

RF Test Report

Project Number: 4711959**Proposal Number: 11802****Report Number: 4711959EMC01****Revision Level: 1****Client: Coulomb, Inc.****Equipment Under Test: Lumin Smart Panel****Model: LS-100212****Contains FCC ID: 2AY52-LSPFN13WLAN****Contains IC: 27016-LSPFN13WLAN****Applicable Standards: FCC Part 15 Subpart C, § 15.247****RSS-247, Issue 2, February 2017****RSS-GEN, Issue 5, February 2021, Amendment 2****ANSI C63.10:2013****Report issued on: 30 June 2021****Test Result: Compliant**

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER: 3212.01

This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

Prepared by:

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Martin Taylor, Project Engineer

Reviewed by:

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Jeremy Pickens, RF Lab Manager

Remarks: This report details the results of the testing carried out on one sample; the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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1 Objective

This report covers testing and data reuse of the WLAN radio portion of a module that has been incorporated into the Lumin Smart Panel, model LS-100212. The WLAN module was previously certified under FCC ID: 2AATL-F23BUUM13 and IC: 24844-F23BUUM13 as a limited single module with no shielding around the RF circuits. The module is being used with no changes; however, a different antenna is being used in this new host product. The conducted data is being reused from the original module certification. Radiated Spurious Emissions, Band Edge Emissions and AC Powerline Conducted Emissions data has been taken with the module installed in the new host. Refer to the data summaries below.

1.1 Summary of Results for Reused Data

Test Description	Test Specification		Test Result
Bandwidth	15.247(a)(2)	RSS-247 S5.2 (a) RSS-GEN S6.7	Compliant ⁽¹⁾
Output Power	15.247(b)(3)	RSS-247 S5.4 (d)	Compliant ⁽¹⁾
Power Spectral Density	15.247(e)	RSS-247 S5.2 (b)	Compliant ⁽¹⁾
Conducted Spurious Emissions / Band Edge	15.247(d)	RSS-247 S5.5	Compliant ⁽¹⁾

(1) Conducted tests from original grant still apply. See Report Number MTE/SAL/F14081080 from Most Technology Service Co., Ltd.

1.2 Summary of Results for Tests in New Host

Test Description	Test Specification		Test Result
Emissions in Restricted Frequency Bands	15.247(d) 15.205, 15.209	RSS-247 S5.5 RSS-GEN S8.9, S8.10	Compliant
Band Edge Emissions in Restricted Frequency Bands	15.205, 15.209	RSS-GEN S8.9, S8.10	Compliant
AC Powerline Conducted Emissions	15.207	RSS-GEN S8.8	Compliant
Antenna Requirement	15.203	RSS-GEN S6.8	Compliant ⁽²⁾

(2) Device uses an external antenna with reverse-polarity SMA connector.

1.3 Modifications Required for Compliance

None.

2 General Information

2.1 Client Information

Name: Coulomb, Inc.
Address: 212 E Main Street, Suite 202
City, State, Zip, Country: Charlottesville, VA 22902, USA

2.2 Test Laboratory

Name: SGS North America, Inc.
Address: 620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country: Suwanee, GA 30024, USA

Accrediting Body: A2LA
Type of lab: Testing Laboratory
Certificate Number: 3212.01
CAB Identifier: US0186

2.3 General Information of EUT

Equipment Under Test: Lumin Smart Panel
Model: LS-100212
Sample ID: 5877

Contains FCC ID: 2AY52-LSPFN13WLAN
Contains IC: 27016-LSPFN13WLAN

Frequency Range: 2412 – 2462 MHz
Data Modes: WLAN IEEE 802.11b/g/n(HT20 & HT40) (DSSS, OFDM)
(Note: Module also has BLE capability, but it is disabled in this host.)
Antenna: External Omni-directional Dipole Antenna (2.8 dBi peak gain)

Rated Voltage: 120/240Vac 60Hz (single/dual phase)
Test Voltage: 120/240Vac 60Hz (dual phase)

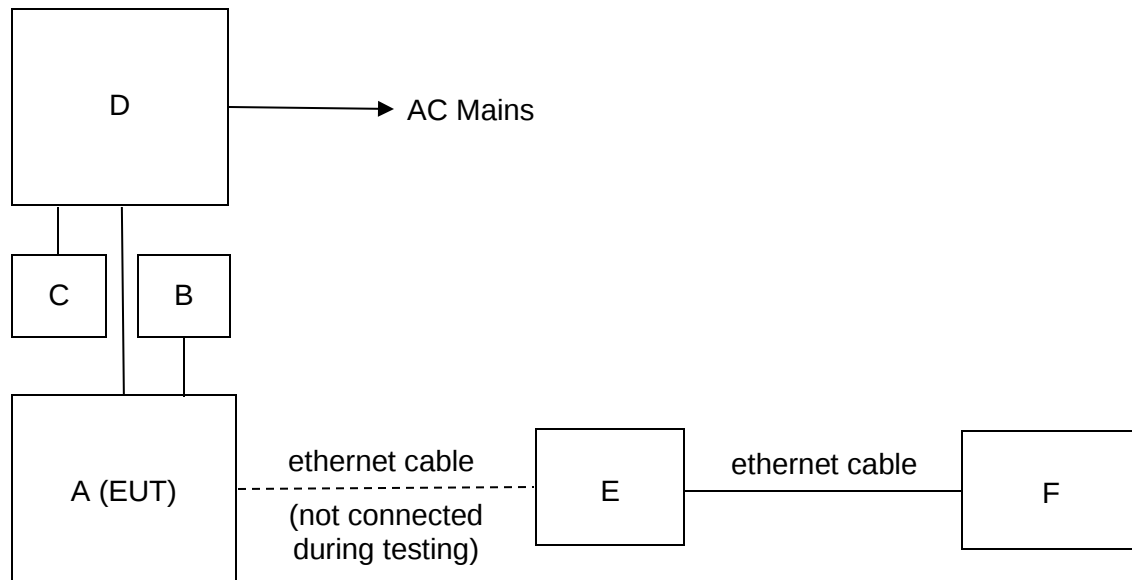
Sample Received Date: 09 December 2020
Dates of testing: 02-19 March 2021

2.4 Operating Modes and Conditions

The EUT was programmed by the manufacturer to allow WLAN radio control using a web application (Lumin WiFi Test Controller). An Ethernet connection was made from the laptop running the web application to the EUT via a router.

For spurious emissions testing, low, middle and high WLAN channels were tested using the worst-case Tx channel configuration based on the original test report on the module, which was 802.11b, 1Mbps. For restricted band band edge testing, low and high channels were tested in all supported data modes (802.11b/g/n-HT20/n-HT40). All data rates were checked, and the worst-case data is reported. A power setting of 56 was used for the WLAN Tx channels.

2.5 EUT Connection Block Diagram



2.6 System Configurations

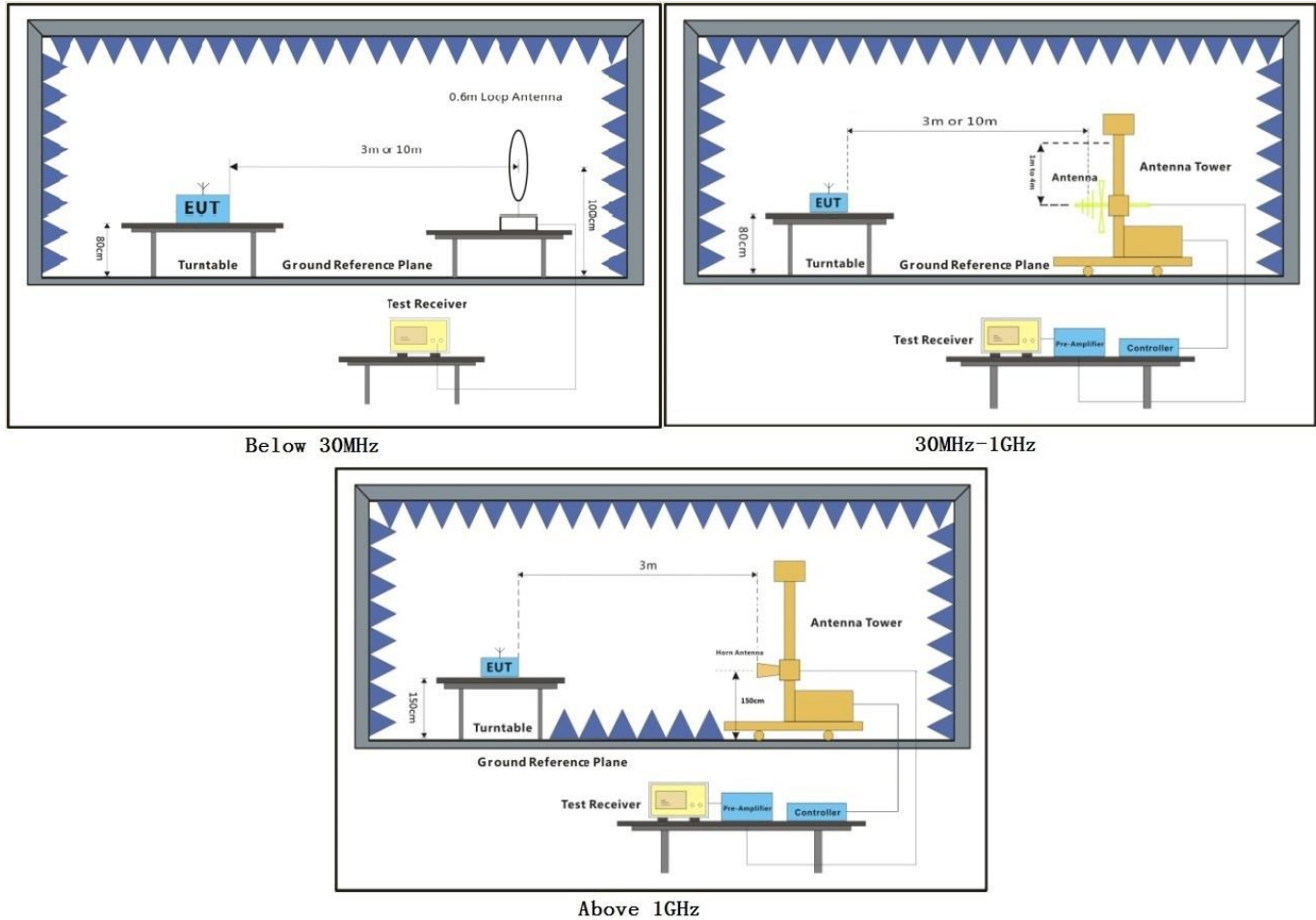
Device Reference	Manufacturer	Description	Model Number	Serial Number
A	Coulomb, Inc.	Lumin Smart Panel (EUT)	LS-100212	Not labeled
B	Coulomb, Inc.	Capacitor Extension Module	Not labeled	Not labeled
C	(various)	Bulb/Socket/Switch (x2)	Not labeled	Not labeled
D	Schneider Electric	Home Electric Service Panel with Breakers	HOMC12UC	Not labeled
E	Netgear	Smart WiFi Router	R7000	3LG23C7F03390
F	Lenovo	Laptop Computer	T500	L3-ABV0N 08/12

3 Emissions in Restricted Frequency Bands

3.1 Test Result

Test Description	Test Specification		Test Result
Emissions in Restricted Frequency Bands	15.247(d) 15.205, 15.209	RSS-247 S5.5 RSS-GEN S8.9, S8.10	Compliant

3.2 Test Setup



3.3 Test Method

Radiated spurious emissions (RSE) in restricted frequency bands were measured using methods defined in ANSI C63.10 clause 11.12.

Low, middle and high channels were tested using the worst-case Tx channel configuration based on the original test report on the certified radio module, which was 802.11b with the lowest data rate of 1Mbps.

Test distances for radiated tests:

9kHz to 30 MHz – The EUT to measurement antenna distance was 3 meters

30 to 1000 MHz - The EUT to measurement antenna distance was 3 meters

1 to 18 GHz - The EUT to measurement antenna distance was 3 meters

Limits within restricted bands of operation:

Frequency	Limits ⁽¹⁾		Peak Limits dBuV/m
	Microvolts/m	dBuV/m	
30 - 88 MHz	100	40 ⁽²⁾	--
88 - 216 MHz	150	43.5 ⁽²⁾	--
216 - 960 MHz	200	46 ⁽²⁾	--
960 - 1000 MHz	500	54 ⁽²⁾	--
1 - 40 GHz	500	54 ⁽³⁾	74

(1) These limits are applicable to emissions outside of the intentional transmit frequency band.

(2) Quasi-peak limit

(3) Average limit

3.4 Test Site

10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions	9kHz-1GHz	1-18GHz
Temperature:	23.0 °C	23.5 °C
Relative Humidity:	31.4 %	27.2 %
Atmospheric Pressure:	98.1 kPa	98.1 kPa

3.5 Test Equipment

9kHz-30MHz

Test End Date: 2-Mar-2021

Tester: ZH

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	7-May-2021
ANTENNA, LOOP, ACTIVE	6502	ETS Lindgren	B085752	20-Aug-2022
RF CABLE	SF106	Huber & Suhner	B085903	28-Sep-2021
RF CABLE	SF106	HUBER & SUHNER	B079713	3-Sep-2021
RF Cable Nm to Nm, 0.01-18GHz	90-195-118	TELEDYNE STORM MICROWAVE	20125	17-Feb-2022

30-1000MHz

Test End Date: 2-Mar-2021

Tester: ZH

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	7-May-2021
ANTENNA, BILOG	JB6	SUNOL	B079690	13-Jan-2023
RF CABLE	SF106	Huber & Suhner	B085903	28-Sep-2021
RF CABLE	SF106	HUBER & SUHNER	B079713	3-Sep-2021
RF Cable Nm to Nm, 0.01-18GHz	90-195-118	TELEDYNE STORM MICROWAVE	20125	17-Feb-2022
RF CABLE	104PE	HUBER & SUHNER	B079793	3-Sep-2021
LOW NOISE AMPLIFIER	ZKL-2+	Mini-Circuits	B079800	25-Sep-2021

1-18GHz

Test End Date: 3-Mar-2021

Tester: PL

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS Lindgren	B079691	10-Aug-2022
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	6-Apr-2021
RF Cable Nm to Nm, 0.01-18GHz	90-195-157	TELEDYNE STORM MICROWAVE	20121	17-Feb-2022
RF CABLE	SUCOFLEX 100	Huber & Suhner	B108523	3-Sep-2021
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	24-Nov-2021
FILTER, HIGH PASS, >2800MHz	HPM50111	MICRO-TRONICS	B085747	8-Sep-2021

Note: The equipment calibration period is 1 year except for the antennas which are on a 2-year period.

Software:

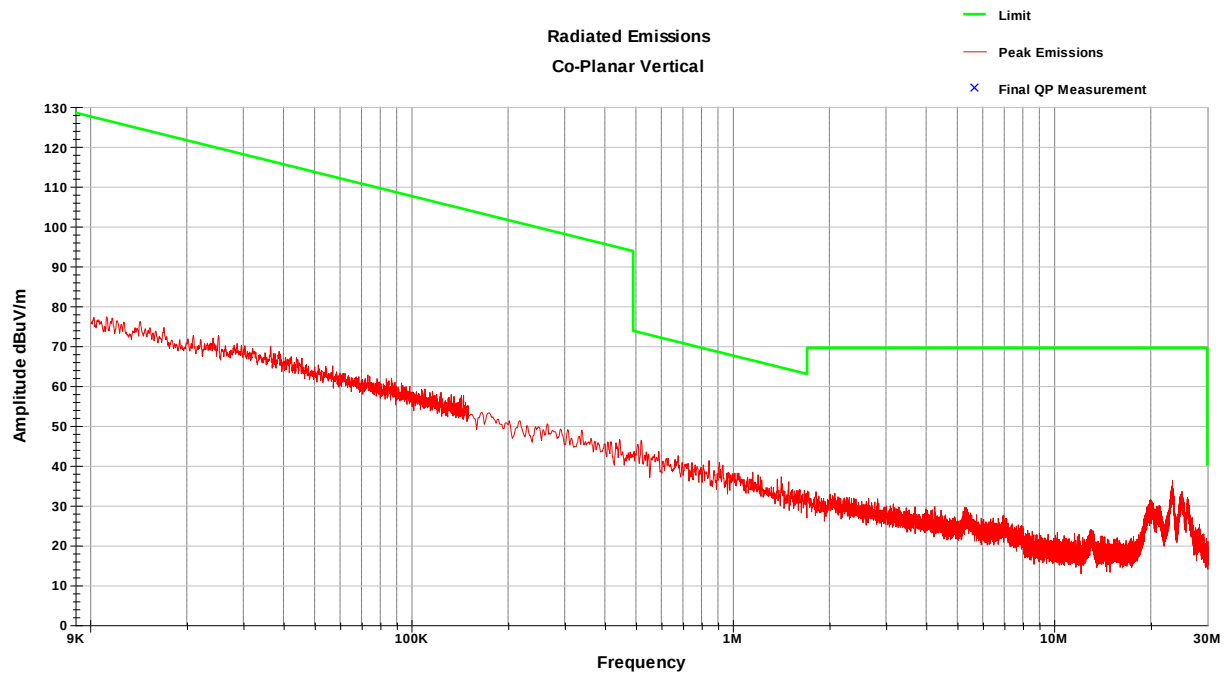
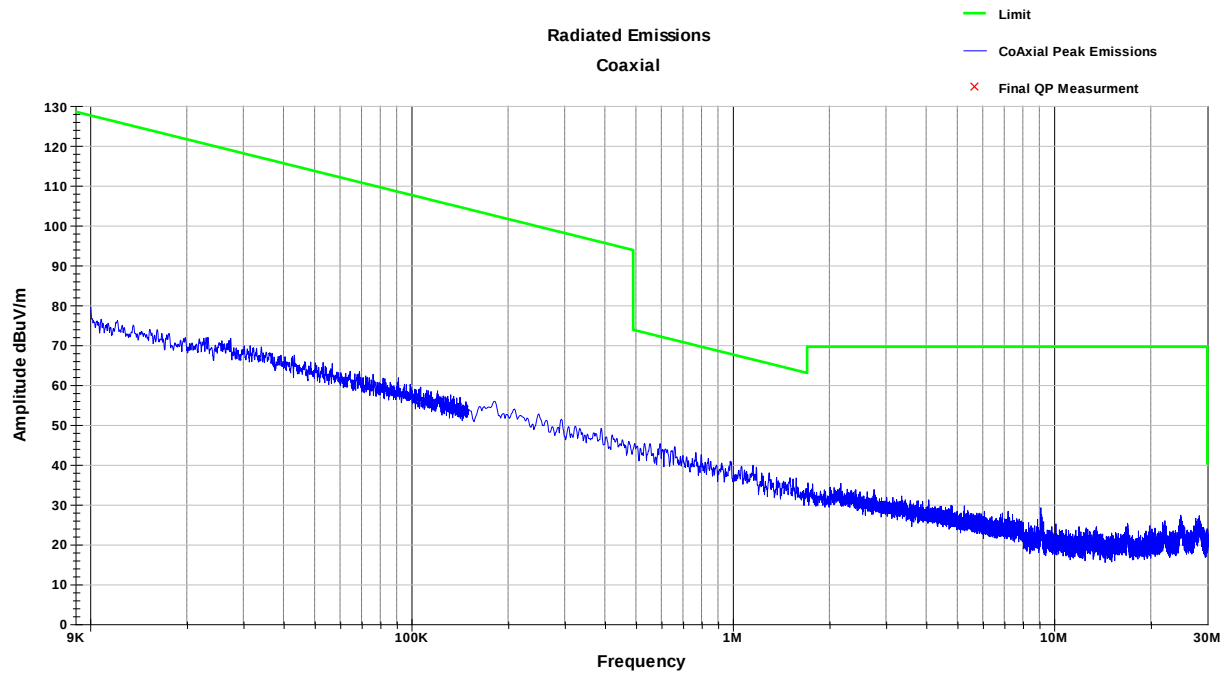
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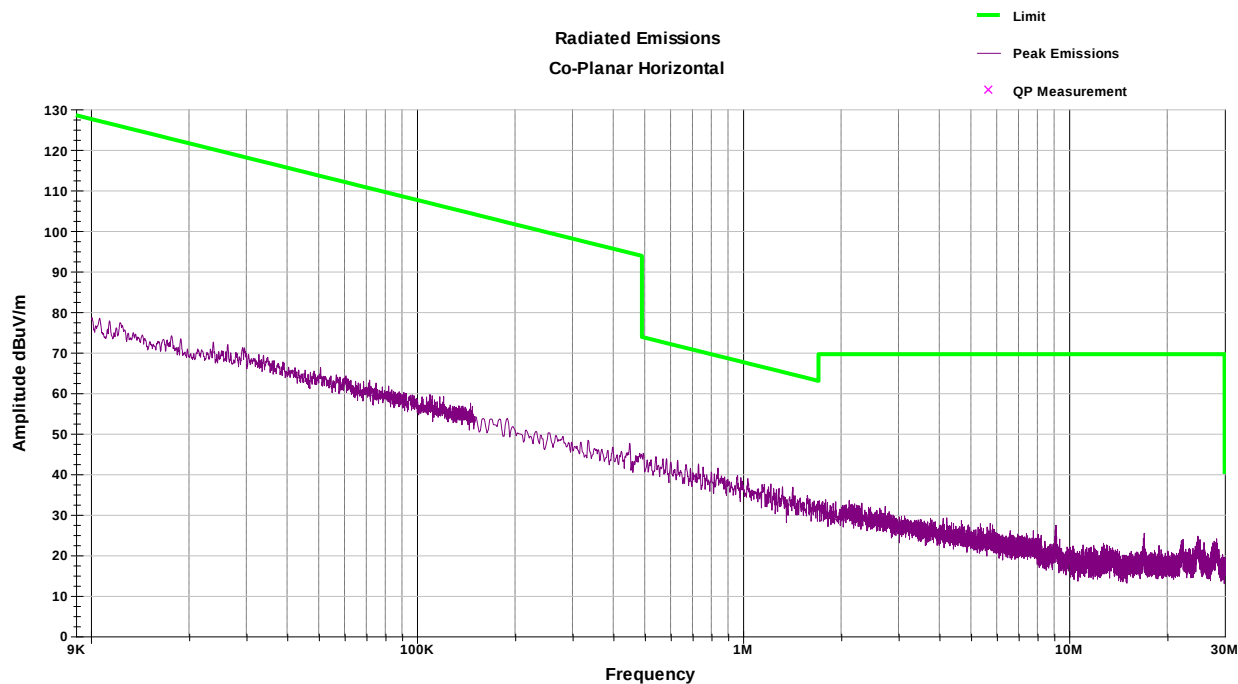
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RSE 1-18GHz t7 210212.TIL

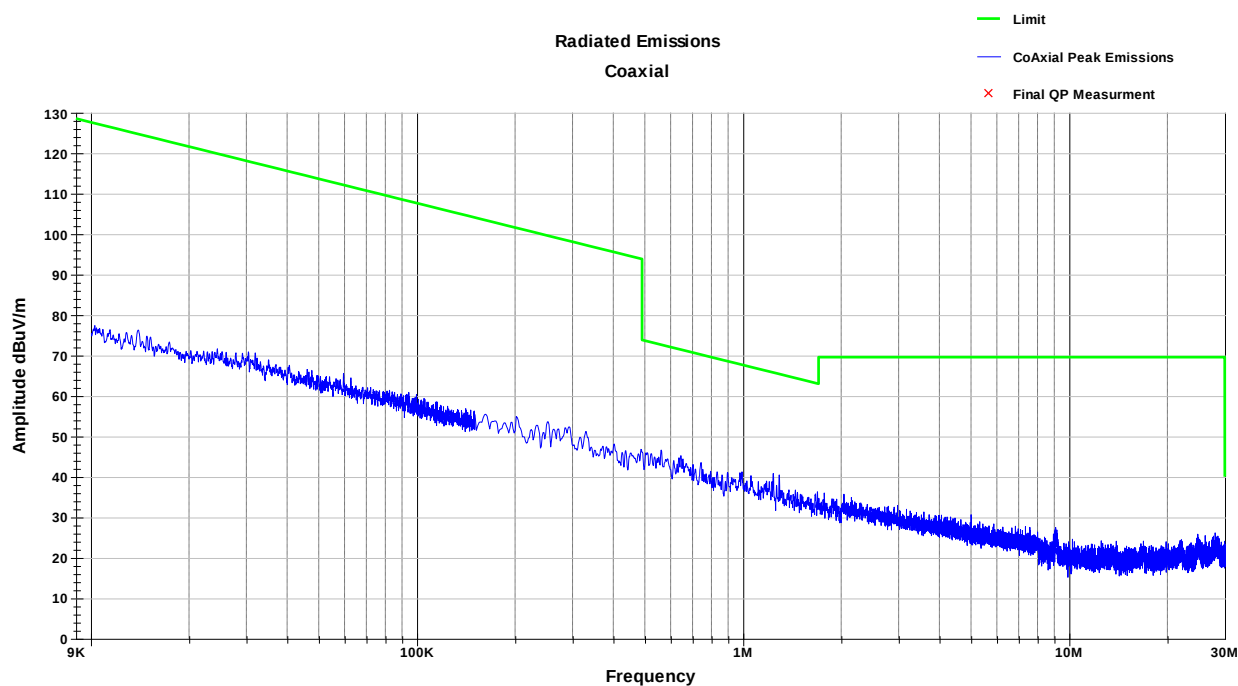
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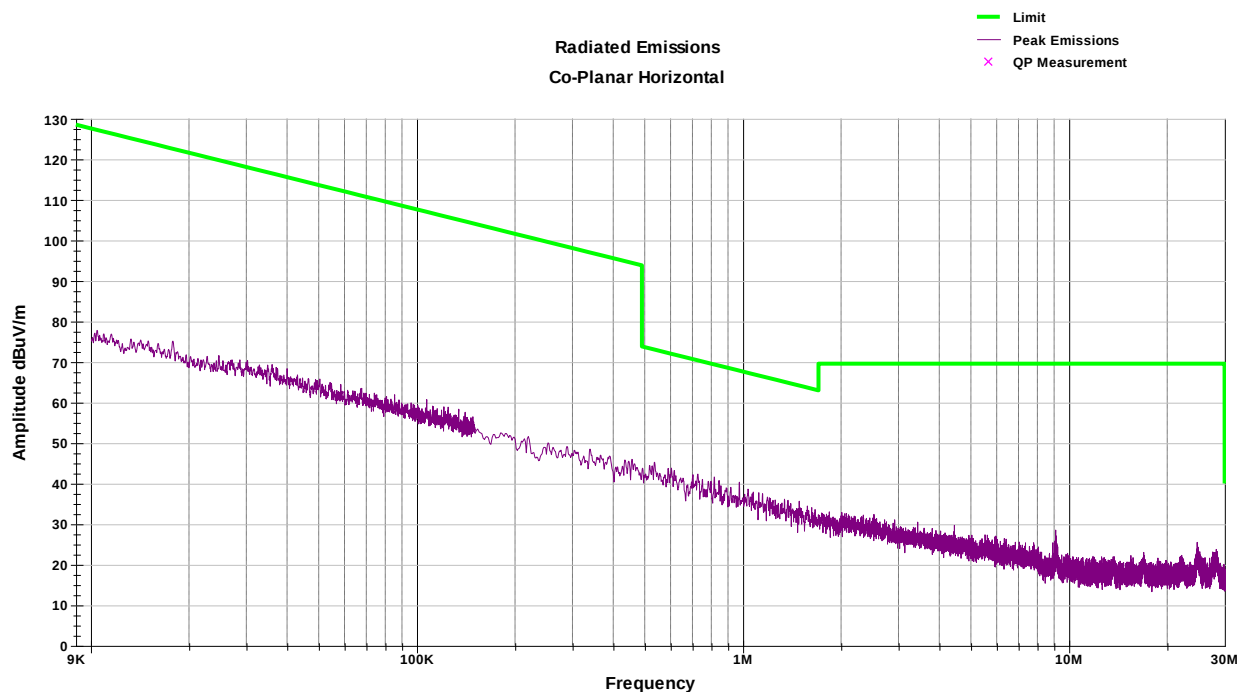
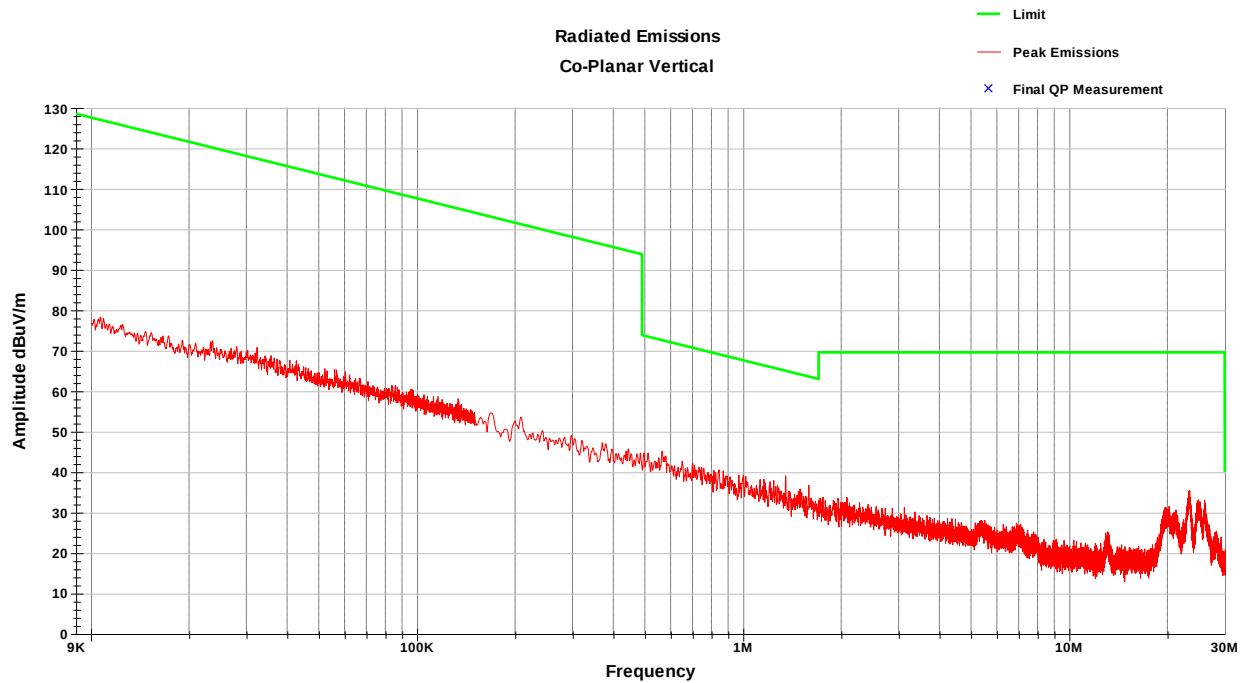
WLAN Channel 1 - (9kHz-30MHz)



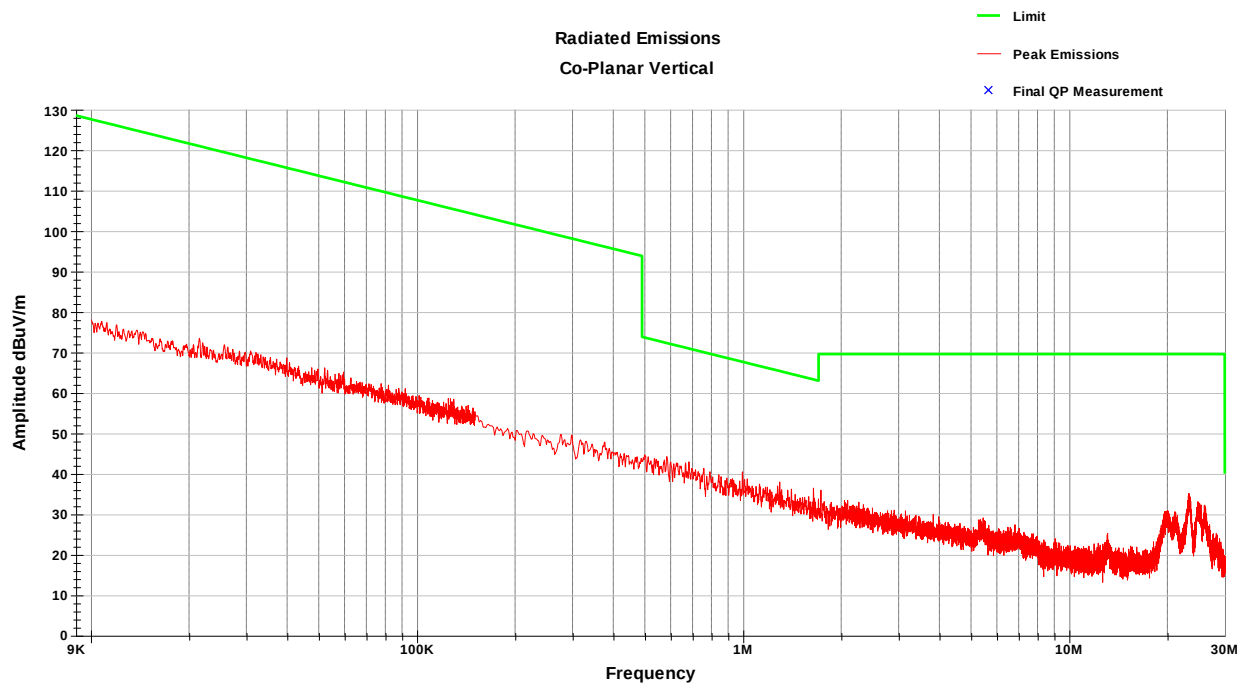
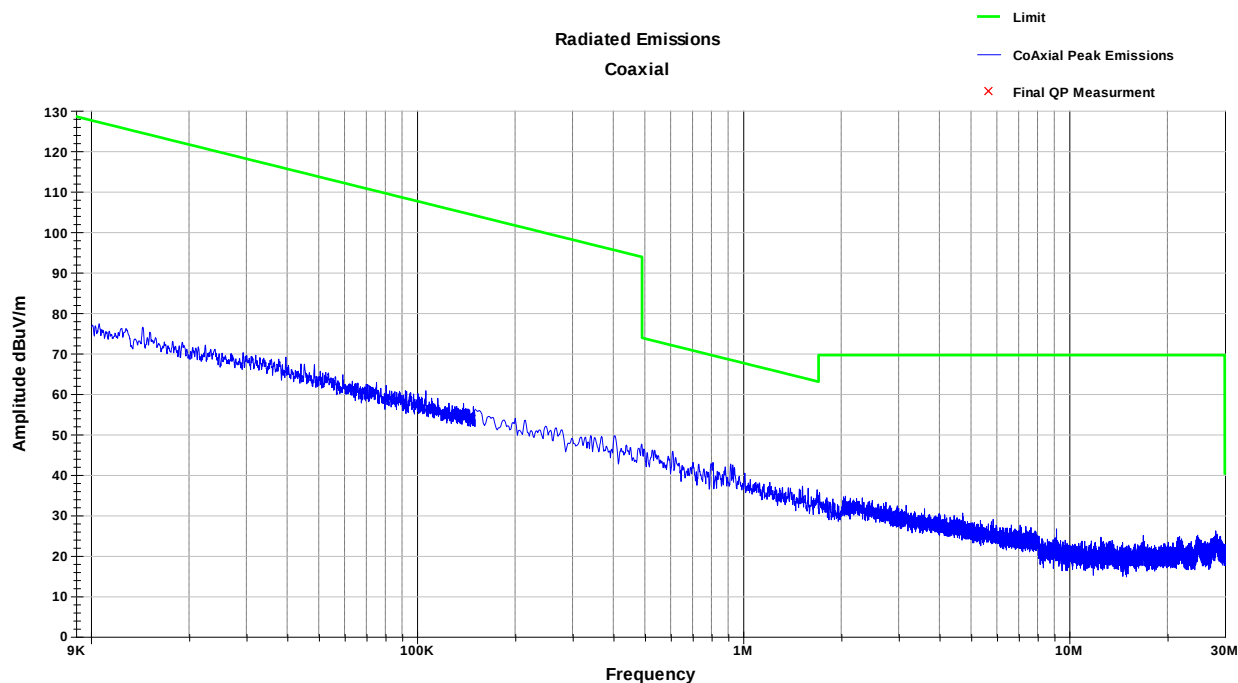


