

RF Test Report

Project Number: 4866869**Proposal:** SUW-202201002154**Report Number:** 4866869EMC05**Revision Level:** 0**Client:** EaseAlert, LLC**Equipment Under Test:** 2.4GHz Transceiver Module**Model Number:** E01**FCC ID:** 2A4C4-E01**Applicable Standards:** ANSI C63.10: 2013 (FCC Part 15 Subpart C, § 15.247)**RSS-247, Issue 2****RSS-GEN Issue 5****Report issued on:** 02 March 2022**Test Result:** Compliant

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER: 3212.01

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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	NS ¹
Peak Output Power	15.247(b)(3)	RSS-247 5.4 (d)	NS ¹
Power Spectral Density	15.247(e)	RSS-247 5.2 (b)	NS ¹
Conducted Spurious Emissions / Band Edge	15.247(d)	RSS-247 5.5	NS ¹
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 ²
AC Powerline Conducted Emissions	15.107, 15.207	RSS-GEN 8.8	Compliant

- 1) Not under the scope of the evaluation. Testing was limited to radiated spurious emissions to support a Class II Permissive Change to address a higher gain antenna than with which the module was certified.
- 2) The antenna will be permanently affixed to the external port.

1.1 Modifications Required for Compliance

None

2 General Information

2.1 Client Information

Name: EaseAlert, LLC
Address: 1903 Sunrise Dr
City, State, Zip, Country: Fernandina Beach, FL 32034, 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: 2.4GHz Transceiver Module
Model Number: E01
Serial Numbers: W121141S02723, W121141S06950, W121141S06659

Frequency Range: 2402 – 2480 MHz
Data Modes: GFSK – 250kbps
Antenna: External Dipole, 5dBi

Rated Voltage: 2.5 – 3.3Vdc
Test Voltage: 2.8Vdc

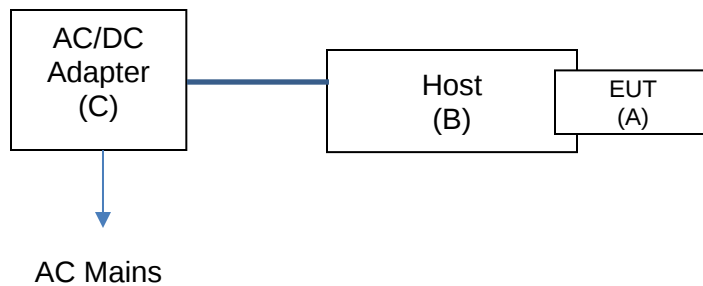
Sample Received Date: 07 January 2022
Dates of testing: 26– 27 January 2022

2.4 Operating Modes and Conditions

Using a programming tool, three separate devices were configured to begin constant modulated transmission upon power-up as follows:

- Unit #1: 2402MHz, 250kbps, Max Power
- Unit #2: 2440MHz, 250kbps, Max Power
- Unit #3: 2480MHz, 250kbps, Max Power

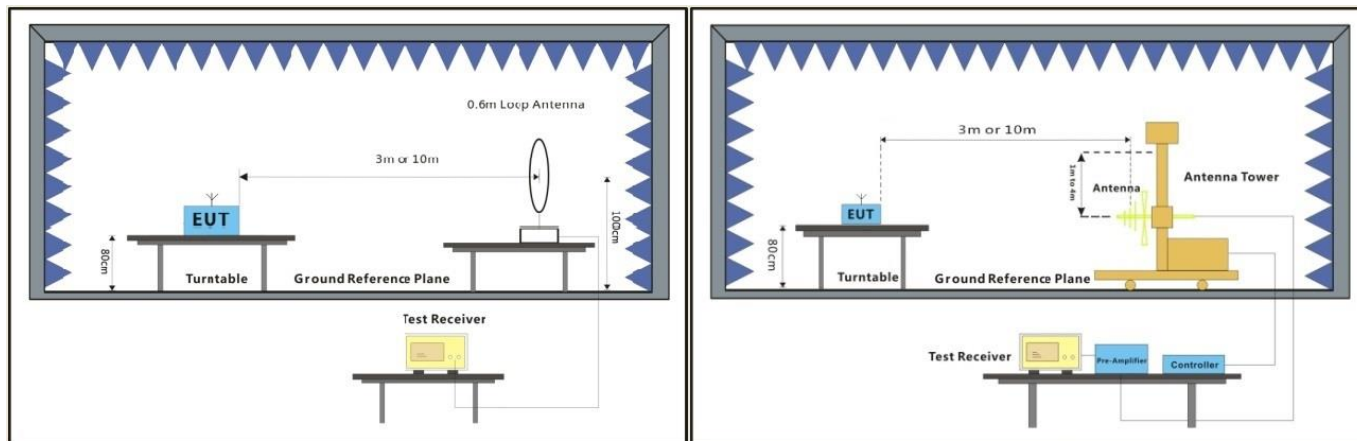
2.5 EUT Connection Block Diagram – Radiated Measurements



2.6 System Configurations

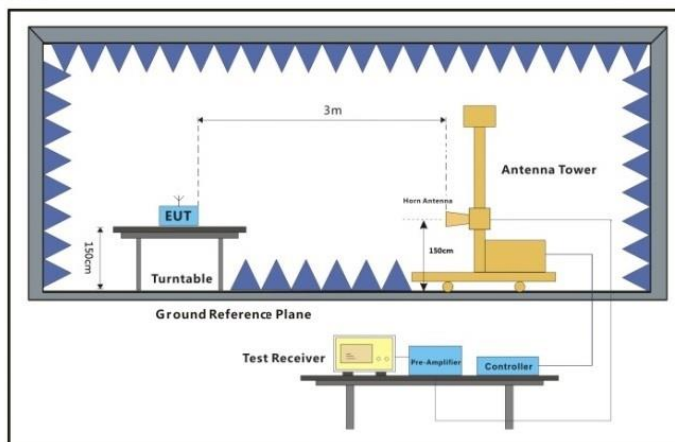
Device reference	Manufacturer	Description	Model Number	Serial Number
A	eByte	2.4GHz Transceiver Module	E01	W121141S02723 W121141S06950 W121141S06659
B	EaseAlert, LLC	Lighted Alert System	BunkAlert	Samples 1, 2, and 3
C	Qualtek	AC/DC Adapter	QFWB-30-12-US01	Not Labeled

2.7 Configuration Diagrams (Radiated)



Below 30MHz

30MHz-1GHz



Above 1GHz

3 Field Strength of Spurious Radiation (Restricted Bands)

3.1 Test Result

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

3.2 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. Three orientations were investigated (X/Y/Z) and the worst-case data is reported (Y-Axis).

