RF Test Report

Project Number:	**4889901**	**Proposal:**	**SUW-202202002395**
Report Number:	**4889901EMC03**	**Revision Level:**	**1**
Client:	**MindMaze SA**		

Equipment Under Test:	**Izar Ball**
Model Number:	**MMIZ-S1**
HVIN:	**Izar Ball**
FCC ID:	**2AYHHMMIZ-S1**
IC:	**26802-MMIZS1**

Applicable Standards:	**ANSI C63.10: 2013 (FCC Part 15 Subpart C, § 15.247)**
	RSS-247, Issue 2
	RSS-GEN Issue 5

Report issued on:	**07 November 2022**
Test Result:	**Compliant**

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER: 3212.01
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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*

None

2 General Information

2.1 *Client Information*

Name:	MindMaze SA
Address:	Chemin de Roseneck 5
City, State, Zip, Country:	Lausanne, 1006, Switzerland

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

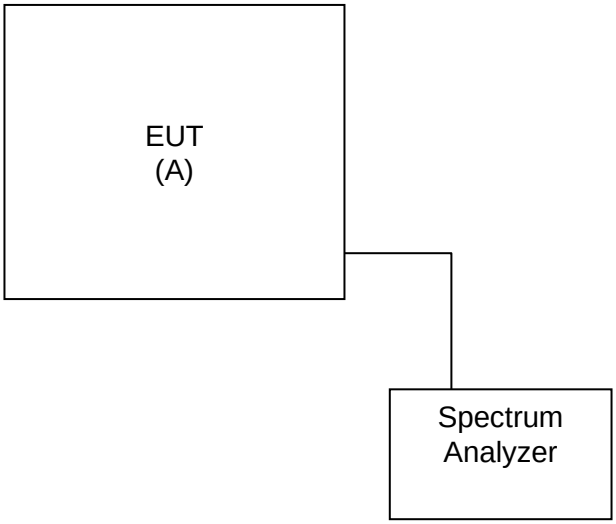
2.3 *General Information of EUT*

Product Description:	Izar Ball
Model Number:	MMIZ-S1
HVIN:	Izar Ball
Serial Number:	IZAR-0E00086, IZAR-0E00087
Firmware Version:	OED
Frequency Range:	2402 – 2480 MHz
Data Modes:	Bluetooth Low Energy – GFSK (S8, S2, 1M, and 2M Data Rates)
Antenna:	SMT Antenna, 3.5dBi (antenova, P/N: SR4W035)
Rated Voltage:	3.7Vdc (Battery), 100-240Vac 50/60Hz (Power Adapter)
Test Voltage:	3.7Vdc, 120Vac 60Hz
Sample Received Date:	14 March 2022
Dates of testing:	23 March to April 4 2022

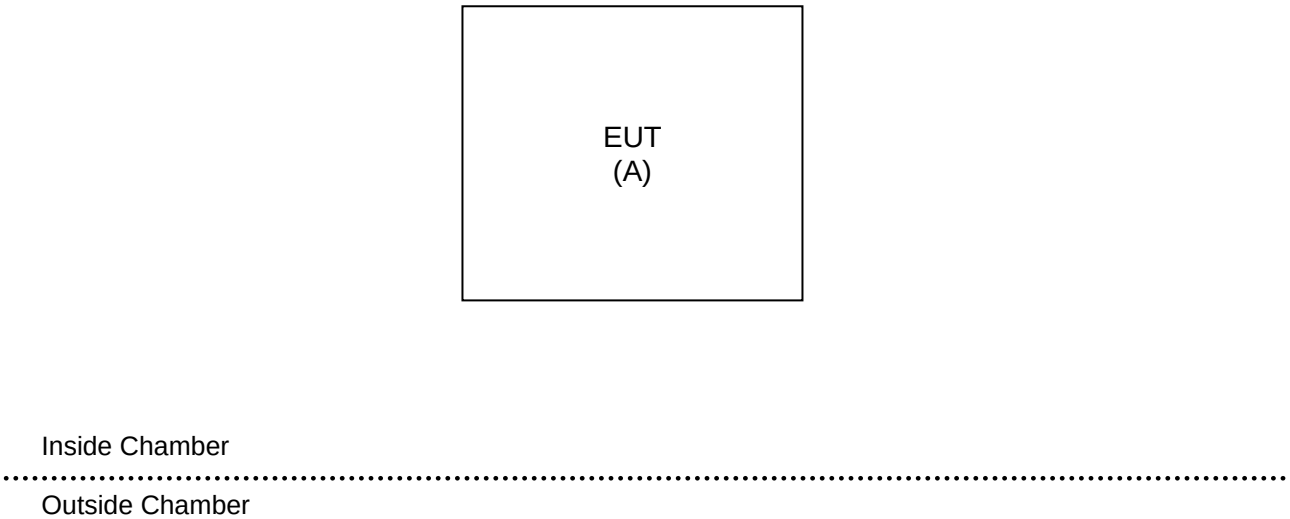
2.4 *Operating Modes and Conditions*

The EUT had SPI port connections added by the manufacturer to connect Nordic Studio RF to transmit on low, middle, and high channels at all data rates. A target power setting of 8 was used for all testing.

2.5 *EUT Connection Block Diagram – Conducted Measurements*



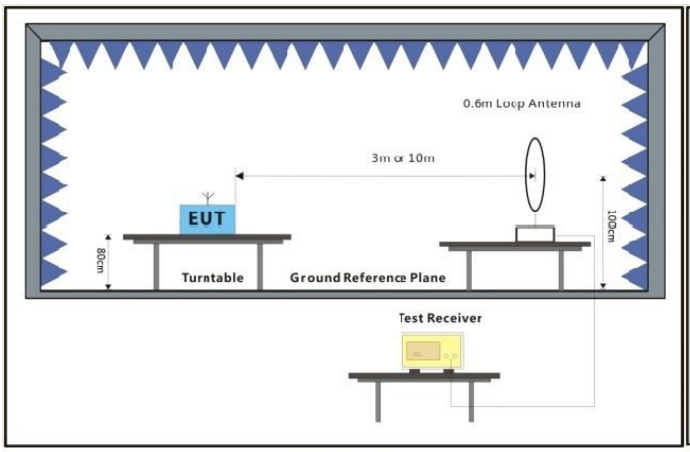
2.6 *EUT Connection Block Diagram – Radiated Measurements*



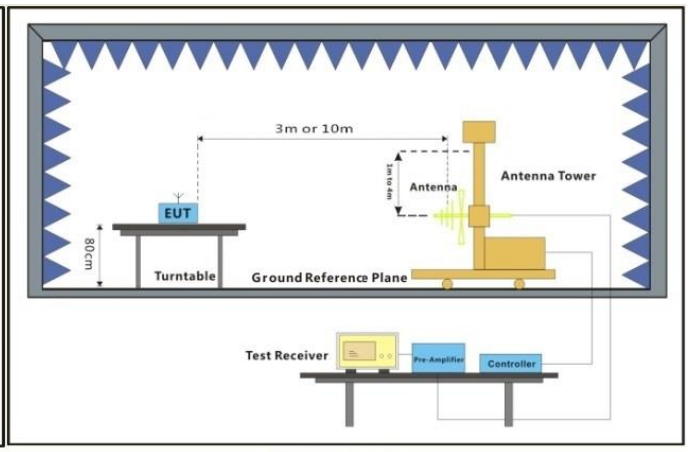
2.7 System Configurations

Device reference	Manufacturer	Description	Model Number	Serial Number
A	MindMaze SA	Izar Ball	MMIZ-S1	IZAR-0E000086, 87
B	MindMaze SA	Izar Ball charger	MMIZ-D1	0E81
C	YHY	AC/DC adapter	E-2013-PWR2-ACDC	NSN

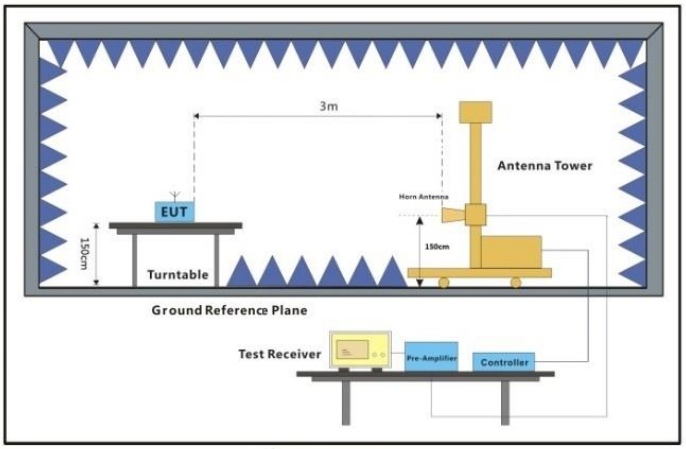
2.8 Configuration Diagrams (Radiated)



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 embedded module soldered to the main PCB and therefore cannot be easily replaced. Part number is antenova SR4W035.

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:	24.2 °C
Relative Humidity:	40.1 %
Atmospheric Pressure:	97.9 kPa

4.4 *Test Equipment*

Test End Date: 3/23/2022 Tester: JOP

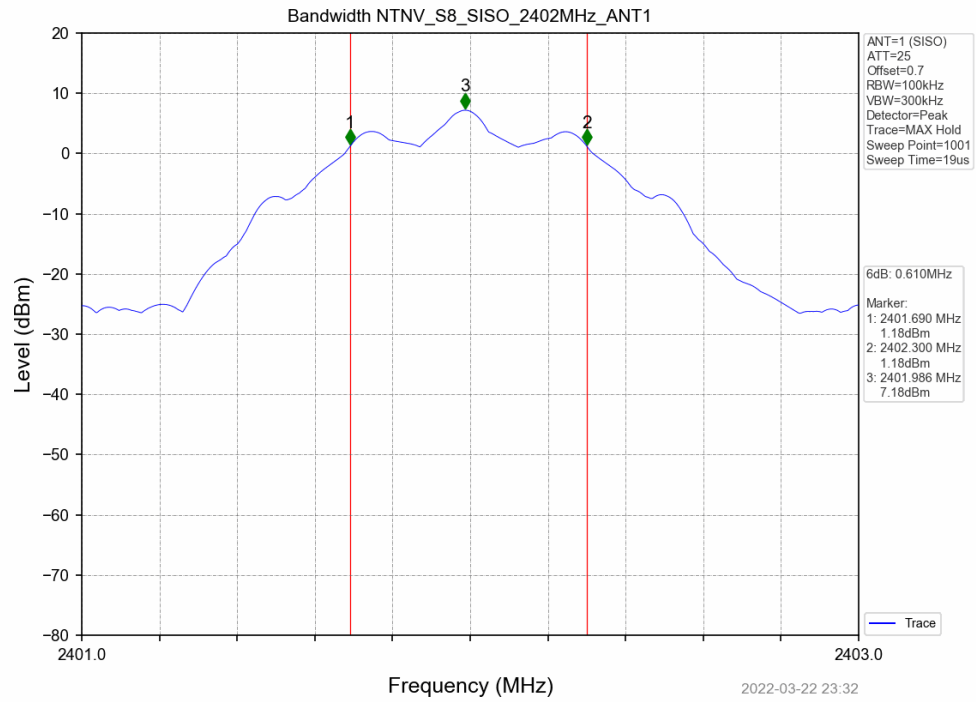
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	EDYNE STORM MICROW	20107	16-Mar-2022	16-Mar-2023
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

4.5 *Test Data – 6dB Bandwidth*

Test Mode	Frequency (MHz)	TX Type	ANT No.	6dB BW (MHz)	Limit (MHz)	Verdict
S8	2402	SISO	1	0.610	≥0.5	PASS
	2440	SISO	1	0.610	≥0.5	PASS
	2480	SISO	1	0.611	≥0.5	PASS
S2	2402	SISO	1	0.714	≥0.5	PASS
	2440	SISO	1	0.716	≥0.5	PASS
	2480	SISO	1	0.704	≥0.5	PASS
1M	2402	SISO	1	0.718	≥0.5	PASS
	2440	SISO	1	0.714	≥0.5	PASS
	2480	SISO	1	0.712	≥0.5	PASS
2M	2402	SISO	1	1.142	≥0.5	PASS
	2440	SISO	1	1.134	≥0.5	PASS
	2480	SISO	1	1.137	≥0.5	PASS

Sample Plot

S8 Low Channel (2402MHz)

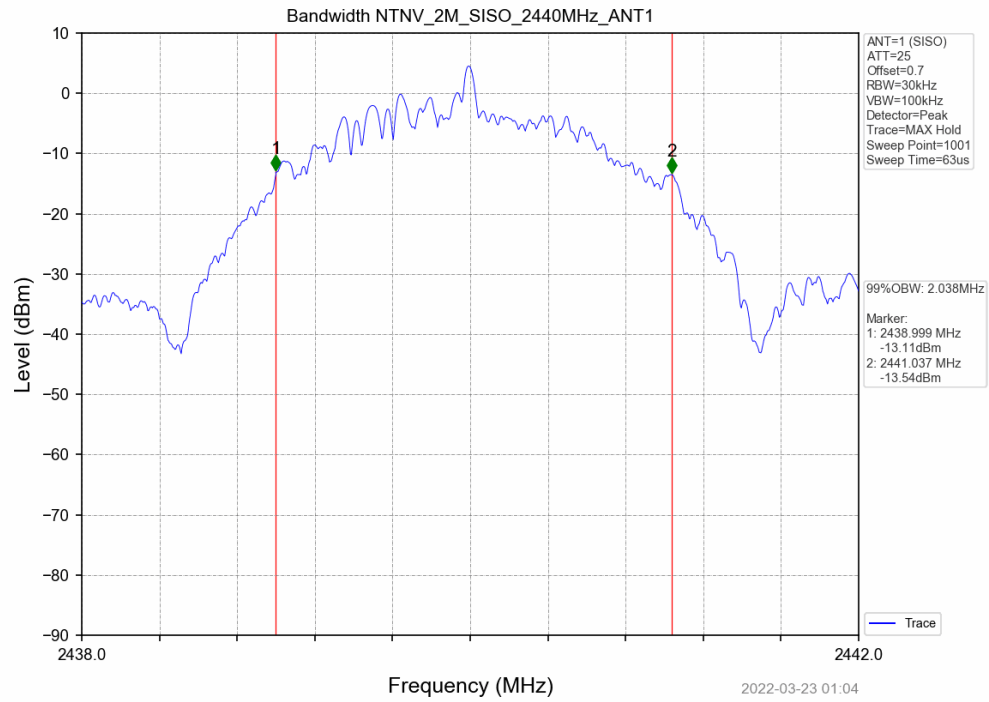


4.6 *Test Data – 99% Bandwidth*

Test Mode	Frequency (MHz)	TX Type	ANT No.	99% OBW (MHz)	Limit (MHz)	Verdict
S8	2402	SISO	1	1.076	≥0.5	Reported
	2440	SISO	1	1.076	≥0.5	Reported
	2480	SISO	1	1.080	≥0.5	Reported
S2	2402	SISO	1	1.036	≥0.5	Reported
	2440	SISO	1	1.038	≥0.5	Reported
	2480	SISO	1	1.040	≥0.5	Reported
1M	2402	SISO	1	1.045	≥0.5	Reported
	2440	SISO	1	1.045	≥0.5	Reported
	2480	SISO	1	1.048	≥0.5	Reported
2M	2402	SISO	1	2.038	≥0.5	Reported
	2440	SISO	1	2.038	≥0.5	Reported
	2480	SISO	1	2.037	≥0.5	Reported

