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FCC RF Test Report

Test Report Number	GLS-20043022-LC-FCC-RF-5000-R2
FCC ID	2AVTI-INPX5000
Applicant	Inpixon
Applicant Address	2479 E Bayshore Rd, Ste 195, Palo Alto, CA 94303
Product Name	Inpixon 5000
Model (s)	INPX-5000
Date of Receipt	05/14/2020
Date of Test	05/14/2020-06/03/2020
Report Issue Date	08/11/2020
Test Standards	47 CFR Part 15 Subpart F
Test Result	**PASS**

Issued by:

Vista Compliance Laboratories
1261 Puerta Del Sol, San Clemente, CA 92673 USA
www.vista-compliance.com

Daniel Bruno (Test Technician)

David Zhang (Technical Manager)

REVISION HISTORY

Report Number	Version	Description	Issued Date
GLS-20043022-LC-FCC-RF-5000	01	Initial report	06/23/2020
GLS-20043022-LC-FCC-RF-5000-R1	R1	Update FCC ID	07/01/2020
GLS-20043022-LC-FCC-RF-5000-R2	R2	Update FCC ID	08/11/2020

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1 Test Summary

Test Item	Test Requirement	Test Method	Result
Antenna Requirement	47 CFR Part 15.203	ANSI C63.10: 2013	Pass
UWB Bandwidth	47 CFR Part 15.503 (a), (d), 15.517 (b)	ANSI C63.10: 2013	Pass
Radiated Emission below 960MHz	47 CFR Part 15.209	ANSI C63.10: 2013	Pass
Radiated Emission above 960MHz	47 CFR Part 15.517 (c), 15.521 (d)	ANSI C63.10: 2013	Pass
Radiated Emission in GPS Bands	47 CFR Part 15.517 (d)	ANSI C63.10: 2013	Pass
Peak Emission in a 50MHz Bandwidth	47 CFR Part 15.517 (e), 15.521 (g)	ANSI C63.10: 2013	Pass
Conducted Emission	47 CFR Part 15.207	ANSI C63.10: 2013	Pass
RF Exposure	47 CFR Part 1.1310	OET Bulletin 65 FCC 447498 D01	Pass

2 General Information

2.1 Applicant

Applicant	Inpixon
Applicant address	2479 E Bayshore Rd, Ste 195, Palo Alto, CA 94303
Manufacturer	Inpixon
Manufacturer Address	2479 E Bayshore Rd, Ste 195, Palo Alto, CA 94303

2.2 Product information

Product Name	Inpixon 5000
Product Description	Inpixon 5000
Model Number	INPX-5000
Family Models	N/A
Serial Number	N/A
Frequency Band	UWB: 3240-4830MHz, 6215-7000MHz
Type of modulation	Pulse Modulation
Equipment Class	UWB
Antenna Information	Ultra-Wideband (UWB) Flex Antenna, P/N: FXUWB20
Clock Frequencies	N/A
Input Power	12VDC, PoE
Power Adapter Manufacturer/Model	EDACPower / EA1024PR 100-240VAC, 1.0A, 50-60Hz
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Simultaneous Transmission	N/A
Additional Info	EMC Emission Class B, DC input port, PoE port

2.3 Test standard and method

Test standard	47 CFR Part 15 Subpart F
Test method	ANSI C63.10: 2013

3 Test Site Information

Lab performing tests	Vista Laboratories, Inc.
Lab Address	1261 Puerta Del Sol, San Clemente, CA 92673 USA
Phone Number	+1 (949) 393-1123
Website	www.vista-compliance.com

Test Condition	Temperature	Humidity	Atmospheric Pressure
RF Testing	23.5°C	58.2%	996 mbar
Radiated Emission Testing	23.5°C	58.2%	996 mbar

4 Modification of EUT / Deviations from Standards

N/A

5 Test Configuration and Operation

5.1 EUT Test Configuration

EUT is powered by external 12VDC AC/DC power adapter or through PoE. Python.exe is used to enable EUT radio module to transmit at set channel continuously for testing purpose. For EMC testing, EUT is in normal operational mode.

The following software was used for testing and to monitor EUT performance

Software	Description
EMISoft Vasona	EMC/RF Spurious emission test software used during testing
Python.exe	To set EUT into continuous TX mode under different channel, etc.

5.2 Supporting Equipment

Description	Manufacturer	Model #	Serial #
Laptop	Dell	Latitude E6440	FFF4JC2
AC/DC adapter	EDACPOWER	EA1024PR	192203392
PoE adapter	Microsemi	9001GR/SP	C17296238000000485

6 Uncertainty of Measurement

Test item	Measurement Uncertainty (dB)
RF Output Power (Conducted)	±1.2 dB
Power Spectral Density	±0.9 dB
Unwanted Emission (conducted)	±2.6 dB
Occupied Channel Bandwidth	±5 %
Radiated Emission (9KHz-30MHz)	±3.5 dB
Radiated Emission (30MHz-1GHz)	±4.6 dB
Radiated Emission (1-18GHz)	±4.9 dB
Radiated Emission (18-40GHz)	±3.5 dB

7 Test Results

7.1 Antenna Requirement

7.1.1 Requirement

Per § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

7.1.2 Result

Analysis:

- EUT uses internal antenna with U.FL connector as coupling method. No standard RF connector is used.

Conclusion:

- EUT complies with antenna requirement in § 15.203.

7.2 UWB Bandwidth

7.2.1 Requirement

Per § 15.503

(a) *UWB bandwidth.* For the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated f_H and the lower boundary is designated f_L. The frequency at which the highest radiated emission occurs is designated f_M.

(b) *Center frequency.* The center frequency, f_C, equals $(f_H + f_L)/2$.

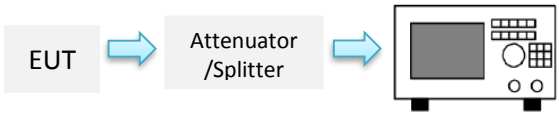
(c) *Fractional bandwidth.* The fractional bandwidth equals $2(f_H - f_L)/ (f_H + f_L)$.

(d) *Ultra-wideband (UWB) transmitter.* An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

Per § 15.517

(b) The UWB bandwidth of a UWB system operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

7.2.2 Test setup



7.2.3 Test Procedure

According to section 10.1 of ANSI C63.10-2013:

The frequency at which the maximum power level is measured with the peak detector is designated fM. The peak power measurements shall be made using a spectrum analyzer or EMI receiver with a 1 MHz resolution bandwidth and a video bandwidth of 1 MHz or greater. The instrument shall be set to peak detection using the maximum-hold trace mode. The outermost 1 MHz segments above and below fM, where the peak power falls by 10 dB relative to the level at fM, are designated as fH and fL, respectively:

a) For the lowest frequency bound f_L, the emission is searched from a frequency lower than f_M that has, by inspection, a peak power much lower than 10 dB less than the power at f_M and increased toward f_M until the peak power indicates 10 dB less than the power at f_M. The frequency of that segment is recorded.

b) This process is repeated for the highest frequency bound f_H, beginning at a frequency higher than f_M that has, by inspection, a peak power much lower than 10 dB below the power at f_M. The frequency of that segment is recorded.

c) The two recorded frequencies represent the highest f_H and lowest f_L bounds of the UWB transmission, and the −10 dB bandwidth (B _ 10) is defined as (f_H _ f_L). The center frequency (f_c) is mathematically determined from (f_H _ f_L) / 2.

d) The fractional bandwidth is defined as $2(f_H$ _ $f_L) / (f_H + f_L)$.

e) Determine whether the _10 dB bandwidth (f_H _ f_L) is ≥500 MHz, or whether the fractional bandwidth $2(f_H$ _ $f_L) / (f_H + f_L)$ is ≥ 0.2.

7.2.4 Test Result

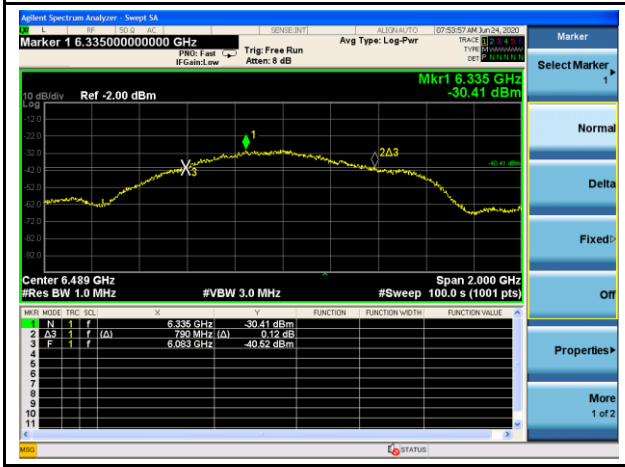
Mode	CH	Fm(MHz)	fL(MHz)	fH(MHz)	fC(MHz)	10 dB Bandwidth (MHz)	Limit (MHz)	Result
UWB	1	3614	3245	3766	3499	521	500	Pass
UWB	3	4661	4218.5	4824.5	4493	606	500	Pass
UWB	5	6457.5	6220.5	6747	6489	526.5	500	Pass
UWB	4	4244	3421	4553	3994	1132	500	Pass
UWB	7	6335	6083	6873	6489	790	500	Pass

10 dB Bandwidth – CH1

10 dB Bandwidth – CH3

10 dB Bandwidth – CH5

10 dB Bandwidth – CH4



10 dB Bandwidth – CH7

7.3 Radiated Emission below 960MHz

7.3.1 Requirement

Per § 15.209

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

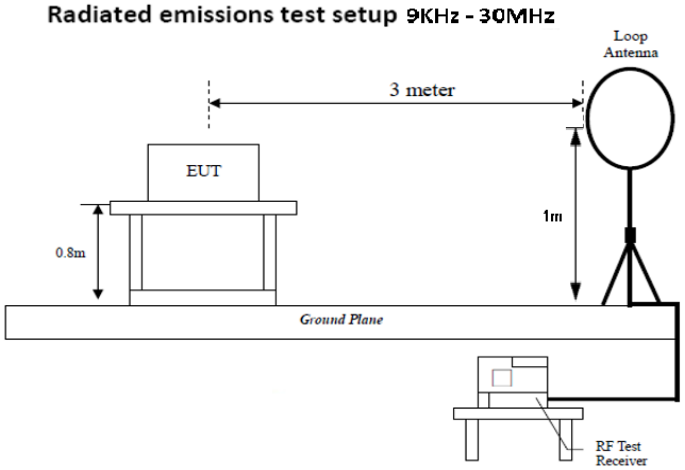
Frequency Range (MHZ)	Field Strength (μV/m)
0.009~0.490	2400/F(KHz)
0.490~1.705	24000/F(KHz)
1.705~30.0	30
30 – 88	100
88 – 216	150
216 – 960	200

Per § 15.517

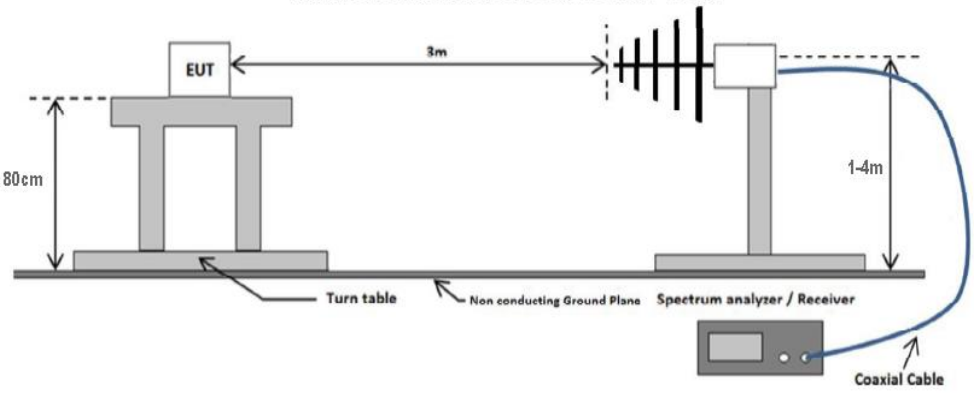
(c) The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209.

