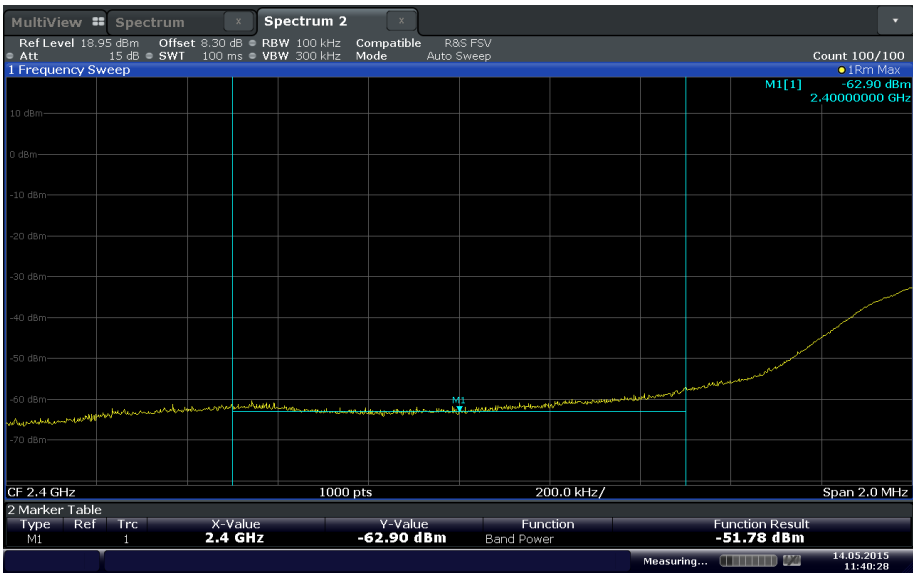
Date: 14.MAY.2015 11:12:23

802.11n 2.4G HT20 Low Channel (2412 MHz). Limit is -30.0 dBm. Margin is -7.02 dB.
(The highest level of the desired power in the 100 kHz bandwidth within the band is 0dBm)



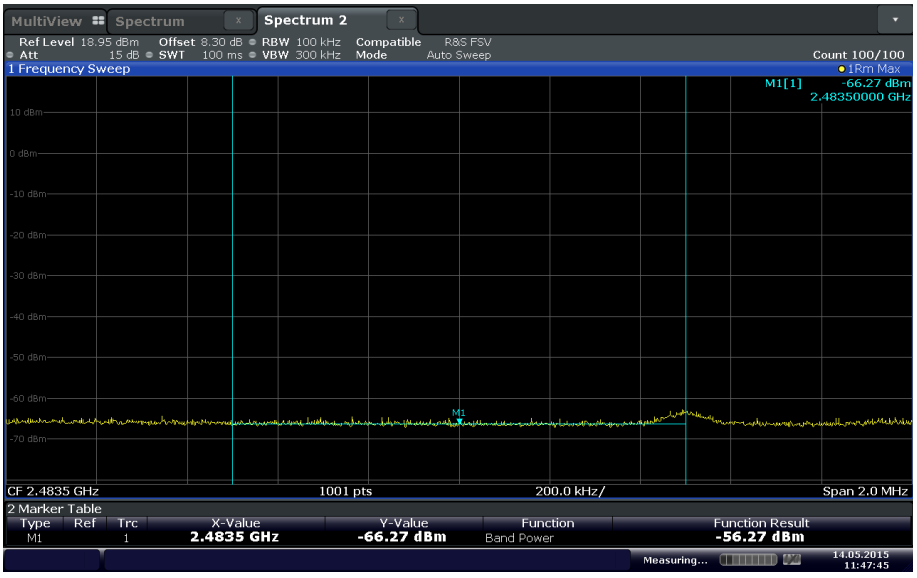
Date: 14.MAY.2015 11:55:20

802.11n 2.4G HT40 Low Channel (2422 MHz). Limit is -31.86 dBm. Margin is -8.16 dB.
(The highest level of the desired power in the 100 kHz bandwidth within the band is -1.86dBm)



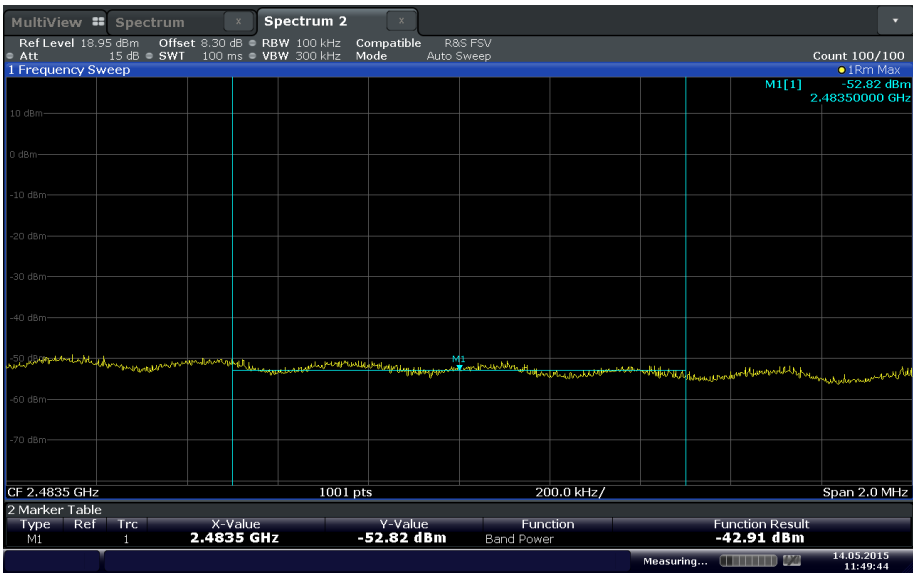
Date: 14.MAY.2015 11:40:28

Bluetooth LE Low Channel (2402 MHz). Limit is -25.01 dBm. Margin is -37.89 dB.
(The highest level of the desired power in the 100 kHz bandwidth within the band is 4.99dBm)



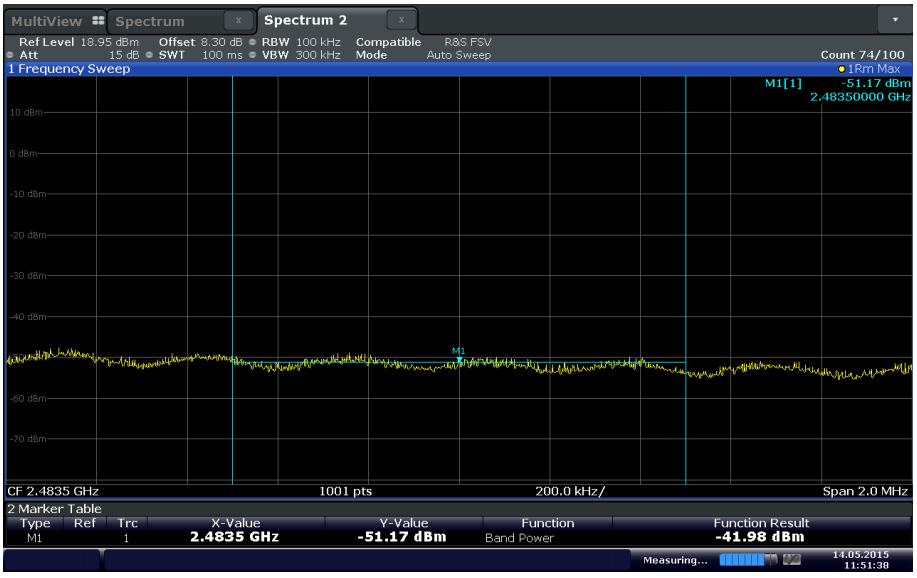
Date: 14.MAY.2015 11:47:46

802.11b High Channel (2462 MHz). Limit is -28.01 dBm. Margin is -38.26 dB.
(The highest level of the desired power in the 100 kHz bandwidth within the band is 1.99dBm)



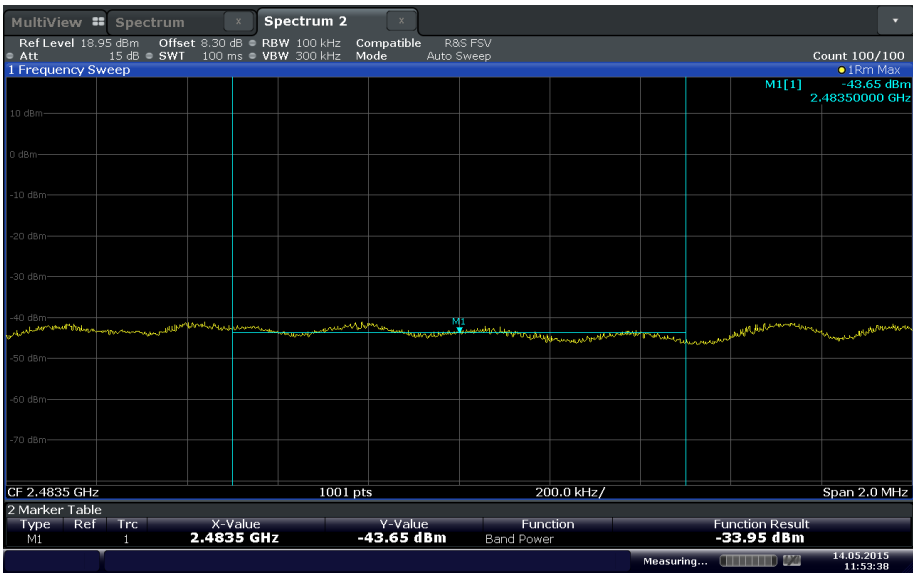
Date: 14.MAY.2015 11:49:44

802.11g High Channel (2462 MHz). Limit is -29.31 dBm. Margin is -23.51 dB.
(The highest level of the desired power in the 100 kHz bandwidth within the band is 0.69dBm)



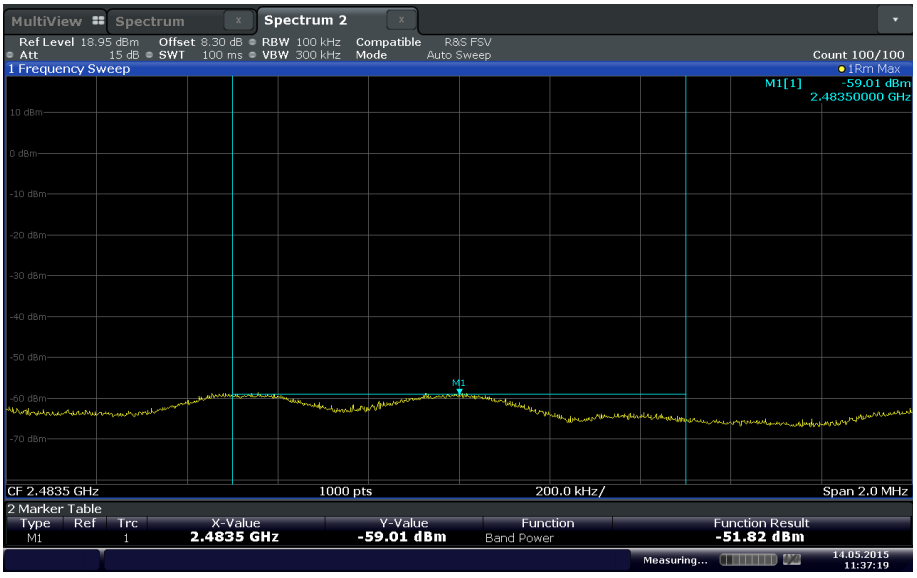
Date: 14.MAY.2015 11:51:39

802.11n 2.4G HT20 High Channel (2462 MHz). Limit is -29.39 dBm. Margin is -21.78dB.
(The highest level of the desired power in the 100 kHz bandwidth within the band is 0.61dBm)



Date: 14.MAY.2015 11:53:38

802.11n 2.4G HT40 High Channel (2452 MHz). Limit is -31.84 dBm. Margin is -11.81 dB.
(The highest level of the desired power in the 100 kHz bandwidth within the band is -1.84dBm)



Date: 14.MAY.2015 11:37:20

Bluetooth LE High Channel (2480 MHz). Limit is -23.37 dBm. Margin is -35.64 dB.
(The highest level of the desired power in the 100 kHz bandwidth within the band is 6.63dBm)

2.5 RADIATED SPURIOUS EMISSIONS

2.5.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(d)
RSS-247, Clause 5.5

2.5.2 Standard Applicable

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

2.5.3 Equipment Under Test and Modification State

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

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

April 28 and May 30, 2015/XYZ

2.5.5 Test Equipment Used

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

2.5.6 Environmental Conditions

Ambient Temperature	23.7 - 24.3°C
Relative Humidity	31.2 - 45.2%
ATM Pressure	99.5 - 99.9 kPa

