ACUITY BRANDS LIGHTING INC

TEST REPORT

SCOPE OF WORK
EMISSIONS TESTING – rSDGR

REPORT NUMBER
103986369ATL-001a

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DOCUMENT CONTROL NUMBER
Non-Specific Radio Report Shell Rev. December 2017

EMISSIONS TEST REPORT

(FULL COMPLIANCE)

Report Number: 103986369ATL-001a
Project Number: G103986369

Report Issue Date: 06/27/2019
Report Revision Date: 07/31/2020

Model(s) Tested: rSDGR

Standards: CFR47 FCC Part 15 Subpart C: 04/2019,
RSS-247 Issue 2 February 2017,
RSS-Gen Issue 5 April 2018

Tested by:
Intertek Testing Services NA, Inc.
1950 Evergreen Blvd, Suite 100
Duluth, GA 30096 USA

Client:
Acuity Brands Lighting Inc
One Lithonia Way
Conyers, GA 30012
USA

Report prepared by Dan Alvarez

Dan Alvarez / EMC Engineer

Report reviewed by Kouma Sinn

Kouma Sinn / EMC Staff Engineer

Table of Contents

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test and Variant Models	--
5	System Setup and Method	---
6	Maximum Peak Output Power RSS-247:2017, ANSI C63.10:2013 (§11.9.2.3.1 Method AVGPM) and KBD 558074 D01 15.247 Meas Guidance v05r02:2019	Pass
7	6 dB Bandwidth and Occupied Bandwidth CFR47 FCC Part 15.247:2019 (a)(2), RSS-247: Issue 2 February 2017, ANSI C63.10:2013 (§11.8.1) and KBD 558074 D01 15.247 Meas Guidance v05r02:2019	Pass
8	Maximum Power Spectral Density CFR47 FCC Part 15.247:2019 (e), RSS-247 Issue 2 February 2017, RSS-247:2017, and ANSI C63.10:2013 (§11.10.2)	Pass
9	Band Edge Compliance FCC Part 15 Subpart C 15.247:2019, Section 15.247 (d) RSS-247 Issue 2: 02/2017), ANSI C 63.10:2013 (§11.12.2.4	Pass
10	Transmitter spurious emissions FCC Part 15 Subpart C 15.247:2019, FCC 15.209 Section 15.247 (d), RSS-247 Issue 2 February 2017, ANSI C 63.10:2013 (§11.12.2.7)	Pass
11	Digital Device and Receiver Radiated Spurious Emissions (CFR47 FCC Part 15 Subpart C 15.209:2019, FCC:15:209; ICES-003:2017 Issue 6, ANSI C 63.10:2013 (§7.6.1; 11.12.2.7), ANSI C 63.4:2014	Pass
12	AC Mains Conducted Emissions FCC 47CFR Part 15.207:2019, FCC15:207, ICES-003 Issue 6 Published: January 2016 Updated: April 2017, ANSI C 63.4:2014	Pass
13	Revision History	--

Notes: The EUT powers from AC mains.

3 Client Information

This EUT was tested at the request of:

Client: Acuity Brands Lighting Inc
One Lithonia Way
Conyers, GA 30012
USA
Contact: Sanjana Dhankani
Telephone: +1 (770) 922-9000
Fax: None
Email: Sanjana.Dhankani@AcuityBrands.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: Acuity Brands Lighting Inc
One Lithonia Way
Conyers, GA 30012
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Wireless Sensor	Acuity	rSDGR 127 N BZ	1844X1810 11500077
Wireless Sensor (modified with coax)	Acuity	rSDGR 127 N BZ	1844X1810 11500032

Receive Date:	06/24/2019
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)
Wireless sensor for use with a light.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Power	Rated Frequency	Number of Phases
120/208/240/277 VAC	480 Watts	50/60 Hz	Single

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Continuously transmitting

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	Acuity software – FCC Gui Interface

Radio/Receiver Characteristics	
Frequency Band(s)	904-926 MHz
Modulation Type(s)	O-QPSK
Data Rates	100 kbps
Power Setting During Test	200
Maximum Output Power	Low Channel (904 MHz): +18.88 dBm Mid Channel (916 MHz): +18.82 dBm High Channel (926 MHz): +18.78 dBm
Test Channels	Low Channel (904 MHz) Mid Channel (916 MHz) High Channel (926 MHz)
Occupied Bandwidth	Low Channel (904 MHz): 1006 kHz Mid Channel (916 MHz): 1000 kHz High Channel (926 MHz): 1000 kHz
6 dB Bandwidth	Low Channel (904 MHz): 625 kHz Mid Channel (916 MHz): 618 kHz High Channel (926 MHz): 618.75 kHz
Frequency Hopper: Number of Hopping Channels	N/A
Frequency Hopper: Channel Dwell Time	N/A
Frequency Hopper: Max interval between two instances of use of the same channel	N/A
MIMO Information (# of Transmit and Receive antenna ports)	1
Equipment Type	Standalone
ETSI LBT/Adaptivity	Non-Adaptive
ETSI Adaptivity Type	N/A
ETSI Temperature Category (I, II, III)	N/A
ETSI Receiver Category (1, 2, 3)	3
Antenna Type and Gain	Integrated, +0.8 dBi

Antenna Requirement – FCC: Section 15.203
The standalone antenna that connects to the U.FL port.

This satisfies the requirements of Section 15.203.

Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

None

5 System Setup and Method

Cables					
ID	Description	Length	Shielding	Ferrites	Termination
1	AC Mains Cable	2.6 m	N/A	N/A	Mains
2	USB Cable	1.6 m	N/A	N/A	Unterminated

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop	Hewlett Packard	15-da0053wm	CND9160T9X

5.1 Method:

Configuration as required by Configuration as required by FCC Part 15 Subpart C 15.247:2019, FCC Part 15 Subpart B:2019, RSS 247 Issue 2: 02/2017, ICES 003 Issue 6: 01/2016 updated 06/2016, RSS-Gen Issue 5 April 2018, RSS-102 Issue 5 March 2015, ANSI C 63.10: 2013, and ANSI C 63.4: 2014; ANSI C63.10:2013; KBD 558074 D01 15.247 Meas Guidance v05r02:2019.

5.2 EUT Block Diagram:

6 Maximum Peak Output Power

6.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, ANSI C63.10 (§11.9.2.3.1) and KBD 558074 D01 15.247 Meas Guidance v05r02:2019.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
212054'	Barometric Pressure/Humidity Datalogger	Extech	SD700	A.074981	10/31/2018	10/31/2019
003178'	Power Meter	Boonton	4321A	36701	12/17/2018	12/17/2019
200125'	Power Sensor, Dual Diode, 10kHz to 8GHz, 20dBm	Boonton	51011-EMC	34915	12/17/2018	12/17/2019
200021'	Attenuator, 40 dB, <18GHz, 100W	Weinschel Corp	48-40-34	BK5886	03/29/2019	03/29/2020

Software Utilized:

Name	Manufacturer	Version
None		

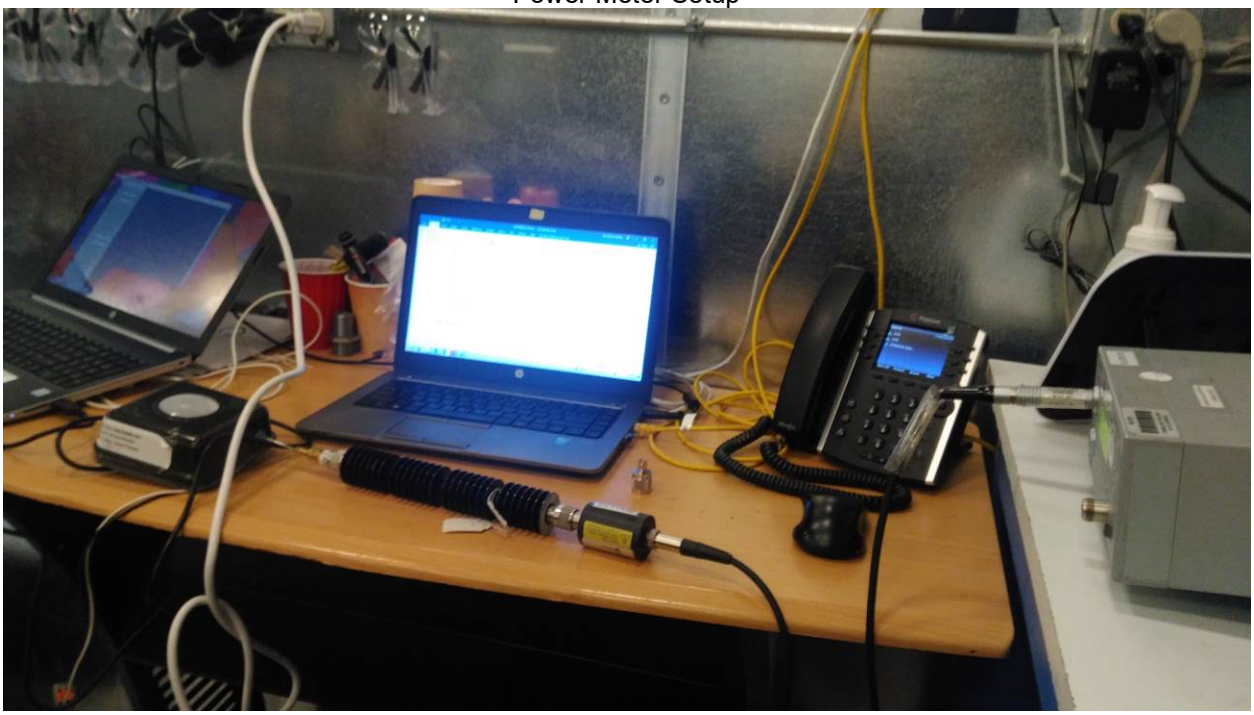
6.3 Results:

The sample tested was found to Comply.

§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt or 30 dBm.

6.4 Setup Photograph:

Power Meter Setup



6.5 Test Data:

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 0.8 dB

Frequency (MHz)	Output Power (dBm)
904	18.88
916	18.82
926	18.78

Test Personnel:	Dan Alvarez	Test Date:	06/28/2019
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247	Limit Applied:	See report section 6.3
Input Voltage:	120VAC,60Hz	Ambient Temperature:	23 ºC
Pretest Verification w/ Ambient Signals or BB Source:	**N/A**	Relative Humidity:	45 %
		Atmospheric Pressure:	998 mbars

Deviations, Additions, or Exclusions: None

7 6 dB Bandwidth and Occupied Bandwidth

7.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, and ANSI C63.10 (§11.8.1).

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
212054'	Barometric Pressure/Humidity Datalogger	Extech	SD700	A.074981	10/31/2018	10/31/2019
200162'	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	10/10/2018	10/10/2019
MM2'	RF Coax Cable 10KHz-18GHz	Maury Microwave	UC-N-MM78	1514381	05/24/2019	05/24/2020
200021'	Attenuator, 40 dB, <18GHz, 100W	Weinschel Corp	48-40-34	BK5886	03/29/2019	03/29/2020

Software Utilized:

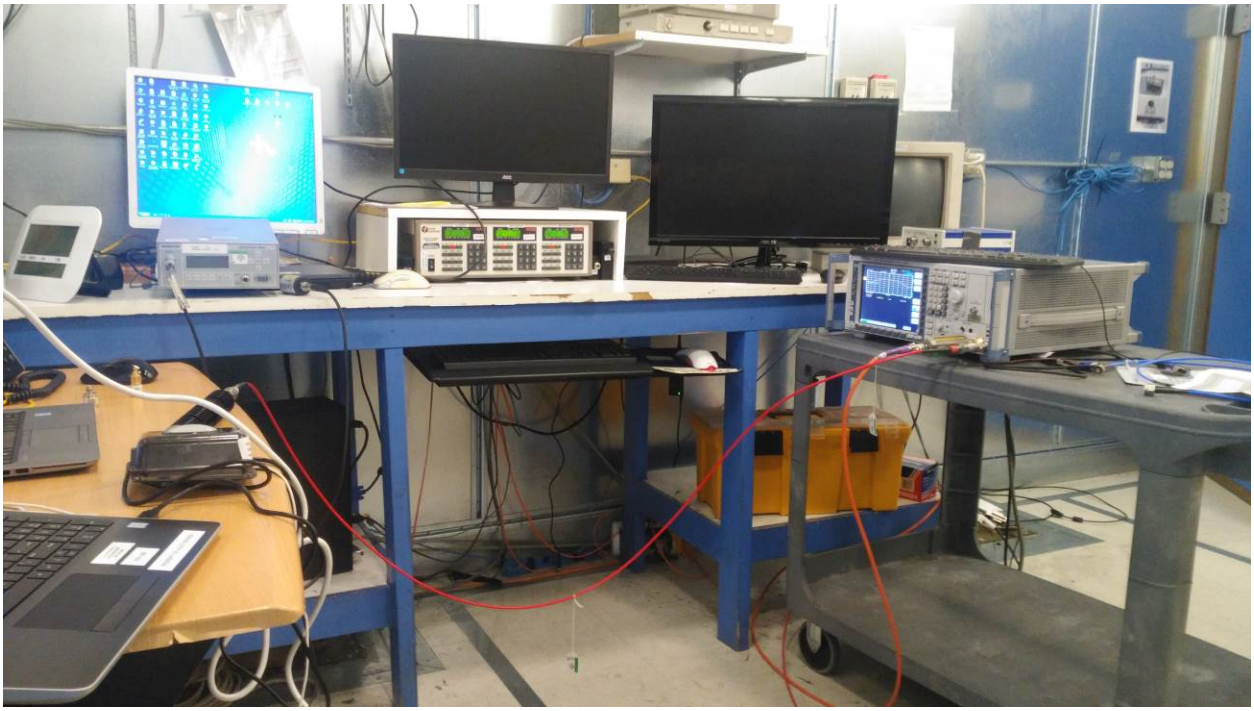
Name	Manufacturer	Version
None		

7.3 Results:

The sample tested was found to Comply.

