

RF Test Report

Project Number: 5024907**Offer Number:** SUW-202302004058**Report Number:** 5024907EMC03**Revision Level:** 1**Client:** Enovate Medical, LLC**Equipment Under Test:** Wireless Medical Cart**Model Number:** Envoy 2.0**HVIN:** ENV2**FCC ID:** 2AQ9D-A0002945**IC:** 24335-A0002945**Applicable Standards:** ANSI C63.10: 2013 (FCC Part 15 Subpart C, § 15.247)**RSS-247, Issue 2****RSS-GEN Issue 5****Report issued on:** 31 October 2023**Test Result:** Compliant

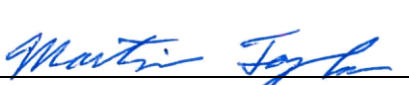
FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER: 3212.01

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Prepared by:


Daniel Alvarez, RF/EMC Sr. Staff Engineer

Reviewed by:


Martin Taylor, Sr. RF Project Engineer

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1 Summary of Test Results

Test Description	Test Specification		Test Result
Bandwidth	15.247(a)(2)	RSS-247 5.2(a) RSS-GEN 6.7	Compliant
Peak Output Power	15.247(b)(3)	RSS-247 5.4 (d)	Compliant
Power Spectral Density	15.247(e)	RSS-247 5.2 (b)	Compliant
Conducted Spurious Emissions / Band Edge	15.247(d)	RSS-247 5.5	Compliant
Emissions in Restricted Frequency Bands	15.205, 15.209	RSS-GEN 8.9, 8.10	Compliant
Antenna Requirement	15.203	RSS-GEN 6.8	Compliant
AC Powerline Conducted Emissions	15.107, 15.207	RSS-GEN 8.8	Compliant

1.1 Modifications Required for Compliance

- Changed from using Nordic board modulation to using BLE Modes for 1M & 2M to comply with Bandwidth Requirements.

2 General Information

2.1 Client Information

Name: Enovate Medical
Address: 1152 Park Avenue
City, State, Zip, Country: Murfreesboro, TN 37129, 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
Designation Number: US1126
CAB Identifier: US0186

2.3 General Information of EUT

Product Description: Wireless Medical Cart
Model Number: Envoy 2.0
HVIN: ENV2
Serial Number: 3193746

Frequency Range: 2402 – 2480 MHz
Data Modes: Nordic Proprietary Protocol (nRF) – GFSK (1M and 2M Data Rates)
BLE 1M/2M
Antenna: External Antenna, 0.7dBi

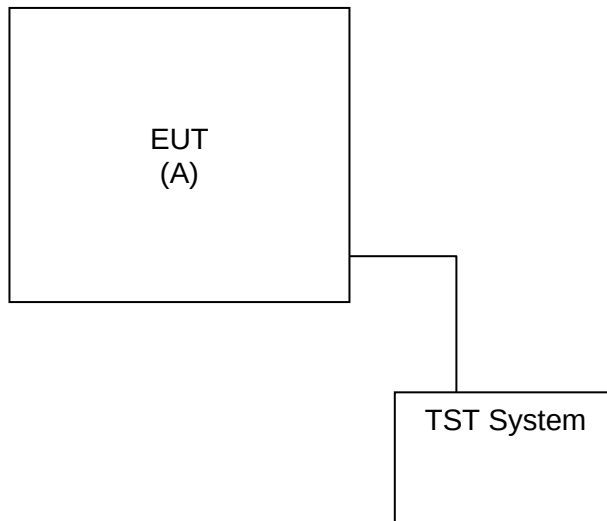
Rated Voltage: Battery, 100-240 Vac 50/60Hz
Test Voltage: Battery & 120Vac 60Hz

Sample Received Date: 07 March 2023
Dates of testing: 01-23 May 2023

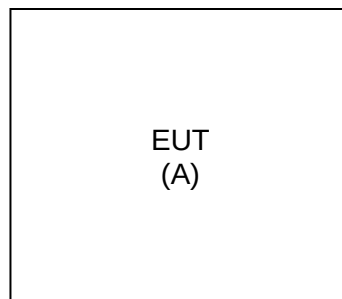
2.4 Operating Modes and Conditions

For this assessment, the nRF board was set to a +4 dBm power setting utilizing the Nordic Proprietary Protocol (nRF) for RSE and Conducted Emissions measurements. All Conducted method measurements were performed with in BLE mode for 1M and 2M protocols. The EUT was programmed to transmit on low, mid, and high channels on the supported modulation and modes of operation.

2.5 EUT Connection Block Diagram – Conducted Measurements



2.6 EUT Connection Block Diagram – Radiated Measurements



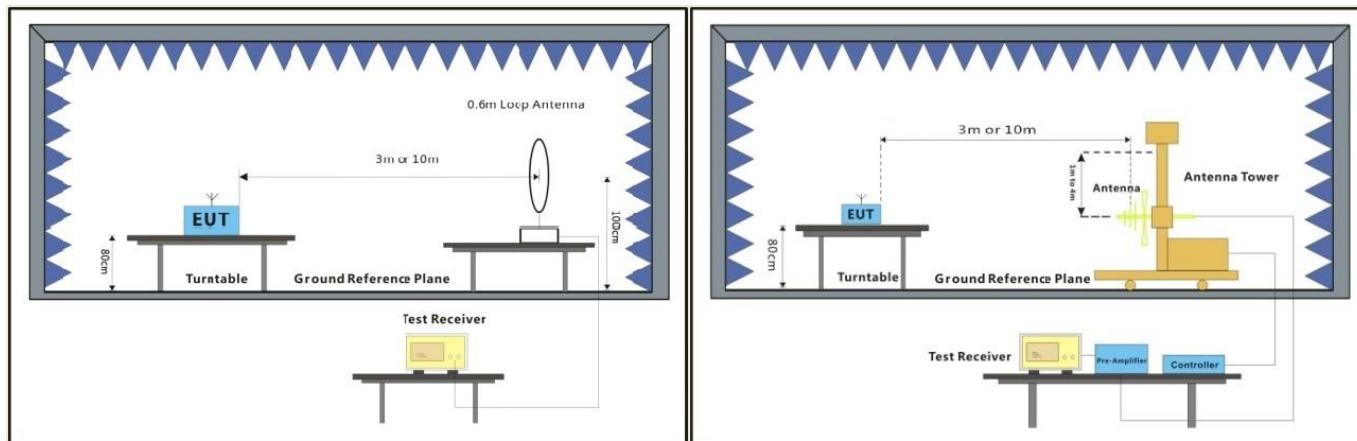
Inside Chamber

.....
Outside Chamber

2.7 System Configurations

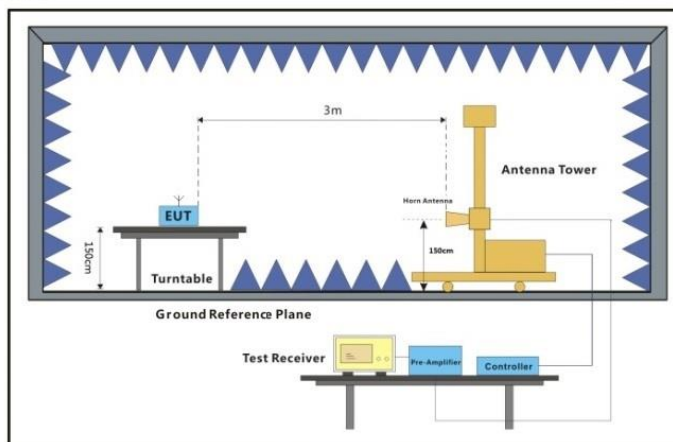
Device reference	Manufacturer	Description	Model Number	Serial Number
A	Enovate Medical	Mobius Medical Cart	ENV0-2DCAC1-A00	3193746

2.8 Configuration Diagrams (Radiated)



Below 30MHz

30MHz-1GHz



Above 1GHz

3 Intentional Radiator Antenna Requirement

3.1 Result

Test Description	Test Specification	Test Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.203	Compliant

3.2 Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit permanently attached antenna or of so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

3.3 Conclusion

The Antenna on this device is an external antenna with a reverse SMA connector.

4 Bandwidth

4.1 Test Result

Test Description	Test Specification		Test Result
6 dB Bandwidth 99% Occupied Bandwidth	15.247(a)(2)	RSS-247 5.2(a) RSS-GEN 6.7	Compliant

4.2 Test Method

The procedures from ANSI C63.10: 2013 clause 11.8 and 558074 D01 DTS Meas. Guidance v05r2 were used to determine the 6 dB bandwidth.

The procedures from ANSI C63.10: 2013 clause 6.9.2 were used to measure the 99% Occupied Bandwidth.

4.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.15 °C

Relative Humidity: 45.4 %

Atmospheric Pressure: 98.24 kPa

4.4 Test Equipment

Test End Date: 23-May-2023

Tester: DA

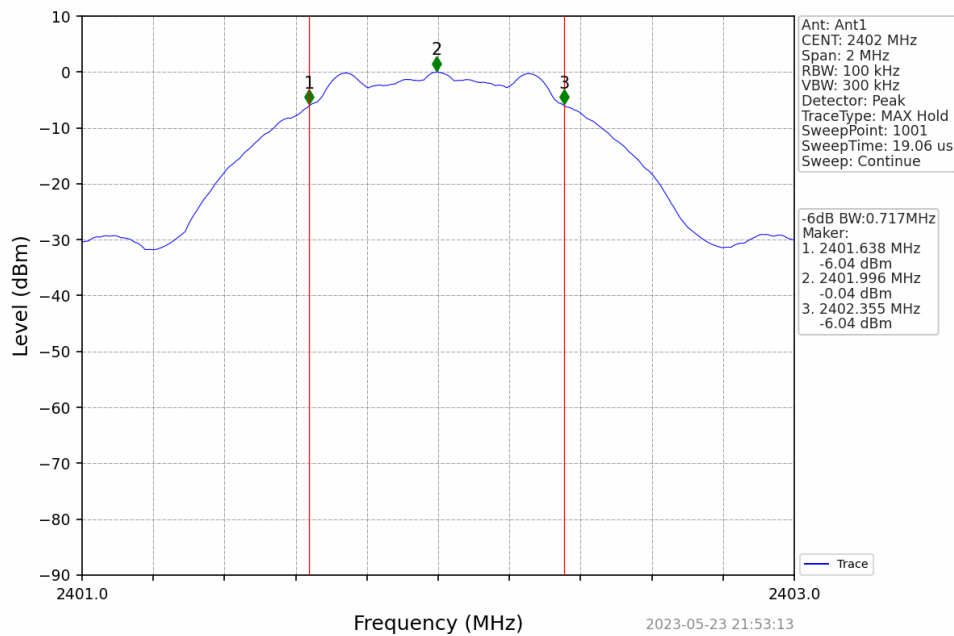
Equipment	Model	Manufacturer	Asset	Cal Date	Cal Due Date
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	7-Dec-2022	7-Dec-2023
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20108	13-Mar-2023	13-Mar-2024
TSTPASS SWITCHBOX	SB2	TSTPASS	23009	CNR	CNR

4.5 Test Data – 6dB Bandwidth

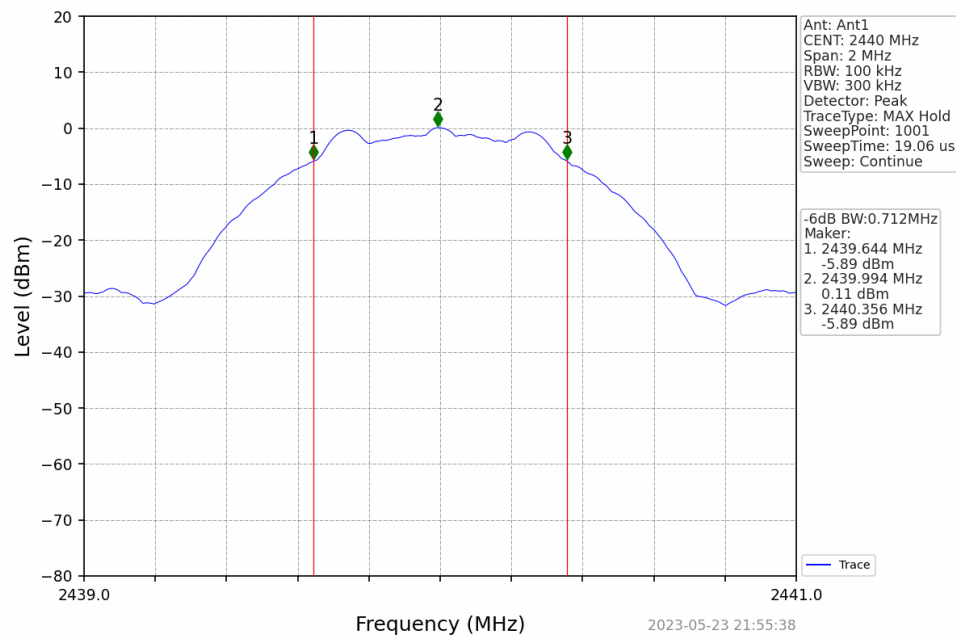
Test Mode	Frequency (MHz)	TX Type	ANT No.	6dB BW (MHz)	Limit (MHz)	Verdict
1M	2402	SISO	1	0.717	≥ 0.5	PASS
	2440	SISO	1	0.712	≥ 0.5	PASS
	2480	SISO	1	0.715	≥ 0.5	PASS
2M	2402	SISO	1	1.205	≥ 0.5	PASS
	2440	SISO	1	1.141	≥ 0.5	PASS
	2480	SISO	1	1.148	≥ 0.5	PASS

Sample Plot

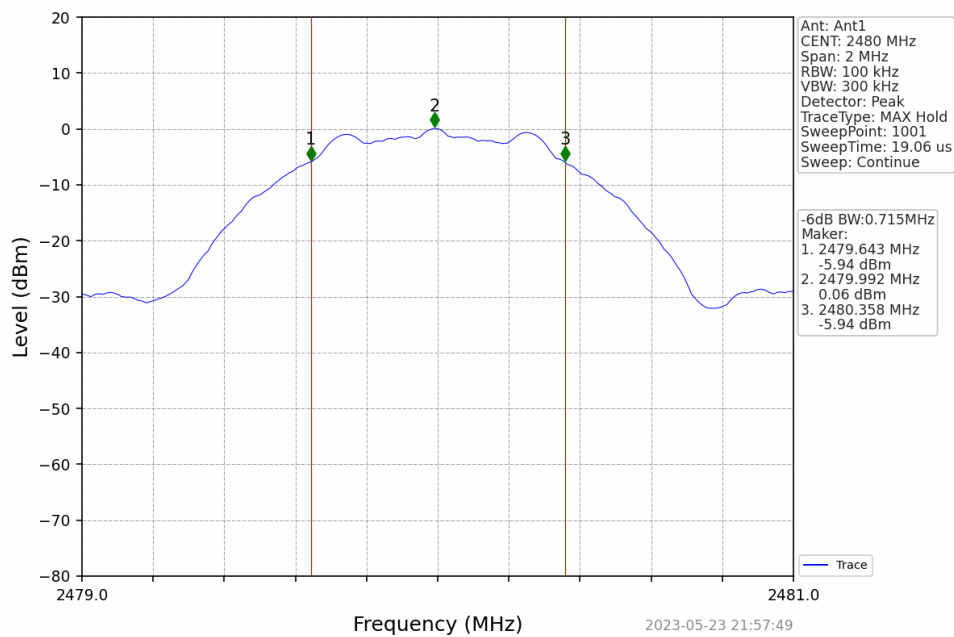
1M Low Channel (2402MHz)



1M Mid Channel (2440 MHz)



1M High Channel (2480 MHz)