7.3.2 Test setup

Radiated emissions test setup 9KHz - 30MHz



Radiated emissions test setup 30 MHz - 1 GHz



7.3.3 Test Procedure

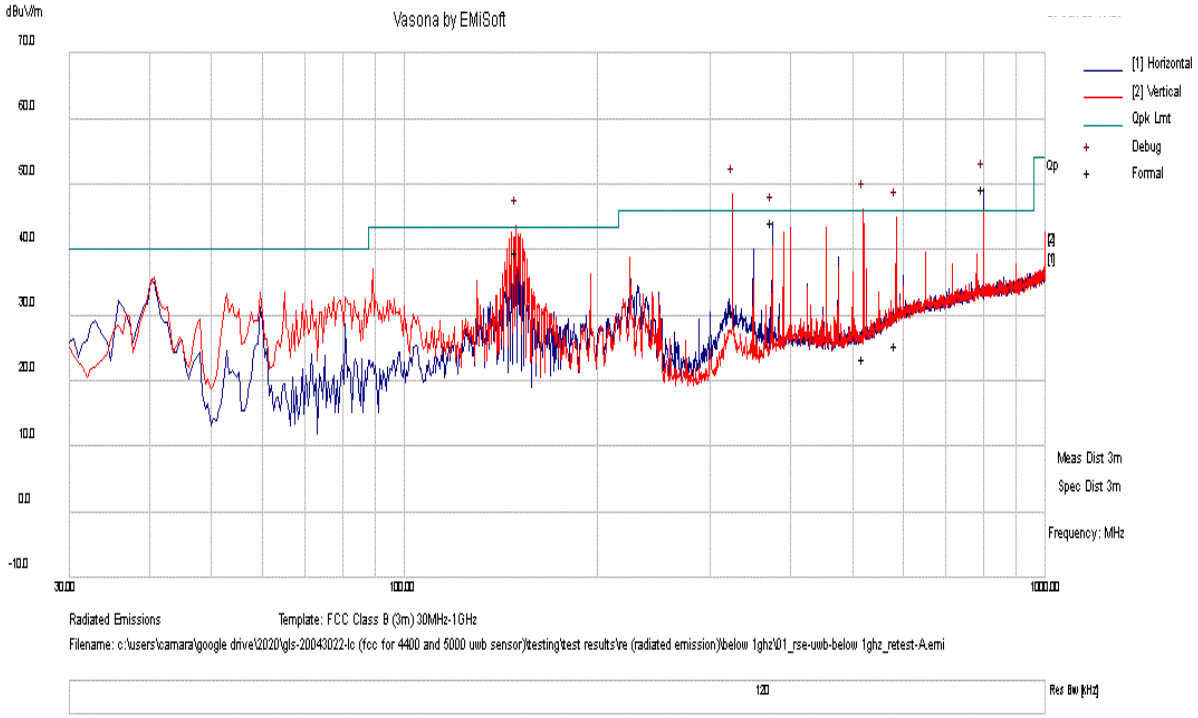
According to section 10.2 and section 6.5 in Radiated spurious emission measurements procedure below 960 MHz in ANSI C63.10-2013. Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.
4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz – 30MHz.
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency between 30MHz - 1GHz.
6. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
7. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

7.3.4 Test Result

RADIATED EMISSIONS BELOW 960 MHZ

Test Standard:	§ 15.209	Mode:	Normal operational
Frequency Range:	30 MHz – 960MHz	Test Date:	05/14/2020-06/03/2020
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	David Zhang
Remark:	With AC/DC adapter	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
800.03	49.10	7.20	-7.00	45.20	Quasi Max	H	182	221	46	-0.8	Pass
325.01	41.80	5.90	-17.10	30.50	Quasi Max	V	164	0	46	-15.5	Pass
149.29	57.90	4.20	-22.30	39.80	Quasi Max	V	110	104	43.5	-3.7	Pass
520.00	29.20	6.30	-12.10	23.40	Quasi Max	V	217	360	46	-22.6	Pass
585.37	28.80	7.00	-10.40	25.50	Quasi Max	V	202	218	46	-20.5	Pass
375.02	52.60	6.20	-14.40	44.40	Quasi Max	H	183	218	46	-1.6	Pass

Radiated Emission between 9KHz – 30MHz test result

Note: no substantial emission is found other than the noise floor. Different modes have been verified.

7.4 Radiated Spurious Emissions above 960 MHz

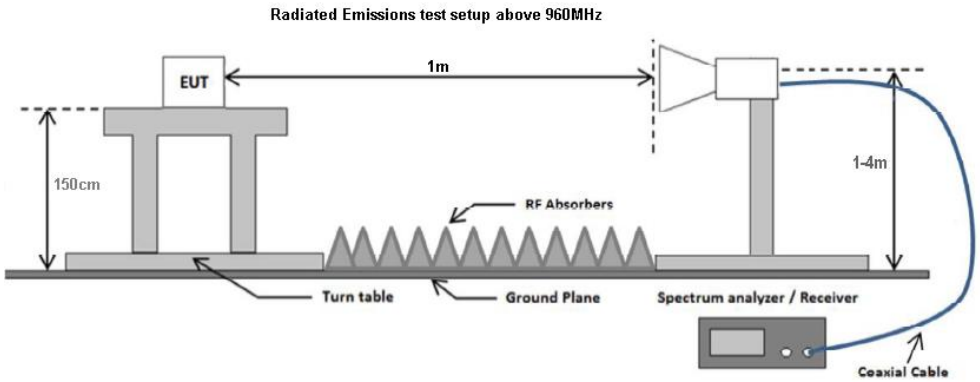
7.4.1 Requirement

§ 15.209, 15.517 (c), 15.521 (d)

The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency Range (MHZ)	EIRP in dBm	EIRP at 3 meter (dBuV/m)
960-1610	−75.3	19.9
1610-1990	−53.3	41.9
1990-3100	−51.3	43.9
3100-10600	−41.3	53.9
Above 10600	−51.3	43.9

7.4.2 Test Setup



7.4.3 Test Procedure

Setting:

Frequency Range: 960MHz to 40GHz

Measurement distance: 1m distance

Spectrum analyzer RBW: 1MHz

Spectrum analyser VBW: 10MHz

Detector Function: Peak for peak emission and RMS for average emission

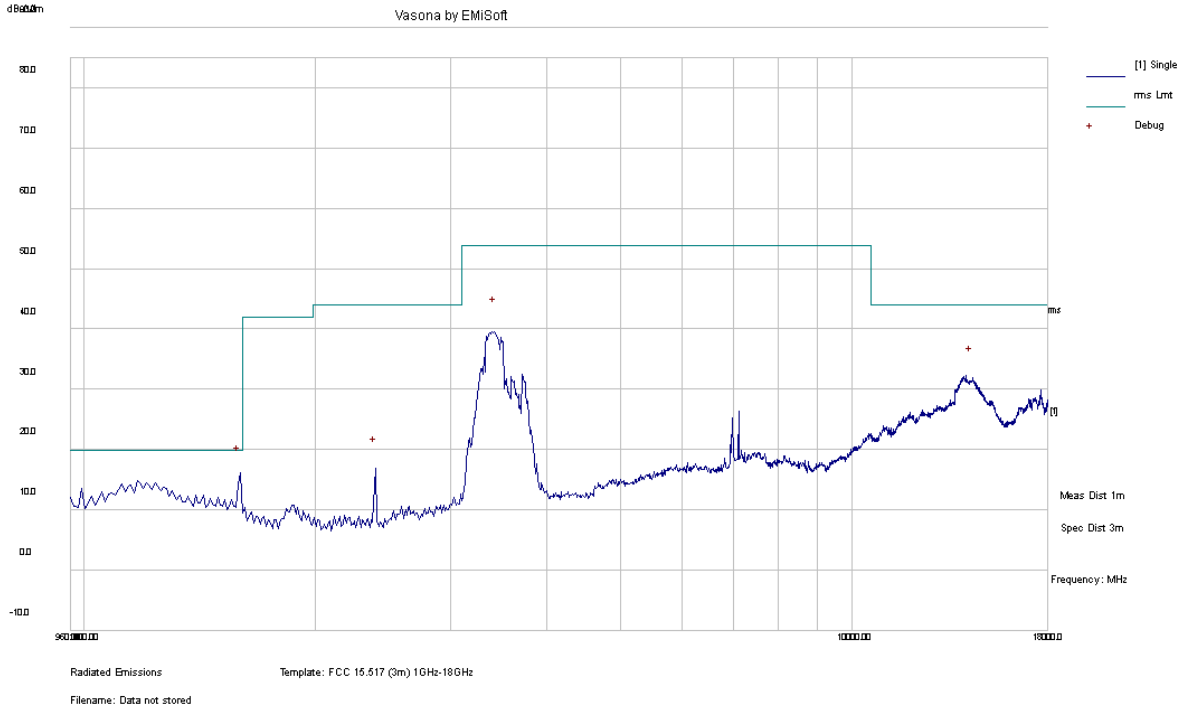
1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission. All X, Y and Z axis are evaluated.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

Note: Actual measurement distance is 1-meter distance and the result is corrected to 3m distance to compare to the 3m distance EIRP limit.

