



RADIO TEST REPORT

For

MODEL NO.: 1707

FCC ID: C3K1707

IC ID: 3048A-1707

Test Report No. R-TR371-FCCIC-UNII2-3

Issue Date: October 24, 2016

FCC CFR47 Part 15 Subpart E
Innovation, Science and Economic Development
Canada RSS-247 Issue 1

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Test Report Attestation

Microsoft Corporation**Model:** 1707**FCC ID:** C3K1707**IC ID:** 3048A-1707**Applicable Standards**

Specification	Test Result
FCC CFR47 Rule Parts 15.207, 15.209, 15.407	Pass
Innovation, Science and Economic Development Canada RSS-247 Issue 1, RSS-GEN Issue 4	Pass

Microsoft EMC Laboratory attests that the product model identified in this report has been tested to and meets the requirements identified in the above standards. The test results in this report solely pertains to the specific sample tested, under the conditions and operating modes as provided by the customer.

This report shall not be used to claim product certification, approval, or endorsement by A2LA or any agency of any Government. Reproduction, duplication or publication of extracts from this test report is prohibited and requires prior written approval of Microsoft EMC Laboratory.

This report replaces the previously issued report #R-TR371-FCCIC-UNII2-2 issued by Microsoft EMC Labs on 10/14/2016.



Written By: Daniel Salinas
Radio Test Lead



Reviewed/ Issued By: Sajay Jose
EMC/RF Compliance Lab Manager

2 Deviations from Standards

None.

3 Facilities and Accreditations

3.1 Test Facility

All test facilities used to collect the test data are located at
Microsoft EMC Laboratory,
17760 NE 67th Ct,
Redmond WA, 98052, USA

3.2 Accreditations

The lab is established and follows procedures as outlined in IEC/ISO 17025 and A2LA accreditation requirements.

A2LA Accredited Testing Certificate Number: 3472.01

FCC Registration Number: US1141

IC Site Registration Numbers: 3048A-3, 3048A-4

3.3 Test Equipment

The site and related equipment are constructed in conformance with the requirements of ANSI C63.4:2014 and other equivalent applicable standards.

Test site requirements for measurements above 1 GHz are in accordance with ANSI C63.4:2014.

ANSI C63.10:2013 and the appropriate KDB test methods were followed.

4 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the product, as specified in CISPR 16-4-2. This represents an expanded uncertainty expressed at 95% confidence level using a coverage factor $k=2$. These levels are for reference only and not included to determine product compliance.

Expanded uncertainty calculations are available upon request.

Test item	Uncertainty	Unit
Radiated disturbance (30 MHz to 1 GHz)	5.99	dB
Radiated disturbance (1 GHz to 18 GHz)	5.12	dB
Conducted Disturbance at Mains Port	3.31	dB
Uncertainty for Conducted Power test	1.277	dB
Uncertainty for Conducted Spurious emission test	2.742	dB
Uncertainty for Bandwidth test	178	kHz
Uncertainty for DC power test	0.05	%
Uncertainty for test site temperature	0.5	°C
Uncertainty for test site Humidity	3	%
Uncertainty for time	0.189	%

5 Product Description

Company Name:	Microsoft Corporation
Address:	One Microsoft Way
City, State, Zip:	Redmond, WA 98052-6399
Customer Contact:	Jennifer Liu
Functional Description of the EUT:	PC with IEEE 802.11a/b/g/n/ac MIMO supporting 20/40/80 MHz bandwidths, Bluetooth and additional 802.11n Radio.
Model:	1707
FCC ID:	C3K1707
IC ID:	3048A-1707
Radio under test:	IEEE 802.11n supporting 20 MHz Bandwidth 5150- 5250 MHz and 5725- 5850 MHz.
Modulation(s):	OFDM
Antenna Information:	Internal Antenna. Manufacturer declared Antenna Gain: 5150-5250 MHz: 0.3 dBi 5725- 5850 MHz: 0.1 dBi
EUT Classification:	UNII
Equipment Design State:	Prototype/Production Equivalent
Equipment Condition:	Good
Test Sample Details:	RF Conducted Test Sample SN: 000250762258 RF Radiated Test Sample SN: 000221262258, 000266762258

5.1 Test Configurations

Test software “QA_Tool_Release_V1.2” provided by the customer and “MT7600 QA V1.0.0.3” from the module vendor was used to program the EUT to transmit continuously.

This report contains data from the following worst-case modes of operation:

802.11n: MCS0; HT MixMode; 20MHz BW and 802.11n: MCS0; HT MixMode; 20MHz BW transmitting simultaneously with Bluetooth 3-DH5: Channel 78.

5.2 Environmental Conditions

Ambient air temperature of the test site was within the range of 10 °C to 40 °C (50 °F to 104 °F) unless the EUT specified testing over a different temperature range. Humidity levels were in the range of 10% to 90% relative humidity. Testing conditions were within tolerance and any deviations required from the EUT are reported.

5.3 Antenna Requirements and Gain Information

The antennas are permanently attached and there are no provisions for connection to an external antenna.

5.4 Equipment Modifications

No modifications were made during testing.

5.5 Dates of Testing

Testing was performed from June 29, 2016 to Oct 13, 2016.

6 Test Results Summary

Test Description	Applicable Bands (GHz)	FCC CFR 47/ISED Rule Part	Limit	Test Result
26dB Emission Bandwidth	5.15 – 5.25 5.25 – 5.35 5.47 – 5.725	15.407 (a) RSS-247 [6.2.1]	Reporting and Measurement Purposes	NA
99% bandwidth	5.15 – 5.25 5.25 – 5.35 5.47 – 5.725	RSS-247 [6.2]	Reporting and Measurement Purposes	NA
6 dB Bandwidth	5.725 – 5.85	15.407 (e) RSS-247 [6.2.4]	$\geq 500\text{kHz}$	Pass
Output Power	5.15 – 5.25	15.407 (a)(1)(iv)	$\leq 250\text{ mW}$ or $10 + 10 \log_{10} B^*$ whichever is less	Pass
		RSS-247 [6.2.1]	$\leq 200\text{ mW}$ or $10 + 10 \log_{10} B^*$ e.i.r.p whichever is less	Pass
	5.25 – 5.35 5.47 – 5.725	15.407 (a)(2) RSS-247 [6.2]	$\leq 250\text{ mW}$ or $11 + 10 \log_{10} B^*$ whichever is less $\leq 1\text{ W}$ or $17 + 10 \log_{10} B^*$ e.i.r.p whichever is less	N/A
	5.725 – 5.85	15.407 (a)(3) RSS-247 [6.2]	$\leq 1000\text{ mW}$	Pass
Power Spectral Density	5.15 – 5.25	15.407 (a)(1)(iv)	$\leq 11\text{dBm/MHz}$	Pass
		RSS-247 [6.2]	$\leq 10\text{dBm/MHz}$ e.i.r.p.	Pass
	5.25 – 5.35 5.47 – 5.725	15.407 (a)(2) RSS-247 [6.2]	$\leq 11\text{dBm/MHz}$	N/A
	5.725 – 5.85	15.407 (a)(3) RSS-247 [6.2]	$\leq 30\text{dBm/500kHz}$	Pass
Radiated Spurious Emissions/ Restricted Band Emissions	5.15 – 5.25 5.25 – 5.35 5.47 – 5.725 5.725 – 5.85	15.407 (b), 15.205, 15.209, RSS-Gen [8.9]	FCC CFR 47 15.209 limits RSS-Gen [8.9]	Pass

AC Power Line Conducted Emissions	5.15 – 5.25 5.25 – 5.35 5.47 – 5.725 5.725 – 5.85	15.407 (b), 15.207 RSS-Gen [8.8]	FCC CFR 47 15.207 limits RSS-Gen [8.8]	Pass
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* Note: B- FCC references 26dB bandwidth and ISED references 99% bandwidth.

7 Test Equipment List

Equipment used for Radiated and Conducted Measurements				
Manufacturer	Description	Model #	Asset #	Calibration Due
Rohde & Schwarz	EMI Test Receiver	ESU40	RF-192	4/13/2017
Rohde & Schwarz	EMI Test Receiver	ESU40	EMC-607	05/26/2017
Rohde & Schwarz	Signal Analyzer	FSV40	RF-228	4/12/2017
Rohde & Schwarz	Power Meter	NRP-Z91	RF-211	4/13/2017
Sunol Sciences	Antenna - Broadband Hybrid	JB6	EMC-640	9/29/2016*
Sunol Sciences	Antenna - Broadband Hybrid	JB6	RF-039	5/26/2017
ETS-Lindgren	Antenna	3117	RF-137	2/25/2017
ETS-Lindgren	Antenna – Standard Gain	3160-09	RF-179	6/3/2017
ETS-Lindgren	Antenna – Standard Gain	3160-10	RF-038	6/3/2017
Rohde & Schwarz	Custom Filter Bank+PreAmp	SFUNIT RX	RF-323	12/10/2016
Rohde & Schwarz	Pre-Amp	TS-PR26	RF-199	12/15/2016
Rohde & Schwarz	Switch and Control Unit	OSP130	RF-249	12/10/2016
Rohde & Schwarz	Switch and Control Unit	OSP130	RF-018	12/18/2016
Rohde & Schwarz	Switch and Control Unit	OSP150	RF-250	12/10/2016
Rohde & Schwarz	Switch and Control Unit	OSP150	RF-019	12/18/2016
Murata	RF Cable	MXHQ87WA3000	RF-415	11/09/2016
MegaPhase	RF Cable	EMC3-N1N1-394	EMC-1034	06/21/2017
Huber & Suhner	RF Cable	Sucoflex 100	RF-350	12/10/2016
Huber & Suhner	RF Cable	Sucoflex 100	RF-352	12/10/2016
Huber & Suhner	RF Cable	Sucoflex 100	RF-350	12/10/2016

Manufacturer	Description	Model #	Asset #	Calibration Due
Huber & Suhner	RF Cable	Sucoflex 100	RF-352	12/10/2016
Huber & Suhner	RF Cable	Sucoflex 102A	RF-269	12/16/2016
Madge Tech	THP Monitor	PRH Temp 2000	EMC-681	11/19/2016
Madge Tech	THP Monitor	PRH Temp 2000	EMC-679	11/19/2016
Micro-Coax	RF Cable	UFA210A-0-0787-300300	RF-292	11/10/2016
Micro-Coax	RF Cable	UTI Flex	RF-354	12/10/2016
Pasternack	Attenuator	PE7087-3	RF-337	01/26/2017
Pasternack	3dB Attenuator	PE7087-3	RF-338	01/29/2017
Pasternack	6dB Attenuator	PE7087-6	RF-432	01/27/2017
ETS-Lindgren	Antenna - Standard Gain	3160-10	RF-179	10/03/2017
Rohde & Schwarz	Pre-Amp	TS-PR40	RF-042	12/18/2016
Rohde & Schwarz	Software	EMC-32 V9.25.00	N/A	N/A

*Note- all equipment in valid calibration status at the time of test.

Equipment used for Line Conducted Emissions Measurement				
Manufacturer	Description	Model #	Asset #	Calibration Due
Rohde & Schwarz	EMI Test Receiver	ESR 3	EMC-669	4/14/2017
Teseq	AE LISN	NNB 51	EMC-187	9/25/2016*
Teseq	Test LISN	NNB 51	EMC-642	11/24/2016
Micro-Coax	RF Cable	UFA210A-1-1800-50U50U	EMC-367	8/6/2016*
Madge Tech	THP Monitor	PRHTemp2000	EMC-169	8/18/2016*
ETS	TILE SW	Ver 7.1.3.22	N/A	N/A
Fluke	Multimeter	189	EMC-231	8/31/2016*

*Note- all equipment in valid calibration status at the time of test- Jun 29, 2016.

8 Test Site Description

8.1 Radiated Emissions Test Site

Radiated measurements are performed in a 3m semi-anechoic chamber, which meets NSA requirements for the frequency range of 30MHz to 1000MHz. For measurements above 1 GHz, absorbers are laid out on the ground plane between the receiving antenna and the EUT to meet Site VSWR requirements in accordance with ANSI C63.4:2014.

8.1.1 Radiated Measurements in 30 MHz - 1000 MHz

The EUT is positioned on a turntable at a height of 80cm using a non-conducting table. A linearly polarized broadband antenna is positioned at 3m from the EUT periphery. The turntable is rotated 360 degrees and the antenna height varied from 1m to 4m to determine the highest emissions. This is repeated for both Horizontal and Vertical polarizations of the measurement antenna. All possible orientations of the EUT were investigated for emissions and the vertical standing mode was identified as the worst case configuration.

8.1.2 Radiated Measurements above 1GHz

The EUT is positioned on a Turntable at a height of 150cm. A linearly polarized antenna is positioned at 3m from the EUT periphery. Guidelines in ANSI C63.10:2013 were followed with respect to maximizing the emissions. The turntable is rotated 360 degrees and the antenna height varied from 1m to 4m (with antenna bore-sighting enabled) to determine the highest emissions. This is repeated for both Horizontal and Vertical polarizations of the measurement antenna. Measurements above 18GHz were performed at a distance of 3m.

8.2 Antenna port conducted measurements

All antenna port conducted measurements were performed on a bench-top setup consisting of a spectrum analyzer, power meter (as necessary), splitters/combiners (as necessary), attenuators, and pre-characterized RF cables.

The correction factors between the EUT and the spectrum analyzer were added internally in the analyzer settings, where applicable. The plots displayed takes into account these correction factors.