§15.247 (a) (2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

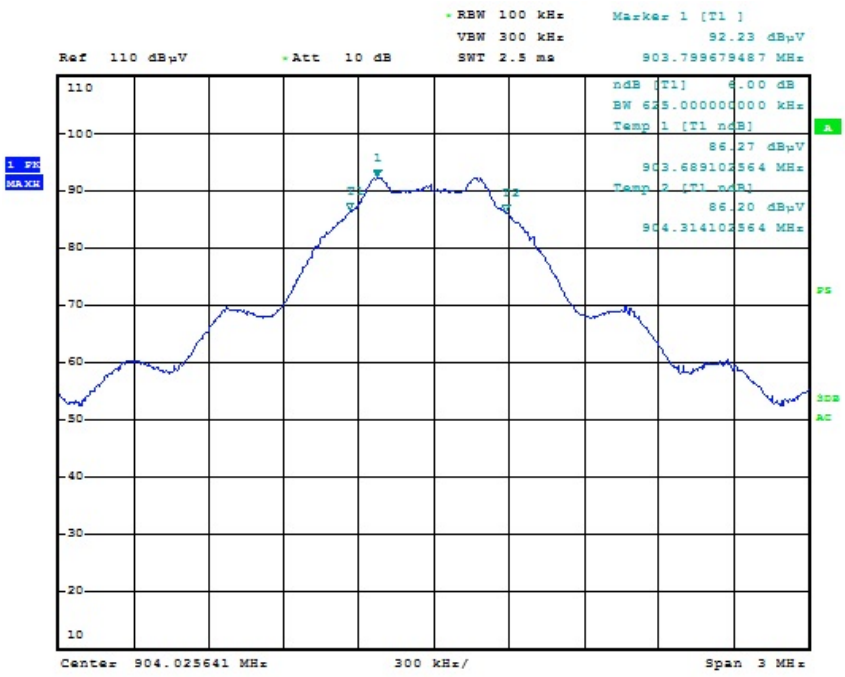
7.4 Setup Photograph:



7.5 Plots/Data:

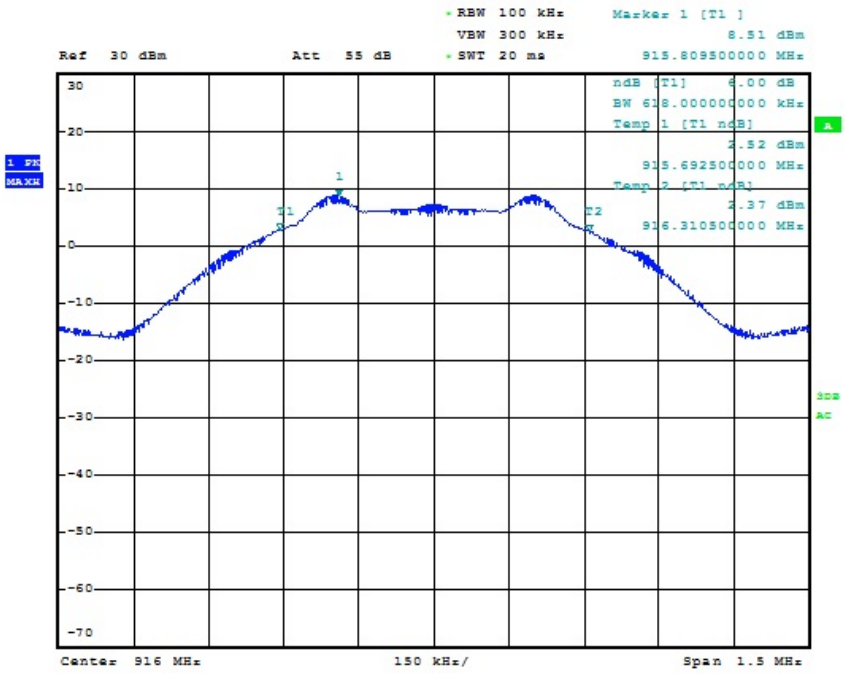
Frequency (MHz)	6 dB DTS Bandwidth	Results
904	625 kHz	Pass
916	618 kHz	Pass
926	618.75 kHz	Pass

6dB DTS Bandwidth - Low Channel

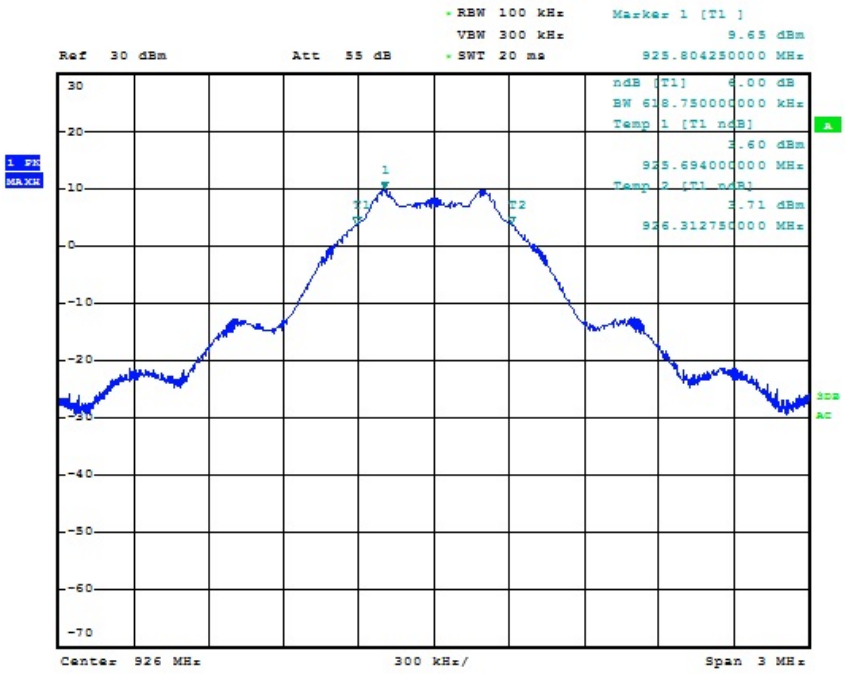


Date: 25.JUN.2019 14:44:36

6dB DTS Bandwidth – Mid Channel



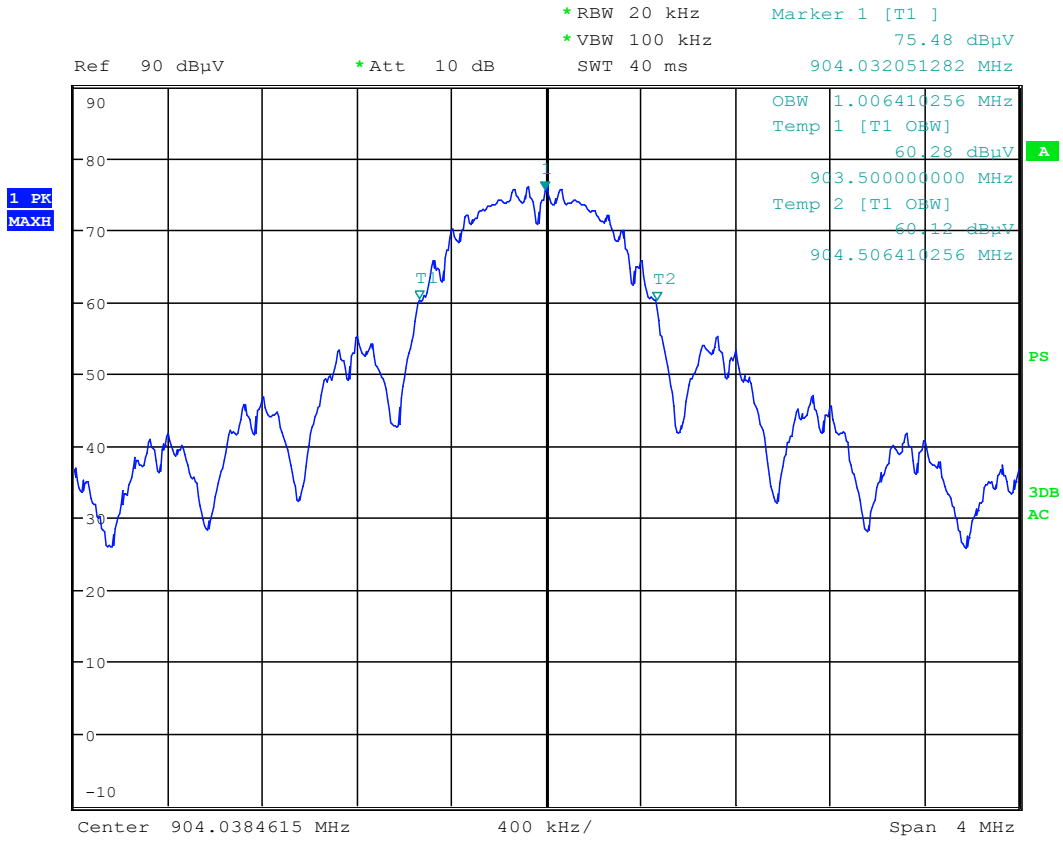
6dB DTS Bandwidth – High Channel



Date: 25.JUN.2019 20:30:21

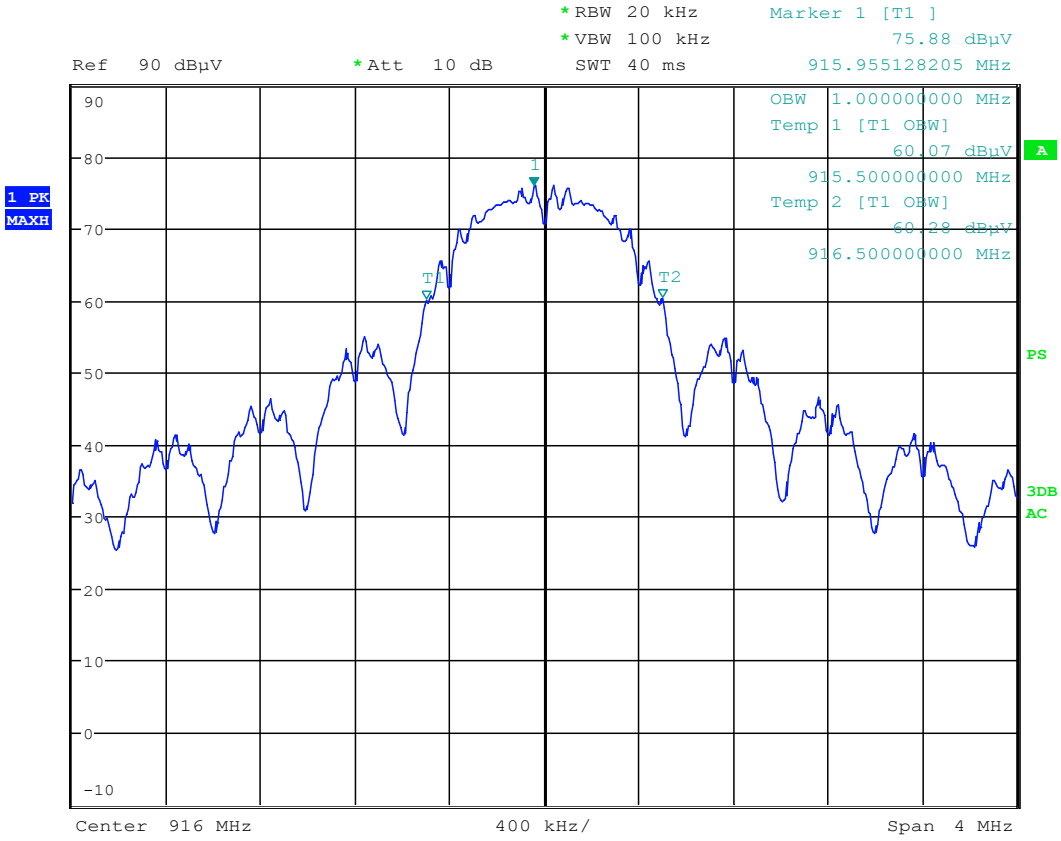
Frequency (MHz)	99% Occupied Bandwidth	Result
904	1006 kHz	Pass
916	1000 kHz	Pass
926	1000 kHz	Pass

99% Occupied Bandwidth – Low Channel



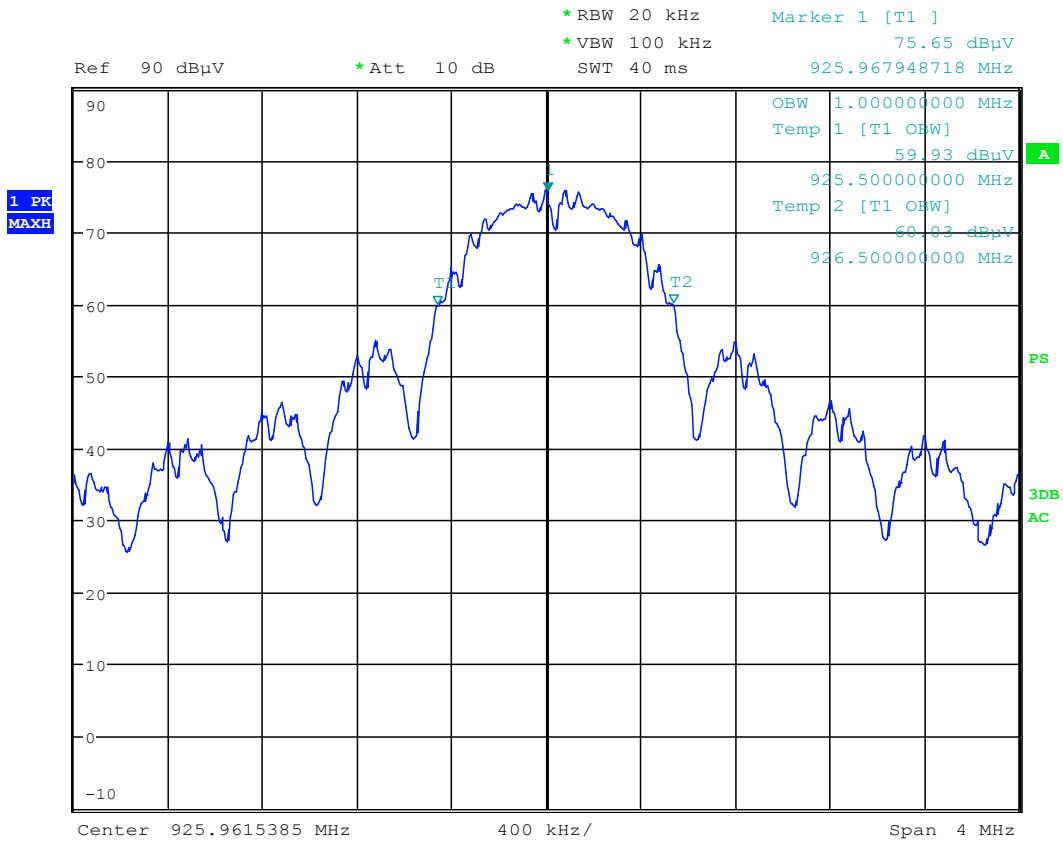
Date: 22.JUL.2019 19:43:39

99% Occupied Bandwidth – Mid Channel



Date: 22.JUL.2019 19:44:48

99% Occupied Bandwidth – High Channel



Date: 22.JUL.2019 19:46:45

Test Personnel:	Dan Alvarez	Test Date:	06/25/2019
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247	Limit Applied:	See report section 7.3
Input Voltage:	120VAC,60Hz	Ambient Temperature:	23 ºC
Pretest Verification w/ Ambient Signals or BB Source:	**N/A**	Relative Humidity:	45 %
		Atmospheric Pressure:	989 mbars

Deviations, Additions, or Exclusions: None

8 Maximum Power Spectral Density

8.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, and ANSI C63.10 (§11.10.7).

