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Report On

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

MIFI8800L Wireless Hotspot Modem

FCC CRF 47 Part 15 Subpart C §15.247

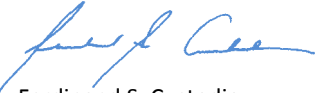
RSS-247 Issue 1: 2015

Report No. 72139211E

August 2018

FCC ID: PKRNVWMIFI8800
IC: 3229A-MIFI8800
Report No. 72139211E



REPORT ON	Radio Testing of the Novatel Wireless Inc. MIFI8800L Wireless Hotspot Modem
TEST REPORT NUMBER	72139211E
PREPARED FOR	Novatel Wireless Inc. 9605 Scranton Road, Suite 300 San Diego, CA 92121 USA
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APPROVED BY	 Ferdinand S. Custodio Name Authorized Signatory Title: Senior EMC Test Engineer/Wireless Team Lead
DATED	<u>August 27, 2018</u>

FCC ID: PKRNVWMIFI8800
IC: 3229A-MIFI8800
Report No. 72139211E



Revision History

72139211E Novatel Wireless Inc. MIFI8800L Wireless Hotspot Modem					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
08/27/2018	Initial Release				Ferdinand Custodio

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SECTION 1

REPORT SUMMARY

Radio Testing of the
Novatel Wireless Inc.
MIFI8800L Wireless Hotspot Modem

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Novatel Wireless Inc. MIFI8800L Wireless Hotspot Modem to the requirements of the following:

- FCC CRF 47 Part 15 Subpart C §15.247: 2017
- RSS-247 Issue 1: 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	Novatel Wireless Inc.
Product Trademark/Brand	Inseego
Product Marketing Name	MiFi 8800L
Model Number(s)	MIFI8800L
FCC ID Number	PKRNVWMIFI8800
IC Number	3229A-MIFI8800
Serial Number(s)	AZ280418A00067
Number of Samples Tested	1
Test Specification/Issue/Date	• FCC CRF 47 Part 15 Subpart C §15.247 (October 1, 2017). • RSS-247 Issue 2 February 2017 - Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices. • RSS-Gen Issue 5 April 2018 - General Requirements for Compliance of Radio Apparatus. • KDB558074 D01 DTS Meas Guidance v04, (April 05, 2017) Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247. • ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Start of Test	July 23, 2018
Finish of Test	August 07, 2018
Name of Engineer(s)	Xiaoying Zhang
Related Document(s)	Supporting documents for EUT certification are separate exhibits.

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CRF 47 Part 15 Subpart C §15.247 with cross-reference to the corresponding ISSED RSS standard is shown below.

Section	FCC Part Sections(s)	ISED Sections	Test Description	Result	Comments/ Base Standard
2.1	§15.247(b)(3)	RSS-247 5.4(d)	Peak Output Power	Compliant	
2.2	§15.207(a)	RSS-Gen 8.8	Conducted Emissions	Compliant	
2.3	-	RSS-Gen 6.7	99% Emission Bandwidth	For reporting purpose only	
2.4	§15.247(a)(2)	RSS-247 5.2(a)	Minimum 6 dB RF Bandwidth	Compliant	
2.5	§15.247(d)	RSS-247 5.5	Out-of-Band Emissions - Conducted	Compliant	
2.6	§15.247(d)	RSS-247 5.5	Band-edge Compliance of RF Conducted Emissions	Compliant	
2.7	§15.247(d)	RSS-247 5.5	Spurious Radiated Emissions	Compliant	
	-	RSS-Gen 7.4	Receiver Spurious Emissions	N/A*	
2.8	§15.247(e)	RSS-247 5.2(b)	Power Spectral Density for Digitally Modulated Device	Compliant	

N/A* Not Applicable. No stand-alone receiver.

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Novatel Wireless Inc. MIFI8800L Wireless Hotspot Modem. The EUT supports LTE, WCDMA/HSPA, 802.11a, 802.11b, 802.11g and 802.11n and 802.11ac. WLAN supports both SISO and MIMO mode. Bands supported for WIFI are 2.4GHz, U-NII 1 and U-NII 3.

1.3.2 EUT General Description

EUT Description	Wireless Hotspot Modem
Product Marketing Name	MiFi 8800L
Model Number(s)	MIFI8800L
Rated Voltage	3.8V, 4500mAh (Rechargeable Li-Ion battery pack) Input 100-240VAC, Output 5V (External AC-DC Power Adapter)
Mode Verified	802.11b, 802.11g and 802.11n in 2.4GHz band
Capability	WCDMA Band 2, 5, LTE Band 2, 4, 5, 7, 13, 14, 46, 48, 66 and 802.11 a/b/g/n/ac
Primary Unit (EUT)	☐ Production ☒ Pre-Production ☐ Engineering

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

2412 MHz to 2462 MHz	0.1 dBi
5170 MHz to 5250 MHz	3.2 dBi
5735 MHz to 5835 MHz	2.9 dBi

1.3.3 Maximum Conducted Output Power

Mode	Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
802.11b MIMO	2412-2462	20.88	122.46
802.11g MIMO	2412-2462	17.87	61.24
802.11 n MIMO	2412-2462	17.64	58.08

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Power measurements using antenna conducted port test setup. Both WLAN antenna (RF0 and RF1) for SISO mode and MIMO mode are verified.
B	Antenna Conducted Port Test Setup. Antenna port (RF0 or RF1) connected directly to the Spectrum Analyser with 10dB external attenuator.
C	Radiated Test Setup (Cabinet Spurious Emissions). Antenna port terminated with 50Ω load.

1.4.2 EUT Exercise Software

The EUT is connected to the support laptop via USB. Tera Term was used to communicate with the EUT. The manufacturer provided different macros to load that configures the RF settings of the EUT. Parameters that could be updated using the macros are 802.11 mode, channel, modulation, bandwidth, TX port and TX power.

1.4.3 Support Equipment and I/O cables

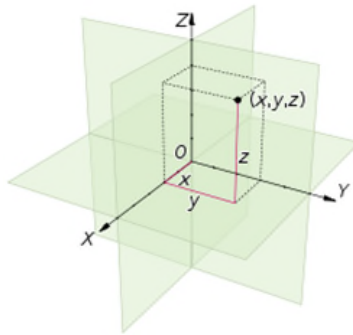
Manufacturer	Equipment/Cable	Description
DELL	Support Laptop	LATITUDE E6410, S/N: 5JK9ZN1
DELL	AC/DC Adapter for the support laptop	Model: DA90PE1-00, P/N: WK890 S/N: CN-0WK890-48661-8CR-N77V-A01
Novatel Wireless	USB Cable (EUT to Support Laptop)	Type A to Type C USB Cable. M/N: NOV7000USB

1.4.4 Worst Case Configuration

Worst-case configuration used in this test report as per maximum conducted output power measurements (averaged across all three channels and data rate available):

Mode	Channel	Data Rate
802.11b	6 (Middle Channel)	2Mbps
802.11g	36 (High Channel)	36 Mbps
802.11n 20MHz	1 (Low Channel)	MCS 2

The EUT is a portable device. For radiated measurements, X, Y and Z orientations were verified during initial prescan to verify the worst axis. No major variation in emissions observed between the three (3) orientations for cabinet spurious emissions. Verifications performed using “Y” configuration.



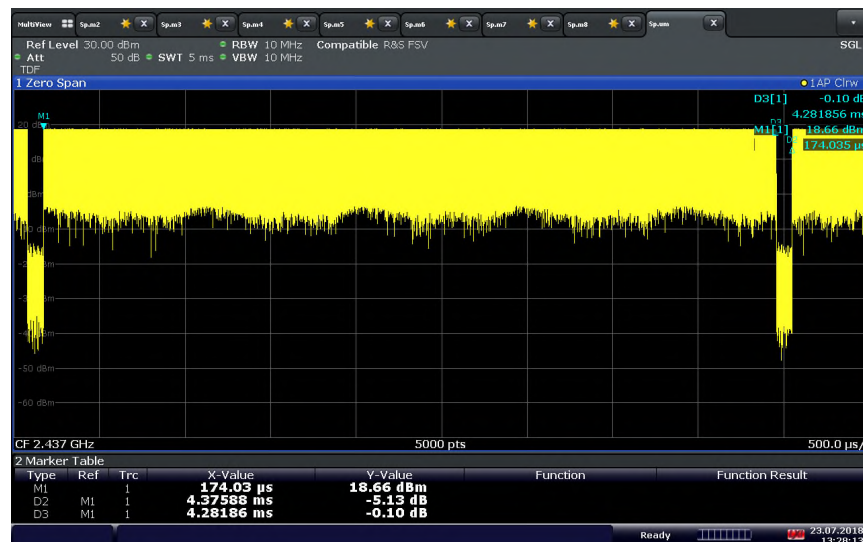
1.4.5 Duty Cycle and Transmission Duration Used (Worst Case Configuration)

Mode	$T (\mu s)$	Duty Cycle (x)	DCCF
802.11b	4281.86	0.9729	0.12 dB
802.11g	243.55	0.6895	1.61 dB
802.11n	459.99	0.8117	0.91 dB



13:19:22 23.07.2018

Sample Duty Cycle Calculation (802.11b) 2 Tx /8.80176 ms



13:28:14 23.07.2018

Sample T Verification (802.11b)

1.4.6 Simplified Test Configuration Diagram

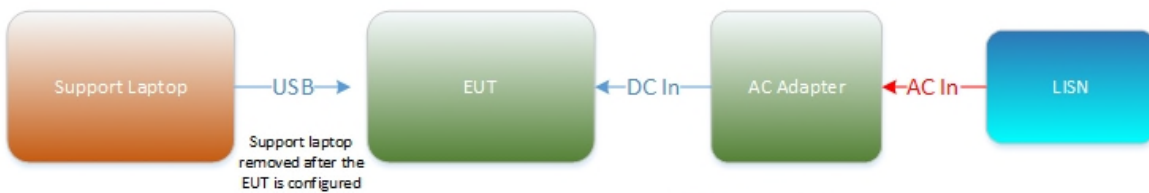
Test Configuration A



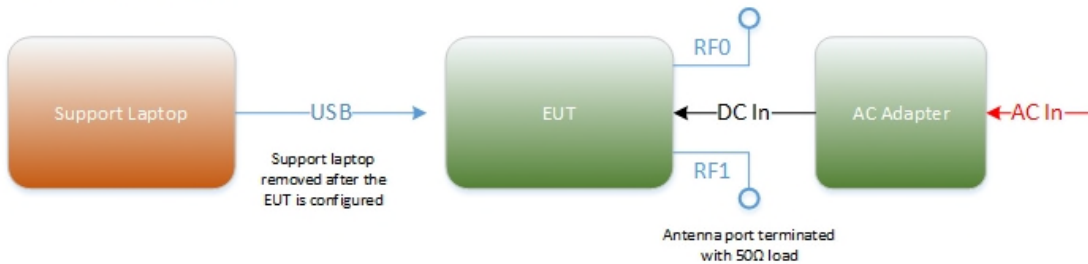
Test Configuration B



Test Configuration C



Test Configuration D



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 AZ280418A00067		
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 C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

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 C63.4-2014. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY LOCATION

1.8.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: 858 678 1400 FAX: 858 546 0364

1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)

16936 Via Del Campo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: (858) 678-1400 Fax: (858) 546-0364.

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Designation 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 Designation is US1146.



1.9.2 Innovation, Science and Economic Development Canada (IC) Registration No.: 3067A-1 & 22806-1

The 10m Semi-anechoic chamber of TÜV SÜD America Inc. (San Diego Rancho Bernardo) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 3067A-1.

The 3m Semi-anechoic chamber of TÜV SÜD America Inc. (San Diego Mira Mesa) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 22806-1.

1.9.3 BSMI – Laboratory Code: SL2-IN-E-028R (US0102)

TÜV Product Service Inc. (San Diego) is a recognized EMC testing laboratory by the BSMI under the MRA (Mutual Recognition Arrangement) with the United States. Accreditation includes CNS 13438 up to 6GHz.

1.9.4 NCC (National Communications Commission - US0102)

TÜV SÜD America Inc. (San Diego) is listed as a Foreign Recognized Telecommunication Equipment Testing Laboratory and is accredited to ISO/IEC 17025 (A2LA Certificate No.2955.13) which under APEC TEL MRA Phase 1 was designated as a Conformity Assessment Body competent to perform testing of equipment subject to the Technical Regulations covered under its scope of accreditation including RTTE01, PLMN01 and PLMN08 for TTE type of testing and LP002 for Low-Power RF Device type of testing.

1.9.5 VCCI – Registration No. A-0280 and A-0281

TÜV SÜD America Inc. (San Diego) is a VCCI registered measurement facility which includes radiated field strength measurement, radiated field strength measurement above 1GHz, mains port interference measurement and telecommunication port interference measurement.

1.9.6 RRA – Identification No. US0102

TÜV SÜD America Inc. (San Diego) is National Radio Research Agency (RRA) recognized laboratory under Phase I of the APEC Tel MRA.

1.9.7 OFCA – U.S. Identification No. US0102

TÜV SÜD America Inc. (San Diego) is recognized by Office of the Communications Authority (OFCA) under Appendix B, Phase I of the APEC Tel MRA.



SECTION 2

TEST DETAILS

Radio Testing of the
Novatel Wireless Inc.
MIFI8800L Wireless Hotspot Modem

2.1 MAXIMUM CONDUCTED OUTPUT POWER

2.1.1 Specification Reference

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

2.1.2 Standard Applicable

(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 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: AZ280418A00067 / Test Configuration A

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

July 23, 2018/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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.8 °C
Relative Humidity	55.3 %
ATM Pressure	98.9 kPa

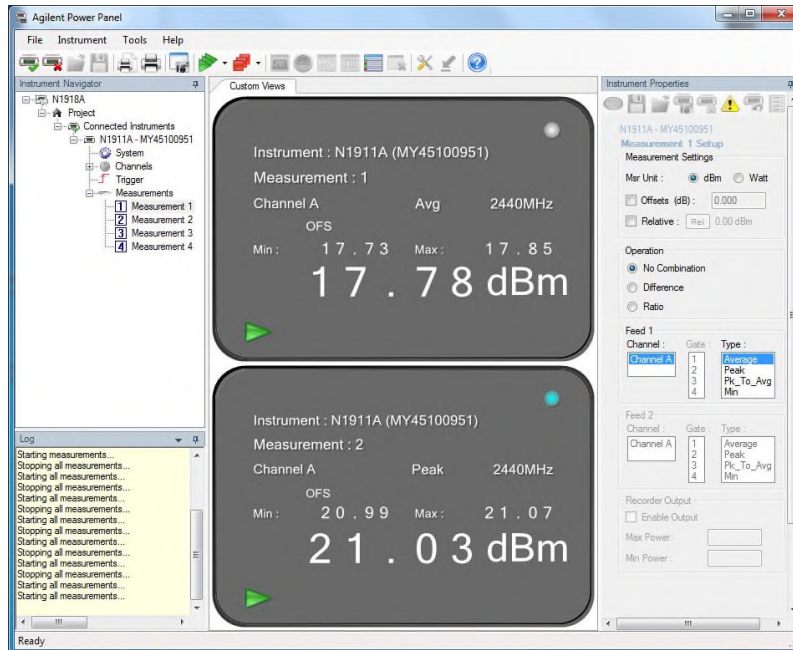
2.1.7 Additional Observations

- This is a conducted test (Maximum conducted [average] output power) using direct connection to power meters. Both antenna ports were monitored even in SISO mode.
- Path loss was measured and added to compensate for the external attenuator and cable used from the antenna port to the power sensor.
- Test methodology is per Clause 9.2.3.1 of KDB 558074 D01 (DTS Meas Guidance v04, April 5, 2018). All conditions under this Clause are satisfied.
- The EUT transmits continuously. Only worst case data rate test result presented.
- EUT complies with the 30dBm limit.

