

RF Test Report

Project Number: 4942239**Proposal:** SUW-202112002041**Report Number:** 4942239EMC02**Revision Level:** 0**Client:** Risk Band LLC**Equipment Under Test:** Wearable Emergency Device**Model Name:** ARIES**Model Number:** RBD30060**FCC ID:** 2AHZ7-300602022**IC:** 21986-300602022**Applicable Standards:** ANSI C63.10: 2013 (FCC Part 15 Subpart C, § 15.247)**RSS-247, Issue 2****RSS-GEN Issue 5****Report issued on:** 12 January 2023**Test Result:** Compliant

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER: 3212.01

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1 Summary of Test Results

Test Description	Test Specification		Test Result
Occupied Bandwidth 20dB Bandwidth	15.247(a)(1)	RSS-247 5.1(a) RSS-GEN 6.7	Compliant
Peak Power Output	15.247(a)(1)	RSS-247 5.4(b)	Compliant
Carrier Frequency Separation	15.247(a)(1)	RSS-247 5.1(b)	Compliant
Number of Hopping Channels	15.247(a)(1)(iii)	RSS-247 5.1(d)	Compliant
Dwell Time	15.247(a)(1)(iii)	RSS-247 5.1(d)	Compliant
Pseudo-Random Hop Sequence	15.247(a)(1)	RSS-247 5.1(a)	Compliant
Conducted Spurious Emissions	15.247(d)	RSS-247 5.5	Compliant
Radiated Spurious Emissions	15.35(b),15.209	RSS-GEN 8.10	Compliant
Band Edge	15.247(d)	RSS-247 5.5	Compliant
Antenna Requirement	15.203	RSS-GEN 6.8	Compliant ¹
AC Powerline Conducted Emissions	15.107, 15.207	RSS-GEN 8.8	Compliant

1) The device utilizes an internal chip antenna.

1.1 Modifications Required for Compliance

None

2 General Information

2.1 Client Information

Name: Risk Band LLC
Address: 1000 Johnnie Dobbs Blvd., Suite 103-312
City, State, Zip, Country: Mount Pleasant, SC, 29464, 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

Equipment Under Test: Wearable Emergency Device
Model Name: ARIES
Model Number: RBD30060
Serial Number: 220512-00013 (Conducted), 220526-00011 (Radiated)

Frequency Range: 2402 – 2480 MHz
Data Modes: Basic Rate / EDR-2 / EDR-3
Antenna: SMT Antenna, 2.1dBi (Antenova, P/N: A5839)

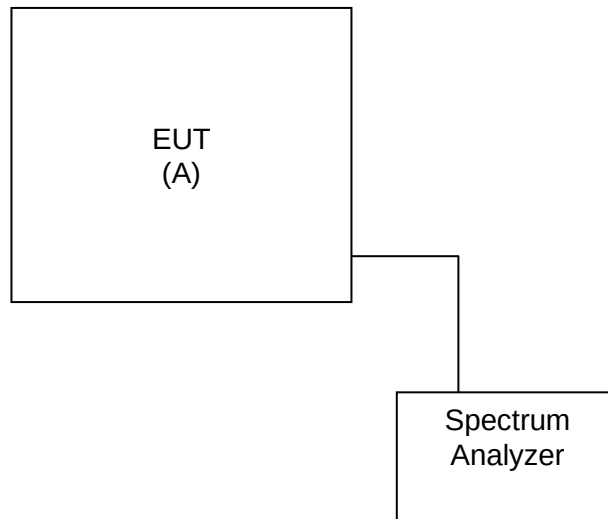
Rated Voltage: 3.7Vdc
Test Voltage: 3.7Vdc

Sample Received Date: 26 July 2022
Dates of testing: 05 – 26 August 2022

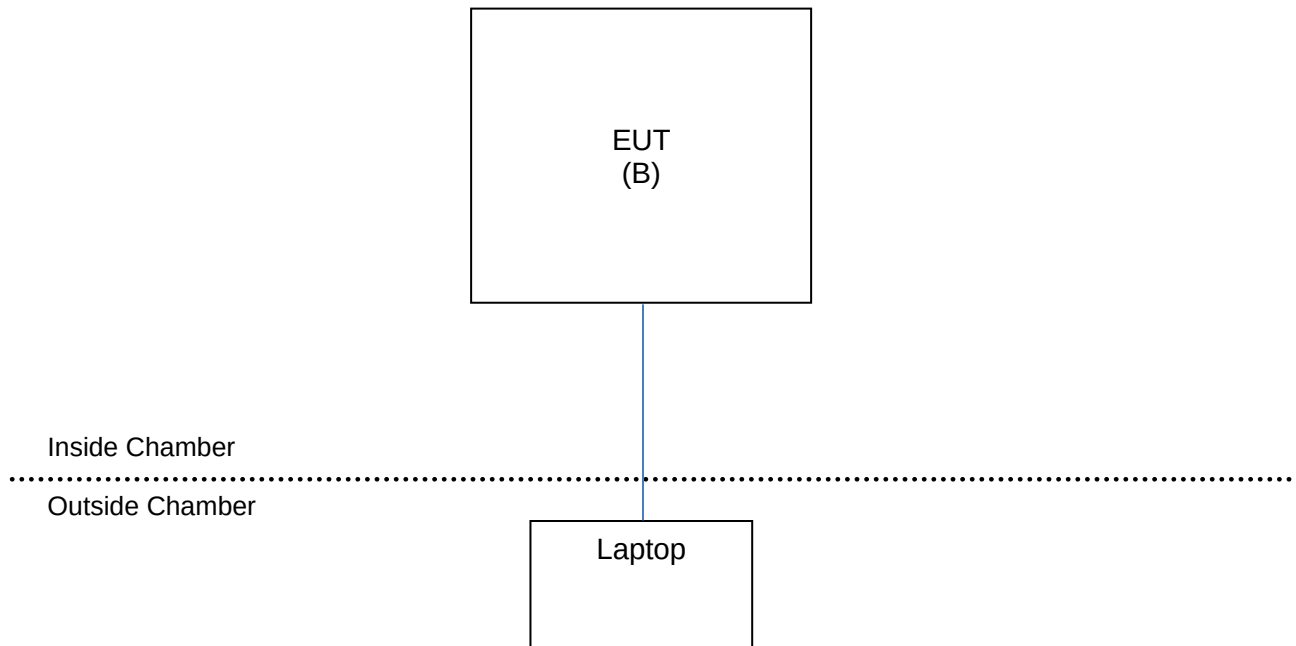
2.4 Operating Modes and Conditions

The EUT was connected via USB to a laptop loaded with ESP32 EspressiF software. Using a terminal program, the EUT was first placed into Direct Test Mode (DTM). Once in DTM, the EspressiF software was used to control the modulation, packet-type, channel, and hopping mode. During testing, the device was configured to transmit at a power setting of 5. For radiated spurious emissions the worst-case orientation was with the EUT on its side (X-Axis).

2.5 EUT Connection Block Diagram – Conducted Measurements



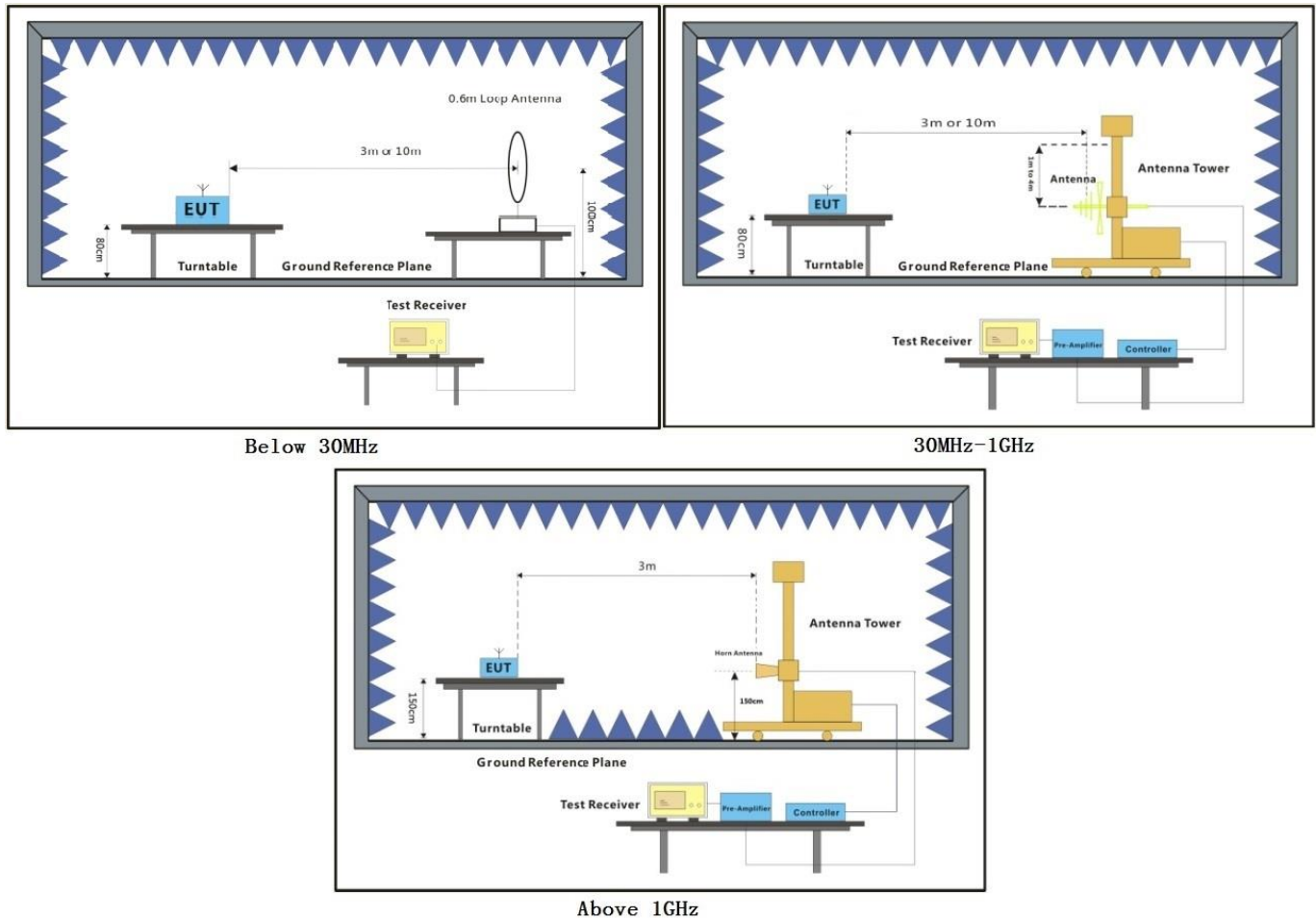
2.6 EUT Connection Block Diagram – Radiated Measurements



2.7 System Configurations

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Risk Band LLC	Wearable Emergency Device	RBD30060	220512-00013
B	Risk Band LLC	Wearable Emergency Device	RBD30060	220526-00011

2.8 Configuration Diagrams (Radiated)



3 Occupied Bandwidth

3.1 Test Result

Test Description	Test Specification		Test Result
Occupied Bandwidth 20dB Bandwidth	15.247(a)(1)	RSS-247 5.1(a) RSS-GEN 6.7	Compliant

3.2 Test Method

The procedures from ANSI C63.10: 2013 Clause 6.9.2 were used to measure the 99% Occupied Bandwidth and 20dB Bandwidth.

3.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.8 °C

Relative Humidity: 49.6 %

Atmospheric Pressure: 98.0 kPa

3.4 Test Equipment

Test End Date: 8/6/2022

Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20109	16-Mar-2022	16-Mar-2023
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

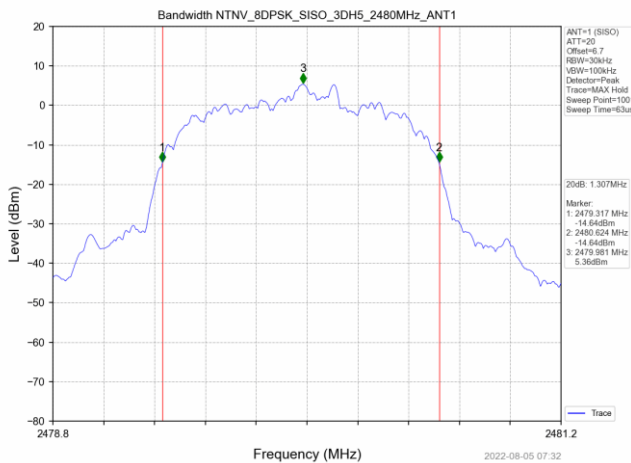
3.5 Test Data

Test Mode	Frequency (MHz)	TX Type	ANT No.	20dB BW (MHz)	99% OBW (MHz)	Verdict
GFSK	2402	SISO	1	0.943	0.837	PASS
	2441	SISO	1	0.943	0.836	PASS
	2480	SISO	1	0.943	0.838	PASS
Pi/4DQPSK	2402	SISO	1	1.321	1.178	PASS
	2441	SISO	1	1.320	1.179	PASS
	2480	SISO	1	1.324	1.183	PASS
8DPSK	2402	SISO	1	1.306	1.178	PASS
	2441	SISO	1	1.306	1.178	PASS
	2480	SISO	1	1.307	1.183	PASS

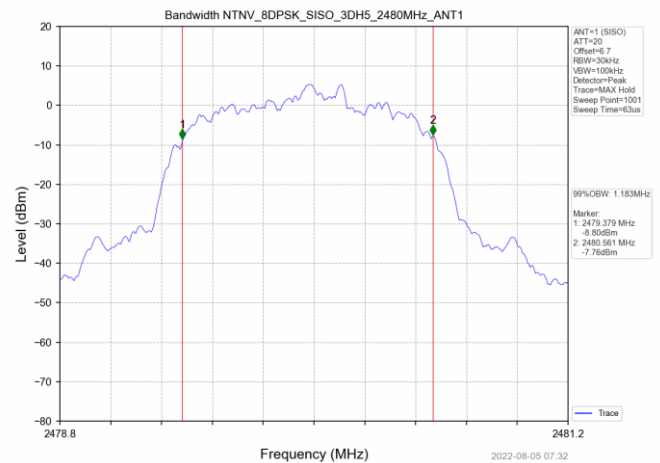
Sample Plots

High Channel 8DPSK (2480MHz)

20dB Bandwidth



99% Occupied Bandwidth



4 Peak Output Power

4.1 Test Result

Test Description	Test Specification		Test Result
Peak Output Power	15.247(a)(1)	RSS-247 5.4(b)	Compliant

4.2 Test Method

Output power measurements were taken using the methods defined in ANSI C63.10, Clause 7.8.5 using a spectrum analyzer.

Limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels: 1 watt.

