RF Test Report

Project Number:	**5088048**	**Offer Number:**	**SUW-202306004868**
Report Number:	**5088048EMC02**	**Revision Level:**	**Rev 1**

Client: **Nederman Corporation**
Equipment Under Test: **Ventilation Monitoring System**
Model: **SAVE System**
FCC ID: **2BCBB-7945167**
IC: **31444-7945167**

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

Report issued on: **30 October 2023**
Report Revised on: **24 January 2024**
Test Result: **Compliant**

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER: 3212.01
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.

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1 Summary of Test Results

Test Description	Test Specification		Test Result
Bandwidth	15.247(a)(2)	RSS-247 S5.2 (a) RSS-GEN S6.6	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 S8.3	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*

Company Name:	Nederman Corporation
Address:	4404-A Chesapeake Drive
City, State, Zip, Country:	Charlotte, NC 28216, 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

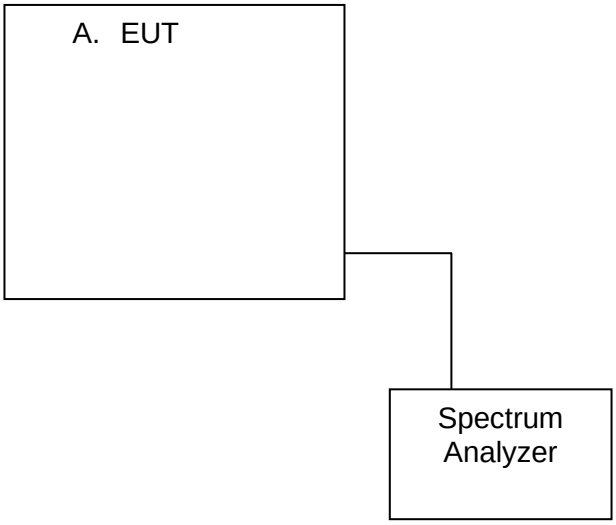
2.3 *General Information of EUT*

Product Marketing Name (PMN):	SAVE System
Model Number (HVIN):	Nederman Save
Firmware Version ID (FVIN):	Not Provided
Serial Number:	Not Provided / SGS ID#
Frequency Range:	903 – 927 MHz
Data Modes:	2GFSK
Antenna:	Linear External Dipole, + 3.22 dBi
Rated Voltage:	100-240Vac 50/60Hz or 277Vac 60Hz
Test Voltage:	120Vac 60Hz
Sample Received Date:	28 August 2023
Dates of testing:	28 August 2023 – October 08, 2023

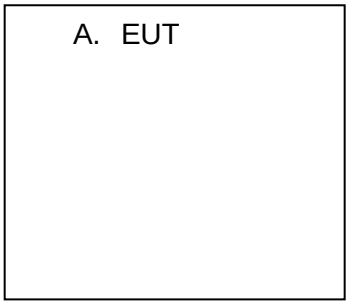
2.4 *Operating Modes and Conditions*

The EUT can be manipulated to select any frequency within 903-927MHz. Only low, mid, and high channels were required.

2.5 *EUT Connection Block Diagram – Conducted Measurements*



2.6 *EUT Connection Block Diagram – Radiated Measurements*



Inside Chamber

Outside Chamber

2.7 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Nederman	Ventilation Controller	Not Provided	Not Provided
B	Nederman	Relays	Not Provided	Not Provided
C	Nederman	Sensors	Not Provided	Not Provided
D	Nederman	Lights	Not Provided	Not Provided
E	Not Provided	900MHz Antenna	Not Provided	Not Provided

2.8 *Similar Models:*

The following listed model(s) were not tested as part of the evaluation of this test report but have been identified by the manufacturer as being electrically similar to the model that was tested with exception of the enclosure. The SAVE System was selected for testing as a representative worst case test sample. SGS makes no claims of compliance for similar models that were not tested.

Similar model: SAVE Controller

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 S6.6	Compliant

3.2 *Test Method*

The procedures from ANSI C63.10: 2013 clause 11.8 and KDB 558074 D01 Measurement Guidance v05r02 were used to determine the 6 dB bandwidth.

3.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	23.39 °C
Relative Humidity:	46.9 %
Atmospheric Pressure:	98.79 kPa

3.4 *Test Equipment*

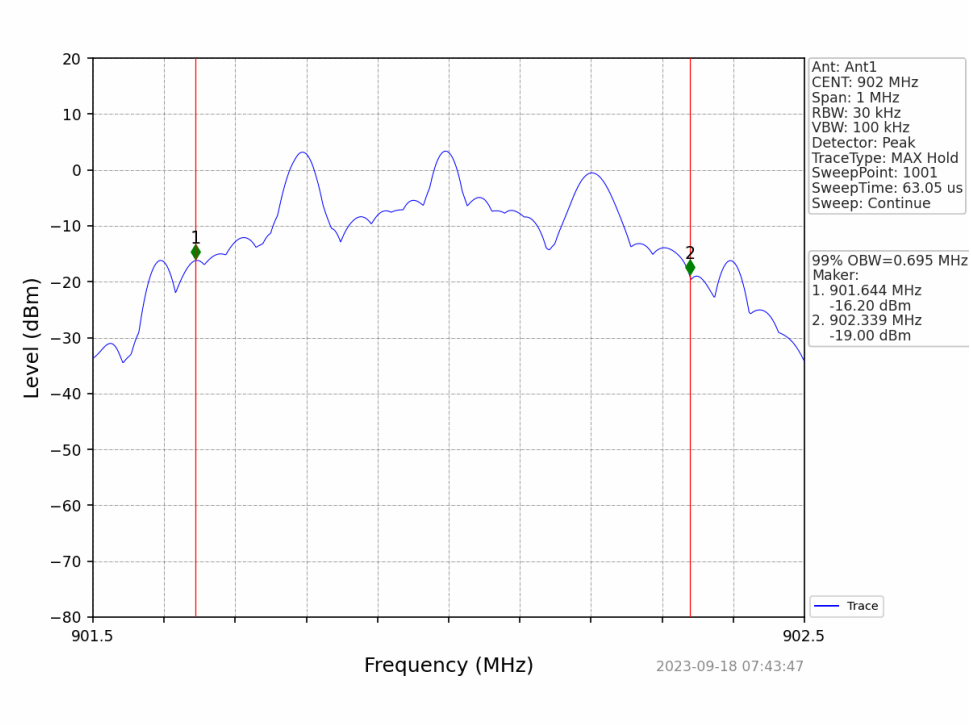
Test End Date:	4-Oct-2023	Tester:	SGM		
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20108	13-Mar-2023	13-Mar-2024
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	7-Dec-2022	7-Dec-2023

Note: The equipment calibration period is 1 year.

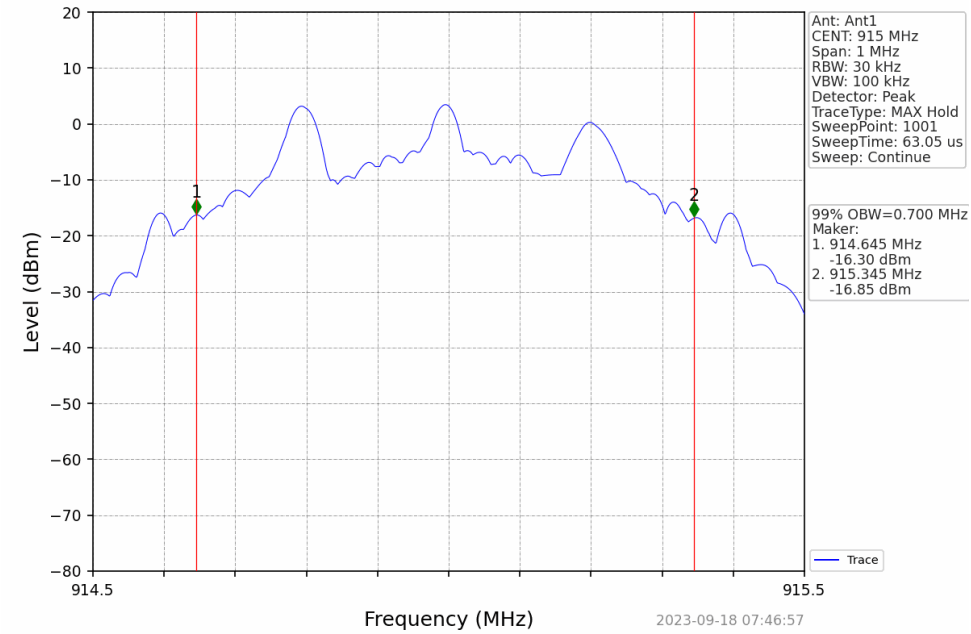
3.5 *Test Data*

Mode	TX Type	Frequency (MHz)	ANT	99% Occupied Bandwidth (MHz) Result	Verdict
2 mW	SISO	902	1	0.695	Pass
		915	1	0.700	Pass
		927	1	0.720	Pass
5 mW	SISO	902	1	0.714	Pass
		915	1	0.723	Pass
		927	1	0.717	Pass