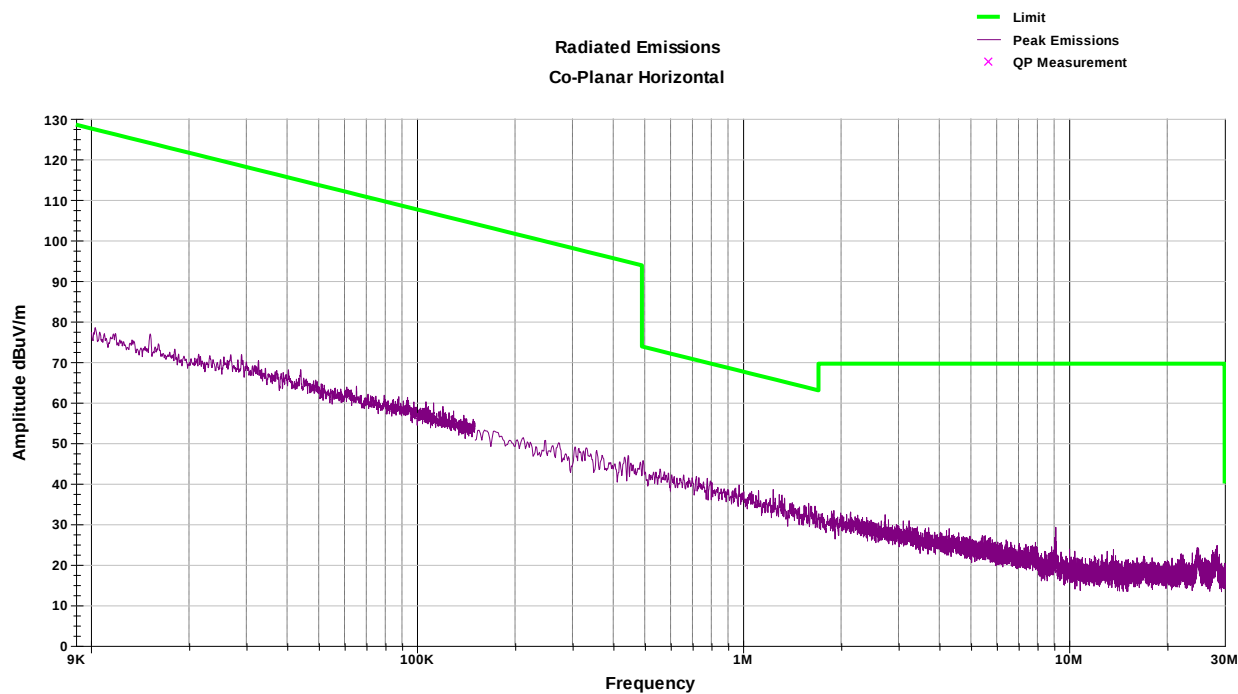
WLAN Channel 6 - (9kHz-30MHz)



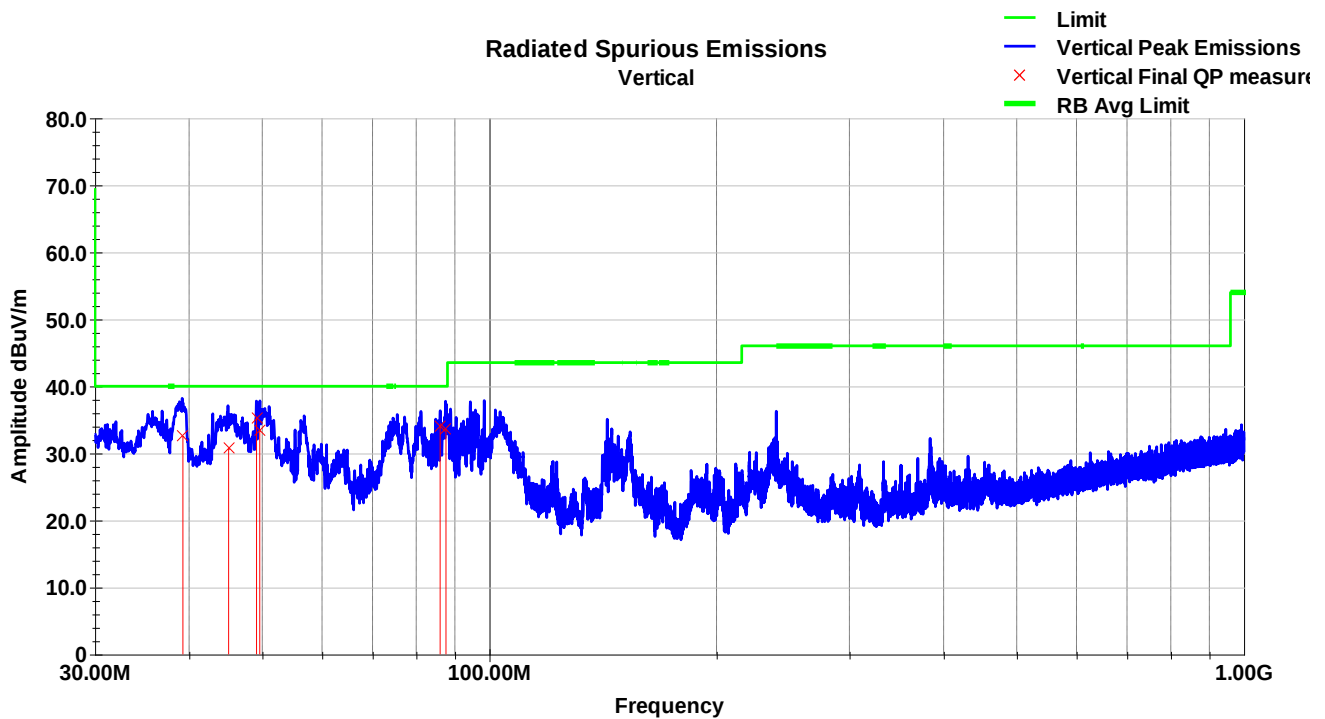


WLAN Channel 11 - (9kHz-30MHz)

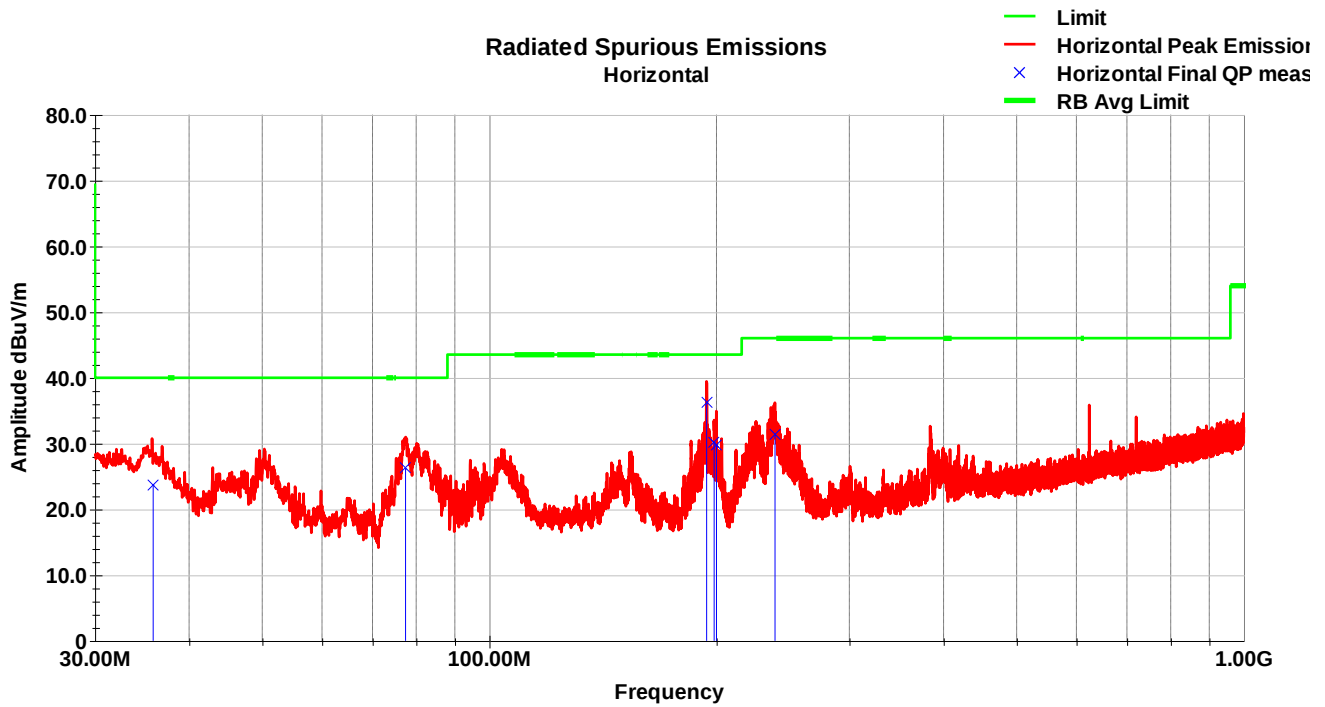




WLAN Channel 1 - (30-1000MHz)

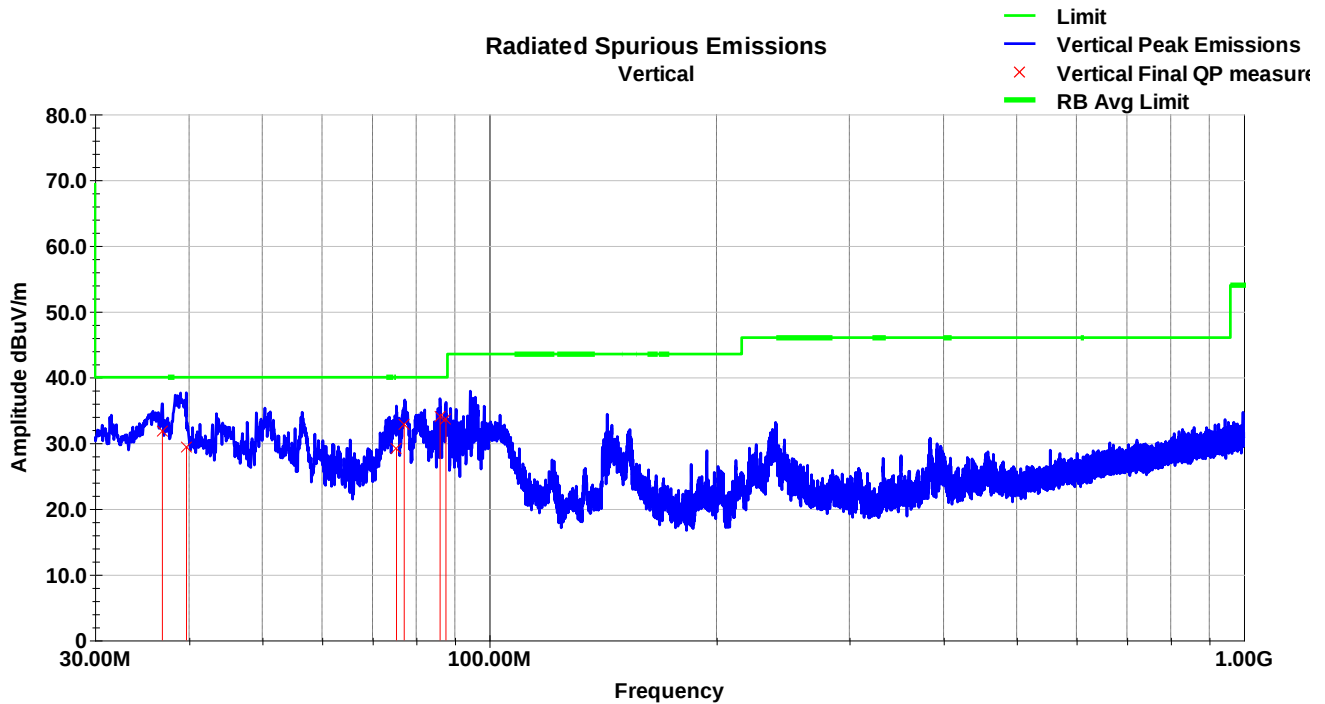


Frequency	Raw QP	Polarity	Azimuth	Height	AF	Loss	Amp	QP Value	Limit	Margin
MHz	(dBuV)	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
39.25	48	V	229	116	15	0.9	31.3	32.6	40	-7.4
45.12	50.1	V	123	106	11	0.9	31.3	30.7	40	-9.3
49.14	56.6	V	323	106	8.9	1	31.3	35.3	40	-4.7
49.62	54.9	V	327	100	8.8	1	31.3	33.4	40	-6.6
86.05	56.3	V	27	136	7.6	1.3	31.2	34	40	-6
87.59	55.8	V	105	121	7.7	1.3	31.2	33.6	40	-6.4
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

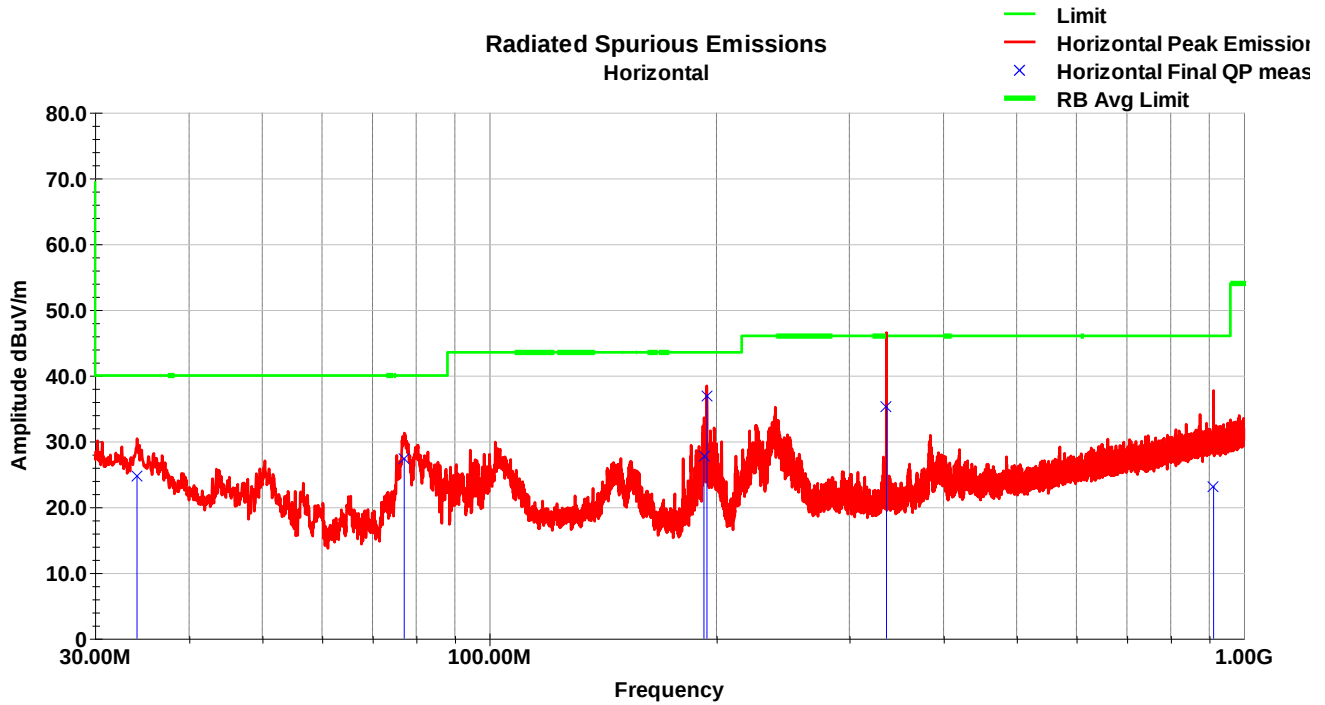


Frequency	Raw QP	Polarity	Azimuth	Height	AF	Loss	Amp	QP Value	Limit	Margin
MHz	(dBuV)	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
35.84	36.6	H	357	361	17.6	0.8	31.3	23.8	40	-16.2
77.42	48.2	H	80	217	8	1.3	31.3	26.2	40	-13.8
194.1	53.5	H	6	157	11.7	2	31	36.2	43.5	-7.3
198.58	46.7	H	358	140	12.5	2	31	30.2	43.5	-13.3
199.99	45.9	H	10	100	12.8	2	31	29.7	43.5	-13.8
239.17	47.9	H	163	112	12.1	2.2	30.9	31.3	46	-14.7
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