8.3 Test Setup Diagrams

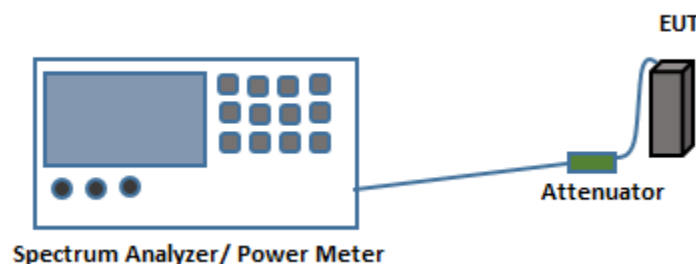


Fig.1. Test Setup for Antenna port conducted measurements

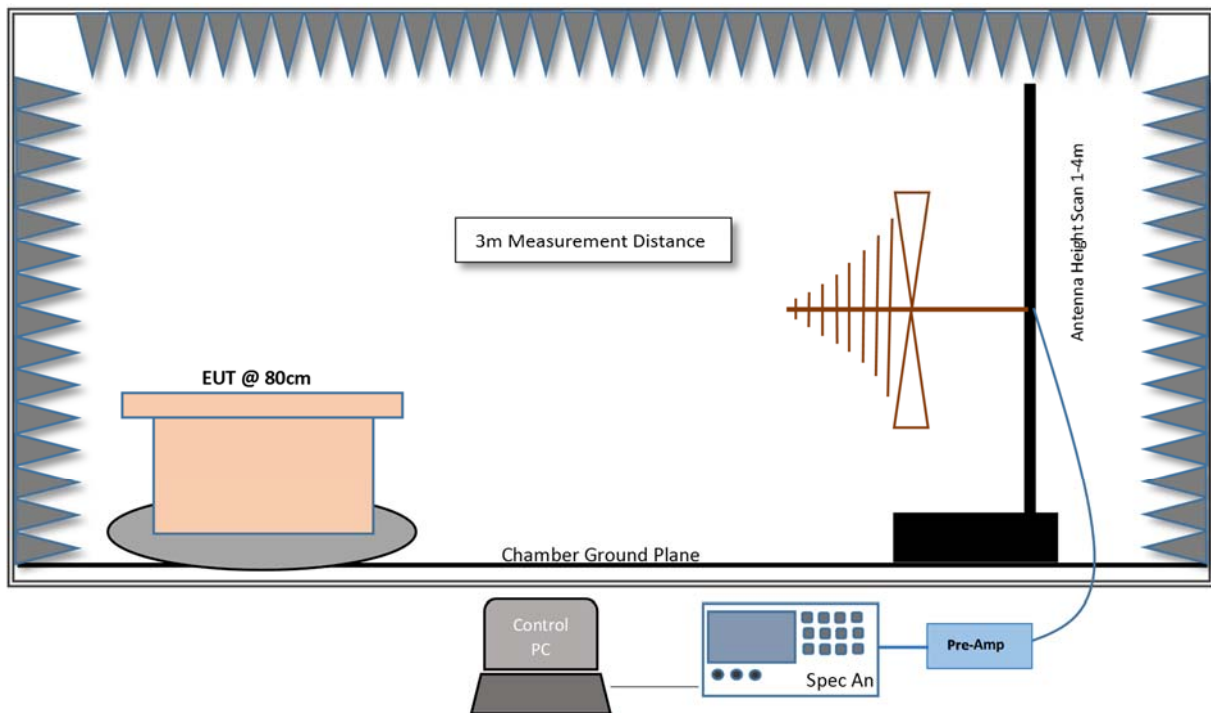


Fig.2. Test Setup for Radiated measurements in 30MHz- 1GHz Range

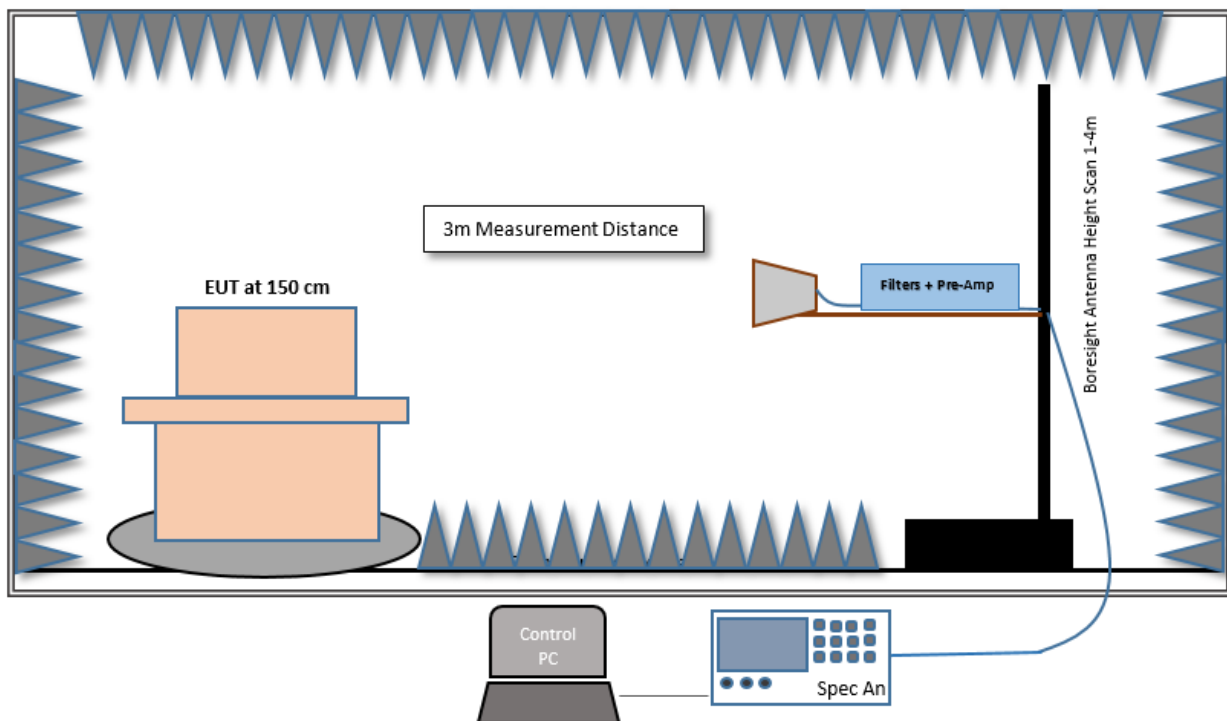


Fig.3. Test Setup for Radiated measurements in 1GHz- 18GHz Range

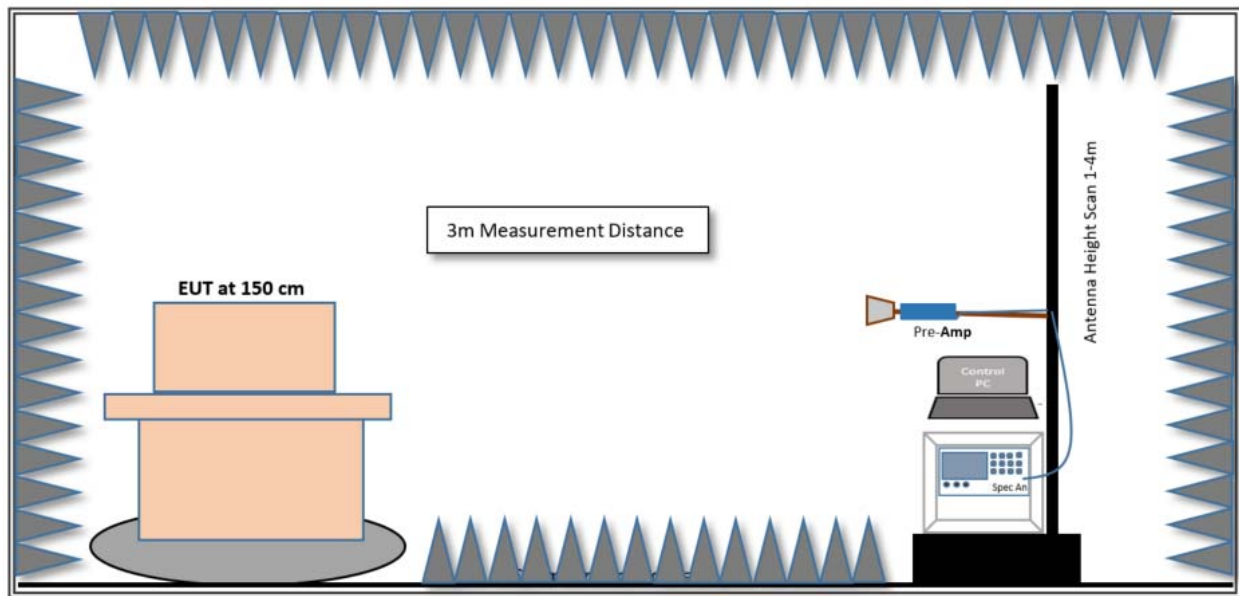


Fig.4. Test Setup for Radiated measurements >18GHz

9 Test Results- Conducted

9.1 26-dB Emission Bandwidth

9.1.1 Test Requirement:

FCC CFR 47 Rule Part 15.407 (a)

ISED RSS-247 [6.2.1]

9.1.2 Test Method:

Measurements were performed according to the procedures defined in KDB 789033- General UNII Test Procedures New Rules v01r02 and ANSI C63.10:2013.

Spectrum Analyzer settings:

RBW = approximately 1% of the Emissions Bandwidth

VBW $\geq$ 3xRBW

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto

The in-built functionality of the Spectrum Analyzer is used to measure the 26-dB emission bandwidth.

9.1.3 Limits:

Reporting and measurement purposes only.

9.1.4 Test Results:

See Section 9.2.4.

9.2 99% Occupied Bandwidth

9.2.1 Test Requirement:

ISED RSS-247 [6.2]

9.2.2 Test Method:

Measurements were performed according to the procedures defined in KDB 789033- General UNII Test Procedures New Rules v01r02 and ANSI C63.10 2013.

Spectrum Analyzer settings:

Set the center frequency to the nominal EUT channel center frequency

Span = 1.5 to 5.0 time the 99% Occupied Bandwidth

RBW = 1% to 5% of the 99% Occupied Bandwidth

VBW $\geq$ 3xRBW

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto

The built-in functionality of the Spectrum Analyzer is used to measure the 99% Occupied Bandwidth.

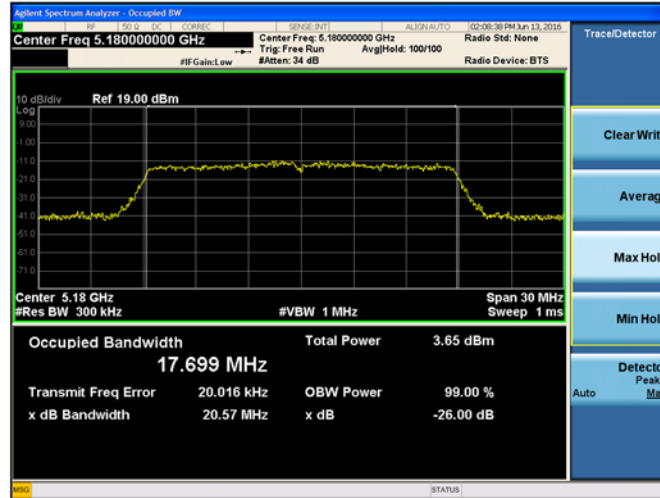
9.2.3 Limits:

Reporting and measurement purposes only.

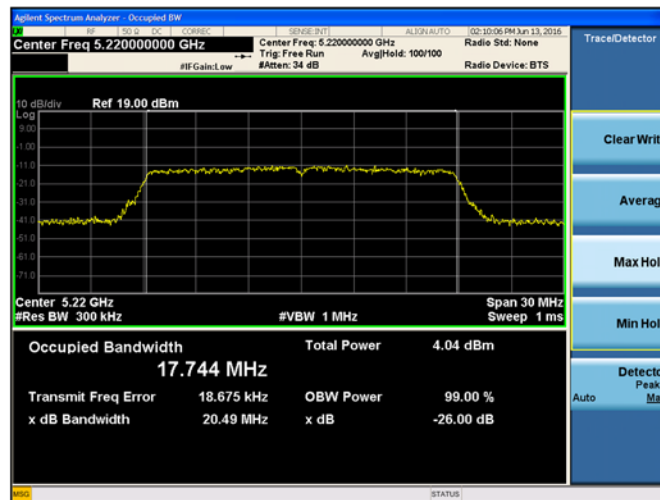
9.2.4 Test Results:

802.11n Bandwidth				
Band	Channel No.	Frequency (MHz)	26-dB Emission Bandwidth (MHz)	99% Occupied BW (MHz)
UNII-1	36	5180	20.57	17.70
	44	5220	20.49	17.74
	48	5240	20.53	17.74
UNII-3	149	5745	20.39	17.68
	157	5785	20.36	17.70
	165	5825	20.22	17.72

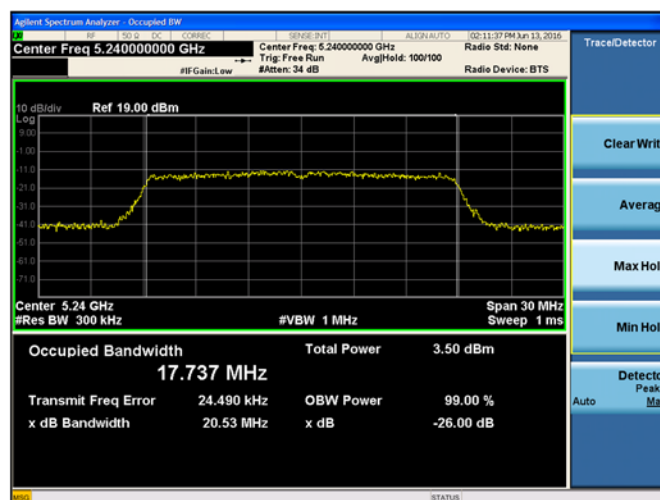
9.2.5 Test Data:



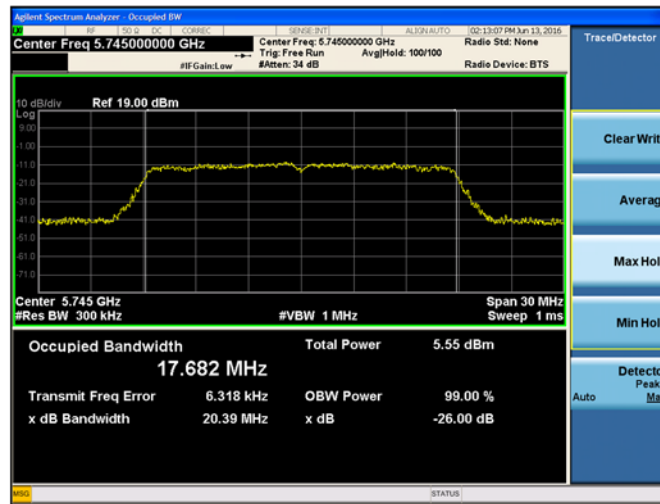
Plot 9-1. 26-dB Emission Bandwidth and 99% OBW 802.11n (Ch. 36)



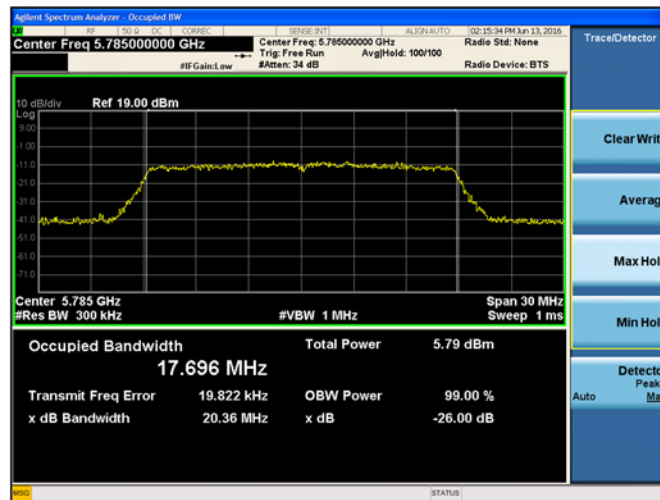
Plot 9-2. 26-dB Emission Bandwidth and 99% OBW 802.11n (Ch. 44)



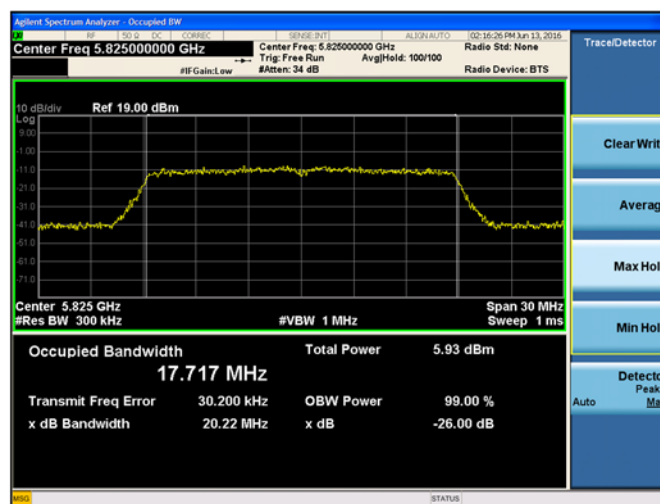
Plot 9-3 26-dB Emission Bandwidth and 99% OBW 802.11n (Ch. 48)



Plot 9-4. 26-dB Emission Bandwidth and 99% OBW 802.11n (Ch. 149)



Plot 9-5. 26-dB Emission Bandwidth and 99% OBW 802.11n (Ch. 157)



Plot 9-6. 26-dB Emission Bandwidth and 99% OBW 802.11n (Ch. 165)

9.3 6-dB Bandwidth

9.3.1 Test Requirement:

FCC CFR 47 Rule Part 15.407 (e)

ISED RSS-247 [6.2.4]

9.3.2 Test Method:

Measurements were performed according to the procedures defined in KDB 789033- General UNII Test Procedures New Rules v01r02 and ANSI C63.10:2013.

Spectrum Analyzer settings:

RBW = 100 kHz

VBW $\geq 3 \times$ RBW

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto

The in-built functionality of the Spectrum Analyzer is used to measure the 6-dB bandwidth.