2.5.7 Additional Observations

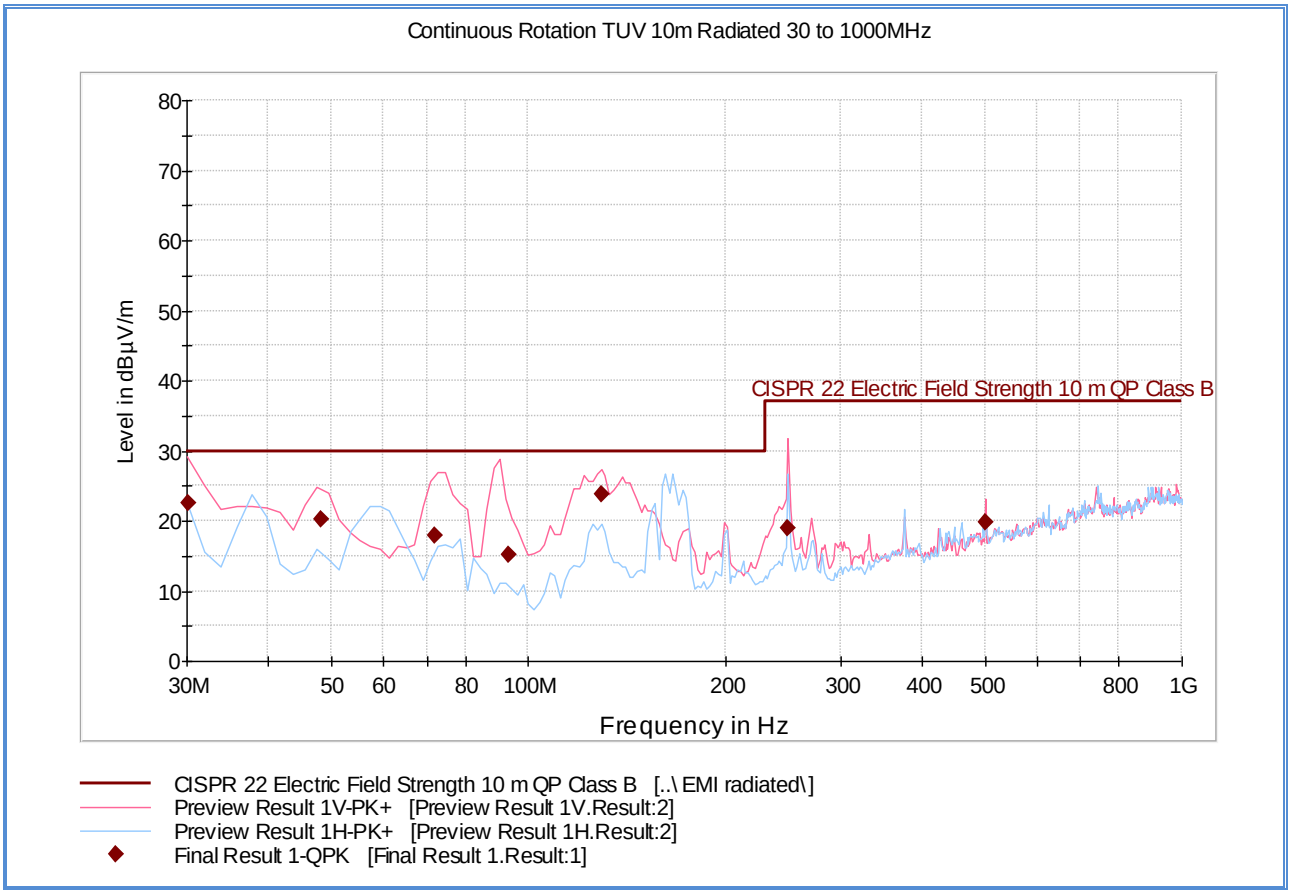
- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic.
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d).
- Only the considered worst case WLAN configuration (802.11b, Mid Channel, 5.5Mbps) and BLE (High Channel) presented for radiated emissions below 1GHz. There are no significant differences in emissions between all modes below 1GHz.

- Only noise floor measurements observed above 18GHz.
- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.5.8 for sample computation.

2.5.8 Sample Computation (Radiated Emission)

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

2.5.9 Test Results - Below 1GHz (Receive Mode)

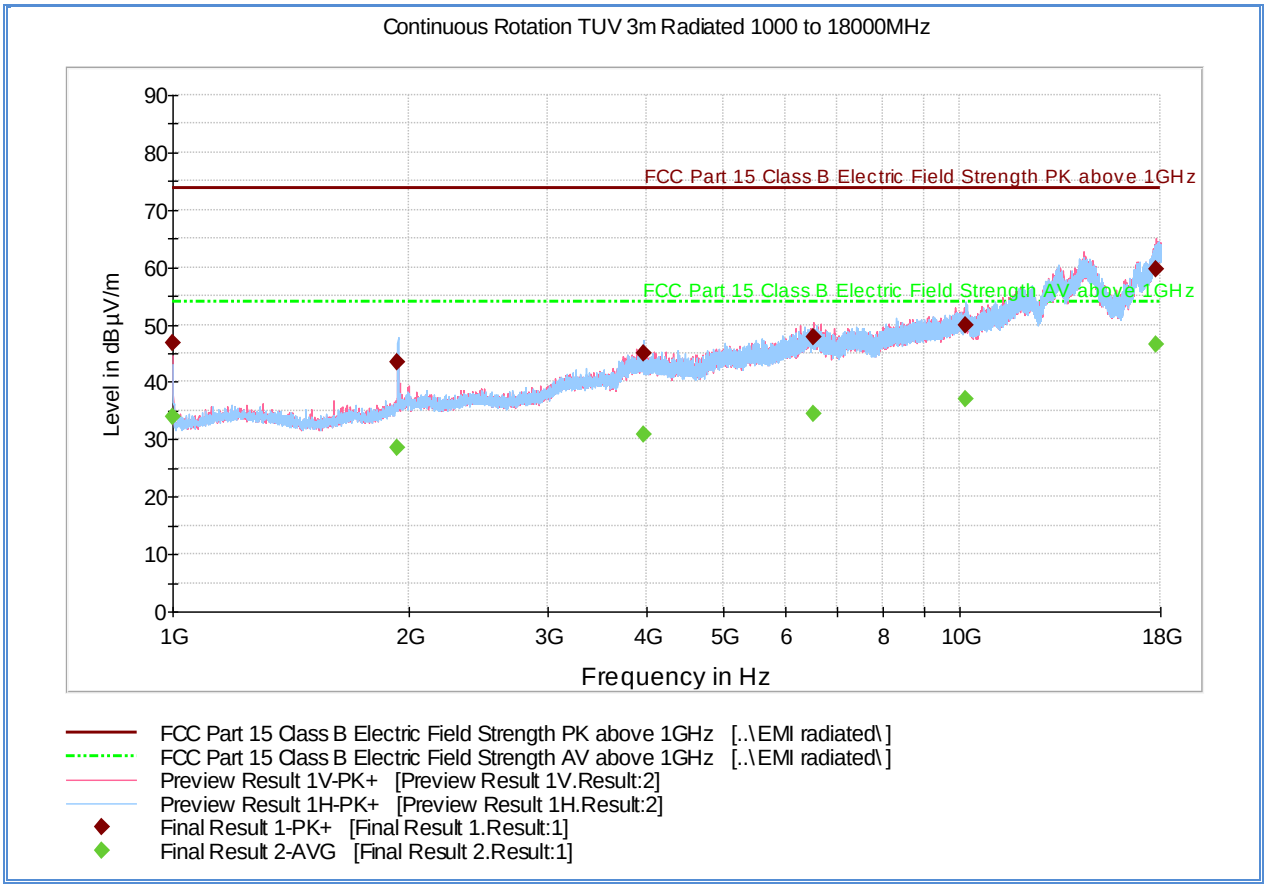


Note: FCC Accepts CISPR 22 by §15.38 Incorporation by reference.

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)
30.080000	22.5	1000.0	120.000	100.0	V	263.0	-13.1	7.5	30.0
48.134990	20.2	1000.0	120.000	105.0	V	104.0	-21.1	9.8	30.0
71.925531	18.0	1000.0	120.000	400.0	V	284.0	-23.1	12.0	30.0
93.460521	15.2	1000.0	120.000	109.0	V	-14.0	-21.5	14.8	30.0
129.298277	23.9	1000.0	120.000	128.0	V	87.0	-22.5	6.1	30.0
249.899319	18.9	1000.0	120.000	150.0	V	189.0	-15.5	18.1	37.0
500.020842	19.7	1000.0	120.000	100.0	V	296.0	-8.6	17.3	37.0

2.5.10 Test Results Above 1GHz (Receive Mode)



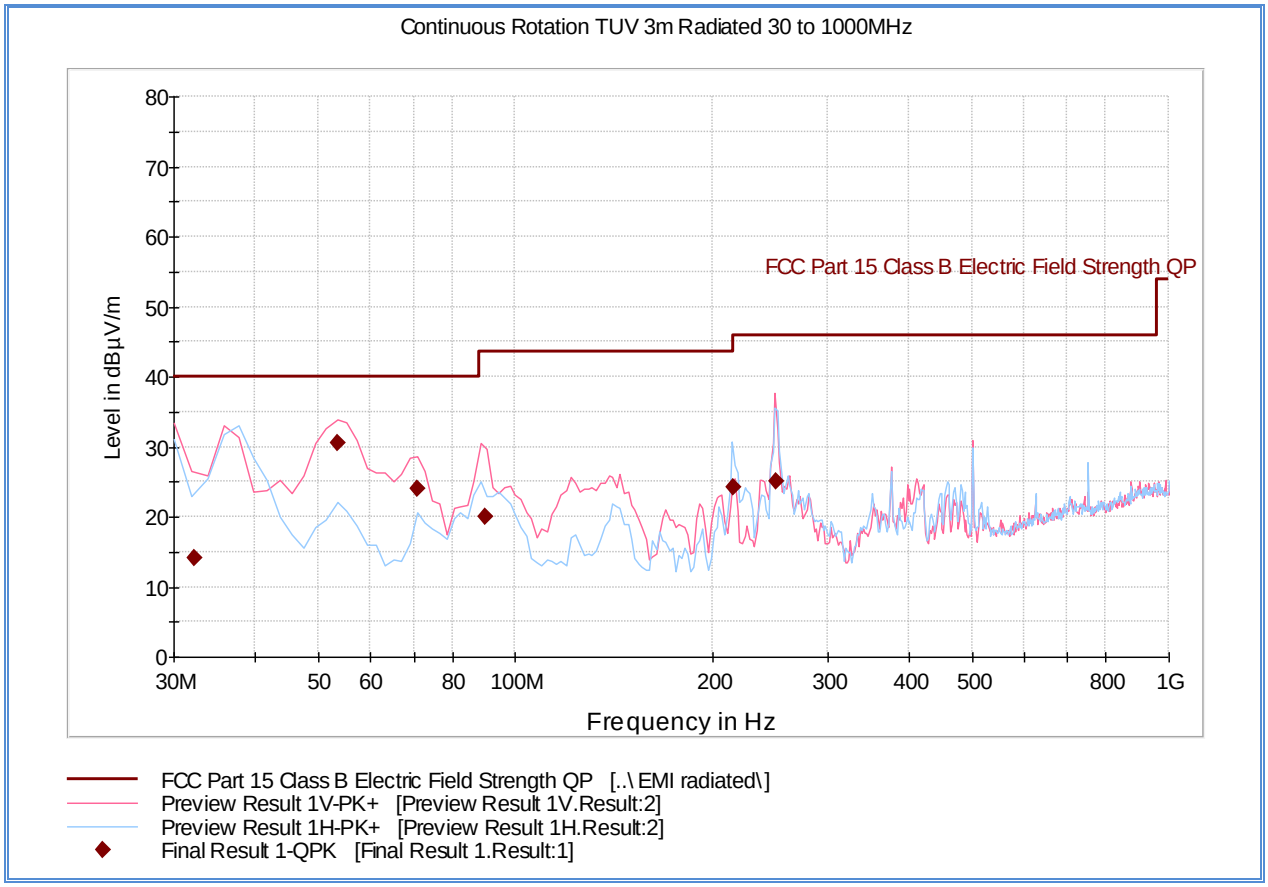
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	46.9	1000.0	1000.000	256.4	V	211.0	-10.5	27.0	73.9
1932.533333	43.4	1000.0	1000.000	354.2	H	272.0	-5.9	30.5	73.9
3967.866667	44.9	1000.0	1000.000	403.6	H	211.0	3.8	29.0	73.9
6512.366667	47.8	1000.0	1000.000	279.3	V	200.0	9.7	26.1	73.9
10191.33333	49.9	1000.0	1000.000	201.3	H	3.0	13.5	24.0	73.9
17797.53333	59.7	1000.0	1000.000	303.5	V	192.0	26.1	14.2	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	33.9	1000.0	1000.000	256.4	V	211.0	-10.5	20.0	53.9
1932.533333	28.6	1000.0	1000.000	354.2	H	272.0	-5.9	25.3	53.9
3967.866667	31.0	1000.0	1000.000	403.6	H	211.0	3.8	22.9	53.9
6512.366667	34.5	1000.0	1000.000	279.3	V	200.0	9.7	19.4	53.9
10191.33333	37.0	1000.0	1000.000	201.3	H	3.0	13.5	16.9	53.9
17797.53333	46.6	1000.0	1000.000	303.5	V	192.0	26.1	7.3	53.9