7.4.4 Test Result

RADIATED EMISSIONS ABOVE 960 MHZ

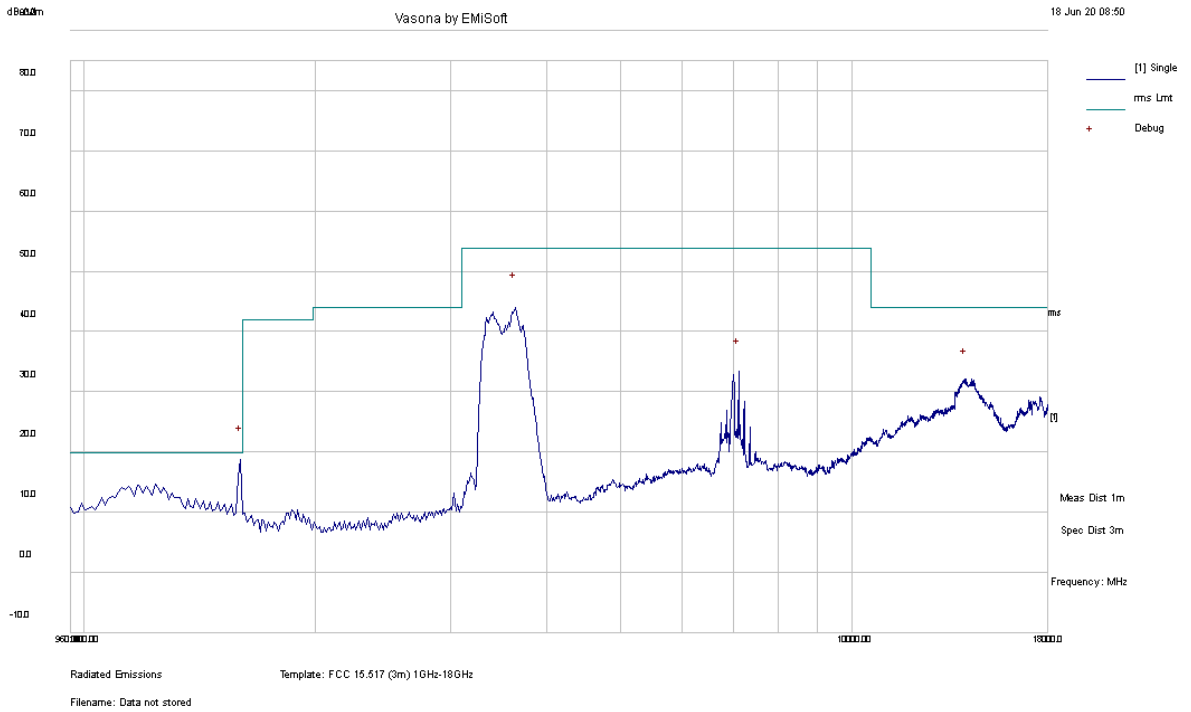
Test Standard:	FCC Part 15F	Mode:	CH1 - Horizontal
Frequency Range:	30 MHz – 960MHz	Test Date:	05/14/2020-06/03/2020
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Limit dBuV/m	Margin dB	Pass/Fail
3420.718	48.91	5.81	-15.23	39.5	RMS	H	53.9	-14.4	Pass
2395.784	30.47	4.83	-18.98	16.32	RMS	H	43.9	-27.58	Pass
1591.71	28.95	4.45	-18.53	14.88	RMS	H	19.9	-5.02	Pass
14258.338	18.05	14.3	-1.04	31.31	RMS	H	43.9	-12.59	Pass

RADIATED EMISSIONS ABOVE 960 MHZ

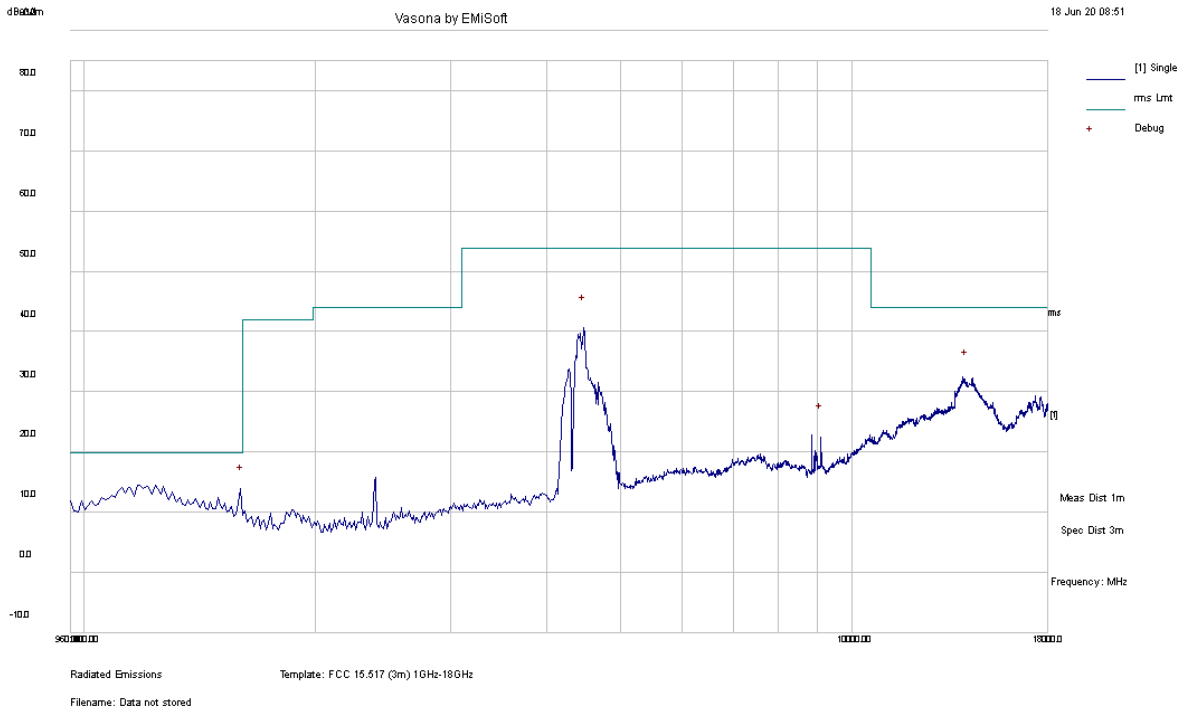
Test Standard:	FCC Part 15F	Mode:	CH1 - Vertical
Frequency Range:	960MHz-18GHz	Test Date:	05/14/2020-06/03/2020
Antenna Type/Polarity:	Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Limit dBuV/m	Margin dB	Pass/Fail
3643.232	52.35	6.05	-14.43	43.97	RMS	V	53.9	-9.93	Pass
7115.966	32.65	8.99	-8.5	33.14	RMS	V	53.9	-20.76	Pass
14030.314	19.24	13.73	-1.52	31.45	RMS	V	43.9	-12.45	Pass
1598.437	32.63	4.45	-18.55	18.53	RMS	V	19.9	-1.37	Pass

RADIATED EMISSIONS ABOVE 960 MHZ

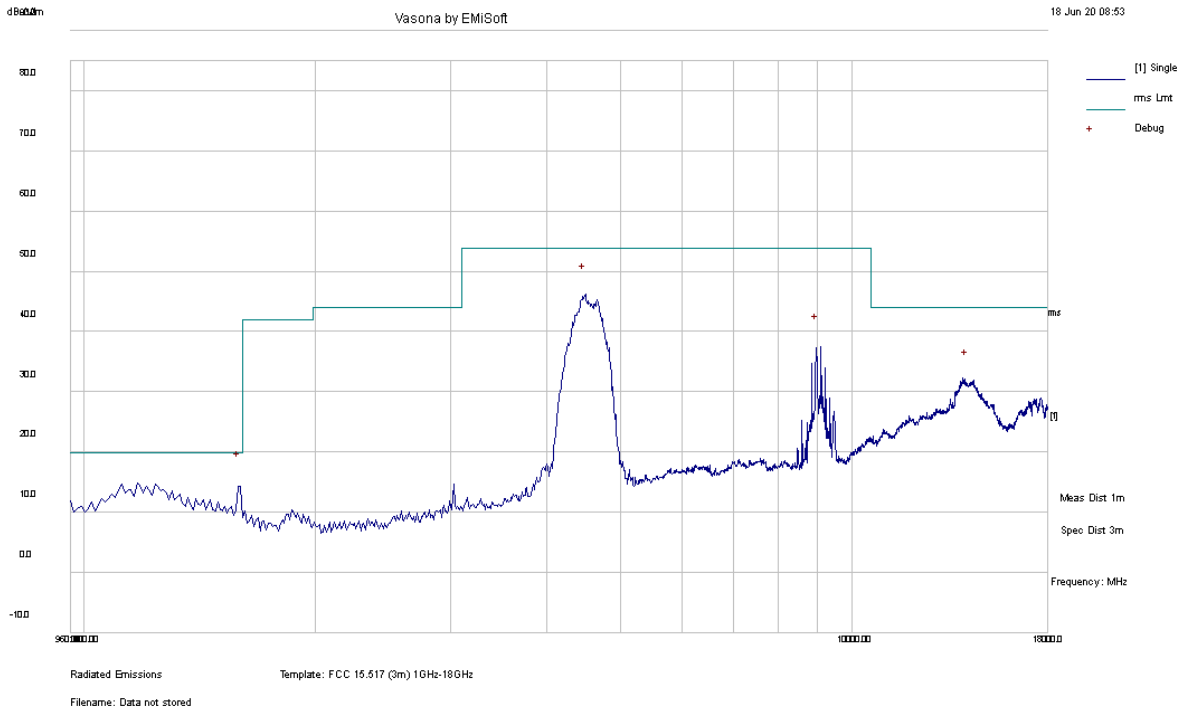
Test Standard:	FCC Part 15F	Mode:	CH3 - Horizontal
Frequency Range:	960MHz-18GHz	Test Date:	05/14/2020-06/03/2020
Antenna Type/Polarity:	Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Limit dBuV/m	Margin dB	Pass/Fail
1603.417	26.22	4.45	-18.58	12.09	RMS	H	19.9	-7.81	Pass
4472.979	46.54	6.78	-13.08	40.23	RMS	H	53.9	-13.67	Pass
9106.938	21.71	10.1	-9.42	22.39	RMS	H	53.9	-31.51	Pass
14071.5	18.82	13.84	-1.44	31.21	RMS	H	43.9	-12.69	Pass