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
212054'	Barometric Pressure/Humidity Datalogger	Extech	SD700	A.074981	10/31/2018	10/31/2019
200162'	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	10/10/2018	10/10/2019
MM2'	RF Coax Cable 10KHz-18GHz	Maury Microwave	UC-N-MM78	1514381	05/24/2019	05/24/2020
200021'	Attenuator, 40 dB, <18GHz, 100W	Weinschel Corp	48-40-34	BK5886	03/29/2019	03/29/2020

Software Utilized:

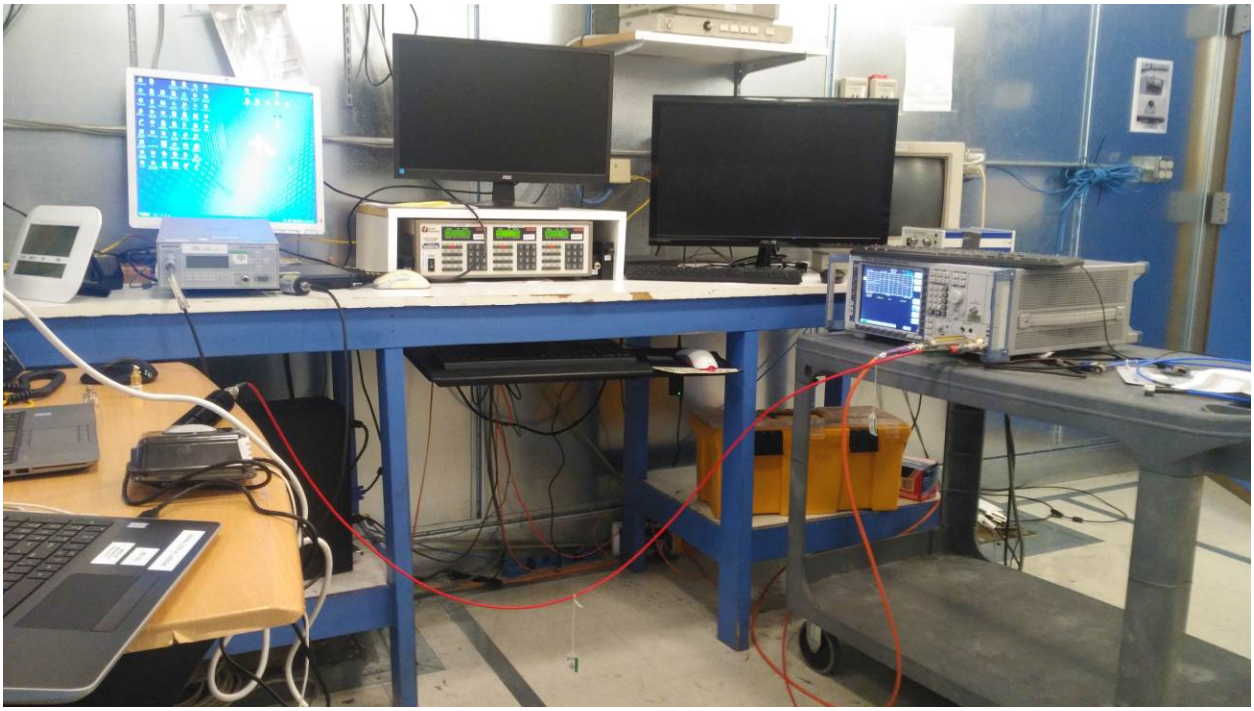
Name	Manufacturer	Version
None		

8.3 Results:

The sample tested was found to Comply.

§15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

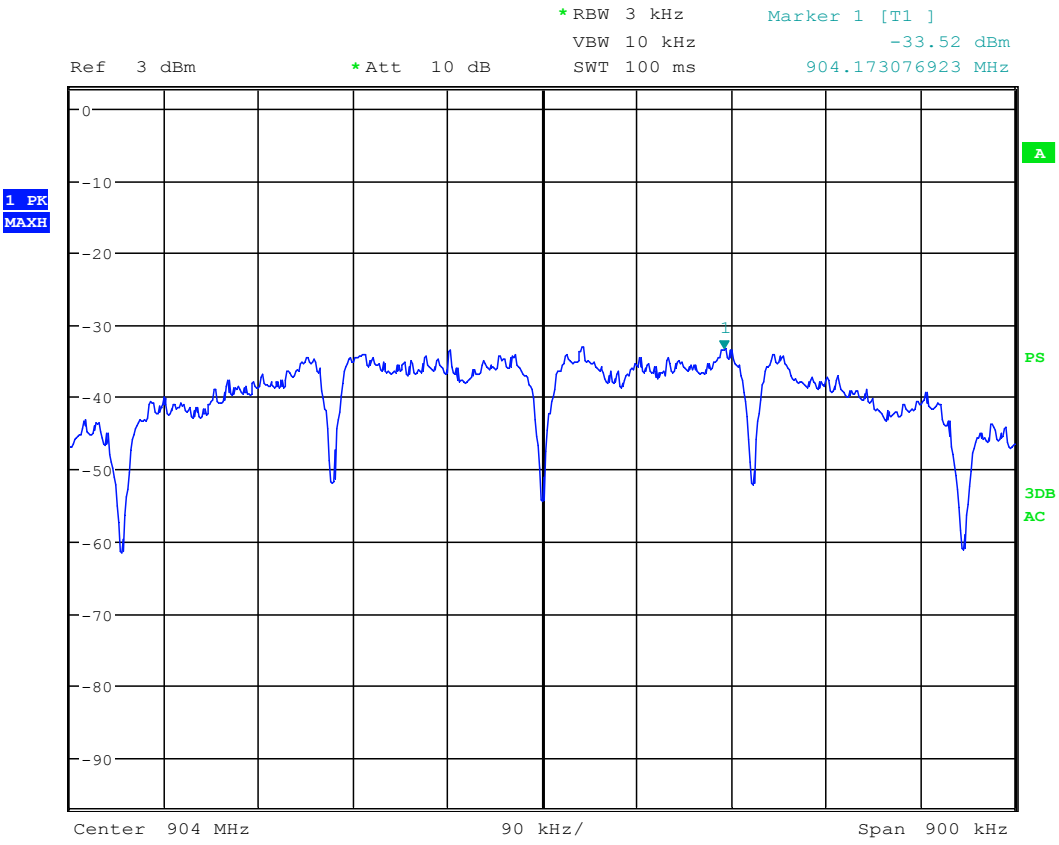
8.4 Setup Photograph:



8.5 Plots/Data:

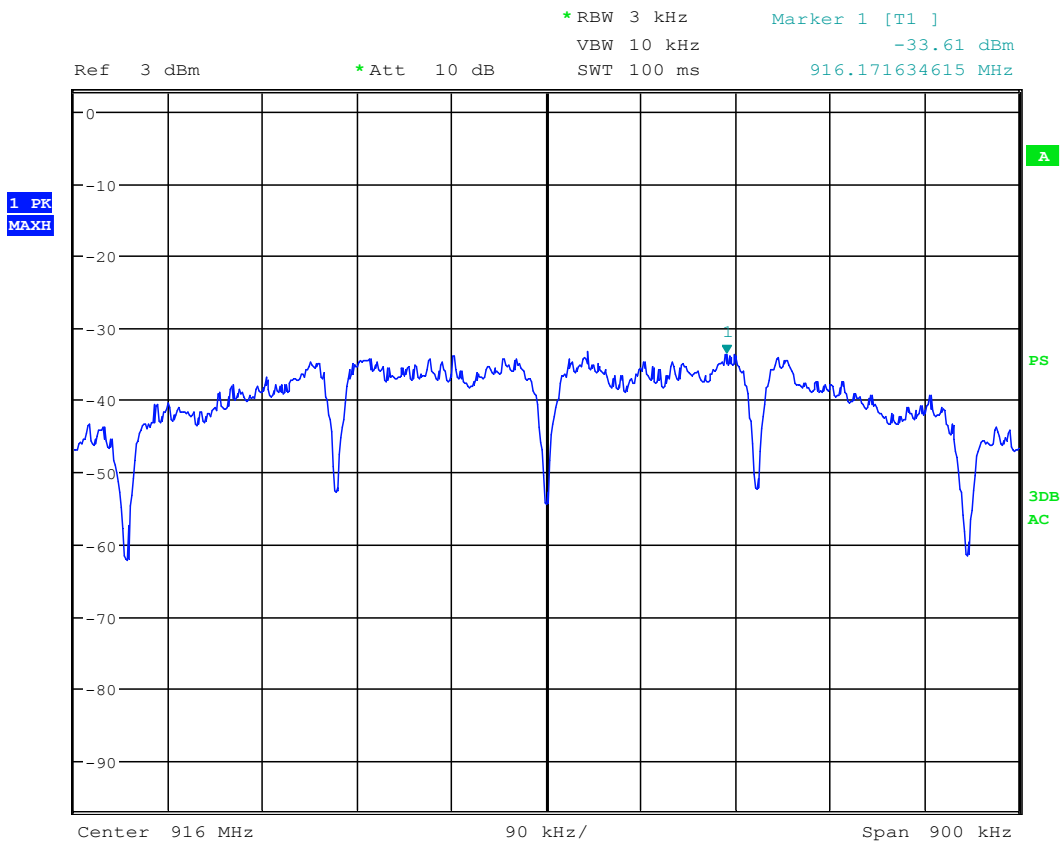
Frequency (MHz)	PSD RBW	Power dBm	Correction Factor	Measurement	Limit	Margin	Result
904	3 kHz	-33.52	39.4	5.88	8	-2.12	Pass
916	3 kHz	-33.61	39.4	5.79	8	-2.21	Pass
926	3 kHz	-33.3	39.4	6.1	8	-1.9	Pass

Z-Axis_Low Channel



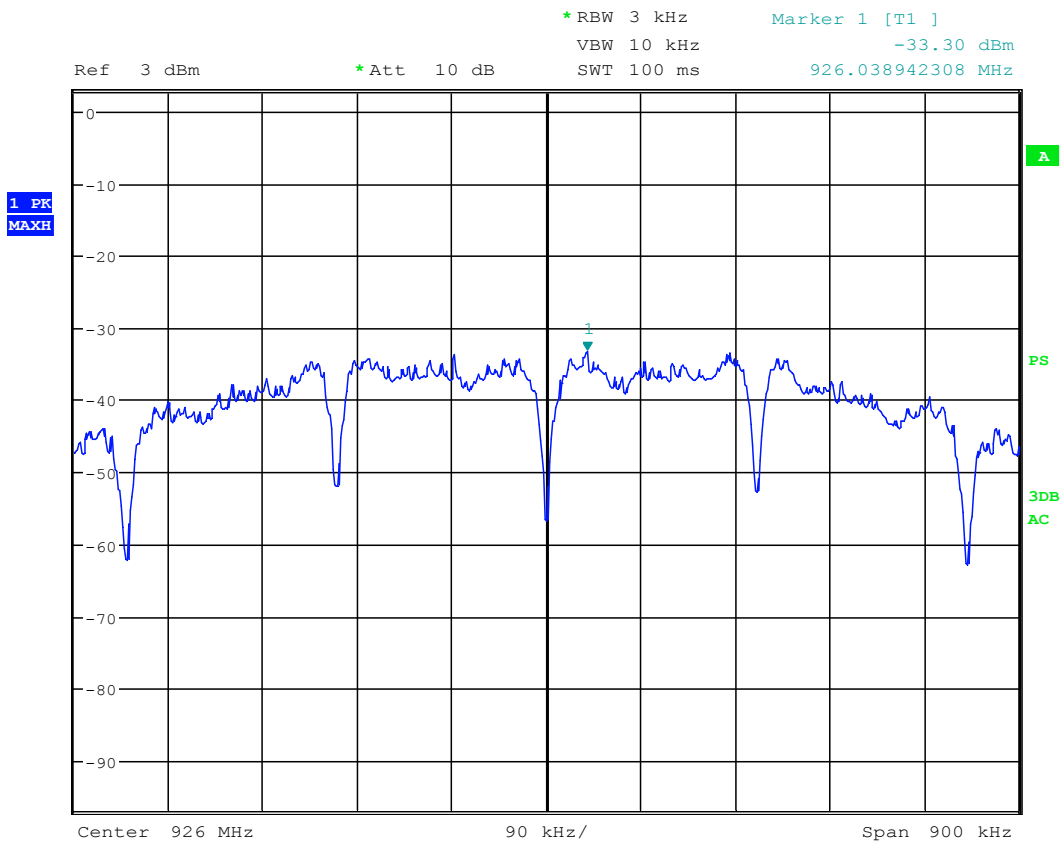
Date: 29.JUN.2019 00:54:54

Z-Axis_Mid Channel



Date: 29.JUN.2019 00:56:00

Z-Axis_High Channel



Date: 29.JUN.2019 00:56:52

Test Personnel:	Dan Alvarez	Test Date:	06/28/2019
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247	Limit Applied:	See report section 8.3
Input Voltage:	120VAC,60 Hz		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	23 ºC
		Relative Humidity:	48 %
		Atmospheric Pressure:	998 mbars

Deviations, Additions, or Exclusions: None

9 Band Edge Compliance

9.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.247 RSS 247, ANSI C 63.10 (§11.12.1).