2.5.11 Test Results Below 1GHz (WLAN worst Case Configuration - 802.11b, Mid Channel, 5.5Mbps)

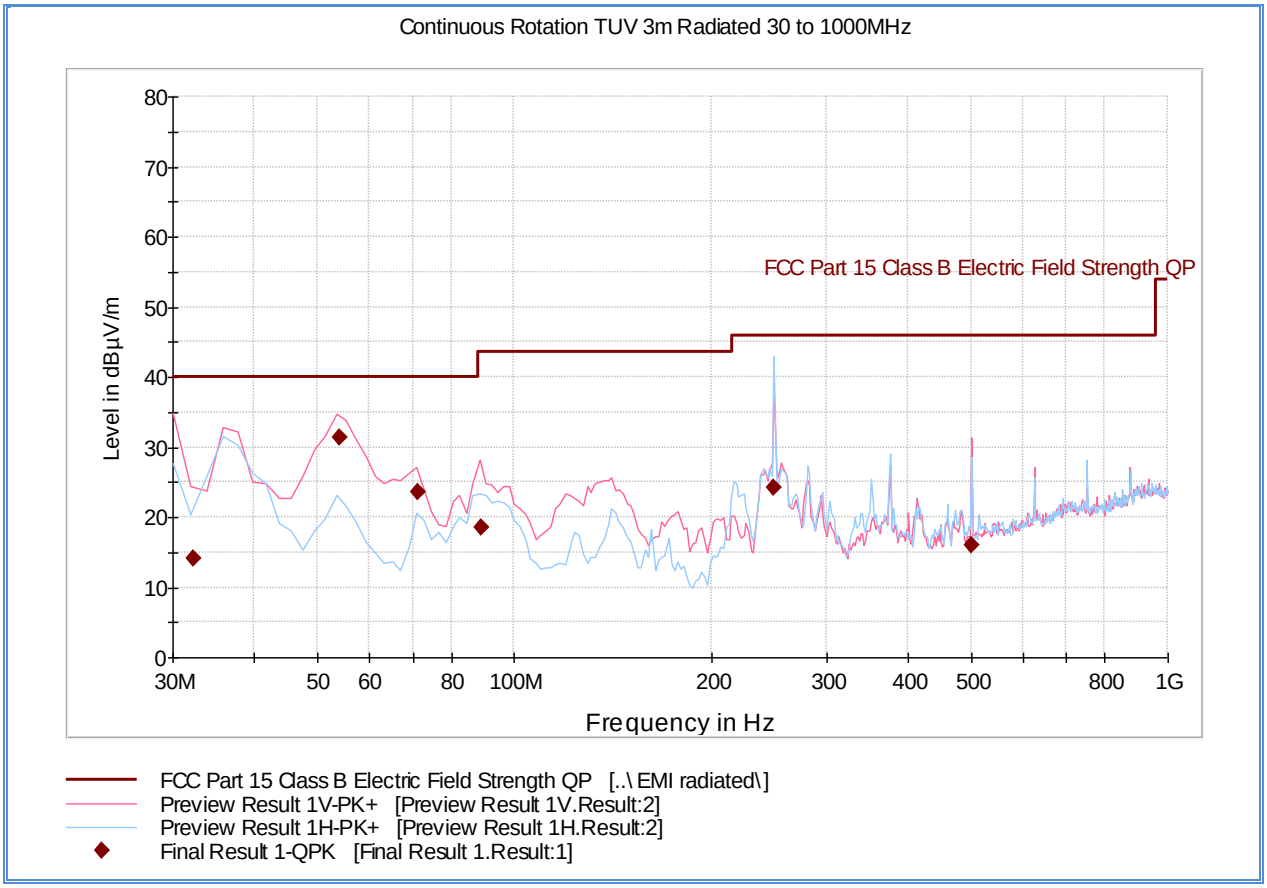


Quasi Peak Data

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

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

2.5.12 Test Results Below 1GHz (Bluetooth LE worst Case Configuration - High Channel)

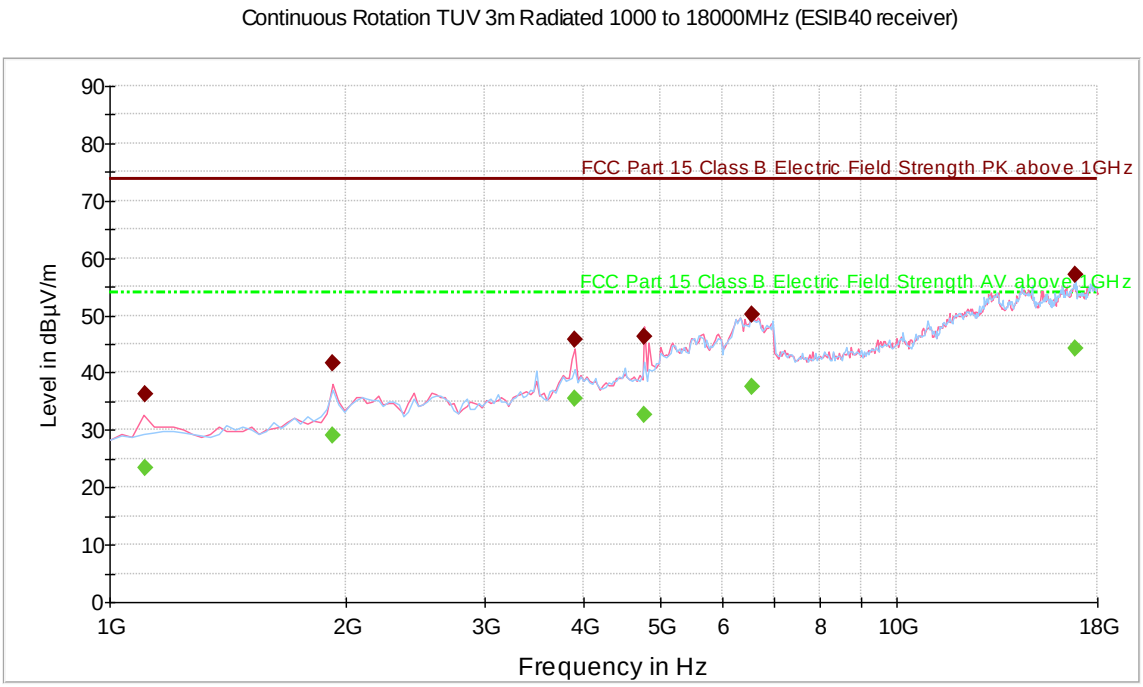


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
32.200000	14.0	1000.0	120.000	150.0	V	343.0	-12.7	26.0	40.0
53.926653	31.4	1000.0	120.000	100.0	V	144.0	-20.8	8.6	40.0
71.061643	23.5	1000.0	120.000	109.0	V	46.0	-22.4	16.5	40.0
88.812745	18.4	1000.0	120.000	100.0	V	181.0	-21.0	25.1	43.5
249.859319	24.2	1000.0	120.000	106.0	H	46.0	-14.5	21.8	46.0
499.860842	16.0	1000.0	120.000	105.0	V	200.0	-7.1	30.0	46.0

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

2.5.13 Test Results Above 1GHz (Bluetooth LE worst Case Configuration - Low Channel)



Peak Data

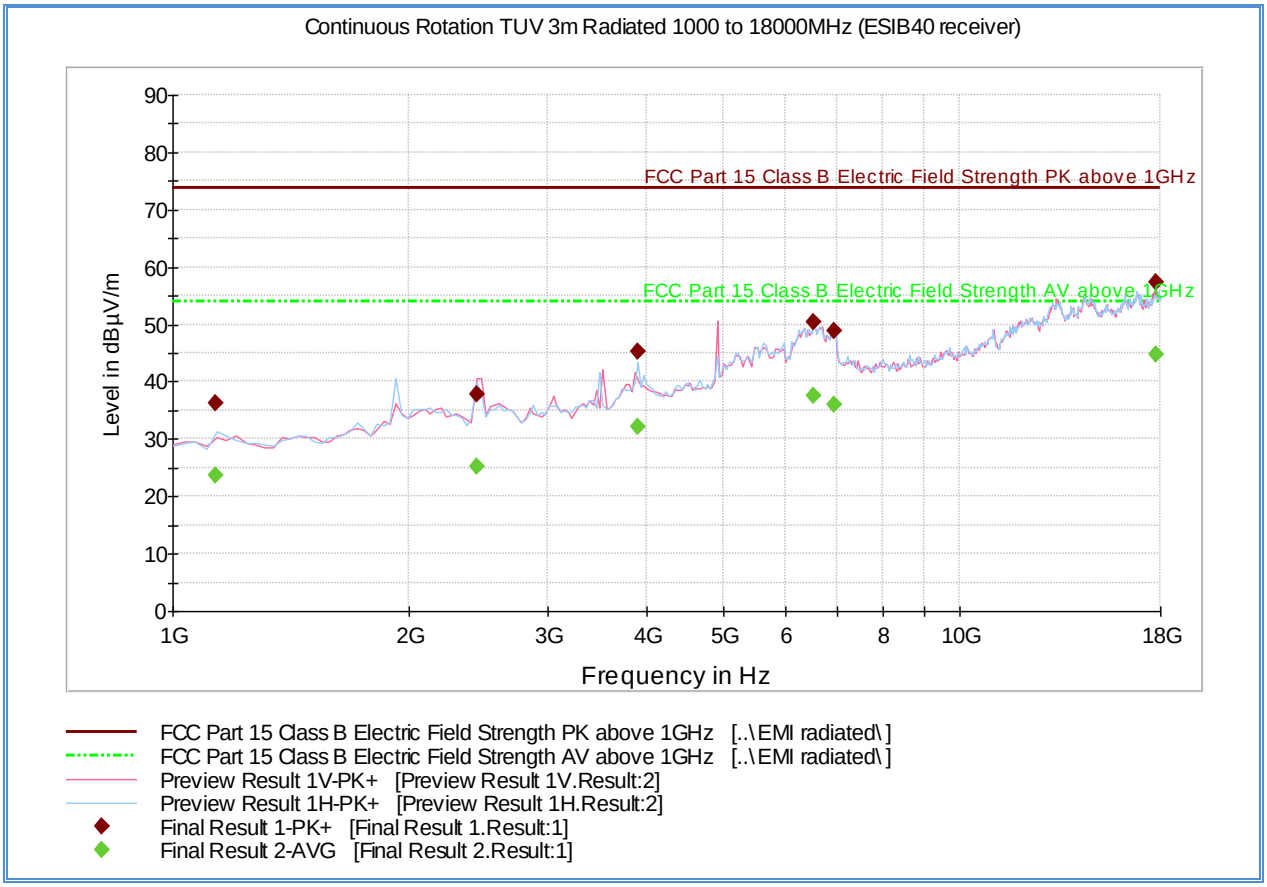
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1109.104409	36.2	1000.0	1000.000	152.2	V	98.0	-7.1	37.7	73.9
1919.539679	41.7	1000.0	1000.000	293.2	V	217.0	-2.0	32.2	73.9
3902.291583	45.8	1000.0	1000.000	337.1	V	-9.0	5.0	28.1	73.9
4786.063126	46.4	1000.0	1000.000	152.2	V	-20.0	5.7	27.5	73.9
6556.406212	50.2	1000.0	1000.000	403.5	H	118.0	11.3	23.7	73.9
16873.851503	57.0	1000.0	1000.000	152.6	H	299.0	22.9	16.9	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)
1109.104409	23.4	1000.0	1000.000	152.2	V	98.0	-7.1	30.5	53.9
1919.539679	28.9	1000.0	1000.000	293.2	V	217.0	-2.0	25.0	53.9
3902.291583	35.5	1000.0	1000.000	337.1	V	-9.0	5.0	18.4	53.9
4786.063126	32.8	1000.0	1000.000	152.2	V	-20.0	5.7	21.1	53.9
6556.406212	37.5	1000.0	1000.000	403.5	H	118.0	11.3	16.4	53.9
16873.851503	44.3	1000.0	1000.000	152.6	H	299.0	22.9	9.6	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 18GHz. Measurements above 18GHz are noise floor figures.