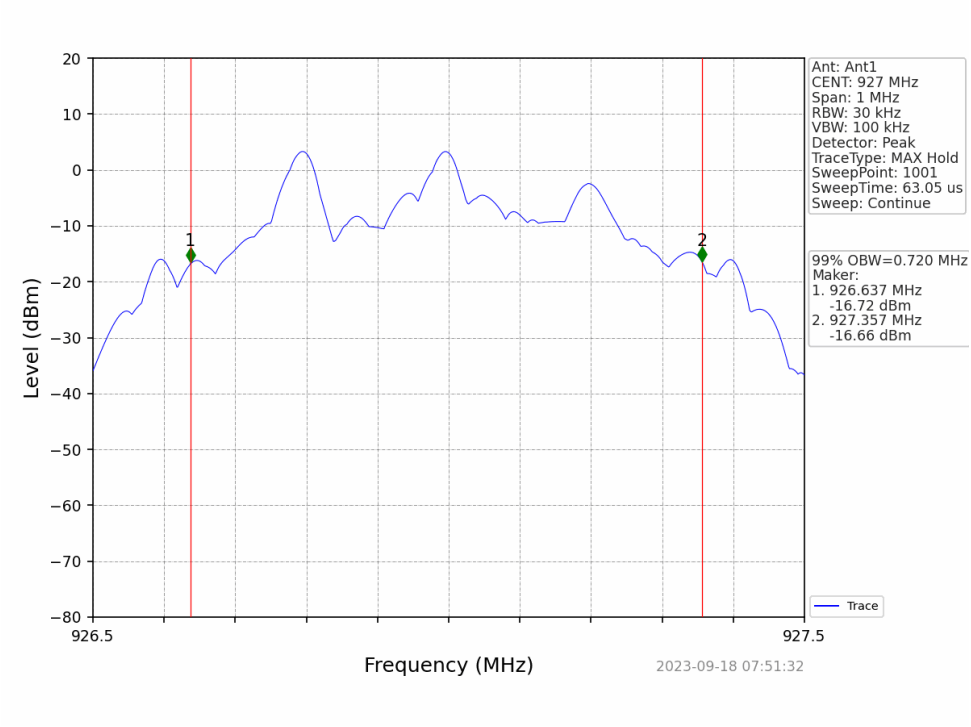
2mW LCH 902MHz



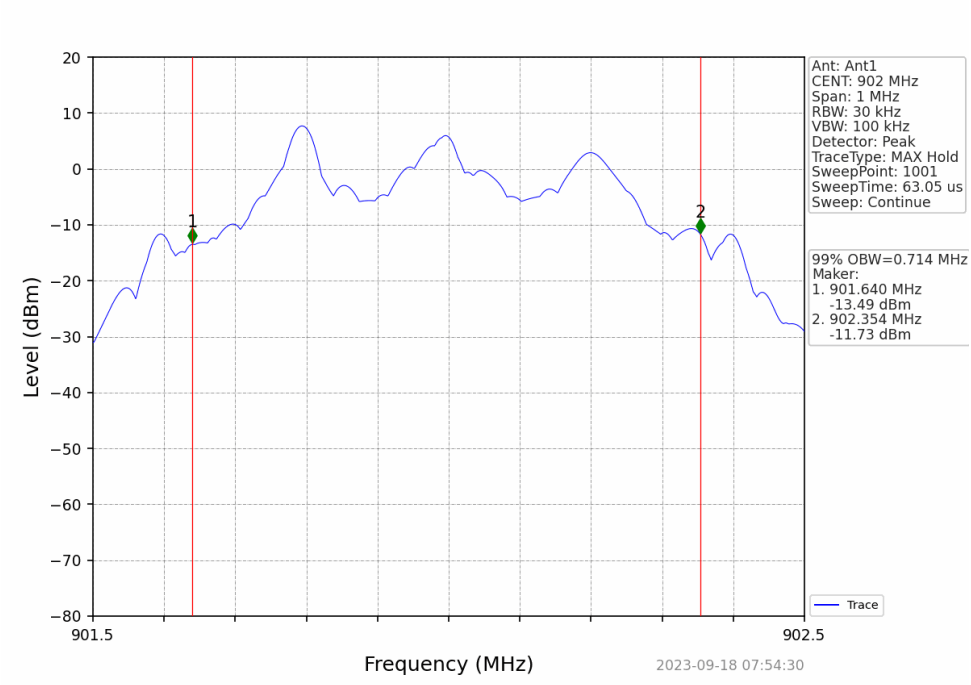
2 mW MCH 915 MHz



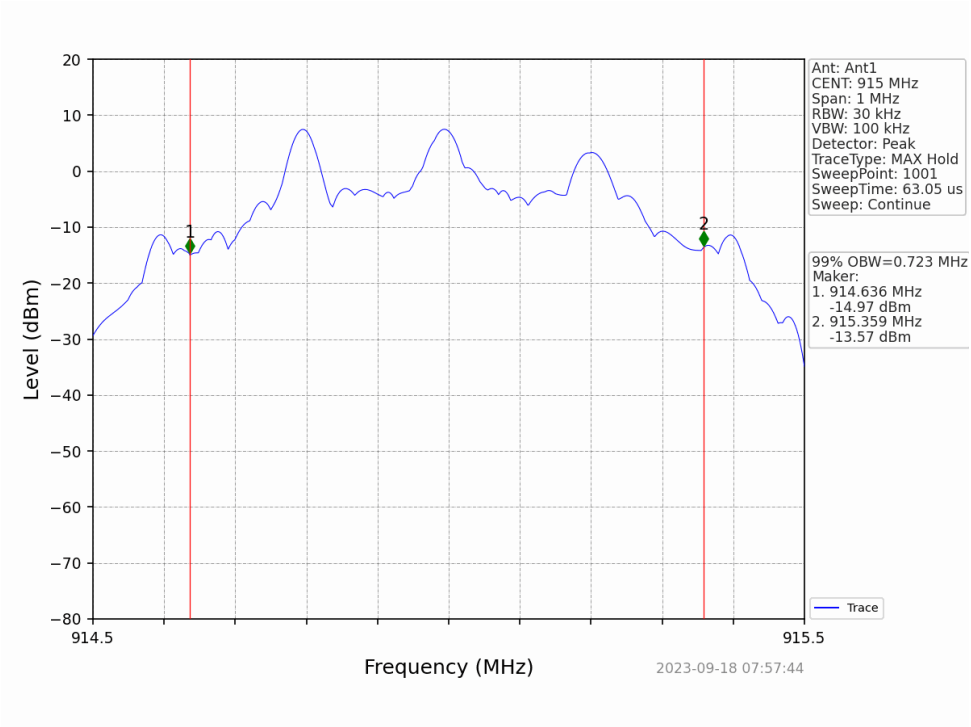
2mW HCH 927 MHz



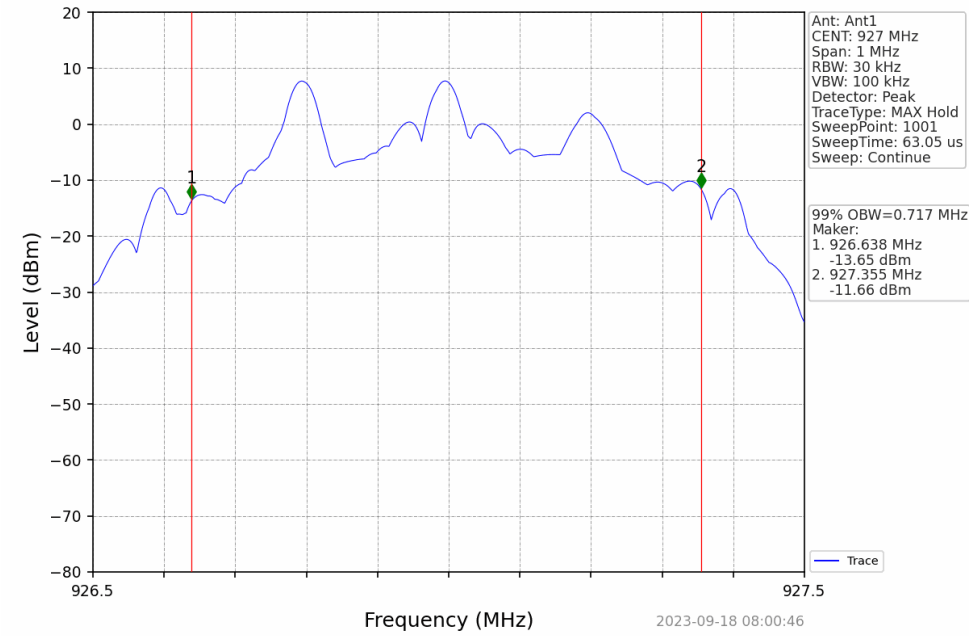
5mW LCH 902 MHz



5mW MCH 915 MHz



5 mW HCH 927 MHz



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 v05r02.

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:	23.72 °C
Relative Humidity:	52.9 %
Atmospheric Pressure:	98.79kPa

4.4 *Test Equipment*

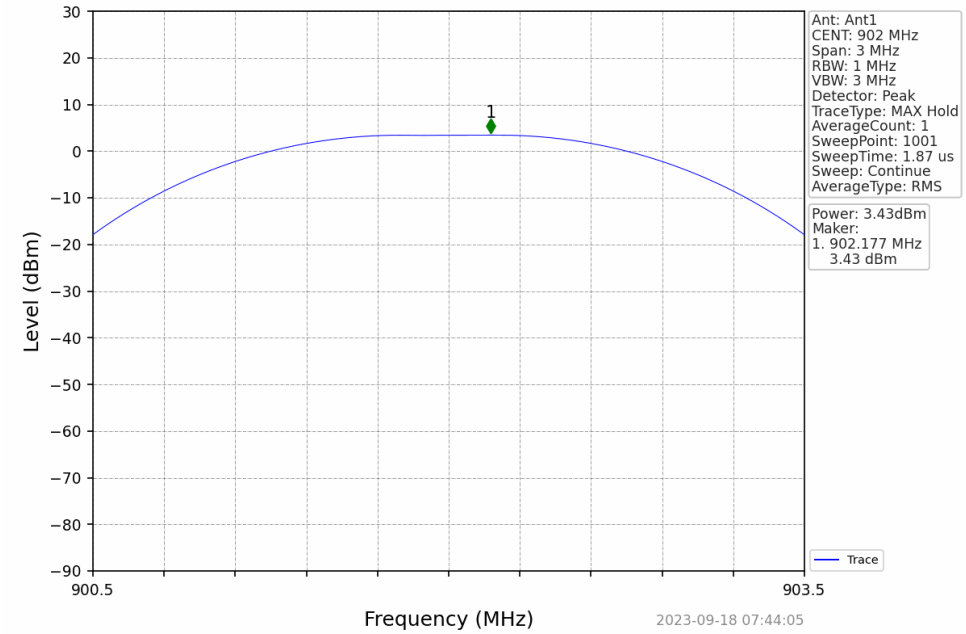
Test End Date:	4-Oct-2023	Tester:	SGM		
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20108	13-Mar-2023	13-Mar-2024
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	7-Dec-2022	7-Dec-2023

Note: The equipment calibration period is 1 year.

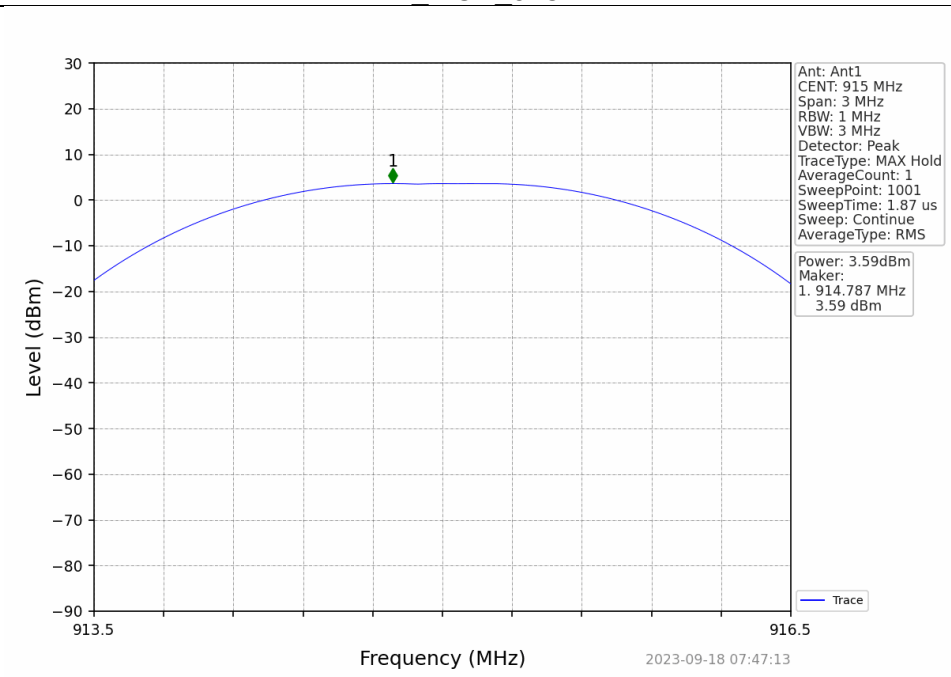
4.5 *Test Data*

Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)		Verdict
			ANT1	Limit	
2 mW	SISO	902	3.43	<=30	Pass
		915	3.59	<=30	Pass
		927	3.44	<=30	Pass
5 mW	SISO	902	8.00	<=30	Pass
		915	8.16	<=30	Pass
		927	7.99	<=30	Pass
Note1: Antenna Gain: Ant1: 3.22dBi;					

