TEST REPORT

Report Number: 104444452MPK-005
Project Number: G104444452
December 08, 2020

Testing performed on the
Proxess Enrollment Reader
Model Number: PXR01-ENR
HVIN: PXR01-ENR

FCC ID: 2AKUZPXR01
IC: 22335-PXR01

to

FCC Part 15 Subpart C (15.225)
Industry Canada RSS-210 Issue 10
FCC Part 15, Subpart B
Industry Canada ICES-003

For

Proxess LLC

Test Performed by:	**Test Authorized by:**
Intertek	Proxess LLC
1365 Adams Court	8100 Southpark Way - Suite A4
Menlo Park, CA 94025 USA	Littleton, CO 80120 USA

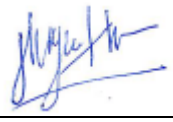
Prepared by: _____ **Date:** December 08, 2020
Hung Huynh

Reviewed by: _____ **Date:** December 08, 2020
Krishna Vemuri

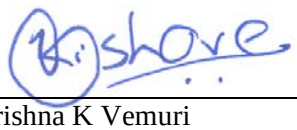
Report No. 104444452MPK-005

Equipment Under Test:	Proxess Enrollment Reader
Trade Name:	Proxess LLC
Model Number:	PXR01-ENR
Serial Number:	MPK2011191608-002
Applicant:	Proxess LLC
Contact:	Jeff Cahill
Address:	8100 Southpark Way - Suite A4 Littleton, CO 80120
Country	USA
Email	Jeff.cahill@proxess.com
Applicable Regulation:	FCC Part 15 Subpart C (15.225) Industry Canada RSS-210 Issue 10 FCC Part 15, Subpart B Industry Canada ICES-003 Issue 7
Test Site Location:	ITS – Site 1 1365 Adams Drive Menlo Park, CA 94025
Date of Test:	November 22 - December 03, 2020

We attest to the accuracy of this report:



Hung Huynh
Project Engineer



Krishna K Vemuri
EMC Manager

TABLE OF CONTENTS

1.0 Summary of Tests

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

Proxess LLC supplied the following description of the EUT:

Reads ISO14443 tags and communicates tag data over USB. Updates ISO14443 tags based off data received over USB. Allows communication over BLE.

Overview of the EUT

Applicant name & address	Proxess LLC 8100 Southpark Way - Suite A4 Littleton, CO 80120
Contact info / Email	Jeff Cahill / jeff.cahill@proxess.com
Model	PXR01-ENR
HVIN:	PXR01-ENR
FCC Identifier	2AKUZPXR01
IC Identifier	22335-PXR01
Operating Frequency	13.56 MHz
Number of Channels	1 each frequency (RFID)
Type of Modulation	ASK Modulation (RFID)
Antenna Type	PCB Trace Antenna (13.56 MHz)

EUT receive date: November 19, 2020
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 22, 2020
Test completion date: December 03, 2020

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

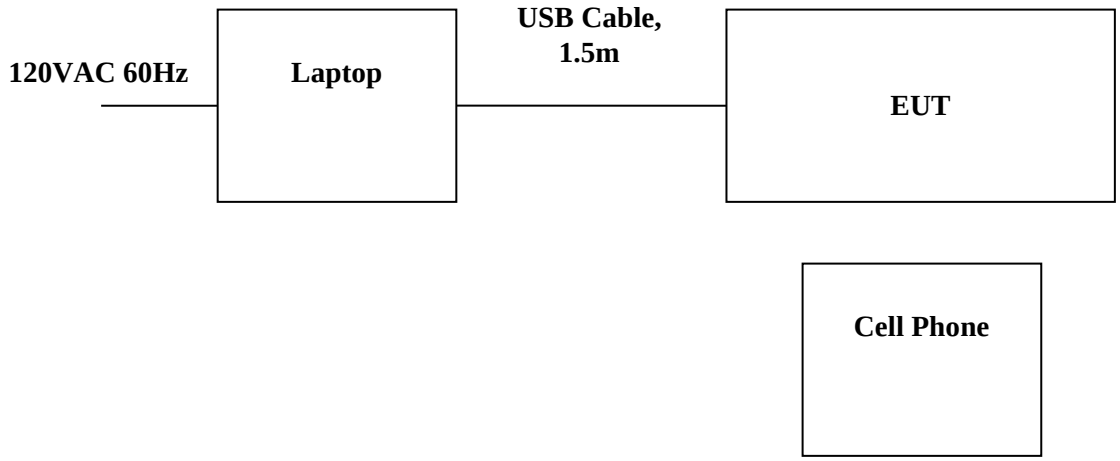
3.1 EUT Photo

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.**
Laptop	HP	14m-dw1023dx
Cell Phone	Samsung	SM-J327U

Test Setup Configuration



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

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: SH6MDBT50Q. See Appendix A for test data and setup photos.

3.4 Software Exercise Program

None.