2.5.14 Test Results Above 1GHz (802.11b worst Case Configuration - High Channel, 5.5Mbps)



Peak Data

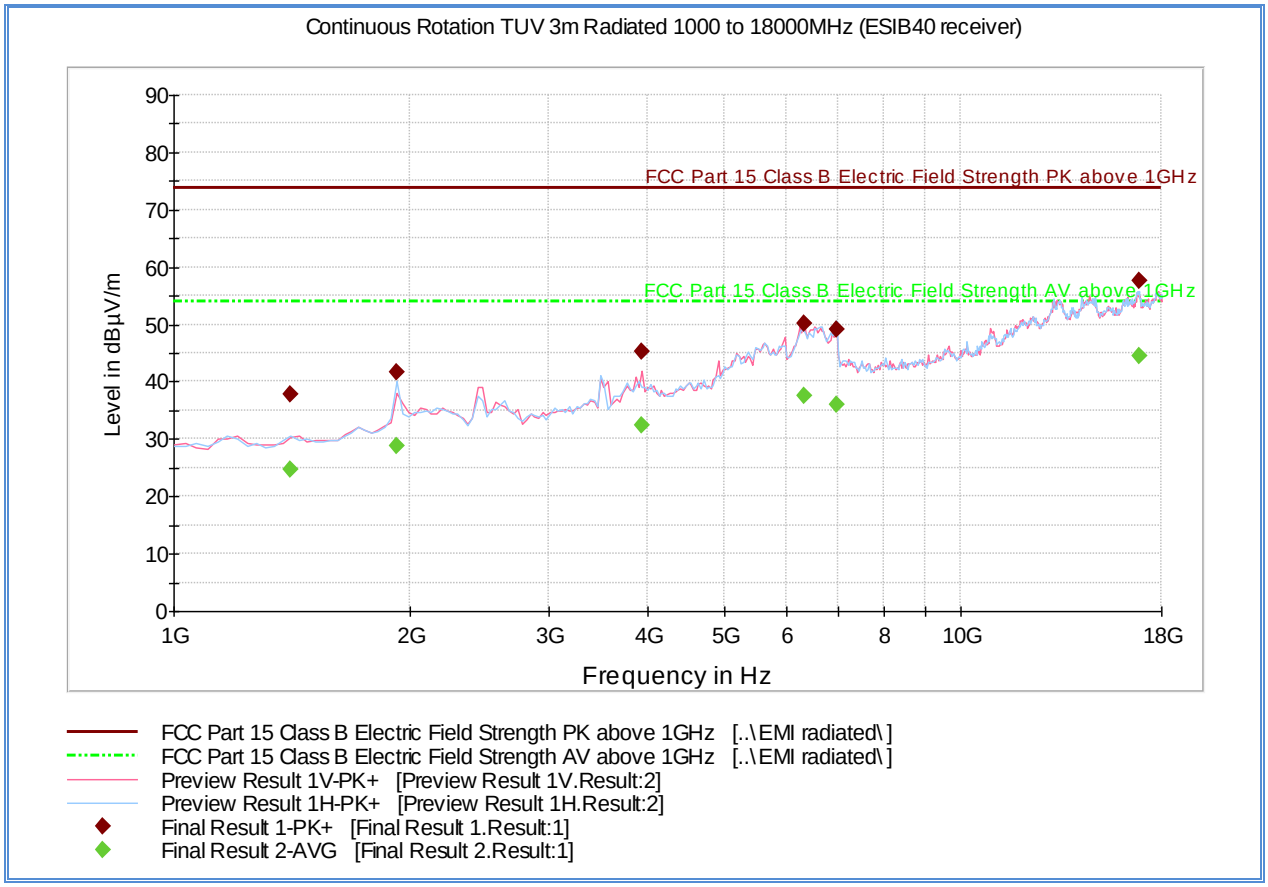
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1134.372545	36.3	1000.0	1000.000	346.2	H	227.0	-6.8	37.6	73.9
2434.161723	37.9	1000.0	1000.000	403.5	V	279.0	-0.4	36.0	73.9
3898.691583	45.2	1000.0	1000.000	241.4	H	75.0	5.0	28.7	73.9
6517.538076	50.3	1000.0	1000.000	230.4	H	196.0	11.2	23.6	73.9
6928.755711	48.9	1000.0	1000.000	403.5	V	102.0	9.3	25.0	73.9
17800.091182	57.3	1000.0	1000.000	184.6	V	19.0	23.3	16.6	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)
1134.372545	23.7	1000.0	1000.000	346.2	H	227.0	-6.8	30.2	53.9
2434.161723	25.2	1000.0	1000.000	403.5	V	279.0	-0.4	28.7	53.9
3898.691583	32.3	1000.0	1000.000	241.4	H	75.0	5.0	21.6	53.9
6517.538076	37.6	1000.0	1000.000	230.4	H	196.0	11.2	16.3	53.9
6928.755711	36.1	1000.0	1000.000	403.5	V	102.0	9.3	17.8	53.9
17800.091182	44.8	1000.0	1000.000	184.6	V	19.0	23.3	9.1	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 18GHz. Measurements above 18GHz are noise floor figures.

2.5.15 Test Results Above 1GHz (802.11g worst Case Configuration - High Channel, 6Mbps)



Peak Data

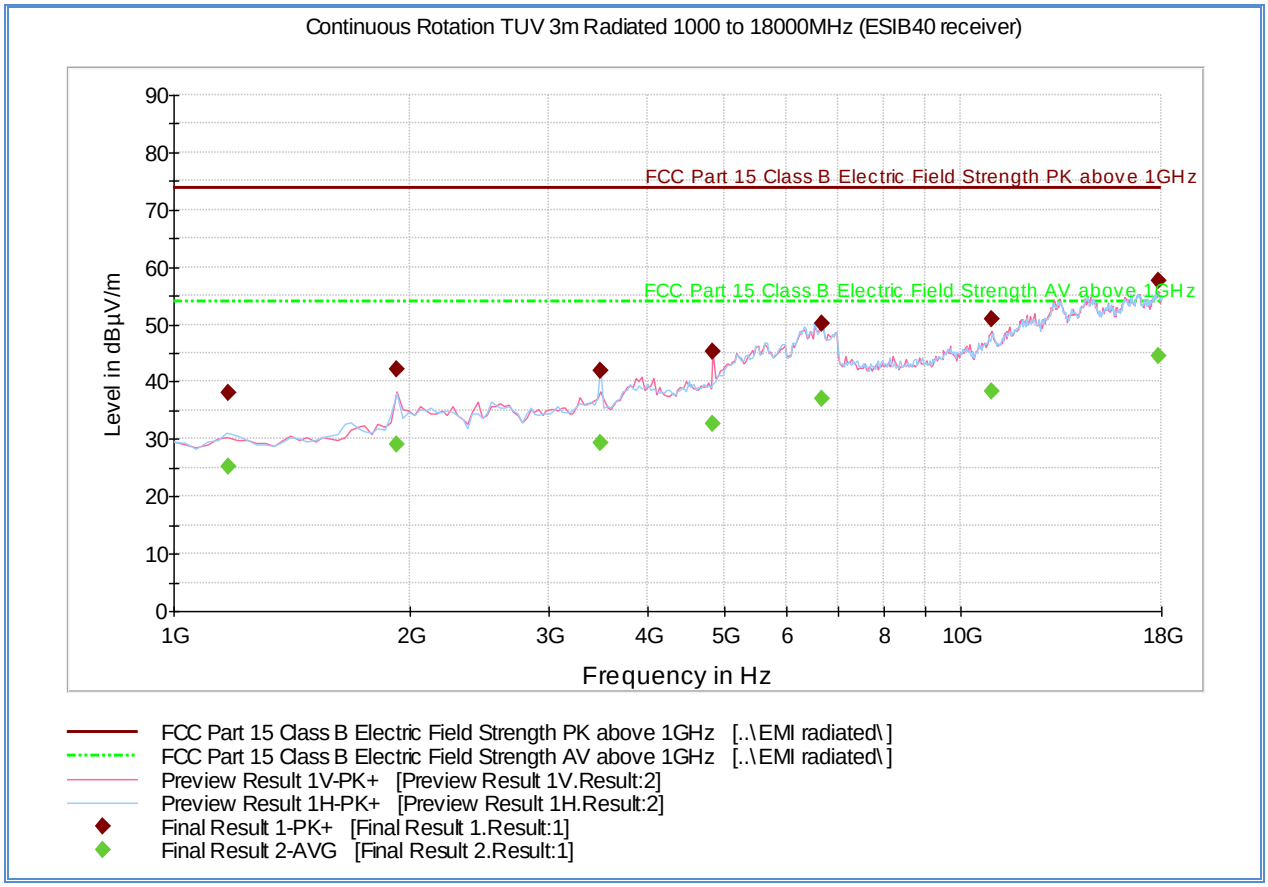
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1406.117635	37.7	1000.0	1000.000	240.4	H	0.0	-5.6	36.2	73.9
1916.339679	41.6	1000.0	1000.000	403.5	H	-4.0	-2.0	32.3	73.9
3927.759719	45.2	1000.0	1000.000	352.1	V	-2.0	4.9	28.7	73.9
6317.529259	50.0	1000.0	1000.000	352.1	V	214.0	10.5	23.9	73.9
6956.823848	49.1	1000.0	1000.000	396.1	H	177.0	9.2	24.8	73.9
16839.383367	57.5	1000.0	1000.000	231.4	H	274.0	23.3	16.4	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)
1406.117635	24.6	1000.0	1000.000	240.4	H	0.0	-5.6	29.3	53.9
1916.339679	28.8	1000.0	1000.000	403.5	H	-4.0	-2.0	25.1	53.9
3927.759719	32.4	1000.0	1000.000	352.1	V	-2.0	4.9	21.5	53.9
6317.529259	37.5	1000.0	1000.000	352.1	V	214.0	10.5	16.4	53.9
6956.823848	35.9	1000.0	1000.000	396.1	H	177.0	9.2	18.0	53.9
16839.383367	44.6	1000.0	1000.000	231.4	H	274.0	23.3	9.3	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 18GHz. Measurements above 18GHz are noise floor figures.