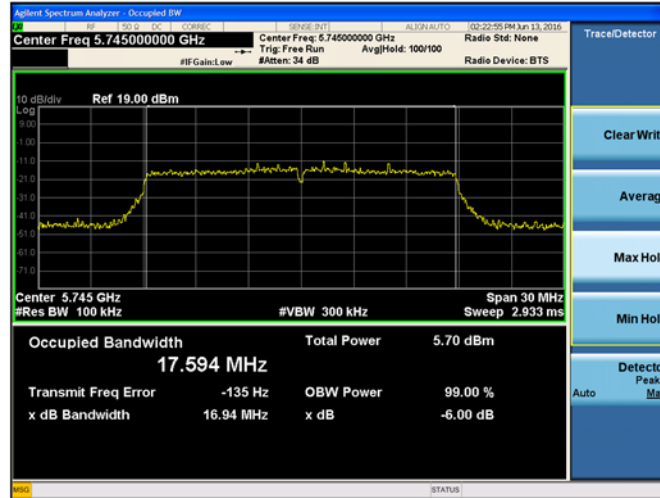
9.3.3 Limits:

The 6-dB Bandwidth shall be ≥ 500 kHz.

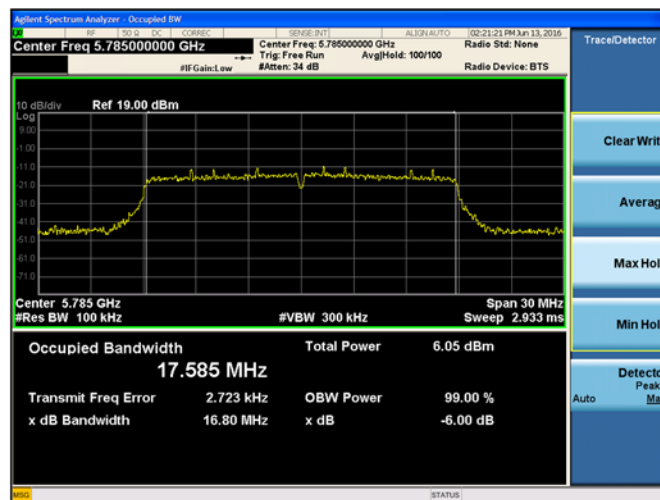
9.3.4 Test Results:

802.11n 6-dB Emission Bandwidth				
Channel No.	Frequency (MHz)	6-dB Emission Bandwidth (MHz)	Limit (MHz)	Result
149	5745	16.94	≥ 0.5	Pass
157	5785	16.80	≥ 0.5	Pass
165	5825	17.14	≥ 0.5	Pass

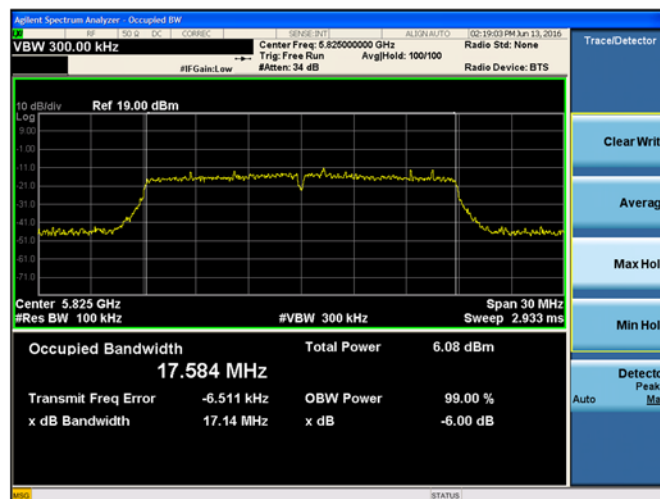
9.3.5 Test Data:



Plot 9-7. 6-dB Bandwidth 802.11n (Ch. 149)



Plot 9-8. 6-dB Bandwidth 802.11n (Ch. 157)



Plot 9-9. 6-dB Bandwidth 802.11n (Ch. 165)

9.4 Maximum Conducted Output Power

9.4.1 Test Requirement:

FCC CFR 47 Rule Part 15.407 (a)

ISED RSS-247 [6.2]

9.4.2 Test Method:

Measurements were performed according to the procedures defined in KDBs 789033- General UNII Test Procedures New Rules v01r02, 662911 D01 Multiple Transmitter Output v02r01, and ANSI C63.10 2013.

Spectrum Analyzer settings:

Average Power:

RBW= 1 MHz

VBW= 3 MHz

Detector = RMS

Trace Mode= Average over 100 traces

Sweep time= Auto

Sweep Point $\geq 2 \times \text{Span} / \text{RBW}$

Span= large enough to encompass the 26-dB Emission Bandwidth or alternatively the 99% Occupied Bandwidth.

Use the band power measurement function to integrate the power over the 26-dB Emission Bandwidth or 99% Occupied Bandwidth.

9.4.3 Limits:

15.407: The maximum conducted output power shall not exceed the limits given the following table for antennas that do not exceed a directional gain > 6dBi:

Band of Operation (MHz)	15.407 Limit
5150 – 5250	24 dBm
5725 – 5825	30 dBm

Note(1): B is the 26-dB Emission bandwidth of signal.

RSS-247: The maximum conducted output power shall not exceed the limits given the following table:

Band of Operation (MHz)	RSS-247 Conducted Output Power Limit	RSS-247 E.I.R.P Limit
5150 – 5250	--	23 dBm or $10 + 10 \log (B)^{(1)}$
5725 – 5825	30 dBm	--

Note(1): B is the 99% Occupied Bandwidth of the signal.

9.4.4 Test Results:

Pass.

802.11n Maximum Conducted Output Power						
Chan. No.	Freq. (MHz)	Total Power (dBm)	15.407 Limit (dBm)	RSS-247 Limit (dBm)	15.407 Margin (dB)	RSS-247 Margin (dB)
36	5180	-2.27	24.00	--	-26.27	--
44	5220	-1.52	24.00	--	-25.52	--
48	5240	-1.51	24.00	--	-25.51	--
149	5745	-0.92	30.00	30.00	-30.92	-30.92
157	5785	-2.75	30.00	30.00	-32.75	-32.75
165	5825	-2.29	30.00	30.00	-32.29	-32.29

802.11n E.I.R.P						
Channel No.	Frequency (MHz)	Total Power (dBm)	Antenna Gain (dBi)	E.I.R.P (dBm)	RSS-247 E.I.R.P Limit (dBm)	RSS-247 E.I.R.P. Margin (dB)
36	5180	-2.27	0.3	-1.97	22.21	-24.18
44	5220	-1.52	0.3	-1.22	22.21	-23.43
48	5240	-1.51	0.3	-1.21	22.22	-23.43
149	5745	-0.92	0.1	-0.82	--	--
157	5785	-2.75	0.1	-2.74	--	--
165	5825	-2.29	0.1	-2.28	--	--

9.4.5 Test Data:

See Section 9.5.5.

9.5 Power Spectral Density

9.5.1 Test Requirement:

FCC CFR 47 Rule Part 15.407 (a)

ISED RSS-247 [6.2]

9.5.2 Test Method:

Spectrum Analyzer settings for devices operating in the bands 5.15 – 5.25 GHz, 5.25 – 5.35GHz, and 5.47 – 5.725GHz:

RBW= 1 MHz

VBW= 3 MHz

Detector = RMS

Trace Mode= Average over 100 traces

Sweep time= Auto

Sweep Point $\geq 2 \times \text{Span} / \text{RBW}$

Span= large enough to encompass the 26-dB Emission Bandwidth or alternatively the 99% Occupied Bandwidth. Use the peak marker function to identify the Maximum Power Spectral Density

Spectrum Analyzer settings for devices operating in the bands 5.725 – 5.85 GHz:

RBW= 100 kHz

VBW= 300 kHz

Detector = RMS

Trace Mode= Average over 100 traces

Sweep time= Auto

Sweep Point $\geq 2 \times \text{Span} / \text{RBW}$

Span= large enough to encompass the 26-dB Emission Bandwidth or alternatively the 99% Occupied Bandwidth. Use the peak marker function to identify the Maximum Power Spectral Density

Offset is added if measurements are performed using a reduced resolution bandwidth 100 kHz, add $10 \times \log(500\text{kHz} / \text{RBW USED})$ to the measured result.

9.5.3 Limits:

15.407: The Maximum Power Spectral Density shall not exceed the limits given the following table for antennas that do not exceed a directional gain > 6dBi:

Band of Operation (MHz)	15.407 Limits
5150 – 5250	11dBm/MHz
5725 – 5825	30dBm/500kHz

Band of Operation (MHz)	RSS-247 Limits
5150 – 5250	10dBm/MHz e.i.r.p.
5725 – 5825	30dBm/500kHz

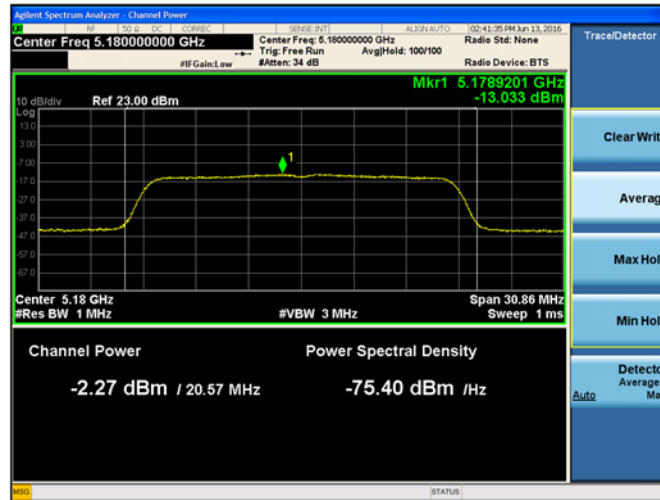
9.5.4 Maximum PSD Test Results:

Pass.

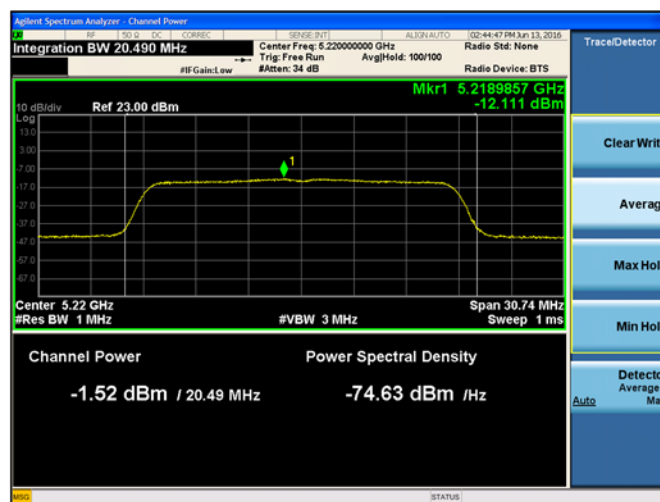
802.11n Maximum Power Spectral Density/MHz								
Chan. No.	Freq. (MHz)	Total PSD $\frac{dBm}{MHz}$	Total Ant. Gain (dBi)	Total EIRP PSD $\frac{dBm}{MHz}$	15.407 Limit $\frac{dBm}{MHz}$	RSS-247 EIRP PSD Limit $\frac{dBm}{MHz}$	15.407 Margin (dB)	RSS-247 Margin (dB)
36	5180	-13.03	0.3	-12.73	11.00	10.00	-24.03	-22.73
44	5220	-12.11	0.3	-11.81	11.00	10.00	-23.11	-21.81
48	5240	-12.22	0.3	-11.92	11.00	10.00	-23.22	-21.92

802.11n Maximum Power Spectral Density/500kHz						
Chan. No.	Freq. (MHz)	Total PSD $\frac{dBm}{500 kHz}$	15.407 Limit $\frac{dBm}{500 kHz}$	RSS-247 Limit $\frac{dBm}{500 kHz}$	15.407 Margin (dB)	RSS-247 Margin (dB)
149	5745	-5.27	30.00	30.00	-35.27	-35.27
157	5785	-5.60	30.00	30.00	-35.60	-35.60
165	5825	-4.76	30.00	30.00	-34.76	-34.76

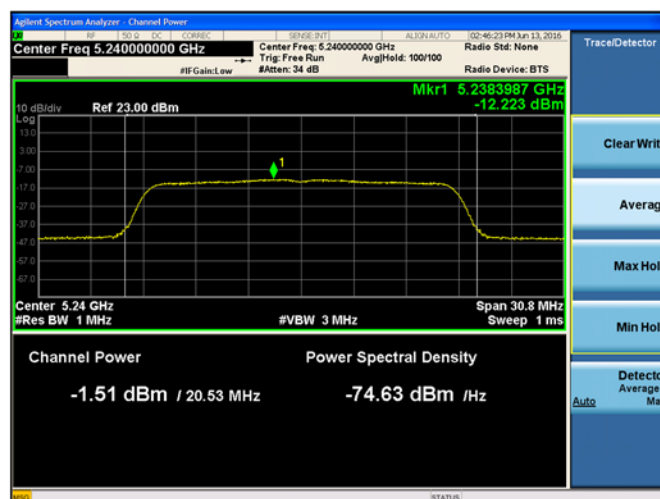
9.5.5 Test Data



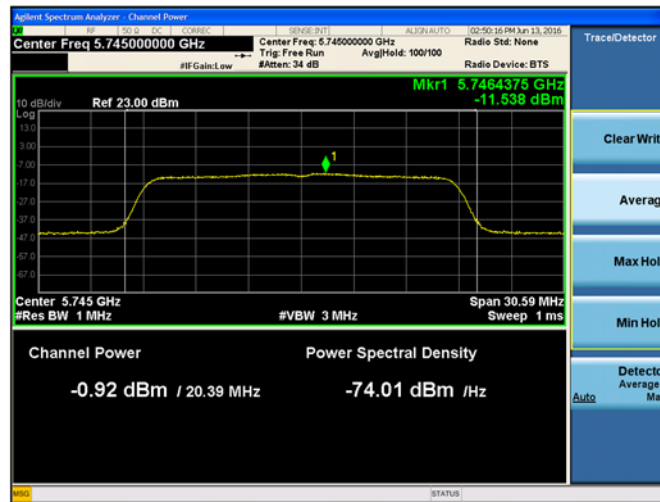
Plot 9-10. Maximum Conducted Output Power and PSD 802.11n (Ch. 36)



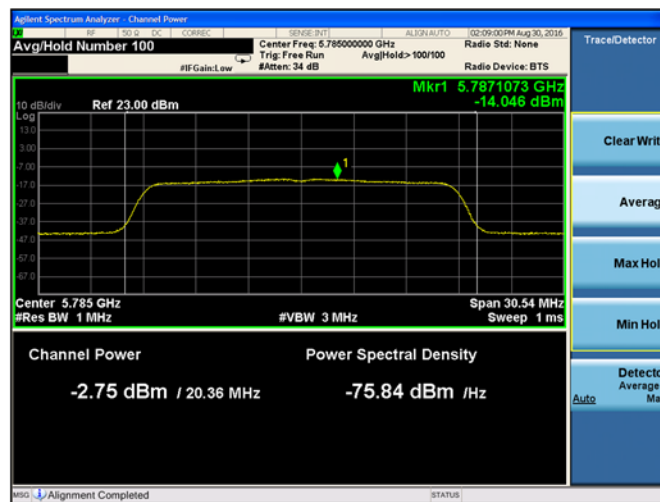
Plot 9-11. Maximum Conducted Output Power and PSD 802.11n (Ch. 44)



