RF Test Report

Project Number:	**4694815**	**Proposal:**	**11548r2**
Report Number:	**4694815EMC01**	**Revision Level:**	**2**

Client:	**BlueCats US, LLC**
Equipment Under Test:	**BC2611**
Model:	**BC2611**
FCC ID:	**2AHXCBC2611**
IC:	**21338-BC2611**
Applicable Standards:	**ANSI C63.10: 2013 (FCC Part 15 Subpart C, § 15.247)**
	RSS-247, Issue 2, February 2017
	RSS-GEN Issue 5, March 2019
Report issued on:	**11 February 2021**
Test Result:	**Compliant**

Prepared by: Aaron Froehlich, EMC Project Engineer

Reviewed by: Jeremy Pickens, RF Lab Manager

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

Table of Contents

1 Summary of Test Results

Test Description	Test Specification		Test Result
Bandwidth	15.247(a)(2)	RSS-247 S5.2 (a) RSS-GEN S6.7	Compliant
Peak Output Power	15.247(b)(3)	RSS-247 S5.4 (d)	Compliant
Power Spectral Density	15.247(e)	RSS-247 S5.2 (b)	Compliant
Conducted Spurious Emissions / Band Edge	15.247(d)	RSS-247 S5.5	Compliant
Field Strength of Spurious Radiation	15.247(d), 15.209	RSS-247 S5.5	Compliant
Emissions in Restricted Frequency Bands	15.205, 15.209	RSS-GEN S8.9, S8.10	Compliant
Antenna Requirement	15.203	RSS-GEN S6.8	Compliant
AC Powerline Conducted Emissions	15.107, 15.207	RSS-GEN S8.8	Compliant

1.1 *Modifications Required for Compliance*

None

2 General Information

2.1 *Client Information*

Name:	BlueCats US, LLC
Address:	6767 Old Madison Pike Suite 300
City, State, Zip, Country:	Huntsville, AL 35806

2.2 *Test Laboratory*

Name:	SGS North America, Inc.
Address:	620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country:	Suwanee, GA 30024, USA
Accrediting Body:	A2LA
Type of lab:	Testing Laboratory
Certificate Number:	3212.01
CAB ID	US0186

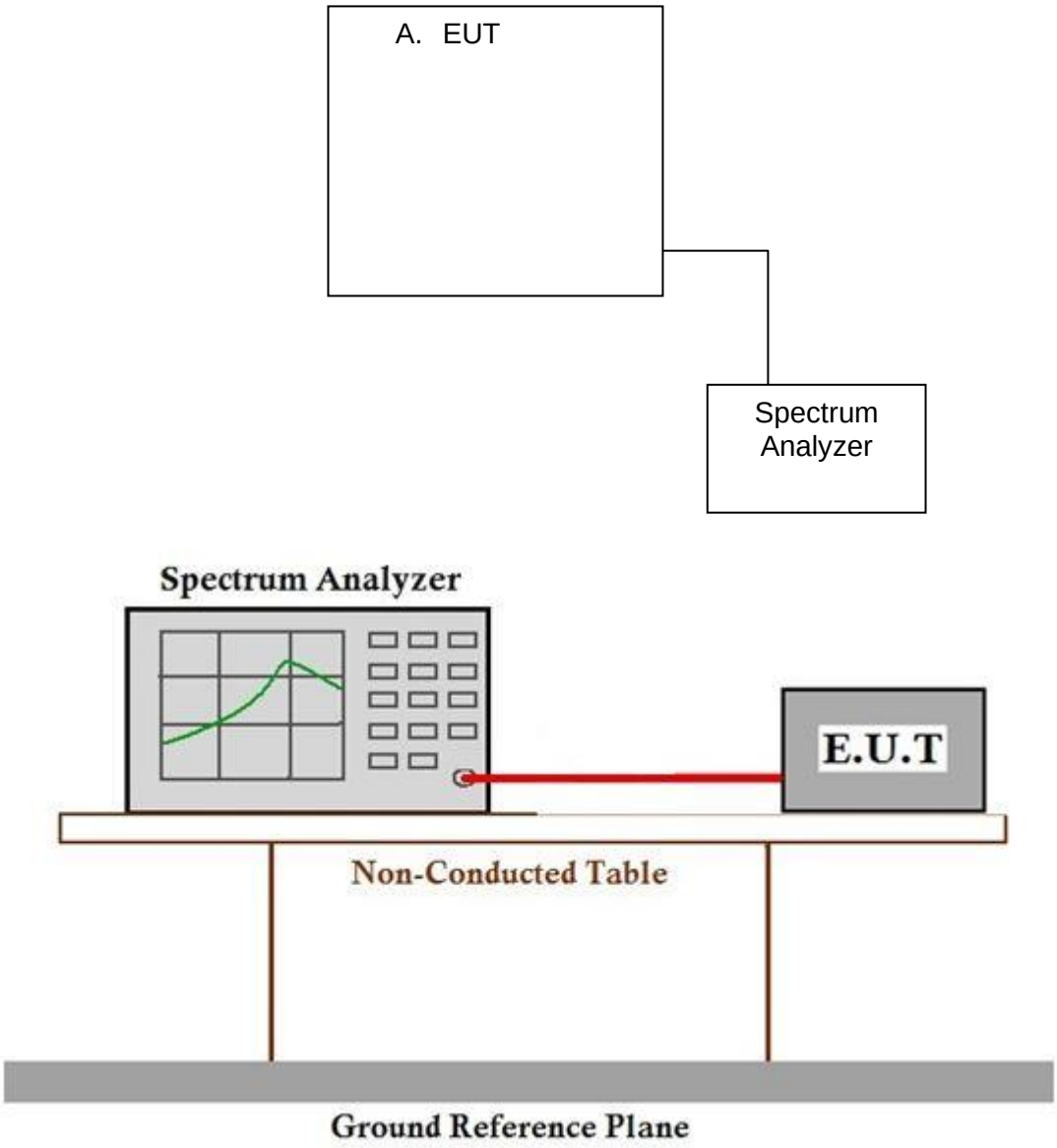
2.3 *General Information of EUT*

Product Marketing Name (PMN):	BC2611
Model Number (HVIN):	BC2611
Serial Number:	5800
Frequency Range:	2402 – 2480 MHz
Data Modes:	Bluetooth Low Energy – GFSK
Antenna:	0.71 dBi pk Trace Antenna
Rated Voltage:	5 Vdc (Input)
Test Voltage:	3.6 Vdc (Battery)
Sample Received Date:	3 November 2020
Dates of testing:	09-24 November 2020

2.4 *Operating Modes and Conditions*

The EUT was programmed by the manufacturer to transmit on low, mid and high channels in 1M and 2M PHY utilizing test mode firmware version 1.0. Power and PSD data were compared to determine the worst-case mode for testing (1M).

2.5 *EUT Connection Block Diagram – Conducted Measurements*

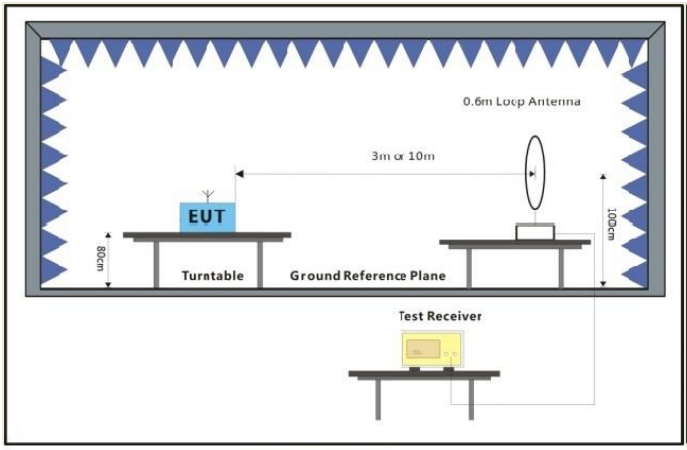


2.6 *EUT Connection Block Diagram – Radiated Measurements*

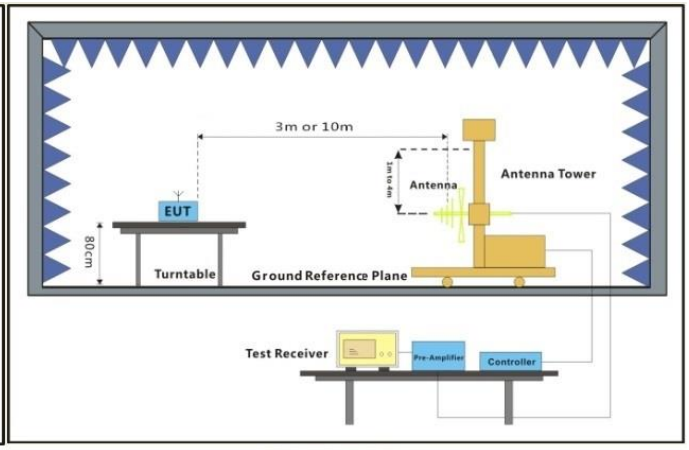
A. EUT

Inside Chamber

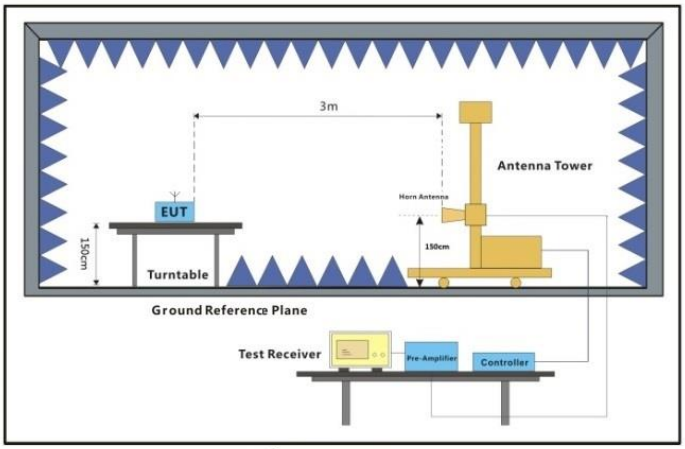
Outside Chamber



Below 30MHz



30MHz-1GHz



Above 1GHz

2.7 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
A	BlueCats US, LLC	UWB wearable device	BC2611	UWB-1 D425CC7015D2

3 Bandwidth

3.1 *Test Result*

Test Description	Test Specification		Test Result
6 dB bandwidth	15.247(a)(2)	RSS-247 S5.2 (a) RSS-GEN S6.7	Compliant

3.2 *Test Method*

The procedures from ANSI C63.10: 2013 clause 11.8 and 558074 D01 DTS Meas Guidance 05r02 were used to determine the 6 dB bandwidth.

3.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	23.6 °C
Relative Humidity:	58.1 %
Atmospheric Pressure:	97.8 kPa

3.4 *Test Equipment*

Test End Date: 10-Nov-2020 Tester: ASF

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF Cable SMA to SMA, 0.01-40GHz	084-0505-059	TELEDYNE STORM MICROWAVE	20108	6-Mar-2021
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2021

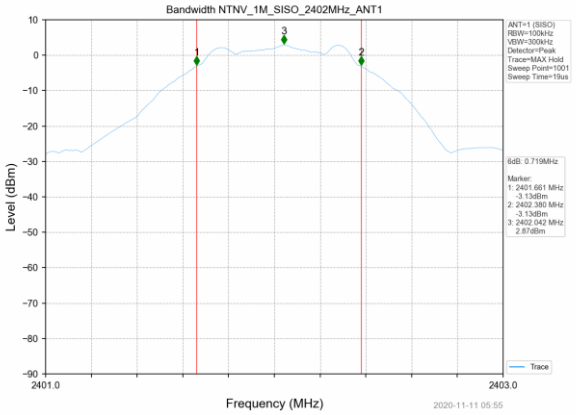
Note: The cable is on a 1 yr cal cycle, the FSV is on a 2 yr cal cycle.

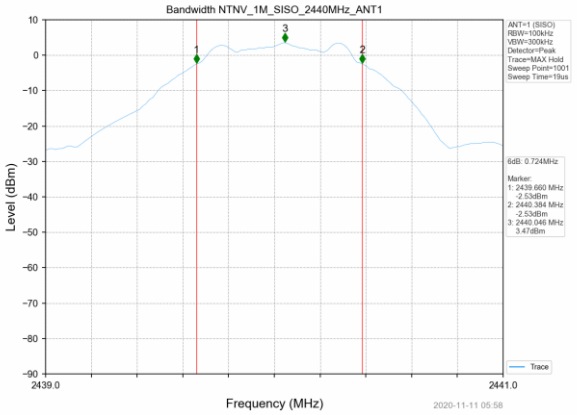
3.5 *Test Data*

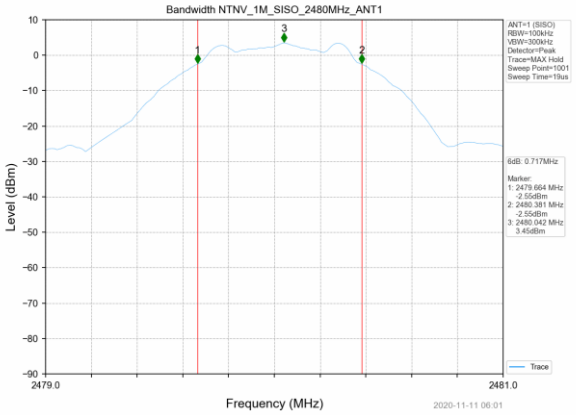
Test Mode	Frequency (MHz)	TX Type	ANT No.	6dB Bandwidth Test Result (MHz)	Limits (MHz)	Verdict
1M	2402	SISO	1	0.719	≥0.5	PASS
	2440	SISO	1	0.724	≥0.5	PASS
	2480	SISO	1	0.717	≥0.5	PASS
2M	2402	SISO	1	1.170	≥0.5	PASS
	2440	SISO	1	1.172	≥0.5	PASS
	2480	SISO	1	1.167	≥0.5	PASS