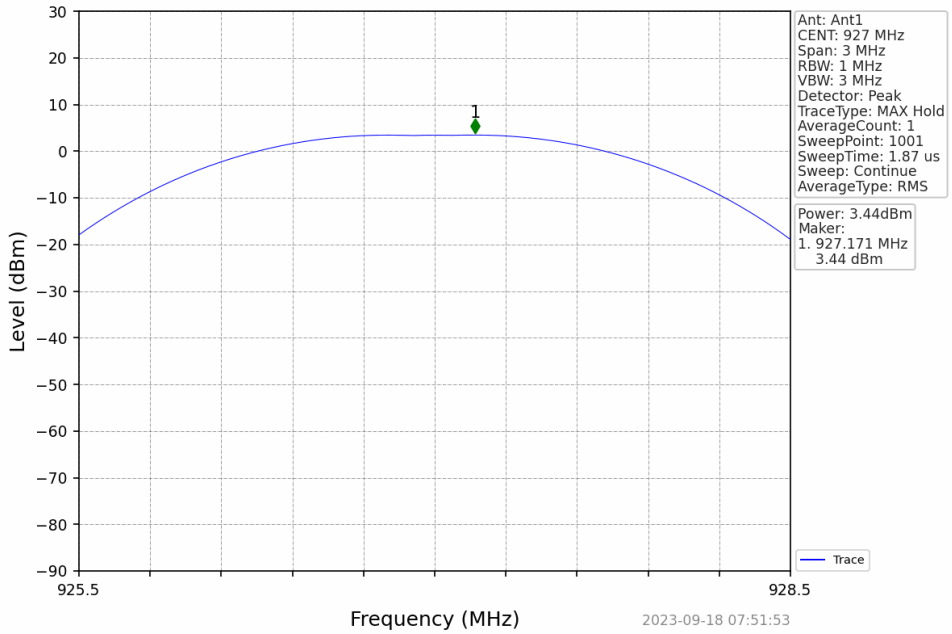
2 mW_LCH_902MHz



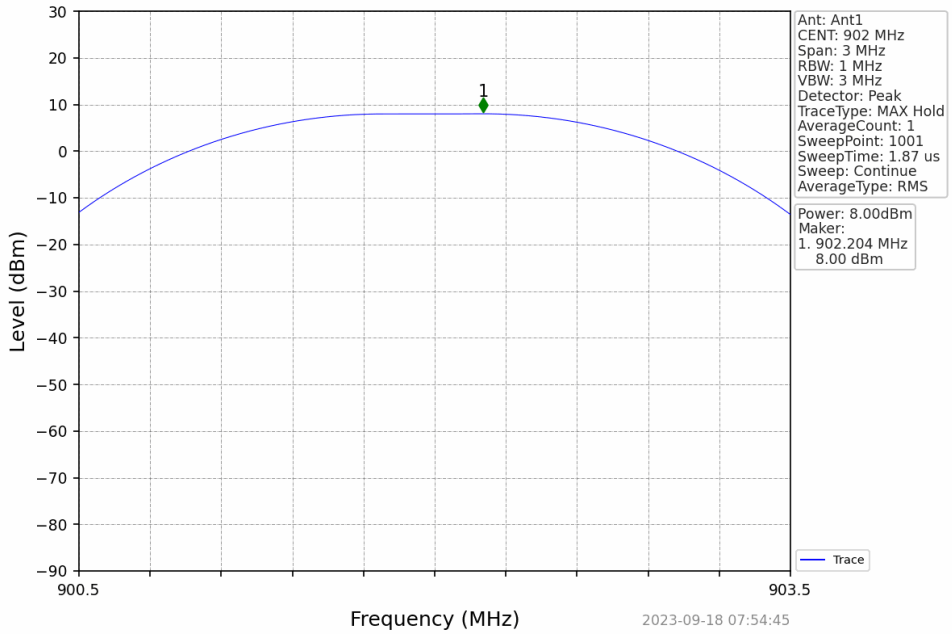
2 mW_MCH_915MHz



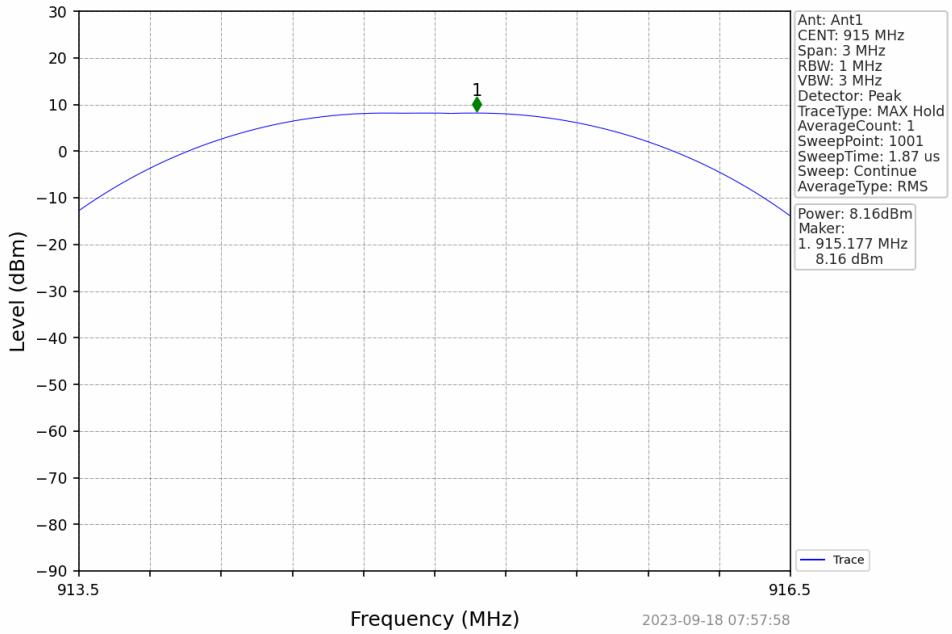
2 mW_HCH_927MHz



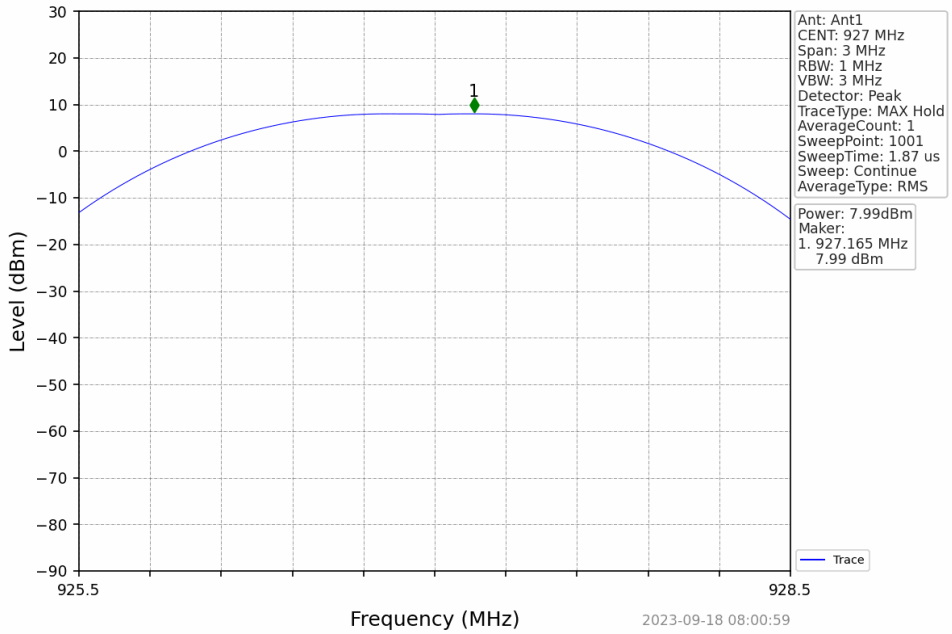
5 mW_LCH_902MHz



5 mW_MCH_915MHz



5 mW_HCH_927MHz



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 v05r02.

Limit
The limit is 8 dBm.

5.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	23.39 °C
Relative Humidity:	46.9 %
Atmospheric Pressure:	98.79kPa

5.4 *Test Equipment*

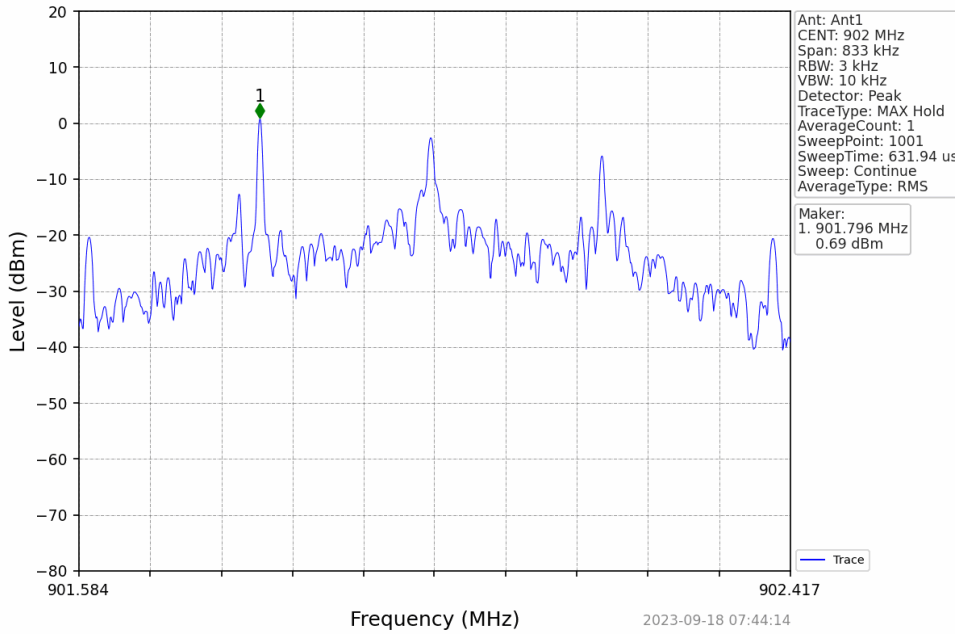
Test End Date:	4-Oct-2023	Tester:	SGM		
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20108	13-Mar-2023	13-Mar-2024
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	7-Dec-2022	7-Dec-2023

Note: The equipment calibration period is 1 year.

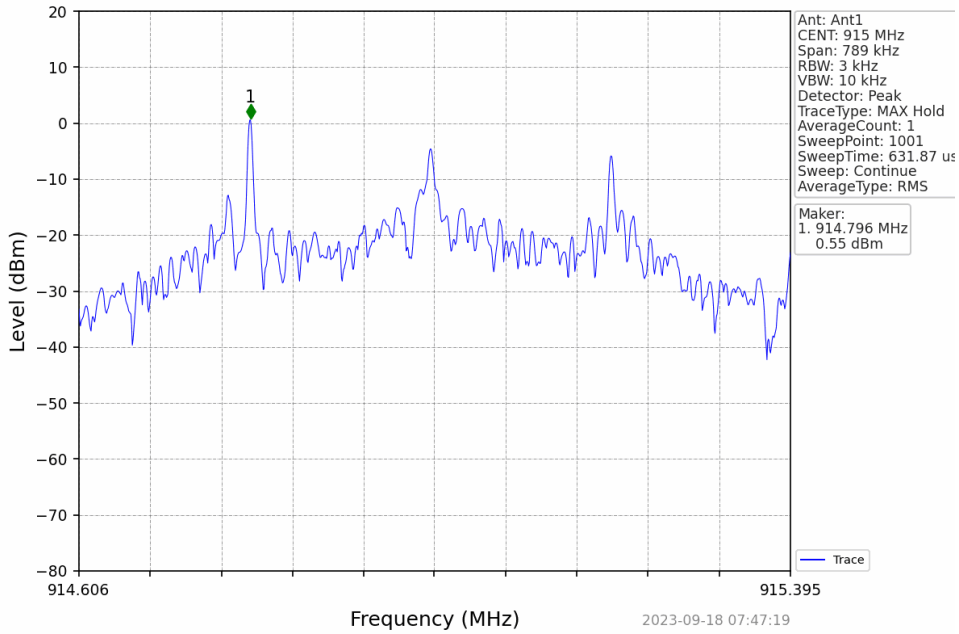
5.5 *Test Data*

Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm/3kHz)		Verdict
			ANT1	Limit	
2 mW	SISO	902	0.69	<=8	Pass
		915	0.55	<=8	Pass
		927	0.58	<=8	Pass
5 mW	SISO	902	6.01	<=8	Pass
		915	2.84	<=8	Pass
		927	5.84	<=8	Pass
Note1: Antenna Gain: Ant1: 3.22dBi;					