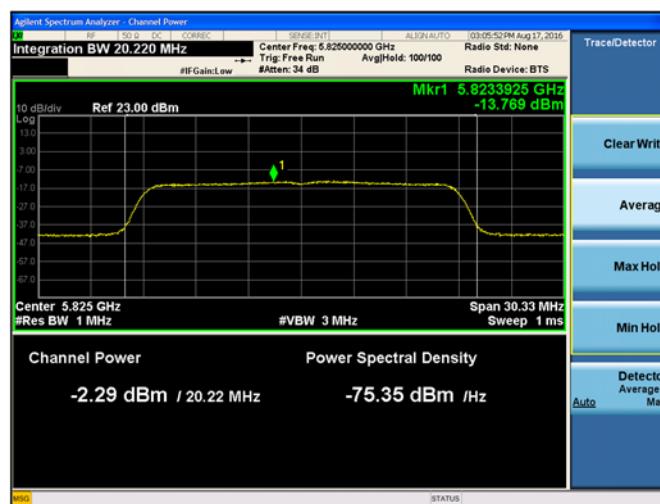
Plot 9-12. Maximum Conducted Output Power and PSD 802.11n (Ch. 48)



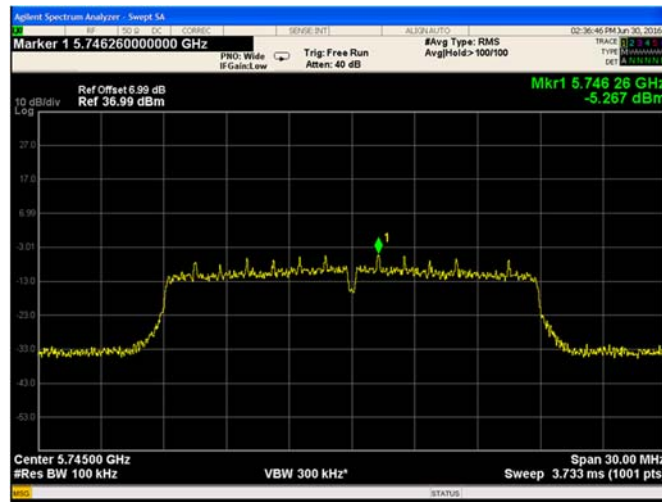
Plot 9-13. Maximum Conducted Output Power and PSD 802.11n (Ch. 149)



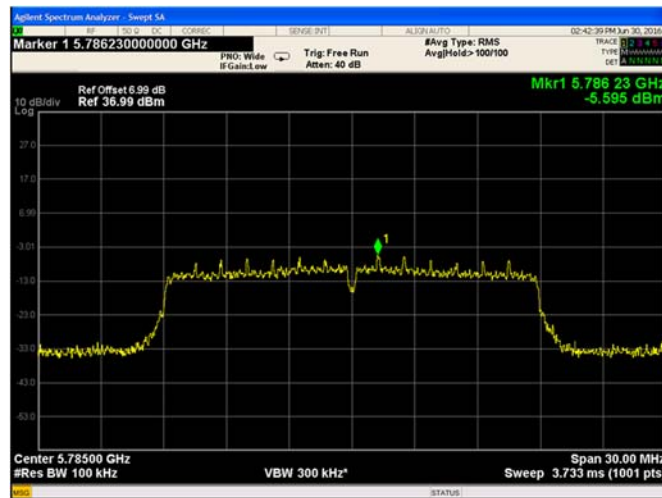
Plot 9-14. Maximum Conducted Output Power and PSD 802.11n (Ch. 157)



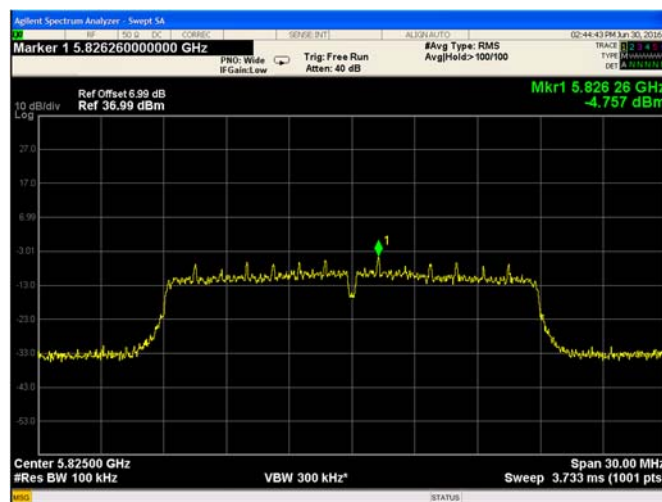
Plot 9-15. Maximum Conducted Output Power and PSD 802.11n (Ch. 165)



Plot 9-16. Maximum Power Spectral Density 802.11n (Ch. 149)



Plot 9-17. Maximum Power Spectral Density 802.11n (Ch. 157)



Plot 9-18. Maximum Power Spectral Density 802.11n (Ch. 165)

9.6 Radiated Spurious and Band Edge Emissions

9.6.1 Test Requirement:

FCC CFR 47 Rule Part 15.407 (b)

ISED RSS-247 [6.2] and RSS GEN [8.9]

9.6.2 Test Method:

Measurements were performed according to the procedure defined in KDB 558074 - Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V03R05 and ANSI C63.10 2013.

Radiated spurious measurements are made from 30MHz to the 10th harmonic of the fundamental frequency of the transmitter. The limit for radiated spurious emissions is per 15.209 and RSS-247 [5.5]. Additionally, emissions found in the restricted bands as listed in 15.205 were tested for compliance per limits in 15.209 and RSS-Gen.

The EUT was tested near the low, middle and high channels of operation in each sub band. Guidelines in ANSI C63.10:2013 were followed with respect to maximizing the emissions. The EUT was placed on a turntable at a height of 80cm from the ground plane in standing position, which was estimated as the worst case orientation for all measurements.

Emissions below 1 GHz were maximized by rotating the EUT for 360 degs and with the antenna height scan performed from 1-4m. The same method was followed for emissions above 1GHz, but with the measurement antenna set in bore-sight mode. Both horizontal and vertical antenna polarizations were investigated. Worst case maximized data is shown in this test report.

A pre-amp and a high pass filter were required for this test, in order to provide the measuring system with sufficient sensitivity. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength.

Radiated Spurious Emissions

Spectrum Analyzer Settings:

30 MHz- 1 GHz:

RBW= 120 kHz

VBW $\geq 3 \times$ RBW

Trace Mode: Peak Detector (Max Hold). Final measurements performed using QP Detector.

Span= 30 MHz- 1 GHz

Sweep time= Auto

Above 1 GHz:

RBW= 1 MHz

VBW= 3 MHz

Trace Mode: Peak Detector (Max Hold) and RMS Average Detector (Max Hold)

Span= 1- 18 GHz and 18- 26.5 GHz.

Sweep time= Auto

Restricted Band-Edge Emissions

Spectrum Analyzer Settings:

RBW= 1 MHz

VBW= 3 MHz

Trace Mode: Peak Detector (Max Hold) and RMS Average Detector (Max Hold)

Span= 2310 – 2500 MHz

Sweep Points = 801

Sweep Time = Peak: Auto; Average: 100 s

Sample Calculation:

Field Strength Level: Amplitude (Analyzer level) + AFCL (Antenna Factor and Cable losses) – Amplifier Gain = 50 dBuV + 33 dB – 25 dB = 78dBuV/m

9.6.3 Limits:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (meters)	Corrected Field Strength for 3m measurement distance (dBμV/m)
0.009-0.490	2400/F (kHz)	300	48.5- 13.8
0.490-1.705	24000/F (kHz)	30	33.8- 23.0
1.705-30	30	30	29.5
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
960-1000	500	3	54
Above 1000	500	3	54 (Average) 74 (Peak)

9.6.4 Test Result:

Pass.

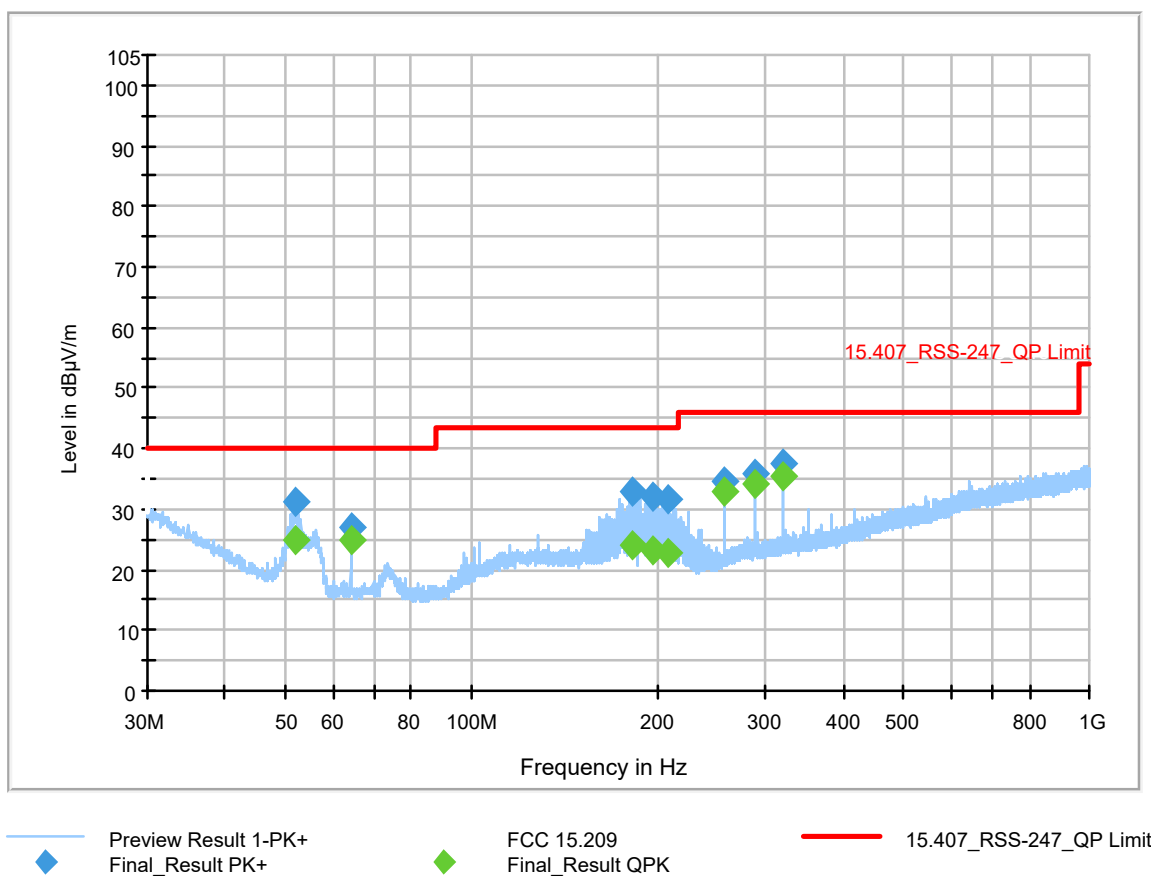
9.6.5 Test Data:

9.6.5.1 802.11n: MCS0; HT MixMode; 20MHz BW

9.6.5.1.1 Radiated Emissions in 30 MHz- 1 GHz range

All channels and modes were tested and worst case emissions in 802.11n mode, channel 149 shown here.

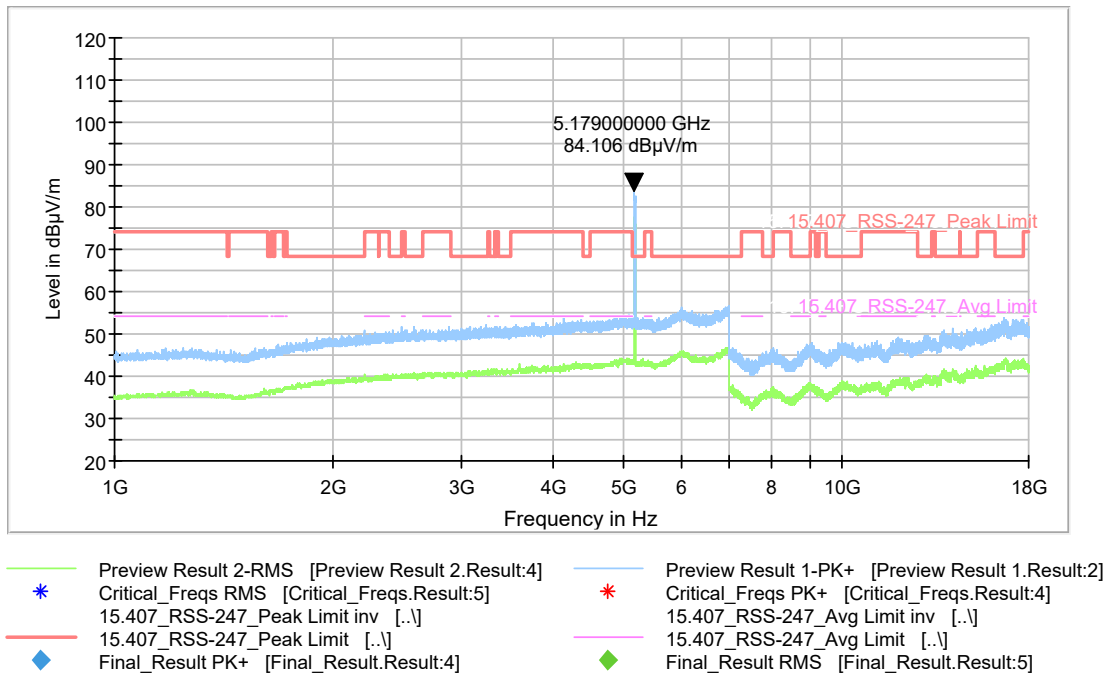
RSE 30-1000 MHz					
Frequency (MHz)	Raw Quasi-Peak Amplitude (dBμV/m)	Correction Factor (dB)	Corrected Quasi-Peak Field Strength (dBμV/m)	Quasi-Peak Limit (dBμV/m)	Quasi-Peak Margin (dB)
52.093	10.28	14.80	25.08	40.00	-14.92
63.9985	9.94	14.80	24.74	40.00	-15.26
182.188	9.91	14.20	24.11	43.52	-19.41
197.5625	8.90	14.20	23.1	43.52	-20.42
208.2655	4.31	18.30	22.61	43.52	-20.91
256.0015	14.69	18.30	32.99	46.02	-13.03
287.9715	15.04	19.10	34.14	46.02	-11.88
319.9815	16.33	19.10	35.43	46.02	-10.59



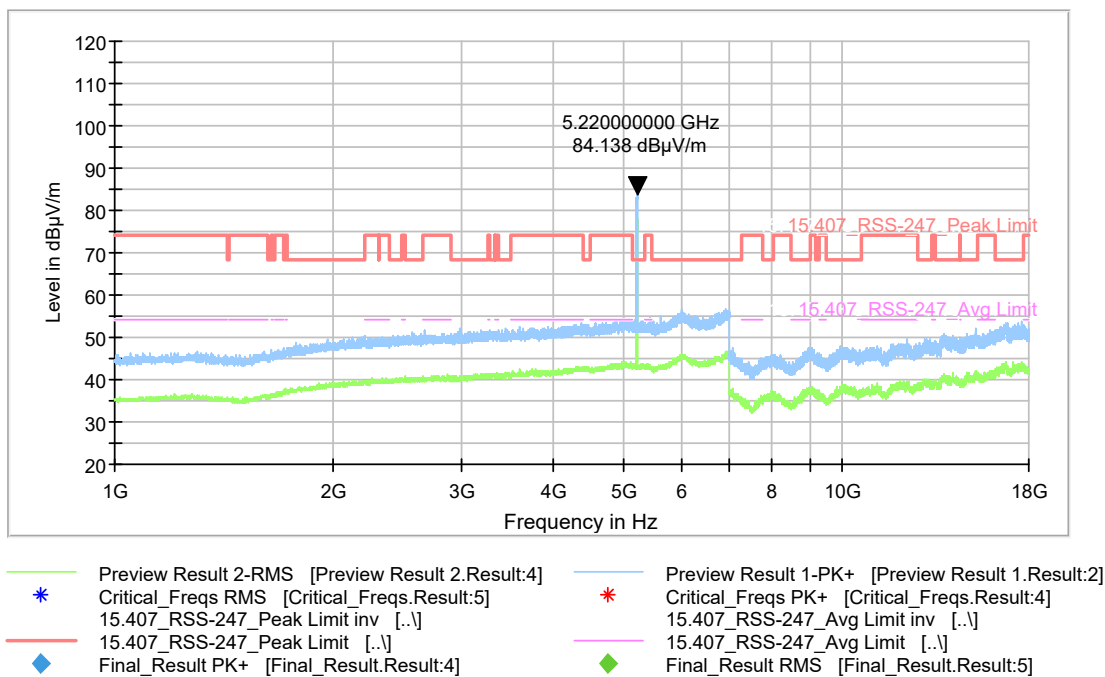
Plot 9-19. Radiated Spurious Emissions 30-1000 MHz Tx 802.11n (Ch. 149)

