

TEST REPORT

Report Number: 103916593MPK-001B
Project Number: G103916593
Original Report Issue Date: December 18, 2019
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Testing performed on the
Keypad Fusion IP Reader
Part Number: ER25
CPN: ER25, ER25-PCB

FCC ID: 2AEI3WLTC-ER2X-SK17
IC: 20063-WLTDHSKER17
to

FCC Part 15 Subpart C (15.209)
FCC Part 15 Subpart C (15.225)
Industry Canada RSS-210 Issue 9
FCC Part 15, Subpart B
Industry Canada ICES-003

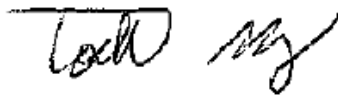
For

WaveLynx Technologies

Test Performed by:
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Date: December 18, 2019

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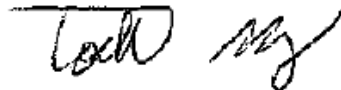
Date: December 18, 2019

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Report No. 103916593MPK-001B

Equipment Under Test:	Keypad Fusion IP Reader
Trade Name:	WaveLynx Technologies
Part Number:	ER25
CPN:	ER25, ER25-PCB
Serial Number:	1101201900000003
Applicant:	WaveLynx Technologies
Contact:	Daniel Field
Address:	100 Technology Drive Suite B150 Broomfield, CO 80021
Country	USA
Email	Danielfield@wavelynxtech.com
Applicable Regulation:	FCC Part 15 Subpart C (15.209) FCC Part 15 Subpart C (15.225) Industry Canada RSS-210 Issue 9 FCC Part 15, Subpart B Industry Canada ICES-003 Issue 6
Test Site Location:	ITS – Site 1 1365 Adams Drive Menlo Park, CA 94025
Date of Test:	November 19 – December 10, 2019

We attest to the accuracy of this report:



Todd Moy
Project Engineer



Krishna K Vemuri
Engineering Team Lead

TABLE OF CONTENTS

1.0	Summary of Tests	5
2.0	General Description	6
2.1	Product Description	6
2.2	Related Submittal(s) Grants	7
2.3	Test Methodology	7
2.4	Test Facility	7
2.5	Measurement Uncertainty	7
3.0	System Test Configuration.....	8
3.1	EUT Photo	8
3.2	Block Diagram of Test Setup.....	9
3.3	Justification	11
3.4	Software Exercise Program.....	11
3.5	Mode of Operation during test.....	11
3.6	Modifications required for Compliance.....	11
3.7	Additions, deviations and exclusions from standards.....	11
4.0	Measurement Results.....	12
4.1	Field Strength of Fundamental and Radiated Emissions Outside the band	12
4.1.1	Requirements	12
4.1.2	Procedure	13
4.1.3	Test Result 15.225 (a)(b)(c).....	14
4.1.4	Test Result 15.225 (d) and 15.209.....	18
4.1.5	Test Configuration Photographs	30
4.2	Frequency Tolerance.....	35
4.2.1	Requirement.....	35
4.2.2	Procedure	35
4.2.3	Test Results 15.225 (e)	36
4.3	Occupied Bandwidth.....	37
4.3.1	Requirements	37
4.3.2	Procedure	37
4.3.3	Test Results.....	38
4.4	AC Line Conducted Emission	40
4.4.1	Requirement.....	40
4.4.2	Procedure	40
4.4.3	Test Result	41
4.5	Radiated Emissions on Digital Parts.....	55
4.5.1	Test Limit.....	55
4.5.2	Procedures.....	55
4.5.3	Test Results.....	56
4.4.4	Test Configuration Photographs	62
5.0	List of test equipment	66
6.0	Document History	67

7. Appendix A: Evaluation for spurious emissions of pre-certified radio module installed inside the host equipment per KDB 996369 D04.....68

- A1.0 Radiated Emissions (ANSI C63.10) 68
 - A1.1 Method 68
 - A1.2 Test Equipment Used: 70
 - A1.3 Result: 70
 - A1.4 Photographs: 71

1.0 Summary of Tests

TEST	REFERENCE FCC 15C	REFERENCE RSS-210	RESULTS
Radiated Emissions	15.209	RSS 210 (4.3)	Complies
Line Conducted Emissions	15.207	RSS-GEN	Complies
Occupied Bandwidth	15.215(c)	RSS-GEN	Complies
Radiated Emissions from Digital Parts	15.109	ICES-003	Complies
Conducted Emissions from Digital Parts	15.107	ICES-003	Complies
Antenna requirement	15.203	RSS-GEN	Complies ¹

¹ The EUT utilizes an internal Antenna.

TEST	REFERENCE FCC 15.225	REFERENCE RSS-210	RESULTS
Field Strength of Fundamental	15.225(a)	B.6	Complies
Radiated Emissions Outside the band	15.225(b), 15.225(c), 15.225(d), 15.209	B.6	Complies
Frequency Tolerance of the Carrier	15.225(e)	B.6	Complies
Line Conducted Emissions	15.207	RSS-GEN	Complies
Occupied Bandwidth	15.215	RSS-GEN	Complies
Antenna requirement	15.203	RSS-GEN	Complies ¹

¹ The EUT utilizes an internal Antenna.

2.0 General Description

2.1 Product Description

WaveLynx Technologies supplied the following description of the EUT:

An IP based Single Gang form factor (with option of keypad) secure access RFID reader and controller designed to read an end user's access badge and provide full door control.

The ER25, ER25-PCB are electrically identical, the only difference between the two devices is that the enclosures are different color and are made up of different materials.

Overview of the EUT

Applicant name & address	WaveLynx Technologies 100 Technology Drive Suite B150 Broomfield, CO 80021
Contact info / Email	Daniel Field / danielfield@wavelynxtech.com
Part Number	ER25
CPN	ER25, ER25-PCB
FCC Identifier	2AEI3WLTC-ER2X-SK17
IC Identifier	20063-WLTDHSKER17
Operating Frequency	125 kHz, 13.56 MHz
Number of Channels	1 each frequency (RFID)
Type of Modulation	ASK Modulation (RFID)
Antenna Type	Wirewound coil (125kHz) PCB Trace Antenna (13.56 MHz)

EUT receive date: November 19, 2019
EUT receive condition: The EUT was received in good condition with no apparent damage. As declared by the Applicant it is identical to the production units.
Test start date: November 19, 2019
Test completion date: December 10, 2019

2.2 Related Submittal(s) Grants

None

2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4: 2014. Radiated tests were performed at an antenna to EUT distance of 10 meters, unless stated otherwise in this test report. All other measurements were made in accordance with the procedures in part 2 of CFR 47 7, ANSI C63.10: 2013, ANSI C63.4-2014 & RSS-GEN Issue 5.

2.4 Test Facility

The radiated emission test site and conducted measurement facility used to collect the data is 10m semi-anechoic chamber located in Menlo Park, California. This test facility and site measurement data have been fully placed on file with the FCC and Industry Canada (Site # 2042L-1).

2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and doesn't take into account the measurement uncertainty.

Estimated Measurement Uncertainty

Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 1 GHz	1 GHz – 2.5 GHz	> 2.5 GHz
RF Power and Power Density – antenna conducted	-	0.7 dB	-
Unwanted emissions - antenna conducted	1.1 dB	1.3 dB	1.9 dB
Bandwidth – antenna conducted	-	30 Hz	-

Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 30MHz	30 MHz – 1 GHz	1 GHz – 18 GHz
Radiated emissions	-	4.7	5.1 dB
AC mains conducted emissions	2.1 dB	-	-

3.0 System Test Configuration

3.1 EUT Photo

ER25-PCB



ER25

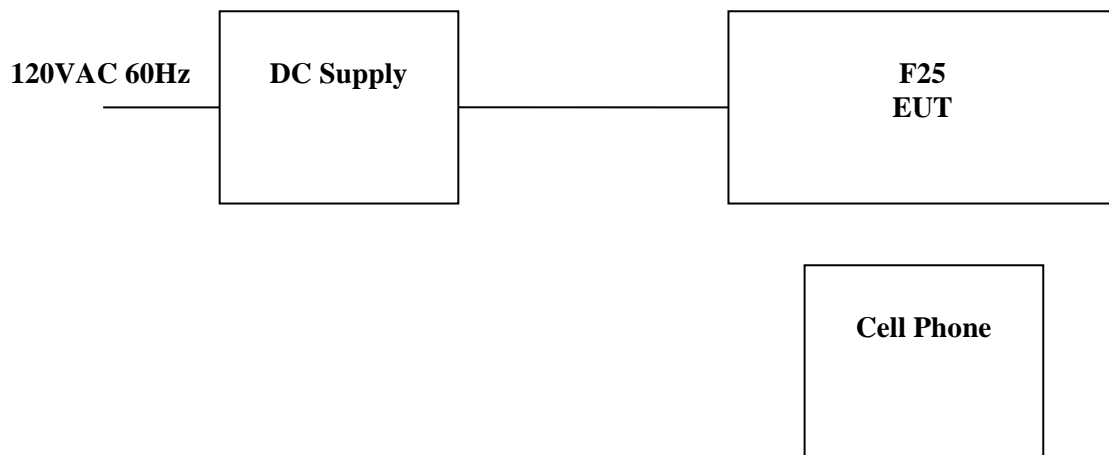


3.2 Block Diagram of Test Setup

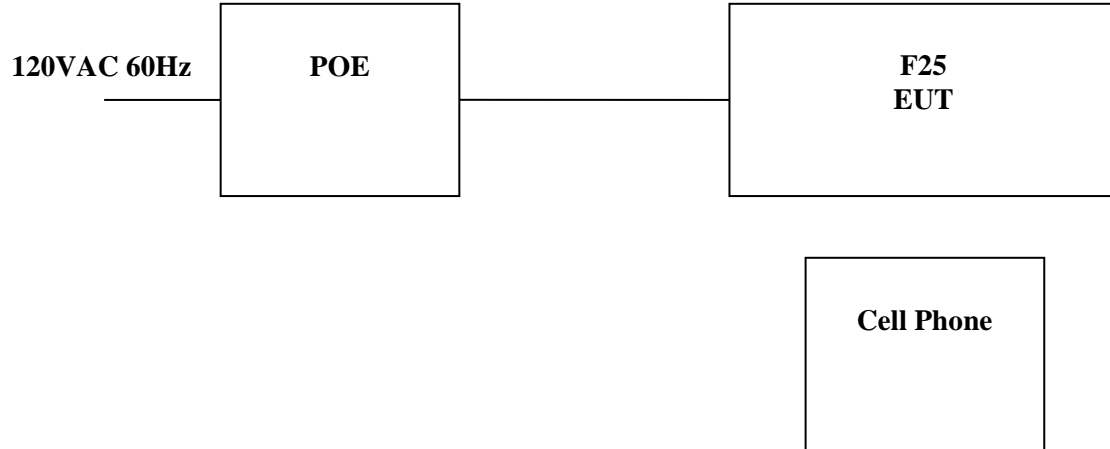
The diagram shown below details the interconnection of the EUT and support equipment. For specific layout, refer to the test configuration photograph in the relevant section of this report.

Support Equipment		
Description	Manufacturer	Model No.
DC Power Supply	Extech	EP-3003
Cell Phone	Apple	iPhone XS Max
POE	Gigabit	POE-I100G

DC Supply Configuration



S = Shielded	F = With Ferrite
U = Unshielded	m = Length in Meters



S = Shielded U = Unshielded	F = With Ferrite m = Length in Meters
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3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT was configured to continuously transmit.

Evaluation for spurious emissions of pre-certified radio module installed inside Host equipment was performed. Radio module FCC ID: WAP2001. See Appendix A for test data and setup photos.

3.4 Software Exercise Program

None

3.5 Mode of Operation during test

The Keypad Fusion IP Reader was set up to continuously transmitting at 125kHz and 13.56MHz. In addition, during tests the EUT was paired and exercised with cell phone for BLE connection.

3.6 Modifications required for Compliance

No modifications were made by the manufacturer to bring the EUT into compliance.

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 Field Strength of Fundamental and Radiated Emissions Outside the band

4.1.1 Requirements

FCC Rules 15.225, 15.209

- a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter (84 dBuV) at 30 meters.
- b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
- c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
- d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

§15.209 Radiated emission limits; general requirements.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

4.1.2 Procedure

Radiated Measurements Below 30 MHz

During the test the EUT is rotated and the measuring antenna angles are varied during the search for maximum signal level.

Radiated emissions are taken at ten meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Measurements for below 30 MHz were made at 10 meters. Data results below are corrected for distance back to 30 meters.

Radiated Measurements Above 30 MHz

During the test the EUT is rotated and the measuring antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at ten meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Measurements for above 30 MHz were made at 10 meters.

Radiated emission measurements were performed from 9kHz to 1 GHz.

Analyzer resolution is:

200Hz or greater for 9kHz to 150kHz

9 kHz or greater for 150kHz to 30 MHz

120 kHz or greater for 30MHz to 1000 MHz

For those frequencies quasi-peak detector applies

Data includes of the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

Field Strength 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 is as follows:

$$FS = RA + AF + CF - AG - DCF$$

Where FS = Field Strength in dB ($\mu\text{V}/\text{m}$)

RA = Receiver Amplitude (including preamplifier) in dB (μV)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB (1/m)

AG = Amplifier Gain in dB

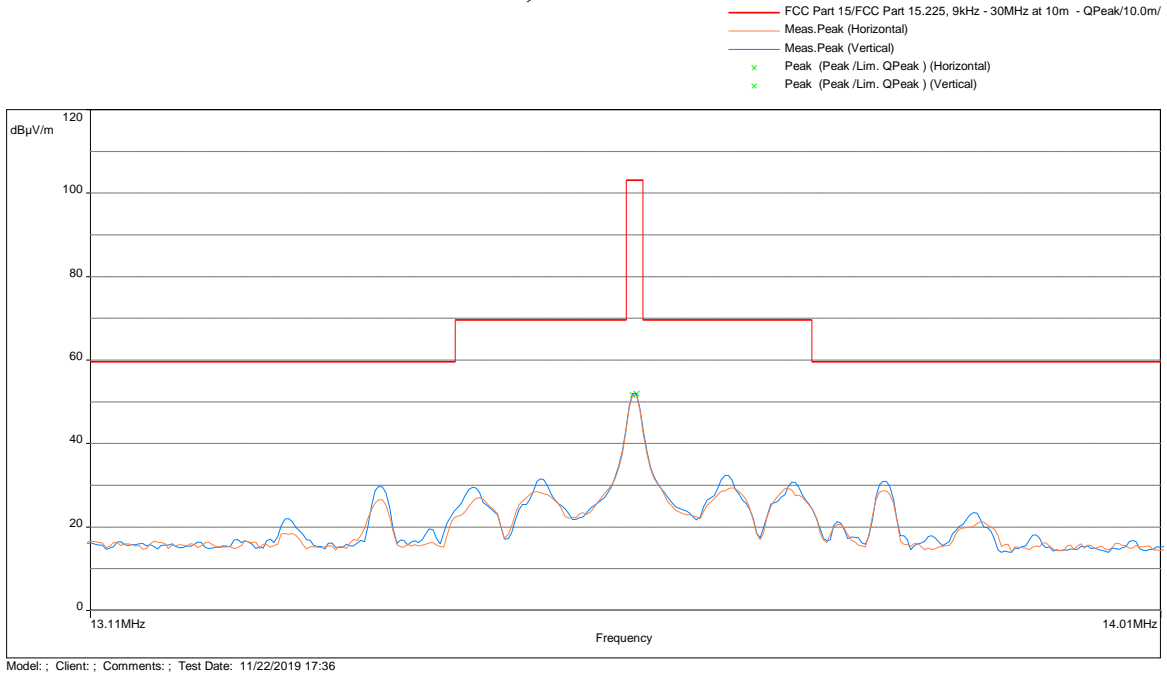
DCF = Distance Correction Factor

Note: FS was measured with loop antenna below 30MHz

4.1.3 Test Result 15.225 (a)(b)(c)

The data below shows the significant emission frequencies, the limit and the margin of compliance. Note: Measurements were performed at parallel and perpendicular orientation of loop antenna, and vertical and horizontal orientations of EUT. The worst case data was presented below.

Fundamental, Black Case with POE

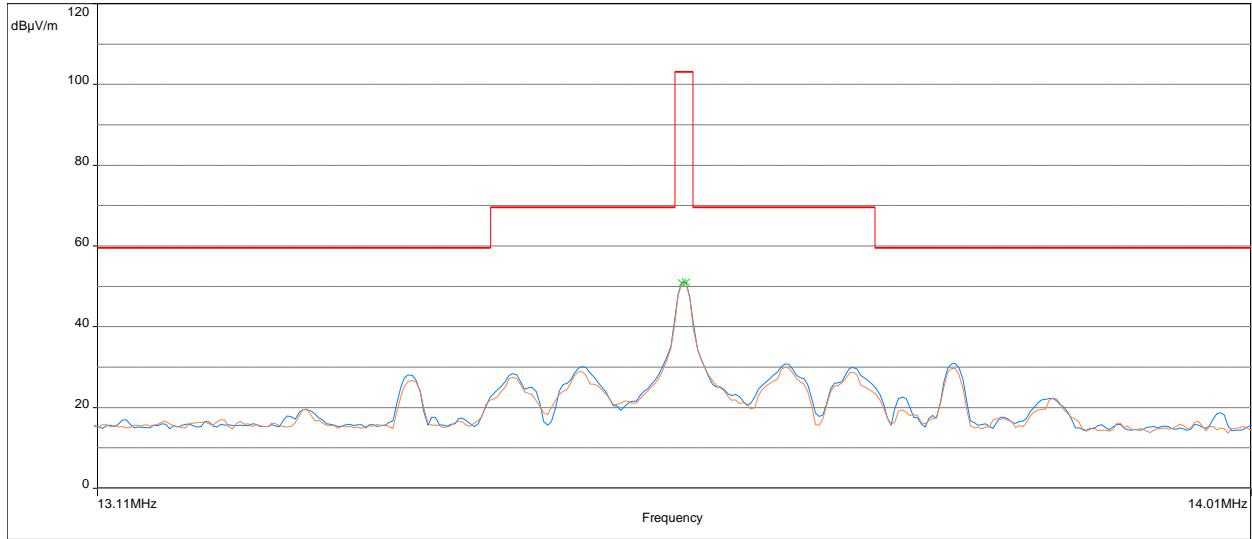


Frequency (MHz)	Peak FS@10m dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	Polarity	RA@10m dB(uV)	Correction dB
13.56	51.6	103.1	-51.5	parallel	48.3	3.3
13.56	51.9	103.1	-51.2	perpendicular	48.6	3.3

Note: Correction = AF+CF-AG

Fundamental, Black Case with DC

- FCC Part 15/FCC Part 15.225, 9kHz - 30MHz at 10m - QPeak/10.0m/
- Meas.Peak (Horizontal)
- Meas.Peak (Vertical)
- × Peak (Peak /Lim. QPeak) (Horizontal)
- × Peak (Peak /Lim. QPeak) (Vertical)



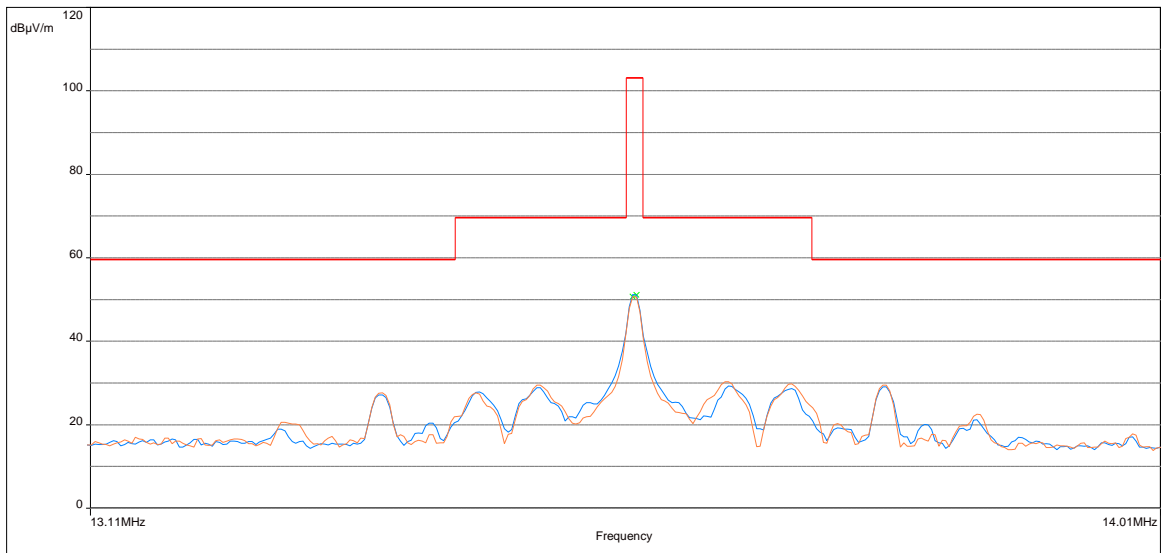
Model: ; Client: ; Comments: ; Test Date: 11/22/2019 17:29

Frequency (MHz)	Peak FS@10m dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	Polarity	RA@10m dB(uV)	Correction dB
13.56	50.7	103.1	-52.4	parallel	47.4	3.3
13.56	51.0	103.1	-52.1	perpendicular	47.7	3.3

Note: Correction = AF+CF-AG

Fundamental, White Case with POE

— FCC Part 15/FCC Part 15.225, 9kHz - 30MHz at 10m - QPeak/10.0m/
— Meas.Peak (Horizontal)
— Meas.Peak (Vertical)
x Peak (Peak /Lim. QPeak) (Horizontal)
x Peak (Peak /Lim. QPeak) (Vertical)

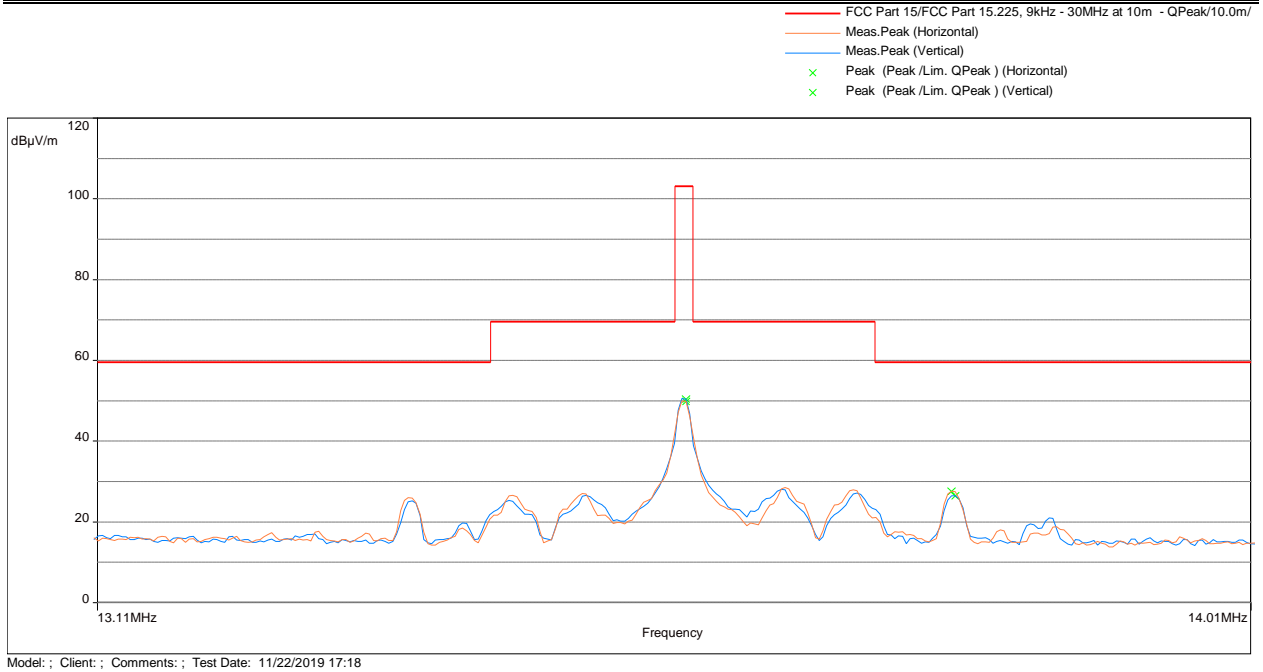


Model: ; Client: ; Comments: ; Test Date: 11/22/2019 17:02

Frequency (MHz)	Peak FS@10m dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	Polarity	RA@10m dB(uV)	Correction dB
13.56	50.7	103.1	-52.4	parallel	47.4	3.3
13.56	51.1	103.1	-52.0	perpendicular	47.8	3.3

