

RF Test Report

Project Number: 4838347

Proposal: SUW-202108001523

Report Number: 4838347EMC02

Revision Level: 1

Client: Landis + Gyr

Equipment Under Test: 900MHz Radio Module

Model Number: M225

FCC ID: R7PEC6R1X1

IC ID: 5294A-EC6R1X1

Applicable Standards: ANSI C63.10: 2013 (FCC Part 15 Subpart C, § 15.249)

RSS-210, Issue 10

RSS-GEN Issue 5

Report issued on: 07 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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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.

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1 Summary of Test Results

Test Description	Test Specification		Test Result
Occupied Bandwidth 20dB Bandwidth	15.215	RSS-GEN 6.7	Compliant
Fundamental Field Strength	15.249(a)	RSS-210 B.10(a)	Compliant
Radiated Spurious Emissions	15.249(a), (d), (e), 15.35(b), 15.209	RSS-210 B.10(a), (b), RSS-GEN 8.10	Compliant
Antenna Requirement	15.203	RSS-GEN 6.8	Compliant ¹
AC Powerline Conducted Emissions	15.107, 15.207	RSS-GEN 8.8	NA ²

- 1) The antenna is bent metal and permanently attached to the PCB.
- 2) The module is battery-powered with no facility for connection to the AC mains.

1.1 Modifications Required for Compliance

None

2 General Information

2.1 Client Information

Name: Landis+Gyr Technology, Inc.
 Address: 30000 Mill Creek Avenue, Suite 100
 City, State, Zip, Country: Alpharetta, GA 30022, USA

2.2 Test Laboratory

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

Accrediting Body: A2LA
 Type of lab: Testing Laboratory
 Certificate Number: 3212.01
 Designation Number: US1126
 CAB Identifier: US0186

2.3 General Information of EUT

Product Description: 900 Mhz Radio Module
 Model Number: M225
 Serial Numbers: Mesh NB/WB: M225Y292100123P25006
 Mesh IP / WiSUN: M225Y292100122P25001

Antenna: Bent Metal Inverted F – 0dBi

Rated Voltage: 5Vdc
 Test Voltage: 5Vdc

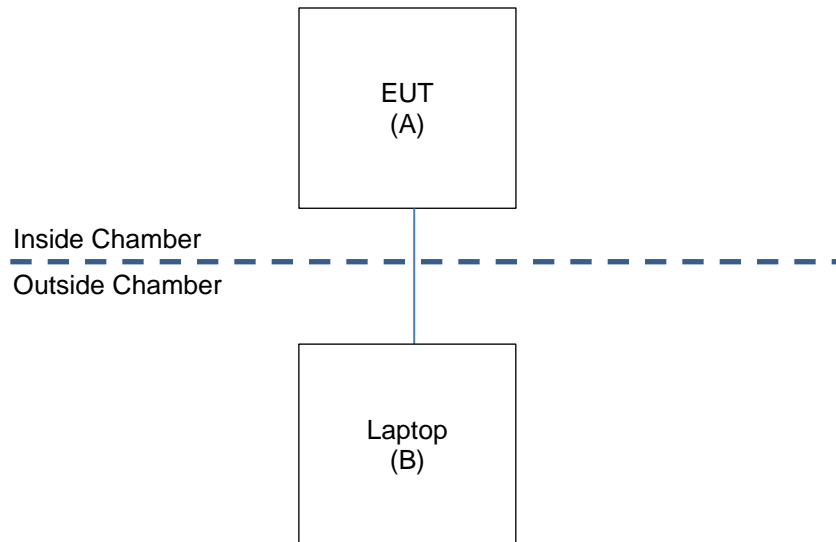
Sample Received Date: 05 October 2021
 Dates of testing: 28 October – 01 November 2021

2.4 Operating Modes and Conditions

Mode of Operation	Frequency Range (MHz)	Number of Hopping Channels	Frequency Separation (kHz)	Data Rates Supported (kbps)
Mode 1	902.3 - 927.7	255	100	19.2
Mode 2	902.4 - 927.6	64	400	50

The test samples were provided with special firmware (S5SL07-14.01.P07) which allowed control of channel, power, data-rate, and hopping operation. The low power setting for all data-rates was configured with a register setting of 00CD.

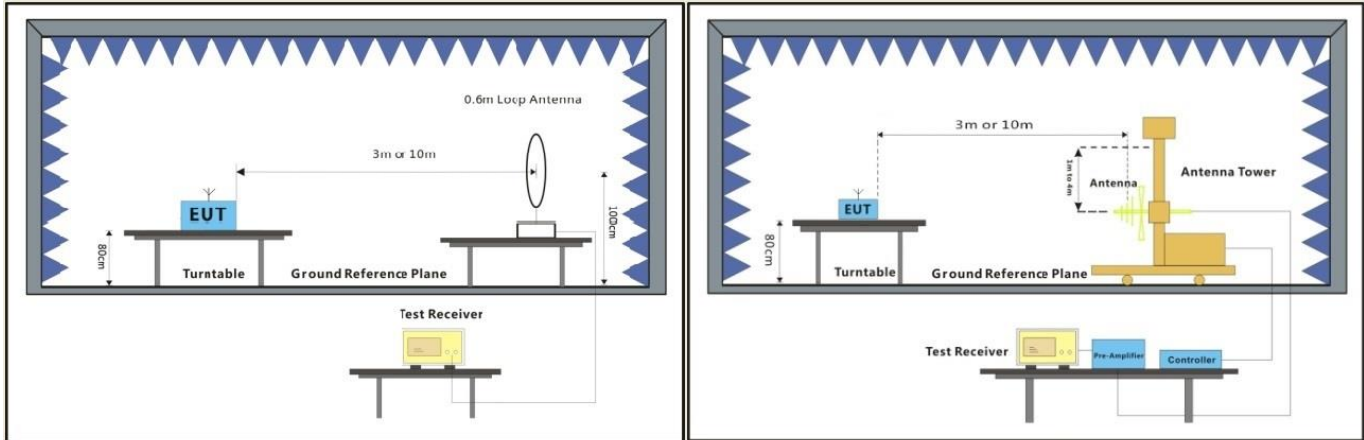
2.5 EUT Connection Block Diagram – Radiated Measurements



2.6 System Configurations

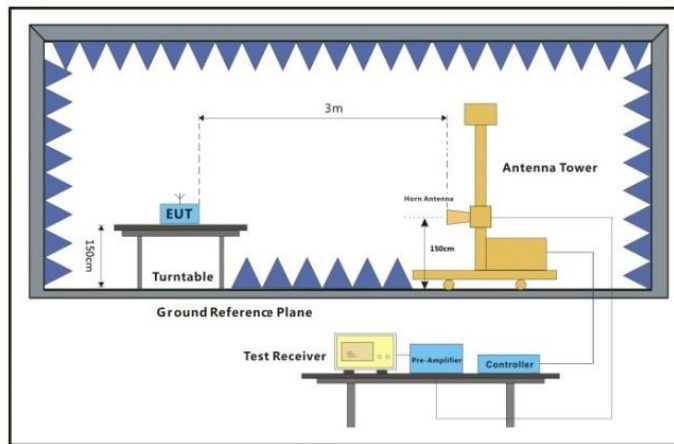
Device reference	Manufacturer	Description	Model Number	Serial Number
A	Landis + Gyr	900MHz Radio Module	M225	Mesh NB/WB: M225Y292100123P25006 Mesh IP / WiSUN: M225Y292100122P25001
B	Lenovo	Laptop	T440p	PB-00-UTCU

2.7 Configuration Diagrams (Radiated)



Below 30MHz

30MHz-1GHz



Above 1GHz

3 Bandwidth

3.1 Test Result

Test Description	Test Specification		Test Result
Occupied Bandwidth 20dB Bandwidth	15.215(c)	RSS-GEN 6.7	Compliant

3.2 Test Method

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

Limit:

The 20 dB bandwidth of the emission shall be contained within the frequency band designated.