Test distance:

- 9k to 30 MHz - Near-field evaluation – no emissions detected
- 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 - Near-field evaluation – no emissions detected

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

3.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.0 °C

Relative Humidity: 40.9 %

Atmospheric Pressure: 98.0 kPa

3.4 Test Equipment

Test End Date: 3/10/2022

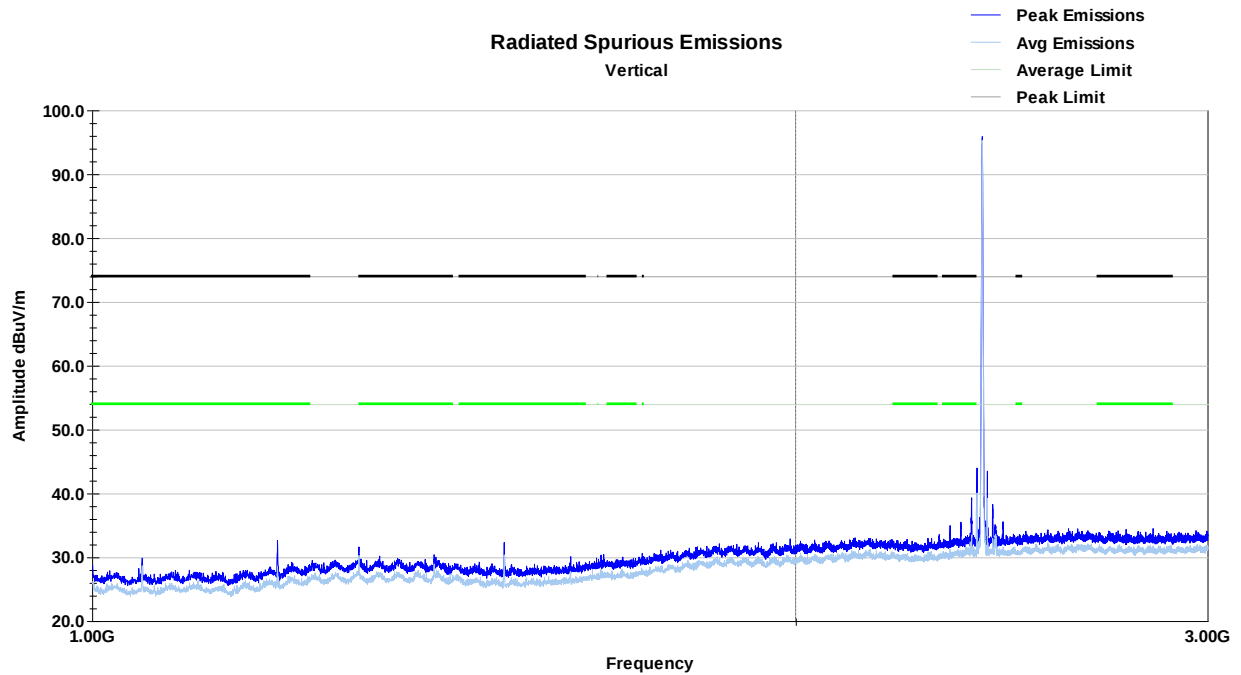
Tester: AB/JP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	7-Oct-2021	7-Oct-2022
RF CABLE NM TO NM, 0.01-18GHZ	90-195-157	TELEDYNE STORM MICROWAVE	20121	14-Feb-2022	14-Feb-2023
RF CABLE NM TO NM, 0.01-18GHZ	90-195-118	TELEDYNE STORM MICROWAVE	20125	25-Aug-2021	25-Aug-2022
N TO N RF CABLE	NC12-N1N1-276	MEGAPHASE	22000	10-Jan-2022	10-Jan-2023
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	B079691	10-Aug-2020	10-Aug-2022
RF CABLE	SF106	HUBER & SUHNER	B079713	26-Aug-2021	26-Aug-2022
RF CABLE	104PE	HUBER & SUHNER	B079793	24-Aug-2021	24-Aug-2022
LOW NOISE AMPLIFIER	ZKL-2+	MINI-CIRCUITS	B079800	18-Oct-2021	18-Oct-2022
FILTER, HIGH PASS, >2800MHZ	HPM50111	MICRO-TRONICS	B085747	6-Jul-2021	6-Jul-2022

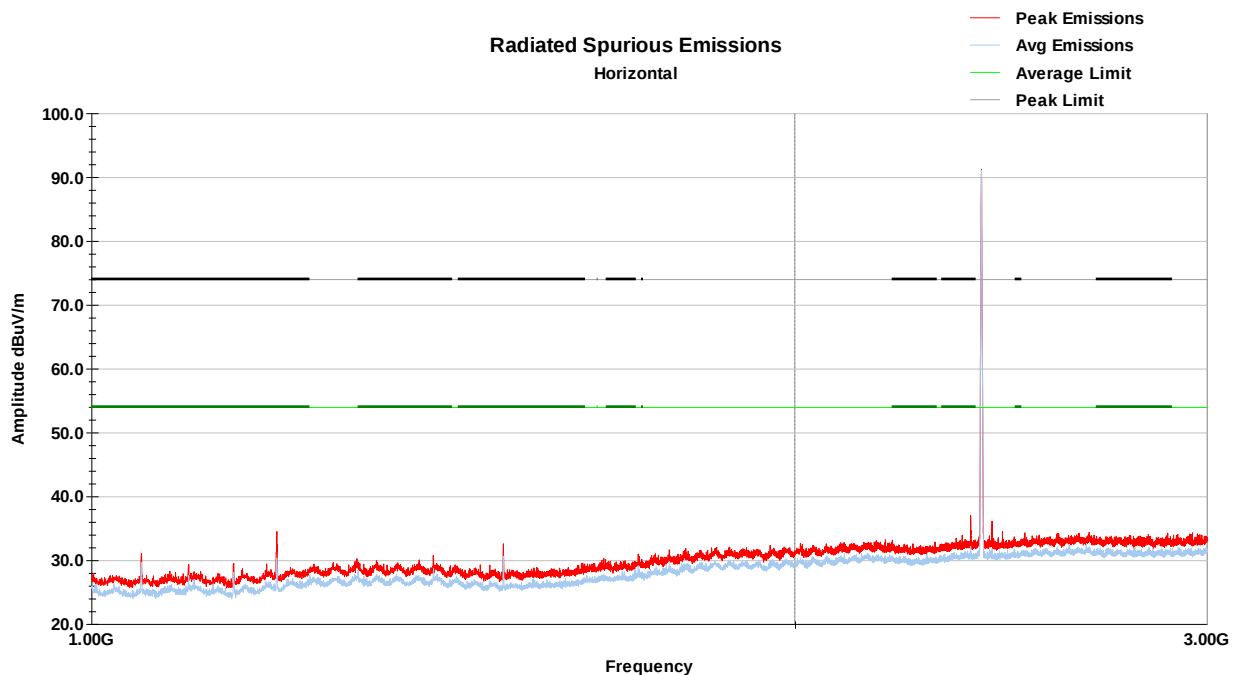
3.5 Test Data – Peak Plots

Below 1GHz, there were no emissions detected that were associated with the radio operation.