2.5.16 Test Results Above 1GHz (802.11n 2.4G worst Case Configuration - HT20 Mid Channel, 13Mbps)



Peak Data

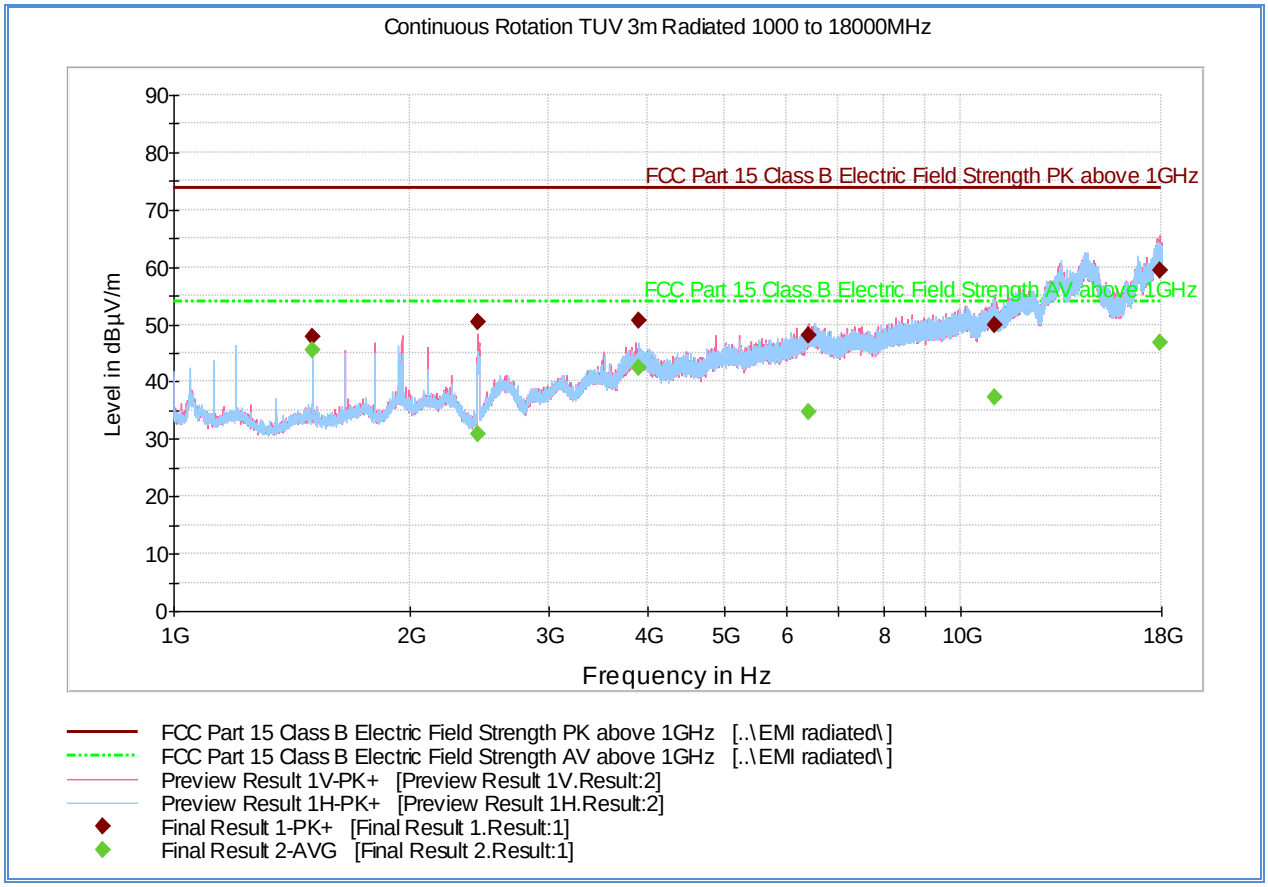
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1171.240681	38.1	1000.0	1000.000	335.1	H	64.0	-6.4	35.8	73.9
1921.539679	42.1	1000.0	1000.000	281.3	V	20.0	-2.0	31.8	73.9
3491.873948	41.9	1000.0	1000.000	152.2	H	69.0	1.7	32.0	73.9
4845.799399	45.3	1000.0	1000.000	152.2	V	23.0	5.9	28.6	73.9
6658.610621	50.2	1000.0	1000.000	346.1	H	124.0	10.9	23.7	73.9
10947.195792	51.0	1000.0	1000.000	403.5	V	84.0	14.7	22.9	73.9
17868.627455	57.5	1000.0	1000.000	212.4	V	0.0	23.1	16.4	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)
1171.240681	25.1	1000.0	1000.000	335.1	H	64.0	-6.4	28.8	53.9
1921.539679	29.0	1000.0	1000.000	281.3	V	20.0	-2.0	24.9	53.9
3491.873948	29.2	1000.0	1000.000	152.2	H	69.0	1.7	24.7	53.9
4845.799399	32.7	1000.0	1000.000	152.2	V	23.0	5.9	21.2	53.9
6658.610621	37.1	1000.0	1000.000	346.1	H	124.0	10.9	16.8	53.9
10947.195792	38.4	1000.0	1000.000	403.5	V	84.0	14.7	15.5	53.9
17868.627455	44.5	1000.0	1000.000	212.4	V	0.0	23.1	9.4	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 18GHz. Measurements above 18GHz are noise floor figures.

2.5.17 Test Results Above 1GHz (802.11n 2.4GHz HT20 MIMO Worst Case Channel)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.000000	47.8	1000.0	1000.000	275.3	H	137.0	-8.8	26.1	73.9
2433.633333	50.3	1000.0	1000.000	238.4	V	244.0	-4.4	23.6	73.9
3899.600000	50.6	1000.0	1000.000	131.7	H	109.0	4.0	23.3	73.9
6416.766667	48.1	1000.0	1000.000	202.3	V	128.0	9.9	25.8	73.9
11066.833333	49.8	1000.0	1000.000	279.3	V	128.0	14.9	24.1	73.9
17903.533333	59.3	1000.0	1000.000	303.2	V	268.0	26.3	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)
1500.000000	45.5	1000.0	1000.000	275.3	H	137.0	-8.8	8.4	53.9
2433.633333	30.8	1000.0	1000.000	238.4	V	244.0	-4.4	23.1	53.9
3899.600000	42.4	1000.0	1000.000	131.7	H	109.0	4.0	11.5	53.9
6416.766667	34.7	1000.0	1000.000	202.3	V	128.0	9.9	19.2	53.9
11066.833333	37.2	1000.0	1000.000	279.3	V	128.0	14.9	16.7	53.9
17903.533333	46.8	1000.0	1000.000	303.2	V	268.0	26.3	7.1	53.9

Test Notes: Measurement was performed with a 2.4GHz notch filter. No significant emissions observed above 18GHz. Measurements above 18GHz are noise floor figures. Only the worst case channel presented (Mid Channel in MIMO mode).

2.6 RADIATED BAND EDGE MEASUREMENTS AND IMMEDIATE RESTRICTED BANDS

2.6.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(d)
RSS-247, Clause 5.5

2.6.2 Standard Applicable

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

2.6.3 Equipment Under Test and Modification State

Serial No: NA/ (Sample #1) / Test Configuration B

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

April 30, 2015/XYZ

2.6.5 Test Equipment Used

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

2.6.6 Environmental Conditions

Ambient Temperature	24.3 °C
Relative Humidity	31.2 %
ATM Pressure	99.5 kPa

2.6.7 Additional Observations

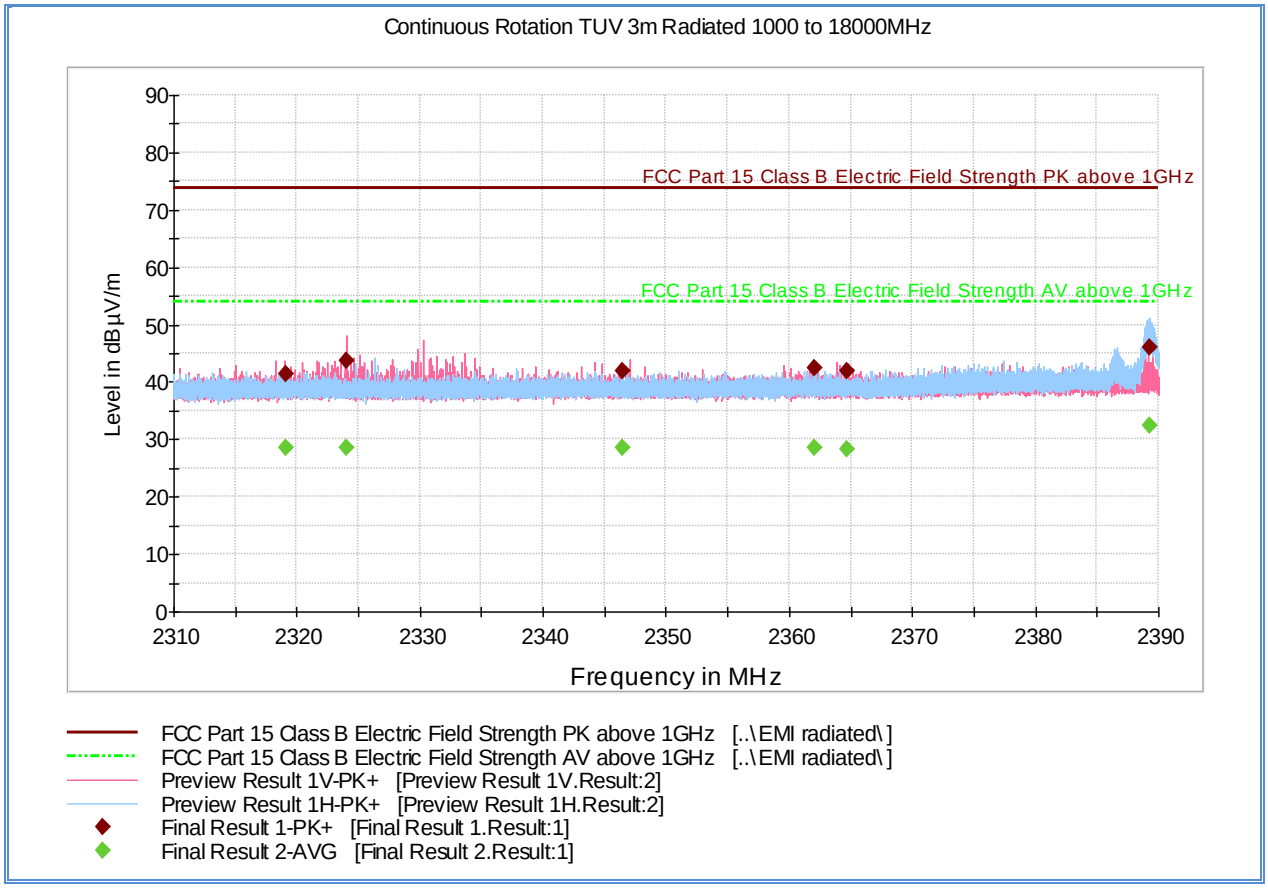
- This is a radiated test. The spectrum was searched from 2310MHz to 2390MHz for lower immediate restricted band and 2483.5MHz to 2500MHz for the upper immediate restricted band.
- There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.
- Only worst-case WiFi mode presented (802.11 n HT20 2.4GHz).

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

2.6.8 Sample Computation (Radiated Emission)

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

2.6.9 Test Results Restricted Band 2310MHz to 2390MHz (Bluetooth LE Low Channel)



Peak Data

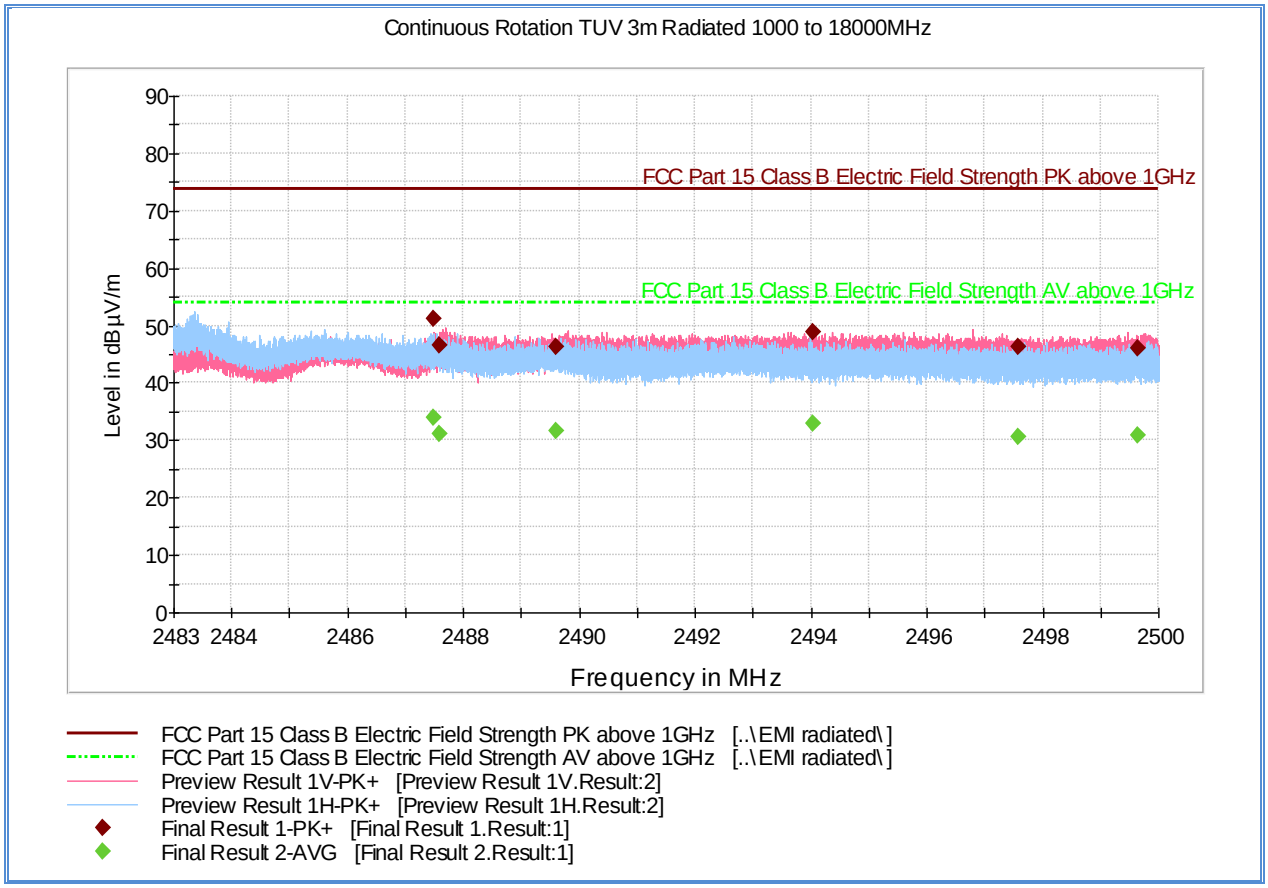
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2319.120000	41.4	1000.0	1000.000	116.7	V	135.0	-0.8	32.5	73.9
2324.002667	43.7	1000.0	1000.000	156.6	V	161.0	-0.7	30.2	73.9
2346.480000	41.8	1000.0	1000.000	122.7	V	162.0	-0.8	32.1	73.9
2362.069333	42.5	1000.0	1000.000	103.7	V	136.0	-0.7	31.4	73.9
2364.698667	42.0	1000.0	1000.000	99.7	V	142.0	-0.7	31.9	73.9
2389.285333	46.0	1000.0	1000.000	122.7	H	320.0	-0.6	27.9	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)
2319.120000	28.5	1000.0	1000.000	116.7	V	135.0	-0.8	25.4	53.9
2324.002667	28.6	1000.0	1000.000	156.6	V	161.0	-0.7	25.3	53.9
2346.480000	28.6	1000.0	1000.000	122.7	V	162.0	-0.8	25.3	53.9
2362.069333	28.5	1000.0	1000.000	103.7	V	136.0	-0.7	25.4	53.9
2364.698667	28.3	1000.0	1000.000	99.7	V	142.0	-0.7	25.6	53.9
2389.285333	32.5	1000.0	1000.000	122.7	H	320.0	-0.6	21.4	53.9