Sample Plot

2M Mid Channel (2480MHz)



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:	24.2 °C
Relative Humidity:	40.1 %
Atmospheric Pressure:	97.9 kPa

5.4 *Test Equipment*

Test End Date: 3/23/2022 Tester: JOP

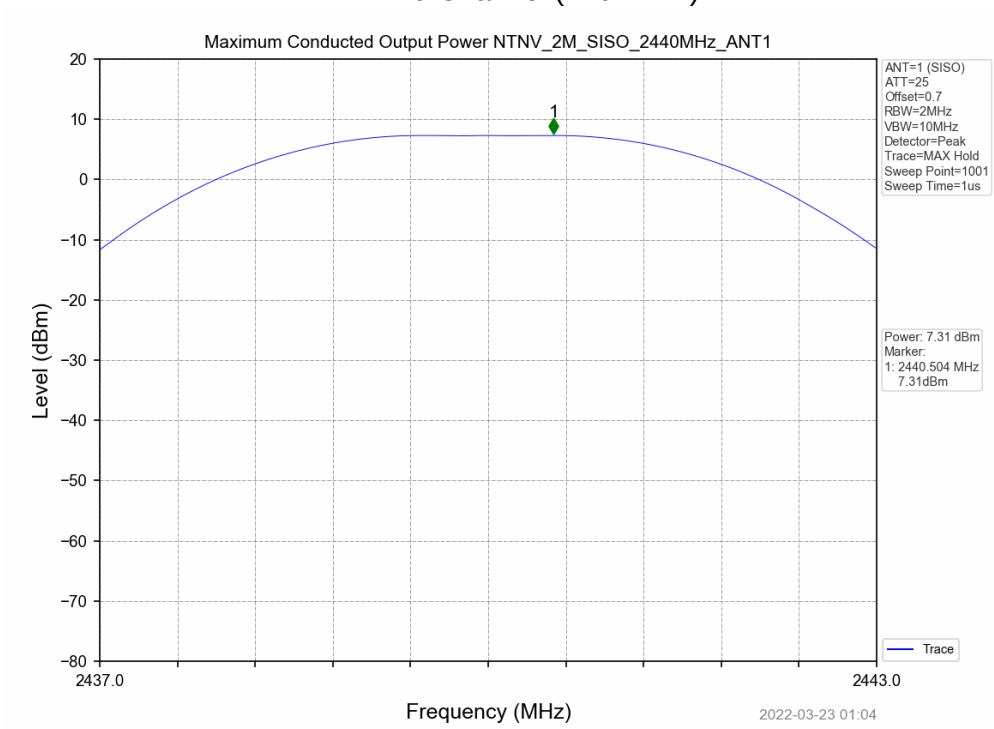
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	EDYNE STORM MICROW	20107	16-Mar-2022	16-Mar-2023
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

5.5 *Test Data*

Test Mode	Frequency (MHz)	TX Type	ANT No.	Peak Output Power (dBm)	Limit (dBm)	Verdict
S8	2402	SISO	1	7.28	30	PASS
	2440	SISO	1	7.28	30	PASS
	2480	SISO	1	7.03	30	PASS
S2	2402	SISO	1	7.26	30	PASS
	2440	SISO	1	7.27	30	PASS
	2480	SISO	1	7.03	30	PASS
1M	2402	SISO	1	7.26	30	PASS
	2440	SISO	1	7.28	30	PASS
	2480	SISO	1	7.03	30	PASS
2M	2402	SISO	1	7.28	30	PASS
	2440	SISO	1	7.31	30	PASS
	2480	SISO	1	7.05	30	PASS

Sample Plot

2M Mid Channel (2402MHz)



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: 24.2 °C
Relative Humidity: 40.1 %
Atmospheric Pressure: 97.9 kPa

6.4 *Test Equipment*

Test End Date: 3/23/2022 Tester: JOP

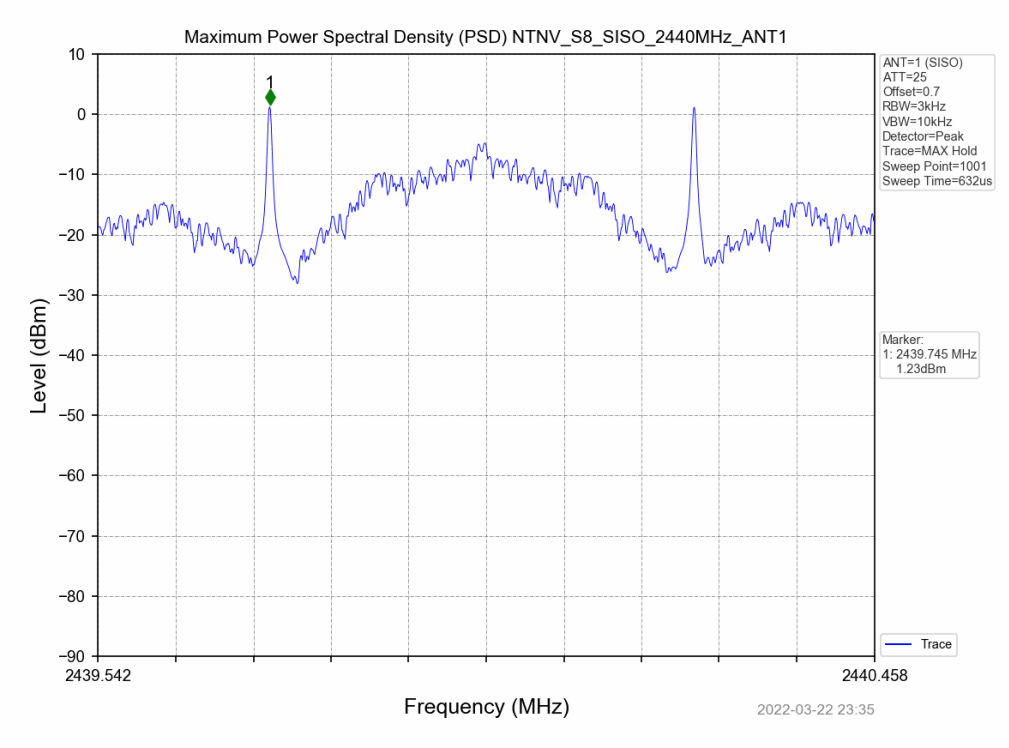
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	EDYNE STORM MICROW	20107	16-Mar-2022	16-Mar-2023
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

6.5 *Test Data*

Frequency (MHz)	Frequency (MHz)	TX Type	ANT No.	Peak PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
S8	2402	SISO	1	1.21	≤8	PASS
	2440	SISO	1	1.23	≤8	PASS
	2480	SISO	1	0.99	≤8	PASS
S2	2402	SISO	1	0.98	≤8	PASS
	2440	SISO	1	0.99	≤8	PASS
	2480	SISO	1	0.83	≤8	PASS
1M	2402	SISO	1	-7.65	≤8	PASS
	2440	SISO	1	-7.69	≤8	PASS
	2480	SISO	1	-8.07	≤8	PASS
2M	2402	SISO	1	-10.35	≤8	PASS
	2440	SISO	1	-10.31	≤8	PASS
	2480	SISO	1	-10.75	≤8	PASS

Sample Plot

S8 Mid Channel (2402MHz)



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:	24.2 °C
Relative Humidity:	40.1 %
Atmospheric Pressure:	97.9 kPa

7.4 *Test Equipment*

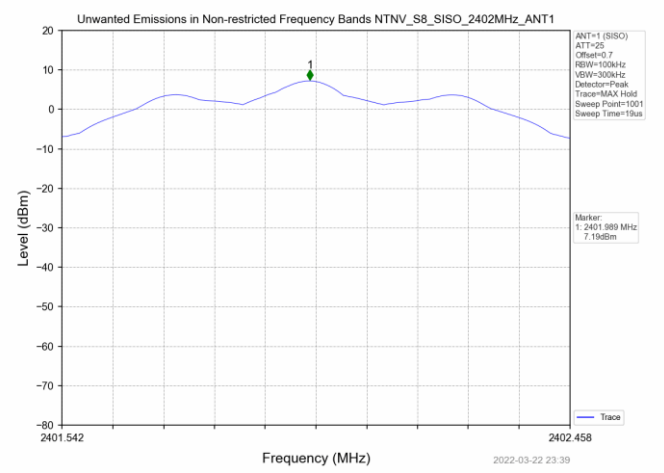
Test End Date: 3/23/2022 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	EDYNE STORM MICROW	20107	16-Mar-2022	16-Mar-2023
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

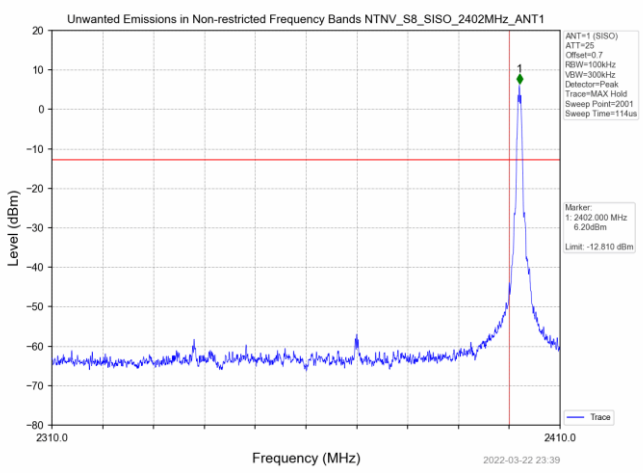
7.5 *Test Data*

Frequency (MHz)	Frequency (MHz)	TX Type	ANT No.	Spurious Conducted Emission (dBm)	Limit (dBm)	Verdict
S8	2402	SISO	1	Refer to test graph	-12.81	PASS
	2440	SISO	1	Refer to test graph	-12.81	PASS
	2480	SISO	1	Refer to test graph	-12.81	PASS
S2	2402	SISO	1	Refer to test graph	-12.76	PASS
	2440	SISO	1	Refer to test graph	-12.76	PASS
	2480	SISO	1	Refer to test graph	-12.76	PASS
1M	2402	SISO	1	Refer to test graph	-12.82	PASS
	2440	SISO	1	Refer to test graph	-12.82	PASS
	2480	SISO	1	Refer to test graph	-12.82	PASS
2M	2402	SISO	1	Refer to test graph	-12.80	PASS
	2440	SISO	1	Refer to test graph	-12.80	PASS
	2480	SISO	1	Refer to test graph	-12.80	PASS

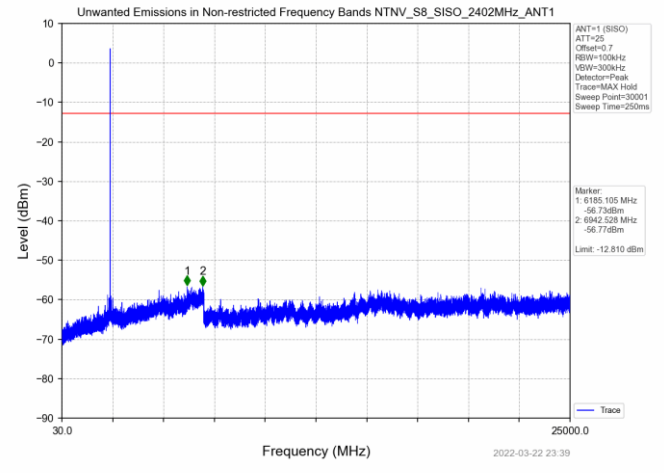
S8 In-Band Reference



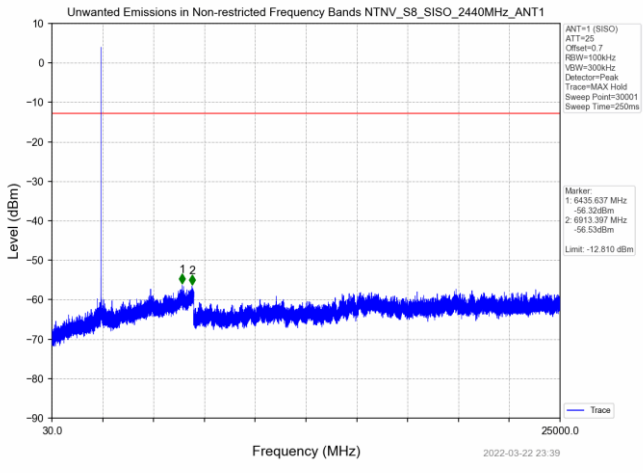
S8 Lower Band Edge - Low Channel (2402MHz)



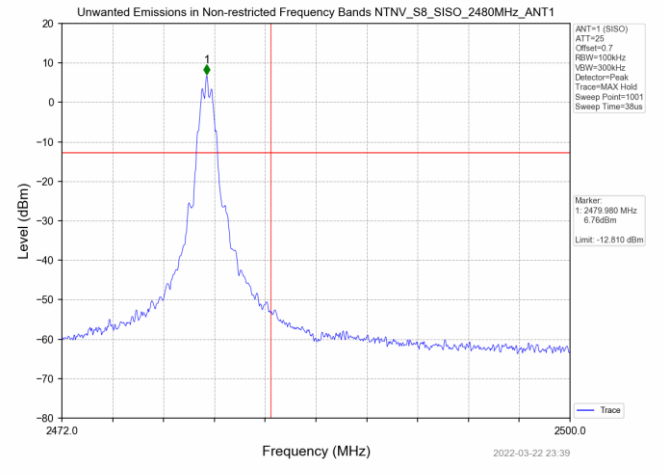
S8 Full Spectrum - Low Channel (2402MHz)



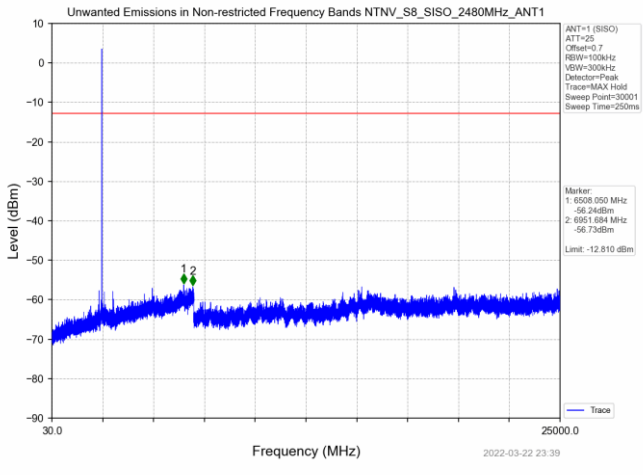
S8 Full Spectrum - Mid Channel (2440MHz)



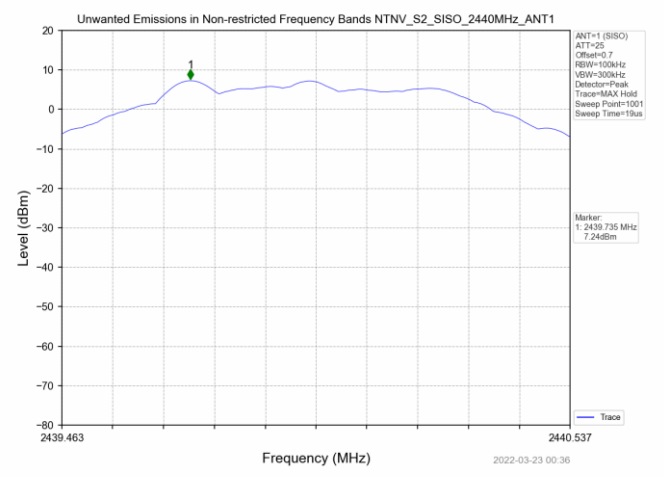
S8 Upper Band Edge – High Channel (2480MHz)