9.6.5.1.2 Radiated Emissions in 1-18 GHz range

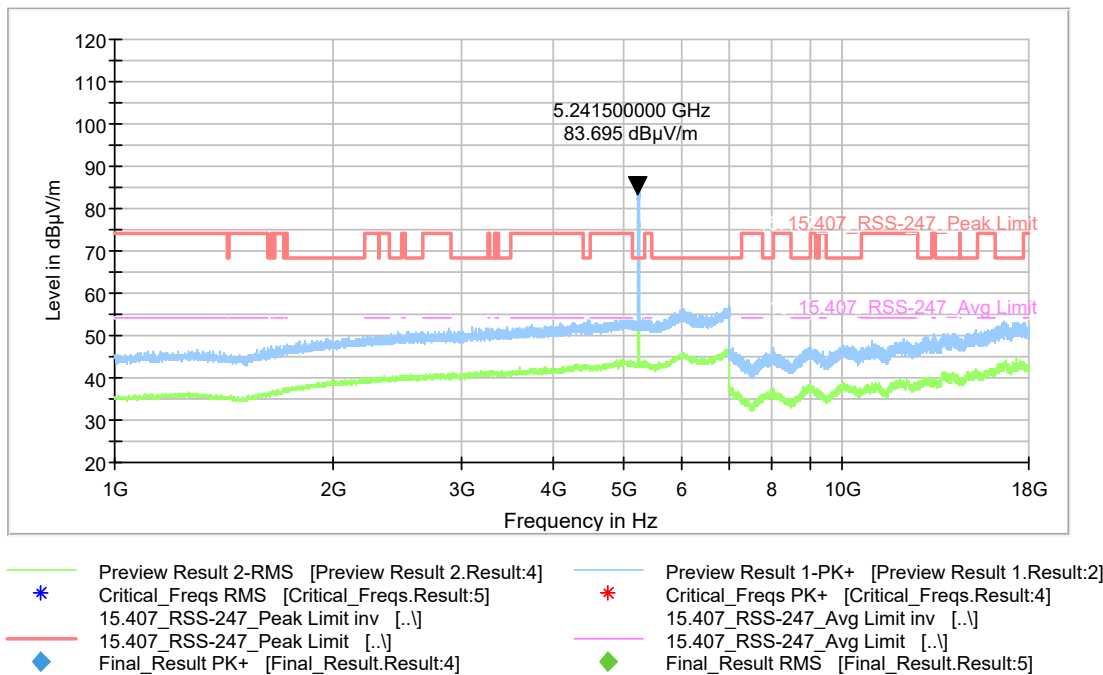
No emissions to report above noise floor.



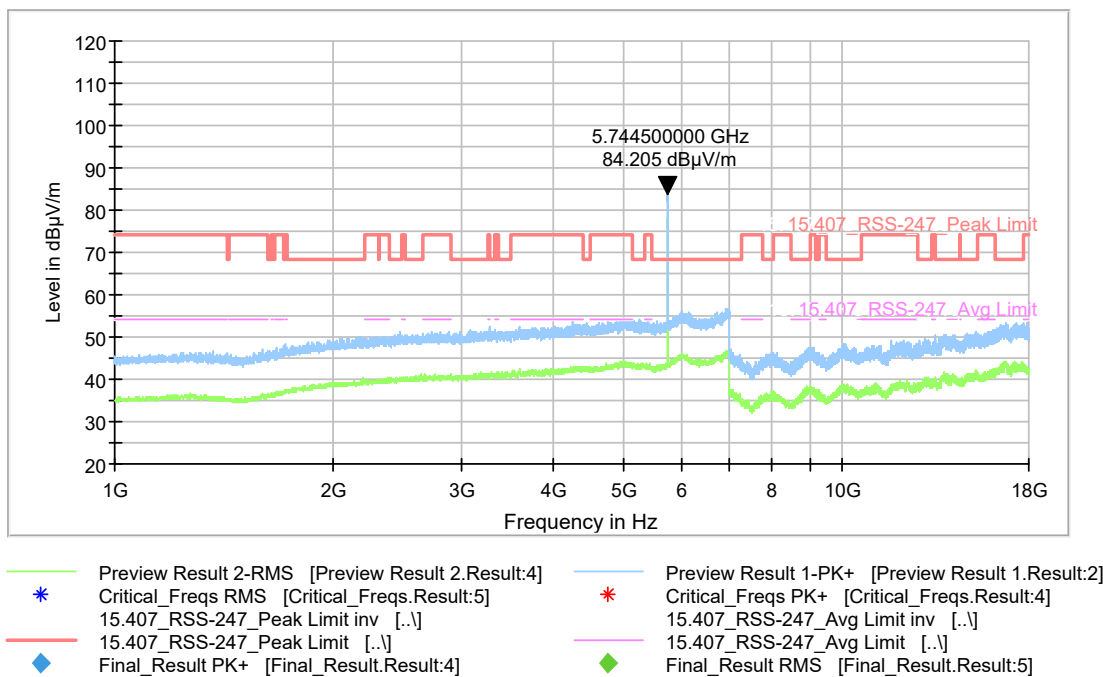
Plot 9-20. Radiated Spurious Emissions 1-18 GHz Tx 802.11n (Ch. 36)



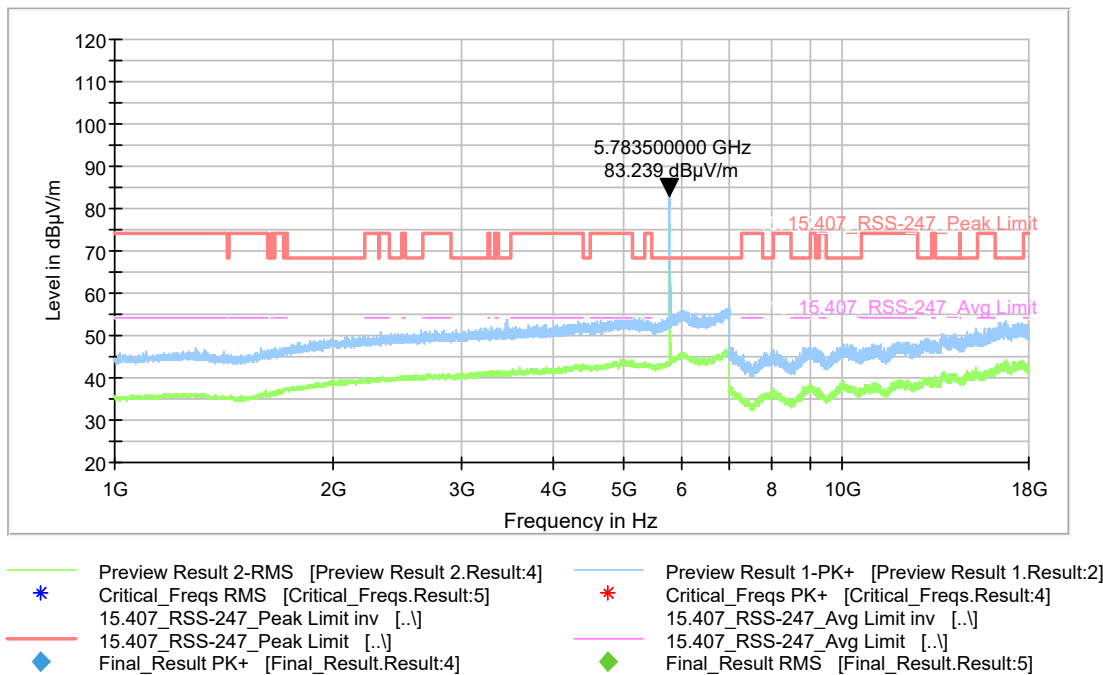
Plot 9-21. Radiated Spurious Emissions 1-18 GHz Tx 802.11n (Ch. 44)



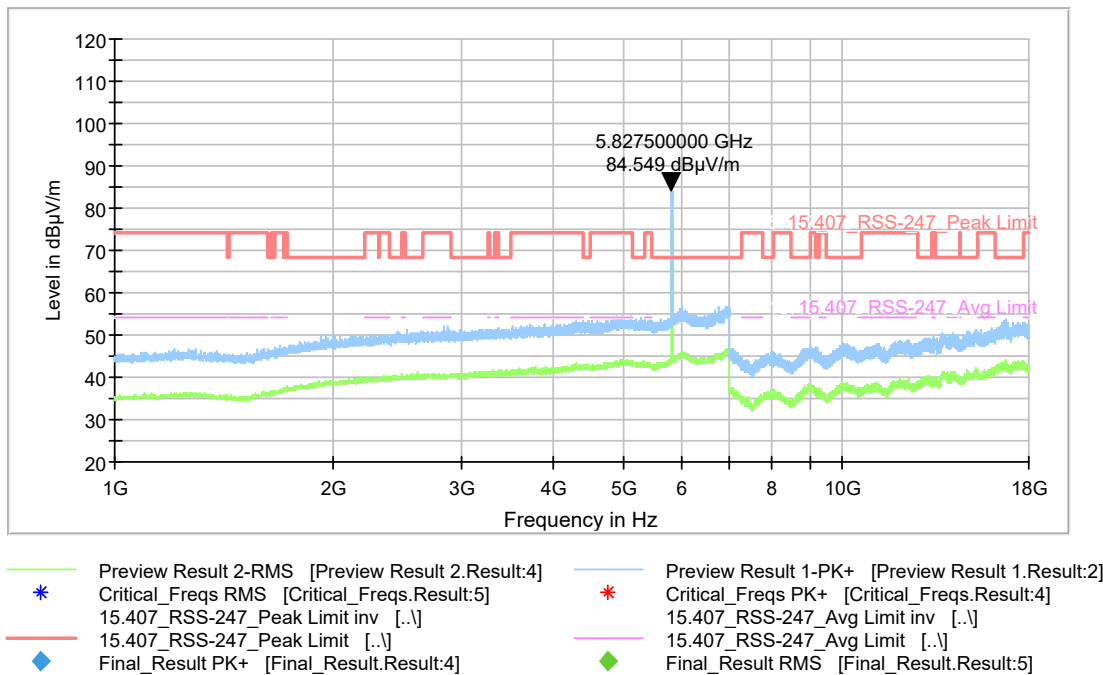
Plot 9-22. Radiated Spurious Emissions 1-18 GHz Tx 802.11n (Ch. 48)



Plot 9-23. Radiated Spurious Emissions 1-18 GHz Tx 802.11n (Ch. 149)



Plot 9-24. Radiated Spurious Emissions 1-18 GHz Tx 802.11n (Ch. 157)

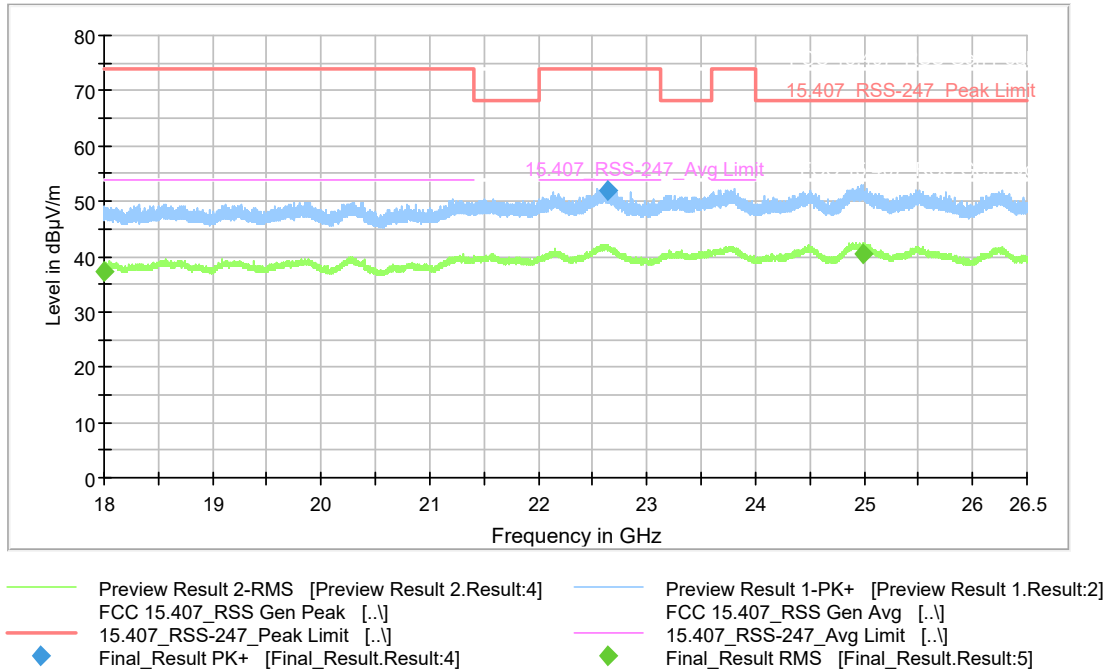


Plot 9-25. Radiated Spurious Emissions 1-18 GHz Tx 802.11n (Ch. 165)

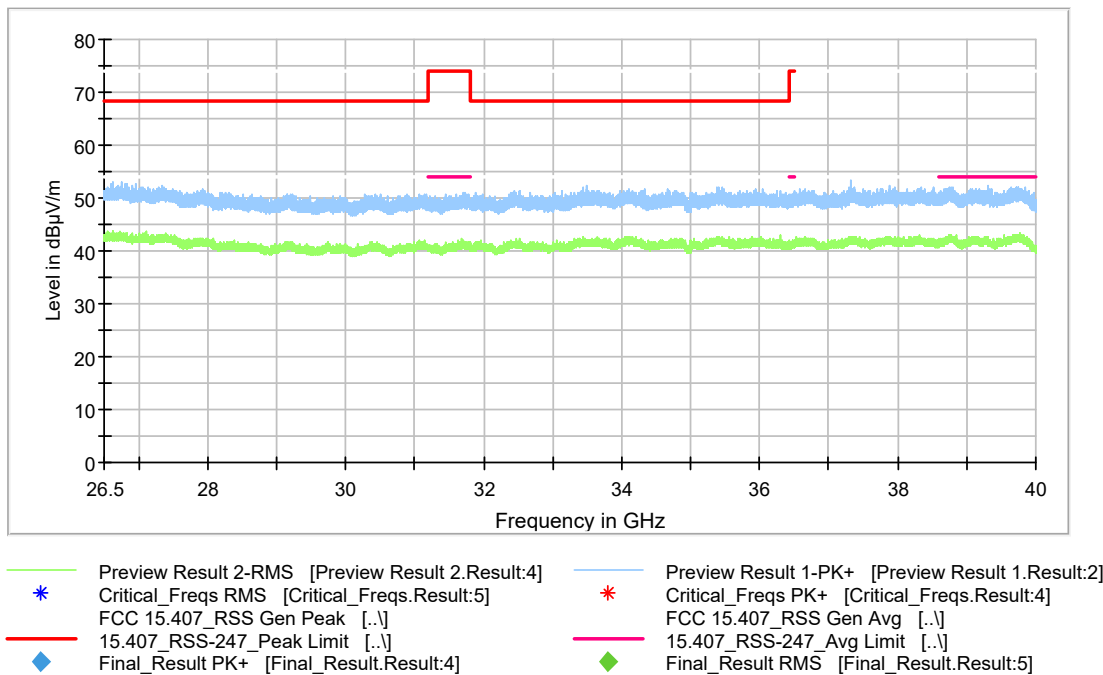
9.6.5.1.3 Emissions in 18-40 GHz range

No significant emissions to report above noise floor.

