

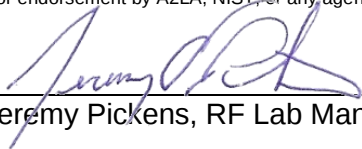
RF Test Report

Project Number: 4875564**Proposal: 01212022NG-1.3****Report Number: 4875564EMC04****Revision Level: 0****Client: OnPoint Systems****Equipment Under Test: GPS Dog Collar for Fence Training****Model Number: SOF-200****FCC ID: 2APPWSOF200****IC ID: 24233-SOF200****Applicable Standards: ANSI C63.10: 2013 (FCC Part 15 Subpart C, § 15.247)****RSS-247, Issue 2****RSS-GEN Issue 5****Report issued on: 29 March 2022****Test Result: Compliant**

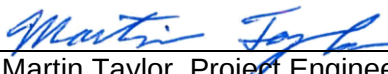
FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER: 3212.01

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

Prepared by:


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Reviewed by:


Martin Taylor, 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
Field Strength of Spurious Radiation	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: OnPoint Systems, LLC
Address: 7 Perimeter Rd
City, State, Zip, Country: Manchester, NH 03103, USA

2.2 Test Laboratory

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

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

2.3 General Information of EUT

Product Marketing Name (PMN): SpotOn
Model Number (HVIN): SOF-200
Firmware Version ID (FVIN): 1.1.0.0
Serial Number: 1064, 1071

Frequency Range: 2402 – 2480 MHz
Data Modes: Bluetooth Low Energy – GFSK
Antenna: External Wire, 1dBi

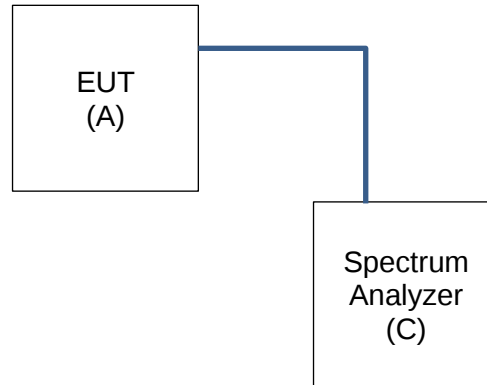
Rated Voltage: 3.6 VDC (Collar), 100-240Vac 50/60Hz Charger
Test Voltage: 3.6 VDC, 120 Vac 60Hz

Sample Received Date: 31 January 2022
Dates of testing: 05-09 February 2022

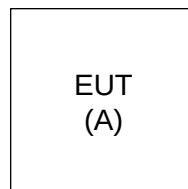
2.4 Operating Modes and Conditions

Connected to EUT via SPI to USB serial interface and entered certain codes to select to transmit on low, mid and high channels in all necessary modulation and modes of operation.

2.5 EUT Connection Block Diagram – Conducted Measurements



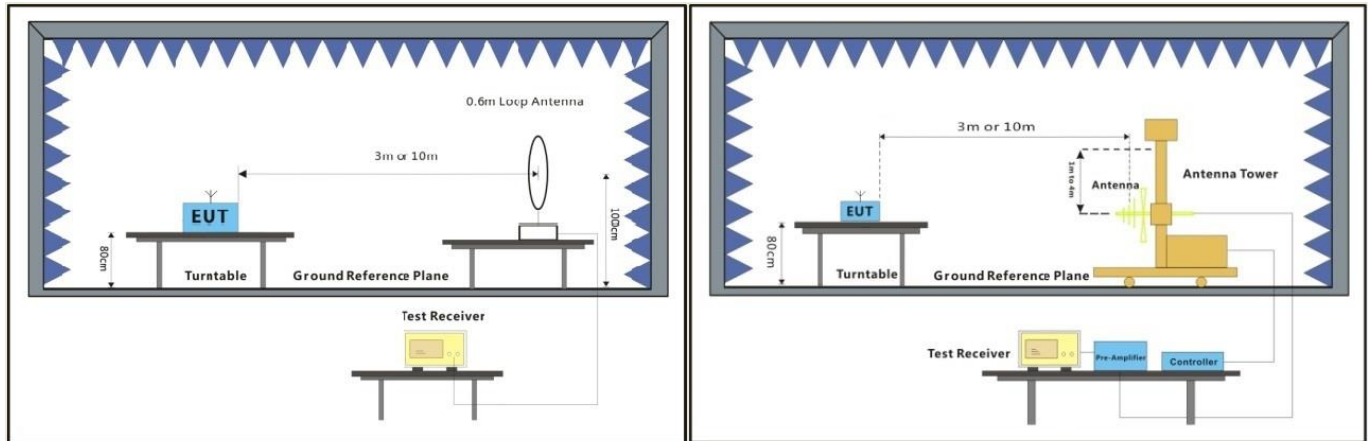
2.6 EUT Connection Block Diagram – Radiated Measurements



2.7 System Configurations

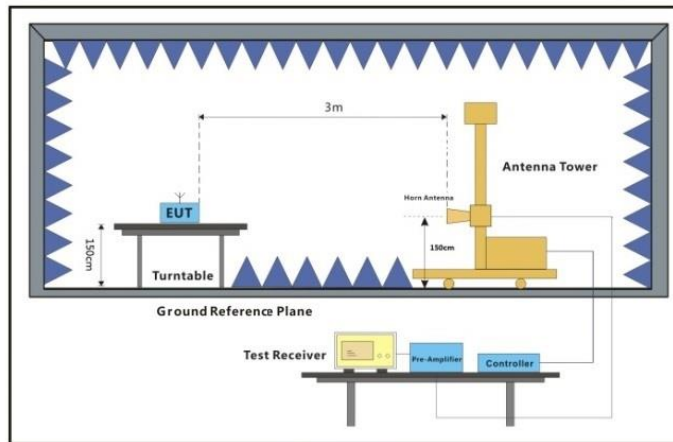
Device reference	Manufacturer	Description	Model Number	Serial Number
A	OnPoint Systems	GPS Dog Fence Collar	SOF-200	1064, 1071 (label)

2.8 Configuration Diagrams (Radiated)



Below 30MHz

30MHz-1GHz



Above 1GHz

3 Bandwidth

3.1 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

3.2 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.

3.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.4 °C

Relative Humidity: 38.7 %

Atmospheric Pressure: 97.9 kPa

3.4 Test Equipment

Test End Date: 3/4/2022

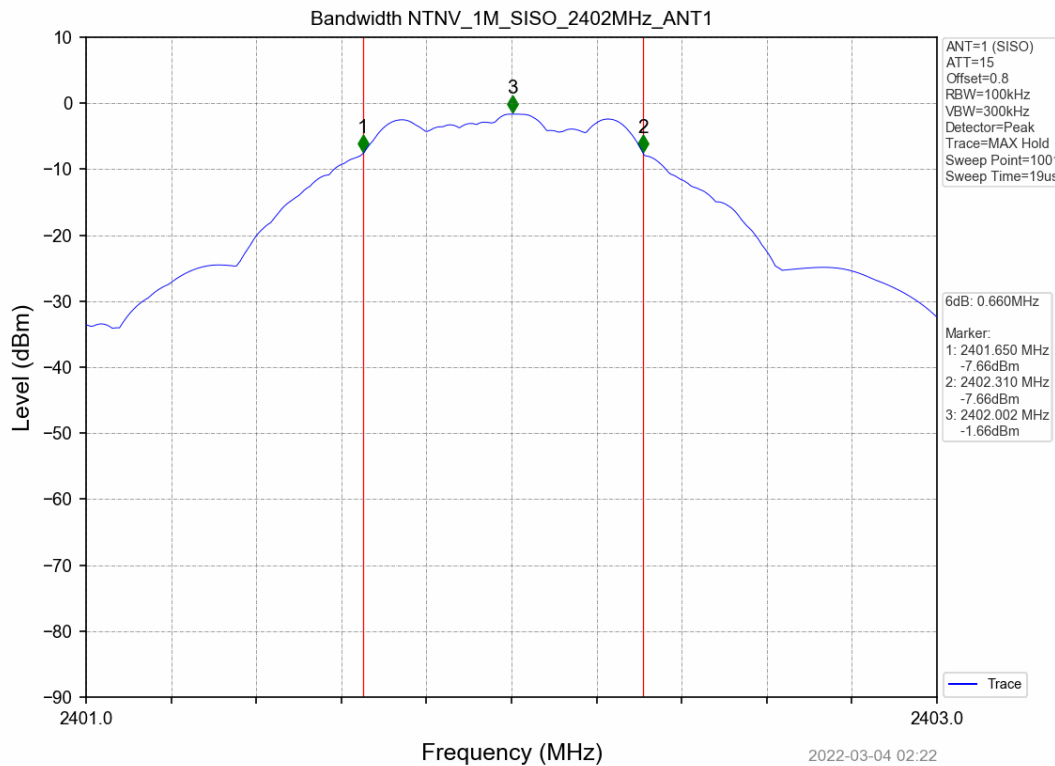
Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM	20107	16-Mar-2021	16-Mar-2022
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

3.5 Test Data – 6dB Bandwidth

Test Mode	Frequency (MHz)	TX Type	ANT No.	6dB Bandwidth		Verdict
				Test Result (MHz)	Limits (MHz)	
1M	2402	SISO	1	0.660	≥ 0.5	PASS
	2440	SISO	1	0.660	≥ 0.5	PASS
	2480	SISO	1	0.661	≥ 0.5	PASS

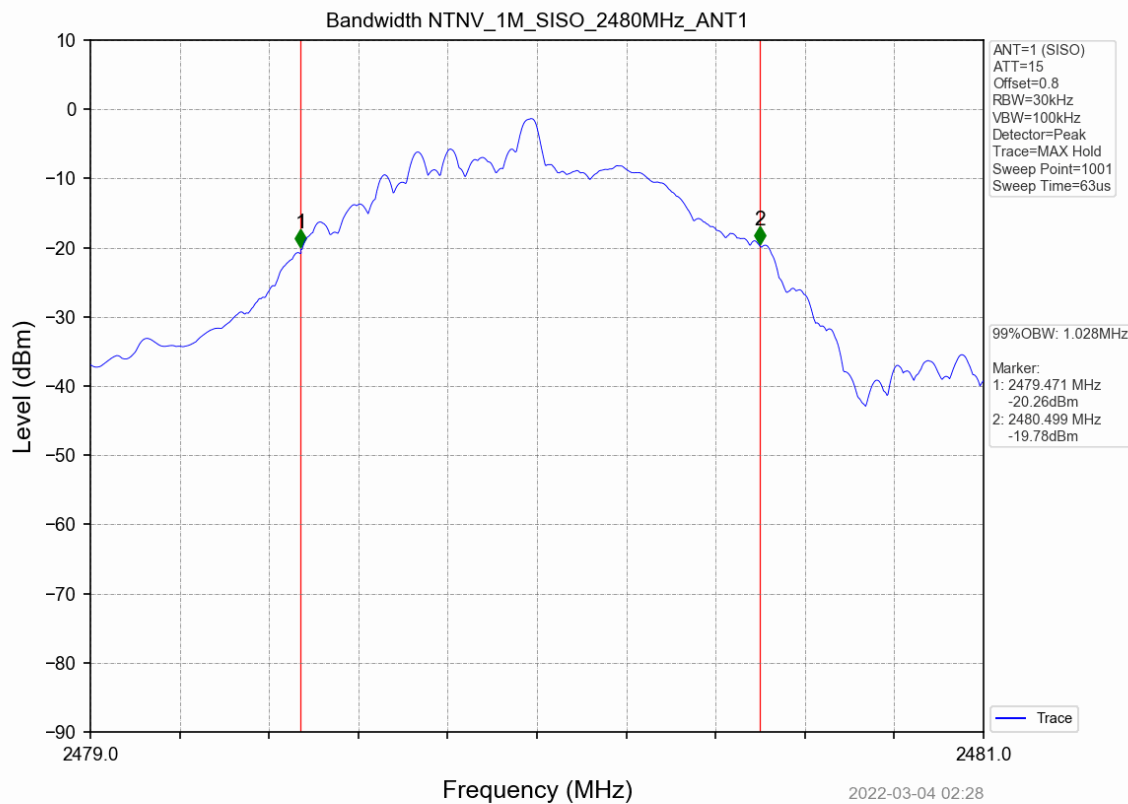
Sample Plot



3.6 Test Data – 99% Bandwidth

Test Mode	Frequency (MHz)	TX Type	ANT No.	99% Occupied Bandwidth	
				Test Result (MHz)	
1M	2402	SISO	1	1.022	Only for Report Use
	2440	SISO	1	1.017	Only for Report Use
	2480	SISO	1	1.028	Only for Report Use

Sample Plot



4 Peak Output Power

4.1 Test Result

Test Description	Test Specification		Test Result
Peak 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 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)