WLAN Channel 6 - (30-1000MHz)

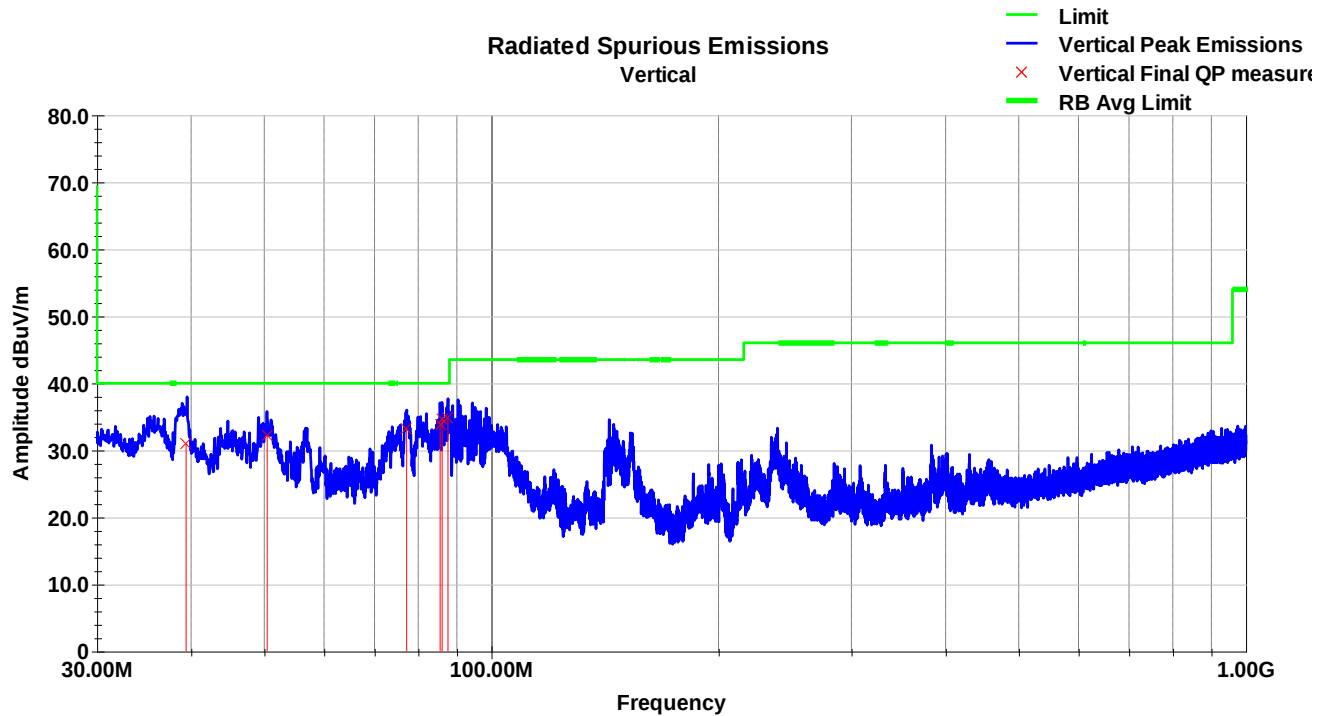


Frequency	Raw QP	Polarity	Azimuth	Height	AF	Loss	Amp	QP Value	Limit	Margin
MHz	(dBuV)	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
36.87	45.4	V	308	130	16.9	0.8	31.3	31.8	40	-8.2
39.68	45.2	V	287	105	14.7	0.9	31.3	29.4	40	-10.6
75.33	51.1	V	134	110	8.1	1.2	31.3	29.1	40	-10.9
77.12	54.8	V	184	100	8	1.3	31.3	32.8	40	-7.2
86.05	56.3	V	20	111	7.6	1.3	31.2	34	40	-6
87.6	56	V	61	101	7.7	1.3	31.2	33.7	40	-6.3
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										



Frequency	Raw QP	Polarity	Azimuth	Height	AF	Loss	Amp	QP Value	Limit	Margin
MHz	(dBuV)	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
34.11	36.2	H	67	400	19	0.8	31.3	24.7	40	-15.3
77.12	49.4	H	265	368	8	1.3	31.3	27.4	40	-12.6
192.52	45.1	H	16	106	11.6	2	31	27.7	43.5	-15.8
194.25	54	H	355	162	11.8	2	31	36.8	43.5	-6.7
336.06	48.6	H	313	157	14.8	2.6	30.8	35.2	46	-10.8
911.97	25.8	H	40	167	22.9	4.5	30	23.2	46	-22.9
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

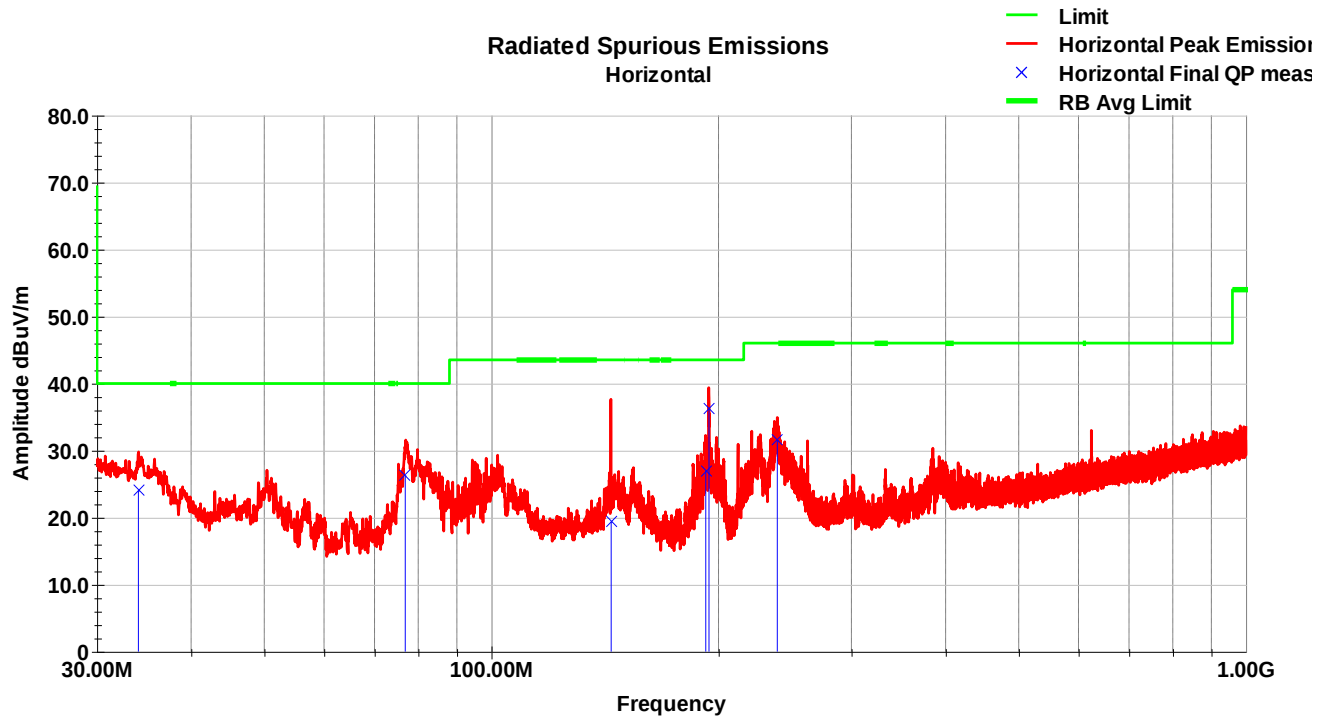
WLAN Channel 11 - (30-1000MHz)



Frequency	Raw QP	Polarity	Azimuth	Height	AF	Loss	Amp	QP Value	Limit	Margin
MHz	(dBuV)	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
39.39	46.4	V	76	107	14.9	0.9	31.3	30.9	40	-9.1
50.45	54	V	3	126	8.5	1	31.3	32.2	40	-7.8
77.22	55.2	V	167	110	8	1.3	31.3	33.2	40	-6.8
85.51	56.2	V	40	123	7.6	1.3	31.2	33.9	40	-6.1
86.05	57	V	57	122	7.6	1.3	31.2	34.7	40	-5.3
87.6	57.1	V	93	117	7.7	1.3	31.2	34.8	40	-5.2

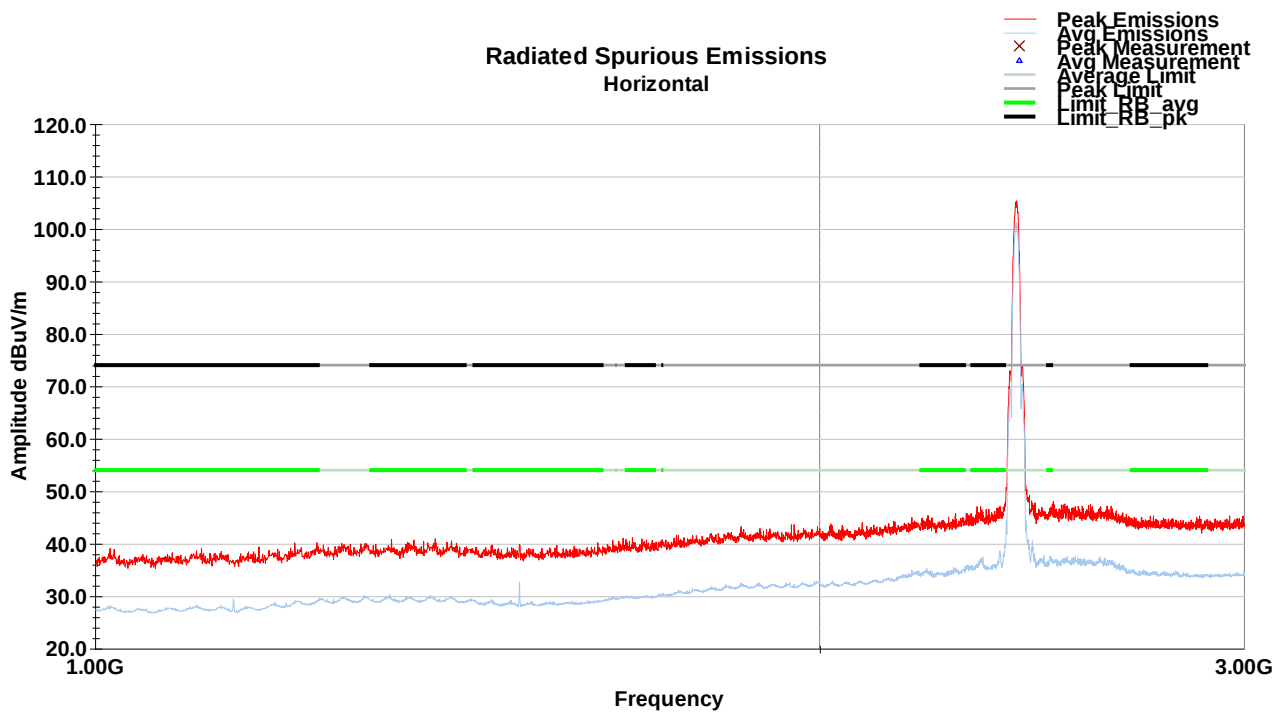
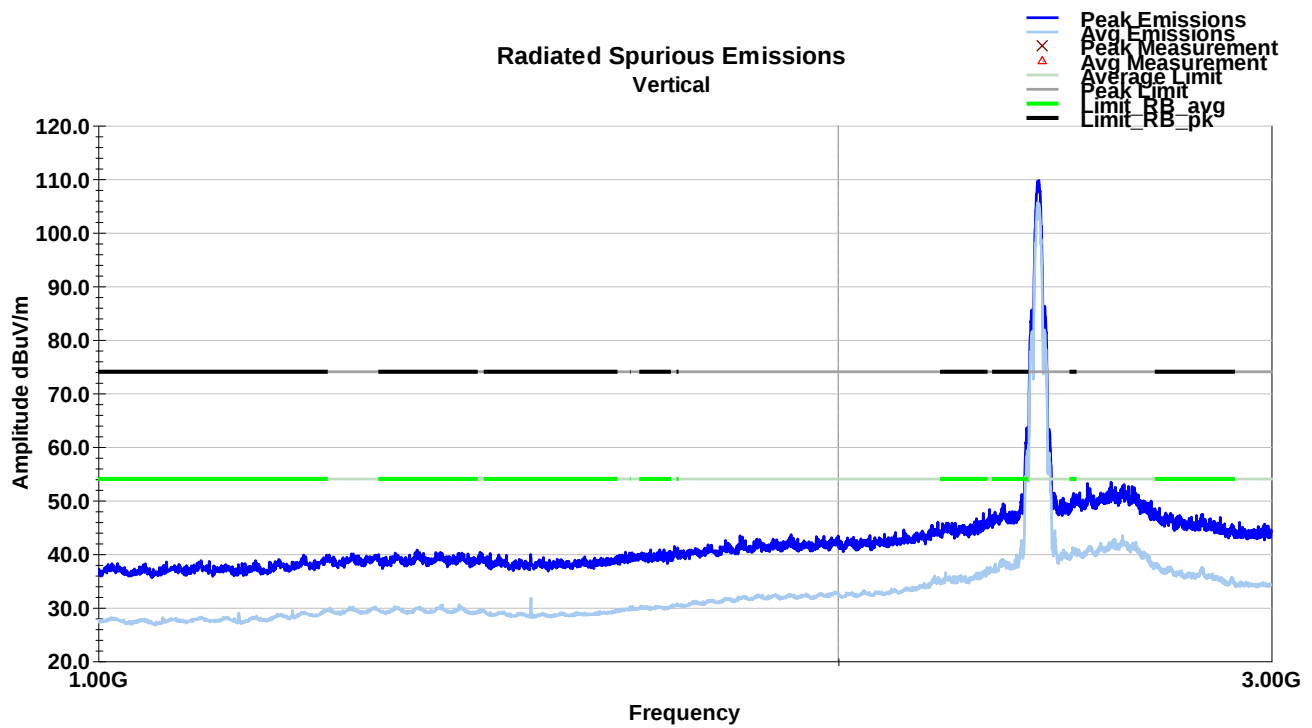
QP Value = Level + AF + CL - Amp