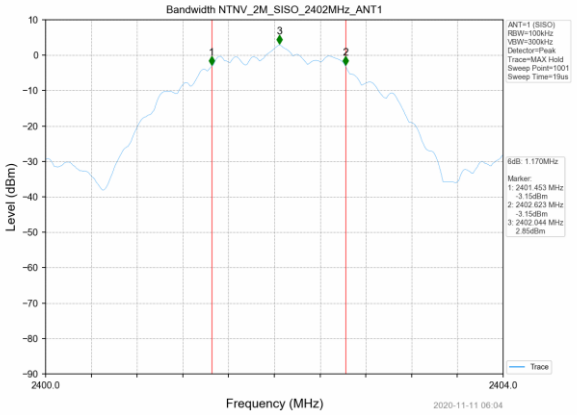
Test Mode	Frequency (MHz)	TX Type	ANT No.	99% Occupied Bandwidth Test Result (MHz)	
1M	2402	SISO	1	1.047	Only for Report Use
	2440	SISO	1	1.054	Only for Report Use
	2480	SISO	1	1.053	Only for Report Use
2M	2402	SISO	1	2.043	Only for Report Use
	2440	SISO	1	2.057	Only for Report Use
	2480	SISO	1	2.056	Only for Report Use

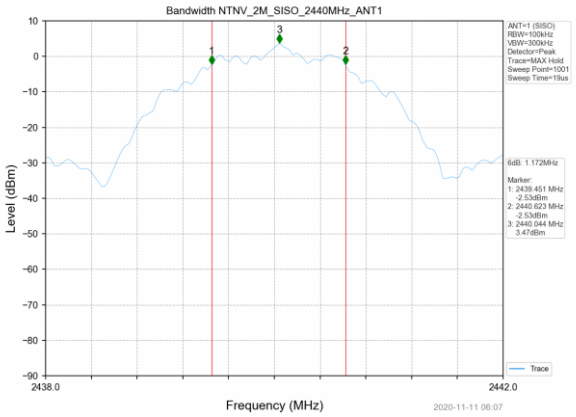
3.5.1 6 dB Plots

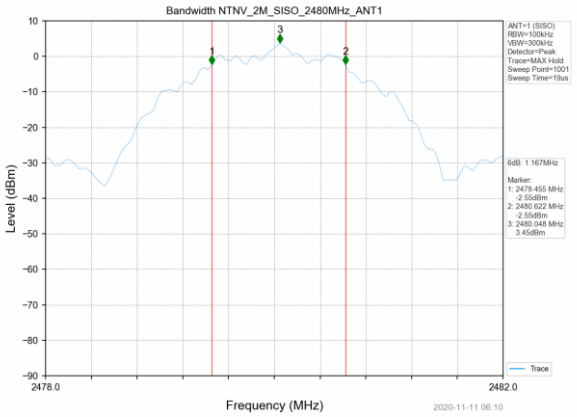




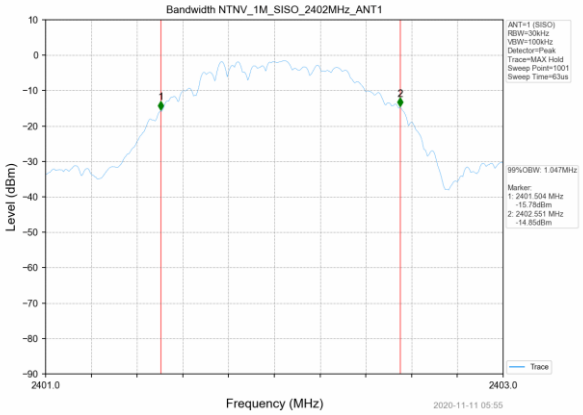


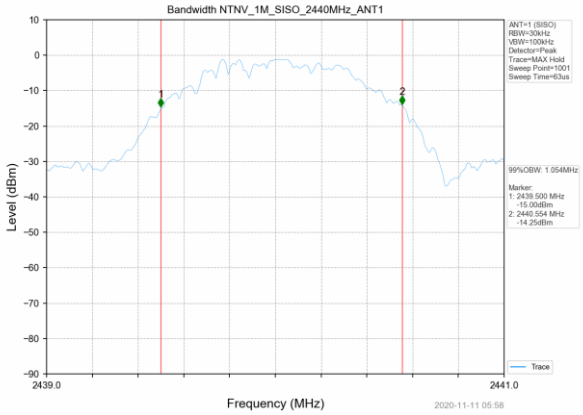


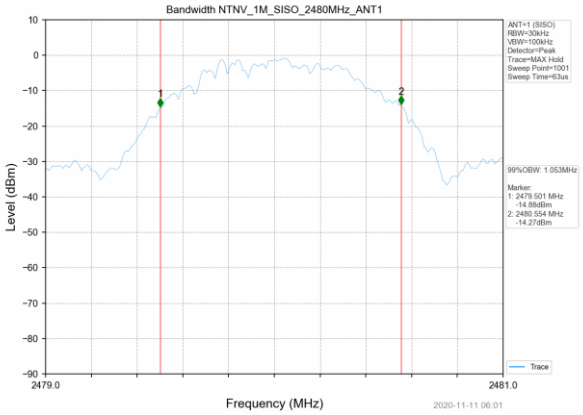


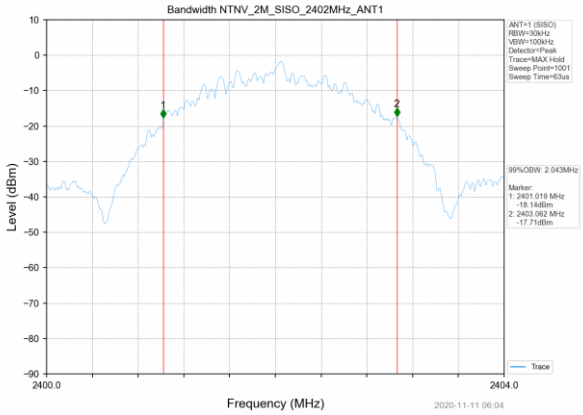


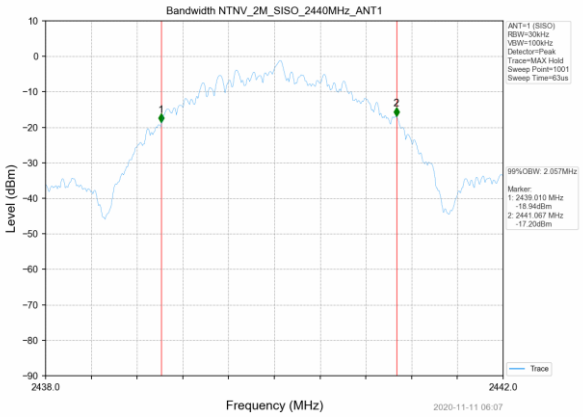
3.5.2 **99% Plots**

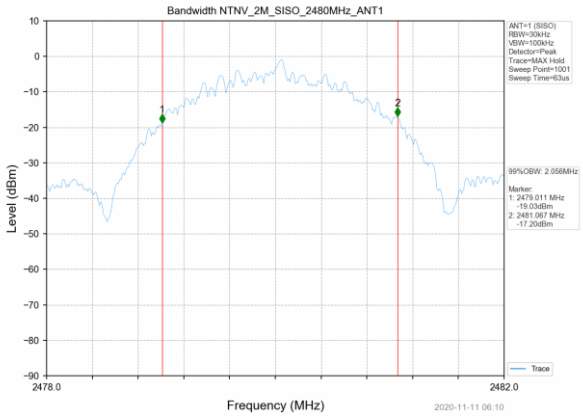

Bandwidth NTNV_1M_SISO_2402MHz_ANT1
Level (dBm)
Frequency (MHz)
2401.0
2403.0
99%OBW: 1.047MHz
Trace


Bandwidth NTNV_1M_SISO_2440MHz_ANT1
Level (dBm)
Frequency (MHz)
2439.0
2441.0
99%OBW: 1.054MHz
Trace


Bandwidth NTNV_1M_SISO_2480MHz_ANT1
Level (dBm)
Frequency (MHz)
2479.0
2481.0
99%OBW: 1.053MHz
Trace


Bandwidth NTNV_2M_SISO_2402MHz_ANT1
Level (dBm)
Frequency (MHz)
2400.0
2404.0
99%OBW: 2.043MHz
Trace


Bandwidth NTNV_2M_SISO_2440MHz_ANT1
Level (dBm)
Frequency (MHz)
2438.0
2442.0
99%OBW: 2.057MHz
Trace


Bandwidth NTNV_2M_SISO_2480MHz_ANT1
Level (dBm)
Frequency (MHz)
2478.0
2482.0
99%OBW: 2.056MHz
Trace

4 RF Output Power

4.1 *Test Result*

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

4.2 *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 05r02.

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)

4.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	23.6 °C
Relative Humidity:	58.1 %
Atmospheric Pressure:	97.8 kPa

4.4 *Test Equipment*

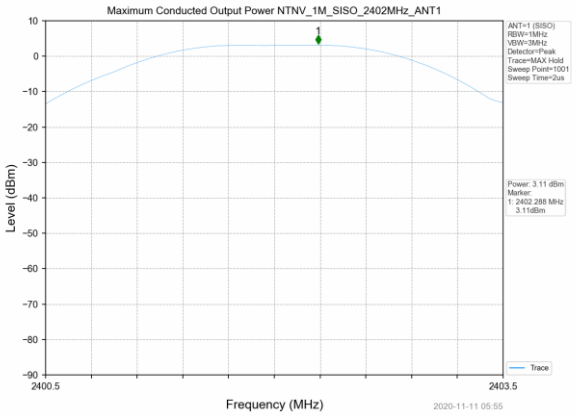
Test End Date: 10-Nov-2020 Tester: ASF

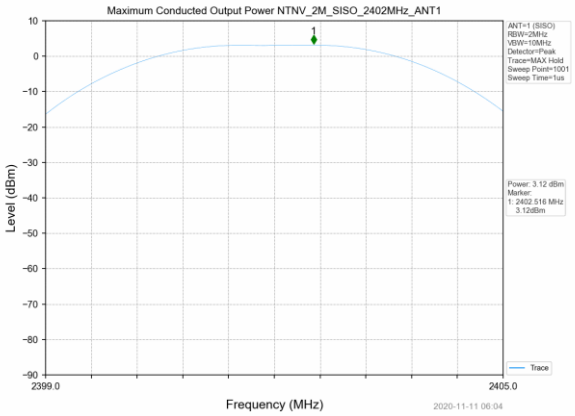
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF Cable SMA to SMA, 0.01-40GHz	084-0505-059	TELEDYNE STORM MICROWAVE	20108	6-Mar-2021
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2021

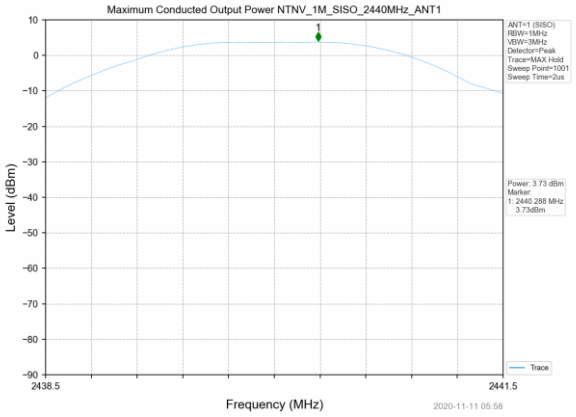
Note: The cable is on a 1 yr cal cycle, the FSV is on a 2 yr cal cycle.

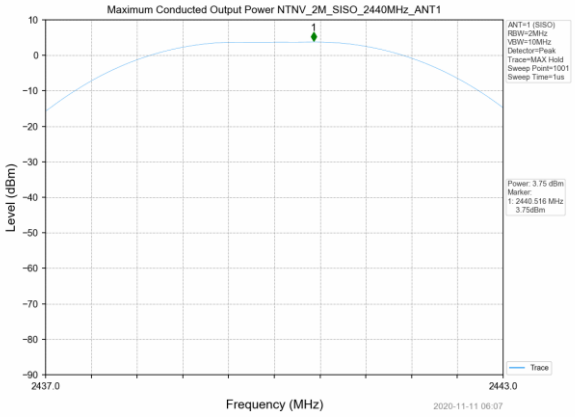
4.5 *Test Data*

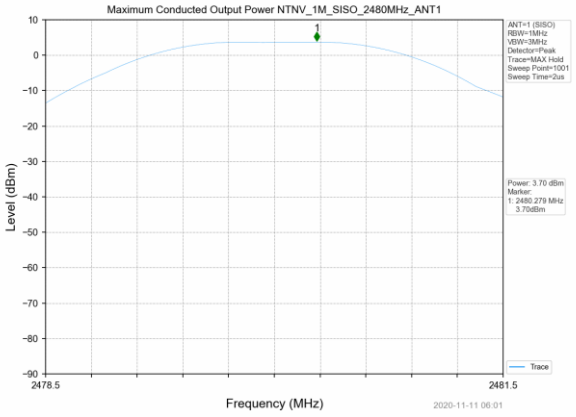
Test Mode	Frequency (MHz)	Measured Peak Output Power (dBm)	Limits (dBm)	Verdict
		Ant 1		
1M	2402	3.11	30	PASS
	2440	3.73	30	PASS
	2480	3.7	30	PASS
2M	2402	3.12	30	PASS
	2440	3.75	30	PASS
	2480	3.72	30	PASS

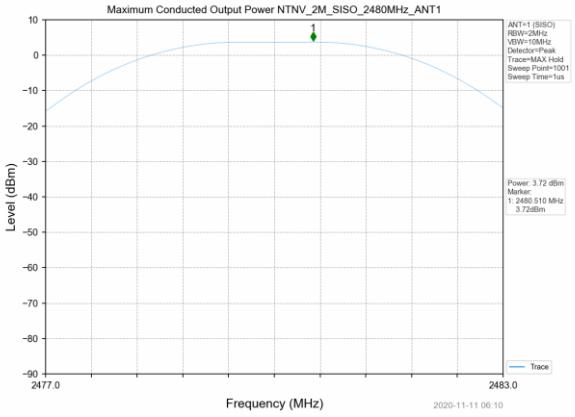












5 Power Spectral Density

5.1 *Test Result*

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

5.2 *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 05r02.

Limit
The limit is 8 dBm.