TEST SITE: EMC Lab & 10m ALSE

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.1 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.8 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.1 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	3.9 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.5 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.1 dB	6.3 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

9.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
212054'	Barometric Pressure/Humidity Datalogger	Extech	SD700	A.074981	10/31/2018	10/31/2019
200162'	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	10/10/2018	10/10/2019
200003'	Attenuator, 03 dB, <18GHz	Weinschel Corp	2	BK7899	02/26/2019	02/26/2020
E211'	RF Coax Cable	Megaphase	TM18-N1N1-120	15055601001	07/03/2018	07/03/2019
TW2 211411'	RF Coax Cable 9KHz-18GHz	Fairview Microwave	FMCA1282-472	TW2	08/07/2018	08/07/2019
200069'	Preamplifier, 10 MHz to 2000 MHz, 40 dB gain	Mini-Circuits	ZKL-2	D011105	10/08/2018	10/08/2019
MP12'	RF Coax Cable low loss - DC to 18 GHz, Type N connectors.	Fiarview Microwave	SCE180060505 -700CM	MP12	02/15/2019	02/15/2020
213312'	Bilog antenna	Teseq	CBL 6112D	40527	06/07/2019	06/07/2020
213451'	Comparison Noise Emitter, Narrowband noise source	Com-Power	CGO-520	281266	NCR	NCR
MM5'	RF Coax Cable 10KHz-18GHz	Maury Microwave	UC-N-MM-118	163203	12/17/2018	12/17/2019

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	Nexio	3.18.0.23

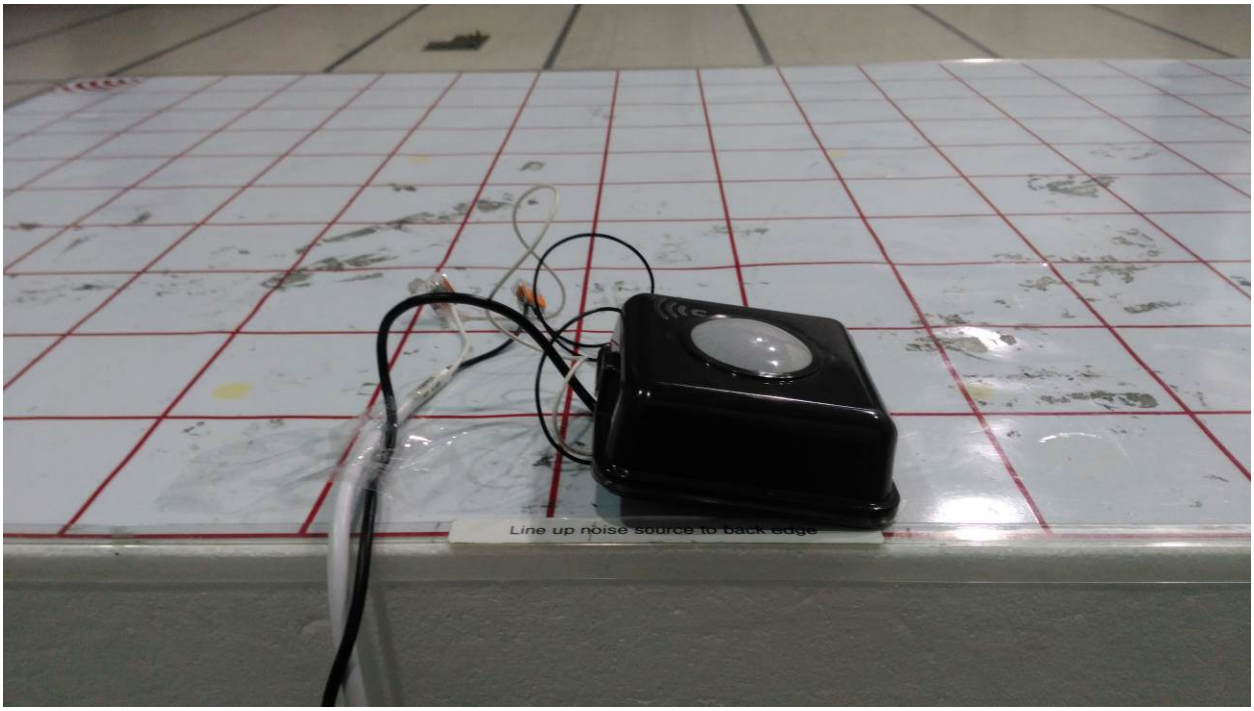
9.3 Results:

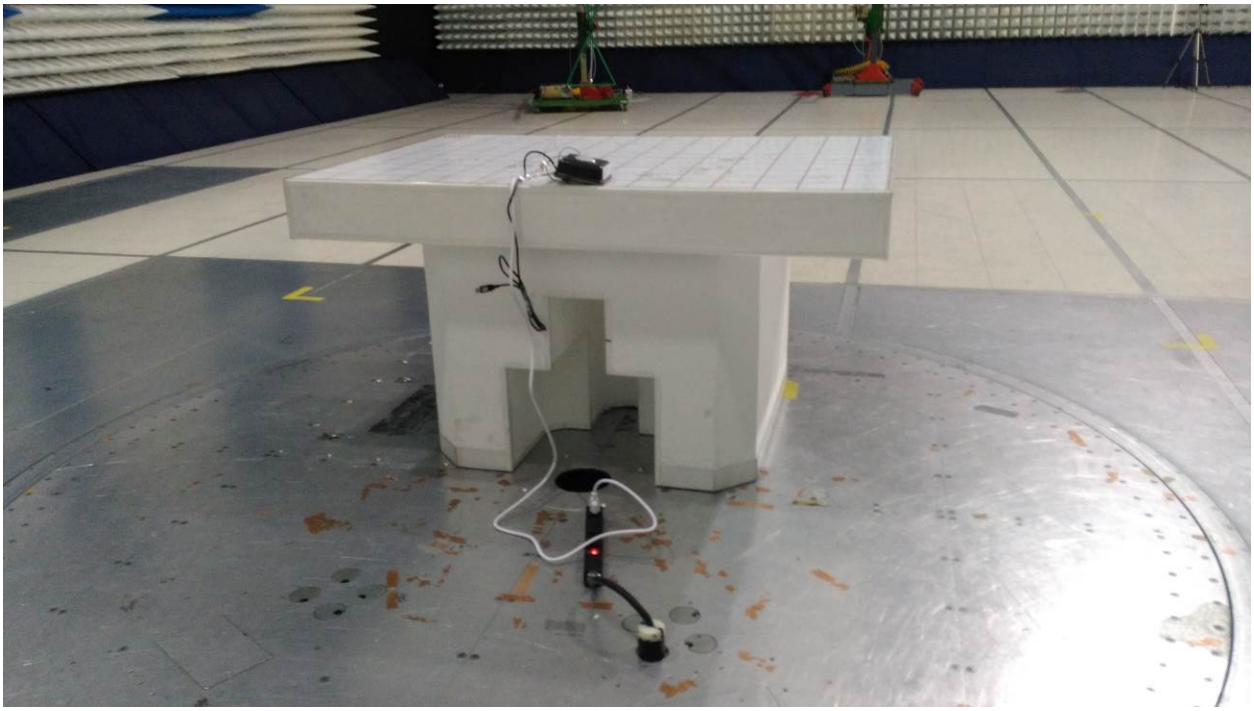
The sample tested was found to Comply.

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))

Note: Emissions were highest in the Z-Axis

9.4 Setup Photograph:

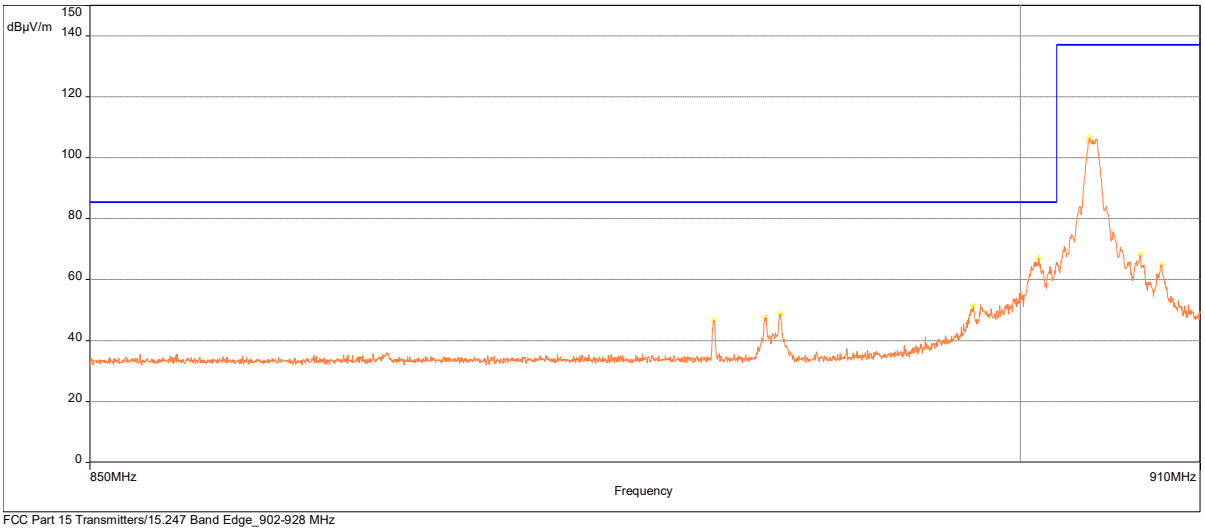




9.5 Plots/Data:

15.247 Band Edge_902-928 MHz- Class

Emissions Graph: rSDG with new antenna_Band Edge 902-928 MHz _Low Channel_Z_w-Limits



FCC Part 15 Transmitters/15.247 Band Edge_902-928 MHz

Data Results:

Peak /Lim. QPeak (8)

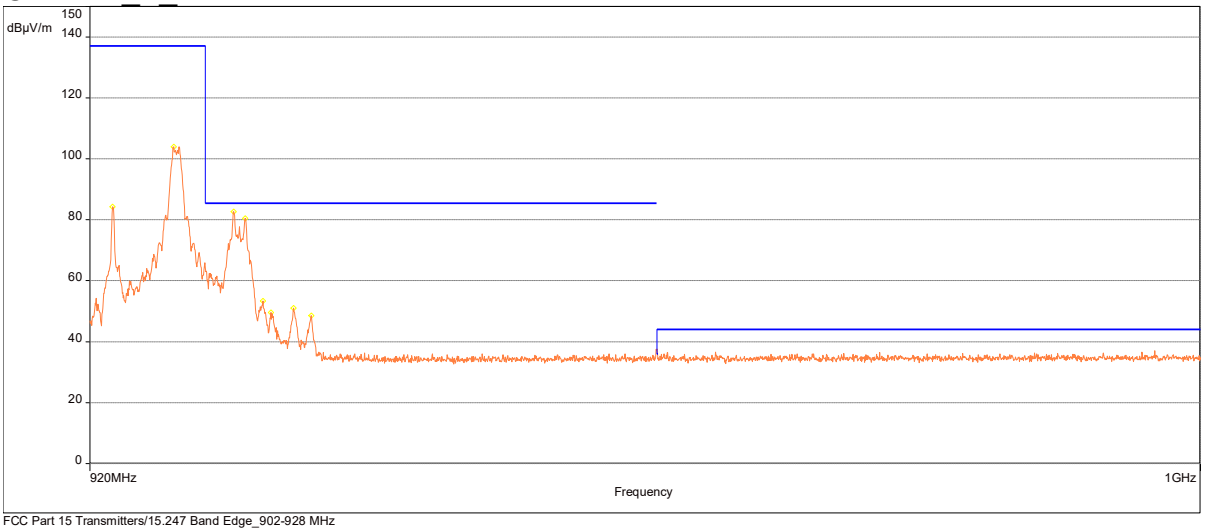
Frequency (MHz)	Peak (dBµV/m)	Lim. QPeak (dBµV/m)	Peak-Lim (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
883.195	46.70	85.47	-38.77	1.02	341.00	Horizontal polarization	-6.69
886	47.61	85.47	-37.86	1.02	348.00	Horizontal polarization	-6.67
886.81	48.71	85.47	-36.76	1.02	343.00	Horizontal polarization	-6.66
897.4	51.27	85.47	-34.2	1.02	348.00	Horizontal polarization	-6.47
901	67.10	85.47	-18.37	1.02	336.00	Horizontal polarization	-6.45
903.835	106.62	137.00	-30.38	1.02	345.00	Horizontal polarization	-6.45
906.655	68.04	137.00	-68.96	1.02	343.00	Horizontal polarization	-6.55
907.84	64.88	137.00	-72.12	1.02	343.00	Horizontal polarization	-6.55

Meas. peak (1)

Frequency (MHz)	SR	Meas.Peak (dBµV/m)	Height (m)	Angle (°)	Correction (dB)
903.835	1	105.47	0.98	342.00	-6.45

15.247 Band Edge_902-928 MHz- Class

Emissions Graph: rSDG with new antenna_Band Edge 902-928 MHz _High Channel_Z_w-Limits



FCC Part 15 Transmitters/15.247 Band Edge_902-928 MHz

Data Results:

Peak /Lim. QPeak (8)

Frequency (MHz)	Peak (dBµV/m)	Lim. QPeak (dBµV/m)	Peak-Lim (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
921.58	84.21	137.00	-52.79	1.02	343.00	Horizontal polarization	-6.50
925.8	104.02	137.00	-32.98	1.02	339.00	Horizontal polarization	-6.45
930	82.70	85.47	-2.77	1.02	350.00	Horizontal polarization	-6.45
930.8	80.44	85.47	-5.03	1.02	359.00	Horizontal polarization	-6.45
932.04	53.31	85.47	-32.16	1.02	355.00	Horizontal polarization	-6.45
932.58	49.57	85.47	-35.90	1.02	348.00	Horizontal polarization	-6.45
934.18	50.98	85.47	-34.49	1.02	339.00	Horizontal polarization	-6.45
935.42	48.57	85.47	-36.90	1.02	353.00	Horizontal polarization	-6.45

Test Personnel:	Dan Alvarez	Test Date:	06/28/2019
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247	Limit Applied:	See report section 9.3
Input Voltage:	120VAC,60Hz		
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Ambient Temperature:	23 ºC
		Relative Humidity:	45 %
		Atmospheric Pressure:	998 mbars

Deviations, Additions, or Exclusions: None

10 Transmitter spurious emissions

10.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.247, FCC 15.209, RSS 247, ICES 003, ANSI C 63.10 (§7.6.1; 11.12.2.7), and ANSI C 63.4.