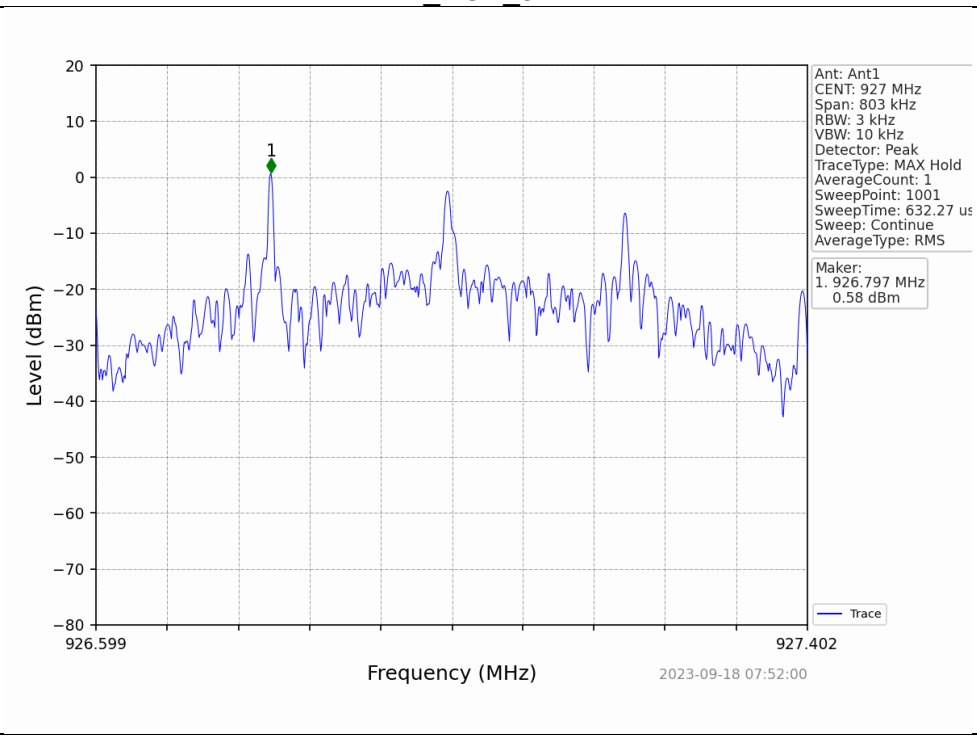
2 mW_LCH_902MHz



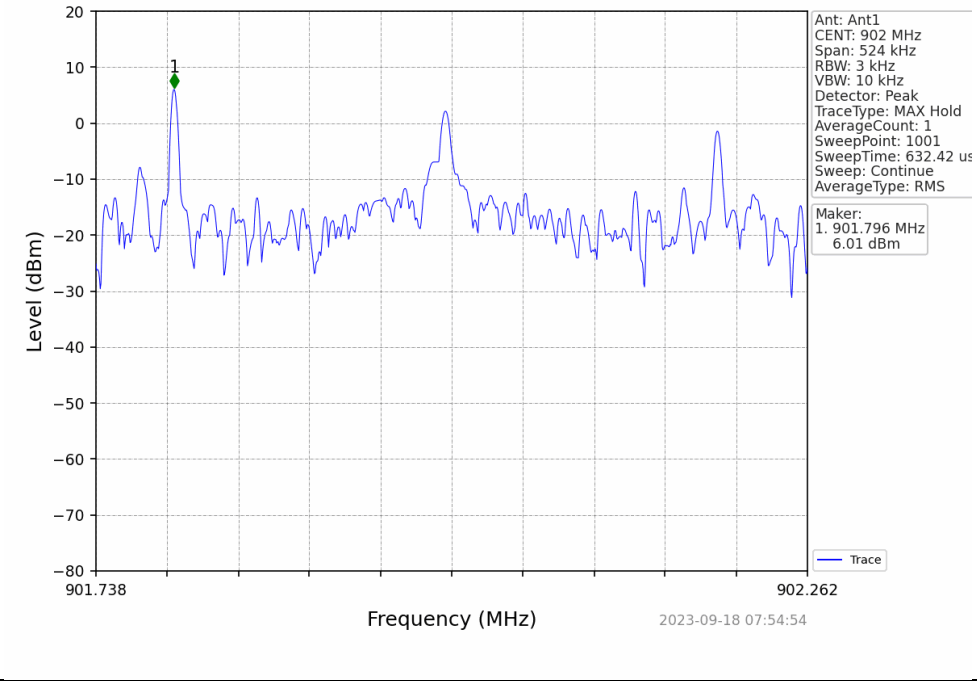
2 mW_MCH_915MHz



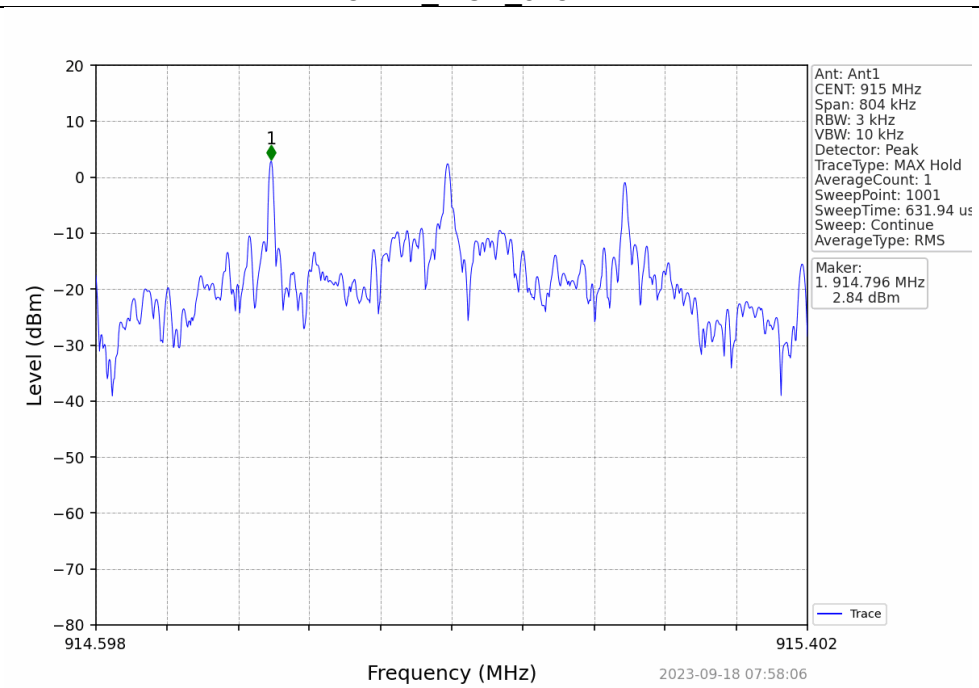
2 mW_HCH_927MHz



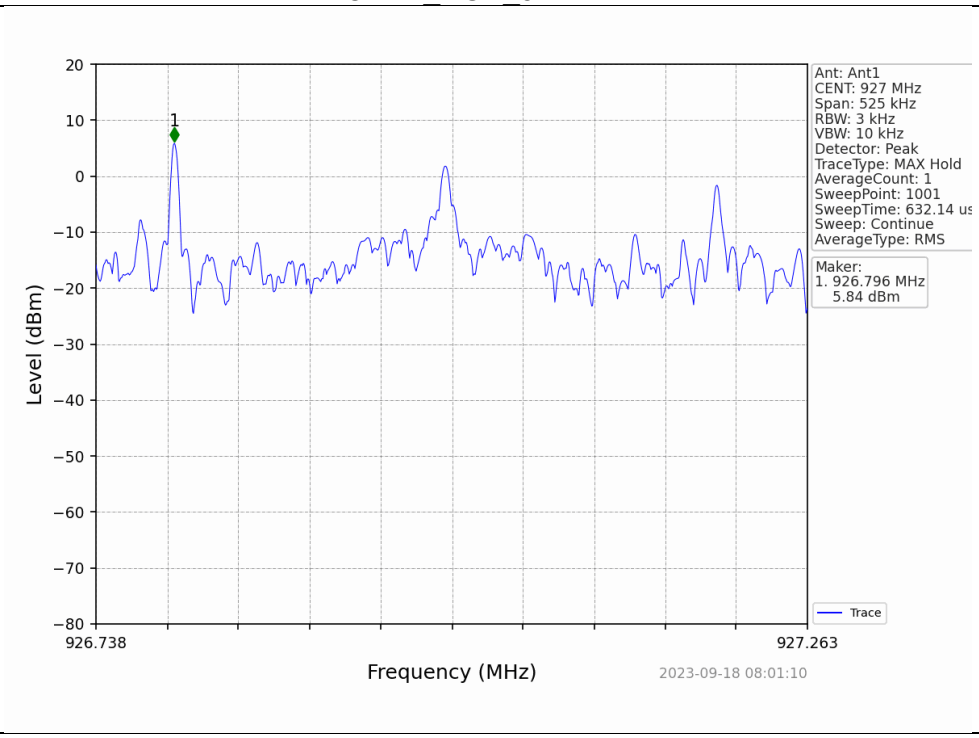
5 mW_LCH_902MHz



5 mW_MCH_915MHz



5 mW_HCH_927MHz



6 Band Edge

6.1 *Test Result*

Test Description	Test Specification	Test Result
Band Edge	4.10.1.5	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 v05r02.

Lowest 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

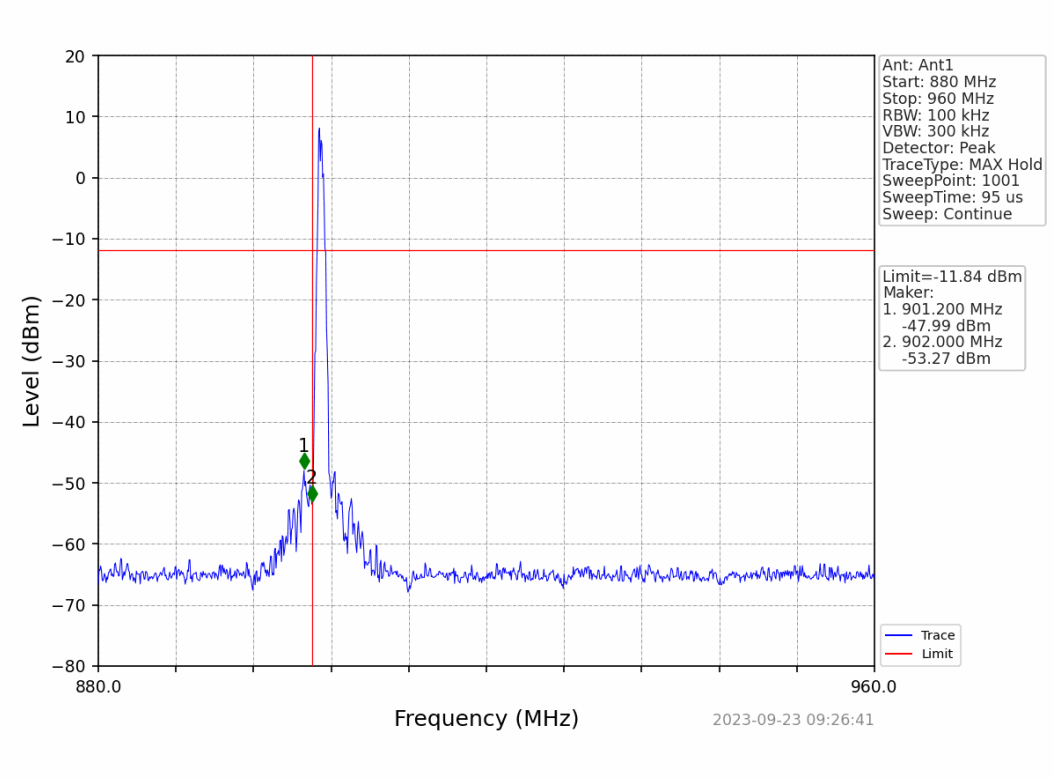
Temperature:	23.38 °C
Relative Humidity:	36.1 %
Atmospheric Pressure:	97.87 kPa

6.4 *Test Equipment*

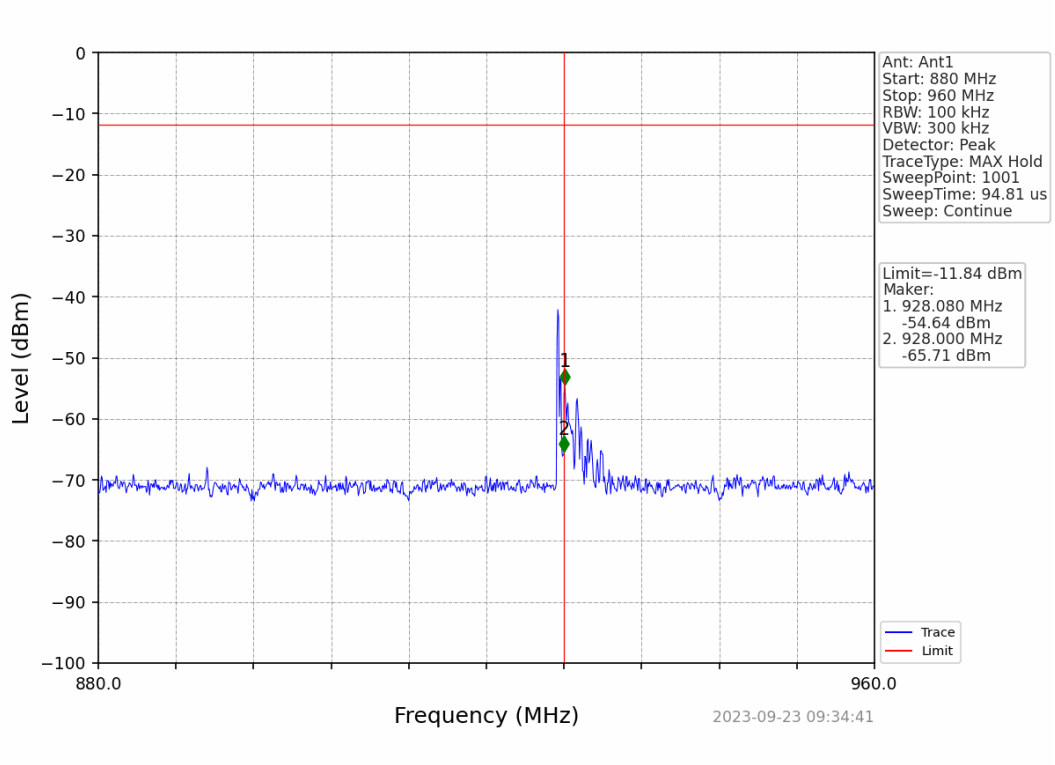
Test End Date:	9-Oct-2023	Tester:	SGM		
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	7-Dec-2022	7-Dec-2023
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	LEDYNE STORM MICROWA	20108	13-Mar-2023	13-Mar-2024

6.5 *Test Data – Band Edge*

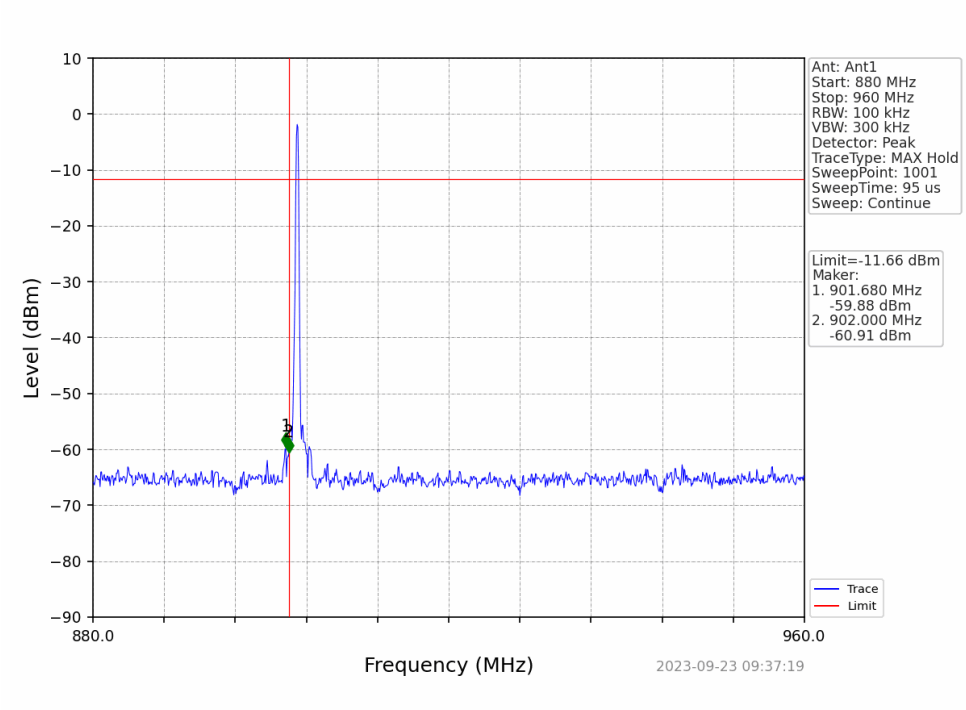
2 mW_LCH_903MHz_Ant1_NTNV



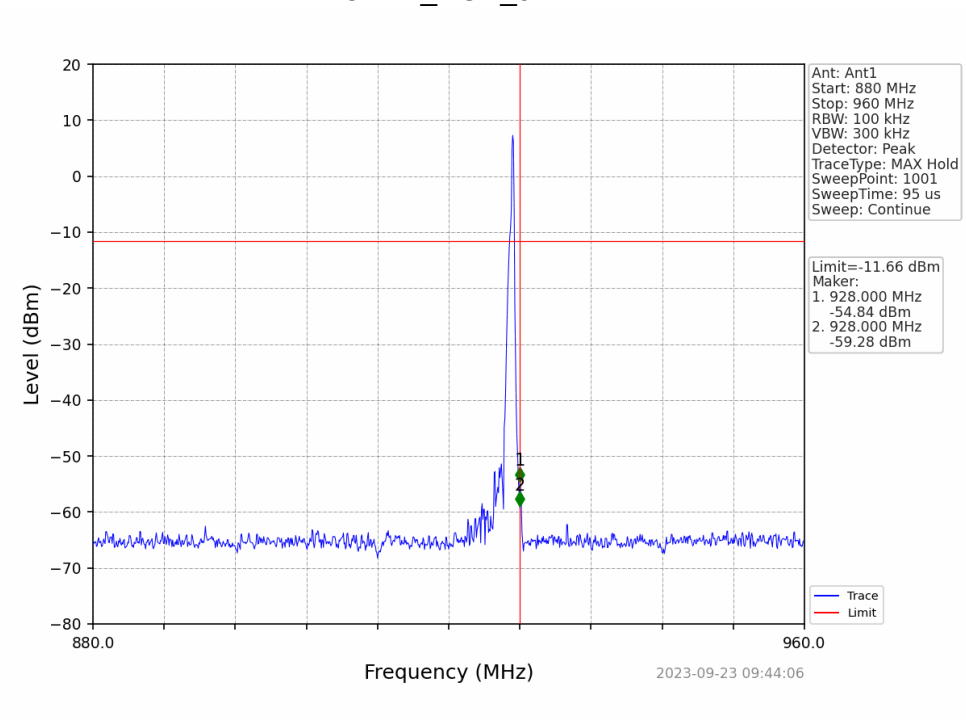
2 mW_HCH_927MHz



5 mW LCH 903MHz



5 mW_HCH_927MHz



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 channels low, middle, and high channels.