4.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.4 °C

Relative Humidity: 38.7 %

Atmospheric Pressure: 97.9 kPa

4.4 Test Equipment

Test End Date: 3/4/2022

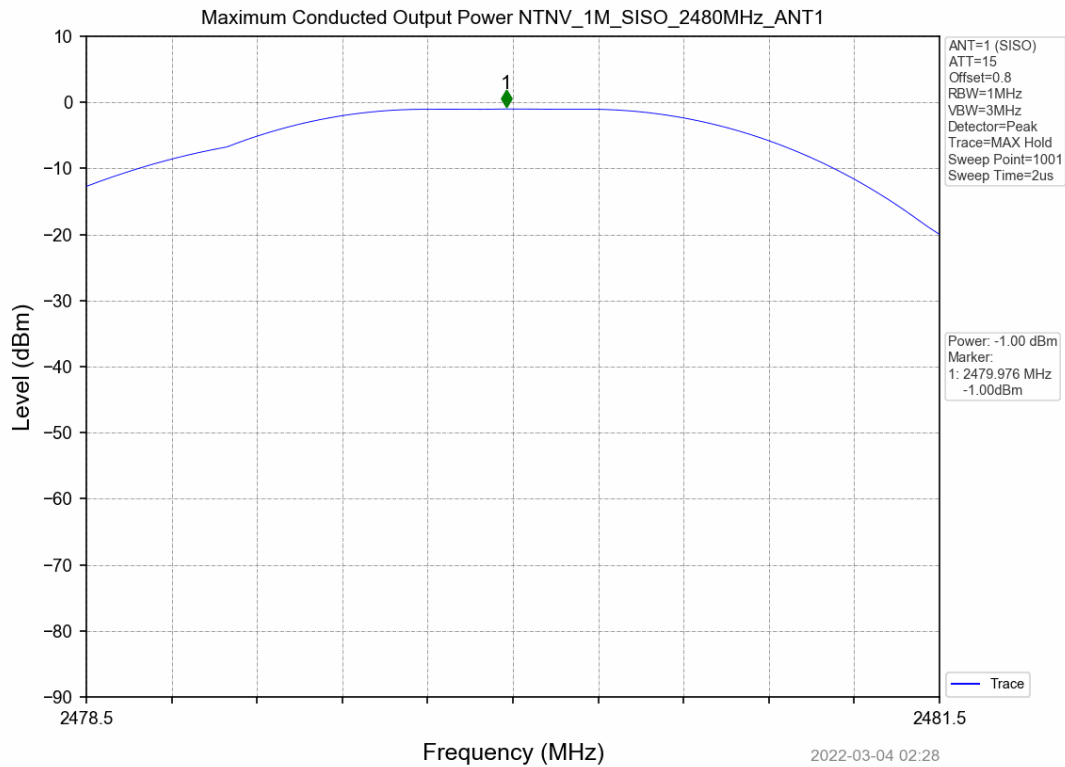
Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM	20107	16-Mar-2021	16-Mar-2022
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

4.5 Test Data

Test Mode	Frequency (MHz)	Tx Type	Measured Peak Output Power (dBm)	Limits (dBm)	Verdict
			Ant 1		
1M	2402	SISO	-1.64	30	PASS
	2440	SISO	-1.35	30	PASS
	2480	SISO	-1.00	30	PASS

Sample Plot



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 v05r2.

Limit

The limit is 8 dBm.

5.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.4 °C

Relative Humidity: 38.7 %

Atmospheric Pressure: 97.9 kPa

5.4 Test Equipment

Test End Date: 3/4/2022

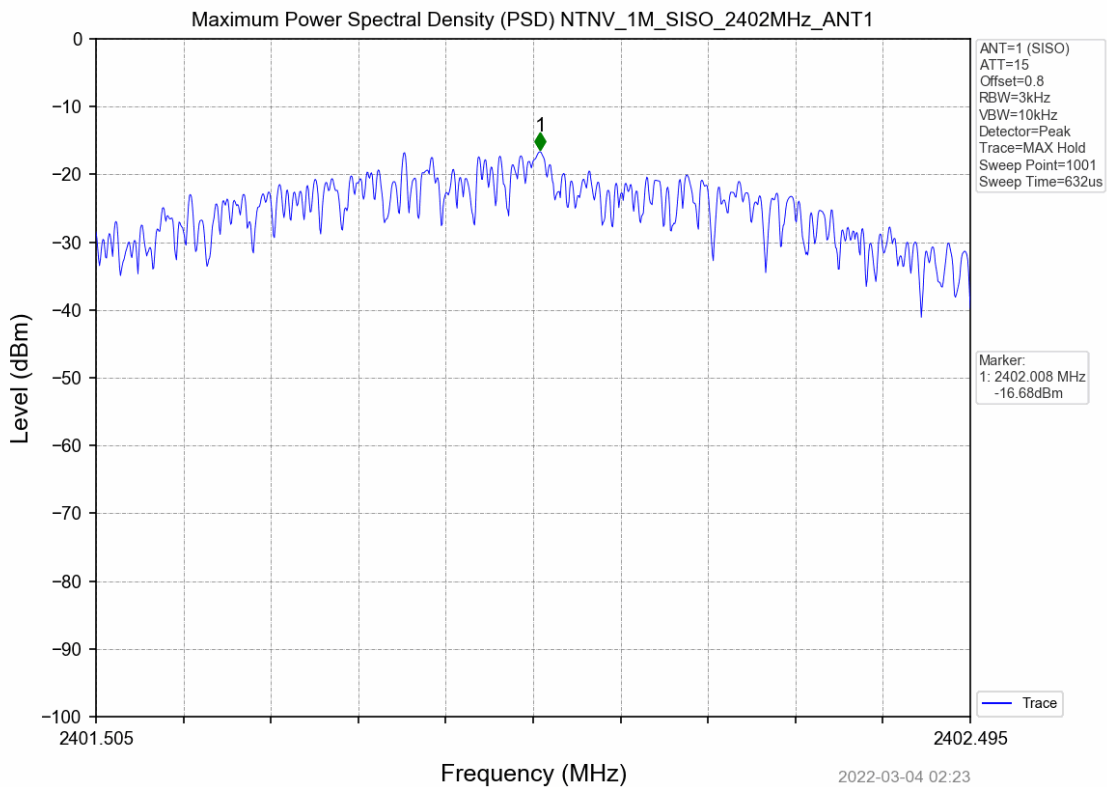
Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM	20107	16-Mar-2021	16-Mar-2022
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

5.5 Test Data

Test Mode	Frequency (MHz)	Tx Type	Maximum Power Spectral Density (dBm/3KHz)	Limits (dBm/3kHz)	Verdict
			Ant 1		
1M	2402	SISO	-16.68	≤8	PASS
	2440	SISO	-15.47	≤8	PASS
	2480	SISO	-14.96	≤8	PASS

Sample Plot



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 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.

6.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.4 °C

Relative Humidity: 38.7 %

Atmospheric Pressure: 97.9 kPa

6.4 Test Equipment

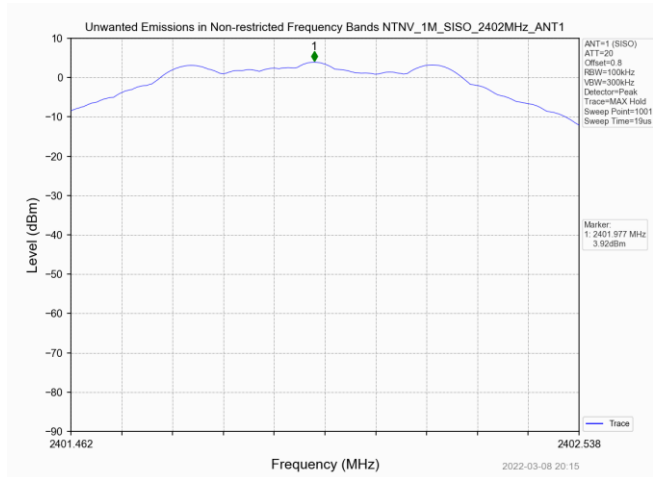
Test End Date: 3/4/2022

Tester: JOP

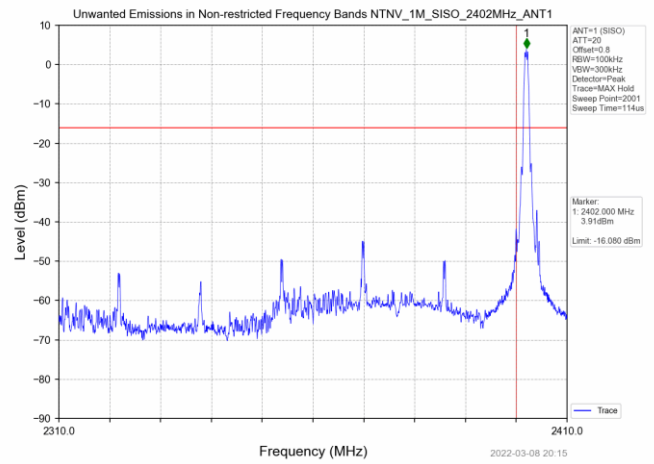
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM	20107	16-Mar-2021	16-Mar-2022
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

6.5 Test Data

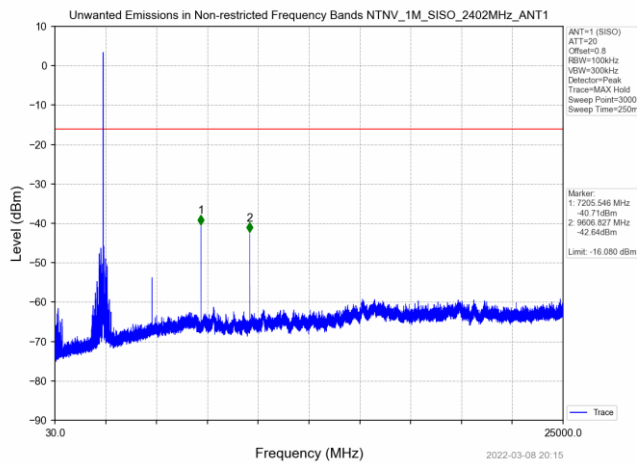
1M In-Band Reference



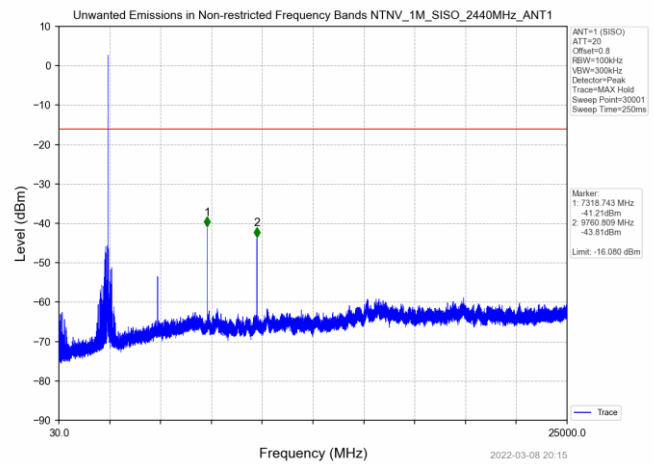
1M Lower Band Edge - Low Channel (2402MHz)



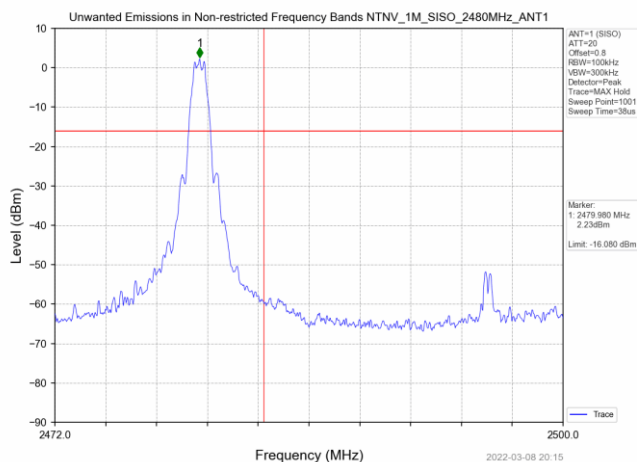
1M Full Spectrum - Low Channel (2402MHz)



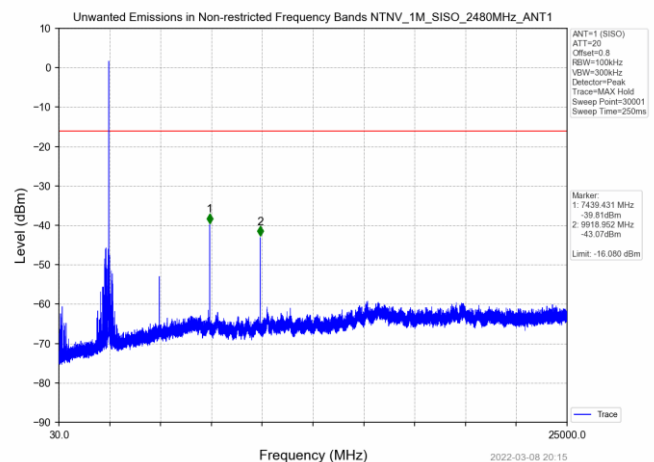
1M Full Spectrum - Mid Channel (2440MHz)



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



1M Full Spectrum - High Channel (2480MHz)



7 Field Strength of Spurious Radiation (Restricted Bands)

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.