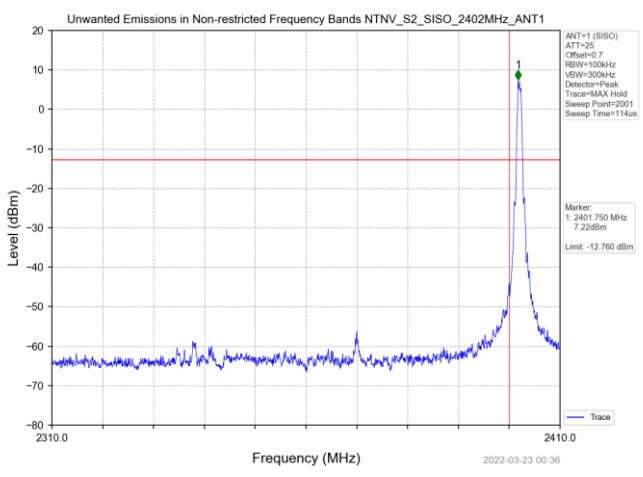
S8 Full Spectrum - High Channel (2480MHz)



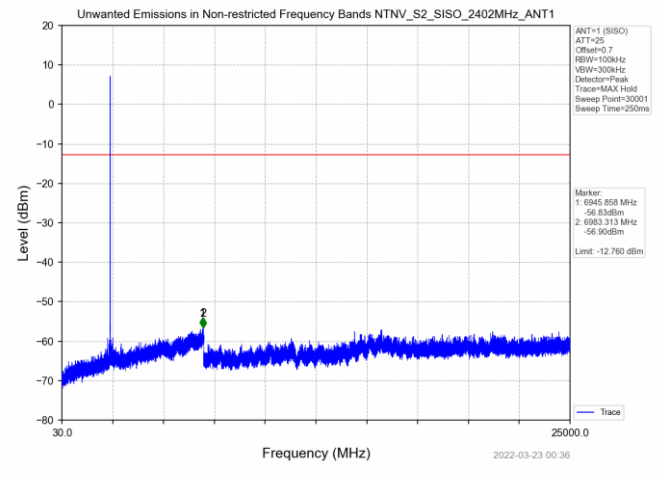
S2 In-Band Reference



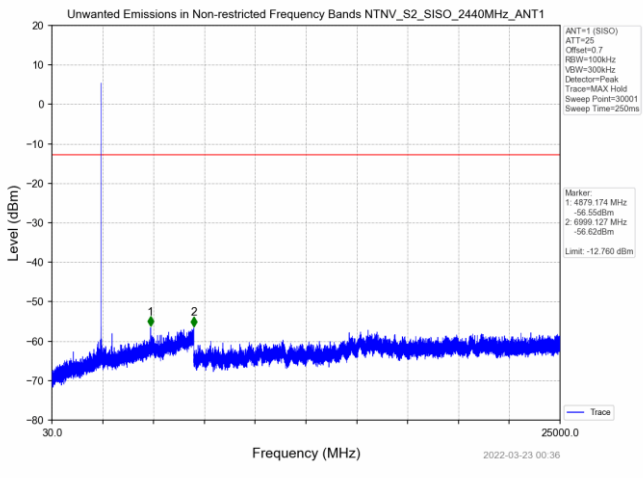
S2 Lower Band Edge - Low Channel (2402MHz)



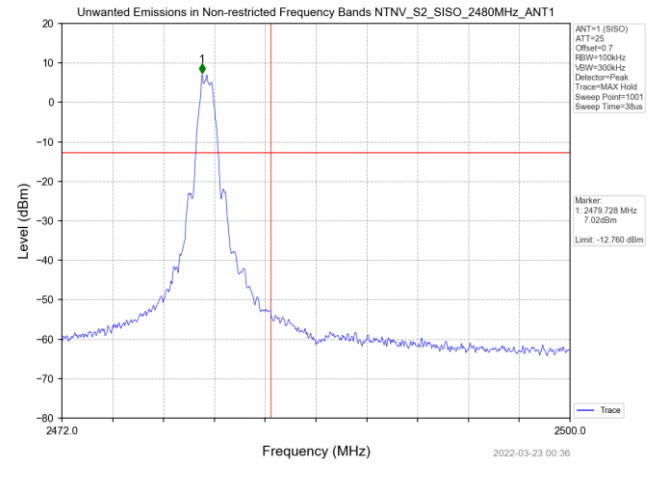
S2 Full Spectrum - Low Channel (2402MHz)



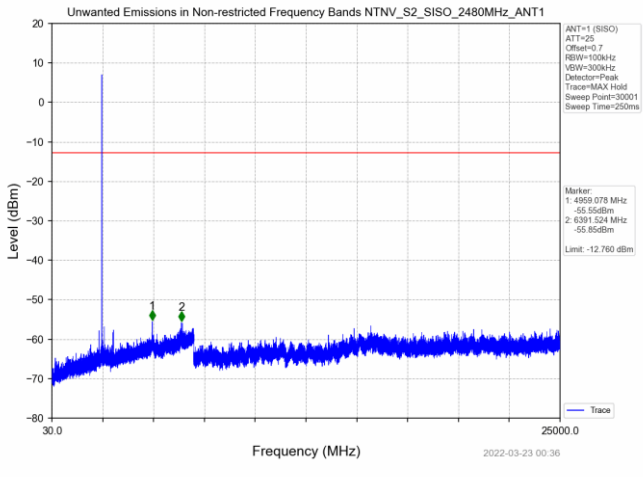
S2 Full Spectrum - Mid Channel (2440MHz)



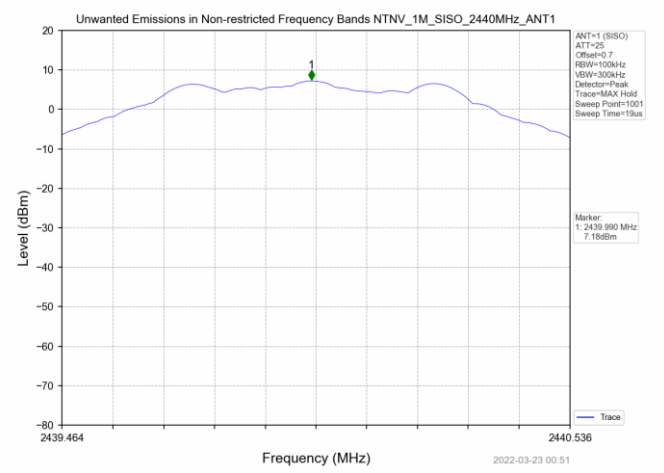
S2 Upper Band Edge – High Channel (2480MHz)



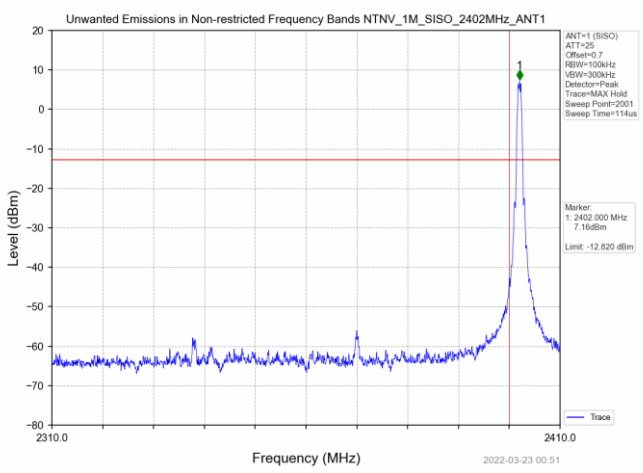
S2 Full Spectrum - High Channel (2480MHz)



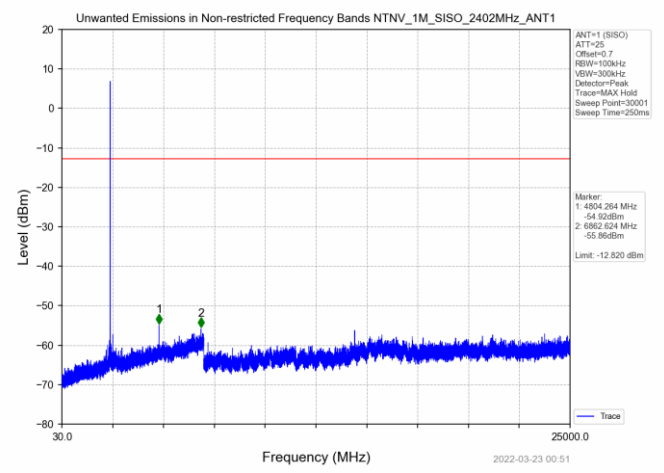
1M In-Band Reference



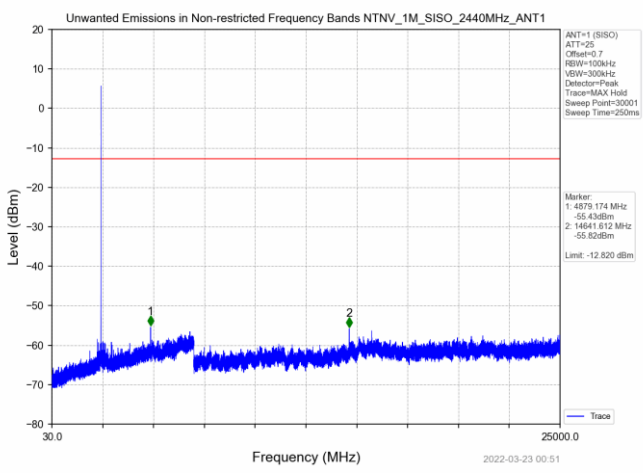
1M Lower Band Edge - Low Channel (2402MHz)



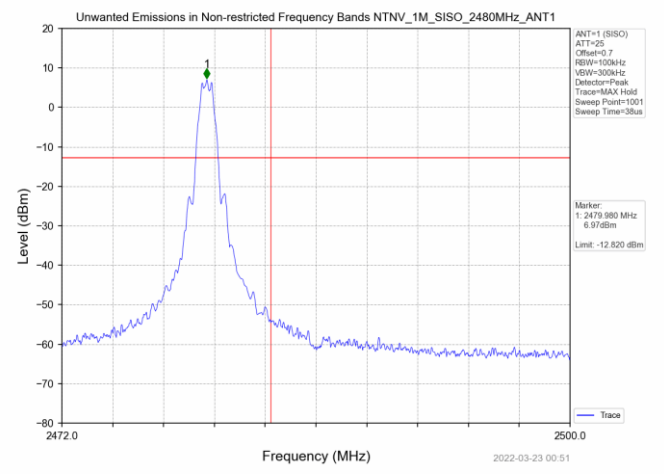
1M Full Spectrum - Low Channel (2402MHz)



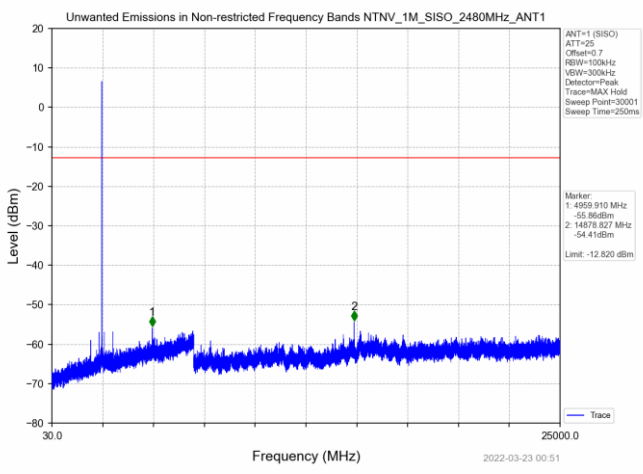
1M Full Spectrum - Mid Channel (2440MHz)



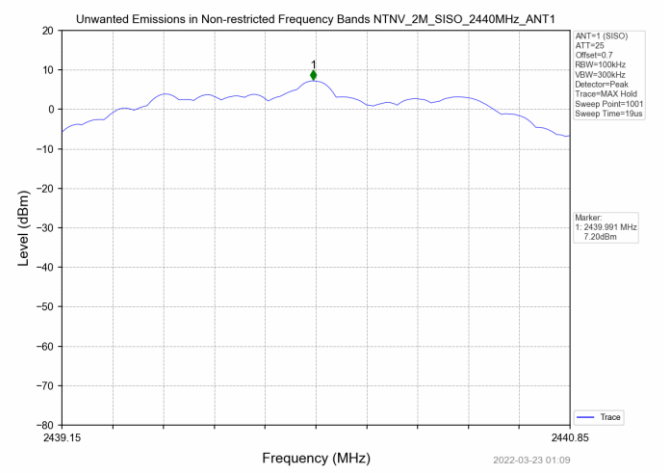
1M Upper Band Edge – High Channel (2480MHz)



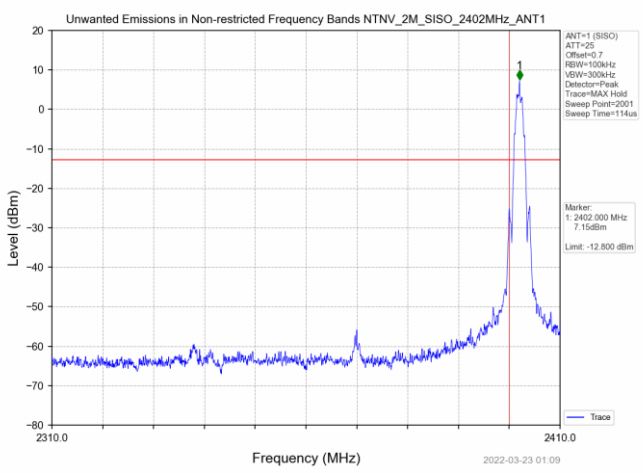
1M Full Spectrum - High Channel (2480MHz)



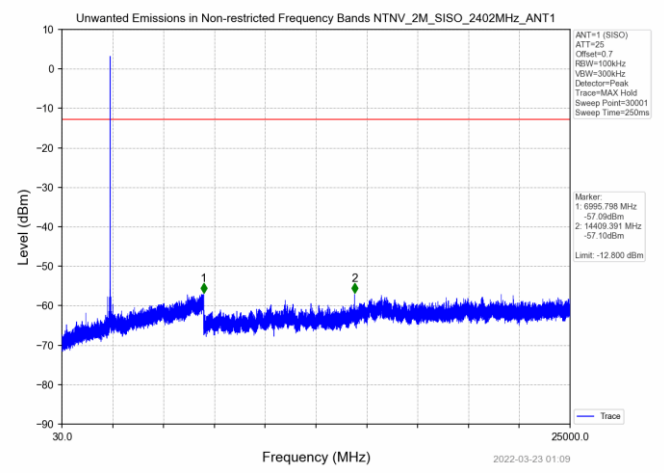
2M In-Band Reference



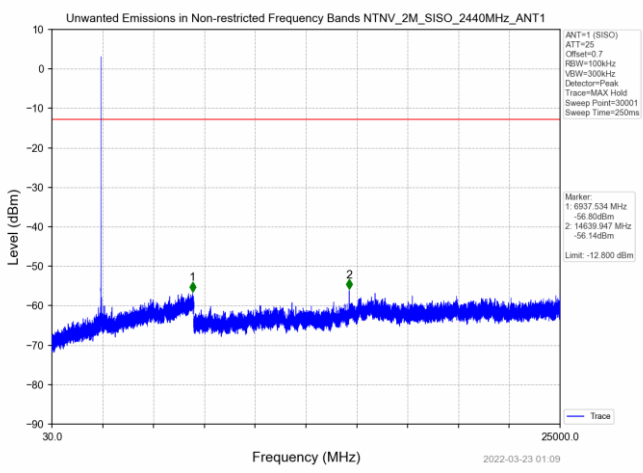
2M Lower Band Edge - Low Channel (2402MHz)



