RF Test Report

Project Number: 4538164

Report Number: 4538164EMC04 **Revision Level:** 0

Client: Atlas Populi (Private) Limited

Equipment Under Test: LRNHEL Module

Model: LRNHEL

Contains FCC ID: 2AC7Z-ESPWROOM32D

Contains FCC ID: 2AURCLRNHEL

Contains IC: 21098-ESPWROOM32D

Contains IC: 6514A-RN2903

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

Report issued on: 16 January 2020

Test Result: Compliant

Tested by: Christopher O'Steen, EMC Technician

Reviewed by: Aaron S. Froehlich, EMC Test Engineer

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.

Table of Contents

1 Summary of Test Results

Test Description	Test Specification		Test Result
Radiated Spurious Emissions	§15.205, §15.209	RSS-GEN 8.9, 8.10	Compliant

1.1 *Modifications Required for Compliance*

None

2 General Information

2.1 *Client Information*

Name:	Atlas Populi (Private) Limited
Address:	281, 2nd Floor, R. A. De Mel Mawatha
City, State, Zip, Country:	Colombo 03, 00300, Sri Lanka

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

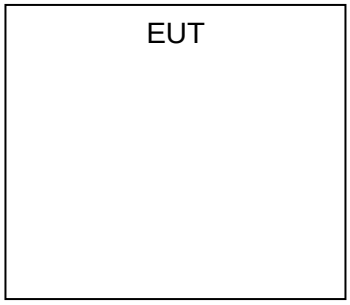
2.3 *General Information of EUT*

Product Marketing Name (PMN):	LRNHEL Module
Model Number (HVIN):	LRNHEL
Serial Number:	Not labeled
Module 1 FCC ID:	2AURCLRNHEL
Module1 Frequency Range:	902.3-927.5 MHz
Module 1 Modulation:	FSK (LoRa)
Module 1 Antenna Type:	Copper Spring (PCB mounted)
Module 1 Antenna Gain:	2.15 dBi
Module 2 FCC ID:	2AC7Z-ESPWROOM32D
Module2 Frequency Range:	2412-2462 MHz
Module 2 Modulation:	802.11 b DSSS 802.11 g/n HT20/HT40 OFDM
Module 2 Antenna Type:	Internal Trace
Module 2 Antenna Gain:	3.7 dBi
Rated Voltage:	3.7VDC
Test Voltage:	3.7VDC
Sample Received Date:	10/20/2019
Dates of testing:	10/28/2019

2.4 *Operating Modes and Conditions*

Traffic was achieved by pinging through Netgear and a laptop.

2.5 *EUT Connection Block Diagram – Radiated Measurements*



2.6 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Atlas Populi (Private) Limited	LRNHEL Module	LRNHEL	Not labeled

3 Field Strength of Spurious Radiation

3.1 *Test Result*

Test Description	Test Specification		Test Result
Spurious Emissions	15.205 and 15.209	RSS-GEN S8.10	Compliant

3.2 *Test Method*

The measurement methods defined in ANSI C63.10 method of clause 6.3, 6.5, and 6.6 were used. The integral antenna was connected during test. The HPF filter was utilized to suppress the fundamental in measurements above 3 GHz for WLAN, and 900MHz for LoRa.

The device was hopping across available channels during testing in normal mode. Worst-case mode was determined to be Basic Rate with DH5 packet type.

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 meter

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*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	22.5 °C
Relative Humidity:	48.2 %
Atmospheric Pressure:	97.4 kPa

