

EMC Test Report

Project Number: 3543741

Report Number: 3543741EMC02 **Revision Level:** 1

Client: Radio Systems Corporation

Equipment Under Test: SportDog Tek 2.0 GPS Unit

FCC ID: KE3-3002862

IC: 2721A-3002862

Applicable Standards: ANSI C63.10: 2013


FCC Part 15 Subpart C, § 15.247

RSS-247, Issue 2, February 2017

Report issued on: 30 March 2020

Test Result: Compliant

Tested by:


Shawn McGuinness, EMC Engineering Leader

Reviewed by:


David Schramm, Operations 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.

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1 Summary of Test Results

Test Description	Test Specification		Test Result
Occupied Bandwidth	15.247(a)(1)	RSS-247 5.2c	Compliant
Transmitter Output Power	15.247(a)(1)	RSS-247 5.4a	Compliant
Conducted Spurious Emissions in 100 kHz bandwidth	15.247(d)	RSS-247 5.5	Compliant
Band Edge	15.247(d)	RSS-GEN 8.9	Compliant
Radiated Spurious Emissions	15.247(d), 15.35(b),15.209, 15.205	RSS-GEN 8.9 RSS-GEN 8.10	Compliant
Pseudo-Random Hop Sequence	15.247(a) (1)	RSS-247 5.2a	Compliant
Channel Separation	15.247(a) (1)	RSS-247 5.2c	Compliant
Number of Hopping Channels	15.247(a) (1)(i)	RSS-247 5.2c	Compliant
Dwell Time	15.247(a) (1)(i)	RSS-247 5.2c	Compliant
Number of hopping frequencies	15.247(a) (1)(i)	RSS-247 5.2c	Compliant
Field strength of receiver spurious radiation	NA	RSS-GEN 7.3	Compliant

1.1 Modifications Required for Compliance

None

2 General Information

2.1 Client Information

Name: Radio Systems Corporation
Address: 10427 Petsafe Way
City, State, Zip, Country: Knoxville TN 37932

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

2.3 General Information of EUT

Marketing Name: Sport DogTek 2.0 GPS Collar
Model: SDT52-14790
Serial Number: GNAR-50105
Frequency Range: 915.0125 – 916.2375MHz
Number of channels: 50
Modulation type: GFSK
Antenna: 1 dBi whip antenna, non-detachable

Rated Voltage: 3.7 VDC Internal Battery

Sample Received Date: 30 July 2014

12 February 2020

Dates of testing: 25 – 27 August 2014

24 February to 17 March 2020

2.4 Operating Modes and Conditions

The EUT was configured in software to allow the EUT to run continuously exercising all modes of operation.

- Exercising was performed with test mode software designed to allow the EUT to operate
 - at normal operating duty cycle
 - hopping enabled
 - hopping stopped and transmitting on low and high channels
 - modulation enabled

3 Occupied Bandwidth

3.1 Test Result

Test Description	Basic Standards	Test Result
Occupied Bandwidth	15.247(a)(1) RSS-247 5.2c	Compliant

3.2 Test Method

Measurements were taken using the 99% OBW function of the measurement receiver.

3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.4 °C

Relative Humidity: 47.8 %

3.4 Test Equipment

Test Date: 25-Aug-2014

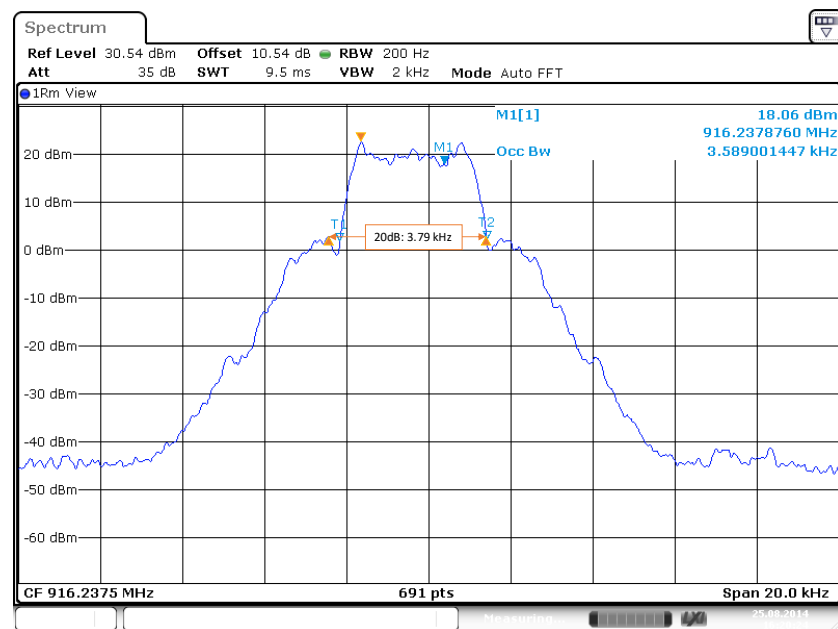
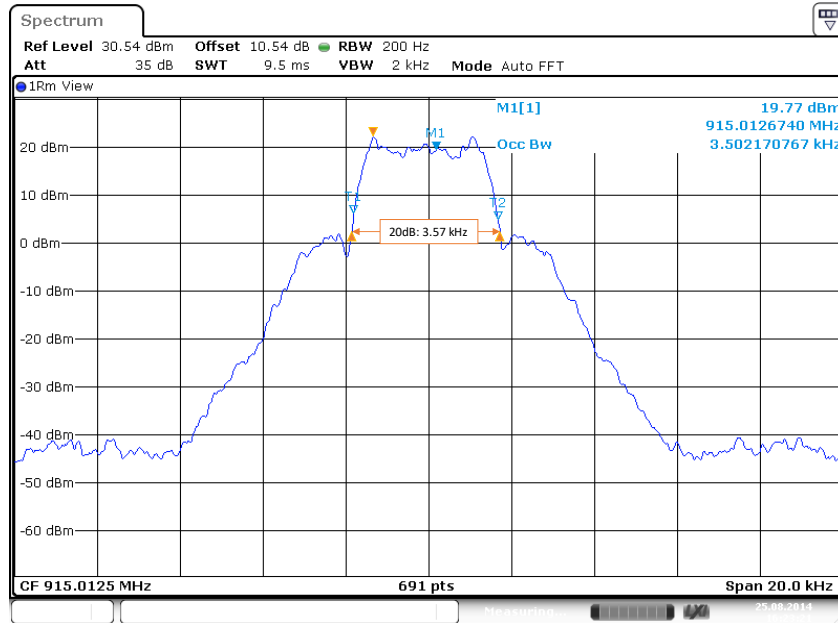
Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	28-Aug-2015
COAXIAL CABLE	1134	GORE	B094785	5-Aug-2015
10DB ATTENUATOR	10DB	UNKNOWN	B095593	7-Aug-2015

Note: The calibration period equipment is 1 year.

3.5 Test Data

Unit	Frequency	Channel No	99% bandwidth kHz	20 dB bandwidth kHz
GNAR-50105	915.0125	0	3.50	3.57
GNAR-50105	916.2375	49	3.59	3.79



4 Transmitter Output Power

4.1 Test Result

Test Description	Test Specification	Test Result
Peak Output Power	15.247(a1) RSS-247 5.4a	Compliant

4.2 Test Method

The measurement procedure used is defined in ANSI C63.10, Section 7.8.5. The output of the EUT was directly connected to a spectrum analyzer with the following settings:

- a) Use the following spectrum analyzer settings:
 - 1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
 - 2) RBW > 20 dB bandwidth of the emission being measured.
 - 3) VBW ≥ RBW.
 - 4) Sweep: Auto.
 - 5) Detector function: Peak.
 - 6) Trace: Max hold.
- b) Allow trace to stabilize.
- c) Use the marker-to-peak function to set the marker to the peak of the emission.
- d) The indicated level is the peak output power, after any corrections for external attenuators and cables.

Limit

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels.

4.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.0 °C
Relative Humidity: 49.7 %

4.4 Test Equipment

Test Date: 25-Aug-2014

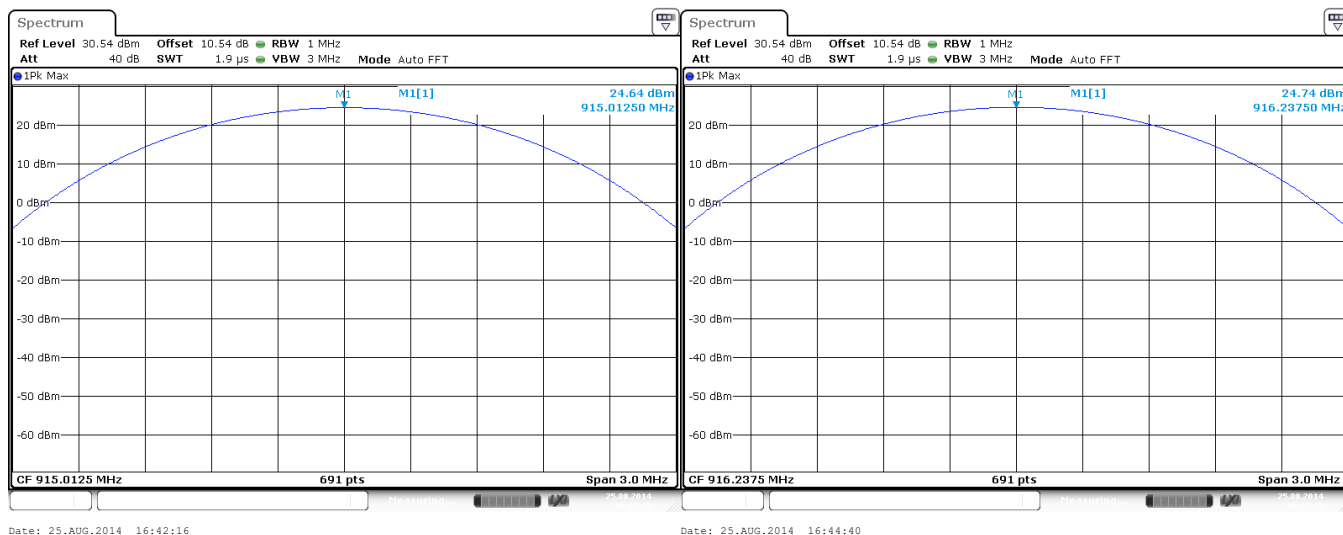
Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	28-Aug-2015
COAXIAL CABLE	1134	GORE	B094785	5-Aug-2015
10DB ATTENUATOR	10DB	UNKNOWN	B095593	7-Aug-2015

Note: The calibration period equipment is 1 year.

4.5 Test Data

Unit	Channel No	Peak Power (dBm)	Limit (dBm)	Margin (dB)
GNAR-50105	0	24.64	30	-5.36
GNAR-50105	49	24.74	30	-5.26



5 Conducted Spurious Emissions

5.1 Test Result

Test Description	Test Specification	Test Result
Conducted Spurious Emissions	15.247(d) RSS-247 5.5	Compliant

5.2 Test Method

Test method: ANSI C63.10 Section 7.8.8.

The test data was measured using a spectrum analyzer with

- Peak detector, max hold
- Resolution bandwidth of at least 100 kHz
- Video bandwidth at least 3x RBW
- Frequency range: 30 MHz to 10 times the operating frequency

The limit is 20 dB below the measured peak power.

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.4 °C
Relative Humidity: 57.0 %

5.4 Test Equipment

Test Date: 26-Aug-2014

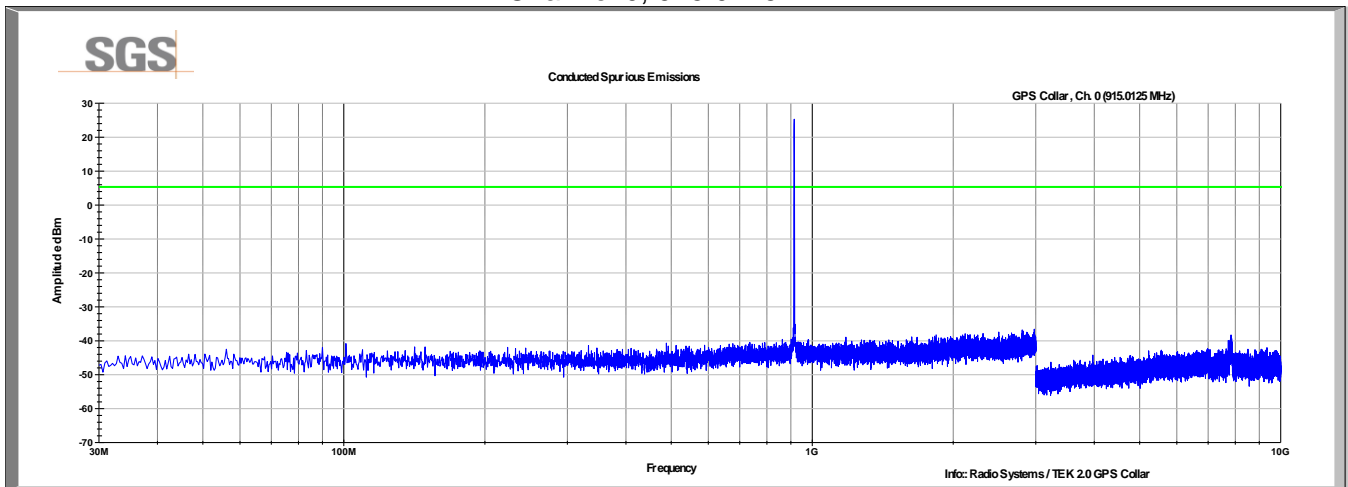
Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	28-Aug-2015
COAXIAL CABLE	1134	GORE	B094785	5-Aug-2015
10DB ATTENUATOR	10DB	UNKNOWN	B095593	7-Aug-2015