Duty Cycle provided by manufacturer was less than 10%. Maximum correction value allowed is 20dB, which is equivalent to a 10% duty cycle. Therefore, we adjusted average values of the harmonics by negative 20dB.

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

7.3 Test Site

10m and 3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions	30-1000MHz:	1-18GHz:
Temperature:	23.4 °C	24.2 °C
Relative Humidity:	43.2 %	42.7 %
Atmospheric Pressure:	98.17 kPa	98.0 kPa

7.4 Test Equipment

30-1000MHz

Test End Date: 8-Mar-2022

Tester: AB

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079690	13-Jan-2021	13-Jan-2023
ATTENUATOR, 4DB 5W	BW-N4W5+	MINI-CIRCUITS	18002	23-Jul-2021	23-Jul-2022
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
RF CABLE NM TO NM, 0.01-18GHZ	90-195-079	TELEDYNE STORM MICROWAVE	20124	14-Feb-2022	14-Feb-2023
LOW NOISE AMPLIFIER	ZKL-2+	MINI-CIRCUITS	B079800	18-Oct-2021	18-Oct-2022
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

1-18GHz

Test End Date: 8-Mar-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
RF CABLE NM TO NM, 0.01-18GHZ	90-195-118	TELEDYNE STORM MICROWAVE	20125	25-Aug-2021	25-Aug-2022
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

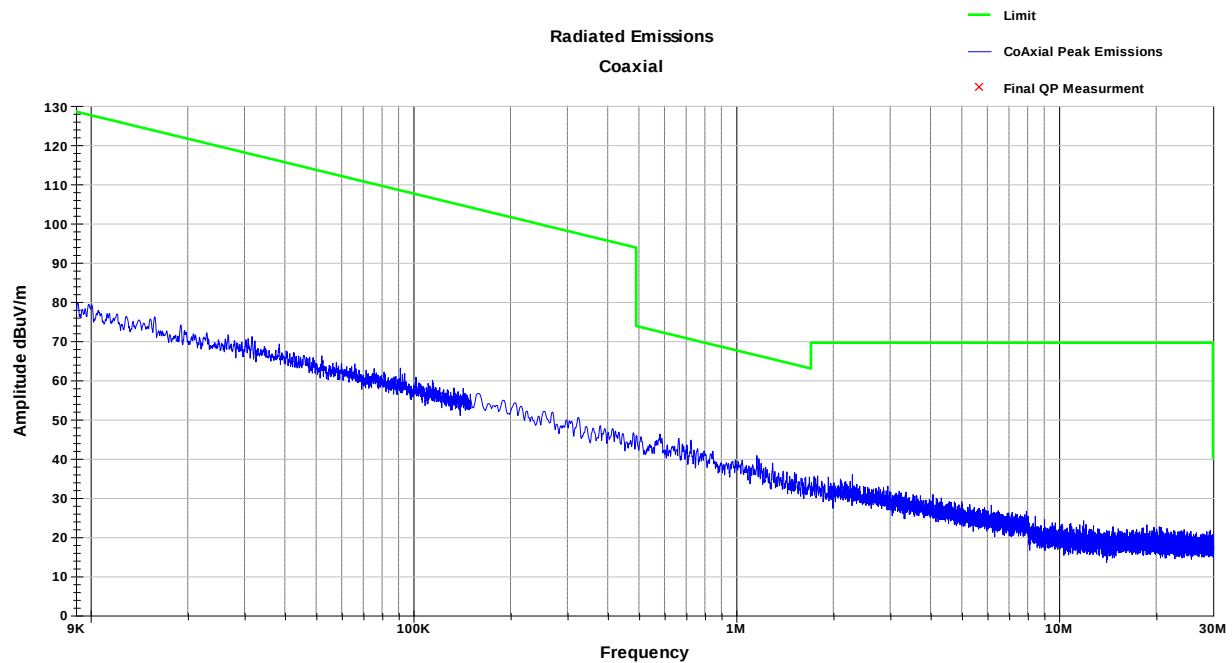
Note: Refer to equipment table for calibration intervals.

7.5 Test Data – Peak Plots

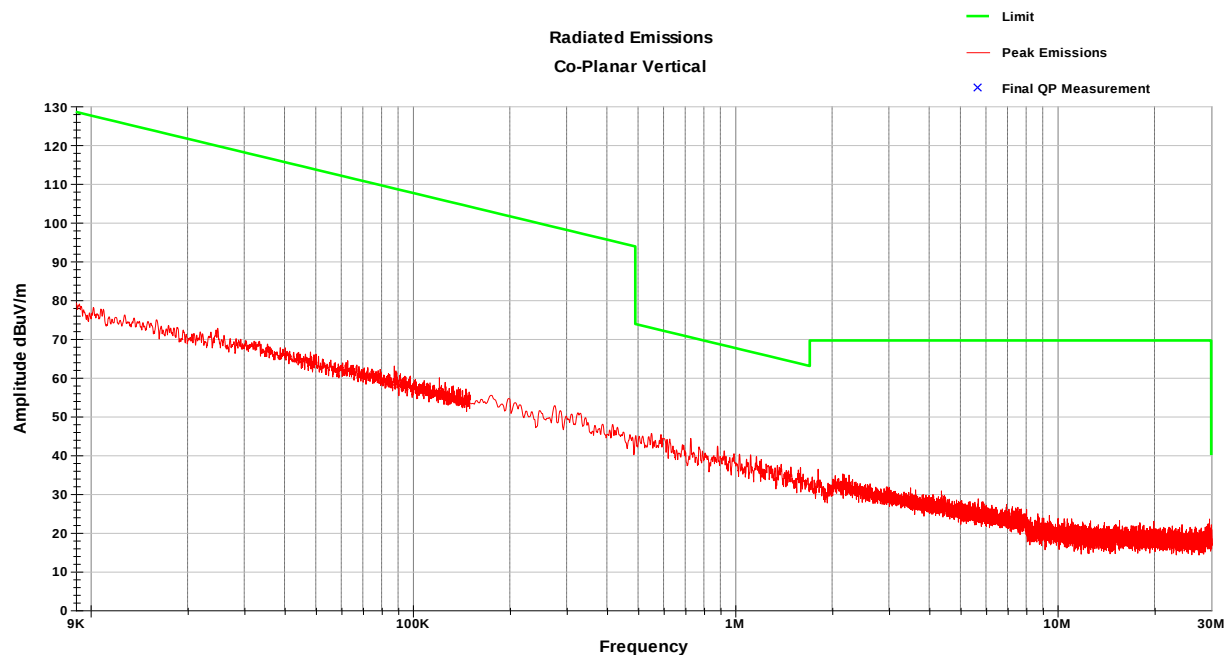
7.5.1 9kHz to 30MHz

Between 9kHz and 30MHz there was no significant deviation with respect to axis or channel.

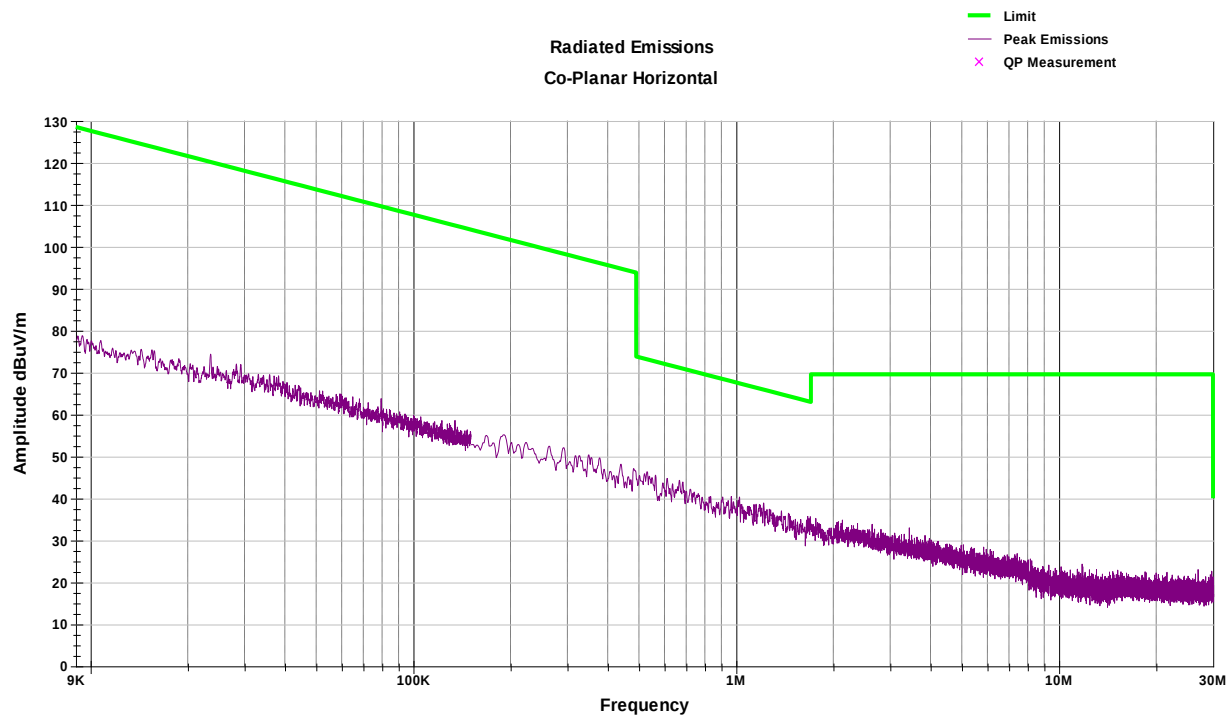
Co-Axial Radiated Spurious Emissions – 9kHz-30MHz (MCH)



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

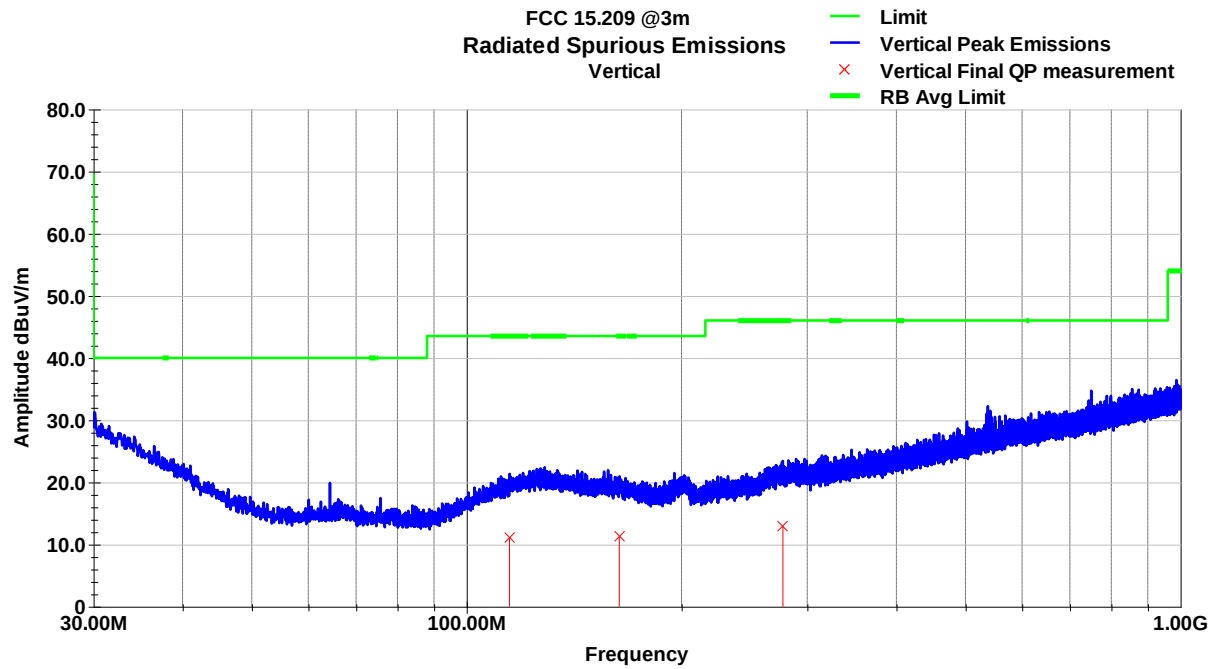


Co-Axial Radiated Spurious Emissions Horizontal – 9kHz-30MHz (MCH)