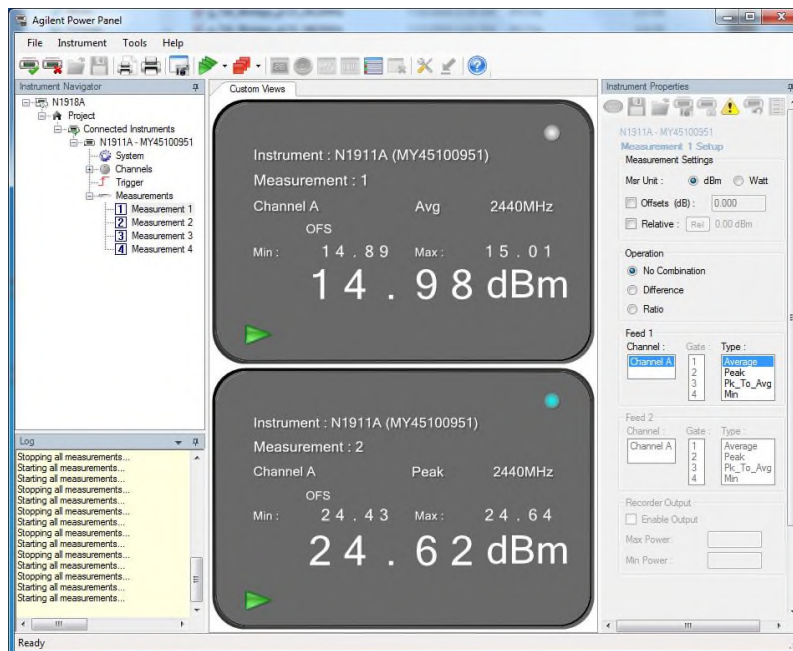
2.1.8 Test Results

WLAN Mode	Channel	Data Rates (Mbps)	Maximum Conducted Output Power (dBm)	
			Worst Case TX Chain	MIMO
802.11b	1 (2412 MHz)	2	17.85	19.94
	6 (2437 MHz)	2	17.78	20.77
	11 (2462 MHz)	2	17.6	20.88
802.11g	1 (2412 MHz)	36	14.91	17.42
	6 (2437 MHz)	36	14.87	17.67
	11 (2462 MHz)	36	14.68	17.87
802.11n	1 (2412 MHz)	21.7 (MCS2)	14.95	17.64
	6 (2437 MHz)	21.7 (MCS2)	14.82	17.63
	11 (2462 MHz)	21.7 (MCS2)	14.63	17.23

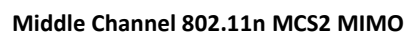
2.1.9 Sample Test Plots



Middle Channel 802.11b 2 Mbps SISO RFO



Middle Channel 802.11g 36 Mbps SISO RFO



2.2 CONDUCTED EMISSIONS

2.2.1 Specification Reference

FCC CFR 47 Part 15, Clause 15.207(a)
RSS-Gen, Section 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 μ H/50 ohms line impedance stabilization network (LISN).

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

**Decreases with the logarithm of the frequency.*

2.2.3 Equipment Under Test and Modification State

Serial No: AZ280418A00067/Test Configuration B

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

July 27, 2018/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/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.9 °C
Relative Humidity	46.1 %
ATM Pressure	98.7 kPa

2.2.7 Additional Observations

Measurement was done using EMC32 V8.53 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.2.8 for sample computation.

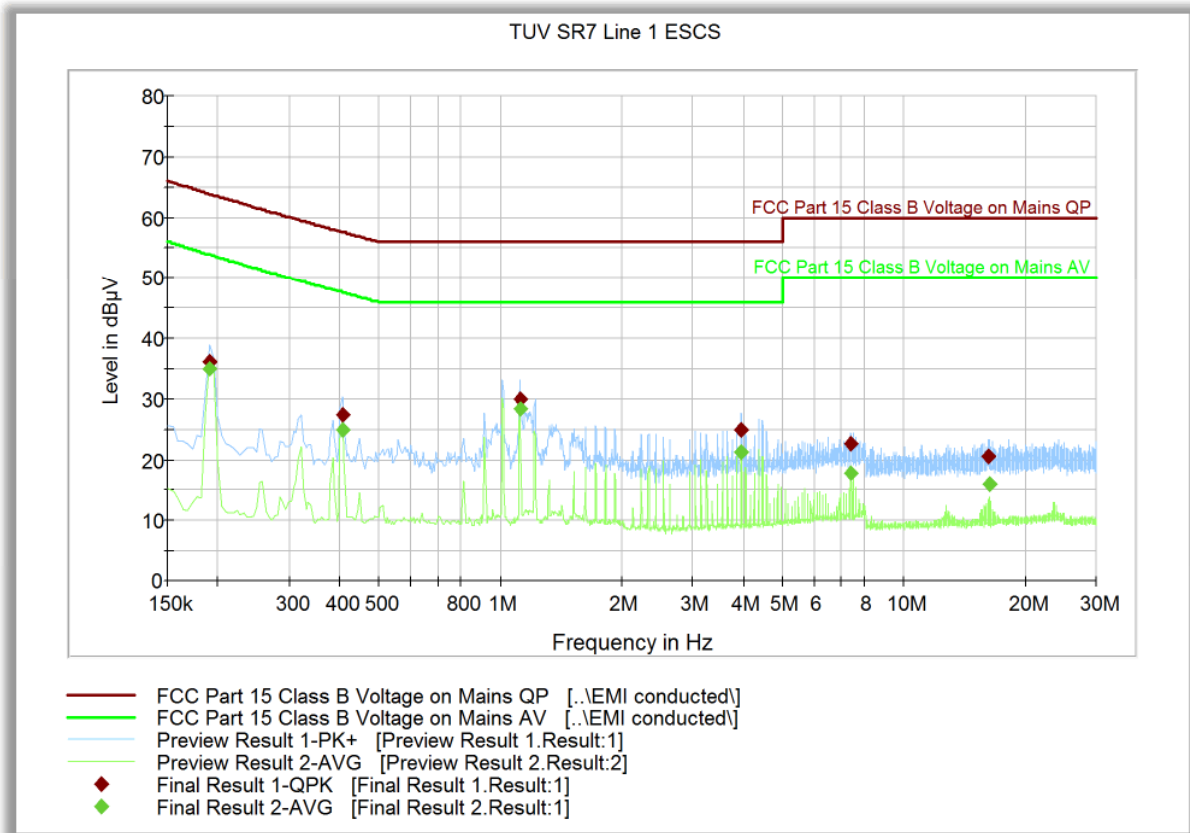
2.2.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (db μ V) @ 150kHz			5.5
Correction Factor (dB)	Asset# 8607 (20 dB attenuator)	19.9	20.7
	Asset# 1177 (cable)	0.15	
	Asset# 1176 (cable)	0.35	
	Asset# 7568 (LISN)	0.30	
Reported QuasiPeak Final Measurement (db μ V) @ 150kHz			26.2

2.2.9 Test Results

Compliant. See attached plots and tables.

2.2.10 MIFI8800L 120VAC 60Hz (Line 1)



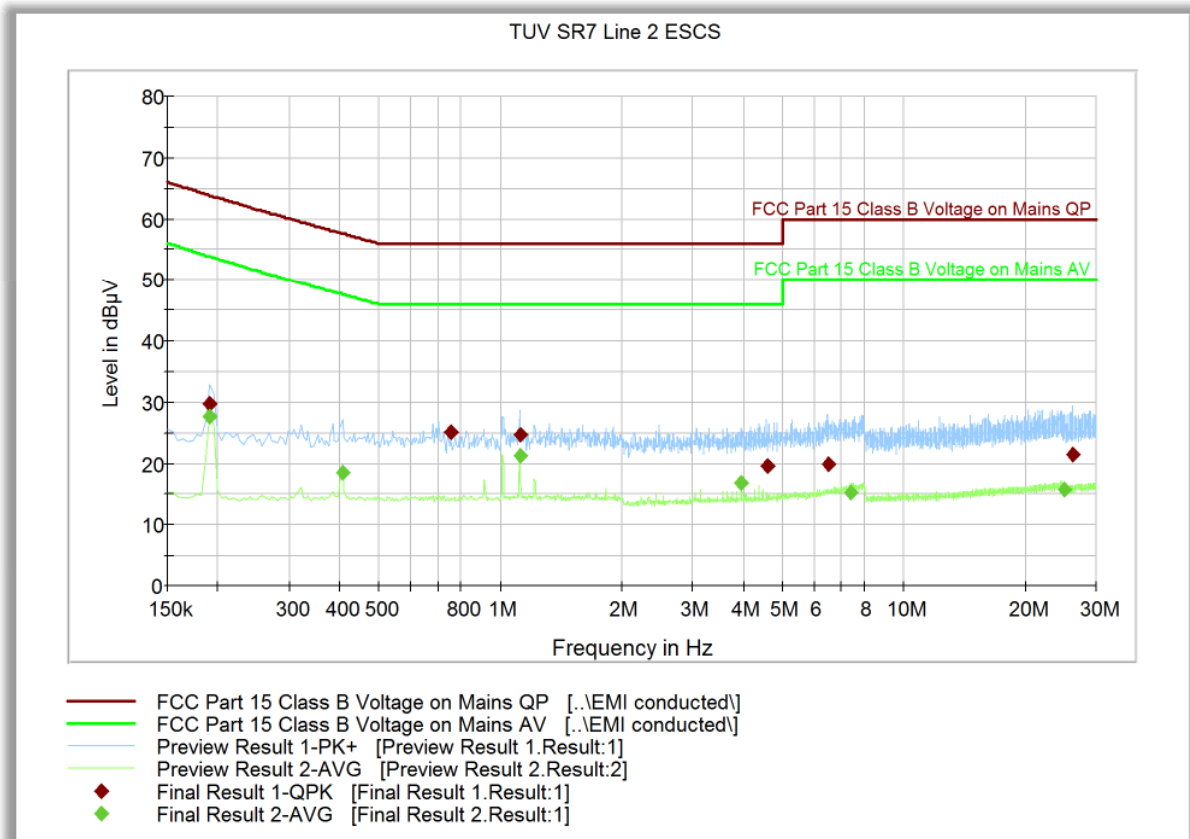
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.190500	36.1	1000.0	9.000	Off	L1	20.2	27.8	63.9
0.406500	27.5	1000.0	9.000	Off	L1	20.3	30.2	57.6
1.117500	29.9	1000.0	9.000	Off	L1	20.2	26.1	56.0
3.961500	25.0	1000.0	9.000	Off	L1	20.5	31.0	56.0
7.413000	22.6	1000.0	9.000	Off	L1	20.5	37.4	60.0
16.219500	20.6	1000.0	9.000	Off	L1	20.7	39.4	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.190500	34.9	1000.0	9.000	Off	L1	20.2	19.0	53.9
0.406500	24.8	1000.0	9.000	Off	L1	20.3	22.8	47.6
1.117500	28.4	1000.0	9.000	Off	L1	20.2	17.6	46.0
3.961500	21.2	1000.0	9.000	Off	L1	20.5	24.8	46.0
7.413000	17.7	1000.0	9.000	Off	L1	20.5	32.3	50.0
16.251000	16.0	1000.0	9.000	Off	L1	20.7	34.0	50.0

2.2.11 MIFI8800L 120VAC 60Hz (Line 2)



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.190500	29.7	1000.0	9.000	Off	N	20.2	34.2	63.9
0.757500	25.2	1000.0	9.000	Off	N	20.2	30.8	56.0
1.117500	24.8	1000.0	9.000	Off	N	20.3	31.2	56.0
4.578000	19.7	1000.0	9.000	Off	N	20.4	36.3	56.0
6.522000	19.9	1000.0	9.000	Off	N	20.6	40.1	60.0
26.196000	21.5	1000.0	9.000	Off	N	20.8	38.5	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.190500	27.7	1000.0	9.000	Off	N	20.2	26.2	53.9
0.406500	18.4	1000.0	9.000	Off	N	20.3	29.2	47.6
1.117500	21.2	1000.0	9.000	Off	N	20.3	24.8	46.0
3.961500	17.0	1000.0	9.000	Off	N	20.5	29.0	46.0
7.413000	15.3	1000.0	9.000	Off	N	20.5	34.7	50.0
24.985500	15.9	1000.0	9.000	Off	N	20.7	34.1	50.0

2.3 99% EMISSION BANDWIDTH

2.3.1 Specification Reference

RSS-Gen, Section 6.7

2.3.2 Standard Applicable

The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

2.3.3 Equipment Under Test and Modification State

Serial No: AZ280418A00067 / Test Configuration B

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

July 23, 2018/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/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.8 °C
Relative Humidity	55.3 %
ATM Pressure	98.9 kPa

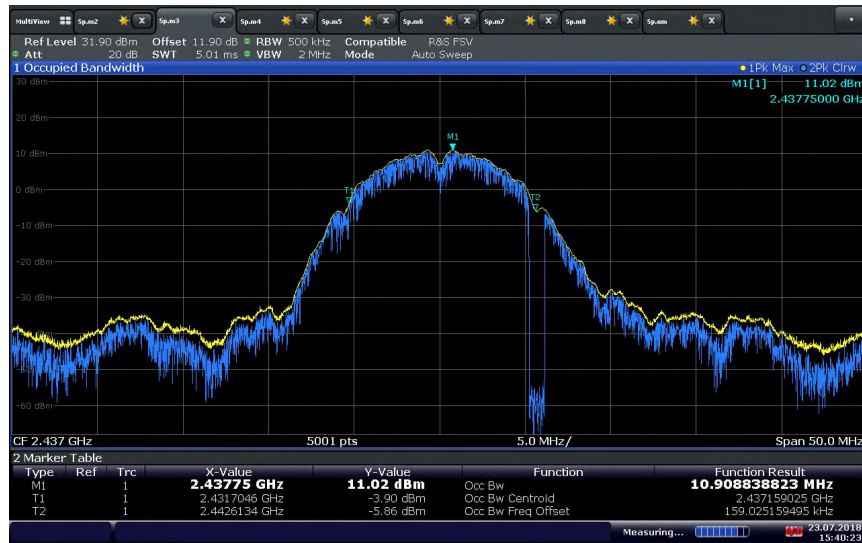
2.3.7 Additional Observations

- This is a conducted test.
- Cable loss was used to compensate for the external attenuator and cable used.
- Span is wide enough to capture the channel transmission.
- RBW is 1% to 5% of the OBW.
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.
- The % Power Bandwidth setting in the spectrum analyser was set to 99% (default).
- The Channel Bandwidth measurement function of the spectrum analyser was used for this test.