3.5 Mode of Operation during test

The Proxess Enrollment Reader was set up to continuously transmitting at 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 (μV/m)

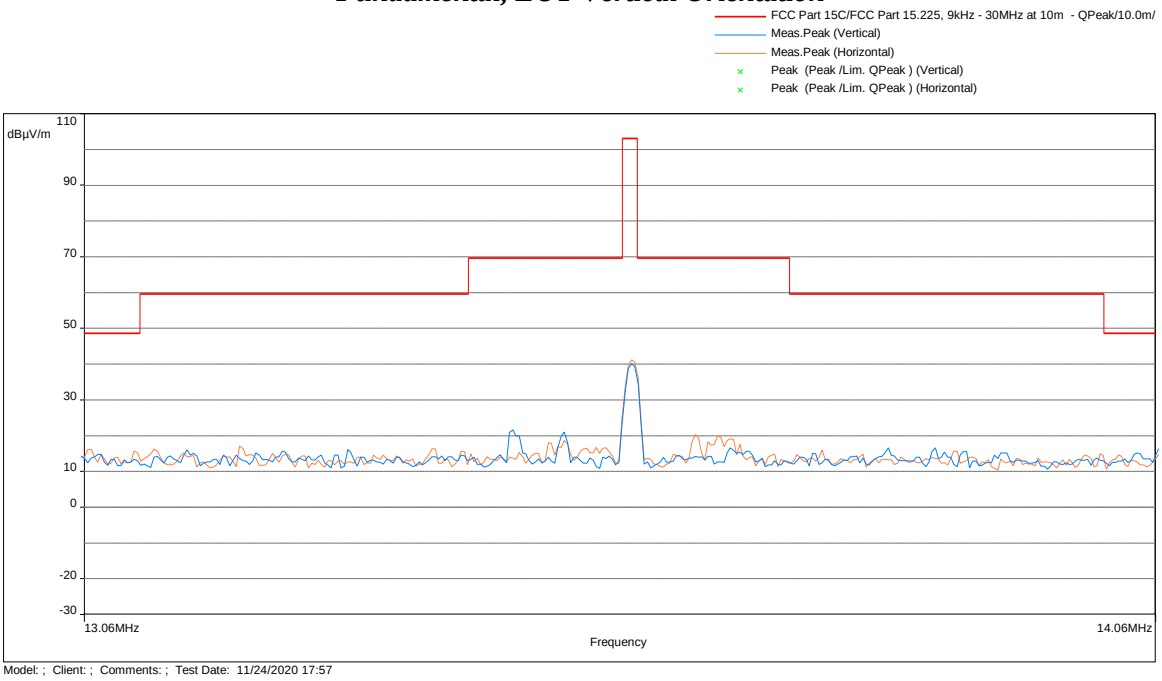
RA = Receiver Amplitude (including preamplifier) in dB (μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB (1/m)
AG = Amplifier Gain in dB
DCF = Distance Correction Factor

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, perpendicular, and horizontal orientation of loop antenna. The worst- case data was presented below.

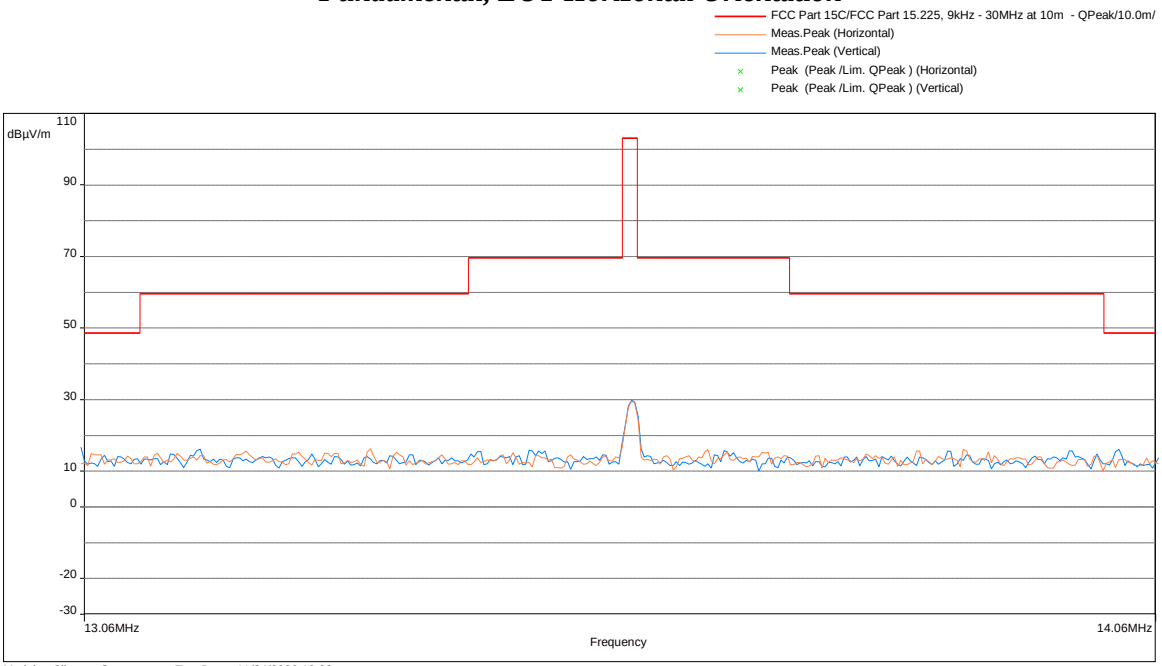
Fundamental, EUT Vertical Orientation



Frequency	Peak FS@10m	Limit@10m	Margin	Polarity	RA@10m	Correction
(MHz)	dB(uV/m)	dB(uV/m)	dB		dB(uV)	dB
13.56	41.25	103.1	-61.85	Parallel	38.60	2.65
13.56	40.10	103.1	-63.00	Perpendicular	37.45	2.65