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

2.6.10 Test Results Restricted Band 2483.5MHz to 2500MHz (Bluetooth LE High Channel)



Peak Data

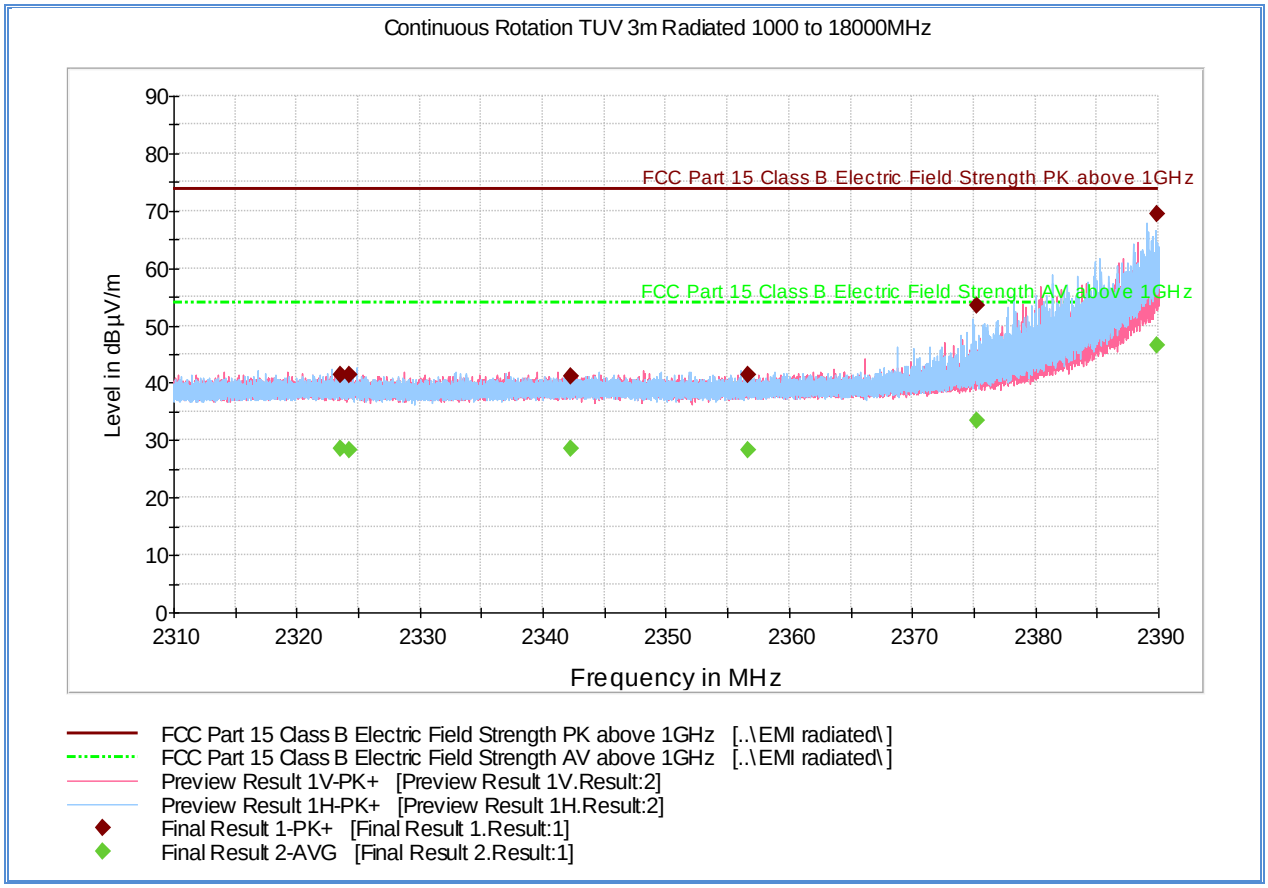
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2487.489733	51.1	1000.0	1000.000	115.7	V	163.0	-0.1	22.8	73.9
2487.589733	46.4	1000.0	1000.000	114.7	H	137.0	-0.1	27.5	73.9
2489.603967	46.3	1000.0	1000.000	188.6	V	150.0	-0.1	27.6	73.9
2494.047100	48.9	1000.0	1000.000	148.7	V	121.0	-0.1	25.0	73.9
2497.581333	46.3	1000.0	1000.000	139.7	V	150.0	-0.1	27.6	73.9
2499.654300	46.1	1000.0	1000.000	124.7	V	150.0	-0.1	27.8	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)
2487.489733	33.9	1000.0	1000.000	115.7	V	163.0	-0.1	20.0	53.9
2487.589733	31.2	1000.0	1000.000	114.7	H	137.0	-0.1	22.7	53.9
2489.603967	31.5	1000.0	1000.000	188.6	V	150.0	-0.1	22.4	53.9
2494.047100	32.8	1000.0	1000.000	148.7	V	121.0	-0.1	21.1	53.9
2497.581333	30.7	1000.0	1000.000	139.7	V	150.0	-0.1	23.2	53.9
2499.654300	31.0	1000.0	1000.000	124.7	V	150.0	-0.1	22.9	53.9

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

2.6.11 Test Results Restricted Band 2310MHz to 2390MHz (Low Channel Worst Case WiFi Mode)



Peak Data

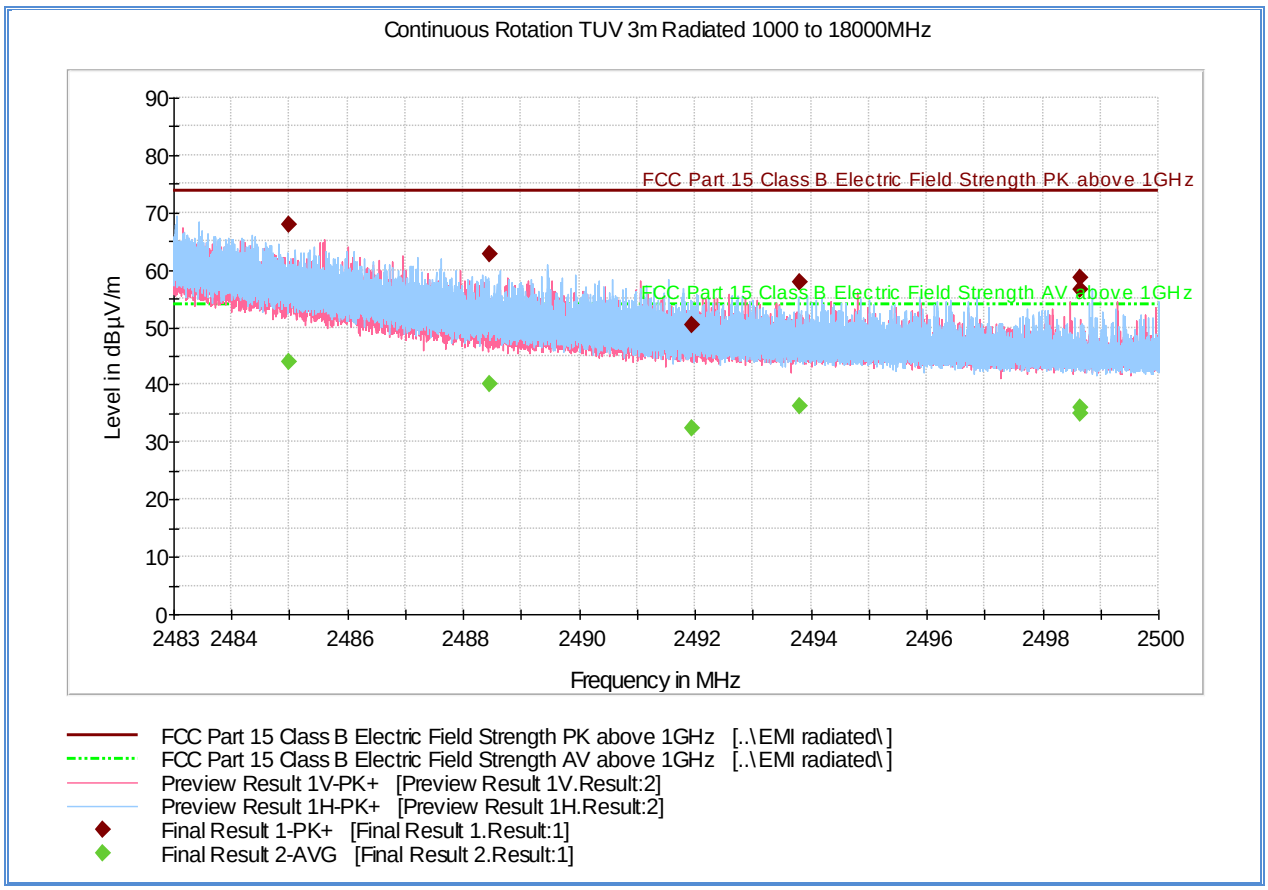
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2323.605333	41.3	1000.0	1000.000	174.6	H	264.0	-0.7	32.6	73.9
2324.312000	41.4	1000.0	1000.000	162.6	H	69.0	-0.7	32.5	73.9
2342.296000	41.1	1000.0	1000.000	266.3	H	210.0	-0.7	32.8	73.9
2356.637333	41.5	1000.0	1000.000	138.7	H	46.0	-0.7	32.4	73.9
2375.253333	53.5	1000.0	1000.000	116.7	H	220.0	-0.7	20.4	73.9
2389.880000	69.5	1000.0	1000.000	117.7	H	219.0	-0.6	4.4	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)
2323.605333	28.5	1000.0	1000.000	174.6	H	264.0	-0.7	25.4	53.9
2324.312000	28.3	1000.0	1000.000	162.6	H	69.0	-0.7	25.6	53.9
2342.296000	28.5	1000.0	1000.000	266.3	H	210.0	-0.7	25.4	53.9
2356.637333	28.4	1000.0	1000.000	138.7	H	46.0	-0.7	25.5	53.9
2375.253333	33.4	1000.0	1000.000	116.7	H	220.0	-0.7	20.5	53.9
2389.880000	46.5	1000.0	1000.000	117.7	H	219.0	-0.6	7.4	53.9

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

2.6.12 Test Results Restricted Band 2483.5MHz to 2500MHz (High Channel Worst Case WiFi Mode)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2484.997667	68.0	1000.0	1000.000	116.7	V	275.0	-0.1	5.9	73.9
2488.445833	62.7	1000.0	1000.000	102.8	H	217.0	-0.1	11.2	73.9
2491.936833	50.3	1000.0	1000.000	115.8	H	132.0	-0.1	23.6	73.9
2493.804233	57.9	1000.0	1000.000	115.7	V	275.0	-0.1	16.0	73.9
2498.656467	58.5	1000.0	1000.000	103.7	H	221.0	-0.1	15.4	73.9
2498.656467	56.6	1000.0	1000.000	113.7	H	333.0	-0.1	17.3	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2484.997667	43.9	1000.0	1000.000	116.7	V	275.0	-0.1	10.0	53.9
2488.445833	40.1	1000.0	1000.000	102.8	H	217.0	-0.1	13.8	53.9
2491.936833	32.3	1000.0	1000.000	115.8	H	132.0	-0.1	21.6	53.9
2493.804233	36.3	1000.0	1000.000	115.7	V	275.0	-0.1	17.6	53.9
2498.656467	35.9	1000.0	1000.000	103.7	H	221.0	-0.1	18.0	53.9
2498.656467	35.0	1000.0	1000.000	113.7	H	333.0	-0.1	18.9	53.9