TEST SITE: EMC Lab & 10m ALSE

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.1 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.8 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.1 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	3.9 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.5 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.1 dB	6.3 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

10.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
212054'	Barometric Pressure/Humidity Datalogger	Extech	SD700	A.074981	10/31/2018	10/31/2019
200162'	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	10/10/2018	10/10/2019
200003'	Attenuator, 03 dB, <18GHz	Weinschel Corp	2	BK7899	02/26/2019	02/26/2020
E211'	RF Coax Cable	Megaphase	TM18-N1N1-120	15055601001	07/03/2018	07/03/2019
TW2 211411'	RF Coax Cable 9KHz-18GHz	Fairview Microwave	FMCA1282-472	TW2	08/07/2018	08/07/2019
200069'	Preamplifier, 10 MHz to 2000 MHz, 40 dB gain	Mini-Circuits	ZKL-2	D011105	10/08/2018	10/08/2019
MP12'	RF Coax Cable low loss - DC to 18 GHz, Type N connectors.	Fiarview Microwave	SCE180060505-700CM	MP12	02/15/2019	02/15/2020
213312'	Bilog antenna	Teseq	CBL 6112D	40527	06/07/2019	06/07/2020
213451'	Comparison Noise Emitter, Narrowband noise source	Com-Power	CGO-520	281266	NCR	NCR
MM5'	RF Coax Cable 10KHz-18GHz	Maury Microwave	UC-N-MM-118	163203	12/17/2018	12/17/2019
213103'	High Pass Filter - Rated 1GHz	Micro-Tronics	HPM50108	140	10/31/2018	10/31/2019
213453'	Preamplifier 500MHz-18GHz	Com-Power	PAM-118A	18040030	09/28/2018	09/28/2019
213058'	DRG Horn Antenna .7 – 18 GHz	A.H. Systems	2455	246	10/23/2018	10/23/2019
SP-1'	RF Coax 10KHz-18GHz	Teledyne Storm Micr	90-088-084	16-02-602	07/03/2018	07/03/2019
MP11'	RF Coax Cable Low loss - DC to 18 GHz, Type N connectors.	Fiarview Microwave	SCE18060505-500CM	MP11	02/15/2019	02/15/2020

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	Nexio	3.18.0.23

10.3 Results:

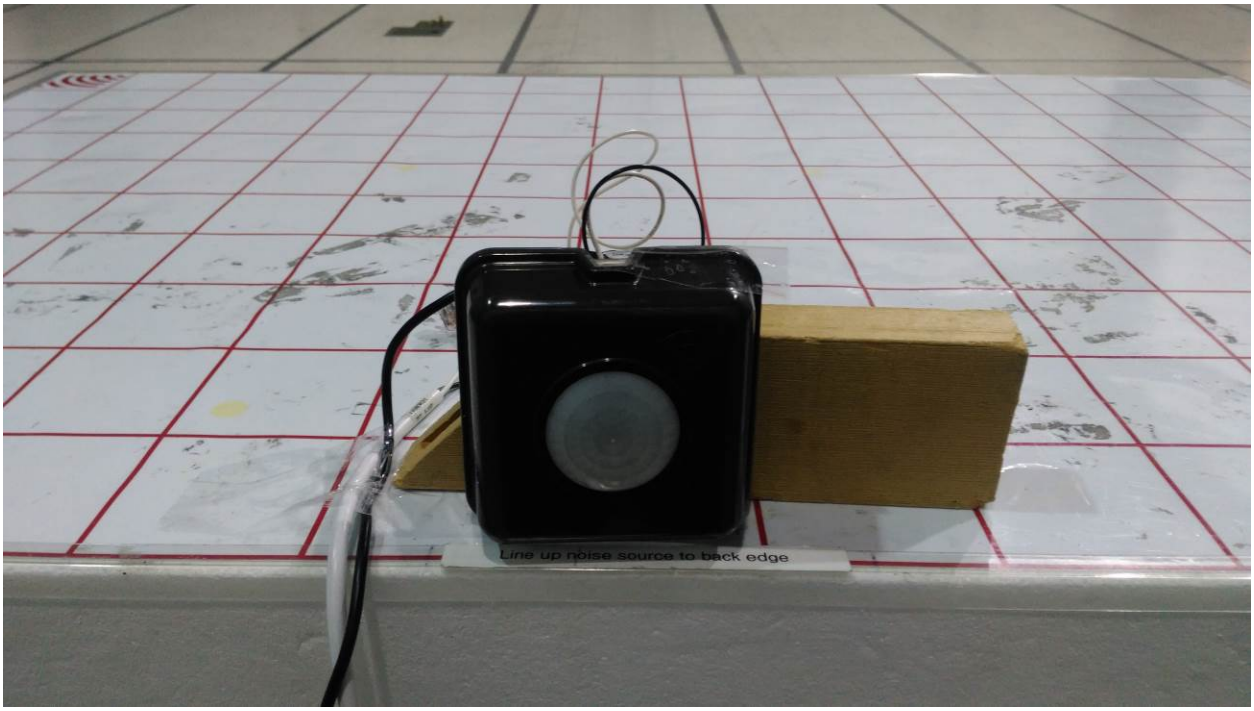
The sample tested was found to Comply.

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))

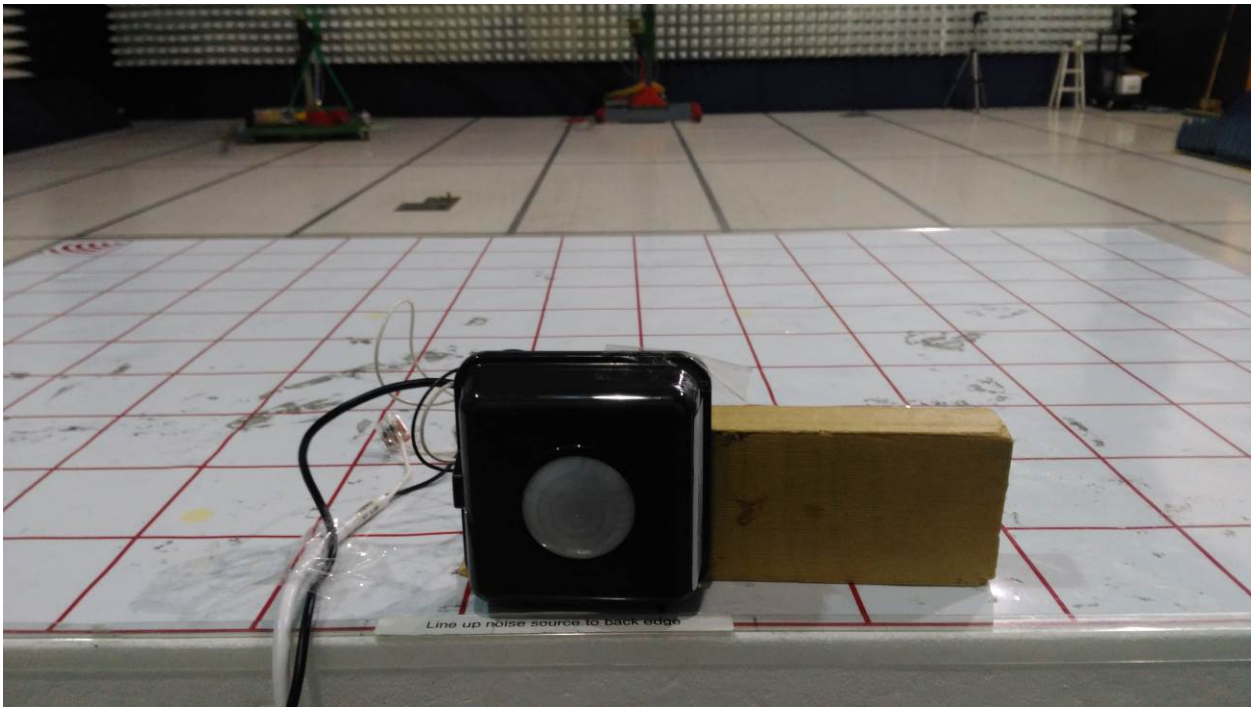
Note: Emissions were highest in the Z-Axis

10.4 Setup Photographs:

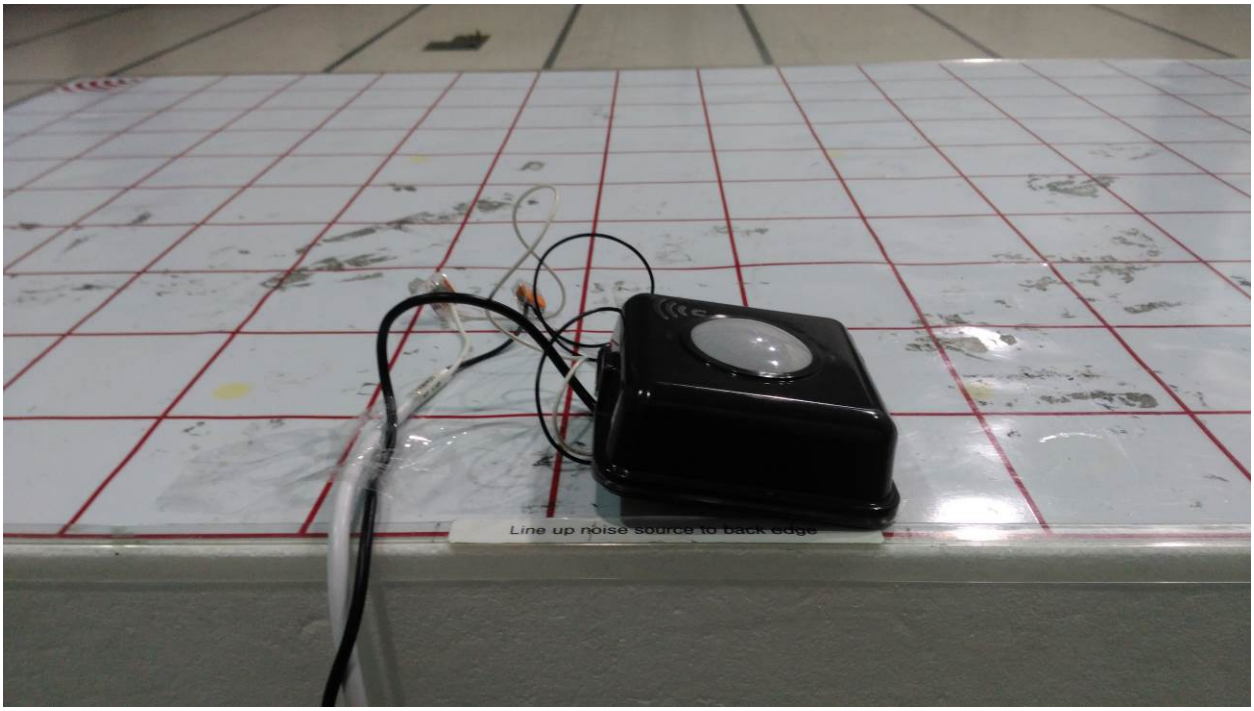
X- Axis

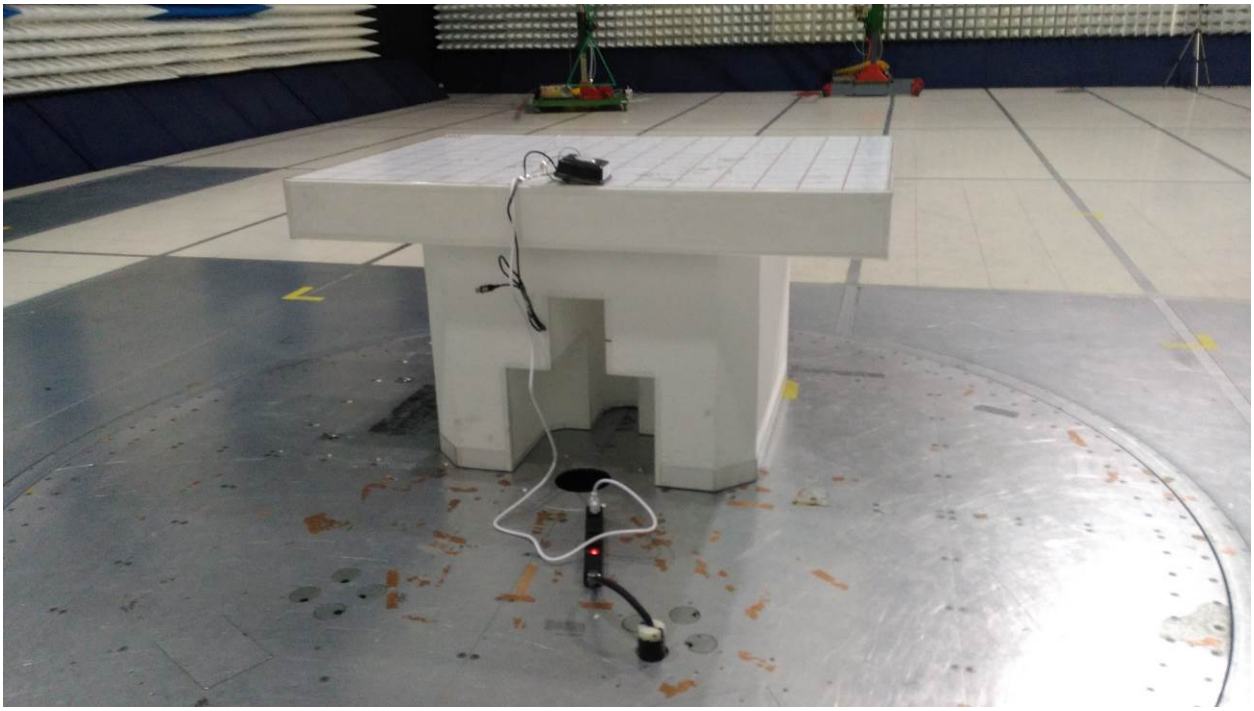


Y-Axis



Z-Axis

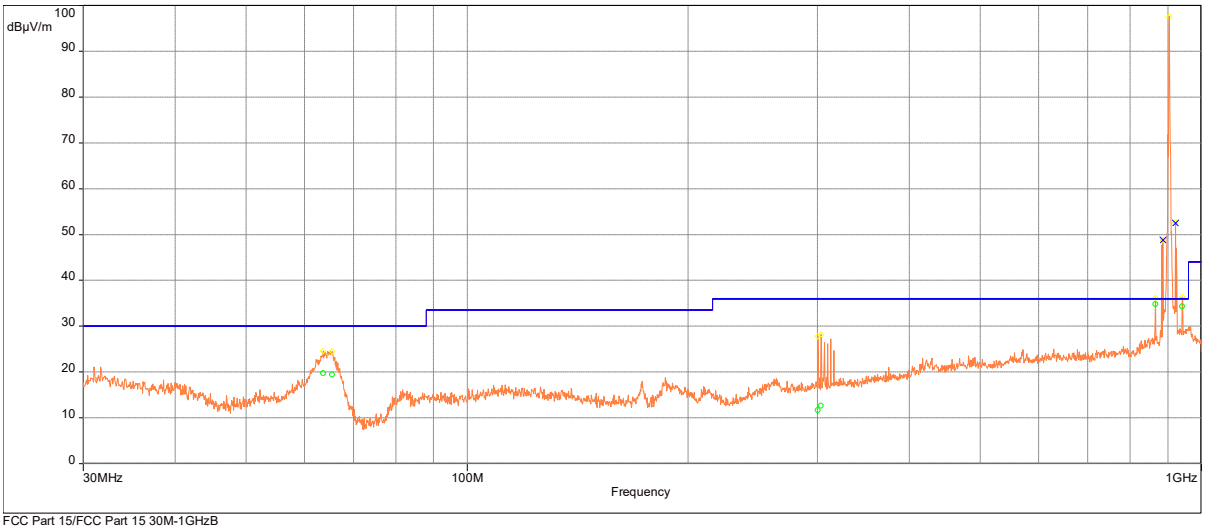




10.5 Plots/Data:

FCC Part 15 30M-1GHz- Class B

Emissions Graph: rSDG with new antenna_RE 30MHz-1GHz_Low Channel 1



FCC Part 15/FCC Part 15 30M-1GHzB

Data Results:

Peak /Lim. QPeak (2)

Frequency (MHz)	SR	Peak (dBµV/m)	Lim. QPeak (dBµV/m)	Peak-Lim (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
904.151875	1	97.57	36.00	61.57	2.98	2.00	Horizontal polarization	-6.47
886.81313	1	48.78	36.00	12.78	181.00	1.00	Horizontal	-6.66
921.611875	1	52.55	36.00	16.55	1.02	180.00	Horizontal polarization	-6.50

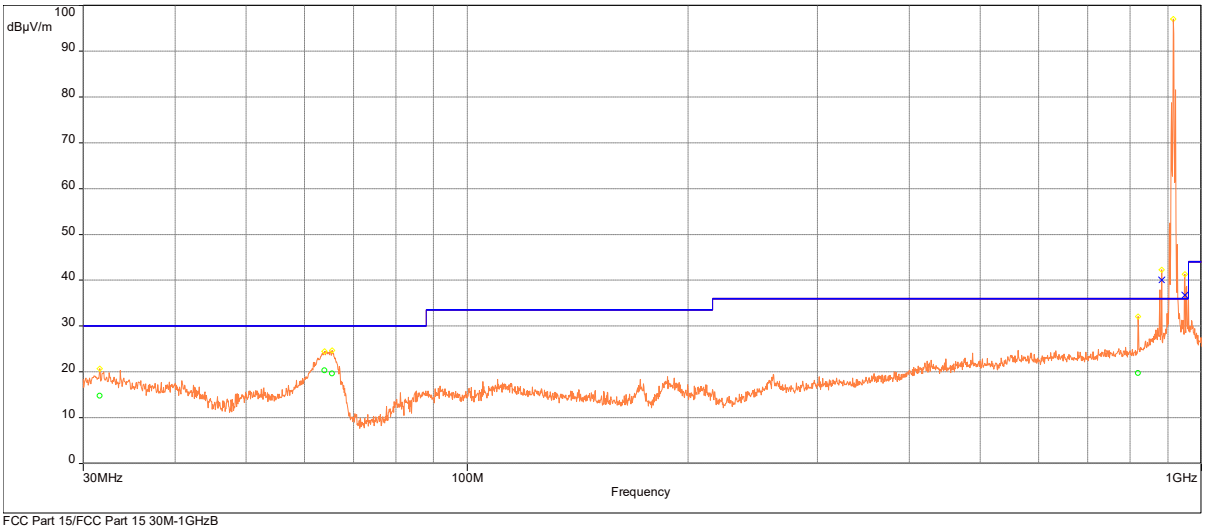
Note: Emissions at 886.8 and 921.6 were greater than 20 dB below the fundamental frequency.

QuasiPeak (PASS) (6)

Frequency (MHz)	SR	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
63.707115 38	1	19.74	30.00	-10.26	321.00	1.66	Vertical	0.10	-23.74
65.465432 69	1	19.49	30.00	-10.51	347.00	2.03	Vertical	0.10	-23.62
300.50875	1	11.67	36.00	-24.33	133.00	1.55	Vertical	0.10	-15.47
303.479572 3	1	12.68	36.00	-23.32	357.00	1.00	Vertical	0.10	-15.35
865.715043 1	1	34.82	36.00	-1.18	176.00	1.09	Horizontal	0.10	-6.93
942.224187 7	1	34.36	36.00	-1.64	4.00	1.06	Horizontal	0.10	-6.38

FCC Part 15 30M-1GHz- Class B

Emissions Graph: rSDG with new antenna_RE 30MHz-1GHz_Mid Channel 7



FCC Part 15/FCC Part 15 30M-1GHzB

Data Results:

Peak /Lim. QPeak (1)

Frequency (MHz)	SR	Peak (dBµV/m)	Lim. QPeak (dBµV/m)	Peak-Lim (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
915.97375	1	96.97	36.00	60.97	1.02	342.00	Horizontal polarization	-6.56
883.2364423	1	40.05	36.00	4.05	179.00	1.23	Horizontal	-6.69
949.2566777	1	36.74	36.00	0.74	351.00	1.09	Horizontal	-6.26

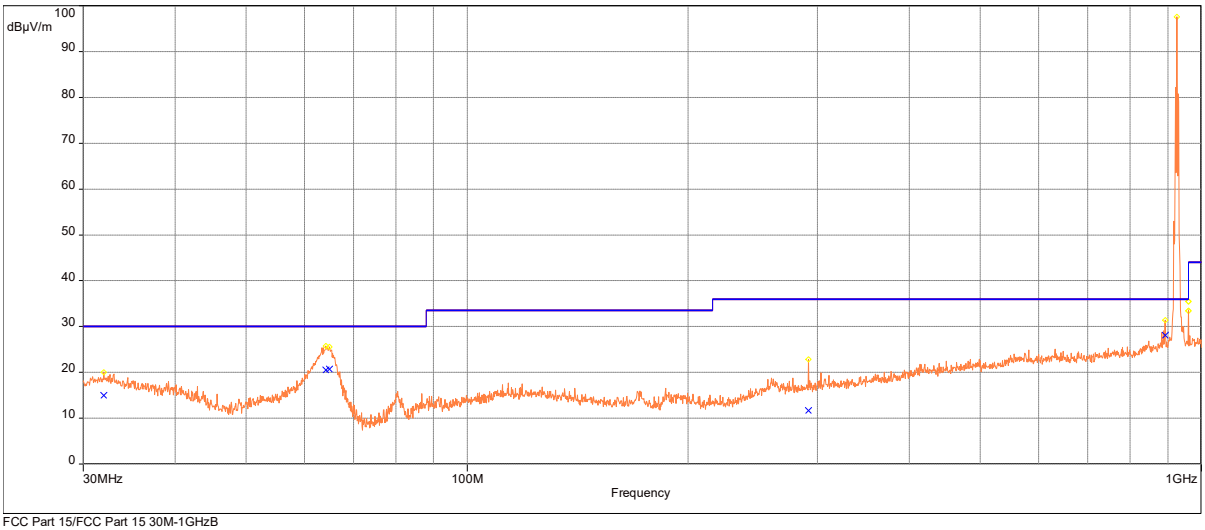
Note: Emissions at 883.2 and 949.2 were greater than 20 dB below the fundamental frequency.

QuasiPeak (PASS) (4)

Frequency (MHz)	SR	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
31.57701923	1	14.81	30.00	-15.19	328.00	3.72	Horizontal	0.10	-13.74
63.94980769	1	20.34	30.00	-9.66	336.00	1.72	Vertical	0.10	-23.74
65.464855777	1	19.67	30.00	-10.33	287.00	2.17	Vertical	0.10	-23.62
820.3679277	1	19.73	36.00	-16.27	347.00	3.30	Horizontal	0.10	-7.85

FCC Part 15 30M-1GHz- Class B

Emissions Graph: rSDG with new antenna_with spacer_RE 30MHz-1GHz_High Channel 12



FCC Part 15/FCC Part 15 30M-1GHzB

Data Results:

Manual meas. (1)

Frequency (MHz)	SR	Meas.Peak (dBµV/m)	Meas.Q-Peak (dBµV/m)	Lim.Q-Peak (dBµV/m)	Meas.Q-Peak-Lim.Q-Peak (dB)	Height (m)	Angle (°)	Correction (dB)
960	1	35.51	33.45	36.00	-2.55	0.99	0.00	-6.07

Peak /Lim. QPeak (1)

Frequency (MHz)	SR	Peak (dBµV/m)	Lim. QPeak (dBµV/m)	Peak-Lim (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
925.855625	1	97.61	36.00	61.61	1.98	157.00	Vertical polarization	-6.45

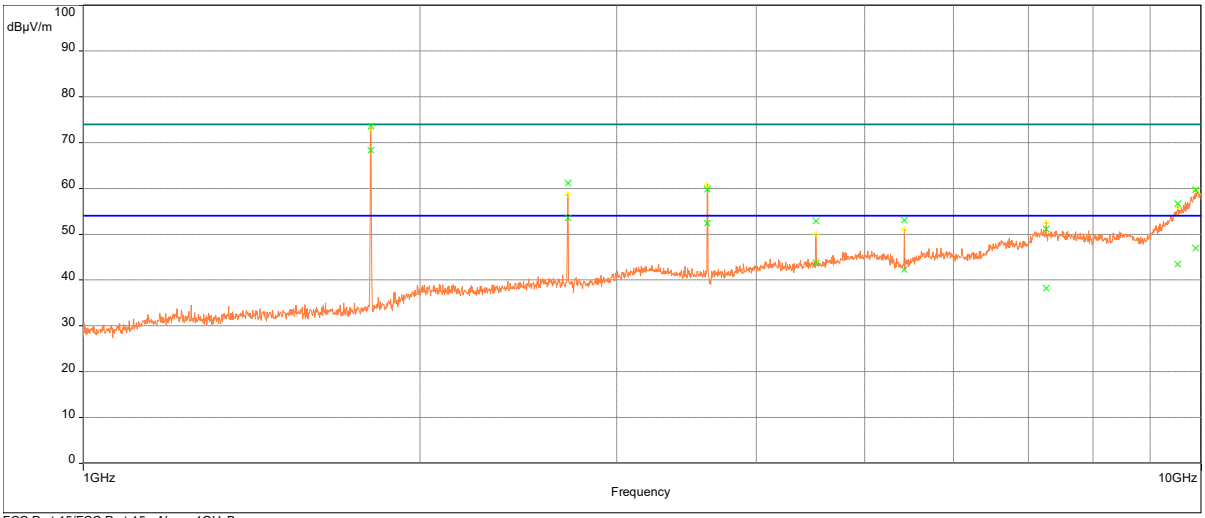
QuasiPeak (PASS) (5)

Frequency (MHz)	SR	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
32.00081731	1	15.01	30.00	-14.99	63.00	1.68	Horizontal	0.10	-13.48
64.192692311	1	20.55	30.00	-9.45	135.00	2.04	Vertical	0.10	-23.72
64.919807689	1	20.66	30.00	-9.34	84.00	1.58	Vertical	0.10	-23.63
291.6573077	1	11.68	36.00	-24.32	325.00	2.03	Vertical	0.10	-15.62
892.4508654	1	28.08	36.00	-7.92	5.00	1.06	Horizontal	0.10	-6.52

Note: Plastic spacer for routing of cabling used in final assembly was added to the unit to achieve compliance.

FCC Part 15 - Above 1GHz- Class B

Emissions Graph: rSDG with new antenna_with spacer_USB CBL Removed_Low Channel 1_RE 1GHz-10GHz_High Pass Filter_adjusted wires



FCC Part 15/FCC Part 15 - Above 1GHzB

Data Results:

Avg (PASS) (7)

Frequency (MHz)	S R	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
2712.581731	1	53.59	54.00	-0.41	275.00	1.89	Vertical	0.10	-2.64
3615.201923	1	52.38	54.00	-1.62	94.00	3.08	Vertical	0.10	-0.96
4521.028846	1	43.77	54.00	-10.23	216.00	2.79	Vertical	0.10	0.56
5425.201923	1	42.25	54.00	-11.75	339.00	1.12	Vertical	0.10	1.56
7264.910256	1	38.19	54.00	-15.81	99.00	3.26	Vertical	0.10	8.31
9527.415064	1	43.45	54.00	-10.55	344.00	3.67	Vertical	0.10	11.85
9885.581731	1	46.92	54.00	-7.08	295.00	3.28	Vertical	0.10	16.23

Frequency (MHz)	S R	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
1808.400641	1	68.30	54.00	14.30	63.00	3.20	Horizontal	0.10	-6.69

*Emission at 1808.40 was greater than 20 dB below the fundamental frequency and meets the requirements of the standard.