4.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.8 °C

Relative Humidity: 49.6 %

Atmospheric Pressure: 98.0 kPa

4.4 Test Equipment

Test End Date: 8/6/2022

Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20109	16-Mar-2022	16-Mar-2023
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

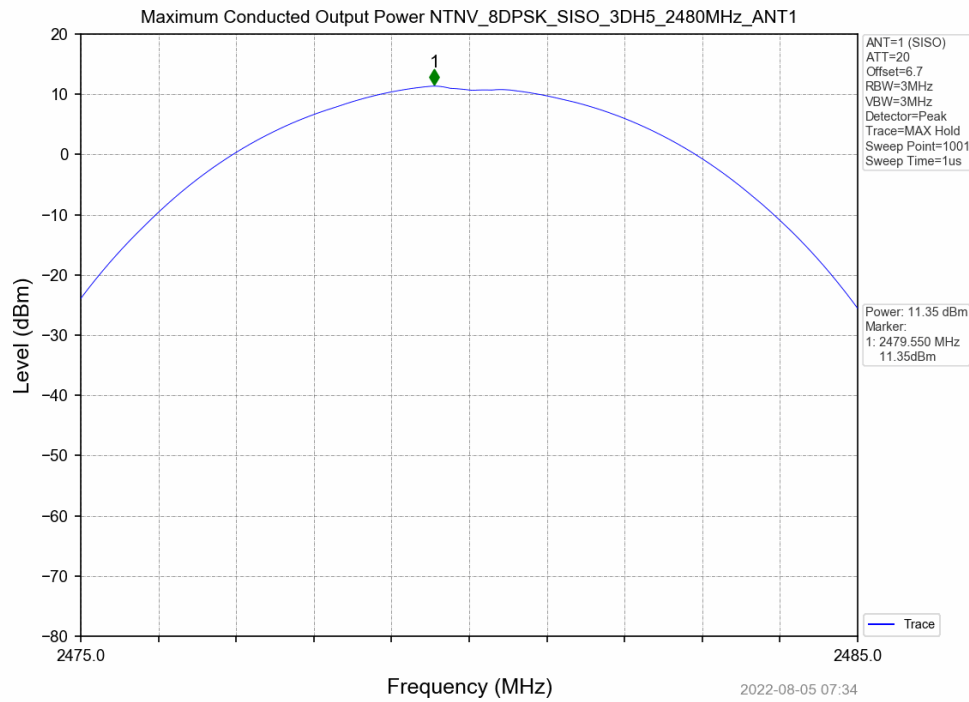
4.5 Test Data

Modulation	Frequency (MHz)	Peak Power (dBm)	Peak Power (mW)	Limit (dBm)	Verdict
GFSK	2402	7.94	6.22	30	PASS
	2441	8.04	6.37	30	PASS
	2480	8.62	7.28	30	PASS
Pi/4DQPSK	2402	10.08	10.19	20.97 ¹	PASS
	2441	10.59	11.46	20.97 ¹	PASS
	2480	10.44	11.07	20.97 ¹	PASS
8DPSK	2402	10.53	11.3	20.97 ¹	PASS
	2441	10.85	12.16	20.97 ¹	PASS
	2480	11.35	13.65	20.97 ¹	PASS

1) The 20dB Bandwidth exceeds the channel spacing; therefore, the limit is reduced to 125mW

Sample Plot

8DPSK High Channel (2480MHz)



5 Carrier Frequency Separation

5.1 Test Result

Test Description	Test Specification		Test Result
Carrier Frequency Separation	15.247(a)(1)	RSS-247 5.1(b)	Compliant

5.2 Test Method

Measurements were taken using the methods defined in ANSI C63.10, Clause 7.8.2 using a spectrum analyzer.

Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the -20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the -20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

5.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.8 °C

Relative Humidity: 49.6 %

Atmospheric Pressure: 98.0 kPa

5.4 Test Equipment

Test End Date: 8/6/2022

Tester: JOP

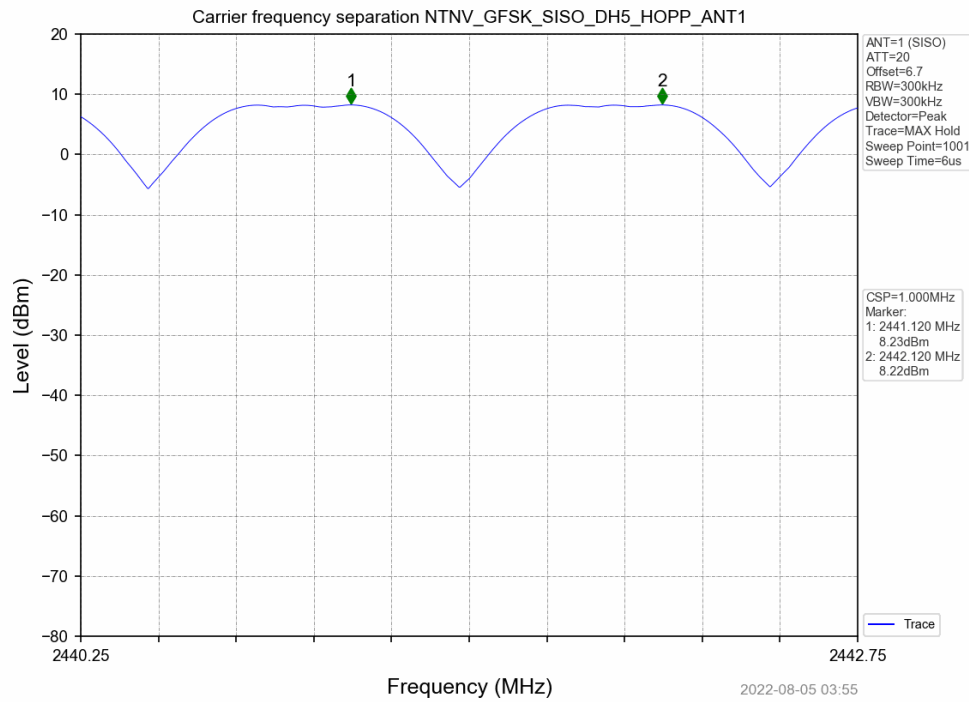
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20109	16-Mar-2022	16-Mar-2023
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

5.5 Test Data

Test Mode	TX Type	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limits (MHz)	Verdict
GFSK	SISO	1.000	0.943	≥0.943	PASS
Pi/4DQPSK	SISO	1.000	1.324	≥0.883	PASS
8DPSK	SISO	1.000	1.307	≥0.871	PASS

Sample Plot

GFSK



6 Number of Hopping Channels

6.1 Test Result

Test Description	Test Specification		Test Result
Number of Hopping Channels	15.247(a)(1)(iii)	RSS-247 5.1(d)	Compliant

6.2 Test Method

Measurements were taken using the methods defined in ANSI C63.10, Clause 7.8.3 using a spectrum analyzer.

Limit

Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

6.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.8 °C

Relative Humidity: 49.6 %

Atmospheric Pressure: 98.0 kPa

6.4 Test Equipment

Test End Date: 8/6/2022

Tester: JOP

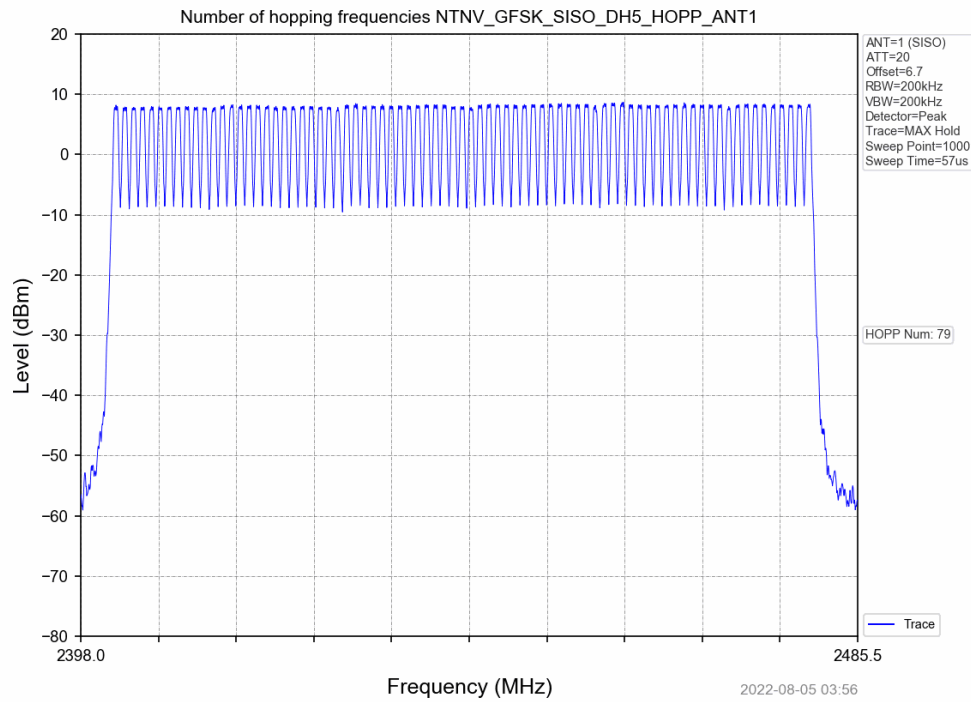
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20109	16-Mar-2022	16-Mar-2023
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

6.5 Test Data

Test Mode	TX Type	Number of Hopping Channels	Limits (MHz)	Verdict
GFSK	SISO	79	≥15	PASS
Pi/4DQPSK	SISO	79	≥15	PASS
8DPSK	SISO	79	≥15	PASS

Sample Plot

GFSK



7 Dwell Time

7.1 Test Result

Test Description	Test Specification		Test Result
Dwell Time	15.247(a)(1)(iii)	RSS-247 5.1(d)	Compliant

7.2 Test Method

Measurements were taken using the methods defined in ANSI C63.10, Clause 7.8.4 using a spectrum analyzer and automated test system.

Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed ($0.4 \times 79 = 31.6\text{s}$).

7.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.8 °C

Relative Humidity: 49.6 %

Atmospheric Pressure: 98.0 kPa

7.4 Test Equipment

Test End Date: 8/6/2022

Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20109	16-Mar-2022	16-Mar-2023
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

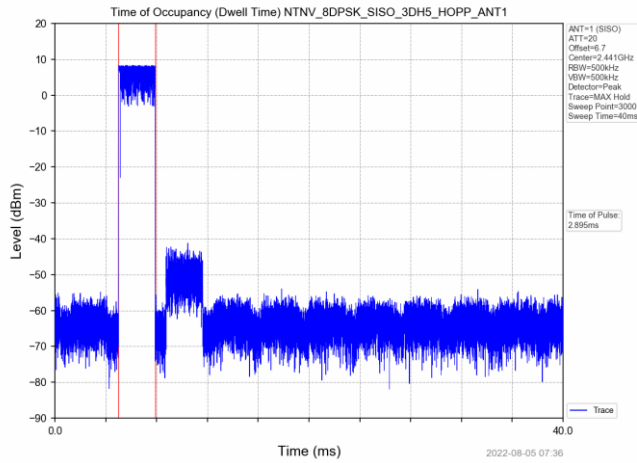
7.5 Test Data

	Packet Type	Pulse Width ms	Pulses per 31.6 sec	Dwell Time (ms)	Limit (ms)	Result
GFSK	DH1	0.378	31.6	320	≤400	PASS
	DH3	1.635	31.6	155	≤400	PASS
	DH5	2.882	31.6	117	≤400	PASS
Pi/4DQPSK	DH1	0.394	31.6	320	≤400	PASS
	DH3	1.647	31.6	159	≤400	PASS
	DH5	2.895	31.6	102	≤400	PASS
8DPSK	DH1	0.393	31.6	320	≤400	PASS
	DH3	1.646	31.6	159	≤400	PASS
	DH5	2.895	31.6	117	≤400	PASS

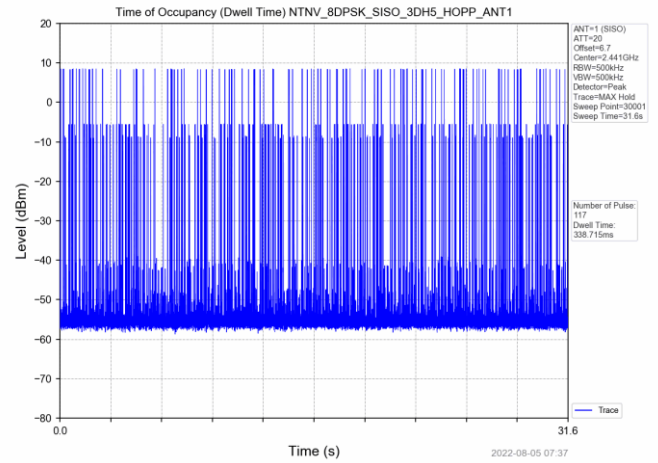
Sample Plot

8DPSK – DH5

Single Pulse Width



Entire Measurement Window



8 Pseudo-Random Hop Sequence

8.1 Test Result

Test Description	Test Specification		Test Result
Pseudo-Random Hop Sequence	15.247(a)(1)	RSS-247 5.1(a)	Compliant

8.2 Test Method

Compliance is demonstrated by Manufacturer's declaration or is stated in the Theory of Operation.

Requirement

The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset, while the long-term distribution appears evenly distributed.

9 Conducted Spurious Emissions / Band Edge

9.1 Test Result

Test Description	Test Specification		Test Result
Conducted Spurious Emissions	15.247(d)	RSS-247 5.5	Compliant

9.2 Test Method

Conducted spurious emissions measurements were taken using the methods defined in ANSI C63.10, Clauses 5.5 and 5.6. Authorized band edge measurements were recorded using the methods in clause 6.10.4. DH-5 was the worst-case packet type for all modes.

Lowest, middle, and highest channels as well as hopping mode were investigated.

Limit:

The limit in any 100 kHz band outside of the authorized band is 20 dB below the maximum in-band peak level.

9.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.8 °C

Relative Humidity: 49.6 %

Atmospheric Pressure: 98.0 kPa

9.4 Test Equipment

Test End Date: 8/6/2022

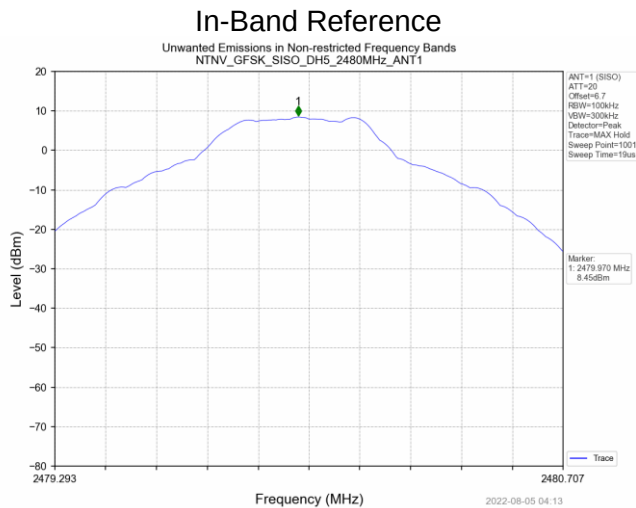
Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20109	16-Mar-2022	16-Mar-2023
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

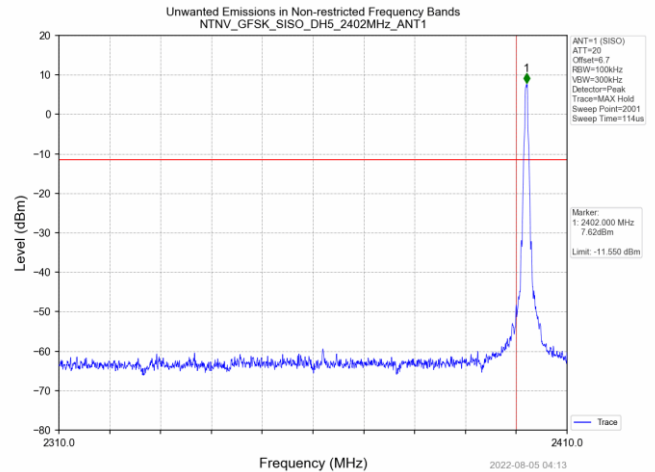
9.5 Test Data

Test Mode	Frequency (MHz)	TX Type	Spurious Conducted Emission (dBm)	Limit (dBm)	Verdict
GFSK	2402	SISO	Refer to test graph	-11.55	PASS
	2441	SISO	Refer to test graph	-11.55	PASS
	2480	SISO	Refer to test graph	-11.55	PASS
	Hopping	SISO	Refer to test graph	-11.55	PASS
Pi/4DQPSK	2402	SISO	Refer to test graph	-11.52	PASS
	2441	SISO	Refer to test graph	-11.52	PASS
	2480	SISO	Refer to test graph	-11.52	PASS
	Hopping	SISO	Refer to test graph	-11.52	PASS
8DPSK	2402	SISO	Refer to test graph	-11.28	PASS
	2441	SISO	Refer to test graph	-11.28	PASS
	2480	SISO	Refer to test graph	-11.28	PASS
	Hopping	SISO	Refer to test graph	-11.28	PASS