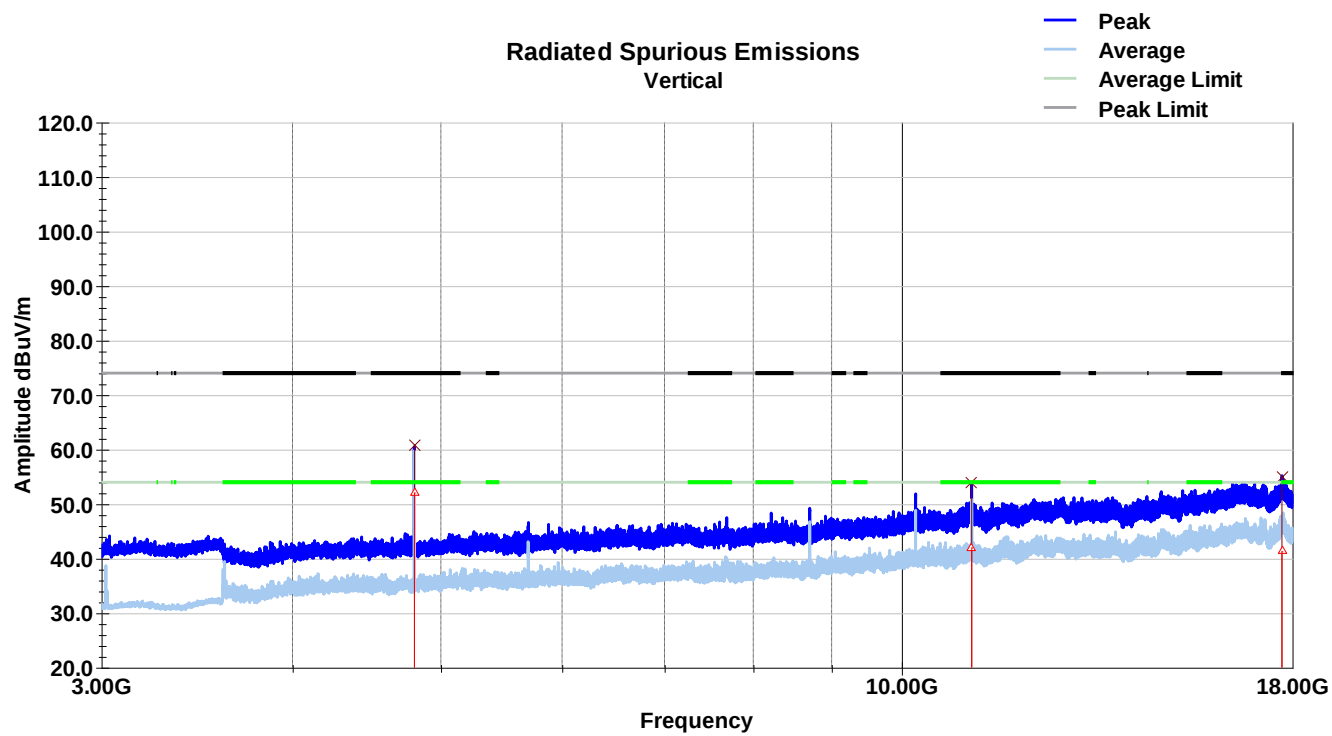
Vertical Radiated Spurious Emissions – 1-3GHz (LCH)



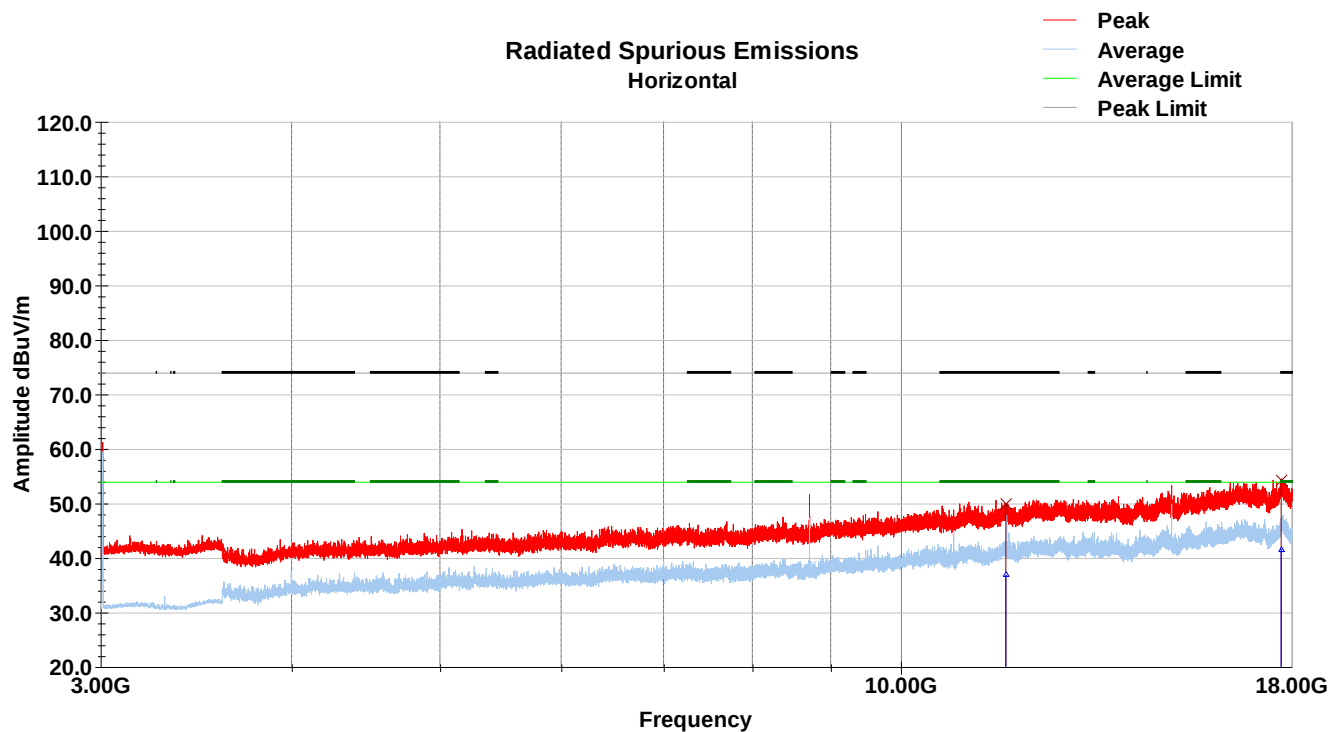
Horizontal Radiated Spurious Emissions – 1-3GHz (LCH)



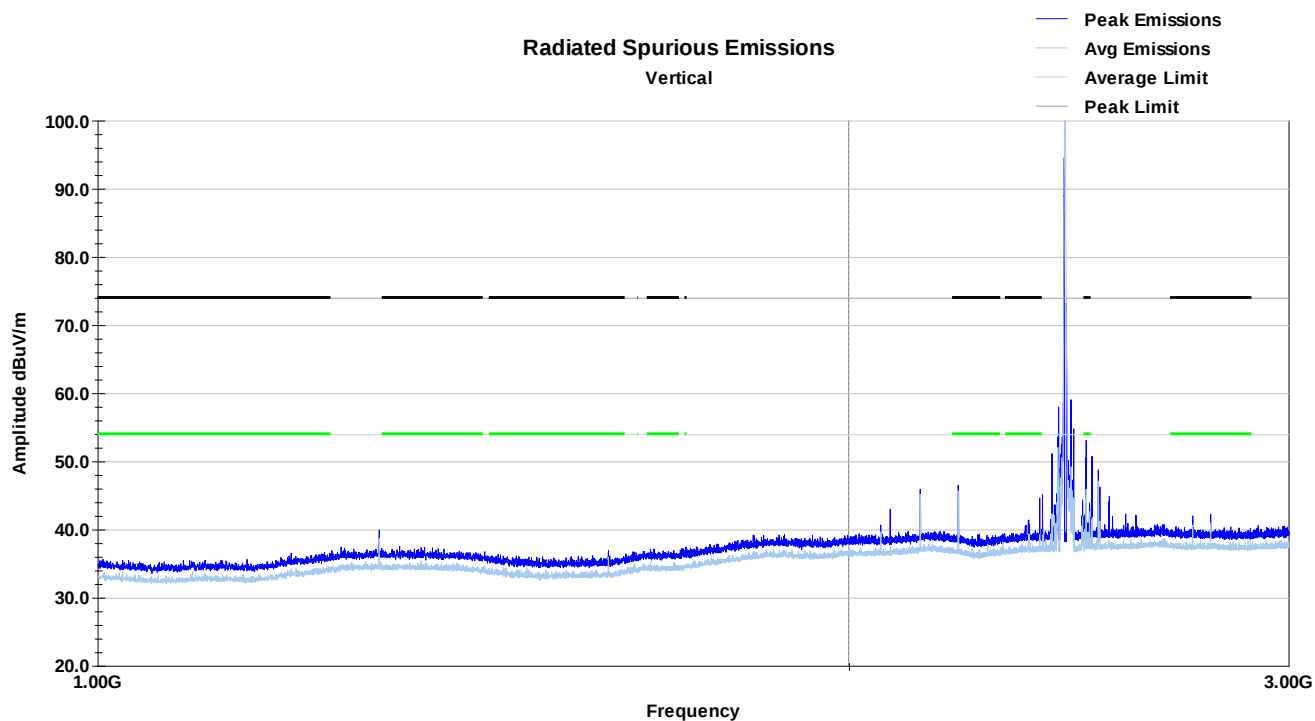
Vertical Radiated Spurious Emissions – 3-18GHz (LCH)