3.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.0 °C

Relative Humidity: 43.9 %

Atmospheric Pressure: 97.9 kPa

3.4 Test Equipment

Test End Date: 11/1/2021

Tester: JP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM	20109	16-Mar-2021	16-Mar-2022
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2019	27-Dec-2021

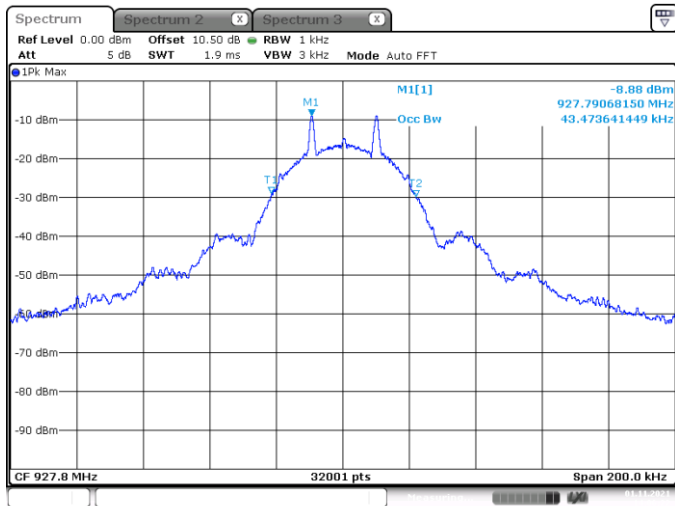
3.5 Test Data

Data Rate (kbps)	Channel	Frequency (MHz)	99% OBW (kHz)	20dB BW (kHz)	Verdict
19.2	0	902.3	43.055	42.292	PASS
	127	915	43.011	42.53	PASS
	255	927.8	43.474	42.18	PASS
50	1	902.4	108.543	107.715	PASS
	63	914.8	109.793	110.918	PASS
	127	927.6	108.153	108.653	PASS

Sample Plots

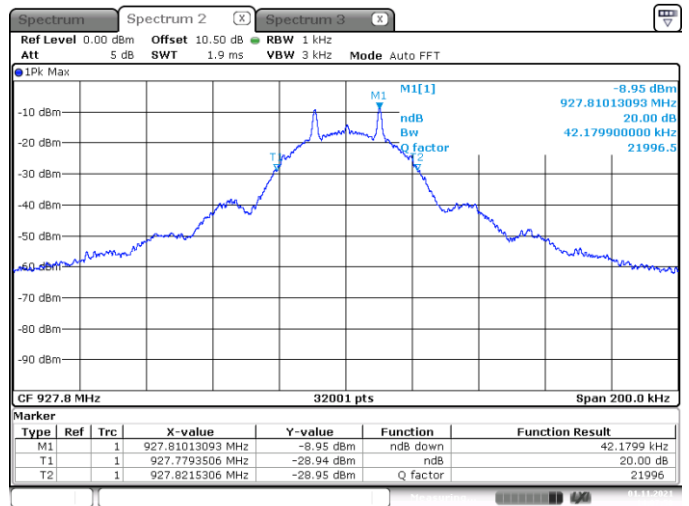
19.2kbps High Channel (927.8MHz)

99% Occupied Bandwidth



Date: 1.NOV.2021 14:06:22

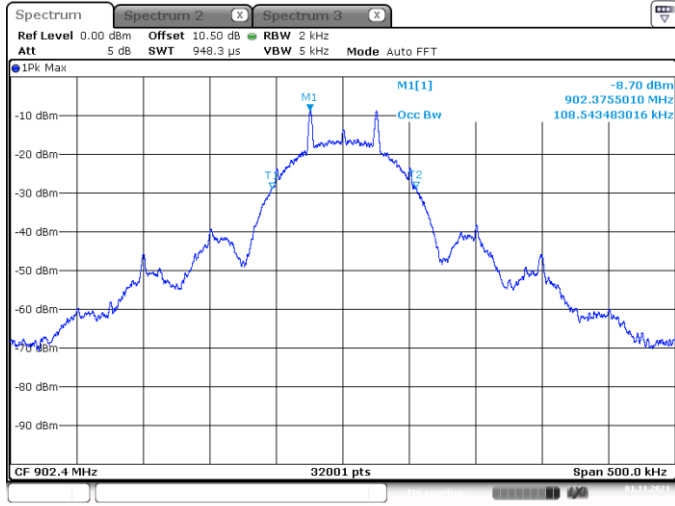
20dB Bandwidth



Date: 1.NOV.2021 14:07:58

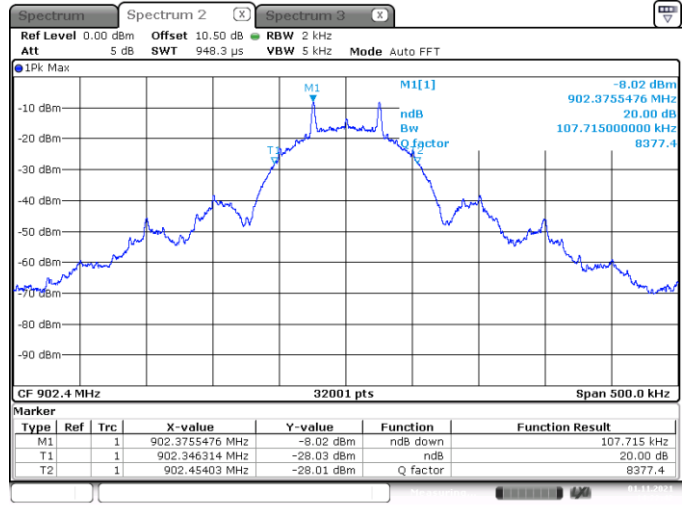
50kbps Low Channel (902.4MHz)

99% Occupied Bandwidth



Date: 1.NOV.2021 14:21:45

20dB Bandwidth



Date: 1.NOV.2021 14:22:42

4 Fundamental Field Strength

4.1 Test Result

Test Description	Test Specification		Test Result
Fundamental Field Strength	15.249(a)	RSS-210 B.10(a)	Compliant

4.2 Test Method

The measurement methods defined in ANSI C63.10: 2013 were used.

Lowest, middle, and highest channels were investigated in all three orthogonal axes – the device was commanded to continuously transmit on low, middle, and high channels. The lowest data rate was evaluated as worst-case, and the worst-case axis was the Z-Axis.

Test distance: 3 meters

Fundamental Field Strength Limits

Frequency	Limits ⁽¹⁾		Detector
	mV/m	dB μ V/m	
902 - 928 MHz	50	94.0	Quasi-Peak
2400 – 2483.5 MHz	50	94.0	Average
5725 - 5875 MHz	50	94.0	Average
24 – 24.25 GHz	250	108.0	Average

4.3 Test Site

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

Environmental Conditions

Temperature: 23.2 °C

Relative Humidity: 41.8 %

Atmospheric Pressure: 96.63 kPa

4.4 Test Equipment

Test End Date: 11/1/2021

Tester: AB

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE NM TO NM, 0.01-18GHZ	90-195-354	TELEDYNE STORM	20119	18-Feb-2021	18-Feb-2022
RF CABLE, NM TO NM.	90-195-157	TELEDYNE STORM	21019	26-Mar-2021	26-Mar-2022
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	21-Jun-2021	21-Jun-2022
ANTENNA, BILOG	JB6	SUNOL	B079690	13-Jan-2021	13-Jan-2023
RF CABLE	104PE	HUBER & SUHNER	B079793	24-Aug-2021	24-Aug-2022
LOW NOISE AMPLIFIER	ZKL-2+	MINI-CIRCUITS	B079817	26-Aug-2021	26-Aug-2022
RF CABLE	SF106	HUBER & SUHNER	B085903	25-Aug-2021	25-Aug-2022

4.5 Test 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)
902.30	89.6	V	171.0	158.0	22.8	5.0	29.5	87.9	94.0	-6.1
902.30	89.8	H	167.0	139.0	22.8	5.0	29.5	88.2	94.0	-5.8
915.00	89.8	V	161.0	144.0	23.0	5.0	29.5	88.3	94.0	-5.7
915.00	87.2	H	190.0	152.0	23.0	5.0	29.5	85.8	94.0	-8.2
927.80	89.5	V	159.0	152.0	23.2	5.1	29.5	88.3	94.0	-5.7
927.80	89.8	H	190.0	141.0	23.2	5.1	29.5	88.6	94.0	-5.4
QP Value = Raw QP + AF + Loss - Amp										
Margin = QP Value - Limit										

5 Radiated Spurious Emissions

5.1 Test Result

Test Description	Test Specification		Test Result
Radiated Spurious Emissions	15.249(a), (d), (e), 15.35(b), 15.209	RSS-210 B.10(a), (b), RSS-GEN 8.10	Compliant

5.2 Test Method

The measurement methods defined in ANSI C63.10: 2013 were used.