RADIATED EMISSIONS ABOVE 960 MHZ

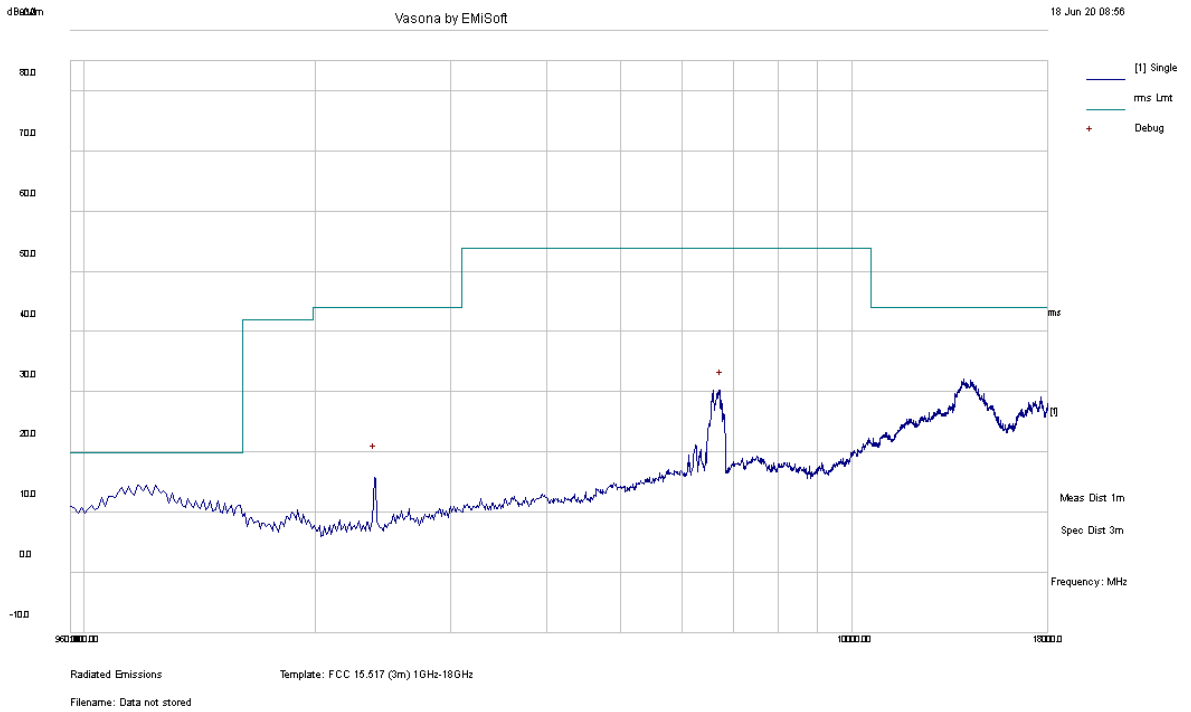
Test Standard:	FCC Part 15F	Mode:	CH3 - Vertical
Frequency Range:	960MHz-18GHz	Test Date:	05/14/2020-06/03/2020
Antenna Type/Polarity:	Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Limit dBuV/m	Margin dB	Pass/Fail
1591.71	28.3	4.45	-18.53	14.23	RMS	V	19.9	-5.67	Pass
4472.979	51.83	6.78	-13.08	45.52	RMS	V	53.9	-8.38	Pass
8989.253	36.47	9.95	-9.2	37.22	RMS	V	53.9	-16.68	Pass
14071.5	18.79	13.84	-1.44	31.18	RMS	V	43.9	-12.72	Pass

RADIATED EMISSIONS ABOVE 960 MHZ

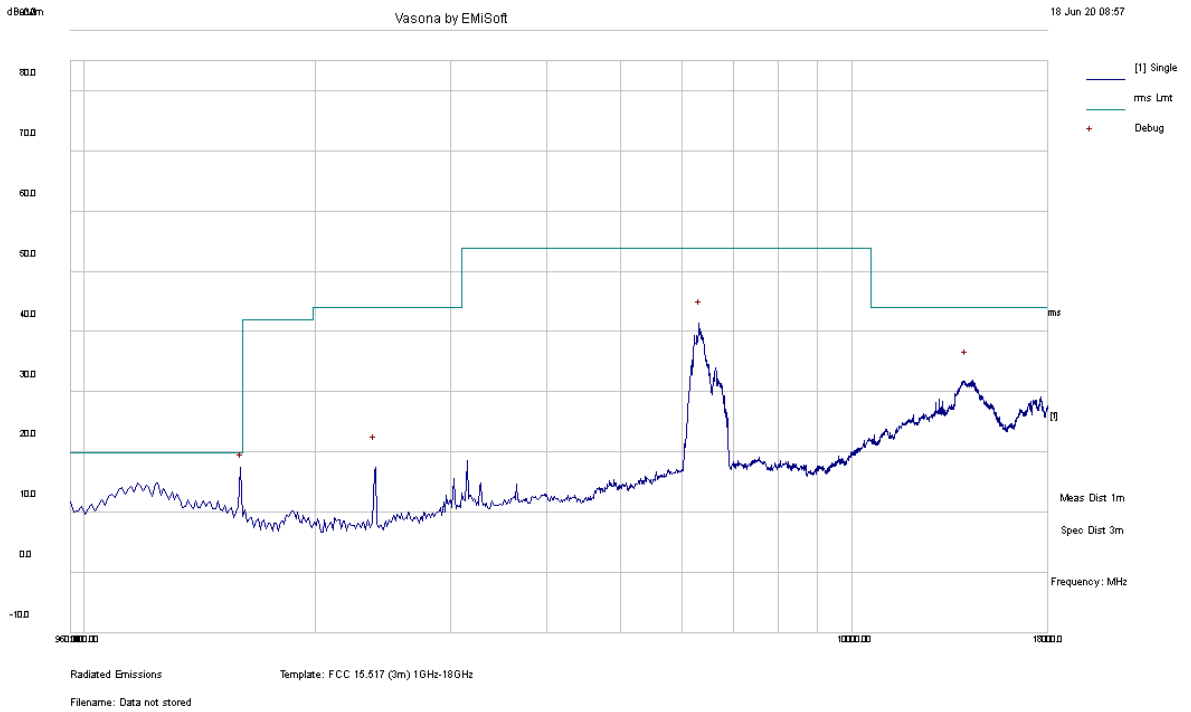
Test Standard:	FCC Part 15F	Mode:	CH5 - Horizontal
Frequency Range:	960MHz-18GHz	Test Date:	05/14/2020-06/03/2020
Antenna Type/Polarity:	Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Limit dBuV/m	Margin dB	Pass/Fail
6752.329	28.3	8.31	-8.75	27.86	RMS	H	53.9	-26.04	Pass
2395.784	29.78	4.83	-18.98	15.63	RMS	H	43.9	-28.27	Pass

RADIATED EMISSIONS ABOVE 960 MHZ

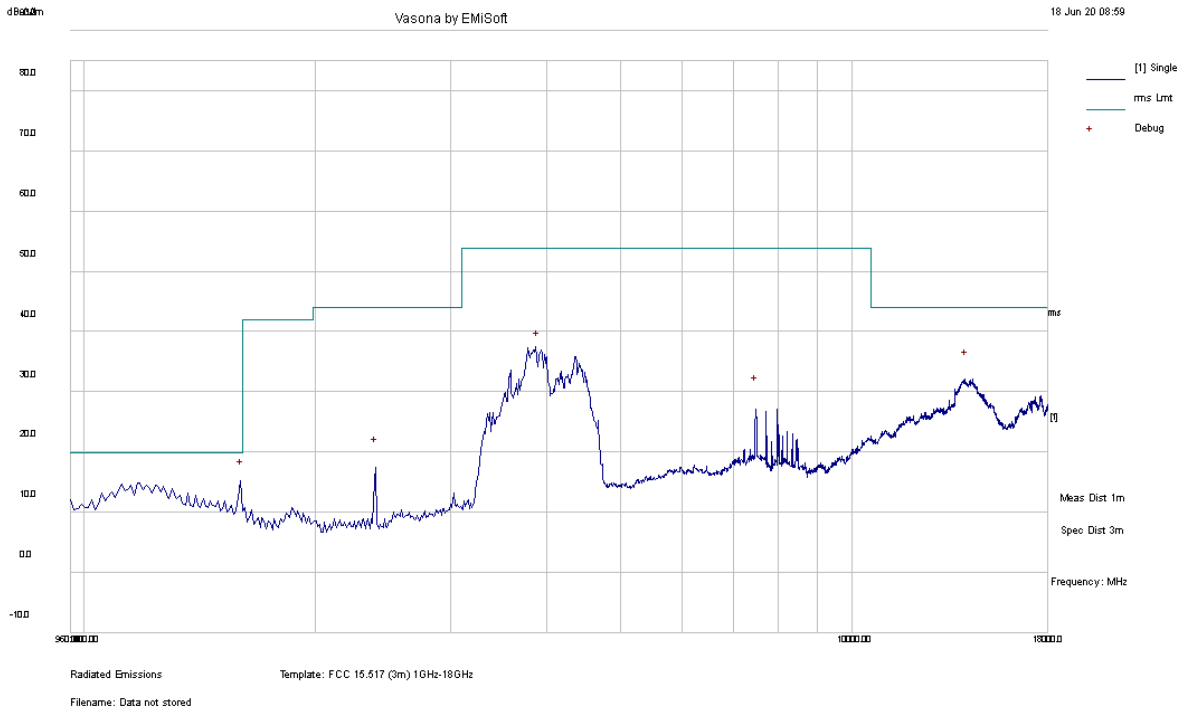
Test Standard:	FCC Part 15F	Mode:	CH5 - Vertical
Frequency Range:	960MHz-18GHz	Test Date:	05/14/2020-06/03/2020
Antenna Type/Polarity:	Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Limit dBuV/m	Margin dB	Pass/Fail
1603.417	28.18	4.45	-18.58	14.05	RMS	V	19.9	-5.85	Pass
2388.772	31.19	4.82	-18.99	17.02	RMS	V	43.9	-26.88	Pass
6339.924	40.8	7.87	-9.02	39.64	RMS	V	53.9	-14.26	Pass
14112.807	18.59	13.94	-1.29	31.23	RMS	V	43.9	-12.67	Pass