Note: Correction = AF+CF-AG

Fundamental, White Case with DC



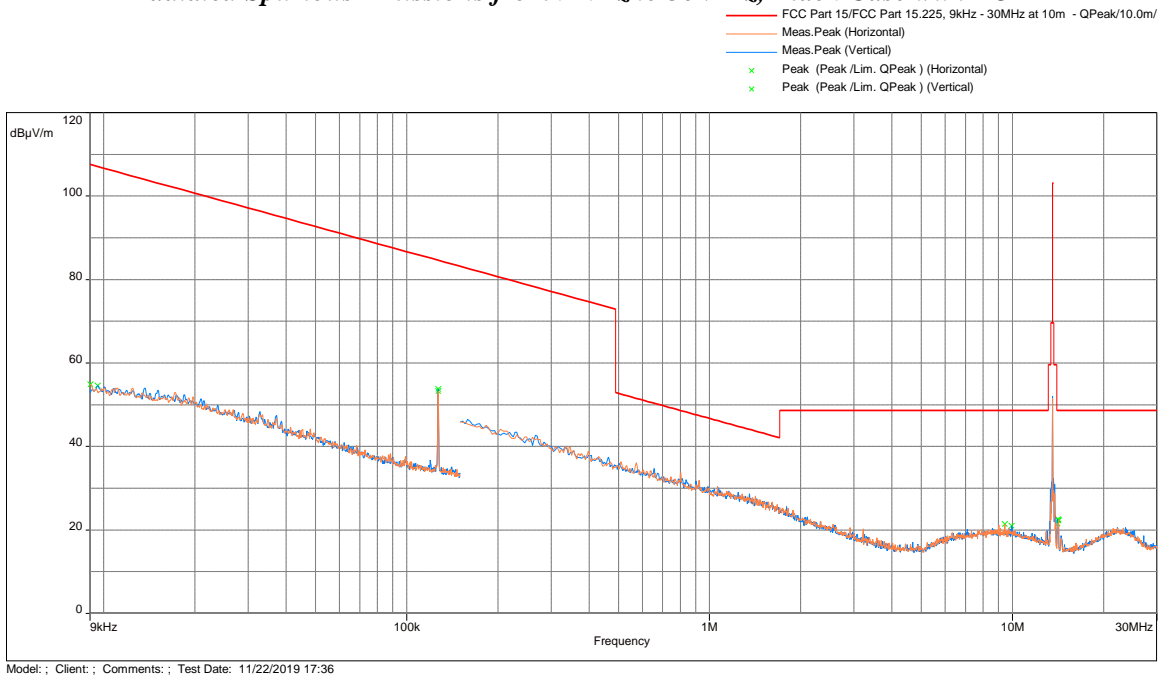
Model: ; Client: ; Comments: ; Test Date: 11/22/2019 17:18

Frequency (MHz)	Peak FS@10m dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	Polarity	RA@10m dB(uV)	Correction dB
13.56	49.9	103.1	-53.2	parallel	46.6	3.3
13.56	50.4	103.1	-52.7	perpendicular	47.1	3.3

Note: Correction = AF+CF-AG

4.1.4 Test Result 15.225 (d) and 15.209

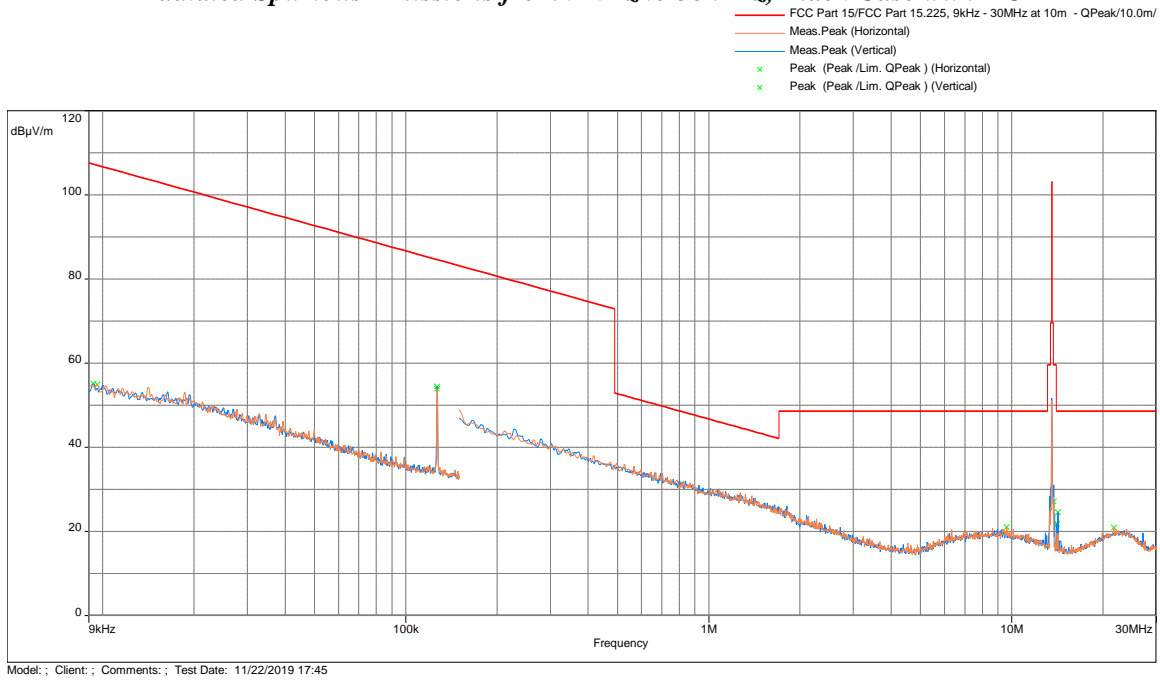
Radiated Spurious Emissions from 9 kHz to 30MHz, Black Case with POE



Frequency (MHz)	Peak FS@10m dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	Polarity	RA@10m dB(uV)	Correction dB
0.127	53.9	84.6	-30.7	parallel	22.1	31.8
0.127	54.5	84.6	-30.2	perpendicular	22.6	31.8

Note: Correction = AF+CF-AG

Radiated Spurious Emissions from 9 kHz to 30MHz, Black Case with DC

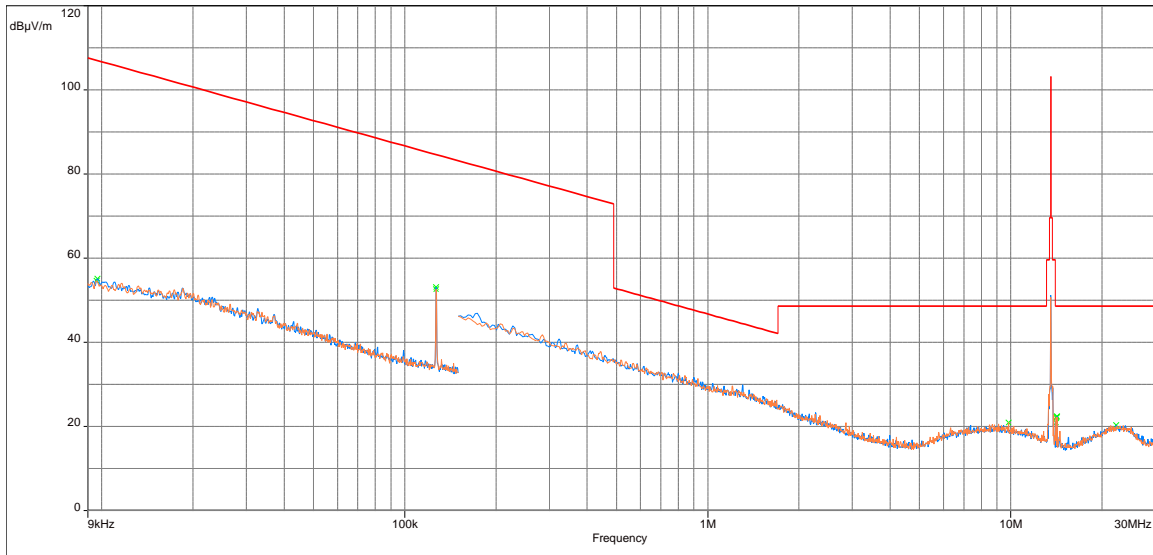


Frequency (MHz)	Peak FS@10m dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	Polarity	RA@10m dB(uV)	Correction dB
0.127	53.9	84.6	-30.7	parallel	22.1	31.8
0.127	54.5	84.6	-30.2	perpendicular	22.6	31.8

Note: Correction = AF+CF-AG

Radiated Spurious Emissions from 9 kHz to 30MHz, White Case with POE

- FCC Part 15/FCC Part 15.225, 9kHz - 30MHz at 10m - QPeak/10.0m/
- Meas.Peak (Horizontal)
- Meas.Peak (Vertical)
- x Peak (Peak /Lim. QPeak) (Horizontal)
- x Peak (Peak /Lim. QPeak) (Vertical)

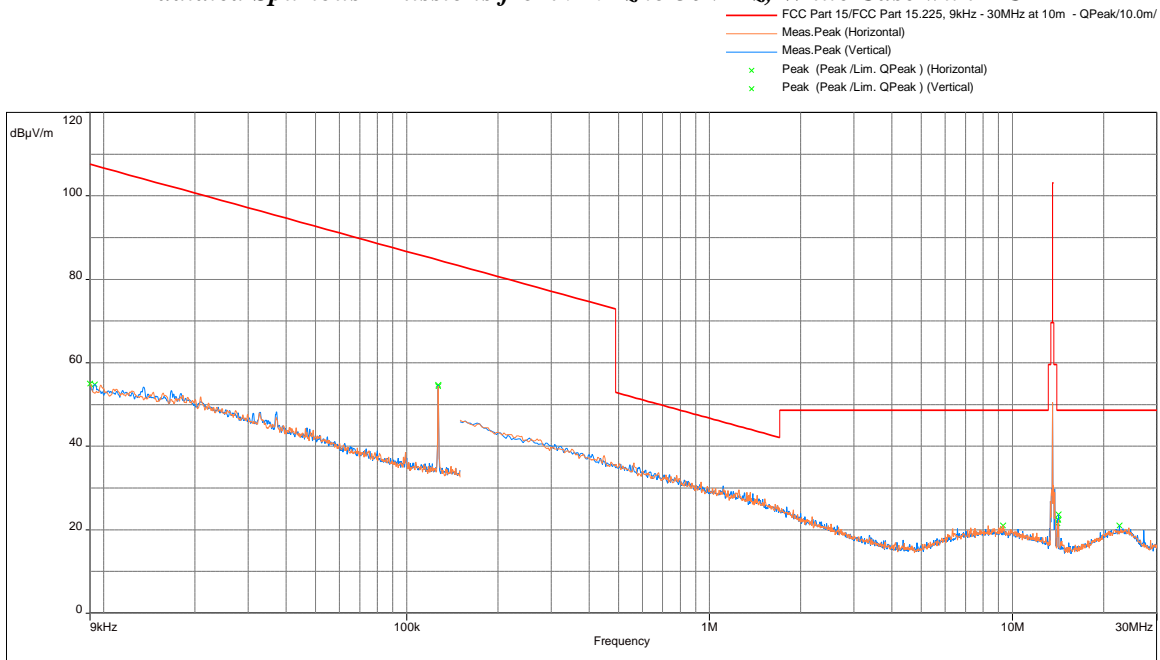


Model: ; Client: ; Comments: ; Test Date: 11/22/2019 17:02

Frequency (MHz)	Peak FS@10m dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	Polarity	RA@10m dB(uV)	Correction dB
0.127	52.6	84.6	-32.0	parallel	20.8	31.8
0.127	53.1	84.6	-31.5	perpendicular	21.3	31.8

Note: Correction = AF+CF-AG

Radiated Spurious Emissions from 9 kHz to 30MHz, White Case with DC

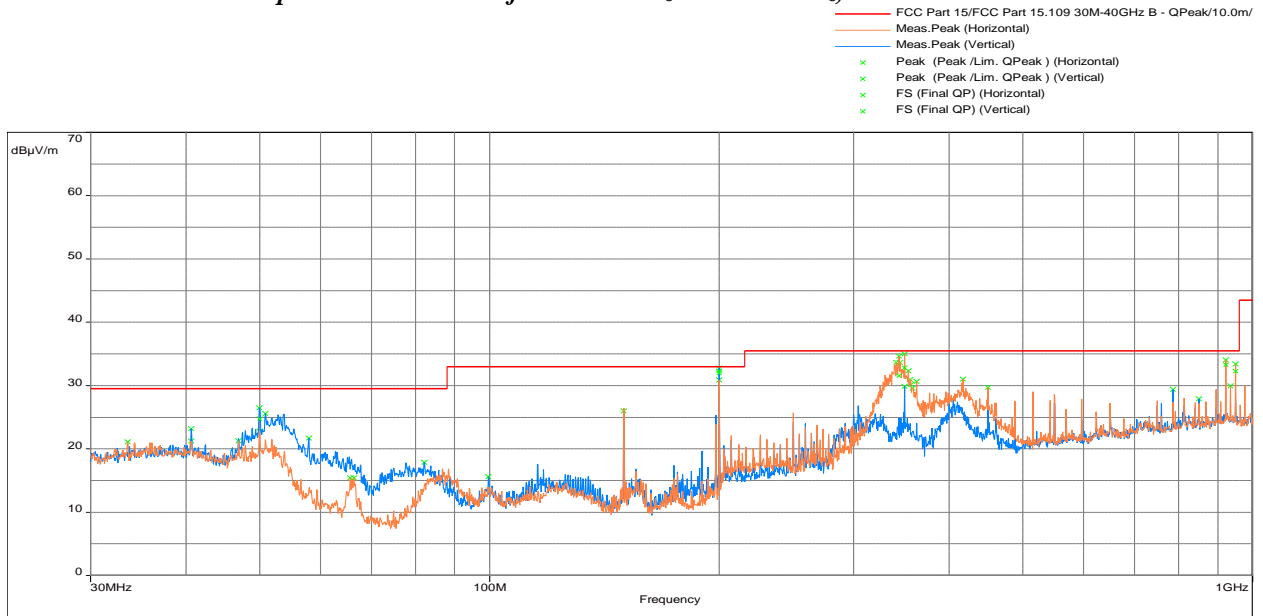


Model: ; Client: ; Comments: ; Test Date: 11/22/2019 16:47

Frequency (MHz)	Peak FS@ 10m dB(uV/m)	Limit@ 10m dB(uV/m)	Margin dB	Polarity	RA@ 10m dB(uV)	Correction dB
0.127	52.8	84.6	-31.8	parallel	21.0	31.8
0.127	53.0	84.6	-31.6	perpendicular	21.2	31.8

Note: Correction = AF+CF-AG

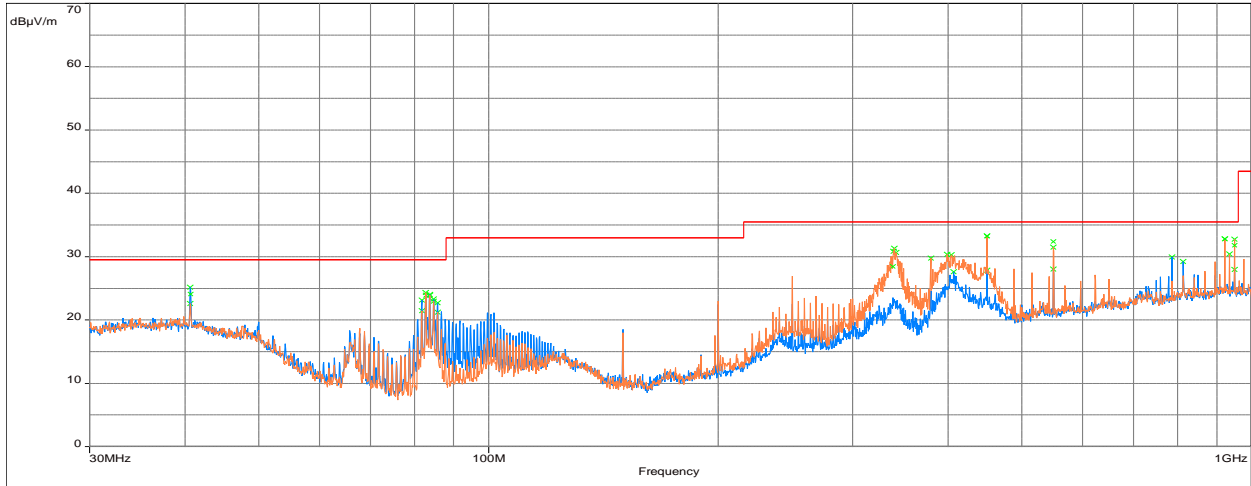
Radiated Spurious Emissions from 30 MHz to 1000 MHz, Black Case with POE



Freq (MHz)	FS @10m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
50.014	24.7	29.5	-4.8	194.3	1.4	Vertical	33.6	-8.9
199.984	32.3	33.0	-0.7	240.8	1.0	Vertical	46.6	-14.3
199.980	32.0	33.0	-1.0	72.3	3.6	Horizontal	46.3	-14.3
344.086	31.5	35.5	-4.0	157.8	2.3	Horizontal	40.5	-9.0
349.973	32.8	35.5	-2.7	340.8	2.5	Horizontal	41.8	-9.0
922.082	33.3	35.5	-2.2	206.3	1.1	Horizontal	33.5	-0.2
949.187	32.2	35.5	-3.3	203.0	1.0	Horizontal	32.3	-0.1

Radiated Spurious Emissions from 30 MHz to 1000 MHz, Black Case with DC

- FCC Part 15/FCC Part 15.109 30M-40GHz B - QPeak/10.0m/
- Meas.Peak (Horizontal)
- Meas.Peak (Vertical)
- x Peak (Peak /Lim. QPeak) (Horizontal)
- x Peak (Peak /Lim. QPeak) (Vertical)
- x FS (Final QP) (Horizontal)
- x FS (Final QP) (Vertical)

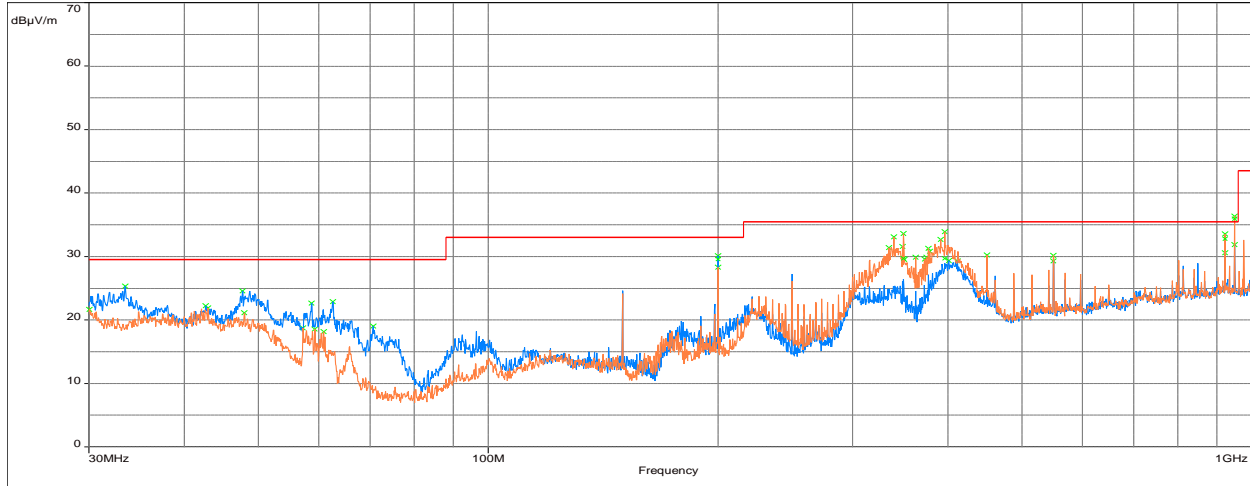


Model: ; Client: ; Comments: ; Test Date: 11/19/2019 19:46

Freq (MHz)	FS @10m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
40.688	24.1	29.5	-5.4	100.3	1.1	Vertical	30.8	-6.7
338.923	28.5	35.5	-7.0	165.8	3.0	Horizontal	37.3	-8.9
449.961	33.2	35.5	-2.3	213.5	1.9	Horizontal	39.8	-6.5
549.948	32.4	35.5	-3.2	136.0	1.4	Horizontal	37.4	-5.0
922.089	32.8	35.5	-2.7	191.0	2.6	Horizontal	33.0	-0.2
949.194	31.8	35.5	-3.7	187.3	2.8	Horizontal	31.9	-0.1

Radiated Spurious Emissions from 30 MHz to 1000 MHz, White Case with POE

- FCC Part 15/FCC Part 15.109 30M-40GHz B - QPeak/10.0m/
- Meas.Peak (Horizontal)
- Meas.Peak (Vertical)
- × Peak (Peak /Lim. QPeak) (Horizontal)
- × Peak (Peak /Lim. QPeak) (Vertical)
- × FS (Final QP) (Horizontal)
- × FS (Final QP) (Vertical)

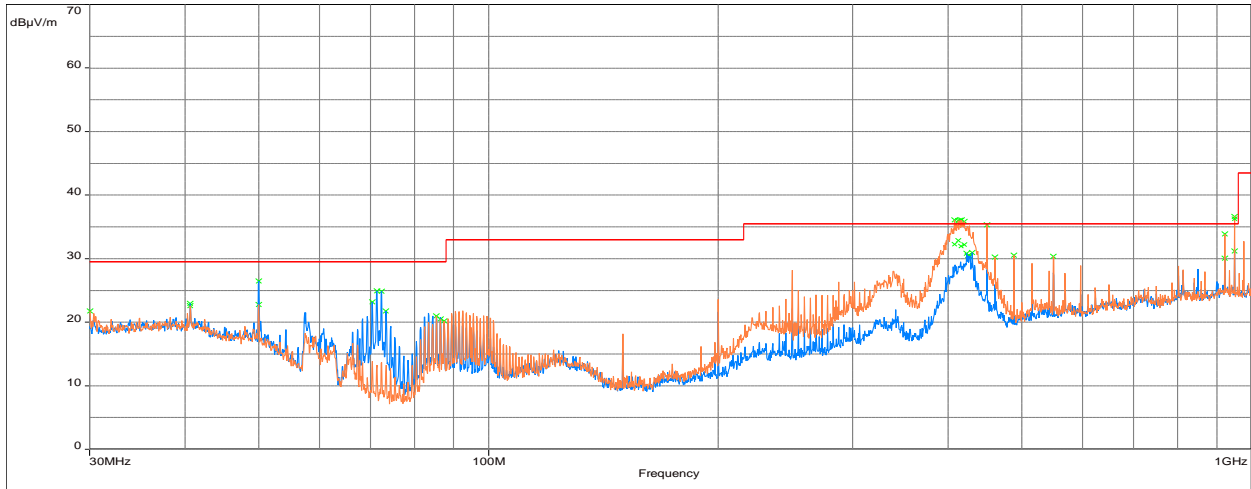


Model: ; Client: ; Comments: ; Test Date: 11/21/2019 17:16

Freq (MHz)	FS @10m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
199.988	29.6	33.0	-3.4	69.0	1.0	Vertical	43.9	-14.3
339.721	33.1	35.5	-2.4	345.8	3.0	Horizontal	41.9	-8.9
349.939	29.7	35.5	-5.8	162.8	2.3	Horizontal	38.7	-9.0
395.986	29.7	35.5	-5.8	318.3	2.1	Horizontal	37.3	-7.6
922.085	32.8	35.5	-2.7	23.0	2.9	Horizontal	33.0	-0.2
949.217	35.3	35.5	-0.2	26.5	2.6	Horizontal	35.4	-0.1