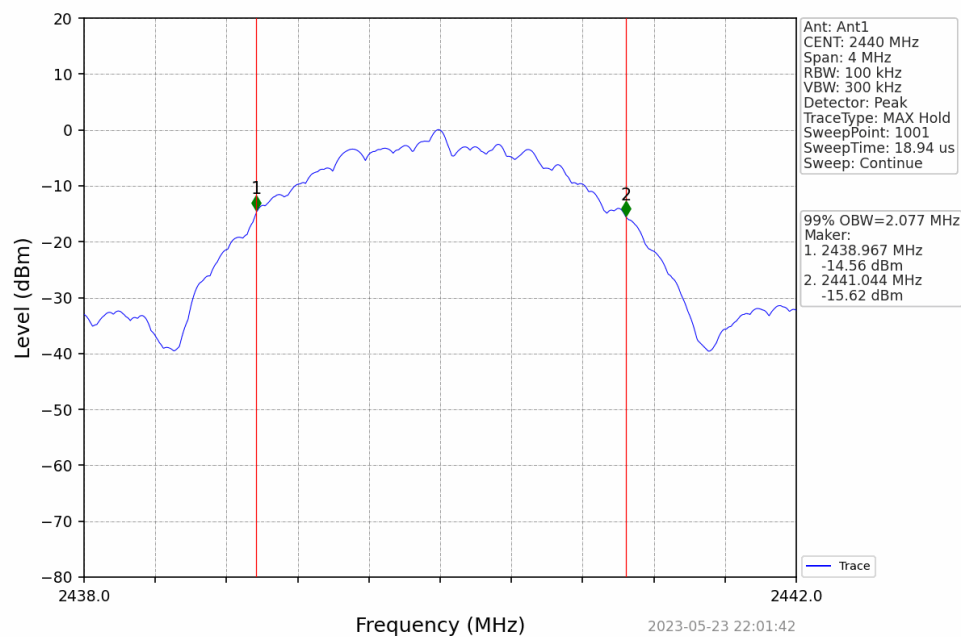


4.6 Test Data – 99% Bandwidth

Test Mode	Frequency (MHz)	TX Type	ANT No.	99% OBW (MHz)	Verdict
1M	2402	SISO	1	1.068	Reported
	2440	SISO	1	1.063	Reported
	2480	SISO	1	1.066	Reported
2M	2402	SISO	1	2.087	Reported
	2440	SISO	1	2.077	Reported
	2480	SISO	1	2.076	Reported

Sample Plot

2M Mid Channel (2440MHz)



5 Peak Output Power

5.1 Test Result

Test Description	Test Specification		Test Result
Peak Output Power	15.247(b)(3)	RSS-247 S5.4 (d)	Compliant

5.2 Test Method

Fundamental peak power measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.9 and KDB 558074 D01 Measurement Guidance v05r2.

Limit

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. For using antennas with greater than 6dBi of gain, the limit is reduced in dB by the amount the gain exceeds 6dBi (e.g., for a 7.4dBi antenna, the limit is reduced from 30dBm to 28.6dBm)

5.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.15 °C

Relative Humidity: 45.4 %

Atmospheric Pressure: 98.24 kPa

5.4 Test Equipment

Test End Date: 23-May-2023

Tester: DA

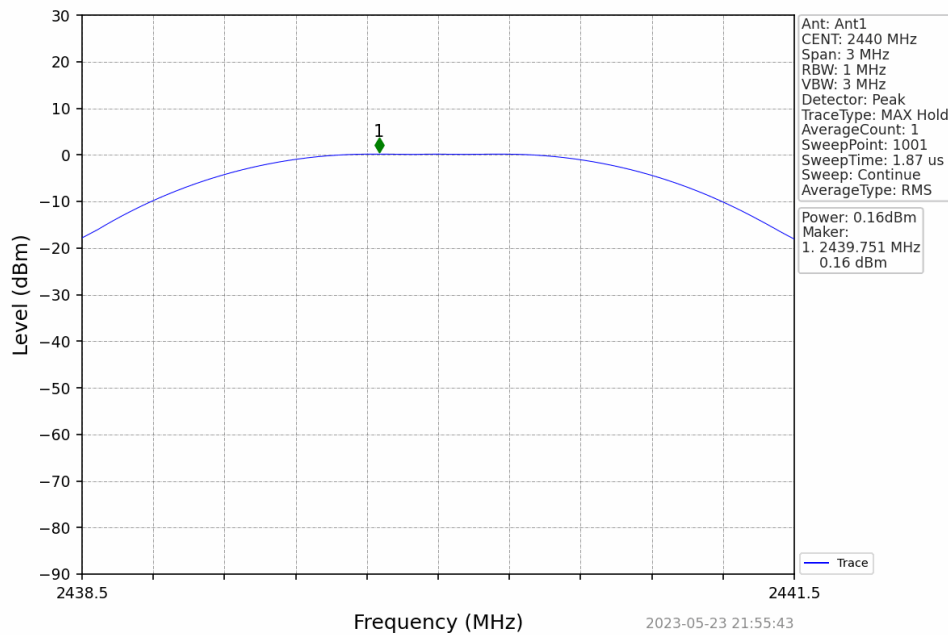
Equipment	Model	Manufacturer	Asset	Cal Date	Cal Due Date
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	7-Dec-2022	7-Dec-2023
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20108	13-Mar-2023	13-Mar-2024
TSTPASS SWITCHBOX	SB2	TSTPASS	23009	CNR	CNR

5.5 Test Data

Test Mode	Frequency (MHz)	TX Type	ANT No.	Peak Output Power (dBm)	Limit (dBm)	Verdict
1M	2402	SISO	1	0.02	30	PASS
	2440	SISO	1	0.16	30	PASS
	2480	SISO	1	0.10	30	PASS
2M	2402	SISO	1	-0.04	30	PASS
	2440	SISO	1	0.13	30	PASS
	2480	SISO	1	0.09	30	PASS

Sample Plot

1M Mid Channel (2480MHz)



6 Power Spectral Density

6.1 Test Result

Test Description	Test Specification		Test Result
Power Spectral Density	15.247(e)	RSS-247 S5.2 (b)	Compliant

6.2 Test Method

Power spectral density measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.10 and KDB 558074 D01 Measurement Guidance v05r2.

Limit

The limit is 8 dBm.

6.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.15 °C

Relative Humidity: 45.4 %

Atmospheric Pressure: 98.24 kPa

6.4 Test Equipment

Test End Date: 23-May-2023

Tester: DA

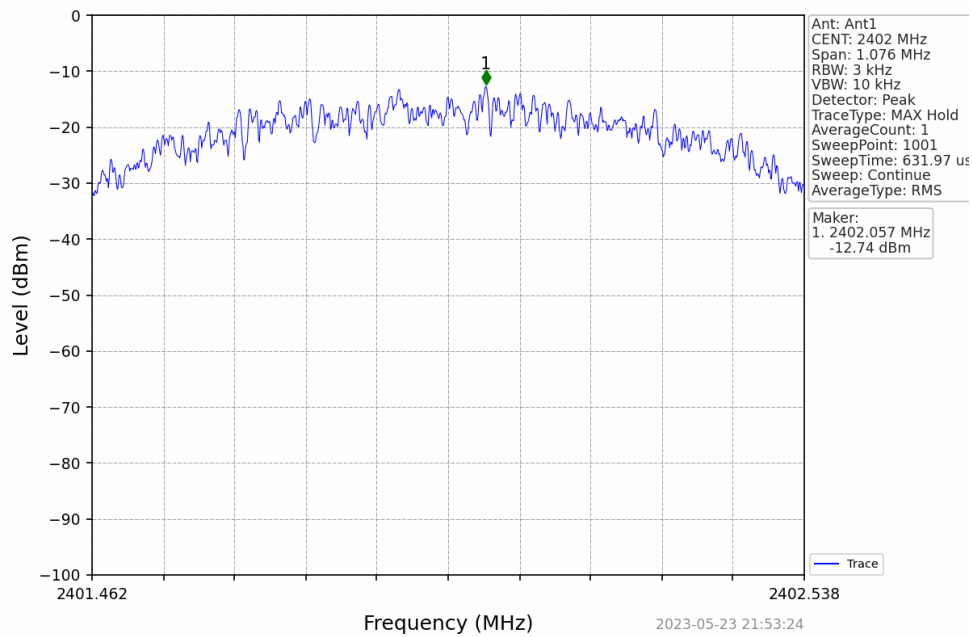
Equipment	Model	Manufacturer	Asset	Cal Date	Cal Due Date
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	7-Dec-2022	7-Dec-2023
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20108	13-Mar-2023	13-Mar-2024
TSTPASS SWITCHBOX	SB2	TSTPASS	23009	CNR	CNR

6.5 Test Data

Frequency (MHz)	Frequency (MHz)	TX Type	ANT No.	Peak PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
1M	2402	SISO	1	-12.74	≤8	PASS
	2440	SISO	1	-13.88	≤8	PASS
	2480	SISO	1	-13.18	≤8	PASS
2M	2402	SISO	1	-16.68	≤8	PASS
	2440	SISO	1	-16.86	≤8	PASS
	2480	SISO	1	-16.48	≤8	PASS

Sample Plot

1M Low Channel (2440MHz)



7 Conducted Spurious Emissions / Band Edge

7.1 Test Result

Test Description	Test Specification		Test Result
Conducted Spurious Emissions	15.247(d)	RSS-247 S5.5	Compliant

7.2 Test Method

Spurious emissions in non-restricted frequency bands were recorded using the methods defined in ANSI C63.10: 2013 clause 11.11 and KDB 558074 D01 Measurement Guidance v05r2.

Lowest, middle, and highest channels were investigated.

Because the maximum conducted peak output power was used to determine compliance with the output power limits, the limit in any 100 kHz band outside of the authorized band is 20 dB below the maximum in-band peak level.

7.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 25.1 °C

Relative Humidity: 44.0 %

Atmospheric Pressure: 102.1 kPa

7.4 Test Equipment

Test End Date: 15-May-2023

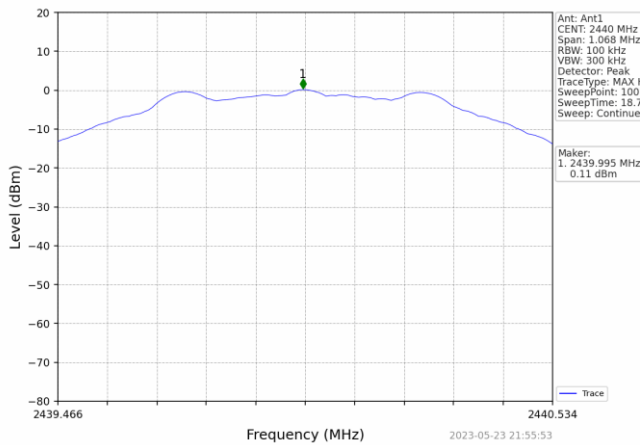
Tester: DA

Equipment	Model	Manufacturer	Asset	Cal Date	Cal Due Date
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	7-Dec-2022	7-Dec-2023
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20108	13-Mar-2023	13-Mar-2024
TSTPASS SWITCHBOX	SB2	TSTPASS	23009	CNR	CNR

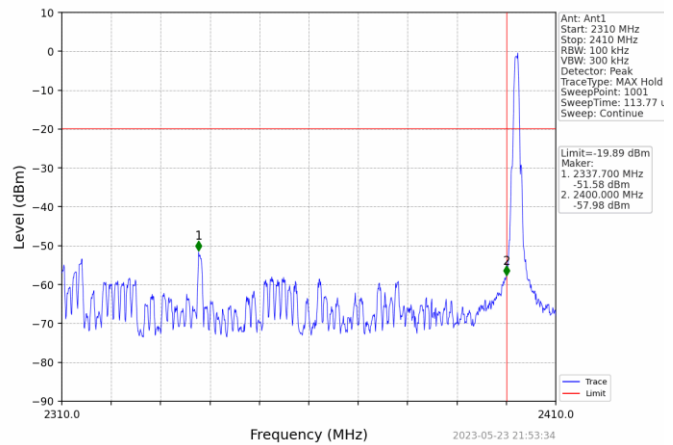
7.5 Test Data

Frequency (MHz)	Frequency (MHz)	TX Type	ANT No.	In-band reference levels (dBm)
1M	2402	SISO	1	0.11
	2440	SISO	1	0.11
	2480	SISO	1	0.11
2M	2402	SISO	1	0.03
	2440	SISO	1	0.03
	2480	SISO	1	0.03

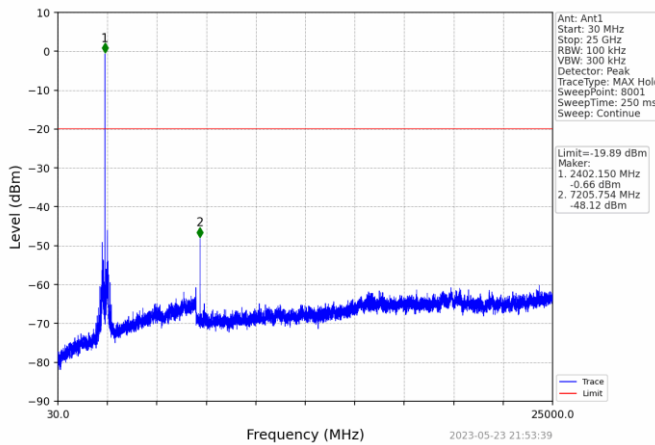
1M In-Band Reference



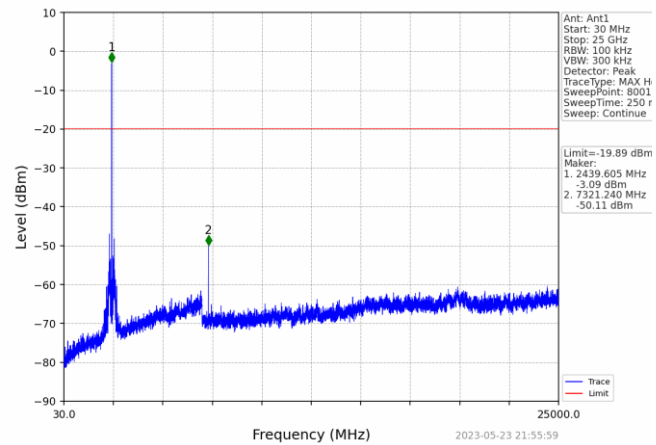
1M Lower Band Edge - Low Channel (2402MHz)



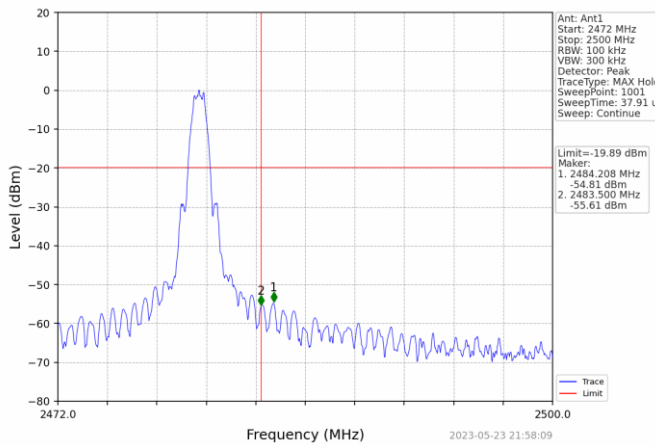
1M Full Spectrum - Low Channel (2402MHz)



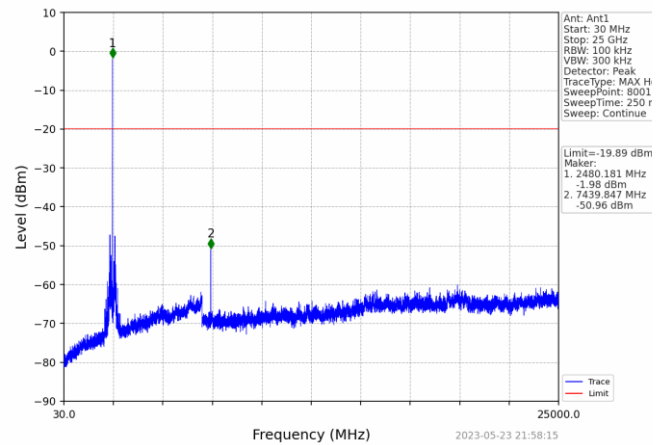
1M Full Spectrum - Mid Channel (2440MHz)