3.4 *Test Equipment*

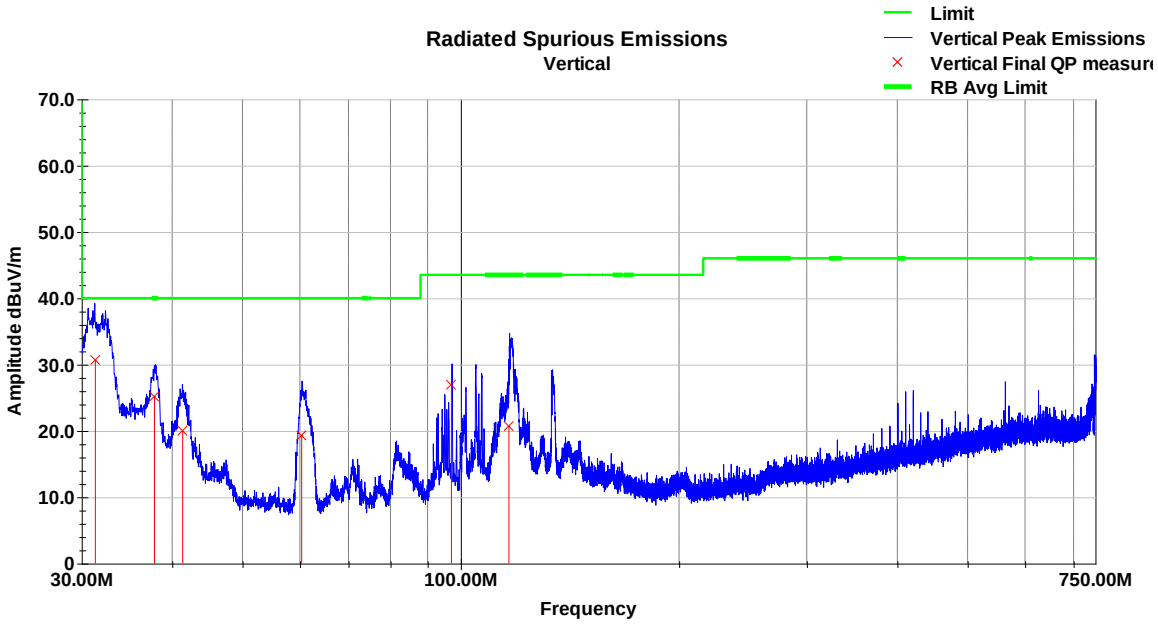
Test End Date: 15-Jan-2020 Tester: CBO

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	1-Aug-2020
ANTENNA, BILOG	JB6	SUNOL	B079690	11-Dec-2020
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	7-Jan-2021
RF CABLE	SUCOFLEX 100	Huber & Suhner	B108523	5-Sep-2020
ANTENNA, DRG HORN (MEDIUM)	3117	ETS Lindgren	B079691	10-Aug-2020
FILTER, HIGH PASS (>2800MHZ)	HPM50111	MICRO-TRONICS	B085747	7-Sep-2020
ANTENNA, HORN (SMALL)	LB-180400-20-C-KF	A-INFO	15007	30-Mar-2020
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	7-Oct-2020
RF Cable SMA	HULL150A-29P-29P-36	HASCO COMPONENTS	19101	14-Sep-2020
RF CABLE N/Male-Male	SUCOTEST 18	HUBER & SUHNER	19002	8-Mar-2020
RF Cable, SMA to N	LL142	CentricRF	19011	21-Mar-2021

Note: The equipment calibration period is 1 year.