7.5.2 30-1000 MHz

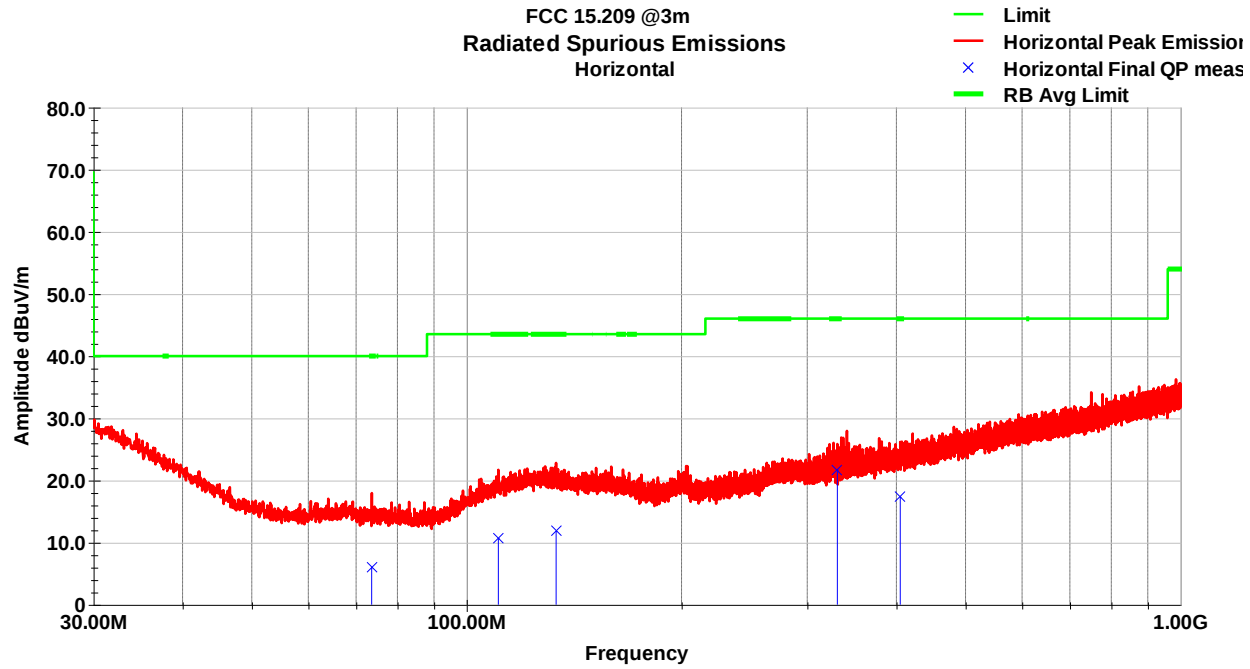
2402MHz Low Channel Vertical Plot



2402MHz Low Channel Vertical Data

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)
114.81	24.0	V	137.0	110.0	13.2	5.4	31.4	11.1	43.5	-32.4
163.64	24.3	V	200.0	247.0	12.6	5.8	31.5	11.2	43.5	-32.3
277.42	24.1	V	122.0	286.0	13.9	6.3	31.5	12.8	46.0	-33.2
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

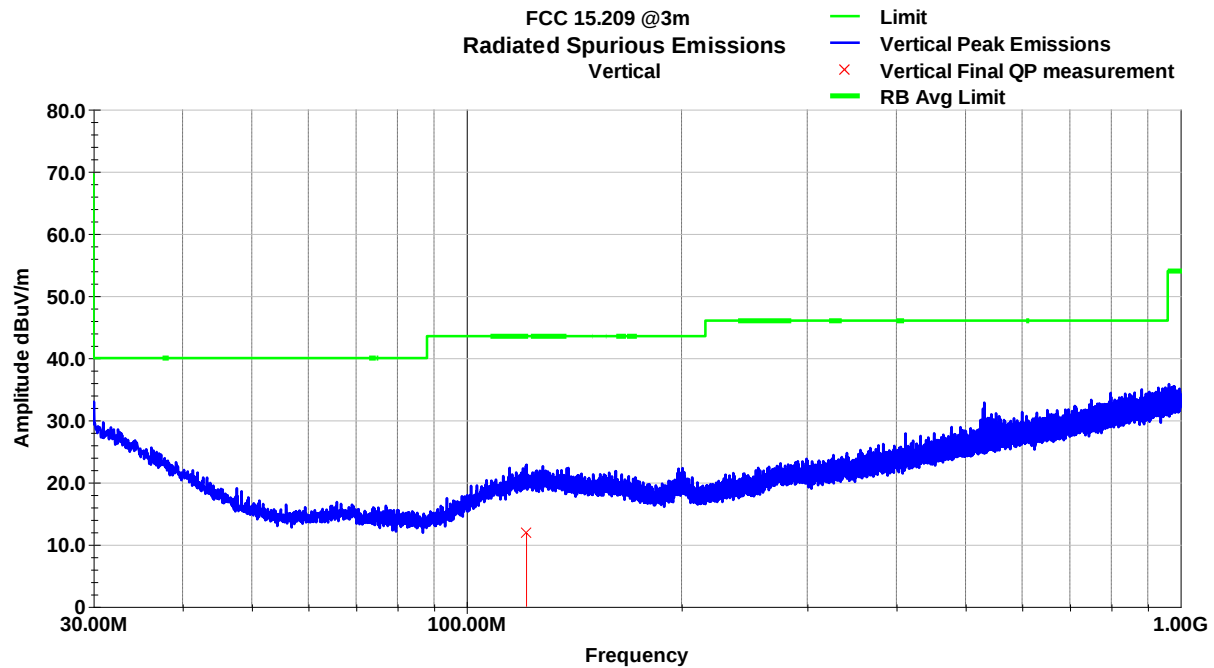
2402MHz Low Channel Horizontal Plot



2402MHz Low Channel Horizontal Data

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)
73.61	24.0	H	339.0	399.0	8.1	5.1	31.2	6.0	40.0	-34.0
110.78	24.2	H	265.0	236.0	12.6	5.4	31.4	10.7	43.5	-32.8
133.44	24.1	H	68.0	104.0	13.7	5.6	31.5	11.9	43.5	-31.7
330.62	31.9	H	355.0	108.0	14.8	6.5	31.5	21.7	46.0	-24.3
405.05	25.7	H	3.0	102.0	16.3	6.8	31.4	17.4	46.0	-28.7
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

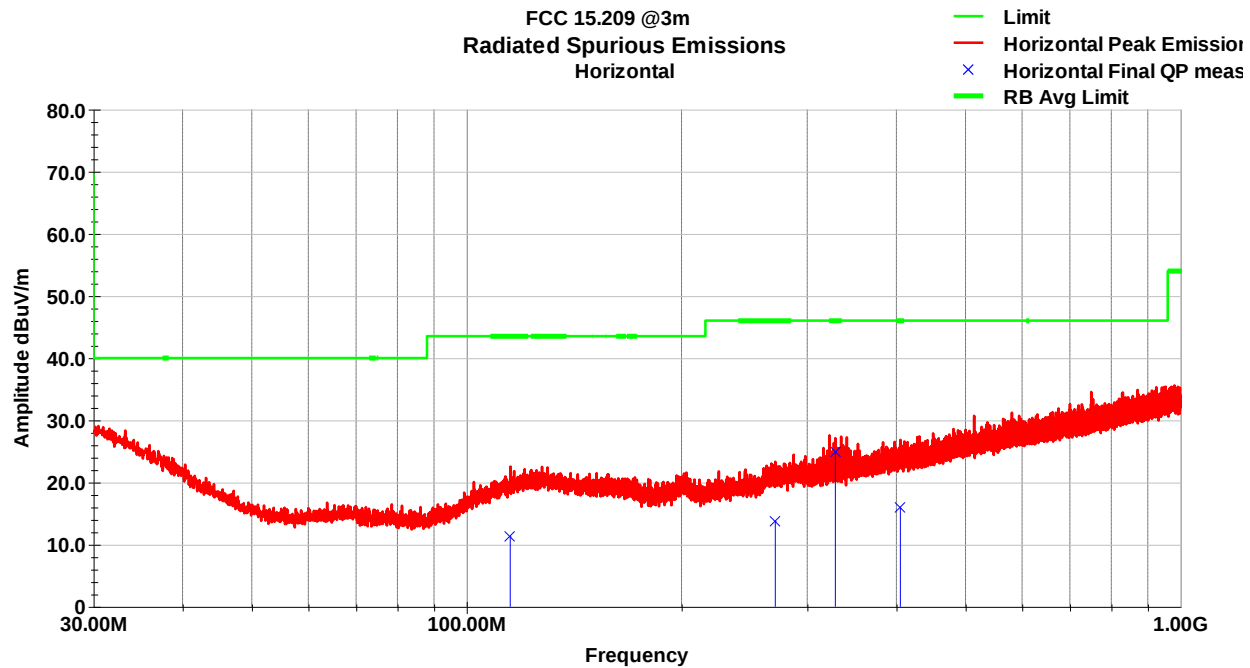
2440MHz Mid Channel Vertical Plot



2440MHz Mid Channel Vertical Data

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)
121.33	24.2	V	359.0	144.0	13.7	5.5	31.5	11.9	43.5	-31.6
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

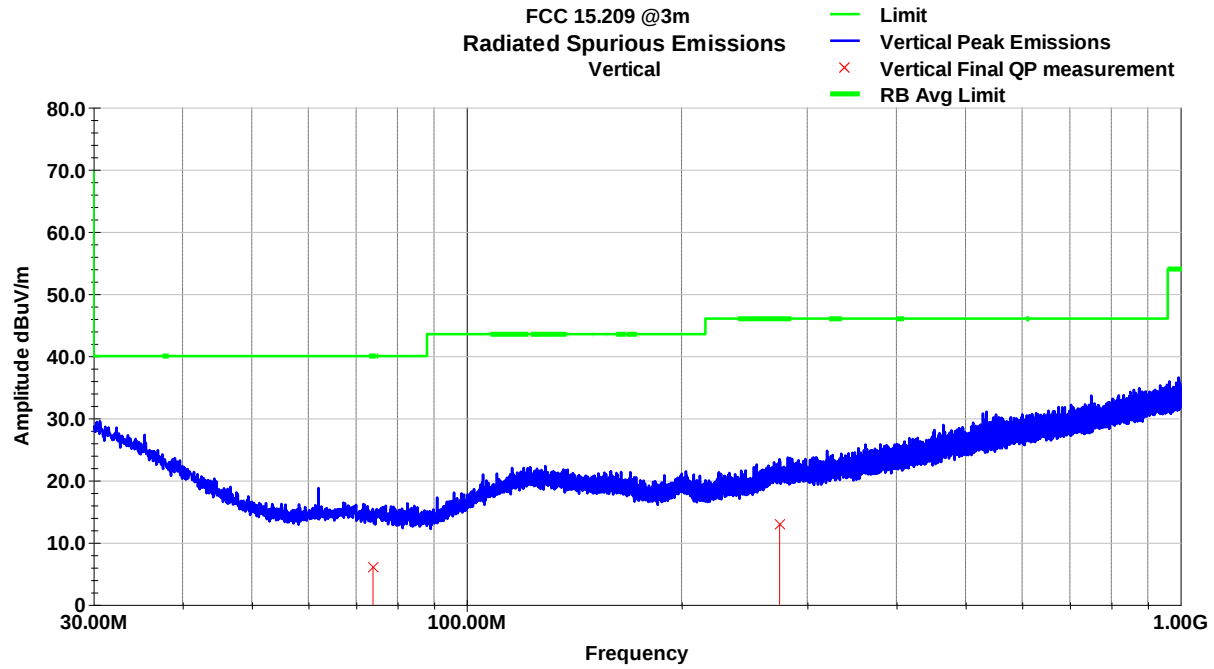
2440MHz Mid Channel Horizontal Plot



2440MHz Mid Channel Horizontal Data

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)
115.11	24.1	H	129.0	126.0	13.2	5.4	31.5	11.3	43.5	-32.2
270.66	25.1	H	167.0	100.0	13.8	6.3	31.5	13.8	46.0	-32.3
328.53	35.0	H	170.0	105.0	14.7	6.5	31.5	24.8	46.0	-21.2
405.22	24.3	H	101.0	114.0	16.3	6.8	31.4	15.9	46.0	-30.1
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