Lowest, middle, and highest channels were investigated in all three orthogonal axes – the device was commanded to continuously transmit on low, middle, and high channels. The lowest data rate was evaluated as worst-case, and the worst-case axis was the Z-Axis.

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

Harmonic Field Strength Limits

Frequency	Limits ⁽¹⁾		Detector
	μV/m	dBμV/m	
902 - 928 MHz	500	54.0	Quasi-Peak
2400 – 2483.5 MHz	500	54.0	Average
5725 - 5875 MHz	500	54.0	Average
24 – 24.25 GHz	2500	68.0	Average

5.3 Test Site

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

Environmental Conditions

Temperature: 23.2 °C

Relative Humidity: 41.8 %

Atmospheric Pressure: 96.63 kPa

5.4 Test Equipment

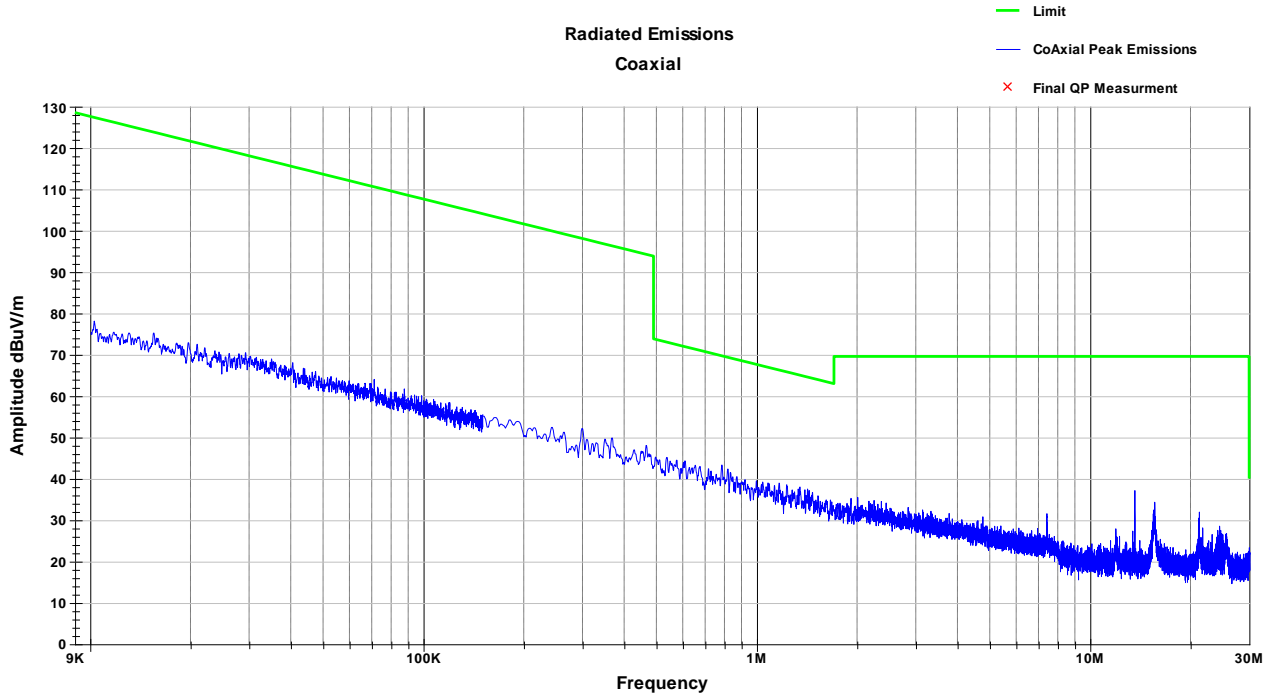
Test End Date: 11/1/2021

Tester: AB/ZH

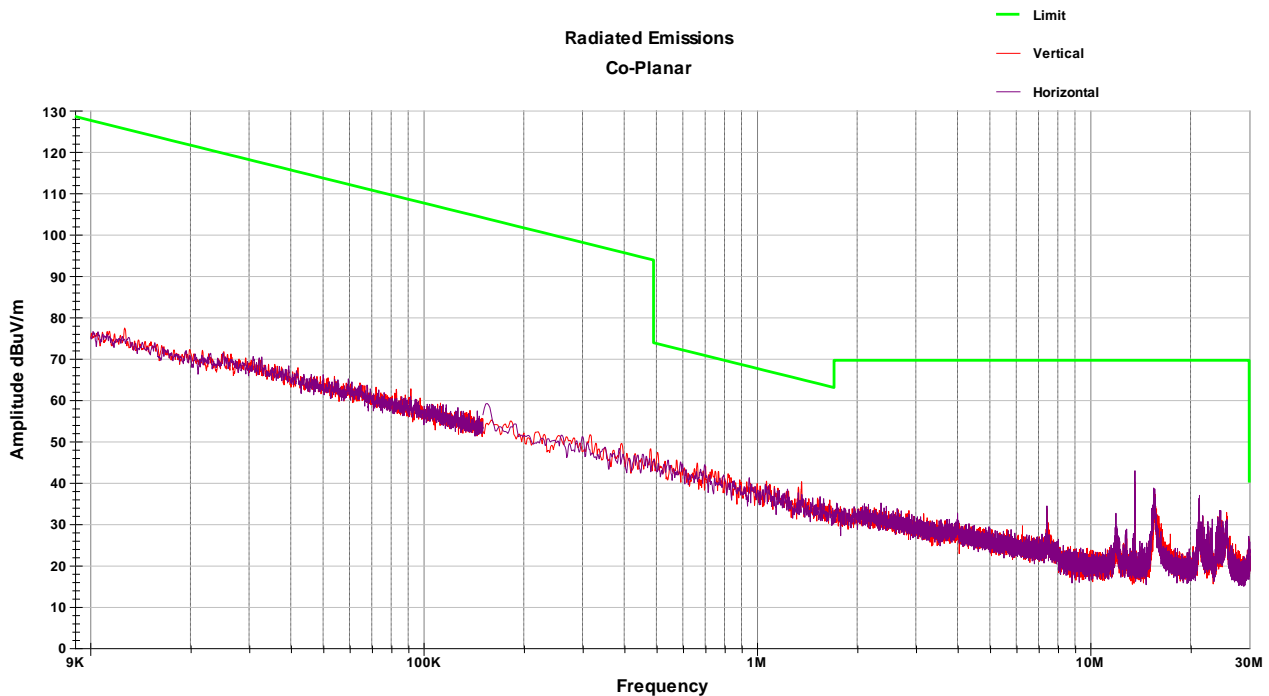
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE NM TO NM, 0.01-18GHZ	90-195-354	TELEDYNE STORM	20119	18-Feb-2021	18-Feb-2022
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-138	TELEDYNE STORM	20111	16-Mar-2021	16-Mar-2022
RF CABLE, NM TO NM.	90-195-157	TELEDYNE STORM	21019	26-Mar-2021	26-Mar-2022
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	21-Jun-2021	21-Jun-2022
ANTENNA, BILOG	JB6	SUNOL	B079690	13-Jan-2021	13-Jan-2023
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079699	15-Jul-2020	15-Jul-2022
RF CABLE	104PE	HUBER & SUHNER	B079793	24-Aug-2021	24-Aug-2022
FILTER, HIGH PASS, >1000MHZ	HPM50108	MICRO-TRONICS	B079802	6-Jul-2021	6-Jul-2022
LOW NOISE AMPLIFIER	ZKL-2+	MINI-CIRCUITS	B079817	26-Aug-2021	26-Aug-2022
ANTENNA, LOOP, ACTIVE	6502	ETS LINDGREN	B085752	20-Aug-2020	20-Aug-2022
RF CABLE	SF106	HUBER & SUHNER	B085903	25-Aug-2021	25-Aug-2022
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	7-Jul-2021	7-Jul-2022