Radiated Spurious Emissions from 30 MHz to 1000 MHz, White Case with DC

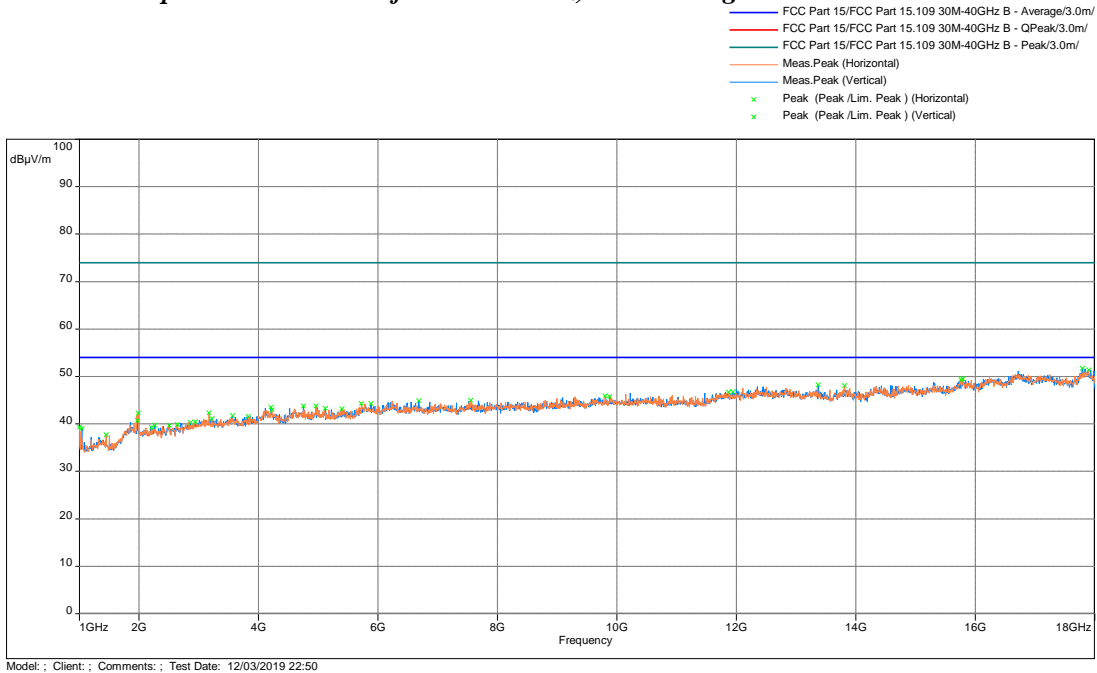
— FCC Part 15/FCC Part 15.109 30M-40GHz B - QPeak/10.0m/
— Meas.Peak (Horizontal)
— Meas.Peak (Vertical)
x Peak (Peak /Lim. QPeak) (Horizontal)
x Peak (Peak /Lim. QPeak) (Vertical)
x FS (Final QP) (Horizontal)



Model: ; Client: ; Comments: ; Test Date: 11/21/2019 18:49

Freq (MHz)	FS @10m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
49.982	22.7	29.5	-6.8	172.5	3.0	Vertical	31.7	-8.9
408.008	32.3	35.5	-3.2	115.8	1.9	Horizontal	39.4	-7.1
412.462	32.9	35.5	-2.6	113.3	2.1	Horizontal	39.8	-7.0
416.012	32.0	35.5	-3.5	101.0	2.4	Horizontal	38.8	-6.9
420.357	32.2	35.5	-3.3	117.3	2.0	Horizontal	39.0	-6.8
949.207	35.3	35.5	-0.2	27.5	2.6	Horizontal	35.4	-0.1

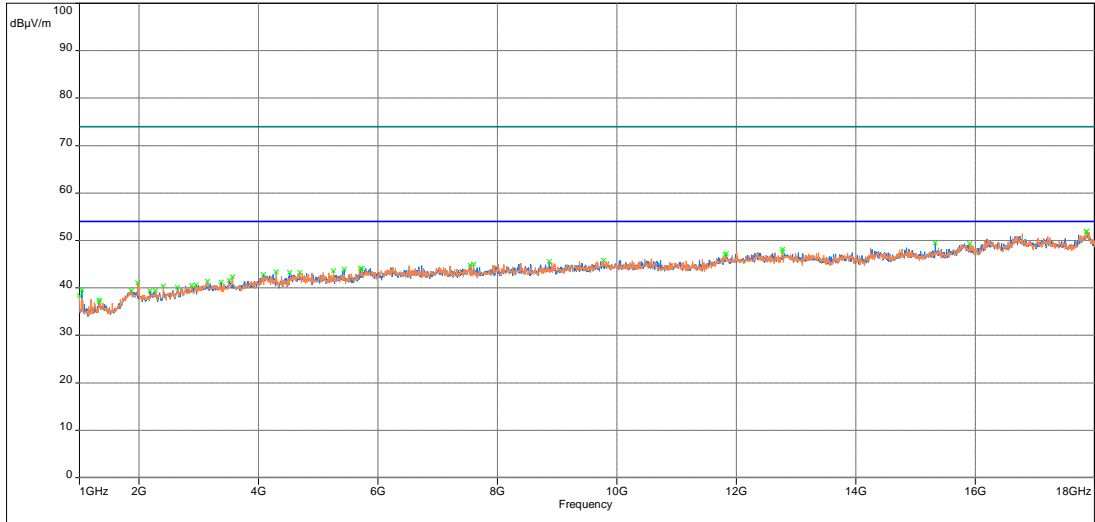
Radiated Spurious Emissions from 1-18 GHz, Peak vs Avg limit Black Case with POE



Freq (MHz)	FS @ 3m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	Correction (dB)
13810.067	48.1	54	-5.9	143.25	3.98	Horizontal	0.8
13366.933	48.2	54	-5.8	251.75	1.01	Vertical	-0.1

Radiated Spurious Emissions from 1-18 GHz, Peak vs Avg limit Black Case with DC

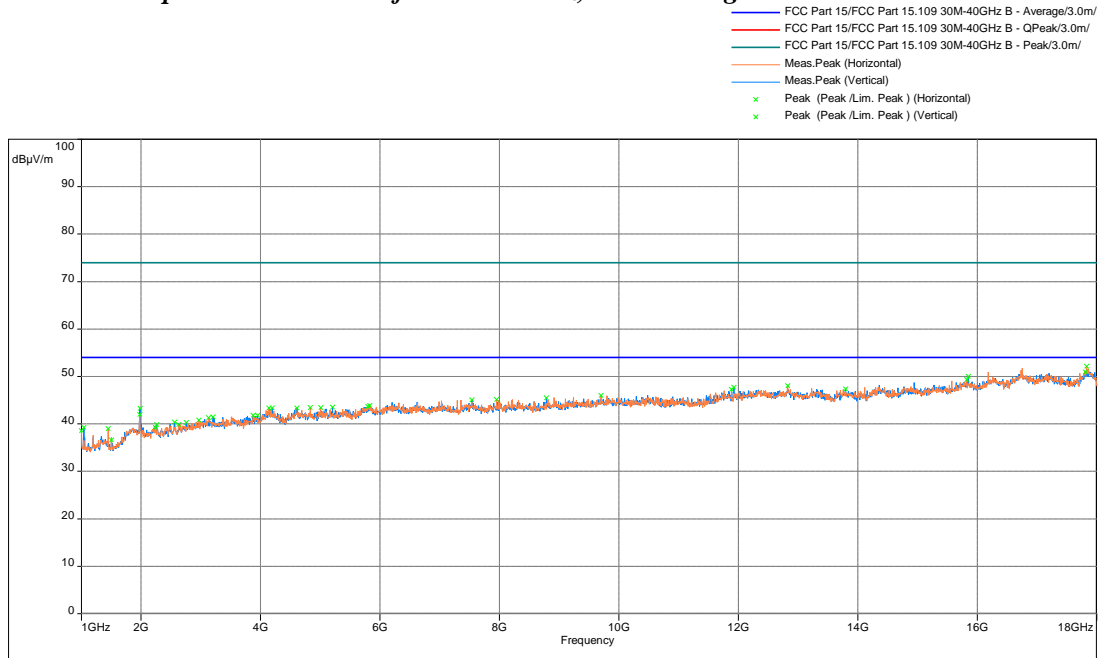
- FCC Part 15/FCC Part 15.109 30M-40GHz B - Average/3.0m/
- FCC Part 15/FCC Part 15.109 30M-40GHz B - QPeak/3.0m/
- FCC Part 15/FCC Part 15.109 30M-40GHz B - Peak/3.0m/
- Meas.Peak (Horizontal)
- Meas.Peak (Vertical)
- x Peak (Peak /Lim. Peak) (Horizontal)
- x Peak (Peak /Lim. Peak) (Vertical)



Model: ; Client: ; Comments: ; Test Date: 12/04/2019 00:42

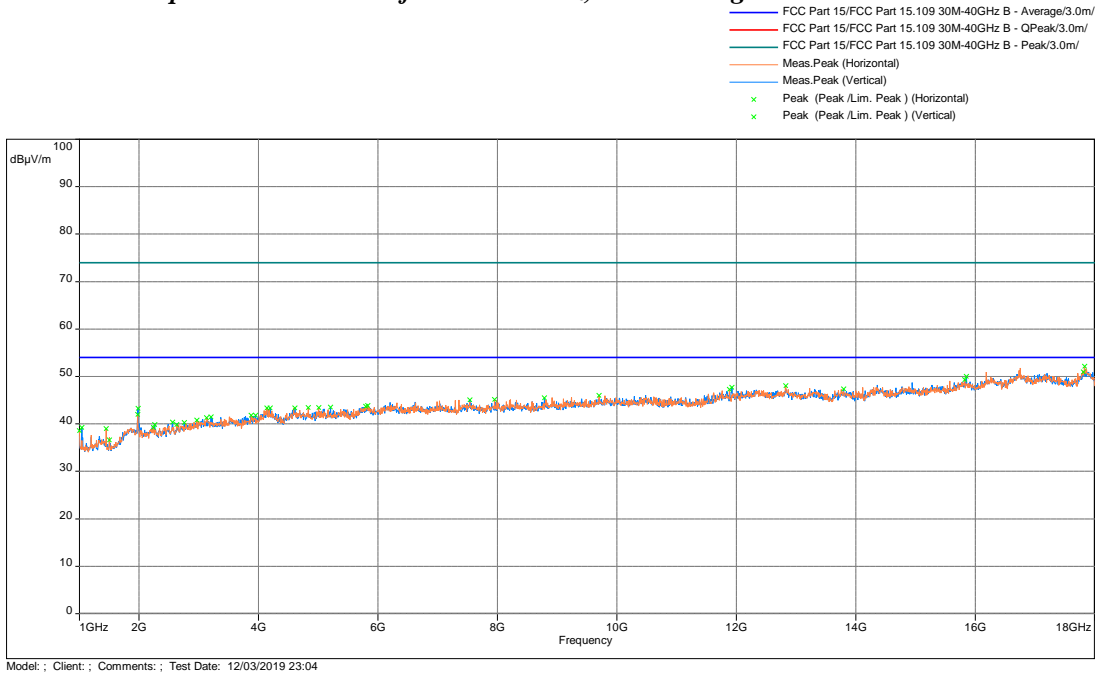
Freq (MHz)	FS @ 3m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	Correction (dB)
12769.667	48.1	54	-5.9	143	3.99	Horizontal	-1.0
12771.367	47.6	54	-6.4	269.5	2.51	Vertical	-1.0

Radiated Spurious Emissions from 1-18 GHz, Peak vs Avg limit White Case with POE



Freq (MHz)	FS @ 3m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	Correction (dB)
12826.333	48.1	54	-5.9	134.5	1	Horizontal	-0.9
11926.467	47.7	54	-6.3	0	3.99	Vertical	-2.7

Radiated Spurious Emissions from 1-18 GHz, Peak vs Avg limit White Case with DC



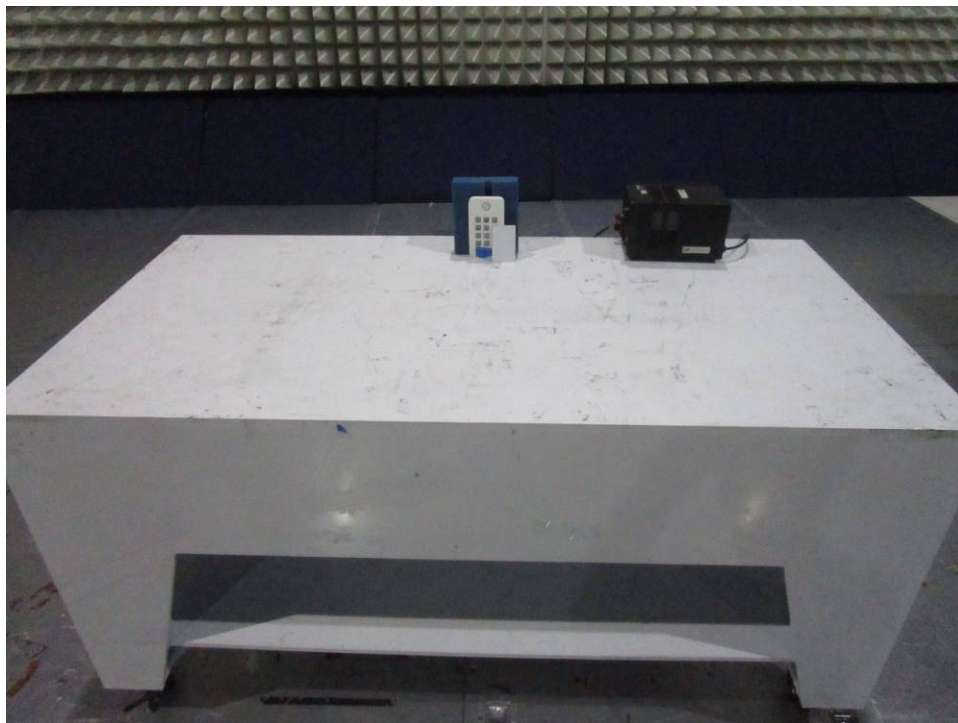
Freq (MHz)	FS @ 3m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	Correction (dB)
12826.333	48.1	54	-5.9	134.5	1	Horizontal	-0.9
11926.467	47.7	54	-6.3	0	3.99	Vertical	-2.7

Result Complies by 0.2 dB

Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz.

4.1.5 Test Configuration Photographs

The following photographs show the testing configurations used.

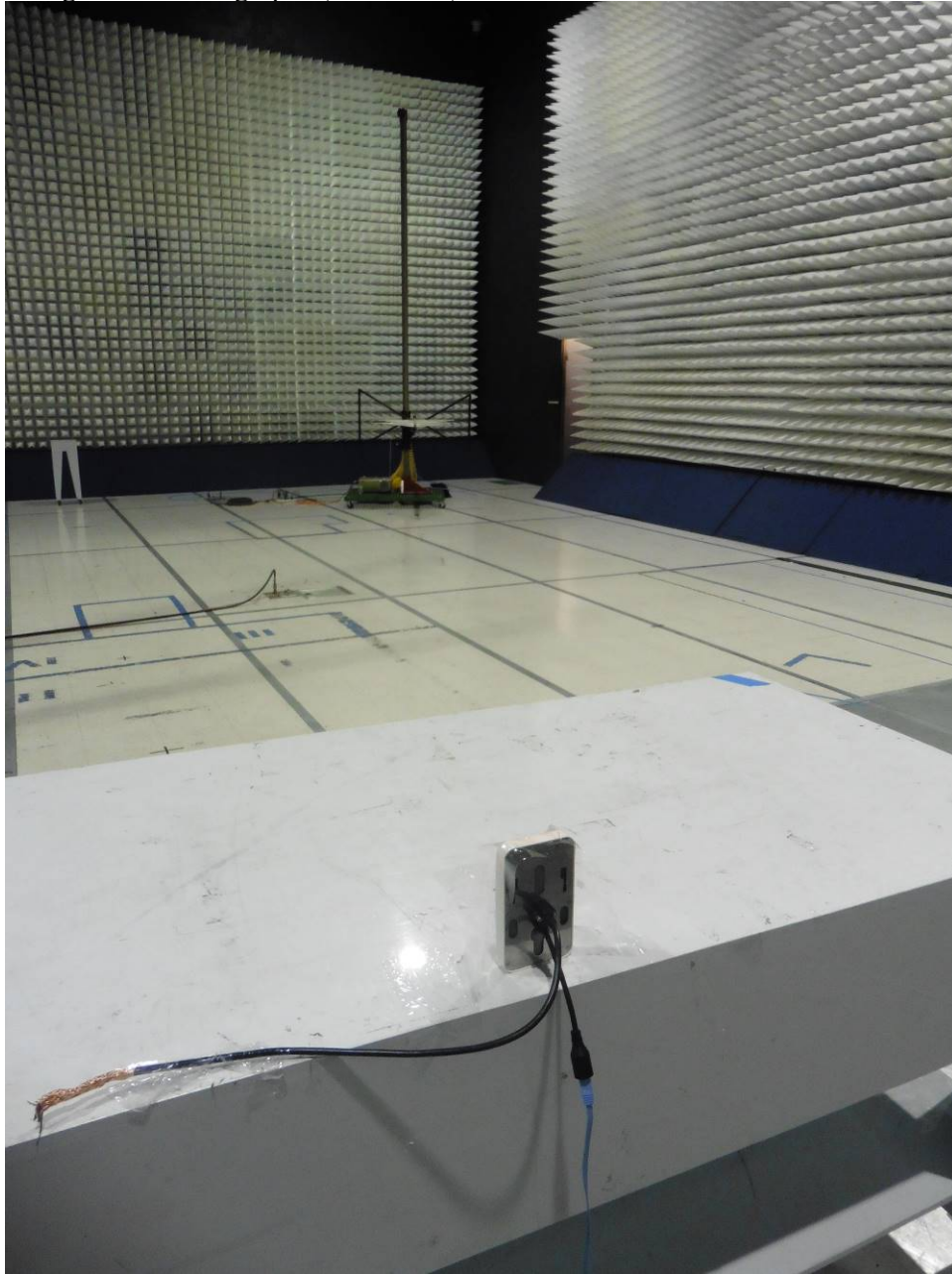


Electromagnetic Radiated Disturbance Setup Photograph

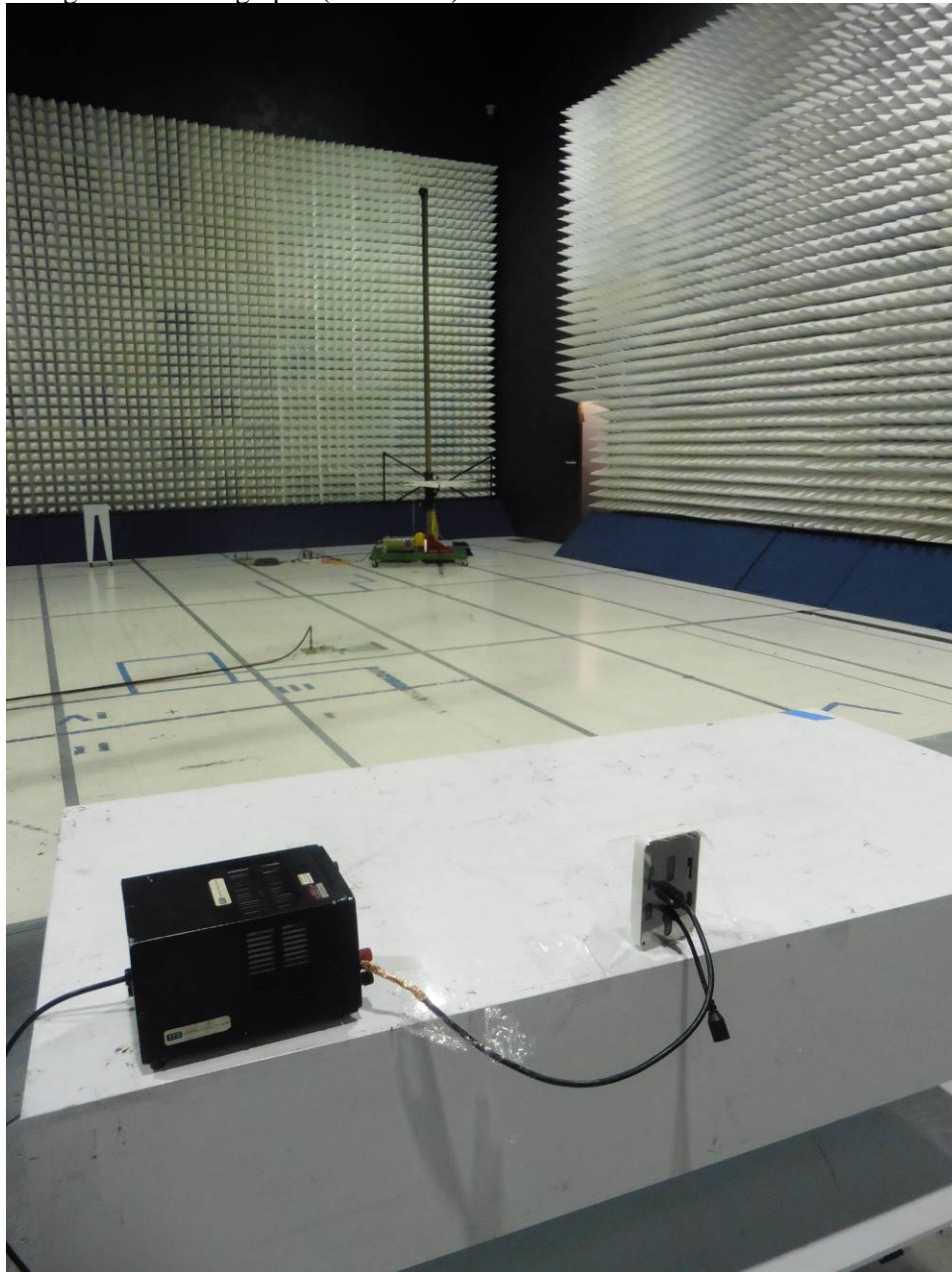
4.1.5 Test Configuration Photographs (Continued)



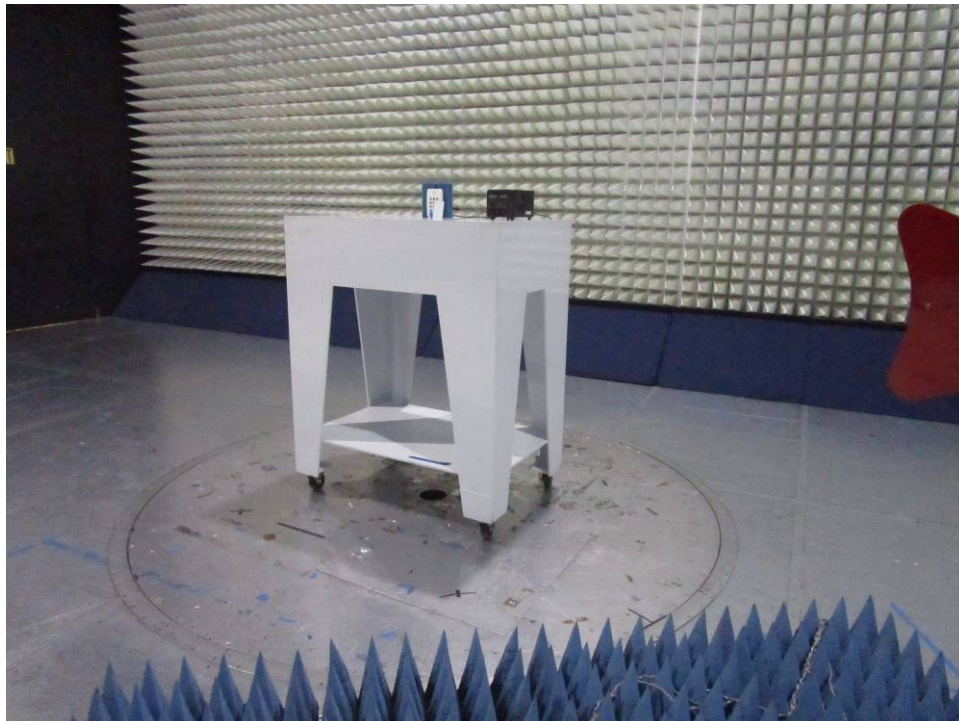
4.1.5 Test Configuration Photographs (Continued)



4.1.5 Test Configuration Photographs (Continued)



4.1.5 Test Configuration Photographs (Continued)



4.2 Frequency Tolerance

4.2.1 Requirement FCC 15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.2.2 Procedure

The EUT was placed in the temperature chamber. The frequency counter was connected to the transmitter output. For each temperature, the carrier frequency was recorded. In addition, the carrier frequency was recorded when the power was set to 13.8 V DC (115% of 12V DC) and to 10.2 V DC (85% of 12V DC).