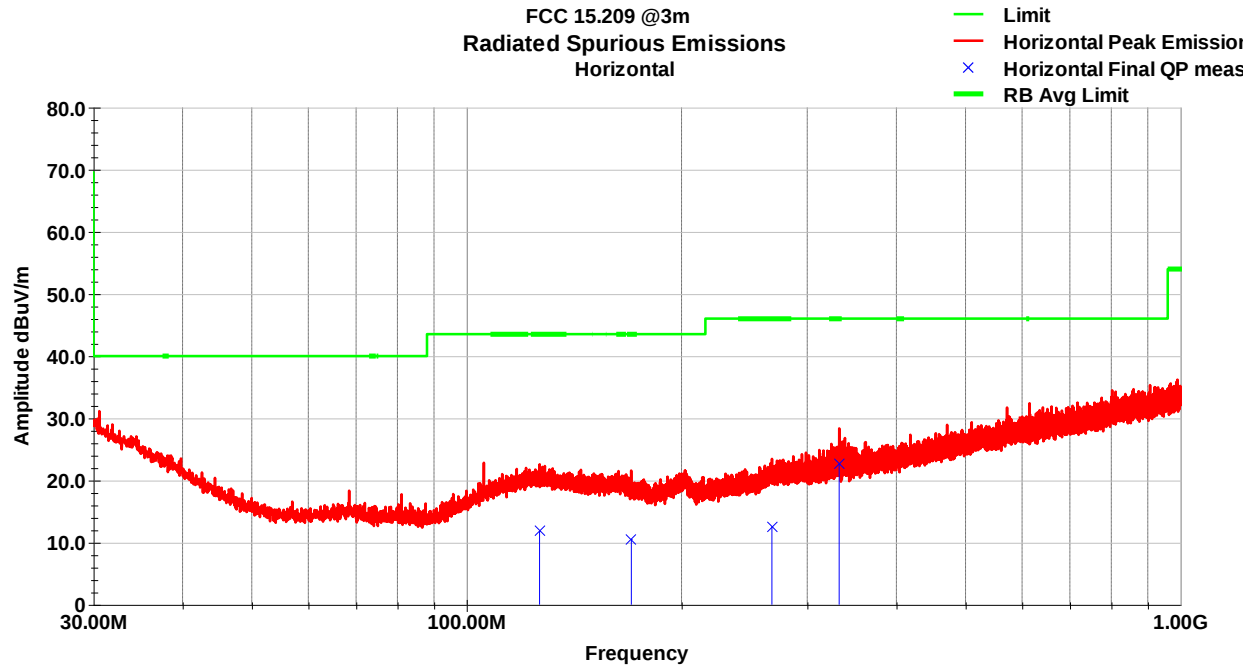
2480MHz High Channel Vertical Plot



2480MHz High Channel Vertical Data

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)
73.92	24.1	V	0.0	270.0	8.1	5.1	31.2	6.1	40.0	-33.9
274.42	24.2	V	342.0	104.0	13.8	6.3	31.5	12.9	46.0	-33.1
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

2480MHz High Channel Horizontal Plot

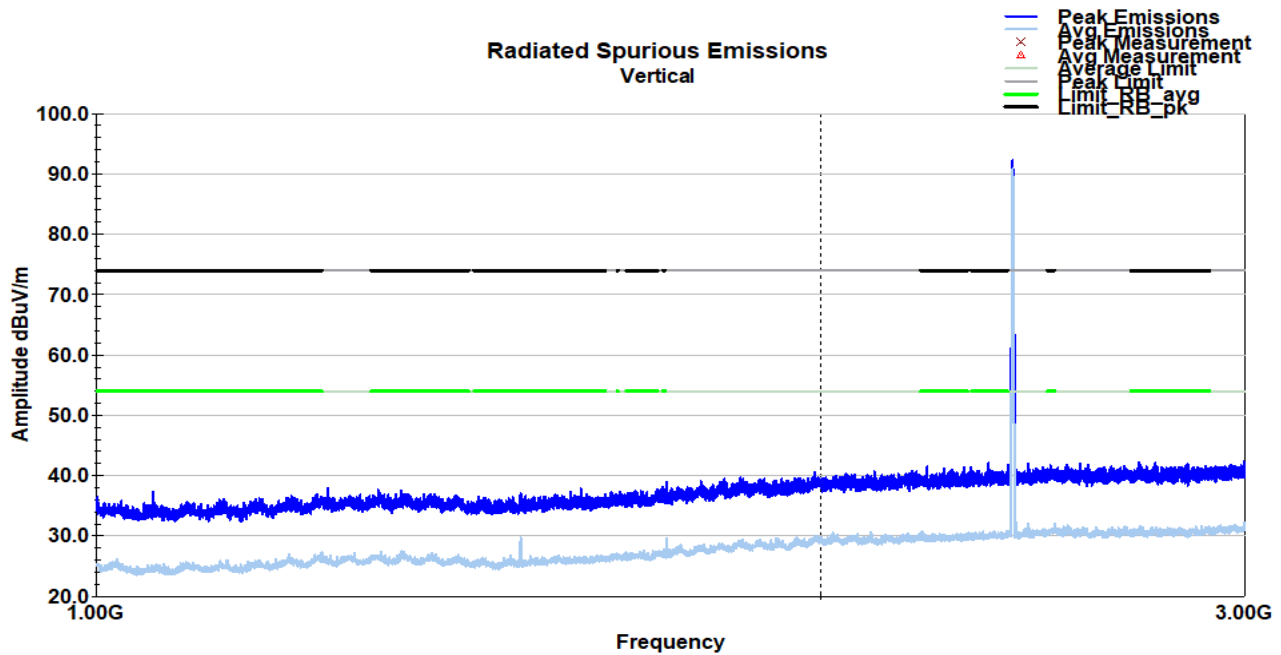


2480MHz High Channel Horizontal Data

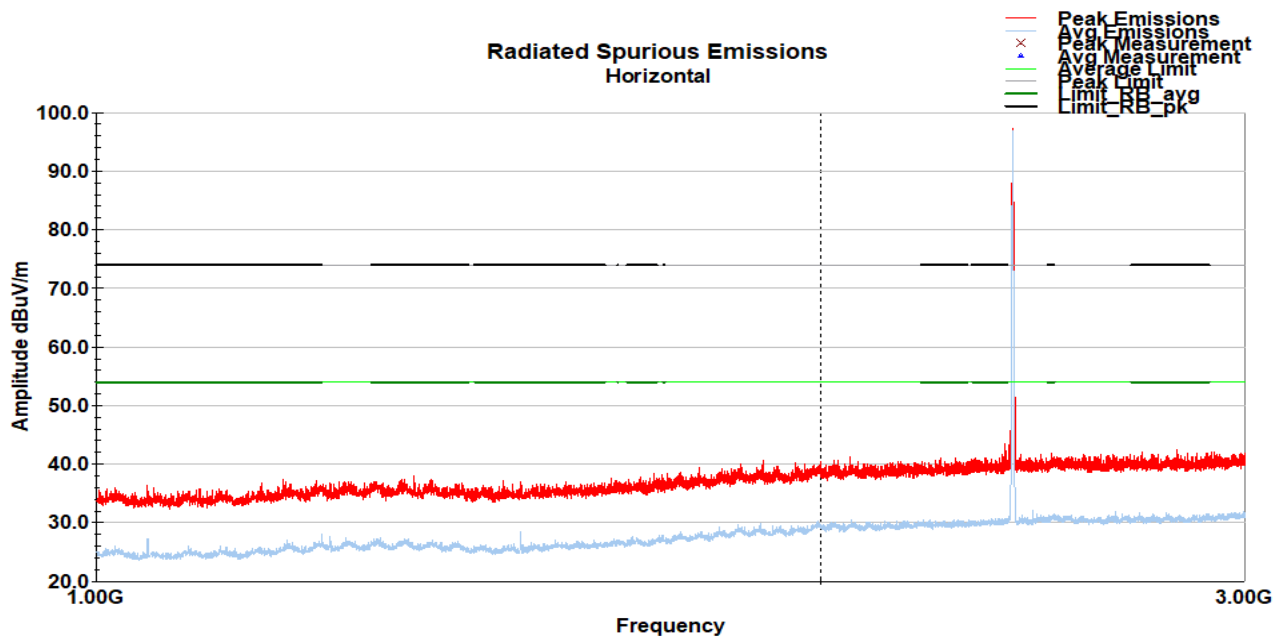
Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
126.51	23.9	H	26.0	227.0	13.9	5.5	31.5	11.9	43.5	-31.6
170.11	24.3	H	335.0	149.0	12.0	5.8	31.5	10.6	43.5	-32.9
267.74	24.1	H	34.0	368.0	13.7	6.3	31.5	12.6	46.0	-33.4
332.63	32.8	H	359.0	113.0	14.8	6.5	31.5	22.7	46.0	-23.3
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