2.3.8 Test Results (For reporting purposes only)

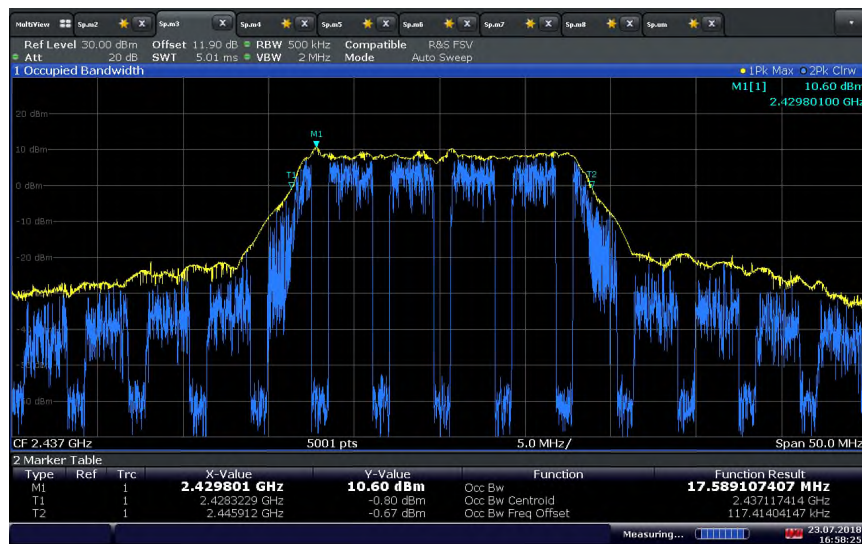
Mode	Channel	Measured 99% Bandwidth (MHz)
802.11b	1 (2412 MHz)	10.79
	6 (2437 MHz)	10.91
	11 (2462 MHz)	10.79
802.11g	1 (2412 MHz)	17.22
	6 (2437 MHz)	17.59
	11 (2462 MHz)	17.41
802.11n 20MHz BW	1 (2412 MHz)	18.15
	6 (2437 MHz)	18.49
	11 (2462 MHz)	18.33

2.3.9 Sample Test Results Plots



15:40:24 23.07.2018

802.11b Middle Channel



16:58:25 23.07.2018

802.11g Middle Channel



16:54:02 23.07.2018

802.11n Middle Channel (20 MHz BW)

2.4 MINIMUM 6 DB RF BANDWIDTH

2.4.1 Specification Reference

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

2.4.2 Standard Applicable

(2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

2.4.3 Equipment Under Test and Modification State

Serial No: AZ280418A00067 / Test Configuration B

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

July 23, 2018/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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.8 °C
Relative Humidity	55.3 %
ATM Pressure	98.9 kPa

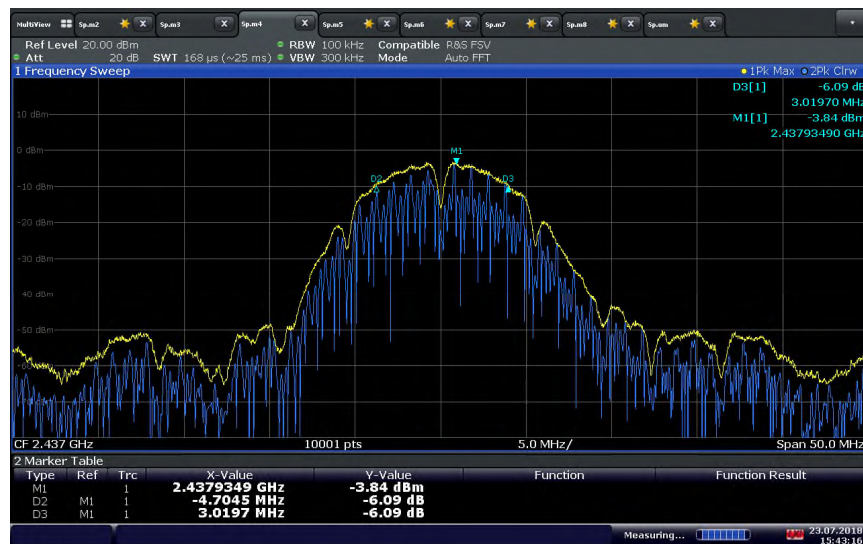
2.4.7 Additional Observations

- This is a conducted test.
- Path loss was measured and added to compensate for the external attenuator and cable used.
- Span is wide enough to capture the channel transmission.
- RBW was set to 100 kHz while VBW is $\geq 3X$ RBW.
- Sweep is auto while Detector used is peak.
- If the “n” dB down marker function of the spectrum analyser is not appropriate for the type of signal being measured, then a horizontal line will be drawn where the signal is 6 dB down from the peak measurement. The BW will be measured using the outermost points where the signal intersects the line.

2.4.8 Test Results

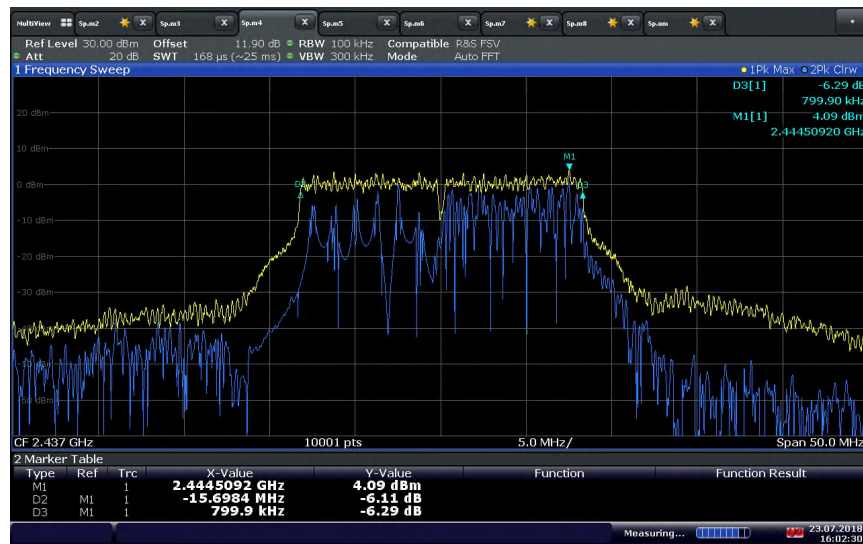
Mode	Channel	Measured Bandwidth (MHz)	Minimum Bandwidth (MHz)	Compliance
802.11b	1 (2412 MHz)	7.3293	0.500	Complies
	6 (2437 MHz)	7.7242	0.500	Complies
	11 (2462 MHz)	7.3893	0.500	Complies
802.11g	1 (2412 MHz)	16.3884	0.500	Complies
	6 (2437 MHz)	16.4983	0.500	Complies
	11 (2462 MHz)	16.4584	0.500	Complies
802.11n 20MHz BW	1 (2412 MHz)	17.8032	0.500	Complies
	6 (2437 MHz)	17.7182	0.500	Complies
	11 (2462 MHz)	17.6482	0.500	Complies

2.4.9 Sample Test Results Plots



15:43:17 23.07.2018

802.11b Middle Channel



802.11g Middle Channel



802.11n Middle Channel (20 MHz BW)

2.5 OUT-OF-BAND EMISSIONS - CONDUCTED

2.5.1 Specification Reference

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

2.5.2 Standard Applicable

(d) 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: AZ280418A00067 / Test Configuration B

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

July 23, 2018/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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

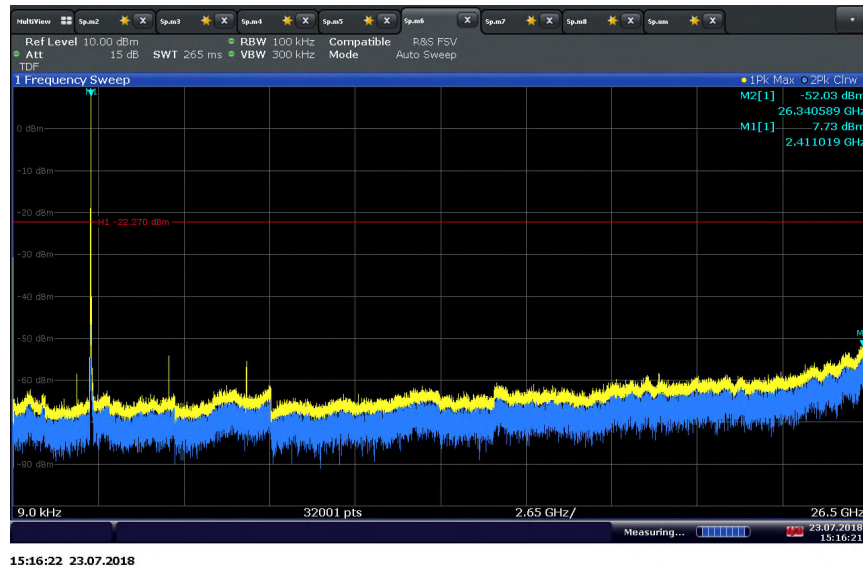
Ambient Temperature	24.8 °C
Relative Humidity	55.3 %
ATM Pressure	98.9 kPa



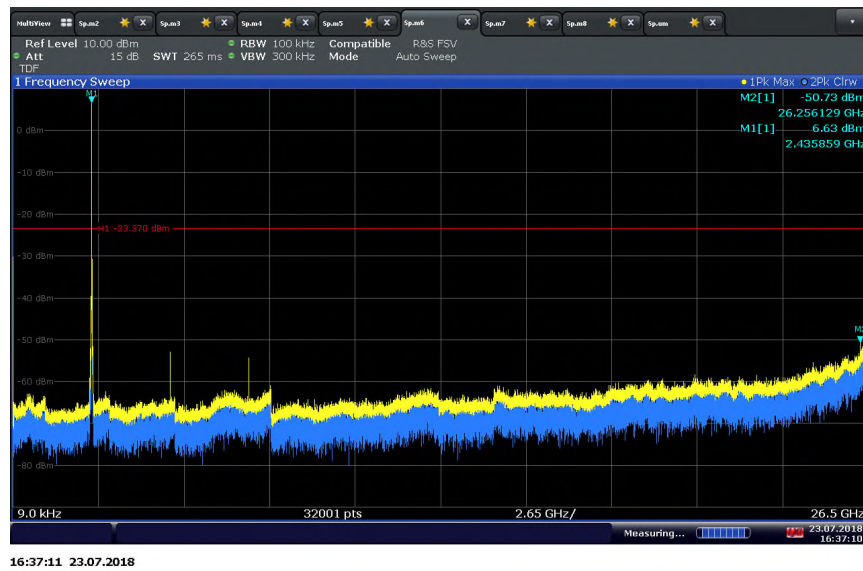
2.5.7 Additional Observations

- This is a conducted test.
- TDF (Transducer Factor) was used to compensate for the external attenuator and cable used.
- 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 (worst case).
- Spectrum was searched from 9 kHz up to 26.5GHz.
- Test performed on the worst case antenna port, there were no spurious emissions observed within 10dB of the limit so EUT complies even MIMO mode considered (limit used -3dB).