5.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	23.6 °C
Relative Humidity:	58.1 %
Atmospheric Pressure:	97.8 kPa

5.4 *Test Equipment*

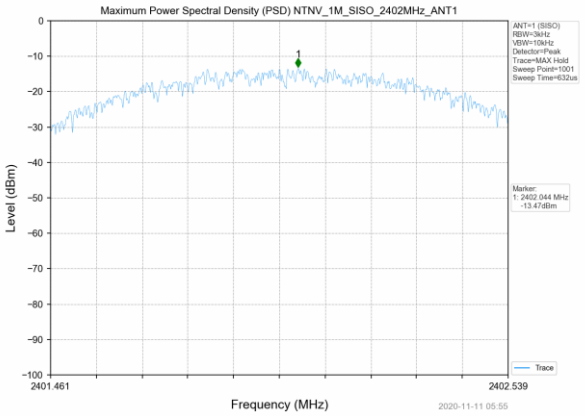
Test End Date: 10-Nov-2020 Tester: ASF

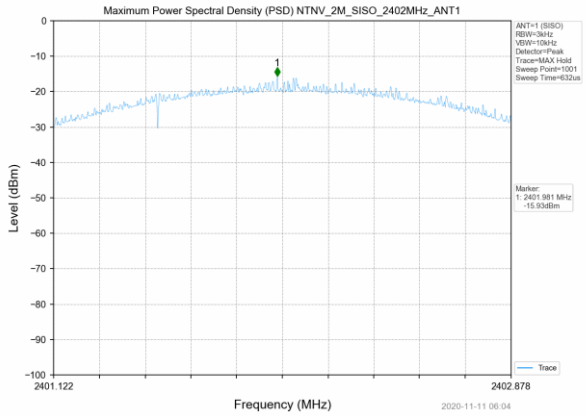
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF Cable SMA to SMA, 0.01-40GHz	084-0505-059	TELEDYNE STORM MICROWAVE	20108	6-Mar-2021
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2021

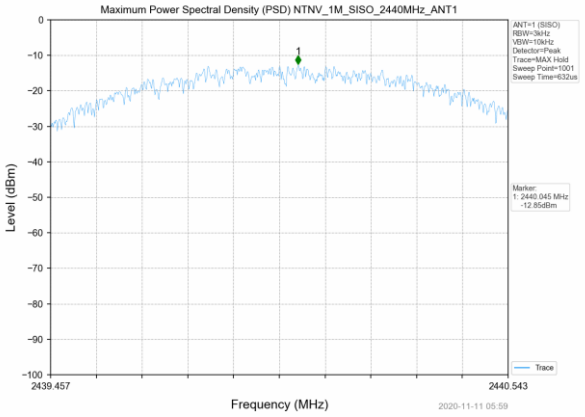
Note: The cable is on a 1 yr cal cycle, the FSV is on a 2 yr cal cycle.

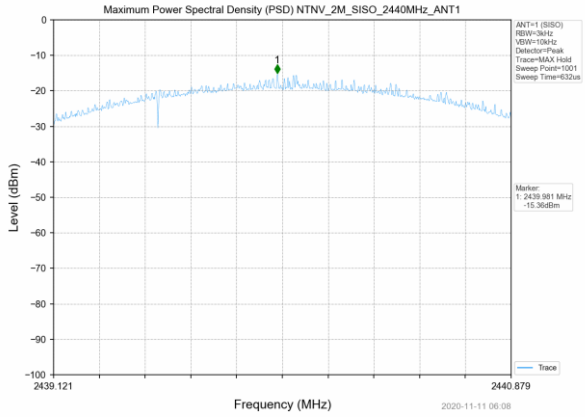
5.5 *Test Data*

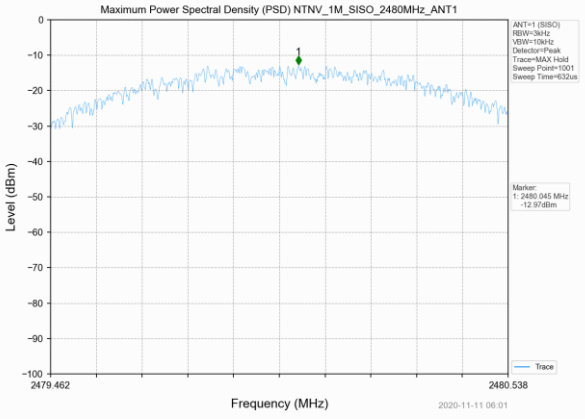
Test Mode	Frequency (MHz)	Maximum Power Spectral Density (dBm/3KHz)	Limits (dBm/3kHz)	Verdict
		Ant 1		
1M	2402	-13.47	≤8	PASS
	2440	-12.85	≤8	PASS
	2480	-12.97	≤8	PASS
2M	2402	-15.93	≤8	PASS
	2440	-15.36	≤8	PASS
	2480	-15.35	≤8	PASS

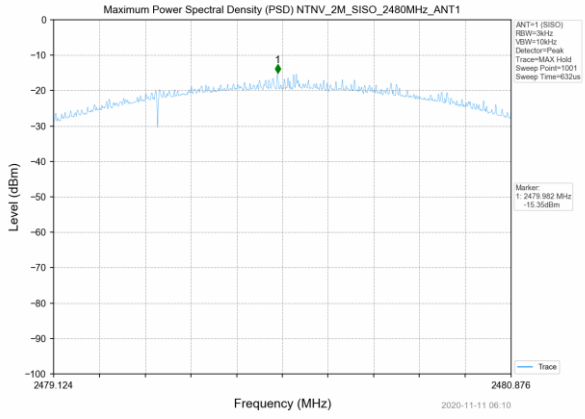












6 Conducted Spurious Emissions / Band Edge

6.1 *Test Result*

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

6.2 *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 05r02.

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.

6.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	23.6 °C
Relative Humidity:	58.1 %
Atmospheric Pressure:	97.8 kPa

6.4 *Test Equipment*

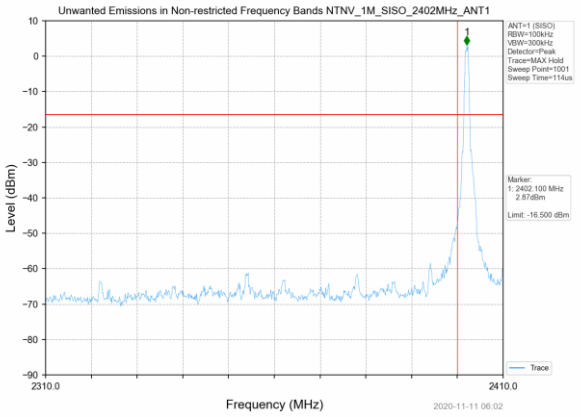
Test End Date: 10-Nov-2020 Tester: ASF

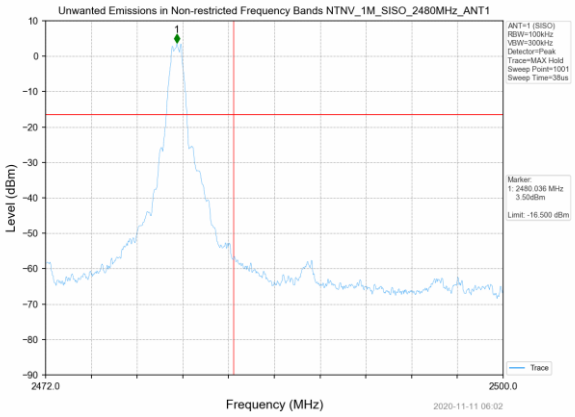
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF Cable SMA to SMA, 0.01-40GHz	084-0505-059	TELEDYNE STORM MICROWAVE	20108	6-Mar-2021
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2021

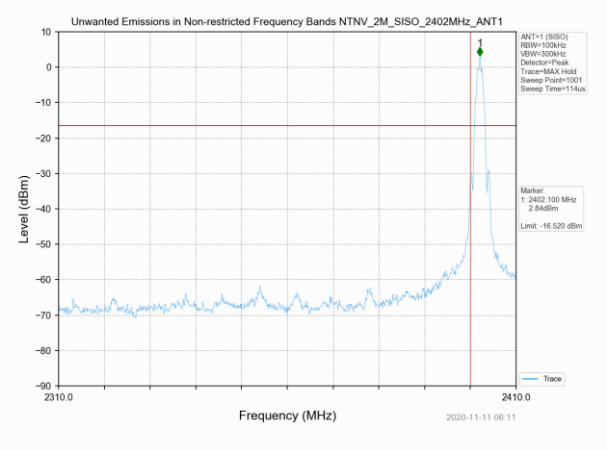
Note: The cable is on a 1 yr cal cycle, the FSV is on a 2 yr cal cycle.

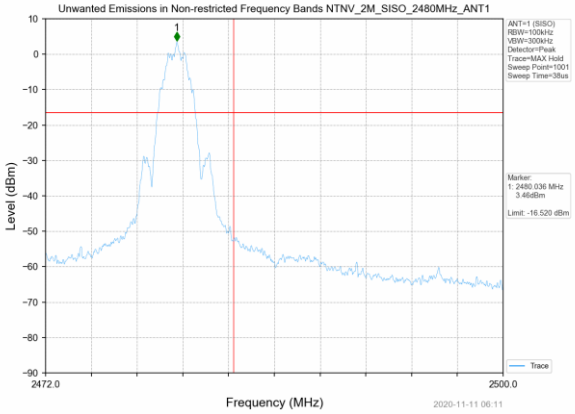
6.5 *Test Data*

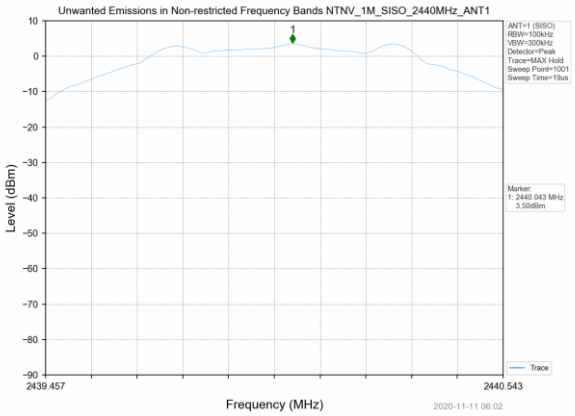
Test Mode	Frequency (MHz)	Spurious Conducted Emission (dBm)	Limits (dBm)	Verdict
1M	2402	Refer to test graph	-16.5	PASS
	2440	Refer to test graph	-16.5	PASS
	2480	Refer to test graph	-16.5	PASS
2M	2402	Refer to test graph	-16.52	PASS
	2440	Refer to test graph	-16.52	PASS
	2480	Refer to test graph	-16.52	PASS

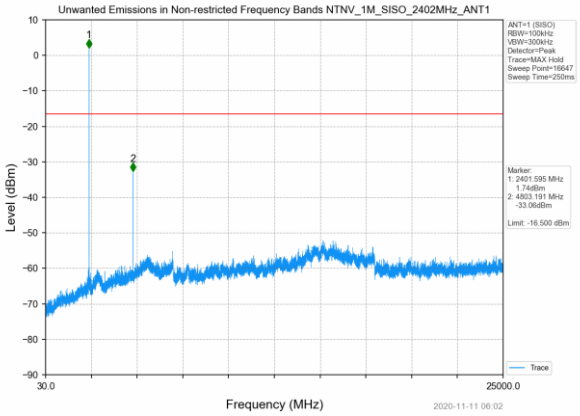


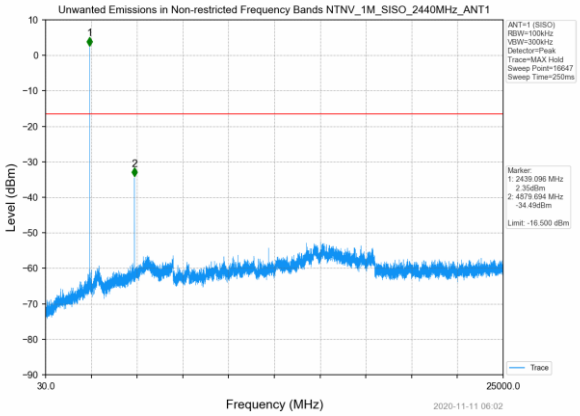







Unwanted Emissions in Non-restricted Frequency Bands NTNV_1M_SISO_2440MHz_ANT1
Level (dBm)
Frequency (MHz)
2439.457
2440.543
2020-11-11 06:02


Unwanted Emissions in Non-restricted Frequency Bands NTNV_1M_SISO_2402MHz_ANT1
Level (dBm)
Frequency (MHz)
30.0
25000.0
2020-11-11 06:02


Unwanted Emissions in Non-restricted Frequency Bands NTNV_1M_SISO_2440MHz_ANT1
Level (dBm)
Frequency (MHz)
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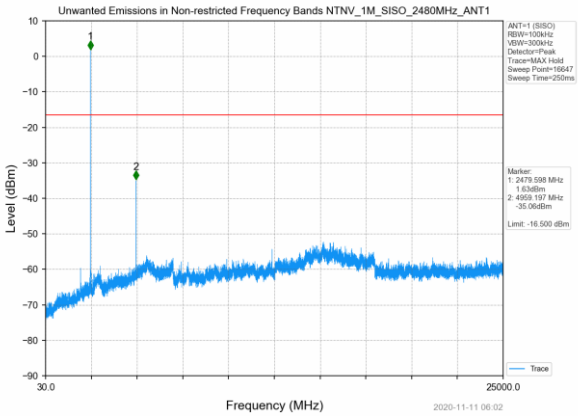
25000.0
2020-11-11 06:02


Unwanted Emissions in Non-restricted Frequency Bands NTNV_1M_SISO_2480MHz_ANT1
Level (dBm)
Frequency (MHz)
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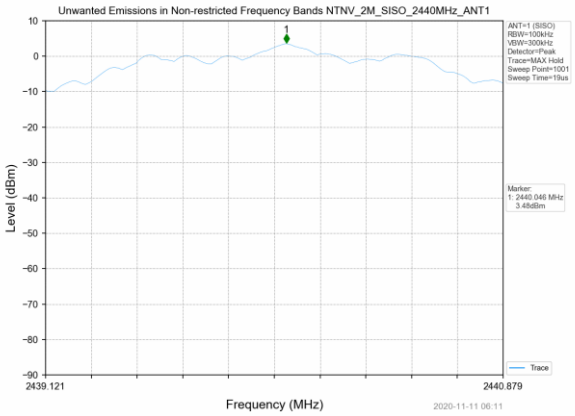
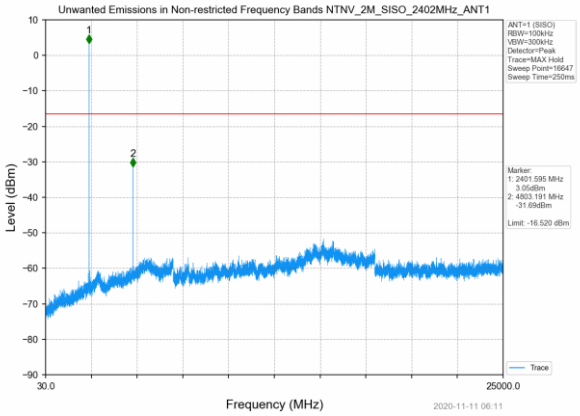
25000.0
2020-11-11 06:02