RADIATED EMISSIONS ABOVE 960 MHZ

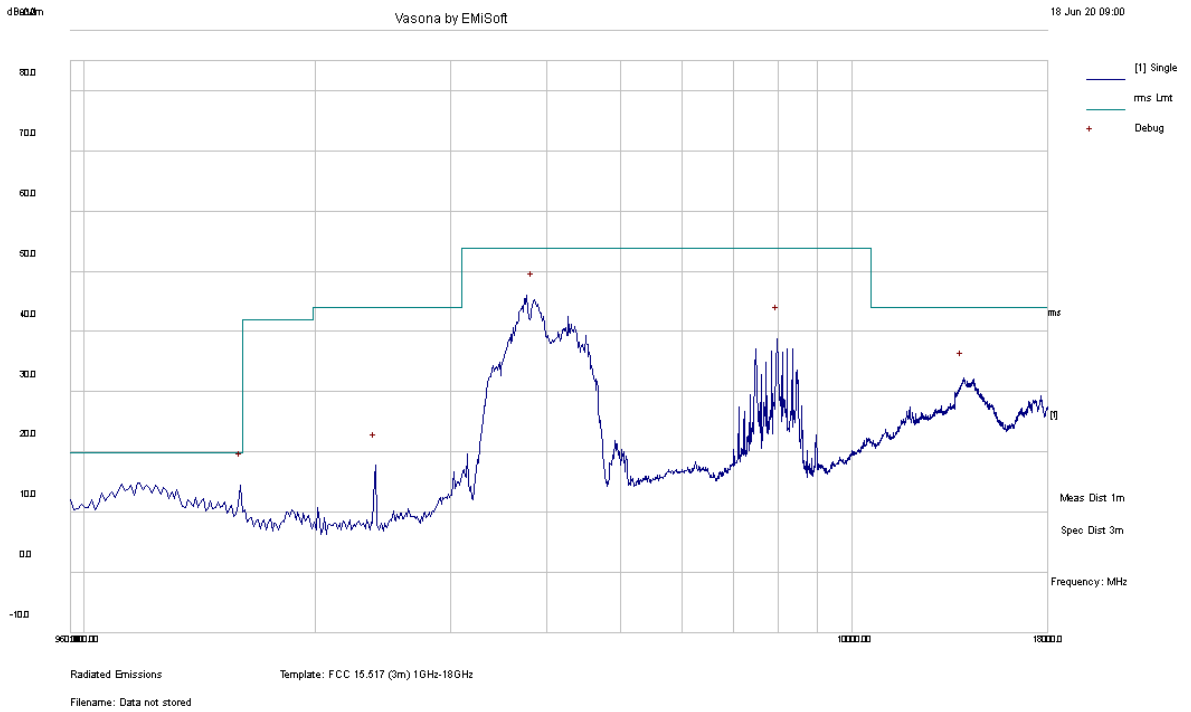
Test Standard:	FCC Part 15F	Mode:	CH4 - Horizontal
Frequency Range:	960MHz-18GHz	Test Date:	05/14/2020-06/03/2020
Antenna Type/Polarity:	Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Limit dBuV/m	Margin dB	Pass/Fail
1603.417	27.21	4.45	-18.58	13.08	RMS	H	19.9	-6.82	Pass
2398.593	30.91	4.83	-18.97	16.77	RMS	H	43.9	-27.13	Pass
3897.318	41.22	6.31	-13.16	34.37	RMS	H	53.9	-19.53	Pass
7499.89	25.78	9.79	-8.71	26.87	RMS	H	53.9	-27.03	Pass
14071.5	18.85	13.84	-1.44	31.24	RMS	H	43.9	-12.66	Pass

RADIATED EMISSIONS ABOVE 960 MHZ

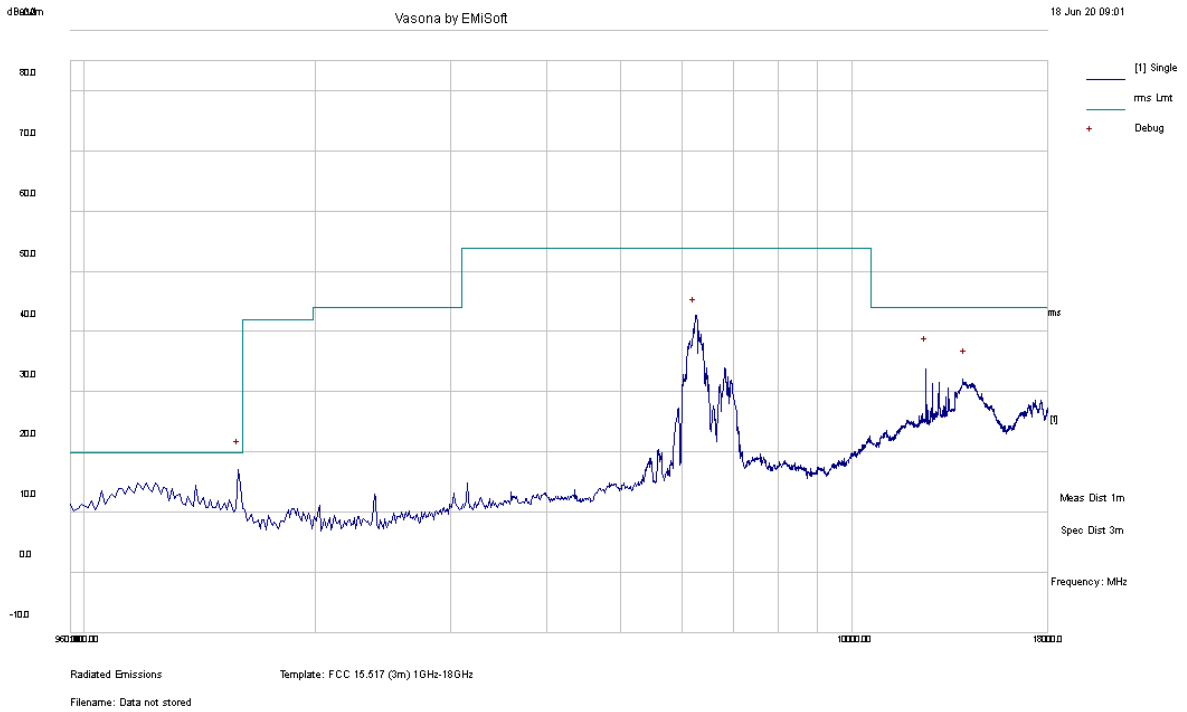
Test Standard:	FCC Part 15F	Mode:	CH4 - Vertical
Frequency Range:	960MHz-18GHz	Test Date:	05/14/2020-06/03/2020
Antenna Type/Polarity:	Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Limit dBuV/m	Margin dB	Pass/Fail
3834.991	51.36	6.25	-13.32	44.29	RMS	V	53.9	-9.61	Pass
1598.724	28.48	4.45	-18.55	14.38	RMS	V	19.9	-5.52	Pass
2395.784	31.6	4.83	-18.98	17.45	RMS	V	43.9	-26.45	Pass
7991.92	38.13	9.78	-9.28	38.63	RMS	V	53.9	-15.27	Pass
13887.111	19.59	13.61	-2.16	31.04	RMS	V	43.9	-12.86	Pass

RADIATED EMISSIONS ABOVE 960 MHZ

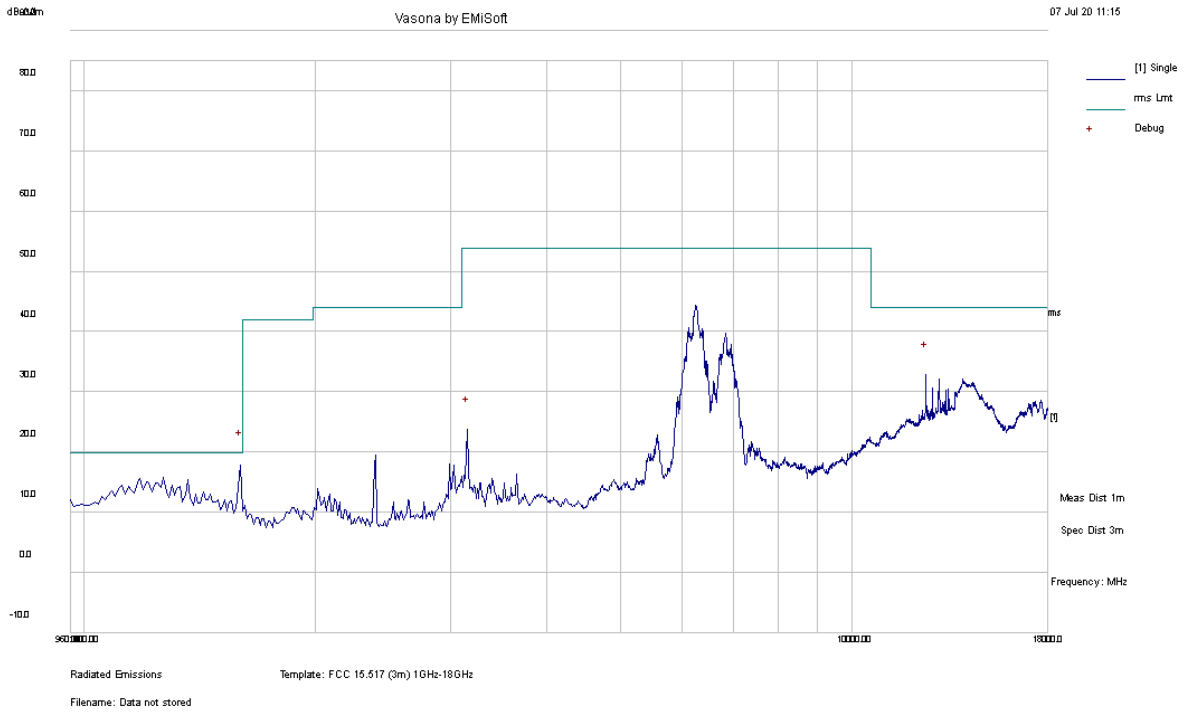
Test Standard:	FCC Part 15F	Mode:	CH7 - Horizontal
Frequency Range:	960MHz-18GHz	Test Date:	05/14/2020-06/03/2020
Antenna Type/Polarity:	Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Limit dBuV/m	Margin dB	Pass/Fail
1591.71	30.37	4.45	-18.53	16.3	RMS	H	19.9	-3.6	Pass
6229.398	40.74	7.87	-8.73	39.88	RMS	H	53.9	-14.02	Pass
12483.665	25.4	13.33	-5.28	33.45	RMS	H	43.9	-10.45	Pass
14030.314	19.19	13.73	-1.52	31.4	RMS	H	43.9	-12.5	Pass

RADIATED EMISSIONS ABOVE 960 MHZ

Test Standard:	FCC Part 15F	Mode:	CH7 - Vertical
Frequency Range:	960MHz-18GHz	Test Date:	05/14/2020-06/03/2020
Antenna Type/Polarity:	Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Limit dBuV/m	Margin dB	Pass/Fail
1598.87	31.95	4.45	-18.55	17.85	RMS	V	19.9	-2.05	Pass
3154.15	34.07	5.54	-16.08	23.53	RMS	V	53.9	-30.37	Pass
6275.21	45.10	7.87	-8.82	44.14	RMS	V	53.9	-9.76	Pass
12483.44	24.35	13.33	-5.28	32.40	RMS	V	43.9	-11.50	Pass

Radiated Emission between 18GHz – 40GHz test result

Note: no substantial emission is found other than the noise floor. Different modes have been verified.