Test distance:

9k to 30 MHz – Near field prescan to determine if there were any emissions.
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*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 23.08 °C
Relative Humidity: 48.3 %
Atmospheric Pressure: 98.62 kPa

7.4 *Test Equipment*

Low Frequency (9kHz to 30 MHz)

Test End Date: 4-Oct-2023 Tester: SGM/ZH/LM

Equipment	Model	Manufacturer	Asset	Cal Date	Cal Due Date
ANTENNA, LOOP, ACTIVE	6502	ETS LINDGREN	B085752	11-Aug-2022	11-Aug-2024
RF CABLE NM TO NM, 0.01-18GHZ	90-195-118	TELEDYNE STORM MICROWAVE	20126	9-Feb-2023	9-Feb-2024
EMI TEST RECEIVER	ESW44	ROHDE & SCHWARZ	22032	24-Nov-2022	24-Nov-2023
RF CABLE NM TO NM, 0.01-18GHZ	90-195-079	TELEDYNE STORM MICROWAVE	20123	9-Feb-2023	9-Feb-2024
RF CABLE RIGHT ANGLE NM TO NM, 0.01-18GHZ	90-076-020	TELEDYNE STORM MICROWAVE	20132	13-Mar-2023	13-Mar-2024

Note: The equipment calibration period is 1 year.
Software: TILE 7 software profile “RSE 9k - 30M 220804” TILE! profile dated 04 August 2022

Med Frequency (30-1000 MHz)

Test End Date: 4-Oct-2023 Tester: SGM/ZH/LM

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079691	15-Aug-2022	15-Aug-2024
RF CABLE NM TO NM, 0.01-18GHZ	90-195-118	TELEDYNE STORM MICROWAVE	20126	9-Feb-2023	9-Feb-2024
RF CABLE NM TO NF, 0.01-18GHZ	90-213-118	TELEDYNE STORM MICROWAVE	20118	13-Mar-2023	13-Mar-2024
RF CABLE RIGHT ANGLE NM TO NM, 0.01-18GHZ	90-076-020	TELEDYNE STORM MICROWAVE	20132	13-Mar-2023	13-Mar-2024
LOW NOISE AMPLIFIER	ZKL-2+	MINI-CIRCUITS	B079817	7-Aug-2023	7-Aug-2024
EMI TEST RECEIVER	ESW44	ROHDE & SCHWARZ	22032	24-Nov-2022	24-Nov-2023

Note: The equipment calibration period is 1 year.
Software: TILE 7 software profile “RE 30-1000MHz 3m Tile7 221014” dated 14 Oct 2022

High Frequency (1-10GHz)

Test End Date: 4-Oct-2023 Tester: SGM/ZH/LM

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079699	29-Jul-2022	29-Jul-2024
RF CABLE, NM TO NM.	90-195-276	TELEDYNE STORM MICROWAVE	21020	CNR	CNR
RF CABLE	104PE	HUBER & SUHNER	B079793	7-Aug-2023	7-Aug-2024
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	10-Oct-2023	10-Oct-2024

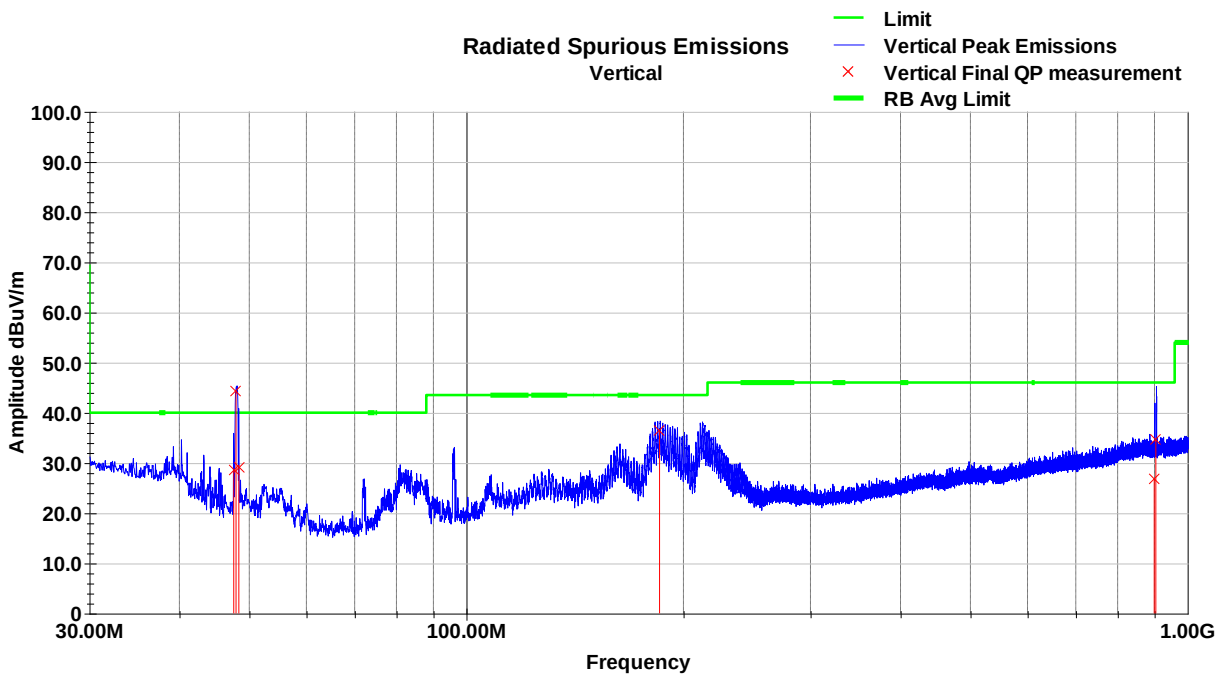
Note: The equipment calibration period is 1 year.
Software: TILE 7 software profile “RE 1-18GHz 3m Tile7 220307” dated 07 March 2022

7.5 *Test Data*

No emissions were detected in the 9kHz to 30MHz frequency range.

7.5.1 30-1000 MHz

Vertical Radiated Spurious Emissions – Peak Plot- 30 -1000 MHz (Low Channel)

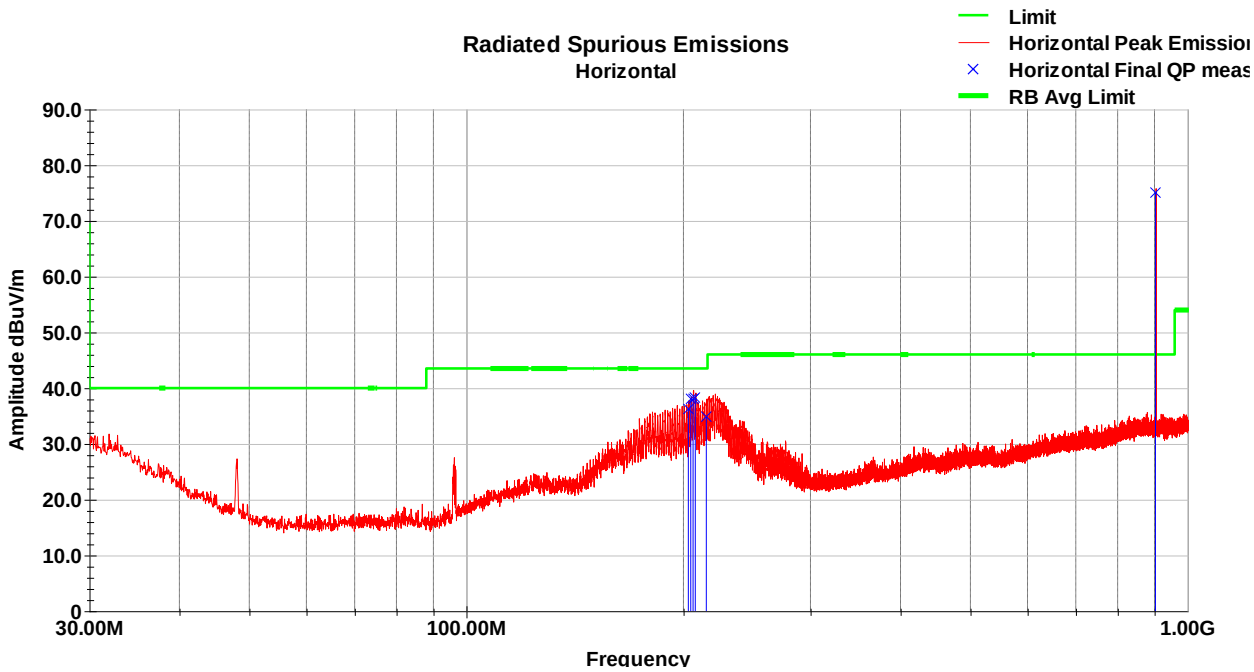


Vertical Radiated Spurious Emissions – Tabular Data- 30 -1000 MHz (Low Channel)

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)
47.58	45.3	V	280.0	100.0	13.7	0.6	31.0	28.6	40.0	-11.4
47.92	61.2	V	139.0	100.0	13.5	0.6	31.0	44.3	40.0	4.3
48.36	46.2	V	133.0	185.0	13.4	0.6	31.0	29.2	40.0	-10.8
185.32	50.5	V	351.0	100.0	15.1	1.3	30.7	36.3	43.5	-7.2
899.25	26.3	V	264.0	100.0	26.9	2.7	29.2	26.7	46.0	-19.3
903.80	34.3	V	329.0	186.0	26.9	2.7	29.2	34.6	46.0	-11.4
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

Note: Frequency at 47.92 MHz was not related to the transmitter and was not compared against the radiated spurious emissions limits.

Horizontal Radiated Spurious Emissions – Peak Plot- 30 -1000 MHz (Low Channel)

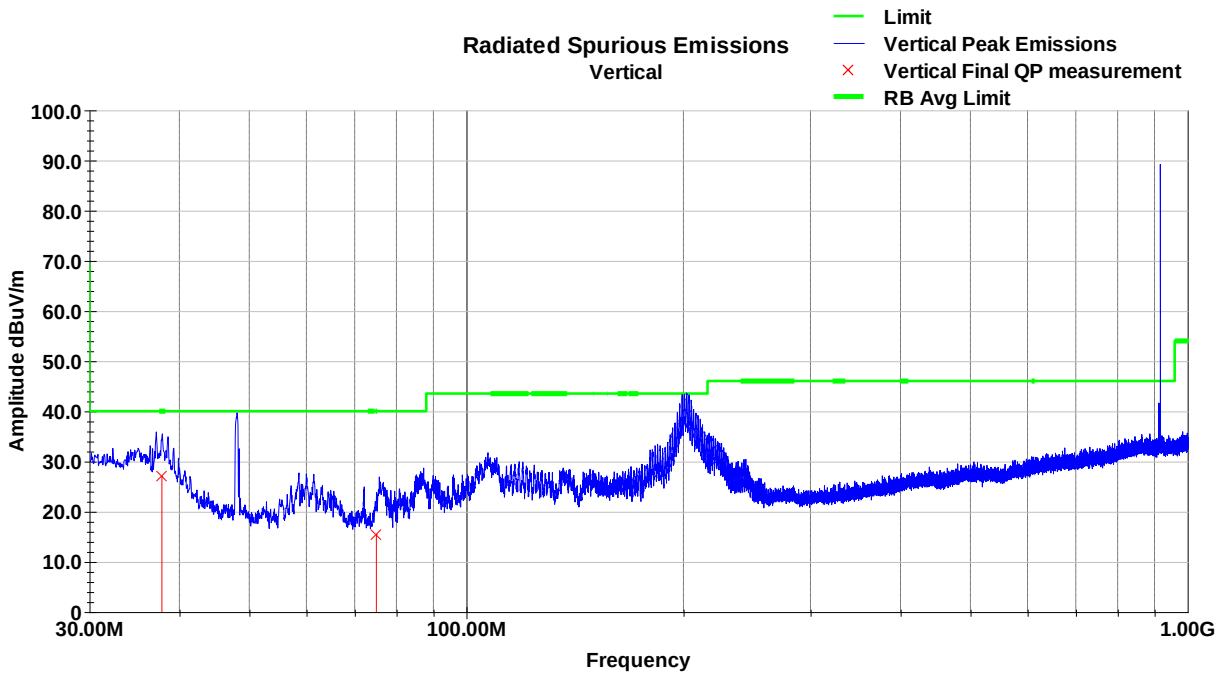


Horizontal Radiated Spurious Emissions – Tabular Data- 30 -1000 MHz (Low Channel)

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)
203.14	48.6	H	87.0	137.0	16.8	1.4	30.6	36.3	43.5	-7.2
204.71	51.0	H	90.0	138.0	16.2	1.4	30.6	38.2	43.5	-5.4
206.24	51.5	H	79.0	117.0	15.6	1.5	30.6	38.0	43.5	-5.5
207.67	51.9	H	99.0	137.0	15.3	1.5	30.6	38.2	43.5	-5.3
215.15	48.6	H	231.0	118.0	15.3	1.5	30.6	34.9	43.5	-8.7
902.80	74.8	H	45.0	175.0	26.9	2.7	29.2	75.2	46.0	29.1
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

Note: Frequency at 902.8 MHz was related to the fundamental carrier frequency of the transmitter and was not compared against the radiated spurious emissions limits.