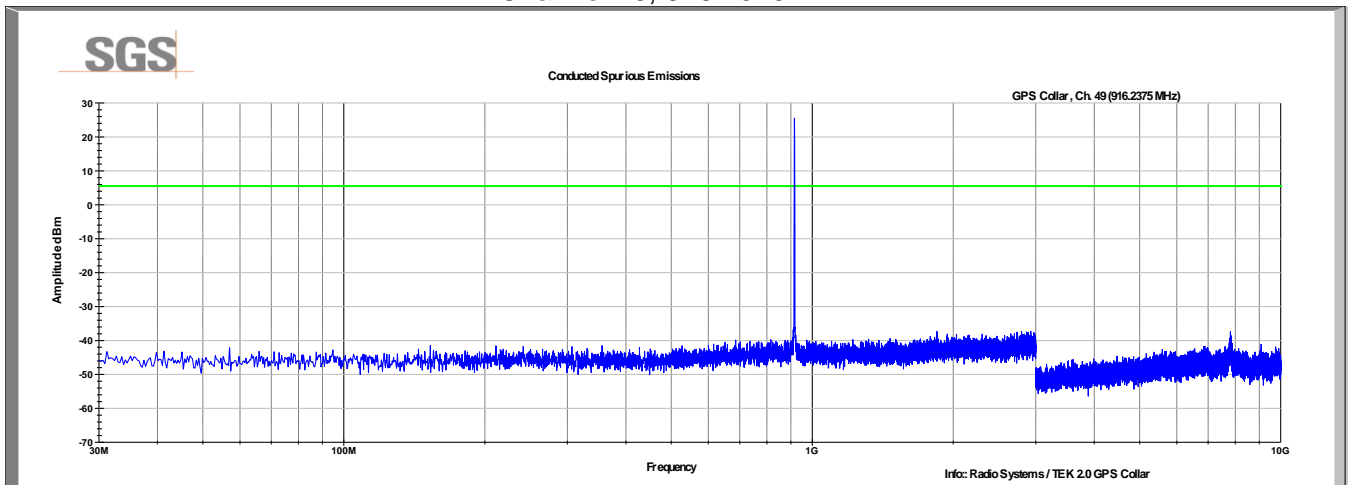
Note: The calibration period equipment is 1 year.

5.5 Test Data

Channel 0, 915.0125 MHz

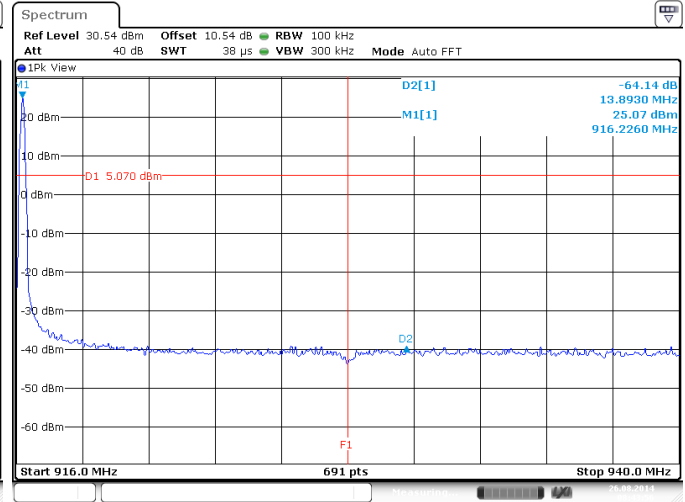
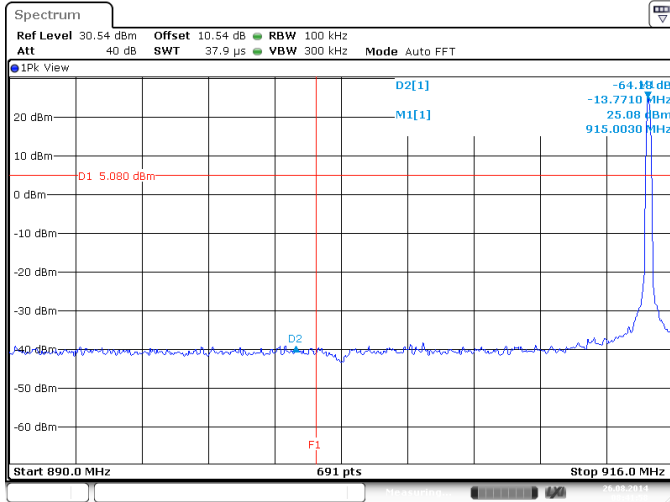


Channel 49, 916.2375 MHz



No spurious emissions detected within 20dB of the limit.

Lower band edge / Upper band edge



6 Field Strength of Spurious Radiation below 1 GHz

6.1 Test Result

Test Description	Test Specification	Test Result
Field strength of spurious radiation	15.247(d), 15.35(b), 15.209, 15.205 RSS-247 5.5, RSS-GEN 8.9, 8.10	Compliant

6.2 Test Method

Exploratory scans were performed over the frequency range as indicated in the tables below using the max hold function and incorporating a Peak detector and using TILE! software. The final test data was measured using a Quasi-Peak detector below 1GHz. The receiver's resolution bandwidth was set to 120 kHz for measurements taken in the 30MHz to 1GHz frequency range. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency. The radiated measurements were recorded and compared to the limits indicated in the table below.

Test distance:

30 MHz to 1 GHz - The EUT to measurement antenna distance is 3 meters

1 to 18 GHz - The EUT to measurement antenna distance is 3 meters

18 to 40 GHz - The EUT to measurement antenna distance is 1 meter

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

6.3 Test Site

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

Environmental Conditions

Temperature: 24.4 °C
Relative Humidity: 43.5 %

6.4 Test Equipment

Test Date: 26-Aug-2014

Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015
BILOG ANTENNA	CBL 6143A	TESEQ	B085931	29-Oct-2014
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079691	24-Jun-2015
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	13-Feb-2015
RF CABLE - 12000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079714	4-Aug-2015
17 FT N TYPE COAX CABLE	HS 84133232	HUBER&SUHNER	B079661	4-Aug-2015
HIGH PASS FILTER	HPM50108	MICRO-TRONICS	B079802	16-Oct-2014

Note: The calibration period equipment is 1 year.

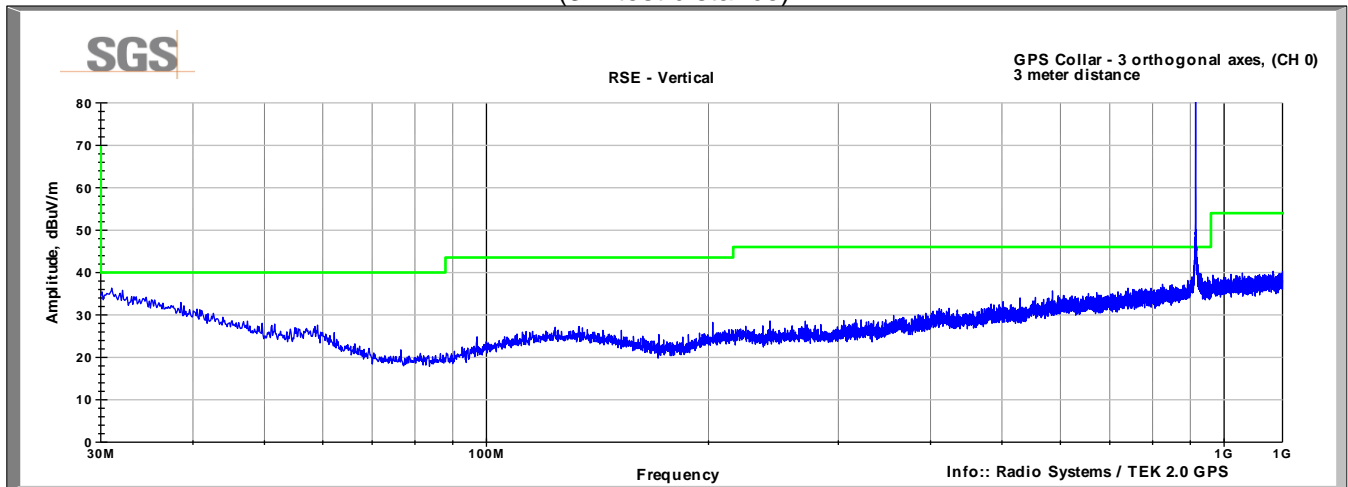
6.5 Test Setup Photographs

Test setup photographs are located in a separate exhibit.

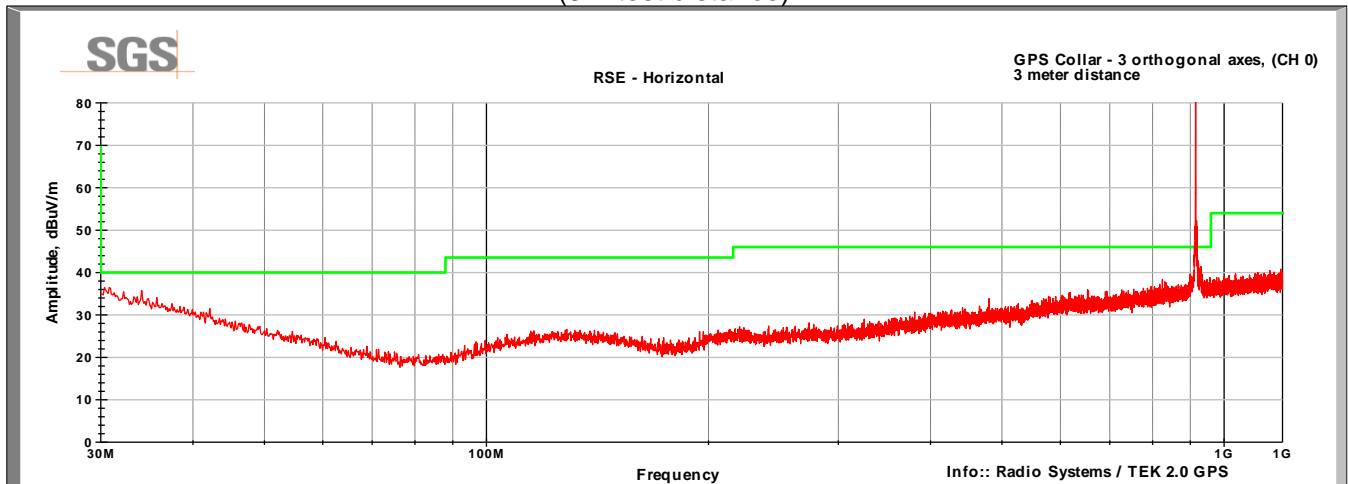
6.6 Test Data

There were no emissions detected from 9kHz to 30 MHz.

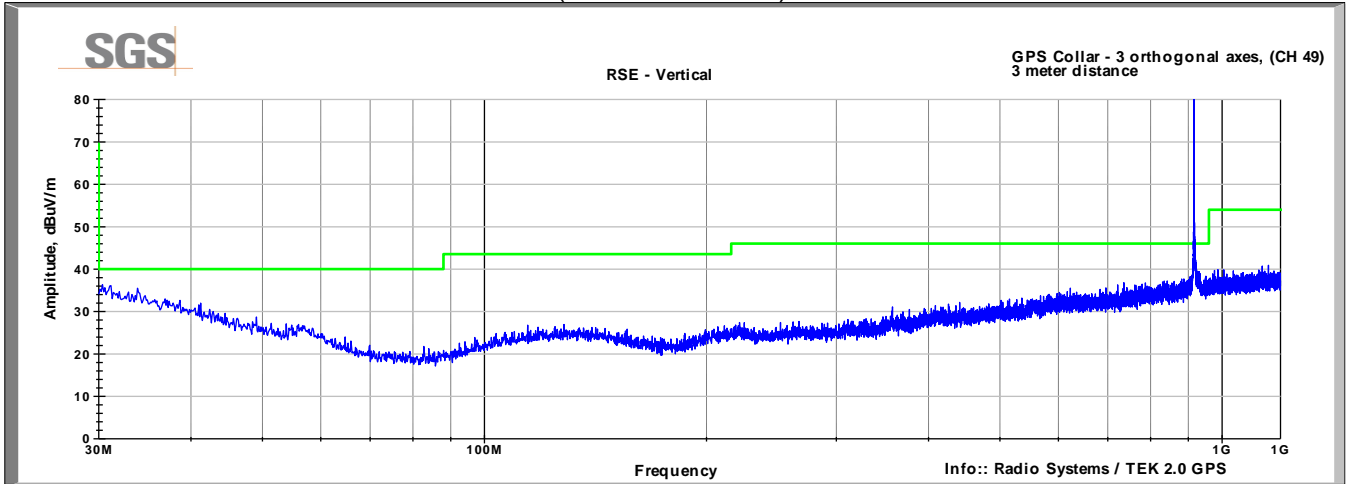
Channel 0
30-1000MHz
Vertical
(3m test distance)