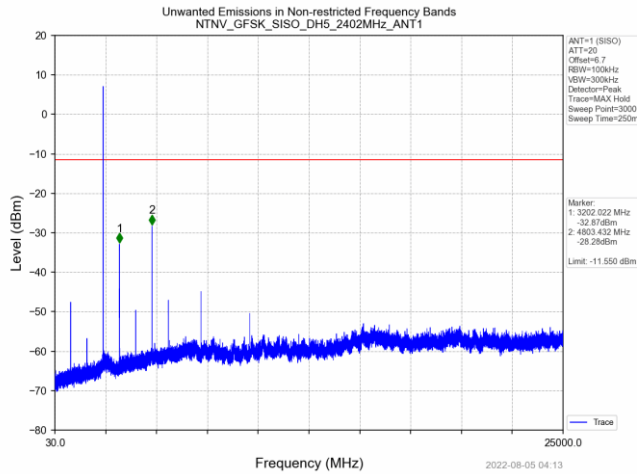
GFSK



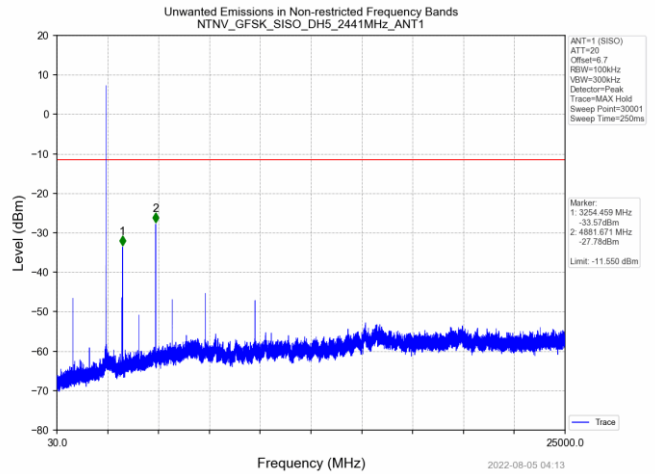
Lower Band Edge - Low Channel (2402MHz)



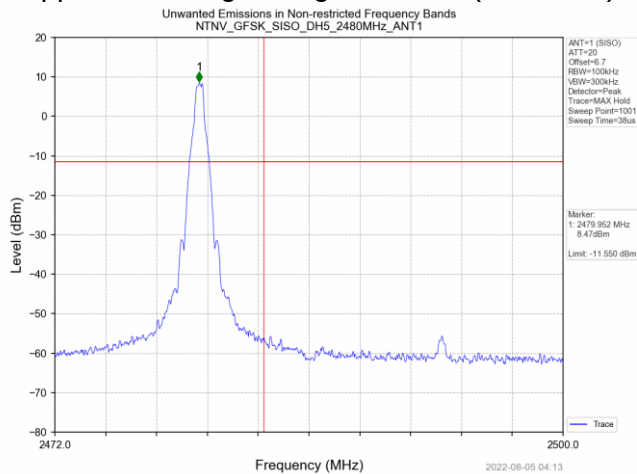
Full Spectrum - Low Channel (2402MHz)



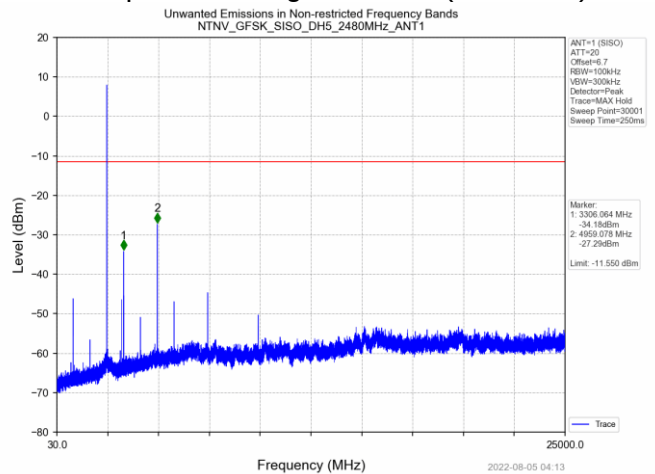
Full Spectrum - Mid Channel (2440MHz)



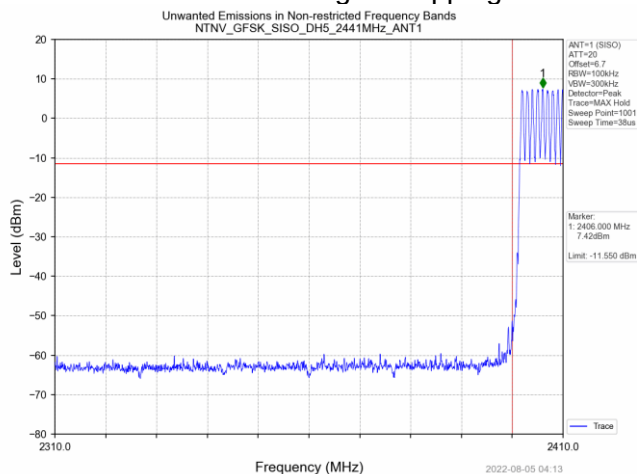
Upper Band Edge – High Channel (2480MHz)



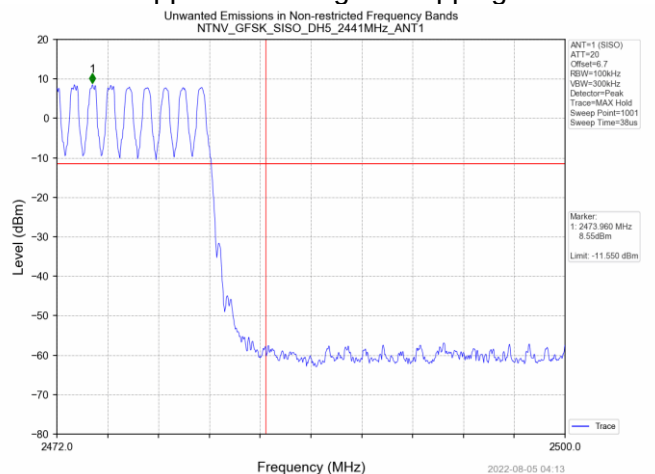
Full Spectrum - High Channel (2480MHz)



Lower Band Edge - Hopping

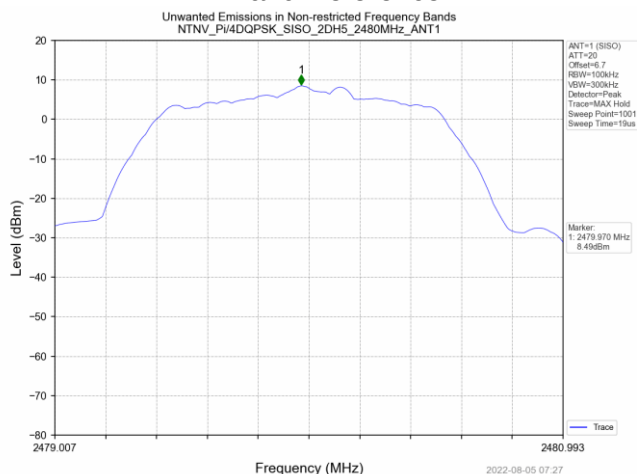


Upper Band Edge – Hopping

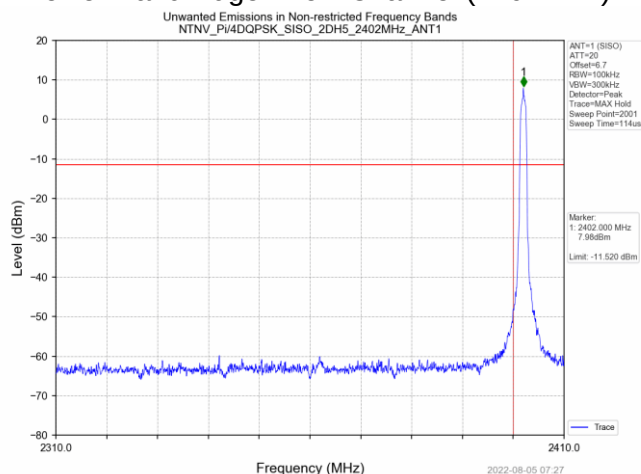


Pi/4DQPSK

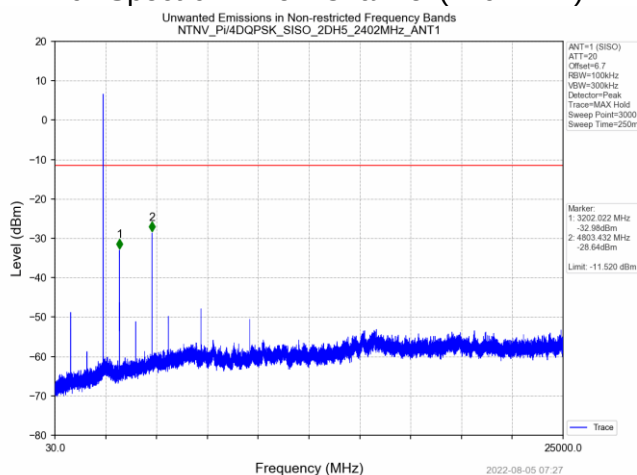
In-Band Reference



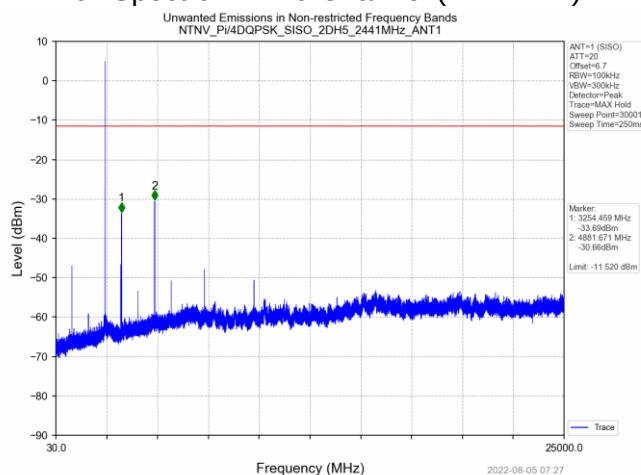
Lower Band Edge - Low Channel (2402MHz)



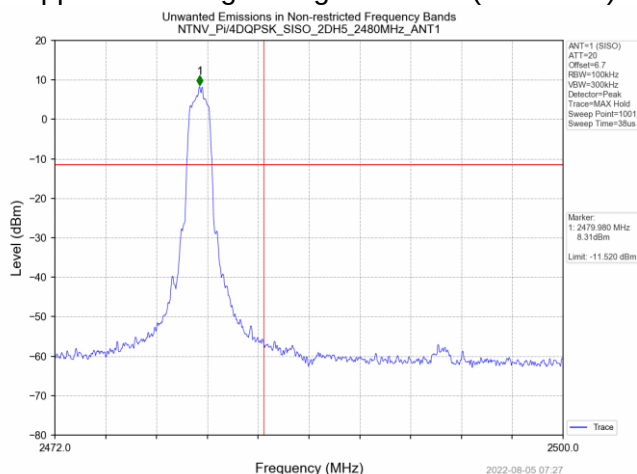
Full Spectrum - Low Channel (2402MHz)



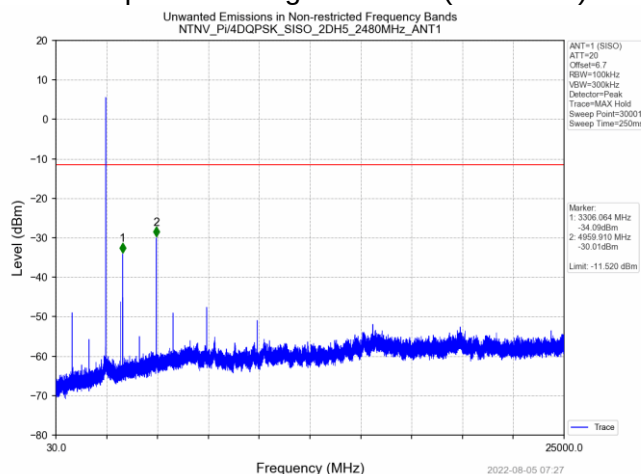
Full Spectrum - Mid Channel (2441MHz)



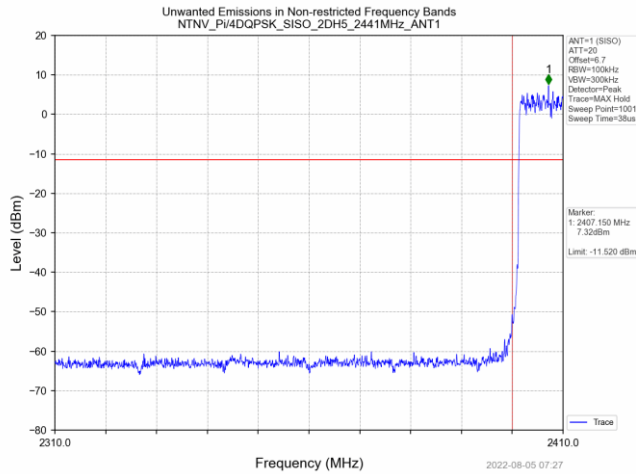
Upper Band Edge - High Channel (2480MHz)



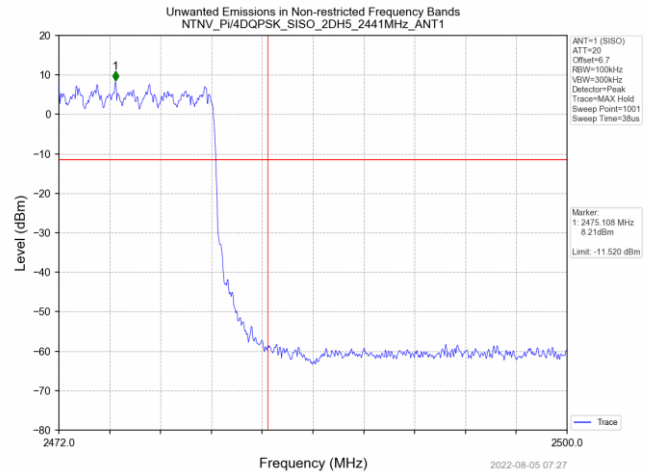
Full Spectrum - High Channel (2480MHz)