5.5 Test Data – Peak Plots

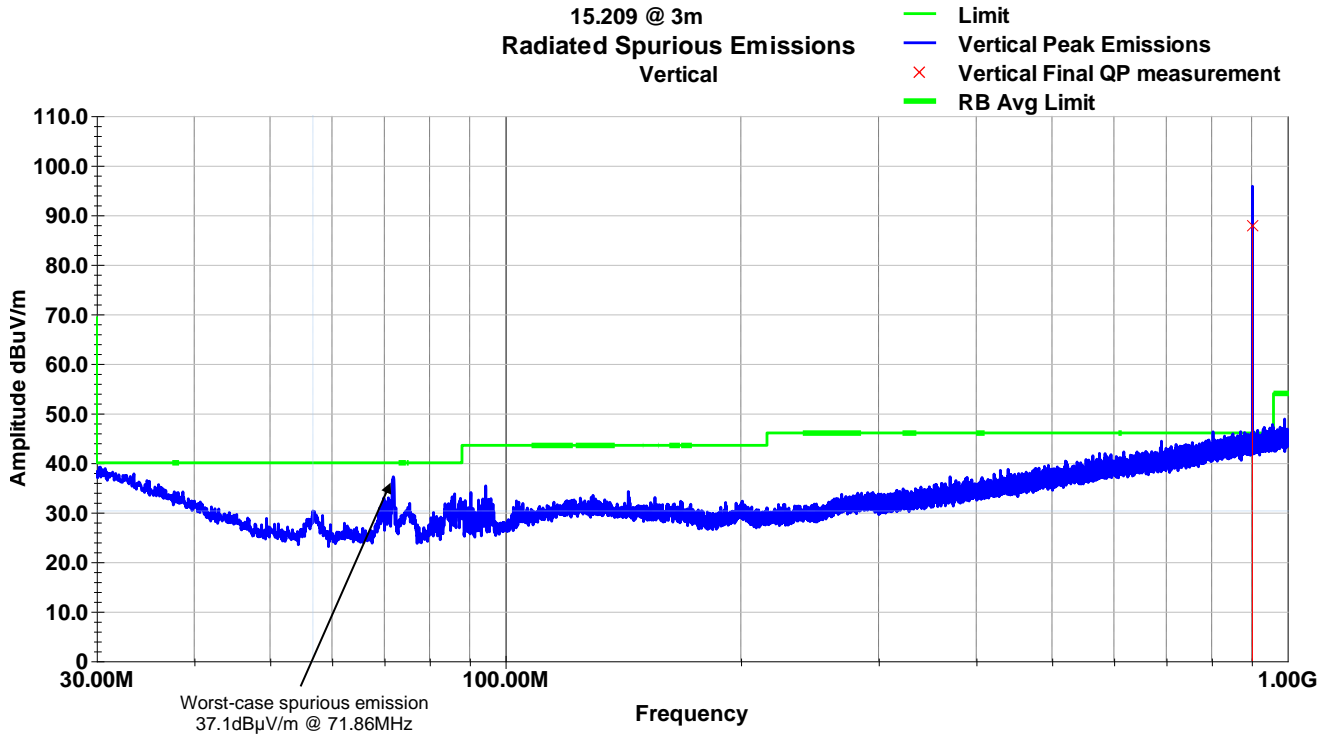
Between 9kHz and 30MHz, there was no significant deviation with respect to axis or channel
 Co-Axial Radiated Spurious Emissions – 9kHz-30MHz (LCH)



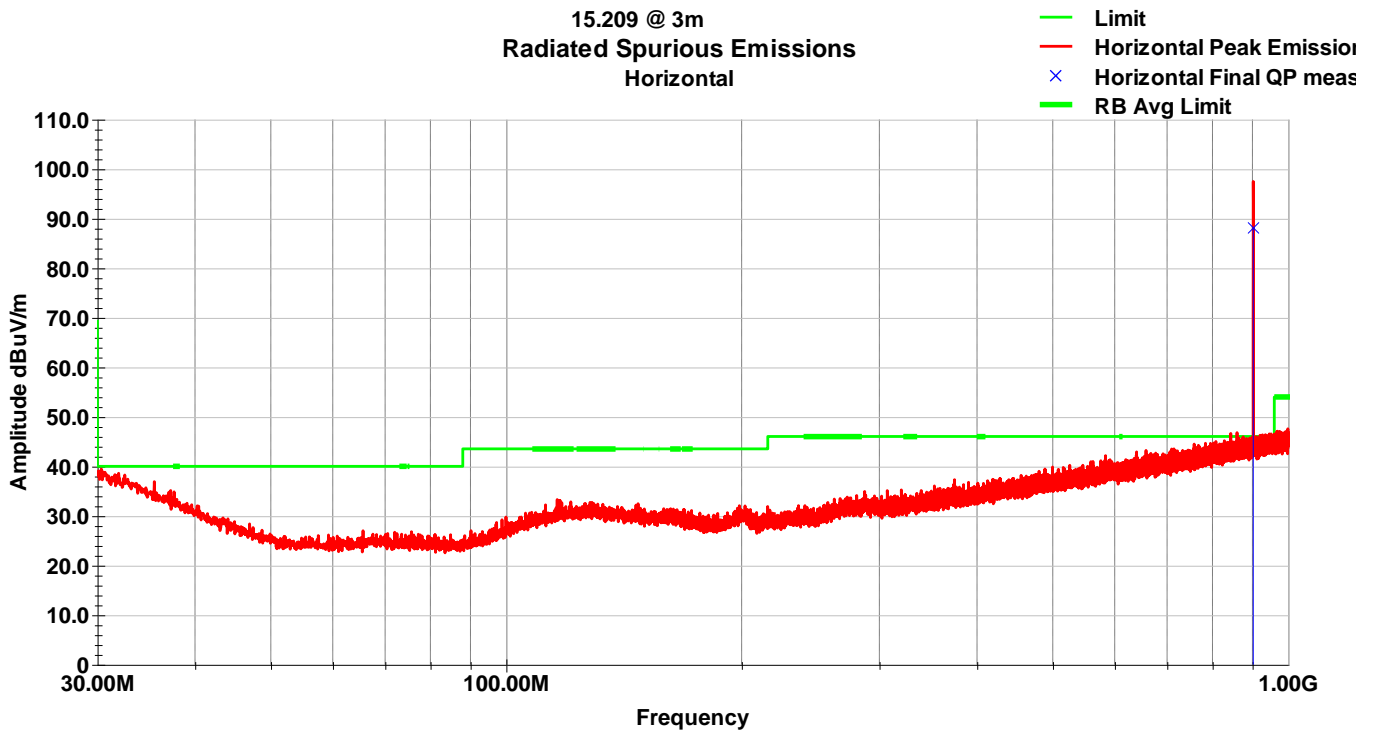
Co-Planar Radiated Spurious Emissions – 9kHz-30MHz (LCH)