7.5.3 1-3 GHz

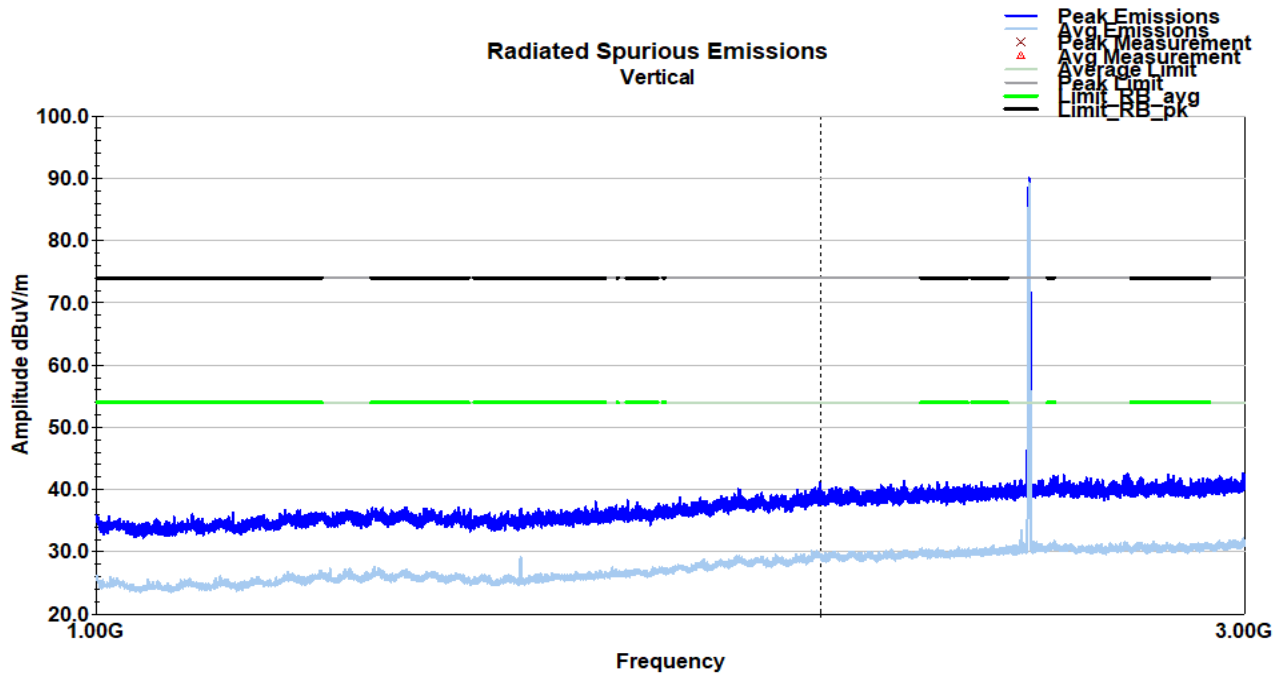
2402MHz Low Channel Vertical Plot



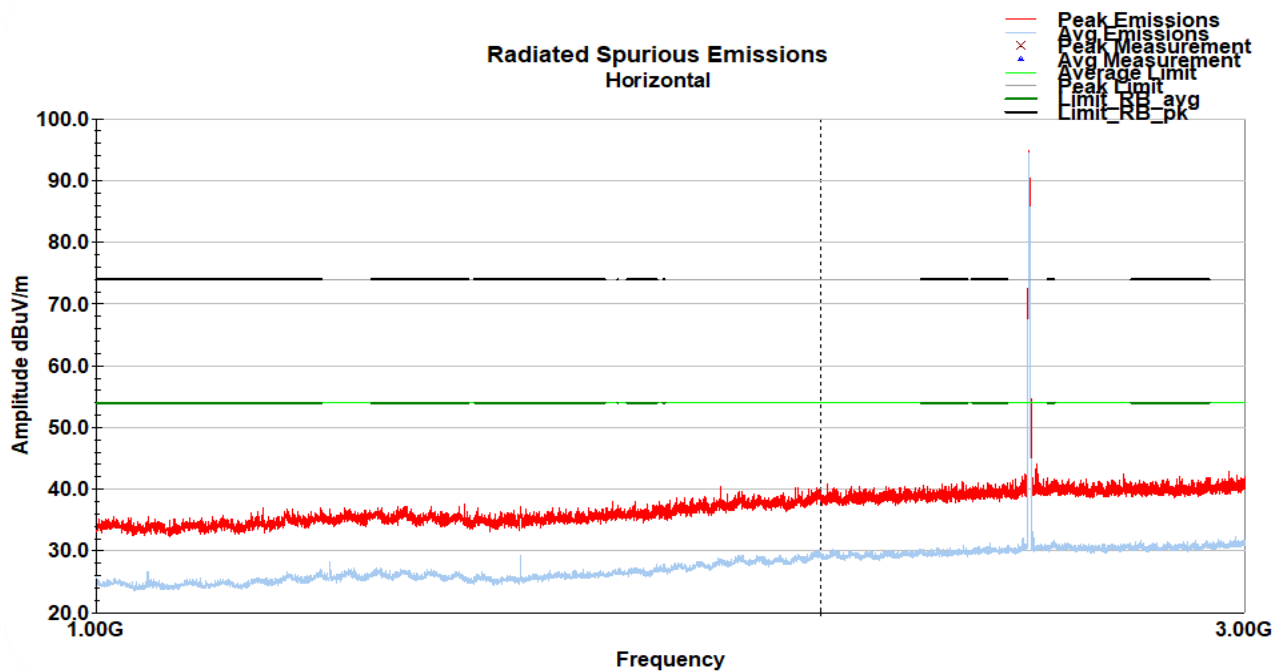
2402MHz Low Channel Horizontal Plot



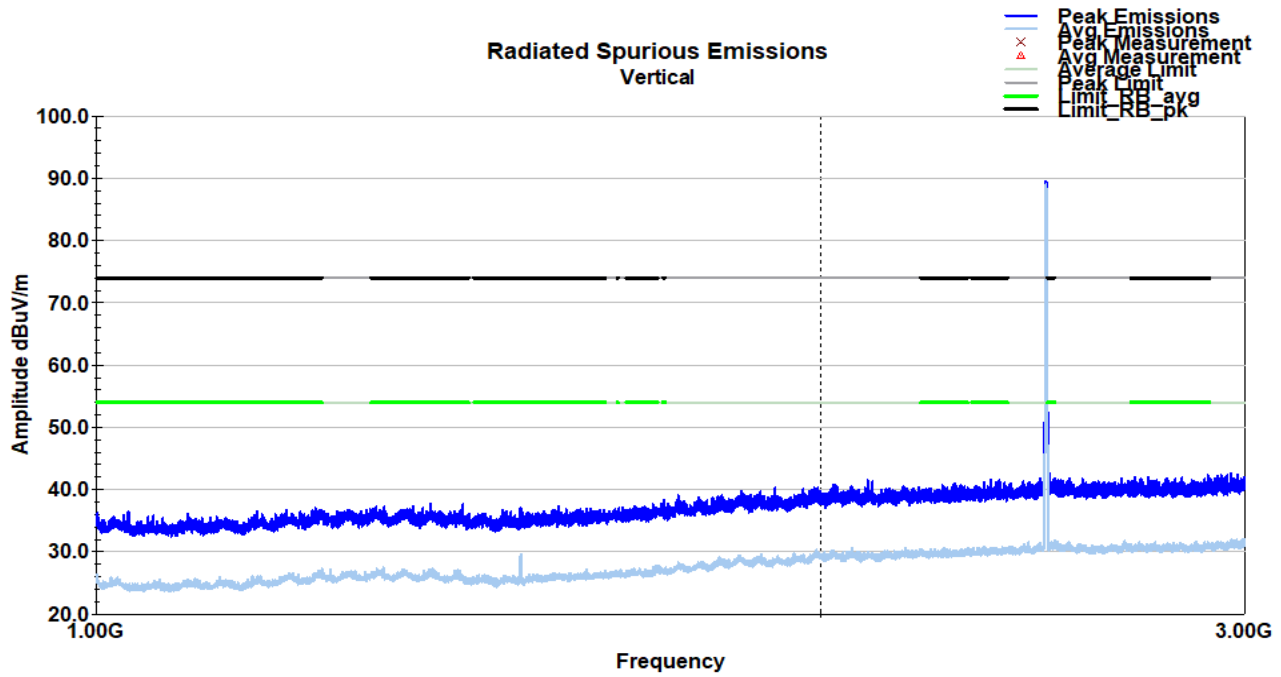
2440MHz Mid Channel Vertical Plot



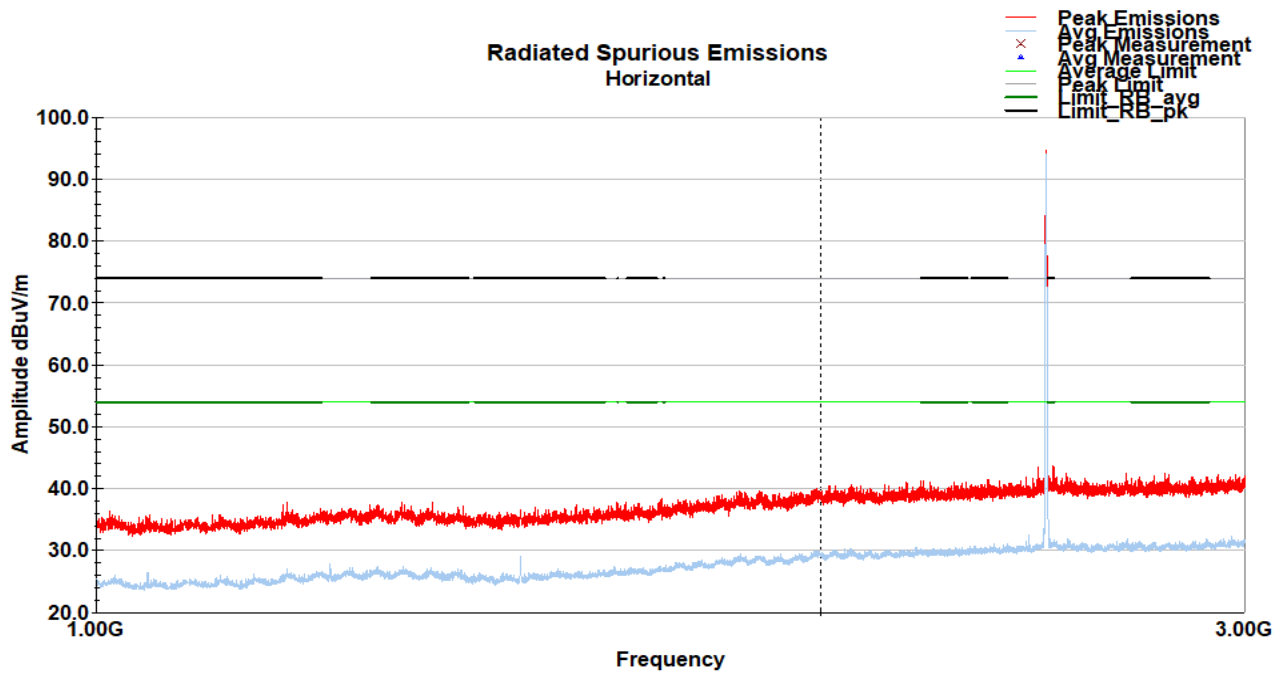
2440MHz Mid Channel Horizontal Plot



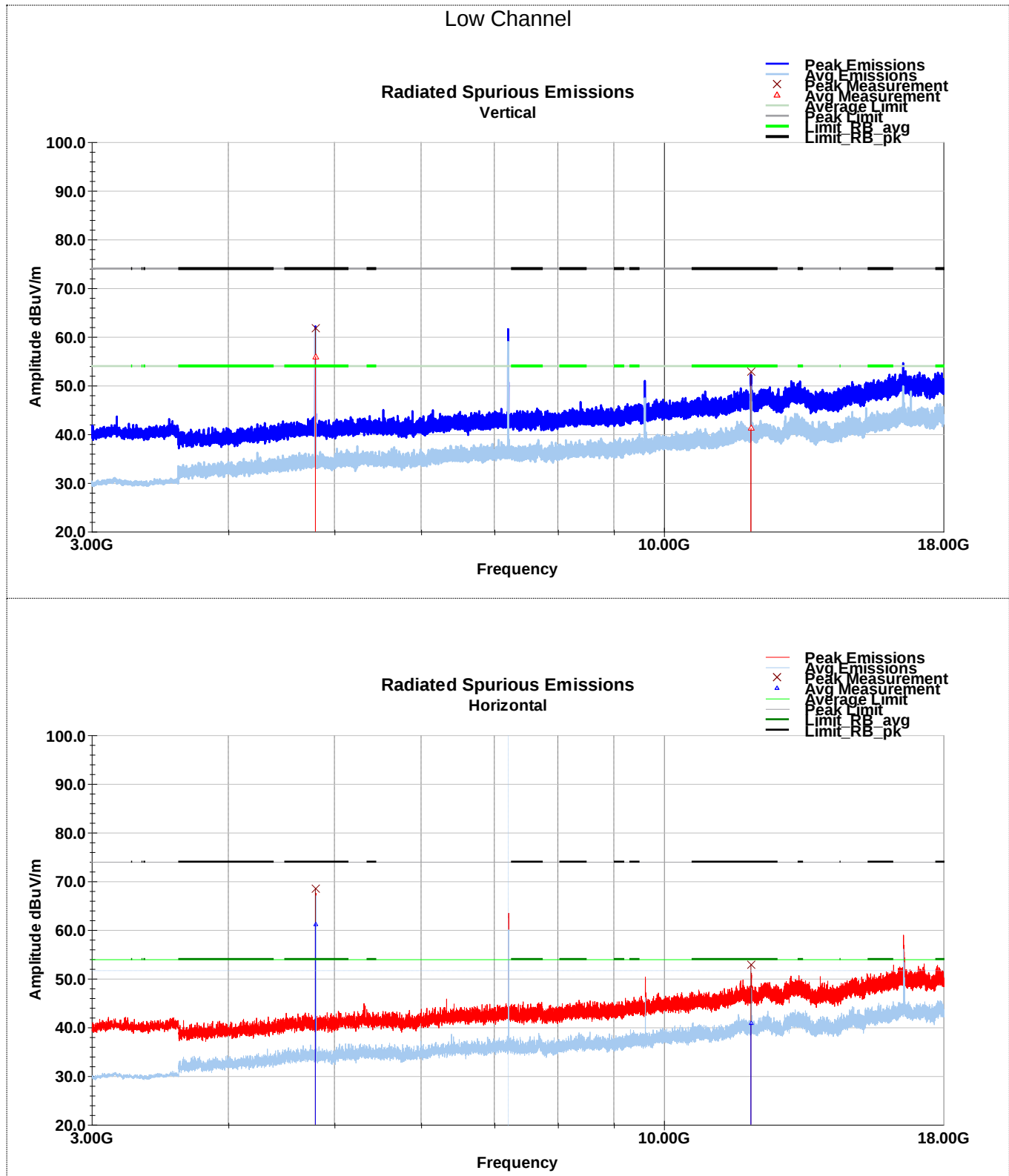
2480MHz High Channel Vertical Plot



2480MHz High Channel Horizontal Plot

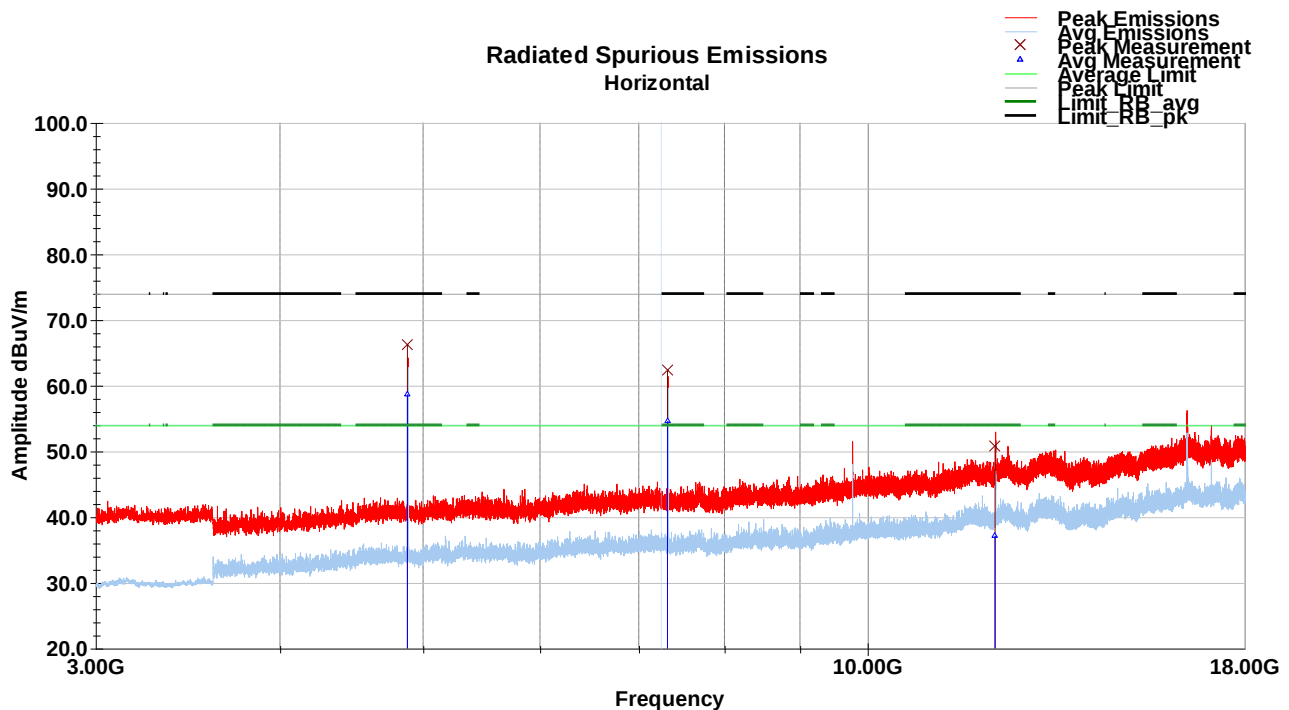
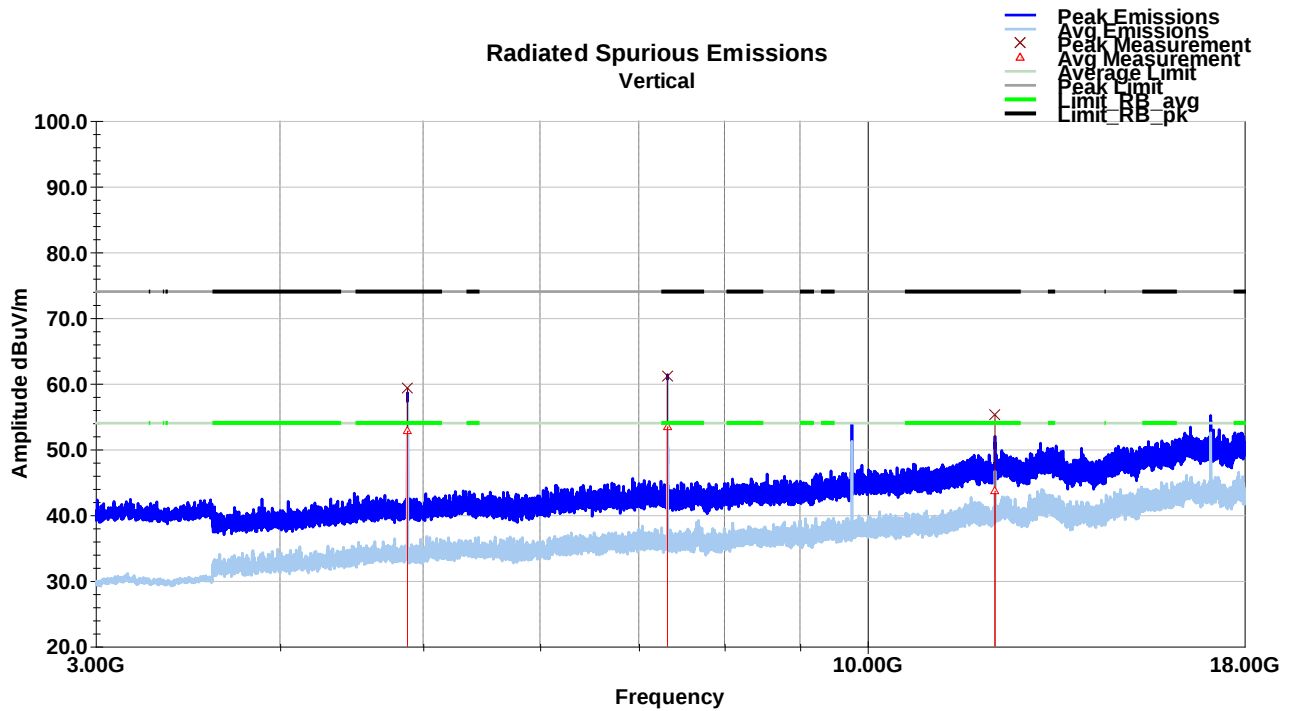