Lower Band Edge - Hopping

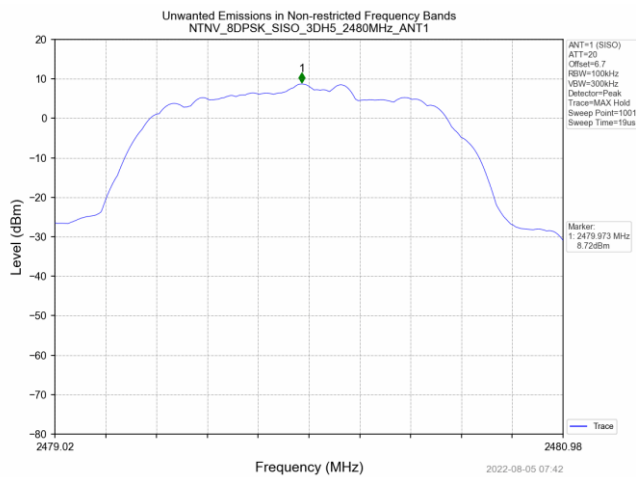


Upper Band Edge - Hopping

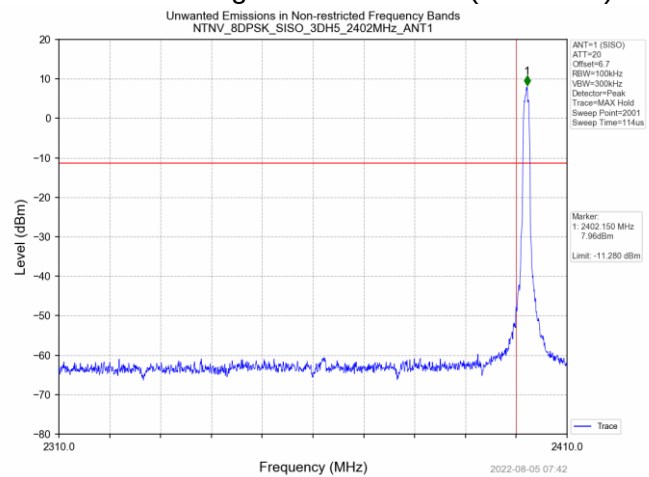


8DPSK

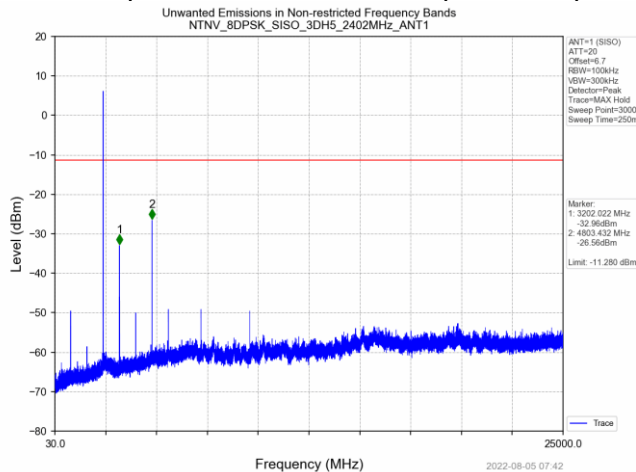
In-Band Reference



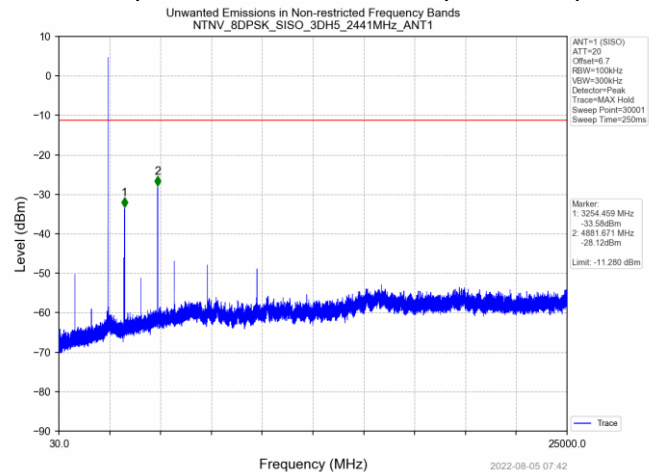
Lower Band Edge - Low Channel (2402MHz)



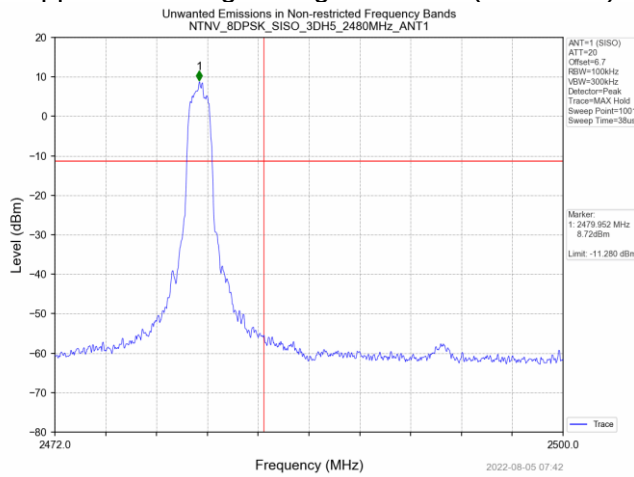
Full Spectrum - Low Channel (2402MHz)



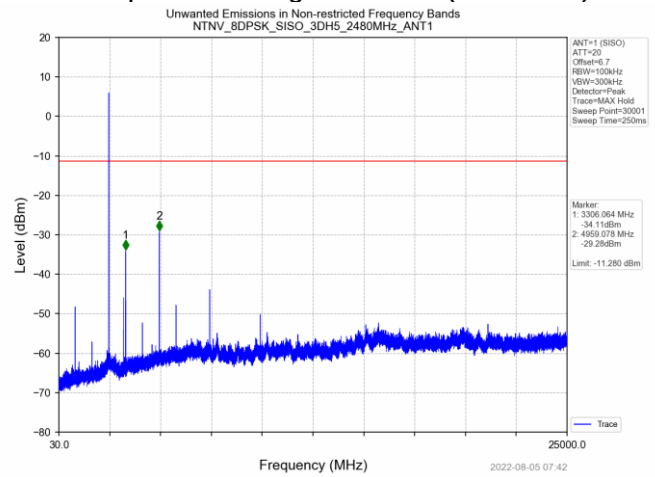
Full Spectrum - Mid Channel (2440MHz)



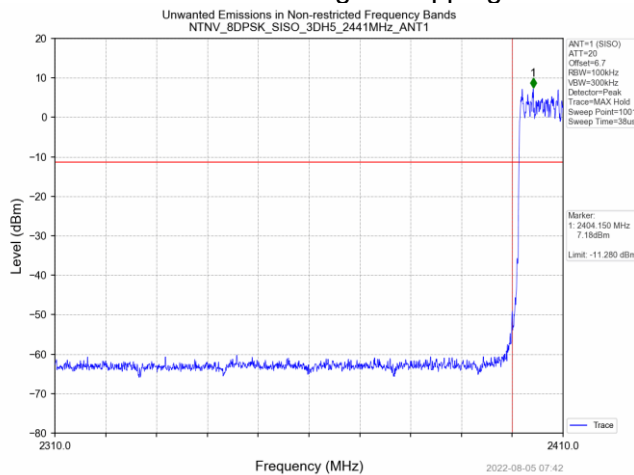
Upper Band Edge – High Channel (2480MHz)



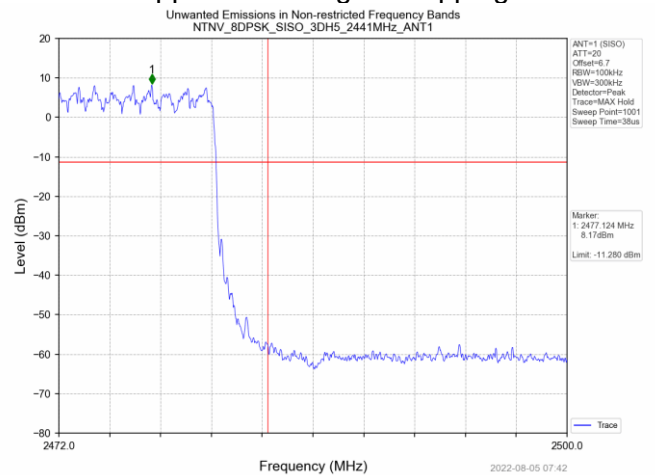
Full Spectrum - High Channel (2480MHz)



Lower Band Edge - Hopping



Upper Band Edge – Hopping



10 Field Strength of Spurious Radiation (Restricted Bands)

10.1 Test Result

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

10.2 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. Worst-case mode for spurious emissions was GFSK with a DH5 packet type.

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

10.3 Test Site

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

Environmental Conditions

Temperature: 22.2 °C

Relative Humidity: 48.6 %

Atmospheric Pressure: 98.2 kPa

10.4 Test Equipment

Test End Date: 8/26/2022

Tester: AB/JP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
PASSIVE LOOP ANTENNA, 9KHZ -	6512	ETS LINDGREN	20151	16-Mar-2022	16-Mar-2023
N TO N RF CABLE	NC12-N1N1-276	MEGAPHASE	22000	10-Jan-2022	10-Jan-2023
RF CABLE	UC-N-MM-275	MAURY MICROWAVE	17015	25-Aug-2021	25-Aug-2022
RF CABLE NM TO NM, 0.01-18GHZ	90-195-079	TELEDYNE STORM	20124	14-Feb-2022	14-Feb-2023
BROADBAND PREAMPLIFIER 9KHZ-	BBV 9745	SCHWARZBECK MESS	20157	16-Mar-2022	16-Mar-2023
FILTER, HIGH PASS, >2800MHZ	HPM50111	MICRO-TRONICS	22017	16-Jun-2022	16-Jun-2023
ANTENNA, BILOG	JB6	SUNOL	B079690	19-Apr-2022	19-Apr-2024
RF CABLE	SF106	HUBER & SUHNER	B079713	26-Aug-2021	26-Aug-2022
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	26-Aug-2021	26-Aug-2022
LOW NOISE AMPLIFIER	ZKL-2+	MINI-CIRCUITS	B079800	18-Oct-2021	18-Oct-2022
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079699	29-Jul-2022	29-Jul-2024
RF CABLE, NM TO NM.	90-195-276	TELEDYNE STORM	21020	16-Mar-2022	16-Mar-2023
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	7-Oct-2021	7-Oct-2022
RECEIVER	ESRP	ROHDE & SCHWARZ	S/N: 101065	17-Dec-2020	17-Dec-2022
RECEIVER	ESW44	ROHDE & SCHWARZ	S/N: 101894	26-Oct-2021	12-Mar-2023

Note: Cable 17015 was used for testing on 23-Aug-2022

Software:

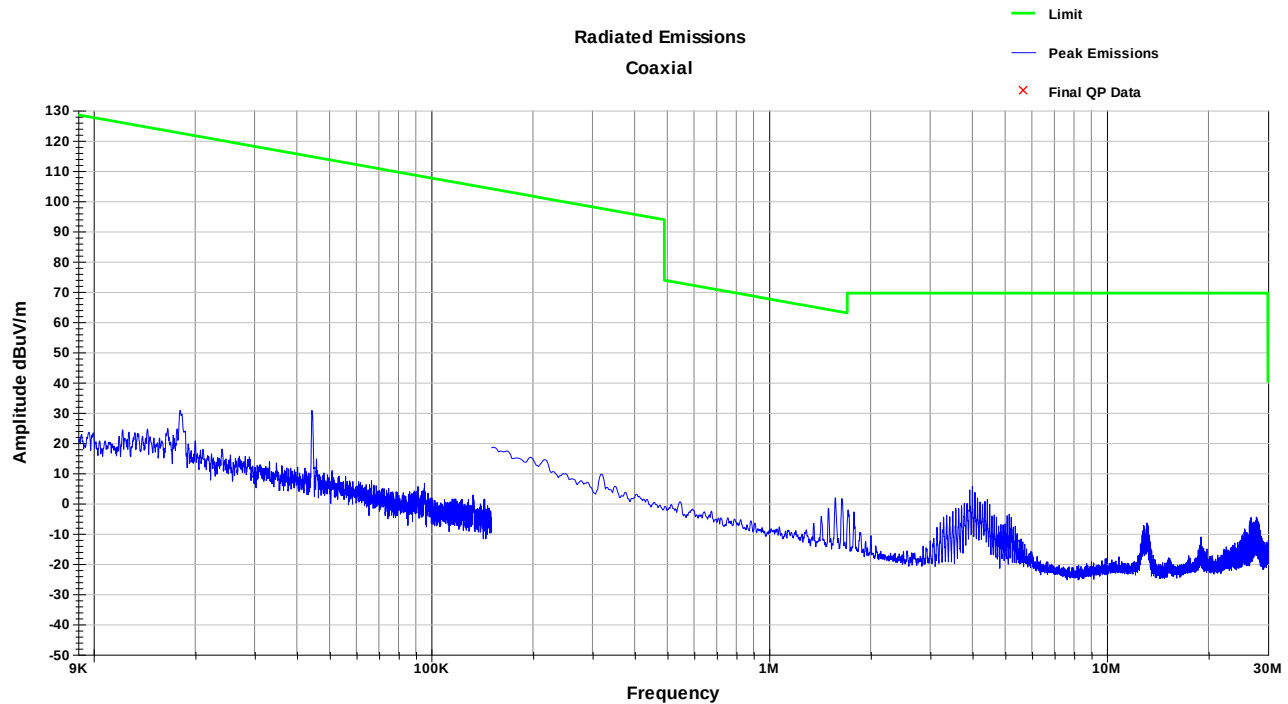
RSE 9k - 30M 220804 Dated 04 August 2022

RSE 30-1000 MHz T7 220318 Dated 18 March 2022

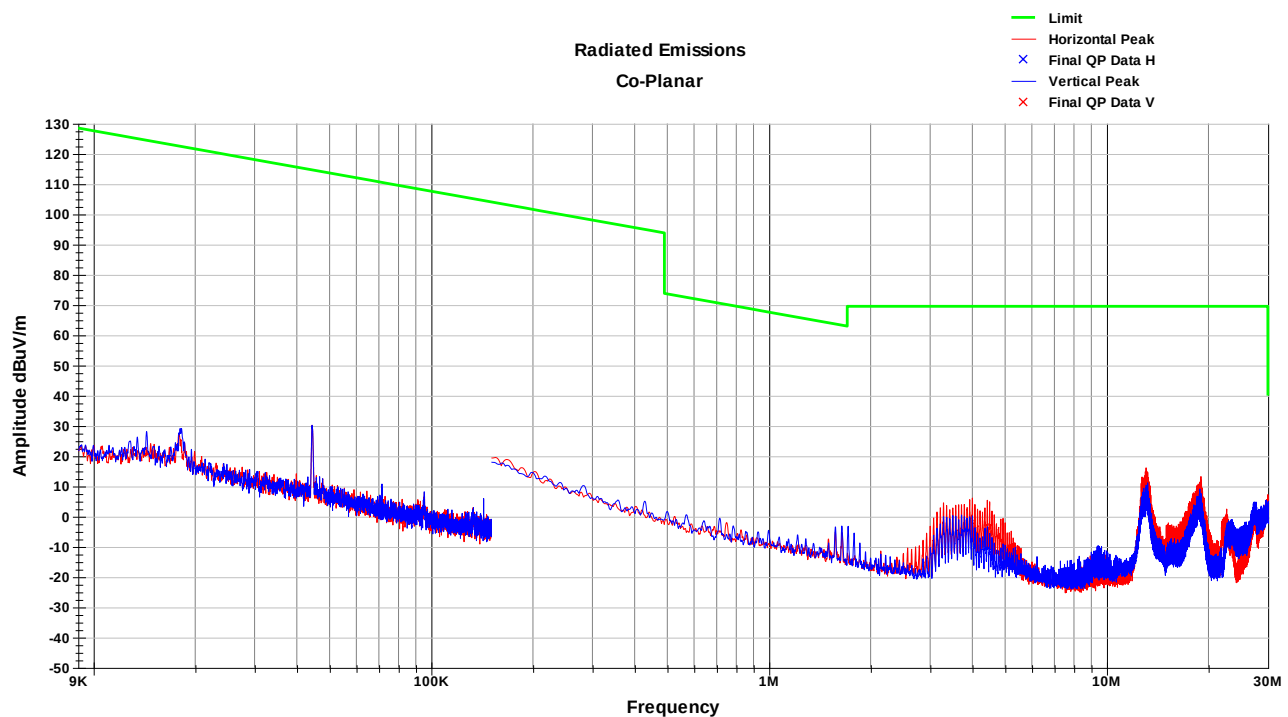
RSE 1-18 GHz T7 210212 Dated 12 February 2021