3.5 *Test Data – Peak Plots*

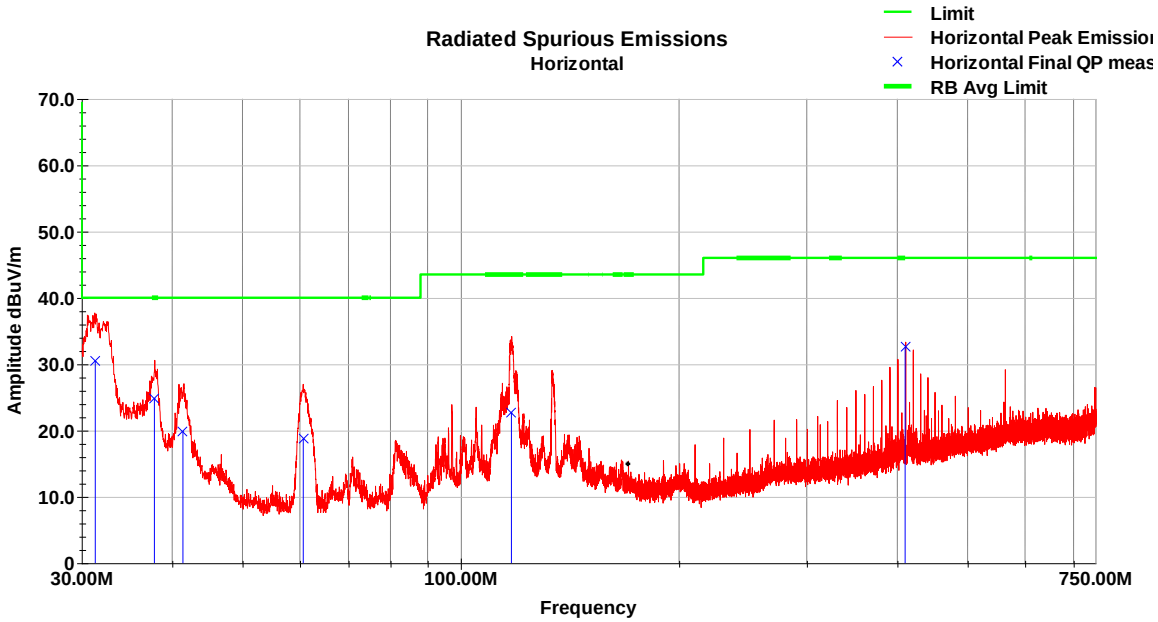
Vertical (30-750MHz)



Vertical Data

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
31.34	38.2	V	306.0	140.0	21.1	0.6	29.2	30.6	40.0	-9.4
37.81	39.4	V	145.0	216.0	16.0	0.6	30.9	25.2	40.0	-14.8
41.35	37.7	V	290.0	217.0	13.5	0.7	31.7	20.0	40.0	-20.0
60.34	45.1	V	143.0	240.0	7.4	0.8	33.9	19.4	40.0	-20.6
97.08	50.2	V	69.0	100.0	9.5	1.1	33.9	26.9	43.5	-16.6
116.52	40.3	V	185.0	227.0	13.4	1.2	34.0	20.7	43.5	-22.8
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

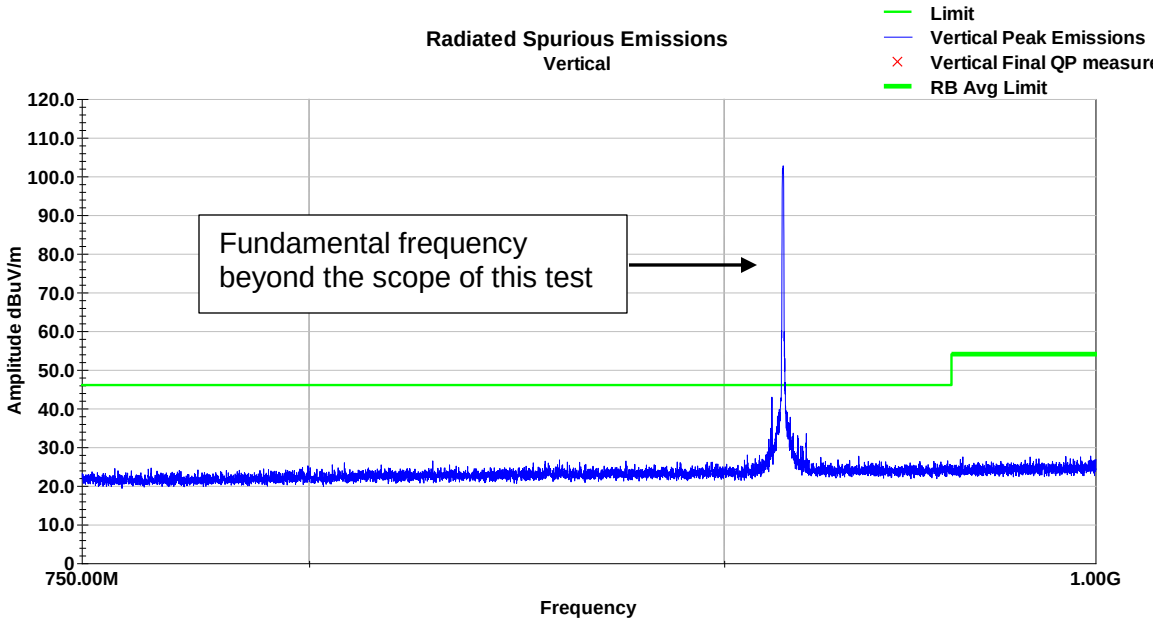
Horizontal (30-750MHz)