Note: Correction = AF+CF–AG- distance correction factor
Distance correction factor=40*log10(limit distance/measured distance)

Fundamental, EUT Horizontal Orientation



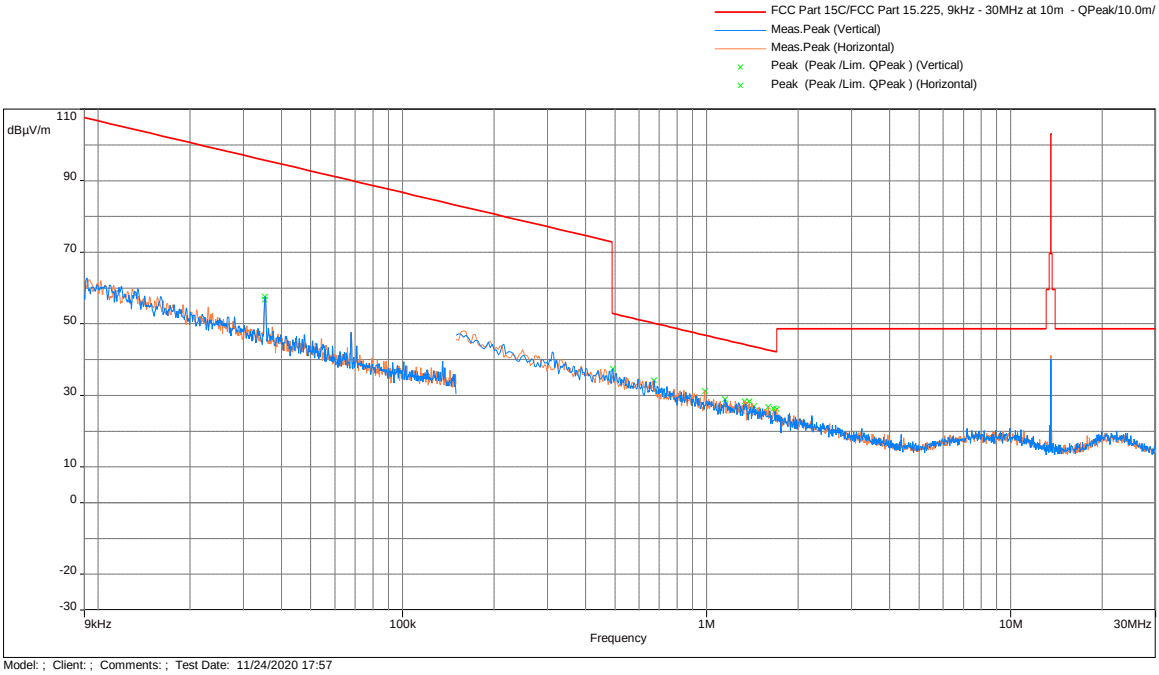
Frequency (MHz)	Peak FS@10m dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	Polarity	RA@10m dB(uV)	Correction dB
13.56	29.87	103.1	-73.23	Parallel	27.22	2.65
13.56	29.56	103.1	-73.54	Perpendicular	26.91	2.65

Note: Correction = AF+CF–AG- distance correction factor
Distance correction factor=40*log10(limit distance/measured distance)