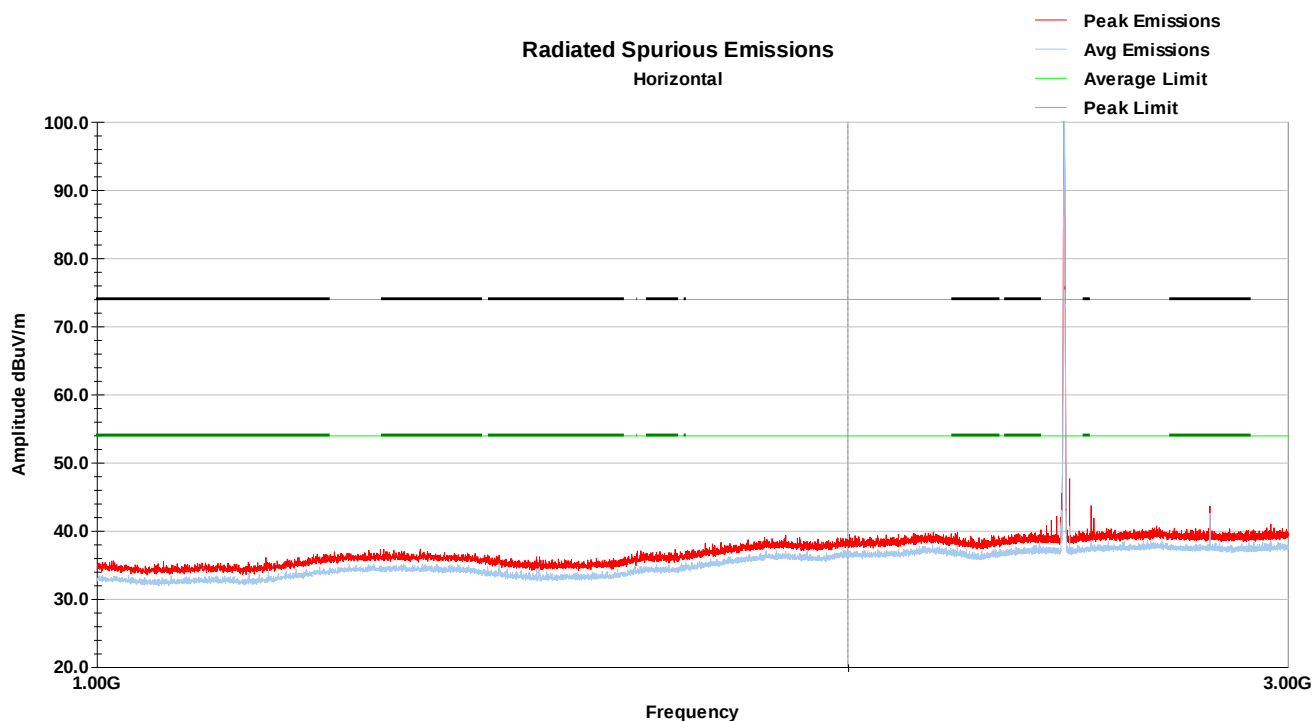
Horizontal Radiated Spurious Emissions – 3-18GHz (LCH)



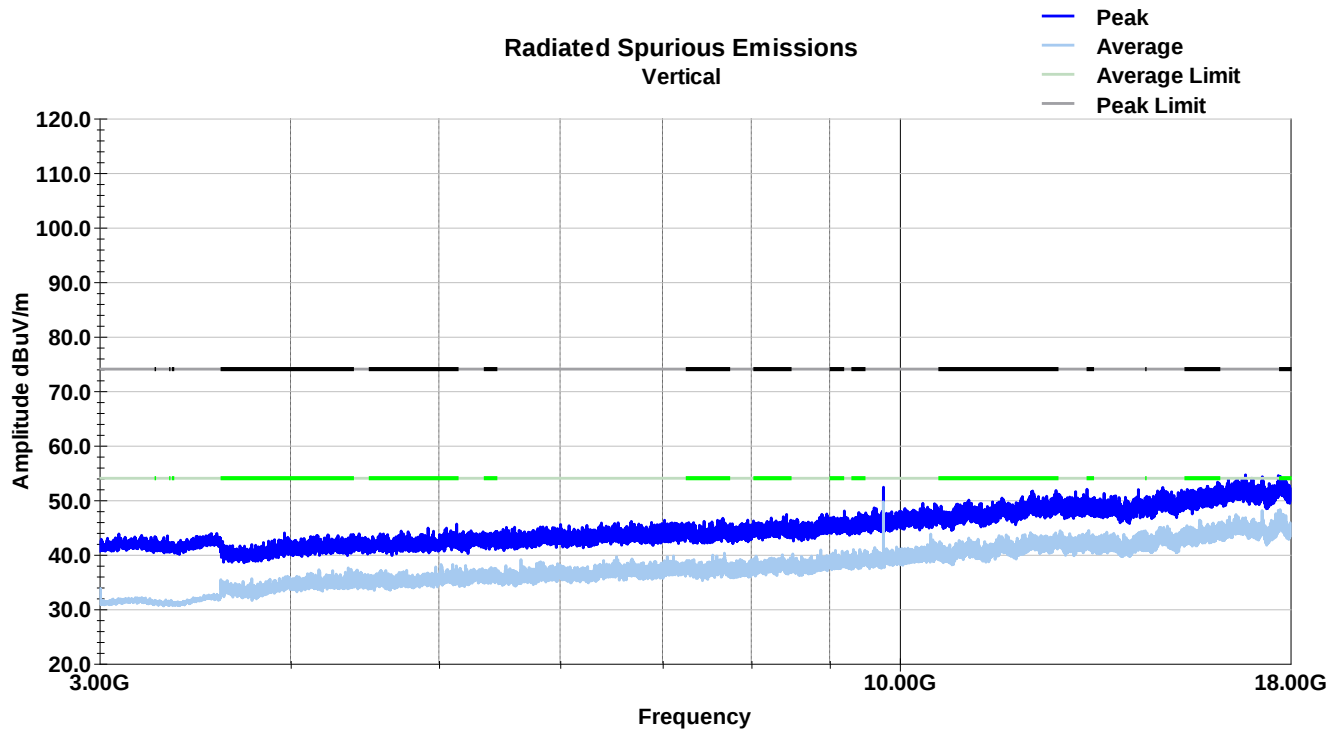
Vertical Radiated Spurious Emissions – 1-3GHz (MCH)