Horizontal Data

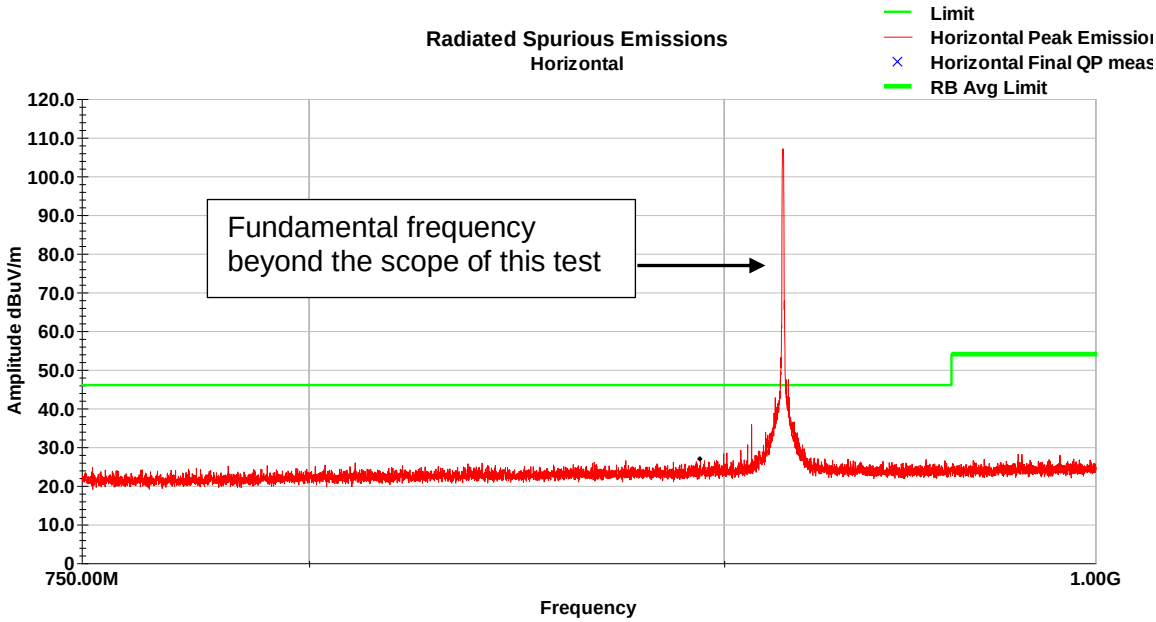
Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
31.33	38.1	H	298.0	113.0	21.1	0.6	29.2	30.5	40.0	-9.5
37.81	39.0	H	187.0	162.0	16.1	0.6	30.9	24.9	40.0	-15.1
41.39	37.5	H	238.0	187.0	13.4	0.7	31.8	19.9	40.0	-20.1
60.65	44.5	H	337.0	100.0	7.4	0.8	33.9	18.8	40.0	-21.2
117.45	42.1	H	346.0	211.0	13.4	1.2	34.0	22.7	43.5	-20.8
409.99	48.9	H	15.0	100.0	16.5	2.2	35.0	32.6	46.0	-13.5
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Vertical (750MHz-1000MHz)