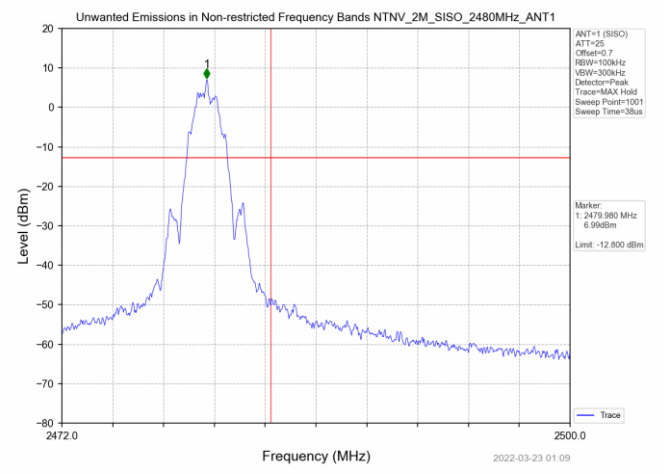
2M Full Spectrum - Low Channel (2402MHz)



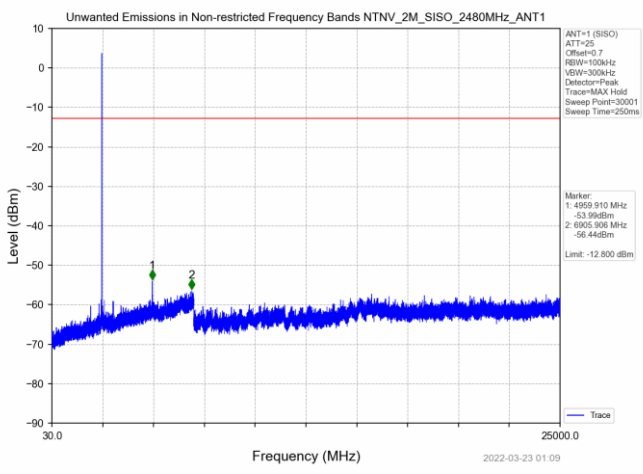
2M Full Spectrum - Mid Channel (2440MHz)



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.

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

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions	Apr 4 2022	Apr 26 2022
Temperature:	21.8 °C	22.1 °C
Relative Humidity:	29.9 %	54.3 %
Atmospheric Pressure:	98.06 kPa	98.3 kPa

8.4 *Test Equipment*

9kHz-30MHz

Test End Date: 26-Apr-2022 Tester: LM

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ANTENNA, LOOP, ACTIVE	6502	ETS LINDGREN	B085752	20-Aug-2020	20-Aug-2022
N to N RF Cable	NC12-N1N1-276	MEGAPHASE	22001	10-Jan-2022	10-Jan-2023
RF CABLE NM TO NF, 0.01-18GHZ	90-213-118	TELEDYNE STORM MICROWAVE	20117	17-Feb-2022	17-Feb-2023
RF CABLE NM TO NM, 0.01-18GHZ	90-195-079	TELEDYNE STORM MICROWAVE	20123	14-Feb-2022	14-Feb-2023
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	9-Jul-2021	9-Jul-2022

30-1000MHz

Test End Date: 4-Apr-2022 Tester: AB

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	NC12-N1N1-276	MEGAPHASE	22000	10-Jan-2022	10-Jan-2023
RF CABLE	SF106	HUBER & SUHNER	B079713	26-Aug-2021	26-Aug-2022
LOW NOISE AMPLIFIER	ZKL-2+	MINI-CIRCUITS	B079800	18-Oct-2021	18-Oct-2022
4DB ATTENUATOR NM TO NF	BW-N4W5+	MINI-CIRCUITS	19004	29-Mar-2022	29-Mar-2023
RF CABLE NM TO NM, 0.01-18GHZ	90-195-079	TELEDYNE STORM MICROWAVE	20124	14-Feb-2022	14-Feb-2023
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	26-Aug-2021	26-Aug-2022
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	9-Jul-2021	9-Jul-2022

Above 1 GHz

Test End Date: 4-Apr-2022 Tester: LM

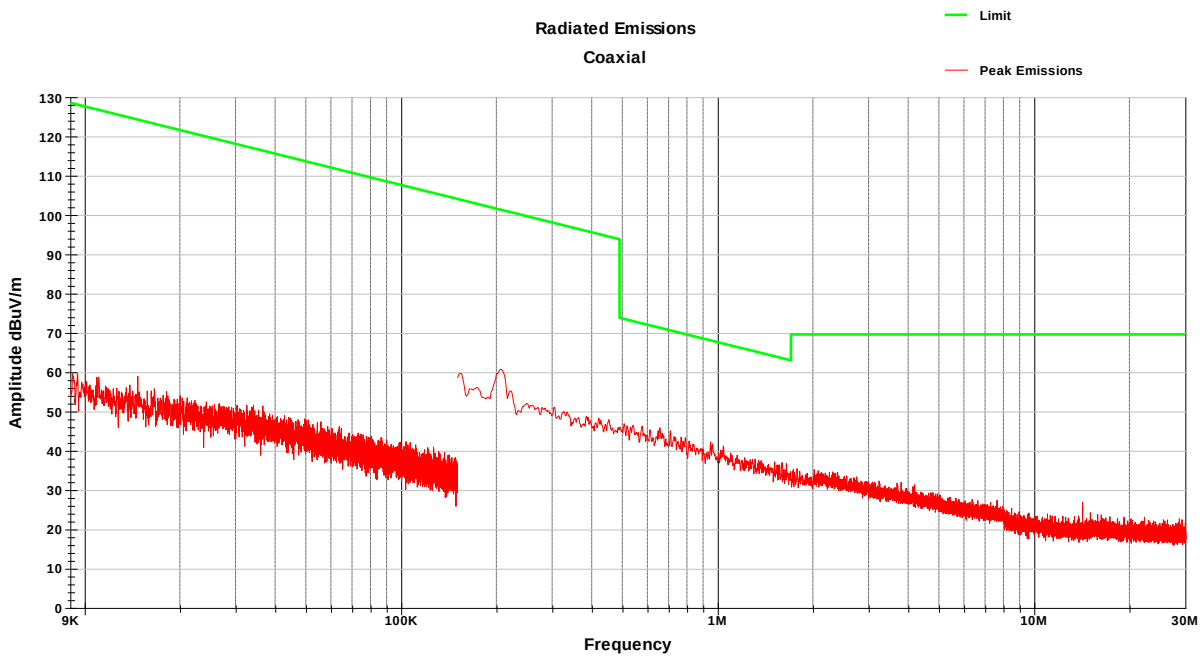
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079699	15-Jul-2020	15-Jul-2022
N to N RF Cable	NC12-N1N1-276	MEGAPHASE	22000	10-Jan-2022	10-Jan-2023
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	7-Oct-2021	7-Oct-2022
RF CABLE	104PE	HUBER & SUHNER	B079793	24-Aug-2021	24-Aug-2022
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	21-Jun-2021	21-Jun-2022

Software:
TILE! RSE 30-1000 MHz T7 March 18 2022
TILE! RSE 9k – 30M Active Red Loop T7 April 19 2022
TILE! RSE 1 – 18 GHz T7 Feb 12 2021

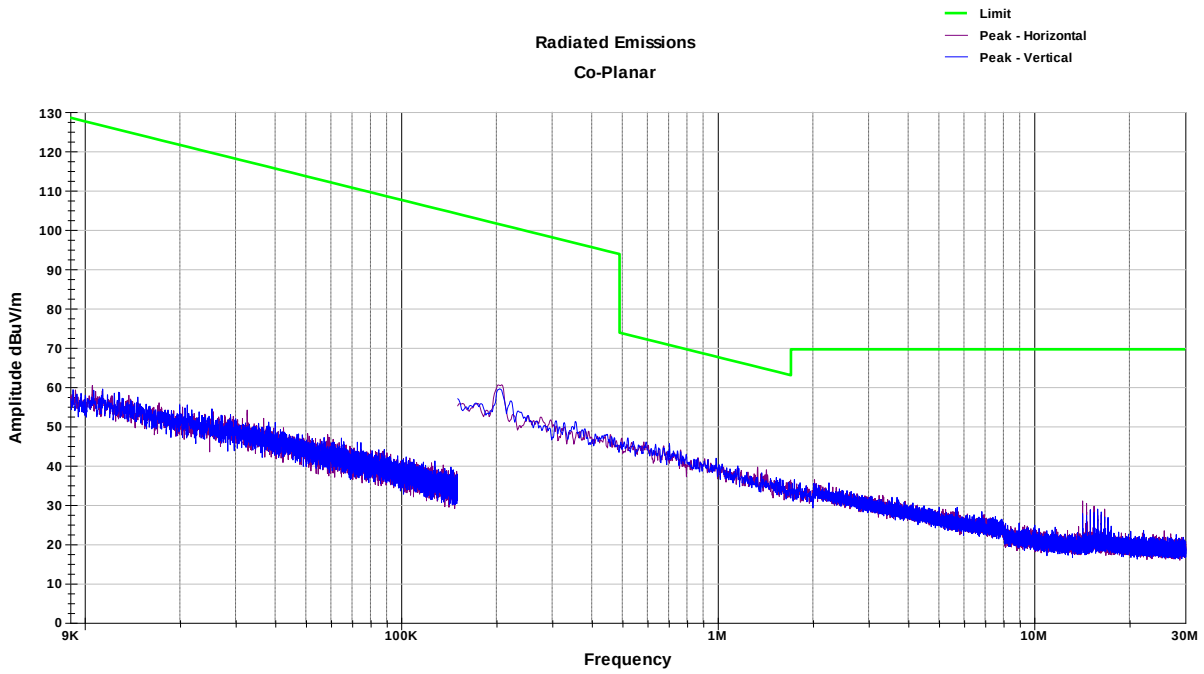
8.5 *Test Data – Peak Plots*

Between 9kHz and 1000MHz, there was no significant deviation with respect to axis or channel

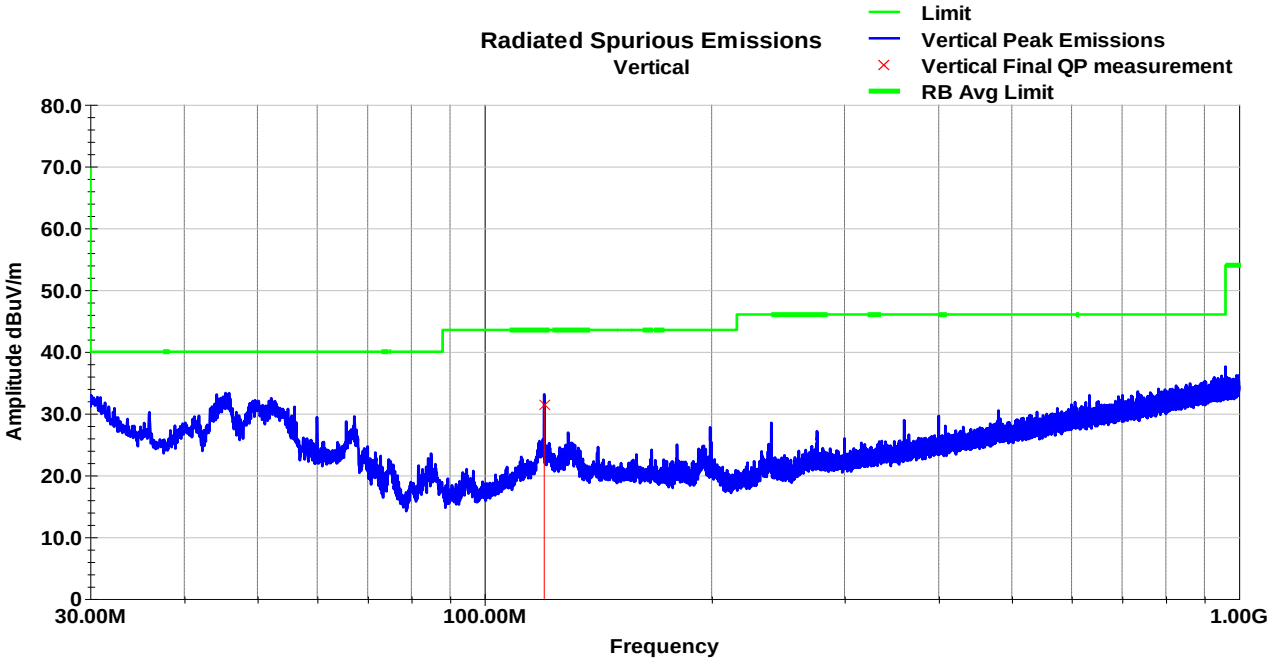
Co-Axial Radiated Spurious Emissions – 9kHz-30MHz



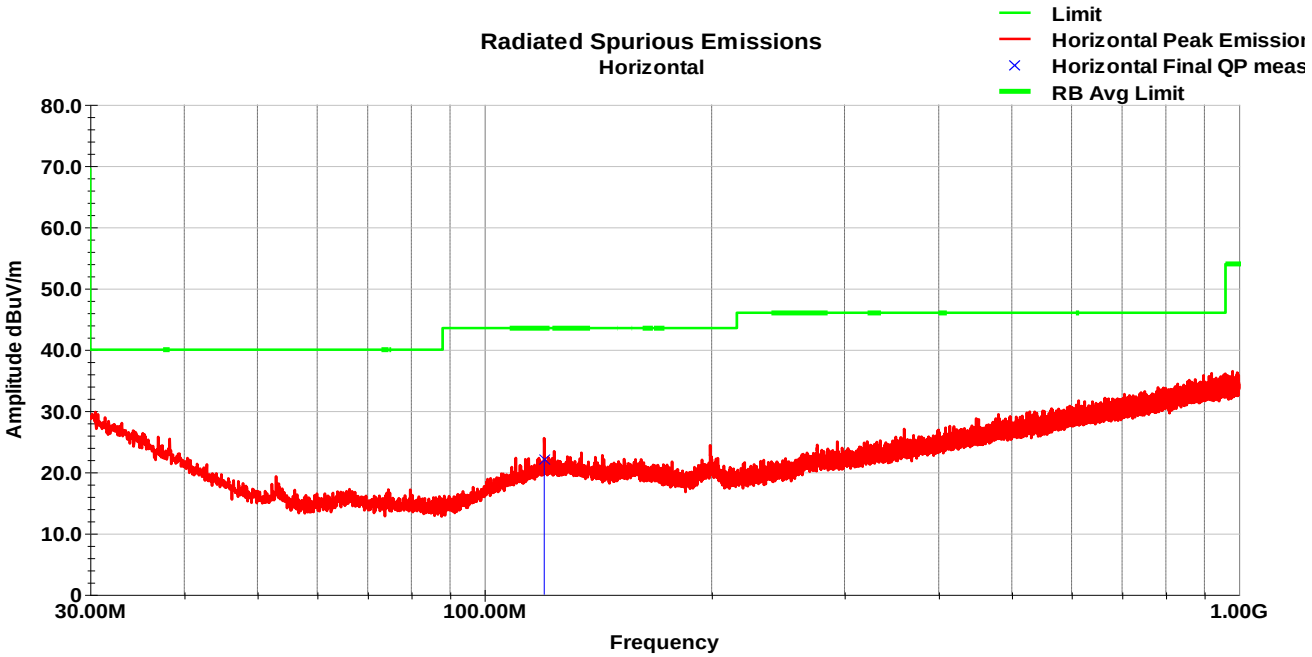
Co-Planar Radiated Spurious Emissions – 9kHz-30MHz