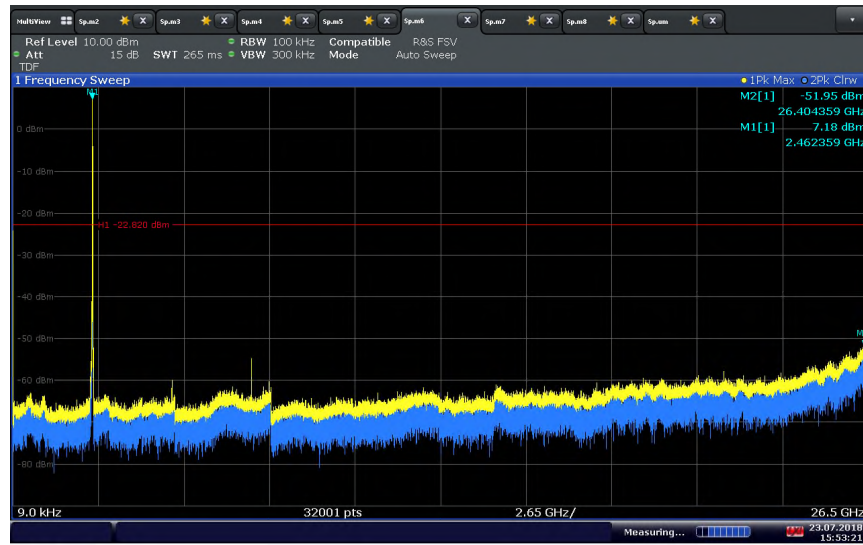
2.5.8 Test Results Plots



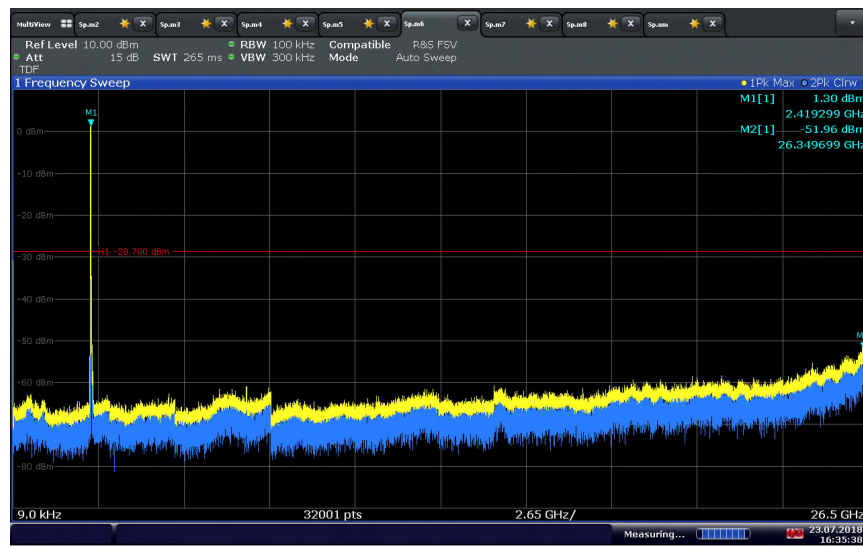
802.11b Low Channel



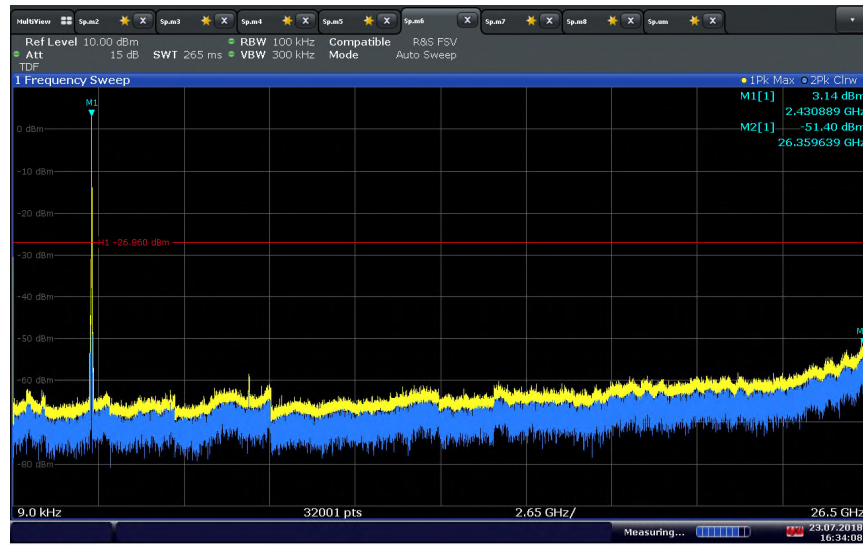
802.11b Middle Channel



802.11b High Channel

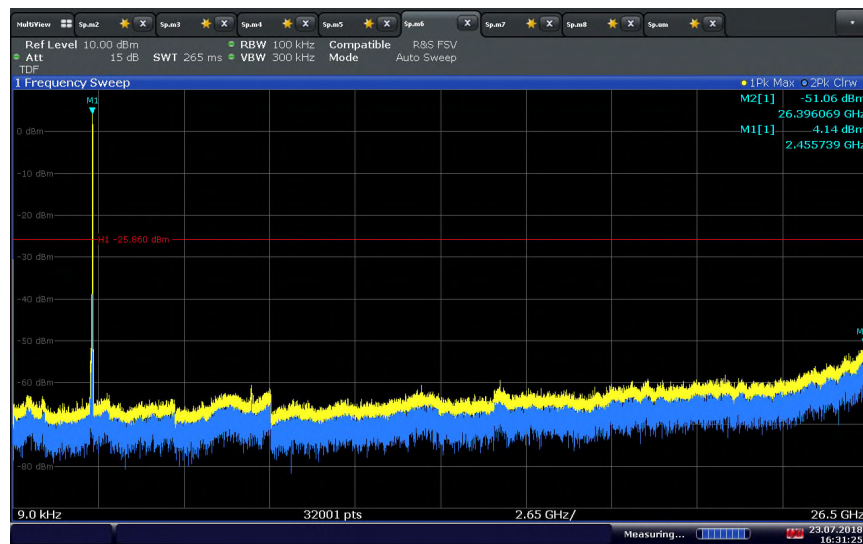


802.11g Low Channel



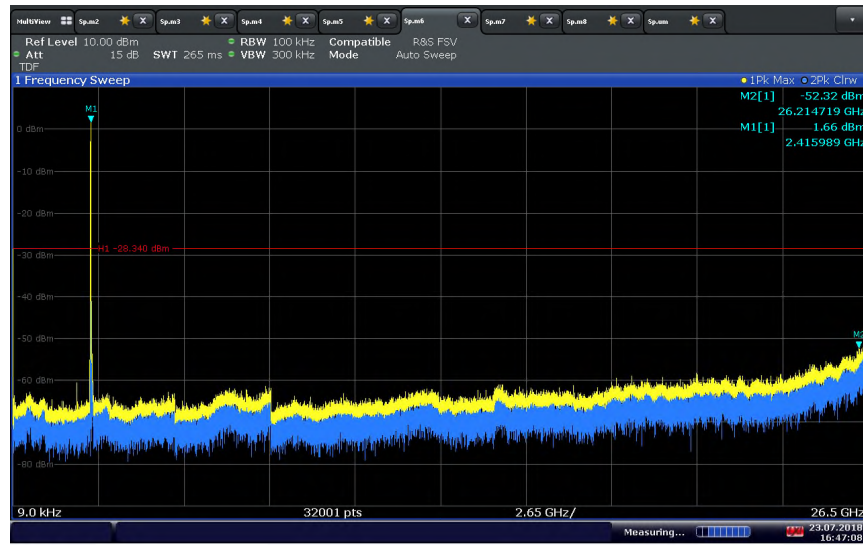
16:34:08 23.07.2018

802.11g Middle Channel



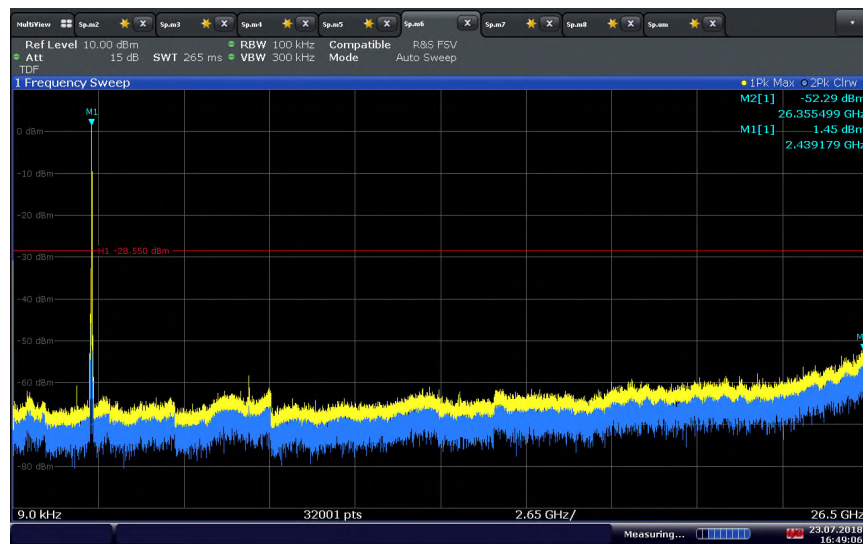
16:31:26 23.07.2018

802.11g High Channel



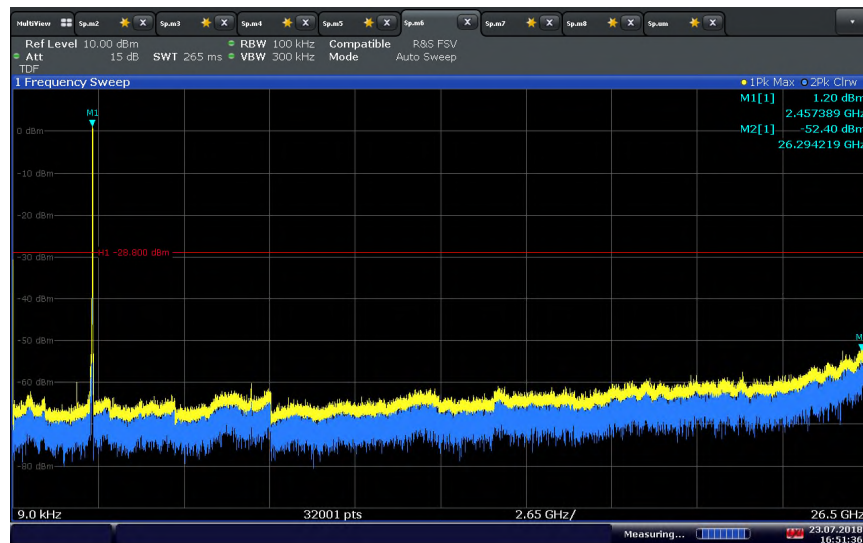
16:47:09 23.07.2018

802.11n Low Channel (20MHz BW)



16:49:07 23.07.2018

802.11n Middle Channel (20MHz BW)



16:51:37 23.07.2018

802.11n High Channel (20MHz BW)

2.6 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

2.6.1 Specification Reference

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

2.6.2 Standard Applicable

See previous test.

2.6.3 Equipment Under Test and Modification State

Serial No: AZ280418A00067 / Test Configuration B

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

July 24, 2018/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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.9 °C
Relative Humidity	55.9 %
ATM Pressure	98.8 kPa

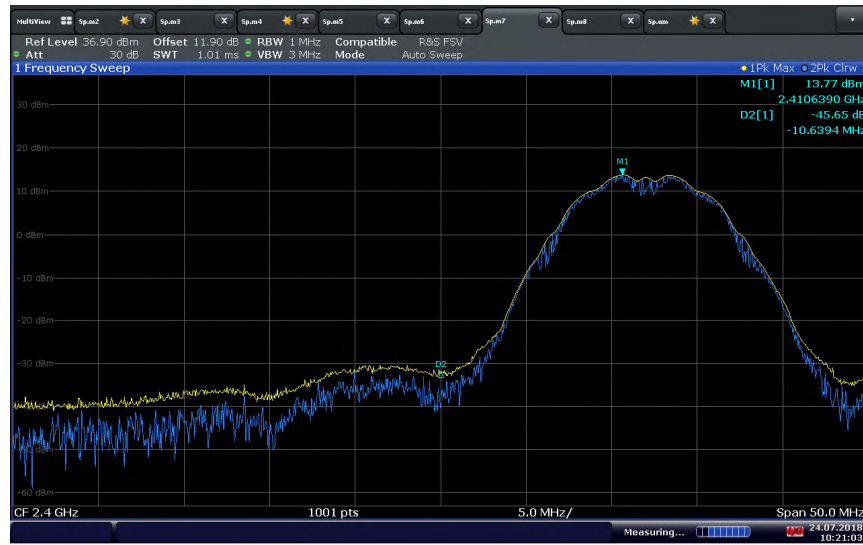
2.6.7 Additional Observations

- This is a conducted test.
- Path loss was measured and added to compensate for the external attenuator and cable used.
- Procedure is per Clause 12.2.4, 12.2.5.2 of KDB558074.

WLAN Mode	Peak Verification	Average Verification
802.11b	Clause 12.2.4	Clause 12.2.5.2
802.11g	Clause 12.2.4	Clause 12.2.5.2
802.11n	Clause 12.2.4	Clause 12.2.5.2

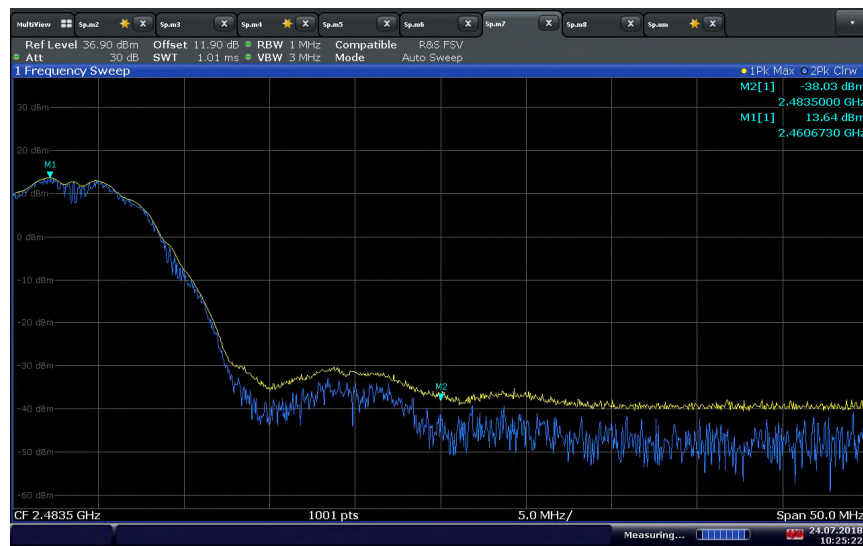
2.6.8 Test Results

Complies. See attached plots.



10:21:03 24.07.2018

802.11b Low Channel (2412 MHz)



10:25:23 24.07.2018

802.11b High Channel (2462 MHz Peak)

Upper Band Edge (in Restricted Band) measurement using Peak Power measurement procedure as per Clause 12.2.4 of KDB558074

Measured Peak = -38.03 dBm, since antenna gain is 0.1 dBi then EIRP is -37.93 dBm. Electric field strength in dBμV/m is then calculated using the formula:

$$E = \text{EIRP} - 20\log D + 104.8$$

Where: E = electric field strength in dBμV/m
 EIRP = equivalent isotropic radiated power in dBm
 D = specific measurement distance in meters

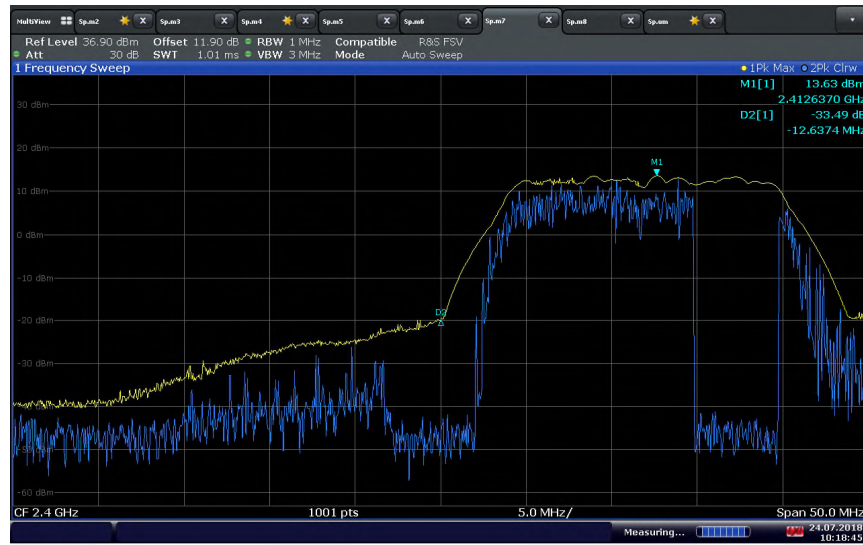
E is therefore = (-36.71 + 0.1 dBi) dBm – (20log 3 meters) + 104.8 + 3dB (MIMO)
 = 60.33 dBμV/m @ 3 meters (complies with 74 dBμV/m Peak limits)



802.11b High Channel (2462 MHz Average)

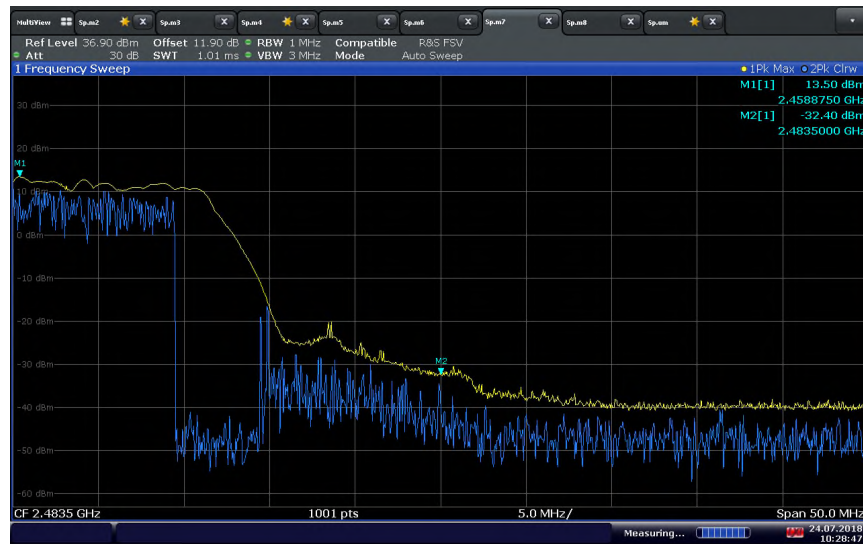
Upper Band Edge (in Restricted Band) measurement using Trace averaging with continuous EUT transmission at full power as per Clause 12.2.5.2 of KDB558074

E is therefore = (-50.08 + 0.1 dBi) dBm – (20log 3 meters) + 104.8 + 3dB (MIMO) + 0.12dB (DCCF)
 = 48.4 dBμV/m @ 3 meters (complies with 54 dBμV/m Average limits)



10:18:46 24.07.2018

802.11g Low Channel (2412 MHz)



10:28:48 24.07.2018

802.11g High Channel (2462 MHz Peak)