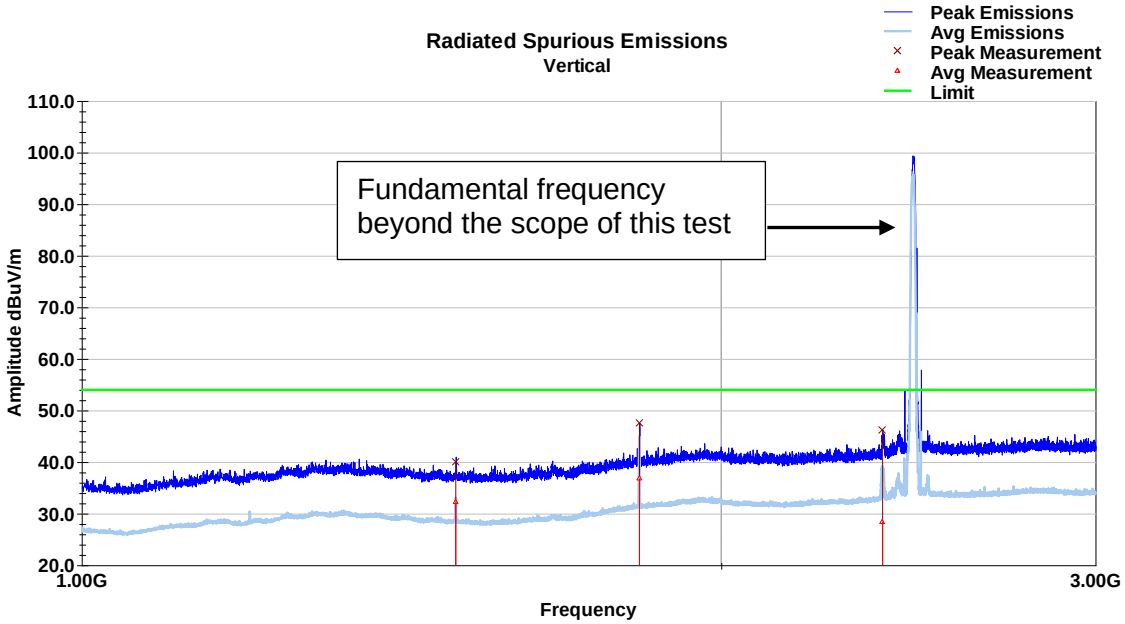
Vertical Data
No measurable harmonics found.

Horizontal (750MHz-1000MHz))



Horizontal Data
No measurable harmonics found.

Vertical (1-3GHz)



Vertical Data

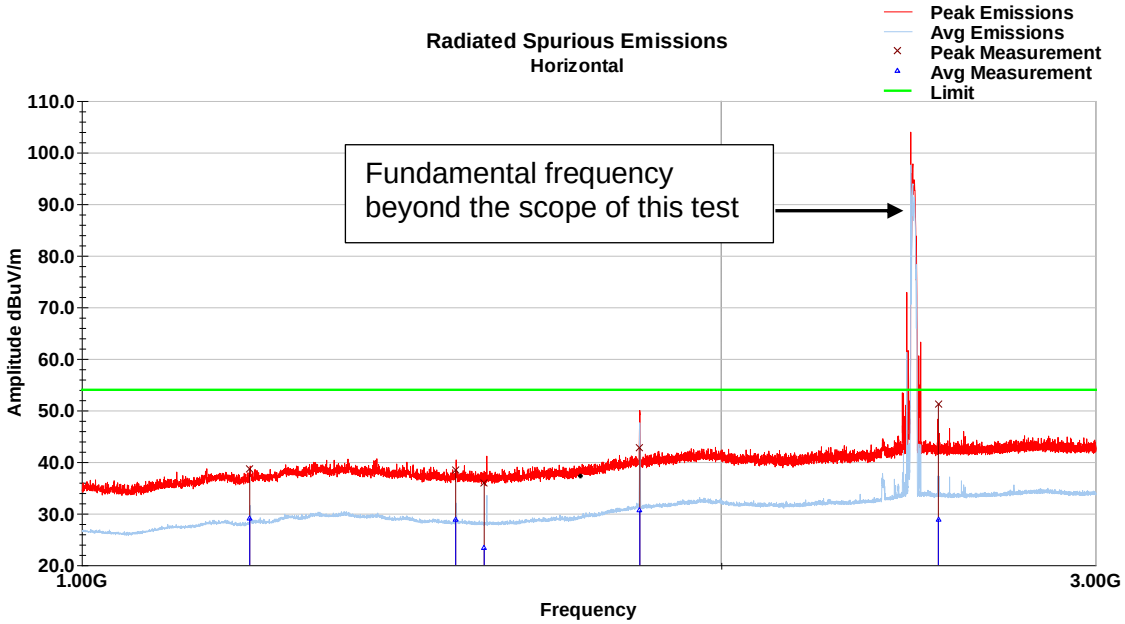
Peak

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
1500.08	45.6	V	236.0	186.0	28.3	1.3	35.0	40.1	74.0	-33.9
1830.40	50.1	V	65.0	214.0	31.0	1.4	35.0	47.5	74.0	-26.5
2382.44	47.4	V	7.0	147.0	32.0	1.6	34.9	46.2	74.0	-27.8
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Average