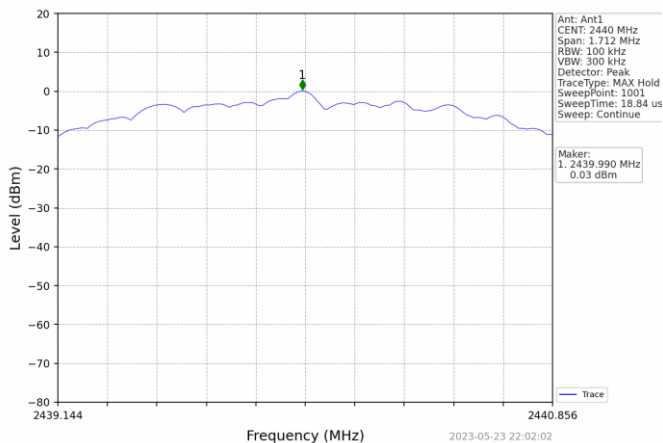
1M Upper Band Edge - High Channel (2480MHz)



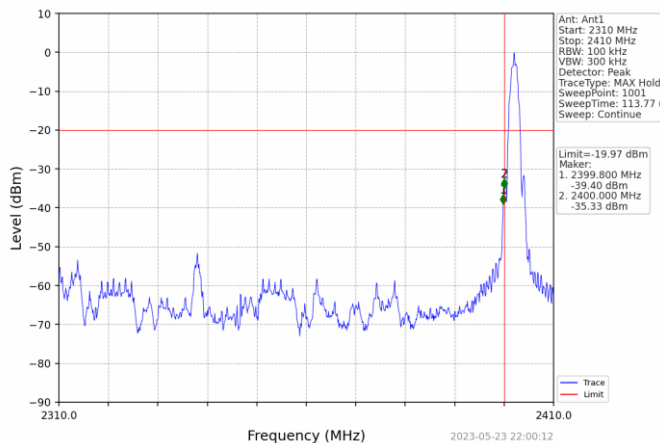
1M Full Spectrum - High Channel (2480MHz)



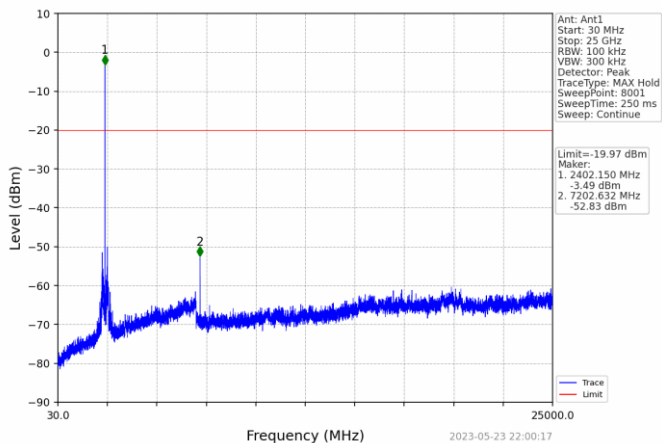
2M In-Band Reference



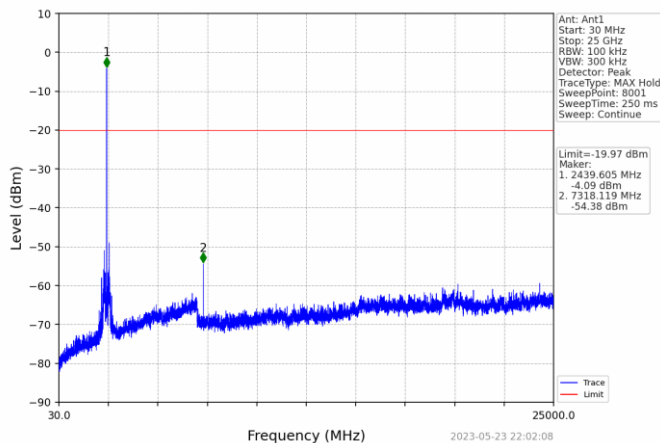
2M Lower Band Edge - Low Channel (2402MHz)



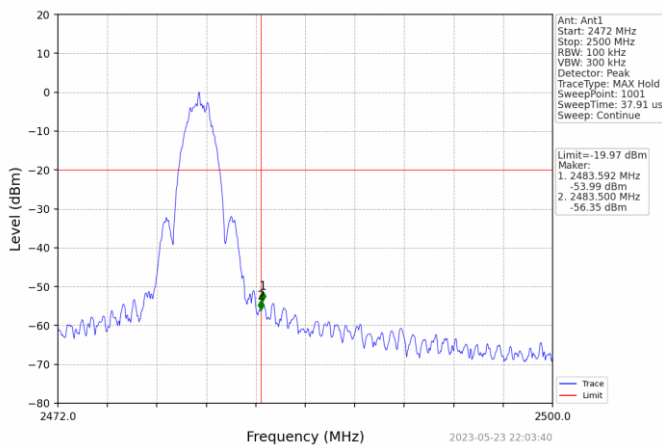
2M Full Spectrum - Low Channel (2402MHz)



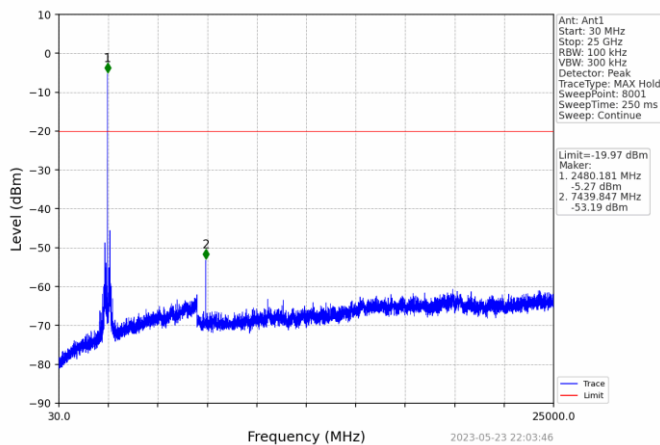
2M Full Spectrum - Mid Channel (2440MHz)



2M Upper Band Edge - High Channel (2480MHz)



2M Full Spectrum - High Channel (2480MHz)



8 Field Strength of Spurious Radiation (Restricted Bands)

8.1 Test Result

Test Description	Test Specification		Test Result
Radiated Spurious Emissions	15.247(d) and 15.209	RSS-247 S5.5	Compliant

8.2 Test Method

The measurement methods defined in ANSI C63.10: 2013 were used.

Lowest, middle, and highest channels were investigated – the device was commanded to continuously transmit on low, middle, and high channels. The EUT is floor standing and only used in this orientation.

Test distance:

- 9k 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
- 18 to 26 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

8.3 Test Site

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

Environmental Conditions	May 11 2023	May 2 2023
Temperature:	22.84 °C	21.74 °C
Relative Humidity:	45.2 %	26.5 %
Atmospheric Pressure:	90.90 kPa	97.23 kPa

8.4 Test Equipment

9kHz-30MHz

Test End Date: 2-May-2023

Tester: LM

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ANTENNA, LOOP, ACTIVE	6502	ETS LINDGREN	B085752	11-Aug-2022	11-Aug-2024
N to N RF Cable	EM-B810NM-276	Echelon	22034	23-Jan-2023	23-Jan-2024
RF CABLE	SF106	HUBER & SUHNER	B079713	25-Aug-2022	25-Aug-2023
EMI TEST RECEIVER	ESW44	ROHDE & SCHWARZ	22027	13-Sep-2022	13-Sep-2023
RF CABLE NM TO NM, 0.01-18GHZ	90-195-079	TELEDYNE STORM MICROWAVE	20124	13-Feb-2023	13-Feb-2024

30-1000MHz

Test End Date: 2-May-2023

Tester: EW

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079690	19-Apr-2022	19-Apr-2024
N to N RF Cable	EM-B810NM-276	Echelon	22034	23-Jan-2023	23-Jan-2024
RF CABLE	SF106	HUBER & SUHNER	B079713	25-Aug-2022	25-Aug-2023
RF CABLE, NM TO NM.	90-195-157	TELEDYNE STORM MICROWAVE	21019	14-Mar-2023	14-Mar-2024
RF CABLE RIGHT ANGLE NM TO NM, 0.01-18GHZ	90-076-020	TELEDYNE STORM MICROWAVE	20131	13-Mar-2023	13-Mar-2024
LOW NOISE AMPLIFIER	ZKL-2+	MINI-CIRCUITS	B079817	25-Aug-2022	25-Aug-2023
ROTARY NM TO NF CONNECTOR	18-2120-0	DIAMOND ANTENNA AND MICROWAVE CORP	22007	13-Mar-2023	13-Mar-2024
EMI TEST RECEIVER	ESW44	ROHDE & SCHWARZ	22027	13-Sep-2022	13-Sep-2023

Above 1 GHz

Test End Date: 11-May-2023

Tester: EW

Equipment	Model	Manufacturer	Asset	Cal Date	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079699	29-Jul-2022	29-Jul-2024
N to N RF Cable	EM-B810NM-276	Echelon	22034	23-Jan-2023	23-Jan-2024
RF CABLE RIGHT ANGLE NM TO NM, 0.01-18GHZ	90-076-020	TELEDYNE STORM MICROWAVE	20132	13-Mar-2023	13-Mar-2024
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	13-Jul-2022	13-Jul-2023
EMI TEST RECEIVER	ESW44	ROHDE & SCHWARZ	22027	13-Sep-2022	13-Sep-2023
FILTER, HIGH PASS, >2800MHZ	HPM50111	MICRO-TRONICS	22017	16-Jun-2022	16-Jun-2023

Software:

TILE! RSE 9k - 30M Active Red Loop 230404 April 04 2023

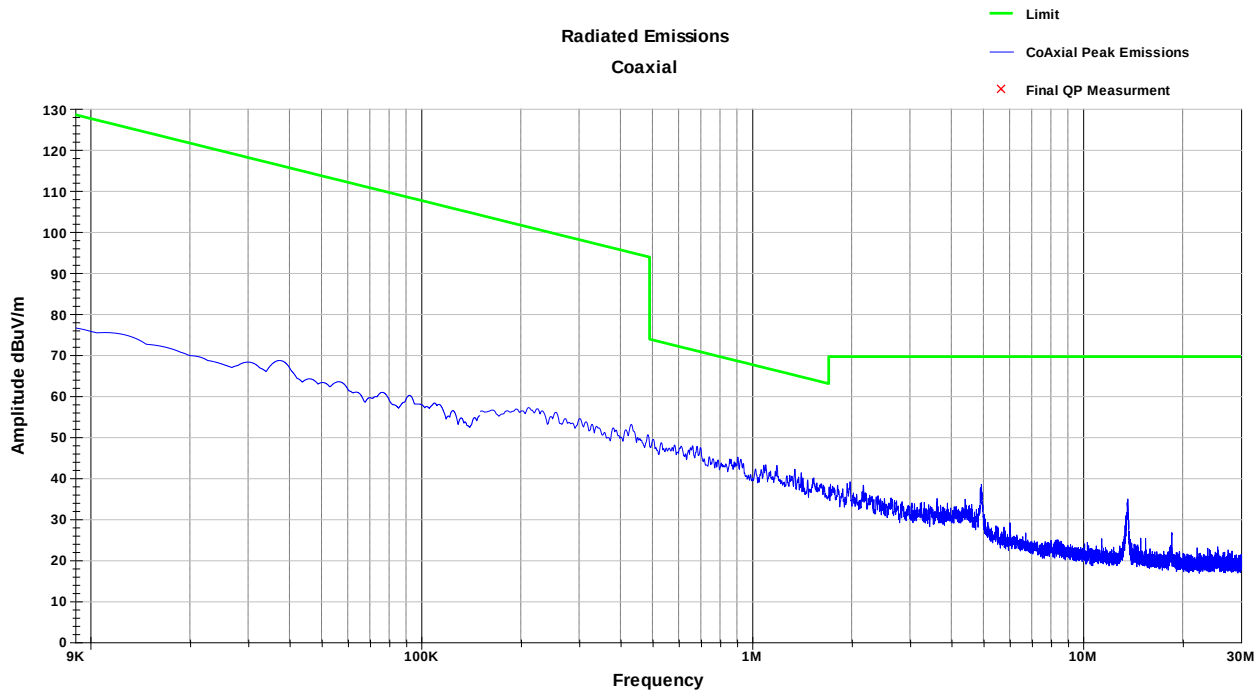
TILE! RSE 30-1000 MHz T7 220318 March 18 2022

TILE! RSE 1-18 GHz T7 210212 Feb 12 2021

Note: Since 2M demonstrated a lower PSD than 1M, only the 1M data is recorded in the report.

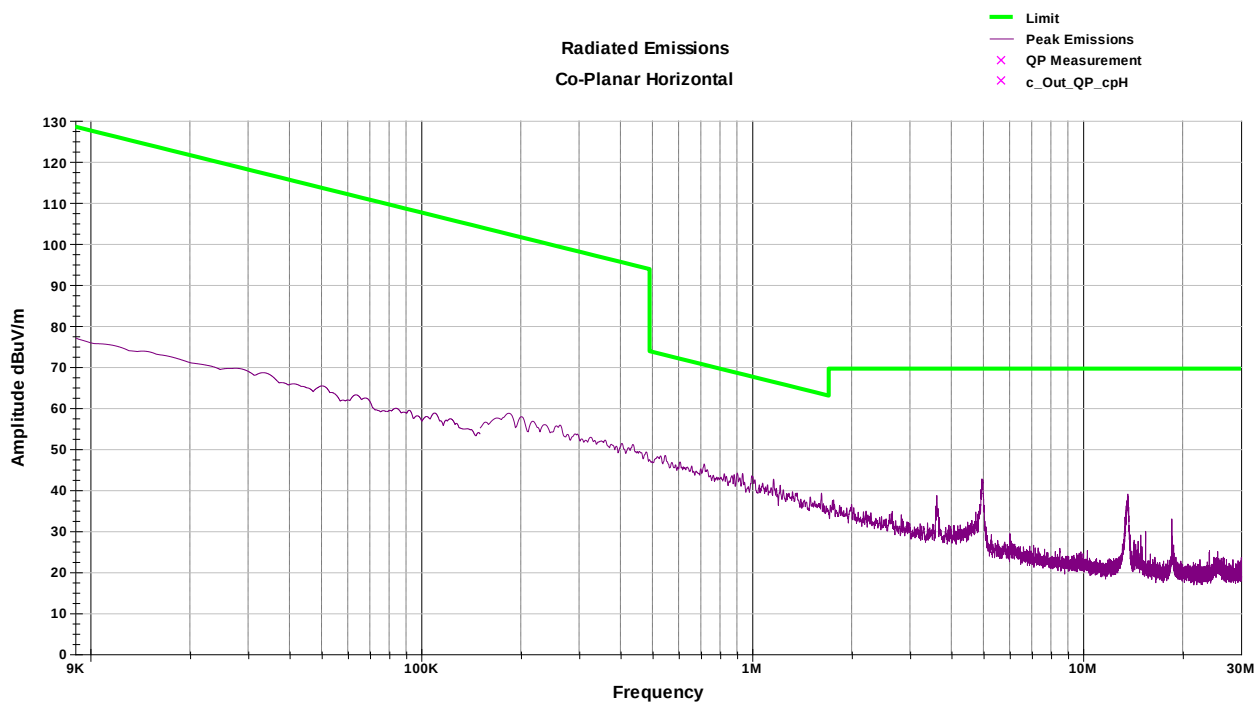
8.5 Test Data – Peak Plots

9 kHz – 30 MHz (Coaxial) 802.11g+n (Sample Plot)