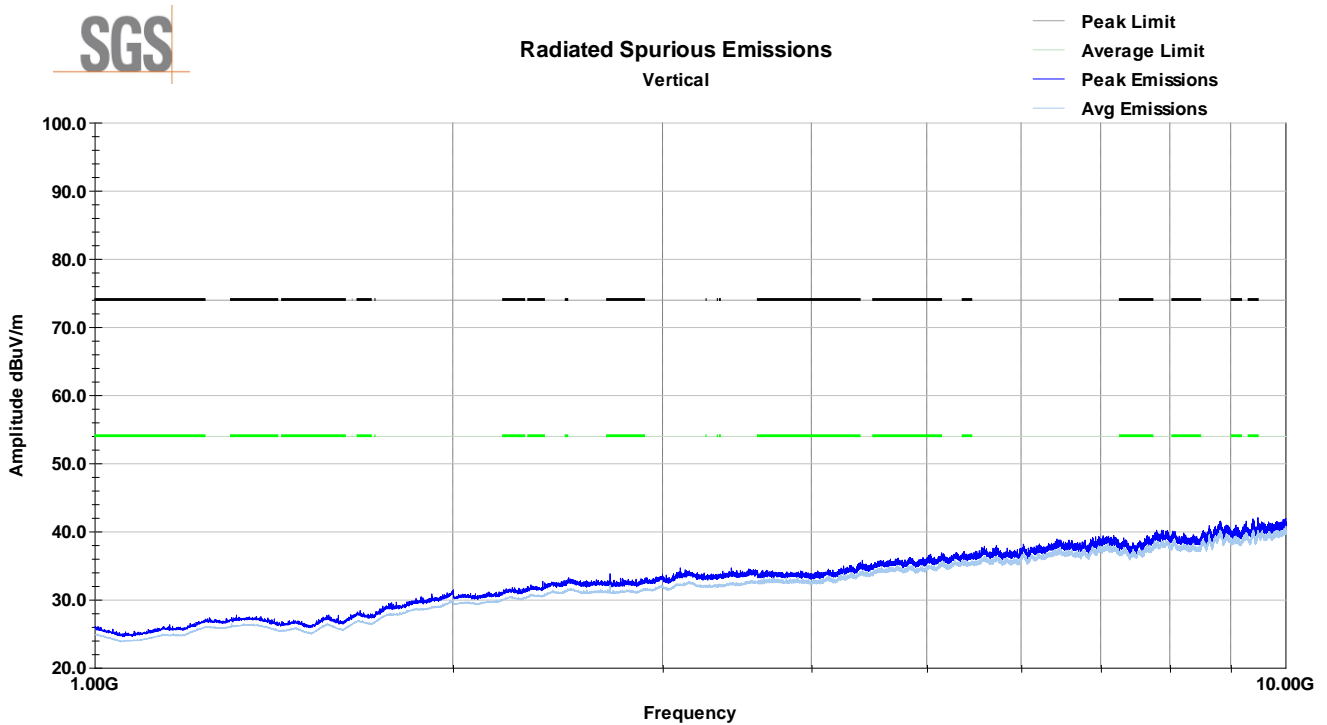
Vertical Radiated Spurious Emissions – 30-1000MHz (19.2kbps LCH)



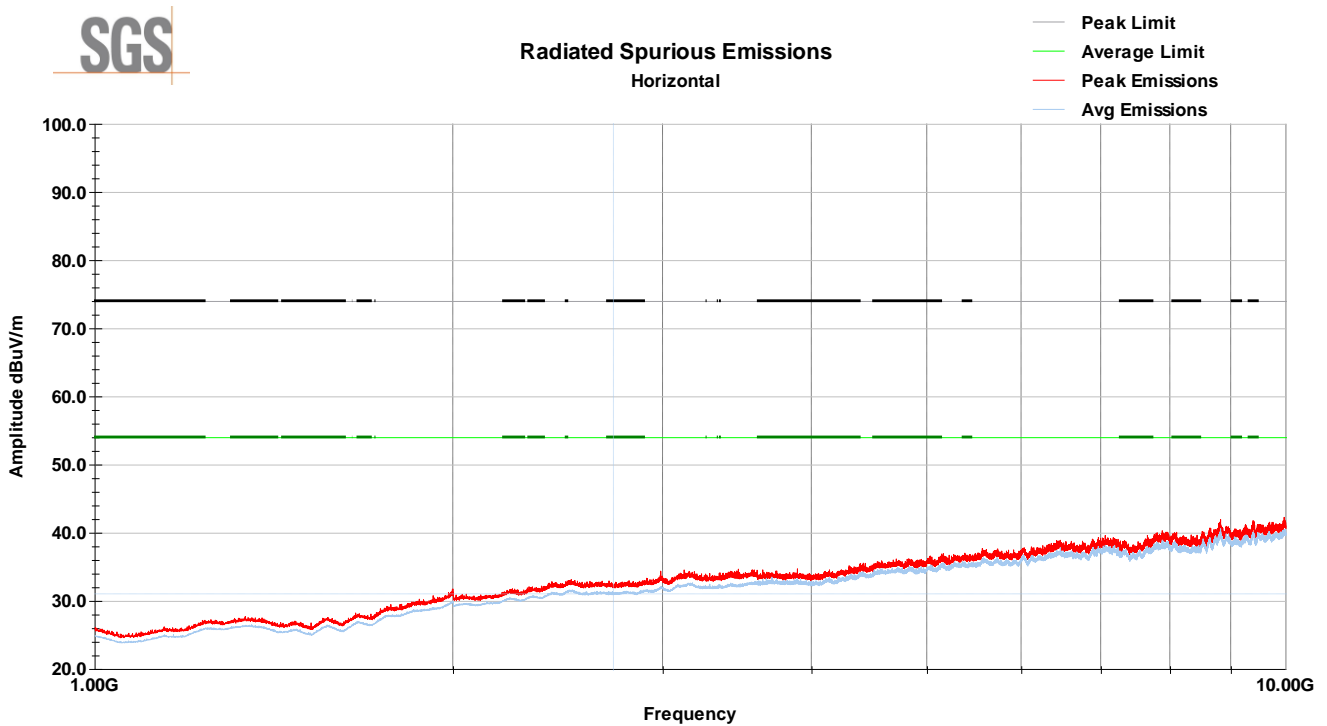
Horizontal Radiated Spurious Emissions – 30-1000MHz (19.2kbps LCH)



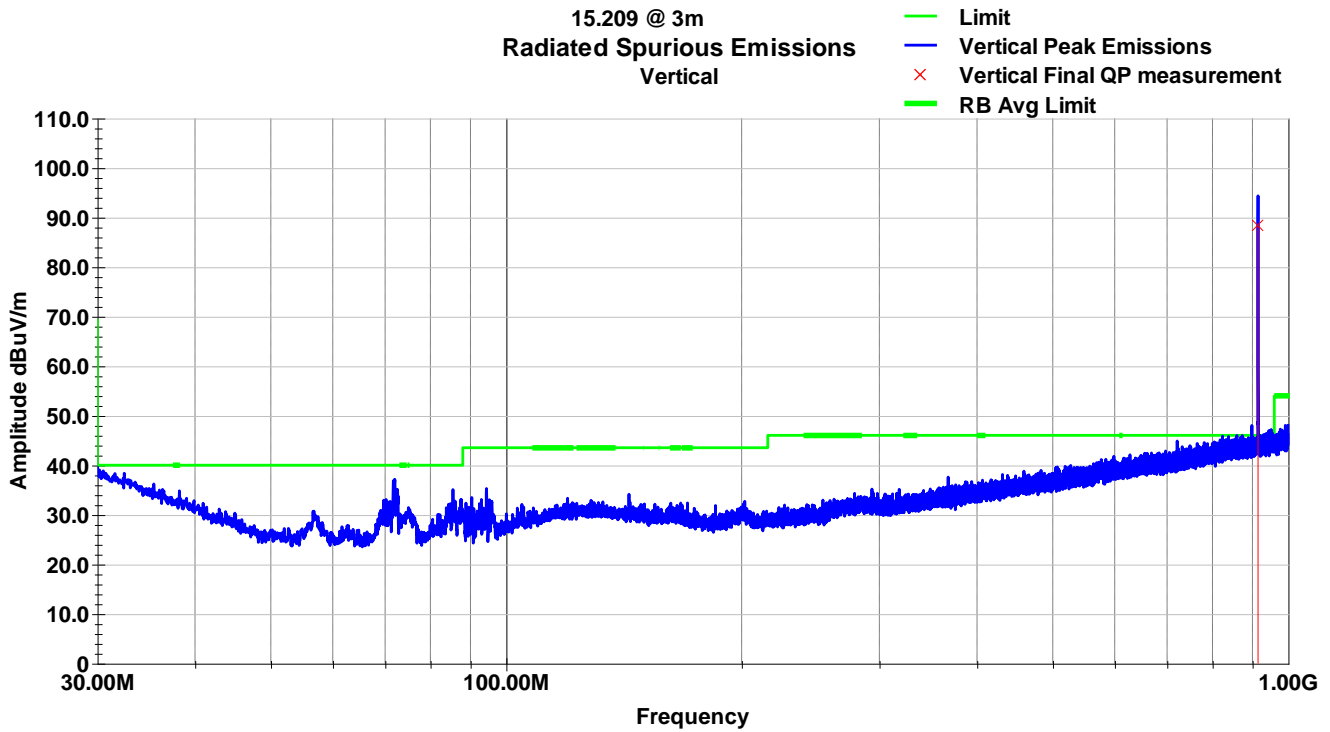
Vertical Radiated Spurious Emissions – 1-10GHz (19.2kbps LCH)