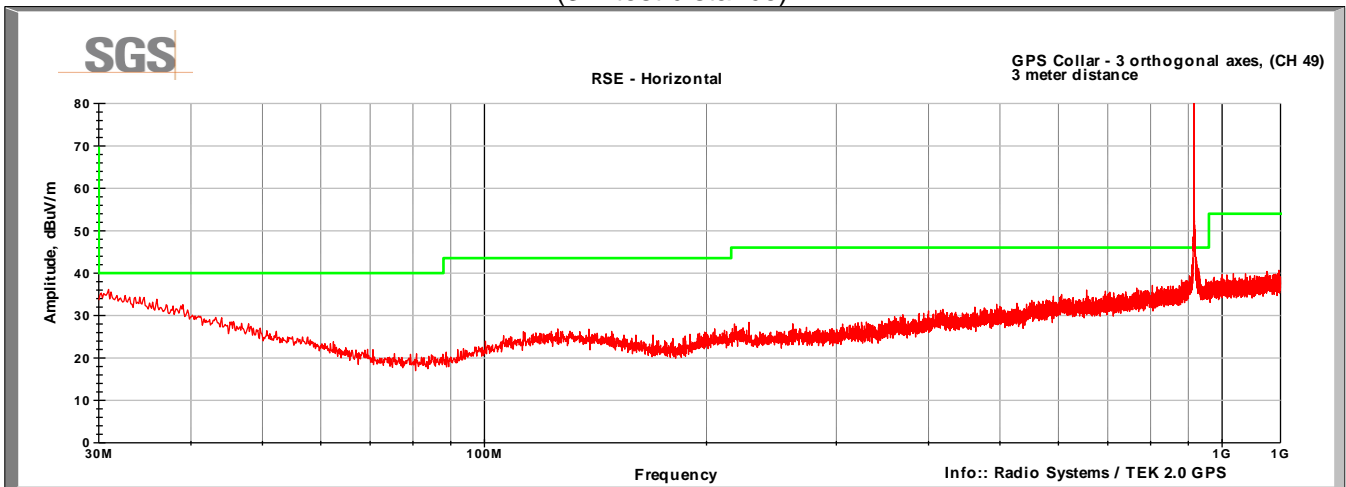
Channel 0
30-1000MHz
Horizontal
(3m test distance)



Channel 49
30-1000MHz
Vertical
(3m test distance)



Channel 49
30-1000MHz
Horizontal
(3m test distance)



7 Field Strength of Spurious Radiation above 1 GHz

7.1 Test Result

Test Description	Test Specification	Test Result
Field strength of spurious radiation	15.247(d), 15.35(b), 15.209, 15.205 RSS-247 5.5, RSS-GEN 8.9, 8.10	Compliant

7.2 Test Method

Exploratory scans were performed over the frequency range as indicated in the tables below using the max hold function and incorporating a Peak detector and using TILE! software. The final test data was measured using a Peak detector above 1GHz. For harmonics of the fundamental, Average measurements were made RMS detector. For emissions other than harmonics of the fundamental, the Average measurements were made using the Average detector. The receiver's resolution bandwidth was set to 1MHz for measurements for 1GHz and higher. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency. The radiated measurements were recorded and compared to the limits indicated in the table below.

Test distance:

30 MHz to 1 GHz - The EUT to measurement antenna distance is 3 meters

1 to 18 GHz - The EUT to measurement antenna distance is 3 meters

18 to 40 GHz - The EUT to measurement antenna distance is 1 meter

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

(4) These limits are applicable to emissions outside of the intentional transmit frequency band.

(5) Quasi-peak limit

(6) Average limit

7.3 Test Site

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

Environmental Conditions

Temperature: 22.1 °C
Relative Humidity: 45.5 %

7.4 Test Equipment

Test End Date: 17-Mar-2020

Tester: ZH

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS Lindgren	B079691	10-Aug-2020
RF CABLE	SF106	HUBER & SUHNER	B079712	5-Sep-2020
RF CABLE	SUCOFLEX 100	Huber & Suhner	B108523	5-Sep-2020
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	6-Mar-2021
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	1-Aug-2020

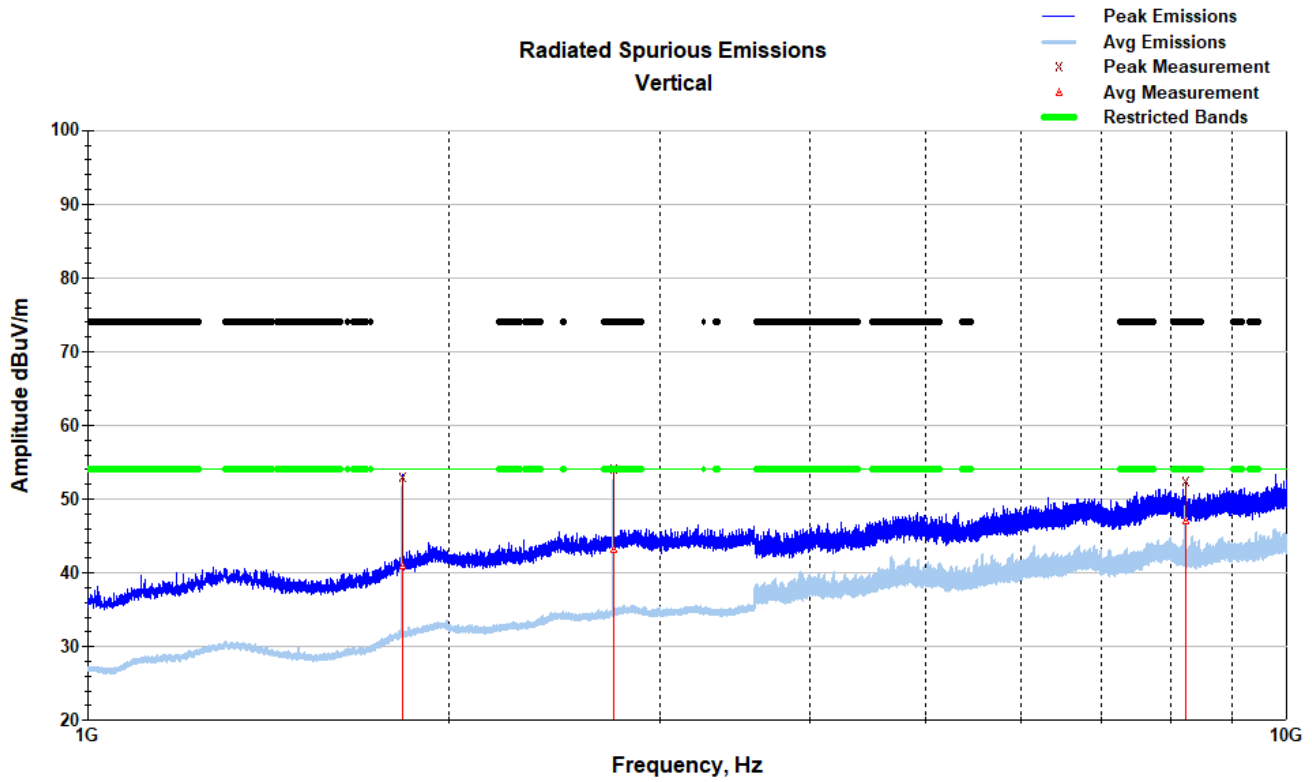
Note: The calibration period equipment is 1 year.

7.5 Test Setup Photographs

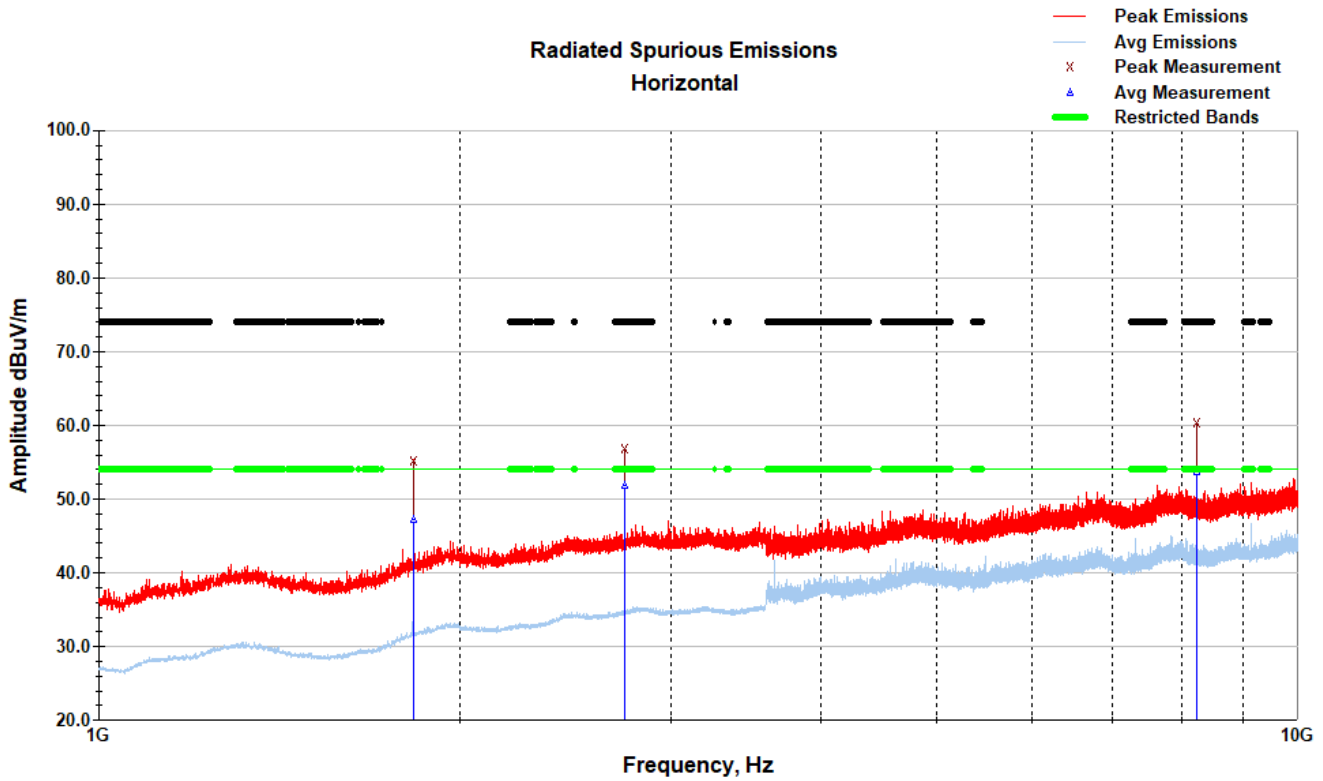
Test setup photographs are located in a separate exhibit.

7.6 Test Data

7.6.1 Channel 0, 915.0125 MHz, x-Axis

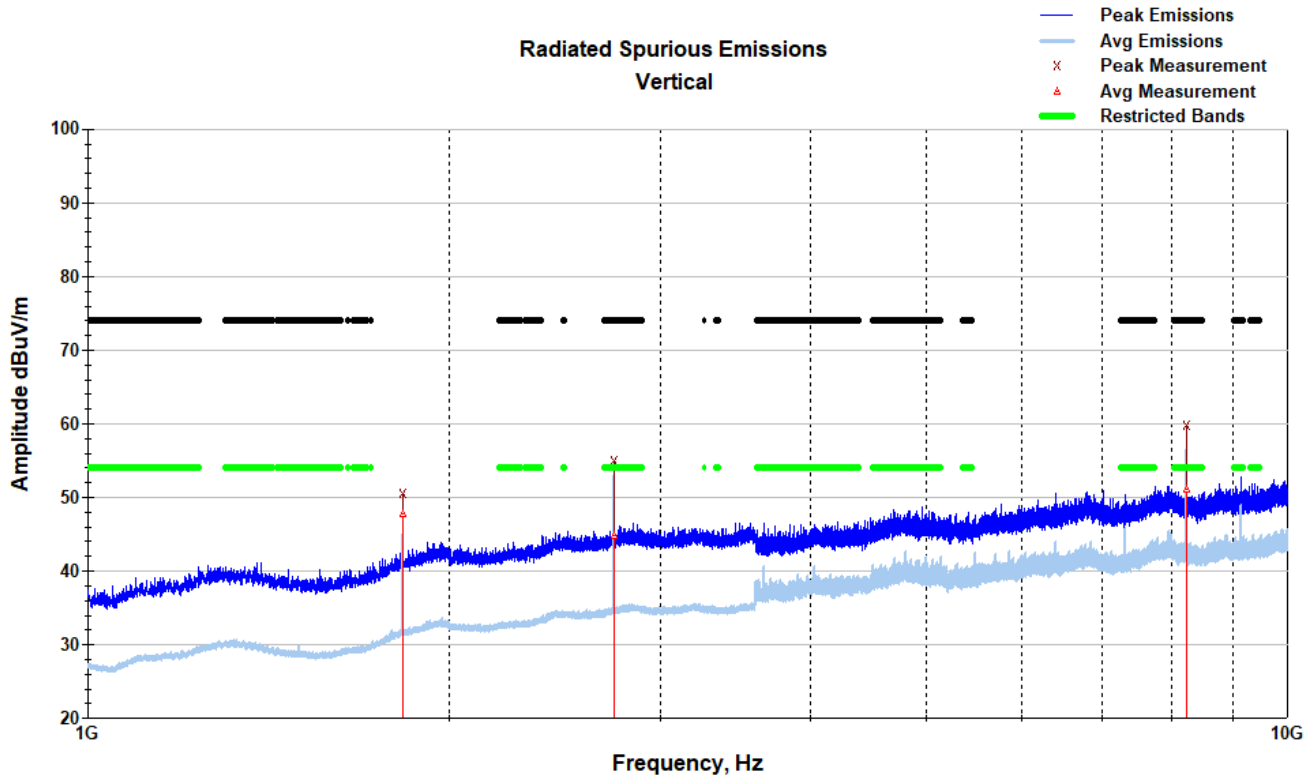


CH	Fund Freq, MHz	Frequency MHz	Level dBuV	Detector	Axis	Polarity (V/H)	Azimuth (deg)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0	915.0125	2745.03	53.7	Peak	X	V	28.4	165.0	32.5	2.7	34.9	54.0	74.0	-20.0
0	915.0125	2745.03	42.9	Avg	X	V	28.4	165.0	32.5	2.7	34.9	43.2	54.0	-10.8
0	915.0125	8235.10	47.1	Peak	X	V	333.3	232.8	35.8	4.8	35.4	52.4	74.0	-21.6
0	915.0125	8235.10	41.7	Avg	X	V	333.3	232.8	35.8	4.8	35.4	47.0	54.0	-7.0