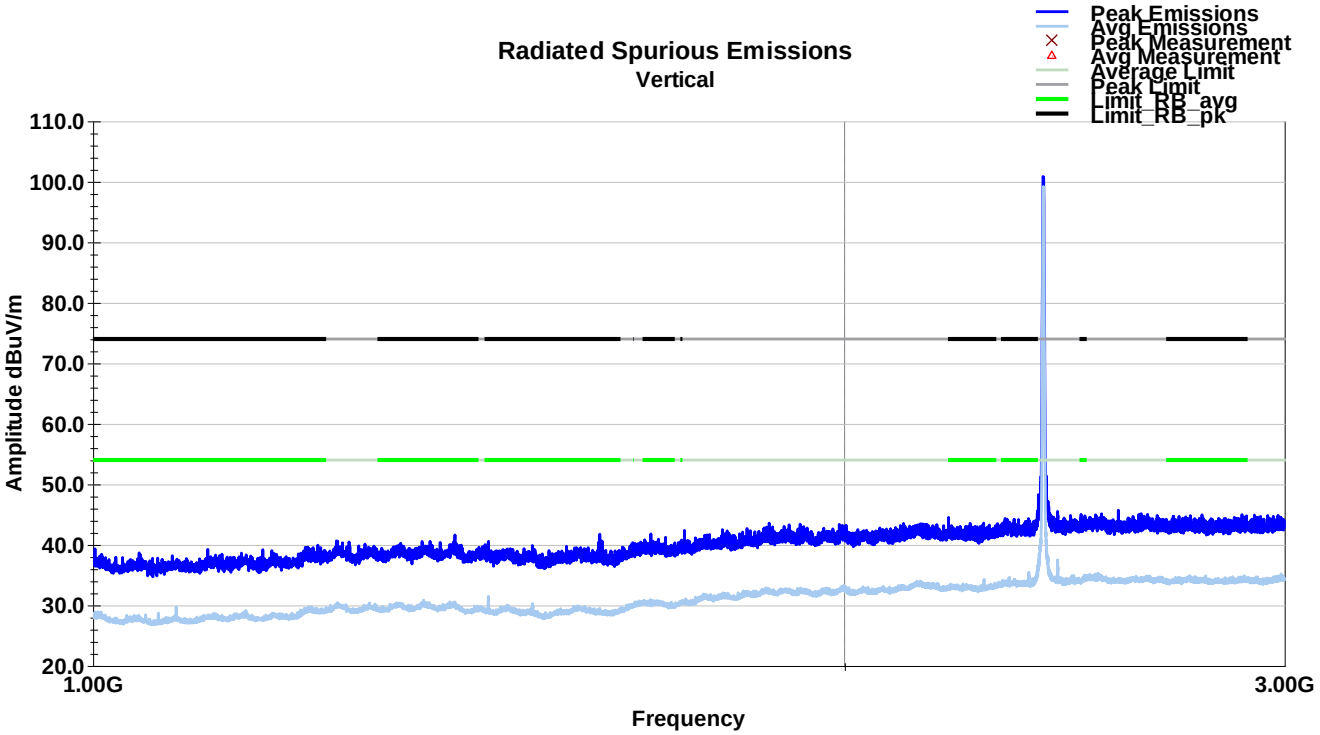
Vertical Radiated Spurious Emissions – 30-1000MHz



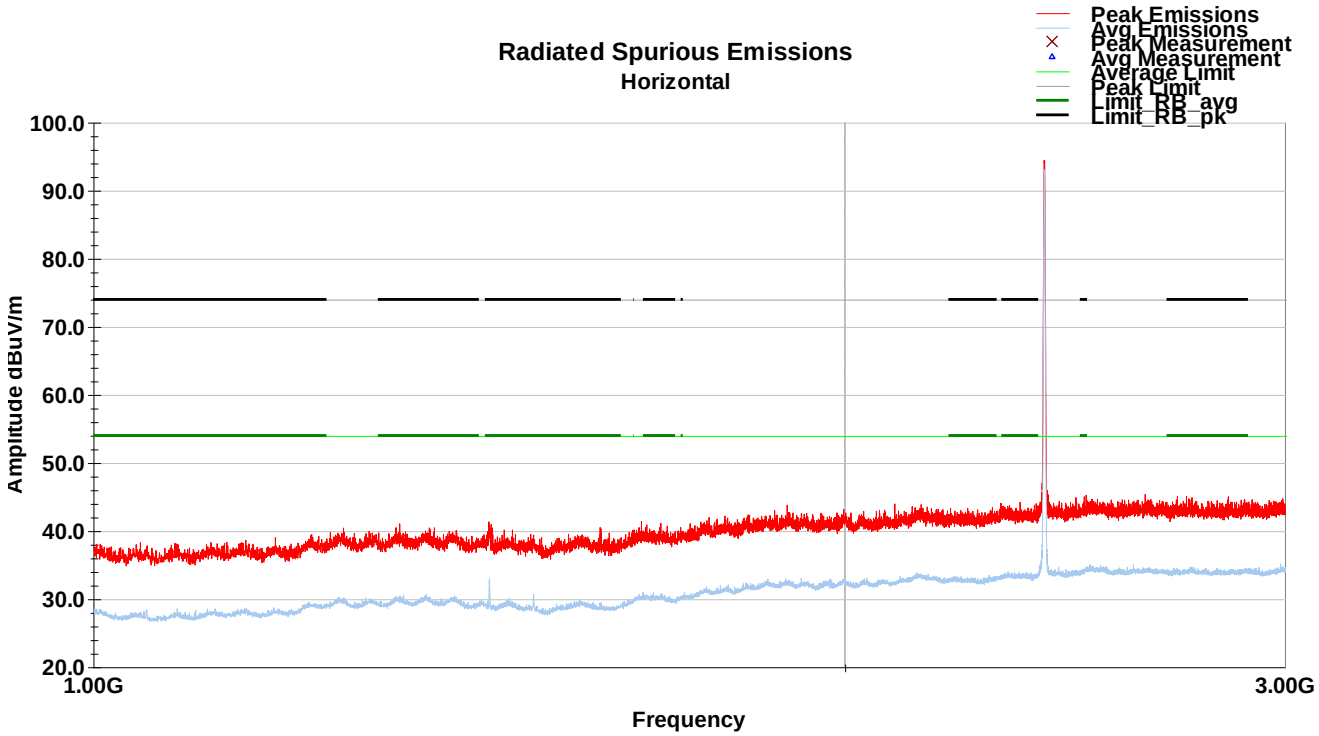
Horizontal Radiated Spurious Emissions – 30-1000MHz



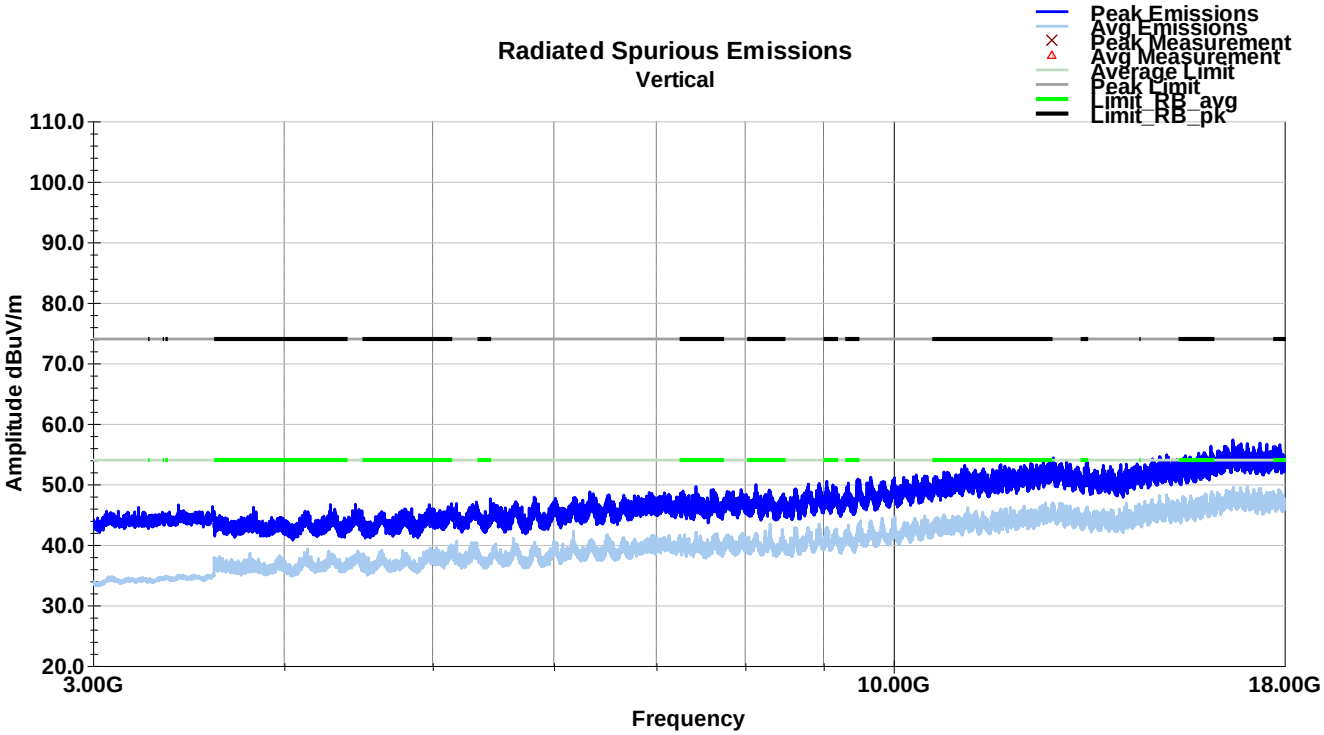
Vertical Radiated Spurious Emissions – 1-3GHz (LCH)



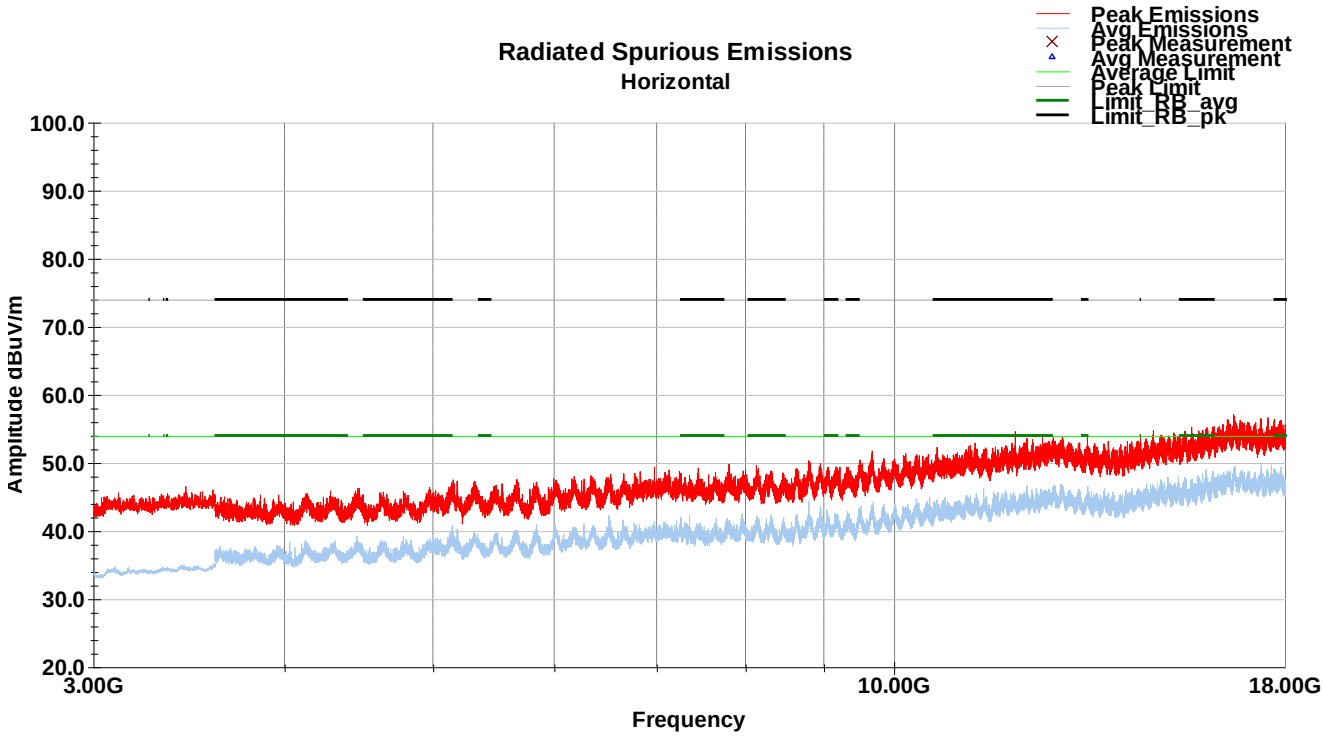
Horizontal Radiated Spurious Emissions – 1-3GHz (LCH)



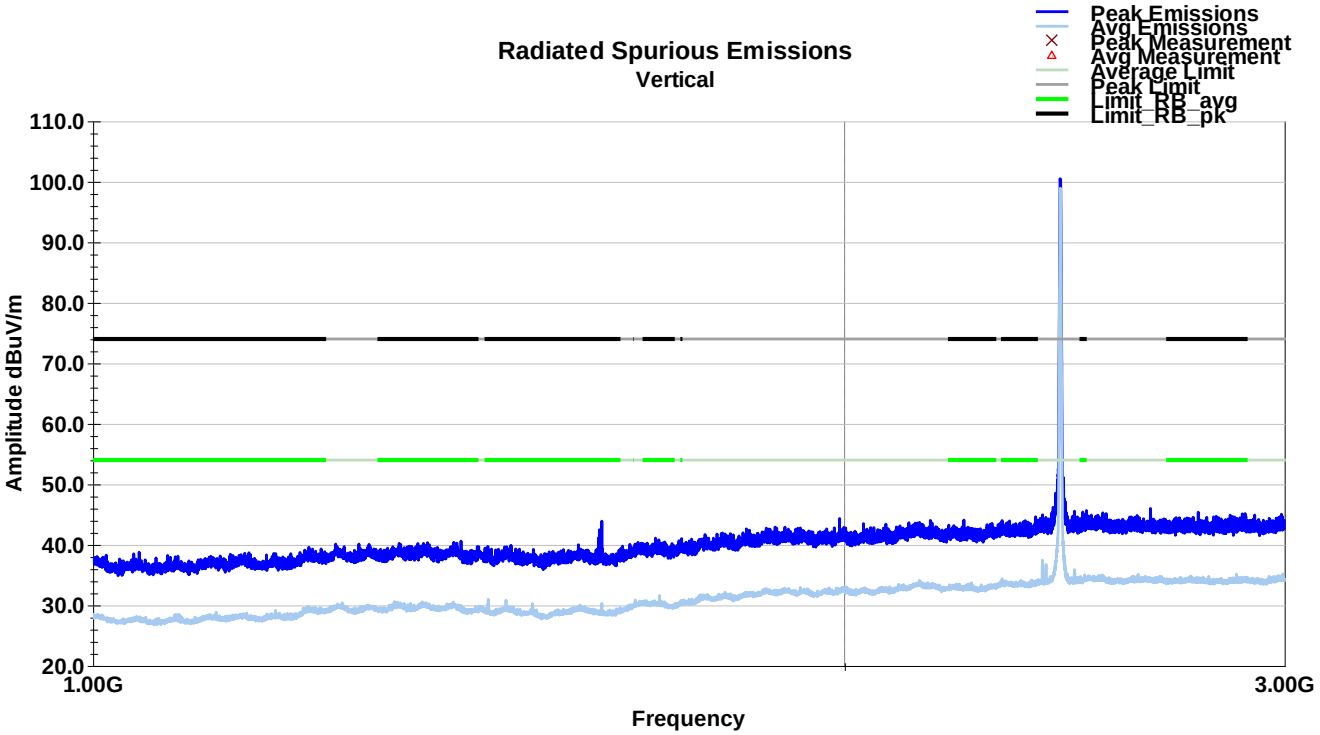
Vertical Radiated Spurious Emissions – 3-18GHz (LCH)