7.5 Radiated Spurious Emissions in GPS bands

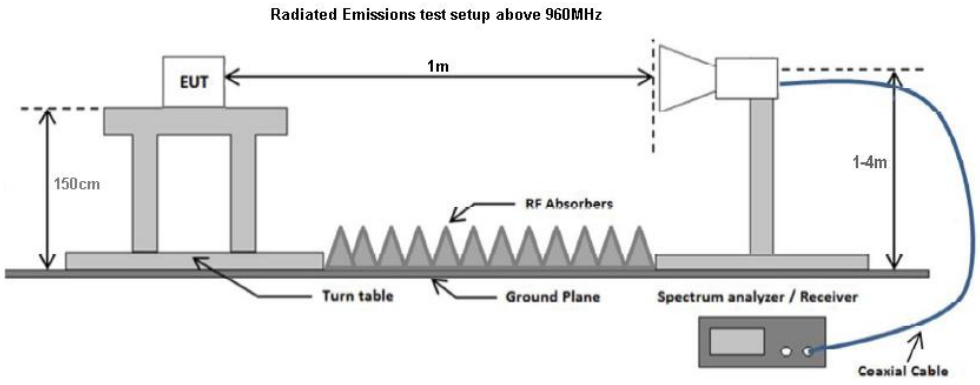
7.5.1 Requirement

§ 15.209, 15.517 (d)

In addition to the radiated emission limits specified in the table in paragraph (c) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency Range (MHZ)	EIRP in dBm	EIRP at 3 meter (dBuV/m)
1164 – 1240	-85.3	9.9
1559 – 1610	-85.3	9.9

7.5.2 Test Setup



7.5.3 Test Procedure

Setting:

Frequency Range: 1164 to 1240MHz and 1559-1610MHz

Measurement distance: 1m distance

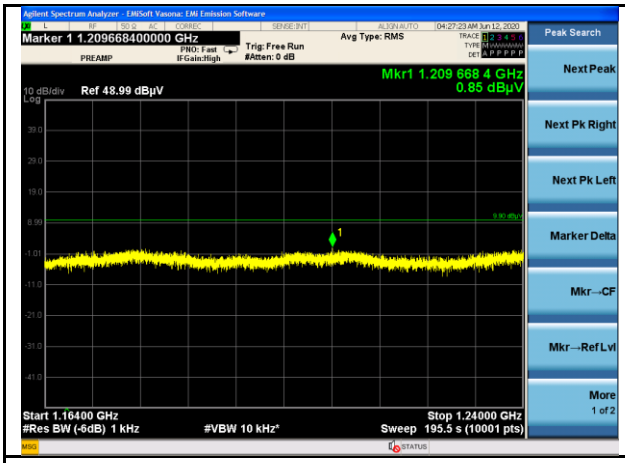
Spectrum analyzer RBW: 1KHz

Spectrum analyser VBW: 10KHz

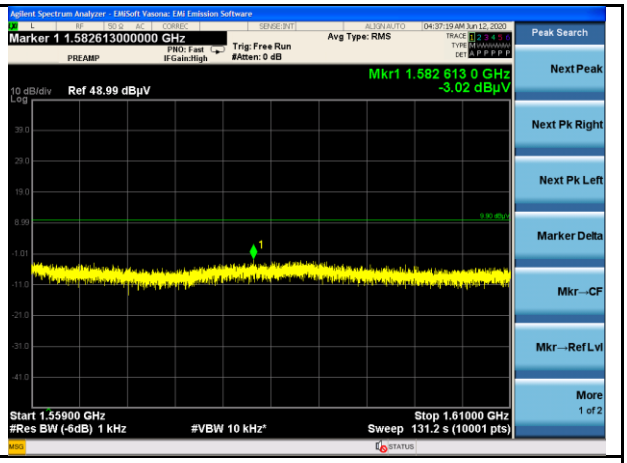
Detector Function: RMS for average emission

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission. All X, Y and Z axis are evaluated.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1KHz and video bandwidth is 10KHz with Peak detection for Peak and average measurement at frequency above 1GHz.
4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

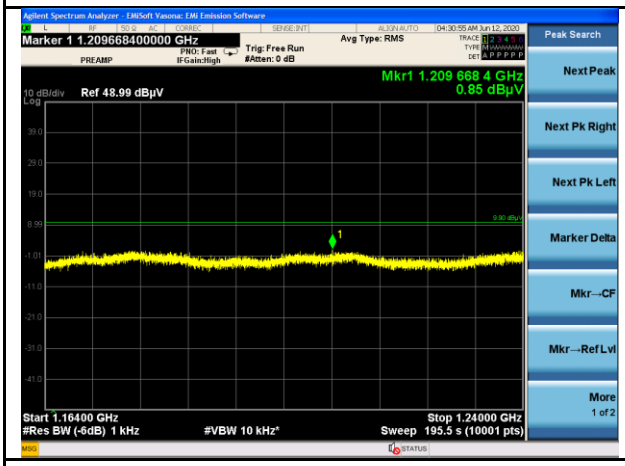
Note: Actual measurement distance is 1-meter distance and the result is corrected to 3m distance to compare to the 3m distance EIRP limit.



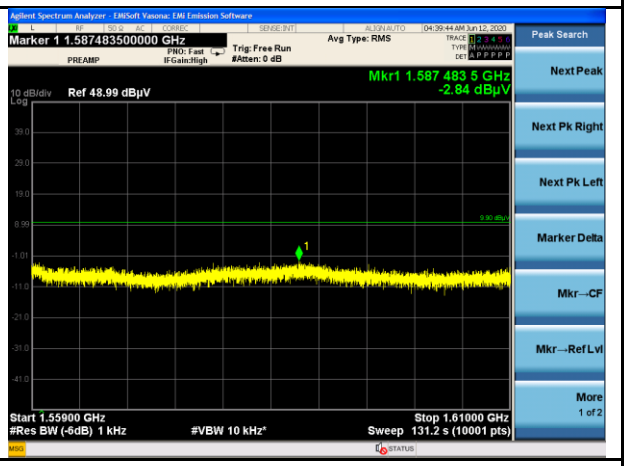
CH1 Emission in GPS lower band



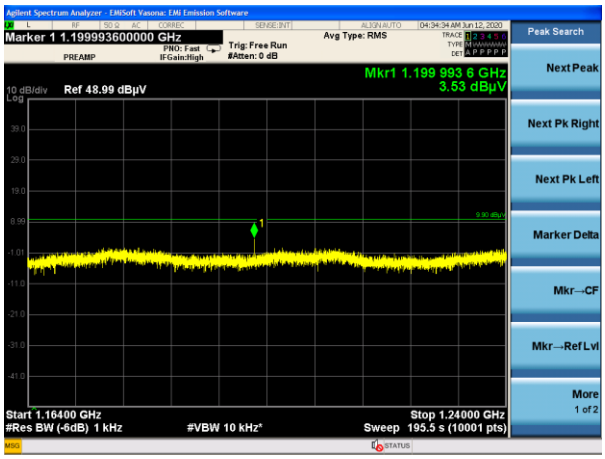
CH1 Emission in GPS higher band



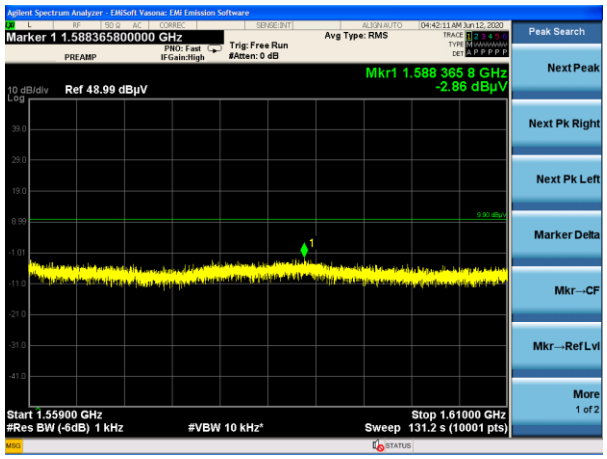
CH3 Emission in GPS lower band



CH3 Emission in GPS higher band



CH7 Emission in GPS lower band



CH7 Emission in GPS higher band

7.6 Peak Emissions in a 50 MHz Bandwidth

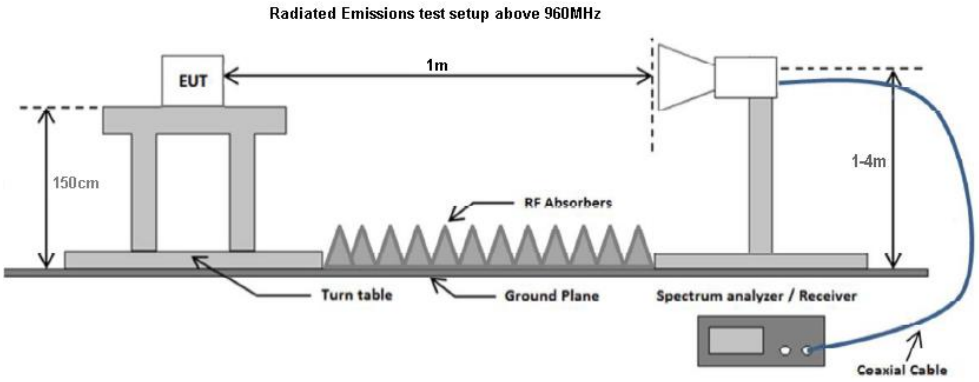
7.6.1 Requirement

§ 15.517 (e), 15.521 (g)

There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, fM. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in §15.521.

Per 15.521 (g), when a peak measurement is required, it is acceptable to use a resolution bandwidth other than the 50 MHz specified in this subpart. This resolution bandwidth shall not be lower than 1 MHz or greater than 50 MHz, and the measurement shall be centered on the frequency at which the highest radiated emission occurs, fM. If a resolution bandwidth other than 50 MHz is employed, the peak EIRP limit shall be 20 log (RBW/50) dBm where RBW is the resolution bandwidth in megahertz that is employed. This may be converted to a peak field strength level at 3 meters using E(dBuV/m) = P(dBm EIRP) + 95.2. If RBW is greater than 3 MHz, the application for certification filed with the Commission must contain a detailed description of the test procedure, calibration of the test setup, and the instrumentation employed in the testing.

7.6.2 Test Setup



7.6.3 Test Procedure

Setting:

Frequency Range: EUT operating frequencies

Measurement distance: 1m distance

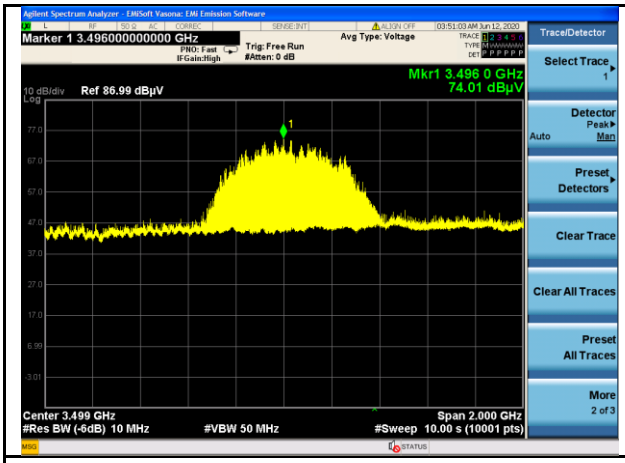
Spectrum analyzer RBW: 10MHz

Spectrum analyser VBW: 50MHz

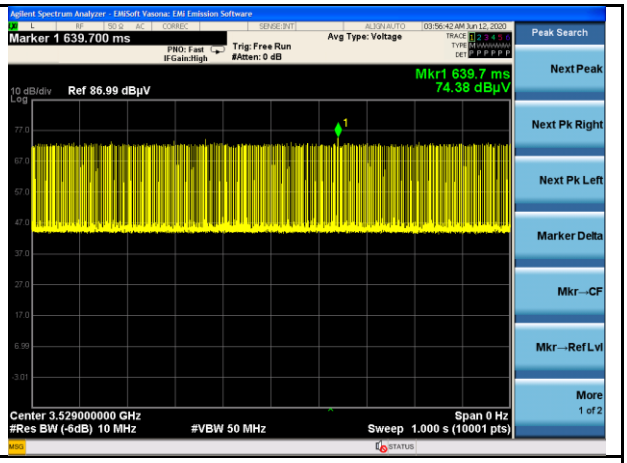
Detector Function: Peak for peak emission

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission. All X, Y and Z axis are evaluated.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth of test receiver/spectrum analyzer is 10MHz and video bandwidth is 50MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

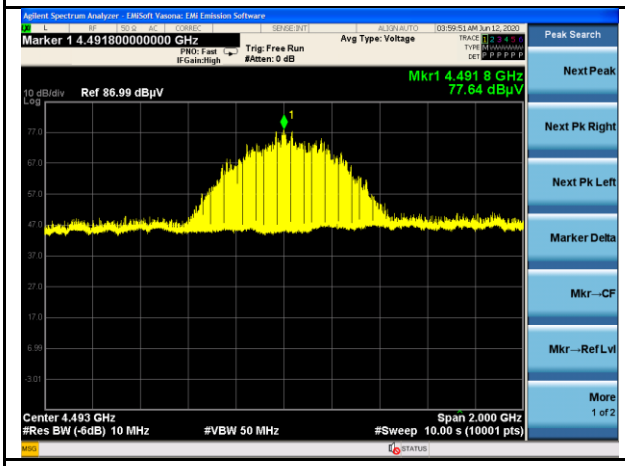
Note: Actual measurement distance is 1-meter distance and the result is converted to 3m distance to compare to the 3m distance EIRP limit.