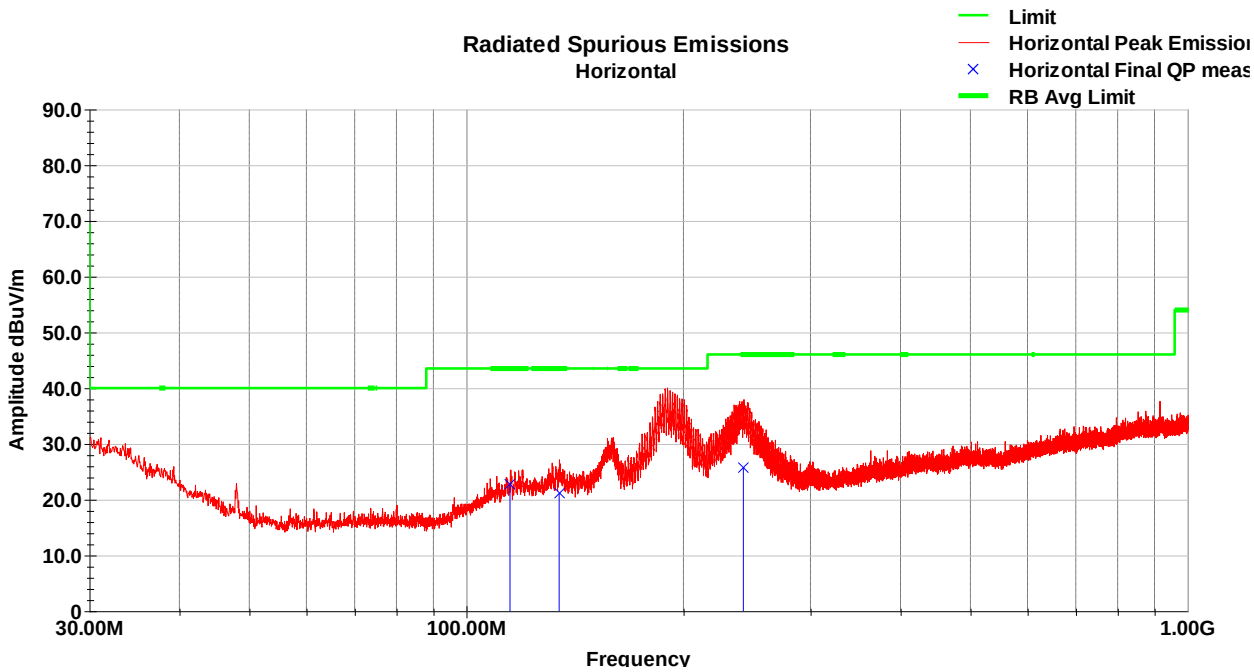
Vertical Radiated Spurious Emissions – Peak Plot- 30 -1000 MHz (Mid Channel)



Vertical Radiated Spurious Emissions – Tabular Data- 30 -1000 MHz (Mid Channel)

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)
37.83	37.4	V	61.0	114.0	20.2	0.5	31.0	27.1	40.0	-12.9
75.02	33.6	V	93.0	100.0	12.1	0.7	30.9	15.5	40.0	-24.5
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

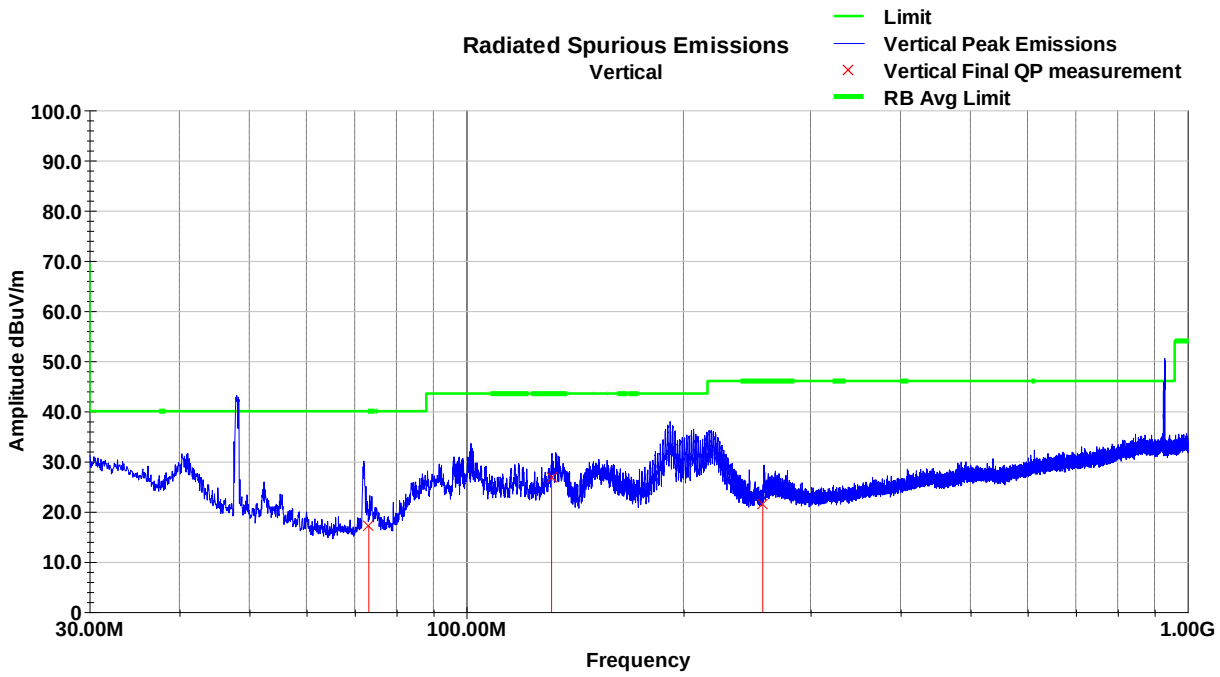
Horizontal Radiated Spurious Emissions – Peak Plot- 30 -1000 MHz (Mid Channel)



Horizontal Radiated Spurious Emissions – Tabular Data- 30 -1000 MHz (Mid Channel)

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)
114.96	35.6	H	38.0	249.0	17.2	0.9	30.8	22.9	43.5	-20.7
134.47	33.4	H	201.0	205.0	17.6	1.0	30.8	21.2	43.5	-22.4
242.20	38.4	H	274.0	100.0	16.3	1.6	30.6	25.8	46.0	-20.2
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

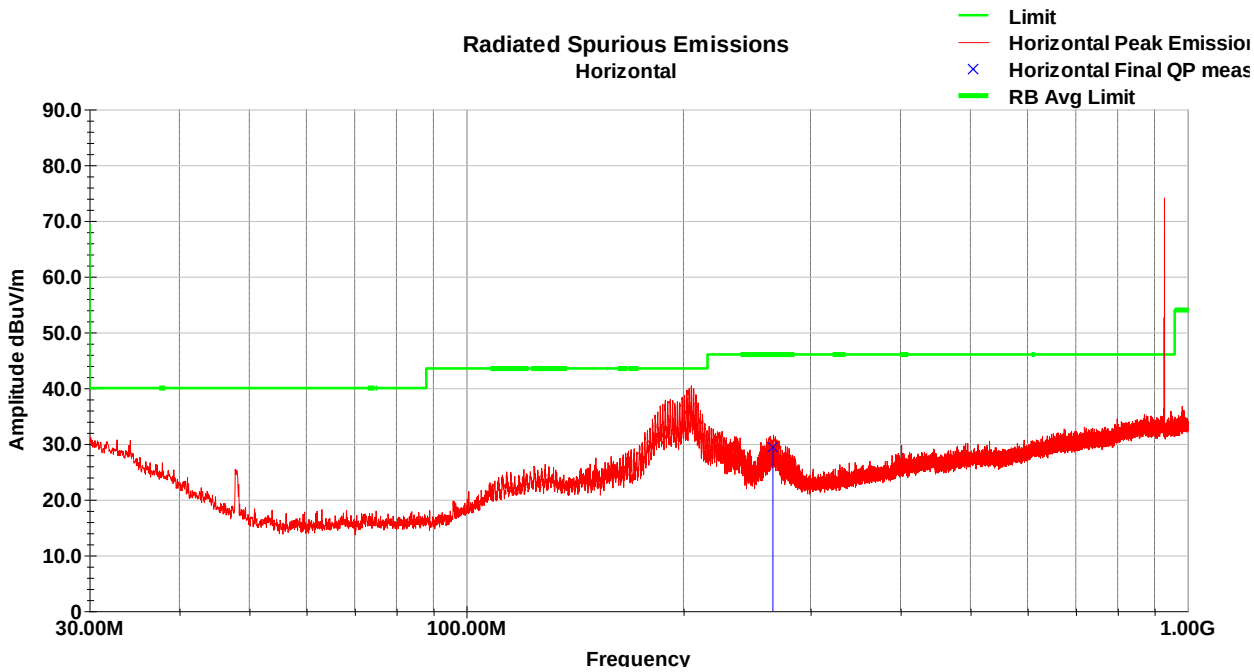
Vertical Radiated Spurious Emissions – Peak Plot- 30 -1000 MHz (High Channel)



Vertical Radiated Spurious Emissions – Tabular Data- 30 -1000 MHz (High Channel)

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)
73.23	35.2	V	312.0	100.0	12.2	0.7	30.9	17.2	40.0	-22.8
131.28	38.9	V	178.0	100.0	17.8	1.0	30.8	26.9	43.5	-16.6
257.68	33.7	V	122.0	100.0	16.6	1.7	30.5	21.4	46.0	-24.6
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

Horizontal Radiated Spurious Emissions – Peak Plot- 30 -1000 MHz (High Channel)

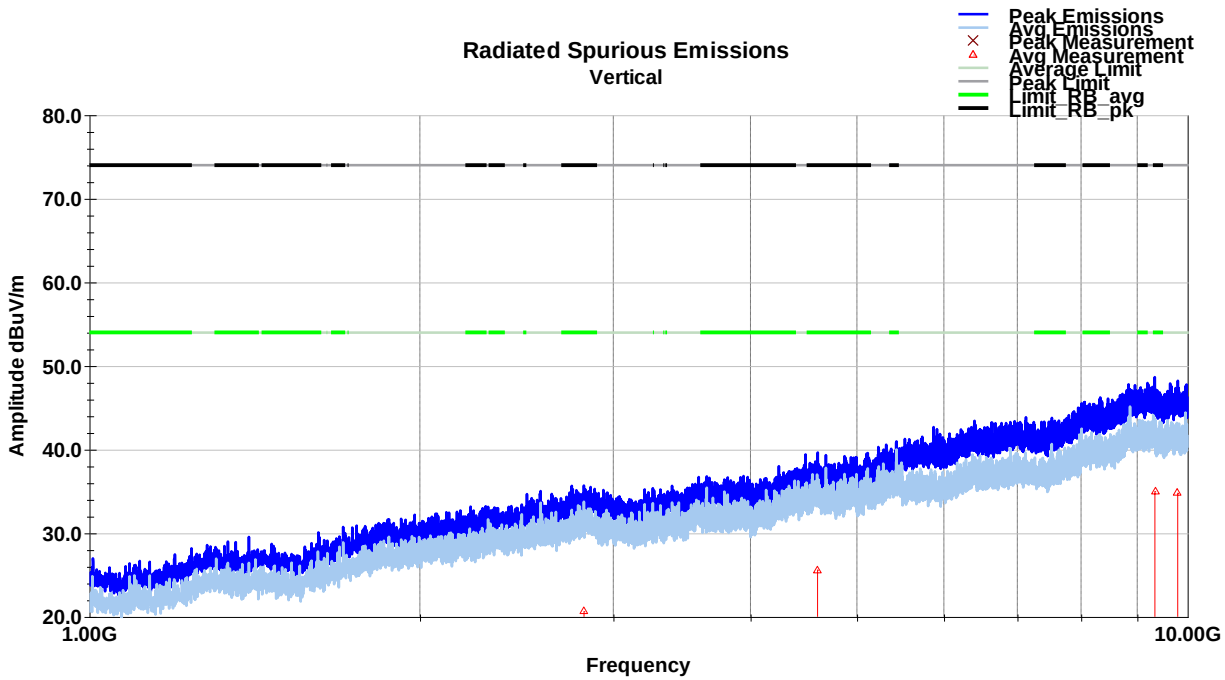


Horizontal Radiated Spurious Emissions – Tabular Data- 30 -1000 MHz (High Channel)

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)
266.17	40.6	H	278.0	100.0	17.6	1.7	30.5	29.4	46.0	-16.6
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

7.5.2 1-13 GHz

Vertical Radiated Spurious Emissions – Peak Plot- 1-10 GHz (Low Channel)



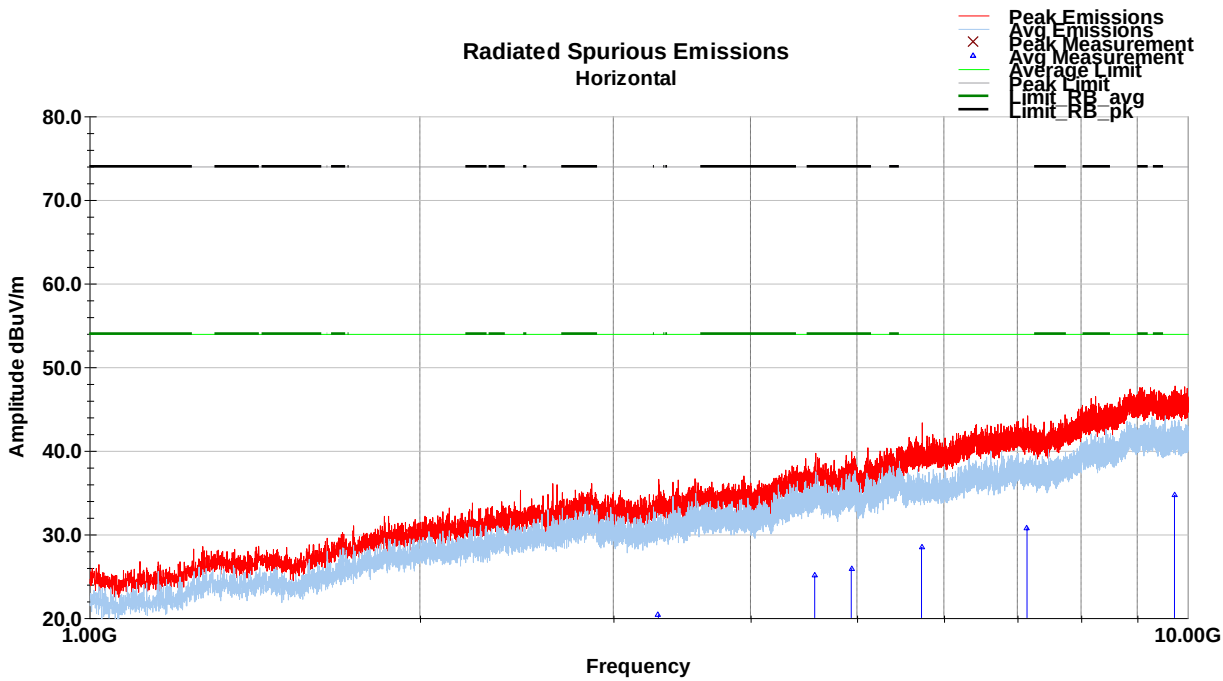
Vertical Radiated Spurious Emissions – Peak Tabular Data- 1-10 GHz (Low Channel)