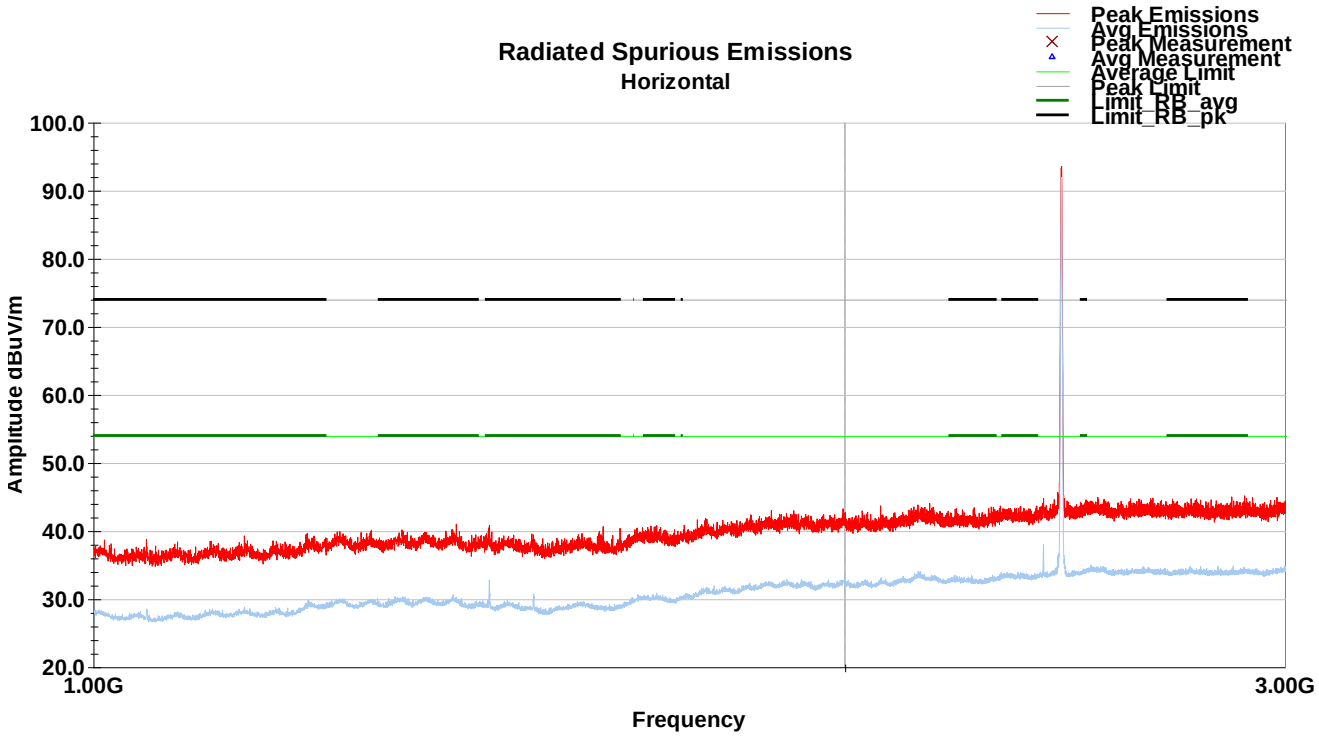
Horizontal Radiated Spurious Emissions – 3-18GHz (LCH)



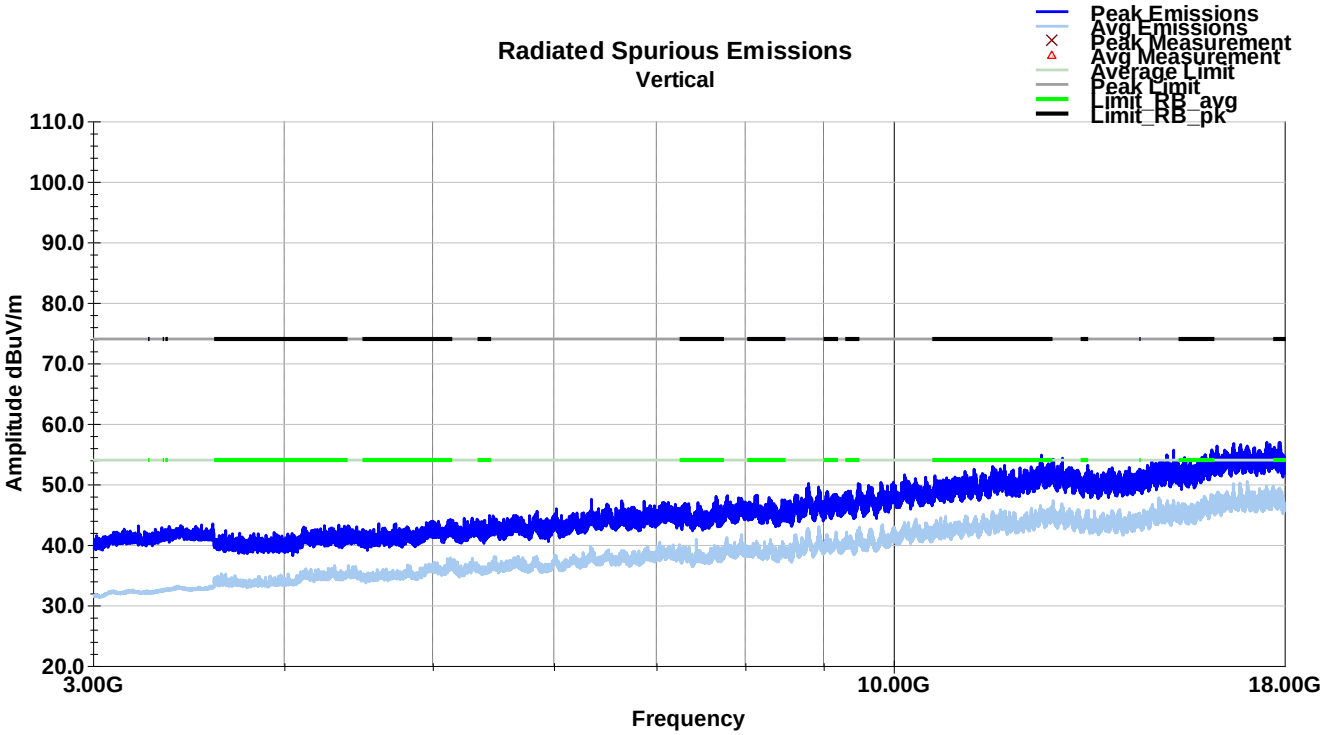
Vertical Radiated Spurious Emissions – 1-3GHz (MCH)



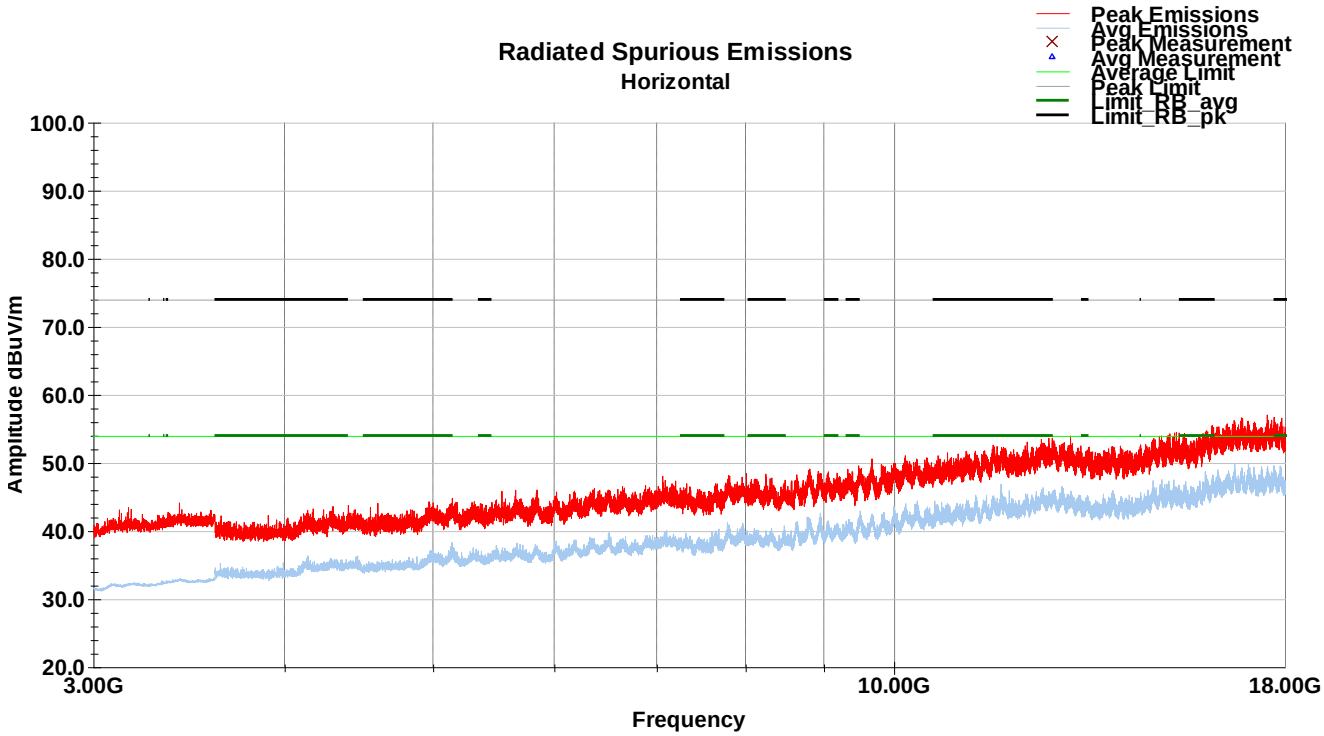
Horizontal Radiated Spurious Emissions – 1-3GHz (MCH)



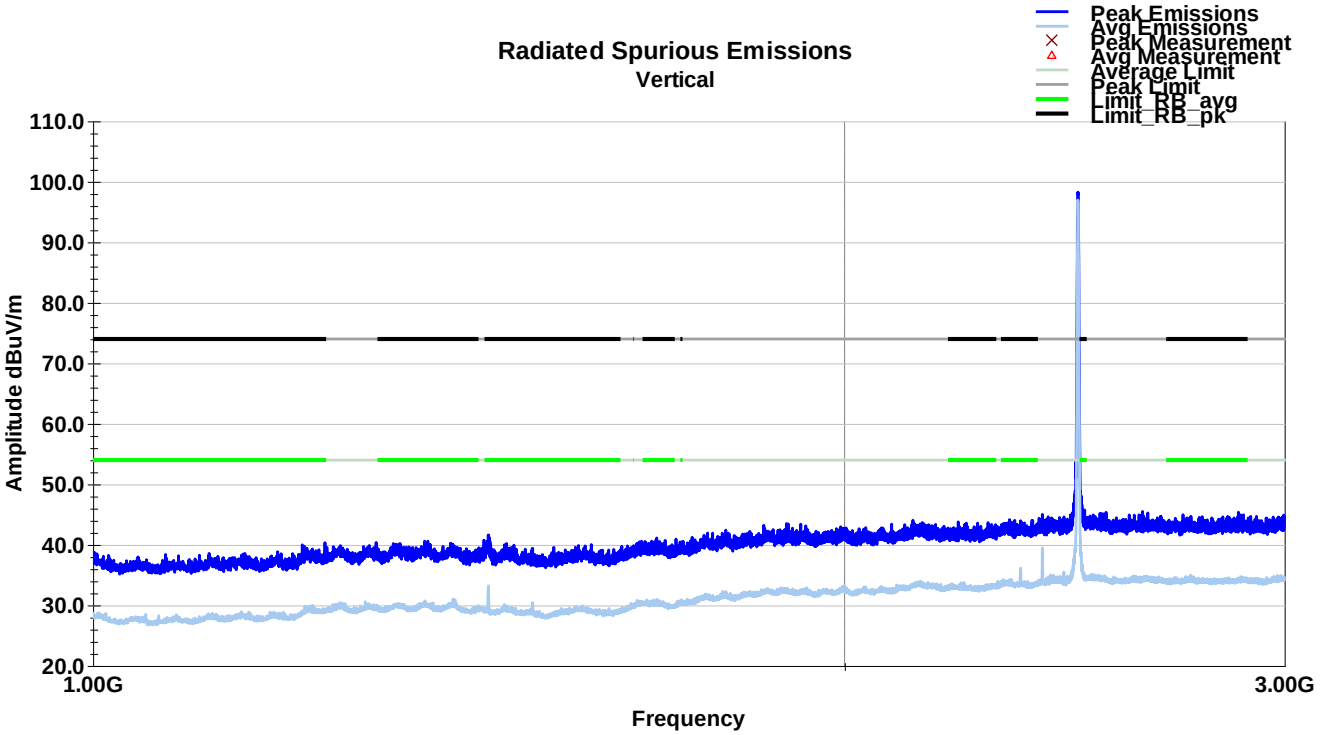
Vertical Radiated Spurious Emissions – 3-18GHz (MCH)