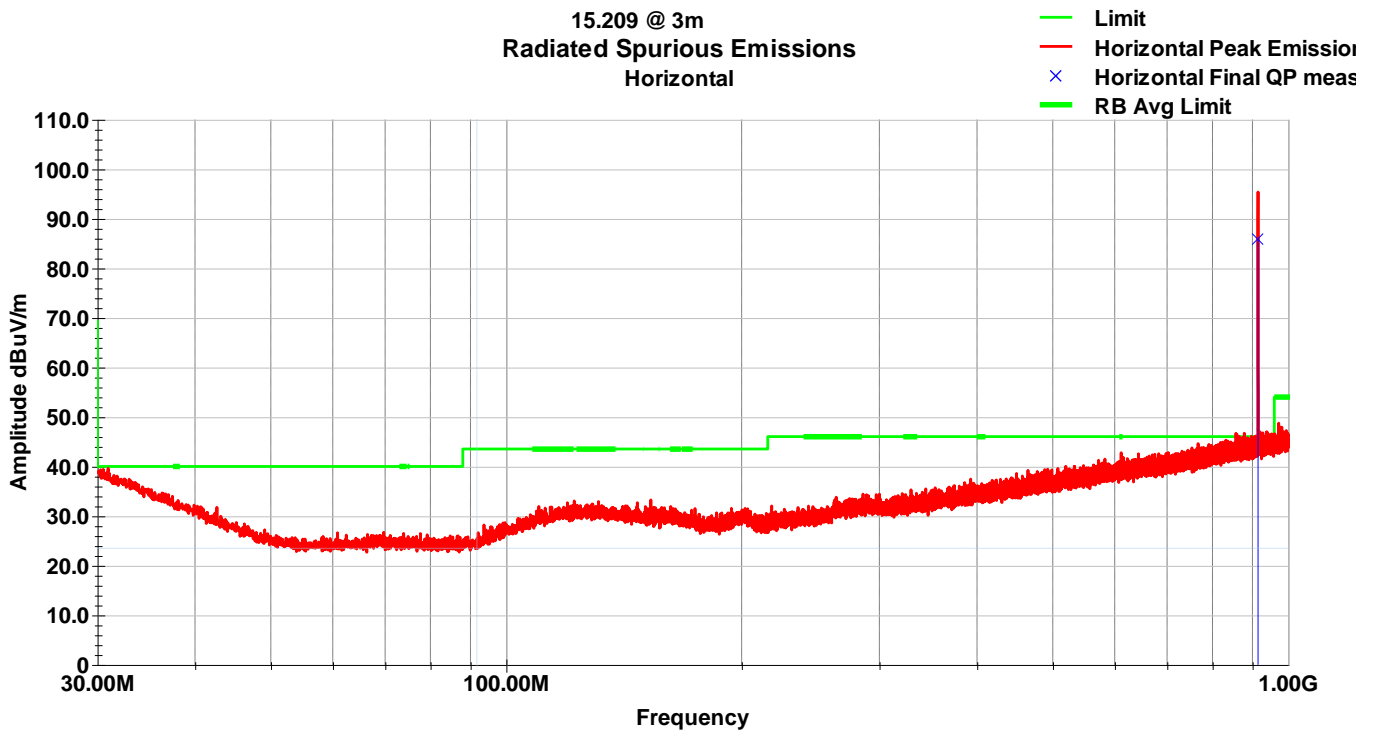
Horizontal Radiated Spurious Emissions – 1-10GHz (19.2kbps LCH)



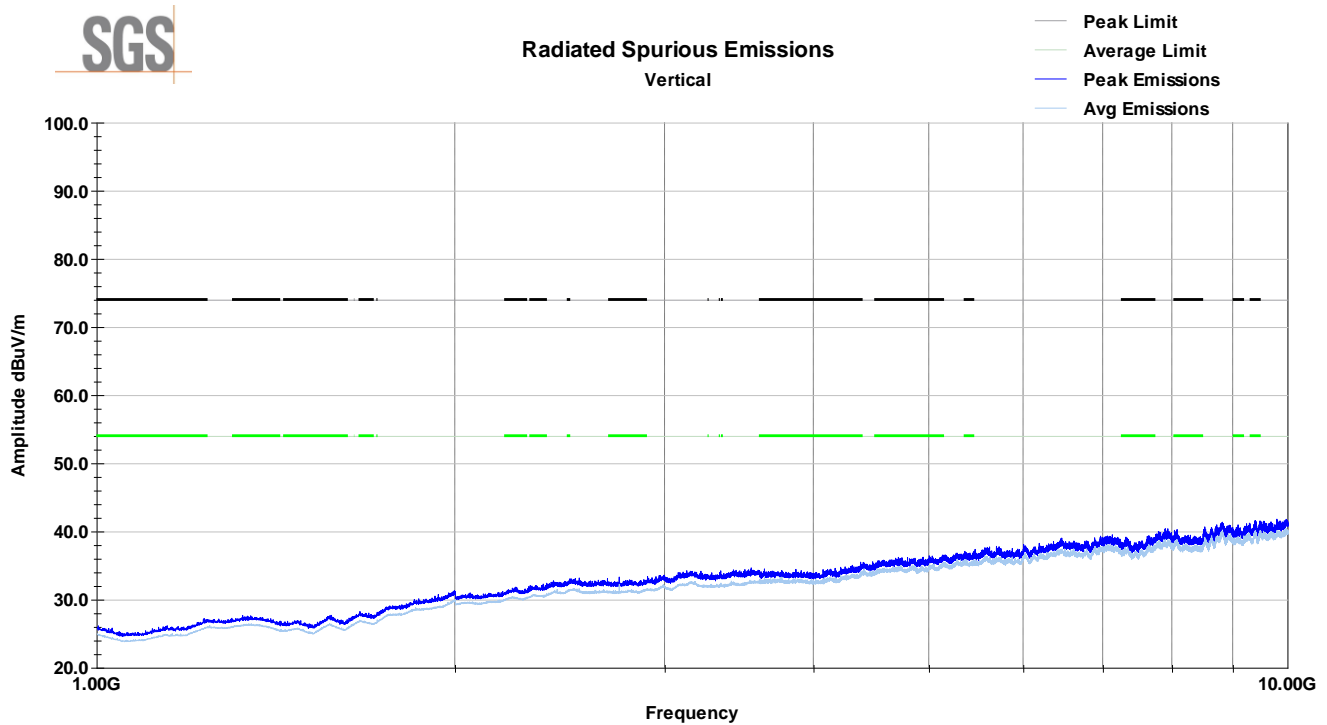
Vertical Radiated Spurious Emissions – 30-1000MHz (19.2kbps MCH)