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
2821.31	NAN	V	200.0	100.0	32.4	2.1	35.2	NAN	NAN	NAN
4604.09	NAN	V	42.0	100.0	34.0	2.6	35.1	NAN	NAN	NAN
9338.75	NAN	V	62.0	117.0	36.4	3.6	35.3	NAN	NAN	NAN
9798.53	NAN	V	216.0	137.0	36.8	3.9	35.3	NAN	NAN	NAN
Final Pk = Raw Pk + AF + Loss - Amp										
Margin = Final Pk - Limit										

Vertical Radiated Spurious Emissions-Average Tabular Data – 1-10 GHz(Low Channel)

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)
2821.31	21.3	V	200.0	100.0	32.4	2.1	35.2	20.7	54.0	-33.3
4604.09	24.2	V	42.0	100.0	34.0	2.6	35.1	25.6	54.0	-28.3
9338.75	30.4	V	62.0	117.0	36.4	3.6	35.3	35.0	54.0	-18.9
9798.53	29.5	V	216.0	137.0	36.8	3.9	35.3	34.8	54.0	-19.1
Final Avg = Raw Avg + AF + Loss - Amp										
Margin = Final Avg - Limit										

Horizontal Radiated Spurious Emissions – Peak Plot- 1-10 GHz (Low Channel)



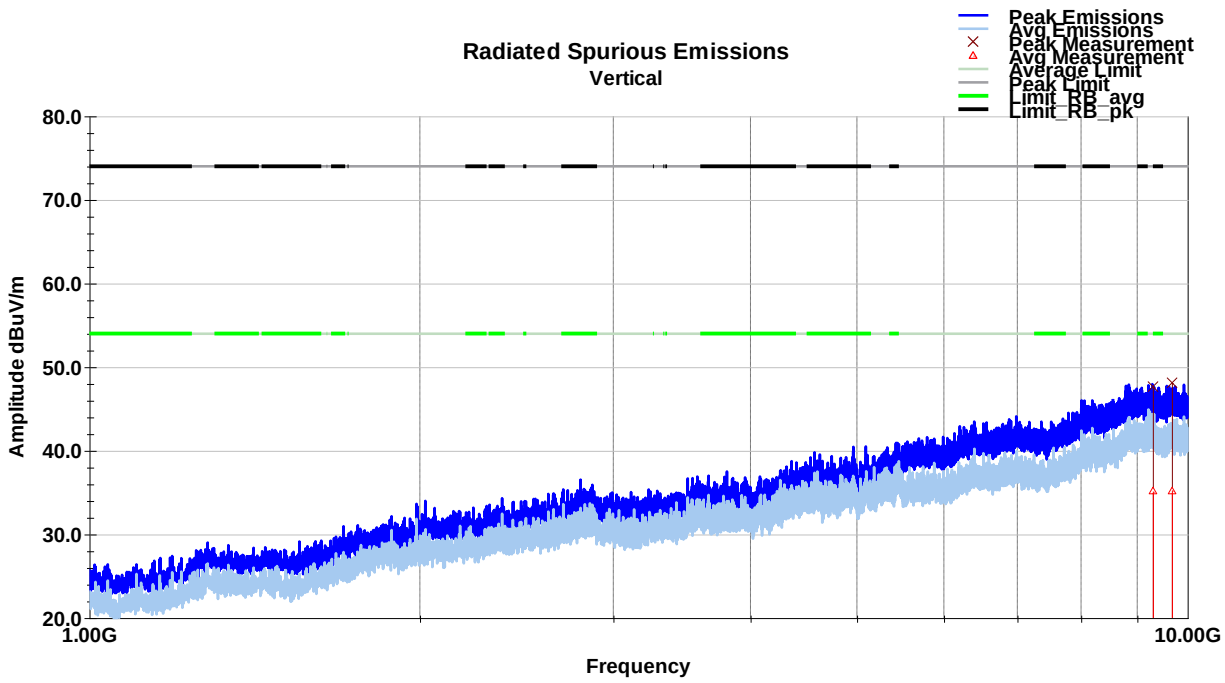
Horizontal Radiated Spurious Emissions – Peak Tabular Data- 1-10 GHz (Low Channel)

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
3297.98	NAN	H	340.0	115.0	32.8	2.5	35.2	NAN	NAN	NAN
4576.85	NAN	H	58.0	250.0	33.9	2.6	35.1	NAN	NAN	NAN
4940.81	NAN	H	106.0	176.0	34.0	3.0	35.2	NAN	NAN	NAN
5725.13	NAN	H	141.0	196.0	34.9	2.9	35.0	NAN	NAN	NAN
7143.71	NAN	H	314.0	214.0	35.6	3.3	35.5	NAN	NAN	NAN
9730.16	NAN	H	94.0	205.0	36.8	3.8	35.4	NAN	NAN	NAN
Final Pk = Raw Pk + AF + Loss - Amp										
Margin = Final Pk - Limit										

Horizontal Radiated Spurious Emissions – Average Tabular Data – 1-10GHz(Low Channel)

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)
3297.98	20.3	H	340.0	115.0	32.8	2.5	35.2	20.4	54.0	-33.6
4576.85	23.7	H	58.0	250.0	33.9	2.6	35.1	25.1	54.0	-28.9
4940.81	24.2	H	106.0	176.0	34.0	3.0	35.2	25.9	54.0	-28.0
5725.13	25.7	H	141.0	196.0	34.9	2.9	35.0	28.5	54.0	-25.5
7143.71	27.4	H	314.0	214.0	35.6	3.3	35.5	30.8	54.0	-23.2
9730.16	29.5	H	94.0	205.0	36.8	3.8	35.4	34.7	54.0	-19.3

Vertical Radiated Spurious Emissions – Peak Plot- 1-10 GHz (Mid Channel)



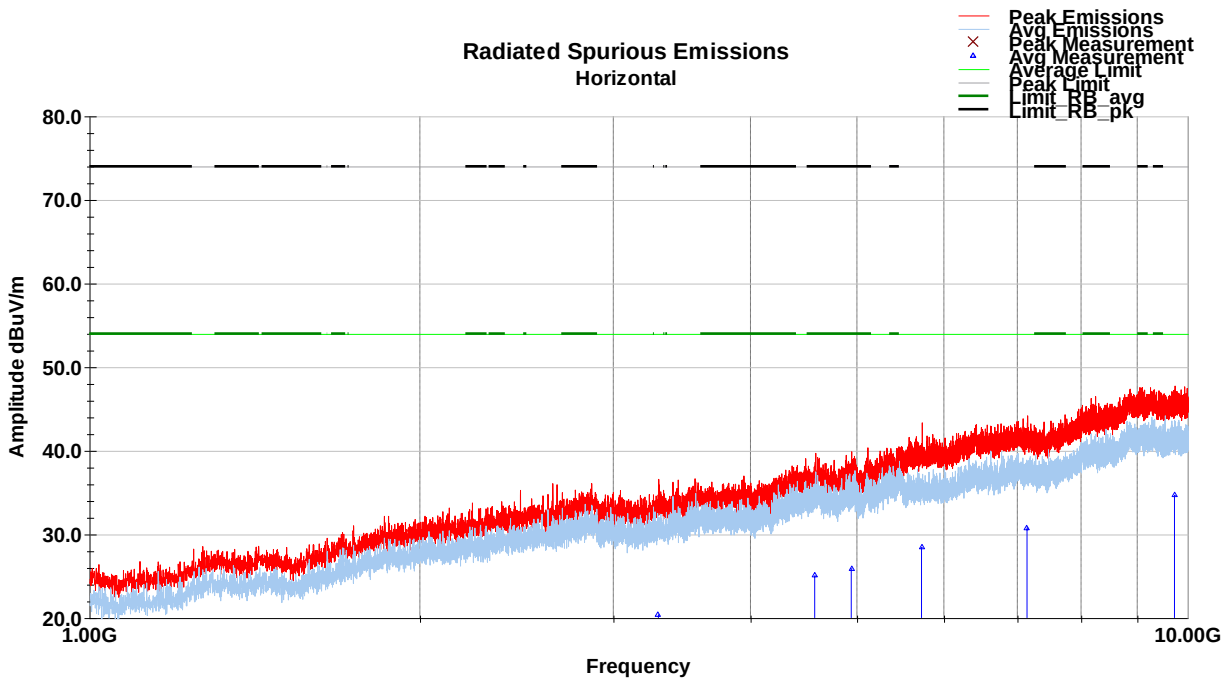
Vertical Radiated Spurious Emissions – Peak Tabular Data- 1-10 GHz (Mid Channel)

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
9310.40	43.0	V	334.0	221.0	36.3	3.6	35.3	47.6	74.0	-26.4
9687.56	42.9	V	131.0	127.0	36.7	3.9	35.4	48.1	74.0	-25.9
aw Pk + AF + Loss - Amp										
in = Final Pk - Limit										

Vertical Radiated Spurious Emissions-Average Tabular Data – 1-10 GHz(Mid Channel)

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)
9310.40	30.5	V	334.0	221.0	36.3	3.6	35.3	35.1	54.0	-18.9
9687.56	30.0	V	131.0	127.0	36.7	3.9	35.4	35.2	54.0	-18.7
Final Avg = Raw Avg + AF + Loss - Amp										
	Margin = Final Avg - Limit									

Horizontal Radiated Spurious Emissions – Peak Plot- 1-10 GHz (Mid Channel)



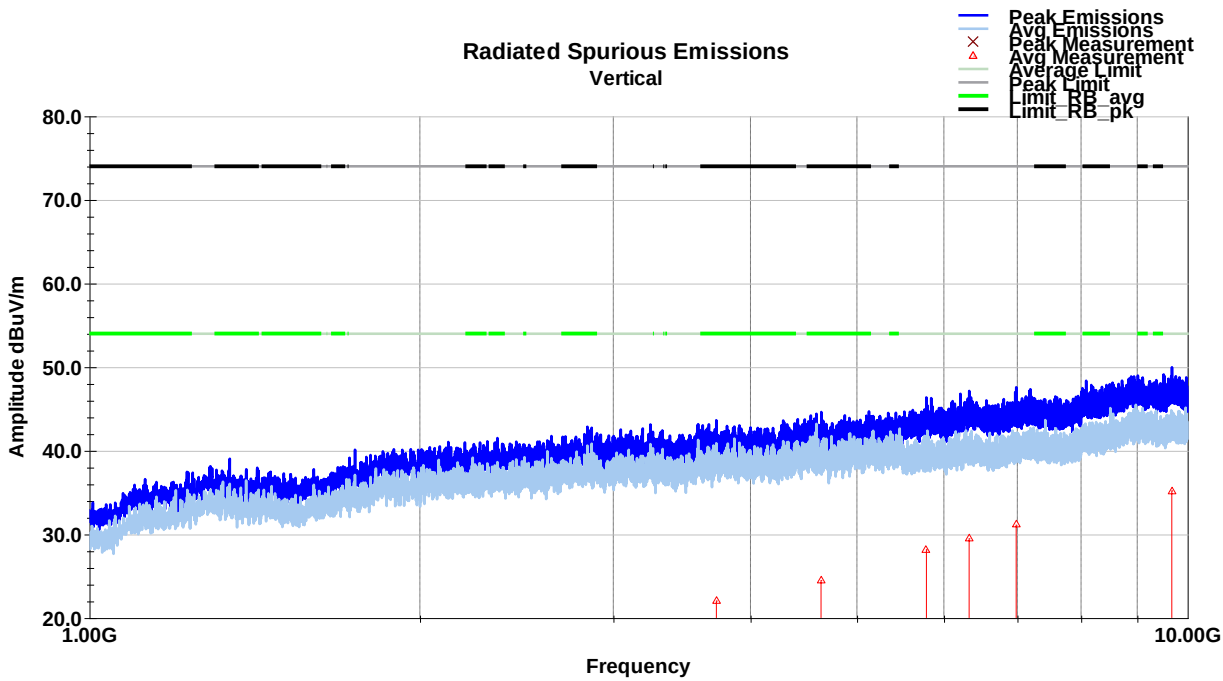
Horizontal Radiated Spurious Emissions – Peak Tabular Data- 1-10 GHz (Mid Channel)

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
9318.32	43.4	H	150.0	204.0	36.3	3.6	35.3	48.0	74.0	-26.0
9689.60	42.8	H	197.0	250.0	36.8	3.9	35.4	48.1	74.0	-25.9
Raw Pk + AF + Loss - Amp										
rgin = Final Pk - Limit										

Horizontal Radiated Spurious Emissions – Average Tabular Data – 1-10GHz(Mid Channel)

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)
9318.32	30.3	H	150.0	204.0	36.3	3.6	35.3	34.9	54.0	-19.1
9689.60	29.9	H	197.0	250.0	36.8	3.9	35.4	35.2	54.0	-18.8
Final Avg = Raw Avg + AF + Loss - Amp										
	Margin = Final Avg - Limit									

Vertical Radiated Spurious Emissions – Peak Plot- 1-10 GHz (High Channel)