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)
1500.08	37.8	V	236.0	186.0	28.3	1.3	35.0	32.3	54.0	-21.6
1830.40	39.4	V	65.0	214.0	31.0	1.4	35.0	36.8	54.0	-17.2
2382.44	29.6	V	7.0	147.0	32.0	1.6	34.9	28.4	54.0	-25.6
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Horizontal (1-3GHz)



Horizontal Data

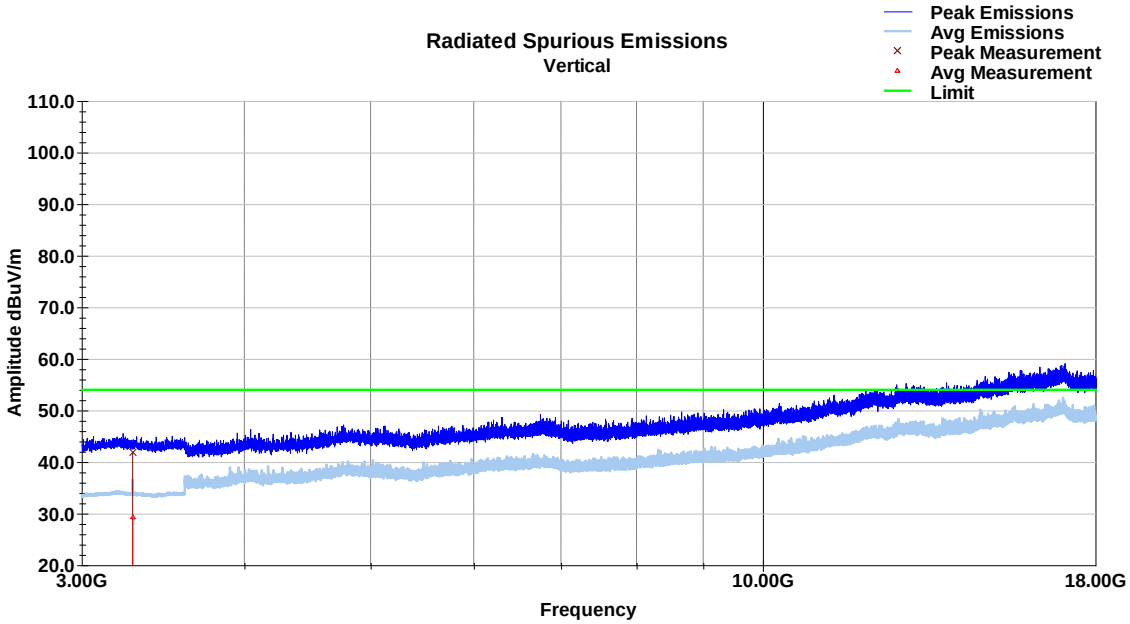
Peak

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
1199.84	44.1	H	352.0	108.0	28.5	1.1	35.0	38.7	74.0	-35.3
1499.96	43.9	H	351.0	249.0	28.3	1.3	35.0	38.4	74.0	-35.6
1546.96	41.6	H	160.0	175.0	28.0	1.3	35.0	35.9	74.0	-38.1
1831.24	45.2	H	133.0	207.0	31.0	1.4	35.0	42.7	74.0	-31.3
2530.64	51.8	H	172.0	238.0	32.5	1.7	34.8	51.2	74.0	-22.8
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Average