4.1.4 Test Result 15.225 (d) and 15.209

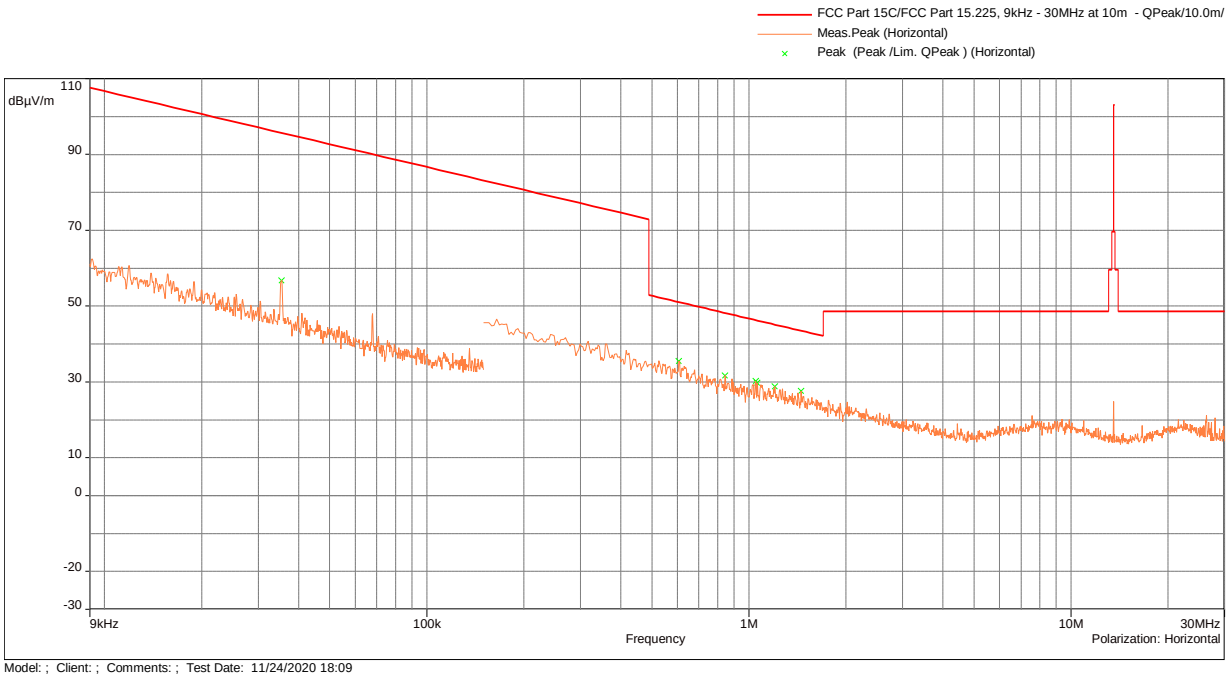
Radiated Spurious Emissions from 9 kHz to 30MHz, EUT Vertical Orientation