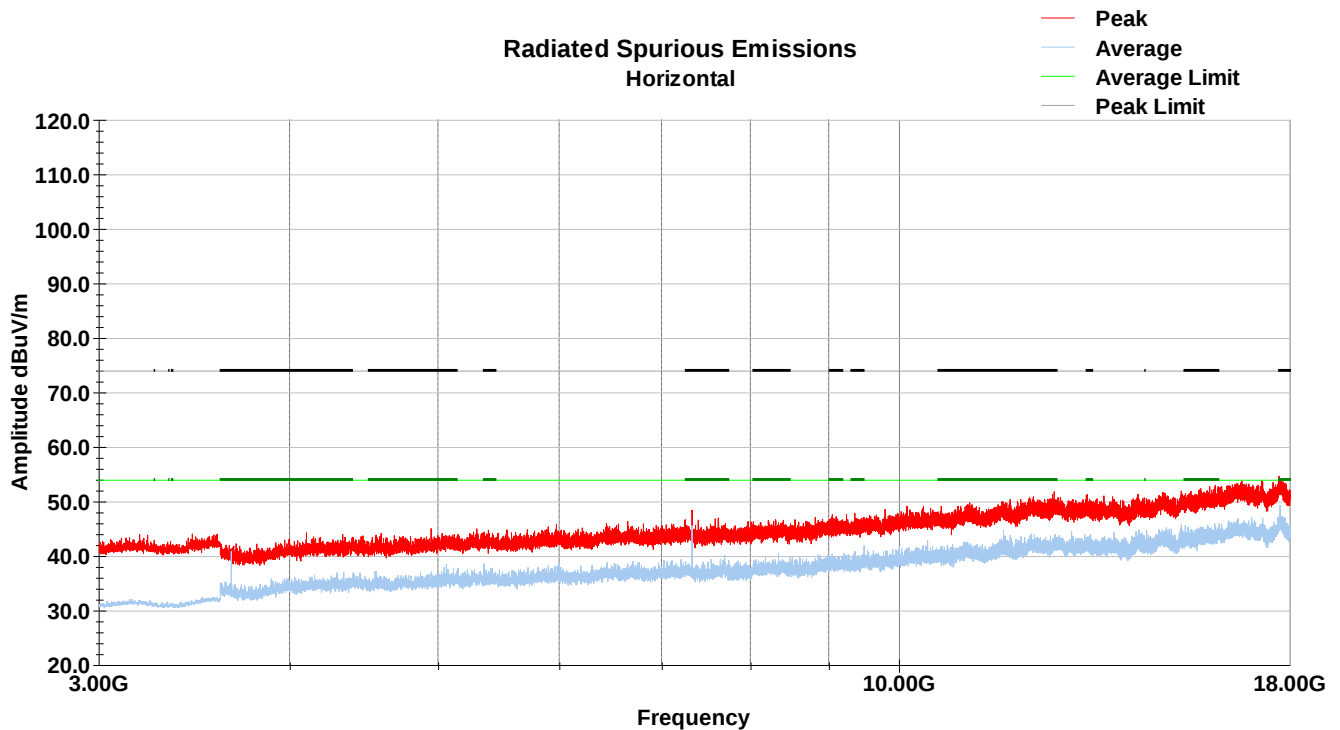
Horizontal Radiated Spurious Emissions – 1-3GHz (MCH)



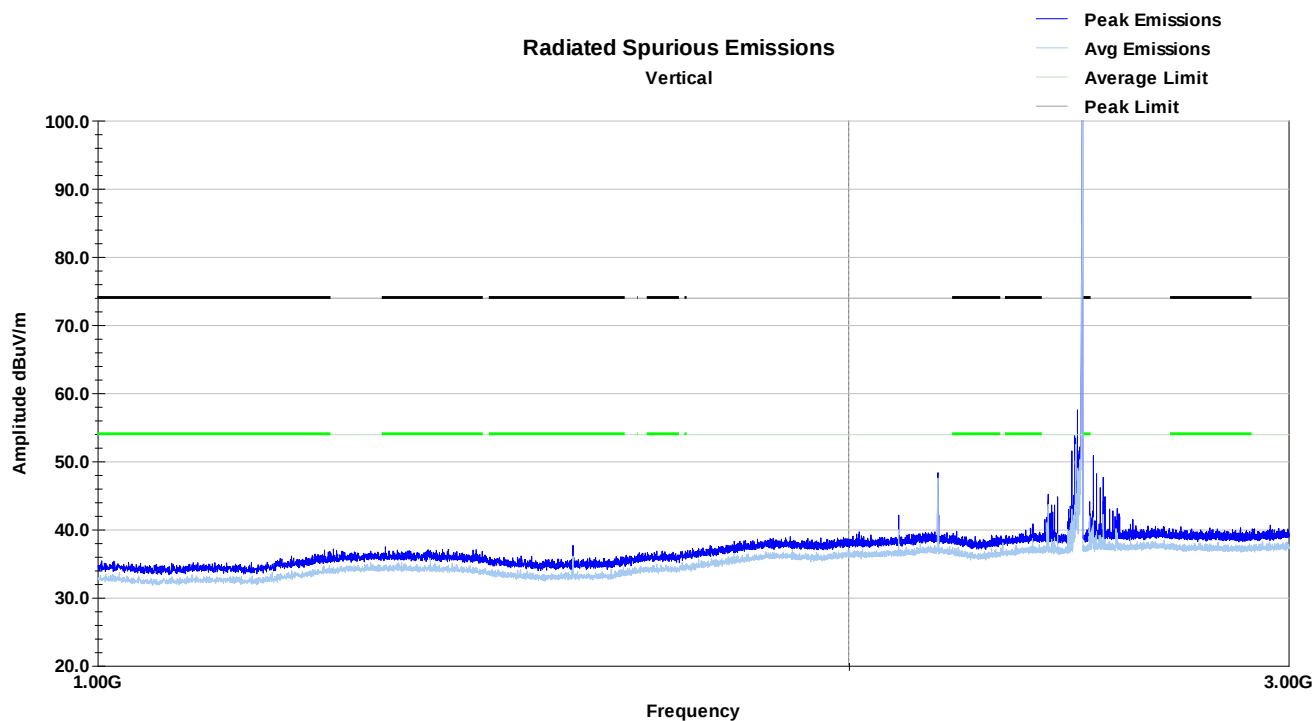
Vertical Radiated Spurious Emissions – 3-18GHz (MCH)



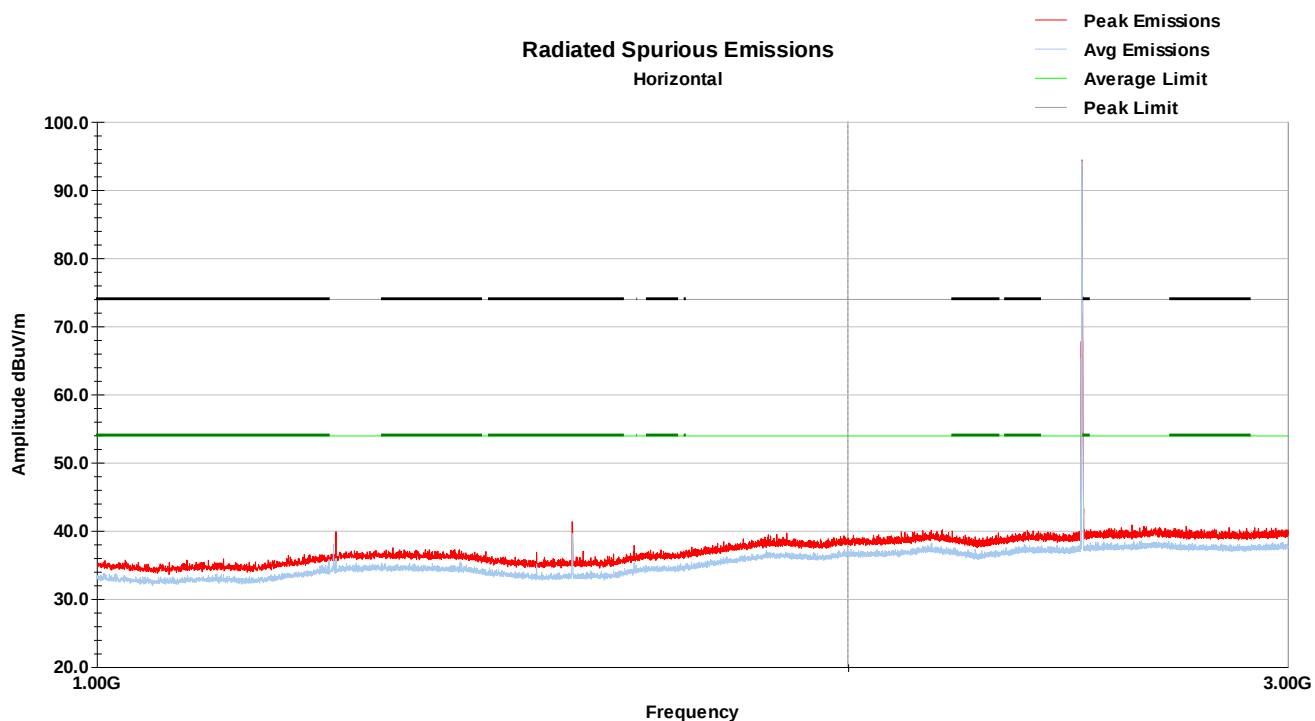
Horizontal Radiated Spurious Emissions – 3-18GHz (MCH)