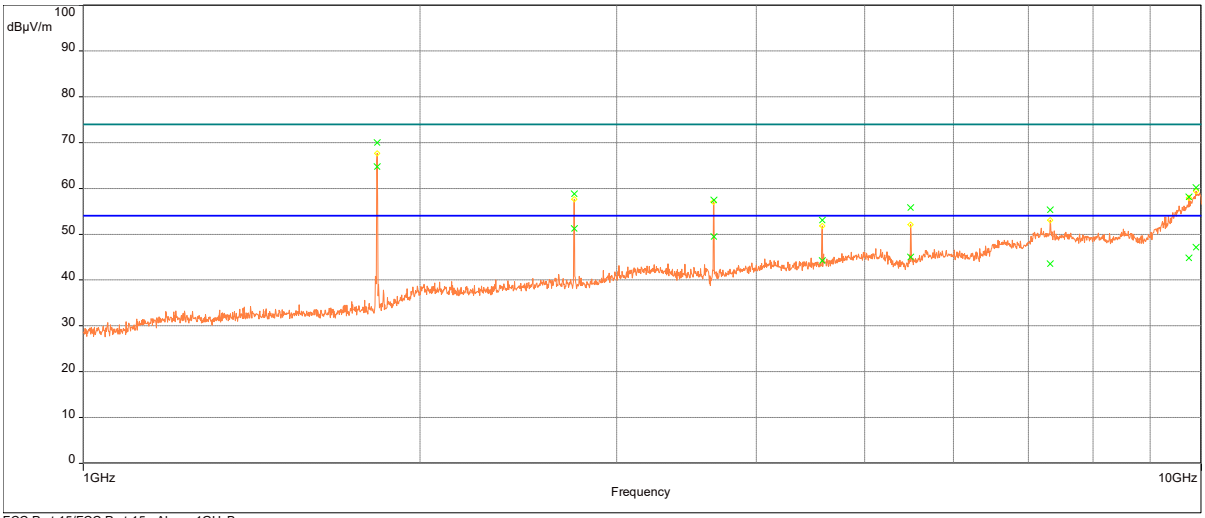
Peak (PASS) (8)

Frequency (MHz)	S R	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
1808.400641	1	73.62	74.00	-0.38	63.00	3.20	Horizontal	0.10	-6.69
2712.581731	1	61.11	74.00	-12.89	275.00	1.89	Vertical	0.10	-2.64

3615.201923	1	59.75	74.00	-14.25	94.00	3.08	Vertical	0.10	-0.96
4521.028846	1	52.86	74.00	-21.14	216.00	2.79	Vertical	0.10	0.56
5425.201923	1	53.03	74.00	-20.97	339.00	1.12	Vertical	0.10	1.56
7264.910256	1	51.12	74.00	-22.88	99.00	3.26	Vertical	0.10	8.31
9527.415064	1	56.67	74.00	-17.33	344.00	3.67	Vertical	0.10	11.85
9885.581731	1	59.66	74.00	-14.34	295.00	3.28	Vertical	0.10	16.23

FCC Part 15 - Above 1GHz- Class B

Emissions Graph: rSDG with new antenna_with spacer_USB CBL Removed_Mid Channel 7_RE 1GHz-10GHz_High Pass Filter



FCC Part 15/FCC Part 15 - Above 1GHzB

Data Results:

Avg (PASS) (7)

Frequency (MHz)	S R	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
2748.626603	1	51.20	54.00	-2.80	278.00	3.68	Horizontal	0.10	-2.53
3663.201923	1	49.49	54.00	-4.51	245.00	3.30	Horizontal	0.10	-0.89
4578.974359	1	44.21	54.00	-9.79	123.00	1.43	Horizontal	0.10	0.77
5497.201923	1	44.98	54.00	-9.02	249.00	1.02	Horizontal	0.10	1.77
7326.403846	1	43.52	54.00	-10.48	360.00	1.29	Horizontal	0.10	7.73
9747.427885	1	44.76	54.00	-9.24	356.00	1.74	Vertical	0.10	14.24
9894.375	1	47.11	54.00	-6.89	113.00	1.50	Horizontal	0.10	16.35

Frequency (MHz)	S R	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
1831.600962	1	64.69	54.00	10.69	82.00	3.25	Horizontal	0.10	-6.44

*Emission at 1808.40 was greater than 20 dB below the fundamental frequency and meets the requirements of the standard.

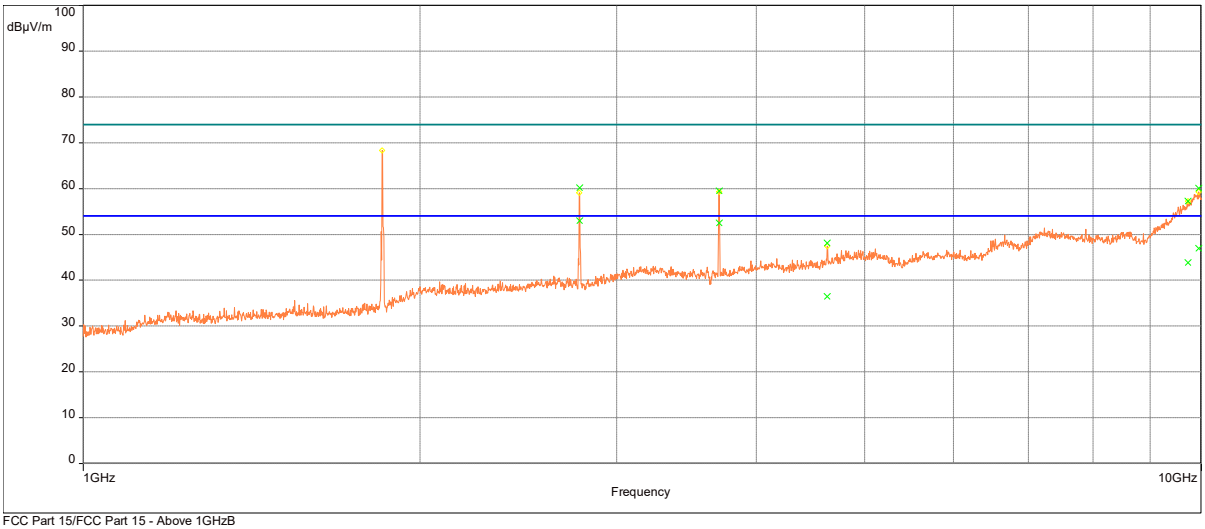
Peak (PASS) (8)

Frequency (MHz)	S R	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
1831.600962	1	69.97	74.00	-4.03	82.00	3.25	Horizontal	0.10	-6.44
2748.626603	1	58.84	74.00	-15.16	278.00	3.68	Horizontal	0.10	-2.53
3663.20192	1	57.48	74.00	-16.52	245.00	3.30	Horizontal	0.10	-0.89

3d									
4578.974359	1	53.03	74.00	-20.97	123.00	1.43	Horizontal	0.10	0.77
5497.201923	1	55.76	74.00	-18.24	249.00	1.02	Horizontal	0.10	1.77
7326.403846	1	55.30	74.00	-18.70	360.00	1.29	Horizontal	0.10	7.73
9747.427885	1	58.08	74.00	-15.92	356.00	1.74	Vertical	0.10	14.24
9894.375	1	60.17	74.00	-13.83	113.00	1.50	Horizontal	0.10	16.35

FCC Part 15 - Above 1GHz- Class B

Emissions Graph: rSDG with new antenna_with spacer_USB Removed_High Channel 12_RE 1GHz-10MHz_High Pass Filter



FCC Part 15/FCC Part 15 - Above 1GHzB

Data Results:

Avg (PASS) (5)

Frequency (MHz)	S R	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
2778.528846	1	53.00	54.00	-1.00	2.00	3.22	Horizontal	0.10	-2.56
3704.801282	1	52.45	54.00	-1.55	262.00	3.56	Vertical	0.10	-0.86
4628.974359	1	36.47	54.00	-17.53	258.00	1.22	Vertical	0.10	1.15
9724.988782	1	43.87	54.00	-10.13	38.00	1.02	Horizontal	0.10	13.91
9948.857372	1	46.99	54.00	-7.01	328.00	2.21	Vertical	0.10	16.92

Peak (PASS) (5)

Frequency (MHz)	S R	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Meas. time (s)	Correction (dB)
2778.528846	1	60.21	74.00	-13.79	2.00	3.22	Horizontal	0.10	-2.56
3704.801282	1	59.50	74.00	-14.50	262.00	3.56	Vertical	0.10	-0.86
4628.974359	1	48.13	74.00	-25.87	258.00	1.22	Vertical	0.10	1.15
9724.988782	1	57.23	74.00	-16.77	38.00	1.02	Horizontal	0.10	13.91
9948.857372	1	60.11	74.00	-13.89	328.00	2.21	Vertical	0.10	16.92

Test Personnel:	Dan Alvarez	Test Date:	06/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247, CFR47 FCC Part 15 Subpart B, RSS-247, ICES-003	Limit Applied:	15.209; 15.205
Input Voltage:	120VAC,60Hz	Ambient Temperature:	23 ºC
Pretest Verification w/ Ambient Signals or BB Source:	Yes	Relative Humidity:	47 %
		Atmospheric Pressure:	989 mbars

Deviations, Additions, or Exclusions: None

11 AC Mains Conducted Emissions

11.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.247, FCC 15.207, RSS 247, ICES 003, and ANSI C 63.4.

TEST SITE:

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

10 Meter Semi-Anechoic Chamber The test site for radiated emissions is located at 1950 Evergreen Blvd, Suite 100, Duluth, Georgia 30096. It is a 10 meter semi-anechoic chamber manufactured by Panashield. Embedded in the floor is a 3 meter diameter turntable.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
AC Line Conducted Emissions	150 kHz - 30 MHz	2.8 dB	3.4dB

As shown in the table above our conducted emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculations

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF
Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN or ISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(49.1\ dB\mu V / 20)}$ = 285.1 μV/m

11.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
MM9'	RF Coax Cable 9KHz-18GHz	Maury Microwave	UC-N-MM267	1635290	10/09/2018	10/09/2019
E211'	RF Coax Cable	Megaphase	TM18-N1N1-120	15055601001	07/13/2018	07/13/2019
213052'	Line Impedance Stabilization Network (LISN) - Rated 9kHz to 30 Mhz, 15 Amps.	Com-Power	LI-215A	191958	03/01/2019	03/01/2020
213152'	Transient Limiter	HEWLETT PACKARD	11947A	3107A01318	12/27/2018	12/27/2019
200076'	Conducted Emissions Site Source	Com-Power	CGC-255	311024	VBU	Verified
200162'	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	10/10/2018	10/10/2019
212054'	Barometric Pressure/Humidity Datalogger	Extech	SD700	A.074981	10/31/2018	10/31/2019
MP4'	RF Coax Cable 9KHz-18GHz	Fairview Microwave	FMCA1282-394	MP4	08/07/2018	08/07/2019

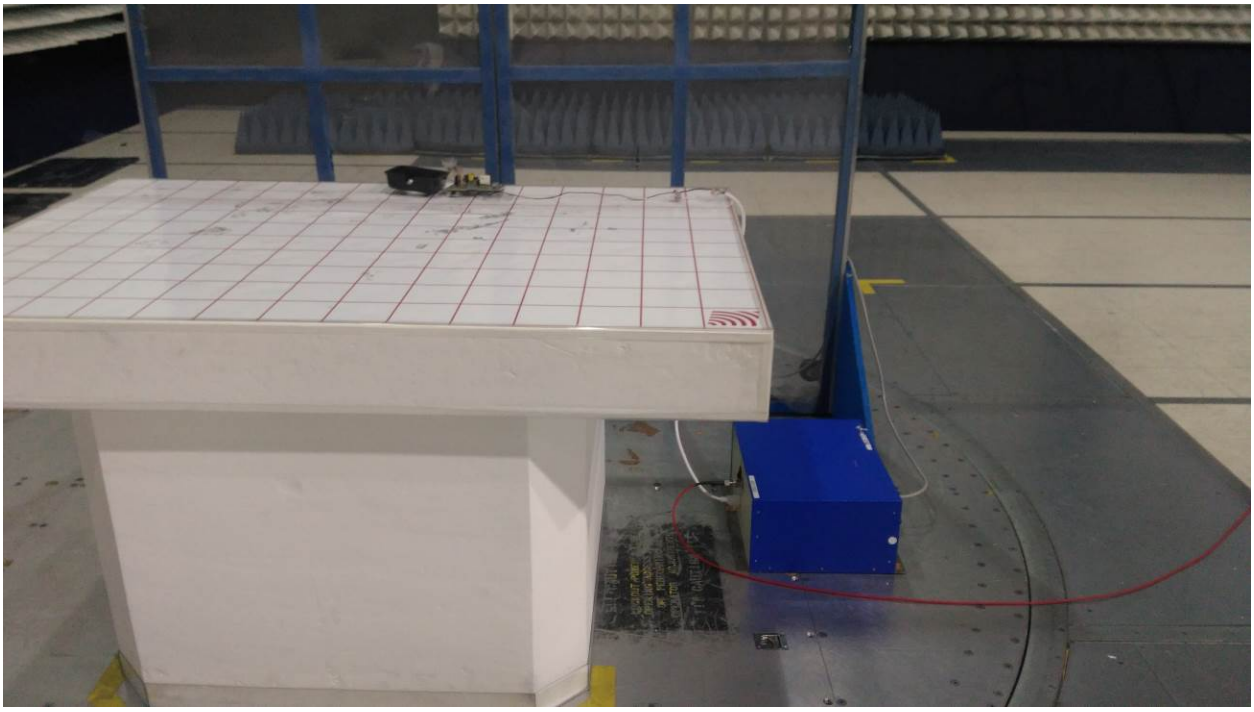
Software Utilized:

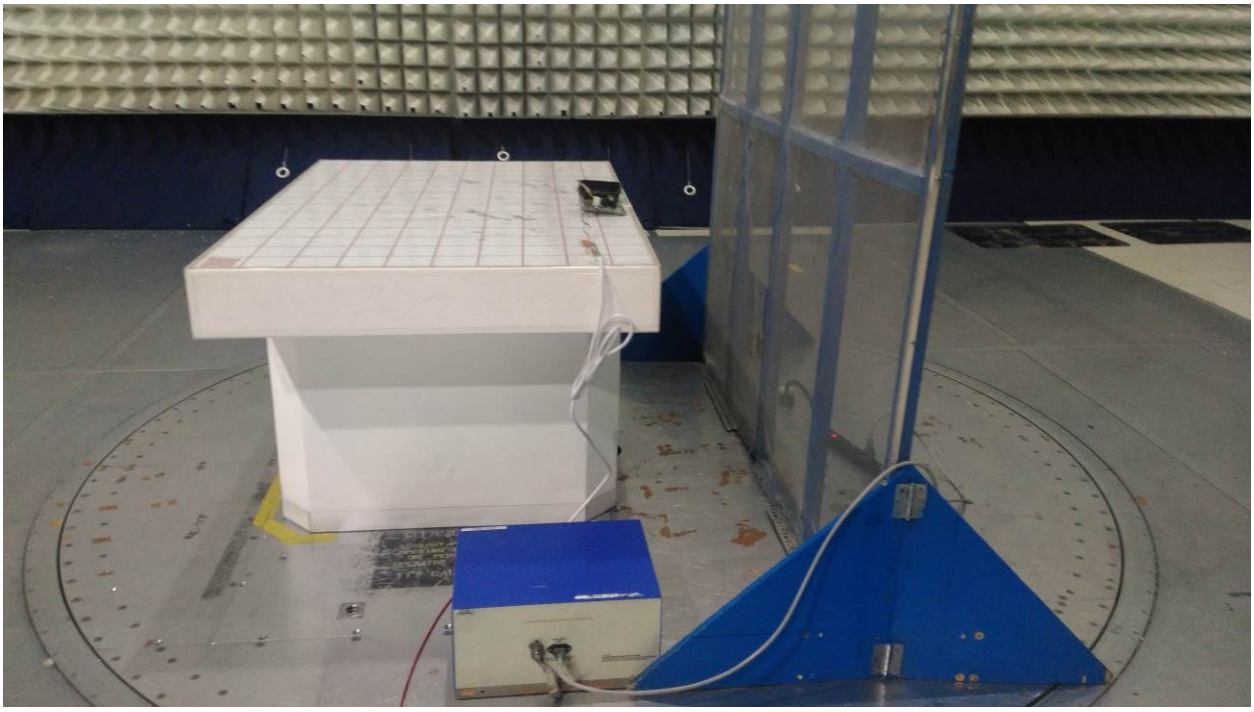
Name	Manufacturer	Version
BAT-EMC	Nexio	3.18.0.23

11.3 Results:

The sample tested was found to Comply.