Parallel and Perpendicular Axis



Model: ; Client: ; Comments: ; Test Date: 11/24/2020 17:57

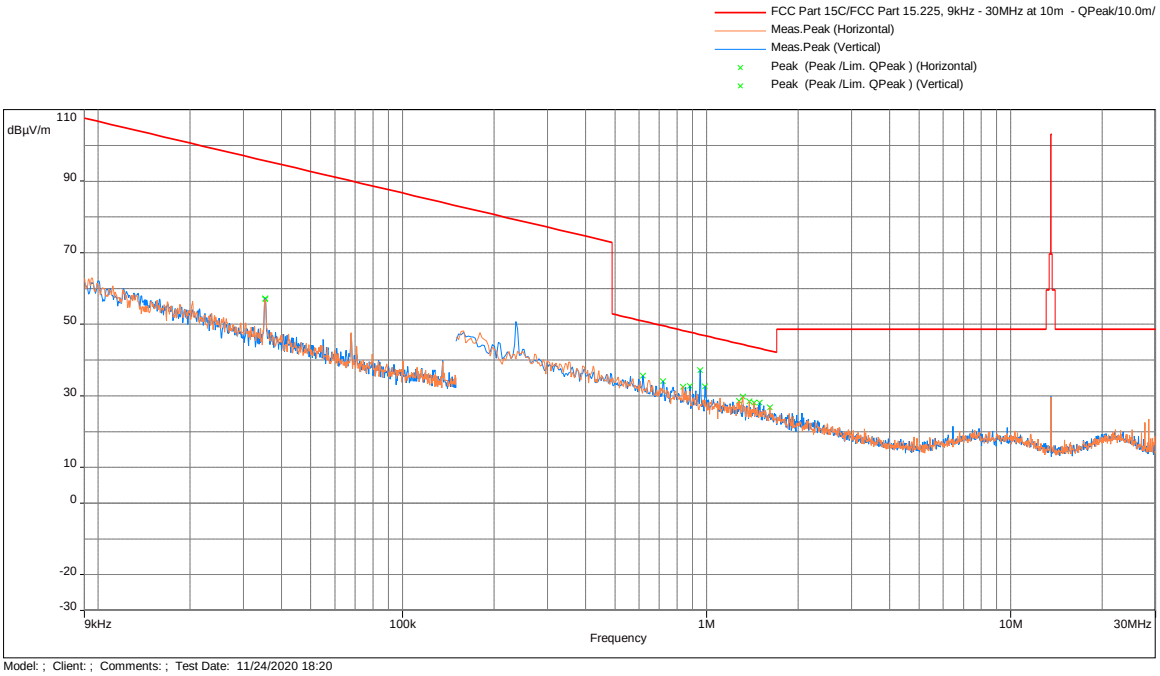
Horizontal Axis



Model: ; Client: ; Comments: ; Test Date: 11/24/2020 18:09

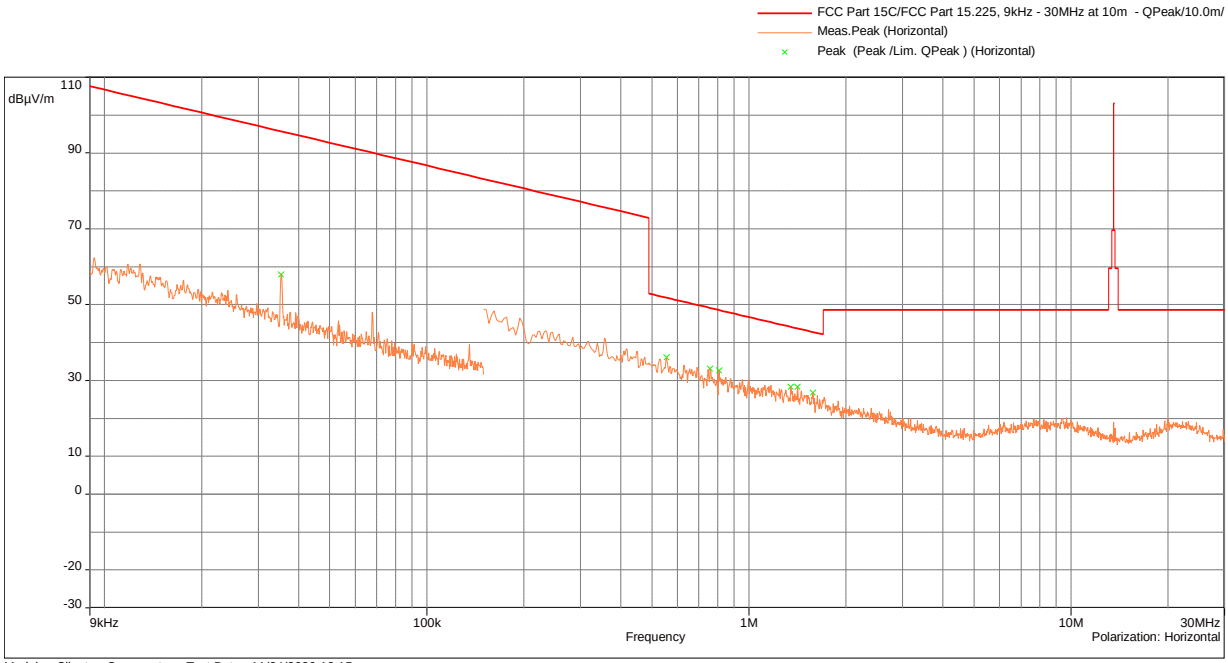
Radiated Spurious Emissions from 9 kHz to 30MHz, EUT Horizontal Orientation

Parallel and Perpendicular Axis



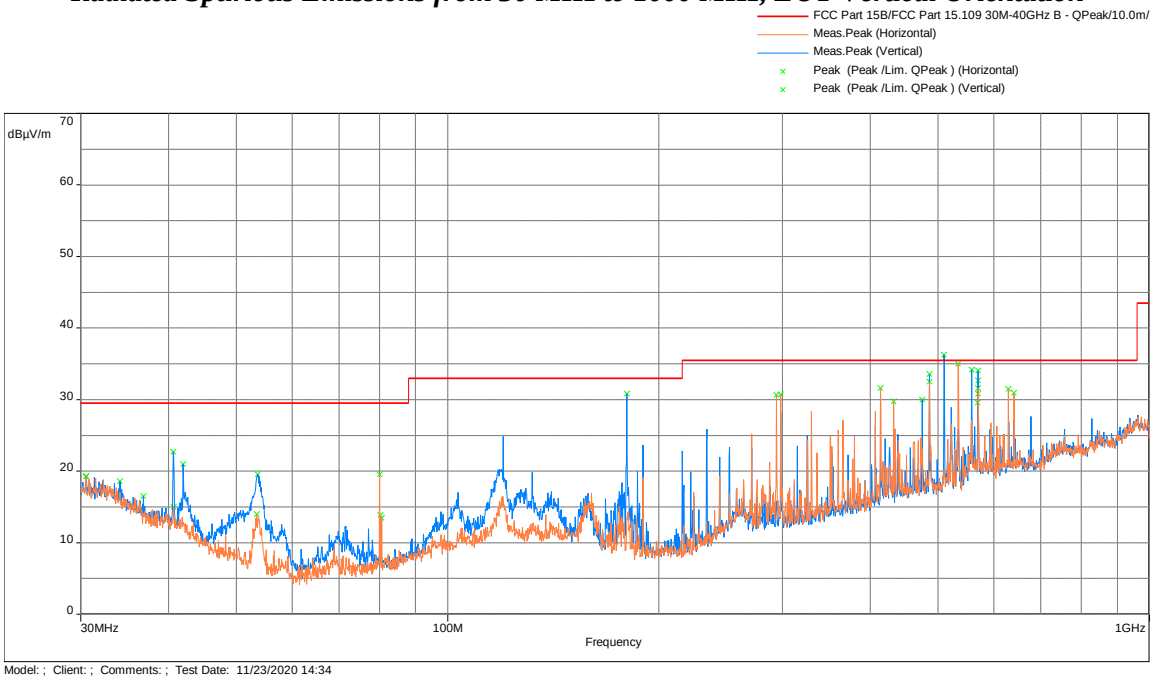
Model: ; Client: ; Comments: ; Test Date: 11/24/2020 18:20