7.5.4 3-18 GHz

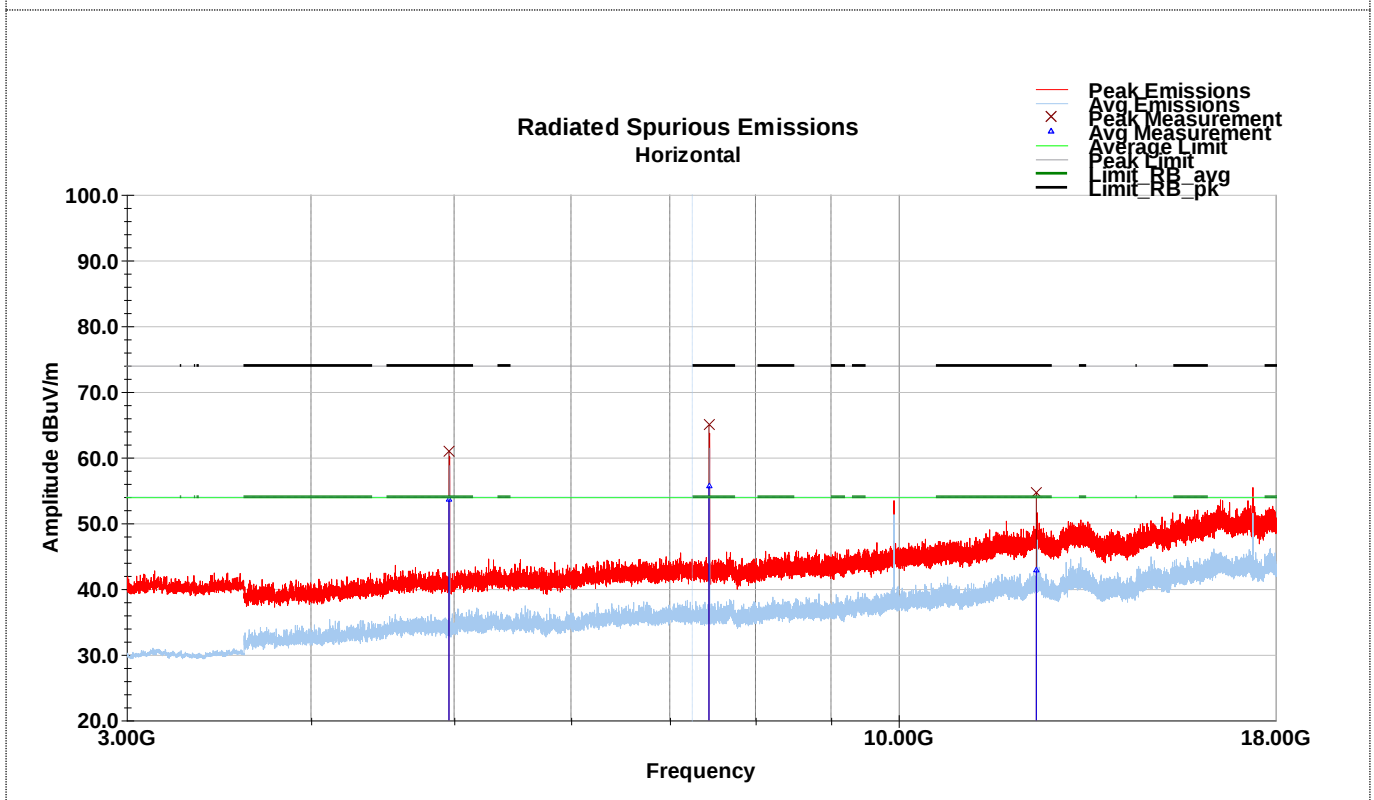
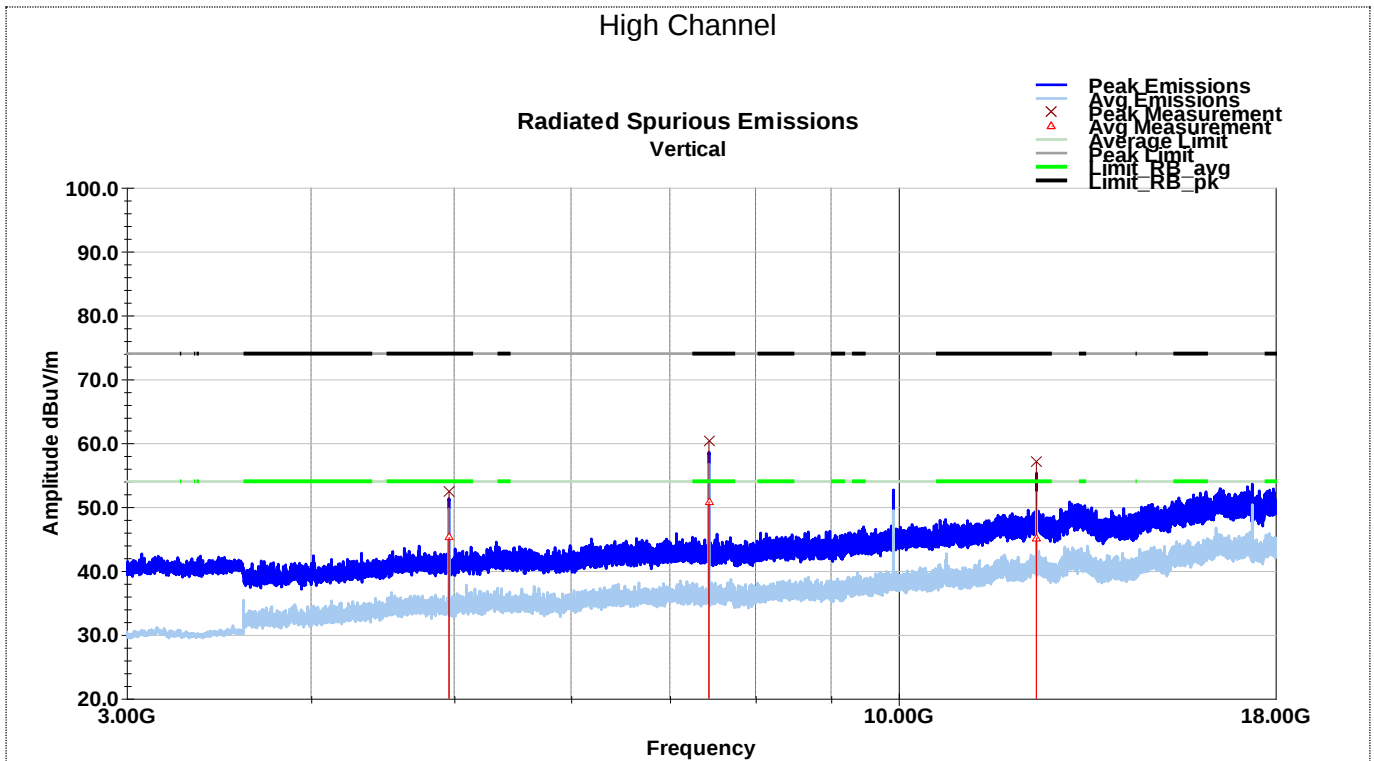


Note: Tabulated data results provided in section 7.6.

Mid Channel



Note: Tabulated data results provided in section 7.6.



Note: Tabulated data results provided in section 7.6.

7.6 Test Data – Tabular Data >1GHz

Tabular Test Results – Peak Data from 3-18GHz

Low CH

Frequency MHz	Raw Pk dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Pk dBuV/m	Limit dBuV/m	Margin dB
4803.92	67.1	V	93.0	127.0	34.6	1.9	42.0	61.7	74.0	-12.3
12008.96	52.0	V	20.0	250.0	38.9	3.6	41.7	52.8	74.0	-21.2
Frequency MHz	Raw Pk dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Pk dBuV/m	Limit dBuV/m	Margin dB
4803.44	73.9	H	67.0	162.0	34.6	1.9	42.0	68.5	74.0	-5.5
12008.84	52.1	H	72.0	100.0	38.9	3.6	41.7	52.9	74.0	-21.1

Mid CH

Frequency MHz	Raw Pk dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Pk dBuV/m	Limit dBuV/m	Margin dB
4880.16	64.8	V	92.0	100.0	34.5	2.0	42.0	59.3	74.0	-14.7
7319.92	64.5	V	121.0	123.0	35.7	2.5	41.6	61.1	74.0	-12.9
12199.20	54.0	V	23.0	235.0	39.0	3.7	41.5	55.3	74.0	-18.7
Frequency MHz	Raw Pk dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Pk dBuV/m	Limit dBuV/m	Margin dB
4879.44	71.7	H	64.0	118.0	34.5	2.0	42.0	66.3	74.0	-7.7
7320.04	65.8	H	118.0	104.0	35.7	2.5	41.6	62.3	74.0	-11.7
12202.08	49.6	H	258.0	220.0	39.0	3.7	41.5	50.8	74.0	-23.2

High CH

Frequency MHz	Raw Pk dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Pk dBuV/m	Limit dBuV/m	Margin dB
4960.16	57.9	V	143.0	151.0	34.5	2.0	42.0	52.4	74.0	-21.6
7439.20	63.7	V	201.0	181.0	35.7	2.5	41.6	60.3	74.0	-13.7
12398.72	55.6	V	116.0	213.0	39.0	3.8	41.3	57.1	74.0	-16.9
Frequency MHz	Raw Pk dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Pk dBuV/m	Limit dBuV/m	Margin dB
4960.40	66.4	H	133.0	101.0	34.5	2.0	42.0	60.9	74.0	-13.1
7440.64	68.3	H	45.0	167.0	35.7	2.5	41.6	64.9	74.0	-9.1
12398.72	53.2	H	71.0	159.0	39.0	3.8	41.3	54.7	74.0	-19.3