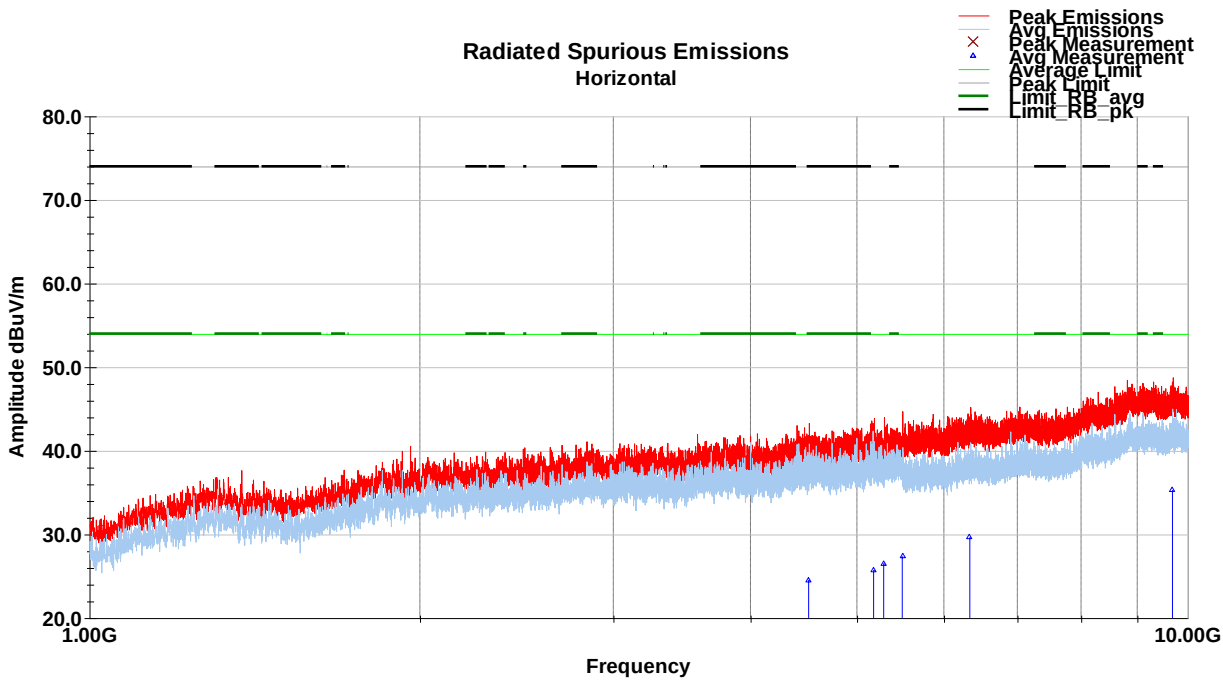
Vertical Radiated Spurious Emissions – Peak Tabular Data- 1-10 GHz (High Channel)

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
3723.92	NAN	V	176.0	248.0	33.1	2.3	35.2	NAN	NAN	NAN
4637.87	NAN	V	163.0	175.0	33.9	2.6	35.2	NAN	NAN	NAN
5784.29	NAN	V	0.0	115.0	35.0	2.9	35.0	NAN	NAN	NAN
6326.36	NAN	V	15.0	175.0	35.6	3.1	35.2	NAN	NAN	NAN
6982.37	NAN	V	131.0	149.0	35.5	3.5	35.4	NAN	NAN	NAN
9676.25	NAN	V	339.0	175.0	36.7	3.9	35.4	NAN	NAN	NAN
Final Pk = Raw Pk + AF + Loss - Amp										
Margin = Final Pk - Limit										

Vertical Radiated Spurious Emissions-Average Tabular Data – 1-10 GHz(High Channel)

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)
3723.92	21.9	V	176.0	248.0	33.1	2.3	35.2	22.1	54.0	-31.9
4637.87	23.1	V	163.0	175.0	33.9	2.6	35.2	24.5	54.0	-29.4
5784.29	25.3	V	0.0	115.0	35.0	2.9	35.0	28.2	54.0	-25.8
6326.36	25.9	V	15.0	175.0	35.6	3.1	35.2	29.5	54.0	-24.4
6982.37	27.5	V	131.0	149.0	35.5	3.5	35.4	31.2	54.0	-22.8
9676.25	30.0	V	339.0	175.0	36.7	3.9	35.4	35.3	54.0	-18.7
Final Avg = Raw Avg + AF + Loss - Amp										
Margin = Final Avg - Limit										

Horizontal Radiated Spurious Emissions – Peak Plot- 1-10 GHz (High Channel)



Horizontal Radiated Spurious Emissions – Peak Tabular Data- 1-10 GHz (High Channel)

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
4519.22	NAN	H	237.0	147.0	33.8	2.6	35.1	NAN	NAN	NAN
5178.71	NAN	H	84.0	155.0	34.2	2.9	35.0	NAN	NAN	NAN
5288.75	NAN	H	276.0	100.0	34.2	2.8	35.0	NAN	NAN	NAN
5498.66	NAN	H	331.0	111.0	34.5	2.8	34.9	NAN	NAN	NAN
6336.26	NAN	H	114.0	155.0	35.7	3.1	35.2	NAN	NAN	NAN
9690.74	NAN	H	138.0	131.0	36.8	3.9	35.4	NAN	NAN	NAN
Final Pk = Raw Pk + AF + Loss - Amp										
Margin = Final Pk - Limit										

Horizontal Radiated Spurious Emissions – Average Tabular Data – 1-10GHz(High Channel)

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)
4519.22	23.3	H	237.0	147.0	33.8	2.6	35.1	24.5	54.0	-29.4
5178.71	23.6	H	84.0	155.0	34.2	2.9	35.0	25.7	54.0	-28.3
5288.75	24.5	H	276.0	100.0	34.2	2.8	35.0	26.5	54.0	-27.5
5498.66	25.0	H	331.0	111.0	34.5	2.8	34.9	27.3	54.0	-26.6
6336.26	26.0	H	114.0	155.0	35.7	3.1	35.2	29.6	54.0	-24.3
9690.74	30.0	H	138.0	131.0	36.8	3.9	35.4	35.3	54.0	-18.7

8 Conducted Emissions

8.1 *Test Result*

Test Description	Test Specification		Test Result
Conducted Emissions	15.207(a)	RSS-GEN 7.2	Compliant

8.2 *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

8.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 21.89 °C
Relative Humidity: 36.6 %
Atmospheric Pressure: 97.96 kPa

8.4 *Test Equipment*

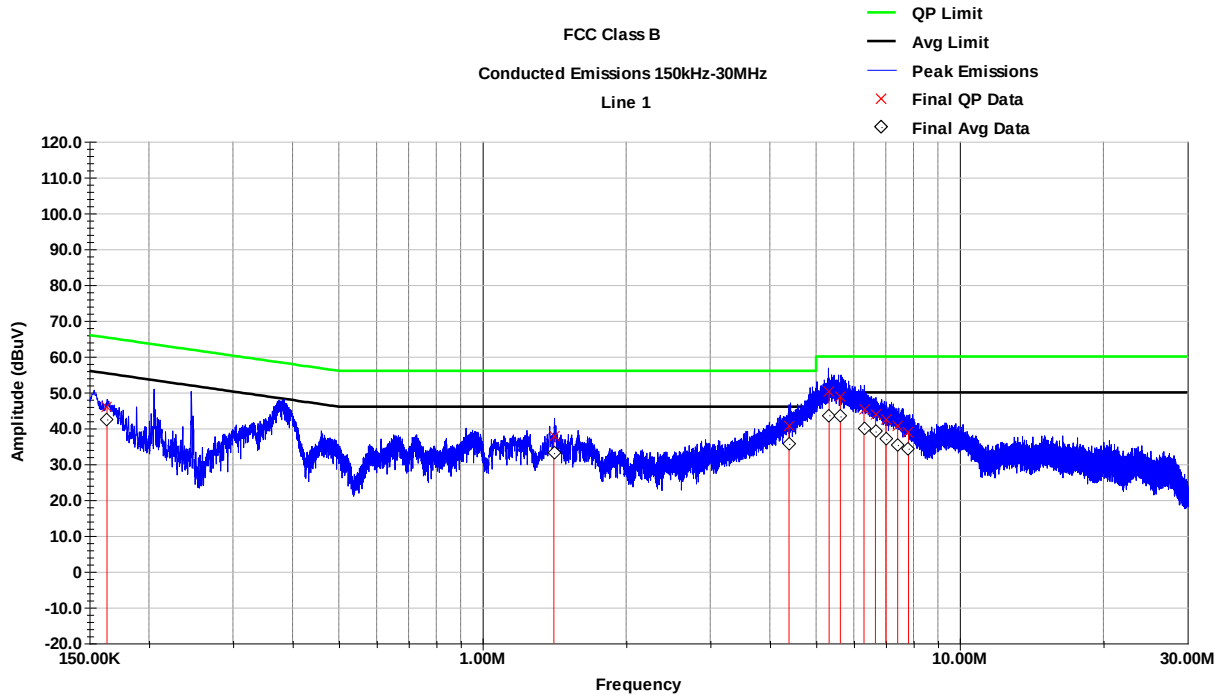
Test End Date:	9-Oct-2023	Tester:	SGM		
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	6-Sep-2023	6-Sep-2024
RF CABLE	UC-N-MM-78	MAURY MICROWAVE	17017	7-Aug-2023	7-Aug-2024
LINE IMPEDANCE	NNB 51	TESEQ	B085882	14-Apr-2023	14-Apr-2024
CONDUCTED COMB	CGC-255	COM-POWER CORPORATION	B079696	CNR	CNR

Note: Refer to the table for calibration intervals.

Software:
TILE 7 software profile "Conducted Emissions Tile7 230206.til" dated 06 02 2023

8.5 *Test Data*

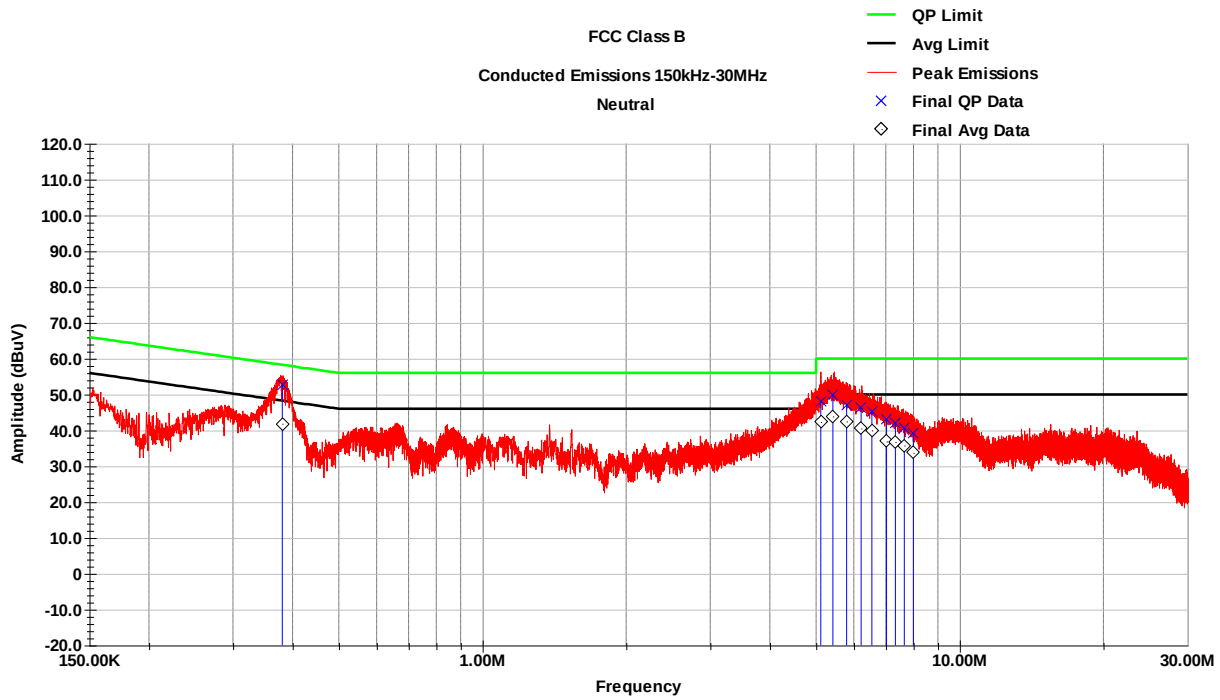
Line 1 Conducted Emissions – Peak Plot



Line 1 Conducted Emissions – Tabular Data

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
0.163	46.0	65.3	-19.3	42.5	55.3	-12.8
1.411	37.7	56	-18.3	33.1	46	-12.9
4.389	40.6	56	-15.4	35.6	46	-10.4
5.326	50.3	60	-9.7	43.7	50	-6.3
5.622	48.8	60.0	-11.2	43.3	50.0	-6.7
6.301	45.2	60.0	-14.8	39.9	50.0	-10.1
6.659	43.8	60.0	-16.2	39.1	50.0	-10.9
7.008	42.3	60.0	-17.7	37.0	50.0	-13.0
7.413	40.7	60.0	-19.3	35.3	50.0	-14.7
7.809	39.0	60.0	-21.0	34.3	50.0	-15.7

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
0.381	52.6	58.3	-5.7	41.9	48.3	-6.4
5.114	48.1	60	-11.9	42.3	50	-7.7
5.423	49.9	60	-10.1	43.9	50	-6.1
5.795	47.2	60	-12.8	42.5	50	-7.5
6.213	46.3	60.0	-13.7	40.5	50.0	-9.5
6.545	45.1	60.0	-14.9	40.0	50.0	-10.0
7.026	43.0	60.0	-17.0	36.9	50.0	-13.1
7.332	41.9	60.0	-18.1	36.7	50.0	-13.3
7.654	40.7	60.0	-19.3	35.8	50.0	-14.2
7.995	39.2	60.0	-20.8	33.7	50.0	-16.3

9 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%

10 Revision History

Revision Level	Description of changes	Revision Date
0	Initial Release	30 October 2023
1	Similar Model referenced in section 2.8; Ant Gain in section 2.3 corrected; section 7 software/equipment updated; HVIN updated	24 January 2024