Margin = QP Value - Limit

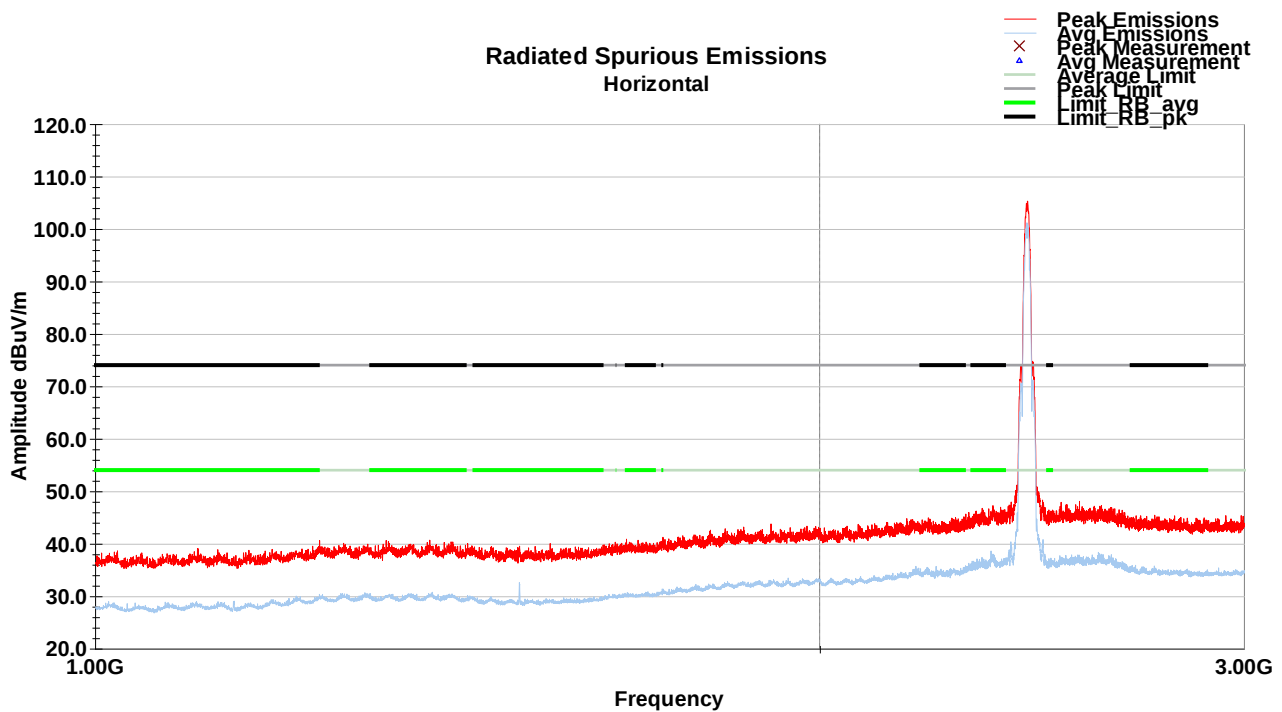
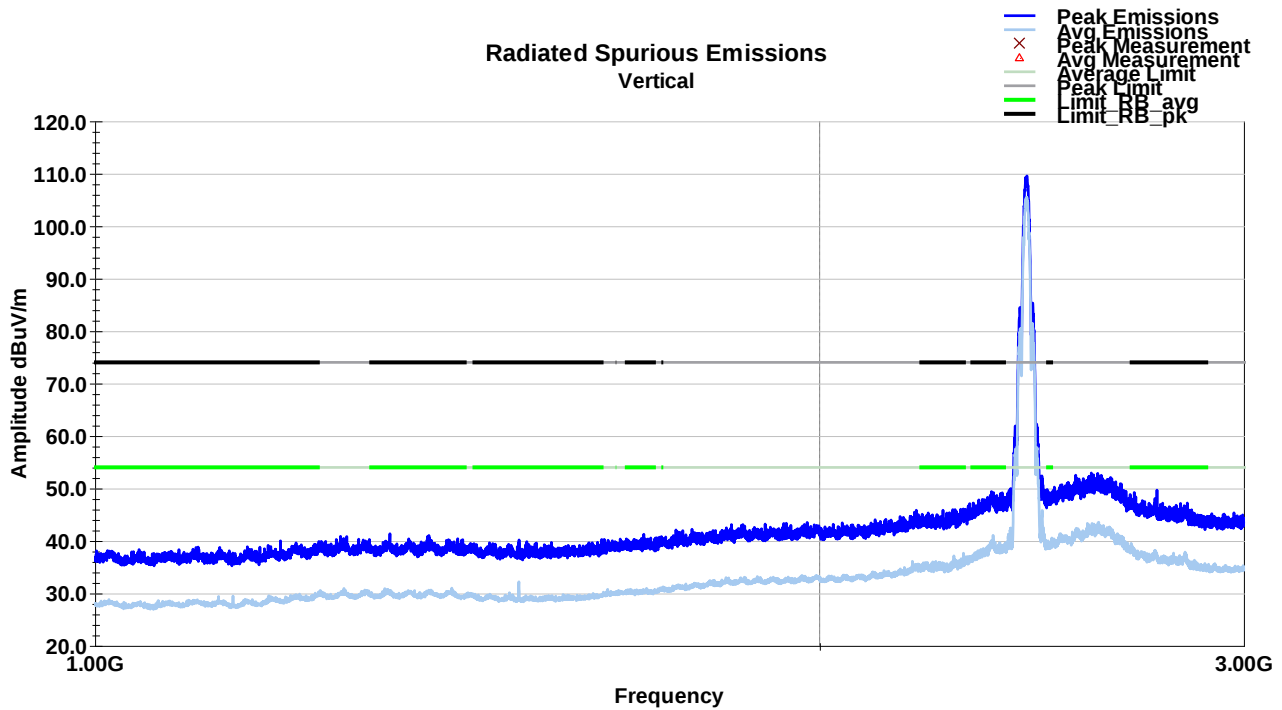


Frequency	Raw QP	Polarity	Azimuth	Height	AF	Loss	Amp	QP Value	Limit	Margin
MHz	(dBuV)	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
34.05	35.5	H	250	400	19.1	0.8	31.3	24	40	-16
76.9	48.3	H	262	266	8	1.3	31.3	26.3	40	-13.7
144.12	35.8	H	204	298	12.9	1.7	31.1	19.4	43.5	-24.1
192.35	44.4	H	0	127	11.5	2	31	27	43.5	-16.5
194.27	53.5	H	5	101	11.8	2	31	36.3	43.5	-7.2
239.33	48.1	H	4	140	12.1	2.2	30.9	31.5	46	-14.5
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

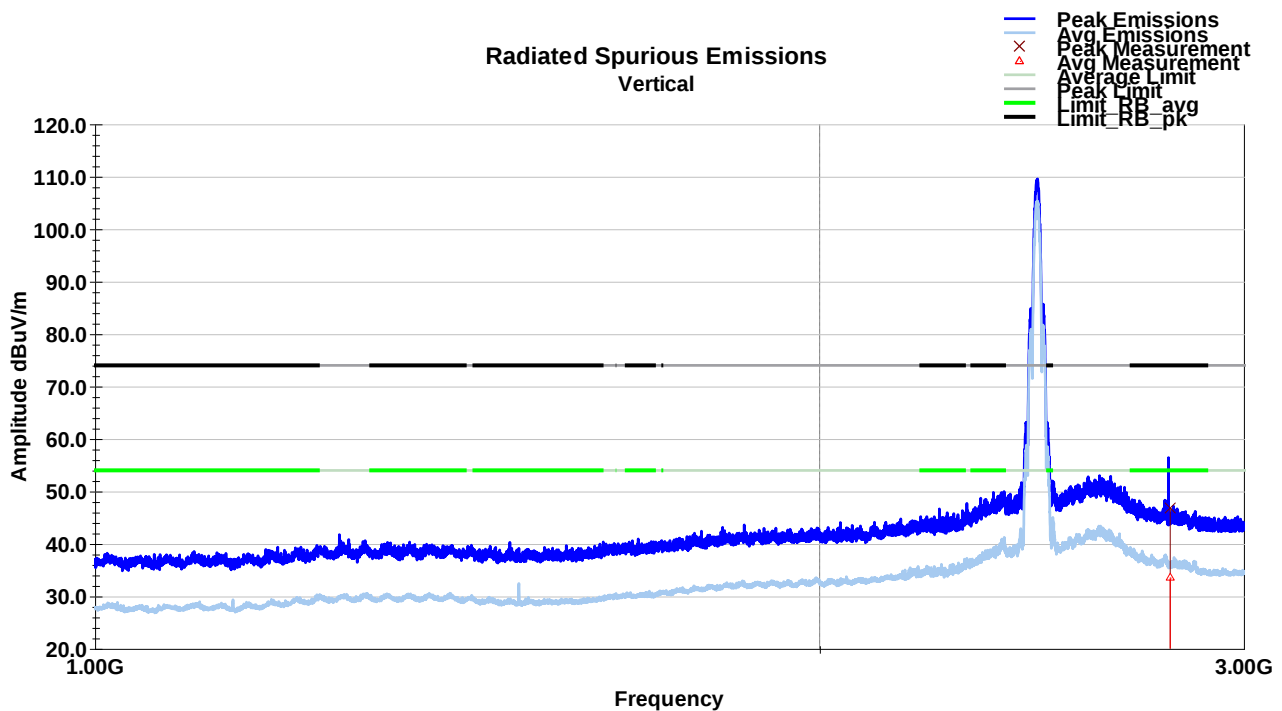
WLAN Channel 1 - (1-3GHz)



WLAN Channel 6 - (1-3GHz)

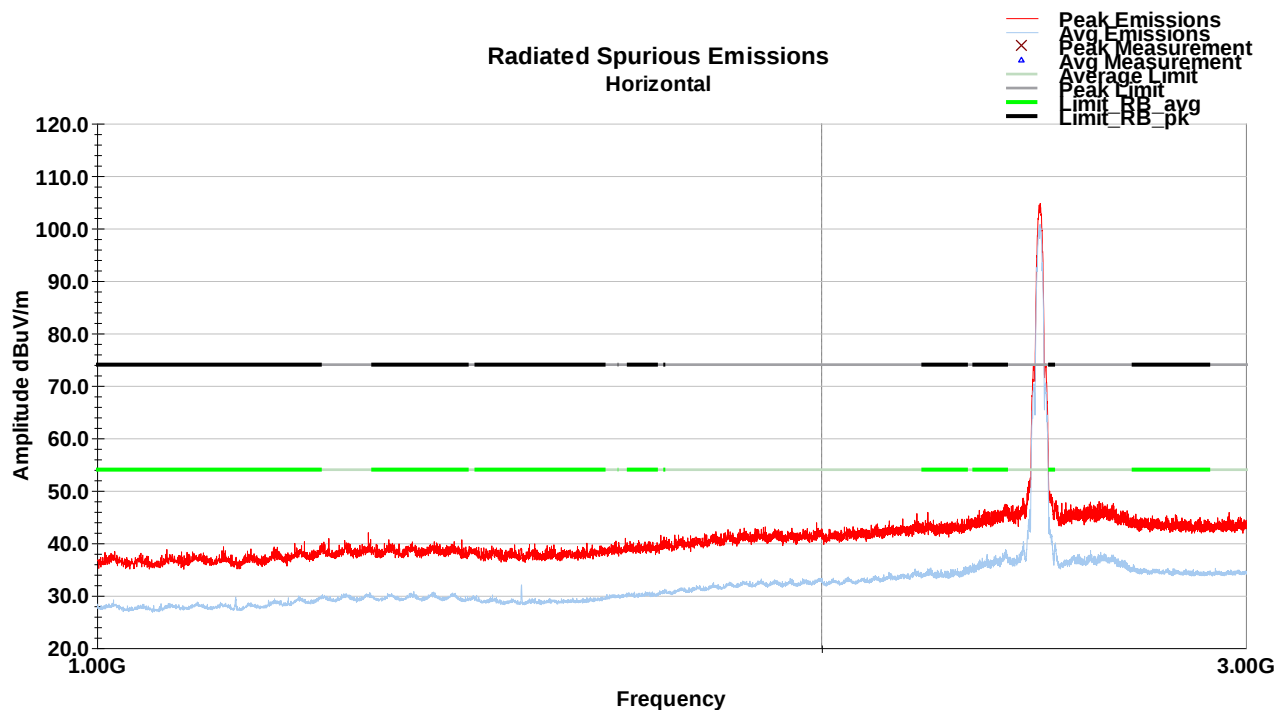


WLAN Channel 11 - (1-3GHz)

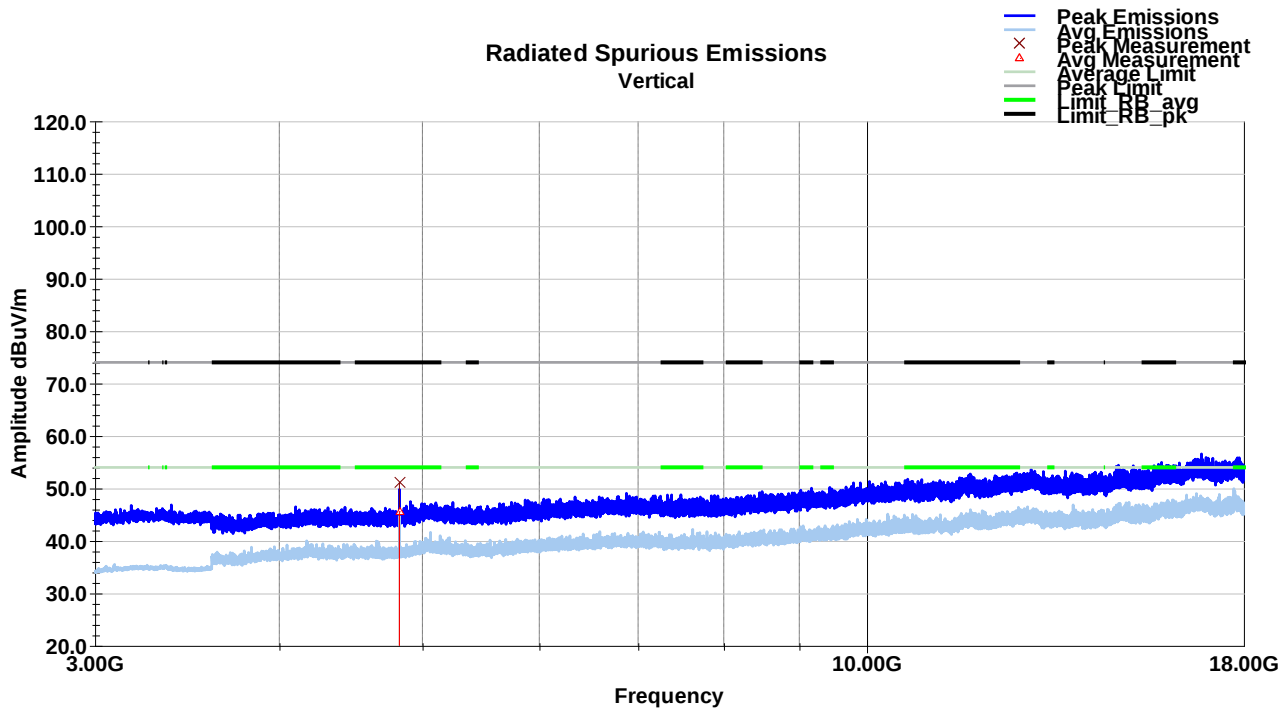


Frequency	Raw Avg	Polarity	Azimuth	Height	AF	Loss	Amp	Final Avg	Limit	Margin
MHz	dBuV	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	dBuV/m	(dBuV/m)	(dB)
2796.48	33.797	V	7	169	32.4	1.9	34.6	33.571	54	-20.4
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Frequency	Raw Pk	Polarity	Azimuth	Height	AF	Loss	Amp	Final Pk	Limit	Margin
MHz	dBuV	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	dBuV/m	dBuV/m	dB
2796.48	47.03	V	7	169	32.4	1.9	34.6	46.8	74	-27.2
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

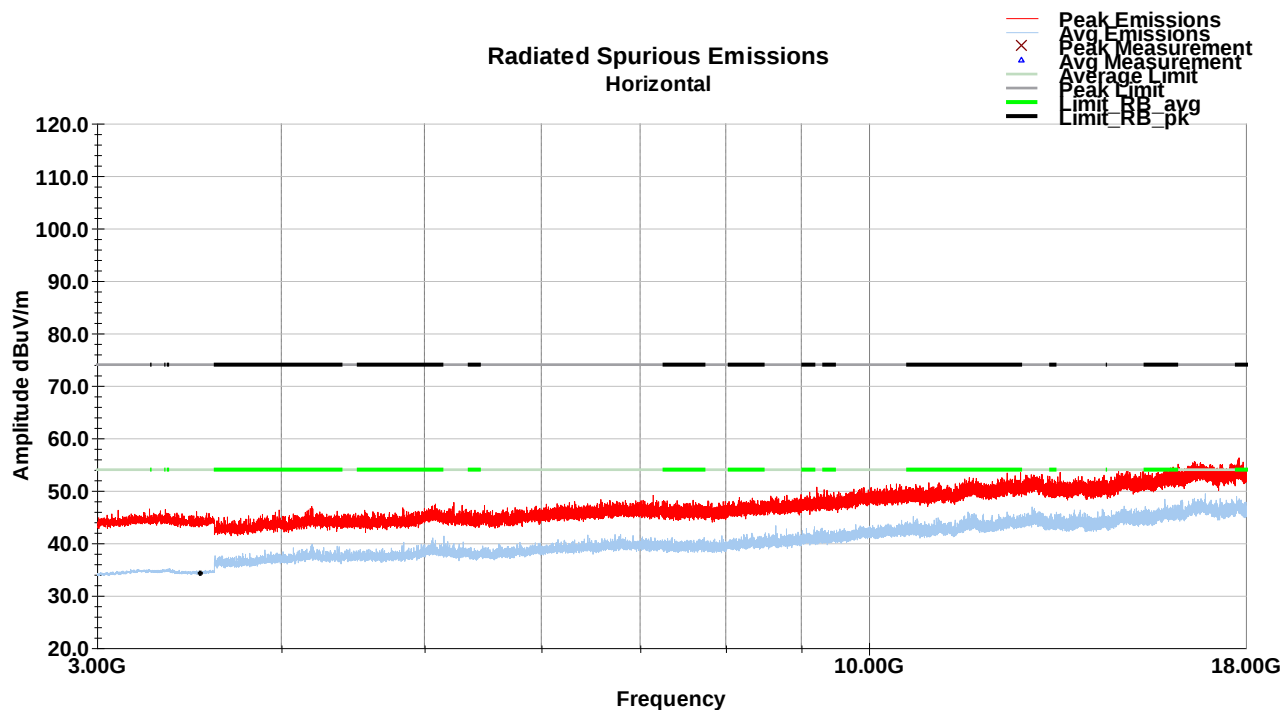


WLAN Channel 1 - (3-18GHz)