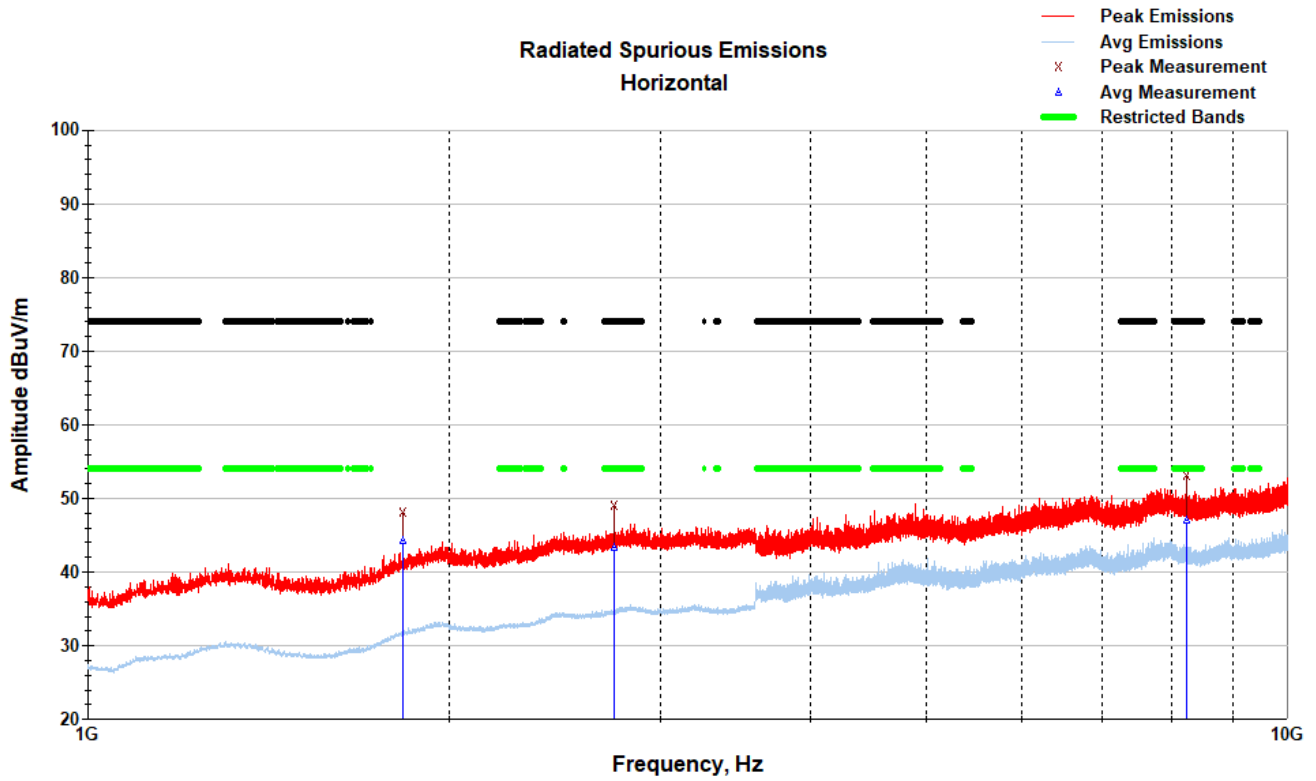


CH	Fund Freq, MHz	Frequency MHz	Level dBuV	Detector	Axis	Polarity (V/H)	Azimuth (deg)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0	915.0125	2745.03	51.5	Avg	X	H	347.8	130.1	32.5	2.7	34.9	51.8	54.0	-2.2
0	915.0125	8235.10	48.4	Avg	X	H	7.6	110.4	35.8	4.8	35.4	53.7	54.0	-0.3
0	915.0125	2745.03	56.5	Peak	X	H	347.8	130.1	32.5	2.7	34.9	56.8	74.0	-17.2
0	915.0125	8235.10	55.1	Peak	X	H	7.6	110.4	35.8	4.8	35.4	60.4	74.0	-13.6

7.6.2 Channel 0, 915.0125 MHz, y-Axis

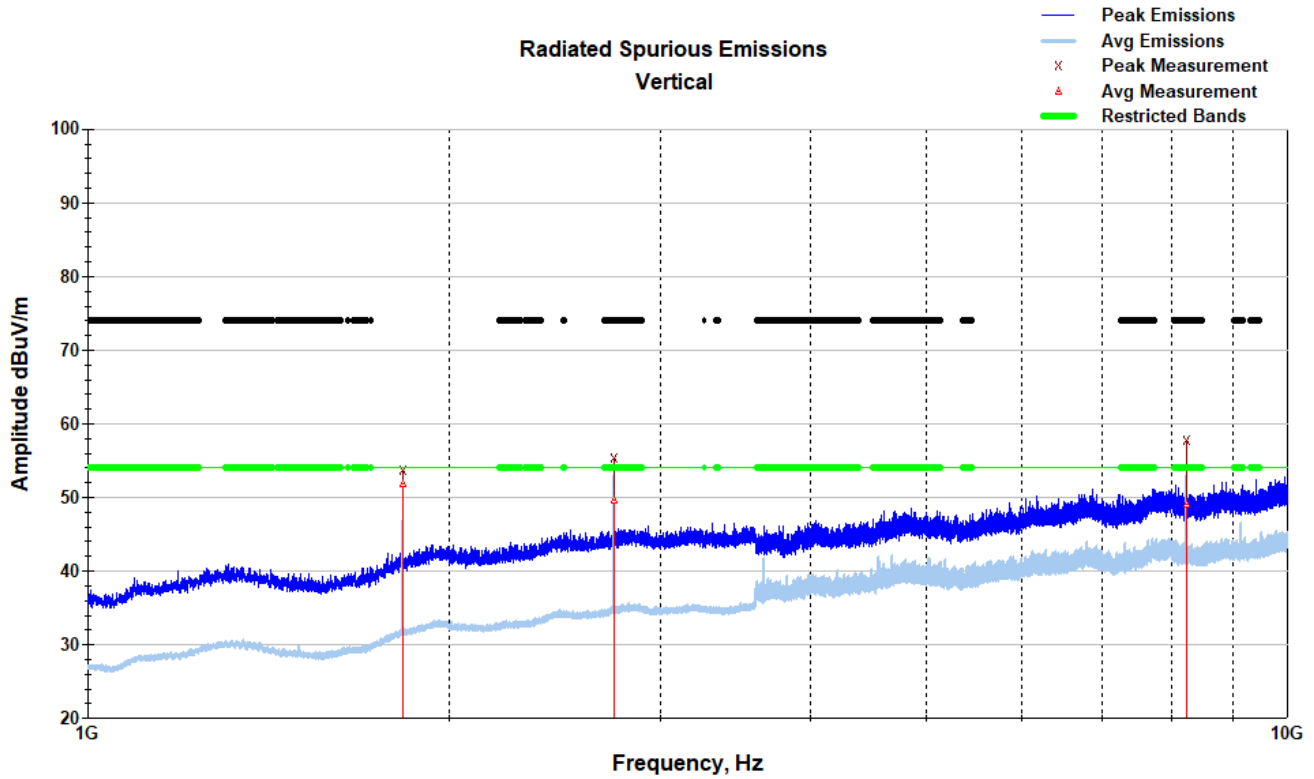


CH	Fund Freq, MHz	Frequency MHz	Level dBuV	Detector	Axis	Polarity (V/H)	Azimuth (deg)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0	915.0125	2745.03	44.5	Avg	Y	V	276.3	236.4	32.5	2.7	34.9	44.8	54.0	-9.2
0	915.0125	8235.10	45.8	Avg	Y	V	121.3	186.9	35.8	4.8	35.4	51.1	54.0	-2.9
0	915.0125	2745.03	54.6	Peak	Y	V	276.3	236.4	32.5	2.7	34.9	54.9	74.0	-19.1
0	915.0125	8235.10	54.5	Peak	Y	V	121.3	186.9	35.8	4.8	35.4	59.8	74.0	-14.2

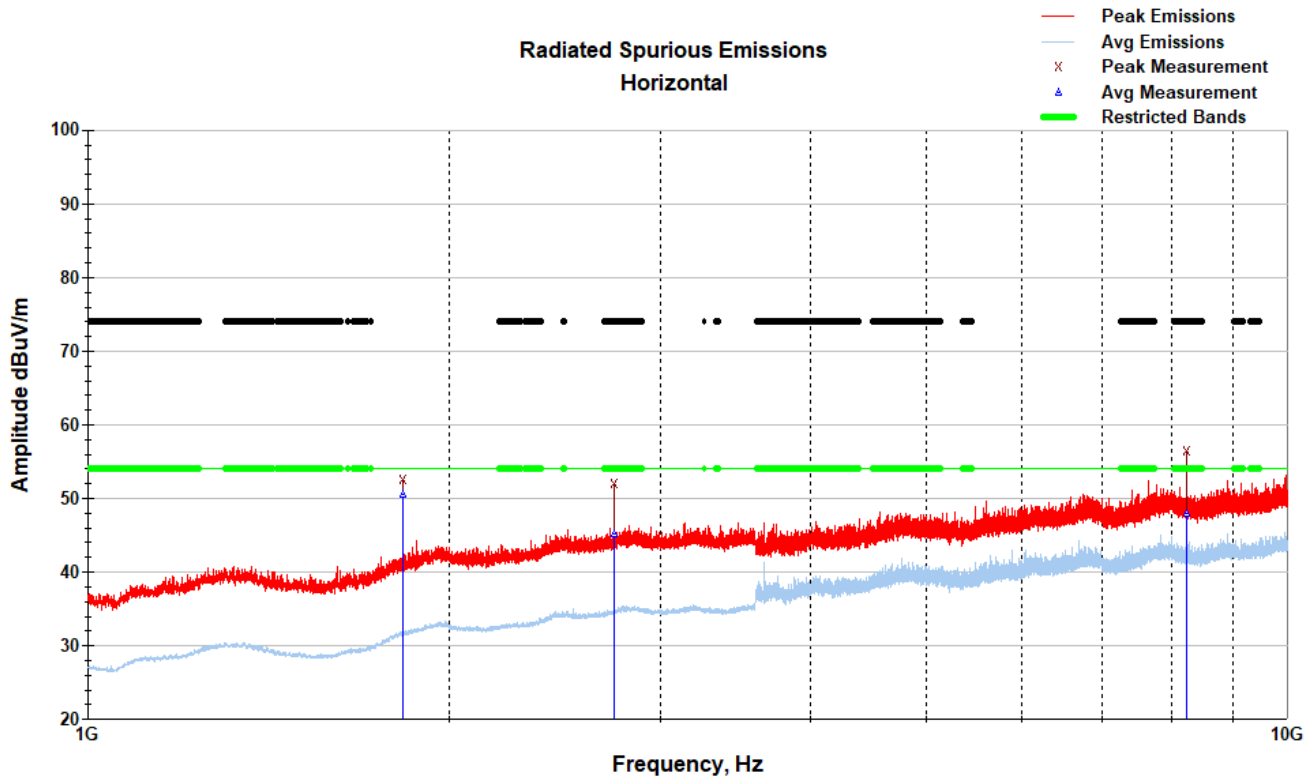


CH	Fund Freq, MHz	Frequency MHz	Level dBuV	Detector	Axis	Polarity (V/H)	Azimuth (deg)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0	915.0125	2745.03	43.1	Avg	Y	H	181.2	186.3	32.5	2.7	34.9	43.4	54.0	-10.6
0	915.0125	8235.10	41.7	Avg	Y	H	196.2	194.8	35.8	4.8	35.4	47.0	54.0	-7.0
0	915.0125	2745.03	48.8	Peak	Y	H	181.2	186.3	32.5	2.7	34.9	49.1	74.0	-24.9
0	915.0125	8235.10	47.9	Peak	Y	H	196.2	194.8	35.8	4.8	35.4	53.2	74.0	-20.8