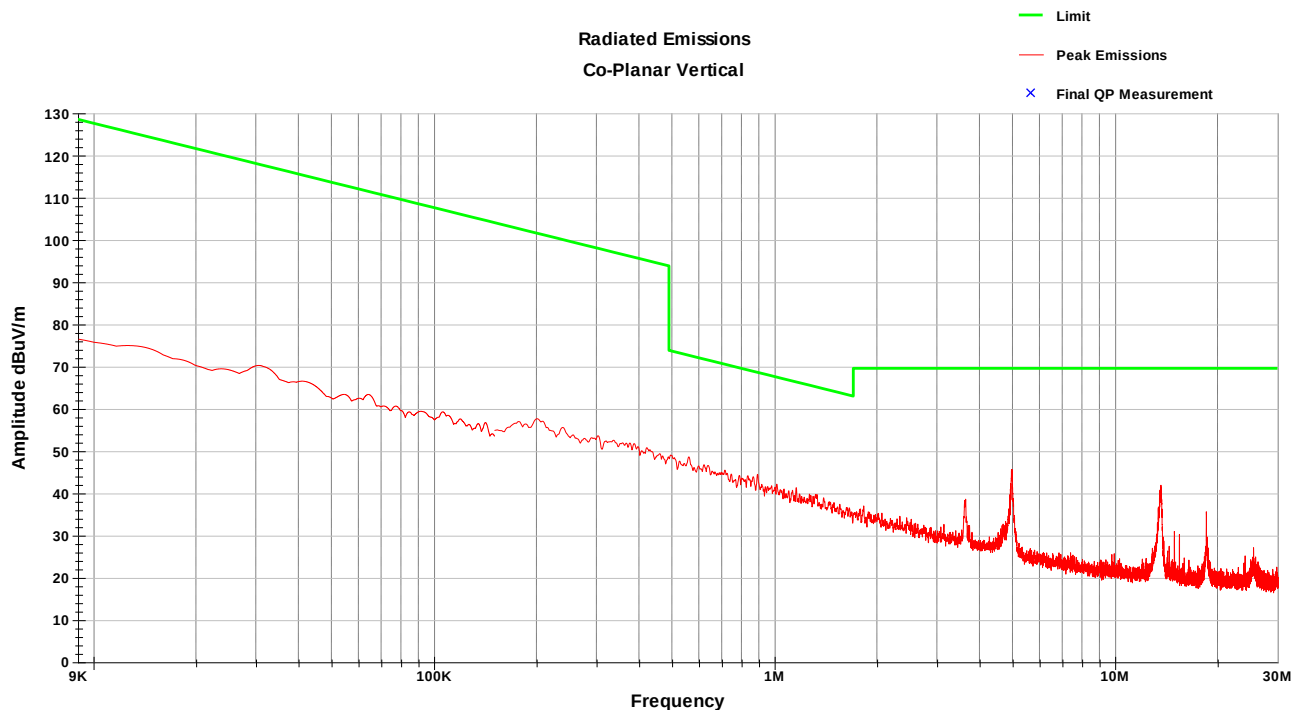
Note: No significant deviation with respect to channel. No discernable difference detected when tested in nRF modes.

9 kHz – 30 MHz (Co-Planar Horizontal) 802.11g+n (Sample Plot)



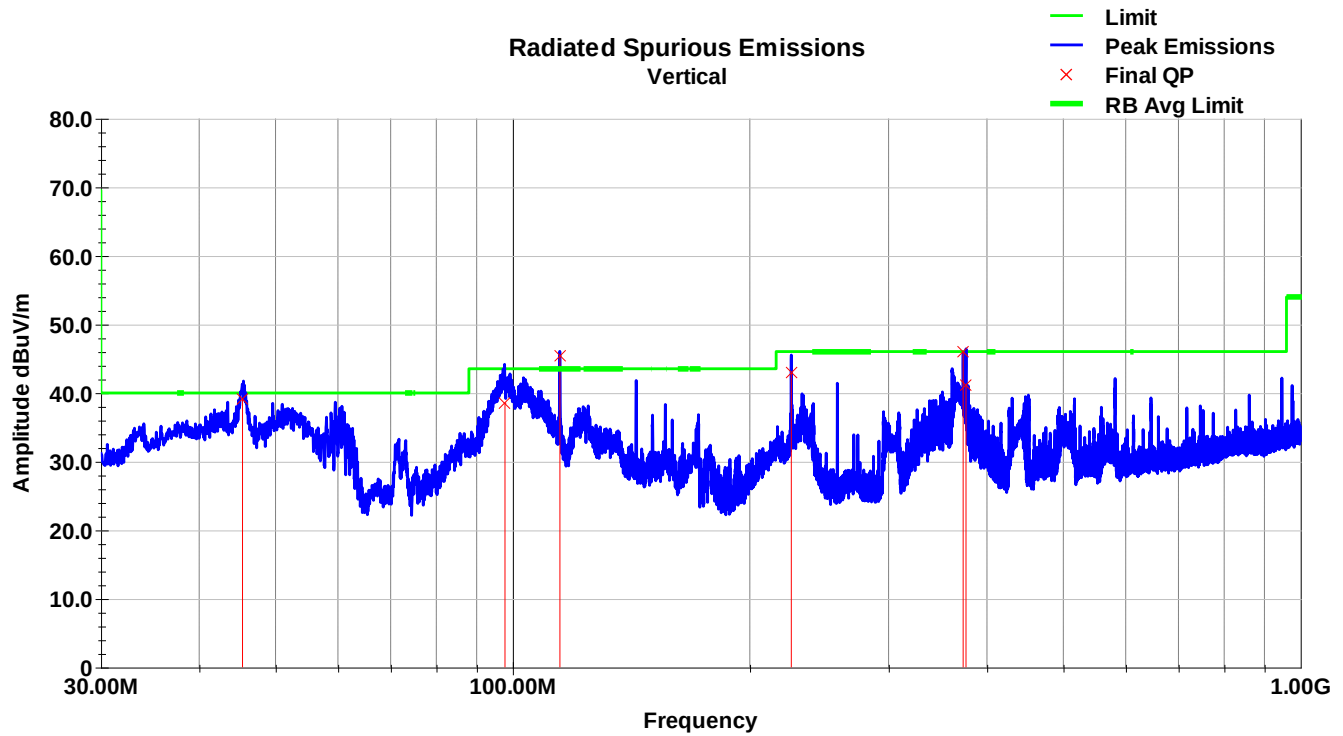
Note: No significant deviation with respect to channel. No discernable difference detected when tested in nRF modes.

9 kHz – 30 MHz (Co-Planar Vertical) 802.11g+n (Sample Plot)



Note: No significant deviation with respect to channel. No discernable difference detected when tested in nRF modes.

Vertical Radiated Spurious Emissions – 30-1000MHz 802.11g+n (Sample Plot)

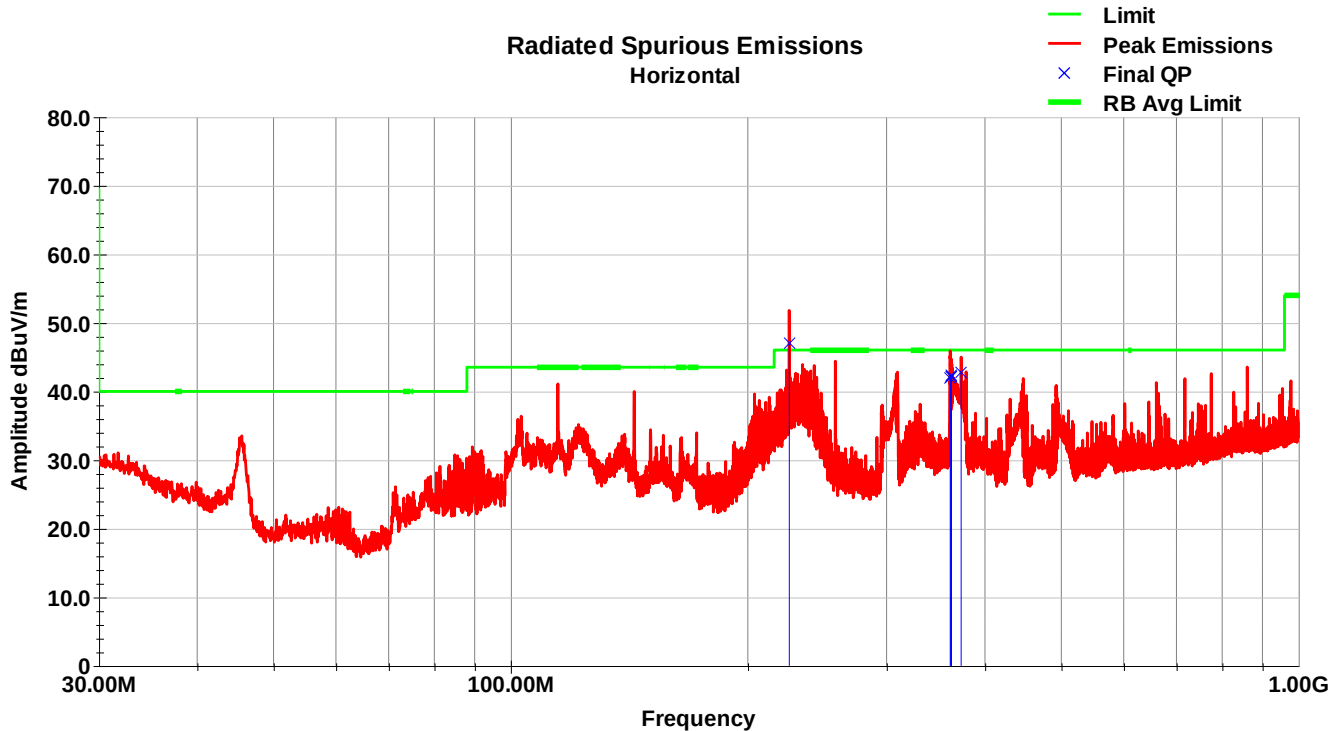


Note: No significant deviation with respect to channel. No discernable difference detected when tested in nRF modes.

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)
45.40	54.6	V	285.0	100.0	14.9	0.6	31.0	39.0	40.0	-1.0
97.78	54.9	V	315.0	100.0	13.7	0.9	30.9	38.6	43.5	-4.9
114.81	58.2	V	8.0	100.0	17.2	1.0	30.9	45.5	43.5	2.0
225.73	56.3	V	278.0	307.0	15.7	1.5	30.6	43.0	46.0	-3.0
373.12	54.7	V	81.0	100.0	19.6	2.0	30.4	45.9	46.0	-0.1
376.22	49.7	V	309.0	100.0	19.7	2.0	30.4	41.1	46.0	-4.9

Note: Emissions above were a result of the unintentional emissions from product and were not a part of the intentional transmitter evaluation.

Horizontal Radiated Spurious Emissions – 30-1000MHz 802.11g+n (Sample Plot)

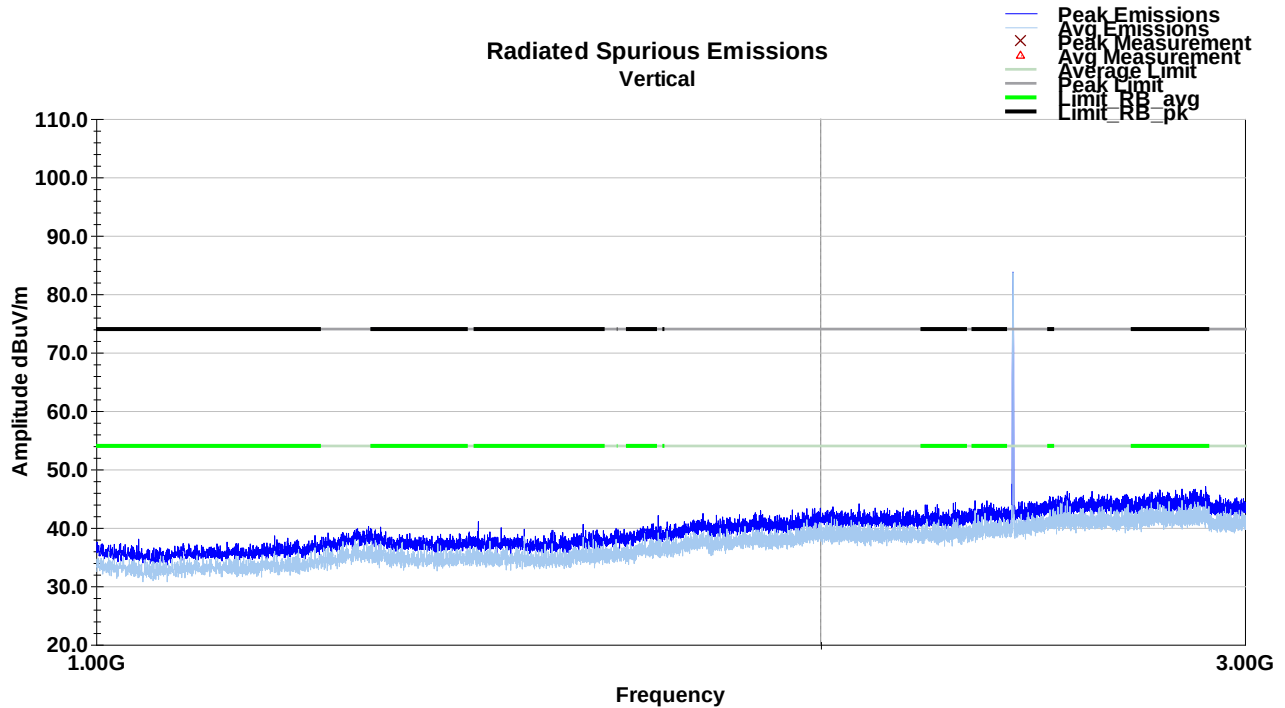


Note: No significant deviation with respect to channel. No discernable difference detected when tested in nRF modes.

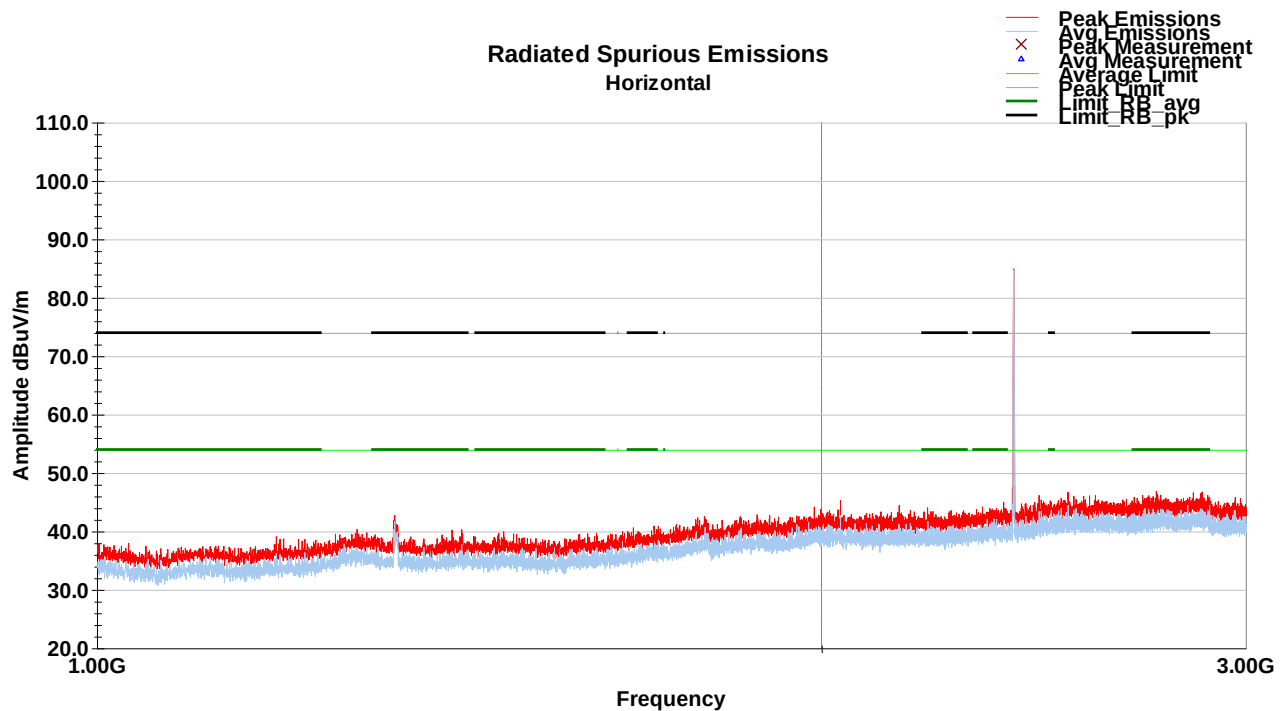
Frequency	Raw Avg	Polarity	Azimuth	Height	AF	Loss	Amp	QP Value	Limit	Margin
MHz	(dBuV)	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
225.75	60.3	H	70.0	100.0	15.7	1.5	30.6	46.9	46.0	0.9
361.35	50.9	H	75.0	100.0	19.5	2.0	30.4	42.0	46.0	-4.0
361.92	51.3	H	74.0	100.0	19.5	2.0	30.4	42.4	46.0	-3.6
362.40	51.0	H	75.0	100.0	19.5	2.0	30.4	42.1	46.0	-3.9
362.73	50.9	H	74.0	100.0	19.5	2.0	30.4	42.1	46.0	-3.9
373.11	51.4	H	269.0	265.0	19.6	2.0	30.4	42.7	46.0	-3.3

Note: Emissions above were a result of the unintentional emissions from product and were not a part of the intentional transmitter evaluation.