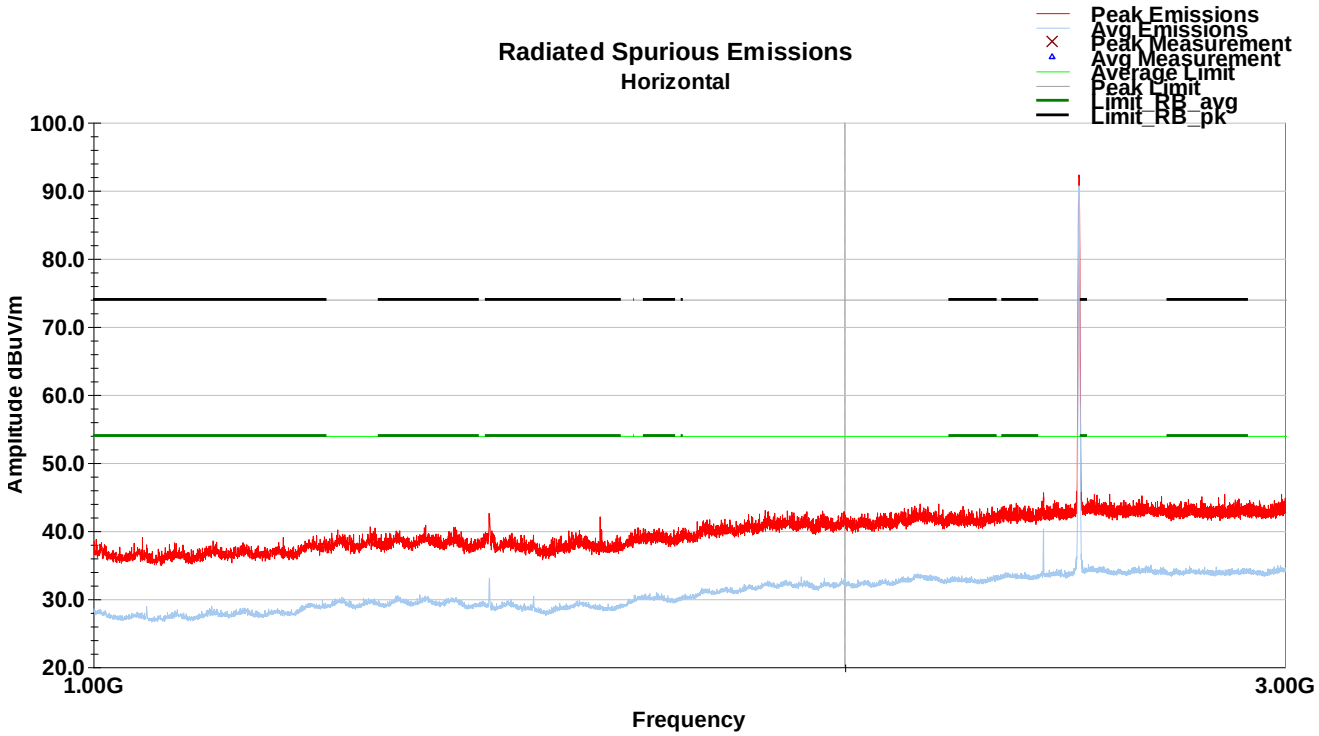
Horizontal Radiated Spurious Emissions – 3-18GHz (MCH)



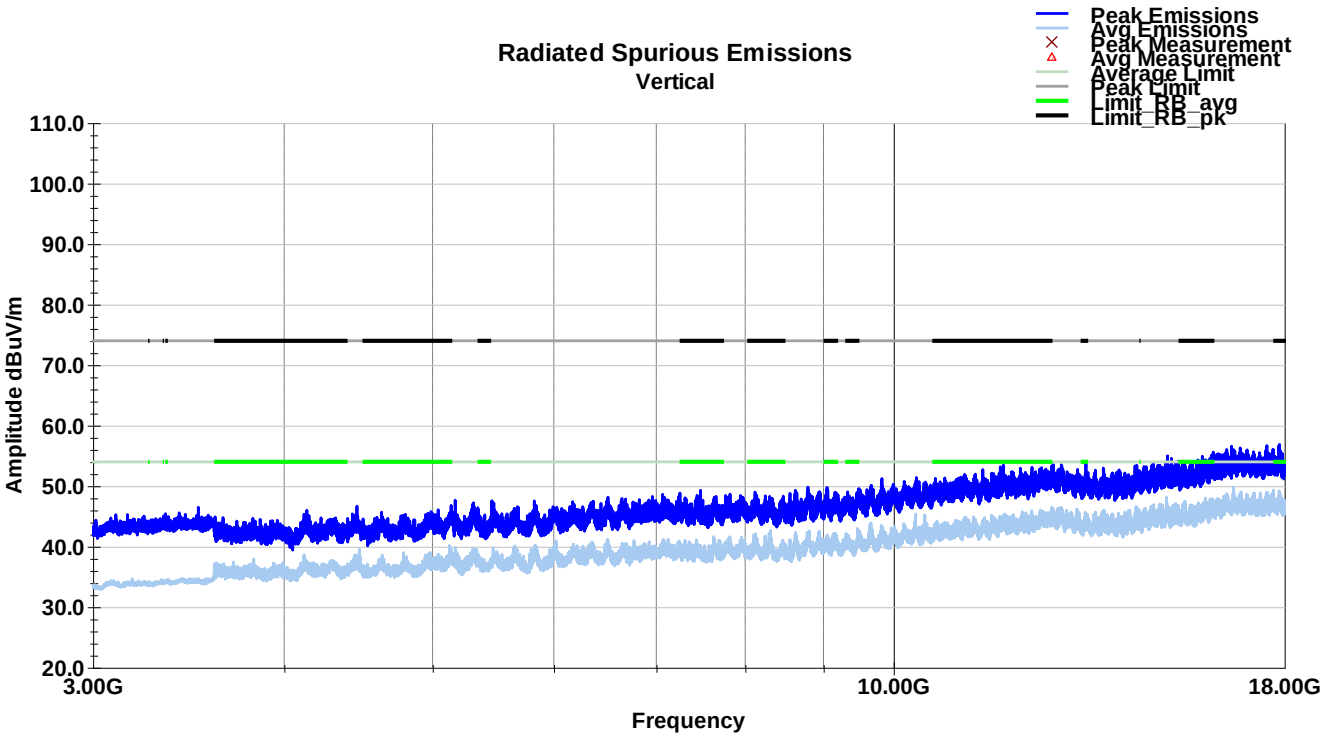
Vertical Radiated Spurious Emissions – 1-3GHz (HCH)



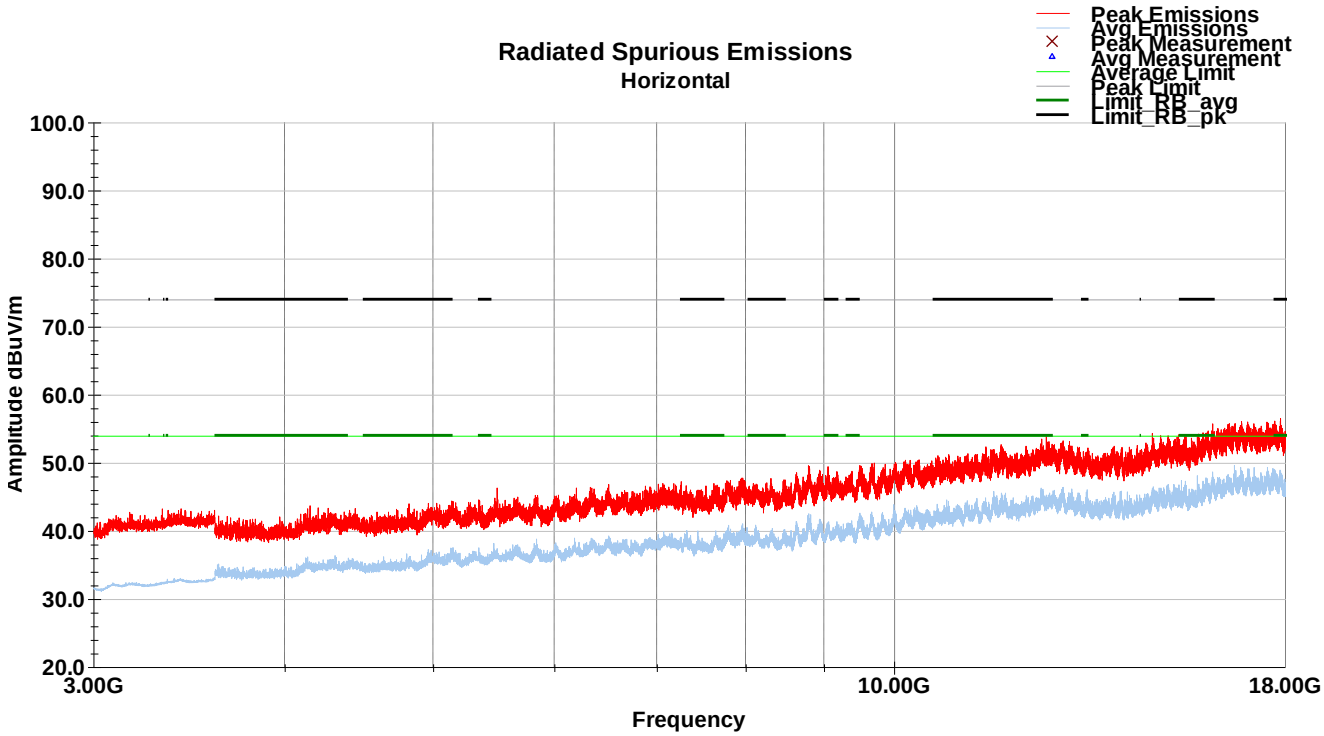
Horizontal Radiated Spurious Emissions – 1-3GHz (HCH)



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



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



8.1 *Test Data – Tabular Data*

Tabular Test Results – Peak Data

Vertical emissions – 30-1000MHz

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
119.98	43.6	V	258.0	245.0	13.6	5.5	31.5	31.2	43.5	-12.3
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

Horizontal emissions – 30-1000MHz

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
120.02	36.0	H	175.0	239.0	13.6	5.5	31.5	23.6	43.5	-20.0
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

Tabular Test Results – Average Data

Note: All emissions captured except for above tables were >20dB from limit.

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

Environmental Conditions

Temperature: 24.2 °C
Relative Humidity: 40.1 %
Atmospheric Pressure: 97.9 kPa

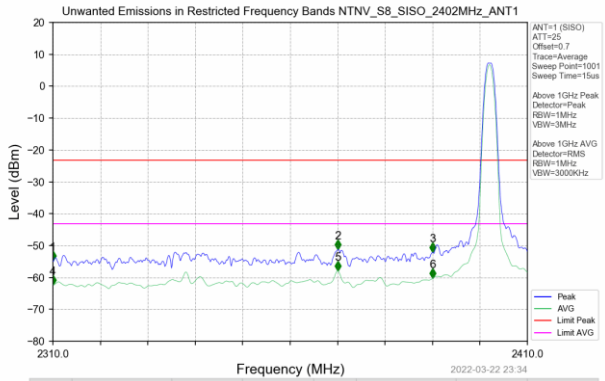
9.4 *Test Equipment*

Test End Date: 3/23/2022 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	EDYNE STORM MICROW	20107	16-Mar-2022	16-Mar-2023
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

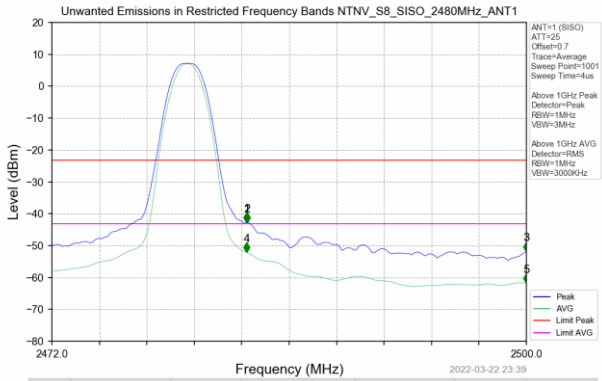
9.5 *Test Data – Restricted Band Edges*

S8 Low Channel



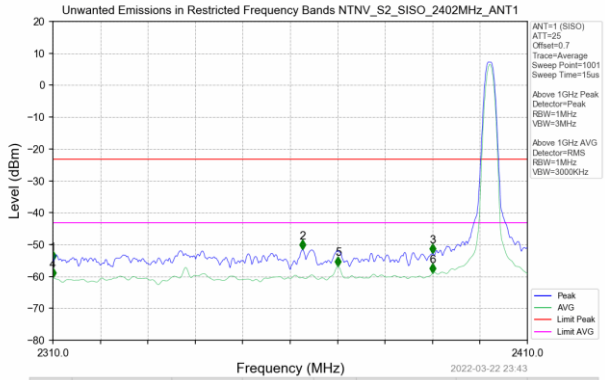
Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2310.000	-54.740	Peak	4	2310.000	-62.313	AVG
2	2370.100	-51.213	Peak	5	2370.000	-57.928	AVG
3	2390.000	-52.196	Peak	6	2390.000	-60.319	AVG

S8 High Channel



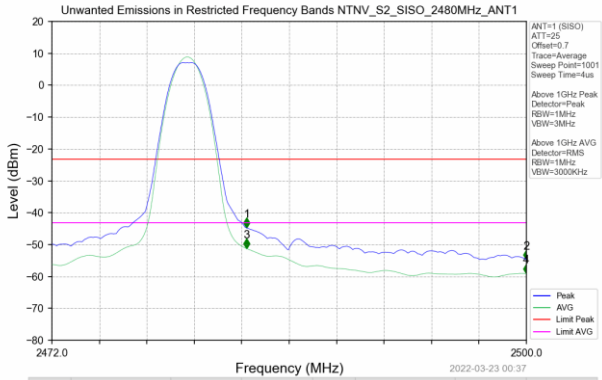
Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2483.500	-42.771	Peak	4	2483.500	-52.125	AVG
2	2483.508	-42.765	Peak	5	2500.000	-61.796	AVG
3	2500.000	-51.867	Peak				

S2 Low Channel



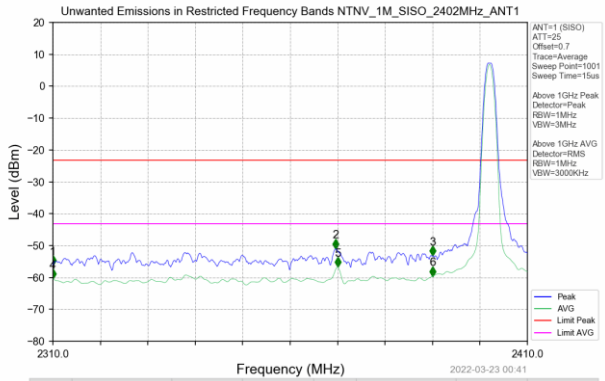
Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2310.000	-55.095	Peak	4	2310.000	-60.498	AVG
2	2362.600	-51.668	Peak	5	2370.100	-56.804	AVG
3	2390.000	-52.822	Peak	6	2390.000	-58.991	AVG

S2 High Channel



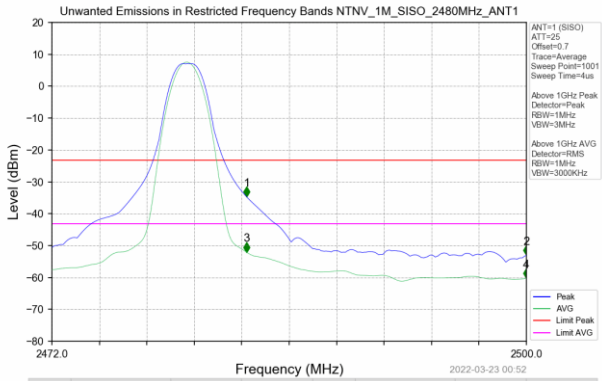
Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2483.500	-44.751	Peak	3	2483.500	-51.228	AVG
2	2500.000	-54.734	Peak	4	2500.000	-59.108	AVG