7.6.3 Channel 0, 915.0125 MHz, z-Axis

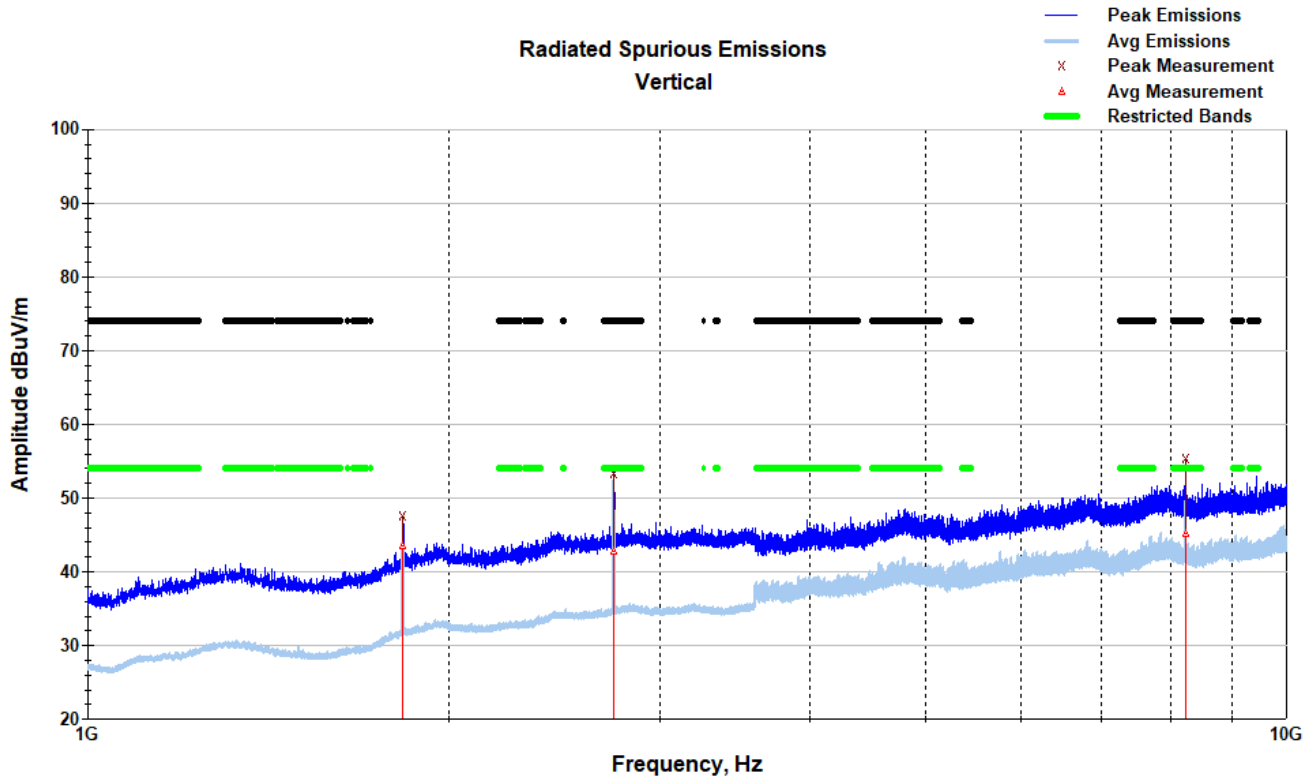


CH	Fund Freq, MHz	Frequency MHz	Level dBuV	Detector	Axis	Polarity (V/H)	Azimuth (deg)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0	915.0125	8235.10	44.3	Avg	Z	V	123.2	162.1	35.8	4.8	35.4	49.6	54.0	-4.4
0	915.0125	8235.10	43.8	Avg	Z	V	313.7	204.8	35.8	4.8	35.4	49.1	54.0	-4.9
0	915.0125	8235.10	50.0	Peak	Z	V	123.2	162.1	35.8	4.8	35.4	55.3	74.0	-18.7
0	915.0125	8235.10	52.4	Peak	Z	V	313.7	204.8	35.8	4.8	35.4	57.7	74.0	-16.3

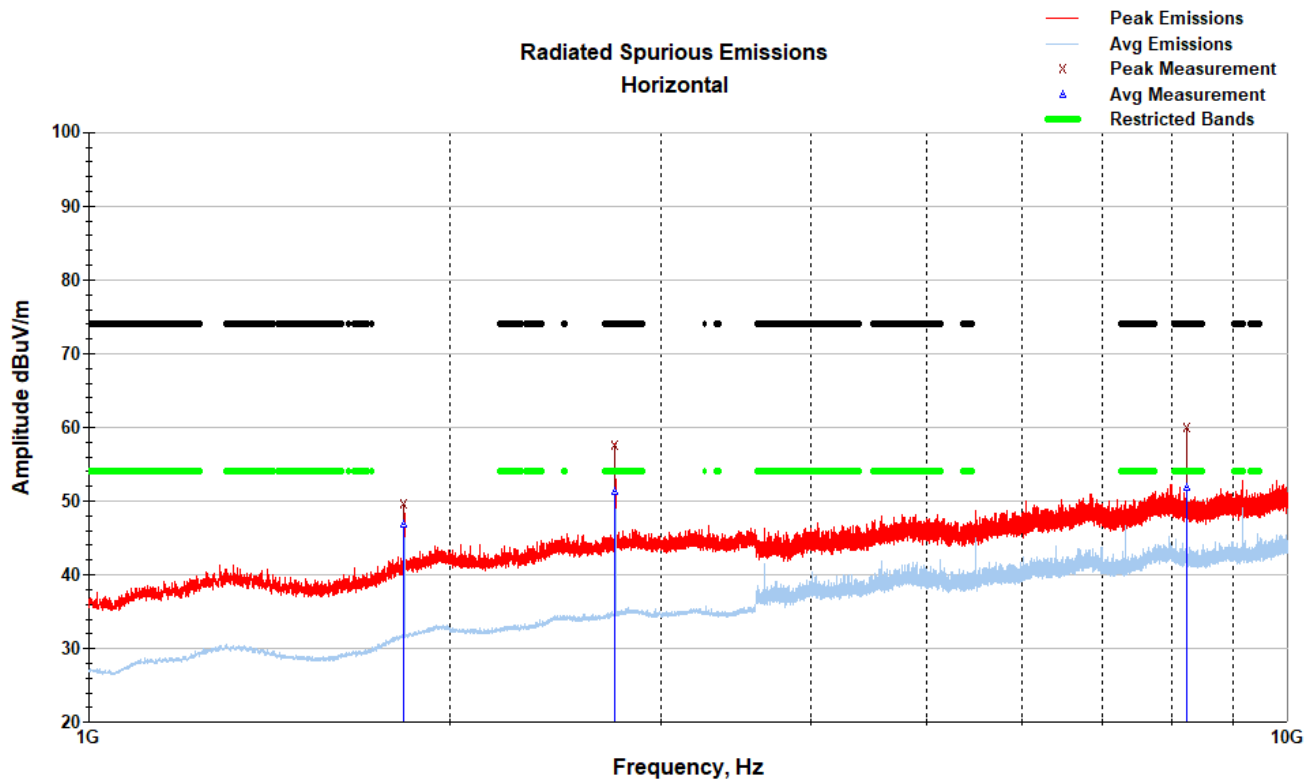


CH	Fund Freq, MHz	Frequency MHz	Level dBuV	Detector	Axis	Polarity (V/H)	Azimuth (deg)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0	915.0125	2745.03	44.8	Avg	Z	H	66.8	163.8	32.5	2.7	34.9	45.1	54.0	-8.9
0	915.0125	2745.03	47.7	Avg	Z	H	289.5	177.7	32.5	2.7	34.9	48.0	54.0	-6.0
0	915.0125	2745.03	51.8	Peak	Z	H	66.8	163.8	32.5	2.7	34.9	52.1	74.0	-21.9
0	915.0125	2745.03	56.2	Peak	Z	H	289.5	177.7	32.5	2.7	34.9	56.5	74.0	-17.5

7.6.4 Channel 49, 916.2375 MHz, x-Axis

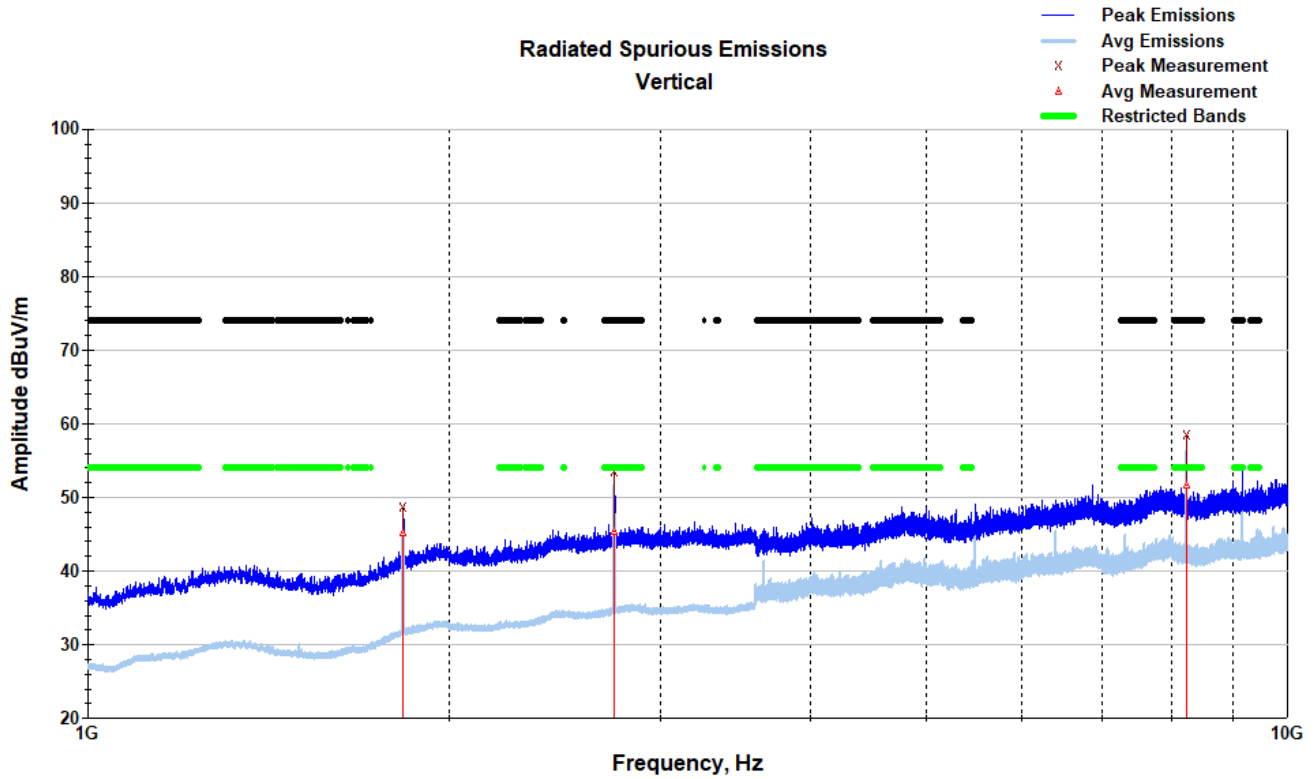


CH	Fund Freq, MHz	Frequency MHz	Level dBuV	Detector	Axis	Polarity (V/H)	Azimuth (deg)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
49	916.2375	2748.71	42.5	Avg	X	V	329.4	173.1	32.5	2.7	34.9	42.8	54.0	-11.2
49	916.2375	8246.17	39.8	Avg	X	V	50.4	188.9	35.8	4.8	35.4	45.1	54.0	-8.9
49	916.2375	2748.71	52.9	Peak	X	V	329.4	173.1	32.5	2.7	34.9	53.2	74.0	-20.8
49	916.2375	8246.17	50.1	Peak	X	V	50.4	188.9	35.8	4.8	35.4	55.4	74.0	-18.6

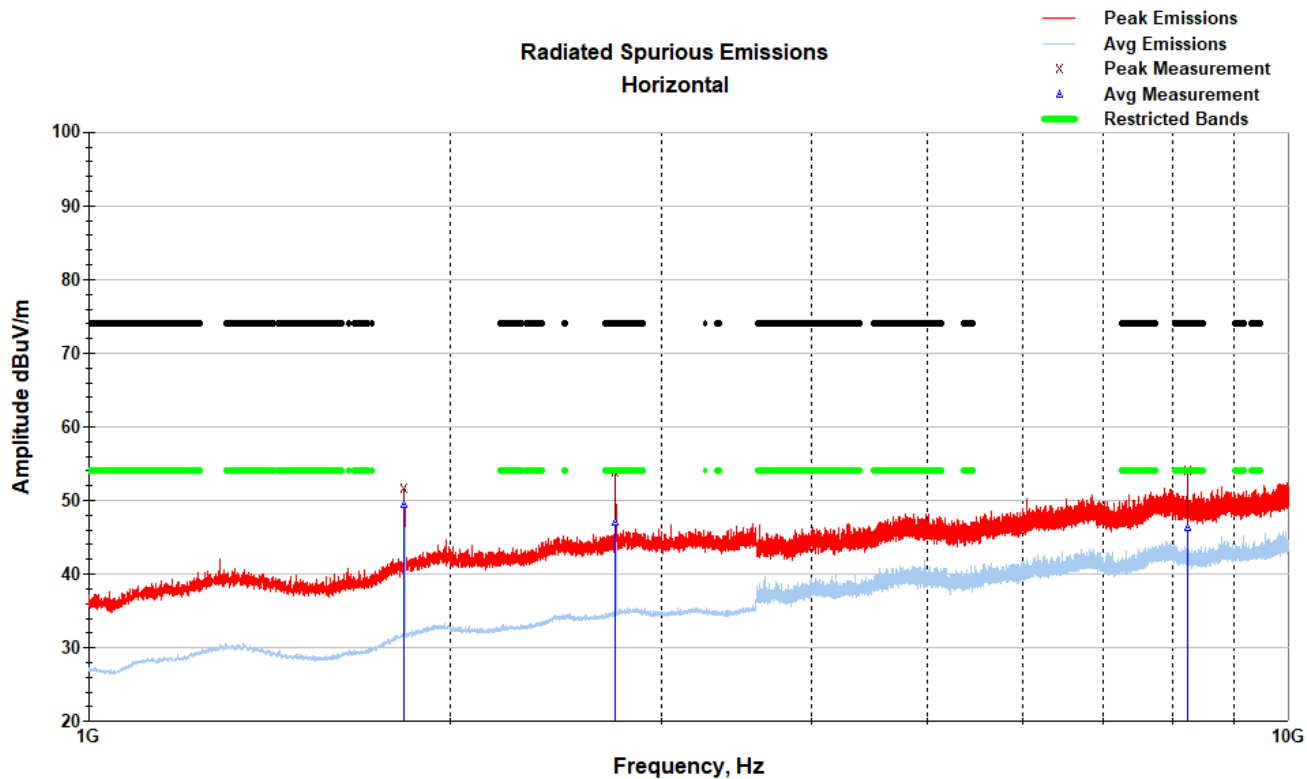


CH	Fund Freq, MHz	Frequency MHz	Level dBuV	Detector	Axis	Polarity (V/H)	Azimuth (deg)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
49	916.2375	2748.71	50.9	Avg	X	H	295.6	155.8	32.5	2.7	34.9	51.2	54.0	-2.8
49	916.2375	8246.17	46.7	Avg	X	H	83.4	175.8	35.8	4.8	35.4	51.9	54.0	-2.0
49	916.2375	2748.71	57.2	Peak	X	H	295.6	155.8	32.5	2.7	34.9	57.5	74.0	-16.5
49	916.2375	8246.17	54.6	Peak	X	H	83.4	175.8	35.8	4.8	35.4	59.9	74.0	-14.1