Horizontal Axis



Model: ; Client: ; Comments: ; Test Date: 11/24/2020 18:15

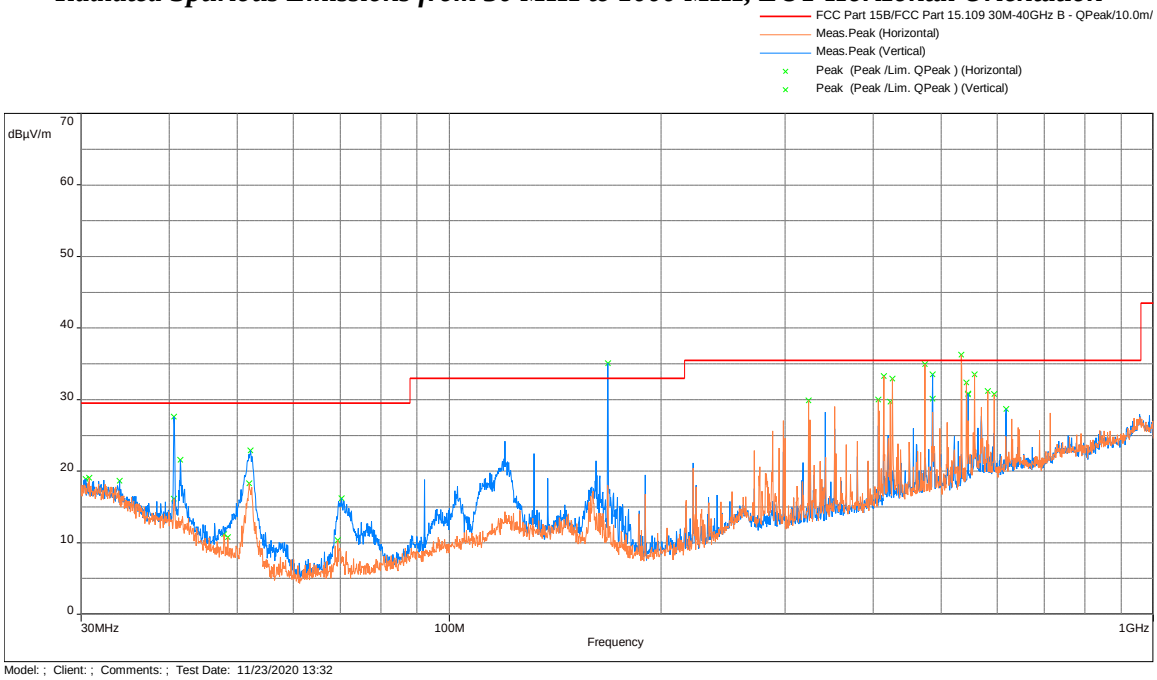
Radiated Spurious Emissions from 30 MHz to 1000 MHz, EUT Vertical Orientation



Freq (MHz)	FS @10m dB(uV/m)	Limit@10m dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
510.2749	30.09	35.50	-5.41	32.00	2.79	Vertical	38.25	-8.17
534.0027	31.13	35.50	-4.37	62.75	1.78	Horizontal	39.08	-7.95
558.002	32.88	35.50	-2.62	270.25	3.23	Vertical	38.70	-5.83
569.9667	34.04	35.50	-1.46	170.75	2.98	Vertical	39.95	-5.91
486.0293	33.59	35.50	-1.91	175.25	2.98	Vertical	42.09	-8.50
180.0267	30.81	33.00	-2.19	260.50	1.02	Vertical	48.74	-17.93

Note: FS = RA + Correction
Correction = AF + CF – Preamp

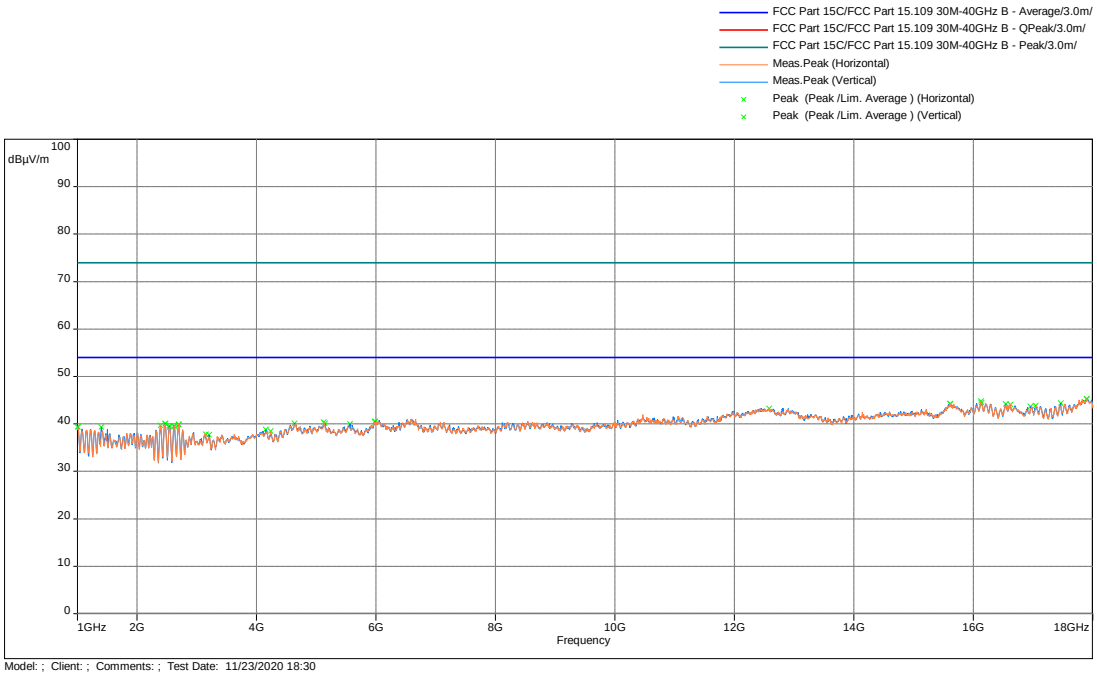
Radiated Spurious Emissions from 30 MHz to 1000 MHz, EUT Horizontal Orientation