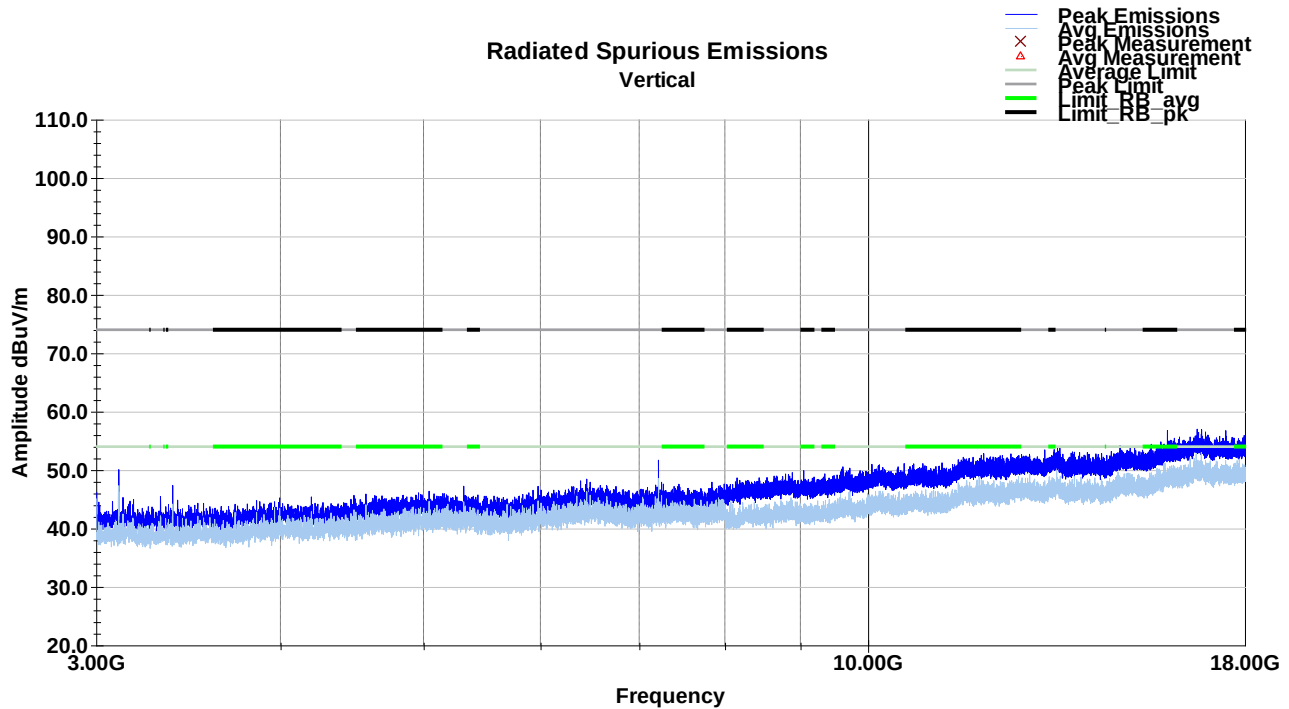
Vertical Radiated Spurious Emissions – 1-3GHz (LCH) nRF 1M



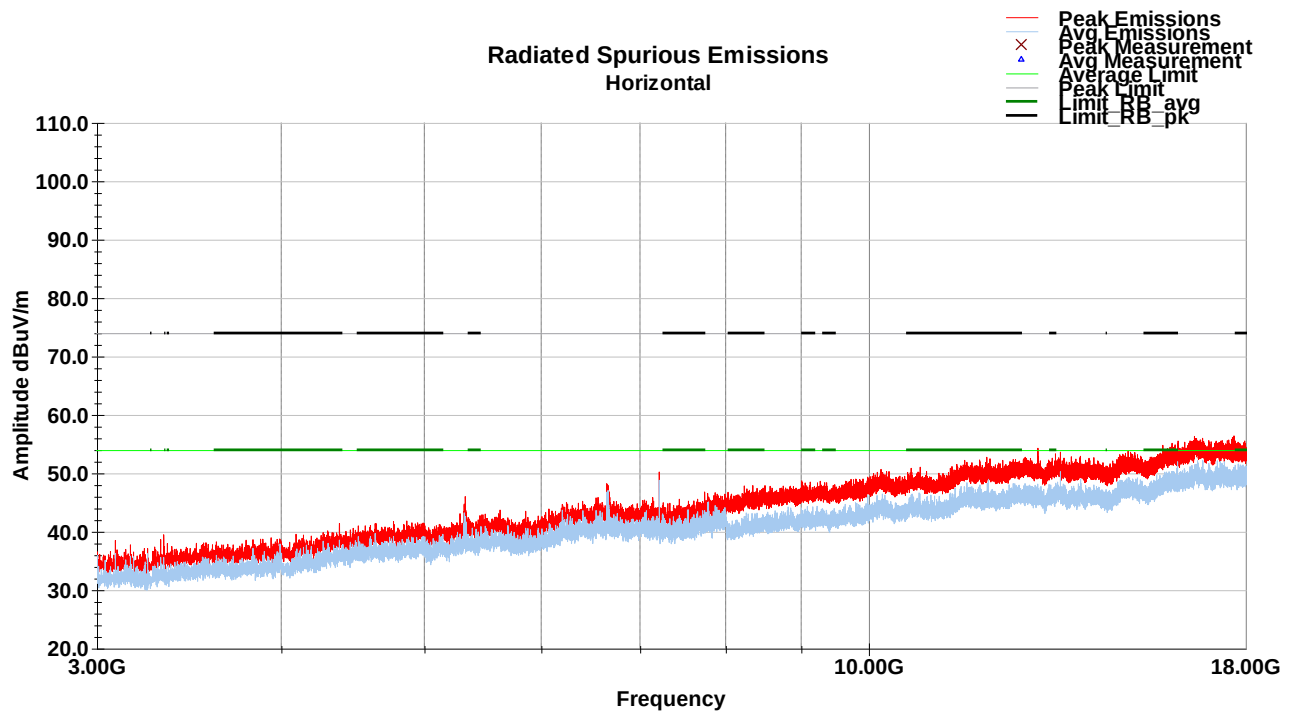
Horizontal Radiated Spurious Emissions – 1-3GHz (LCH) nRF 1M



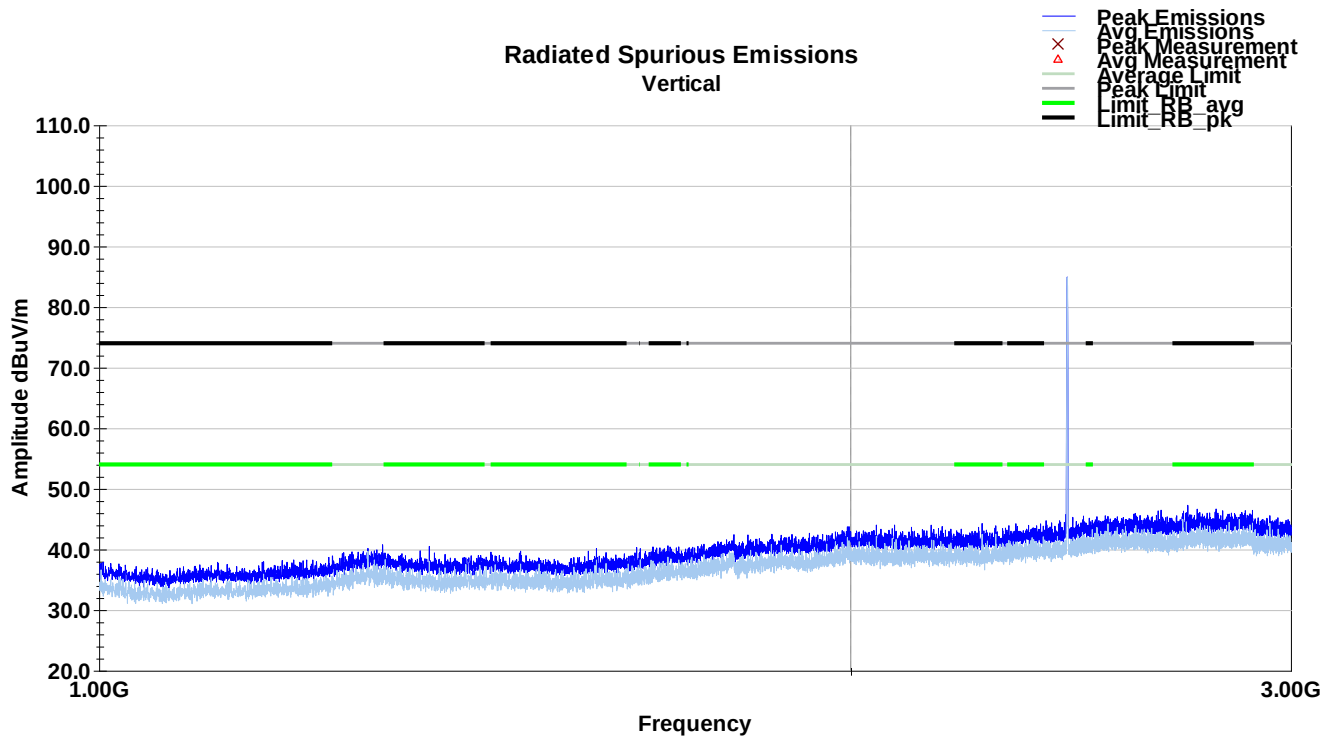
Vertical Radiated Spurious Emissions – 3-18GHz (LCH) nRF 1M



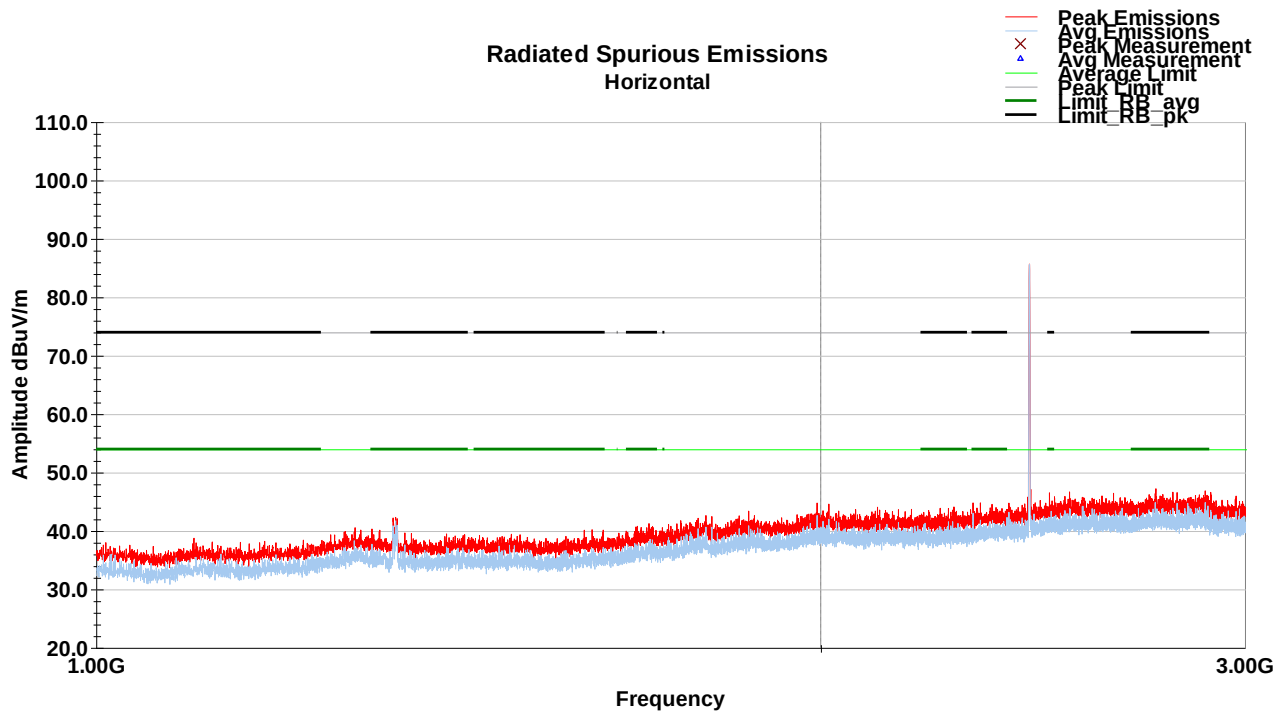
Horizontal Radiated Spurious Emissions – 3-18GHz (LCH) nRF 1M



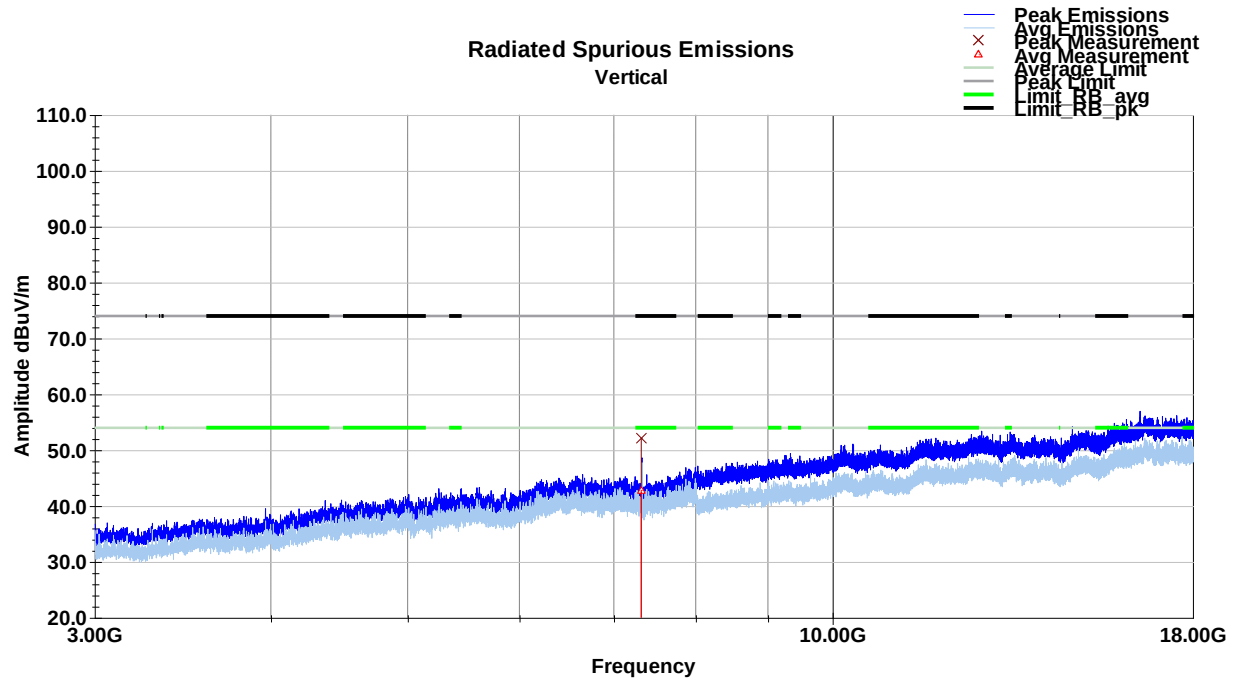
Vertical Radiated Spurious Emissions – 1-3GHz (MCH) nRF 1M