7.6.5 Channel 49, 916.2375 MHz, y-Axis

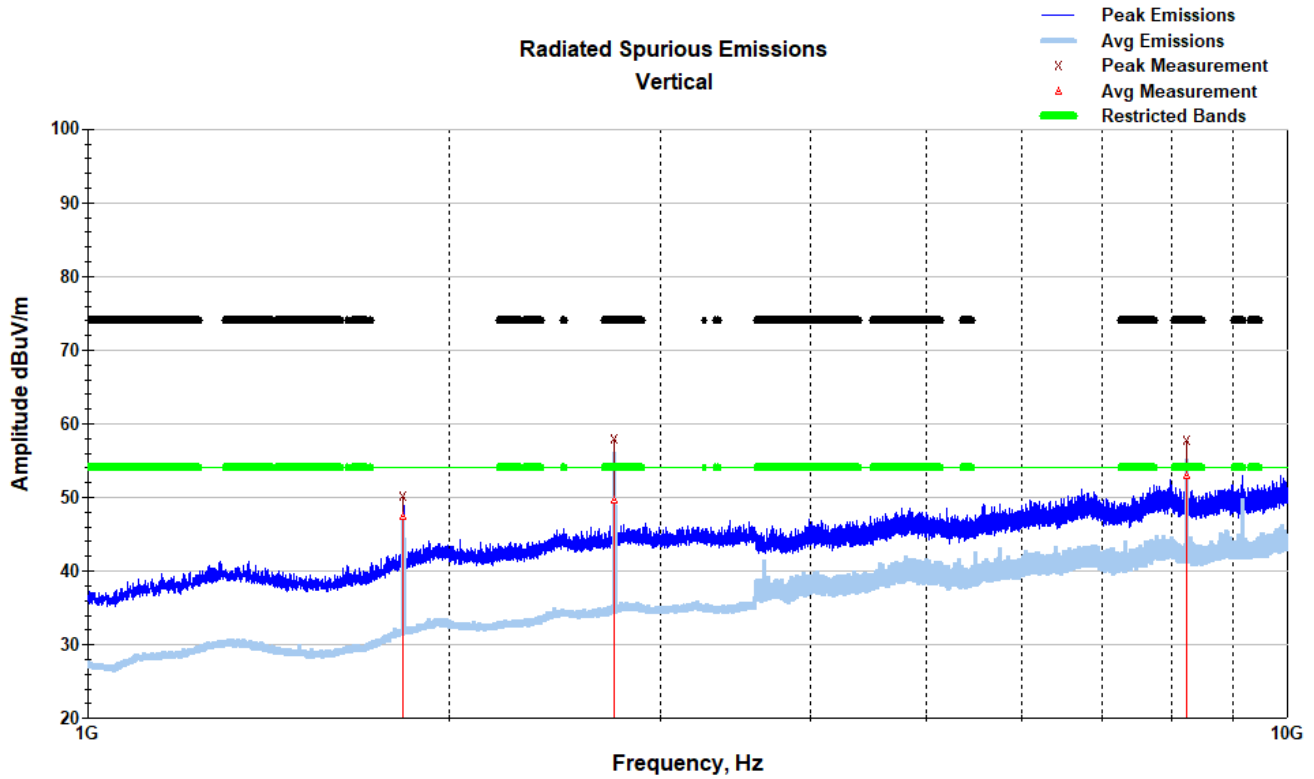


CH	Fund Freq. MHz	Frequency MHz	Level dBuV	Detector	Axis	Polarity (V/H)	Azimuth (deg)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
49	916.2375	2748.71	45.1	Avg	Y	V	132.8	212.9	32.5	2.7	34.9	45.4	54.0	-8.6
49	916.2375	8246.13	46.4	Avg	Y	V	114.8	213.9	35.8	4.8	35.4	51.7	54.0	-2.3
49	916.2375	2748.71	53.1	Peak	Y	V	132.8	212.9	32.5	2.7	34.9	53.4	74.0	-20.6
49	916.2375	8246.13	53.1	Peak	Y	V	114.8	213.9	35.8	4.8	35.4	58.4	74.0	-15.6

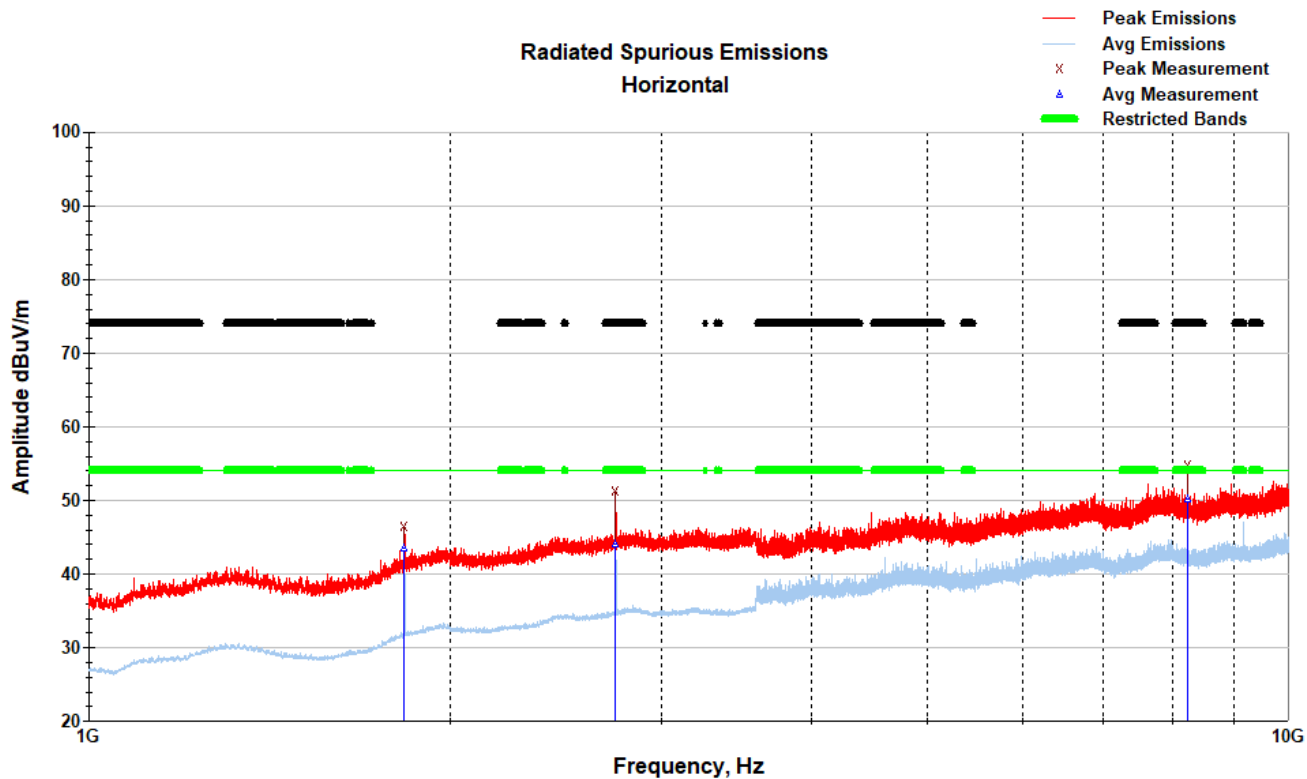


CH	Fund Freq, MHz	Frequency MHz	Level dBuV	Detector	Axis	Polarity (V/H)	Azimuth (deg)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
49	916.2375	2748.71	46.7	Avg	Y	H	53.0	212.8	32.5	2.7	34.9	47.0	54.0	-7.0
49	916.2375	8246.13	41.0	Avg	Y	H	189.5	174.5	35.8	4.8	35.4	46.3	54.0	-7.7
49	916.2375	2748.71	53.5	Peak	Y	H	53.0	212.8	32.5	2.7	34.9	53.8	74.0	-20.2
49	916.2375	8246.13	48.8	Peak	Y	H	189.5	174.5	35.8	4.8	35.4	54.1	74.0	-19.9

7.6.6 Channel 49, 916.2375 MHz, z-Axis



CH	Fund Freq, MHz	Frequency MHz	Level dBuV	Detector	Axis	Polarity (V/H)	Azimuth (deg)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
49	916.2375	2748.71	49.4	Avg	Z	V	279.6	100.0	32.5	2.7	34.9	49.7	54.0	-4.3
49	916.2375	8246.13	47.7	Avg	Z	V	120.3	154.5	35.8	4.8	35.4	53.0	54.0	-1.0
49	916.2375	2748.71	57.7	Peak	Z	V	279.6	100.0	32.5	2.7	34.9	58.0	74.0	-16.0
49	916.2375	8246.13	52.4	Peak	Z	V	120.3	154.5	35.8	4.8	35.4	57.7	74.0	-16.3



CH	Fund Freq, MHz	Frequency MHz	Level dBuV	Detector	Axis	Polarity (V/H)	Azimuth (deg)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
49	916.2375	2748.71	43.7	Avg	Z	H	186.4	248.6	32.5	2.7	34.9	44.0	54.0	-10.0
49	916.2375	8246.13	44.8	Avg	Z	H	314.5	192.3	35.8	4.8	35.4	50.1	54.0	-3.9
49	916.2375	2748.71	51.0	Peak	Z	H	186.4	248.6	32.5	2.7	34.9	51.3	74.0	-22.7
49	916.2375	8246.13	49.4	Peak	Z	H	314.5	192.3	35.8	4.8	35.4	54.7	74.0	-19.3

8 Pseudo-Random Hop Sequence

8.1 Test Result

Test Description	Test Specification	Test Result
Pseudo-Random Hop Sequence	FCC Part 15.247(a)(1) RSS-247 5.2a	Compliant ⁽¹⁾

Note (1): The theory of operation states that the device operates using a pseudo-random hopping technique.

8.2 Test Method

Compliance is demonstrated by Manufacturer's declaration or is stated in the Theory of Operation.

Requirement

The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset, while the long-term distribution appears evenly distributed.

9 Channel Separation

9.1 Test Result

Test Description	Test Specification	Test Result
Channel Separation	FCC Part 15.247(a)(1) RSS-247 5.2c	Compliant

9.2 Test Method

The test data was measured using a spectrum analyzer with Peak detector (max hold) and a resolution bandwidth of 500 Hz. The trace was allowed to continue until the investigated channels stabilized.

Requirement

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the -20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the -20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

9.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.7 °C
Relative Humidity: 49.8 %

9.4 Test Equipment

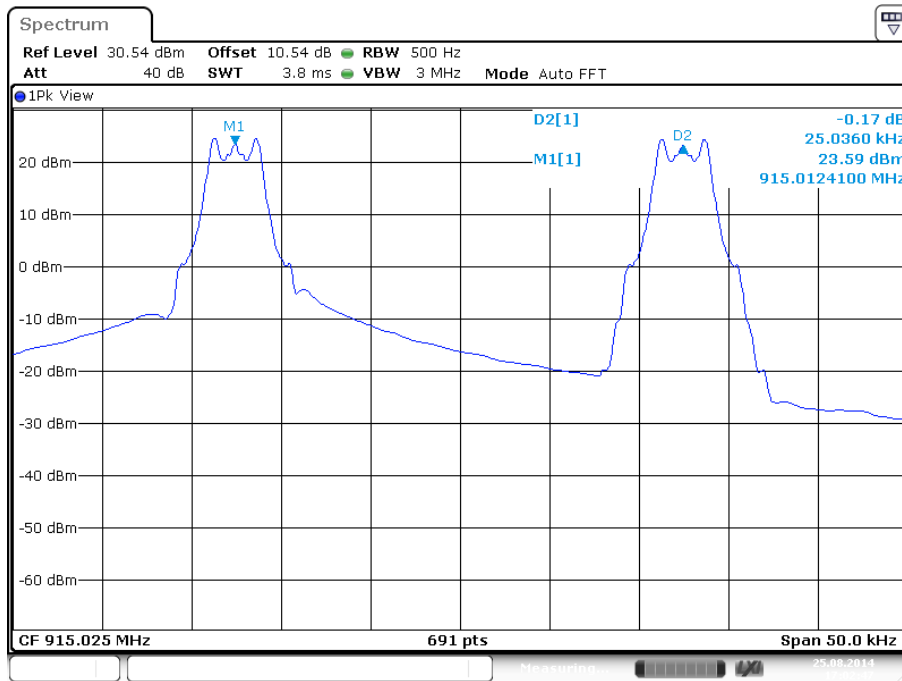
Test Date: 25-Aug-2014

Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	28-Aug-2015
COAXIAL CABLE	1134	GORE	B094785	5-Aug-2015
10DB ATTENUATOR	10DB	UNKNOWN	B095593	7-Aug-2015

Note: The calibration period equipment is 1 year.