Freq (MHz)	FS @10m dB(uV/m)	Limit@10m dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
168.0003	29.24	33.00	-3.76	32.50	1.28	Vertical	46.31	-17.07
474.0029	31.09	35.50	-4.41	155.00	1.37	Horizontal	39.80	-8.71
533.9866	31.57	35.50	-3.93	273.75	1.64	Horizontal	39.52	-7.95
40.67	27.62	29.50	-1.88	40.50	1.02	Vertical	41.97	-14.35
557.5183	33.53	35.50	-1.97	37.50	2.98	Horizontal	39.36	-5.83
486.0617	33.49	35.50	-2.01	35.50	1.02	Vertical	41.98	-8.49

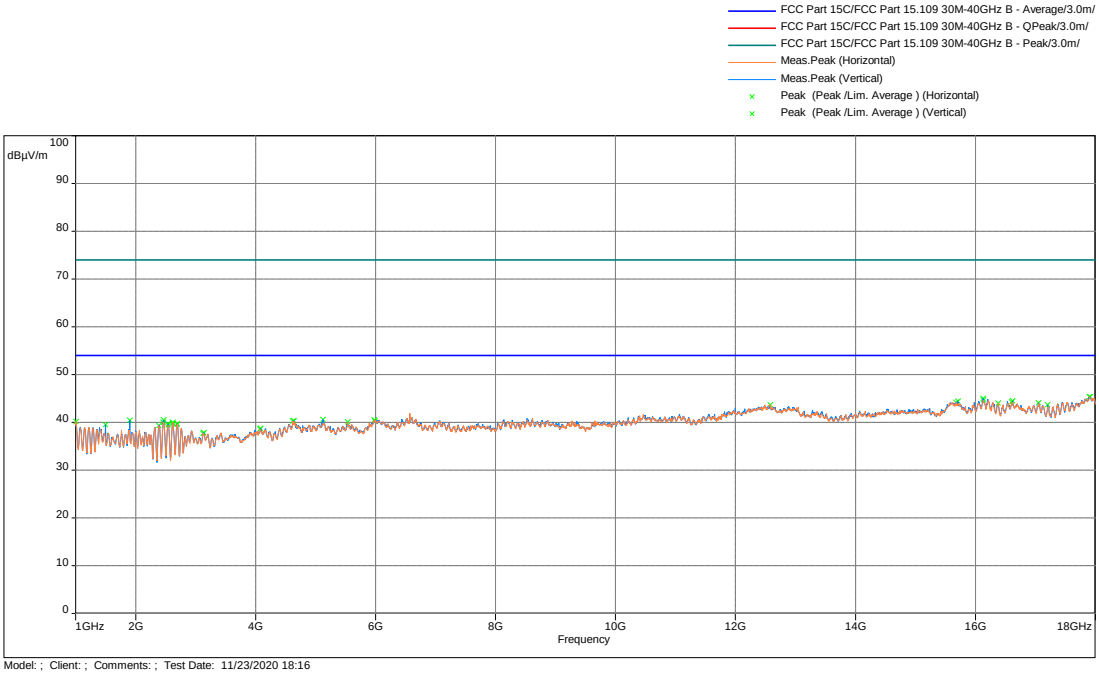
Note: FS = RA + Correction
Correction = AF + CF – Preamp

Radiated Spurious Emissions from 1-18 GHz, Peak vs Peak and Ave limit, EUT Vertical Orientation



Model: ; Client: ; Comments: ; Test Date: 11/23/2020 18:30

Radiated Spurious Emissions from 1-18 GHz, Peak vs Peak and Ave limit, EUT Horizontal Orientation