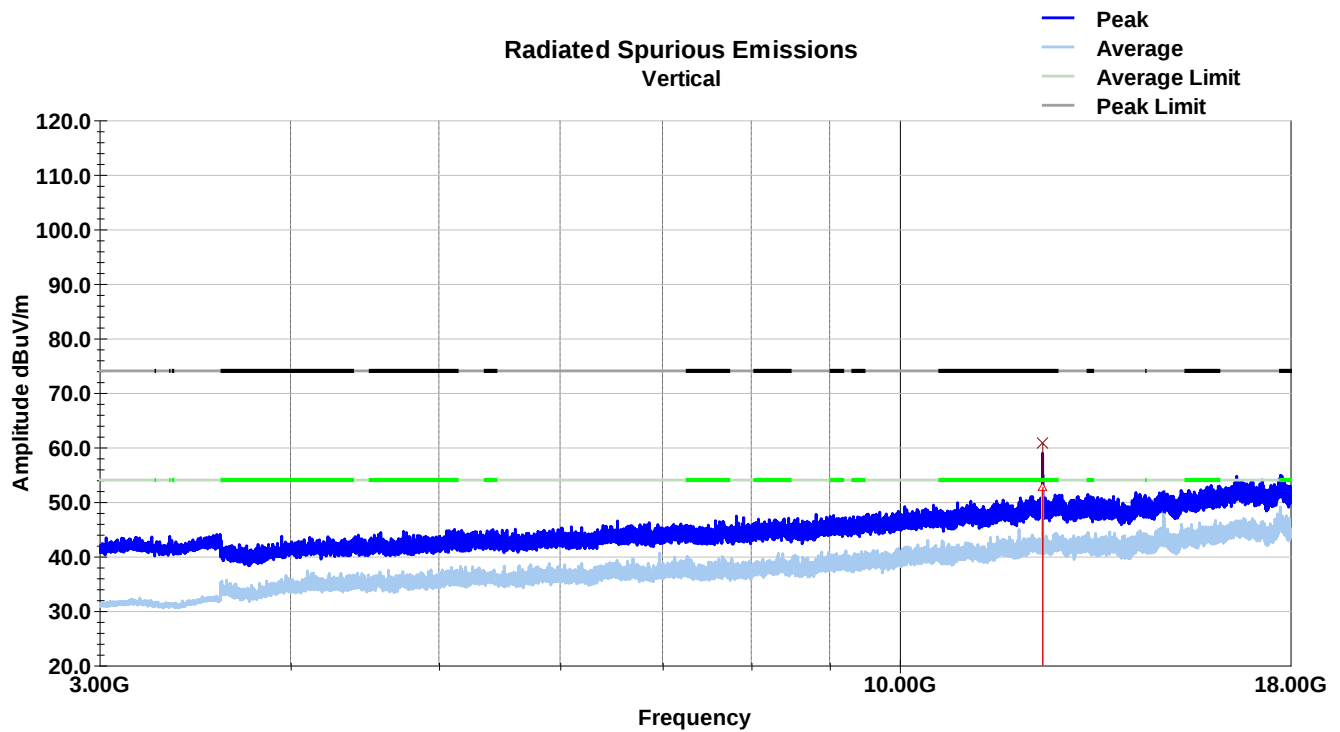
Vertical Radiated Spurious Emissions – 1-3GHz (HCH)



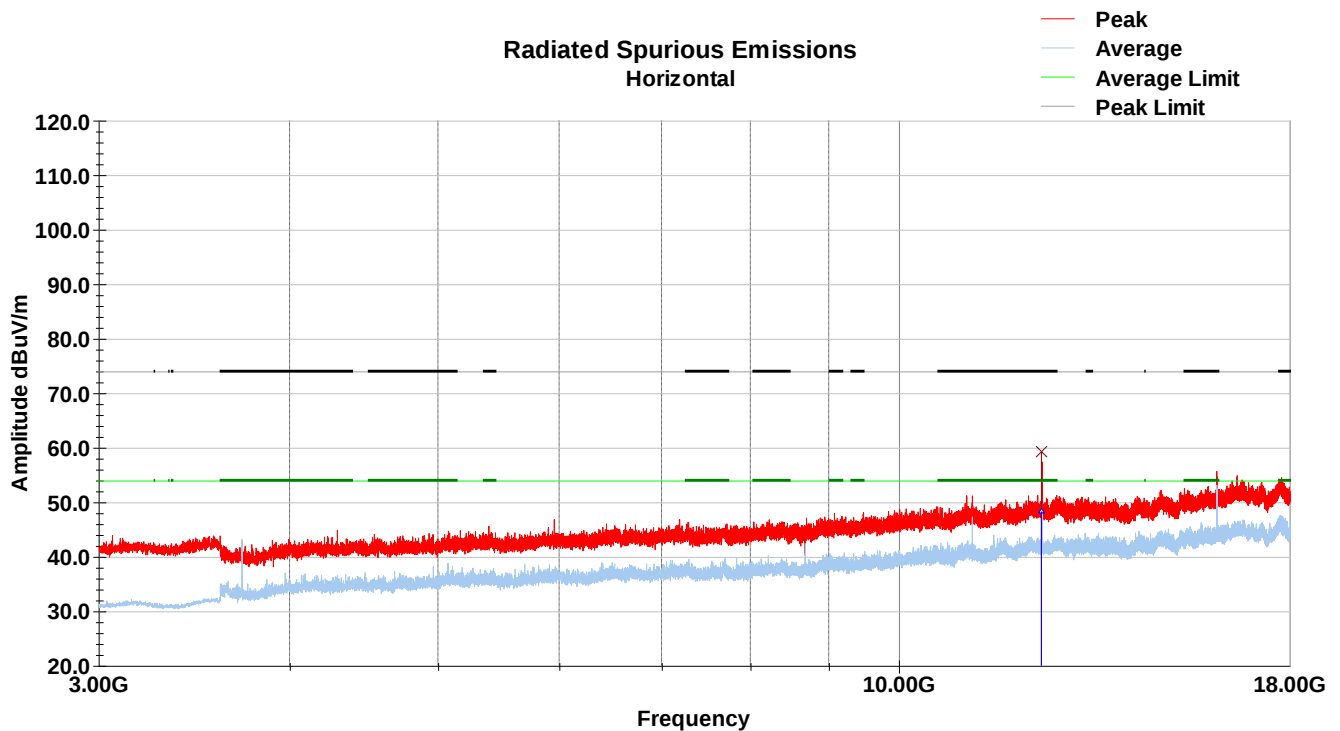
Horizontal Radiated Spurious Emissions – 1-3GHz (HCH)



Vertical Radiated Spurious Emissions – 3-18GHz (HCH)



Horizontal Radiated Spurious Emissions – 3-18GHz (HCH)