1M Low Channel



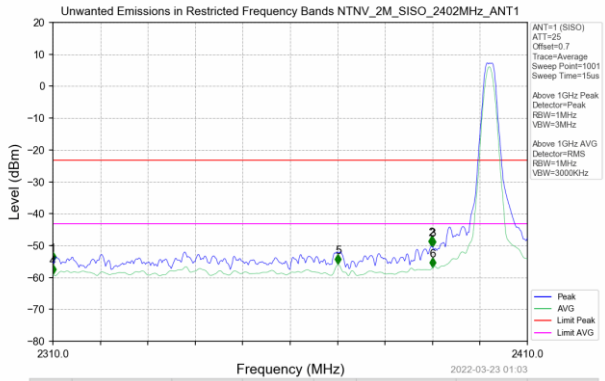
Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2310.000	-56.134	Peak	4	2310.000	-60.438	AVG
2	2369.600	-51.011	Peak	5	2370.000	-56.798	AVG
3	2390.000	-53.267	Peak	6	2390.000	-59.656	AVG

1M High Channel



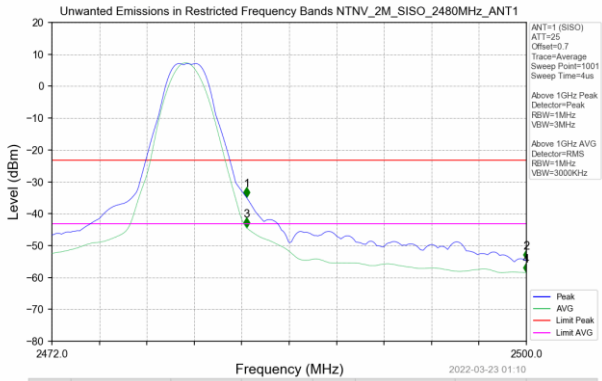
Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2483.500	-34.661	Peak	3	2483.500	-52.053	AVG
2	2500.000	-53.074	Peak	4	2500.000	-60.280	AVG

2M Low Channel



Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2310.000	-55.165	Peak	4	2310.000	-58.957	AVG
2	2389.800	-50.243	Peak	5	2370.100	-55.895	AVG
3	2390.000	-50.451	Peak	6	2390.000	-56.906	AVG

2M High Channel



Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2483.500	-34.896	Peak	3	2483.500	-44.328	AVG
2	2500.000	-54.503	Peak	4	2500.000	-58.519	AVG

10 Conducted Emissions

10.1 *Test Result*

Test Description	Classification	Basic Standard	Test Result
Conducted Emissions	B	RSS-GEN 7.2.4 15.207 ANSI C63.4	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	Class A Limits (dBµV)	Class B Limits (dBµV)
0.15 to 0.5 MHz	Quasi-Peak 79 / Average 66	Quasi-Peak 66 to 56 / Average 56 to 46
0.5 to 5 MHz	Quasi-Peak 73 / Average 60	Quasi-Peak 56 / Average 46
5 to 30 MHz	Quasi-Peak 73 / Average 60	Quasi-Peak 60 / Averge 50

10.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 21.2 °C
Relative Humidity: 48.2 %
Atmospheric Pressure: 96.66 kPa

10.4 *Test Equipment*

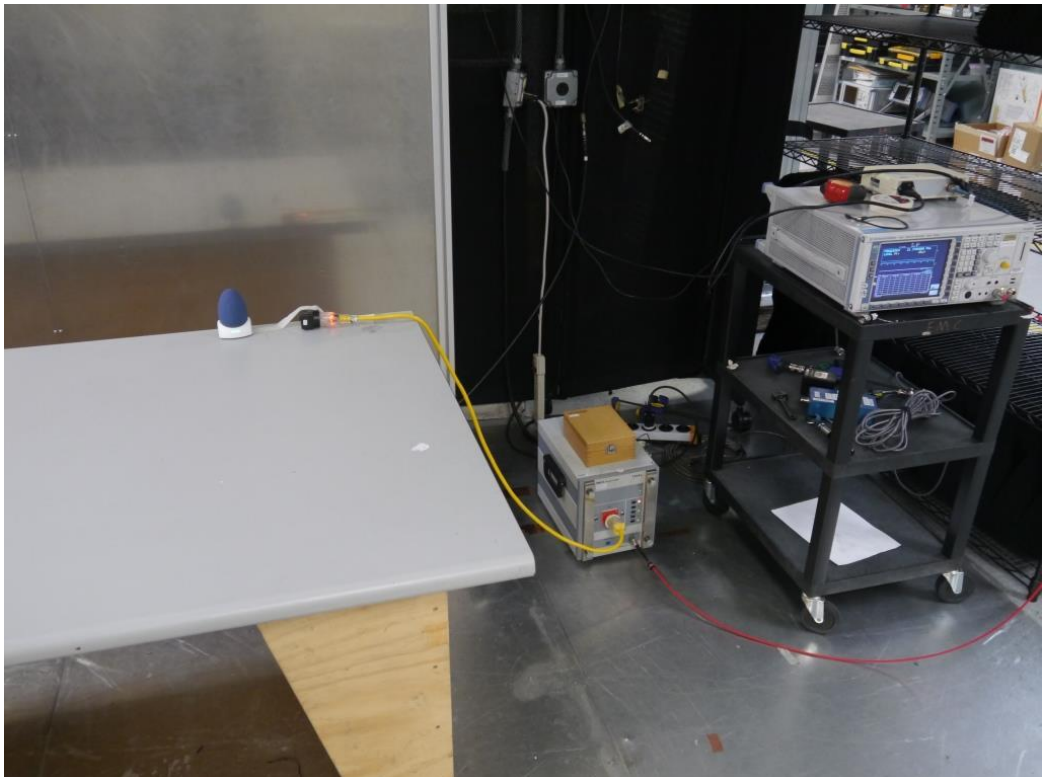
Test End Date: 31-Mar-2022 Tester: ZH

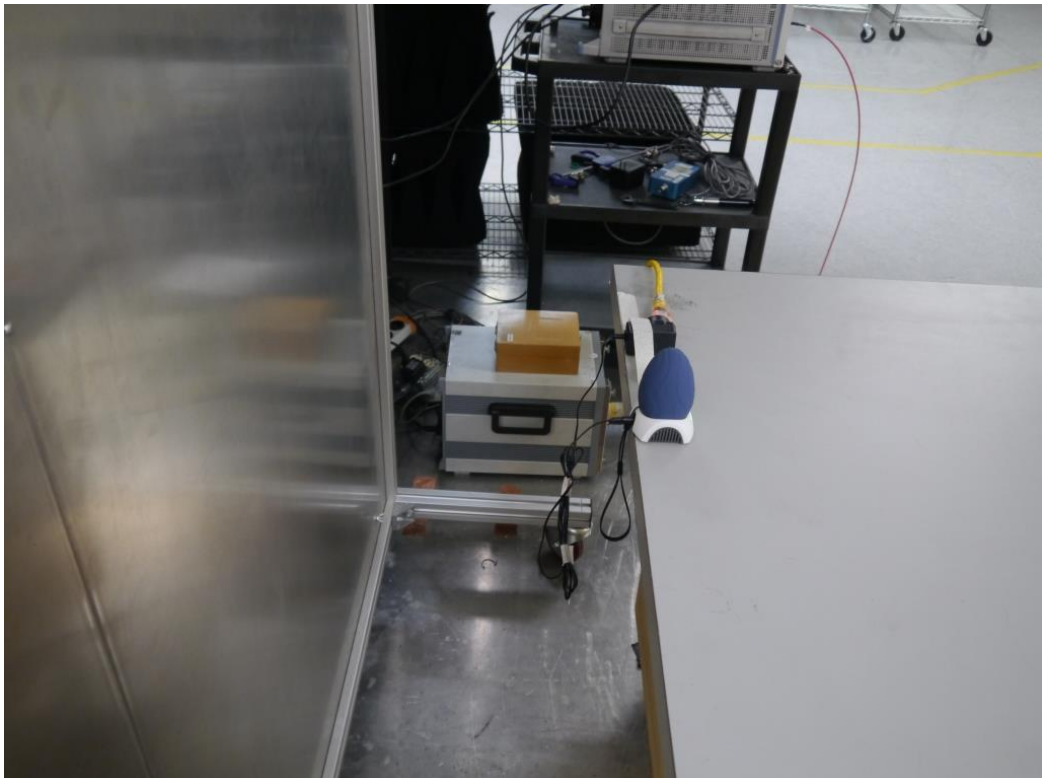
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	9-Jul-2021	9-Jul-2022
LINE IMPEDANCE STABILIZATION NETWORK	NNB 51	TESEQ	B087573	3-Feb-2022	3-Feb-2023
RF CABLE	UC-N-MM-78	MAURY MICROWAVE	17016	25-Aug-2021	25-Aug-2022

Note: Refer to the table for calibration intervals.

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

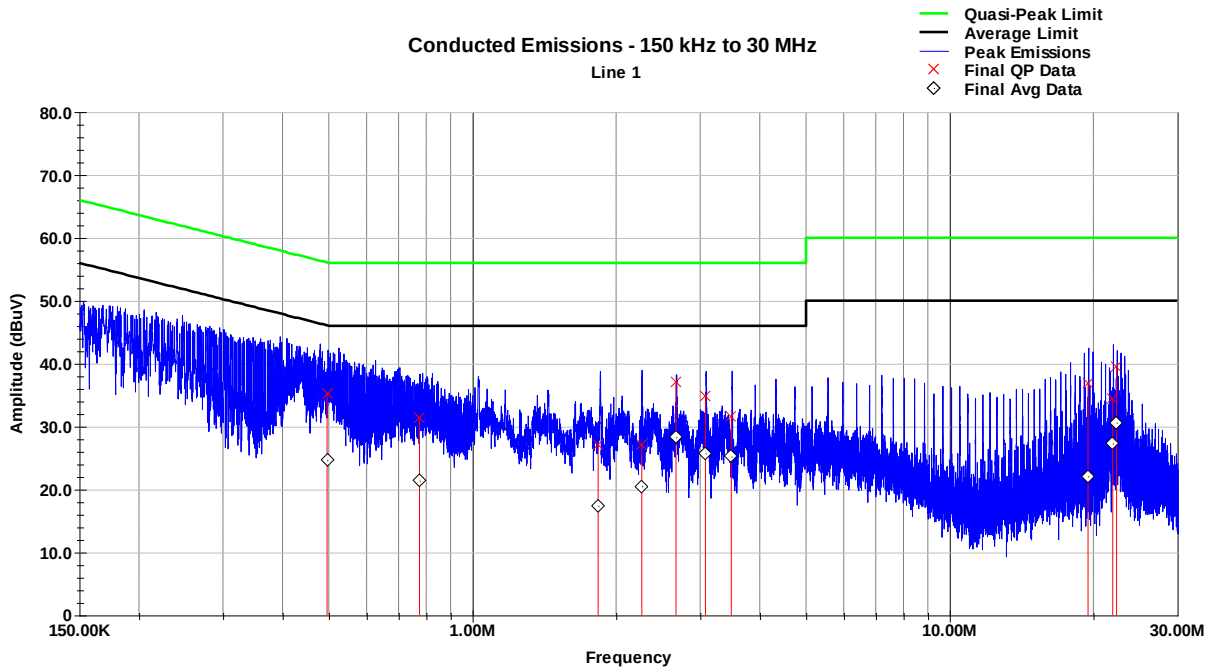
10.5 *Test Setup Photographs*





10.6 *Test Data*

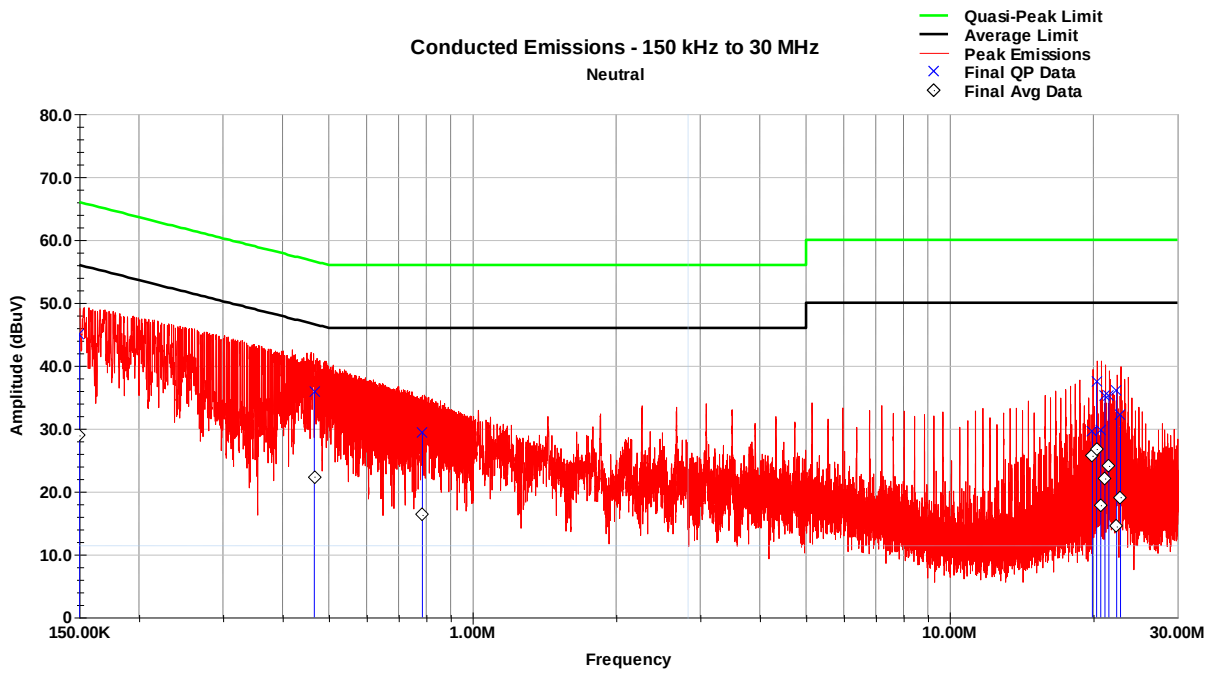
Line 1 Conducted Emissions – Peak Plot



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
0.496	35.2	56.1	-20.9	24.7	46.1	-21.4
0.775	31.4	56.0	-24.6	21.4	46.0	-24.6
1.834	27.1	56.0	-28.9	17.4	46.0	-28.6
2.264	27.1	56.0	-28.9	20.5	46.0	-25.5
2.670	37.0	56.0	-19.0	28.3	46.0	-17.7
3.078	34.9	56.0	-21.1	25.7	46.0	-20.3
3.485	31.6	56.0	-24.4	25.2	46.0	-20.8
19.498	36.9	60.0	-23.1	22.1	50.0	-27.9
21.960	34.4	60.0	-25.6	27.3	50.0	-22.7
22.374	39.6	60.0	-20.4	30.6	50.0	-19.4

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
0.150	44.9	66.0	-21.1	28.9	56.0	-27.1
0.466	35.9	56.6	-20.7	22.4	46.6	-24.2
0.785	29.4	56.0	-26.6	16.3	46.0	-29.7
19.911	29.5	60.0	-30.5	25.7	50.0	-24.3
20.320	37.5	60.0	-22.5	26.8	50.0	-23.2
20.727	29.7	60.0	-30.3	17.8	50.0	-32.2
21.154	35.2	60.0	-24.8	22.1	50.0	-27.9
21.556	35.2	60.0	-24.8	24.1	50.0	-25.9
22.380	36.1	60.0	-23.9	14.5	50.0	-35.5
22.796	32.2	60.0	-27.8	19.1	50.0	-30.9

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)).

	Expanded Uncertainty for Normal k factor equal to 2	
Parameter	Required	Laboratory Actual
Radio Frequency	±1 x 10-5	±9.8 x 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	±1°C	±0.5°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	25 April 2022
1	Updated sections 3 & 10	07 November 2022