4.2.3 Test Results 15.225 (e)

Nominal Frequency: 13560000 Hz

Voltage (DC)	Temperature (C)	Measured Frequency (Hz)	Deviation from Reference (Hz)	Deviation (%)
12	-20	13560160	80	0.00059
12	-10	13560112	32	0.000236
12	0	13560096	16	0.000118
12	10	13560096	16	0.000118
12	20	13560080	0	0
12	30	13560048	-32	0.000236
12	40	13560032	-48	0.000354
12	50	13560016	-64	0.000472
10.2	20	13560064	-16	0.000118
13.8	20	13560032	-48	0.000354

4.3 Occupied Bandwidth FCC 15.215

4.3.1 Requirements

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

4.3.2 Procedure

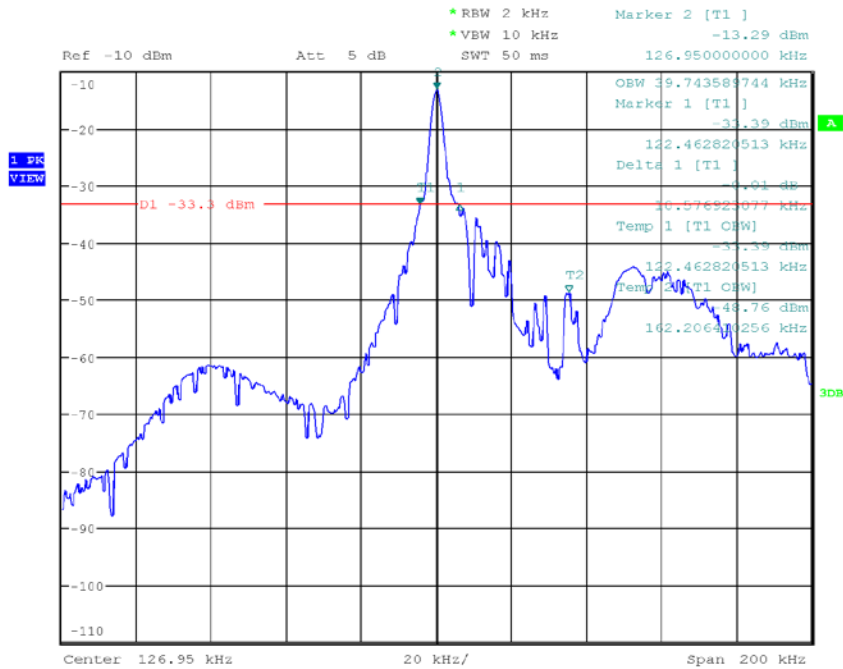
The EUT was setup to transmit in normal operating condition.

Measurements were made with the loop antenna in close proximity of the EUT. Following the procedures of ANSI 63.10: 2013, the 20dB bandwidth measurements were taken. The following plots show Occupied Bandwidth.

4.3.3 Test Results

Frequency (MHz)	-20 dB Channel Bandwidth (kHz)	99% Channel Bandwidth (kHz)
0.126	10.577	39.744

-20dB & 99% Channel Bandwidth Plot

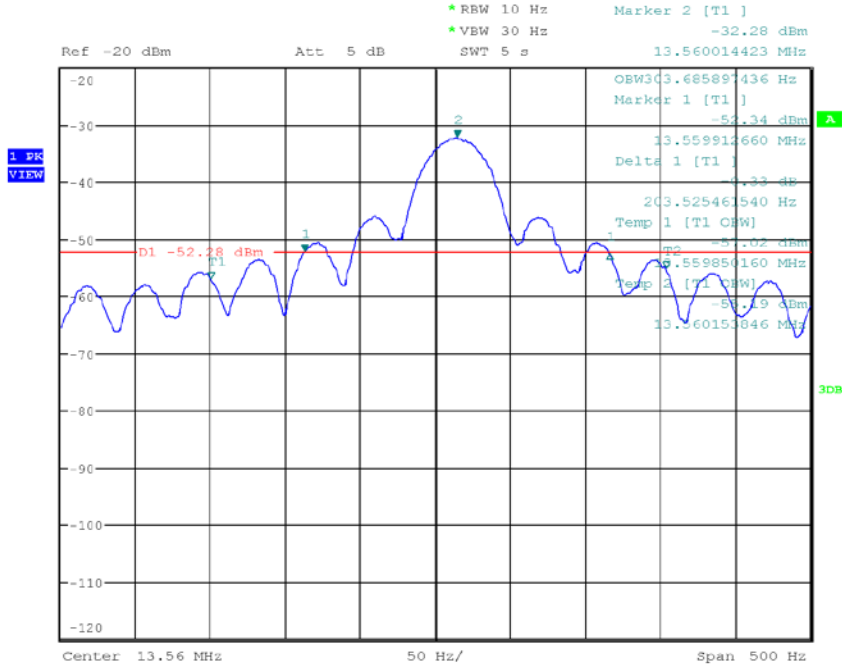


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4.3.3 Test Results (Continued)

Frequency (MHz)	-20 dB Channel Bandwidth (Hz)	99% Channel Bandwidth (Hz)
13.56	203.525	303.686

-20dB & 99% Channel Bandwidth Plot



Date: 19.NOV.2019 15:43:47

4.4 AC Line Conducted Emission
FCC Rule 15.207, FCC 15.107

4.4.1 Requirement

Frequency Band MHz	Class B Limit dB(μ V)		Class A Limit dB(μ V)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *	79	66
0.50-5.00	56	46	73	60
5.00-30.00	60	50	73	60

Note: *Decreases linearly with the logarithm of the frequency. At the transition frequency the lower limit applies.

4.4.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

EUT was placed in transmission mode then tested for conducted emissions per 15.207 & 15.107 to ensure the device complies with 15.207 & 15.107.

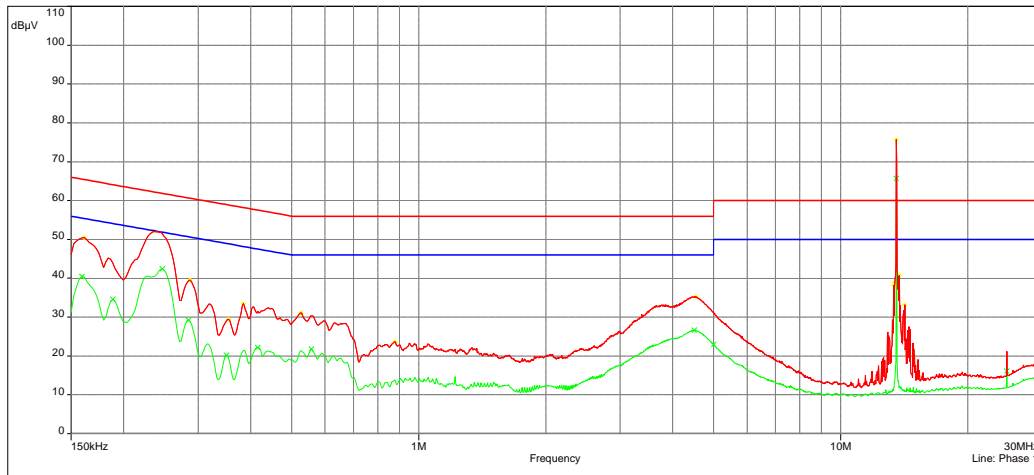
4.4.3 Test Result

15.107 & 15.207

AC Line Conducted Emission, 120VAC 60Hz Phase 1, POE Configuration without termination

Sub-range 1
 Frequencies: 150 kHz - 30 MHz (Mode: - Step: 2.25 kHz)
 Settings: BBW: 9kHz, VBW: 30kHz, Sweep time: 1e+03 ms, Attenuation: 10 dB, Sweep count 3, Preamp: Off, LN Preamp: Off, Preselector: On
 Line: Phase 1

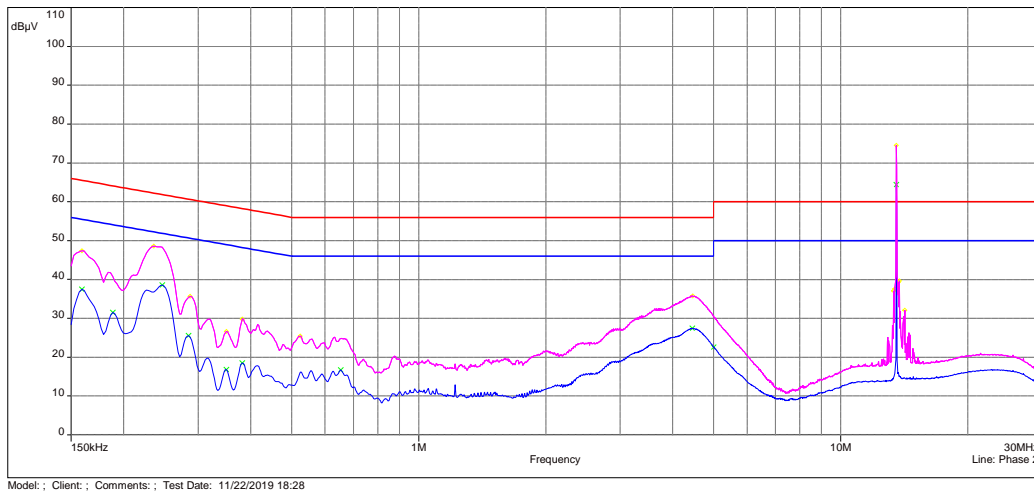
- FCC Part 15/FCC Part 15.107 B - Average/
- FCC Part 15/FCC Part 15.107 B - QPeak/
- Meas.QPeak (Phase 1)
- Mes. CISPR AVG (Phase 1)
- ◊ QPeak (QPeak /Lim. QPeak) (Phase 1)
- × CISPR AVG (CISPR AVG /Lim. Average) (Phase 1)



AC Line Conducted Emission, 120VAC 60Hz Phase 2, POE Configuration without termination

Sub-range 2
 Frequencies: 150 kHz - 30 MHz (Mode: - Step: 2.25 kHz)
 Settings: BBW: 9kHz, VBW: 30kHz, Sweep time: 1e+03 ms, Attenuation: 10 dB, Sweep count 1, Preamp: Off, LN Preamp: Off, Preselector: On
 Line: Phase 2

- FCC Part 15/FCC Part 15.107 B - Average/
- FCC Part 15/FCC Part 15.107 B - QPeak/
- Meas.QPeak (Phase 2)
- Mes. CISPR AVG (Phase 2)
- ◊ QPeak (QPeak /Lim. QPeak) (Phase 2)
- × CISPR AVG (CISPR AVG /Lim. Average) (Phase 2)



4.4.3 Test Result (Continued)

Frequency (MHz)	QPeak (dB μ V)	Lim. QPeak (dB μ V)	Margin (dB)	Comment	Correction (dB)
0.159	47.4	65.5	-18.2	Phase 2	11.9
0.161	50.5	65.4	-14.9	Phase 1	11.9
0.236	48.6	62.3	-13.7	Phase 2	11.9
0.236	52.1	62.3	-10.2	Phase 1	11.9
0.287	35.7	60.6	-24.9	Phase 2	11.9
0.287	39.6	60.6	-21.0	Phase 1	11.9
0.350	26.6	59.0	-32.3	Phase 2	11.9
0.355	29.5	58.9	-29.4	Phase 1	11.9
0.382	29.8	58.2	-28.4	Phase 2	12.0
0.384	33.5	58.2	-24.7	Phase 1	12.0
0.524	25.4	56	-30.6	Phase 2	12.0
0.526	31.1	56	-24.9	Phase 1	12.0
0.879	23.7	56	-32.3	Phase 1	12.0
4.466	35.8	56	-20.2	Phase 2	12.2
4.535	35.3	56	-20.7	Phase 1	12.2
13.349	38.3	60	-21.7	Phase 1	12.4
13.349	37.1	60	-23.0	Phase 2	12.4
13.427	38.8	60	-21.2	Phase 1	12.4
13.427	37.6	60	-22.4	Phase 2	12.4
13.693	40.4	60	-19.6	Phase 1	12.4
13.693	39.2	60	-20.8	Phase 2	12.4
13.772	40.9	60	-19.1	Phase 1	12.4
13.772	39.6	60	-20.4	Phase 2	12.4
14.195	33.2	60	-26.8	Phase 1	12.4
14.197	32.1	60	-27.9	Phase 2	12.4

4.4.3 Test Result (Continued)

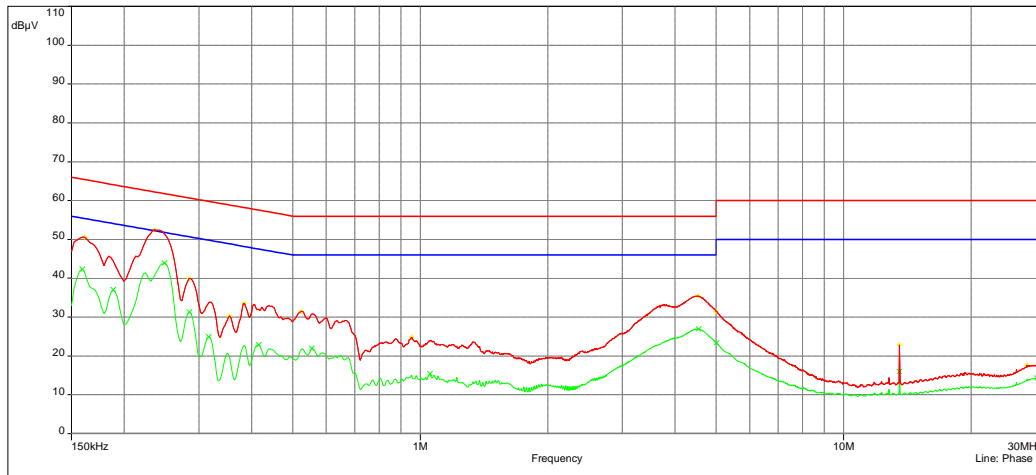
Frequency (MHz)	Avg (dBμV)	Lim. Avg (dBμV)	Margin (dB)	Comment	Correction (dB)
0.159	37.5	55.5	-18.1	Phase 2	11.9
0.159	40.5	55.5	-15.0	Phase 1	11.9
0.188	31.5	54.1	-22.6	Phase 2	11.9
0.188	34.6	54.1	-19.5	Phase 1	11.9
0.247	42.4	51.9	-9.5	Phase 1	11.9
0.247	38.6	51.9	-13.3	Phase 2	11.9
0.285	25.5	50.7	-25.2	Phase 2	11.9
0.285	29.2	50.7	-21.4	Phase 1	11.9
0.350	16.8	49.0	-32.2	Phase 2	11.9
0.350	20.2	49.0	-28.7	Phase 1	11.9
0.382	18.5	48.2	-29.7	Phase 2	12.0
0.416	22.2	47.5	-25.4	Phase 1	12.0
0.557	21.8	46	-24.3	Phase 1	12.0
0.654	16.7	46	-29.3	Phase 2	12.0
4.448	27.4	46	-18.6	Phase 2	12.2
4.502	26.7	46	-19.3	Phase 1	12.2
5.001	22.9	50	-27.1	Phase 1	12.2
5.001	22.6	50	-27.4	Phase 2	12.2
24.747	16.1	50	-33.9	Phase 1	12.6

15.107 & 15.207

AC Line Conducted Emission, 120VAC 60Hz Phase 1, POE Configuration with termination

- FCC Part 15/FCC Part 15.107 B - Average/
- FCC Part 15/FCC Part 15.107 B - QPeak/
- Meas.QPeak (Phase 1)
- Mes. CISPR AVG (Phase 1)
- o QPeak (QPeak /Lim. QPeak) (Phase 1)
- x CISPR AVG (CISPR AVG /Lim. Average) (Phase 1)

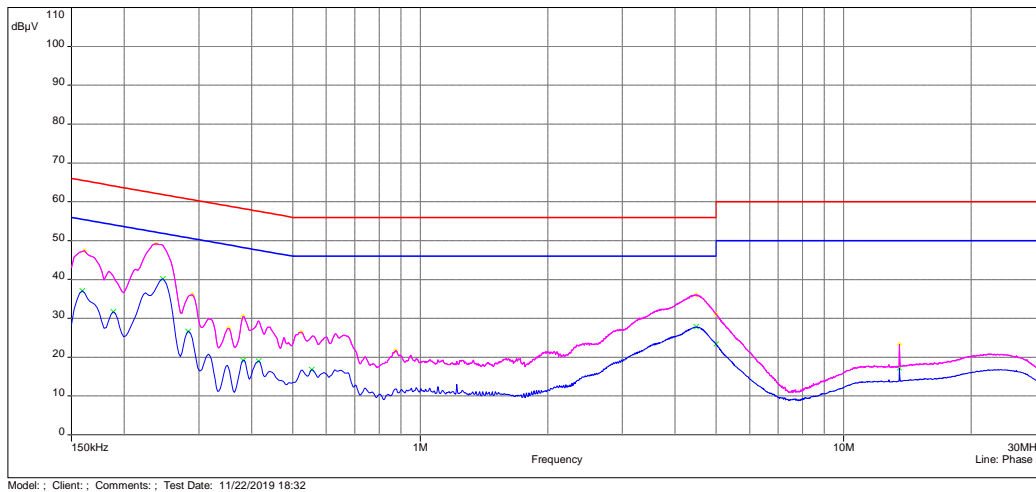
Sub-range 1
 Frequencies: 150 kHz - 30 MHz (Mode: - Step: 2.25 kHz)
 Settings: BBW: 9kHz, VBW: 30kHz, Sweep time: 1e+03 ms, Attenuation: 10 dB, Sweep count 3, Preamp: Off, LN Preamp: Off, Preselector: On
 Line:Phase 1



AC Line Conducted Emission, 120VAC 60Hz Phase 2, POE Configuration with termination

- FCC Part 15/FCC Part 15.107 B - Average/
- FCC Part 15/FCC Part 15.107 B - QPeak/
- Meas.QPeak (Phase 2)
- Mes. CISPR AVG (Phase 2)
- o QPeak (QPeak /Lim. QPeak) (Phase 2)
- x CISPR AVG (CISPR AVG /Lim. Average) (Phase 2)

Sub-range 2
 Frequencies: 150 kHz - 30 MHz (Mode: - Step: 2.25 kHz)
 Settings: BBW: 9kHz, VBW: 30kHz, Sweep time: 1e+03 ms, Attenuation: 10 dB, Sweep count 1, Preamp: Off, LN Preamp: Off, Preselector: On
 Line:Phase 2



Frequency (MHz)	QPeak (dB μ V)	Lim. QPeak (dB μ V)	Margin (dB)	Comment	Correction (dB)
0.161	47.4	65.4	-18.0	Phase 2	11.9
0.161	50.6	65.4	-14.8	Phase 1	11.9
0.236	52.5	62.3	-9.7	Phase 1	11.9
0.238	49.2	62.2	-13.0	Phase 2	11.9
0.285	39.9	60.7	-20.7	Phase 1	11.9
0.290	36.1	60.5	-24.5	Phase 2	11.9
0.353	27.4	58.9	-31.5	Phase 2	11.9
0.355	30.3	58.9	-28.6	Phase 1	11.9
0.382	30.6	58.2	-27.7	Phase 2	12.0
0.384	33.6	58.2	-24.7	Phase 1	12.0
0.524	31.6	56	-24.5	Phase 1	12.0
0.524	26.5	56	-29.6	Phase 2	12.0
0.875	21.7	56	-34.3	Phase 2	12.0
0.956	24.8	56	-31.2	Phase 1	12.0
4.486	36.1	56	-19.9	Phase 2	12.2
4.538	35.5	56	-20.5	Phase 1	12.2
5.003	31.5	60	-28.5	Phase 1	12.2
5.003	31.1	60	-28.9	Phase 2	12.2
13.560	23.2	60	-36.8	Phase 2	12.4
13.560	22.8	60	-37.2	Phase 1	12.4
27.121	17.7	60	-42.3	Phase 1	12.6

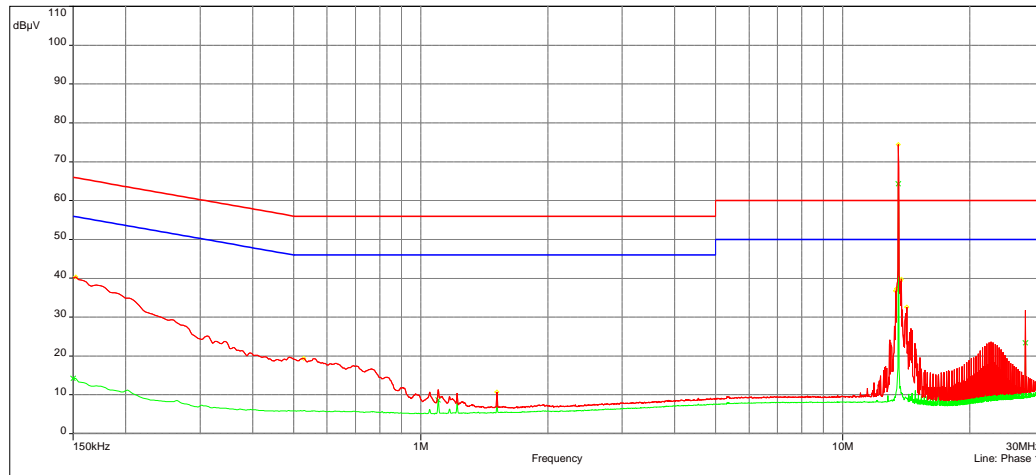
Frequency (MHz)	Avg (dBμV)	Lim. Avg (dBμV)	Margin (dB)	Comment	Correction (dB)
0.159	42.3	55.5	-13.2	Phase 1	11.9
0.159	37.1	55.5	-18.5	Phase 2	11.9
0.188	31.7	54.1	-22.4	Phase 2	11.9
0.188	37.1	54.1	-17.0	Phase 1	11.9
0.247	40.1	51.9	-11.7	Phase 2	11.9
0.249	43.9	51.8	-7.9	Phase 1	11.9
0.283	26.6	50.7	-24.1	Phase 2	11.9
0.285	31.3	50.7	-19.4	Phase 1	11.9
0.317	25.0	49.8	-24.8	Phase 1	12.0
0.382	19.2	48.2	-29.0	Phase 2	12.0
0.416	19.0	47.5	-28.6	Phase 2	12.0
0.416	22.9	47.5	-24.6	Phase 1	12.0
0.555	22.0	46	-24.0	Phase 1	12.0
0.555	16.8	46	-29.2	Phase 2	12.0
1.055	15.4	46	-30.6	Phase 1	12.0
4.486	27.8	46	-18.2	Phase 2	12.2
4.542	27.0	46	-19.0	Phase 1	12.2
5.003	23.4	50	-26.7	Phase 2	12.2
5.012	23.4	50	-26.6	Phase 1	12.2
13.560	16.0	50	-34.0	Phase 1	12.4
13.560	17.2	50	-32.8	Phase 2	12.4
28.633	14.3	50	-35.7	Phase 1	12.6

15.107 & 15.207

AC Line Conducted Emission, 120VAC 60Hz Phase 1, DC Supply Configuration without termination

- FCC Part 15/FCC Part 15.107 B - Average/
- FCC Part 15/FCC Part 15.107 B - QPeak/
- Meas.QPeak (Phase 1)
- Mes. CISPR AVG (Phase 1)
- ◊ QPeak (QPeak/Lim. QPeak) (Phase 1)
- × CISPR AVG (CISPR AVG/Lim. Average) (Phase 1)

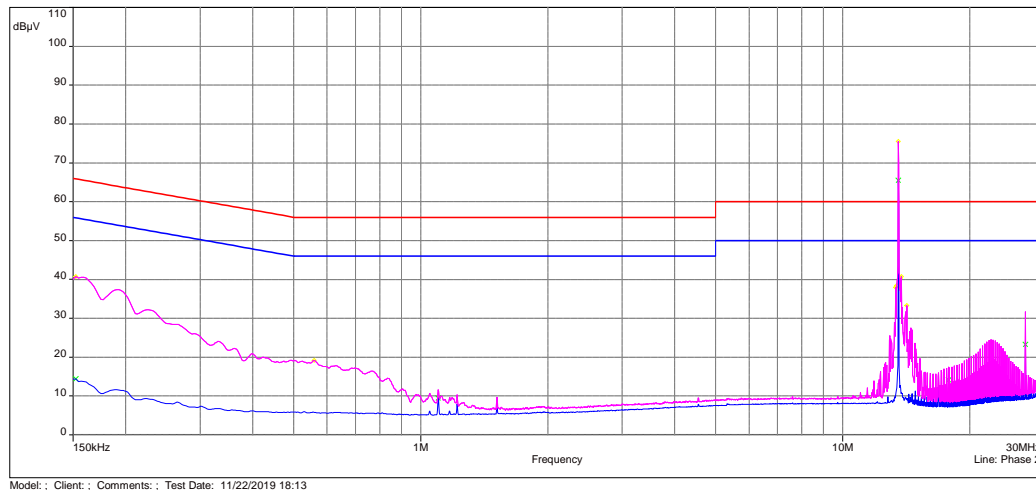
Sub-range 1
 Frequencies: 150 kHz - 30 MHz (Mode: - Step: 2.25 kHz)
 Settings: BBW: 9kHz, VBW: 30kHz, Sweep time: 1e+03 ms, Attenuation: 10 dB, Sweep count 3, Preamp: Off, LN Preamp: Off, Preselector: On
 Line:Phase 1