Unwanted Emissions in Non-restricted Frequency Bands NTNV_2M_SISO_2440MHz_ANT1
Level (dBm)
Frequency (MHz)
2439.121
2440.879
2020-11-11 06:11


Unwanted Emissions in Non-restricted Frequency Bands NTNV_2M_SISO_2402MHz_ANT1
Level (dBm)
Frequency (MHz)
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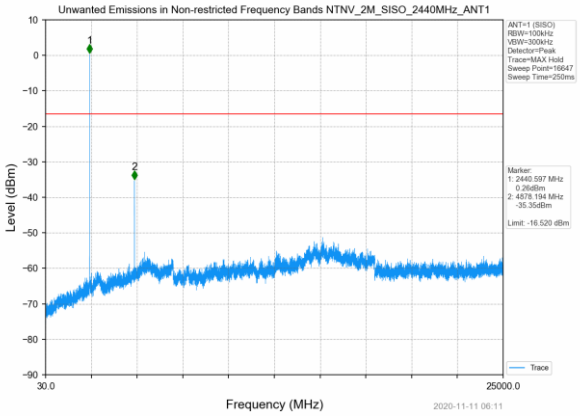
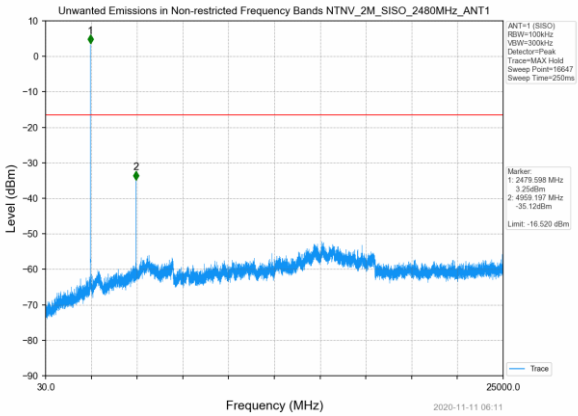
25000.0
2020-11-11 06:11


Unwanted Emissions in Non-restricted Frequency Bands NTNV_2M_SISO_2440MHz_ANT1
Level (dBm)
Frequency (MHz)
30.0
25000.0
2020-11-11 06:11


Unwanted Emissions in Non-restricted Frequency Bands NTNV_2M_SISO_2480MHz_ANT1
Level (dBm)
Frequency (MHz)
30.0
25000.0
2020-11-11 06:11

7 Field Strength of Spurious Radiation

7.1 *Test Result*

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

7.2 *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 1 meter

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

7.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	22.5 °C
Relative Humidity:	31.9 %
Atmospheric Pressure:	98.88 kPa

7.4 *Test Equipment*

30-1000MHz

Test Date: 24-Nov-2020 Tester: ZH

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079690	11-Dec-2018	11-Dec-2020
RF Cable Nm to Nm, 0.01-18GHz	90-195-276	TELEDYNE STORM MICROWAVE	20114	2-Mar-2020	2-Mar-2021
LOW NOISE AMPLIFIER	ZKL-2+	Mini-Circuits	B079800	25-Sep-2020	25-Sep-2021
RF CABLE	SF106	HUBER & SUHNER	B079713	3-Sep-2020	3-Sep-2021
RF Cable Nm to Nm, 0.01-18GHz	90-195-118	TELEDYNE STORM MICROWAVE	20126	2-Mar-2020	2-Mar-2021
RF CABLE	SUCOFLEX 100	Huber & Suhner	B108523	3-Sep-2020	3-Sep-2021
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	7-May-2020	7-May-2021

1-12.75GHz

Test Date: 24-Nov-2020 Tester: ZH

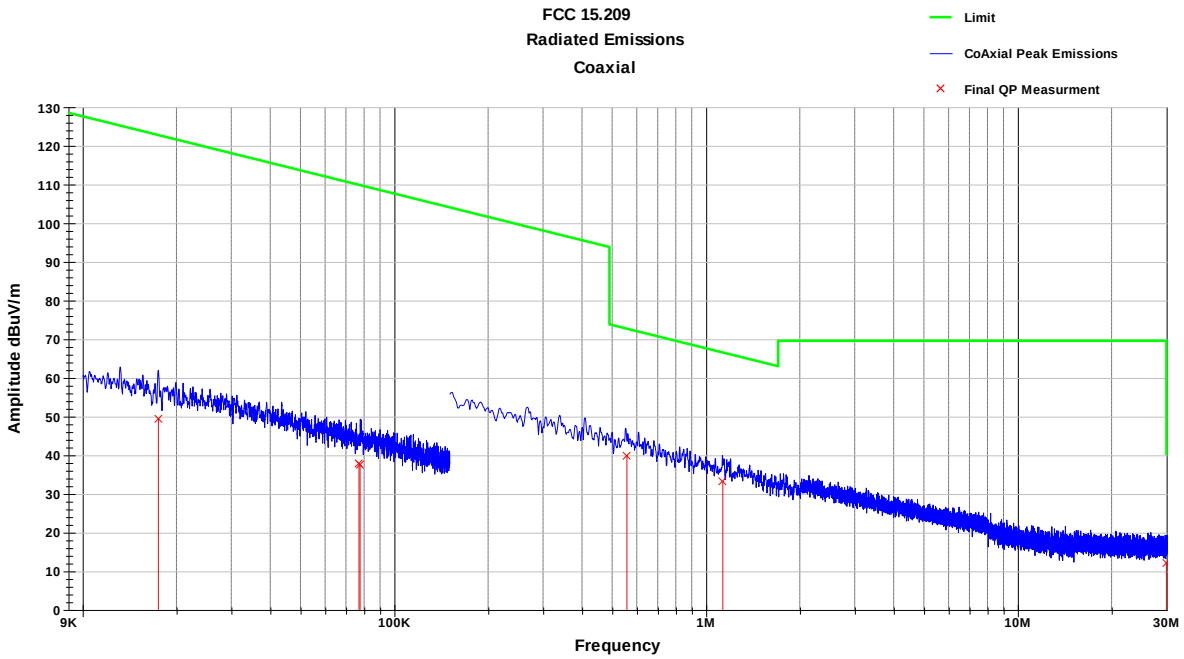
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS Lindgren	B079691	10-Aug-2020	10-Aug-2022
RF Cable Nm to Nm, 0.01-18GHz	90-195-276	TELEDYNE STORM MICROWAVE	20114	2-Mar-2020	2-Mar-2021
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	28-Oct-2020	28-Oct-2021
RF CABLE	SUCOFLEX 100	Huber & Suhner	B108523	3-Sep-2020	3-Sep-2021
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	6-Apr-2020	6-Apr-2021

Software:
“RSE 30-1000 MHz” T7 October 2020
“RSE 1-12.75 GHz” T7 October 2020

7.5 *Test Data*

7.5.1 9kHz-30MHz

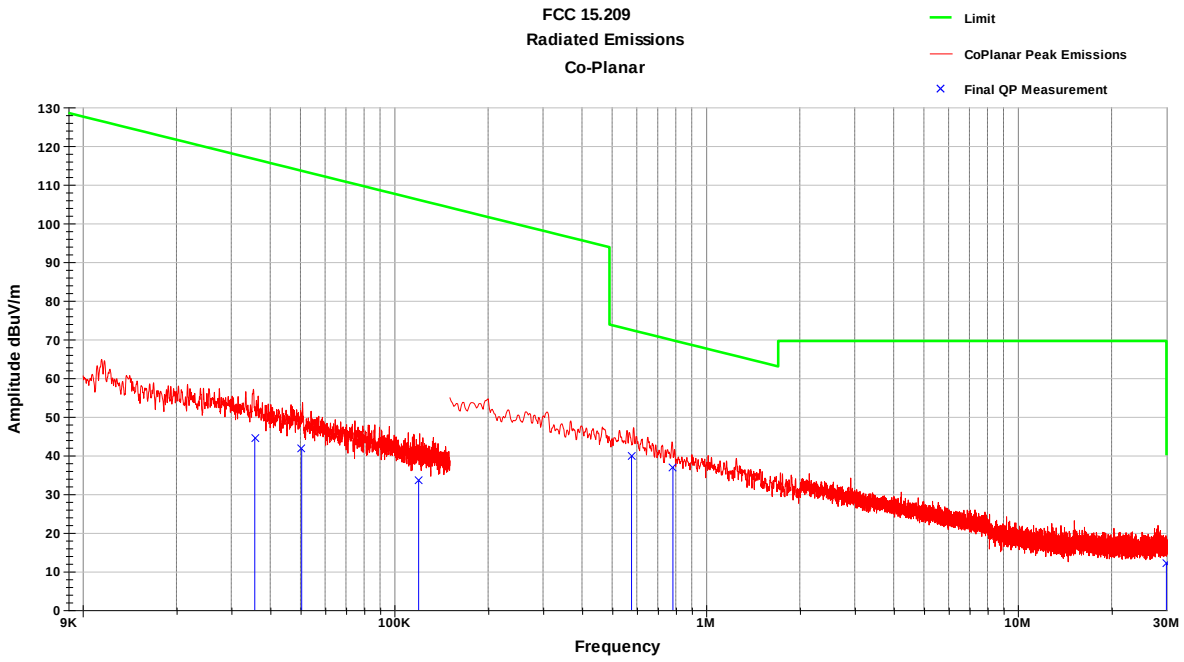
Coaxial Radiated Emissions Plot



Coaxial Radiated Emissions Data

Frequency MHz	Raw QP (dBuV)	Azimuth (degrees)	Height (cm)	AF (dB)	CL (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.02	33.8	239.0	100.0	16.0	0.0	50.0	123.0	-73.0
0.08	26.2	102.0	100.0	12.0	0.0	38.0	110.0	-72.0
0.08	25.8	96.0	100.0	12.0	0.0	37.0	110.0	-72.0
0.56	28.6	64.0	100.0	11.3	0.1	40.0	72.7	-32.7
1.13	21.7	291.0	100.0	11.5	0.1	33.3	66.5	-33.3
29.99	3.4	348.0	100.0	8.2	0.5	12.2	69.5	-57.4
QP Value = Level + AF + CL - Amp								
Margin = QP Value - Limit								

Coplanar Radiated Emissions Plot

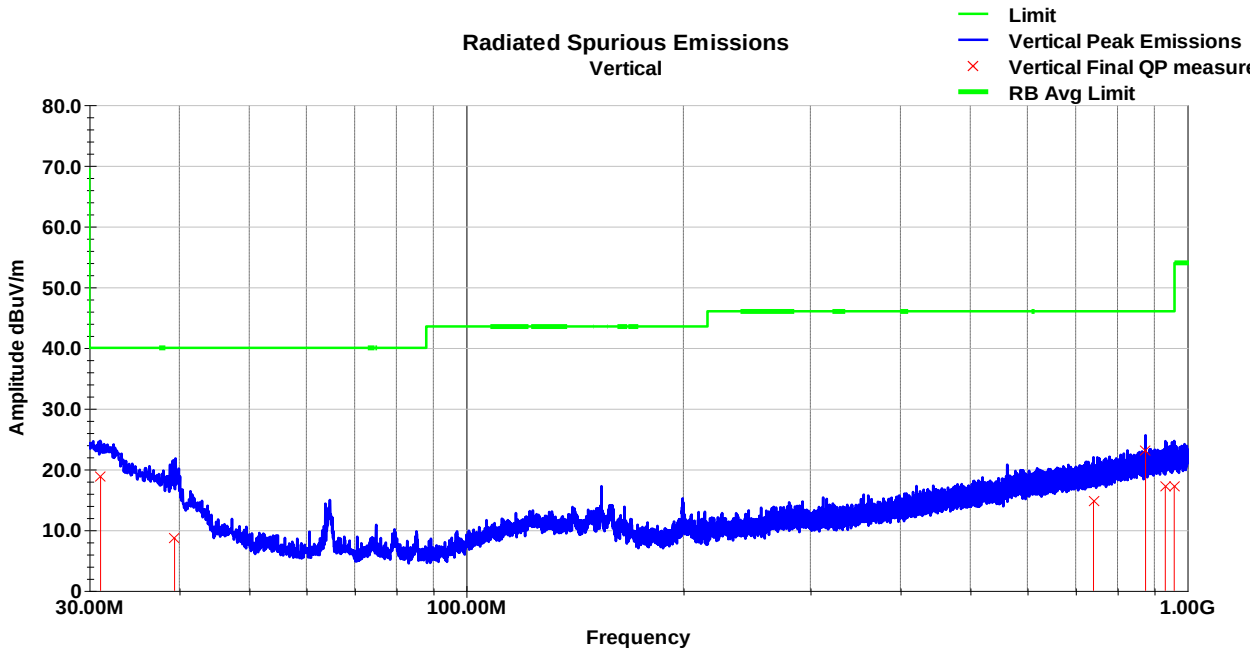


Coplanar Radiated Emissions Data

Frequency MHz	Raw QP (dBuV)	Azimuth (degrees)	Height (cm)	AF (dB)	CL (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.04	31.1	29.0	100.0	13.4	0.1	44.5	116.6	-72.1
0.05	29.6	277.0	100.0	12.0	0.1	41.7	113.5	-71.9
0.12	22.1	359.0	100.0	11.3	0.1	33.4	106.0	-72.6
0.58	28.4	321.0	100.0	11.3	0.1	39.8	72.4	-32.6
0.78	25.5	154.0	100.0	11.3	0.1	36.9	69.7	-32.8
29.99	3.5	19.0	100.0	8.2	0.5	12.2	69.5	-57.4
QP Value = Level + AF + CL - Amp								
Margin = QP Value - Limit								

7.5.2 **30-1000 MHz** (Y-axis had highest emissions)