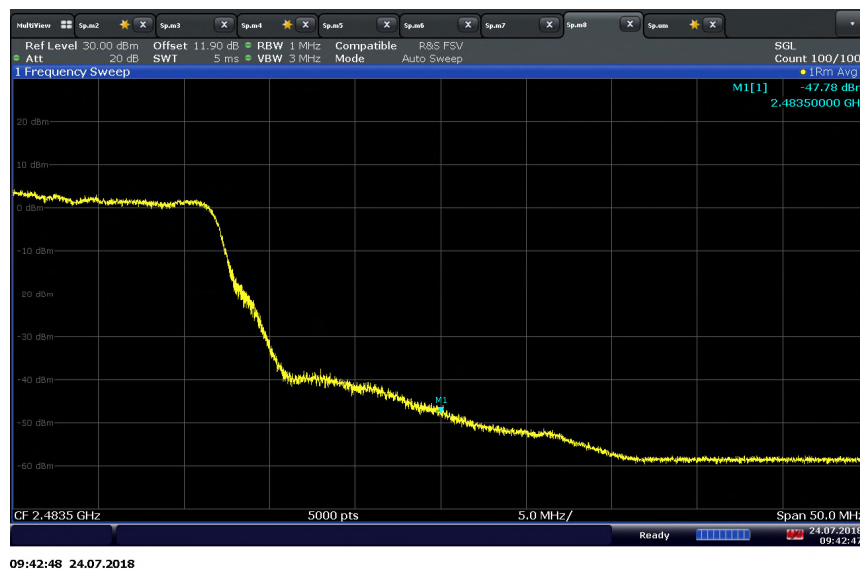
Upper Band Edge (in Restricted Band) measurement using Peak Power measurement procedure as per Clause 12.2.4 of KDB558074

Measured Peak = -32.4 dBm, since antenna gain is 0.1 dBi then EIRP is -32.3 dBm. Electric field strength in dBμV/m is then calculated using the formula:

$$E = \text{EIRP} - 20\log D + 104.8$$

Where: E = electric field strength in dBμV/m
 EIRP = equivalent isotropic radiated power in dBm
 D = specific measurement distance in meters

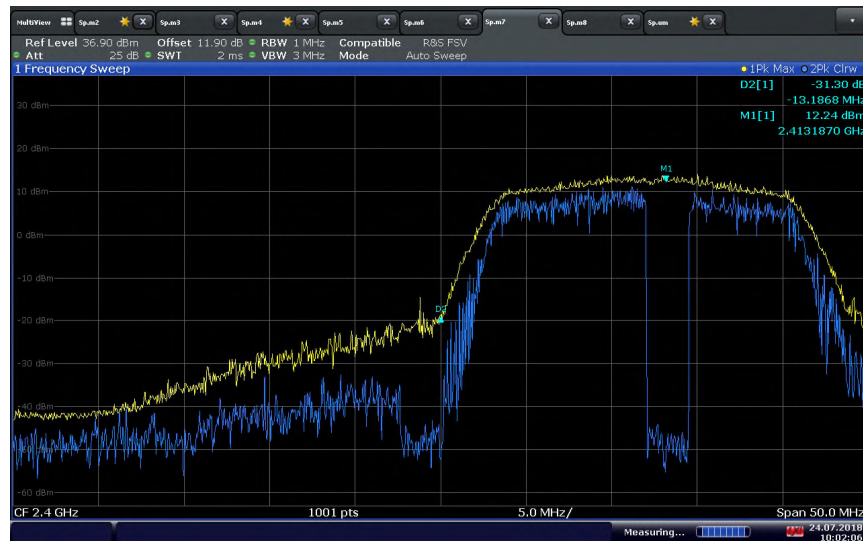
E is therefore = (-33.49 + 0.1 dBi) dBm – (20log 3 meters) + 104.8 + 3dB (MIMO)
 = 65.96 dBμV/m @ 3 meters (complies with 74 dBμV/m Peak limits)



802.11g High Channel (2462 MHz Average)

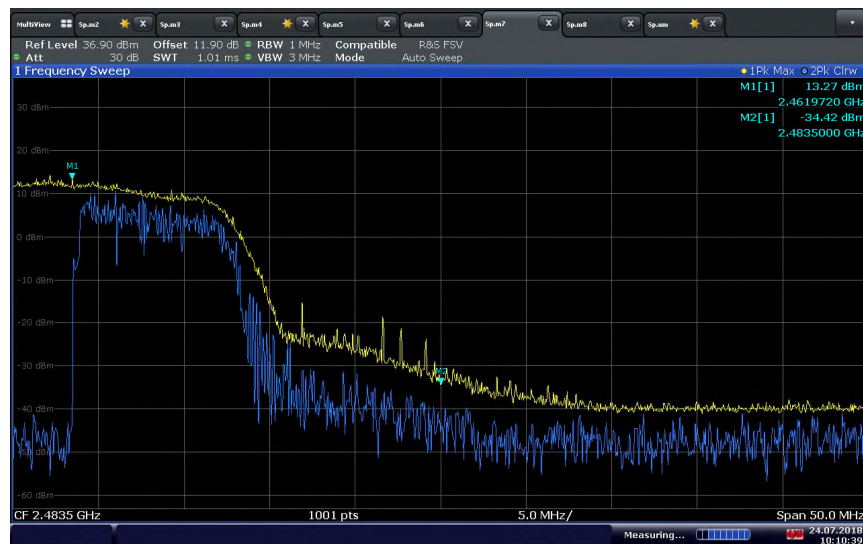
Upper Band Edge (in Restricted Band) measurement using Trace averaging across on and off times of the EUT transmissions followed by duty cycle correction as per Clause 12.2.5.2 of KDB558074

E is therefore = (-47.78 + 0.1 dBi) dBm – (20log 3 meters) + 104.8 + 3dB (MIMO) + 1.61dB (DCCF)
 = 52.19dBμV/m @ 3 meters (complies with 54 dBμV/m Average limits)



10:02:06 24.07.2018

802.11n Low Channel (2412 MHz)



10:10:39 24.07.2018

802.11n High Channel (2462 MHz Peak)

Upper Band Edge (in Restricted Band) measurement using Peak Power measurement procedure as per Clause 12.2.4 of KDB558074

Measured Peak = -34.42 dBm, since antenna gain is 0.1 dBi then EIRP is -34.32 dBm. Electric field strength in dBμV/m is then calculated using the formula:

$$E = \text{EIRP} - 20\log D + 104.8$$

Where: E = electric field strength in dBμV/m
 EIRP = equivalent isotropic radiated power in dBm
 D = specific measurement distance in meters

E is therefore = (-34.42 + 0.1 dBi) dBm – (20log 3 meters) + 104.8 + 3dB (MIMO)
 = 63.94 dBμV/m @ 3 meters (complies with 74 dBμV/m Peak limits)



802.11n High Channel (2462 MHz Average)

Upper Band Edge (in Restricted Band) measurement using Trace averaging across on and off times of the EUT transmissions followed by duty cycle correction as per Clause 12.2.5.2 of KDB558074

E is therefore = (-49.02 + 0.1 dBi) dBm – (20log 3 meters) + 104.8 + 3dB (MIMO) + 0.91 dB (DCCF)
 = 50.25 dBμV/m @ 3 meters (complies with 54 dBμV/m Average limits)

2.7 SPURIOUS RADIATED EMISSIONS

2.7.1 Specification Reference

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

2.7.2 Standard Applicable

(d) 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)).

2.7.3 Equipment Under Test and Modification State

Serial No: AZ280418A00067 / Test Configuration C

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

July 27 and 28, 2018/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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.9 – 26.5 °C
Relative Humidity	56.1 – 57.0 %
ATM Pressure	98.7 – 98.8 kPa



2.7.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic.
- Test Methodology is per Clause 12.1 of KDB558074 D01 DTS Meas Guidance v04.
- 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 worst case channel and data rate/MCS presented.
- 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 2.7.8 for sample computation.

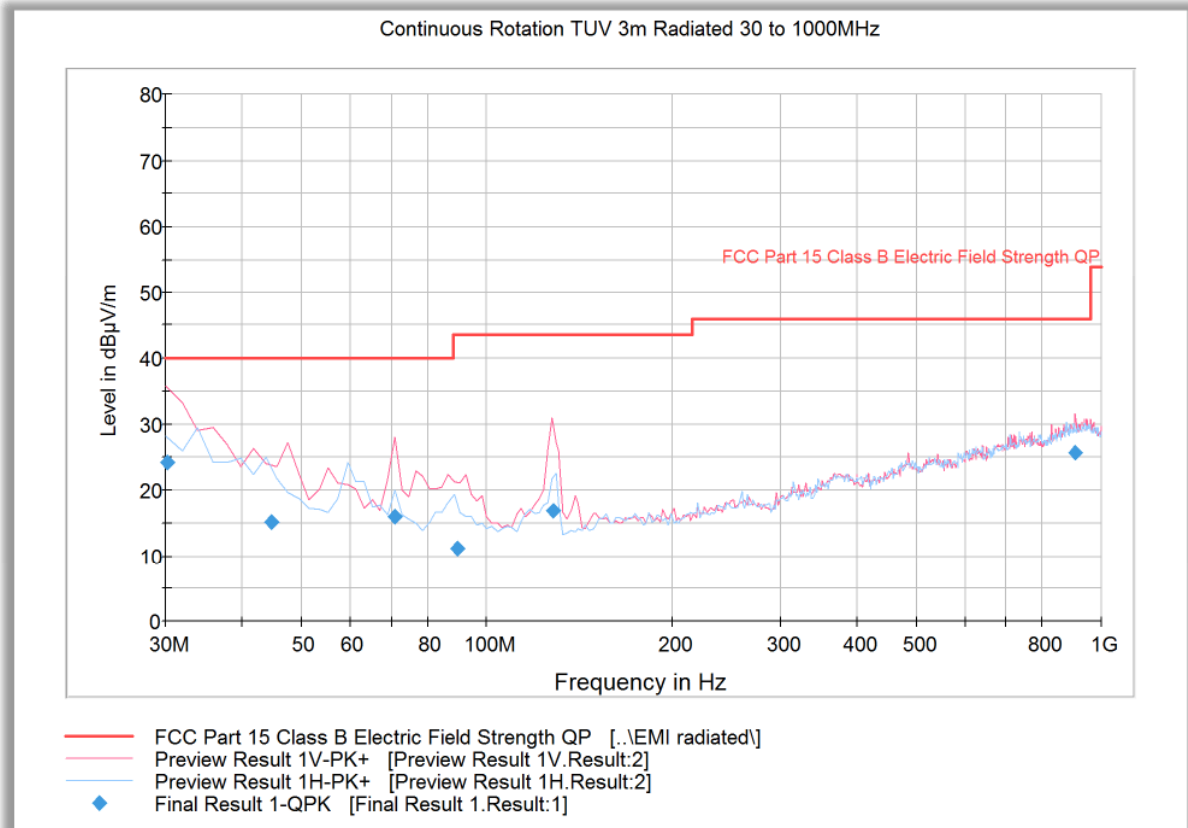
2.7.8 Sample Computation (Radiated Emission)

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

2.7.9 Test Results

See attached plots.

2.7.10 Test Results Below 1GHz (Worst Case Configuration – 802.11b High Channel 2 Mbps MIMO)

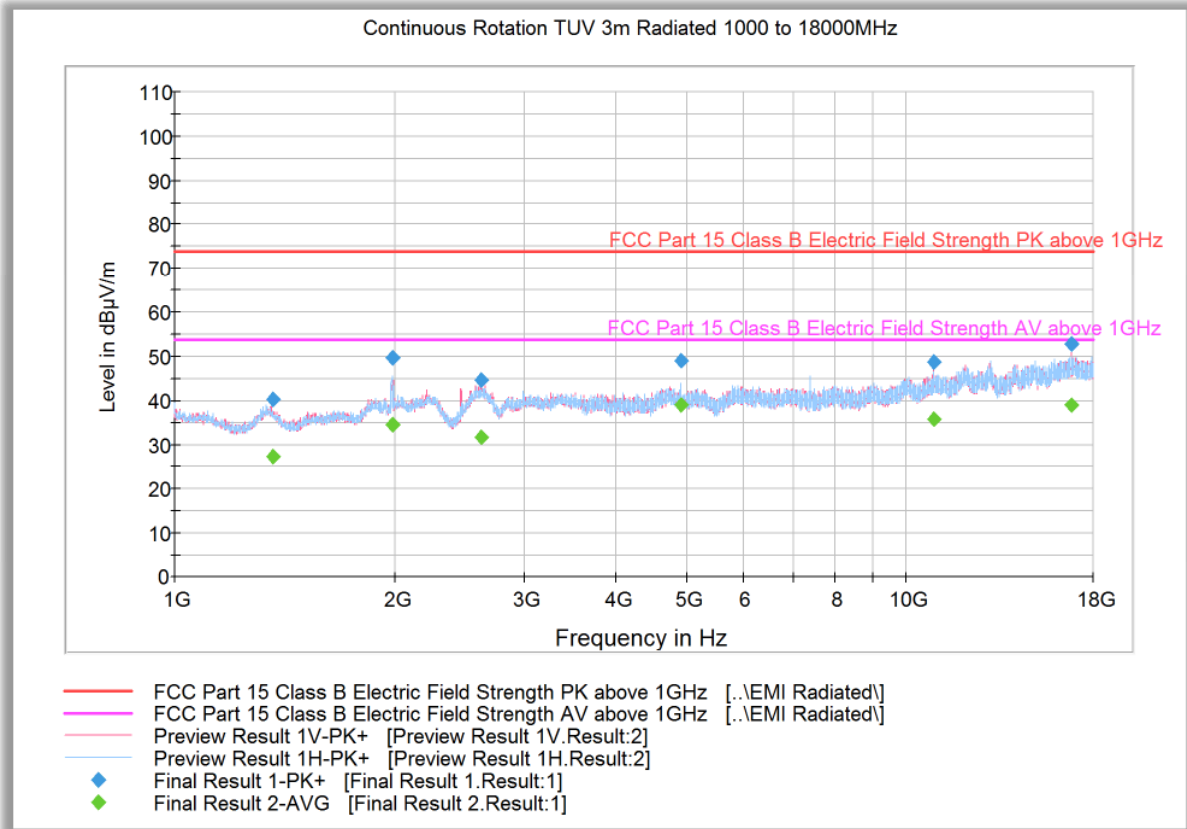


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.160000	24.1	1000.0	120.000	121.0	V	2.0	-6.5	15.9	40.0
44.454990	15.1	1000.0	120.000	159.0	V	128.0	-13.9	24.9	40.0
70.701643	16.1	1000.0	120.000	100.0	V	246.0	-17.2	23.9	40.0
89.532745	11.1	1000.0	120.000	106.0	V	284.0	-16.3	32.4	43.5
127.994389	16.7	1000.0	120.000	109.0	V	-4.0	-16.1	26.8	43.5
905.453387	25.6	1000.0	120.000	143.0	V	250.0	6.6	20.4	46.0

Test Notes: Only worst case channel presented for cabinet spurious emissions.