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)
1199.84	34.5	H	352.0	108.0	28.5	1.1	35.0	29.1	54.0	-24.9
1499.96	34.4	H	351.0	249.0	28.3	1.3	35.0	28.9	54.0	-25.0
1546.96	29.0	H	160.0	175.0	28.0	1.3	35.0	23.3	54.0	-30.7
1831.24	33.2	H	133.0	207.0	31.0	1.4	35.0	30.6	54.0	-23.4
2530.64	29.5	H	172.0	238.0	32.5	1.7	34.8	28.9	54.0	-25.0
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Vertical (3-18GHz)



Vertical Data

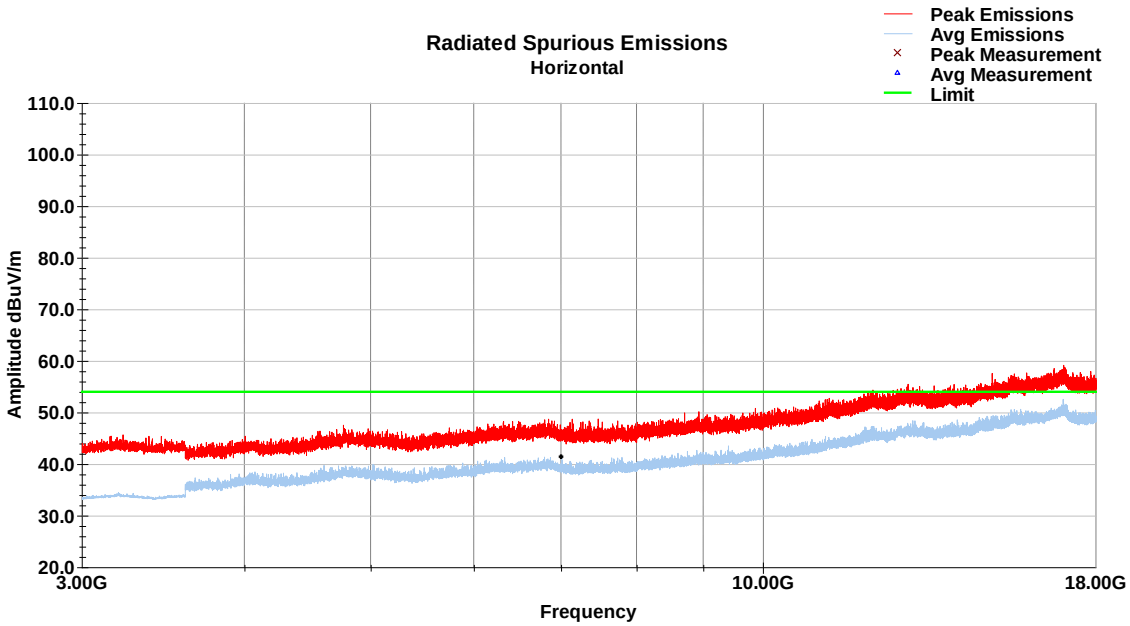
Peak

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
3283.62	41.8	V	250.0	175.0	33.0	2.0	34.9	41.9	74.0	-32.1
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Average