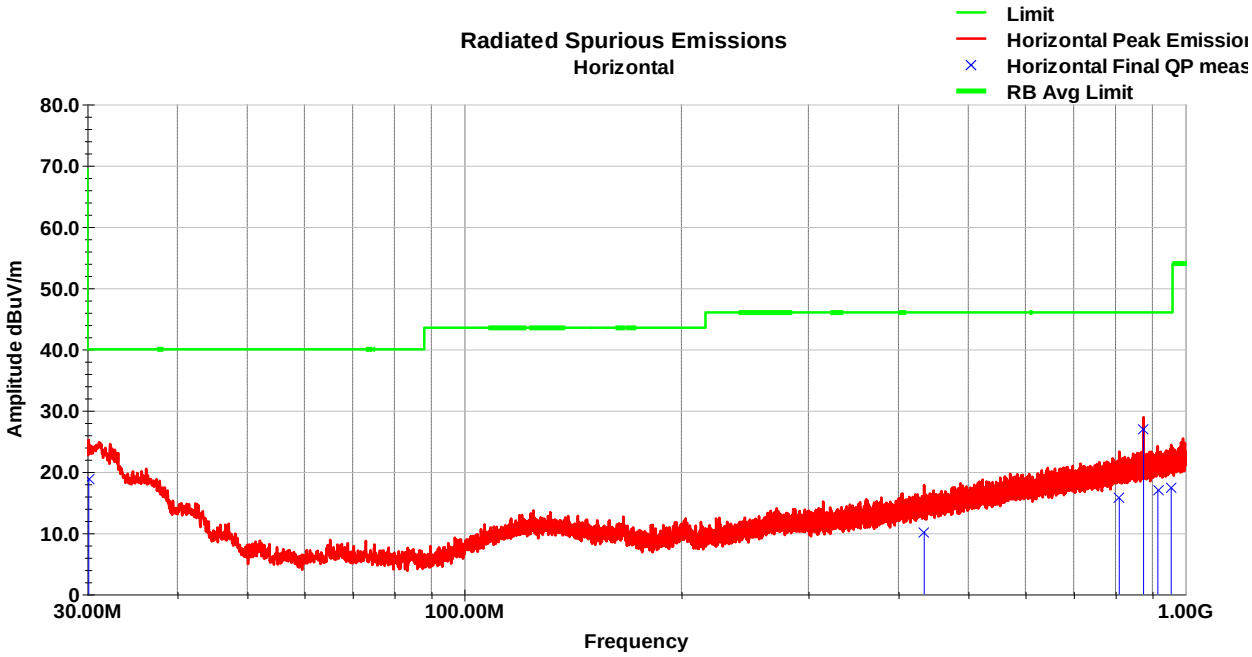
Vertical Radiated Spurious Emissions Plot – Channel 0



Vertical Radiated Spurious Emissions Data

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)
31.1	37	V	22	109	21.2	0.6	40	18.8	40	-21.2
39.39	34.7	V	151	175	14.8	0.7	41.5	8.7	40	-31.3
740.99	33.3	V	153	370	21.2	3	42.8	14.7	46	-31.3
875.09	39.9	V	2	389	22.7	3.3	42.8	23.1	46	-22.9
932.18	33.2	V	341	277	23.3	3.4	42.8	17.2	46	-28.9
959.1	33.2	V	31	175	23.4	3.4	42.8	17.3	46	-28.8
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

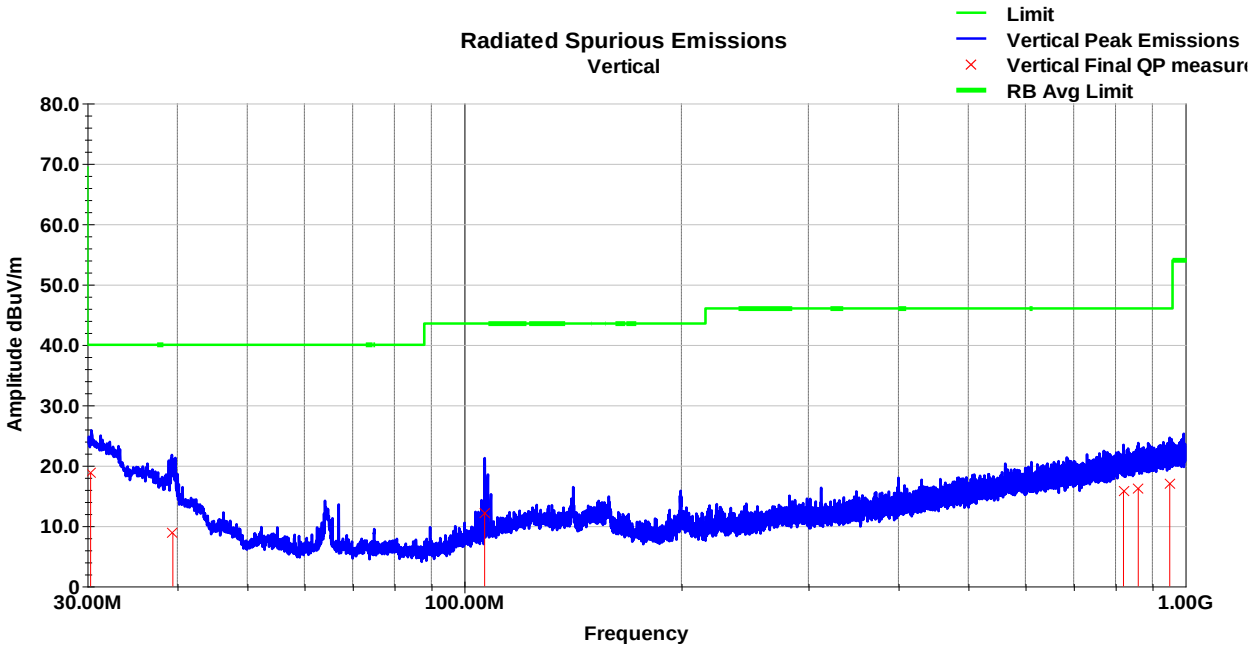
Horizontal Radiated Spurious Emissions Plot – Channel 0



Horizontal Radiated Spurious Emissions Data

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)
30.15	35.9	H	15	212	22.1	0.6	39.8	18.8	40	-21.2
434.36	33.6	H	286	121	17	2.3	42.8	10.1	46	-35.9
809.66	33.2	H	291	253	22.1	3.1	42.8	15.7	46	-30.3
875.07	43.8	H	52	151	22.7	3.3	42.8	27	46	-19
915.81	33.3	H	321	325	23.1	3.4	42.8	17	46	-29
955.76	33.2	H	295	248	23.4	3.4	42.8	17.3	46	-28.7
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

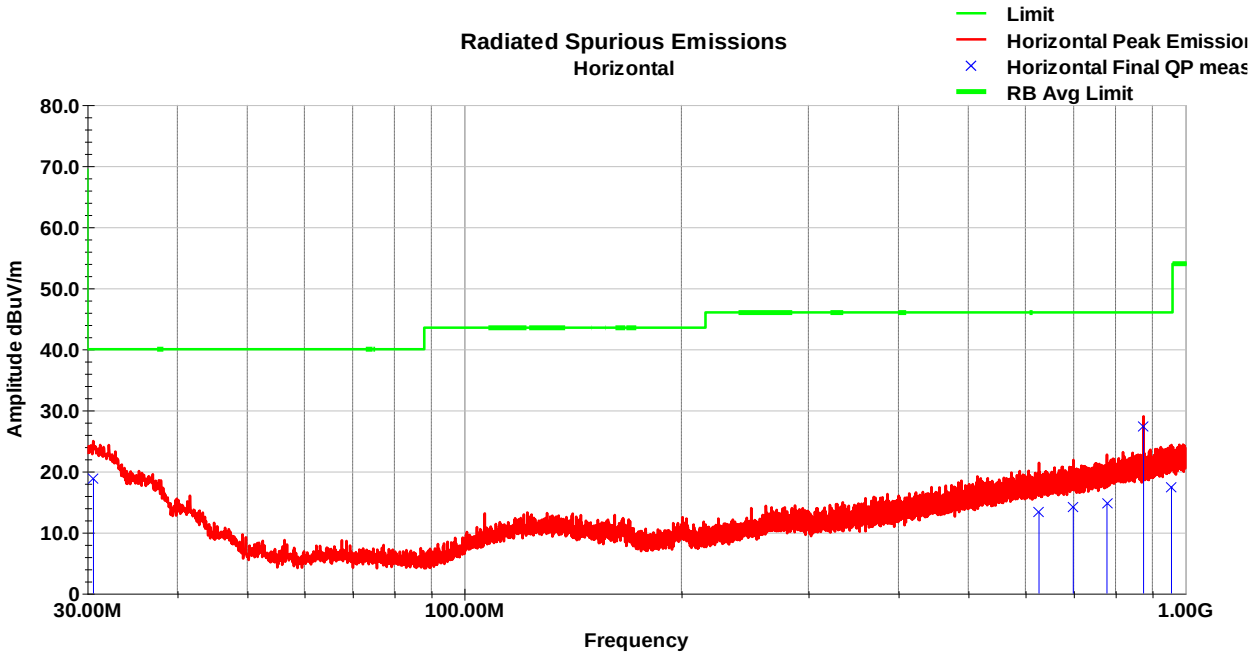
Vertical Radiated Spurious Emissions Plot – Channel 19



Vertical Radiated Spurious Emissions Data

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)
30.32	36.1	V	88	296	21.9	0.6	39.8	18.7	40	-21.3
39.43	34.9	V	140	136	14.8	0.7	41.5	8.8	40	-31.2
106.71	42.9	V	190	101	11.7	1.1	43.7	12.1	43.5	-31.4
820.77	33.1	V	358	147	22.3	3.2	42.8	15.7	46	-30.3
860.4	33.1	V	315	106	22.7	3.2	42.8	16.2	46	-29.8
951.33	33.1	V	228	304	23.3	3.4	42.8	17.1	46	-28.9
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

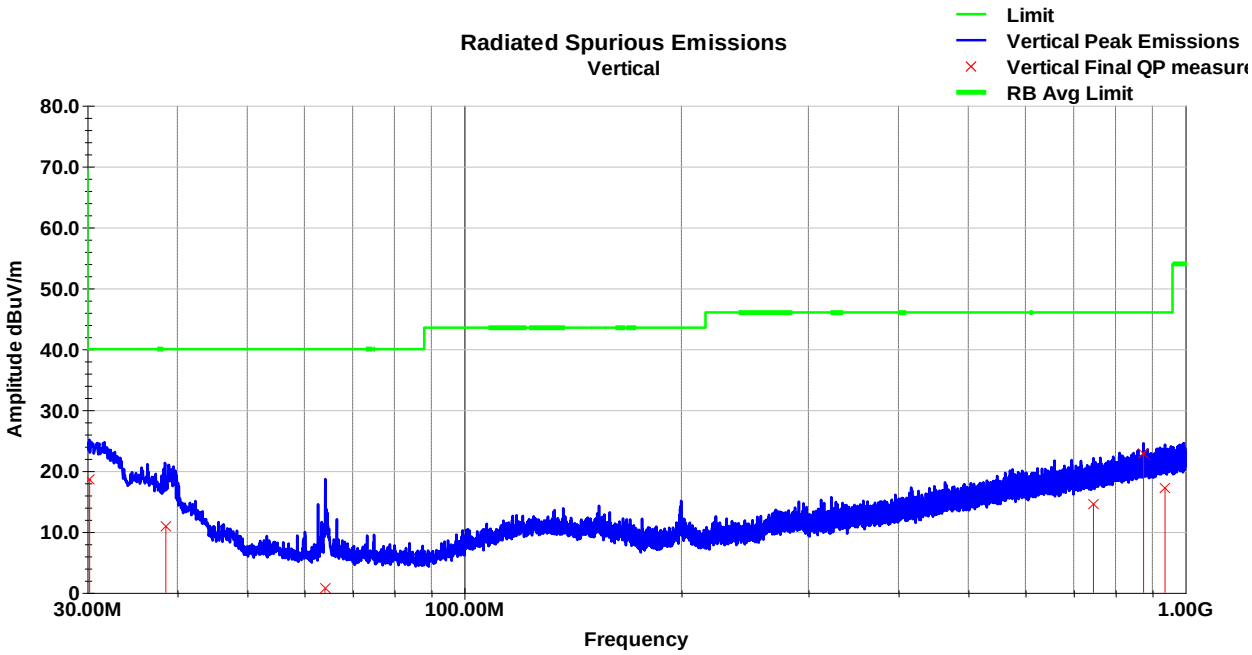
Horizontal Radiated Spurious Emissions Plot – Channel 19



Horizontal Radiated Spurious Emissions Data

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)
30.6	36.4	H	138	181	21.7	0.6	39.9	18.8	40	-21.2
626.7	33.2	H	336	240	20.1	2.8	42.8	13.3	46	-32.8
699.24	33.3	H	24	322	20.7	2.9	42.8	14.2	46	-31.9
778.61	33	H	177	368	21.4	3.1	42.8	14.7	46	-31.3
875.1	44.1	H	193	101	22.7	3.3	42.8	27.3	46	-18.8
956.55	33.4	H	255	275	23.4	3.4	42.8	17.5	46	-28.5
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