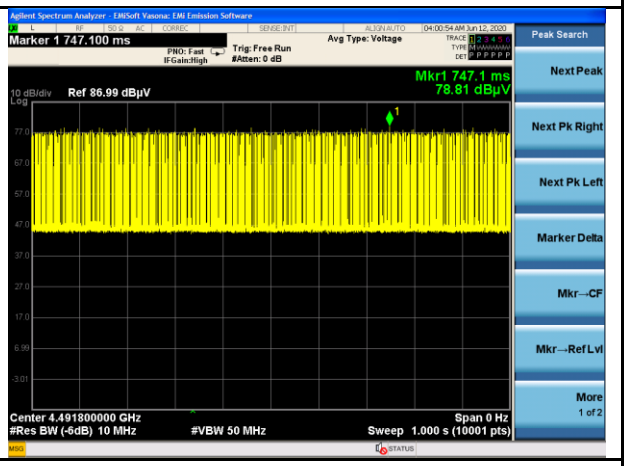
Peak Power Emission (CH1) – Peak search



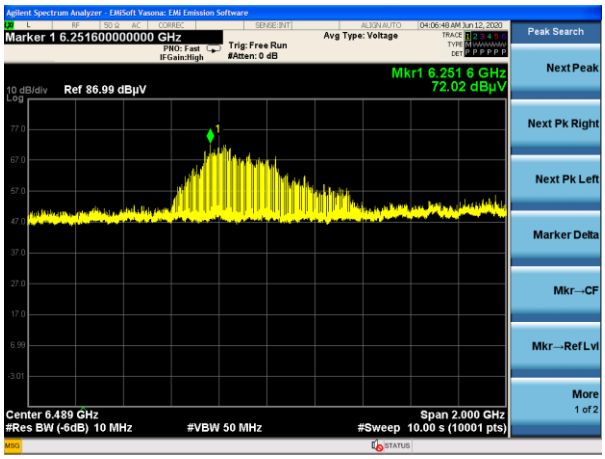
Peak Power Emission (CH1) – Zoom



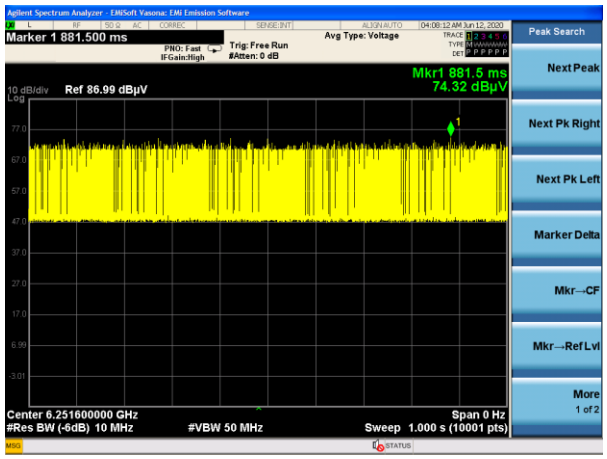
Peak Power Emission (CH3) – Peak search



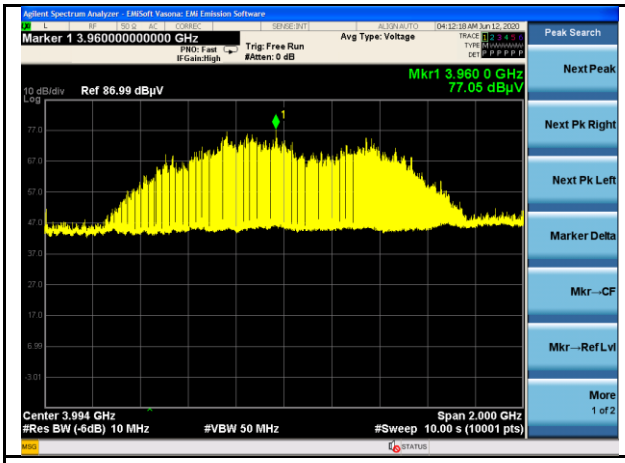
Peak Power Emission (CH3) – Zoom



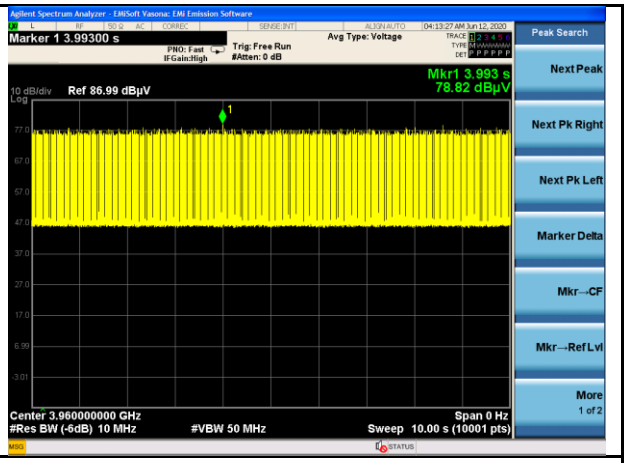
Peak Power Emission (CH5) – Peak search



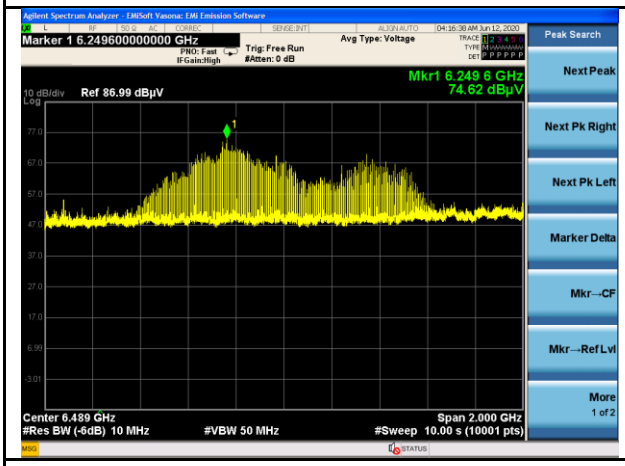
Peak Power Emission (CH5) – Zoom



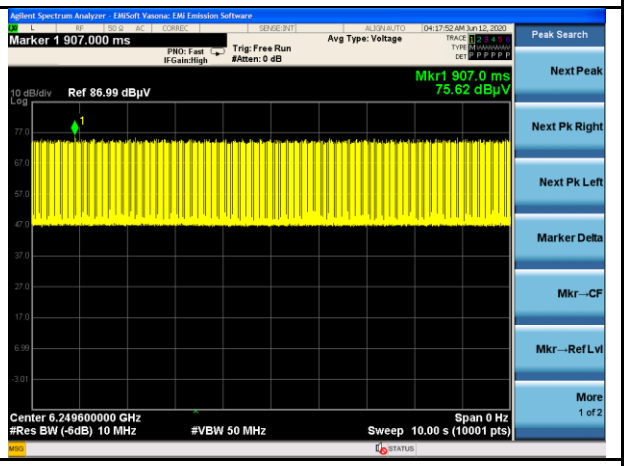
Peak Power Emission (CH4) – Peak search



Peak Power Emission (CH4) – Zoom



Peak Power Emission (CH7) – Peak search



Peak Power Emission (CH7) – Zoom

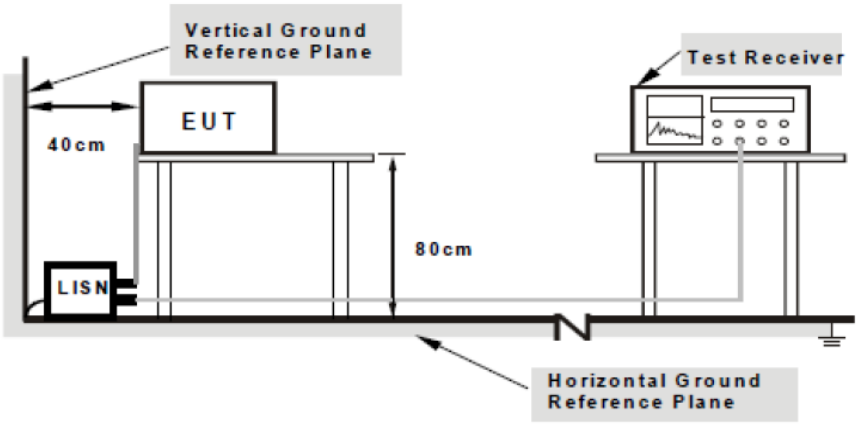
7.7 Conducted Emissions

7.7.1 Requirement

Per § 15.107 (a), ICES-003, except for Class A digital device, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms' line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Section	Frequency ranges (MHz)	Limit (dBuV)	
		QP	Average
Class B devices	0.15 – 0.5	66 – 56	56 – 46
	0.5 – 5	56	46
	5 - 30	60	50
NOTE 1 The lower limit shall apply at the transition frequencies.			

7.7.2 Test Setup



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.