All channels and modes were tested and data from 802.11n mode, channel 36 shown here.

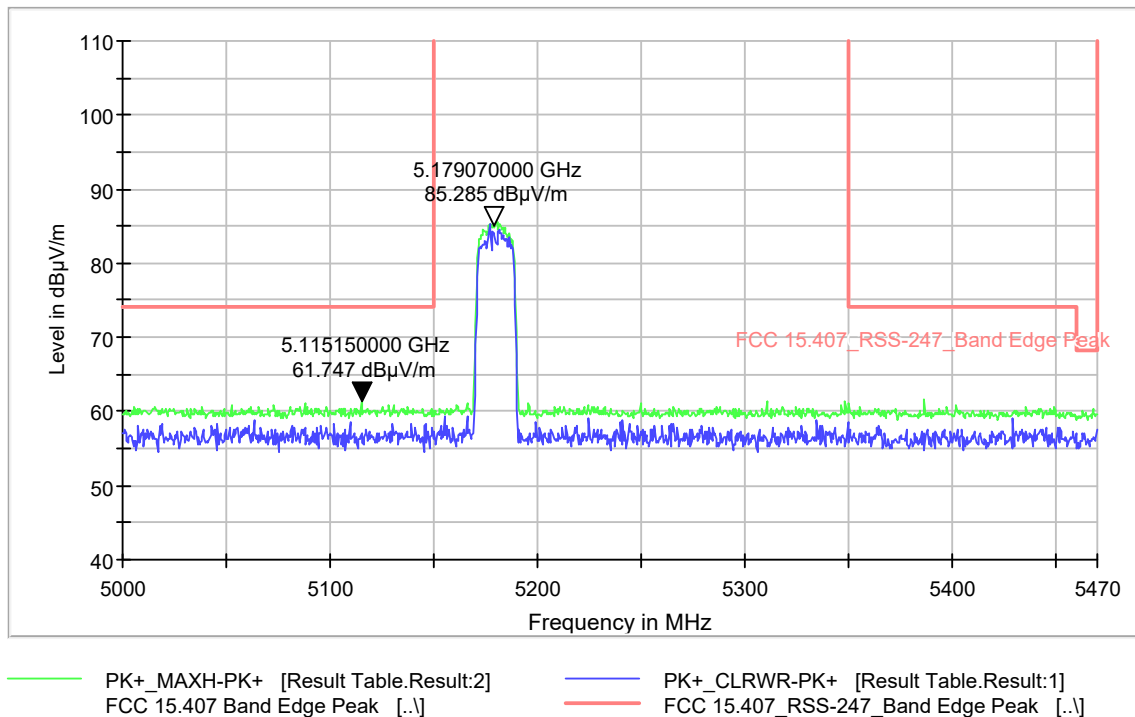


Plot 9-26. Radiated Spurious Emissions 18-26.5 GHz Tx 802.11n (Ch. 36)

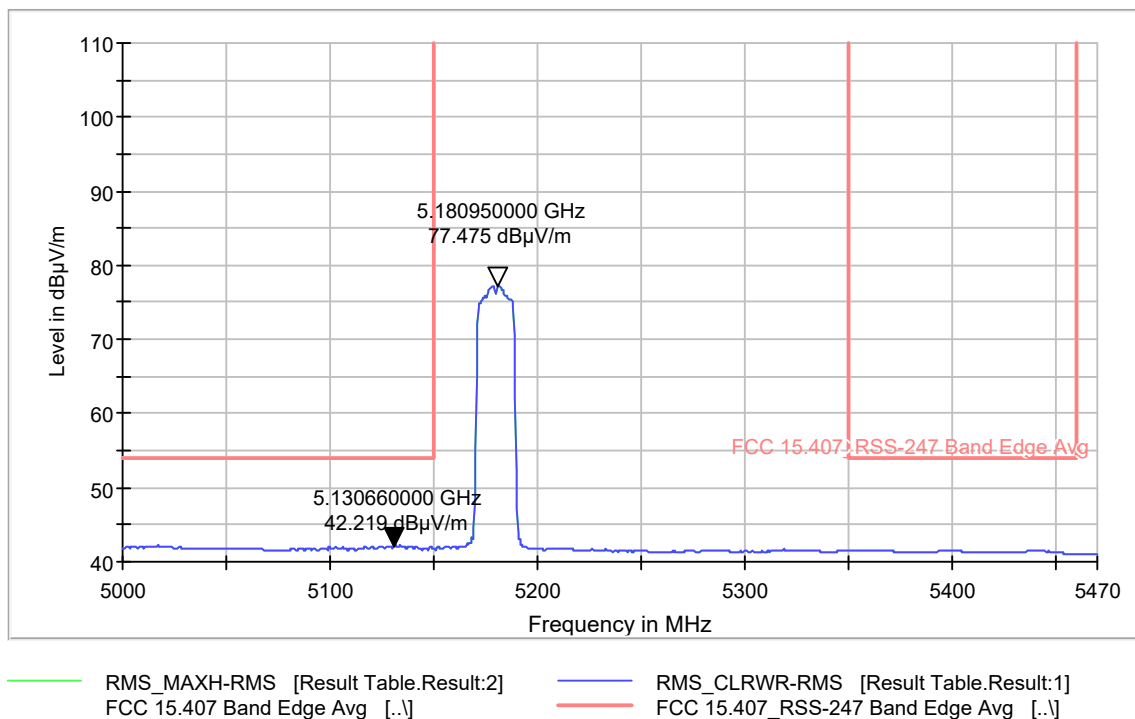


Plot 9-27. Radiated Spurious Emissions 26.5-40 GHz Tx 802.11n (Ch. 36)

9.6.5.1.4 Radiated Restricted Band-edge emissions 802.11n



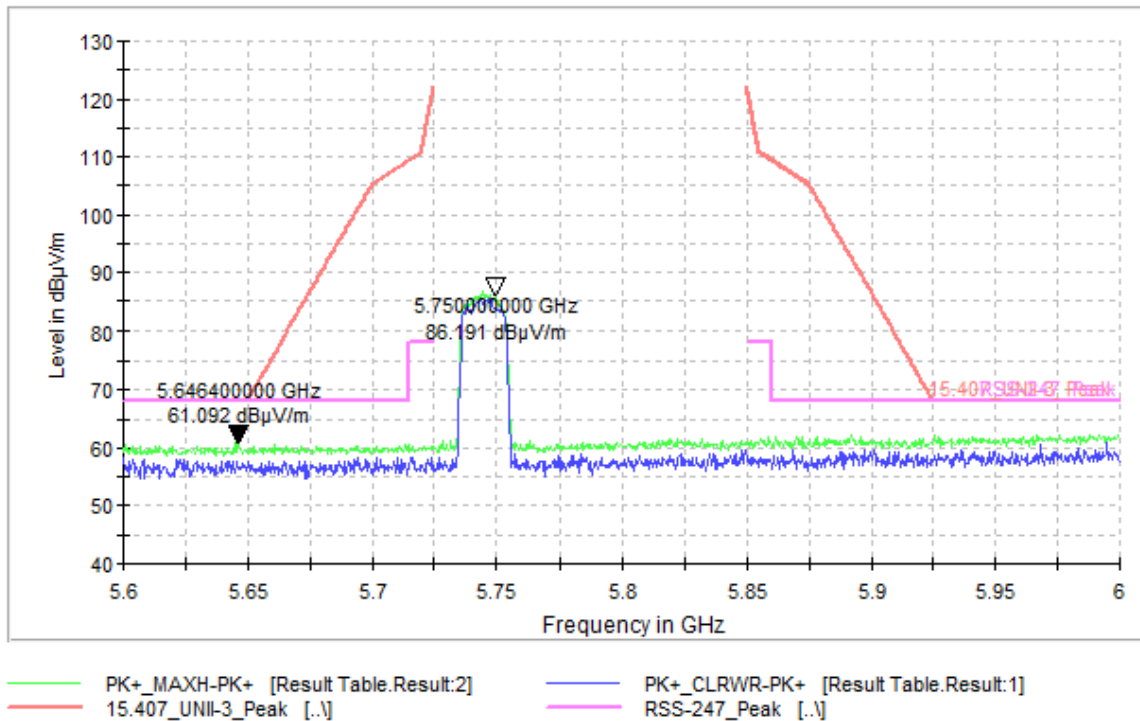
Plot 9-28. Peak Radiated Band Edge Emissions Tx 802.11n (Ch. 36)



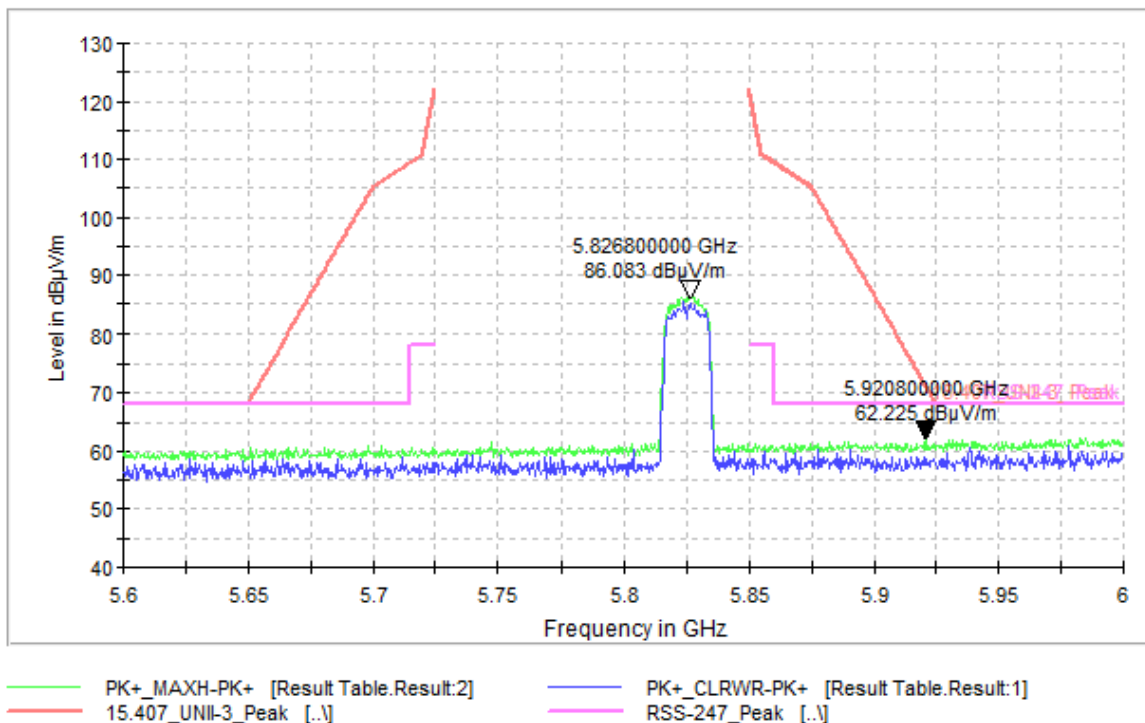
Plot 9-29. Average Radiated Band Edge Emissions Tx 802.11n (Ch. 36)

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9.6.5.1.5 Undesirable emissions outside the band of operation 802.11n



Plot 9-30. Peak Radiated Band Edge Emissions Tx 802.11n (Ch. 149)



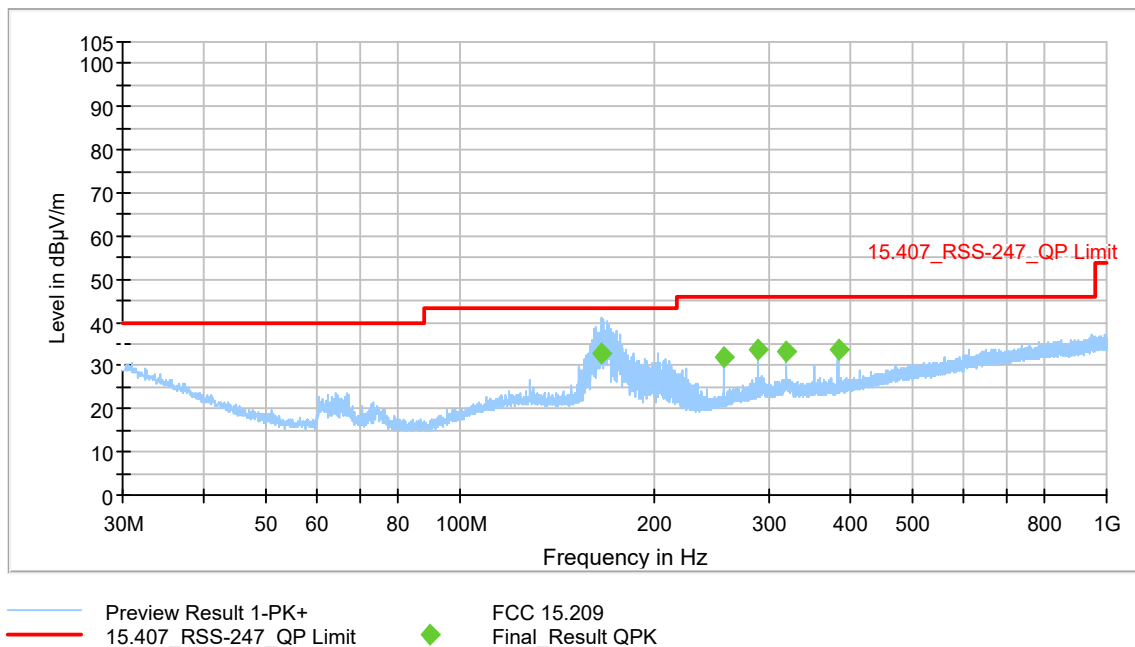
Plot 9-31. Peak Radiated Band Edge Emissions Tx 802.11n (Ch. 165)

9.6.5.2 Simultaneous Transmission: 802.11n: MCS0; HT MixMode; 20MHz and Bluetooth 3-DH5 Channel 78

Simultaneous transmission is possible using the same antenna for BT and the additional 802.11 radio. Worst case results reported here.