Horizontal Radiated Spurious Emissions – 1-3GHz (MCH) nRF 1M

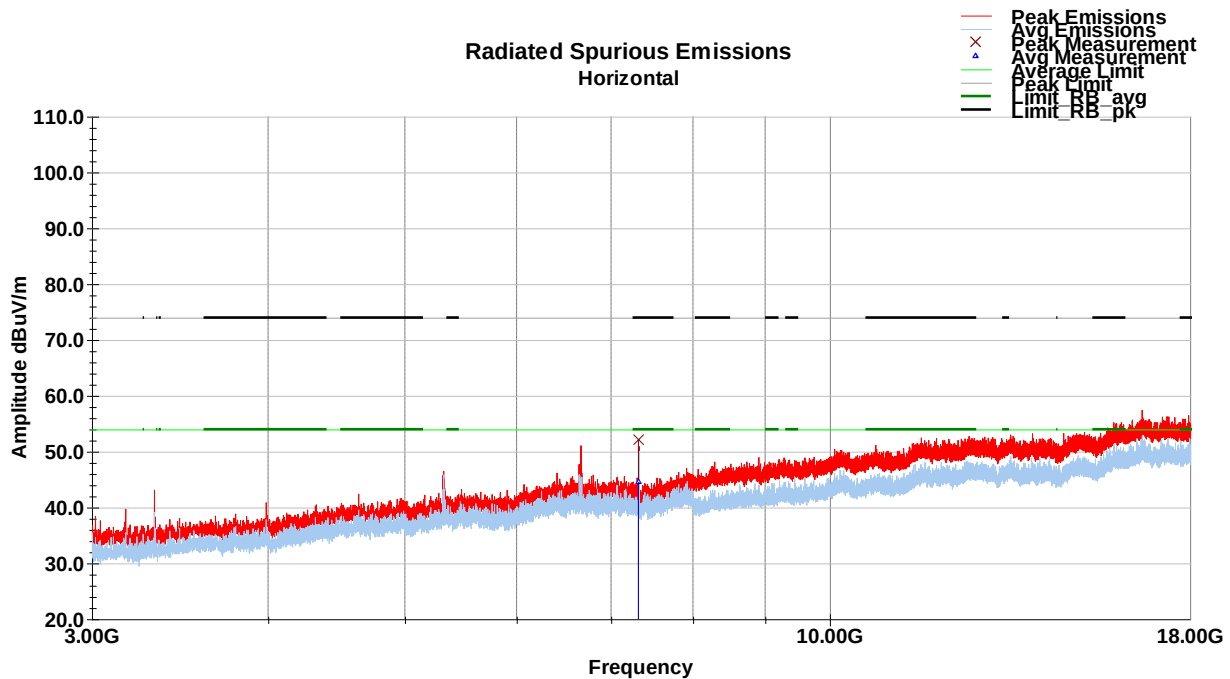


Vertical Radiated Spurious Emissions – 3-18GHz (MCH) nRF 1M



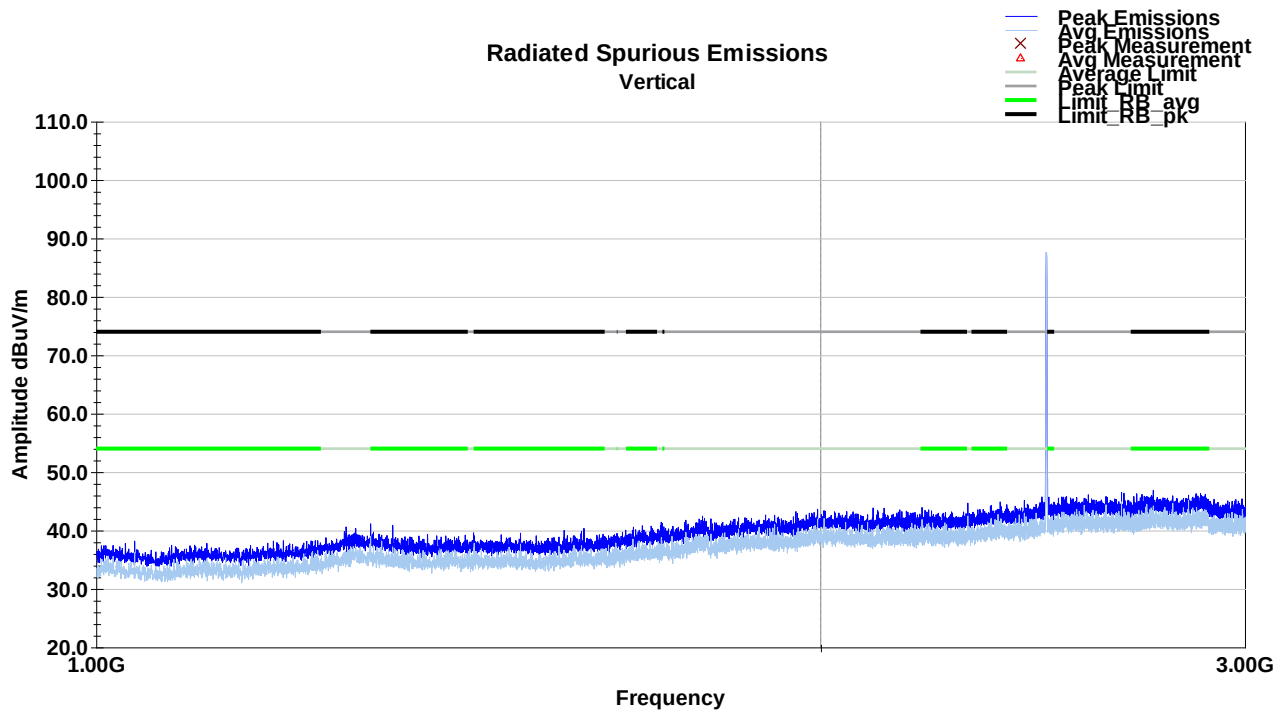
Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Avg dBuV/m	Limit (dBuV/m)	Margin (dB)
7319.30	38.0	V	338.0	103.0	35.8	3.3	34.2	42.9	54.0	-11.1

Horizontal Radiated Spurious Emissions – 3-18GHz (MCH) nRF 1M

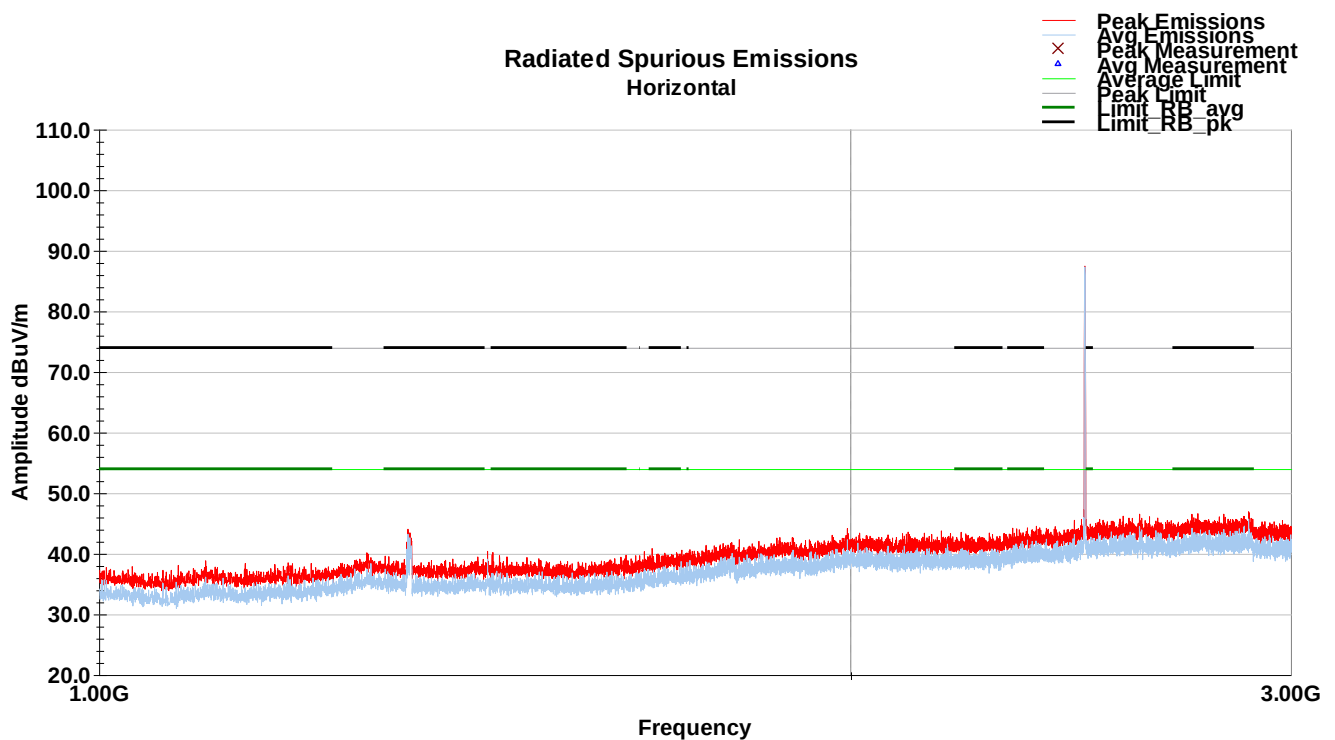


Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Avg Value dBuV/m	Limit (dBuV/m)	Margin (dB)
7319.48	39.7	H	11.0	100.0	35.8	3.3	34.2	44.5	54.0	-9.4

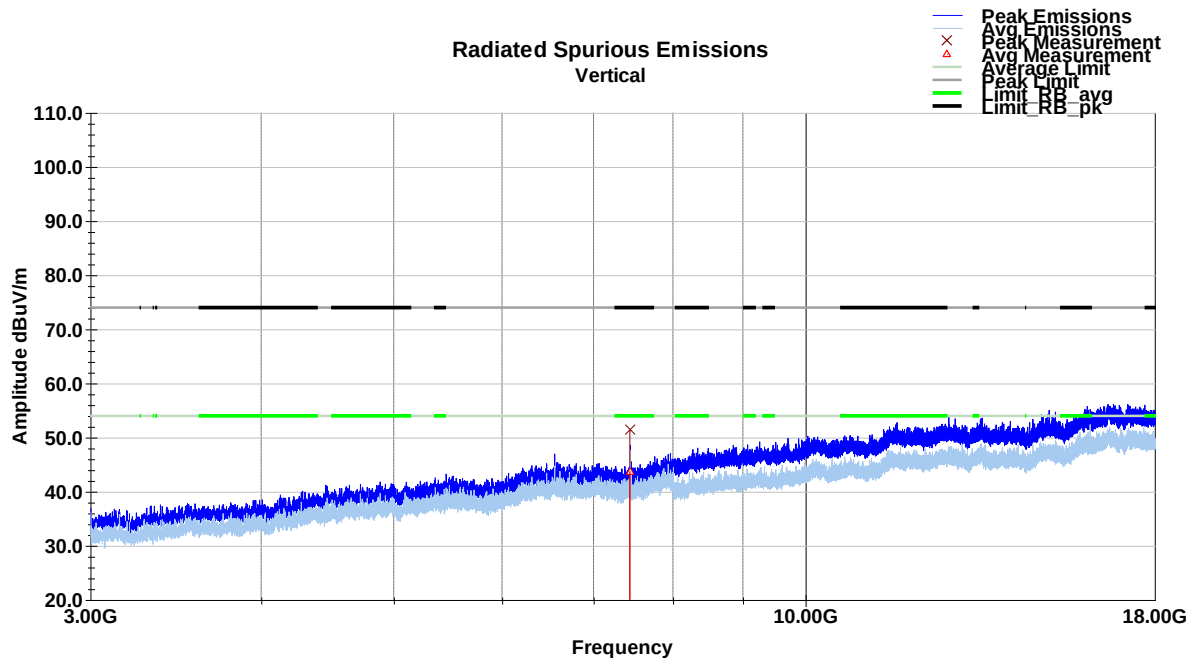
Vertical Radiated Spurious Emissions – 1-3GHz (HCH) nRF 1M



Horizontal Radiated Spurious Emissions – 1-3GHz (HCH) nRF 1M

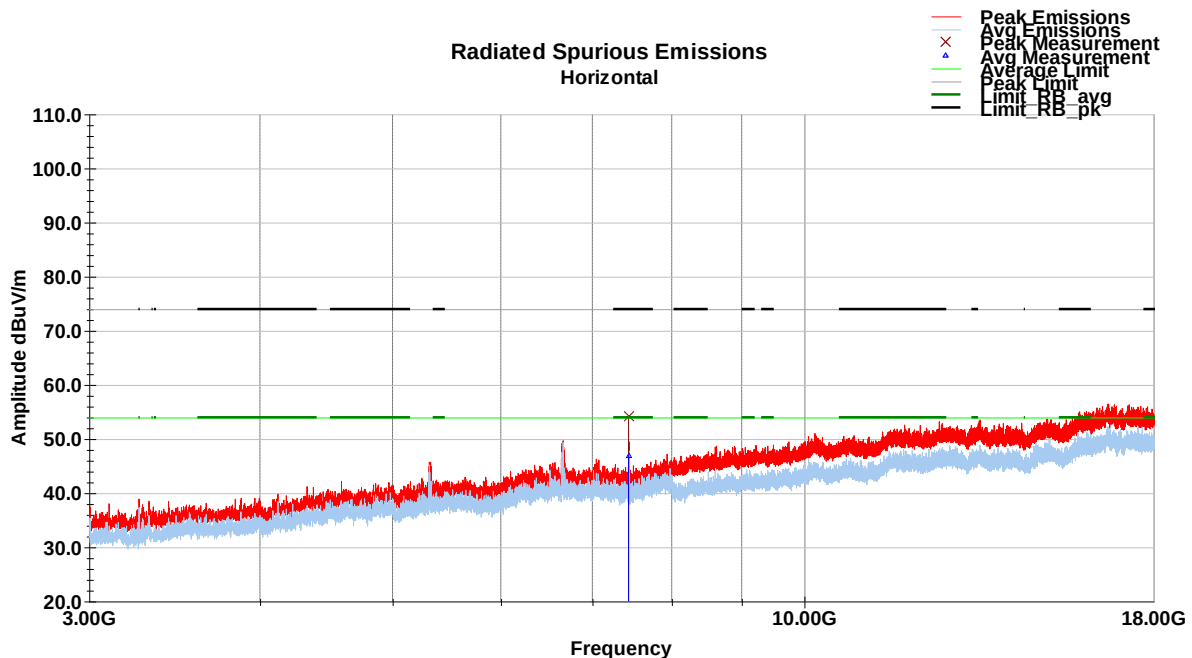


Vertical Radiated Spurious Emissions – 3-18GHz (HCH) nRF 1M



Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Avg dBuV/m	Limit (dBuV/m)	Margin (dB)
7440.52	38.8	V	333.0	109.0	35.8	3.3	34.1	43.7	54.0	-10.3

Horizontal Radiated Spurious Emissions – 3-18GHz (HCH) nRF 1M



Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Avg Value dBuV/m	Limit (dBuV/m)	Margin (dB)
7439.44	42.0	H	11.0	204.0	35.8	3.3	34.1	47.0	54.0	-7.0

Note: All emissions captured except for above tables were >20dB from limit. No discernable emissions from 18-26 GHz.