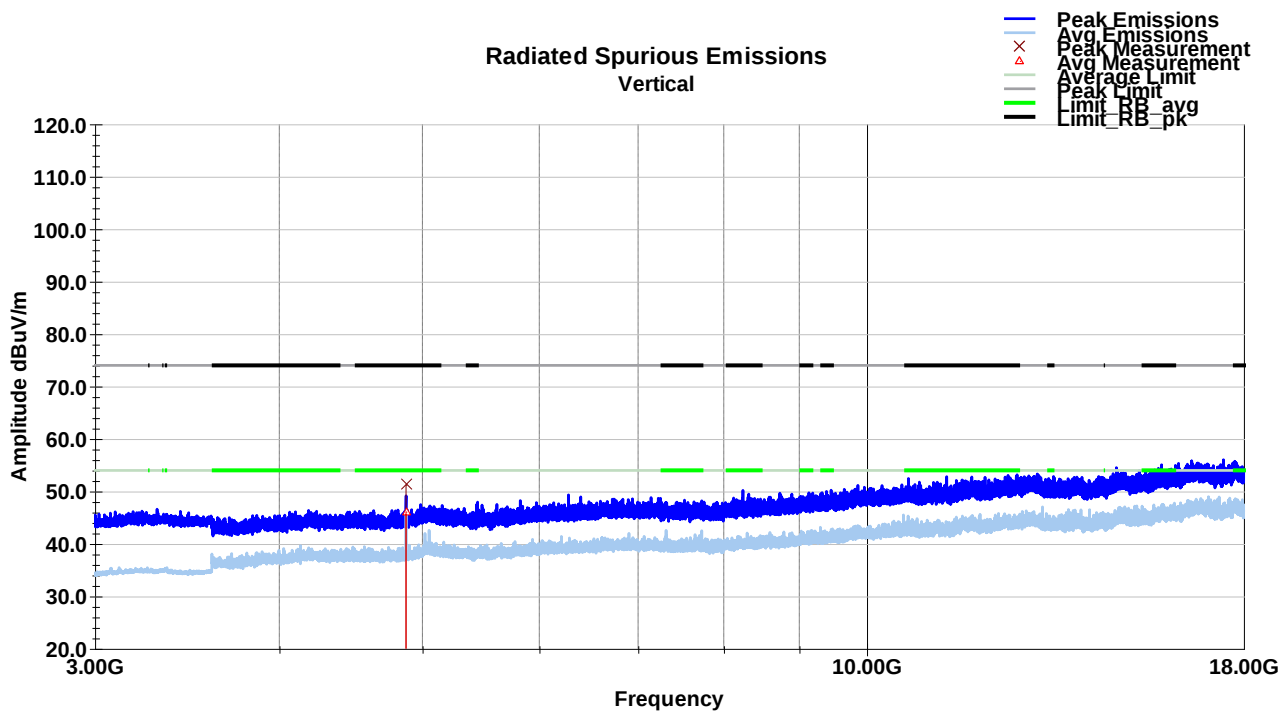


Frequency	Raw Avg	Polarity	Azimuth	Height	AF	Loss	Amp	Final Avg	Limit	Margin
MHz	dBuV	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	dBuV/m	(dBuV/m)	(dB)
4823.8	43.544	V	55	217	34.3	2.4	34.6	45.649	54	-8.3
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Frequency	Raw Pk	Polarity	Azimuth	Height	AF	Loss	Amp	Final Pk	Limit	Margin
MHz	dBuV	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	dBuV/m	dBuV/m	dB
4823.8	49.031	V	55	217	34.3	2.4	34.6	51.1	74	-22.9
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

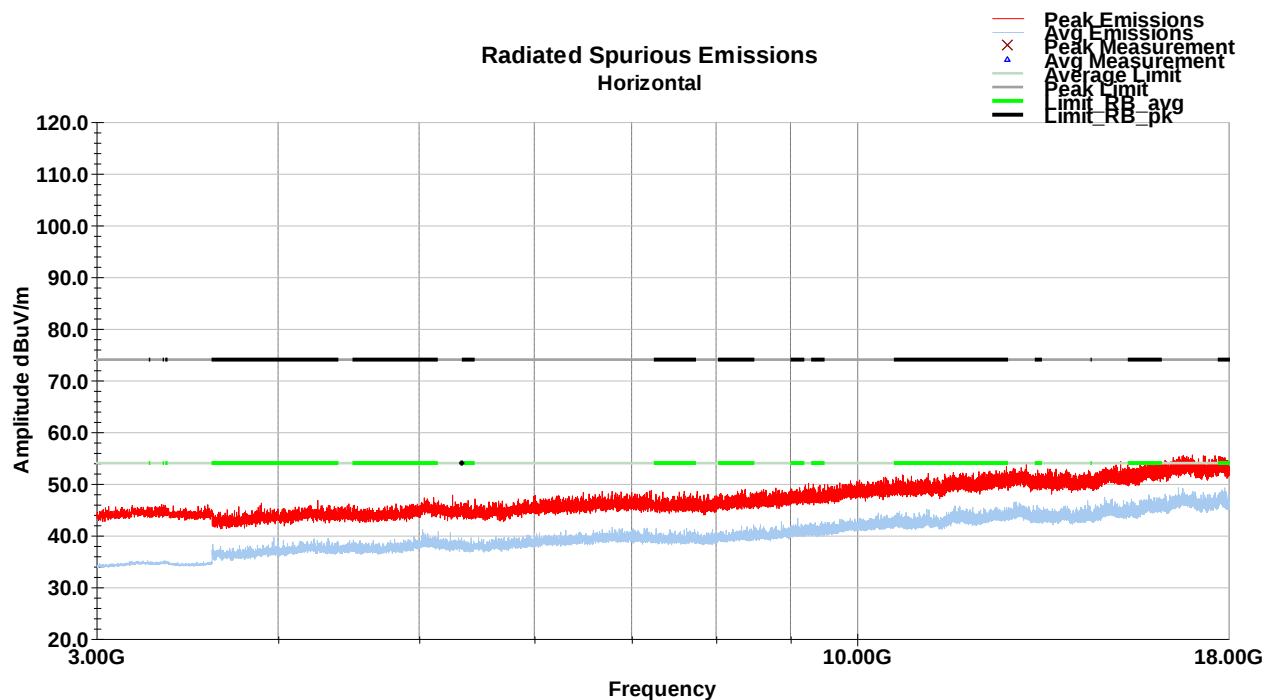


WLAN Channel 6 - (3-18GHz)

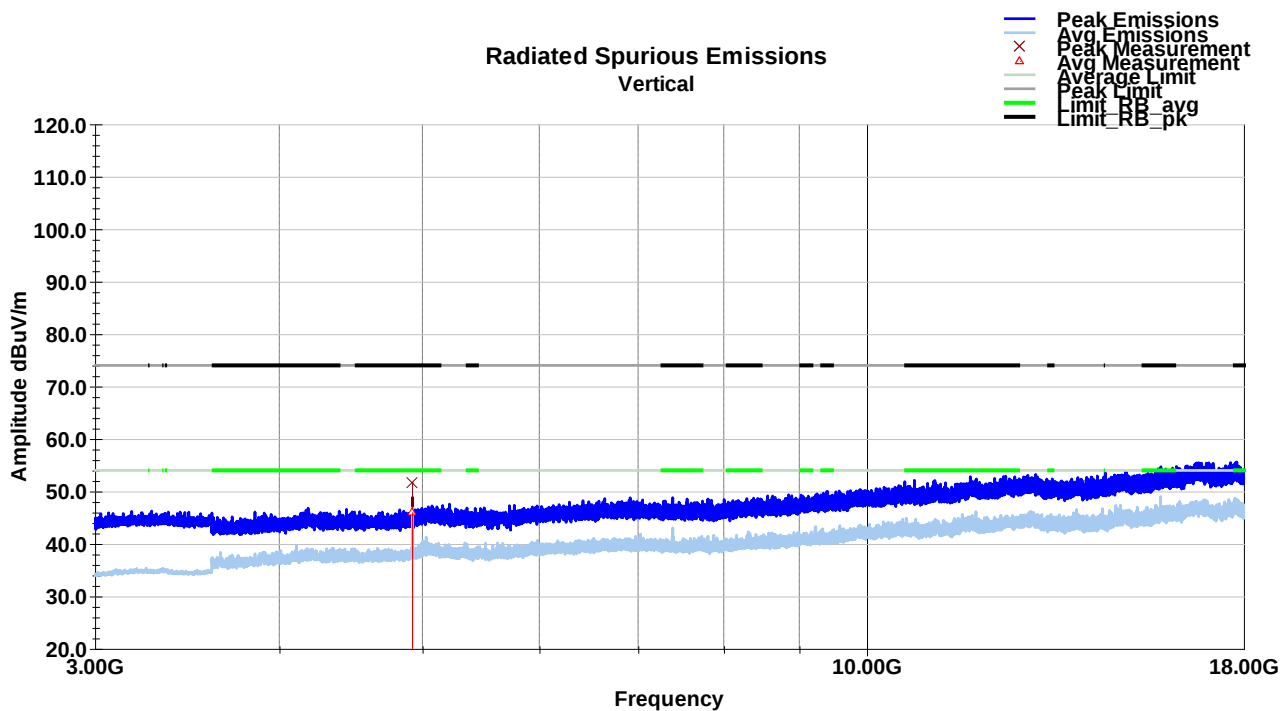


Frequency	Raw Avg	Polarity	Azimuth	Height	AF	Loss	Amp	Final Avg	Limit	Margin
MHz	dBuV	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	dBuV/m	(dBuV/m)	(dB)
4873.82	43.97	V	58	169	34.4	2.4	34.6	46.155	54	-7.8
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Frequency	Raw Pk	Polarity	Azimuth	Height	AF	Loss	Amp	Final Pk	Limit	Margin
MHz	dBuV	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	dBuV/m	dBuV/m	dB
4873.82	49.1	V	58	169	34.4	2.4	34.6	51.3	74	-22.7
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

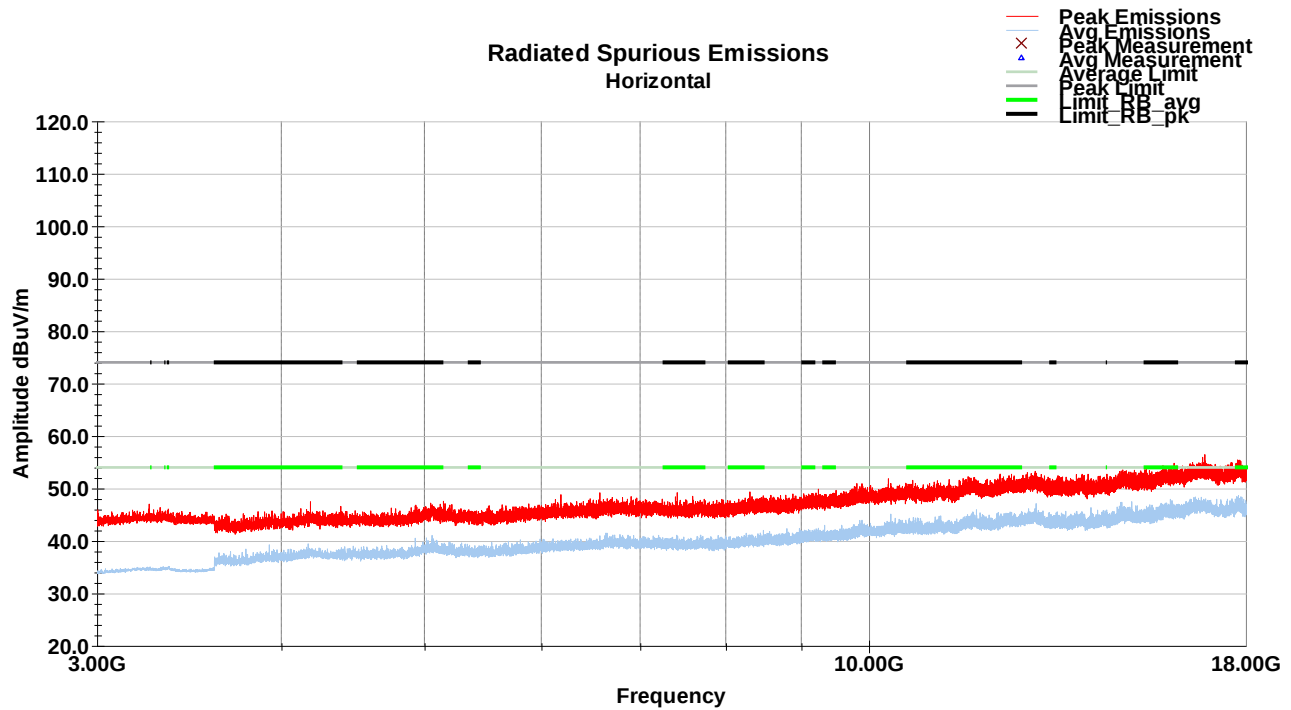


WLAN Channel 11 - (3-18GHz)



Frequency	Raw Avg	Polarity	Azimuth	Height	AF	Loss	Amp	Final Avg	Limit	Margin
MHz	dBuV	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	dBuV/m	(dBuV/m)	(dB)
4923.92	43.645	V	58	221	34.5	2.4	34.6	45.948	54	-8
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Frequency	Raw Pk	Polarity	Azimuth	Height	AF	Loss	Amp	Final Pk	Limit	Margin
MHz	dBuV	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	dBuV/m	dBuV/m	dB
4923.92	49.398	V	58	221	34.5	2.4	34.6	51.7	74	-22.3
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										



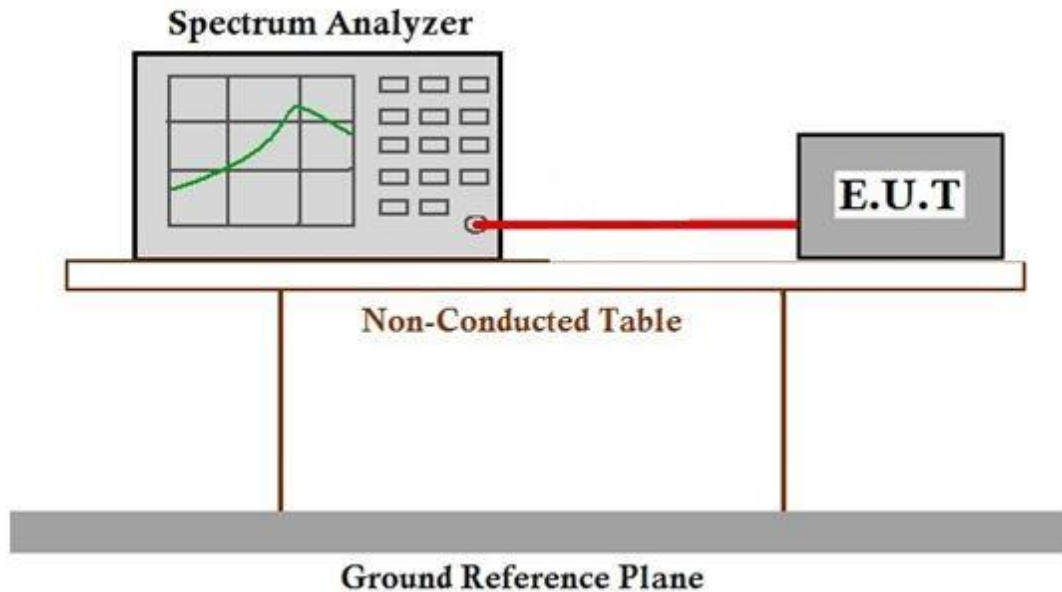
Note: Since no emissions were observed in 5-18GHz range, the 18-20GHz range was not tested.

4 Band Edge Emissions in Restricted Frequency Bands

4.1 Test Result

Test Description	Test Specification		Test Result
Band Edge Emissions in Restricted Frequency Bands	15.205, 15.209	RSS-GEN S8.9, 8.10	Compliant

4.2 Test Setup



4.3 Test Method

Field strength measurements were performed at the restricted band edges of 2390MHz and 2483.5MHz. Measurements were made using the conducted methods defined in ANSI C63.10: 2013 clause 11.12.2.