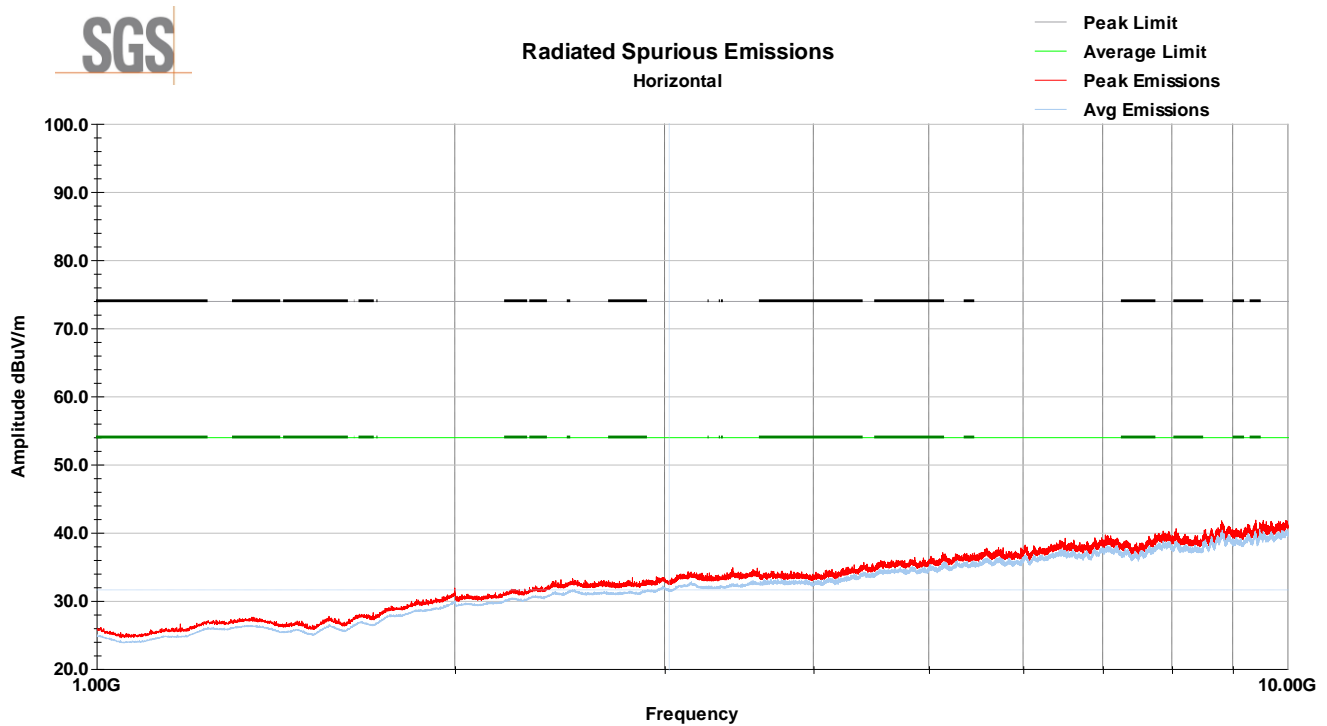
Horizontal Radiated Spurious Emissions – 30-1000MHz (19.2kbps MCH)



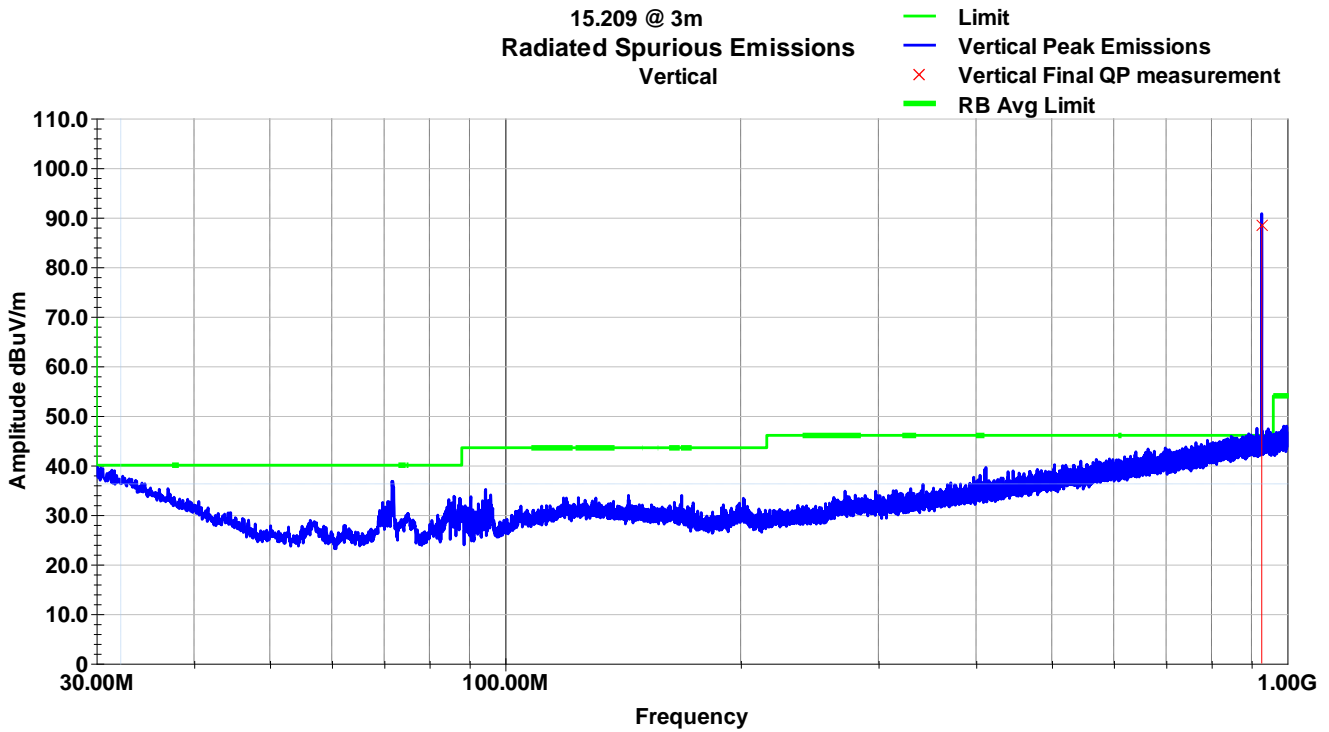
Vertical Radiated Spurious Emissions – 1-10GHz (19.2kbps MCH)



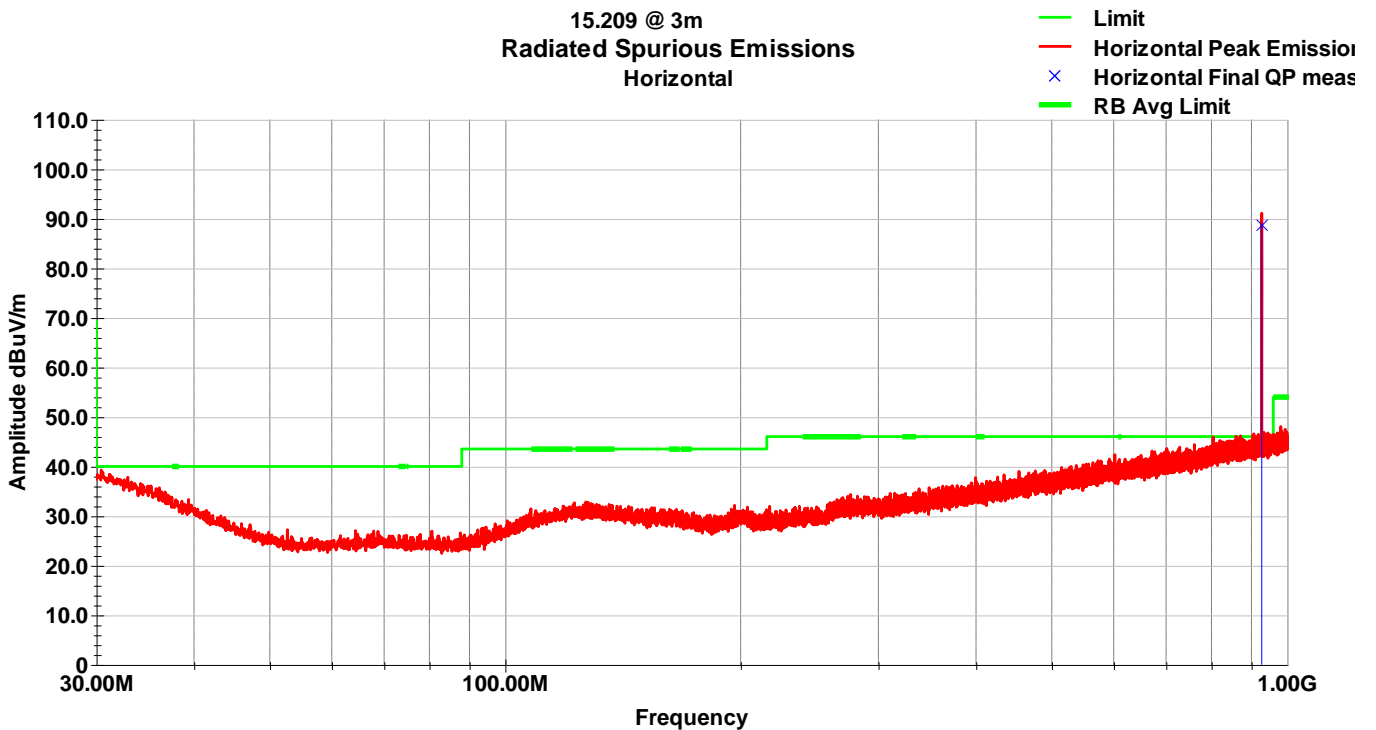
Horizontal Radiated Spurious Emissions – 1-10GHz (19.2kbps MCH)