AC Line Conducted Emission, 120VAC 60Hz Phase 2, DC Supply Configuration without termination

- FCC Part 15/FCC Part 15.107 B - Average/
- FCC Part 15/FCC Part 15.107 B - QPeak/
- Meas.QPeak (Phase 2)
- Mes. CISPR AVG (Phase 2)
- ◊ QPeak (QPeak/Lim. QPeak) (Phase 2)
- × CISPR AVG (CISPR AVG/Lim. Average) (Phase 2)

Sub-range 2
 Frequencies: 150 kHz - 30 MHz (Mode: - Step: 2.25 kHz)
 Settings: BBW: 9kHz, VBW: 30kHz, Sweep time: 1e+03 ms, Attenuation: 10 dB, Sweep count 1, Preamp: Off, LN Preamp: Off, Preselector: On
 Line:Phase 2



4.4.3 Test Result (Continued)

Frequency (MHz)	QPeak (dBμV)	Lim. QPeak (dBμV)	Margin (dB)	Comment	Correction (dB)
0.152	40.3	65.9	-25.6	Phase 1	11.9
0.152	40.8	65.9	-25.1	Phase 2	11.9
0.528	19.4	56	-36.6	Phase 1	12.0
0.560	19.2	56	-36.8	Phase 2	12.0
1.516	10.7	56	-45.3	Phase 1	12.1
13.349	38.0	60	-22.0	Phase 2	12.4
13.349	36.8	60	-23.2	Phase 1	12.4
13.427	37.4	60	-22.6	Phase 1	12.4
13.427	38.5	60	-21.5	Phase 2	12.4
13.693	39.3	60	-20.7	Phase 1	12.4
13.693	40.3	60	-19.7	Phase 2	12.4
13.772	39.8	60	-20.2	Phase 1	12.4
13.772	40.8	60	-19.3	Phase 2	12.4
14.195	32.6	60	-27.4	Phase 1	12.4
14.195	33.3	60	-26.7	Phase 2	12.4

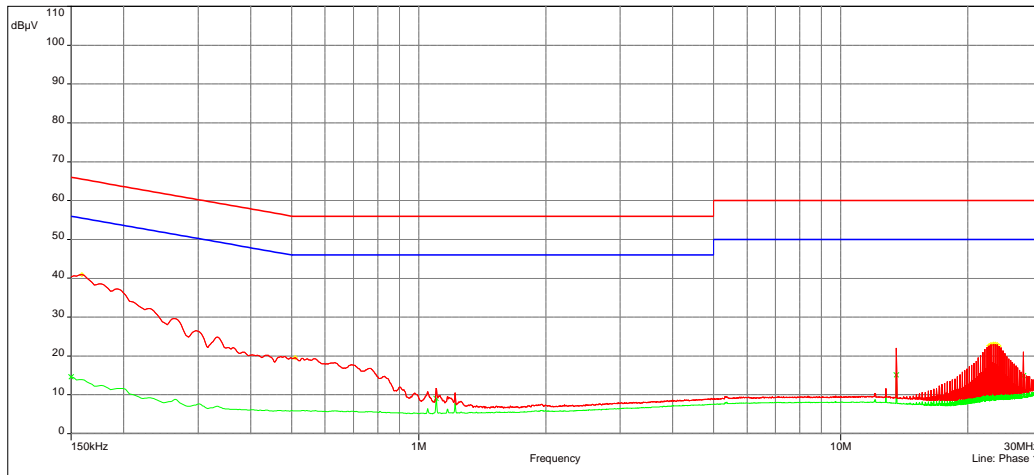
Frequency (MHz)	Avg (dBμV)	Lim. Avg (dBμV)	Margin (dB)	Comment	Correction (dB)
0.150	14.3	56	-41.7	Phase 1	11.9
0.152	14.5	55.9	-41.4	Phase 2	11.9
1.100	8.6	46	-37.4	Phase 1	12.0
1.100	9.5	46	-36.5	Phase 2	12.0
17.826	14.2	50	-35.9	Phase 2	12.5
22.223	13.7	50	-36.4	Phase 1	12.5
22.477	13.8	50	-36.2	Phase 1	12.5
22.477	14.3	50	-35.8	Phase 2	12.5
22.731	13.8	50	-36.2	Phase 1	12.5
22.731	14.3	50	-35.7	Phase 2	12.5
22.983	13.5	50	-36.5	Phase 1	12.6
22.983	14.2	50	-35.8	Phase 2	12.6
27.121	23.3	50	-26.7	Phase 2	12.6
27.121	23.4	50	-26.6	Phase 1	12.6

15.107 & 15.207

AC Line Conducted Emission, 120VAC 60Hz Phase 1, DC Supply Configuration with termination

- FCC Part 15/FCC Part 15.107 B - Average/
- FCC Part 15/FCC Part 15.107 B - QPeak/
- Meas.QPeak (Phase 1)
- Mes. CISPR AVG (Phase 1)
- ◊ QPeak (QPeak/Lim. QPeak) (Phase 1)
- × CISPR AVG (CISPR AVG/Lim. Average) (Phase 1)

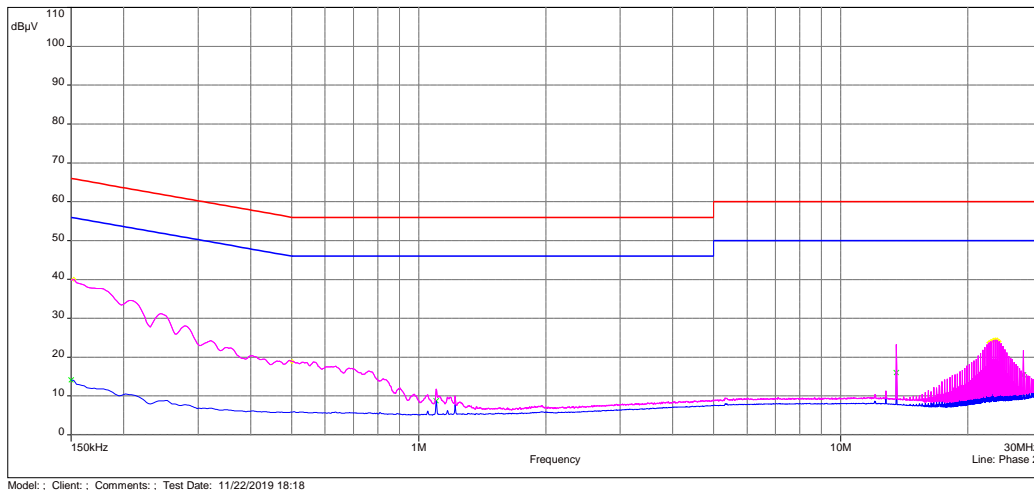
Sub-range 1
 Frequencies: 150 kHz - 30 MHz (Mode: - Step: 2.25 kHz)
 Settings: BBW: 9kHz, VBW: 30kHz, Sweep time: 1e+03 ms, Attenuation: 10 dB, Sweep count 3, Preamp: Off, LN Preamp: Off, Preselector: On
 Line:Phase 1



AC Line Conducted Emission, 120VAC 60Hz Phase 2, DC Supply Configuration with termination

- FCC Part 15/FCC Part 15.107 B - Average/
- FCC Part 15/FCC Part 15.107 B - QPeak/
- Meas.QPeak (Phase 2)
- Mes. CISPR AVG (Phase 2)
- ◊ QPeak (QPeak/Lim. QPeak) (Phase 2)
- × CISPR AVG (CISPR AVG/Lim. Average) (Phase 2)

Sub-range 2
 Frequencies: 150 kHz - 30 MHz (Mode: - Step: 2.25 kHz)
 Settings: BBW: 9kHz, VBW: 30kHz, Sweep time: 1e+03 ms, Attenuation: 10 dB, Sweep count 1, Preamp: Off, LN Preamp: Off, Preselector: On
 Line:Phase 2



4.4.3 Test Result (Continued)

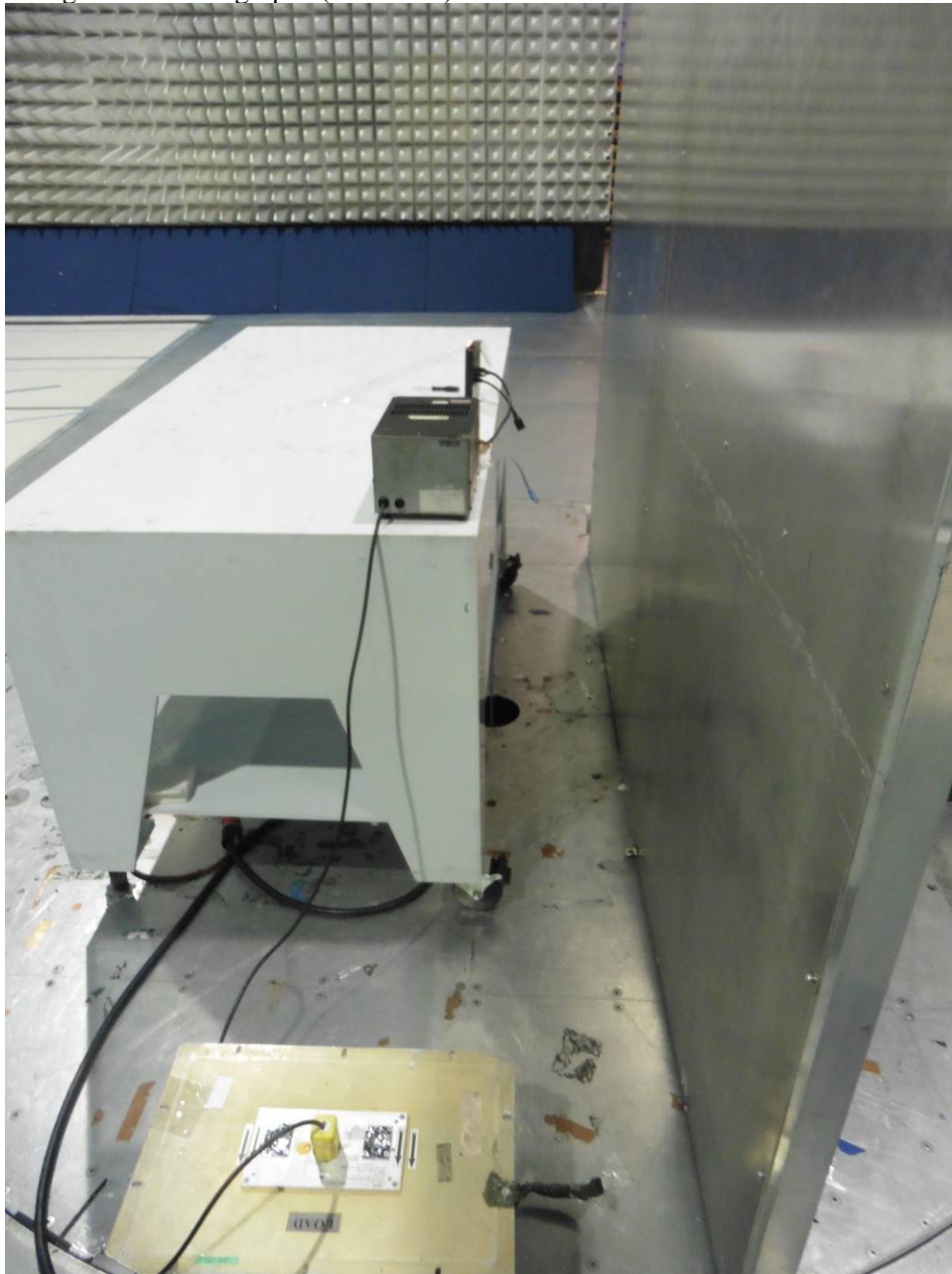
Frequency (MHz)	QPeak (dBμV)	Lim. QPeak (dBμV)	Margin (dB)	Comment	Correction (dB)
0.152	40.0	65.9	-25.9	Phase 2	11.9
0.159	40.9	65.5	-24.6	Phase 1	11.9
0.501	18.9	56	-37.1	Phase 2	12.0
0.510	19.6	56	-36.5	Phase 1	12.0
22.731	22.9	60	-37.1	Phase 1	12.5
22.731	24.0	60	-36.0	Phase 2	12.5
22.983	23.1	60	-36.9	Phase 1	12.6
22.983	24.4	60	-35.6	Phase 2	12.6
23.237	23.0	60	-37.0	Phase 1	12.6
23.237	24.4	60	-35.6	Phase 2	12.6
23.492	22.9	60	-37.1	Phase 1	12.6
23.492	24.4	60	-35.6	Phase 2	12.6
23.746	24.1	60	-35.9	Phase 2	12.6
23.746	22.6	60	-37.4	Phase 1	12.6

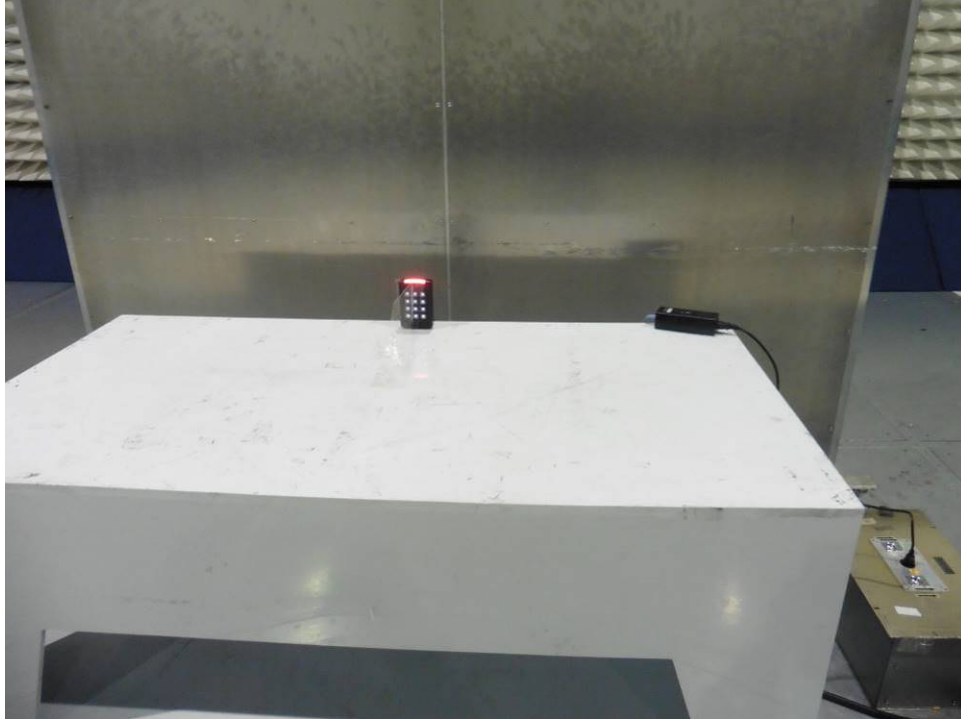
Frequency (MHz)	Avg (dBμV)	Lim. Avg (dBμV)	Margin (dB)	Comment	Correction (dB)
0.150	14.6	56	-41.4	Phase 1	11.9
0.150	14.1	56	-41.9	Phase 2	11.9
1.100	9.0	46	-37.0	Phase 1	12.0
1.100	8.8	46	-37.2	Phase 2	12.0
13.560	15.1	50	-34.9	Phase 1	12.4
13.560	16.0	50	-34.0	Phase 2	12.4
22.731	13.9	50	-36.1	Phase 1	12.5
22.983	14.1	50	-35.9	Phase 1	12.6
22.983	14.8	50	-35.2	Phase 2	12.6
23.237	14.1	50	-35.9	Phase 1	12.6
23.237	14.9	50	-35.1	Phase 2	12.6
23.492	14.0	50	-36.0	Phase 1	12.6
23.492	14.9	50	-35.1	Phase 2	12.6
23.746	14.7	50	-35.3	Phase 2	12.6
27.121	15.4	50	-34.6	Phase 2	12.6
27.121	14.9	50	-35.1	Phase 1	12.6

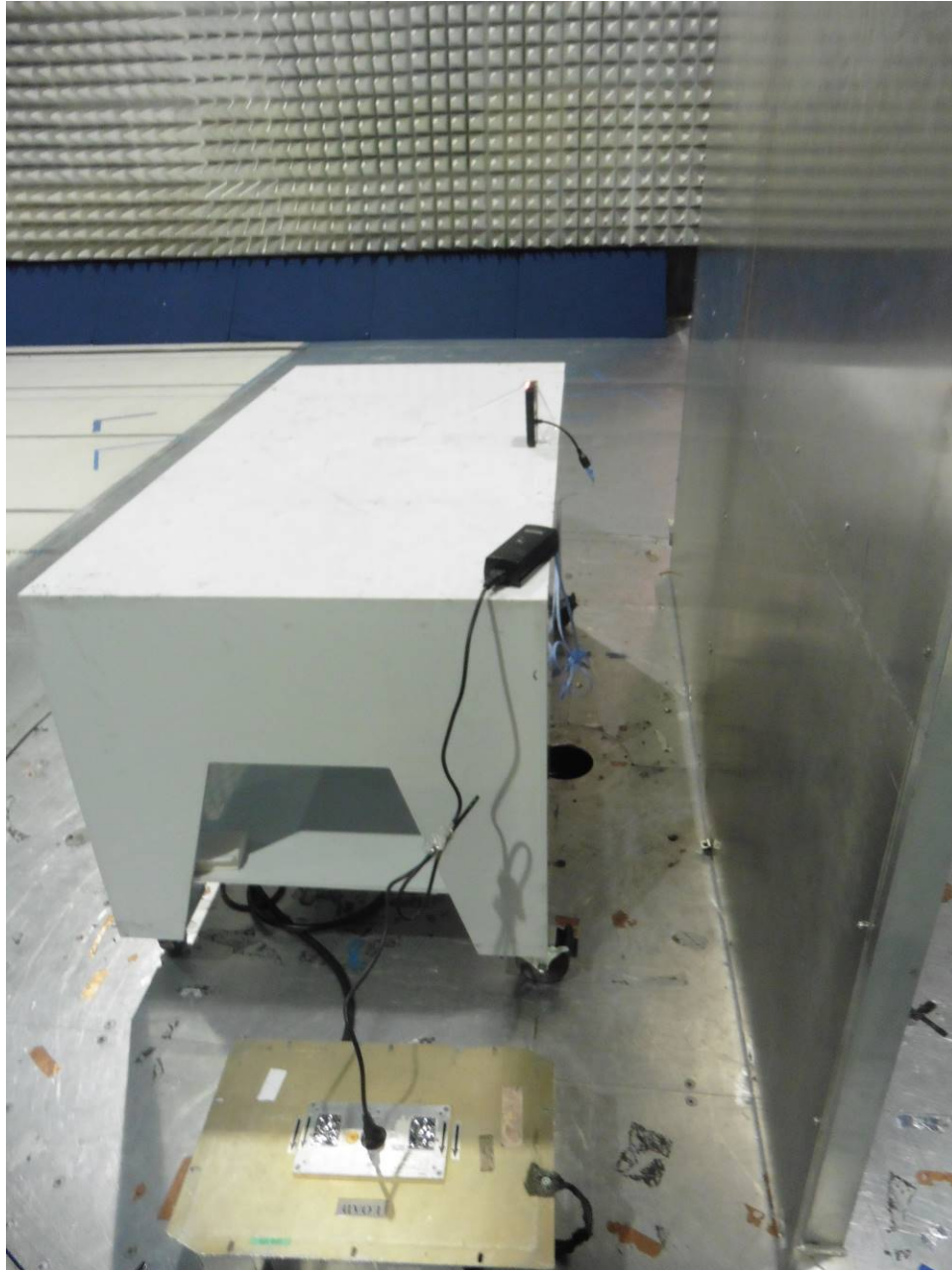
4.3.4 Test Configuration Photographs



4.3.4 Test Configuration Photographs (continued):







4.5 Radiated Emissions on Digital Parts
FCC Ref: 15.109, ICES 003, RSS Gen

4.5.1 Test Limit

Limits for Electromagnetic Radiated Emissions FCC Section 15.109(b), ICES 003*, RSS GEN

Frequency (MHz)	Class A at 10m dB(μV/m)	Class B at 3m dB(μV/m)
30-88	39	40.0
88-216	43.5	43.5
216-960	46.4	46.0
Above 960	49.5	54.0

* According to FCC Part 15.109(g) an alternative to the radiated emission limits shown above, digital devices may be shown to comply with the limit of CISPR Pub. 22

4.5.2 Procedures

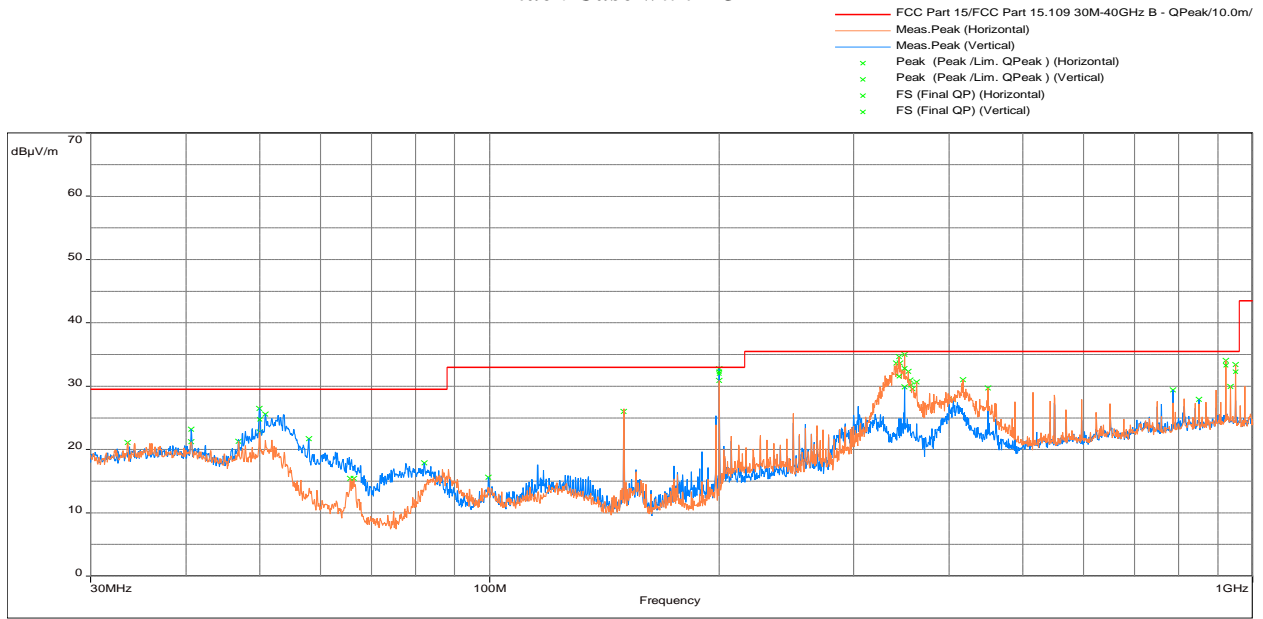
Radiated measurements were taken. 120 kHz resolution bandwidth was used from 30 MHz - 1 GHz. 1 MHz resolution bandwidth was used for measurements done above 1 GHz. All plots are corrected for cable loss, antenna factor, and preamp.

Radiated emission measurements were performed from 30 MHz to 18000 MHz. The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

Measurements recorded in this section were made with the Transmitter in Tx mode.