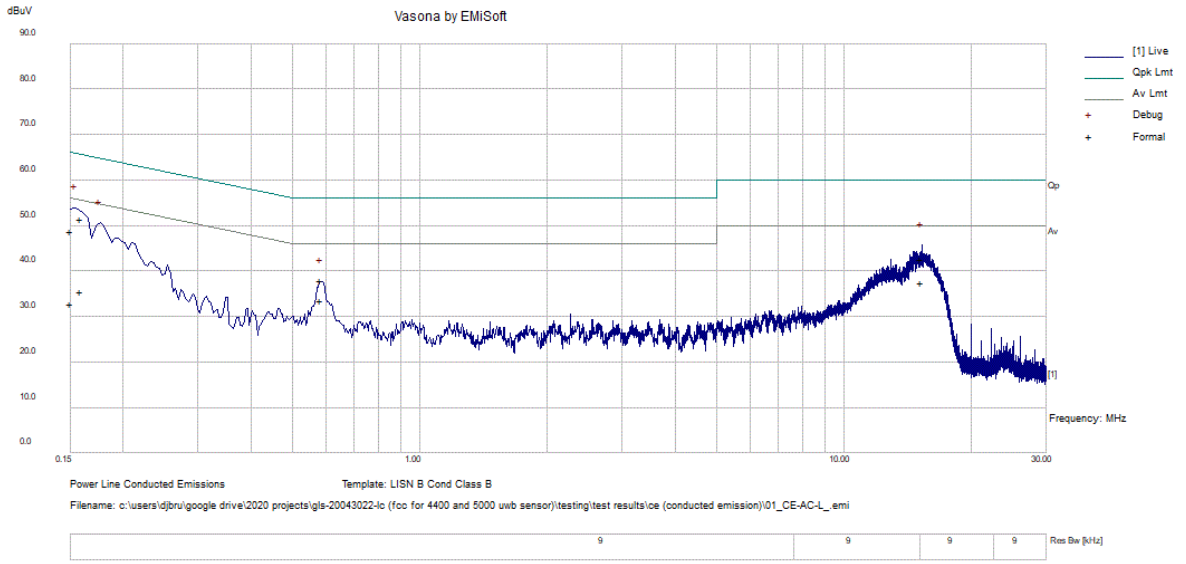
7.7.3 Test Procedure

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment was powered separately from another main supply.
5. The EUT was switched on and allowed to warm up to its normal operating condition.
6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.
7. High peaks, relative to the limit line, were then selected.
8. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz. For FCC tests, only Quasi-peak measurements were made; while for CISPR/EN tests, both Quasi-peak and Average measurements were made
9. All possible modes of operation were investigated. Only the worst case emissions were measured and reported. All other emissions were relatively insignificant.

7.7.4 Test Result

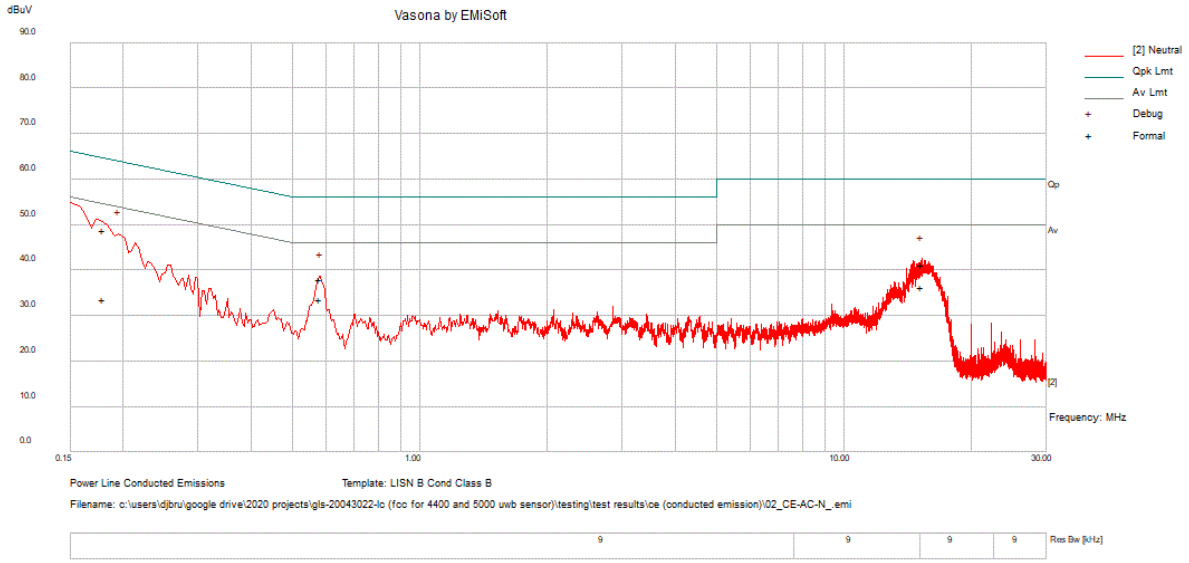
CONDUCTED EMISSIONS

Test Standard:	47CFR 15.207	Mode:	Conducted Emission
Frequency Range:	0.15 - 30MHz	Test Date:	05/14/2020-06/03/2020
Line:	Live	Test Personnel:	Daniel Bruno
Remark:	With AC/DC adapter	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass/Fail
0.15	38.60	10.10	0.20	48.90	Quasi Peak	Live	66.00	-17.10	Pass
0.16	41.20	10.10	0.20	51.50	Quasi Peak	Live	65.50	-14.00	Pass
15.24	31.70	10.70	0.30	42.70	Quasi Peak	Live	60.00	-17.30	Pass
0.59	27.90	10.10	0.10	38.10	Quasi Peak	Live	56.00	-17.90	Pass
0.15	22.70	10.10	0.20	33.00	Average	Live	56.00	-23.00	Pass
0.16	25.40	10.10	0.20	35.70	Average	Live	55.50	-19.80	Pass
15.24	26.50	10.70	0.30	37.50	Average	Live	50.00	-12.50	Pass
0.59	23.30	10.10	0.10	33.50	Average	Live	46.00	-12.50	Pass

Test Standard:	47CFR 15.207	Mode:	Conducted Emission
Frequency Range:	0.15 - 30MHz	Test Date:	05/14/2020-06/03/2020
Line:	Neutral	Test Personnel:	Daniel Bruno
Remark:	With AC/DC adapter	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass/Fail
0.18	38.50	10.10	0.20	48.70	Quasi Peak	Neutral	64.50	-15.80	Pass
0.58	27.80	10.10	0.10	38.00	Quasi Peak	Neutral	56.00	-18.00	Pass
15.24	30.40	10.70	0.30	41.40	Quasi Peak	Neutral	60.00	-18.60	Pass
0.18	23.40	10.10	0.20	33.70	Average	Neutral	54.50	-20.80	Pass
0.58	23.50	10.10	0.10	33.80	Average	Neutral	46.00	-12.20	Pass
15.24	25.40	10.70	0.30	36.40	Average	Neutral	50.00	-13.60	Pass

7.8 RF Exposure Evaluation

7.8.1 Requirement

RF Exposure Requirements:	47 CFR §1.1307(b)
RF Radiation Exposure Limits:	47 CFR §1.1310
RF Radiation Exposure Guidelines:	FCC OST/OET Bulletin Number 65
EUT Frequency Band:	3240-4830MHz 6215-7000MHz

1) SAR Test Exclusion for <6GHz

According to the procedure in KDB447498 (v05r02) section 4.3,

1g-SAR testing is excluded if the following criteria is met.

$(P/d)^* \sqrt{f} \leq 3.0$ for 1-g SAR

10g-SAR testing is excluded if the following criteria is met.

$(P/d)^* \sqrt{f} \leq 7.5$ for 10-g SAR

Where

P is the time averaged maximum conducted power in mW

d minimum separation distance in mm

f is the frequency in GHz

The distance between the antenna and human body is 5 mm. The calculation was based on the distance of 5 mm.

Radio	Frequency (MHz)	Max Radiated Power (dBm)	Max Radiated Output Power (mW)	Measurement distance (mm)	Test Exclusion Threshold Result
UWB	3240-4830MHz	-2.43	0.571	5	0.251

The above results show that the device is excluded for both standalone 1g-SAR and 10g-SAR testing.

2) MPE Calculation for >6GHz

The SAR Test Exclusion Threshold of the guidance is limited only up to 6GHz. According to OET Bulletin 65, the portable device operating at frequencies above 6GHz is evaluated in terms of MPE limits.

Radio	Frequency (MHz)	Max Radiated Power (dBm)	Max Radiated Output Power (mW)	Separation distance (cm)	Power Density (mW/ cm2)	MPE Limit (mW/ cm2)
UWB	6215-7000	-5.63	0.274	0.5	0.087	1

The above results show that the device complies with the MPE requirement with 5mm separation distance.

8 EUT and Test Setup Photos

See FCC exhibits

9 Test Instrument List

Equipment	Manufacturer	Model	Instrument Number	Cal. Date	Cal. Due
Semi-Anechoic Chamber	ETS-Lindgren	10M	VL001	10/18/19	10/18/20
Shielding Control Room	ETS-Lindgren	Series 81	VL006	N/A	N/A
Spectrum Analyzer	Keysight	N9020A	MY50110074	6/17/19	6/17/20
Spectrum Analyser (9kHz-40GHz)	R&S	FSP38	100630	6/15/19	6/15/20
EMC Test Receiver	R&S	ESL6	100230	6/14/19	6/14/20
LISN (9KHz – 30MHz)	EMCO	3816/2	9705-1066	5/4/20	5/4/21
Bi-Log Antenna	ETS-Lindgren	3142E	217921	11/15/2019	11/15/2020
Horn Antenna (1-18GHz)	Electro-Metrics	EM-6961	6292	5/14/2020	5/14/2021
Horn Antenna (18-40GHz)	Com-Power	AH-840	101109	6/24/19	6/24/20
Preamplifier	RF Bay, Inc.	LPA-10-20	11180621	7/15/2019	7/15/2020
True RMS Multi-meter	UNI-T	UT181A	C173014829	5/5/2020	5/5/2021
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	5/15/2020	5/15/2021
RF Attenuator	Pasternack	PE7005-3	VL061	7/16/2019	7/16/2020
Preamplifier 100KHz - 40GHz	Aeroflex	33711-392-77150-11	064	7/16/2019	7/16/2020
EM Center Control	ETS-Lindgren	7006-001	160136	N/A	N/A
Turn Table	ETS-Lindgren	2181-3.03	VL002	N/A	N/A
Boresight Antenna Tower	ETS-Lindgren	2171B	VL003	N/A	N/A
Loop Antenna (9k-30MHz)	Com-Power	AL-130	121012	5/16/20	5/16/21
RE test cable(below 6GHz)	Vista	RE-6GHz-01	RE-6GHz-01	7/16/2019	7/16/2020
RE test cable (1-18GHz)	PhaseTrack	II-240	RE-18GHz-01	7/16/2019	7/16/2020
RE test cable (>18GHz)	Sucoflex	104	344903/4	7/16/2019	7/16/2020
Pulse limiter	Com-Power	LIT-930A	531727	7/16/2019	7/16/2020
CE test cable #1	FIRST RF	FRF-C-1002-001	CE-6GHz-01	7/16/2019	7/16/2020
CE test cable#2	FIRST RF	FRF-C-1002-001	CE-6GHz-02	7/16/2019	7/16/2020