2.7.11 Test Results Above 1GHz (Worst Case Configuration – 802.11b High Channel 2 Mbps MIMO)



Peak Data

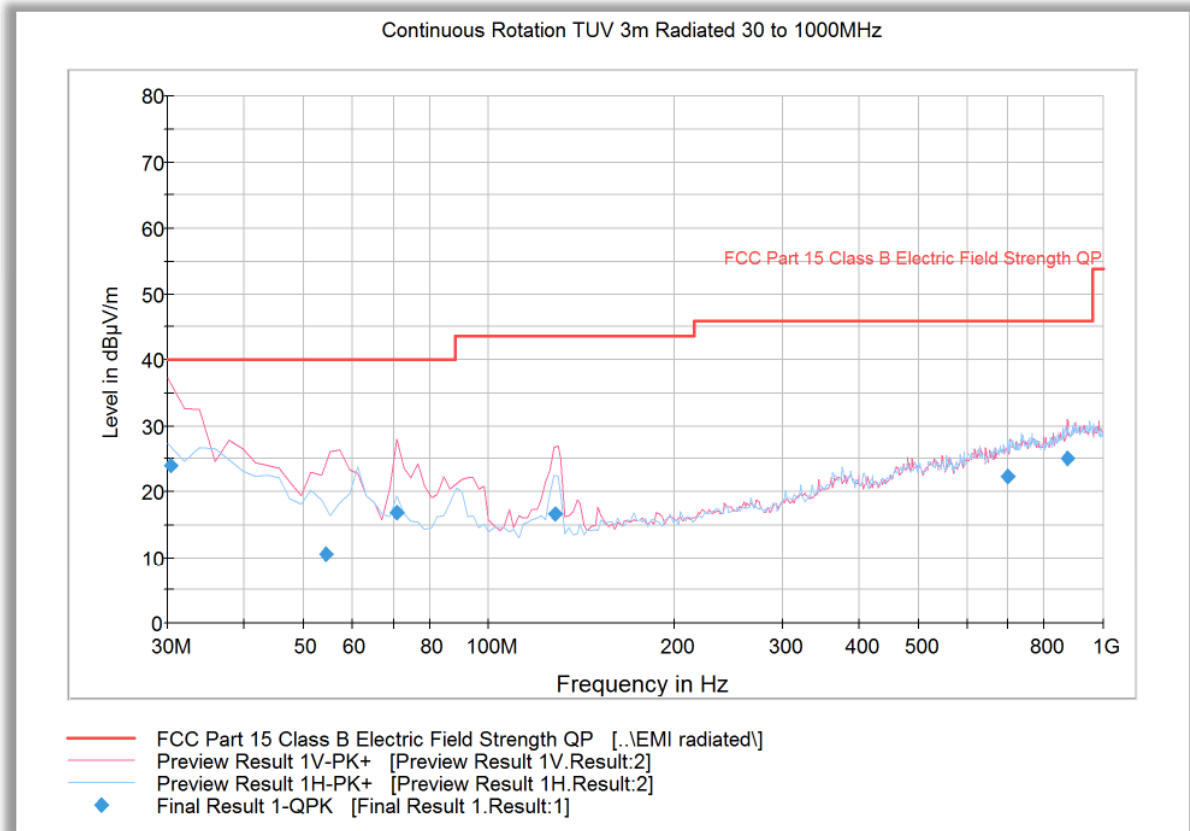
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1365.466667	40.2	1000.0	1000.000	131.7	V	192.0	-5.3	33.7	73.9
1981.300000	49.7	1000.0	1000.000	146.7	H	207.0	-2.3	24.2	73.9
2629.733333	44.8	1000.0	1000.000	103.7	V	320.0	-0.4	29.1	73.9
4923.966667	48.9	1000.0	1000.000	303.2	H	320.0	3.5	25.0	73.9
10910.833333	48.8	1000.0	1000.000	218.4	V	145.0	11.5	25.1	73.9
16813.433333	52.8	1000.0	1000.000	131.7	V	253.0	17.9	21.1	73.9

Average Data

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1365.466667	27.4	1000.0	1000.000	131.7	V	192.0	-5.3	26.5	53.9
1981.300000	34.7	1000.0	1000.000	146.7	H	207.0	-2.3	19.2	53.9
2629.733333	31.8	1000.0	1000.000	103.7	V	320.0	-0.4	22.1	53.9
4923.966667	39.1	1000.0	1000.000	303.2	H	320.0	3.5	14.8	53.9
10910.833333	35.9	1000.0	1000.000	218.4	V	145.0	11.5	18.0	53.9
16813.433333	38.9	1000.0	1000.000	131.7	V	253.0	17.9	15.0	53.9

Test Notes: No significant emissions observed above 18GHz. Measurements above 18GHz were noise floor figures. 2.4GHz notch filter used for this test.

2.7.12 Test Results Below 1GHz (Worst Case Configuration – 802.11g High Channel 36 Mbps MIMO)

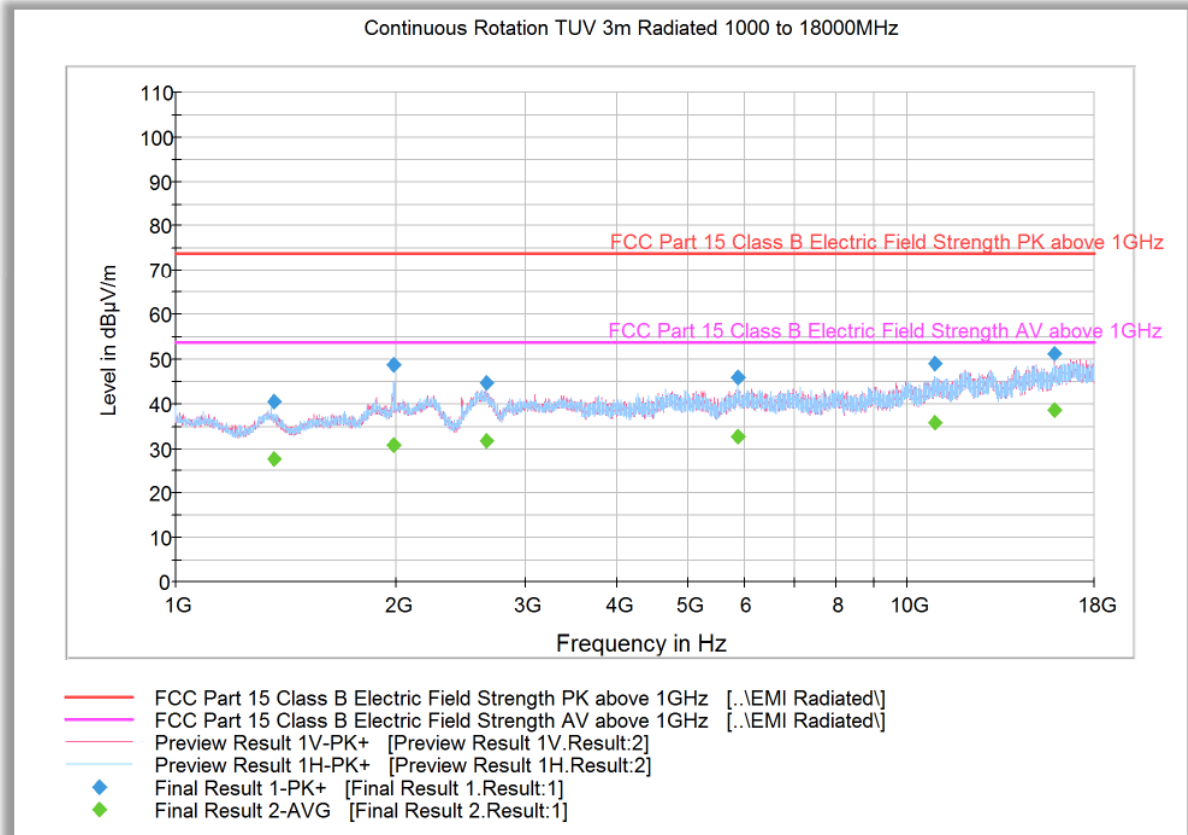


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.360000	24.1	1000.0	120.000	105.0	V	3.0	-6.6	15.9	40.0
54.374429	10.5	1000.0	120.000	105.0	V	246.0	-15.9	29.5	40.0
70.861643	16.8	1000.0	120.000	100.0	V	247.0	-17.2	23.2	40.0
127.978277	16.7	1000.0	120.000	100.0	V	282.0	-16.1	26.8	43.5
698.657395	22.2	1000.0	120.000	155.0	H	176.0	2.8	23.8	46.0
875.551182	25.1	1000.0	120.000	105.0	V	305.0	5.7	20.9	46.0

Test Notes: Only worst case channel presented for cabinet spurious emissions.

2.7.13 Test Results Above 1GHz (Worst Case Configuration – 802.11g High Channel 36 Mbps MIMO)



Peak Data

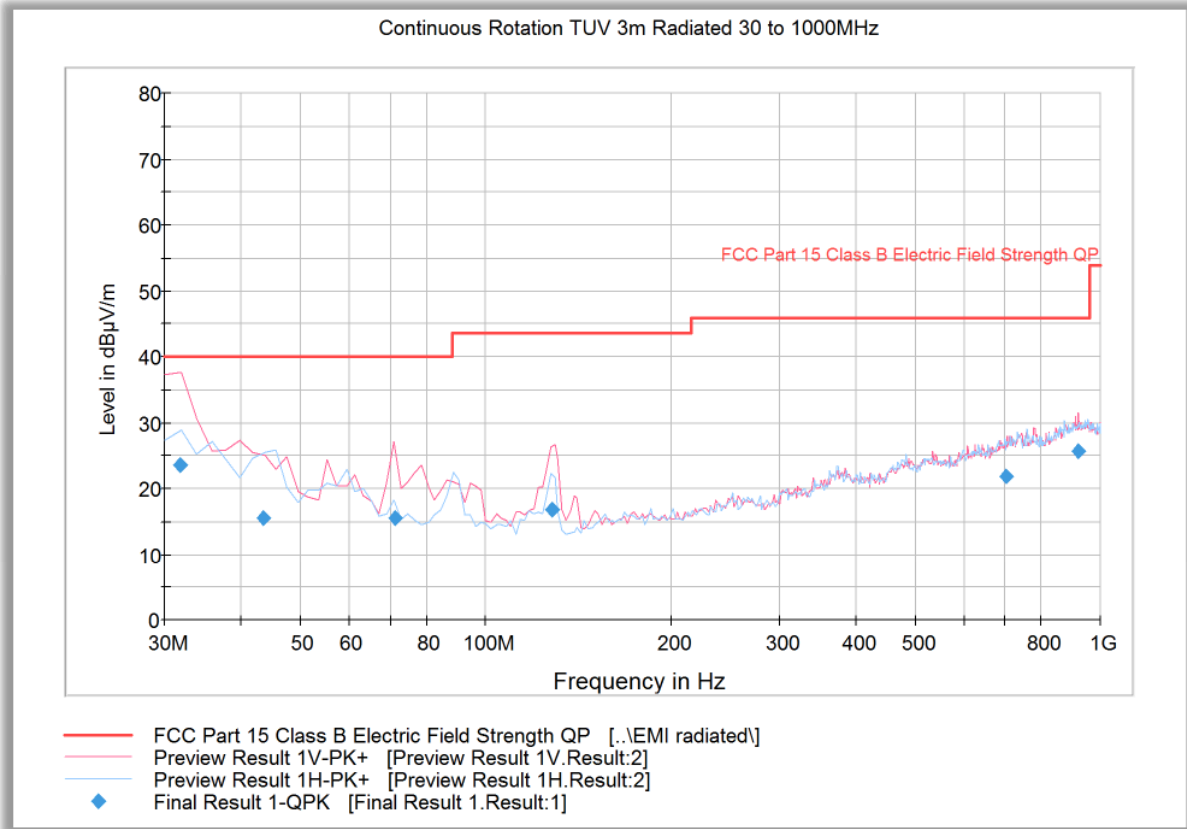
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1360.800000	40.5	1000.0	1000.000	209.4	V	54.0	-5.2	33.4	73.9
1987.900000	48.8	1000.0	1000.000	116.7	H	149.0	-2.3	25.1	73.9
2662.833333	44.7	1000.0	1000.000	352.7	H	143.0	-0.2	29.2	73.9
5852.366667	45.9	1000.0	1000.000	302.2	H	35.0	5.4	28.0	73.9
10902.633333	48.9	1000.0	1000.000	346.1	H	293.0	11.5	25.0	73.9
15834.200000	51.3	1000.0	1000.000	155.2	V	78.0	16.2	22.6	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)
1360.800000	27.5	1000.0	1000.000	209.4	V	54.0	-5.2	26.4	53.9
1987.900000	30.7	1000.0	1000.000	116.7	H	149.0	-2.3	23.2	53.9
2662.833333	31.8	1000.0	1000.000	352.7	H	143.0	-0.2	22.1	53.9
5852.366667	32.7	1000.0	1000.000	302.2	H	35.0	5.4	21.2	53.9
10902.633333	35.8	1000.0	1000.000	346.1	H	293.0	11.5	18.1	53.9
15834.200000	38.5	1000.0	1000.000	155.2	V	78.0	16.2	15.4	53.9

Test Notes: No significant emissions observed above 18GHz. Measurements above 18GHz were noise floor figures. 2.4GHz notch filter used for this test.

2.7.14 Test Results Below 1GHz (Worst Case Configuration – 802.11n Low Channel MCS2 MIMO)

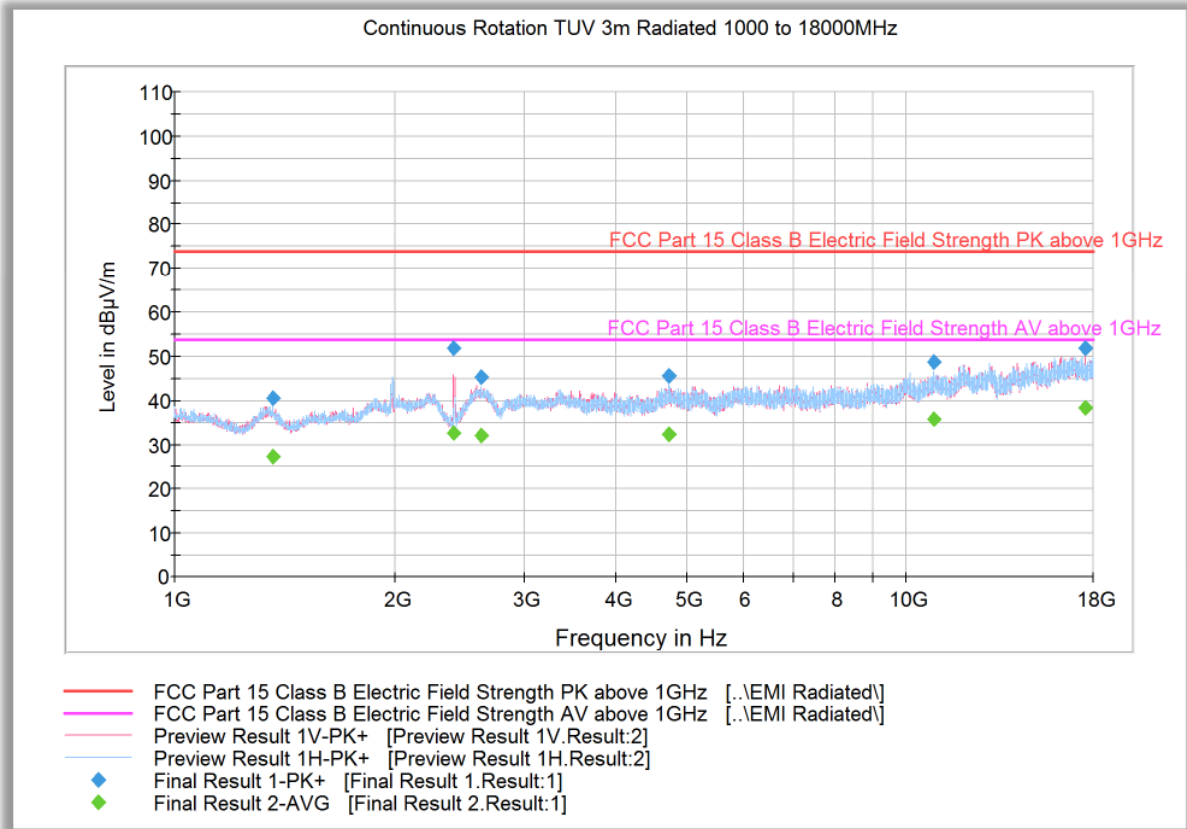


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
31.720000	23.5	1000.0	120.000	100.0	V	286.0	-7.7	16.5	40.0
43.311102	15.6	1000.0	120.000	277.0	H	15.0	-13.6	24.4	40.0
70.981643	15.5	1000.0	120.000	110.0	V	243.0	-17.2	24.5	40.0
127.978277	16.8	1000.0	120.000	100.0	V	2.0	-16.1	26.7	43.5
701.417395	22.0	1000.0	120.000	150.0	H	313.0	2.9	24.0	46.0
921.444489	25.7	1000.0	120.000	237.0	V	111.0	6.7	20.3	46.0

Test Notes: Only worst case channel presented for cabinet spurious emissions.