9.5 Test Data



10 Number of Hopping Channels

10.1 Test Result

Test Description	Test Specification	Test Result
Number of Hopping Channels	FCC Part 15.247(a)(1)(i) RSS-247 5.2c	Compliant

10.2 Test Method

The test data was measured using a spectrum analyzer with Peak detector (max hold) and a resolution bandwidth of 500 Hz. The trace was allowed to stabilize until all channels were displayed.

Requirement

For frequency hopping systems operating in the 902-928 MHz band, if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies.

10.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.7 °C
Relative Humidity: 37.8 %

10.4 Test Equipment

Test Date: 25-Aug-2014

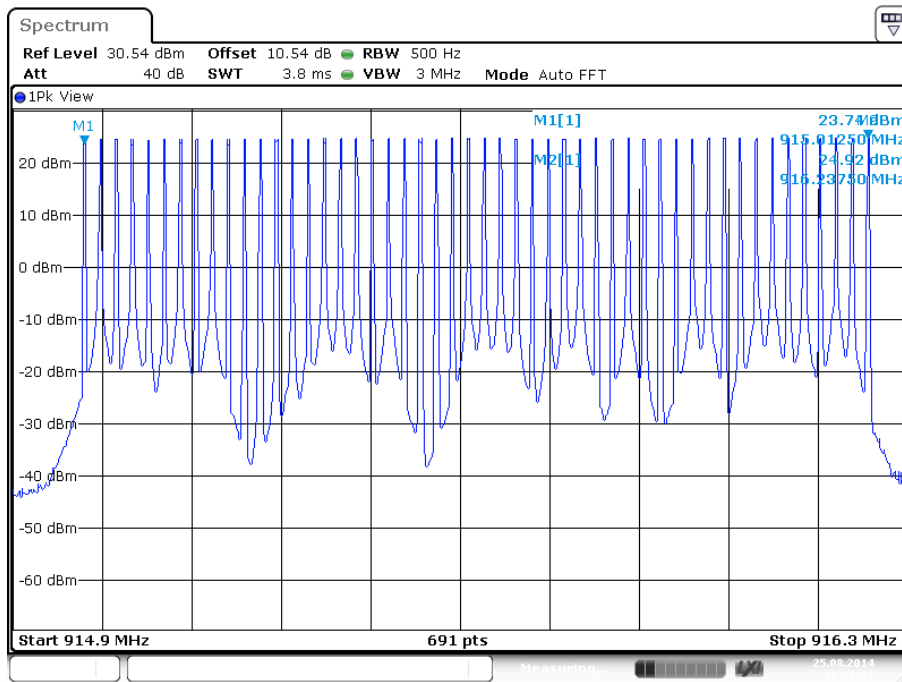
Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	28-Aug-2015
COAXIAL CABLE	1134	GORE	B094785	5-Aug-2015
10DB ATTENUATOR	10DB	UNKNOWN	B095593	7-Aug-2015

Note: The calibration period equipment is 1 year.

10.5 Test Data

There are 50 Channels.



Date: 25.AUG.2014 17:00:33

11 Dwell Time

11.1 Test Result

Test Description	Test Specification	Test Result
Dwell Time	FCC Part 15.247(a)(1)(i) RSS-247 5.2c	Compliant

11.2 Test Method

The EUT was set to test mode which allowed it to be controlled by the Bluetooth Tester. The Bluetooth Tester was then set to operate on US/EU Hopping Scheme with pseudo-random data. For each packet type and data rate, the pulse width of the packet was measured and the number of pulses were counted over the total observation period.

Requirement

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed.

11.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 21.7 °C
Relative Humidity: 46.9 %

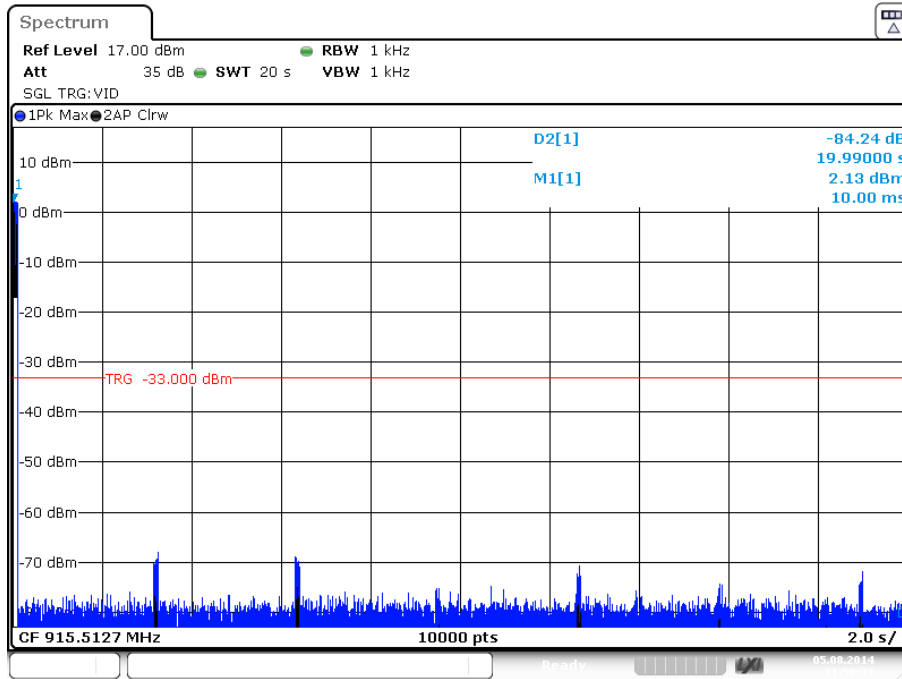
11.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	FSV 30	R&S	101595	28 Aug 2014

Note: The calibration period equipment is 1 year.

11.5 Test Data

Measured total dwell time over 20 seconds was measured to be 102 ms.



12 Receiver Spurious Emissions

12.1 Test Result

Test Description	Test Specification	Test Result
Field strength of spurious radiation	RSS-GEN 7.3	Compliant

12.2 Test Method

Exploratory scans were performed over the frequency range as indicated in the tables below using the max hold function and incorporating a Peak detector and using TILE! software. The final test data was measured using a Quasi-Peak detector below 1GHz and a Peak detector above 1GHz. The receiver's resolution bandwidth was set to 120 kHz for measurements taken in the 30MHz to 1GHz frequency range and 1MHz for measurements for 1GHz and higher. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency. The radiated measurements were recorded and compared to the limits indicated in the table below.

Test distance:

30 MHz to 1 GHz - The EUT to measurement antenna distance is 3 meters

1 to 18 GHz - The EUT to measurement antenna distance is 3 meters

18 to 40 GHz - The EUT to measurement antenna distance is 1 meter

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

(7) These limits are applicable to emissions outside of the intentional transmit frequency band.

(8) Quasi-peak limit

(9) Average limit

12.3 Test Site

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

Environmental Conditions

Temperature: 24.4 °C
Relative Humidity: 43.5 %

12.4 Test Equipment

Test Date: 26-Aug-2014

Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015
BILOG ANTENNA	CBL 6143A	TESEQ	B085931	29-Oct-2014
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079691	24-Jun-2015
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	13-Feb-2015
RF CABLE - 12000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079714	4-Aug-2015
17 FT N TYPE COAX CABLE	HS 84133232	HUBER&SUHNER	B079661	4-Aug-2015
HIGH PASS FILTER	HPM50108	MICRO-TRONICS	B079802	16-Oct-2014

Note: The calibration period equipment is 1 year.

12.5 Test Setup Photographs

Test setup photographs are located in a separate exhibit.

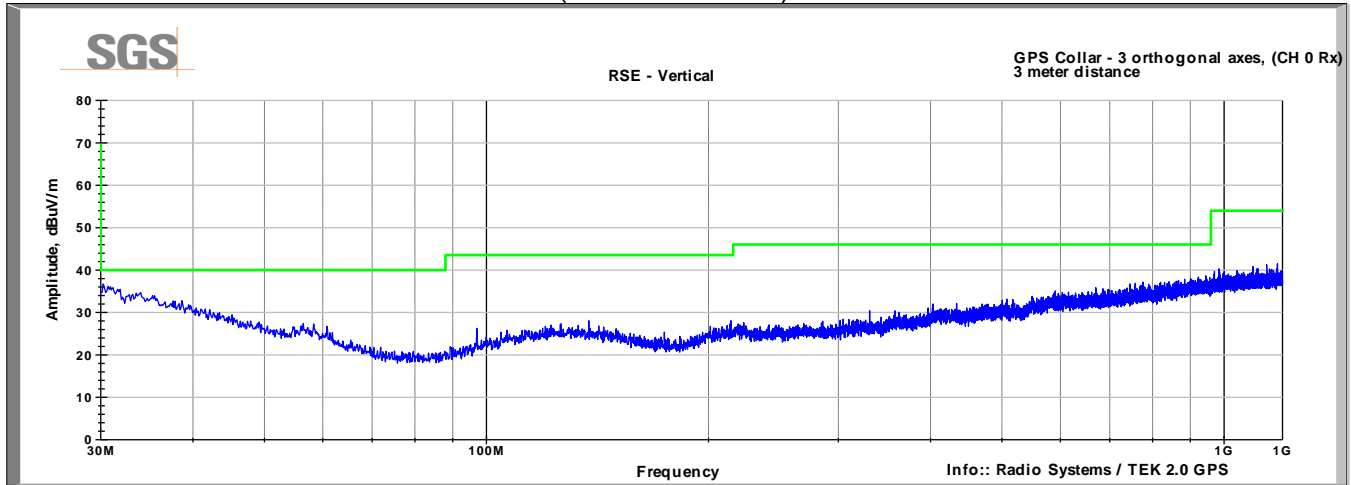
12.6 Test Data

Channel 0 (Rx Mode)

30-1000MHz

Vertical

(3m test distance)

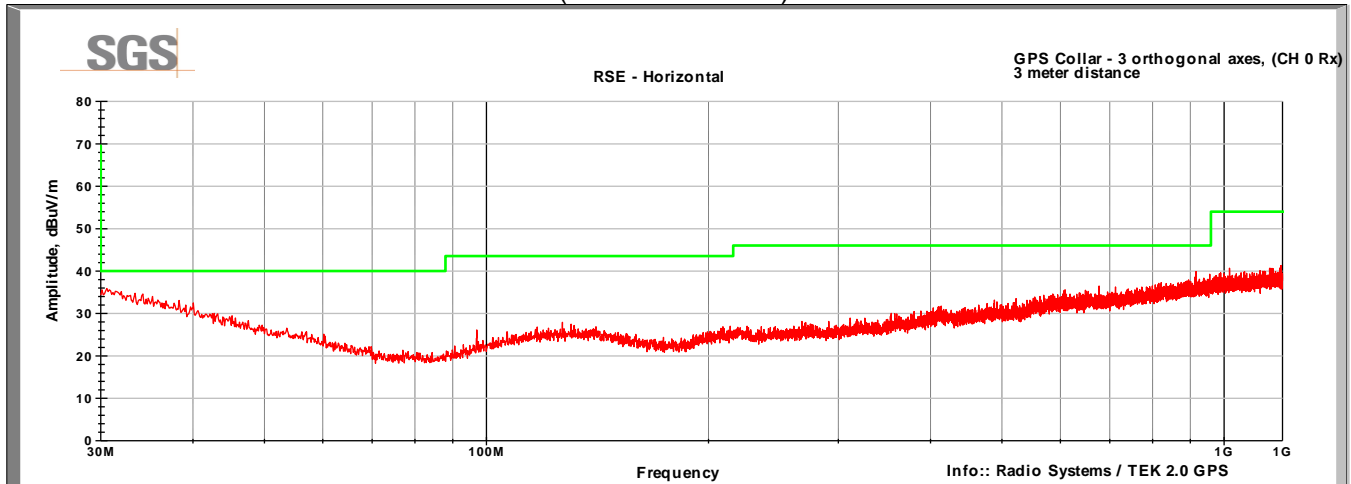


Channel 0 (Rx Mode)