3.6 Test Data – Tabular Data

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	Detector
Low Channel (2402MHz)											
4804.00	49.2	V	307.0	250.0	34.3	2.4	42.0	60.9	74.0	-13.1	Peak
4804.00	36.4	V	307.0	250.0	34.3	2.4	42.0	52.1	54.0	-1.9	Average
11112.34	48.9	V	33.0	175.0	37.9	4.1	42.0	53.9	74.0	-20.1	Peak
11112.34	36.1	V	33.0	175.0	37.9	4.1	42.0	42.1	54.0	-12.0	Average
Mid Channel (2440MHz)											
No spurious emissions detected											
High Channel (2480MHz)											
12400.00	46.4	V	177.0	195.0	38.9	4.6	41.3	60.7	74.0	-13.3	Peak
12400.00	34.2	V	177.0	195.0	38.9	4.6	41.3	52.7	54.0	-1.3	Average
12400.00	57.0	H	72.0	175.0	38.9	4.5	41.3	59.2	74.0	-14.8	Peak
12400.00	34.5	H	72.0	175.0	38.9	4.5	41.3	48.2	54.0	-5.8	Average
QP Value = Level + AF + CL - Amp											
Margin = QP Value - Limit											

Note: There were no emissions detected above 18GHz

4 Emissions in Restricted Frequency Bands (Band Edge)

4.1 Test Result

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

4.2 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.

4.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.0 °C

Relative Humidity: 40.9 %

Atmospheric Pressure: 98.0 kPa

4.4 Test Equipment

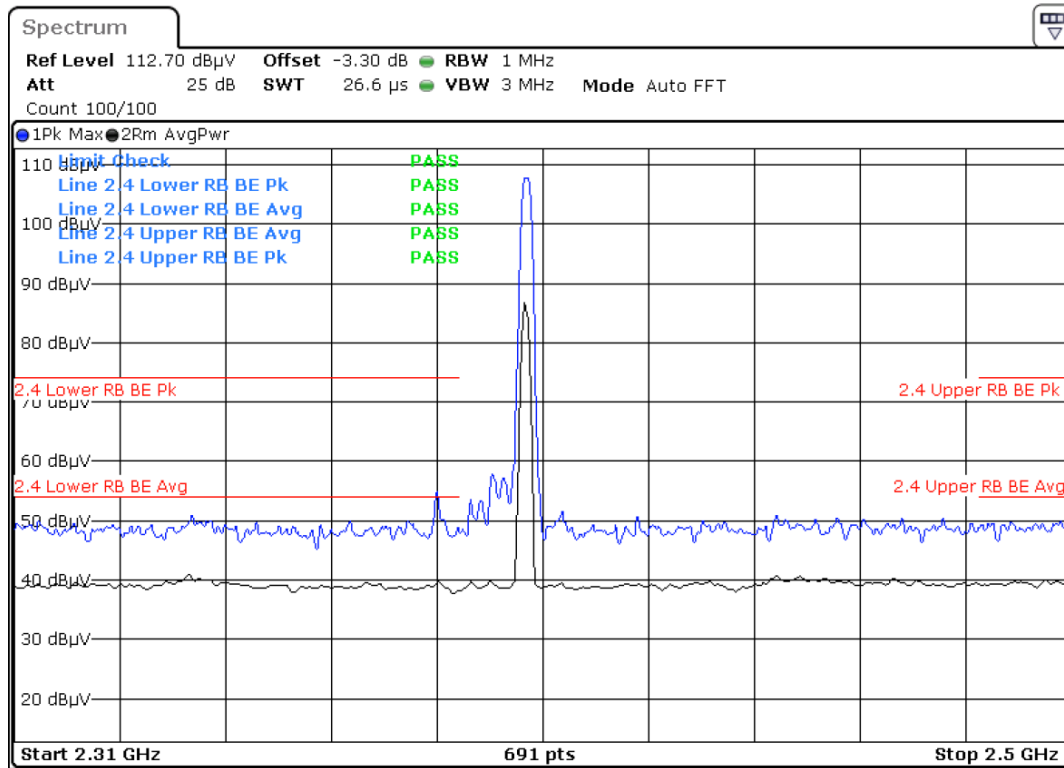
Test End Date: 2/17/2022

Tester: JOP

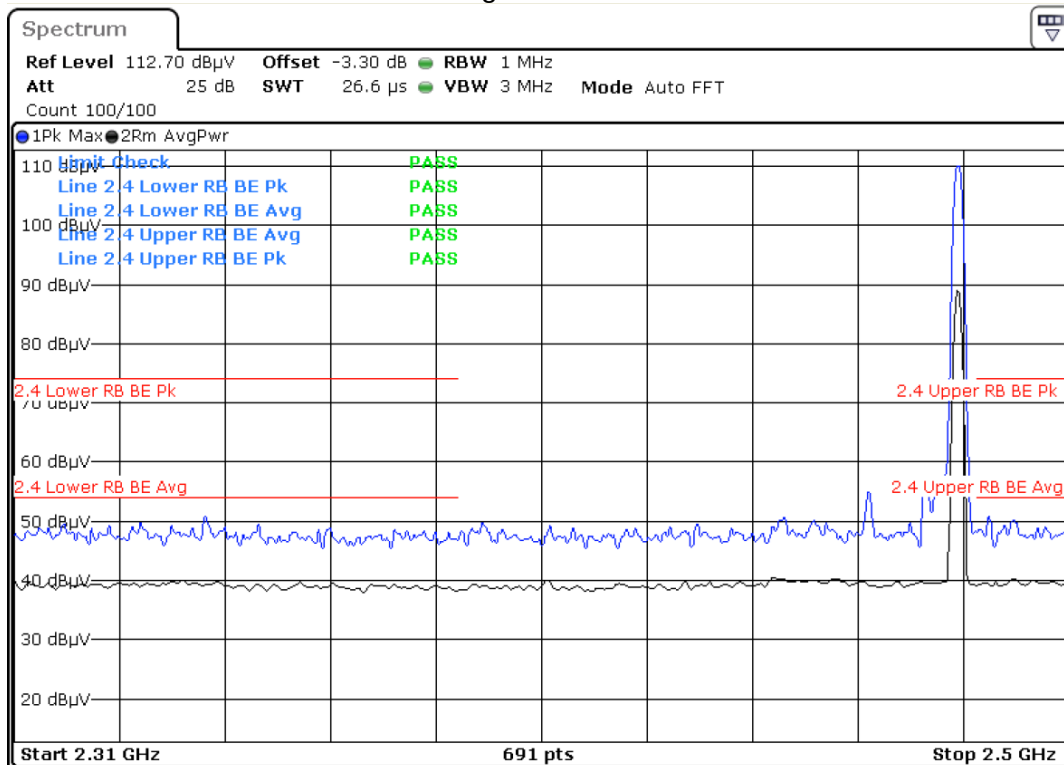
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
ATTENUATOR, 3DB	BW-S3W2	MINI-CIRCUITS	15019	7-Oct-2021	7-Oct-2022
RF CABLE	SF102	HUBER & SUHNER	B079823	9-Sep-2021	9-Sep-2022
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Jan-2022	4-Jan-2024

4.5 Test Data – Restricted Band Edges

Low Channel



High Channel



5 Conducted Emissions

5.1 Test Result

Test Description	Test Specification	Test Result
Conducted Emissions	RSS-GEN ANSI C63.4:2014	Compliant

5.2 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	Limits (dBμV)
0.15 to 0.5 MHz	Quasi-Peak 66 to 56 / Average 56 to 46
0.5 to 5 MHz	Quasi-Peak 56 / Average 46
5 to 30 MHz	Quasi-Peak 60 / Average 50