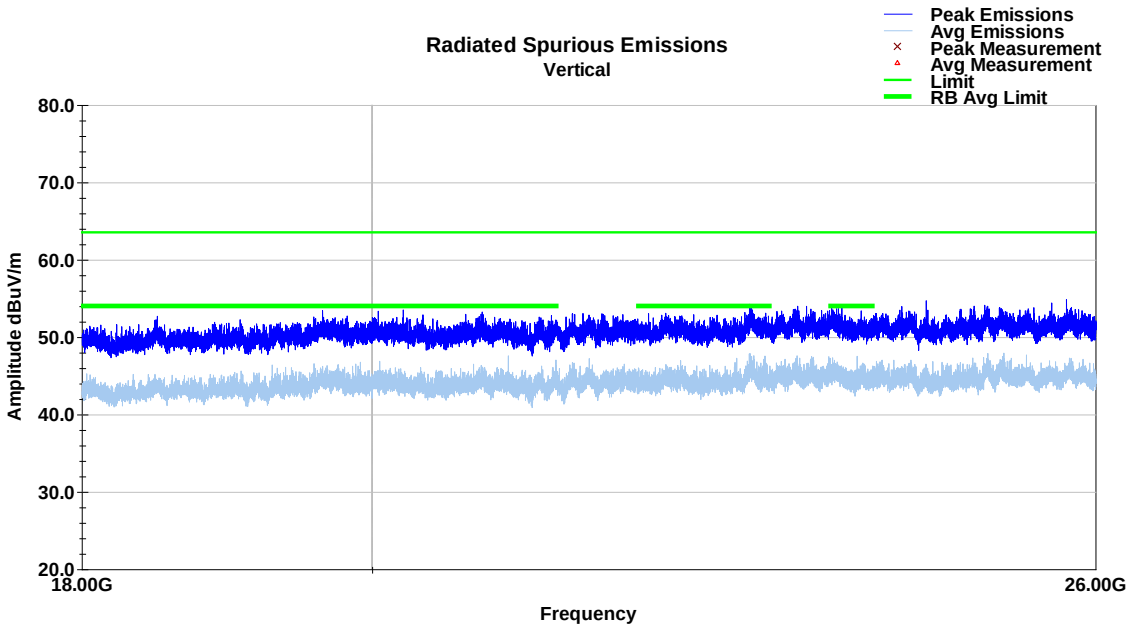
Frequency MHz	Raw Avg dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	Final Avg dBuV/m	Limit (dBuV/m)	Margin (dB)
3283.62	29.2	V	250.0	175.0	33.0	2.0	34.9	29.4	54.0	-24.6
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Horizontal (3-18GHz)



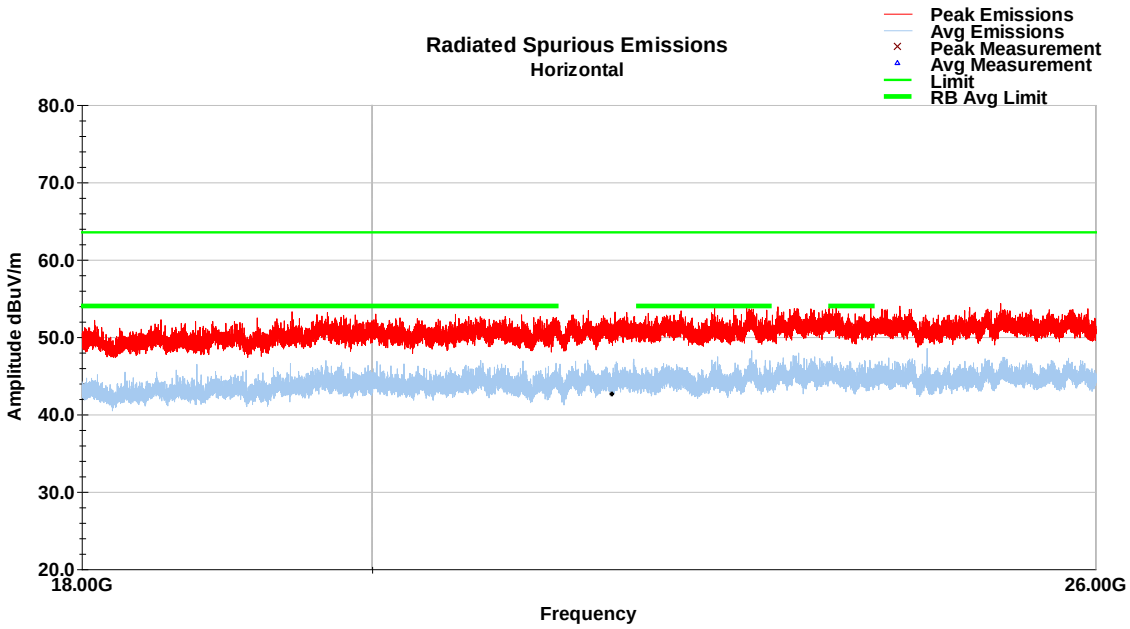
Horizontal Data
No measurable harmonics found.

Vertical (18-26GHz)



Vertical Data
No measurable harmonics found.

Horizontal (18-26GHz)



Horizontal Data
No measurable harmonics found.

4 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	16 January 2020