2.7.15 Test Results Above 1GHz (Worst Case Configuration – 802.11n Low Channel MCS2 MIMO)



Peak Data

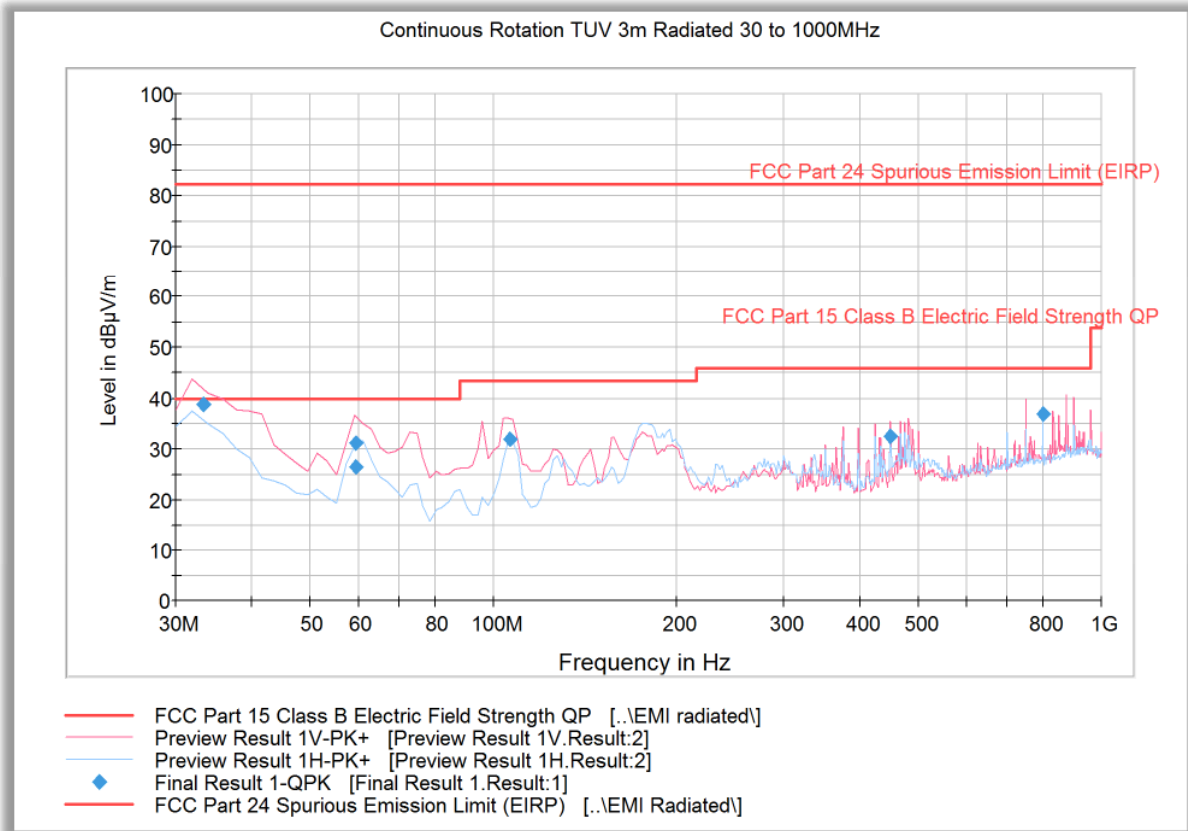
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1362.866667	40.4	1000.0	1000.000	151.2	H	-20.0	-5.2	33.5	73.9
2407.800000	52.0	1000.0	1000.000	306.2	V	293.0	-1.1	21.9	73.9
2622.166667	45.1	1000.0	1000.000	296.2	H	308.0	-0.4	28.8	73.9
4741.000000	45.7	1000.0	1000.000	136.7	H	309.0	3.5	28.2	73.9
10895.700000	48.7	1000.0	1000.000	151.6	H	277.0	11.5	25.2	73.9
17517.733333	51.8	1000.0	1000.000	152.2	V	164.0	17.7	22.1	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1362.866667	27.5	1000.0	1000.000	151.2	H	-20.0	-5.2	26.4	53.9
2407.800000	32.6	1000.0	1000.000	306.2	V	293.0	-1.1	21.3	53.9
2622.166667	32.1	1000.0	1000.000	296.2	H	308.0	-0.4	21.8	53.9
4741.000000	32.4	1000.0	1000.000	136.7	H	309.0	3.5	21.5	53.9
10895.700000	35.7	1000.0	1000.000	151.6	H	277.0	11.5	18.2	53.9
17517.733333	38.5	1000.0	1000.000	152.2	V	164.0	17.7	15.4	53.9

Test Notes: No significant emissions observed above 18GHz. Measurements above 18GHz were noise floor figures. 2.4GHz notch filter used for this test.

2.7.16 Test Results Below 1GHz (Co-located TX, both WLAN and Cell radio are active)

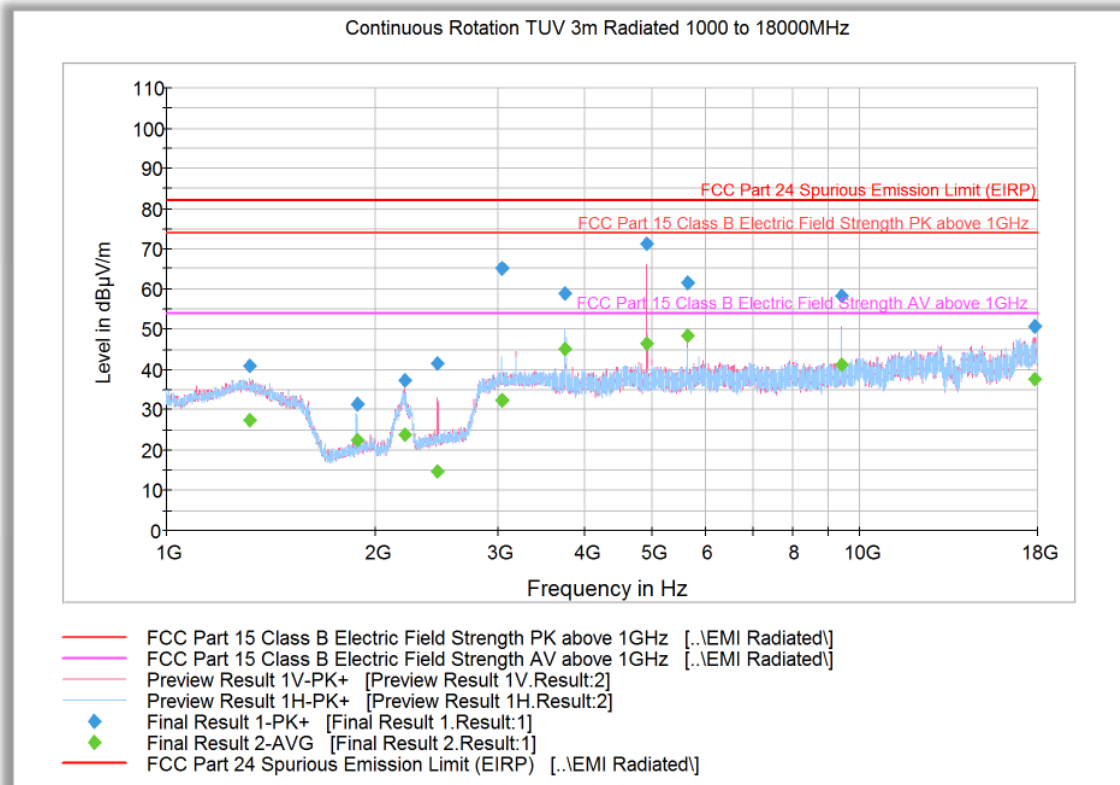


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
33.400000	38.7	1000.0	120.000	100.0	V	150.0	-9.1	1.3	40.0
59.542204	31.3	1000.0	120.000	150.0	V	3.0	-17.0	8.7	40.0
59.558317	26.5	1000.0	120.000	109.0	V	1.0	-17.0	13.5	40.0
106.667735	32.0	1000.0	120.000	100.0	V	246.0	-15.3	11.5	43.5
449.999760	32.6	1000.0	120.000	213.0	V	178.0	-3.2	3.4	46.0
800.003447	36.8	1000.0	120.000	100.0	V	170.0	4.0	9.2	46.0

Test Notes: Only worst case WLAN and licensed test configuration presented.

2.7.17 Test Results Above 1GHz (Co-located TX, both WLAN and Cell radio are active)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1315.266667	40.8	1000.0	1000.000	100.0	H	5.0	-5.2	33.1	73.9
1879.700000	31.4	1000.0	1000.000	299.0	H	11.0	-2.7	42.5	73.9
2201.866667	37.3	1000.0	1000.000	299.0	V	10.0	-1.7	36.6	73.9
2460.733333	41.7	1000.0	1000.000	136.0	V	11.0	-0.7	32.2	73.9
3043.200000	65.1	1000.0	1000.000	225.0	H	5.0	0.7	8.8	73.9
3756.633333	58.8	1000.0	1000.000	292.0	H	11.0	1.9	15.1	73.9
4923.966667	71.2	1000.0	1000.000	250.0	V	16.0	3.5	2.9	73.9
5636.600000	61.7	1000.0	1000.000	173.0	V	11.0	5.0	12.2	73.9
9403.866667	58.2	1000.0	1000.000	173.0	V	11.0	8.6	15.7	73.9
17870.800000	50.8	1000.0	1000.000	199.0	V	17.0	17.7	23.1	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1315.266667	27.4	1000.0	1000.000	100.0	H	5.0	-5.2	26.5	53.9
1879.700000	22.7	1000.0	1000.000	299.0	H	11.0	-2.7	31.2	53.9
2201.866667	24.0	1000.0	1000.000	299.0	V	10.0	-1.7	29.9	53.9
2460.733333	14.6	1000.0	1000.000	136.0	V	11.0	-0.7	39.3	53.9
3043.200000	32.4	1000.0	1000.000	225.0	H	5.0	0.7	21.5	53.9
3756.633333	45.1	1000.0	1000.000	292.0	H	11.0	1.9	8.8	53.9
4923.966667	46.5	1000.0	1000.000	250.0	V	16.0	3.5	7.4	53.9
5636.600000	48.5	1000.0	1000.000	173.0	V	11.0	5.0	5.4	53.9
9403.866667	41.1	1000.0	1000.000	173.0	V	11.0	8.6	12.8	53.9
17870.800000	37.7	1000.0	1000.000	199.0	V	17.0	17.7	16.2	53.9

Test Notes: Only worst case WLAN and licensed test configuration presented. 1.8 GHz and 2.4 GHz Notches were used during the test.

2.8 POWER SPECTRAL DENSITY

2.8.1 Specification Reference

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

2.8.2 Standard Applicable

(e) 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.

2.8.3 Equipment Under Test and Modification State

Serial No: AZ280418A00067 / Test Configuration B

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

July 23, 2018/XYZ

2.8.5 Test Equipment Used

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

2.8.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.8 °C
Relative Humidity	55.3 %
ATM Pressure	98.9 kPa

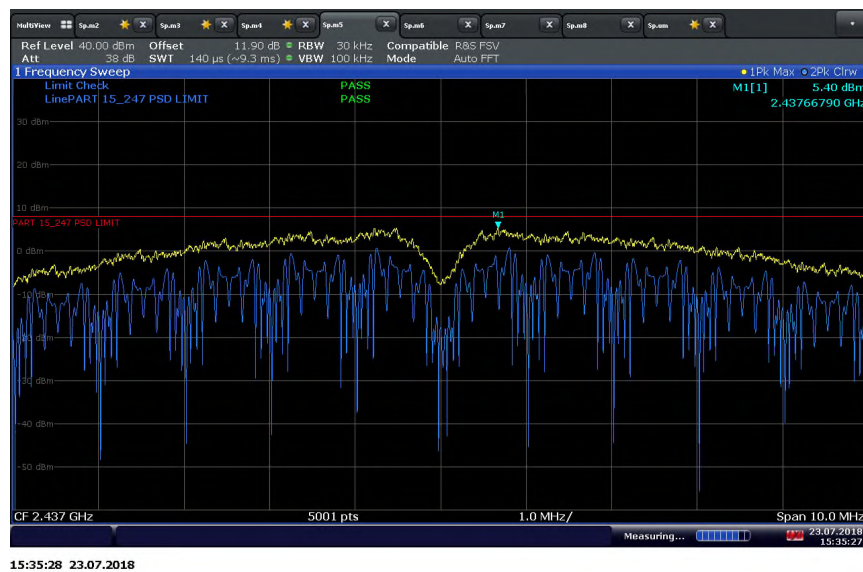
2.8.7 Additional Observations

- This is a conducted test.
- Test procedure is per Section 10.2 of KDB 558074 (April 15, 2017).
- Span is 1.5 times the DTS bandwidth.
- Path loss was measured and to compensate for the external attenuator and cable used.
- Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
- Set the VBW $\geq 3 \times \text{RBW}$
- Detector is Peak
- Sweep time is Auto Couple.
- Trace mode is max hold
- Trace allowed to fully stabilize.
- The RBW used during testing shall be reported.