9.6.5.2.1 Radiated Emissions in 30 MHz- 1 GHz range – Simultaneous Transmission

RSE 30-1000 MHz					
Frequency (MHz)	Raw Quasi-Peak Amplitude (dB μ V/m)	Correction Factor (dB)	Corrected Quasi-Peak Field Strength (dB μ V/m)	Quasi-Peak Limit (dB μ V/m)	Quasi-Peak Margin (dB)
165.55	13.61	19.2	32.81	43.50	-10.69
256.00	12.85	19.3	32.15	46.00	-13.85
287.97	12.63	20.9	33.53	46.00	-12.47
319.98	12.06	21.4	33.46	46.00	-12.54
383.99	10.77	22.8	33.57	46.00	-12.43



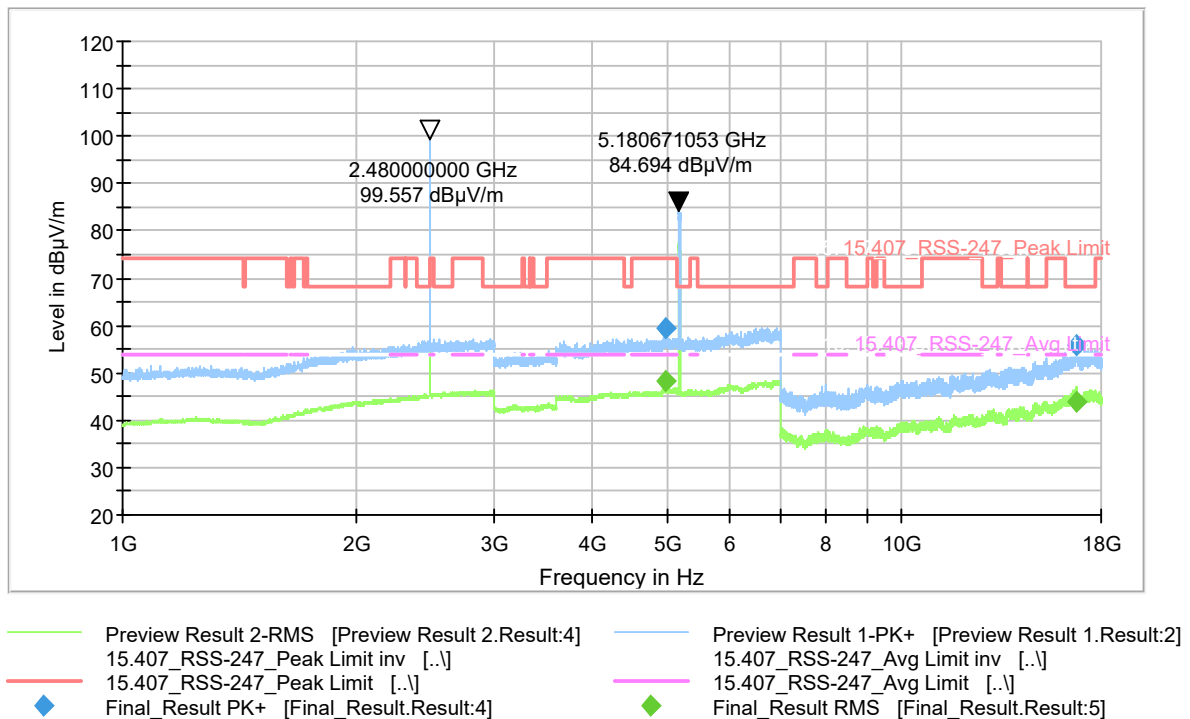
Plot 9-32 Radiated Spurious Emissions 30-1000 MHz Tx 802.11n (Ch. 165) + BT 3-DH5 (ch.78)

9.6.5.2.2 Radiated Emissions in 1-18 GHz range – Simultaneous Transmission

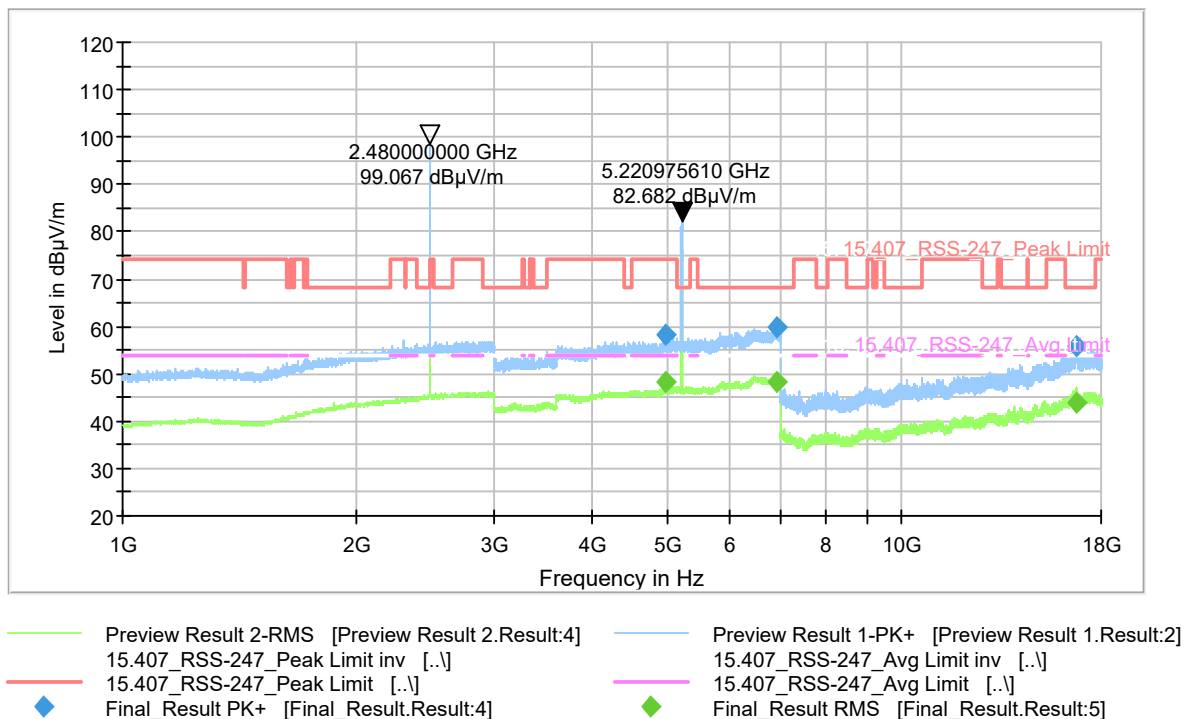
RSE 1-18GHz – Peak Data						
Ch.	Frequency (MHz)	Raw Peak Amplitude (dBμV/m)	Correction Factor (dB)	Corrected Peak Field Strength (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)
5180	4959.64	50.57	8.7	59.27	74	-14.73
5180	16696.61	32.08	23.9	55.98	68.2	-12.22
5220	4959.83	49.7	8.7	58.4	74	-15.6
5220	6896.68	47.24	12.6	59.84	68.2	-8.36
5220	16738.91	31.9	23.8	55.7	68.2	-12.5
5240	6967.96	47.91	11.8	59.71	68.2	-8.49
5240	16749.30	32.14	23.9	56.04	68.2	-12.16
5745	6975.44	48.27	11.8	60.07	68.2	-8.13
5745	16748.51	31.82	23.9	55.72	68.2	-12.48
5785	6966.14	47.21	11.8	59.01	68.2	-9.19
5785	16785.30	32.31	23.7	56.01	68.2	-12.19
5825	4959.94	48.37	8.7	57.07	74	-16.93
5825	6726.96	35.17	24	59.17	68.2	-9.03
5825	16681.58	31.92	24.2	56.12	68.2	-12.08

RSE 1-18GHz – Average Data							
Ch.	Frequency (MHz)	Raw RMS Avg. Amplitude (dBμV/m)	Correction Factor (dB)	Duty Cycle factor (dB)	Corrected RMS Avg. Field Strength (dBμV/m)	RMS Avg. Limit (dBμV/m)	RMS Avg. Margin (dB)
5180	4959.64	39.71	8.7	1.13	49.54	54	-4.46
5180	16728.24	-15.3	24.0	0	45.14	N/A	N/A
5220	4959.83	39.72	8.7	1.13	49.55	54	-4.45
5220	6896.68	35.53	12.6	0	48.13	N/A	N/A
5220	16727.40	19.92	24.1	0	44.02	N/A	N/A
5240	6967.64	35.82	11.8	0	47.62	N/A	N/A
5240	16708.71	20.03	24.1	0	44.13	N/A	N/A
5745	6973.72	35.8	11.8	0	47.6	N/A	N/A
5745	16759.73	20.29	23.9	0	44.19	N/A	N/A
5785	6962.40	35.78	11.8	0	47.58	N/A	N/A
5785	16714.79	19.95	24.2	0	44.15	N/A	N/A
5825	4959.94	39.4	8.7	1.13	49.23	54	-4.77
5825	6726.96	23.22	24.0	0	47.22	N/A	N/A
5825	16681.58	19.71	24.2	0	43.91	N/A	N/A

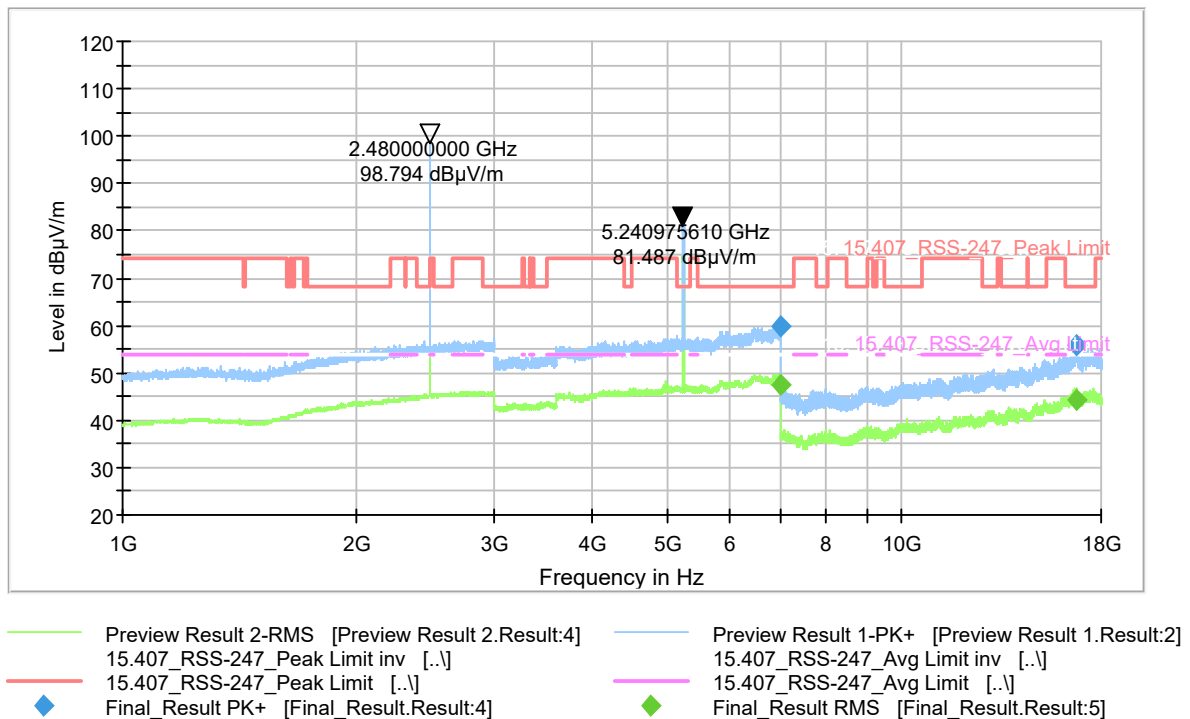
Note: Limits marked as N/A are for emissions which fall into unrestricted frequency bands.



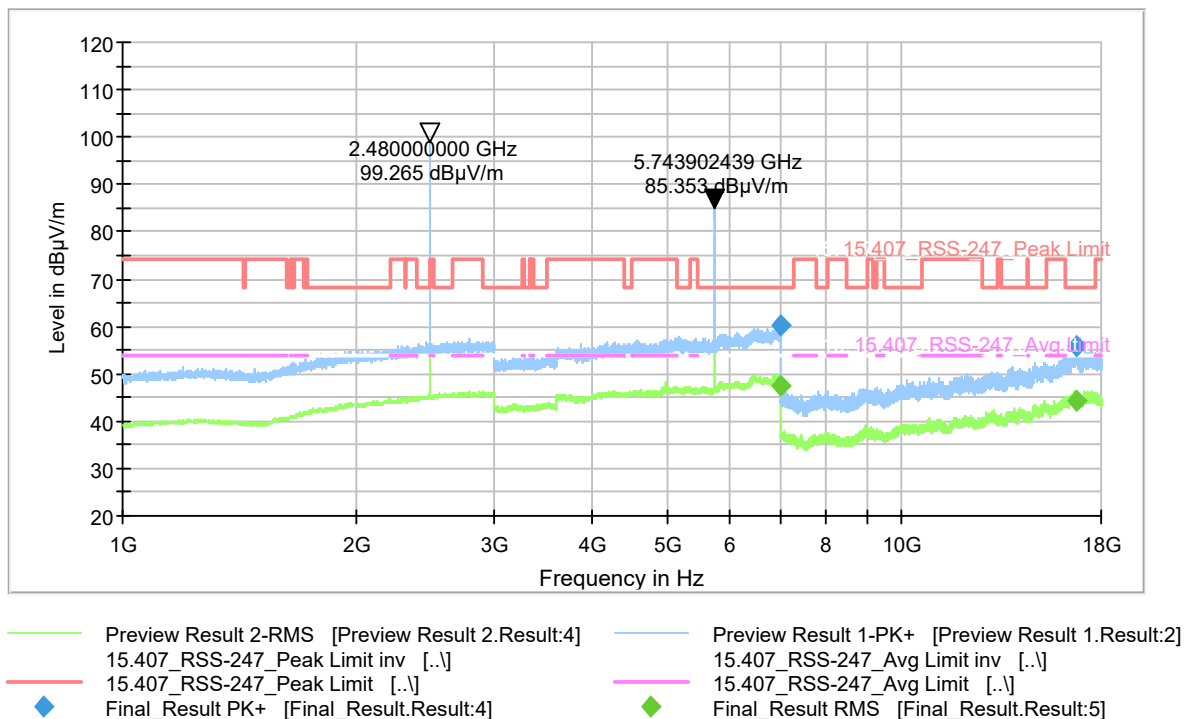
Plot 9-33. Radiated Spurious Emissions 1-18 GHz Tx 802.11n (Ch. 36) + BT 3-DH5 (ch.78)



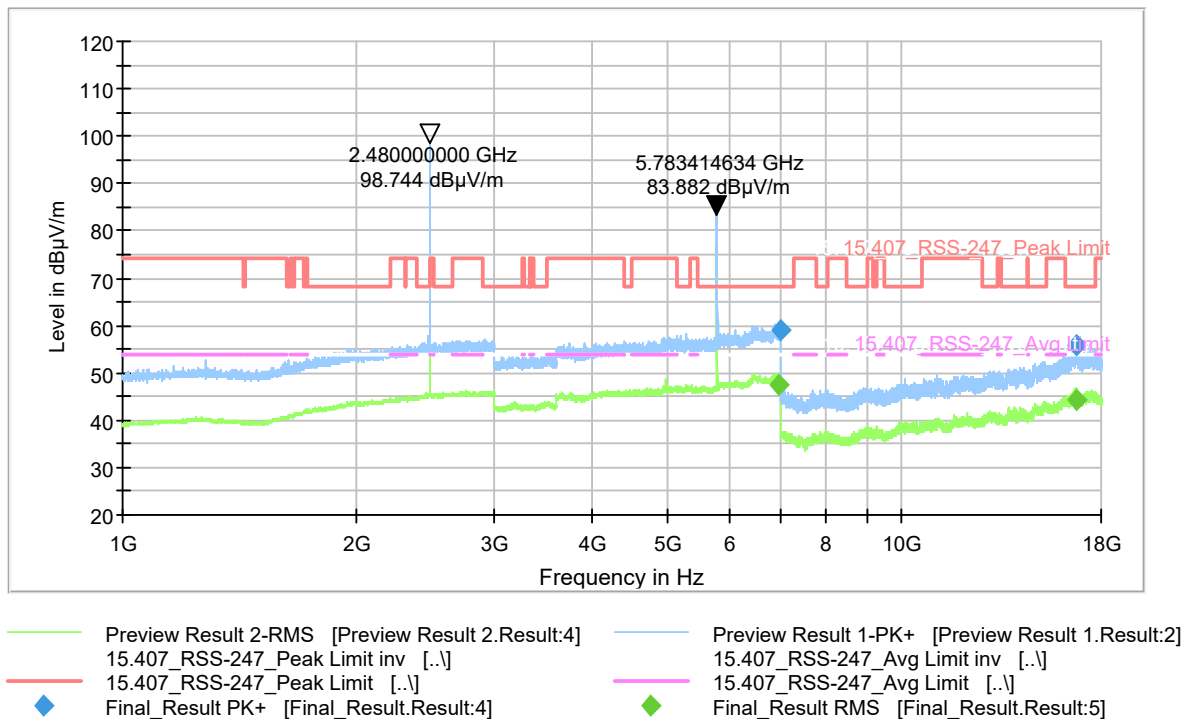
Plot 9-34. Radiated Spurious Emissions 1-18 GHz Tx 802.11n (Ch. 44) + BT 3-DH5 (ch.78)