11.4 Setup Photographs:

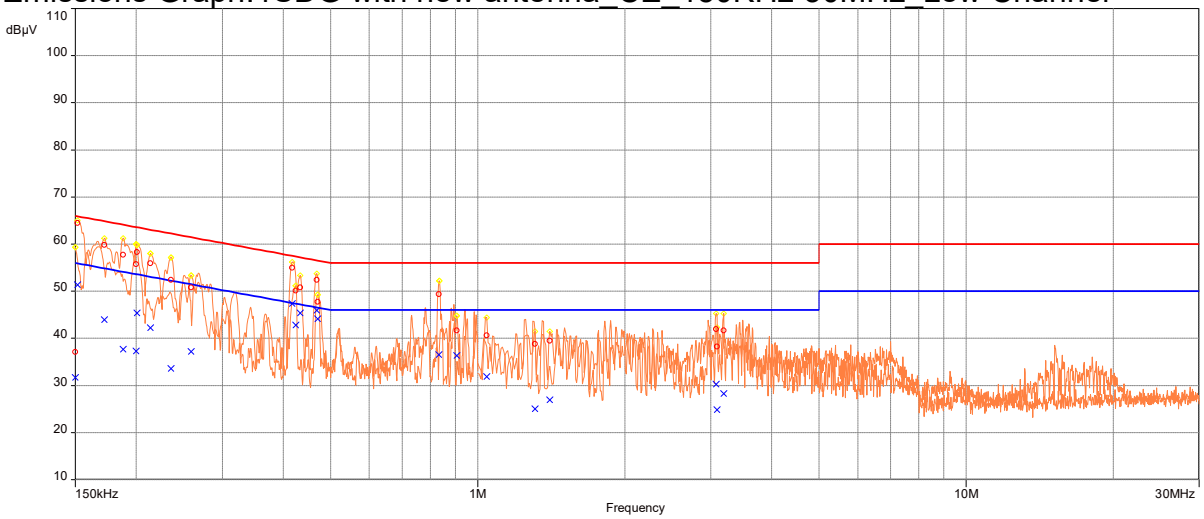




11.5 Plots/Data:

FCC Part 15.207– Class

Emissions Graph: rSDG with new antenna_CE_150KHz-30MHz_Low Channel



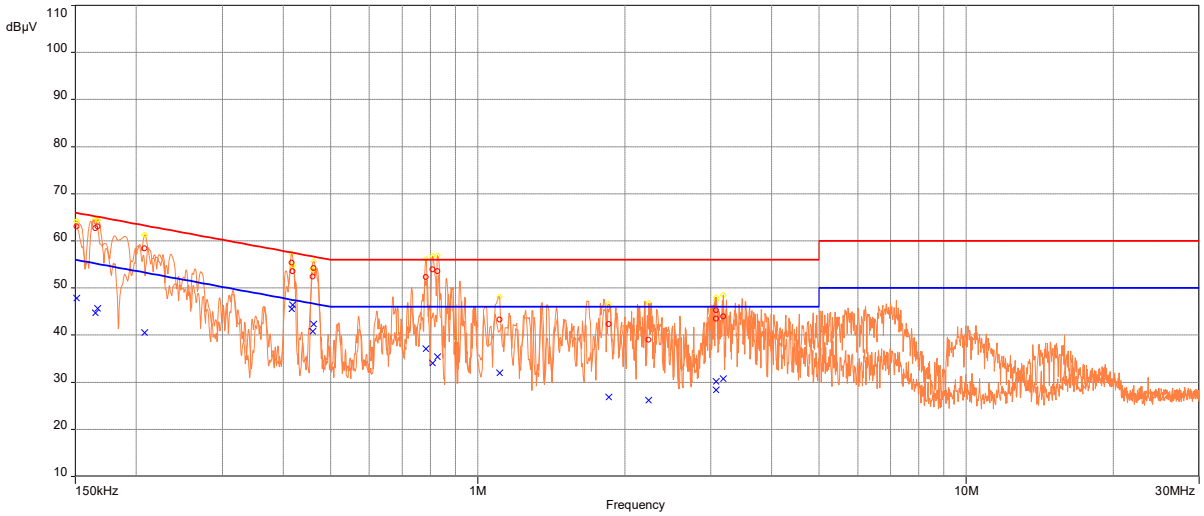
Data Results:

Final QP and AVG (22)

Frequency (MHz)	SR	AVG Level (dBuV)	QP Level (dBuV)	AVG Limit (dBuV)	QP Limit (dBuV)	AVG Margin (dB)	QPeak Margin (dB)	Position	Correction (dB)
0.1516711538	1	51.38	64.50	55.91	65.91	-4.53	-1.41	Phase 1	10.18
0.2007586538	1	45.38	58.29	53.58	63.58	-8.19	-5.29	Phase 1	10.16
0.2137067308	1	42.23	55.90	53.06	63.06	-10.83	-7.16	Phase 1	10.16
0.4168278846	1	47.33	55.02	47.51	57.51	-0.18	-2.49	Phase 1	10.20
0.4680115385	1	45.99	52.40	46.55	56.55	-0.56	-4.15	Phase 1	10.21
0.8336230769	1	36.52	49.35	46.00	56.00	-9.48	-6.65	Phase 1	10.24
1.0435	2	31.91	40.65	46.00	56.00	-14.09	-15.35	Phase 1	10.24
3.080764423	2	30.26	41.96	46.00	56.00	-15.74	-14.04	Phase 1	10.24
3.1895	2	28.27	41.68	46.00	56.00	-17.73	-14.32	Phase 1	10.24
0.1499855769	3	31.69	37.08	56.00	66.00	-24.31	-28.92	Neutral	10.11
0.1720711538	3	43.96	59.78	54.86	64.86	-10.90	-5.08	Neutral	10.11
0.1880086538	3	37.67	57.70	54.12	64.12	-16.45	-6.42	Neutral	10.11
0.1996961538	3	37.33	55.78	53.62	63.62	-16.29	-7.85	Neutral	10.11
0.2353817308	3	33.59	52.43	52.26	62.26	-18.66	-9.83	Neutral	10.12
0.2589692308	3	37.17	50.76	51.46	61.46	-14.30	-10.70	Neutral	10.12
0.4238259615	3	42.79	50.13	47.37	57.37	-4.58	-7.24	Neutral	10.16
0.4329778846	3	45.41	50.81	47.19	57.19	-1.78	-6.39	Neutral	10.16
0.4705615385	3	44.14	47.70	46.50	56.50	-2.37	-8.80	Neutral	10.17
0.9060711538	3	36.33	41.63	46.00	56.00	-9.67	-14.37	Neutral	10.21
1.31175	4	25.01	38.80	46.00	56.00	-20.99	-17.20	Neutral	10.21
1.406	4	26.92	39.43	46.00	56.00	-19.08	-16.57	Neutral	10.21
3.088014423	4	24.81	38.25	46.00	56.00	-21.19	-17.75	Neutral	10.20

FCC Part 15.207– Class

Emissions Graph: rSDG with new antenna_CE_150KHz-30MHz_Mid Channel



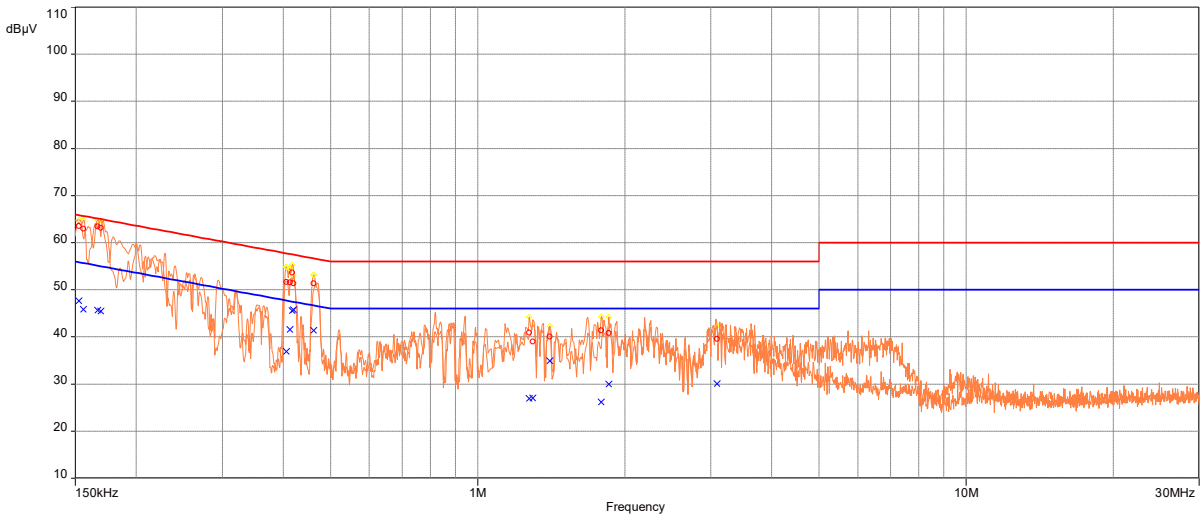
Data Results:

Final QP and AVG (17)

Frequency (MHz)	SR	AVG Level (dBuV)	QP Level (dBuV)	AVG Limit (dBuV)	QP Limit (dBuV)	AVG Margin (dB)	QPeak Margin (dB)	Position	Correction (dB)
0.1648461538	1	44.72	62.64	55.21	65.21	-10.49	-2.57	Phase 1	10.17
0.4159778846	1	45.53	55.37	47.53	57.53	-2.00	-2.16	Phase 1	10.20
0.4614384615	1	42.37	54.20	46.67	56.67	-4.29	-2.47	Phase 1	10.21
1.8555	2	26.83	42.32	46.00	56.00	-19.17	-13.68	Phase 1	10.25
2.239735577	2	26.18	39.02	46.00	56.00	-19.82	-16.98	Phase 1	10.25
3.080764423	2	28.39	43.49	46.00	56.00	-17.61	-12.51	Phase 1	10.24
0.1510480769	3	47.85	63.08	55.94	65.94	-8.09	-2.86	Neutral	10.11
0.1667586538	3	45.66	63.04	55.12	65.12	-9.46	-2.08	Neutral	10.11
0.2081961538	3	40.53	58.36	53.28	63.28	-12.75	-4.91	Neutral	10.11
0.4176778846	3	46.37	53.51	47.49	57.49	-1.12	-3.98	Neutral	10.16
0.4597384615	3	40.77	52.42	46.70	56.70	-5.93	-4.28	Neutral	10.17
0.7834913462	3	37.11	52.34	46.00	56.00	-8.89	-3.66	Neutral	10.20
0.8085519231	3	34.10	53.97	46.00	56.00	-11.90	-2.03	Neutral	10.20
0.8281019231	3	35.38	53.53	46.00	56.00	-10.62	-2.47	Neutral	10.20
1.10875	4	31.95	43.27	46.00	56.00	-14.05	-12.73	Neutral	10.21
3.08075	4	30.17	45.30	46.00	56.00	-15.83	-10.70	Neutral	10.20
3.18225	4	30.69	43.99	46.00	56.00	-15.31	-12.01	Neutral	10.20

FCC Part 15.207– Class

Emissions Graph: rSDG with new antenna_Orientation of power cable adjusted_CE_150KHz-30MHz_High Channel



Data Results:

Final QP and AVG (15)

Frequency (MHz)	S R	AVG Level (dBuV)	QP Level (dBuV)	AVG Limit (dBuV)	QP Limit (dBuV)	AVG Margin (dB)	QPeak Margin (dB)	Position	Correction (dB)
0.1525355769	1	47.61	63.54	55.86	65.86	-8.25	-2.32	Phase 1	10.18
0.1667586538	1	45.67	63.43	55.12	65.12	-9.45	-1.69	Phase 1	10.17
0.4053528846	1	36.91	51.62	47.74	57.74	-10.83	-6.12	Phase 1	10.19
0.4125778846	1	41.57	51.53	47.59	57.59	-6.03	-6.07	Phase 1	10.20
0.4172528846	1	45.52	53.60	47.50	57.50	-1.98	-3.90	Phase 1	10.20
0.4618490385	1	41.35	51.32	46.66	56.66	-5.31	-5.33	Phase 1	10.21
1.29725	2	27.02	38.99	46.00	56.00	-18.98	-17.01	Phase 1	10.25
1.406	2	34.92	40.02	46.00	56.00	-11.08	-15.98	Phase 1	10.25
3.088014423	2	30.05	39.60	46.00	56.00	-15.95	-16.40	Phase 1	10.24
0.1559355769	3	45.89	62.94	55.68	65.68	-9.79	-2.74	Neutral	10.11
0.1690961538	3	45.48	63.14	55.00	65.00	-9.52	-1.86	Neutral	10.11
0.4198028846	3	45.71	51.39	47.45	57.45	-1.74	-6.06	Neutral	10.16
1.2755	4	26.89	40.88	46.00	56.00	-19.11	-15.12	Neutral	10.21
1.79025	4	26.13	41.41	46.00	56.00	-19.87	-14.59	Neutral	10.21
1.8555	4	29.93	40.78	46.00	56.00	-16.07	-15.22	Neutral	10.21

Test Personnel:	Dan Alvarez	Test Date:	06/27/2019
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15 Subpart B, ICES-003	Limit Applied:	15.207
Input Voltage:	120VAC,60Hz	Ambient Temperature:	23 ºC
Pretest Verification w/ Ambient Signals or BB Source:	**Yes**	Relative Humidity:	48 %
		Atmospheric Pressure:	989 mbars

Deviations, Additions, or Exclusions: None

12 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	06/27/2019	103986369ATL-001	DH		Original Issue
1	07/31/2020	103986369ATL-001a	DH	KPS KPS	Updated Sections per TCB recommendations