10.5 Test Data – Peak Plots

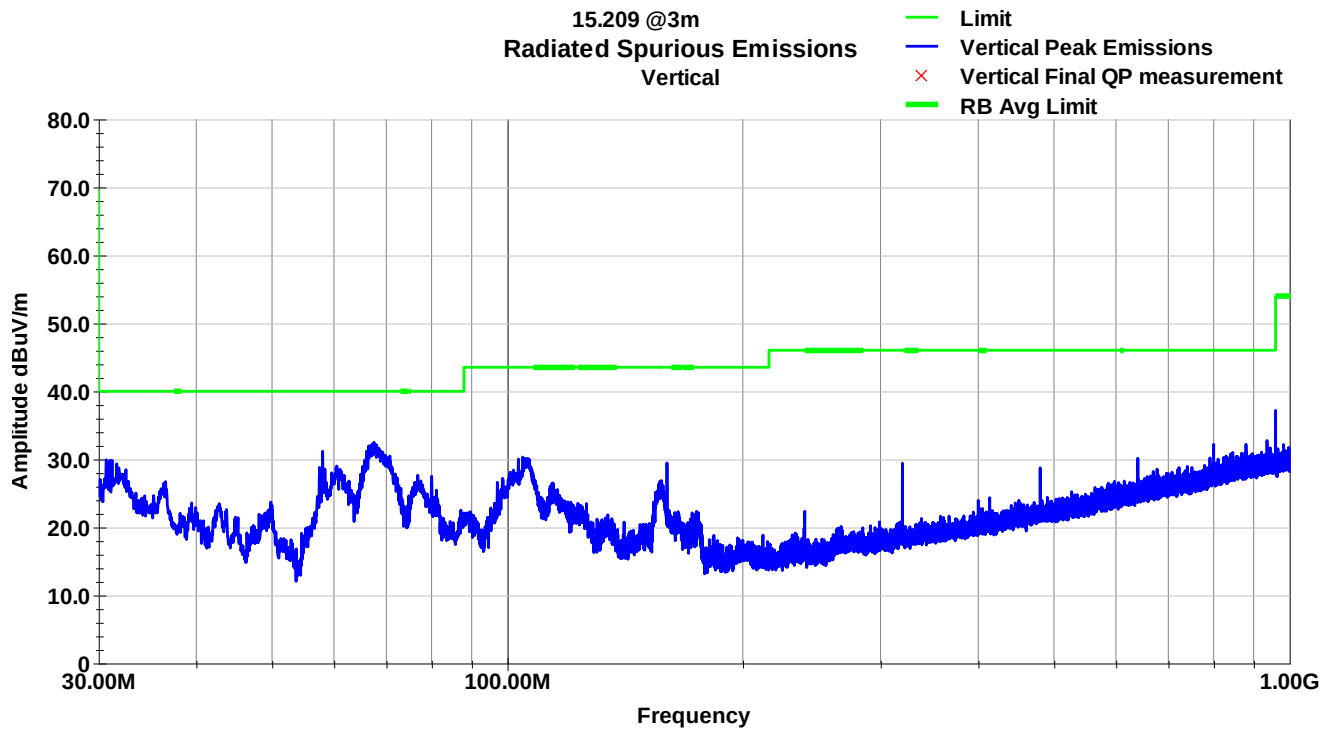
Between 9kHz and 1000MHz, there was no significant deviation with respect to axis or channel
Co-Axial Radiated Spurious Emissions – 9kHz-30MHz (LCH)



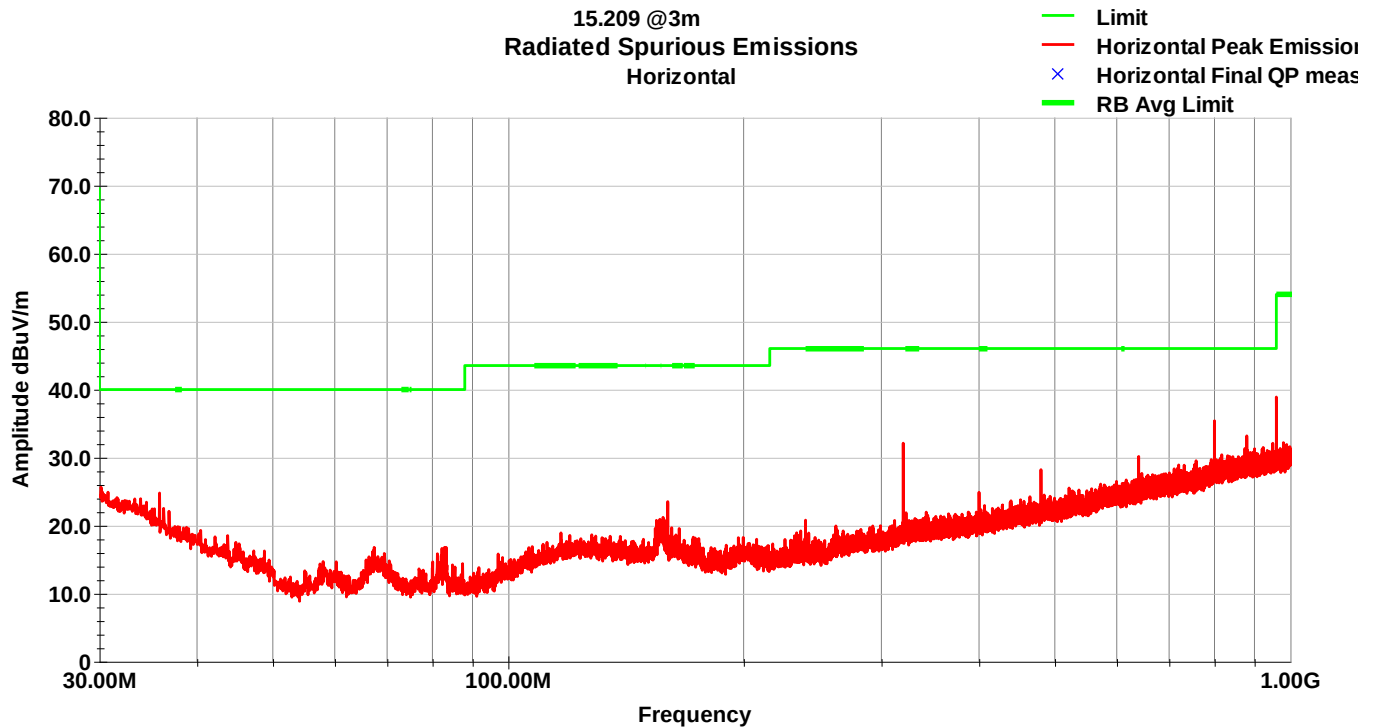
Co-Planar Radiated Spurious Emissions – 9kHz-30MHz (LCH)



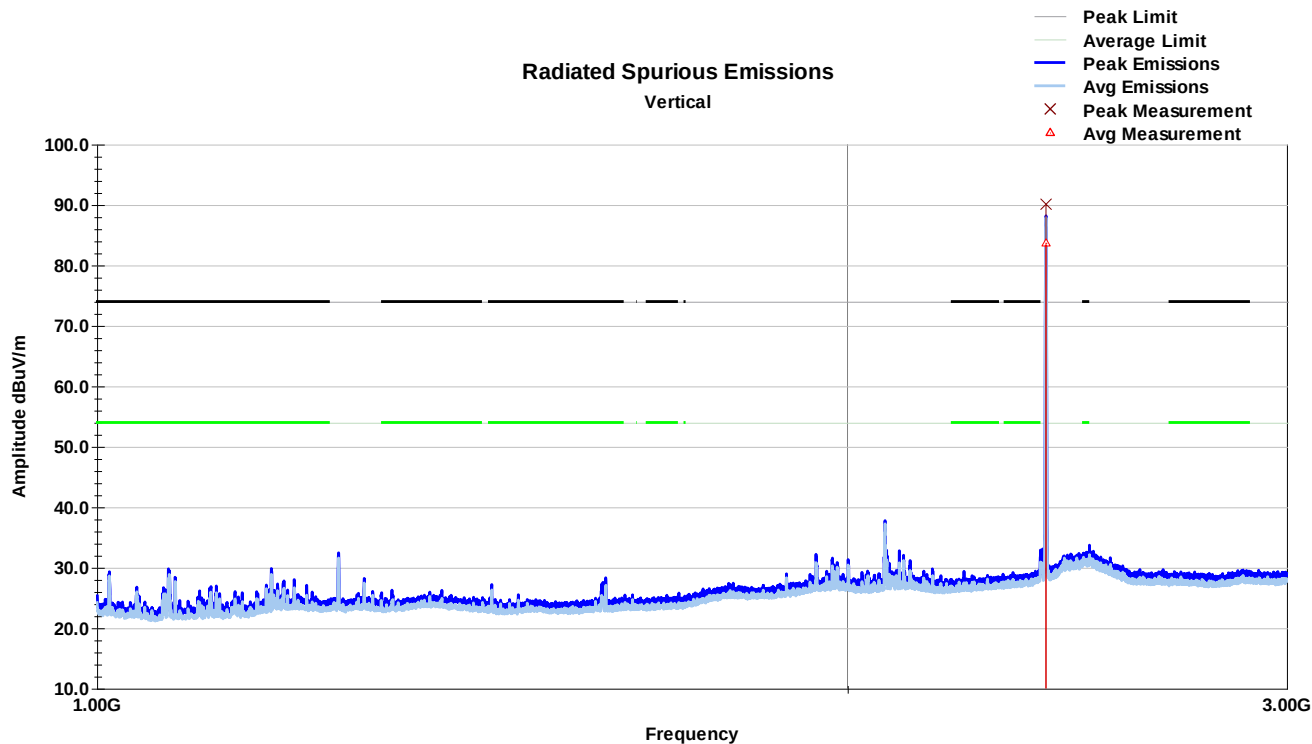
Vertical Radiated Spurious Emissions – 30-1000MHz (LCH)



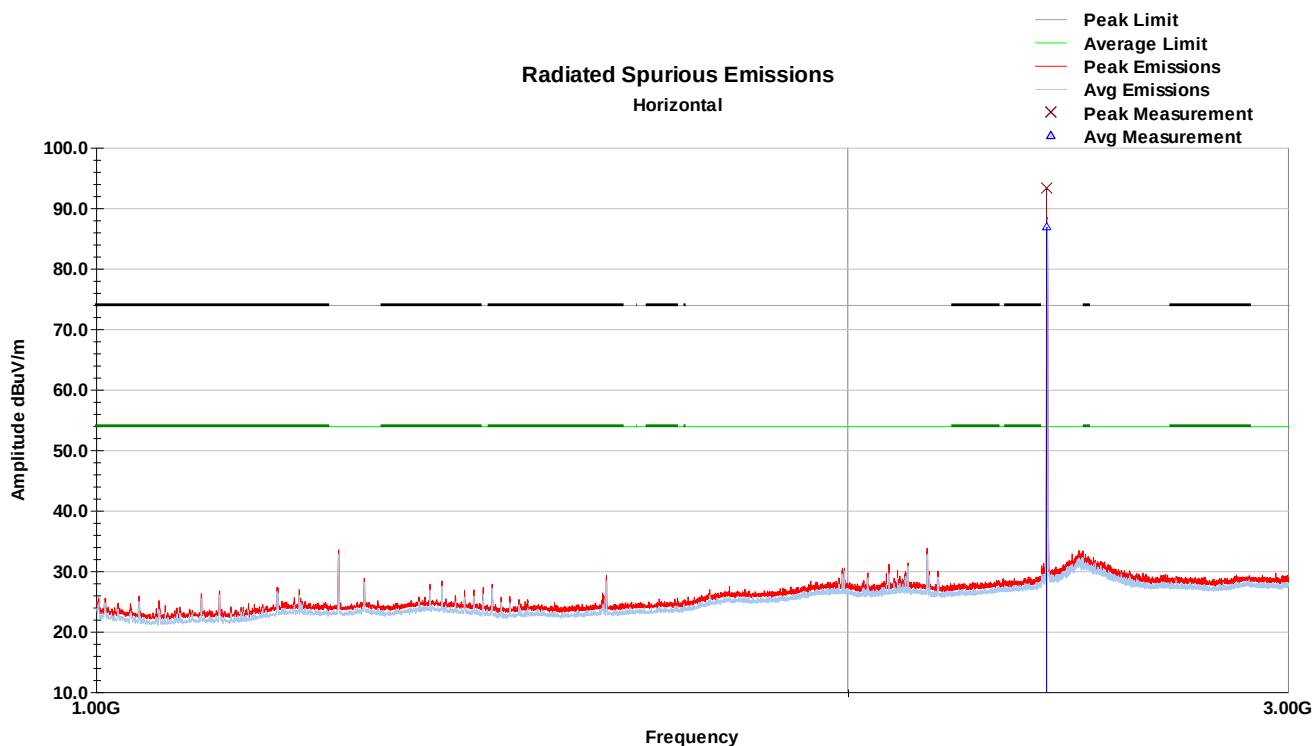
Horizontal Radiated Spurious Emissions – 30-1000MHz (LCH)



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

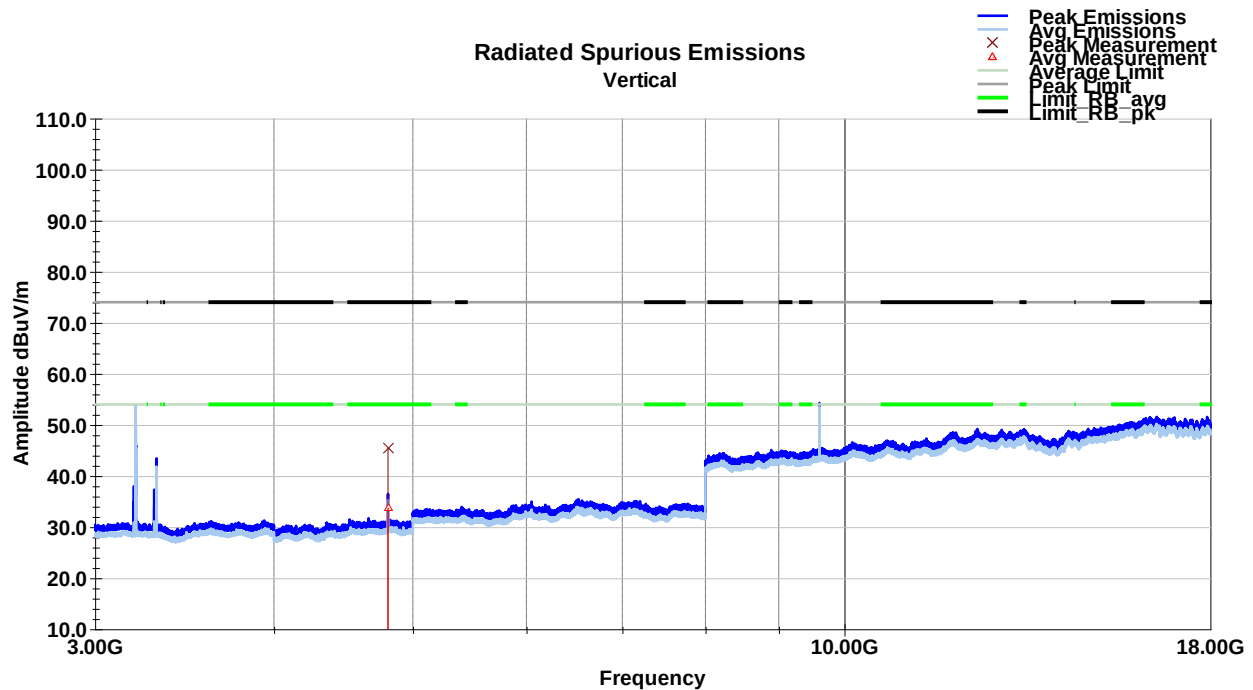


Horizontal Radiated Spurious Emissions – 1-3GHz (LCH)