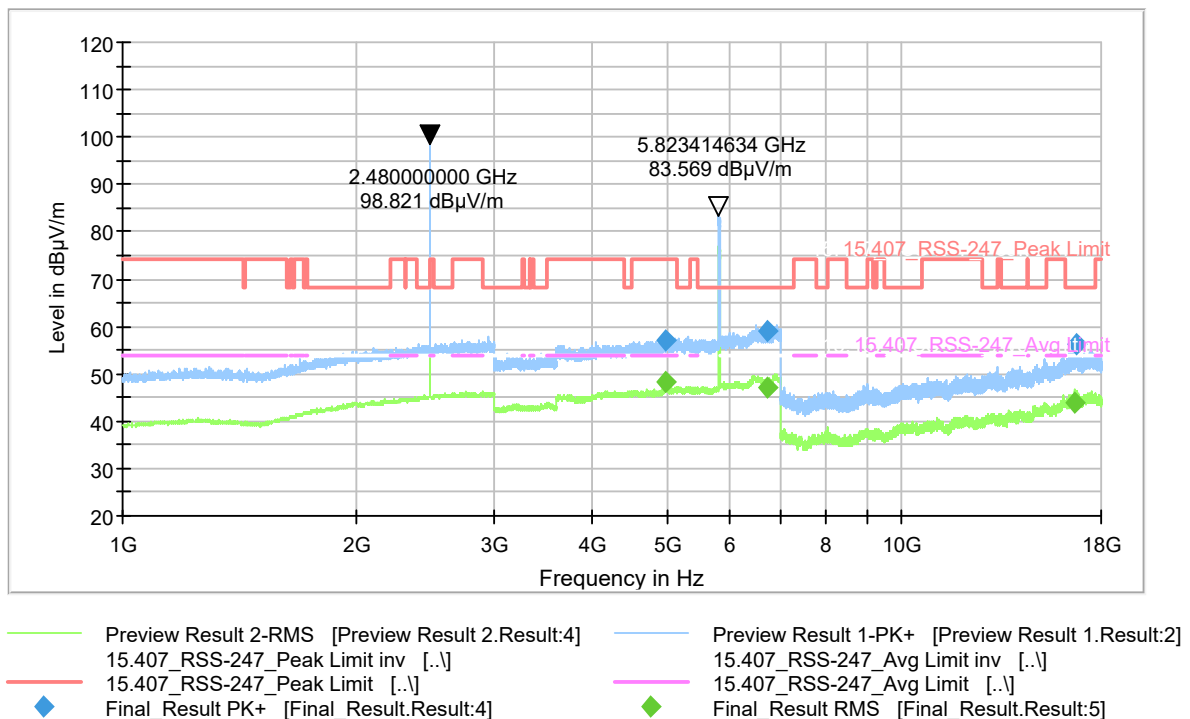
Plot 9-35. Radiated Spurious Emissions 1-18 GHz Tx 802.11n (Ch. 48) + BT 3-DH5 (ch.78)



Plot 9-36. Radiated Spurious Emissions 1-18 GHz Tx 802.11n (Ch. 149) + BT 3-DH5 (ch.78)



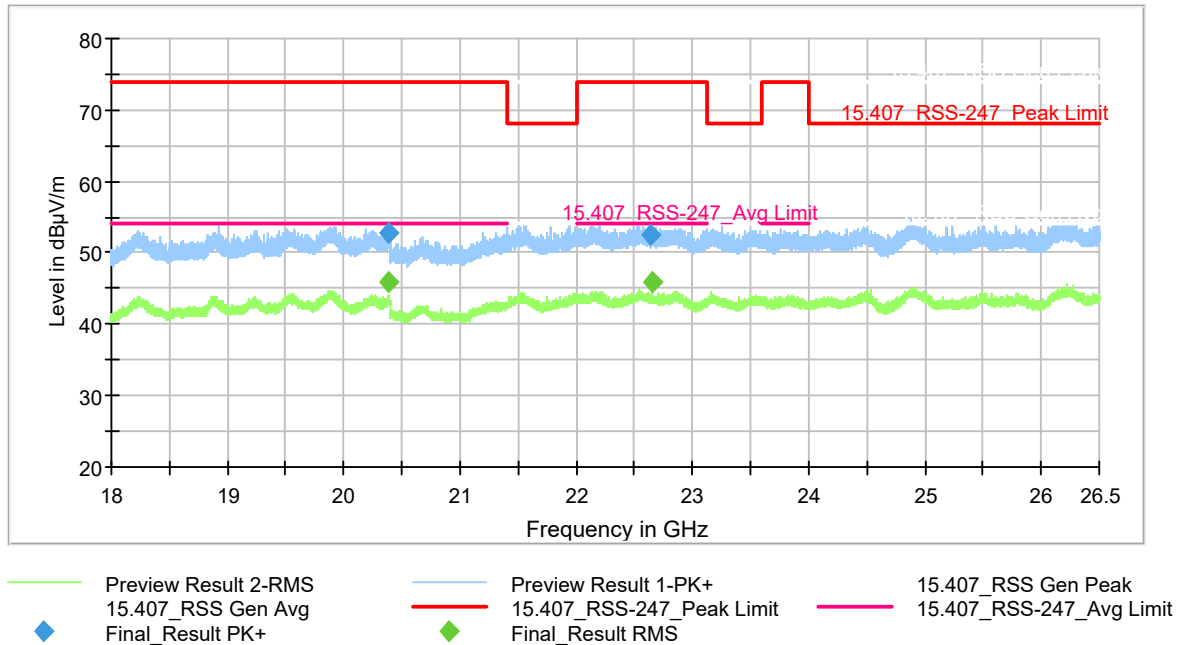
Plot 9-37. Radiated Spurious Emissions 1-18 GHz Tx 802.11n (Ch. 157) + BT 3-DH5 (ch.78)



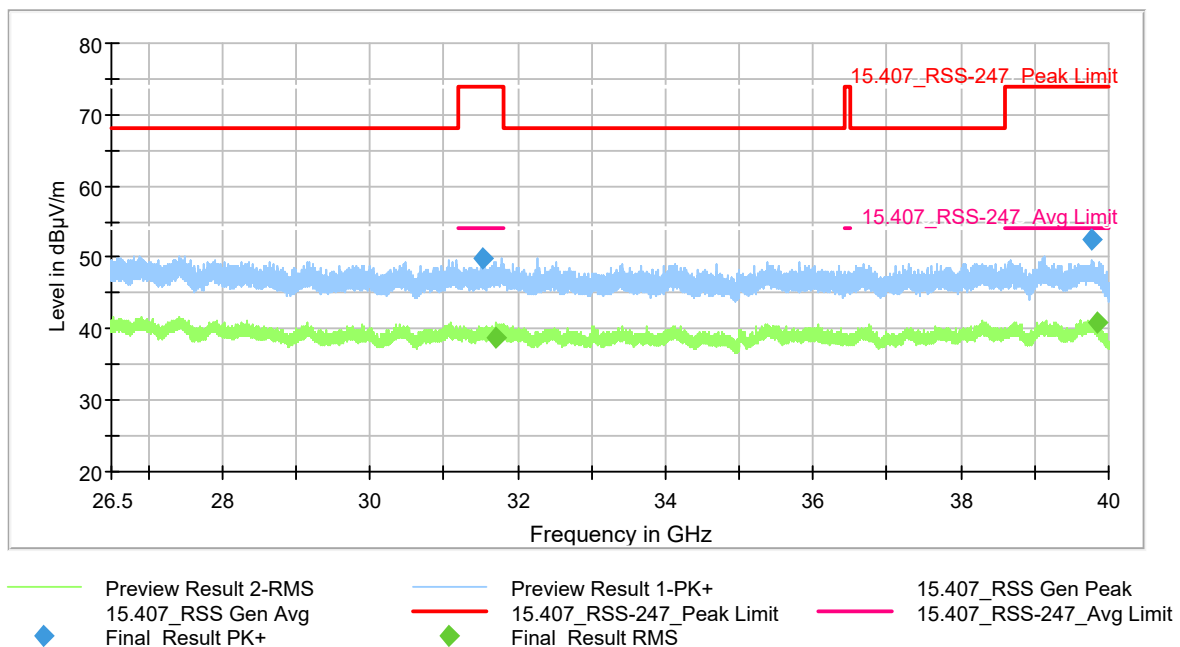
Plot 9-38. Radiated Spurious Emissions 1-18 GHz Tx 802.11n (Ch. 165) + BT 3-DH5 (ch.78)

9.6.5.2.3 Radiated Emissions in 18-40 GHz range – Simultaneous Transmission

No significant emissions to report above noise floor.



Plot 9-39. Radiated Spurious Emissions 18-26.5 GHz Tx 802.11n (Ch. 165) + BT 3-DH5 (ch.78)



Plot 9-40. Radiated Spurious Emissions 26.5-40 GHz Tx 802.11n (Ch. 165) + BT 3-DH5 (ch.78)

9.7 AC Line Conducted Emissions

9.7.1 Test Requirements

FCC CFR 47 Rule Part 15.207 (a)

ISED RSS Gen [8.8]

9.7.2 Test Method

Conducted power line measurements were made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Equipment was tested with the power cords that were used under normal operating conditions. The following measurements were made using a LISN (Line Impedance Stabilization Network). AC powered peripherals were attached to a second LISN with the 50 ohm measurement port terminated by a 50 ohm resistive load.

Test Configuration: Channel 36, HTMIX Mode, Data Rate MCS0 6.5Mbps.

EMI Receiver Settings:

150 kHz – 30 MHz:

RBW= 9 kHz

VBW $\geq 3 \times$ RBW

Trace Mode: Peak Detector (Max Hold).

Final measurements were performed using Quasi-Peak and Average Detectors.

Span= 150 kHz – 30 MHz

Sweep time= Auto

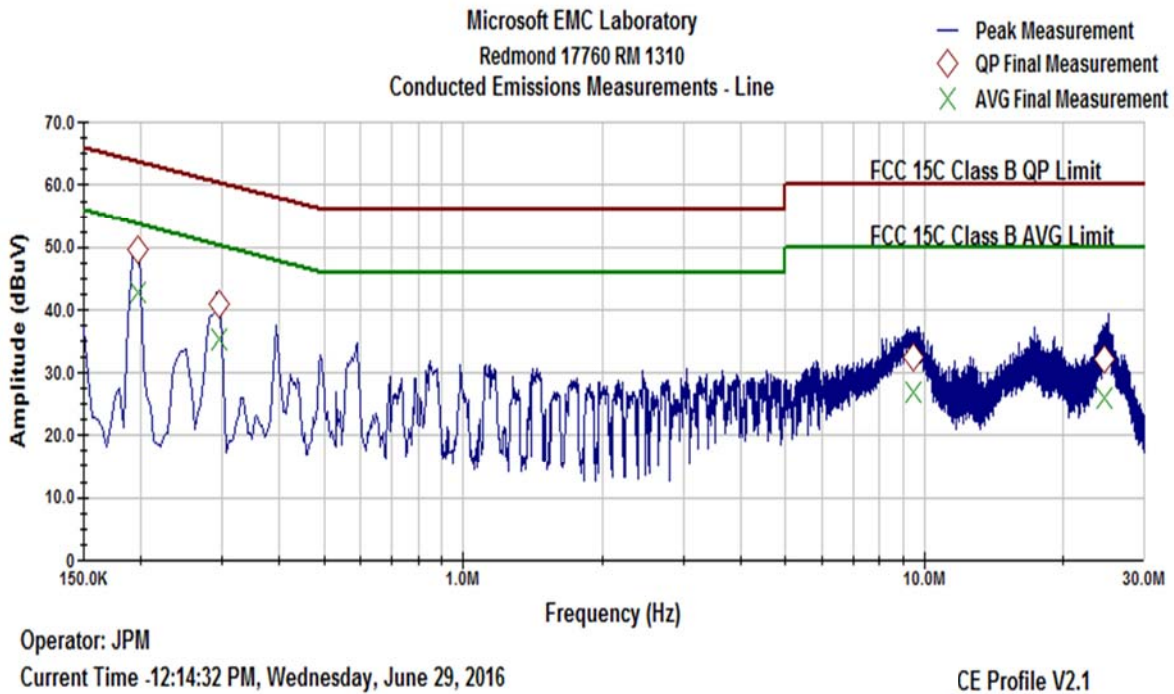
9.7.3 Limit

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

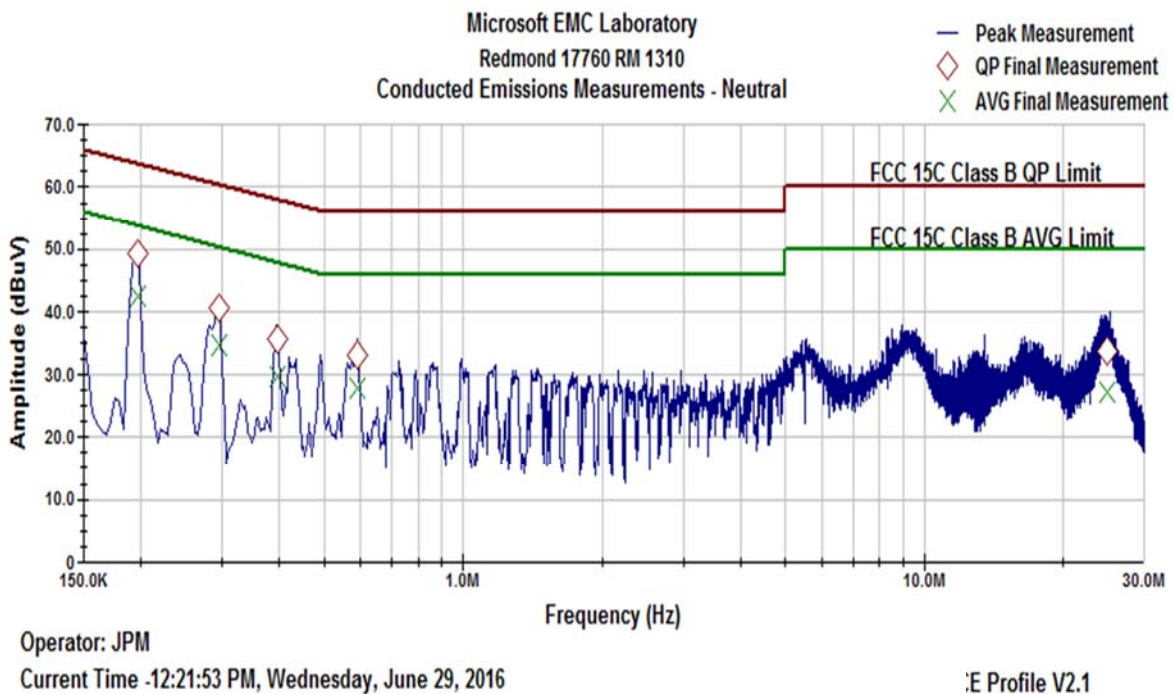
9.7.4 Test Result:

Pass

9.7.5 Test Data:



Plot 9-41. AC Line Conducted Emissions- Line (150 kHz- 30 MHz)



Plot 9-42. AC Line Conducted Emissions- Neutral (150 kHz- 30 MHz)

Frequency (MHz)	QP Net Reading (dBμV)	AVG Net Reading (dBμV)	Quasi-Peak Limit (dBμV)	Average Limit (dBμV)	Line Tested (L or N)	Quasi-Peak Margin (dB)	Average Margin (dB)
0.198	49.52	42.89	64.64	54.635	L	-15.11	-11.75
0.197	49.25	42.59	64.64	54.644	N	-15.39	-12.06
0.295	40.81	35.24	61.86	51.863	L	-21.05	-16.62
0.295	40.45	34.81	61.85	51.85	N	-21.41	-17.04
0.591	33.26	27.74	56.00	46.00	N	-22.74	-18.27
0.395	35.60	29.68	59.00	49.00	N	-23.40	-19.32
24.95	33.75	27.09	60.00	50.00	N	-26.25	-22.91
9.49	32.42	26.96	60.00	50.00	L	-27.58	-23.04
24.601	32.28	26.12	60.00	50.00	L	-27.72	-23.88

End of Report