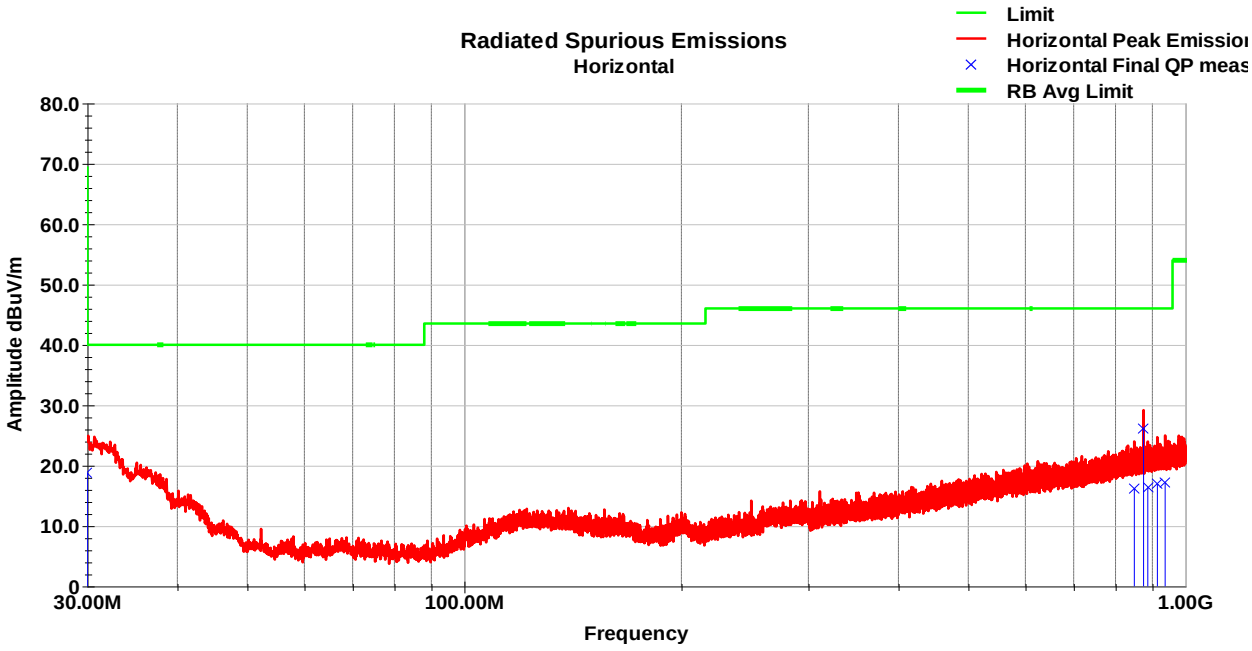
Vertical Radiated Spurious Emissions Plot – Channel 39



Vertical Radiated Spurious Emissions Data

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)
30.22	35.9	V	309	137	22	0.6	39.8	18.7	40	-21.3
38.56	36.1	V	151	156	15.5	0.6	41.4	10.8	40	-29.2
64.07	35.7	V	186	323	7.7	0.9	43.6	0.7	40	-39.3
745.74	33.1	V	75	228	21.2	3	42.8	14.6	46	-31.5
875.09	39.8	V	117	390	22.7	3.3	42.8	22.9	46	-23.1
937.22	33.2	V	324	170	23.3	3.4	42.8	17.2	46	-28.9
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Horizontal Radiated Spurious Emissions Plot – Channel 39

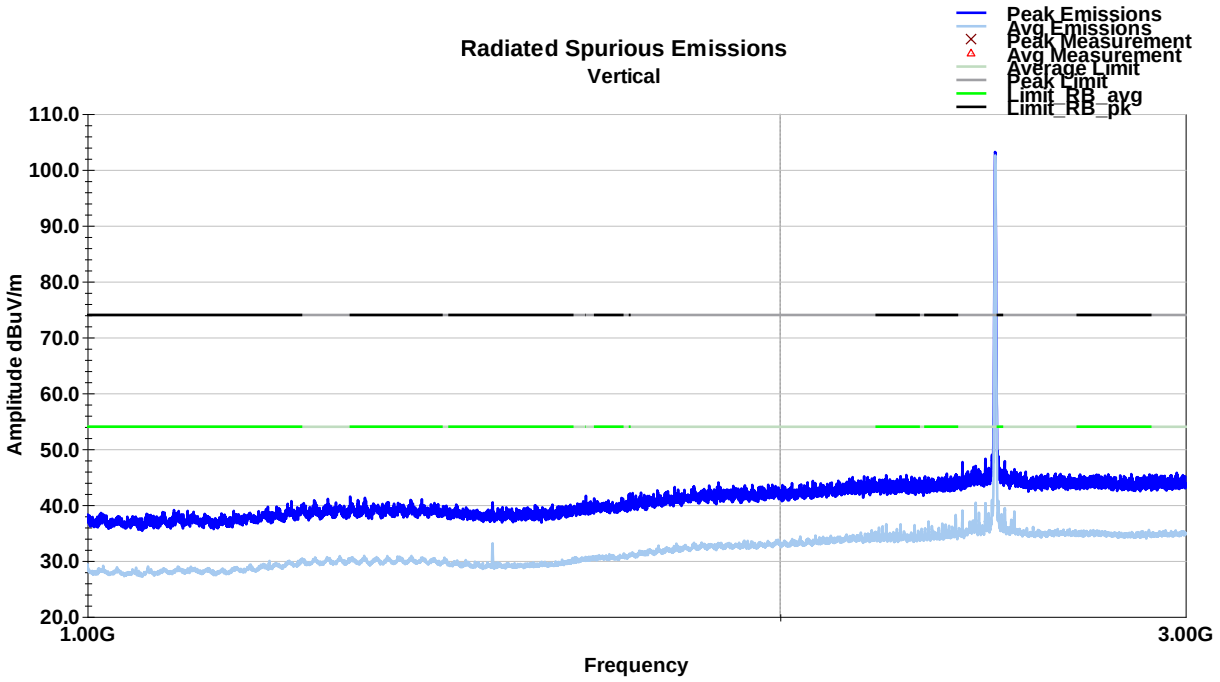


Horizontal Radiated Spurious Emissions Data

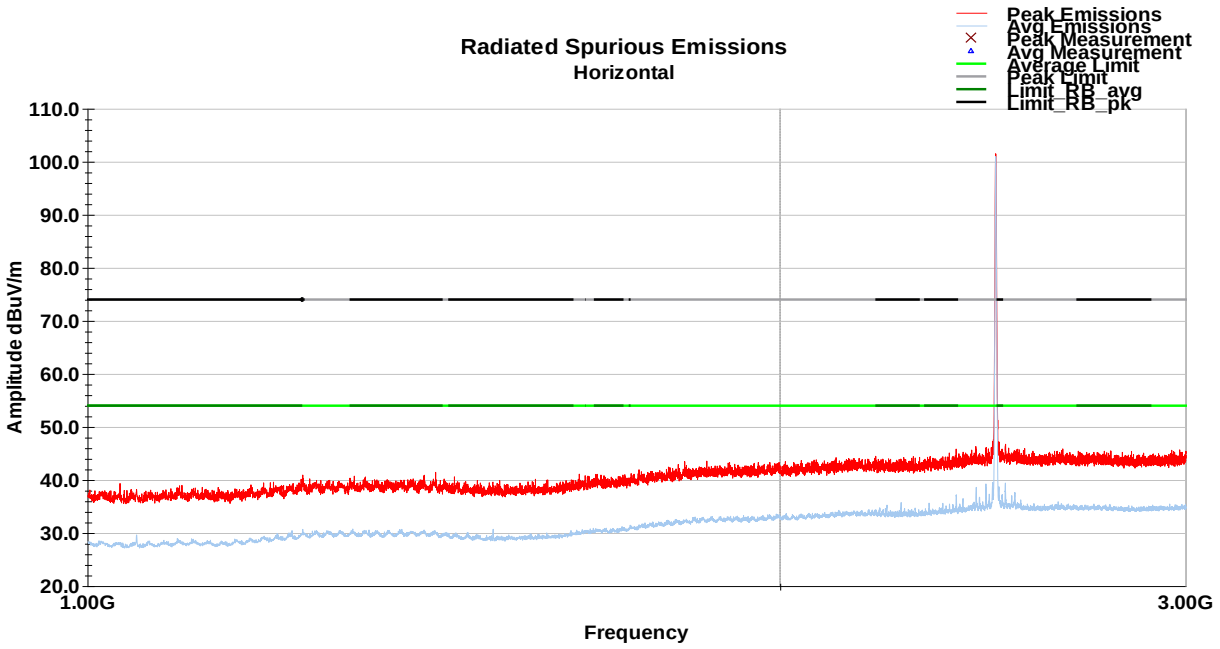
Frequency	Raw QP	Polarity	Azimuth	Height	AF	Loss	Amp	QP Value	Limit	Margin
MHz	(dBuV)	(V/H)	(degrees)	(cm)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
30	35.7	H	66	100	22.2	0.6	39.8	18.7	40	-21.3
849.57	33.2	H	132	224	22.6	3.2	42.8	16.2	46	-29.8
875.11	43	H	217	100	22.7	3.3	42.8	26.1	46	-19.9
887.03	33.2	H	225	397	22.7	3.3	42.8	16.4	46	-29.6
914.41	33.2	H	3	284	23.1	3.4	42.8	16.9	46	-29.1
937.61	33.2	H	181	293	23.3	3.4	42.8	17.2	46	-28.8
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

7.5.4 1-3 GHz (Y-axis had highest emissions)

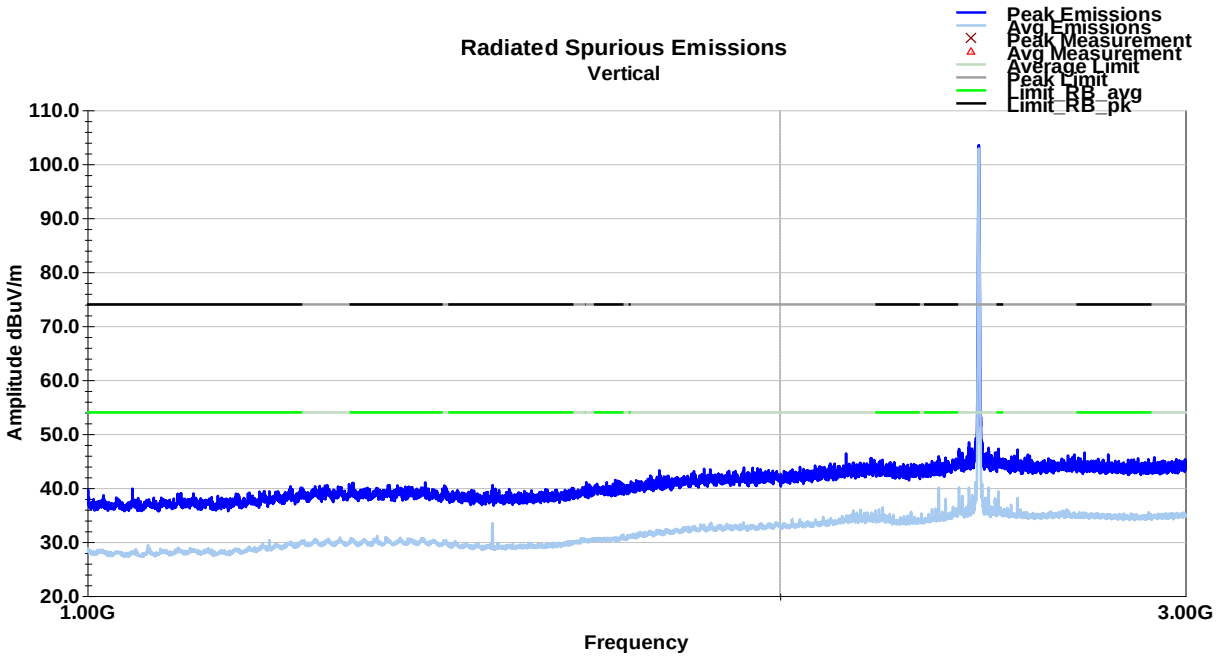
Vertical Radiated Spurious Emissions – Channel 0



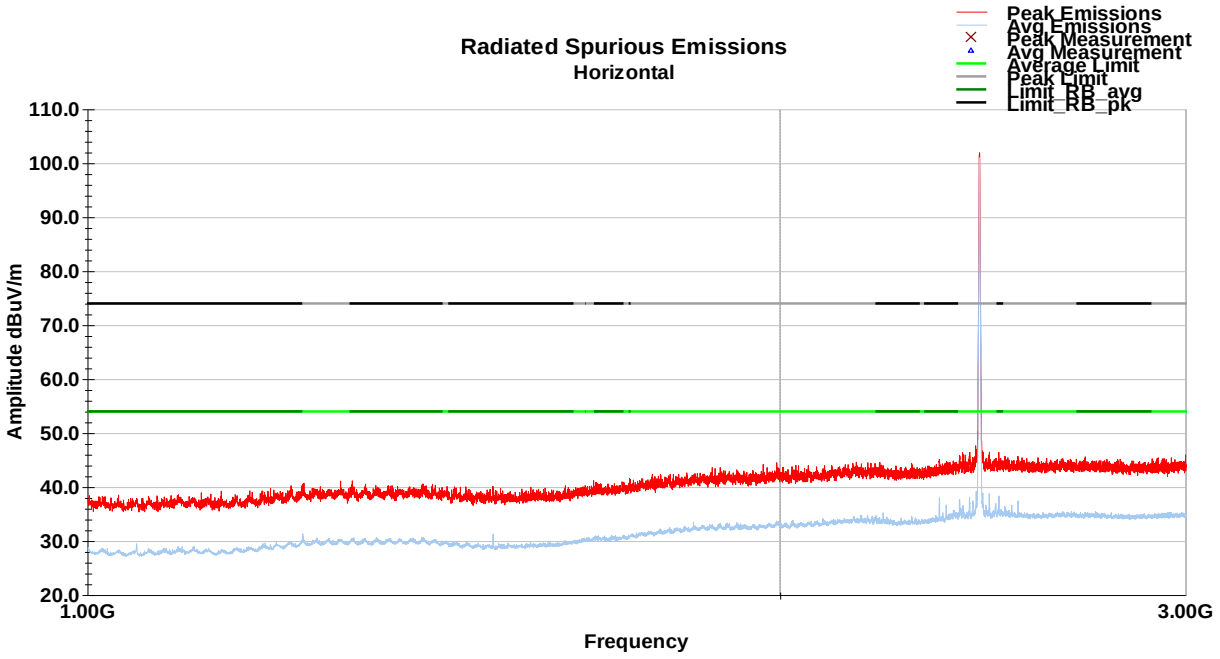
Horizontal Radiated Spurious Emissions – Channel 0