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

2.7 POWER SPECTRAL DENSITY

2.7.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(e)
RSS-247, Clause 5.2(2)

2.7.2 Standard Applicable

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

2.7.3 Equipment Under Test and Modification State

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

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

May 14, 2015/XYZ

2.7.5 Test Equipment Used

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

2.7.6 Environmental Conditions

Ambient Temperature	25.5°C
Relative Humidity	36.8%
ATM Pressure	98.8kPa

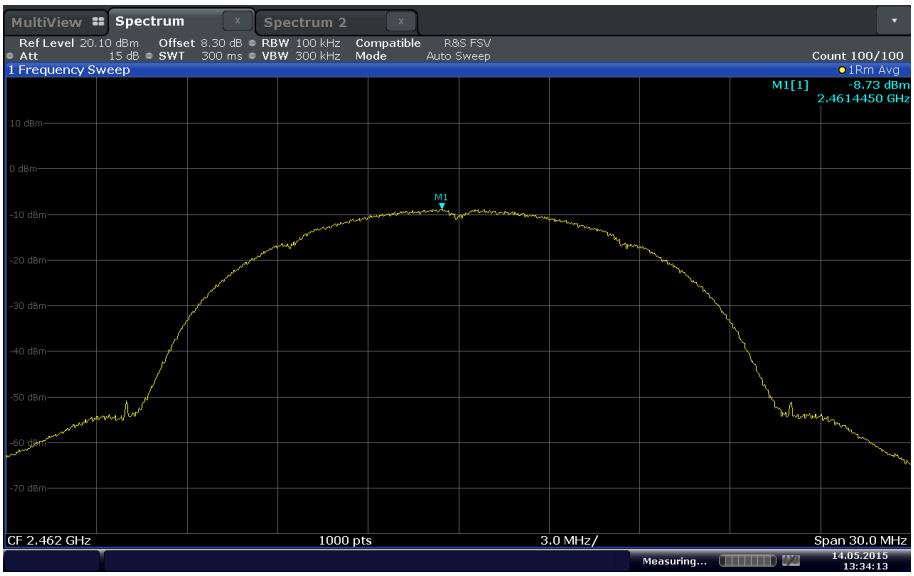
2.7.7 Additional Observations

- This is a conducted test.
- Test procedure is per Section 10.3 of KDB 558074 D01 (DTS Meas Guidance v03r02, June 05, 2014)..
- The path loss for was measured and entered as a level offset
- Detector is RMS power averaging.
- Trace averaging mode over 100 traces.
- Sweep time is Auto.
- EUT complies with 100 kHz RBW.
- For MIMO mode, the limit was adjusted using a factor of 10log(N) dB where “N” is the number of outputs and assuming number of spatial streams is 1 (MCS 0).

2.7.8 Test Results Summary

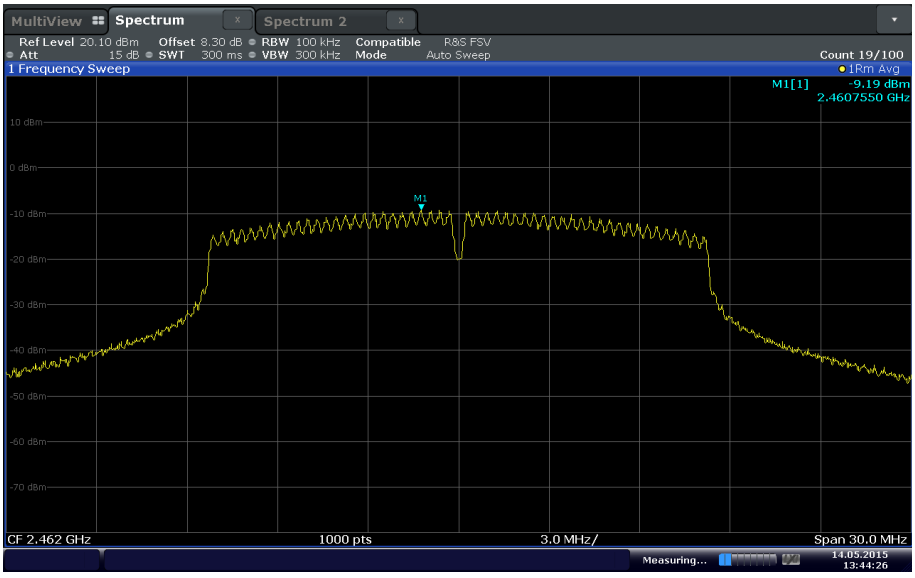
Mode	Channel	Data Rates (Mbps)	Marker Reading using 100 kHz RBW (dBm)	PSD Limit (dBm)	Margin (dB)	Compliance
802.11b	1 (2412 MHz)	5.5	-9.74	8	17.74	Complies
	6 (2437 MHz)	5.5	-14.52	8	22.52	Complies
	11 (2462 MHz)	5.5	-8.73	8	16.73	Complies
802.11g	1 (2412 MHz)	6	-10.8	8	18.8	Complies
	6 (2437 MHz)	6	-9.6	8	17.6	Complies
	11 (2462 MHz)	6	-9.19	8	17.19	Complies
802.11n HT20	1 (2412 MHz)	mcs 0 (6.50 Mbps)	-10.6	8	18.60	Complies
	6 (2437 MHz)	mcs 0 (6.50 Mbps)	-8.85	8	16.85	Complies
	11 (2462 MHz)	mcs 0 (6.50 Mbps)	-10.35	8	18.35	Complies
802.11n HT20 MIMO	6 (2437 MHz)	mcs 1(13.0 Mbps)	-9.89	5	14.89	Complies
802.11n HT40	3 (2422 MHz)	mcs 6 (121.50 Mbps)	-17.75	8	25.75	Complies
	6 (2437 MHz)	mcs 6 (121.50 Mbps)	-18.23	8	26.23	Complies
	9 (2452 MHz)	mcs 6 (121.50 Mbps)	-17.27	8	25.27	Complies
Bluetooth LE	37 (2402 MHz)	GFSK @ 1Mbps	-1.16	8	9.16	Complies
	17 (2440 MHz)	GFSK @ 1Mbps	1.10	8	9.10	Complies
	39 (2480 MHz)	GFSK @ 1Mbps	0.06	8	8.06	Complies

2.7.9 Test Results Plots



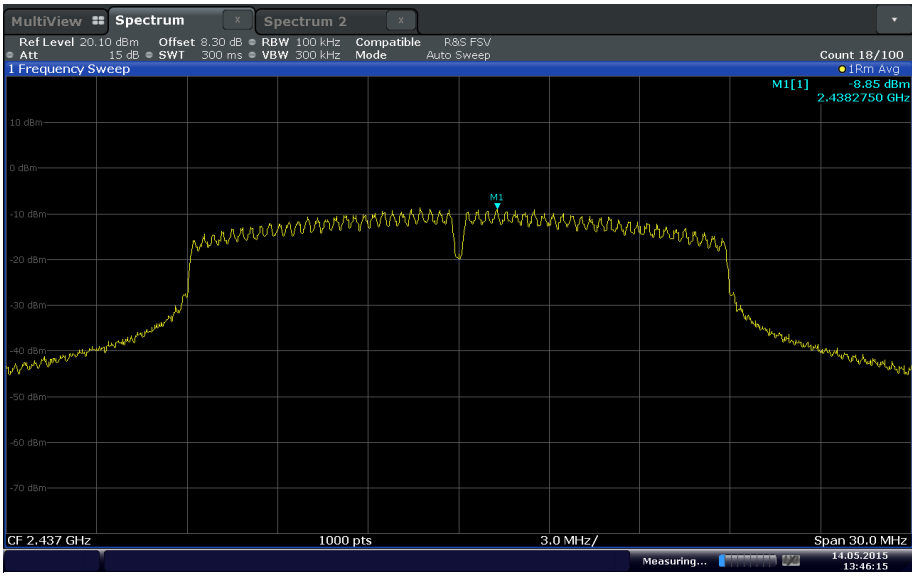
Date: 14.MAY.2015 13:34:13

802.11b Worst Case Channel



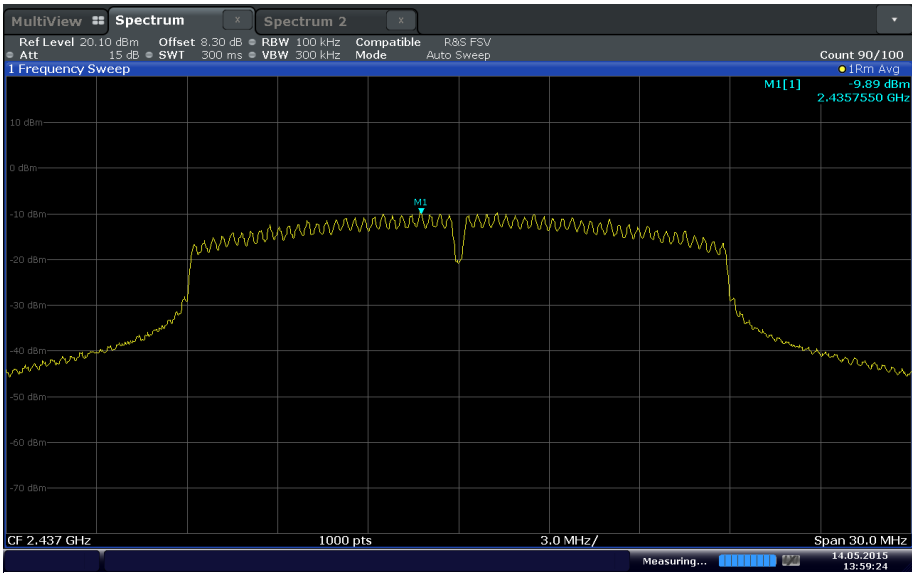
Date: 14.MAY.2015 13:44:26

802.11g Worst Case Channel



Date: 14.MAY.2015 13:46:16

802.11n 2.4G HT20 Worst Case Channel



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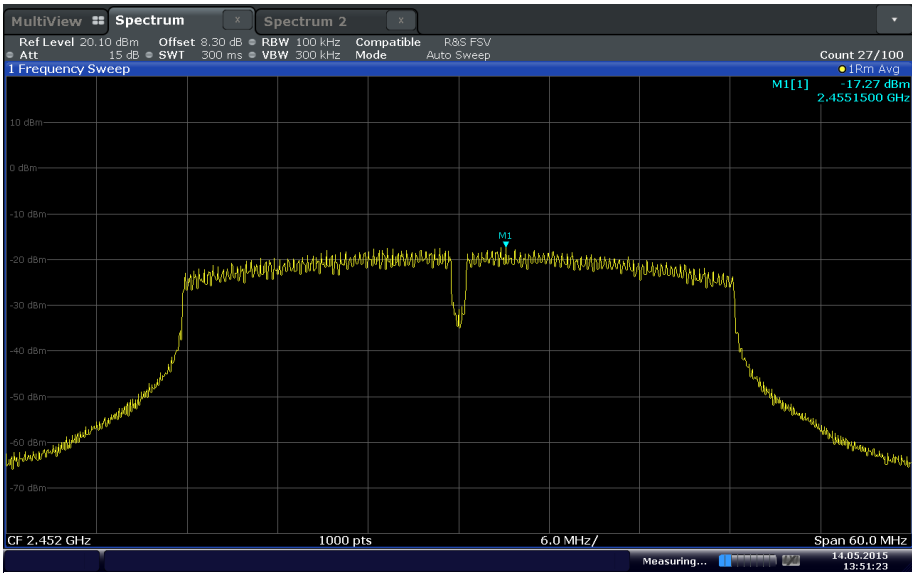
802.11n 2.4G HT20 MIMO Worst Case Channel



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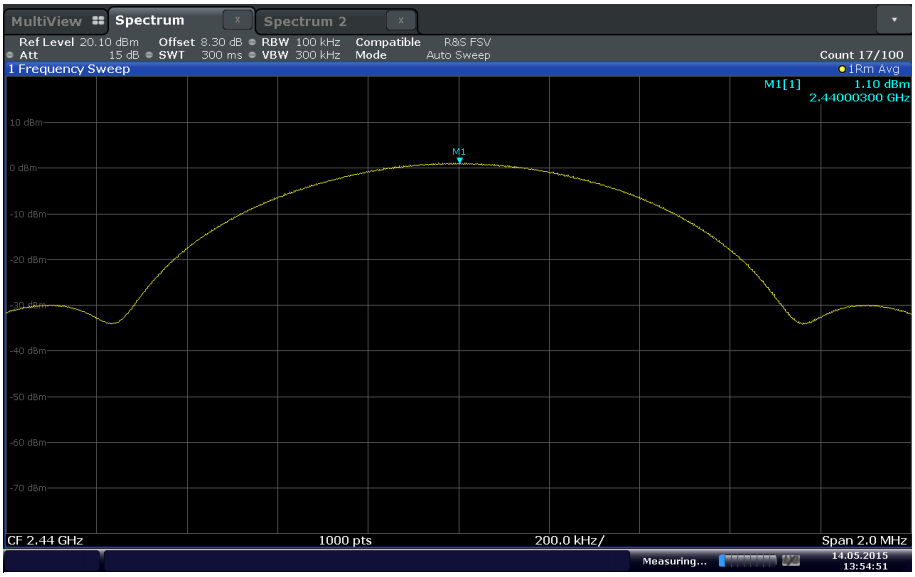
802.11n 2.4G HT40 Worst Case Channel