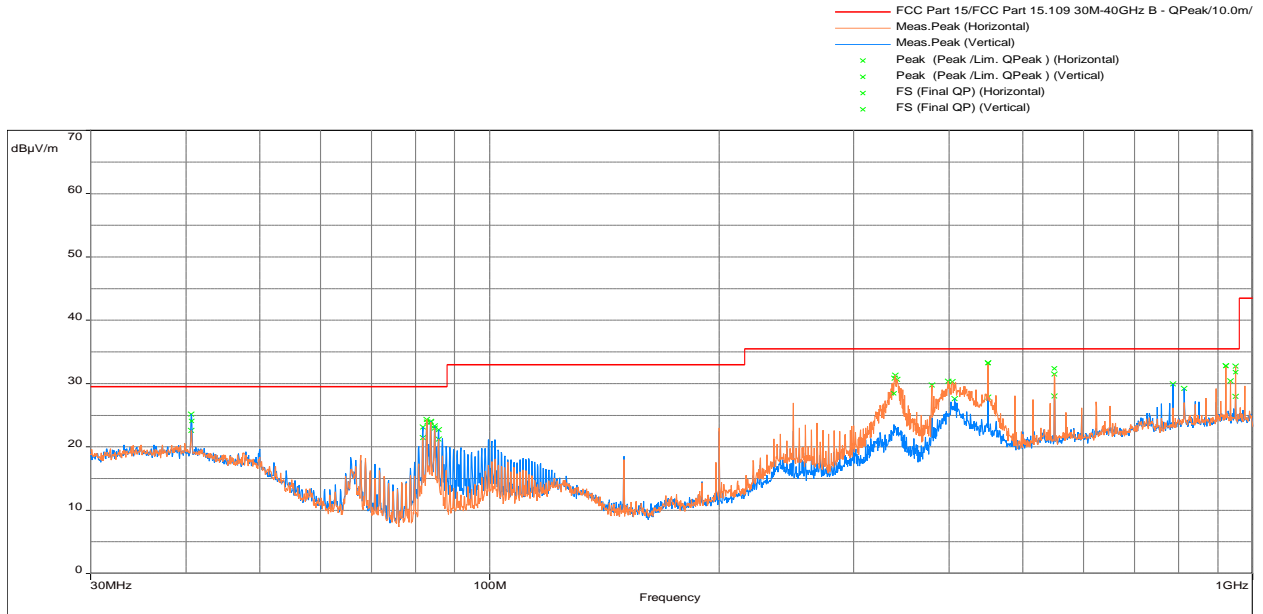
4.5.3 Test Results

FCC Part 15 Subpart B and ICES-003, Radiated Disturbance, 30 MHz to 1000 MHz, Black Case with POE



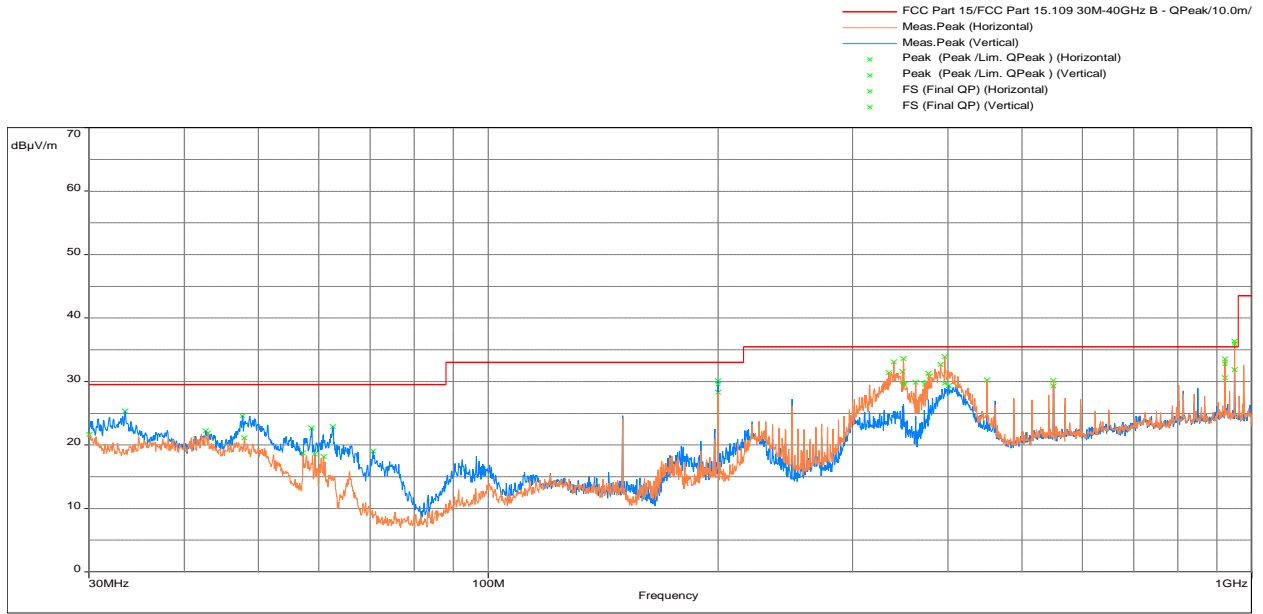
Freq (MHz)	FS @10m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
50.014	24.7	29.5	-4.8	194.3	1.4	Vertical	33.6	-8.9
199.984	32.3	33.0	-0.7	240.8	1.0	Vertical	46.6	-14.3
199.980	32.0	33.0	-1.0	72.3	3.6	Horizontal	46.3	-14.3
344.086	31.5	35.5	-4.0	157.8	2.3	Horizontal	40.5	-9.0
349.973	32.8	35.5	-2.7	340.8	2.5	Horizontal	41.8	-9.0
922.082	33.3	35.5	-2.2	206.3	1.1	Horizontal	33.5	-0.2
949.187	32.2	35.5	-3.3	203.0	1.0	Horizontal	32.3	-0.1

FCC Part 15 Subpart B and ICES-003, Radiated Disturbance, 30 MHz to 1000 MHz, Black Case with DC



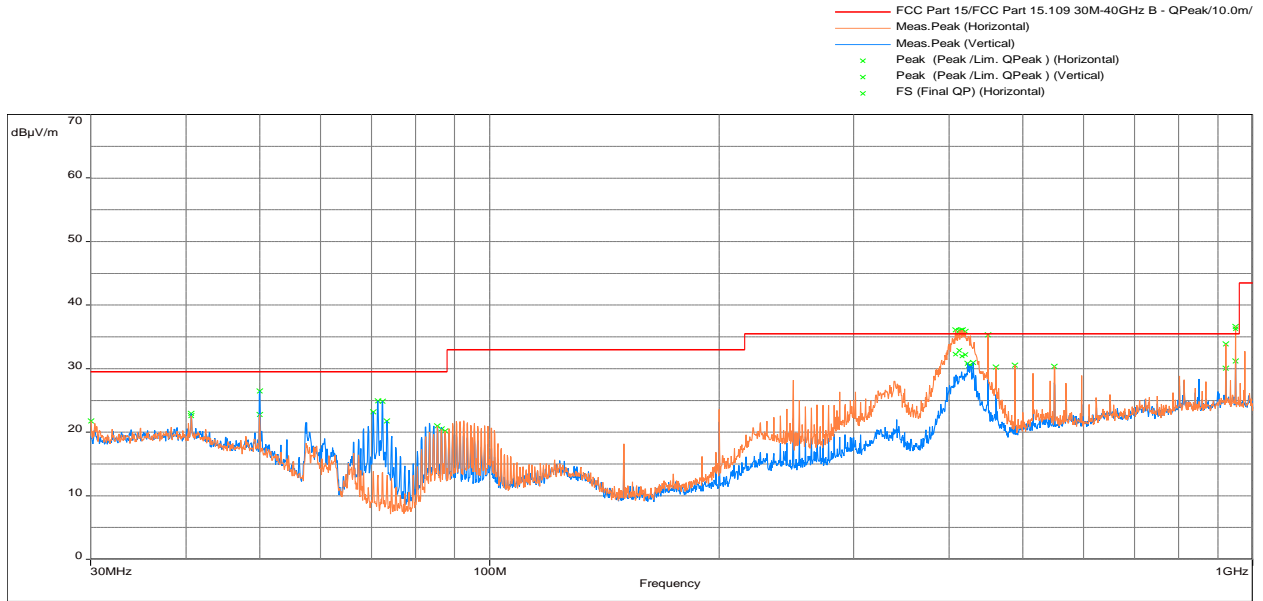
Freq (MHz)	FS @10m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
40.688	24.1	29.5	-5.4	100.3	1.1	Vertical	30.8	-6.7
338.923	28.5	35.5	-7.0	165.8	3.0	Horizontal	37.3	-8.9
449.961	33.2	35.5	-2.3	213.5	1.9	Horizontal	39.8	-6.5
549.948	32.4	35.5	-3.2	136.0	1.4	Horizontal	37.4	-5.0
922.089	32.8	35.5	-2.7	191.0	2.6	Horizontal	33.0	-0.2
949.194	31.8	35.5	-3.7	187.3	2.8	Horizontal	31.9	-0.1

FCC Part 15 Subpart B and ICES-003, Radiated Disturbance, 30 MHz to 1000 MHz, White Case with POE



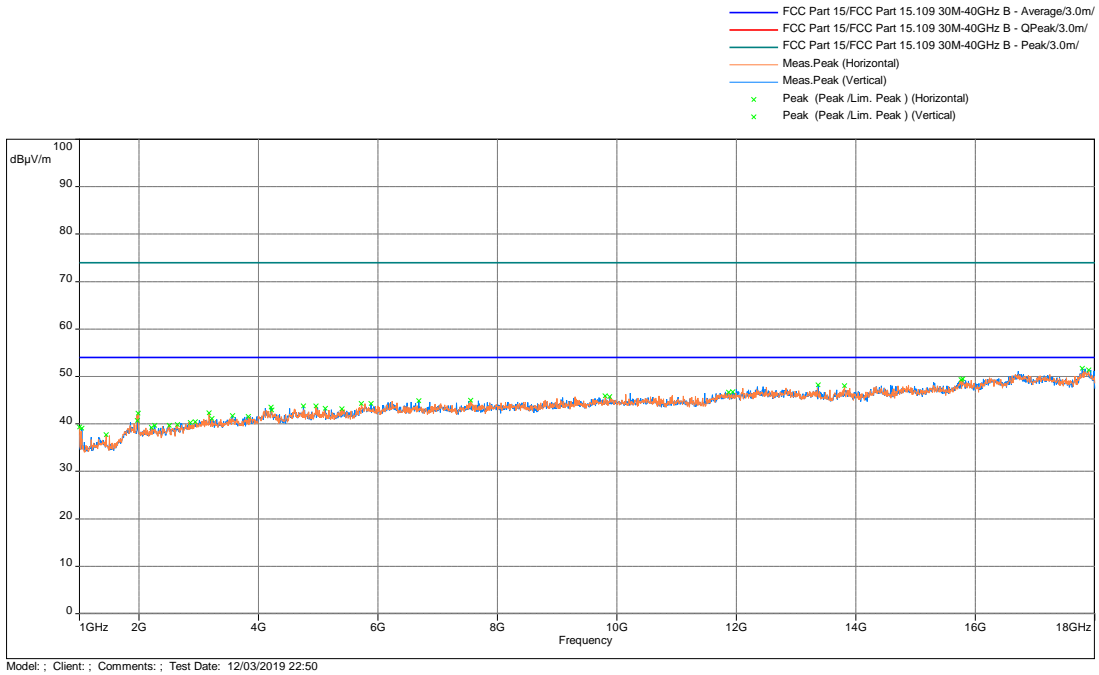
Freq (MHz)	FS @10m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
199.988	29.6	33.0	-3.4	69.0	1.0	Vertical	43.9	-14.3
339.721	33.1	35.5	-2.4	345.8	3.0	Horizontal	41.9	-8.9
349.939	29.7	35.5	-5.8	162.8	2.3	Horizontal	38.7	-9.0
395.986	29.7	35.5	-5.8	318.3	2.1	Horizontal	37.3	-7.6
922.085	32.8	35.5	-2.7	23.0	2.9	Horizontal	33.0	-0.2
949.217	35.3	35.5	-0.2	26.5	2.6	Horizontal	35.4	-0.1

FCC Part 15 Subpart B and ICES-003, Radiated Disturbance, 30 MHz to 1000 MHz, White Case with DC

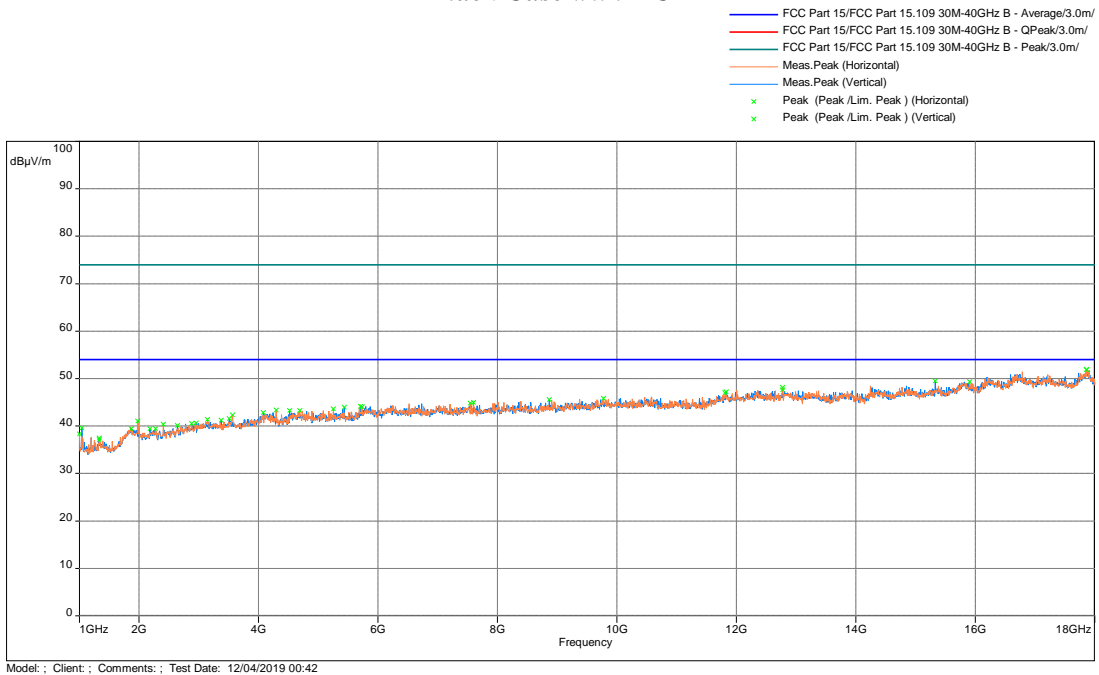


Freq (MHz)	FS @10m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
49.982	22.7	29.5	-6.8	172.5	3.0	Vertical	31.7	-8.9
408.008	32.3	35.5	-3.2	115.8	1.9	Horizontal	39.4	-7.1
412.462	32.9	35.5	-2.6	113.3	2.1	Horizontal	39.8	-7.0
416.012	32.0	35.5	-3.5	101.0	2.4	Horizontal	38.8	-6.9
420.357	32.2	35.5	-3.3	117.3	2.0	Horizontal	39.0	-6.8
949.207	35.3	35.5	-0.2	27.5	2.6	Horizontal	35.4	-0.1

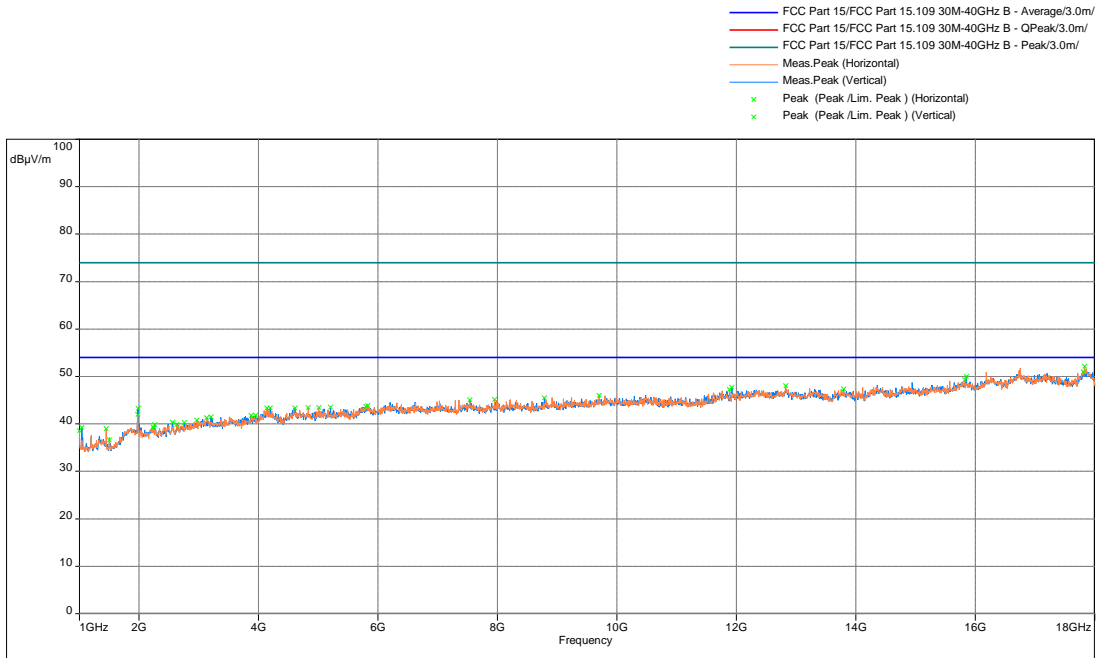
FCC Part 15 Subpart B and ICES-003, Radiated Disturbance, 1-18 GHz, Peak vs Avg limit Black Case with POE



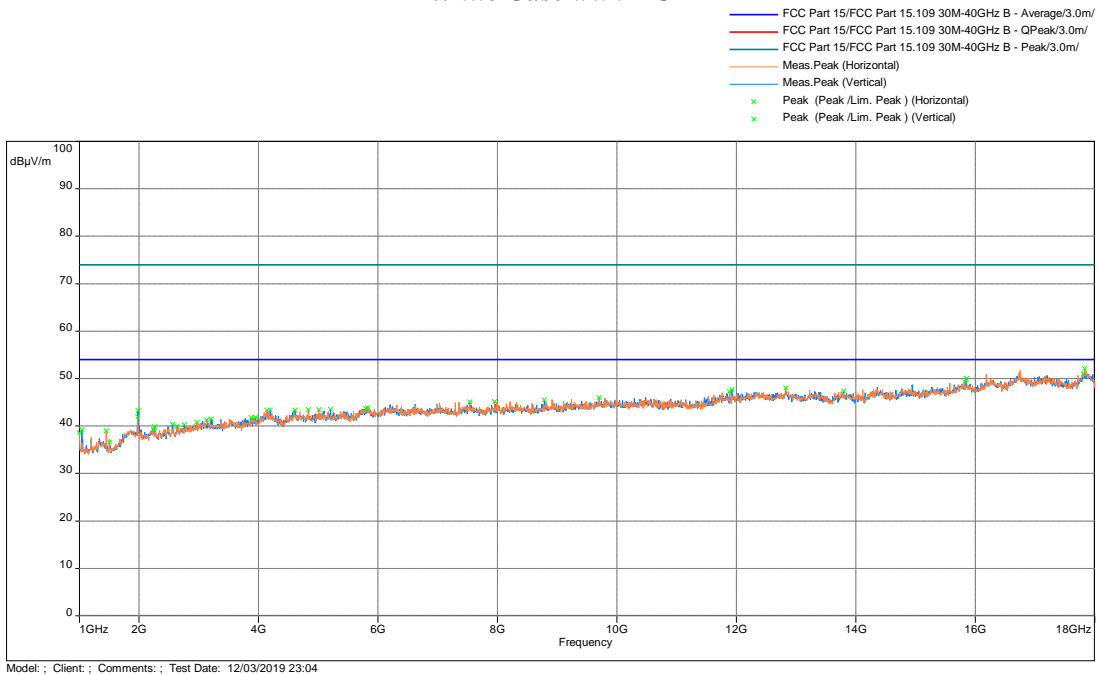
FCC Part 15 Subpart B and ICES-003, Radiated Disturbance, 1-18 GHz, Peak vs Avg limit Black Case with DC



FCC Part 15 Subpart B and ICES-003, Radiated Disturbance, 1-18 GHz, Peak vs Avg limit White Case with POE



FCC Part 15 Subpart B and ICES-003, Radiated Disturbance, 1-18 GHz, Peak vs Avg limit White Case with DC

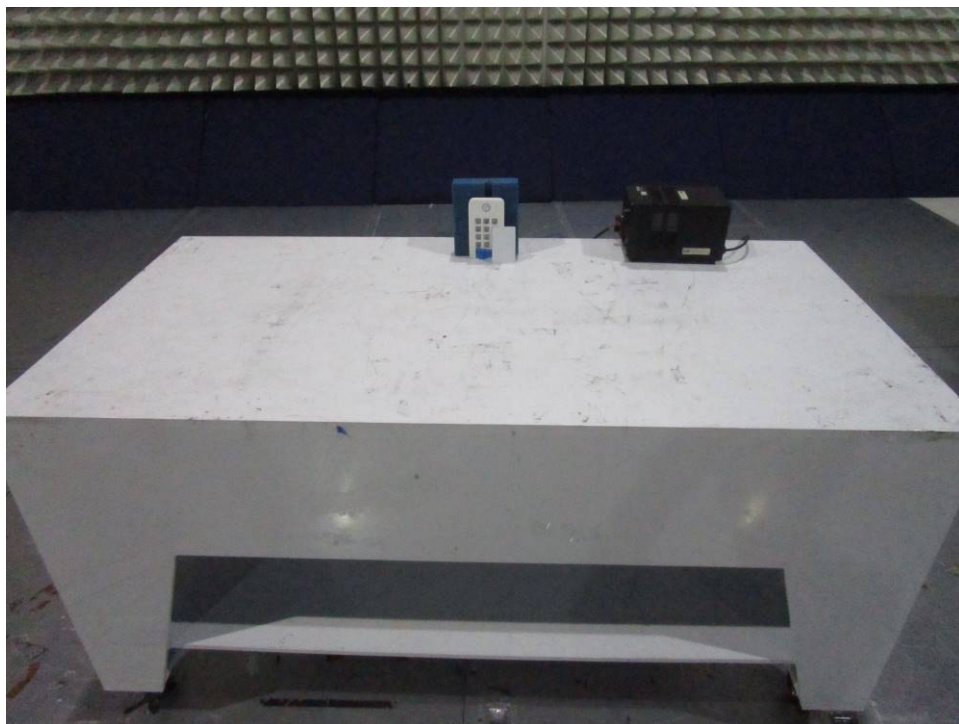


Results

Complies by 0.2 dB for FCC Part 15 Subpart B and ICES-003

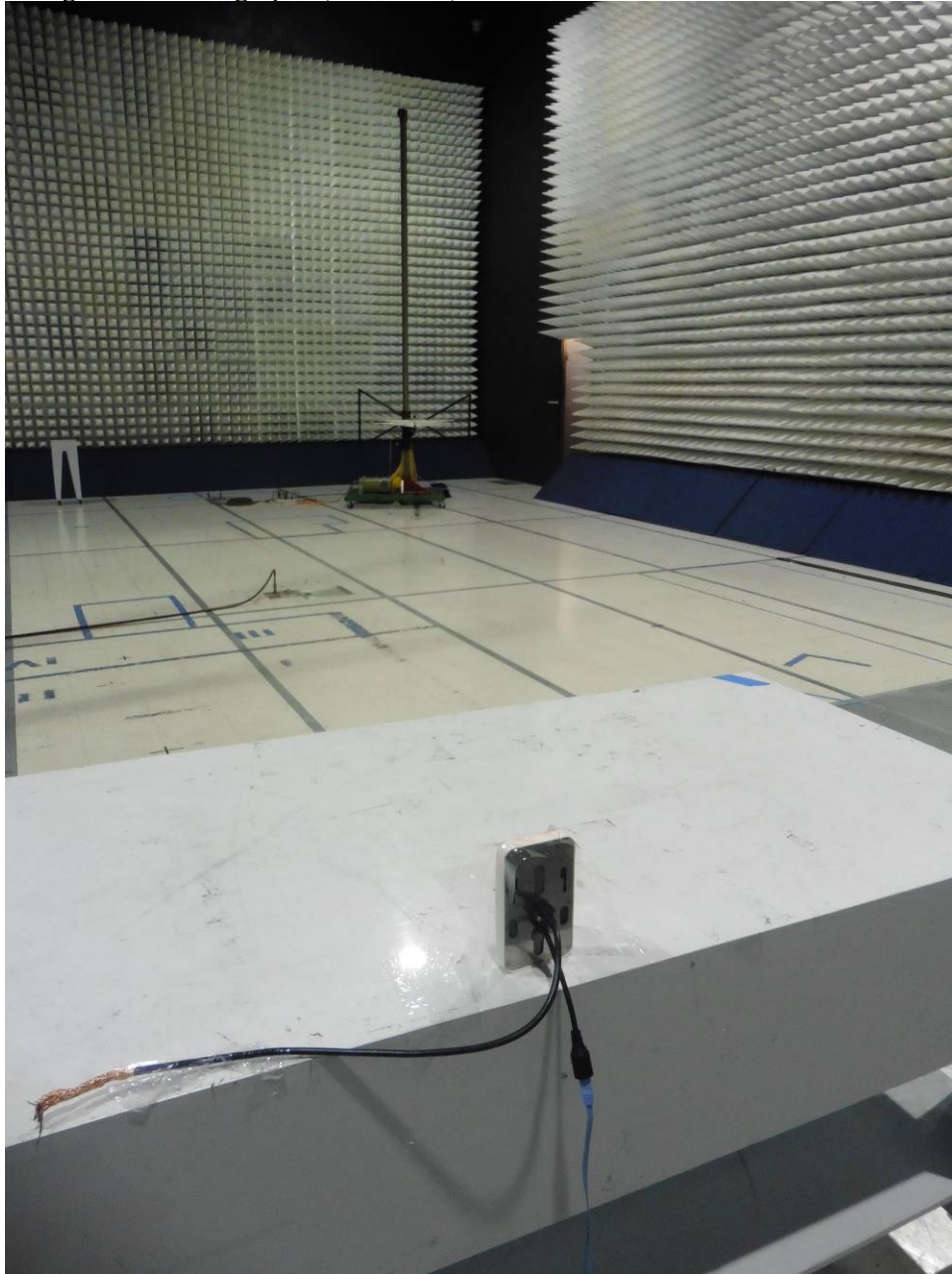
4.4.4 Test Configuration Photographs

The following photographs show the testing configurations used.