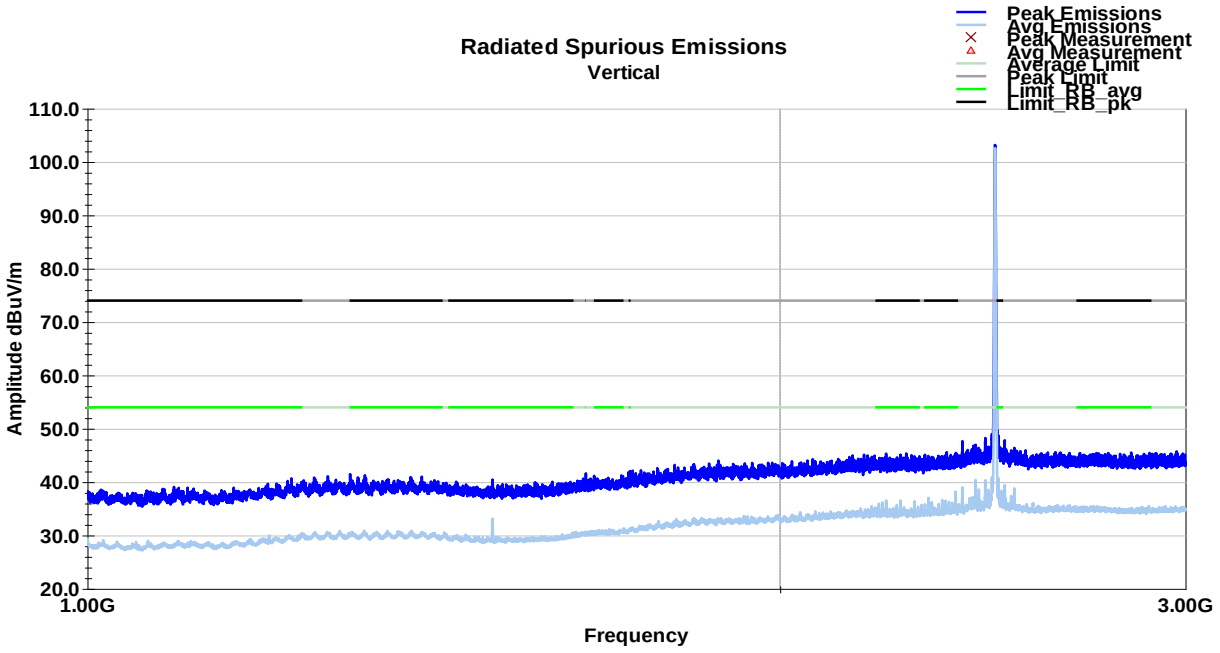
Vertical Radiated Spurious Emissions – Channel 19



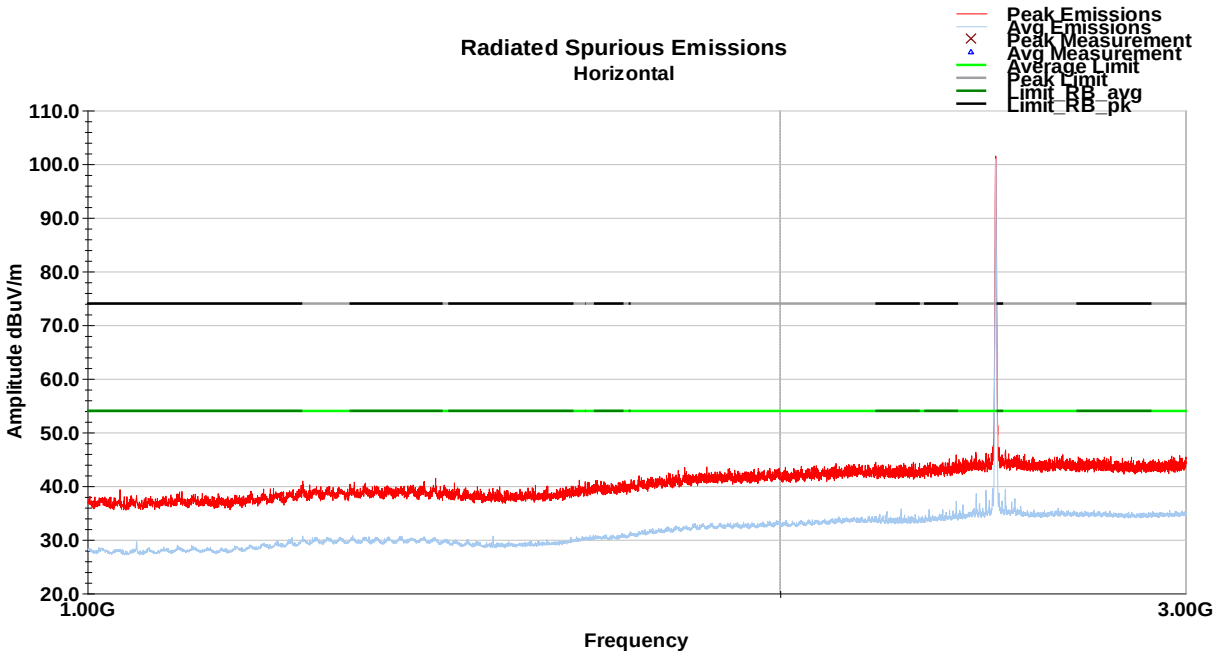
Horizontal Radiated Spurious Emissions – Channel 19



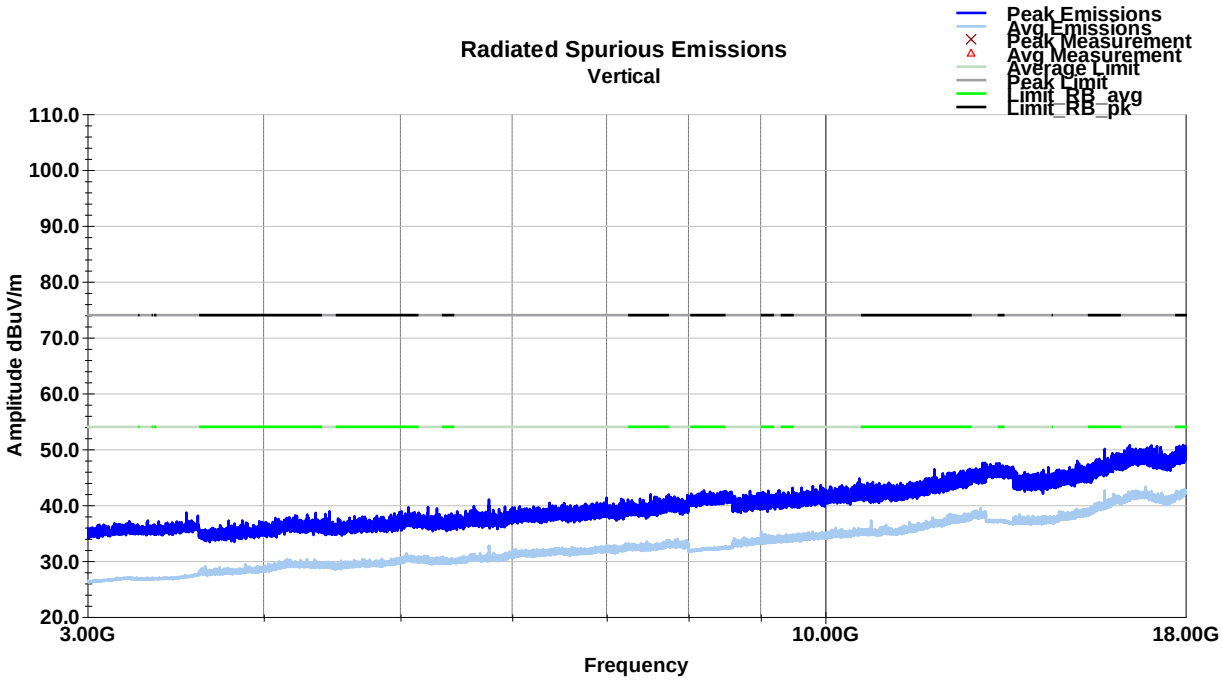
Vertical Radiated Spurious Emissions – Channel 39

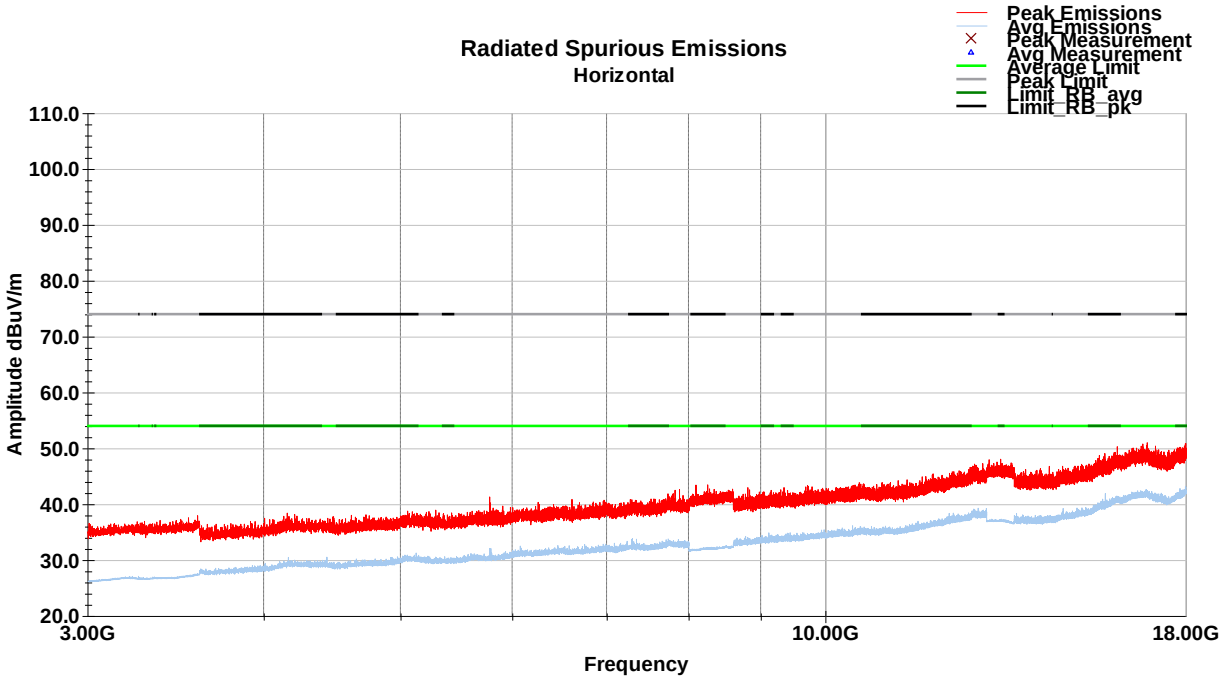


Horizontal Radiated Spurious Emissions – Channel 39

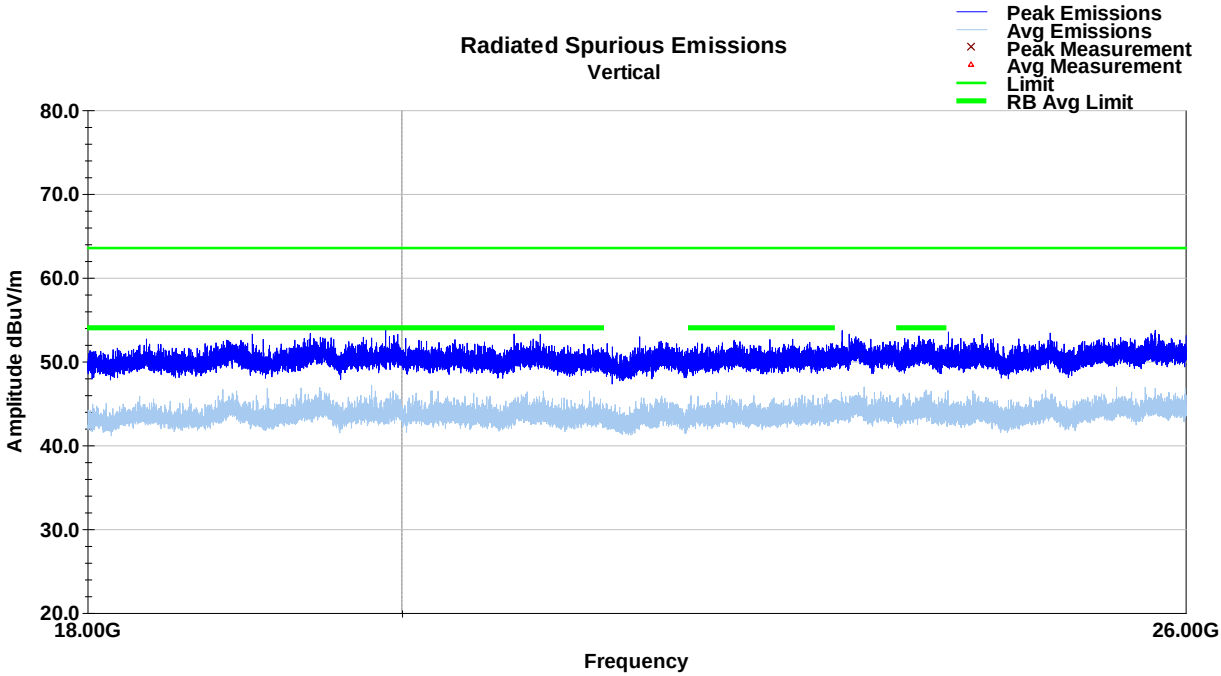


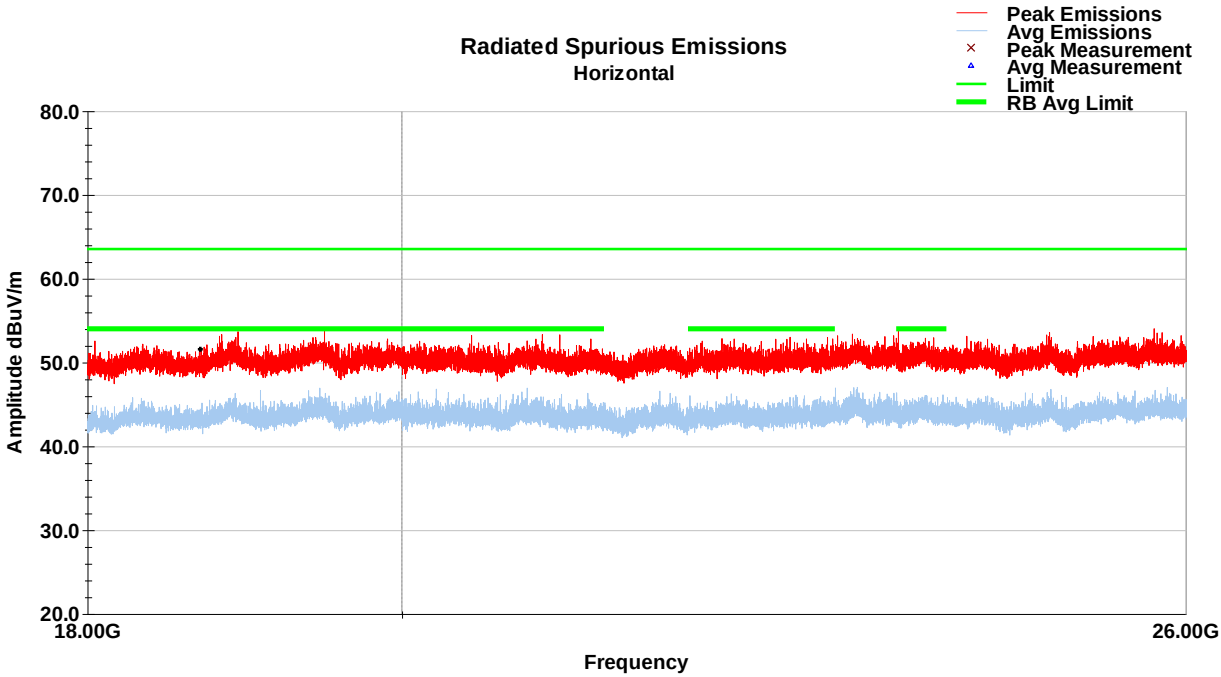
7.5.5 **3-18 GHz** (All Axis and Channels had similar results – No harmonics present above the noise floor)





7.5.6 **18-26 GHz -** (All Axis and Channels had similar results)





8 Emissions in Restricted Frequency Bands – Band Edges

8.1 *Test Result*

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

8.2 *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.