4.4 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.9 °C
Relative Humidity: 31.9 %
Atmospheric Pressure: 98.1 kPa

4.5 Test Equipment

Test End Date: 19-Mar-2021

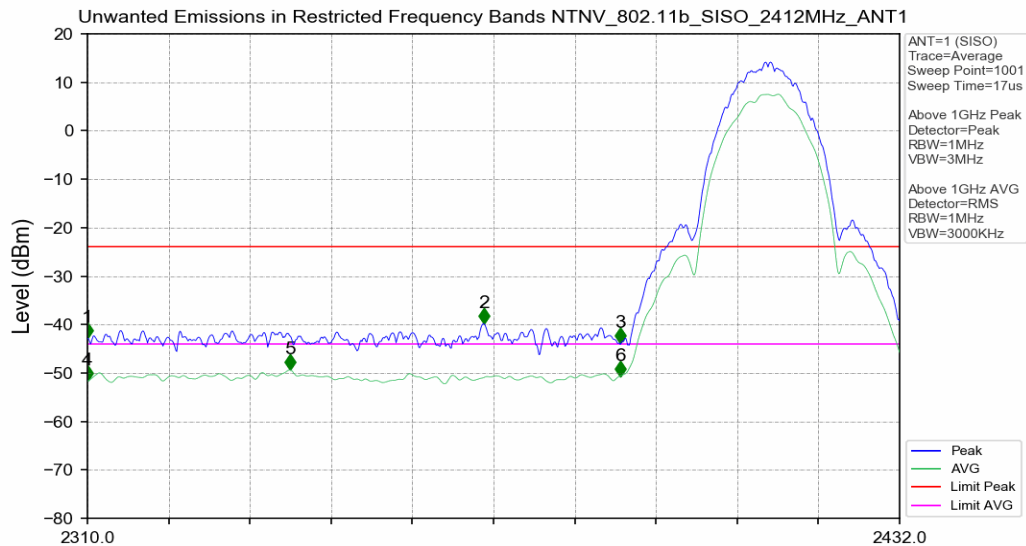
Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF Cable, SMA to N	LL142	CentricRF	19011	11-Mar-2021	11-Mar-2022
ATTENUATOR, 10DB	BW-S10W2	Mini-Circuits	15032	28-Sep-2020	28-Sep-2021
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2019	27-Dec-2021

Note: The equipment calibration period is 1 year except for the FSV30 which is on a 2-year period.

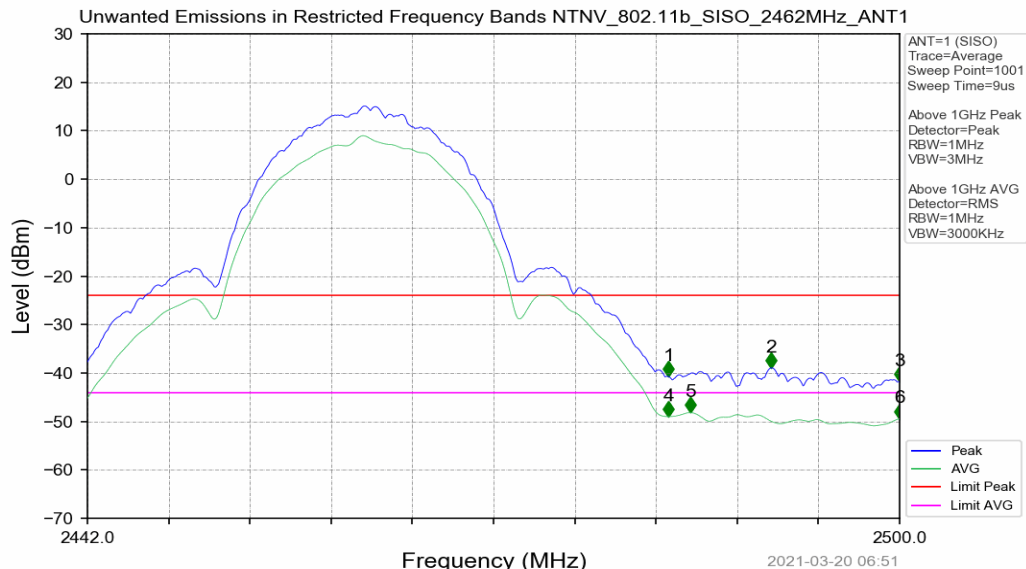
4.6 Test Data - Plots

802.11b – Low Channel



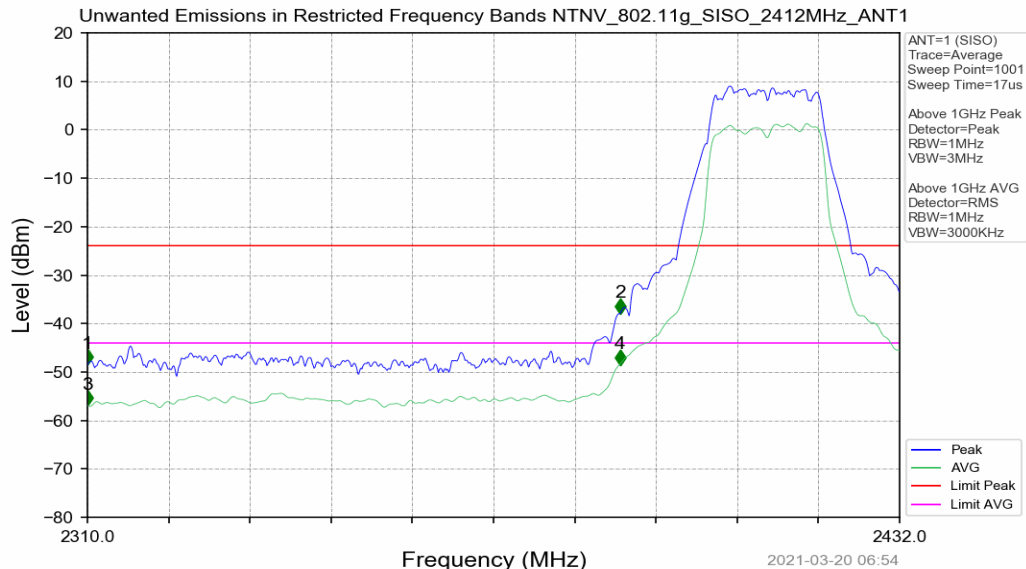
Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2310.000	-42.816	Peak	4	2310.000	-51.652	AVG
2	2369.536	-39.834	Peak	5	2340.378	-49.351	AVG
3	2390.000	-43.921	Peak	6	2390.000	-50.694	AVG

802.11b – High Channel



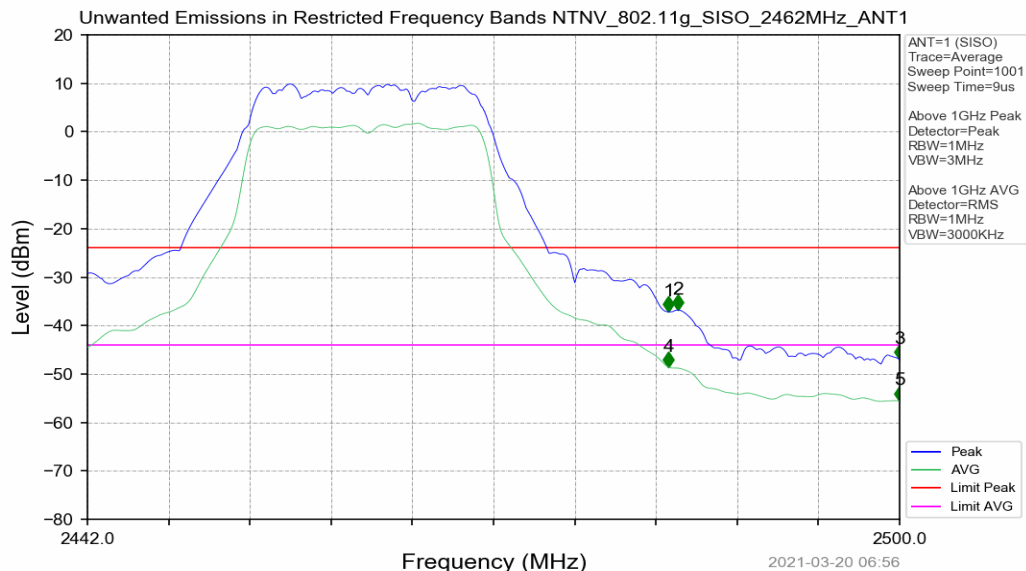
Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2483.500	-40.717	Peak	4	2483.500	-48.997	AVG
2	2490.836	-38.934	Peak	5	2485.036	-48.194	AVG
3	2500.000	-41.801	Peak	6	2500.000	-49.479	AVG

802.11g – Low Channel



Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2310.000	-48.447	Peak	3	2310.000	-56.865	AVG
2	2390.000	-37.937	Peak	4	2390.000	-48.514	AVG

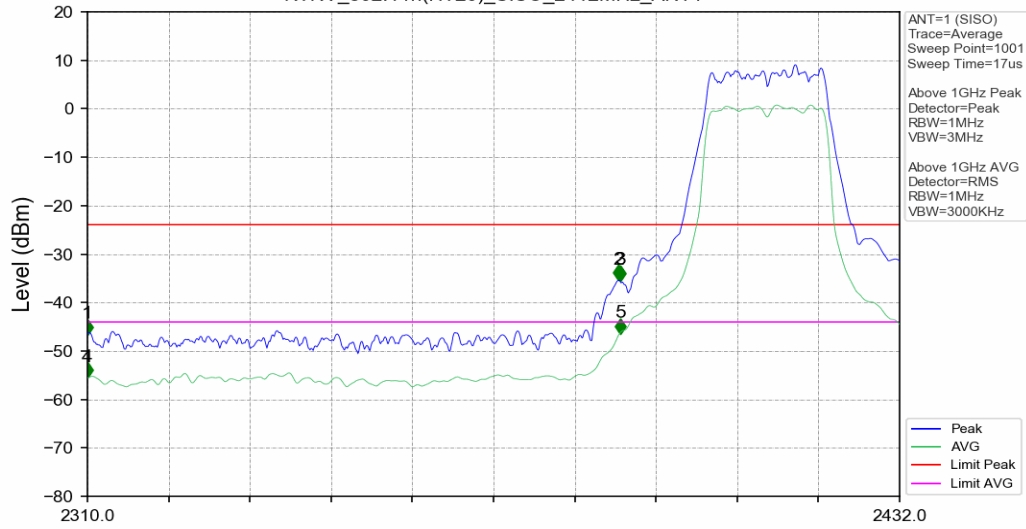
802.11g – High Channel



Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2483.500	-37.177	Peak	4	2483.500	-48.555	AVG
2	2484.166	-36.802	Peak	5	2500.000	-55.597	AVG
3	2500.000	-47.075	Peak				

802.11n HT20 – Low Channel

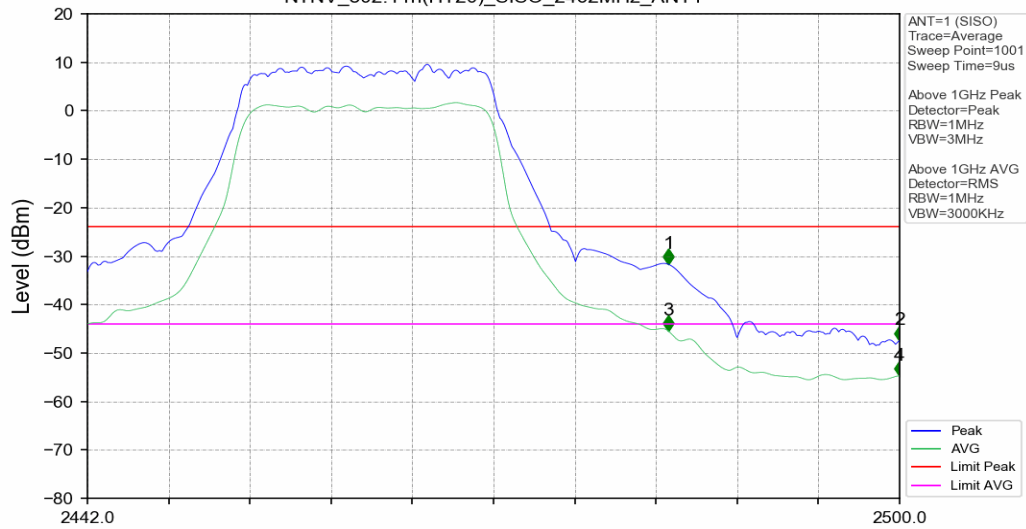
Unwanted Emissions in Restricted Frequency Bands
NTNV_802.11n(HT20)_SISO_2412MHz_ANT1



Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2310.000	-46.596	Peak	4	2310.000	-55.562	AVG
2	2389.788	-35.415	Peak	5	2390.000	-46.411	AVG
3	2390.000	-35.472	Peak				

802.11n HT20 – High Channel

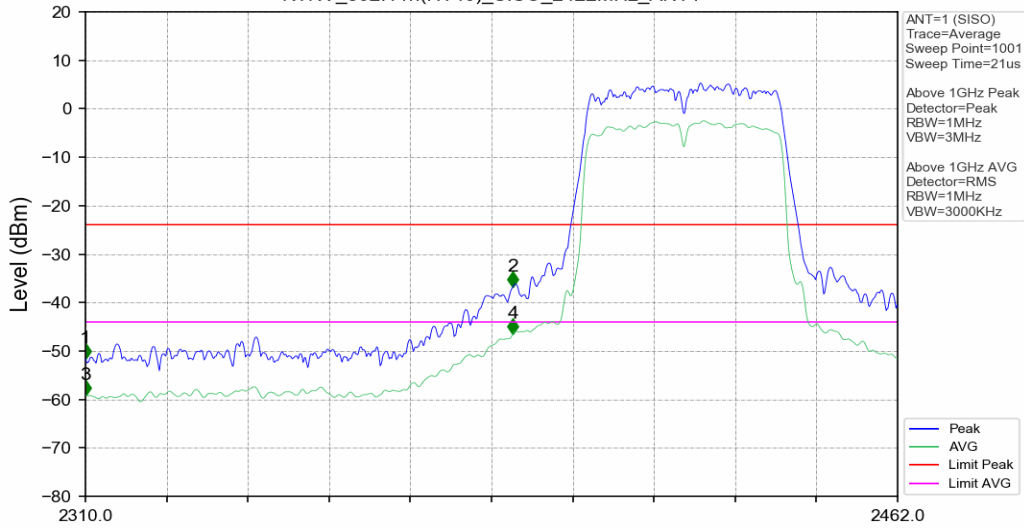
Unwanted Emissions in Restricted Frequency Bands
NTNV_802.11n(HT20)_SISO_2462MHz_ANT1



Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2483.500	-31.680	Peak	3	2483.500	-45.430	AVG
2	2500.000	-47.489	Peak	4	2500.000	-54.765	AVG

802.11n HT40 – Low Channel

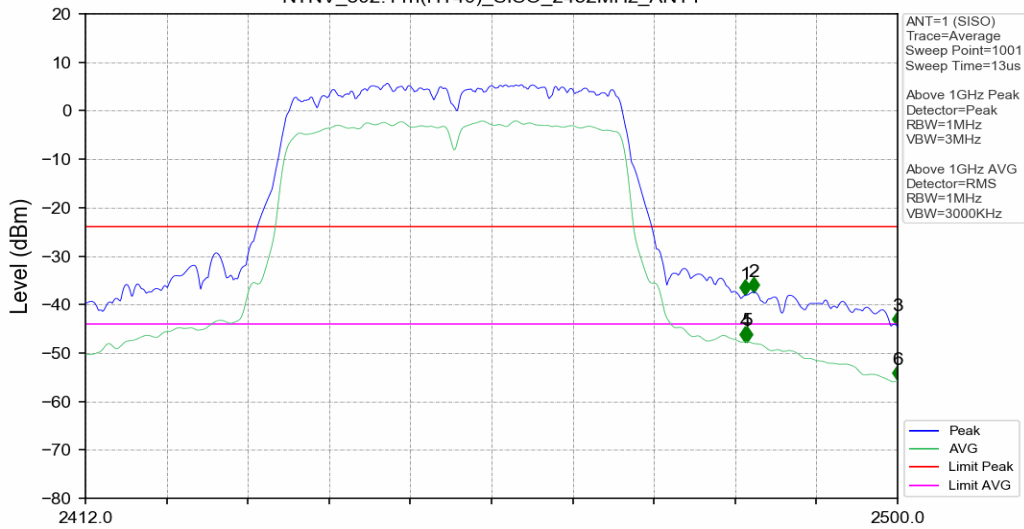
Unwanted Emissions in Restricted Frequency Bands
NTNV_802.11n(HT40)_SISO_2422MHz_ANT1



Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2310.000	-51.571	Peak	3	2310.000	-59.141	AVG
2	2390.000	-36.793	Peak	4	2390.000	-46.553	AVG

802.11n HT40 – High Channel

Unwanted Emissions in Restricted Frequency Bands
NTNV_802.11n(HT40)_SISO_2452MHz_ANT1



Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2483.500	-38.090	Peak	4	2483.500	-47.685	AVG
2	2484.424	-37.456	Peak	5	2483.632	-47.659	AVG
3	2500.000	-44.559	Peak	6	2500.000	-55.688	AVG