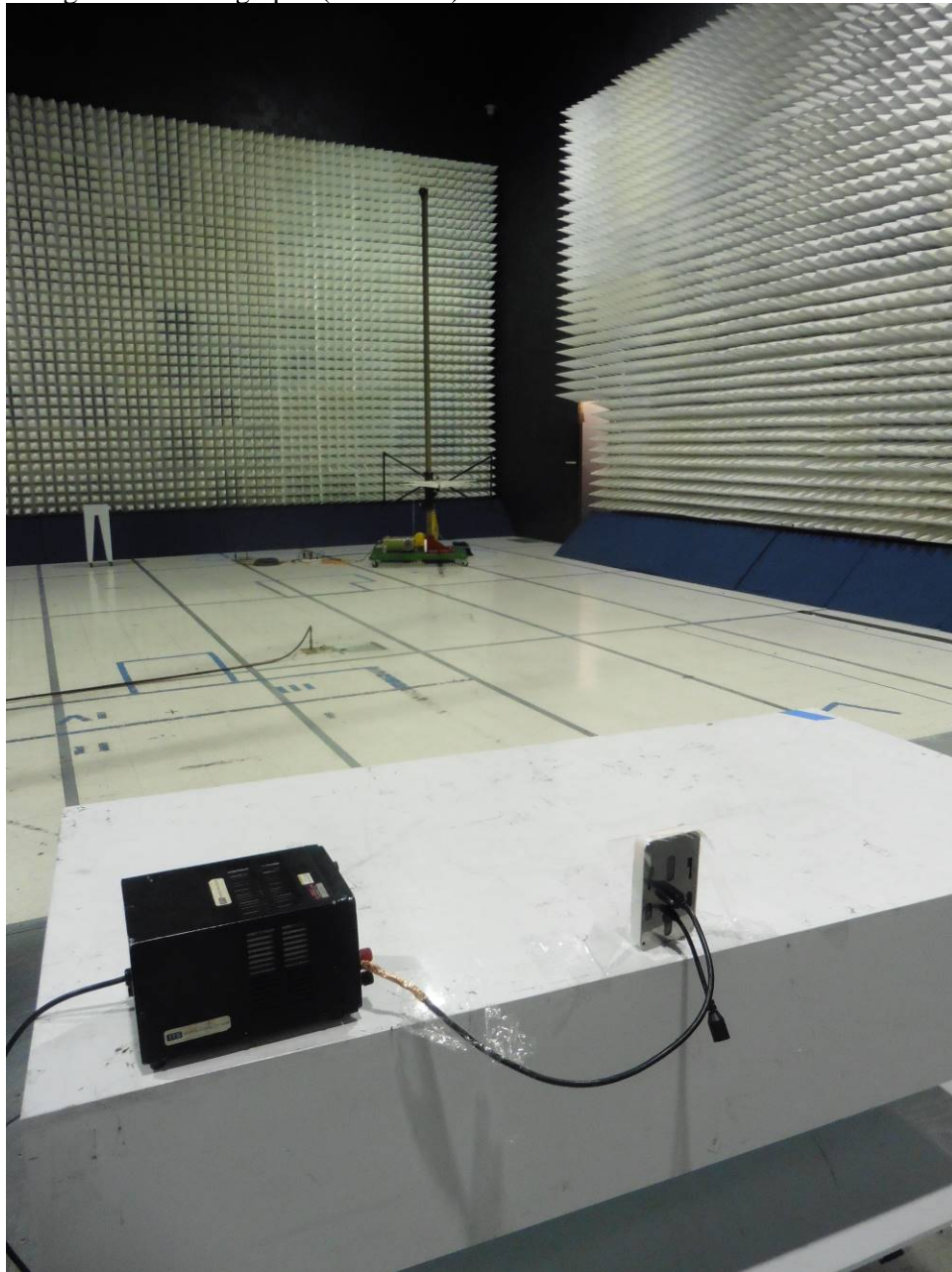


Electromagnetic Radiated Disturbance Setup Photograph

4.4.4 Test Configuration Photographs (Continued)

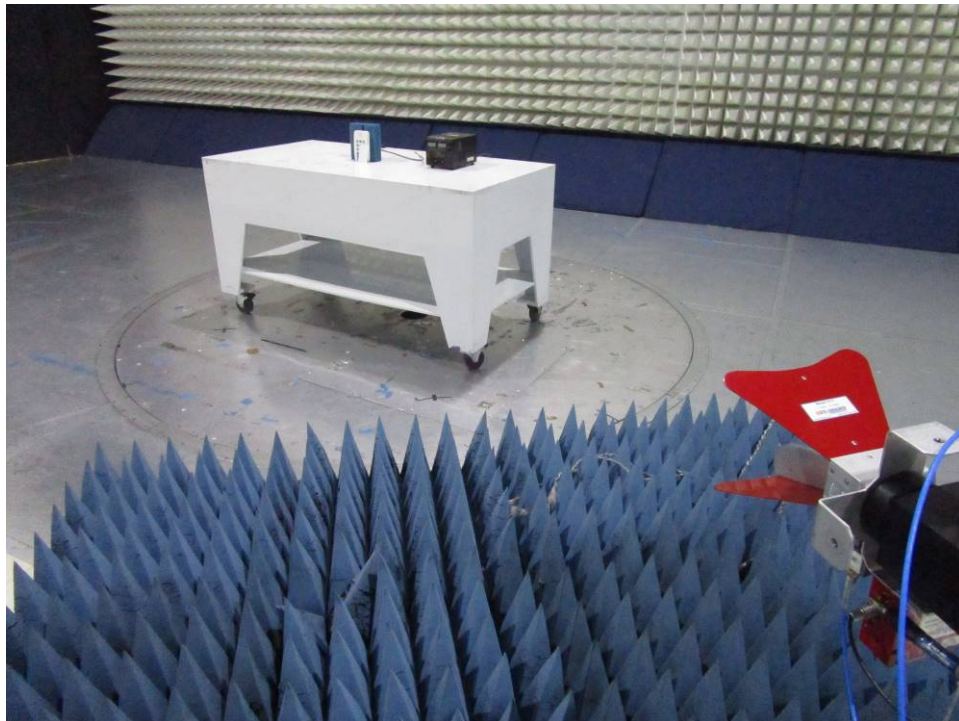
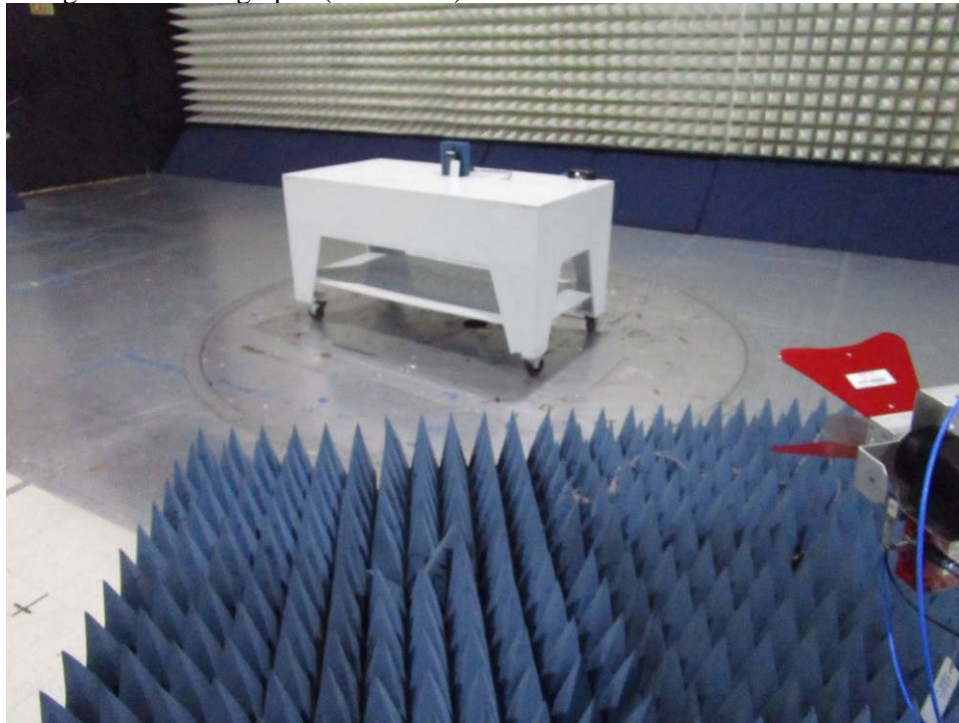


4.4.4 Test Configuration Photographs (Continued)



Electromagnetic Radiated Disturbance Setup Photograph

4.4.4 Test Configuration Photographs (Continued)



5.0 List of test equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Asset No.	Calibration	Cal Due
EMI Receiver	Rohde and Schwarz	ESR	ITS 01607	12	10/23/20
Spectrum Analyzer	Rohde and Schwarz	FSU	ITS 00913	12	03/26/20
Passive Loop Antenna	EMCO	6512	ITS 001598	12	10/22/20
Pre-Amplifier	Sonoma	310	ITS 00942	12	03/15/20
BI-Log Antenna	Antenna Research	LPB-2513	ITS 00355	12	04/24/20
Horn Antenna	ETS-Lindgren	3117-PA	ITS 01636	12	01/17/20
Horn Antenna	ETS Lindgren	3116C	ITS 01376	12	04/15/20
Pre-Amplifier	Miteq	TTA1840-35-S-M	ITS 01393	12	02/08/20
Notch Filter	Micro-Tronics	BRM50702	ITS 01166	12	05/14/20
Loop Sensor	Solar Electronics	7334-1	ITS 01608	12	10/09/19
RF Cable	Megaphase	EMC1-K1K1-236	ITS 01537	12	02/20/20
RF Cable	TRU Corporation	TRU CORE 300	ITS 01330	12	05/09/20
RF Cable	TRU Corporation	TRU CORE 300	ITS 00465	12	08/16/20
RF Cable	TRU Corporation	TRU CORE 300	ITS 01470	12	08/16/20
LISN	FCC	FCC-LISN-50-50-M-H	ITS 00551	12	11/13/20
Transient Limiter	COM-POWER	LIT-153A	ITS 01452	12	08/30/20

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
BAT-EMC	Nexio	3.17.0.10	Wavelynx, ML_11-19-2019.bpp

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewer Initials	Date	Change
1.0 / G103916593	TM	KV	December 18, 2019	Original document
2.0 / G103916593	TM	KV	June 03, 2020	Updated Model Number from F25 to ER25 per client's request.
3.0 / G103916593	TM	KV	June 11, 2020	Updated report with new FCC ID, IC ID and CPNs per client's request.

7. Appendix A: Evaluation for spurious emissions of pre-certified radio module installed inside the host equipment per KDB 996369 D04.

A1.0 Radiated Emissions (ANSI C63.10)

A1.1 Method

Tests are performed in accordance with ANSI C63.10, FCC 47CFR PT 15.247.

TEST SITE: 10m ALSE

10m ALSE: The test facility is located at 1365 Adams Court, Menlo Park, California. The test site is a 10-meter semi-anechoic chamber. The site meets the characteristics of ANSI C63.10:2013. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters. Above 1 GHz an antenna mast with boresight capabilities is used.

The A2LA certificate number for this site is 1755-01

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	U _{CISPR}
Radiated Emissions, 10m	30-200 MHz	4.7 dB	6.3 dB
Radiated Emissions, 10m	200-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	1-18 GHz	5.1 dB	5.2 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 32.

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 dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- 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 dB μ V 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 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

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

To convert from dB μ V to μ V or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μ V
NF = Net Reading in dB μ V

Example:

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

A1.2 Test Equipment Used:

See Section 5.0 for specific equipment used for this test

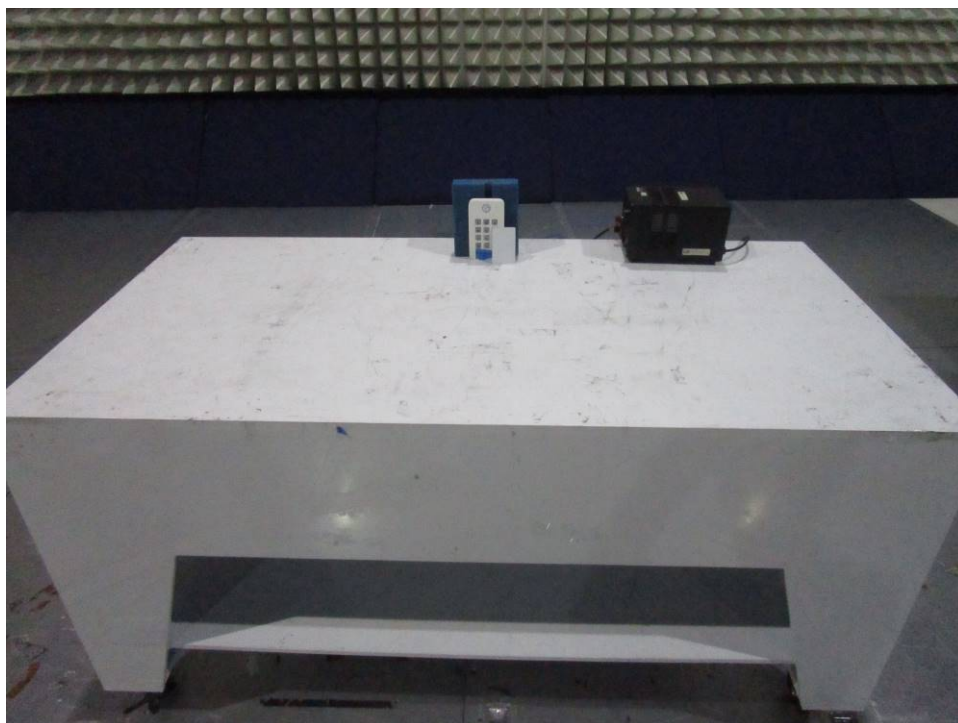
Software Utilized:

Name	Manufacturer	Version
BAT-EMC	NEXIO	3.17.0.10

A1.3 Result:

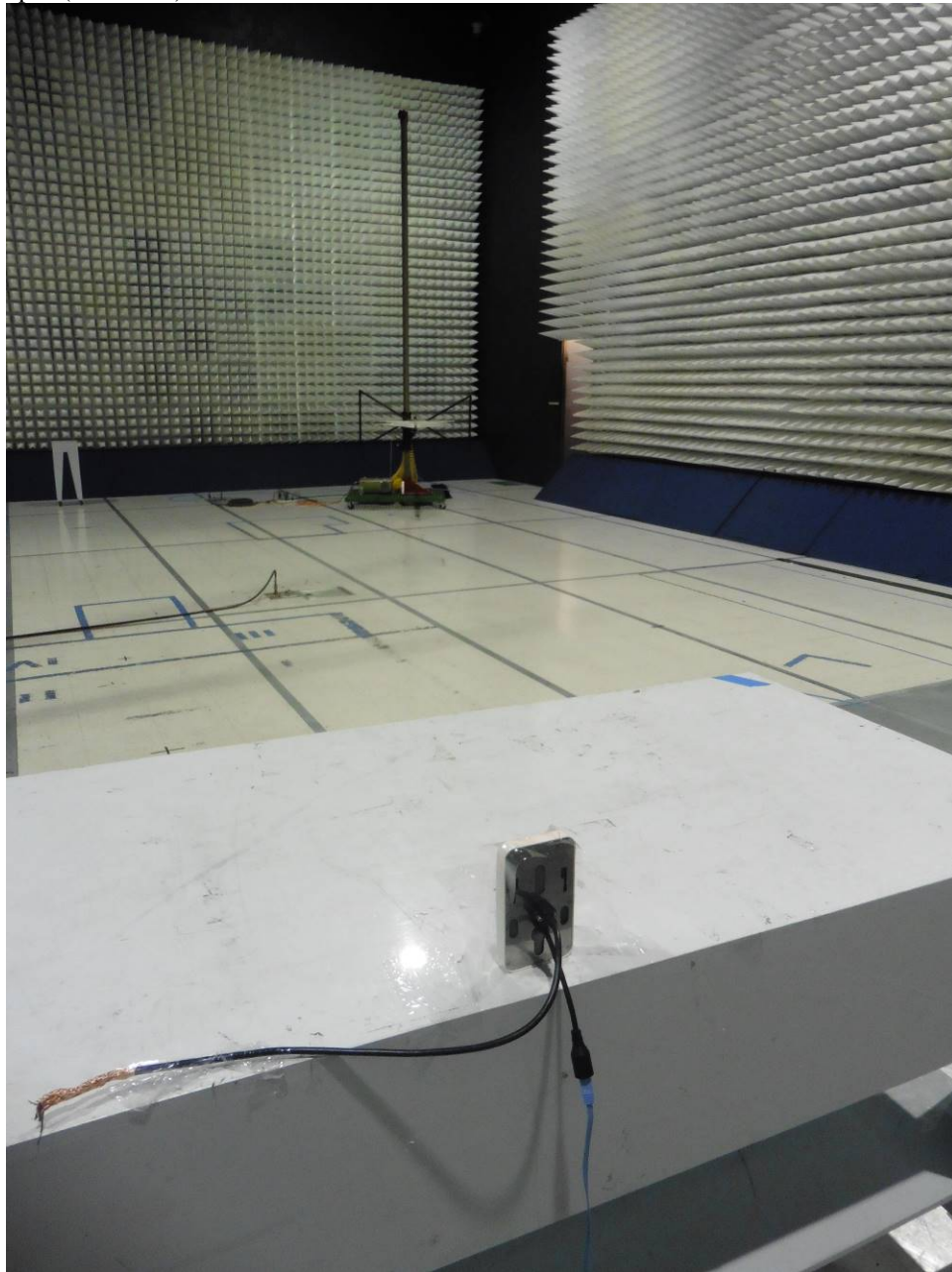
The sample tested was found to comply.

A1.4 Photographs:
The following photographs show the testing configurations used.

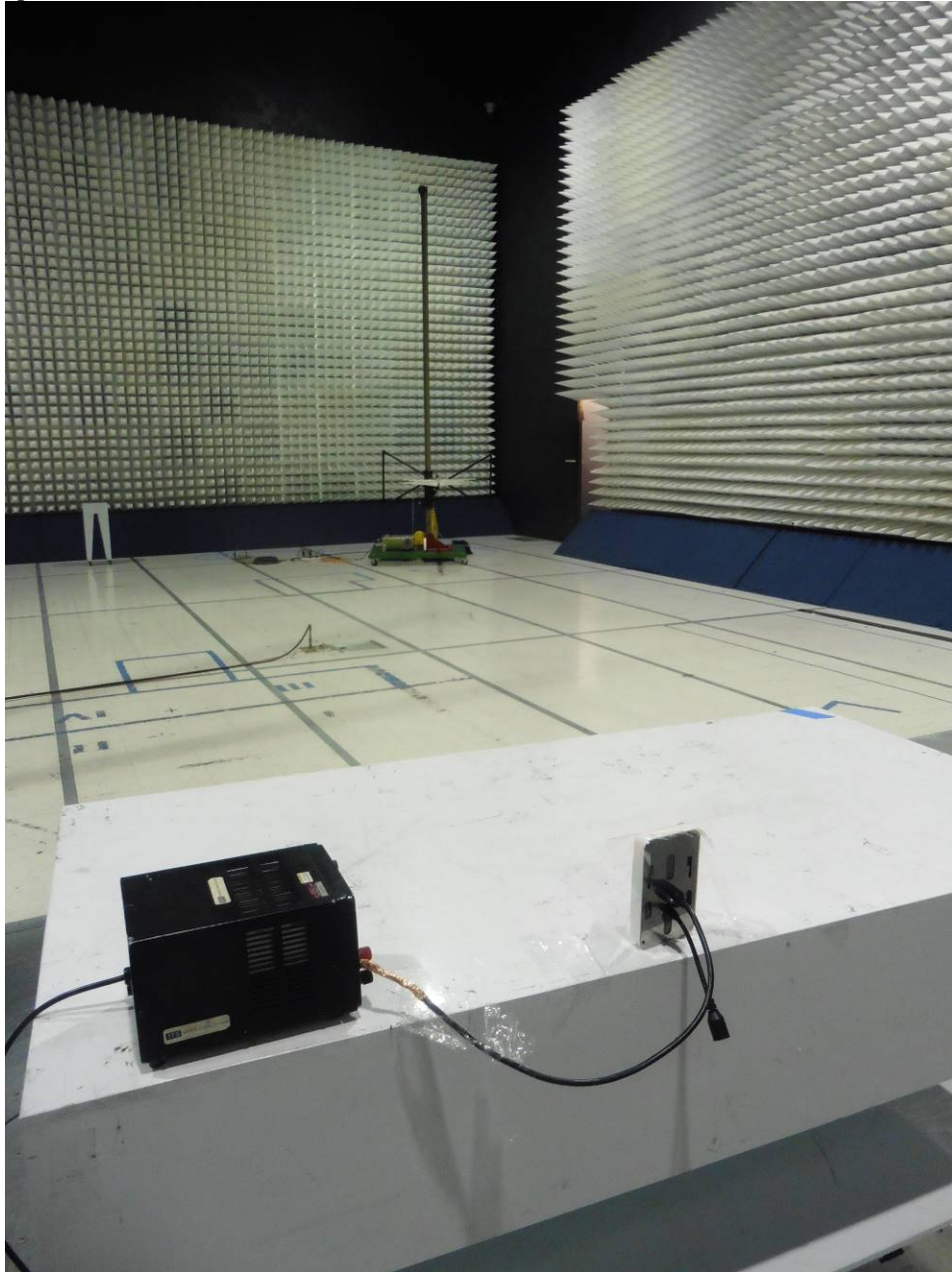


Electromagnetic Radiated Disturbance Setup Photograph

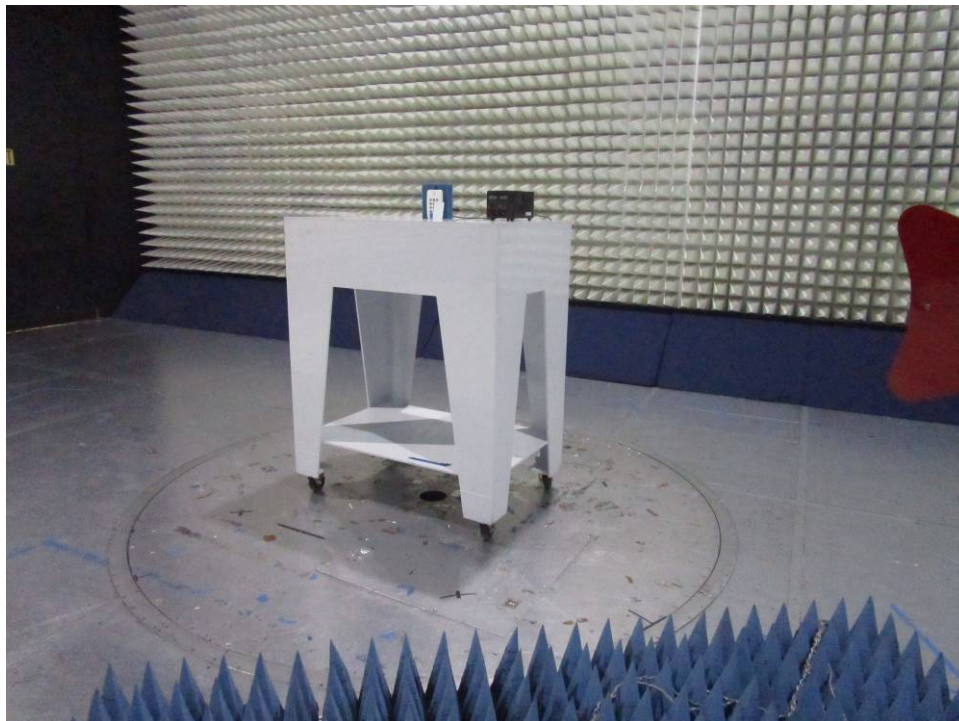
A1.4 Photographs (continued):