8.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	23.6 °C
Relative Humidity:	58.1 %
Atmospheric Pressure:	97.8 kPa

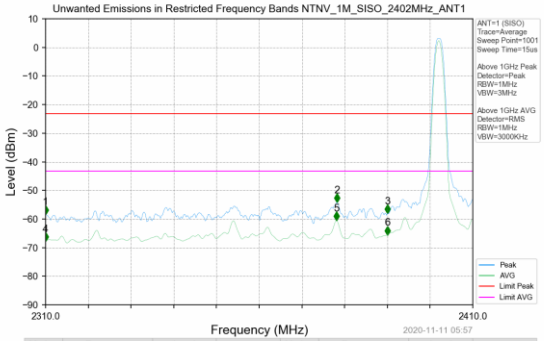
8.4 *Test Equipment*

Test End Date: 10-Nov-2020 Tester: ASF

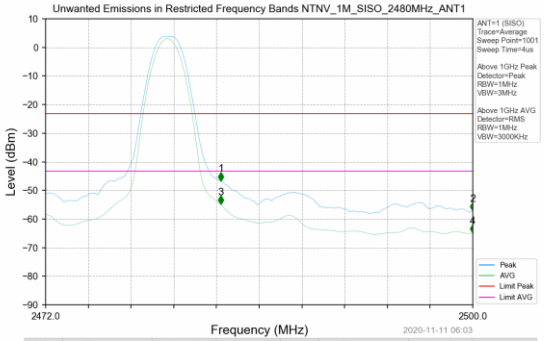
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF Cable SMA to SMA, 0.01-40GHz	084-0505-059	TELEDYNE STORM MICROWAVE	20108	6-Mar-2021
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2021

Note: The cable is on a 1 yr cal cycle, the FSV is on a 2 yr cal cycle.

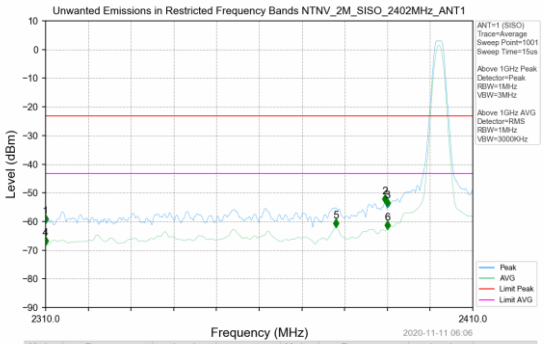
8.5 *Test Data – Restricted Band Edge*



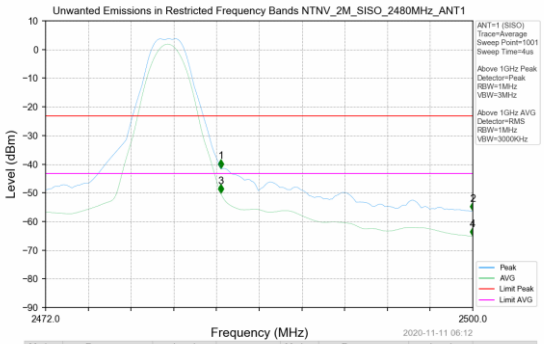
Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2310.000	-58.354	Peak	4	2310.000	-67.784	AVG
2	2378.200	-54.183	Peak	5	2378.100	-60.555	AVG
3	2390.000	-58.095	Peak	6	2390.000	-65.586	AVG



Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2483.500	-46.708	Peak	3	2483.500	-54.943	AVG
2	2500.000	-57.250	Peak	4	2500.000	-64.941	AVG



Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2310.000	-60.631	Peak	4	2310.000	-68.213	AVG
2	2389.400	-53.652	Peak	5	2378.000	-62.081	AVG
3	2390.000	-55.111	Peak	6	2390.000	-62.898	AVG



Marker No	Frequency (MHz)	Level (dBm)	Remark	Marker No	Frequency (MHz)	Level (dBm)	Remark
1	2483.500	-41.420	Peak	3	2483.500	-50.093	AVG
2	2500.000	-56.316	Peak	4	2500.000	-65.165	AVG

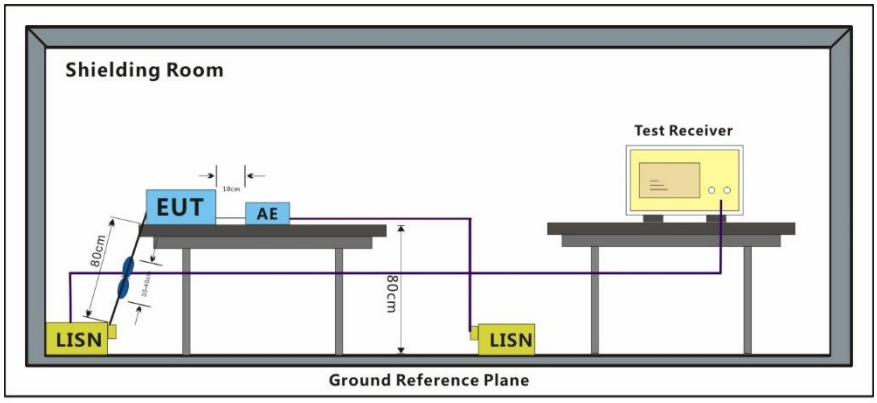
9 Conducted Emissions

9.1 *Test Result*

Test Description	Test Specification		Test Result
Conducted Emissions	15.107, 15.207	RSS-GEN S8.8	Compliant

9.2 *Test Method*

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



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

9.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23°C

Relative Humidity: 39.5 %

9.4 *Test Equipment*

Test End Date: 9-Nov-2020 Tester: PV

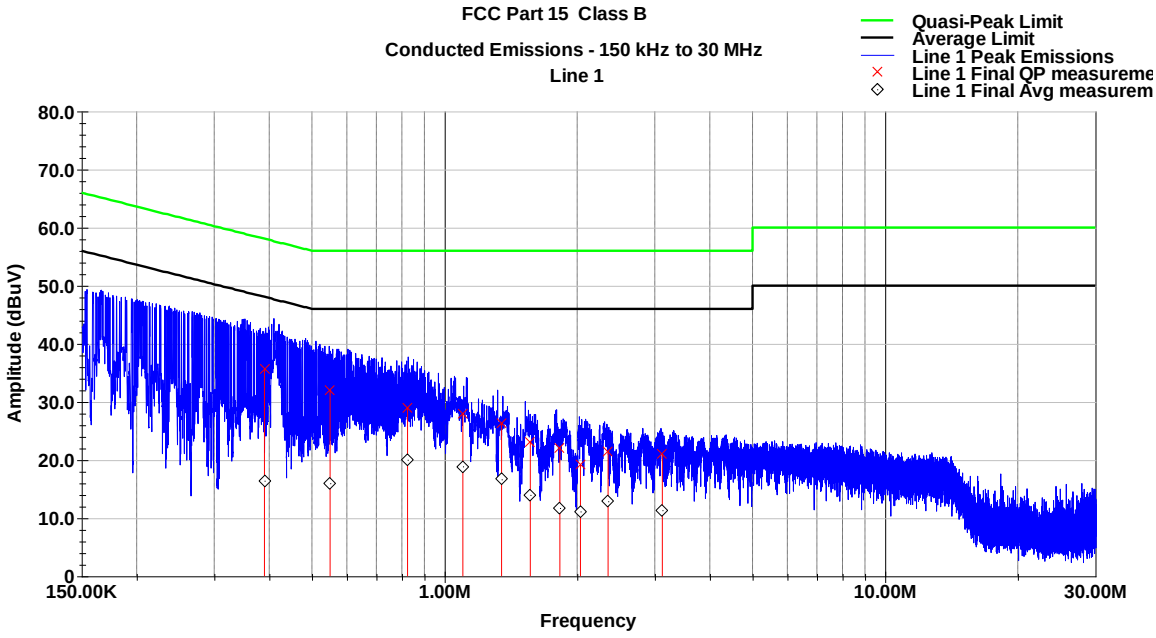
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	7-May-2020	7-May-2021
LINE IMPEDANCE STABILIZATION NETWORK	NNB 51	TESEQ	B087573	16-Dec-2019	16-Dec-2020
RF CABLE	UC-N-MM-78	MAURY MICROWAVE	17017	3-Sep-2020	3-Sep-2021
ANTENNA, DRG HORN (SMALL)	3116B	ETS Lindgren	B079697	6-Apr-2020	6-Apr-2022

Notes:

The equipment calibration period is 1 year.
CNR – Calibration Not Required
Software: Conducted Emissions Tile 7.til Oct 2020

9.5 *Test Data*

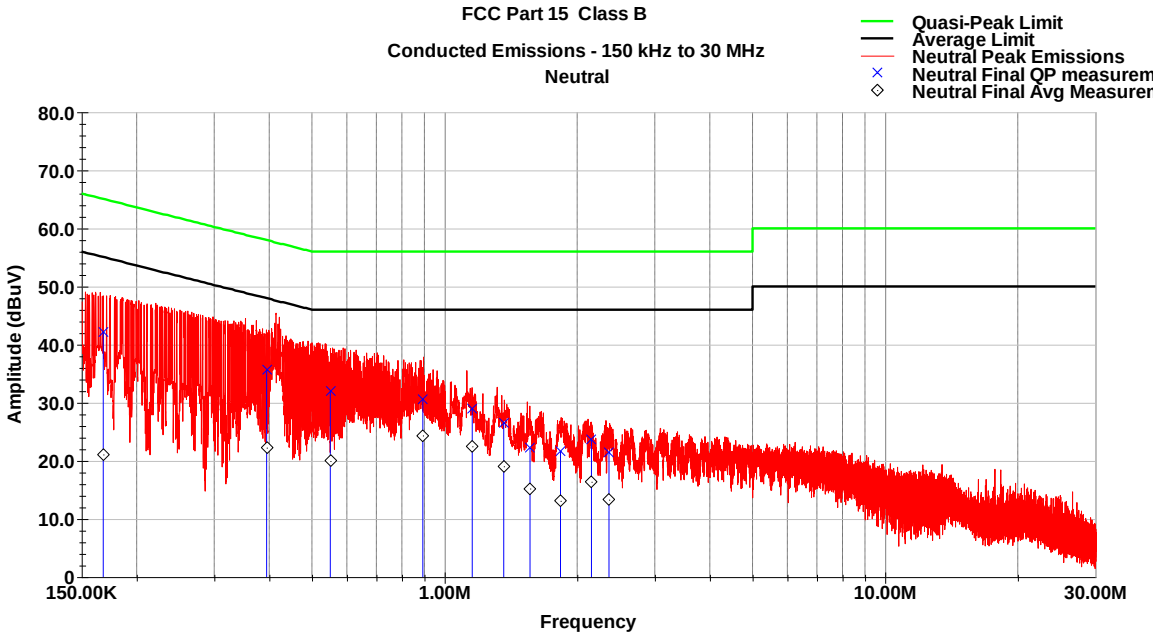
Line 1 Conducted Emissions Plot



Line 1 Conducted Emissions Data

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
0.390	35.6	58.1	-22.5	16.4	48.1	-31.7
0.550	32.0	56.0	-24.0	16.0	46.0	-30.0
0.824	29.1	56.0	-26.9	20.1	46.0	-25.9
1.100	28.0	56.0	-28.0	18.9	46.0	-27.1
1.347	26.3	56.0	-29.7	16.7	46.0	-29.3
1.565	23.1	56.0	-32.9	14.0	46.0	-32.0
1.827	22.2	56.0	-33.8	11.8	46.0	-34.2
2.034	19.2	56.0	-36.8	11.2	46.0	-34.8
2.350	21.5	56.0	-34.5	12.9	46.0	-33.1
3.121	21.0	56.0	-35.0	11.4	46.0	-34.6

Neutral Conducted Emissions Plot



Neutral Conducted Emissions Data

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
0.168	42.1	65.1	-22.9	21.1	55.1	-34.0
0.395	35.6	58.0	-22.4	22.3	48.0	-25.7
0.550	32.0	56.0	-24.0	20.0	46.0	-26.0
0.892	30.6	56.0	-25.4	24.4	46.0	-21.6
1.155	29.0	56.0	-27.0	22.5	46.0	-23.5
1.362	26.5	56.0	-29.5	19.1	46.0	-26.9
1.563	22.2	56.0	-33.8	15.2	46.0	-30.8
1.833	21.7	56.0	-34.3	13.1	46.0	-32.9
2.155	23.6	56.0	-32.4	16.4	46.0	-29.6
2.362	21.5	56.0	-34.5	13.3	46.0	-32.7

10 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%

11 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	12 January 2021
1	Updated section 7.4 to include receiver used during testing.	18 January 2021
2	Updated Section 2.3 to include Firmware version utilized during testing	11 February 2021