4.7 Test Data – Tabular Data

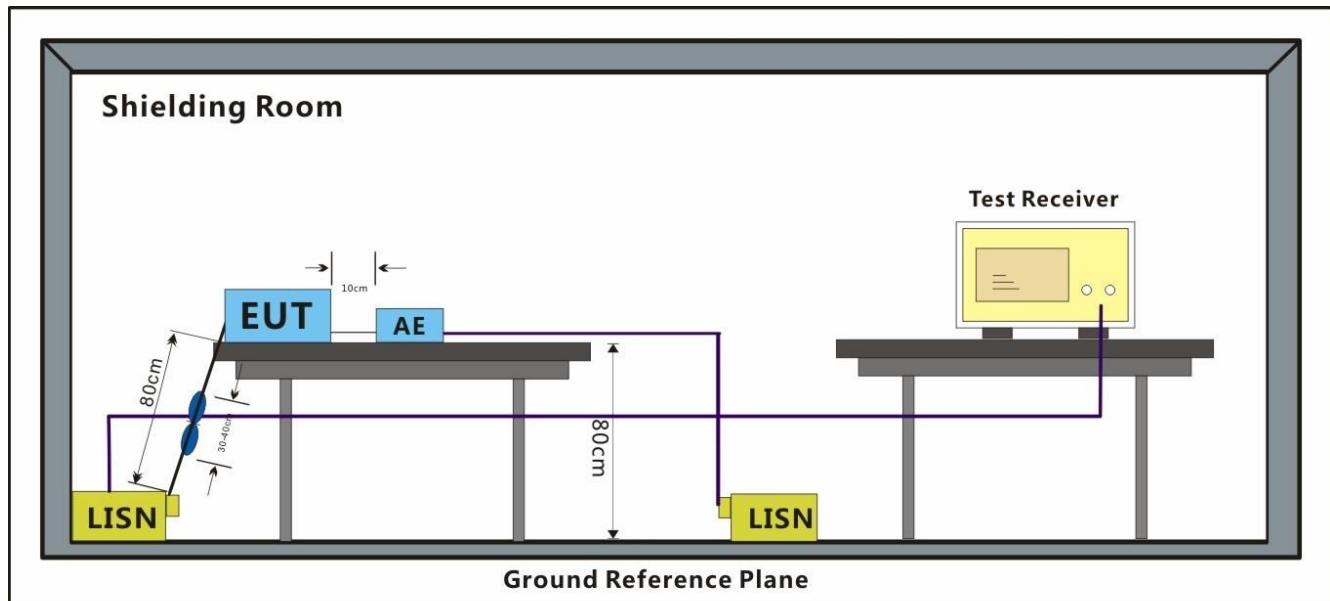
Test Mode	Test Frequency (MHz)	Frequency (MHz)	Reading Level (dBm)	Antenna Gain (dBi)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
802.11b	2412	2310	-51.7	2.8	46.4	54	-7.7	AVG
			-42.8	2.8	55.2	74	-18.8	Peak
		2340.378	-49.4	2.8	48.7	54	-5.4	AVG
		2369.536	-39.8	2.8	58.2	74	-15.8	Peak
		2390	-50.7	2.8	47.3	54	-6.7	AVG
			-43.9	2.8	54.1	74	-19.9	Peak
	2462	2483.5	-49.0	2.8	49.0	54	-5.0	AVG
			-40.7	2.8	57.3	74	-16.7	Peak
		2485.036	-48.2	2.8	49.8	54	-4.2	AVG
		2490.836	-38.9	2.8	59.1	74	-14.9	Peak
		2500	-49.5	2.8	48.5	54	-5.5	AVG
			-41.8	2.8	56.2	74	-17.8	Peak
802.11g	2412	2310	-56.9	2.8	41.1	54	-12.9	AVG
			-48.5	2.8	49.6	74	-24.5	Peak
		2390	-48.5	2.8	49.5	54	-4.5	AVG
			-37.9	2.8	60.1	74	-13.9	Peak
	2462	2483.5	-48.6	2.8	49.5	54	-4.6	AVG
			-37.2	2.8	60.8	74	-13.2	Peak
		2484.166	-36.8	2.8	61.2	74	-12.8	Peak
		2500	-55.6	2.8	42.4	54	-11.6	AVG
			-47.1	2.8	50.9	74	-23.1	Peak
		2500	-47.1	2.8	50.9	74	-23.1	Peak
802.11n(HT20)	2412	2310	-55.6	2.8	42.4	54	-11.6	AVG
			-46.6	2.8	51.4	74	-22.6	Peak
		2389.788	-35.4	2.8	62.6	74	-11.4	Peak
			-35.4	2.8	62.6	74	-11.4	Peak
		2390	-46.4	2.8	51.6	54	-2.4	AVG
			-35.5	2.8	62.5	74	-11.5	Peak
	2462	2483.5	-45.4	2.8	52.6	54	-1.4	AVG
			-31.7	2.8	66.3	74	-7.7	Peak
		2500	-54.8	2.8	43.2	54	-10.8	AVG
			-47.5	2.8	50.5	74	-23.5	Peak
802.11n(HT40)	2422	2310	-59.1	2.8	38.9	54	-15.1	AVG
			-51.6	2.8	46.4	74	-27.6	Peak
		2390	-46.6	2.8	51.5	54	-2.6	AVG
			-36.8	2.8	61.2	74	-12.8	Peak
	2452	2483.5	-47.7	2.8	50.3	54	-3.7	AVG
			-38.1	2.8	59.9	74	-14.1	Peak
		2483.632	-47.7	2.8	50.3	54	-3.7	AVG
		2484.424	-37.5	2.8	60.5	74	-13.5	Peak
		2500	-55.7	2.8	42.3	54	-11.7	AVG
			-44.6	2.8	53.4	74	-20.6	Peak

5 AC Powerline Conducted Emissions

5.1 Test Result

Test Description	Test Specification		Test Result
AC Powerline Conducted Emissions	15.207	RSS-GEN S8.8	Compliant

5.2 Test Setup



5.3 Test Method

With the receiver's resolution bandwidth was set to 9 kHz, exploratory scans were performed over the measuring frequency range (0.15 MHz to 30 MHz) using a max hold mode incorporating a Peak detector and Average detector and using the TILE! software. The final test data was measured using a Quasi-Peak detector and Average detector and compared against the limits indicated in the table below.

Frequency Range	Class A Limits (dBuV)	Class B Limits (dBuV)
0.15 to 0.5 MHz	Avg 66 QP 79	Avg 56 to 46 QP 66 to 56
0.5 to 5 MHz	Avg 60 QP 73	Avg 46 Pk 56
5 to 30 MHz		Avg 50 Pk 60

5.4 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions:

Temperature: 22.9°C

Relative Humidity: 29.5%

Atmospheric Pressure 97.46kpa

5.5 Test Equipment

Test End Date: 5-Mar-2021

Tester: ZH

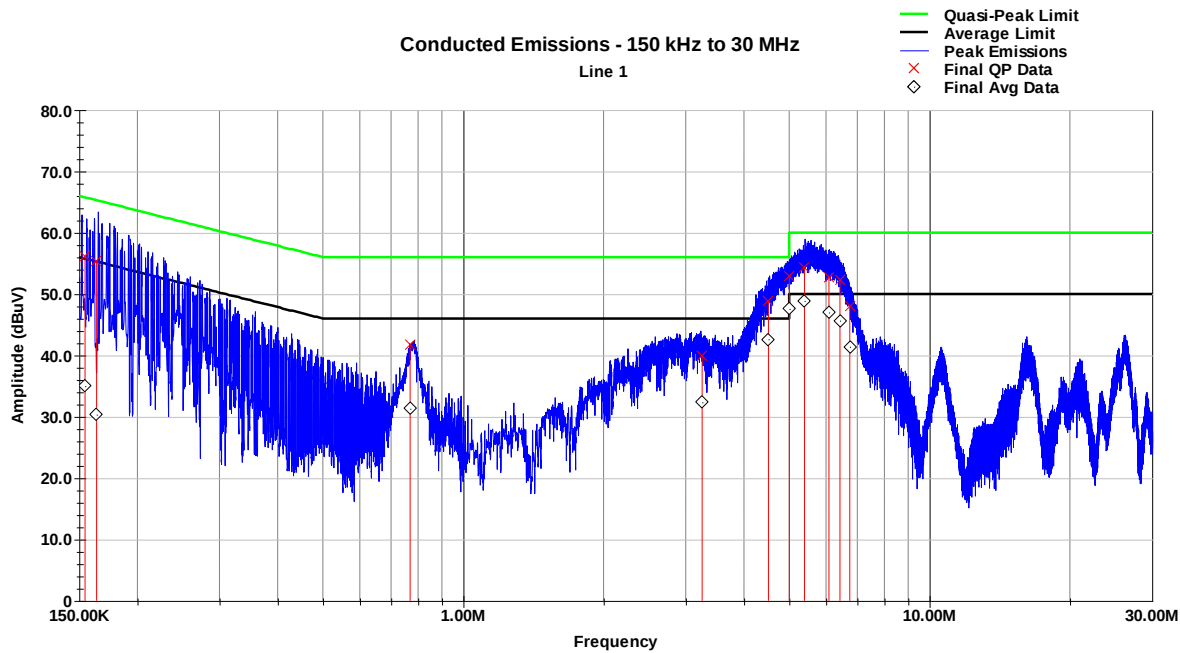
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	7-May-2021
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	6-Apr-2021
3PHASE LISN	NSLK 8163 RC	CHWARZBECK MESS ELEKTRONIK	16015	27-Jul-2021
RF CABLE	UC-N-MM-78	MAURY MICROWAVE	17017	3-Sep-2021

Notes: The equipment calibration period is 1 year.

Software: Conducted Emissions Tile7 210216.til

5.6 Test Data

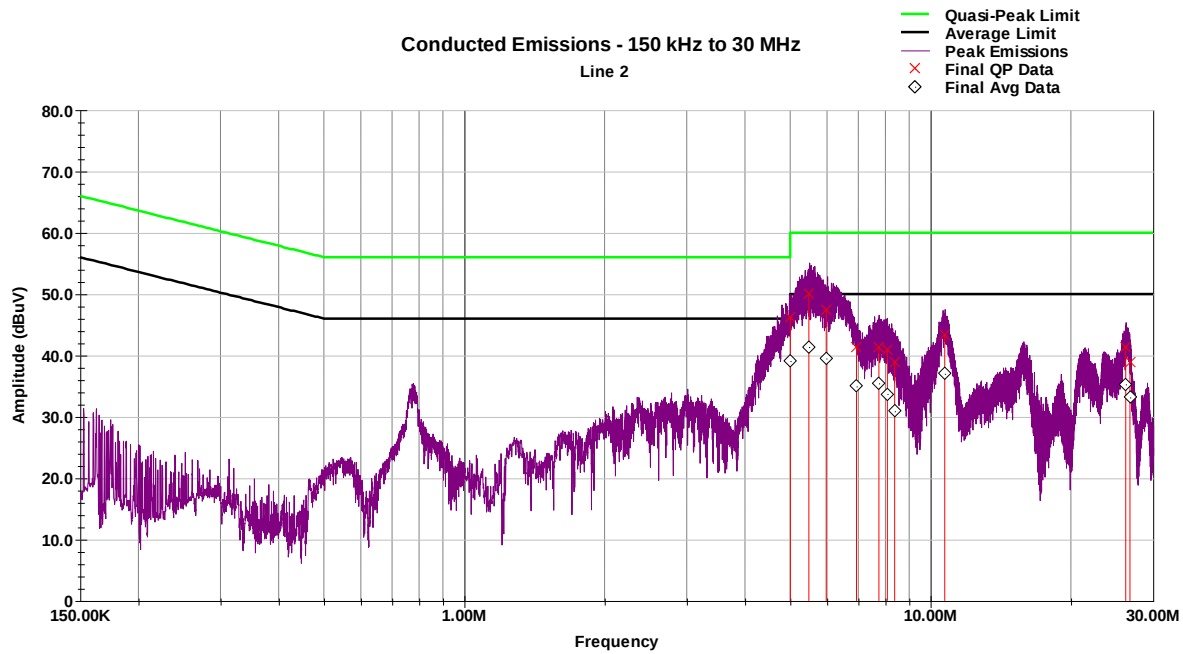
Line 1 Plot



Line 1 Data

Frequency	QP Value	QP Limit	QP Margin	Avg Value	Avg Limit	Avg Margin
MHz	dBuV	dBuV	dB	dBuV	dBuV	dB
0.154	56.2	65.7	-9.5	35	55.7	-20.7
0.164	55.3	65.3	-10	30.4	55.3	-24.9
0.769	41.7	56	-14.3	31.3	46	-14.7
3.254	39.9	56	-16.1	32.4	46	-13.6
4.514	48.8	56	-7.2	42.6	46	-3.4
5.006	52.9	60	-7.1	47.6	50	-2.4
5.393	54.3	60	-5.7	48.9	50	-1.1
6.086	52.8	60	-7.2	47	50	-3
6.424	52.3	60	-7.7	45.7	50	-4.3
6.743	48.1	60	-11.9	41.4	50	-8.6

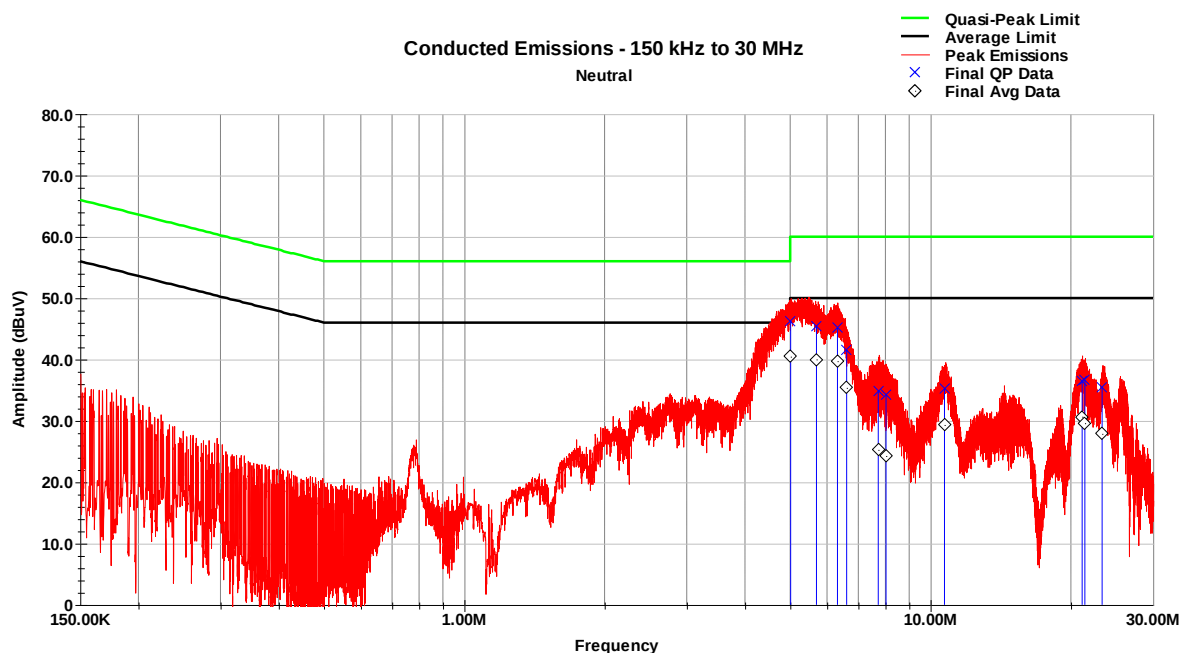
Line 2 Plot



Line 2 Data

Frequency	QP Value	QP Limit	QP Margin	Avg Value	Avg Limit	Avg Margin
MHz	dBuV	dBuV	dB	dBuV	dBuV	dB
5.005	46.3	60	-13.7	39.1	50	-10.9
5.484	50	60	-10	41.4	50	-8.6
5.974	47.4	60	-12.6	39.5	50	-10.5
6.938	41.4	60	-18.6	35	50	-15
7.748	41.4	60	-18.6	35.5	50	-14.5
8.078	40.9	60	-19.1	33.7	50	-16.3
8.375	39	60	-21	30.9	50	-19.1
10.727	43.3	60	-16.7	37	50	-13
26.225	41.4	60	-18.6	35.3	50	-14.7
26.77	39	60	-21	33.2	50	-16.8

Neutral Plot



Neutral Data

Frequency	QP Value	QP Limit	QP Margin	Avg Value	Avg Limit	Avg Margin
MHz	dBuV	dBuV	dB	dBuV	dBuV	dB
5.013	46.2	60	-13.8	40.5	50	-9.5
5.694	45.4	60	-14.6	40	50	-10
6.316	45.1	60	-14.9	39.7	50	-10.3
6.608	41.5	60	-18.5	35.4	50	-14.6
7.726	34.9	60	-25.1	25.3	50	-24.7
8.026	34.2	60	-25.8	24.3	50	-25.7
10.713	35.3	60	-24.7	29.3	50	-20.7
21.141	36.4	60	-23.6	30.7	50	-19.3
21.429	36.6	60	-23.4	29.6	50	-20.4
23.335	35.4	60	-24.6	27.9	50	-22.1

6 Measurement Uncertainty

The measurement uncertainty figures are calculated in accordance with TR 100 028-1 [2] and correspond to an expansion factor (coverage factor) $k = 2$ (which provides confidence levels of 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Parameter	Expanded Uncertainty for Normal k factor equal to 2	
	Required	Laboratory Actual
Radio Frequency	$\pm 1 \times 10^{-5}$	$\pm 9.8 \times 10^{-8}$
total RF power, conducted	± 1.5 dB	± 1.2 dB
RF power density, conducted	± 3 dB	± 0.7 dB
spurious emissions, conducted	± 3 dB	± 2.1 dB
all emissions, radiated	± 6 dB	± 4.8 dB
temperature	$\pm 1^{\circ}\text{C}$	$\pm 0.5^{\circ}\text{C}$
humidity	± 5 %	± 3.5 %
DC and low frequency voltages	± 3 %	± 0.4 %
Conducted disturbance at mains port using AMN	± 3.4 dB	± 2.5 dB

7 Revision History

Revision Level	Description of changes	Revision Date
Draft	--	26 March 2021
0	Initial release	14 June 2021
1	Corrected original IC number for RF module in section 1	30 June 2021