A1.4 Photographs (continued):

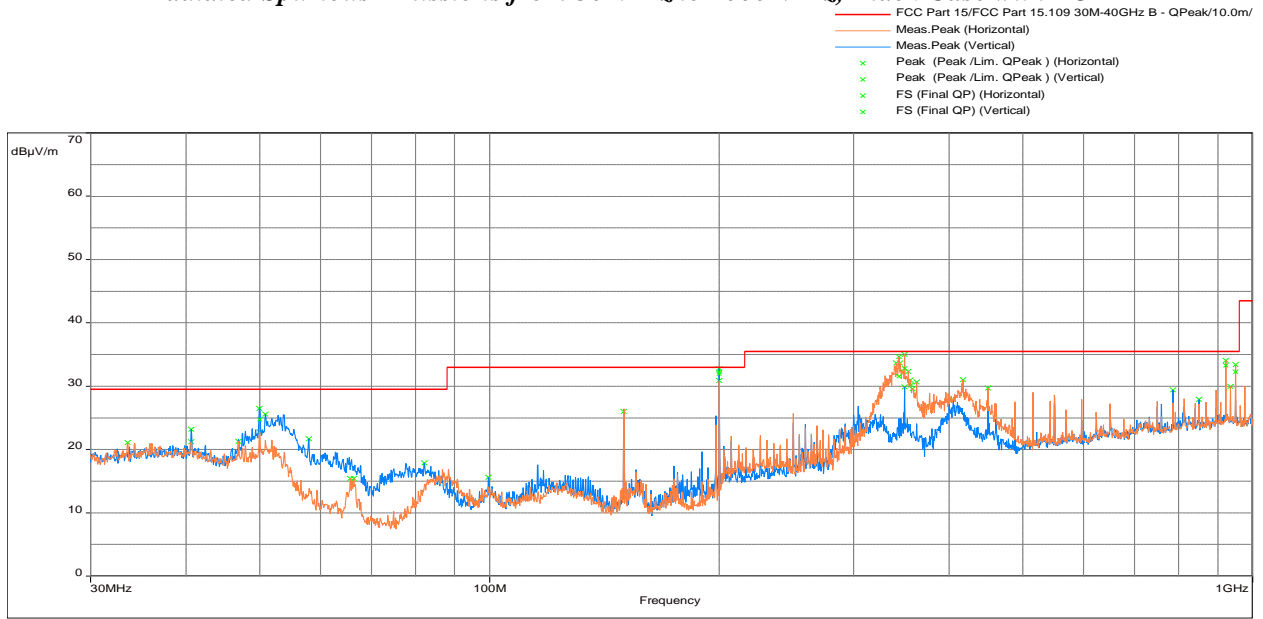


A1.4 Photographs (continued):



A1.5 Test Data

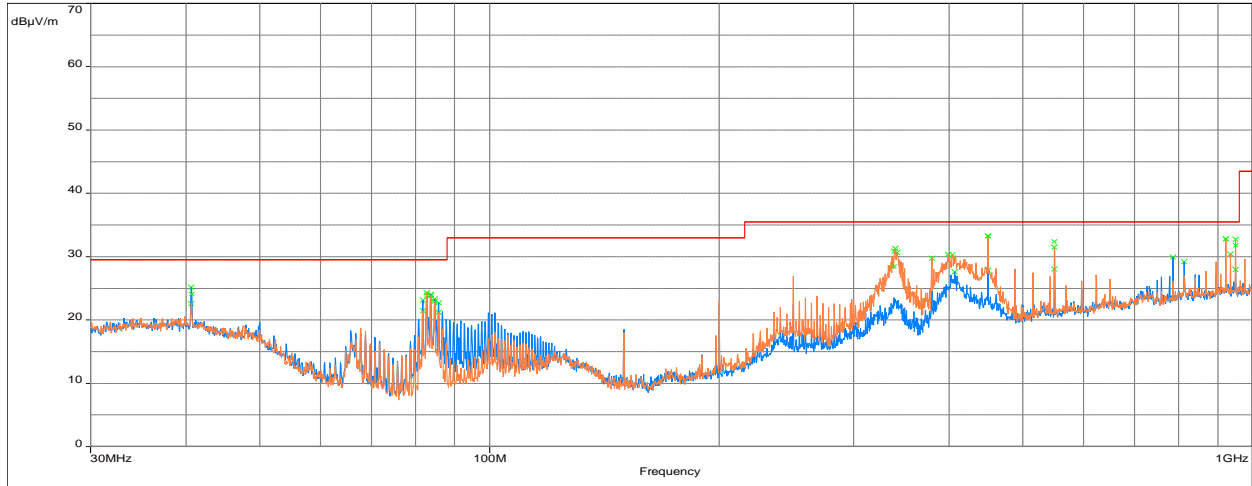
Radiated Spurious Emissions from 30 MHz to 1000 MHz, Black Case with POE



Freq (MHz)	FS @10m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
50.014	24.7	29.5	-4.8	194.3	1.4	Vertical	33.6	-8.9
199.984	32.3	33.0	-0.7	240.8	1.0	Vertical	46.6	-14.3
199.980	32.0	33.0	-1.0	72.3	3.6	Horizontal	46.3	-14.3
344.086	31.5	35.5	-4.0	157.8	2.3	Horizontal	40.5	-9.0
349.973	32.8	35.5	-2.7	340.8	2.5	Horizontal	41.8	-9.0
922.082	33.3	35.5	-2.2	206.3	1.1	Horizontal	33.5	-0.2
949.187	32.2	35.5	-3.3	203.0	1.0	Horizontal	32.3	-0.1

Radiated Spurious Emissions from 30 MHz to 1000 MHz, Black Case with DC

- FCC Part 15/FCC Part 15.109 30M-40GHz B - QPeak/10.0m/
- Meas.Peak (Horizontal)
- Meas.Peak (Vertical)
- x Peak (Peak /Lim. QPeak) (Horizontal)
- x Peak (Peak /Lim. QPeak) (Vertical)
- x FS (Final QP) (Horizontal)
- x FS (Final QP) (Vertical)

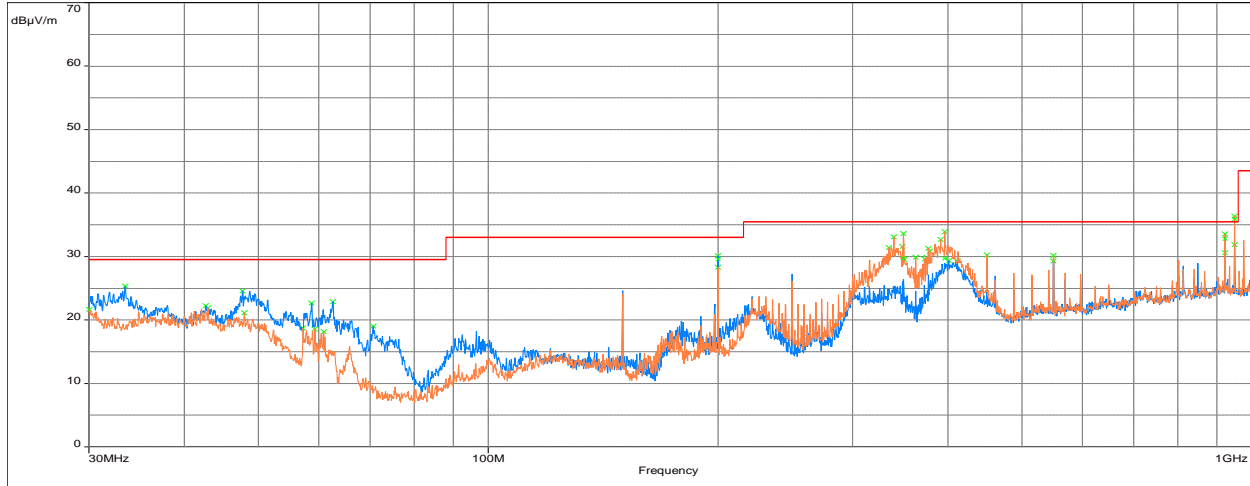


Model : Client : Comments : Test Date: 11/19/2019 19:46

Freq (MHz)	FS @10m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
40.688	24.1	29.5	-5.4	100.3	1.1	Vertical	30.8	-6.7
338.923	28.5	35.5	-7.0	165.8	3.0	Horizontal	37.3	-8.9
449.961	33.2	35.5	-2.3	213.5	1.9	Horizontal	39.8	-6.5
549.948	32.4	35.5	-3.2	136.0	1.4	Horizontal	37.4	-5.0
922.089	32.8	35.5	-2.7	191.0	2.6	Horizontal	33.0	-0.2
949.194	31.8	35.5	-3.7	187.3	2.8	Horizontal	31.9	-0.1

Radiated Spurious Emissions from 30 MHz to 1000 MHz, White Case with POE

- FCC Part 15/FCC Part 15.109 30M-40GHz B - QPeak/10.0m/
- Meas.Peak (Horizontal)
- Meas.Peak (Vertical)
- × Peak (Peak /Lim. QPeak) (Horizontal)
- × Peak (Peak /Lim. QPeak) (Vertical)
- × FS (Final QP) (Horizontal)
- × FS (Final QP) (Vertical)

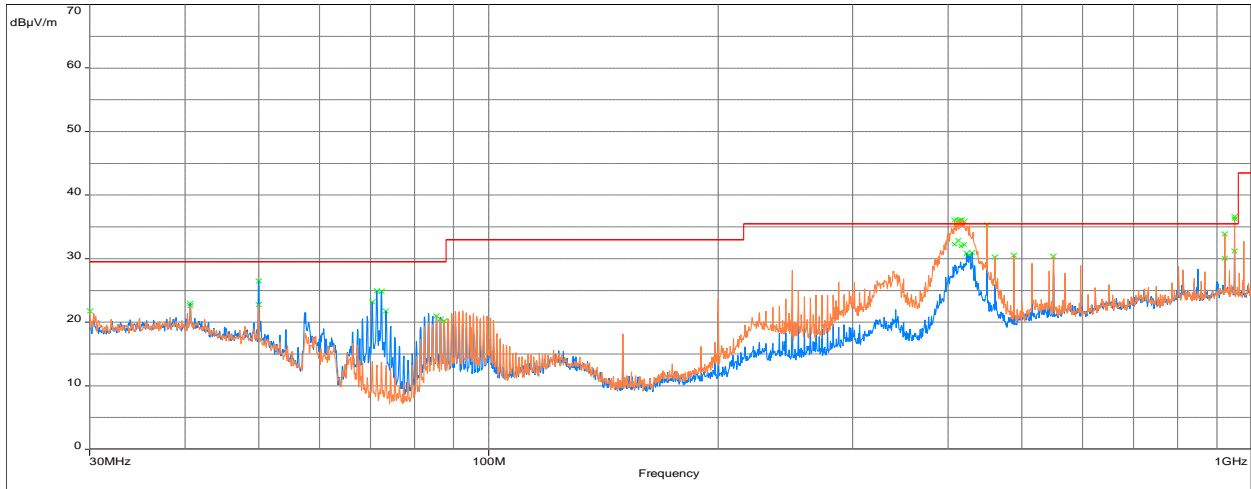


Model: ; Client: ; Comments: ; Test Date: 11/21/2019 17:16

Freq (MHz)	FS @10m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
199.988	29.6	33.0	-3.4	69.0	1.0	Vertical	43.9	-14.3
339.721	33.1	35.5	-2.4	345.8	3.0	Horizontal	41.9	-8.9
349.939	29.7	35.5	-5.8	162.8	2.3	Horizontal	38.7	-9.0
395.986	29.7	35.5	-5.8	318.3	2.1	Horizontal	37.3	-7.6
922.085	32.8	35.5	-2.7	23.0	2.9	Horizontal	33.0	-0.2
949.217	35.3	35.5	-0.2	26.5	2.6	Horizontal	35.4	-0.1

Radiated Spurious Emissions from 30 MHz to 1000 MHz, White Case with DC

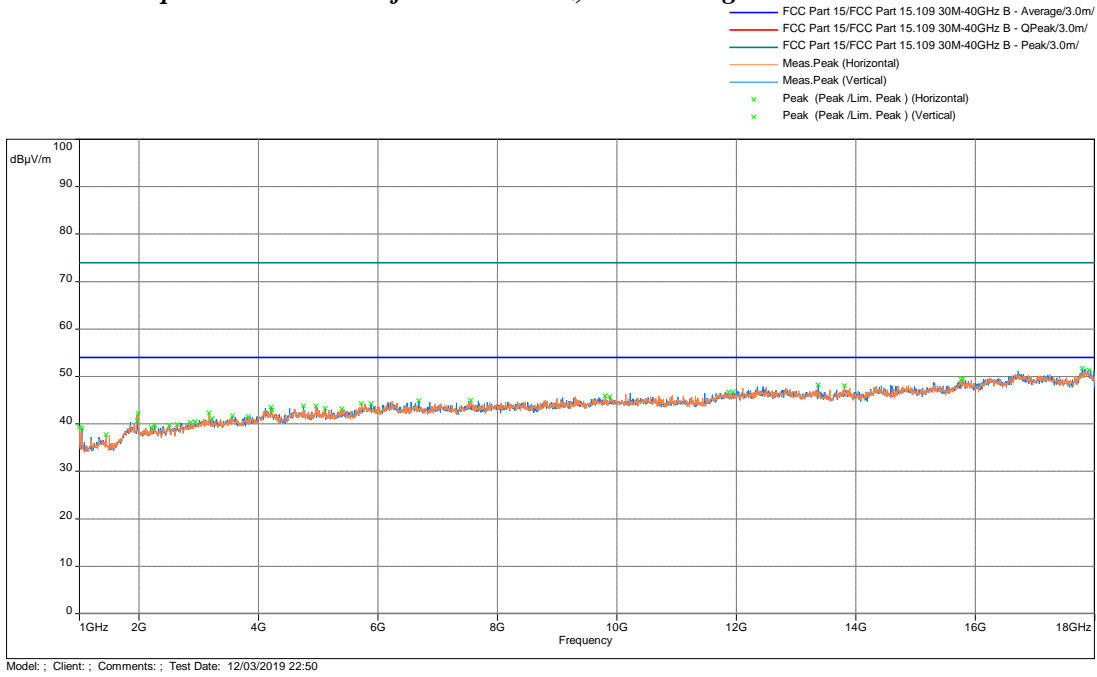
— FCC Part 15/FCC Part 15.109 30M-40GHz B - QPeak/10.0m/
— Meas.Peak (Horizontal)
— Meas.Peak (Vertical)
x Peak (Peak /Lim. QPeak) (Horizontal)
x Peak (Peak /Lim. QPeak) (Vertical)
x FS (Final QP) (Horizontal)



Model: ; Client: ; Comments: ; Test Date: 11/21/2019 18:49

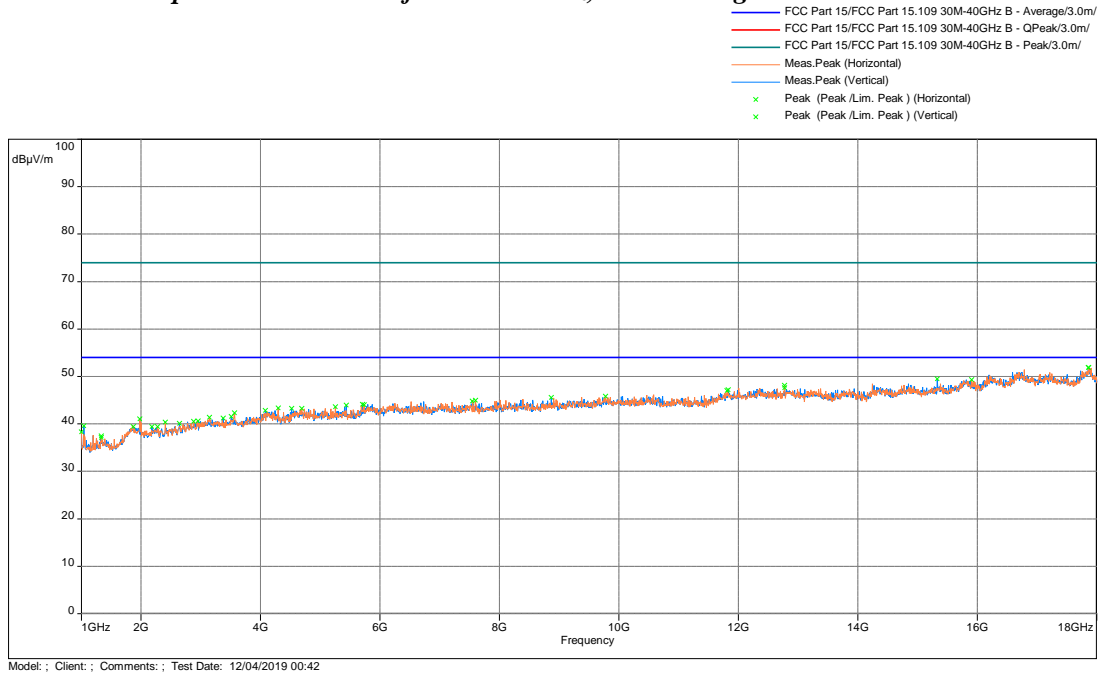
Freq (MHz)	FS @10m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
49.982	22.7	29.5	-6.8	172.5	3.0	Vertical	31.7	-8.9
408.008	32.3	35.5	-3.2	115.8	1.9	Horizontal	39.4	-7.1
412.462	32.9	35.5	-2.6	113.3	2.1	Horizontal	39.8	-7.0
416.012	32.0	35.5	-3.5	101.0	2.4	Horizontal	38.8	-6.9
420.357	32.2	35.5	-3.3	117.3	2.0	Horizontal	39.0	-6.8
949.207	35.3	35.5	-0.2	27.5	2.6	Horizontal	35.4	-0.1

Radiated Spurious Emissions from 1-18 GHz, Peak vs Avg limit Black Case with POE



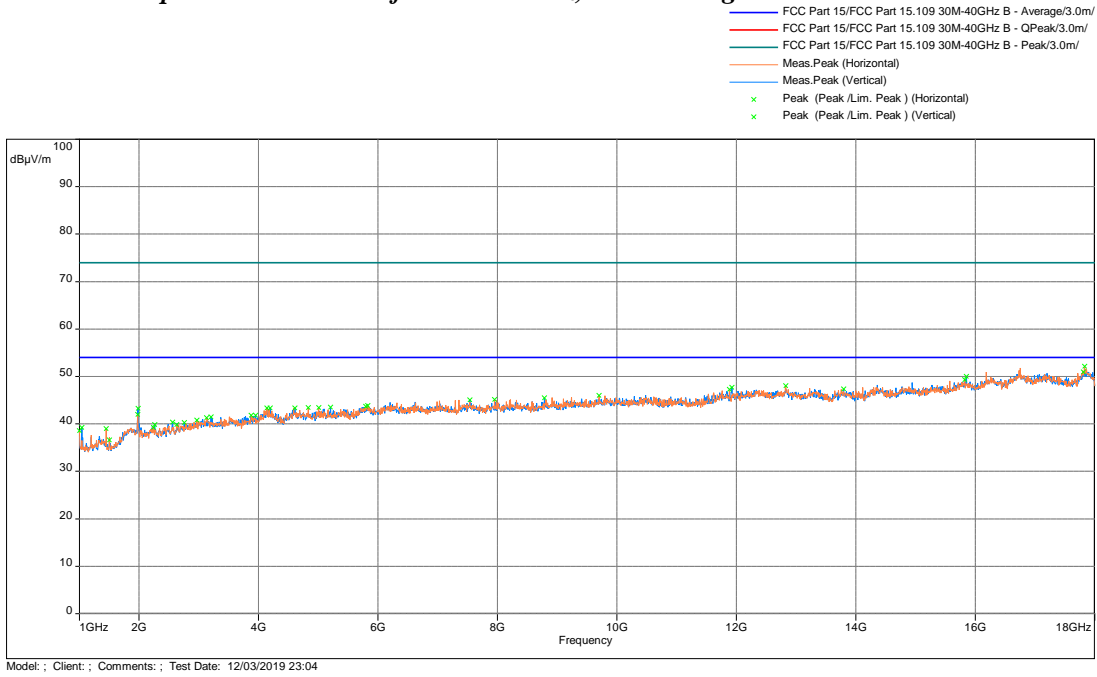
Freq (MHz)	FS @ 3m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	Correction (dB)
13810.067	48.1	54	-5.9	143.25	3.98	Horizontal	0.8
13366.933	48.2	54	-5.8	251.75	1.01	Vertical	-0.1

Radiated Spurious Emissions from 1-18 GHz, Peak vs Avg limit Black Case with DC



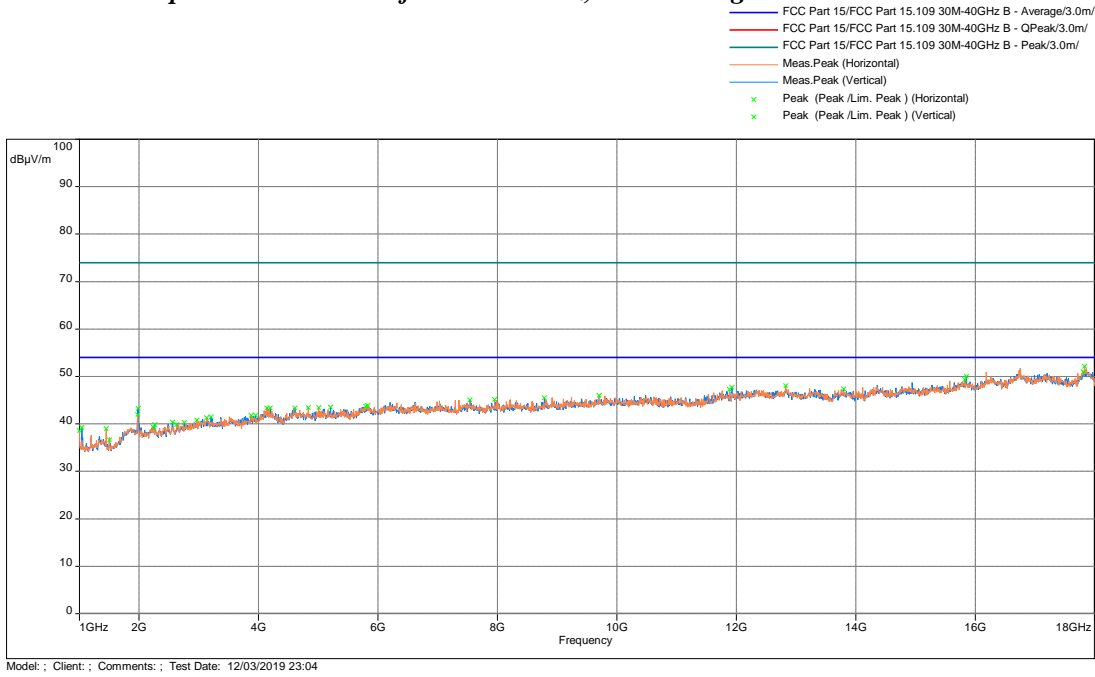
Freq (MHz)	FS @ 3m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	Correction (dB)
12769.667	48.1	54	-5.9	143	3.99	Horizontal	-1.0
12771.367	47.6	54	-6.4	269.5	2.51	Vertical	-1.0

Radiated Spurious Emissions from 1-18 GHz, Peak vs Avg limit White Case with POE



Freq (MHz)	FS @ 3m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	Correction (dB)
12826.333	48.1	54	-5.9	134.5	1	Horizontal	-0.9
11926.467	47.7	54	-6.3	0	3.99	Vertical	-2.7

Radiated Spurious Emissions from 1-18 GHz, Peak vs Avg limit White Case with DC



Freq (MHz)	FS @ 3m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	Correction (dB)
12826.333	48.1	54	-5.9	134.5	1	Horizontal	-0.9
11926.467	47.7	54	-6.3	0	3.99	Vertical	-2.7

Result **Complies by 0.2 dB**

Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz.

END OF REPORT