Tabular Test Results – Average Data with Duty Cycle Correction

Low CH

Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Avg dBuV/m	Limit (dBuV/m)	Margin (dB)	DCC (dB)	Calc Margin (dB)
4803.92	61.3	V	93.0	127.0	34.6	1.9	42.0	55.9	54.0	1.9	-20.0	-18.1
12008.96	40.4	V	20.0	250.0	38.9	3.6	41.7	41.2	54.0	-12.8	-20.0	-32.8
Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Avg Value dBuV/m	Limit (dBuV/m)	Margin (dB)	DCC (dB)	Calc Margin (dB)
4803.44	66.7	H	67.0	162.0	34.6	1.9	42.0	61.2	54.0	7.3	-20.0	-12.7
12008.84	40.0	H	72.0	100.0	38.9	3.6	41.7	40.8	54.0	-13.2	-20.0	-33.2

Mid CH

Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Avg dBuV/m	Limit (dBuV/m)	Margin (dB)	DCC (dB)	Calc Margin (dB)
4880.16	58.3	V	92.0	100.0	34.5	2.0	42.0	52.8	54.0	-1.2	-20.0	-21.2
7319.92	56.9	V	121.0	123.0	35.7	2.5	41.6	53.5	54.0	-0.5	-20.0	-20.5
12199.20	42.5	V	23.0	235.0	39.0	3.7	41.5	43.7	54.0	-10.3	-20.0	-30.3
Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Avg Value dBuV/m	Limit (dBuV/m)	Margin (dB)	DCC (dB)	Calc Margin (dB)
4879.44	64.1	H	64.0	118.0	34.5	2.0	42.0	58.7	54.0	4.7	-20.0	-15.3
7320.04	58.0	H	118.0	104.0	35.7	2.5	41.6	54.6	54.0	0.6	-20.0	-19.4
12202.08	35.9	H	258.0	220.0	39.0	3.7	41.5	37.1	54.0	-16.8	-20.0	-36.8

High CH

Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Avg dBuV/m	Limit (dBuV/m)	Margin (dB)	DCC (dB)	Calc Margin (dB)
4960.16	50.7	V	143.0	151.0	34.5	2.0	42.0	45.2	54.0	-8.7	-20.0	-28.7
7439.20	54.2	V	201.0	181.0	35.7	2.5	41.6	50.8	54.0	-3.2	-20.0	-23.2
12398.72	43.7	V	116.0	213.0	39.0	3.8	41.3	45.2	54.0	-8.8	-20.0	-28.8
Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Avg Value dBuV/m	Limit (dBuV/m)	Margin (dB)	DCC (dB)	Calc Margin (dB)
4960.40	59.1	H	133.0	101.0	34.5	2.0	42.0	53.6	54.0	-0.3	-20.0	-20.3
7440.64	59.0	H	45.0	167.0	35.7	2.5	41.6	55.7	54.0	1.7	-20.0	-18.3
12398.72	41.4	H	71.0	159.0	39.0	3.8	41.3	42.9	54.0	-11.0	-20.0	-31.0
Avg Value = Level + AF + CL - Amp												
Calc Margin = Avg Value - Limit + DCC												

8 Emissions in Restricted Frequency Bands (Band Edge)

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

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.4 °C

Relative Humidity: 38.7 %

Atmospheric Pressure: 97.9 kPa

8.4 Test Equipment

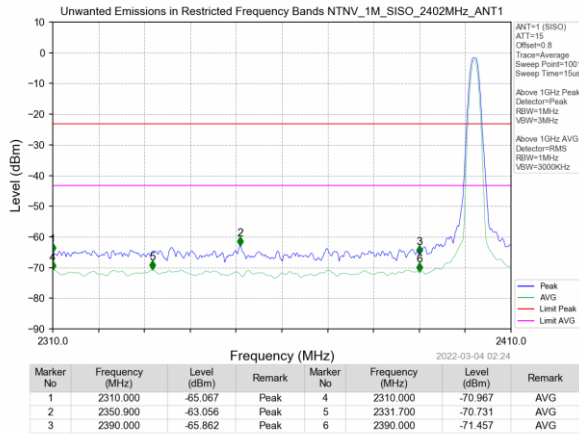
Test End Date: 3/4/2022

Tester: JOP

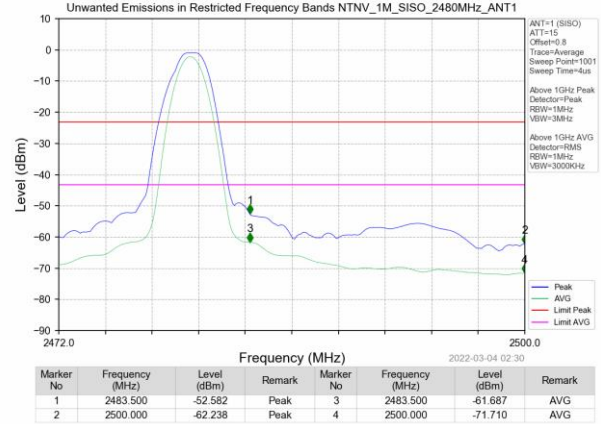
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM	20107	16-Mar-2021	16-Mar-2022
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

8.5 Test Data – Restricted Band Edges

1M Low Channel



1M High Channel



9 AC Conducted Emissions

9.1 Test Result

Test Description	Basic Standards	Test Result
Conducted Emissions, Class B	RSS-GEN 7.2.4 15.207 ANSI C63.4:2014	Compliant

9.2 Test Method

With the receiver's resolution bandwidth was set to 9 kHz the exploratory scans were performed over the measuring frequency range (0.15MHz to 30MHz) 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) CISPR
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 60 QP 73	Avg 50 Pk 60

9.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.2°C

Relative Humidity: 25.7%

Atmospheric Pressure: 98.35 kPa

9.4 Test Equipment

Test End Date: 2-Feb-2022

Tester: ZH

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
LINE IMPEDANCE STABILIZATION	NNB 51	TESEQ	B085882	21-Apr-2021	21-Apr-2022
RF CABLE	UC-N-MM-78	MAURY MICROWAVE	17016	25-Aug-2021	25-Aug-2022
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	9-Jul-2021	9-Jul-2022

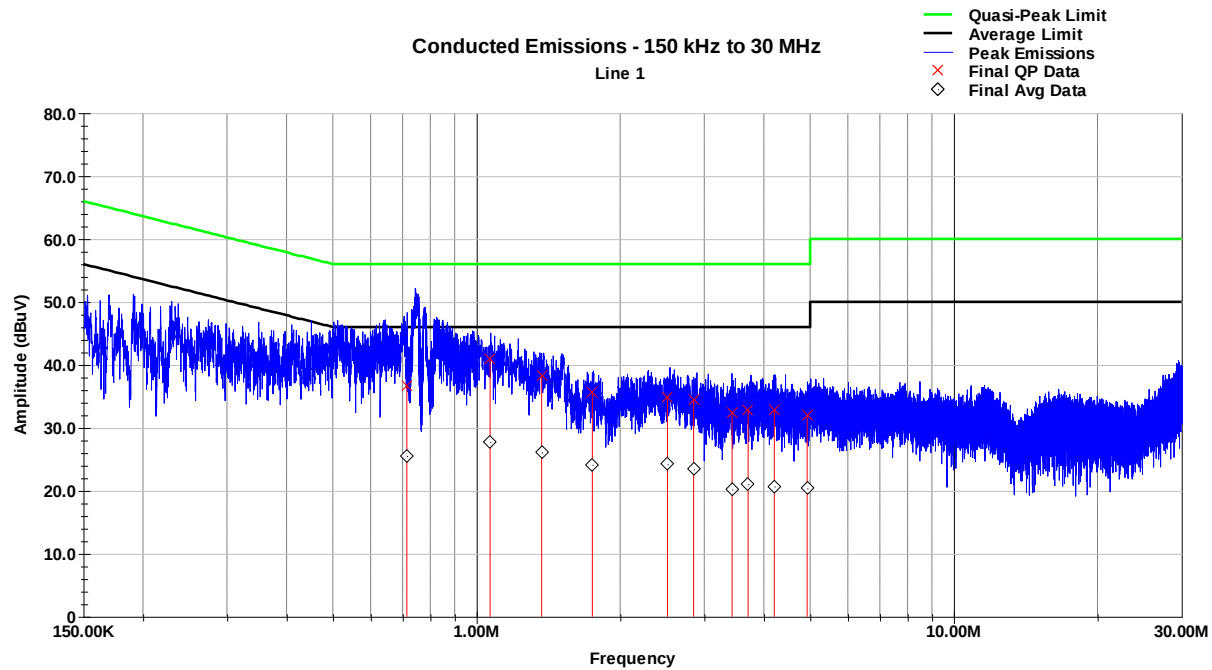
Note: Refer to the table for calibration intervals.

Software:

TILE! software profile "Conducted Emissions Tile7 210216.til" dated 16 02 2021

9.5 Test Data

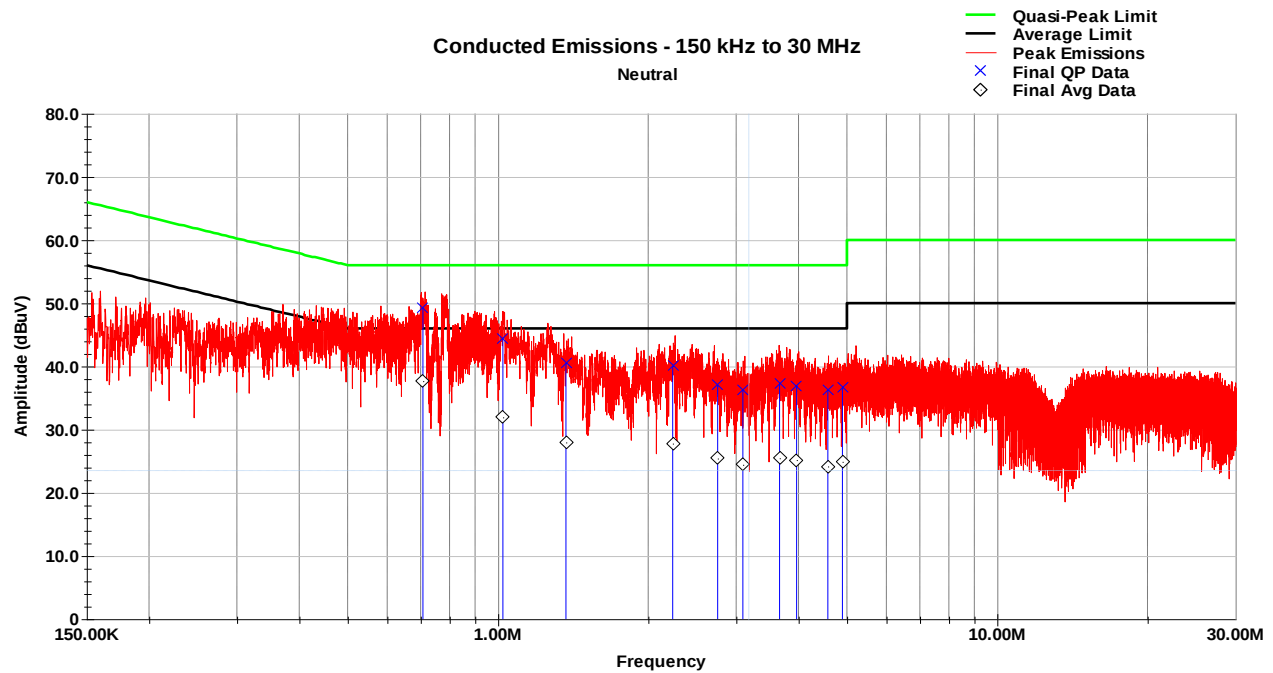
Line 1 Conducted Emissions Plot 150kHz-30MHz



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
0.715	36.6	56.0	-19.4	25.5	46.0	-20.5
1.068	41.0	56.0	-15.0	27.7	46.0	-18.3
1.369	38.3	56.0	-17.7	26.1	46.0	-19.9
1.748	35.6	56.0	-20.4	24.1	46.0	-21.9
2.513	34.8	56.0	-21.2	24.2	46.0	-21.8
2.850	34.4	56.0	-21.6	23.4	46.0	-22.6
3.431	32.4	56.0	-23.6	20.2	46.0	-25.8
3.707	32.8	56.0	-23.2	21.1	46.0	-24.9
4.207	32.7	56.0	-23.3	20.7	46.0	-25.3
4.929	32.0	56.0	-24.0	20.4	46.0	-25.6

Neutral Conducted Emissions Plot 150kHz-30MHz



Neutral Conducted Emissions Data

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
0.708	49.3	56.0	-6.7	37.7	46.0	-8.3
1.023	44.5	56.0	-11.5	31.9	46.0	-14.1
1.368	40.5	56.0	-15.5	28.0	46.0	-18.0
2.239	40.1	56.0	-15.9	27.8	46.0	-18.2
2.755	37.0	56.0	-19.0	25.4	46.0	-20.6
3.094	36.3	56.0	-19.7	24.4	46.0	-21.6
3.664	37.4	56.0	-18.6	25.5	46.0	-20.5
3.964	36.9	56.0	-19.1	25.2	46.0	-20.8
4.578	36.3	56.0	-19.7	24.2	46.0	-21.8
4.897	36.7	56.0	-19.3	24.9	46.0	-21.1

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)).

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 %

11 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	29 March 2022