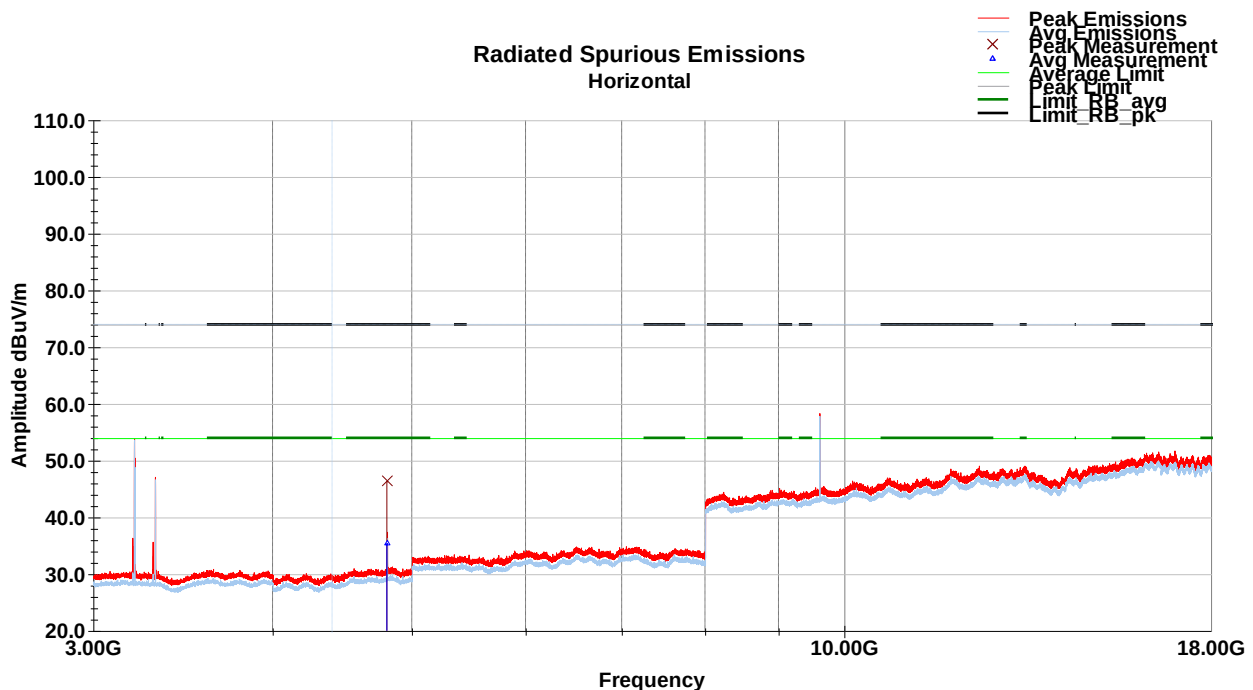


Vertical Radiated Spurious Emissions – 3-18GHz (LCH)

Other spurious emissions are not within restricted bands

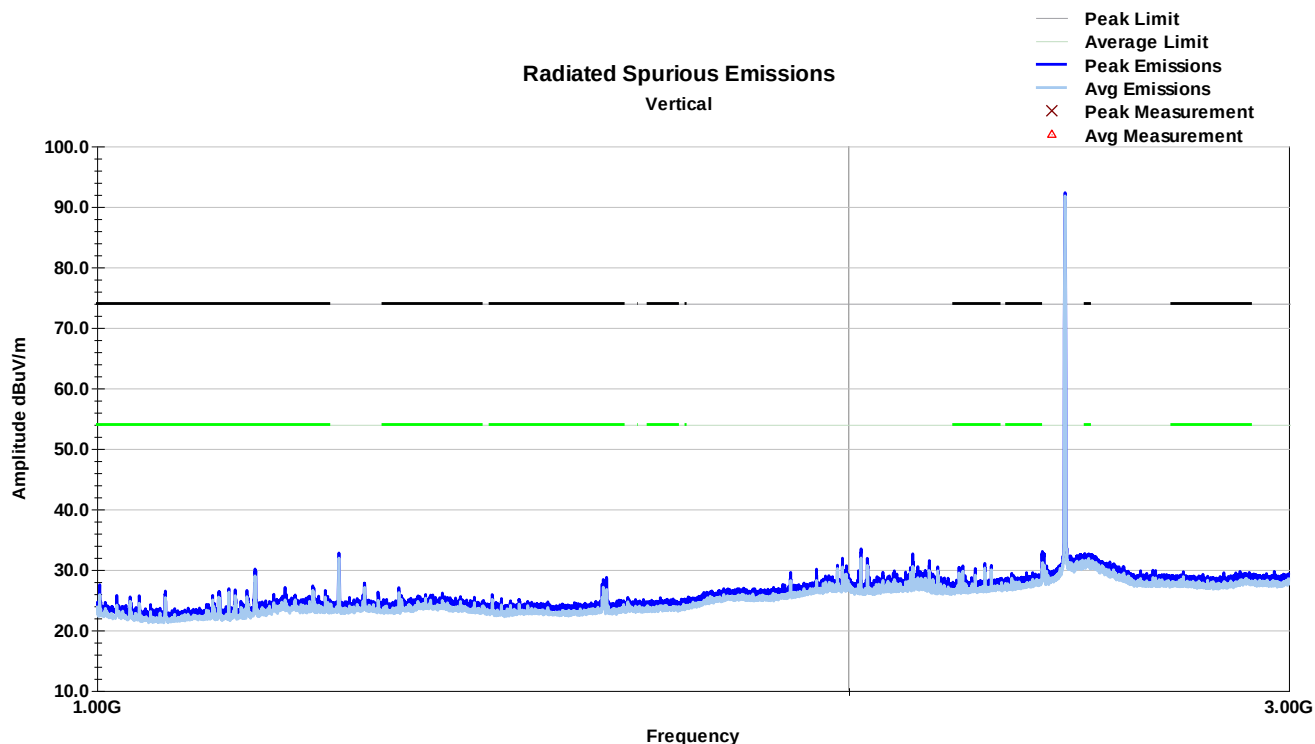


Horizontal Radiated Spurious Emissions – 3-18GHz (LCH)

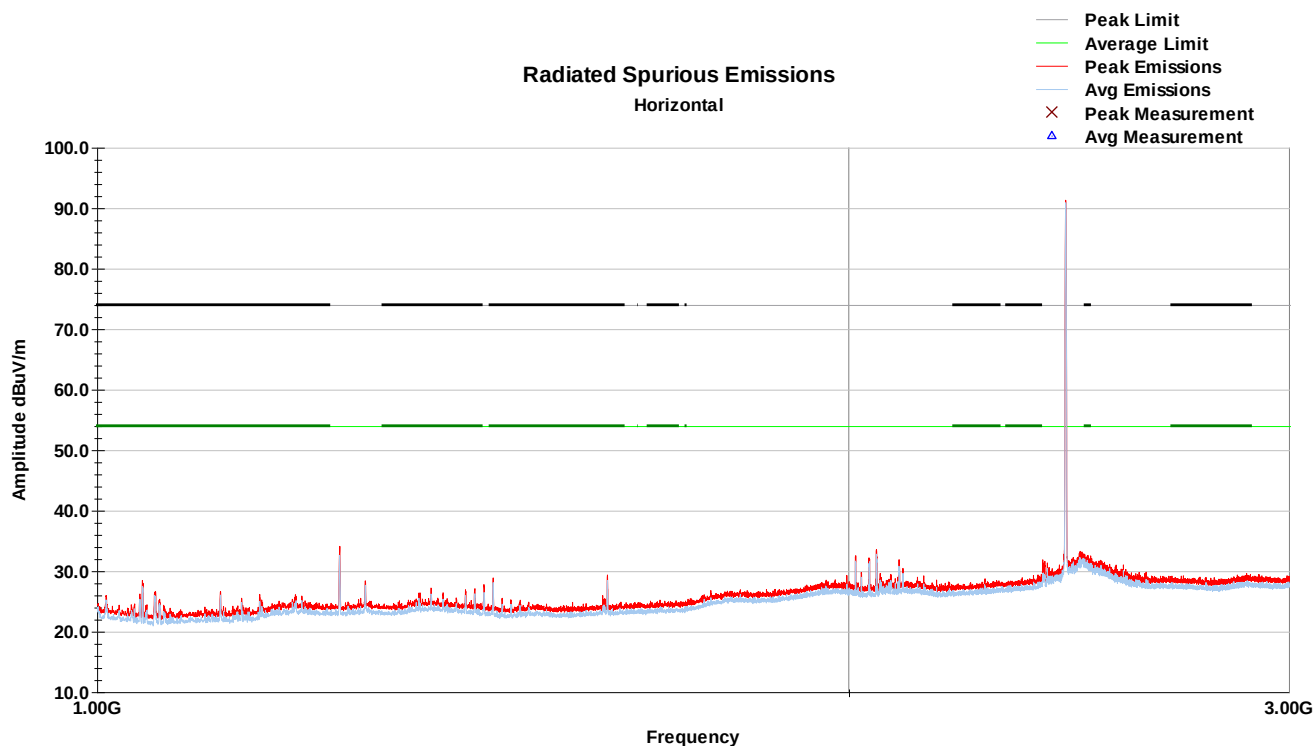


Other spurious emissions are not within restricted bands

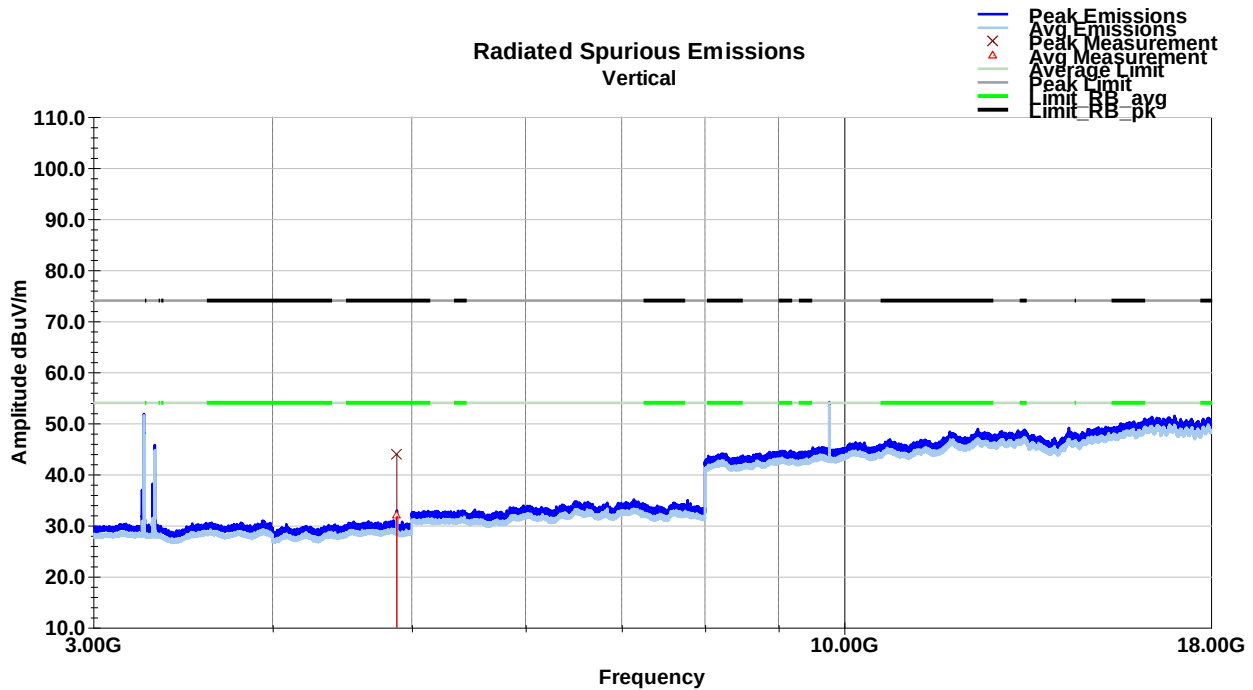
Vertical Radiated Spurious Emissions – 1-3GHz (MCH)



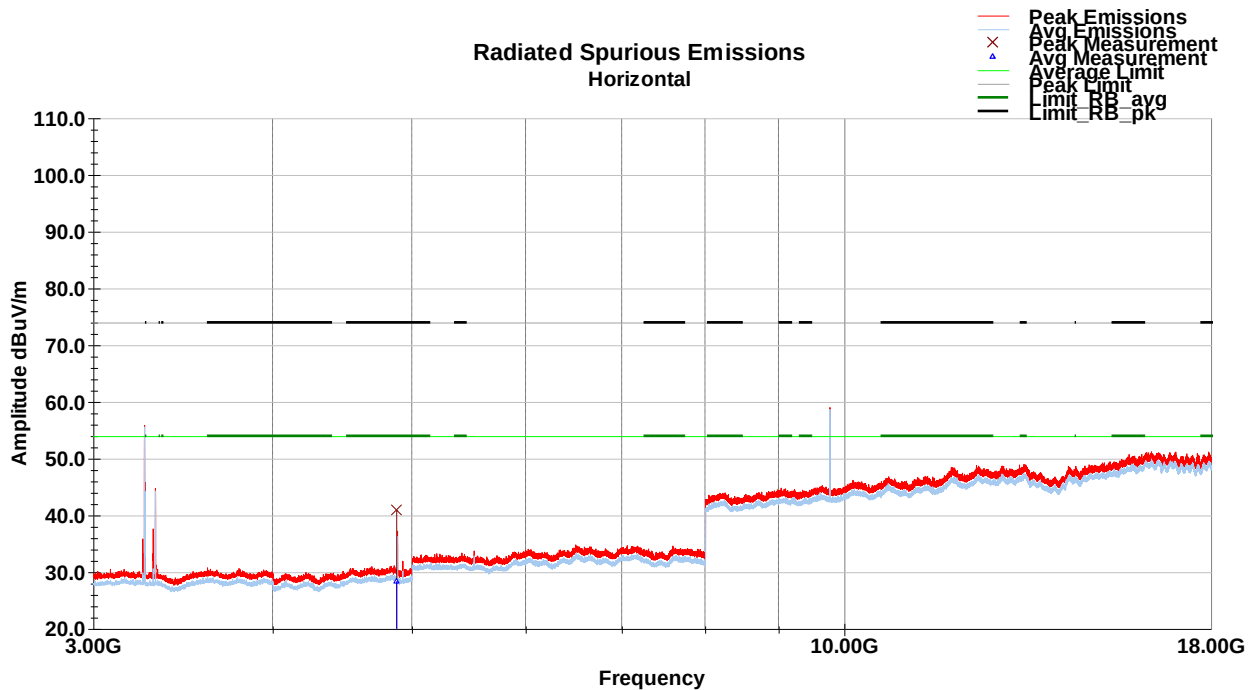
Horizontal Radiated Spurious Emissions – 1-3GHz (MCH)