9 Emissions in Restricted Frequency Bands (Band Edge)

9.1 Test Result

Test Description	Test Specification		Test Result
Restricted Band Emissions	15.205 / 15.209	RSS-GEN S8.9 / 8.10	Compliant

9.2 Test Method

Field strength measurements were performed at the restricted band edges of 2390MHz and 2483.5MHz for each modulation. Measurements were made using the conducted methods defined in ANSI C63.10, Section 11.12.2.

9.3 Test Site

EMC Laboratory, Suwanee, GA

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.15 °C

Relative Humidity: 45.4 %

Atmospheric Pressure: 98.24 kPa

9.4 Test Equipment

Test End Date: 23-May-2023

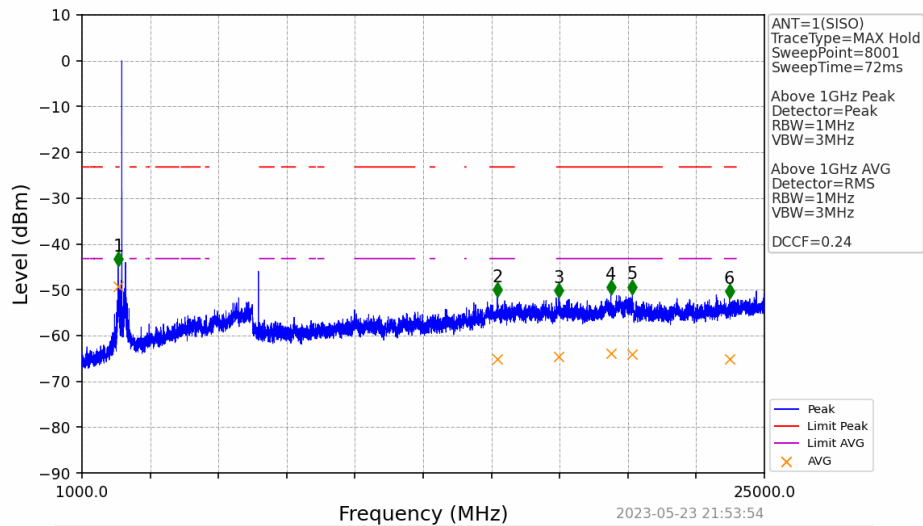
Tester: DA

Equipment	Model	Manufacturer	Asset	Cal Date	Cal Due Date
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	7-Dec-2022	7-Dec-2023
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20108	13-Mar-2023	13-Mar-2024
TSTPASS SWITCHBOX	SB2	TSTPASS	23009	CNR	CNR

9.5 Test Data – Restricted Band Edges

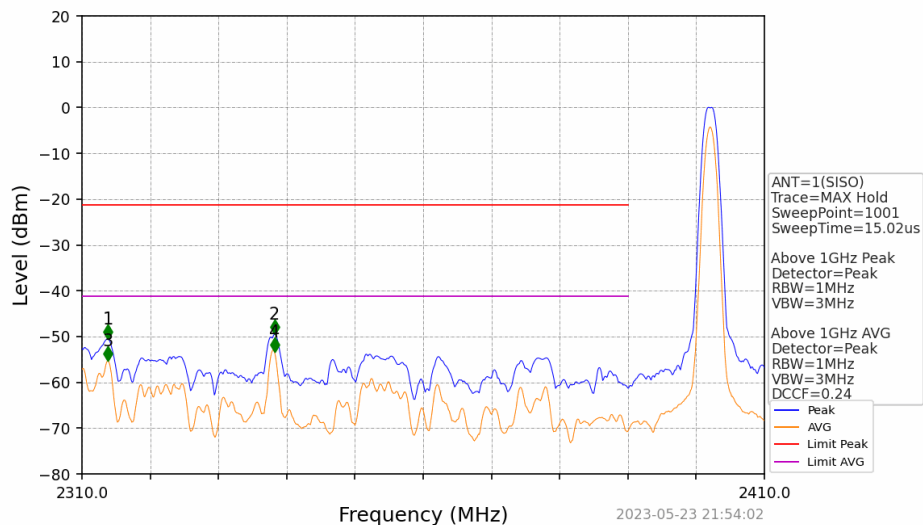
Mode	TX Type	Frequency (MHz)	ANT	Level of Unwanted Emissions (dBm)		Verdict
				Result	Limit	
1M	SISO	2402	1	Refer To Test Graph		Pass
		2440	1	Refer To Test Graph		Pass
		2480	1	Refer To Test Graph		Pass
2M	SISO	2402	1	Refer To Test Graph		Pass
		2440	1	Refer To Test Graph		Pass
		2480	1	Refer To Test Graph		Pass

1M_LCH_2402MHz_Ant1_NTNV



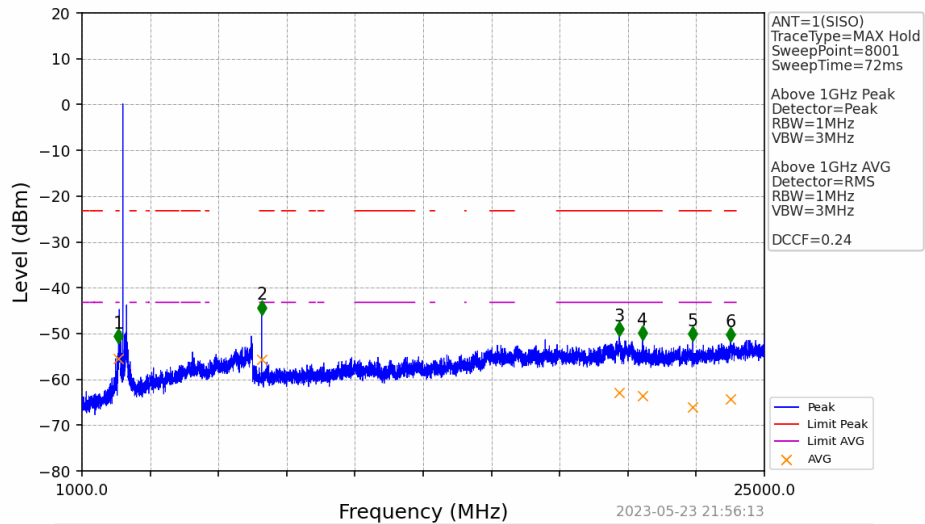
No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	2272	-44.83	-21.20	21.63	Pass	Peak	7	2272	-49.18	-41.20	5.98	Pass	AVG
2	15607	-51.60	-21.20	28.41	Pass	Peak	8	15607	-65.13	-41.20	21.93	Pass	AVG
3	17770	-51.79	-21.20	28.59	Pass	Peak	9	17770	-64.67	-41.20	21.47	Pass	AVG
4	19600	-51.03	-21.20	27.83	Pass	Peak	10	19600	-63.87	-41.20	20.67	Pass	AVG
5	20359	-50.96	-21.20	27.76	Pass	Peak	11	20359	-64.00	-41.20	20.80	Pass	AVG
6	23767	-51.92	-21.20	28.72	Pass	Peak	12	23767	-65.17	-41.20	21.97	Pass	AVG

1M_LCH_2402MHz_Ant1_NTNV



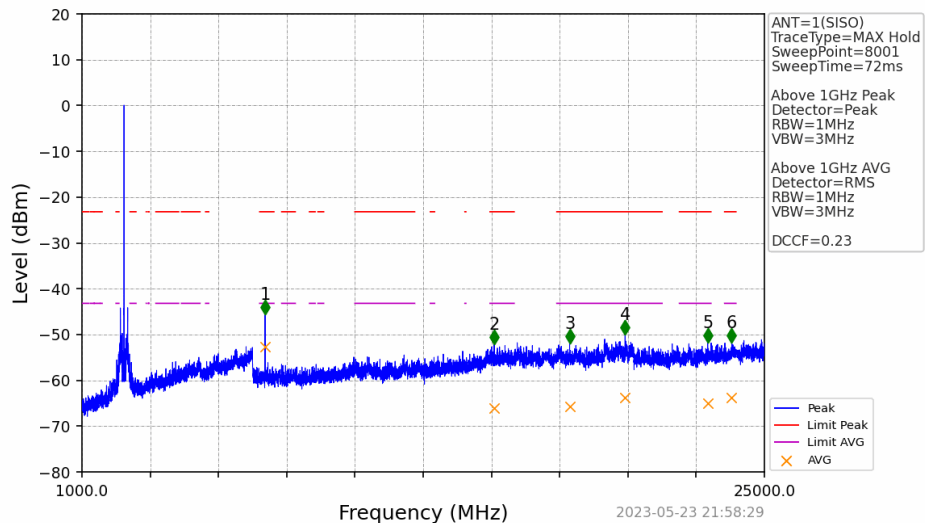
No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	2313.800	-50.56	-21.20	27.36	Pass	Peak	3	2313.800	/	-21.20	/	/	AVG
2	2338.200	-49.51	-21.20	26.31	Pass	Peak	4	2338.200	/	-21.20	/	/	AVG

1M_MCH_2440MHz_Ant1_NTNV



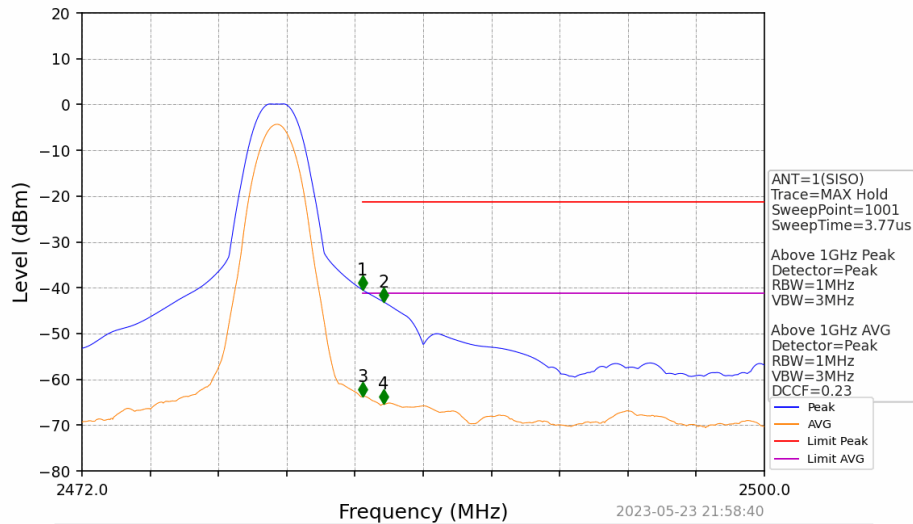
No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	2287	-52.09	-21.20	28.89	Pass	Peak	7	2287	-55.52	-41.20	12.32	Pass	AVG
2	7318	-45.89	-21.20	22.69	Pass	Peak	8	7318	-55.74	-41.20	12.54	Pass	AVG
3	19897	-50.58	-21.20	27.38	Pass	Peak	9	19897	-62.98	-41.20	19.78	Pass	AVG
4	20713	-51.48	-21.20	28.28	Pass	Peak	10	20713	-63.65	-41.20	20.45	Pass	AVG
5	22480	-51.62	-21.20	28.42	Pass	Peak	11	22480	-66.06	-41.20	22.86	Pass	AVG
6	23809	-51.77	-21.20	28.57	Pass	Peak	12	23809	-64.34	-41.20	21.14	Pass	AVG

1M_HCH_2480MHz_Ant1_NTNV

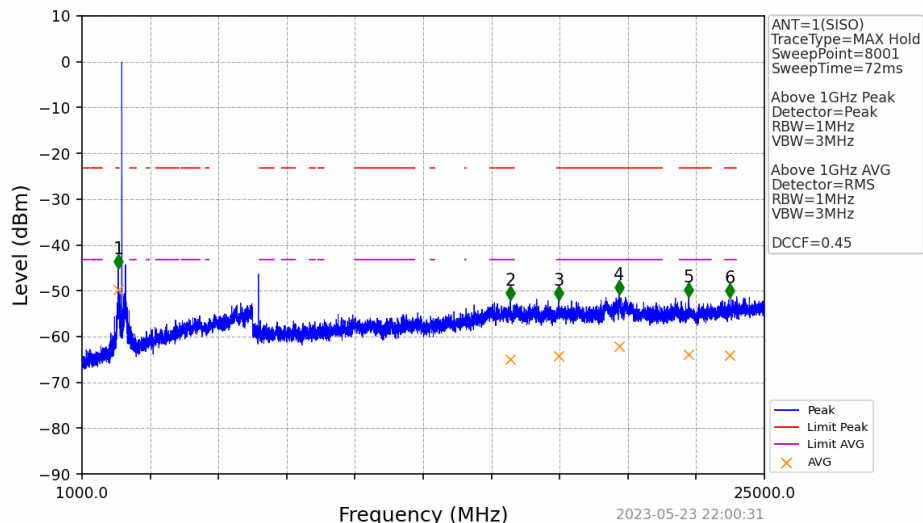


No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	7441	-45.67	-21.20	22.47	Pass	Peak	7	7441	-52.66	-41.20	9.46	Pass	AVG
2	15496	-52.12	-21.20	28.92	Pass	Peak	8	15496	-66.02	-41.20	22.82	Pass	AVG
3	18151	-51.99	-21.20	28.79	Pass	Peak	9	18151	-65.66	-41.20	22.45	Pass	AVG
4	20101	-50.07	-21.20	26.87	Pass	Peak	10	20101	-63.84	-41.20	20.64	Pass	AVG
5	23005	-51.78	-21.20	28.58	Pass	Peak	11	23005	-64.97	-41.20	21.77	Pass	AVG
6	23851	-51.73	-21.20	28.54	Pass	Peak	12	23851	-63.73	-41.20	20.53	Pass	AVG