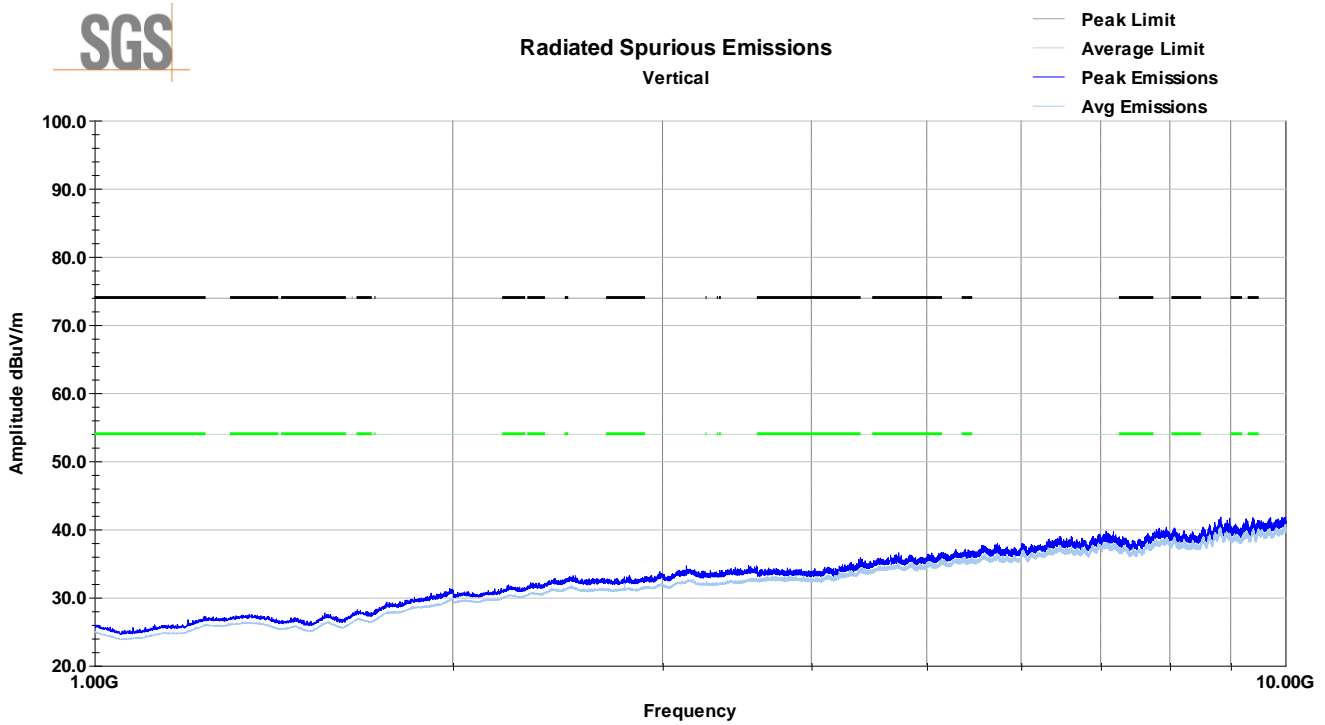
Vertical Radiated Spurious Emissions – 30-1000MHz (19.2kbps HCH)



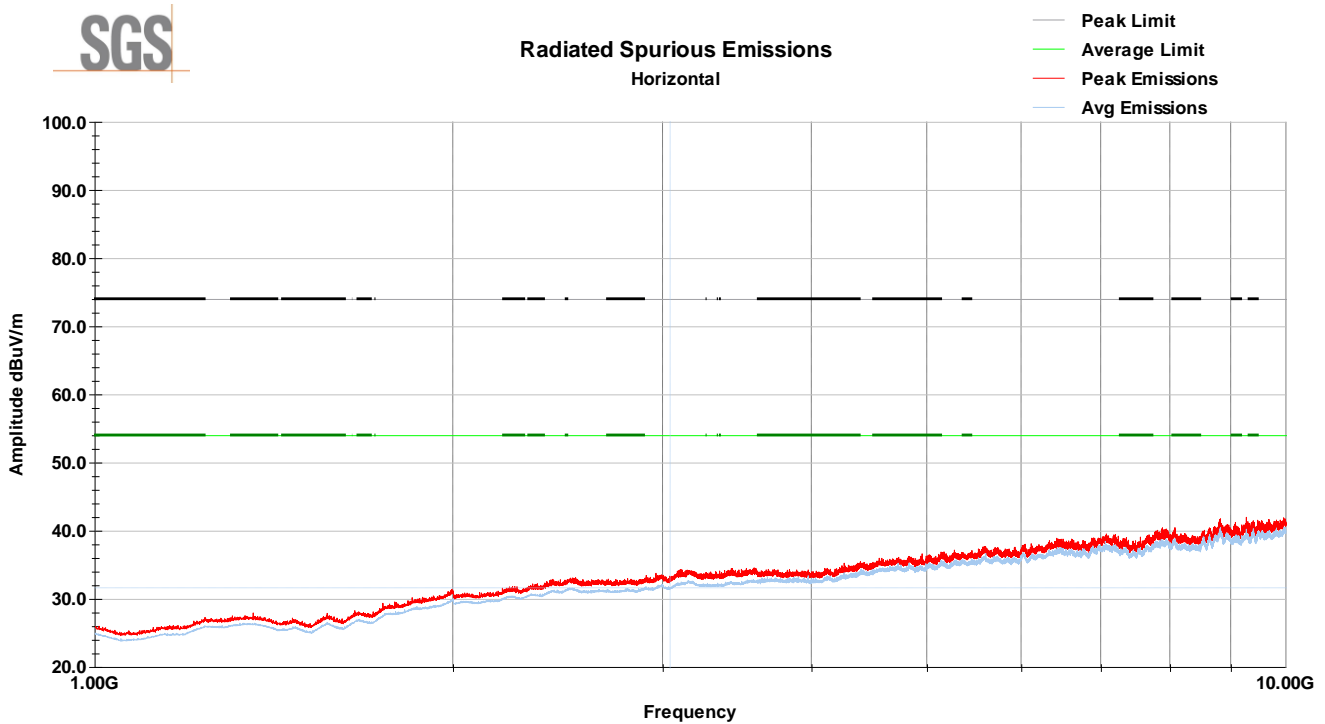
Horizontal Radiated Spurious Emissions – 30-1000MHz (19.2kbps HCH)



Vertical Radiated Spurious Emissions – 1-10GHz (19.2kbps HCH)



Horizontal Radiated Spurious Emissions – 1-10GHz (19.2kbps HCH)



5.6 *Test Data – Tabular Data*

Tabular Test Results

Worst-case emission identified on Page 13. There were no other spurious emissions detected above the noise floor

6 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 %

7 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	18 November 2021
1	- Added clarification in data table in Section 5.6 regarding spurious emissions	07 March 2022