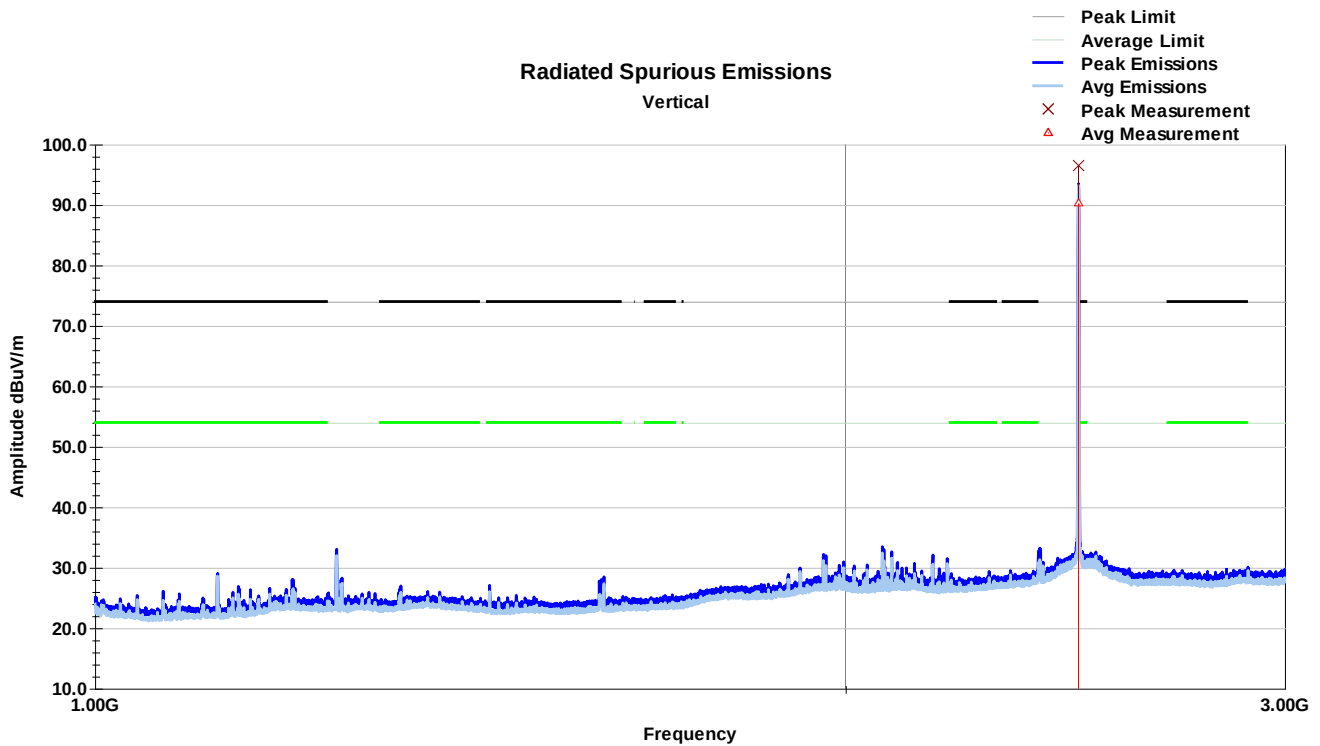
Vertical Radiated Spurious Emissions – 3-18GHz (MCH)



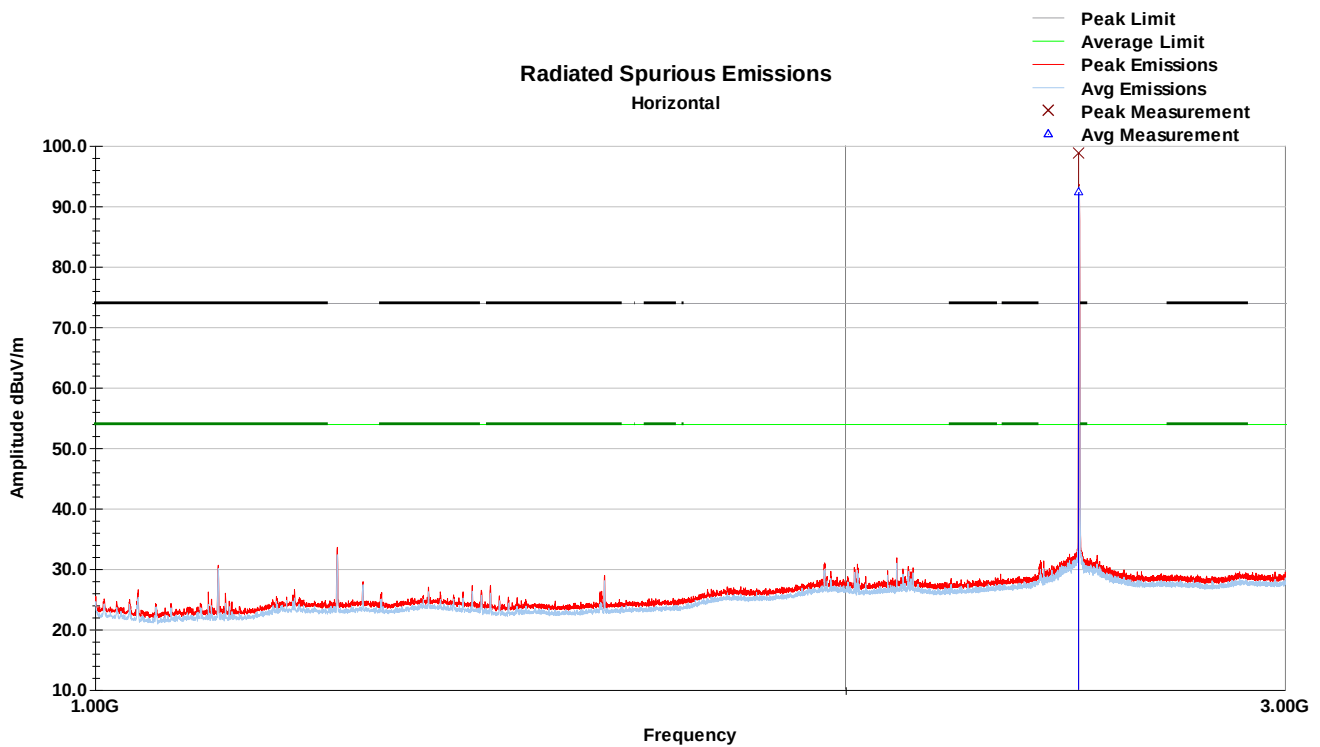
Horizontal Radiated Spurious Emissions – 3-18GHz (MCH)



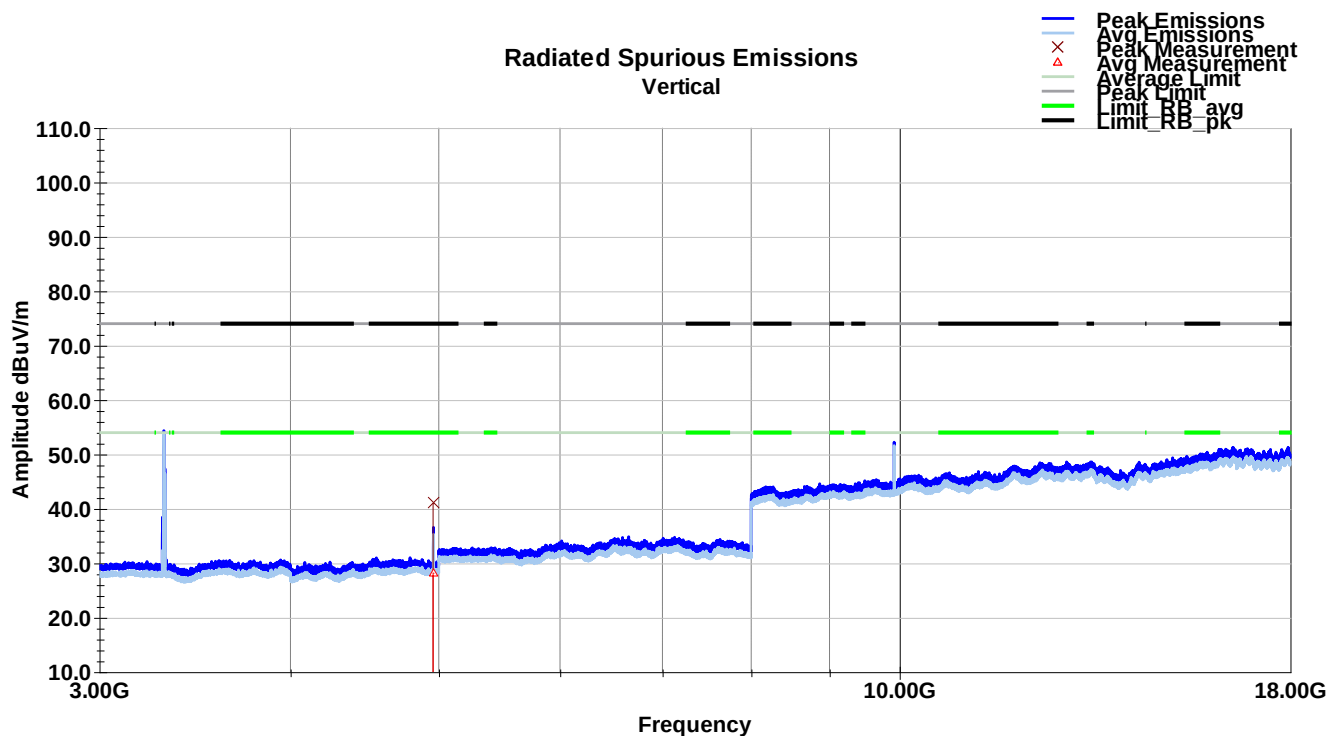
Vertical Radiated Spurious Emissions – 1-3GHz (HCH)



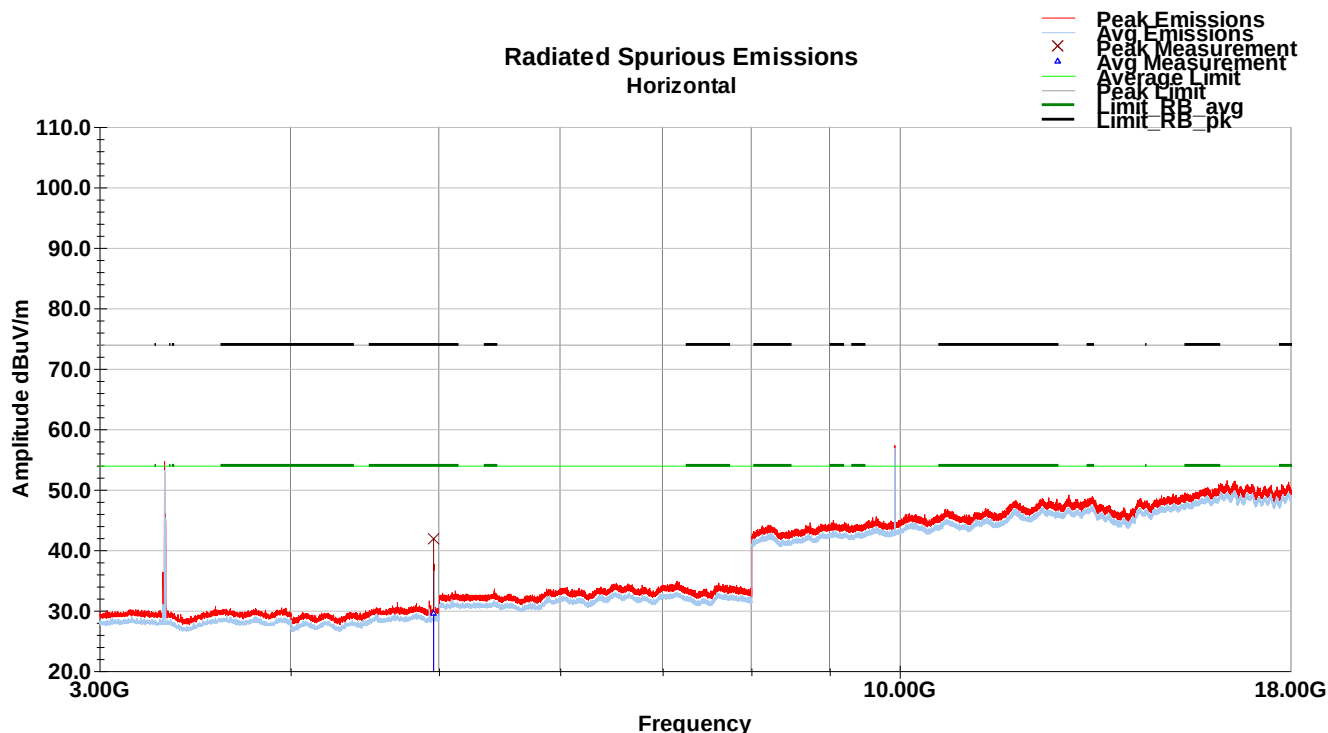
Horizontal Radiated Spurious Emissions – 1-3GHz (HCH)



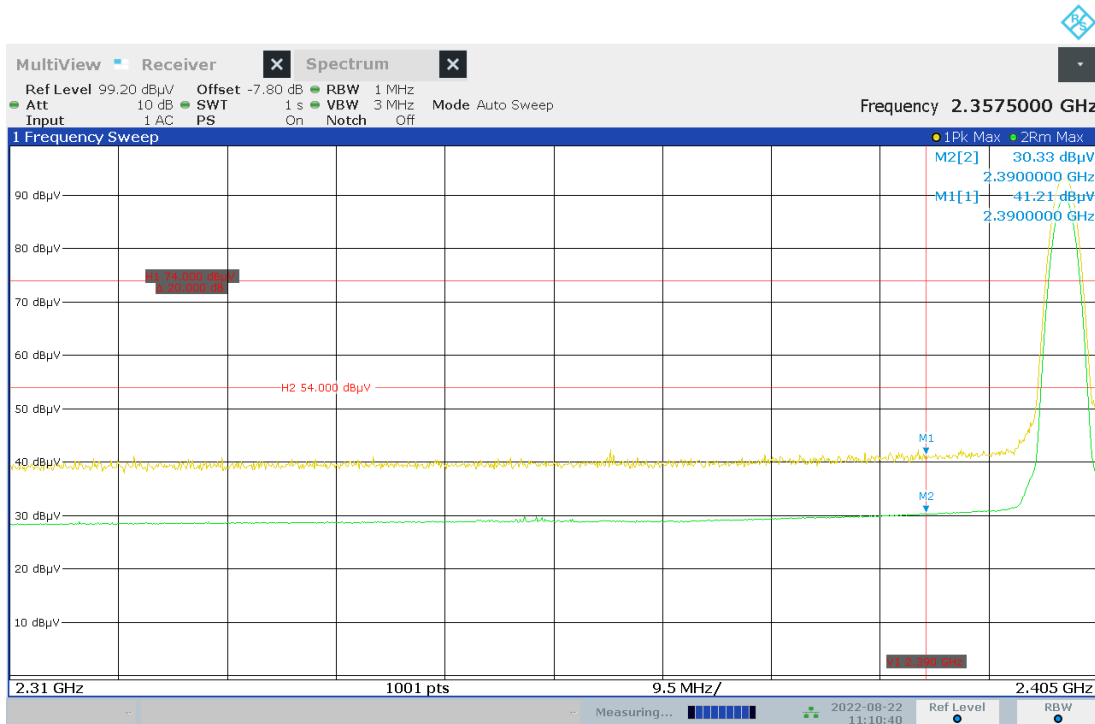
Vertical Radiated Spurious Emissions – 3-18GHz (HCH)