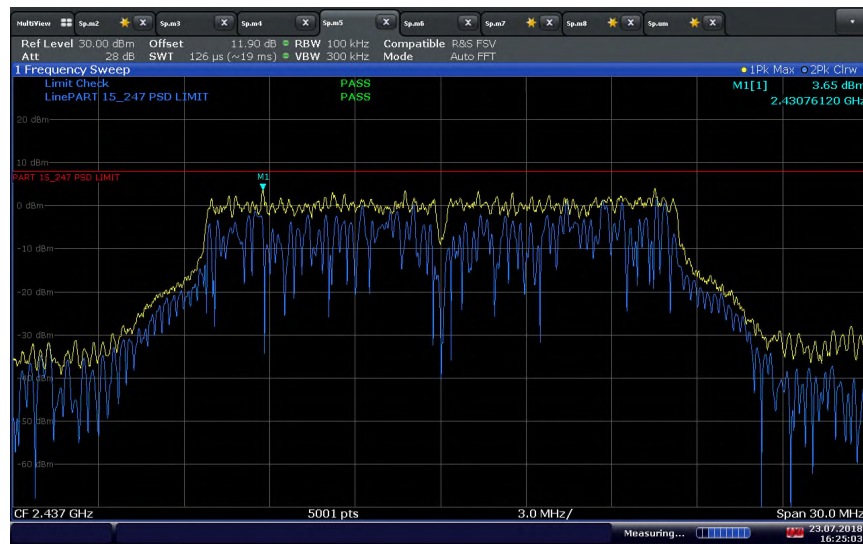
2.8.8 Test Results Summary

Mode	Channel	Marker Reading (dBm)/RBW used	PSD Limit (dBm)	Margin (dB)	Compliance
802.11b	1 (2412 MHz)	5.5/30kHz	8	2.5	Complies
	6 (2437 MHz)	5.4/30kHz	8	2.6	Complies
	11 (2462 MHz)	5.89/30kHz	8	2.11	Complies
802.11g	1 (2412 MHz)	3.64/100kHz	8	4.36	Complies
	6 (2437 MHz)	3.65/100kHz	8	4.35	Complies
	11 (2462 MHz)	3.56/100kHz	8	4.44	Complies
802.11n 20MHz BW	1 (2412 MHz)	2.48/100kHz	8	5.52	Complies
	6 (2437 MHz)	3.05/100kHz	8	4.95	Complies
	11 (2462 MHz)	3.27/100kHz	8	5.3	Complies

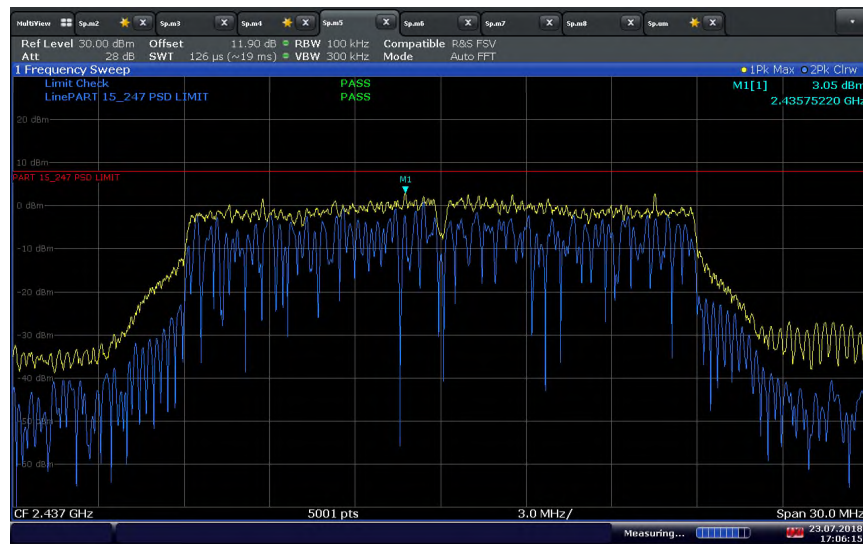
2.8.9 Sample Test Results Plots



802.11b Middle Channel



802.11g Middle Channel



802.11n Middle Channel

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IC: 3229A-MIFI8800
Report No. 72139211E



SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

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

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Antenna Conducted Port Setup						
7662	P-Series Power Meter	N1911A	MY45100951	Agilent	06/15/18	06/15/19
7661	50MHz-18GHz Wideband Power Sensor	N1921A	MY45241383	Agilent	06/15/18	06/15/19
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/19/17	09/19/19
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	12/14/17	12/14/18
-	10dB Attenuator	VAT-10W2+2W	N/A	MCL	Verified by 7608 and 7582	
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 7608 and 7582	
AC Conducted Emissions Test Setup						
1024	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	09/15/17	09/15/18
7567	LISN	FCC-LISN-50-25-2	120304	Fischer Custom Comm.	12/14/17	12/14/19
8822	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	Verified by 7608 and 7582	
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	Verified by 7608 and 7582	
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	12/14/17	12/14/18
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/19/17	09/19/19
Radiated Test Setup						
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	12/14/17	12/14/18
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	09/19/17	09/19/19
1033	Bilog Antenna	3142C	00044556	EMCO	10/11/16	10/11/18
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	06/16/18	06/16/20
1193	Pre-amplifier	PAM-0202	185	A.H. Systems, Inc.	04/11/18	04/11/19
8921	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	Verified by 7608 and 7582	
8923	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	Verified by 7608 and 7582	
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	10/25/17	10/25/18
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	07/13/18	07/13/19
8628	Pre-amplifier	QLI-01182835-JO	8986002	Quinstar	02/06/18	02/06/19
8806	1.8 GHz Band Notch Filter	BRM50707	005	Micro-Tronics	Verified by 7608 and 7582	
6815	2.4 GHz Band Notch Filter	BRM50702	008	Micro-Tronics	Verified by 7608 and 7582	

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Miscellaneous						
6708	Multimeter	34401A	US36086974	Hewlett Packard	07/18/18	07/18/19
11312	Mini Environmental Quality Meter	850027	CF099-56010- 340	Sper Scientific	02/26/18	02/26/19
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

3.2 MEASUREMENT UNCERTAINTY

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

3.2.1 Radiated Emission Measurements (Below 1GHz)

Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2	Cables	Rectangular	0.50	0.29	0.08
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.75	0.43	0.19
5	Site	Rectangular	3.52	1.44	2.07
6	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					1.68
Coverage Factor (k):					2
Expanded Uncertainty:					3.36

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	3.00	1.22	1.50
6	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					1.49
Coverage Factor (k):					2
Expanded Uncertainty:					2.99

3.2.3 Conducted Antenna Port Measurement

Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.34	0.20	0.04
2	Cables	Rectangular	0.30	0.17	0.03
3	EUT Setup	Rectangular	0.50	0.29	0.08
Combined Uncertainty (u_c):					0.39
Coverage Factor (k):					1.96
Expanded Uncertainty:					0.76

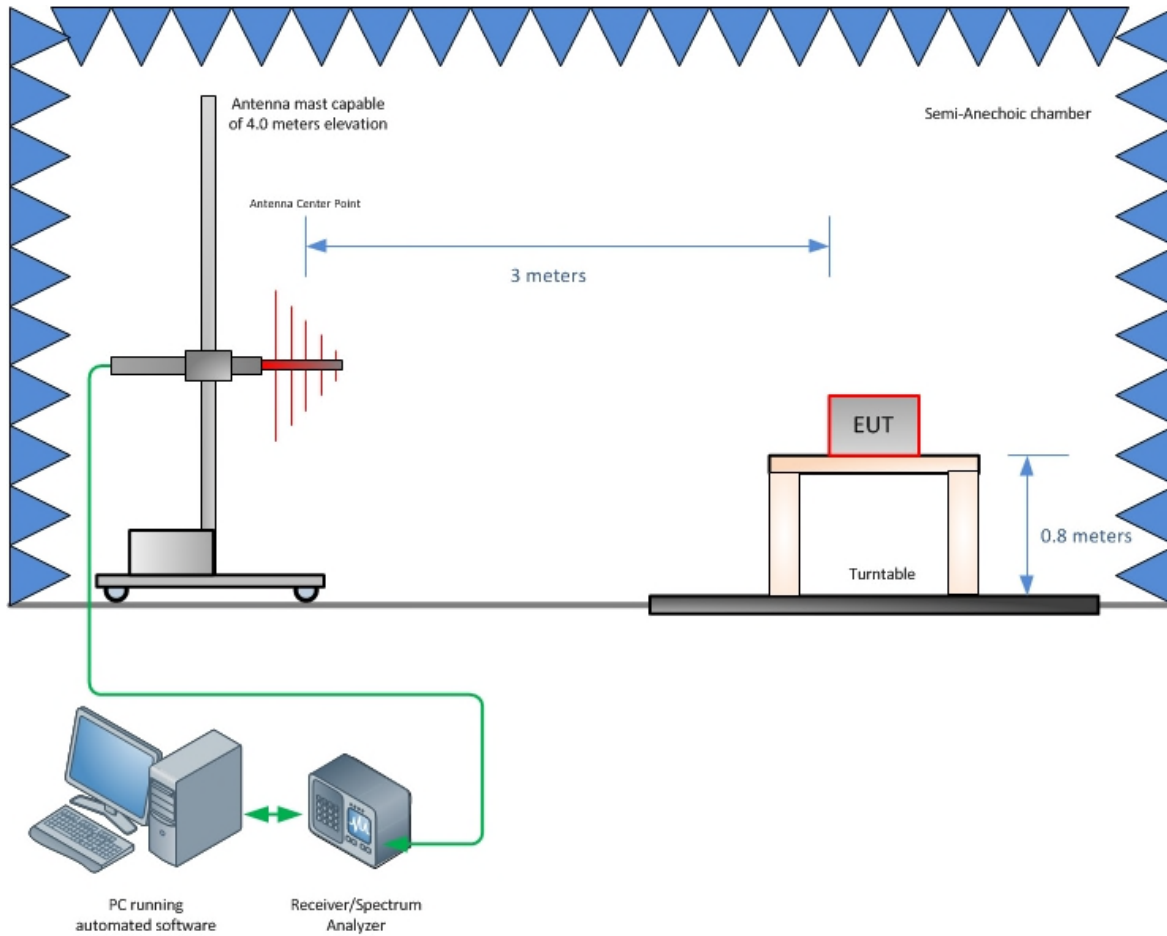
3.2.4 AC Conducted Emissions

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

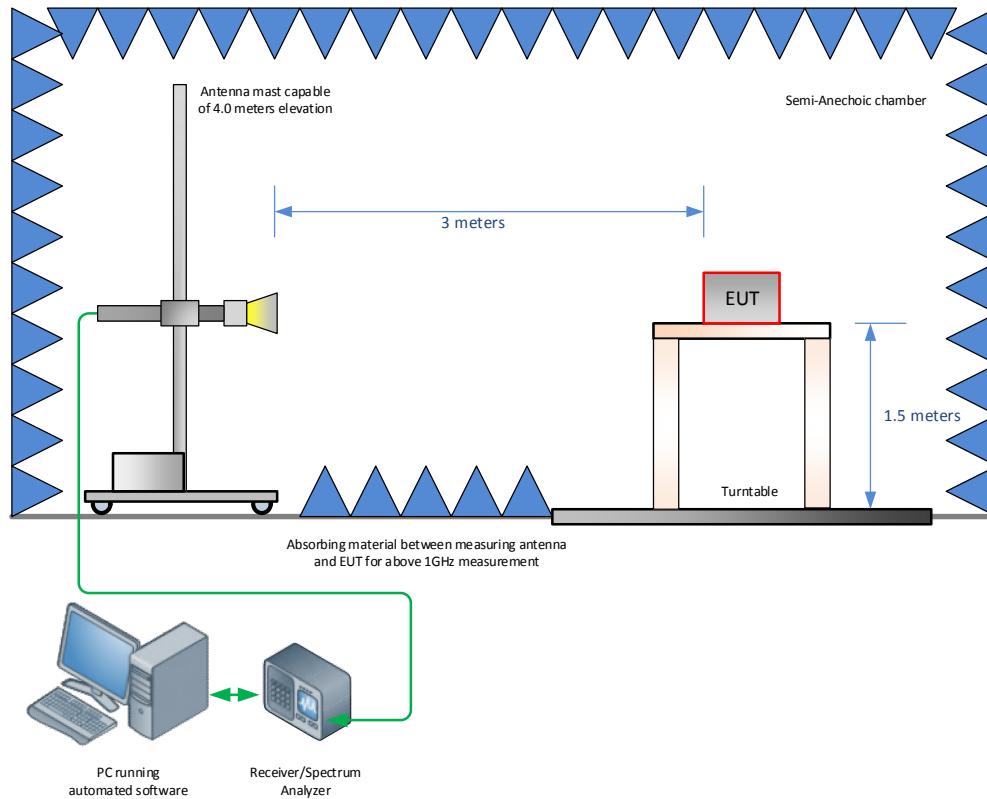
SECTION 4

DIAGRAM OF TEST SETUP

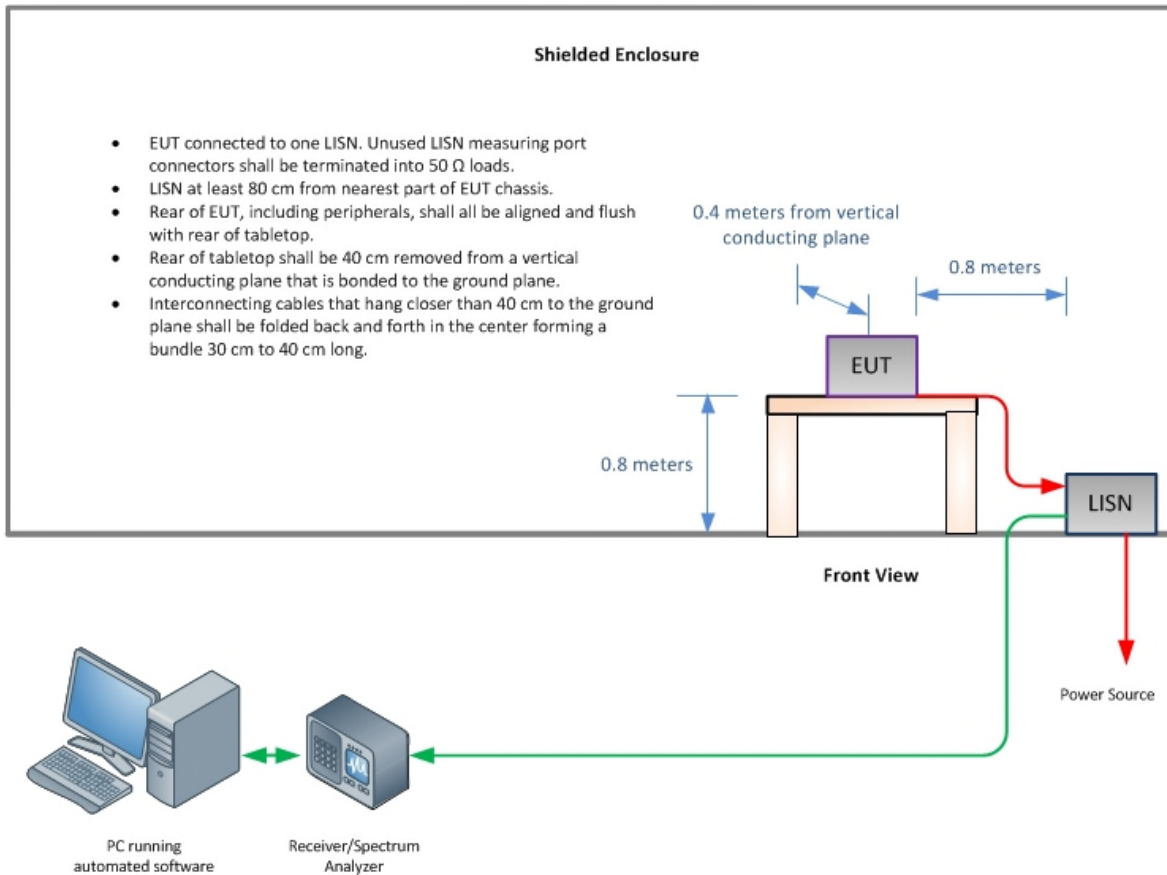
4.1 TEST SETUP DIAGRAM



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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