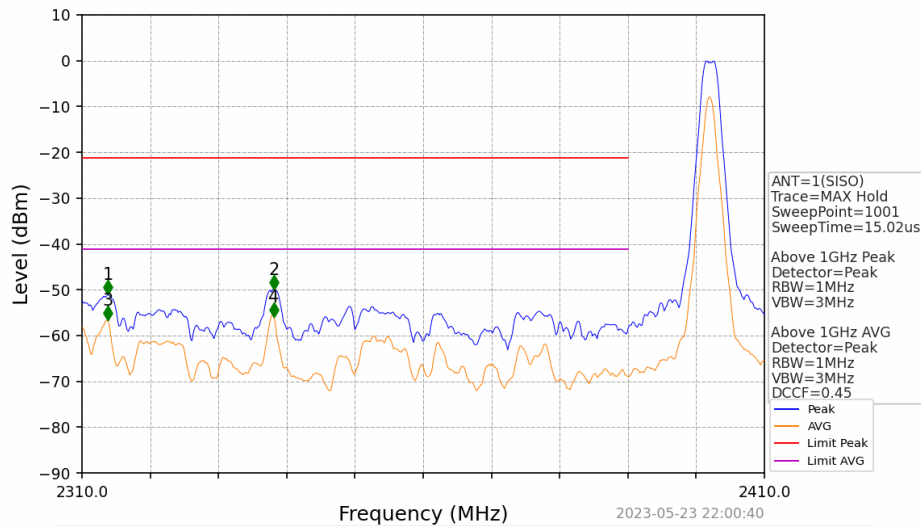
1M_HCH_2480MHz_Ant1_NTNV



2M_LCH_2402MHz_Ant1_NTNV

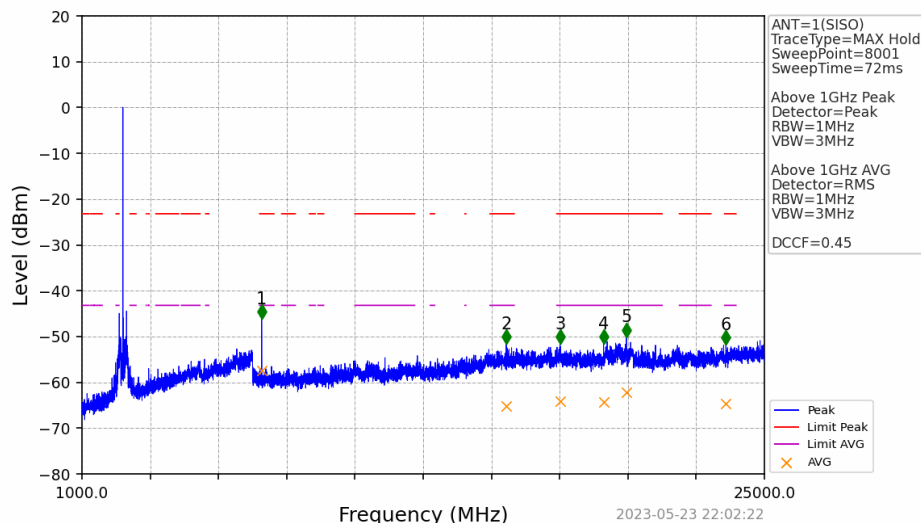


2M_LCH_2402MHz_Ant1_NTNV



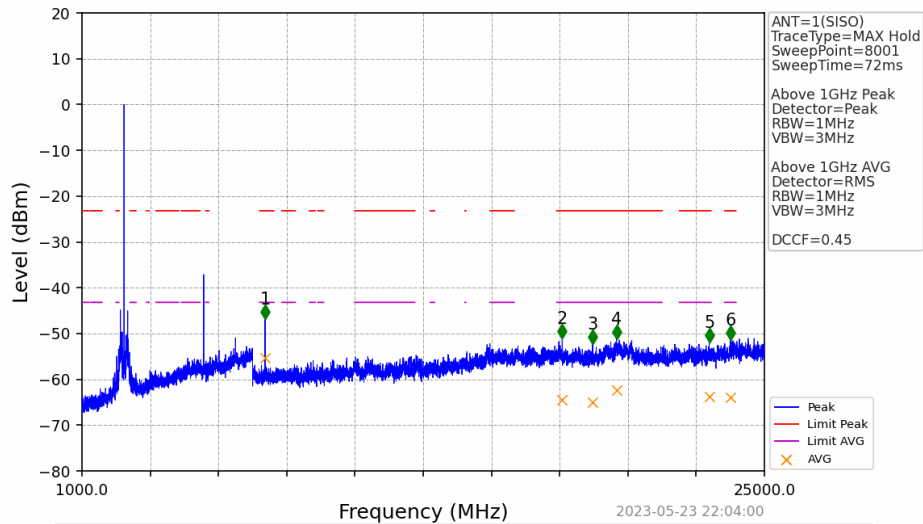
No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	2313.800	-51.06	-21.20	27.86	Pass	Peak	3	2313.800	/	-21.20	/	/	AVG
2	2338.100	-49.91	-21.20	26.71	Pass	Peak	4	2338.100	/	-21.20	/	/	AVG

2M_MCH_2440MHz_Ant1_NTNV



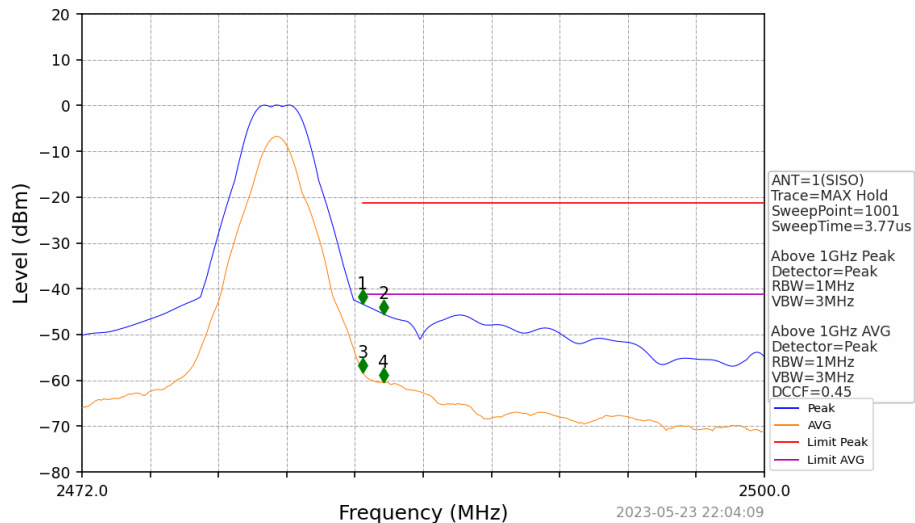
No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	7318	-46.12	-21.20	22.92	Pass	Peak	7	7318	-57.38	-41.20	14.18	Pass	AVG
2	15919	-51.58	-21.20	28.38	Pass	Peak	8	15919	-65.23	-41.20	22.03	Pass	AVG
3	17812	-51.62	-21.20	28.42	Pass	Peak	9	17812	-64.09	-41.20	20.89	Pass	AVG
4	19342	-51.67	-21.20	28.47	Pass	Peak	10	19342	-64.25	-41.20	21.05	Pass	AVG
5	20146	-50.10	-21.20	26.90	Pass	Peak	11	20146	-62.25	-41.20	19.05	Pass	AVG
6	23647	-51.78	-21.20	28.59	Pass	Peak	12	23647	-64.59	-41.20	21.39	Pass	AVG

2M_HCH_2480MHz_Ant1_NTNV



No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	7441	-46.86	-21.20	23.66	Pass	Peak	7	7441	-55.37	-41.20	12.17	Pass	AVG
2	17890	-51.11	-21.20	27.91	Pass	Peak	8	17890	-64.46	-41.20	21.26	Pass	AVG
3	18958	-52.32	-21.20	29.12	Pass	Peak	9	18958	-64.93	-41.20	21.73	Pass	AVG
4	19798	-51.28	-21.20	28.08	Pass	Peak	10	19798	-62.30	-41.20	19.10	Pass	AVG
5	23059	-51.97	-21.20	28.77	Pass	Peak	11	23059	-63.80	-41.20	20.60	Pass	AVG
6	23809	-51.43	-21.20	28.23	Pass	Peak	12	23809	-64.00	-41.20	20.80	Pass	AVG

2M_HCH_2480MHz_Ant1_NTNV



No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	2483.508	-43.35	-21.20	20.15	Pass	Peak	3	2483.508	/	-21.20	/	/	AVG
2	2484.376	-45.53	-21.20	22.33	Pass	Peak	4	2484.376	/	-21.20	/	/	AVG

10 Conducted Emissions

10.1 Test Result

Test Description	Basic Standard	Test Result
Conducted Emissions	RSS-GEN 8.8 15.207 ANSI C63.10	Compliant

10.2 Test Method

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

Frequency Range	FCC 15.207 Limits (dBμV)
0.15 to 0.5 MHz	Quasi-Peak 66 to 56 / Average 56 to 46
0.5 to 5 MHz	Quasi-Peak 56 / Average 46
5 to 30 MHz	Quasi-Peak 60 / Average 50

10.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.9 °C

Relative Humidity: 54.6 %

Atmospheric Pressure: 101.6 kPa

10.4 Test Equipment

Test End Date: 16-May-2023

Tester: DA

Equipment	Model	Manufacturer	Asset	Cal Date	Cal Due Date
EMI TEST RECEIVER	ESW44	ROHDE & SCHWARZ	22032	24-Nov-2022	24-Nov-2023
LINE IMPEDANCE STABILIZATION NETWORK	NNB 51	TESEQ	B087573	13-Dec-2022	13-Dec-2023
RF CABLE	UC-N-MM-78	MAURY MICROWAVE	17017	25-Aug-2022	25-Aug-2023

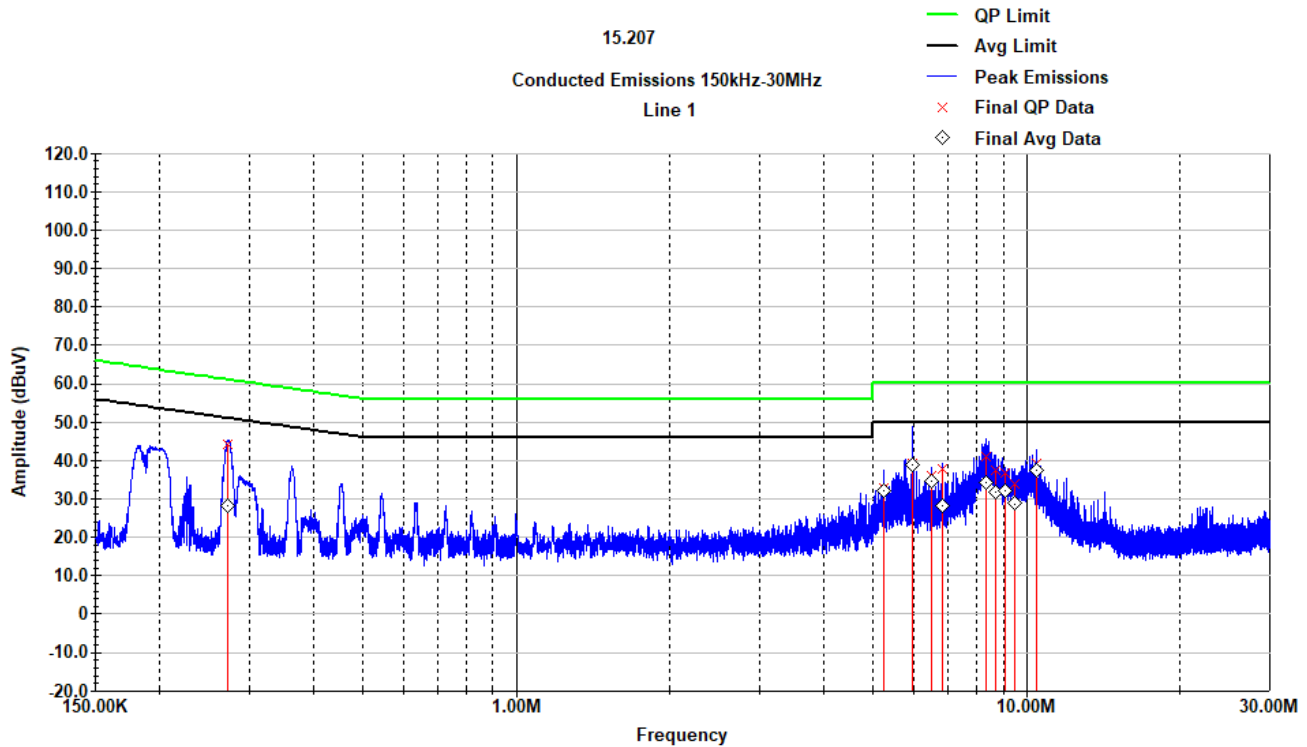
Note: Refer to the table for calibration intervals.

Software:

TILE! software profile "Conducted Emissions T7 230206.TIL" dated 06 02 2023

10.5 Test Data

1M - Line 1 Conducted Emissions – Peak Plot

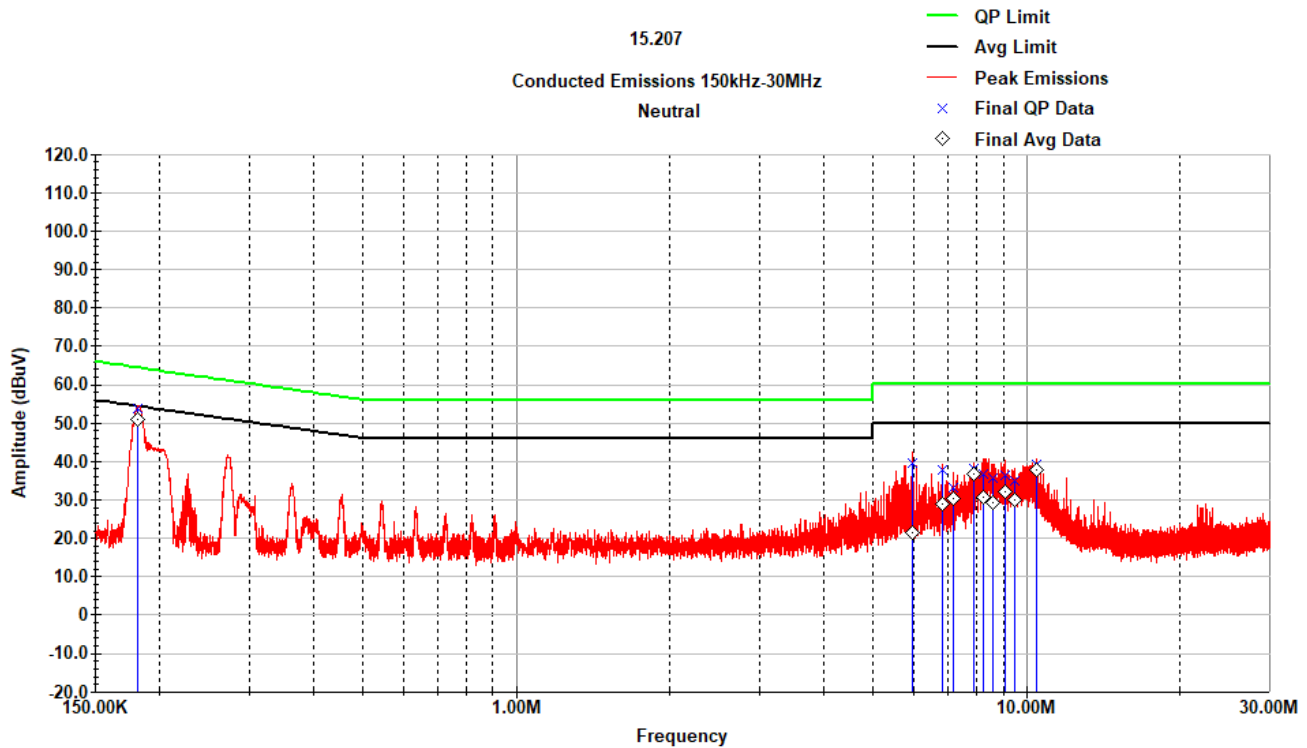


Line 1 Conducted Emissions – Tabular Data

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
0.272	44.3	61.1	-16.8	28.2	51.1	-22.8
5.260	32.9	60.0	-27.1	32.2	50.0	-17.8
5.991	39.3	60.0	-20.7	38.9	50.0	-11.1
6.506	35.9	60.0	-24.1	34.5	50.0	-15.5
6.827	37.9	60.0	-22.1	28.2	50.0	-21.8
8.329	41.2	60.0	-18.8	34.3	50.0	-15.7
8.699	37.4	60.0	-22.6	31.9	50.0	-18.1
9.072	36.6	60.0	-23.4	32.1	50.0	-17.9
9.465	33.8	60.0	-26.2	28.7	50.0	-21.3
10.480	39.1	60.0	-20.9	37.5	50.0	-12.5

No discernable difference between 1M and 2M Data Rates.

Neutral Conducted Emissions – Peak Plot



Neutral Conducted Emissions – Tabular Data

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
0.181	53.7	64.5	-10.7	51.1	54.5	-3.4
5.987	39.5	60.0	-20.5	21.4	50.0	-28.6
6.827	37.9	60.0	-22.1	29.0	50.0	-21.0
7.197	33.1	60.0	-26.9	30.5	50.0	-19.5
7.877	38.3	60.0	-21.7	36.7	50.0	-13.3
8.249	36.7	60.0	-23.3	30.7	50.0	-19.3
8.611	35.7	60.0	-24.3	29.2	50.0	-20.8
9.073	36.3	60.0	-23.7	32.2	50.0	-17.8
9.467	34.8	60.0	-25.2	29.9	50.0	-20.1
10.480	39.2	60.0	-20.8	37.8	50.0	-12.2

No discernable difference between 1M and 2M Data Rates.

11 Measurement Uncertainty

The measurement uncertainty figures are be calculated in accordance with TR 100 028-1 [2] and correspond to an expansion factor (coverage factor) $k = 2$ (which provide 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 %

12 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	17 October 2023
1	Updated Test Equipment in section 8.4	31 October 2023