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

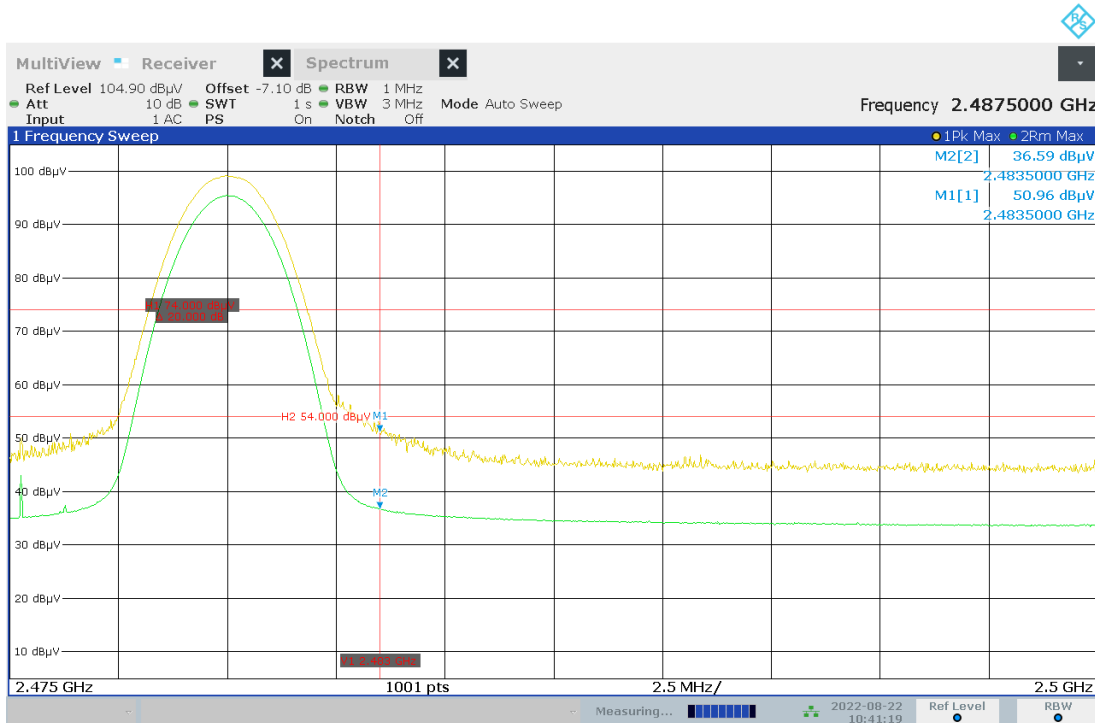


Sample Band Edge Plots Low Channel – EDR-3



11:10:41 AM 08/22/2022

High Channel – EDR-3



10:41:20 AM 08/22/2022

10.6 Test Data – Tabular Data

Tabular Test Results

Frequency MHz	Raw dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final dBuV/m	Limit dBuV/m	Margin dB	Detector	Data Rate
Low Channel (2402MHz)												
2390.00	49.2	H	201.0	125.0	32.0	2.5	42.2	41.5	74.0	-32.5	Peak	GFSK - DH5
2390.00	37.9	H	201.0	125.0	32.0	2.5	42.2	30.2	54.0	-23.8	Average	GFSK - DH5
2390.00	49.2	H	201.0	125.0	32.0	2.5	42.2	41.5	74.0	-32.5	Peak	EDR2 - DH5
2390.00	38.0	H	201.0	125.0	32.0	2.5	42.2	30.3	54.0	-23.7	Average	EDR2 - DH5
2390.00	48.9	H	201.0	125.0	32.0	2.5	42.2	41.2	74.0	-32.8	Peak	EDR3 - DH5
2390.00	38.0	H	201.0	125.0	32.0	2.5	42.2	30.3	54.0	-23.7	Average	EDR3 - DH5
4804.00	49.3	V	81.0	250.0	34.6	3.4	42.0	45.4	74.0	-28.6	Peak	EDR3 - DH5
4804.00	37.7	V	81.0	250.0	34.6	3.4	42.0	33.7	54.0	-20.3	Average	EDR3 - DH5
4804.00	50.3	H	52.0	250.0	34.6	3.4	42.0	46.4	74.0	-27.6	Peak	EDR3 - DH5
4804.00	39.4	H	52.0	250.0	34.6	3.4	42.0	35.5	54.0	-18.5	Average	EDR3 - DH5
Mid Channel (2441MHz)												
4882.00	47.9	V	211.0	250.0	34.5	3.5	42.0	43.9	74.0	-30.1	Peak	EDR3 - DH5
4882.00	35.8	V	211.0	250.0	34.5	3.5	42.0	31.9	54.0	-22.1	Average	EDR3 - DH5
4882.00	44.8	H	48.0	250.0	34.5	3.5	42.0	40.9	74.0	-33.1	Peak	EDR3 - DH5
4882.00	32.3	H	48.0	250.0	34.5	3.5	42.0	28.4	54.0	-25.6	Average	EDR3 - DH5
High Channel (2480MHz)												
2483.50	57.4	H	46.0	162.0	32.6	2.5	42.2	50.3	74.0	-23.7	Peak	GFSK - DH5
2483.50	43.7	H	46.0	162.0	32.6	2.5	42.2	36.6	54.0	-17.4	Average	GFSK - DH5
2483.50	59.1	H	46.0	162.0	32.6	2.5	42.2	52.0	74.0	-22.0	Peak	EDR2 - DH5
2483.50	43.8	H	46.0	162.0	32.6	2.5	42.2	36.7	54.0	-17.3	Average	EDR2 - DH5
2483.50	58.1	H	46.0	162.0	32.6	2.5	42.2	51.0	74.0	-23.0	Peak	EDR3 - DH5
2483.50	43.7	H	46.0	162.0	32.6	2.5	42.2	36.6	54.0	-17.4	Average	EDR3 - DH5
4960.00	45.0	V	-1.0	250.0	34.5	3.6	42.0	41.0	74.0	-33.0	Peak	EDR3 - DH5
4960.00	32.2	V	-1.0	250.0	34.5	3.6	42.0	28.3	54.0	-25.7	Average	EDR3 - DH5
4960.00	45.9	H	72.0	250.0	34.5	3.6	42.0	42.0	74.0	-32.0	Peak	EDR3 - DH5
4960.00	33.3	H	72.0	250.0	34.5	3.6	42.0	29.4	54.0	-24.6	Average	EDR3 - DH5
Final = Raw + AF + CL - Amp												
Margin = Final - Limit												

Note: There were no emissions detected above 18GHz

11 Conducted Emissions

11.1 Test Result

Test Description	Classification	Basic Standards	Test Result
Conducted Emissions	B	ANSI C63.4 / RSS-GEN	Compliant

11.2 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	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

11.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.0 °C

Relative Humidity: 47.9 %

Atmospheric Pressure: 98.14 kPa

11.4 Test Equipment

Test End Date: 24-Aug-2022

Tester: AB

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
LINE IMPEDANCE STABILIZATION NETWORK	NNB 51	TESEQ	B085882	15-Apr-2022	15-Apr-2023
RF CABLE	UC-N-MM-78	MAURY MICROWAVE	17017	25-Aug-2021	25-Aug-2022
EMI RECEIVER	ESW44	ROHDE & SCHWARZ	B079793	26-Oct-2021	12-Mar-2023

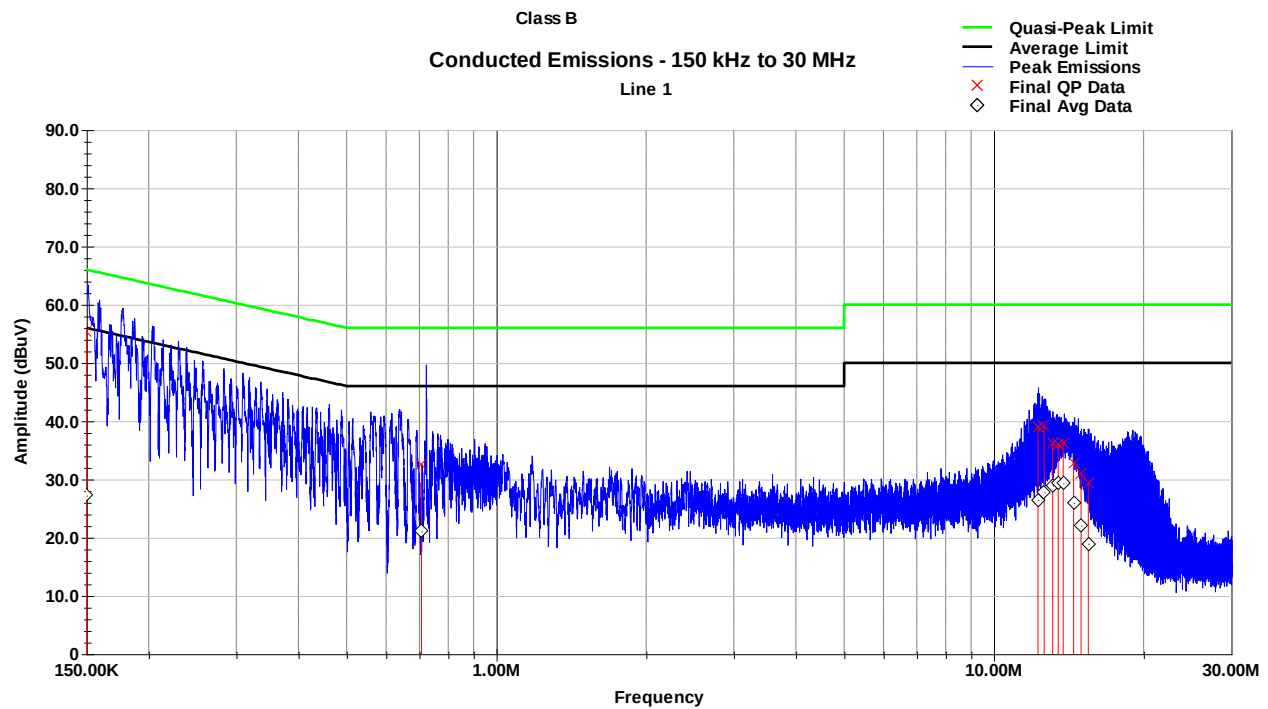
Note: Refer to equipment list for calibration intervals.

Software:

TILE! software profile "Conducted Emissions T7 220318.TIL" dated 18 03 2022

11.5 Test Data

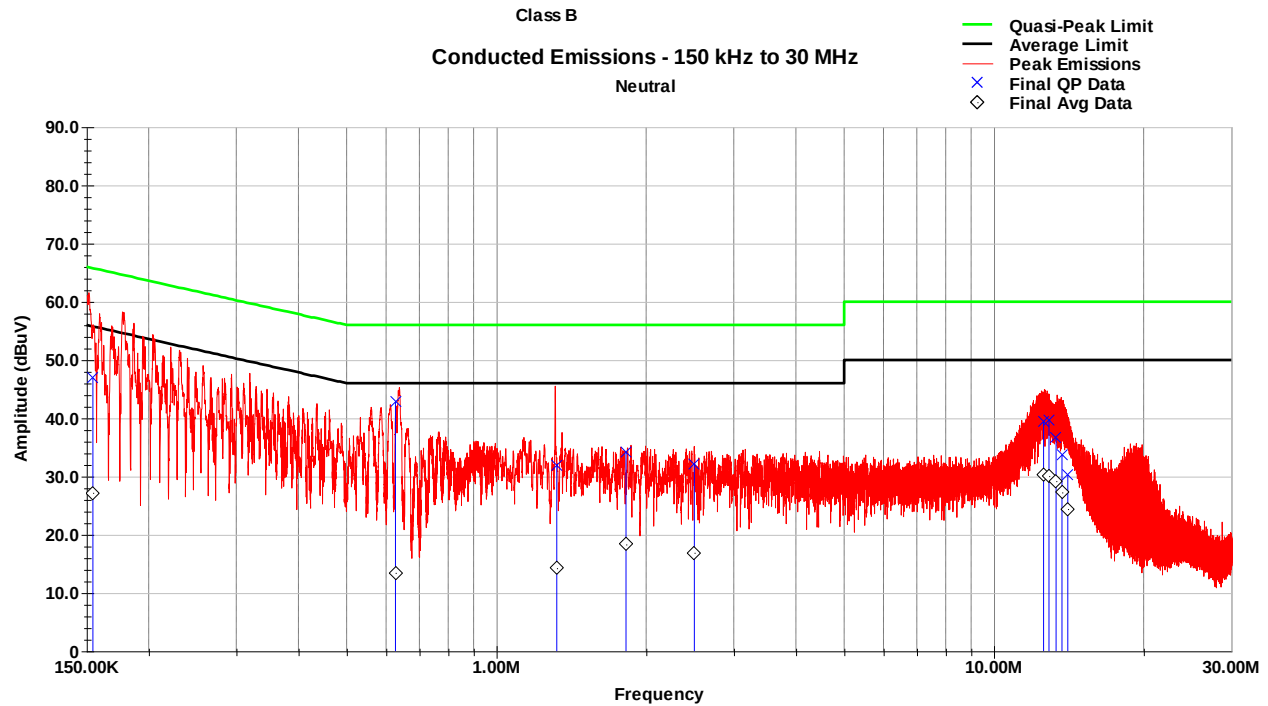
Line 1 Conducted Emissions – Peak Plot



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
0.150	55.5	66.0	-10.5	27.2	56.0	-28.8
0.707	32.6	56.0	-23.4	21.0	46.0	-25.0
12.261	38.9	60.0	-21.1	26.5	50.0	-23.5
12.620	39.1	60.0	-20.9	27.9	50.0	-22.1
13.128	36.2	60.0	-23.8	29.0	50.0	-21.0
13.463	36.1	60.0	-23.9	29.5	50.0	-20.5
13.784	36.2	60.0	-23.8	29.3	50.0	-20.7
14.460	32.8	60.0	-27.2	25.9	50.0	-24.1
14.973	31.1	60.0	-28.9	22.0	50.0	-28.0
15.483	29.3	60.0	-30.7	19.0	50.0	-31.0

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
0.154	46.9	65.7	-18.8	27.2	55.7	-28.5
0.627	42.9	56.0	-13.1	13.5	46.0	-32.5
1.322	31.9	56.0	-24.1	14.3	46.0	-31.7
1.822	34.1	56.0	-21.9	18.3	46.0	-27.7
2.499	32.1	56.0	-23.9	16.9	46.0	-29.1
12.586	39.4	60.0	-20.6	30.3	50.0	-19.7
12.903	39.7	60.0	-20.3	30.1	50.0	-19.9
13.334	36.6	60.0	-23.4	29.2	50.0	-20.8
13.703	33.6	60.0	-26.4	27.3	50.0	-22.7
14.075	30.3	60.0	-29.7	24.4	50.0	-25.6

12 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 %

13 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	12 January 2023