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.8 °C

Relative Humidity: 35.2 %

Atmospheric Pressure: 97.9 kPa

5.4 Test Equipment

Test End Date: 1/28/2022

Tester: JOP

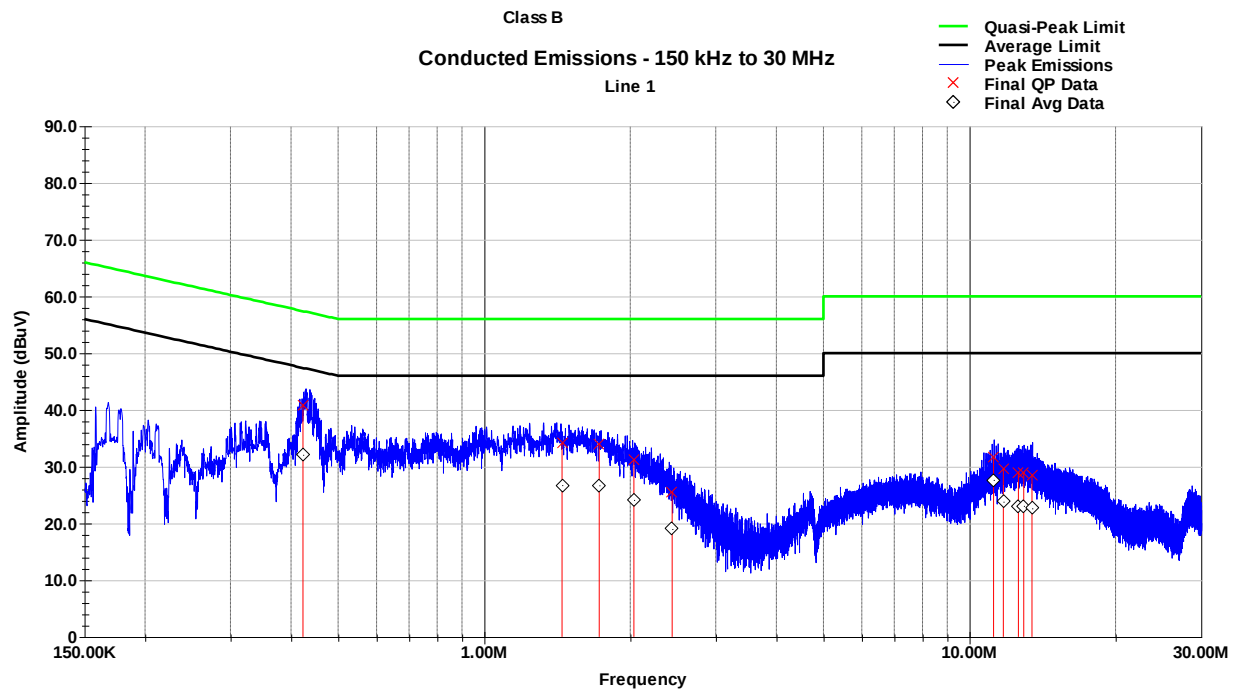
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF CABLE	UC-N-MM-78	MAURY MICROWAVE	17016	25-Aug-2021	25-Aug-2022
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	21-Jun-2021	21-Jun-2022
LINE IMPEDANCE STABILIZATION	NNB 51	TESEQ	B085882	21-Apr-2021	21-Apr-2022

Software:

TILE! software profile "Conducted Emissions T7 210216" dated 16 February 2021

5.5 Test Data

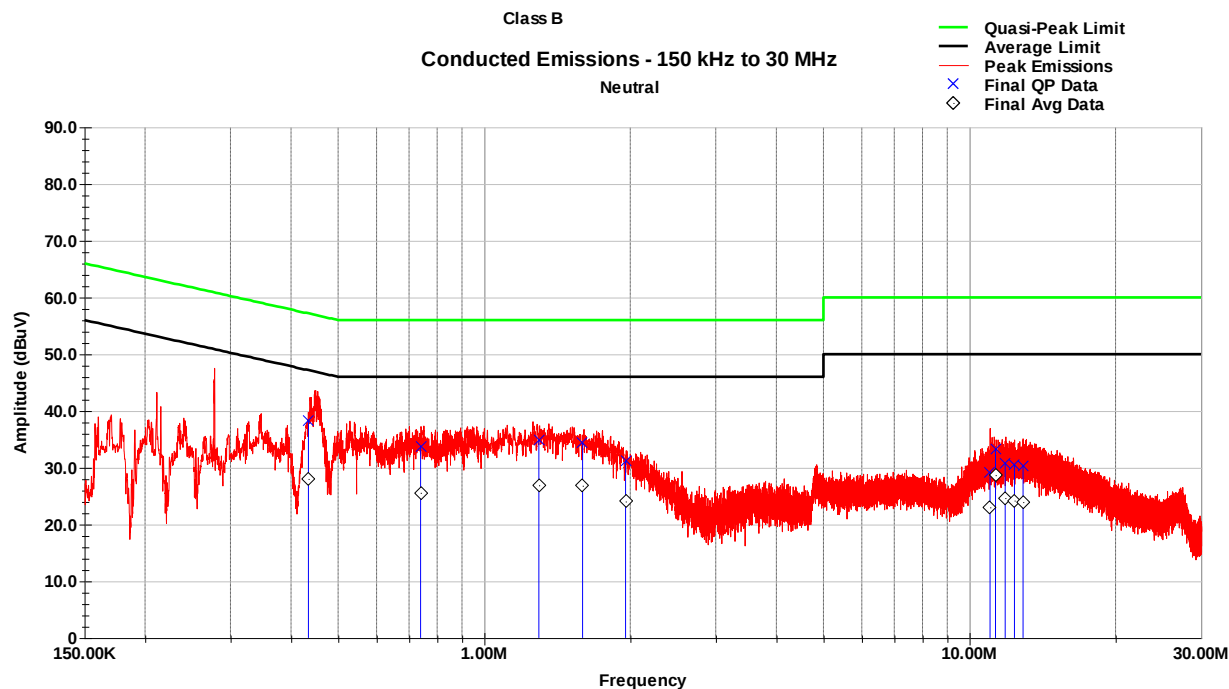
Line 1 Conducted Emissions – Peak Plot



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
0.423	40.8	57.3	-16.6	32.1	47.3	-15.2
1.447	34.1	56.0	-21.9	26.8	46.0	-19.2
1.726	34.0	56.0	-22.0	26.7	46.0	-19.3
2.034	31.3	56.0	-24.7	24.1	46.0	-21.9
2.440	25.5	56.0	-30.5	19.0	46.0	-27.0
11.208	31.6	60.0	-28.4	27.7	50.0	-22.3
11.742	29.7	60.0	-30.3	23.8	50.0	-26.2
12.617	29.0	60.0	-31.0	23.0	50.0	-27.0
12.934	29.0	60.0	-31.0	23.1	50.0	-26.9
13.457	28.5	60.0	-31.5	22.7	50.0	-27.3

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
0.434	38.4	57.2	-18.8	28.0	47.2	-19.2
0.739	33.8	56.0	-22.2	25.6	46.0	-20.4
1.296	34.8	56.0	-21.2	26.9	46.0	-19.1
1.595	34.4	56.0	-21.6	26.8	46.0	-19.2
1.956	31.1	56.0	-24.9	24.1	46.0	-21.9
11.024	29.2	60.0	-30.8	23.0	50.0	-27.0
11.315	33.3	60.0	-26.7	28.7	50.0	-21.3
11.848	30.7	60.0	-29.3	24.7	50.0	-25.3
12.380	30.5	60.0	-29.5	24.2	50.0	-25.8
12.895	30.4	60.0	-29.6	24.0	50.0	-26.0

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 %	$\pm 3.5\%$
DC and low frequency voltages	± 3 %	$\pm 0.4\%$

7 Revision History

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