Date: 14.MAY.2015 13:54:51

Bluetooth LE Worst Case Channel

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

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

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
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
7569	Series Power Meter	N1911A P-	MY45100625	Agilent	05/22/14	05/22/15
7605	50MHz-18GHz Wideband Power Sensor	N1921A	MY51100054	Agilent	04/10/15	04/10/16
-	6dB Attenuator	606-06-1F4/DR	-	MECA	Verified by 1003 and 7569	
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
8816	2.4GHz to 2.5GHz Notch Filter	BRM50702	133	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 6752	
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

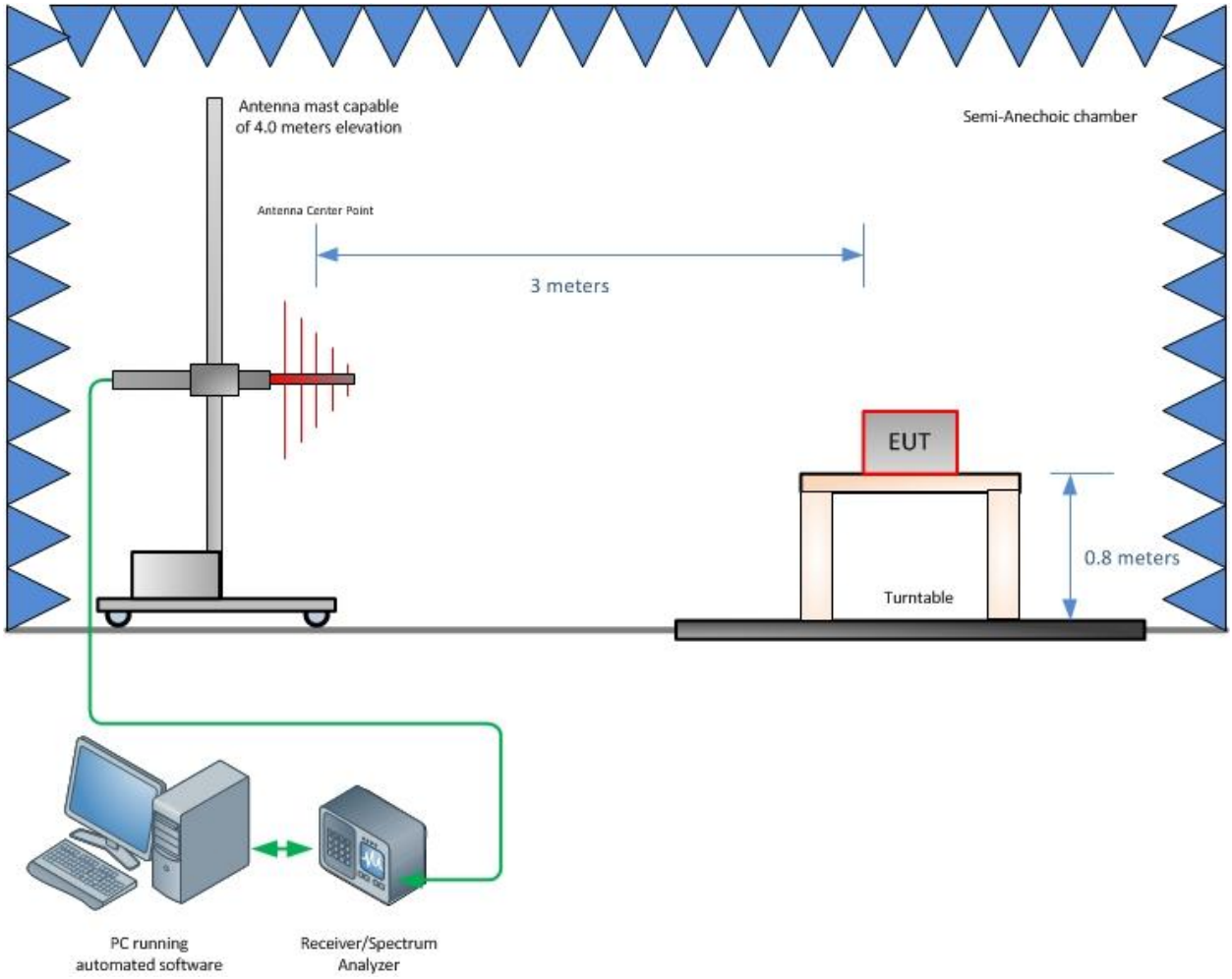
3.2.1 AC Conducted Emissions Measurements

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

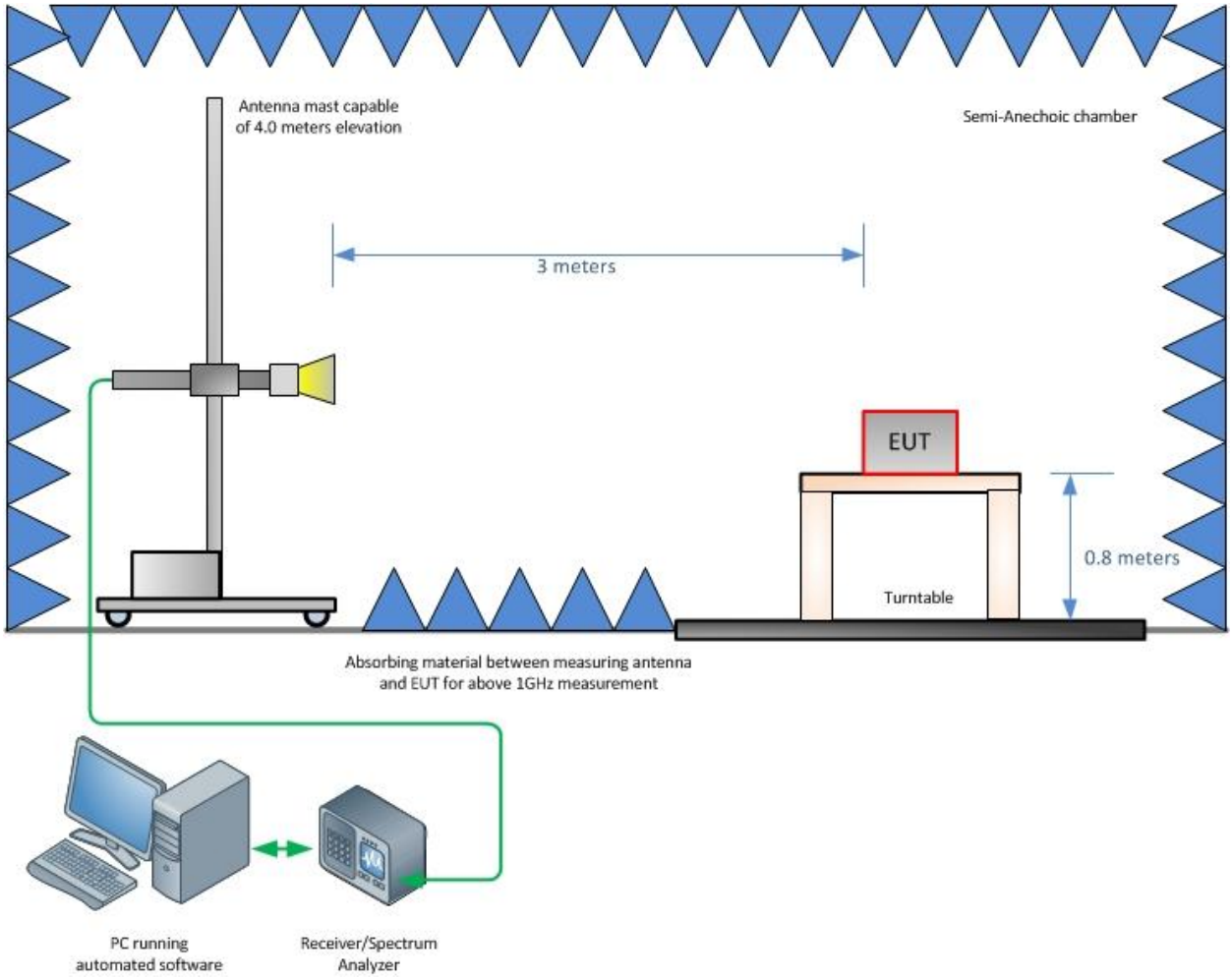
SECTION 4

DIAGRAM OF TEST SETUP

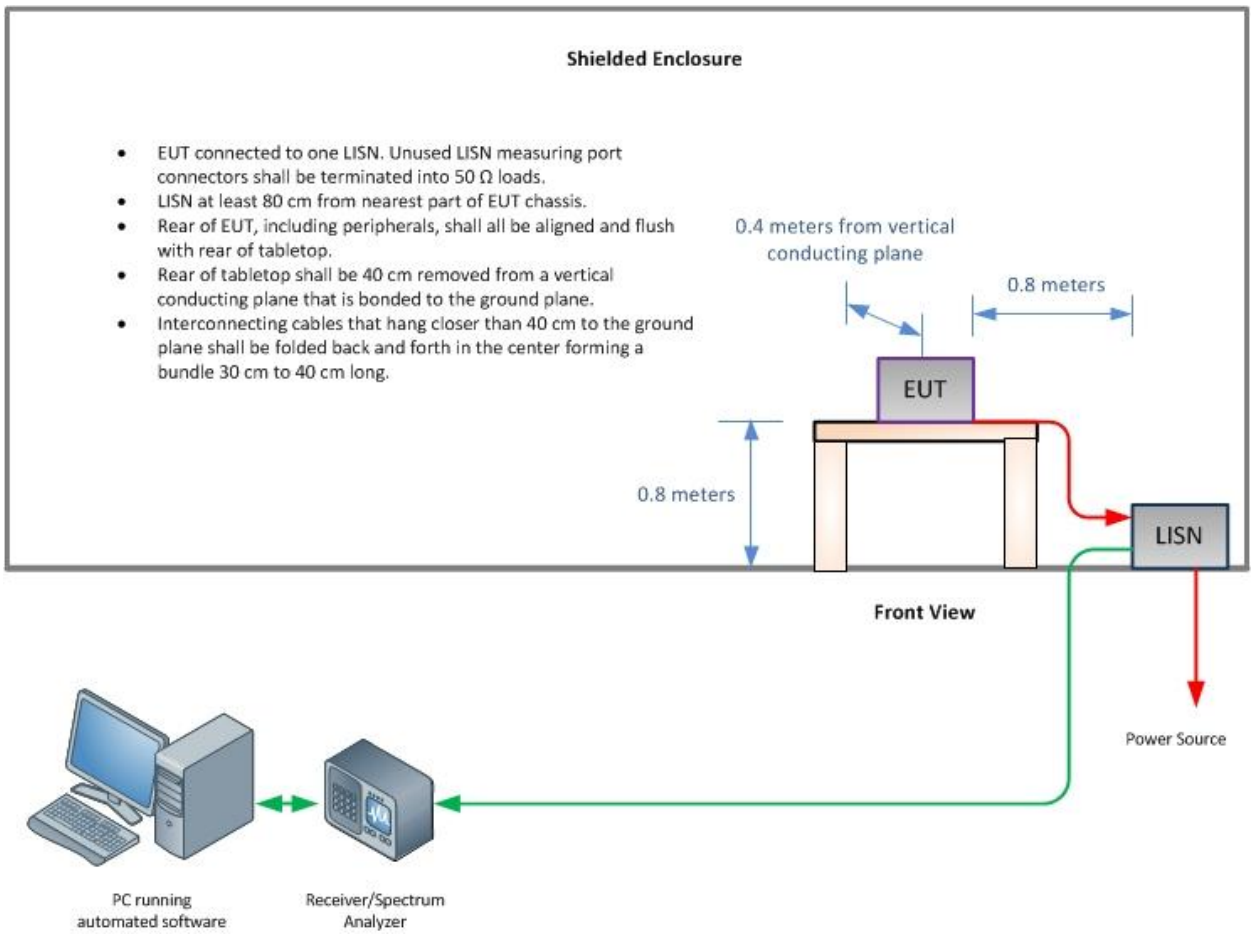
4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)



Conducted Emission Test Setup

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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