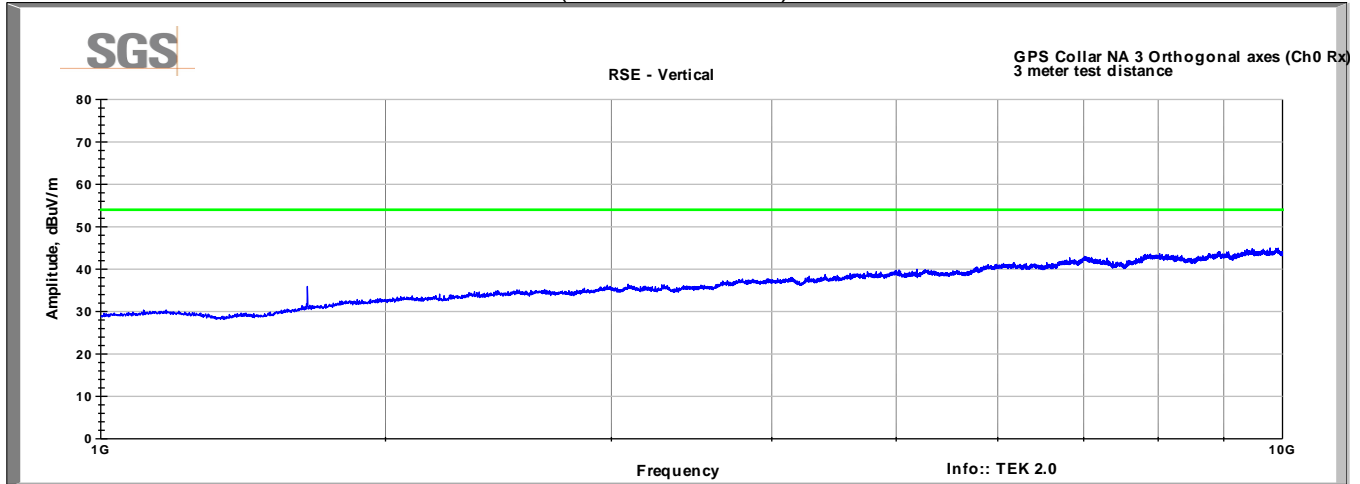
30-1000MHz

Horizontal

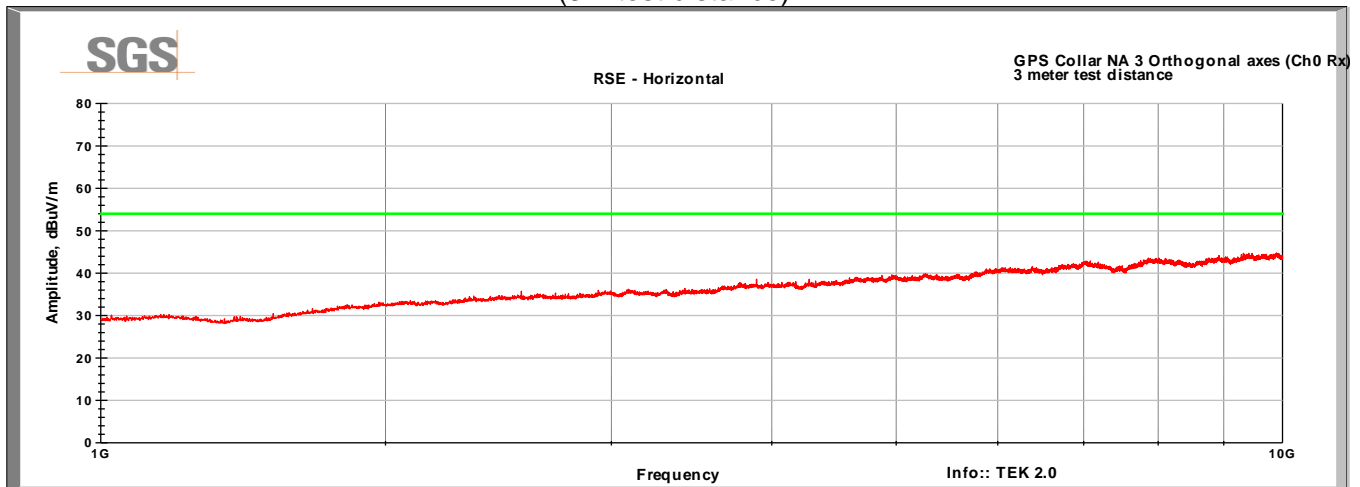
(3m test distance)



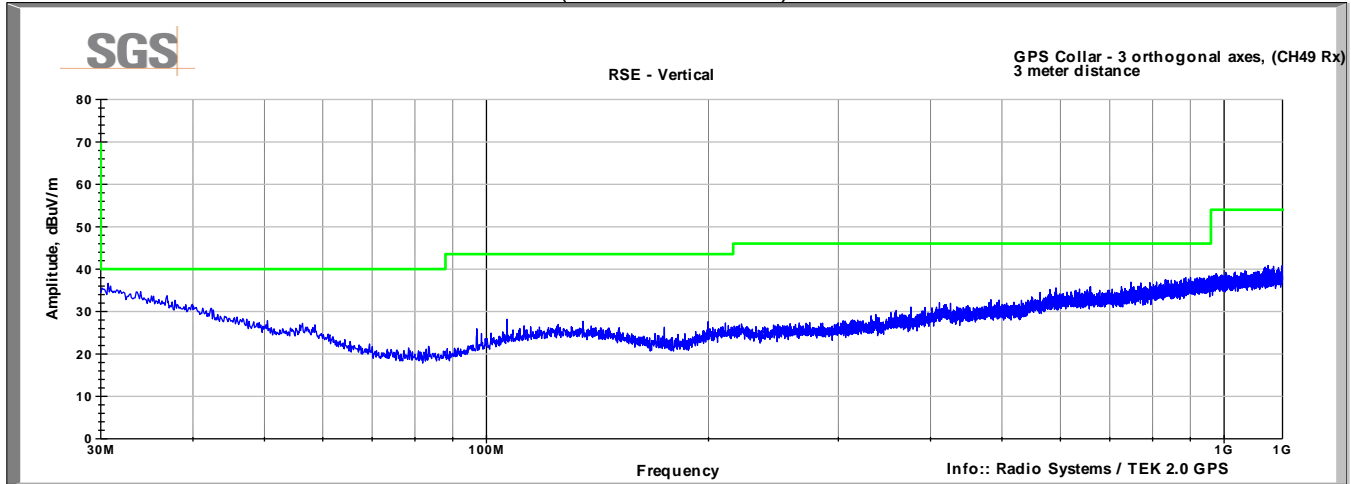
Channel 0 (Rx Mode)
 1-10GHz
 Vertical
 (3m test distance)



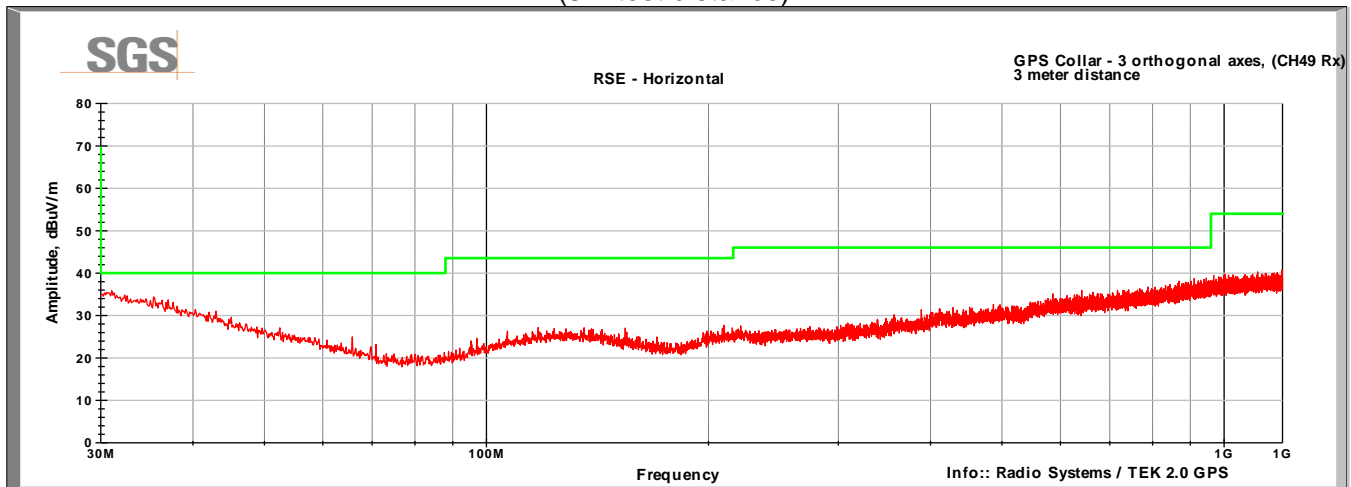
Channel 0 (Rx Mode)
 1-10GHz
 Horizontal
 (3m test distance)



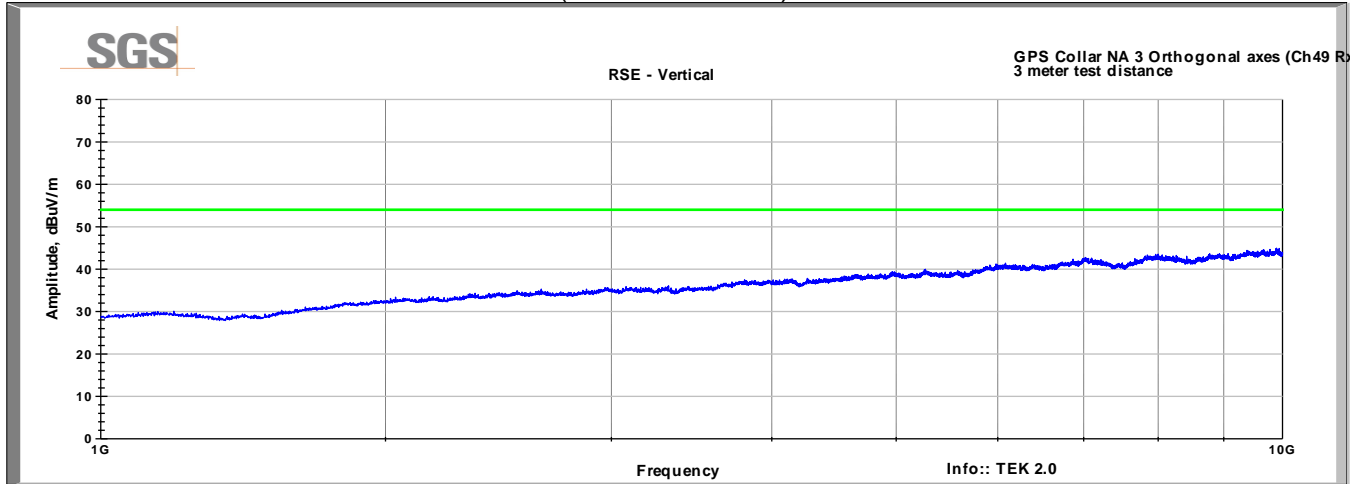
Channel 49 (Rx Mode)
30-1000MHz
Vertical
(3m test distance)



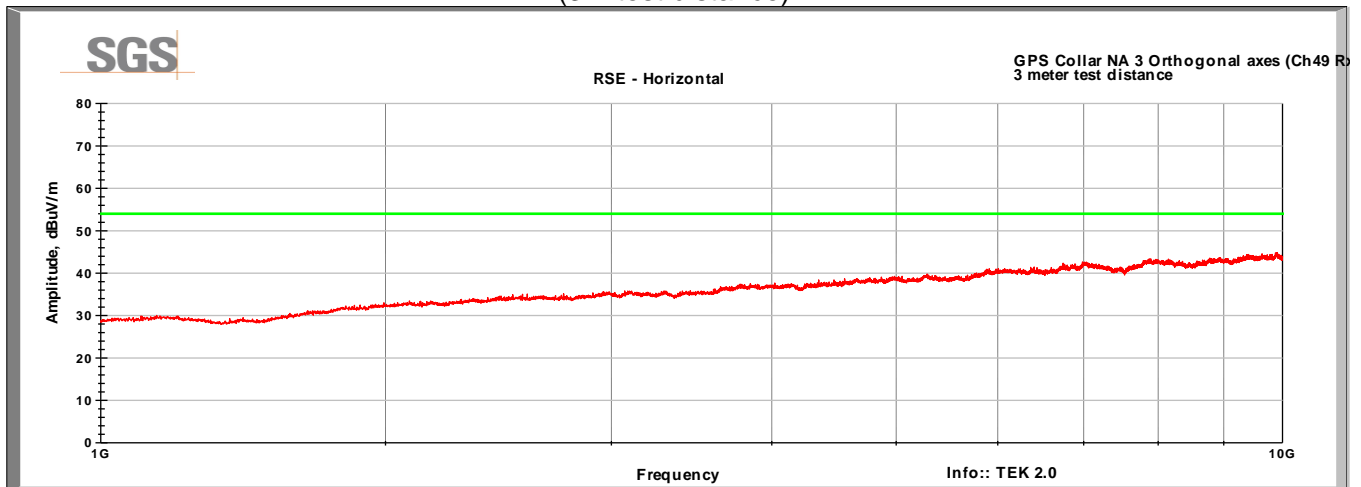
Channel 49 (Rx Mode)
30-1000MHz
Horizontal
(3m test distance)



Channel 49 (Rx Mode)
 1-10GHz
 Vertical
 (3m test distance)



Channel 49 (Rx Mode)
 1-10GHz
 Horizontal
 (3m test distance)



13 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	28 August 2014
1	Updated references to ANSI C63.10:2013 and RSS-247, Issue 2. Performed transmitter testing above 1 GHz due to change in test methods.	30 March 2020