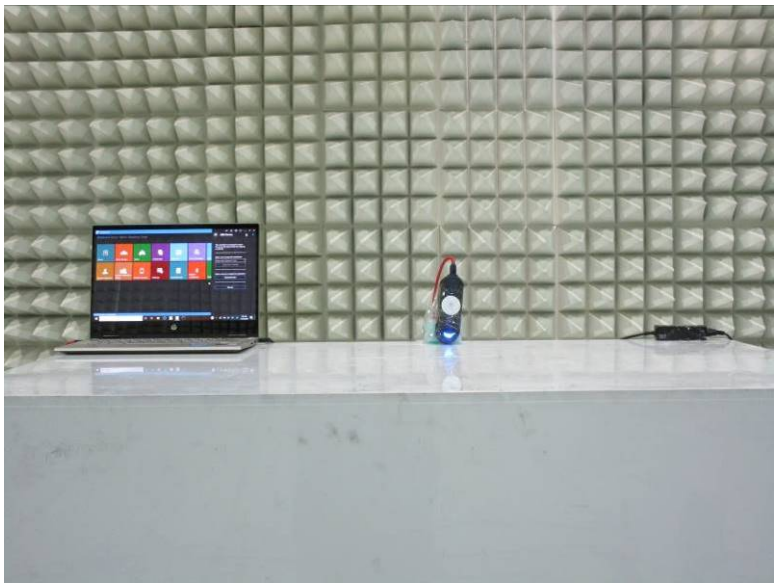


Model: ; Client: ; Comments: ; Test Date: 11/23/2020 18:16

Result	**Complies** by 1.46 dB

4.1.5 Test Configuration Photographs

The following photographs show the testing configurations used.

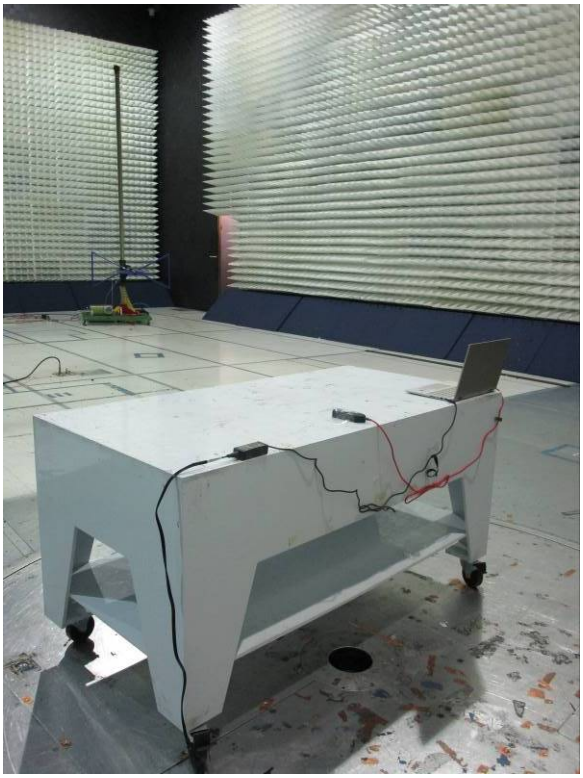


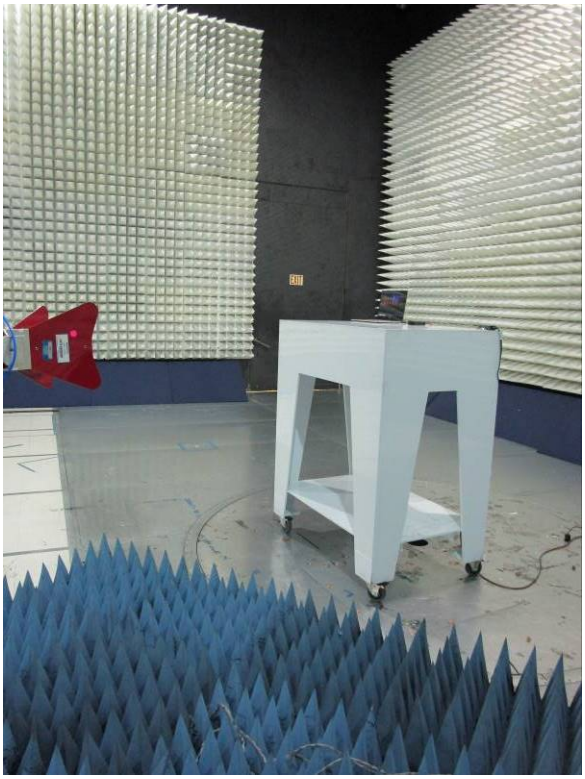
Electromagnetic Radiated Disturbance Setup Photograph

4.1.5 Test Configuration Photographs (Continued)

Electromagnetic Radiated Disturbance Setup Photograph

4.1.5 Test Configuration Photographs (Continued)





Electromagnetic Radiated Disturbance Setup Photograph

4.2 Frequency Tolerance

4.2.1 Requirement
FCC 15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within ±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 of the host (laptop) was set to 138 VAC (115% of 120VAC) and to 102 VAC (85% of 120V AC).

4.2.3 Test Results 15.225 (e)

Nominal Frequency: 13561368 Hz

Voltage	Temperature (C)	Measured Frequency (Hz)	Deviation from Reference (Hz)	Deviation (%)
USB powered	-20	13561387	19	0.00014
USB powered	-10	13561391	23	0.00017
USB powered	0	13561378	10	0.00007
USB powered	10	13561362	-6	-0.00004
USB powered	20	13561368	0	0.00000
USB powered	30	13561602	234	0.00173
USB powered	40	13561352	-16	-0.00012
USB powered	50	13561602	234	0.00173
USB powered Laptop @ 102Vac	20	13561368	0	0.00000
USB powered Laptop @ 138Vac	20	13561368	0	0.00000

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

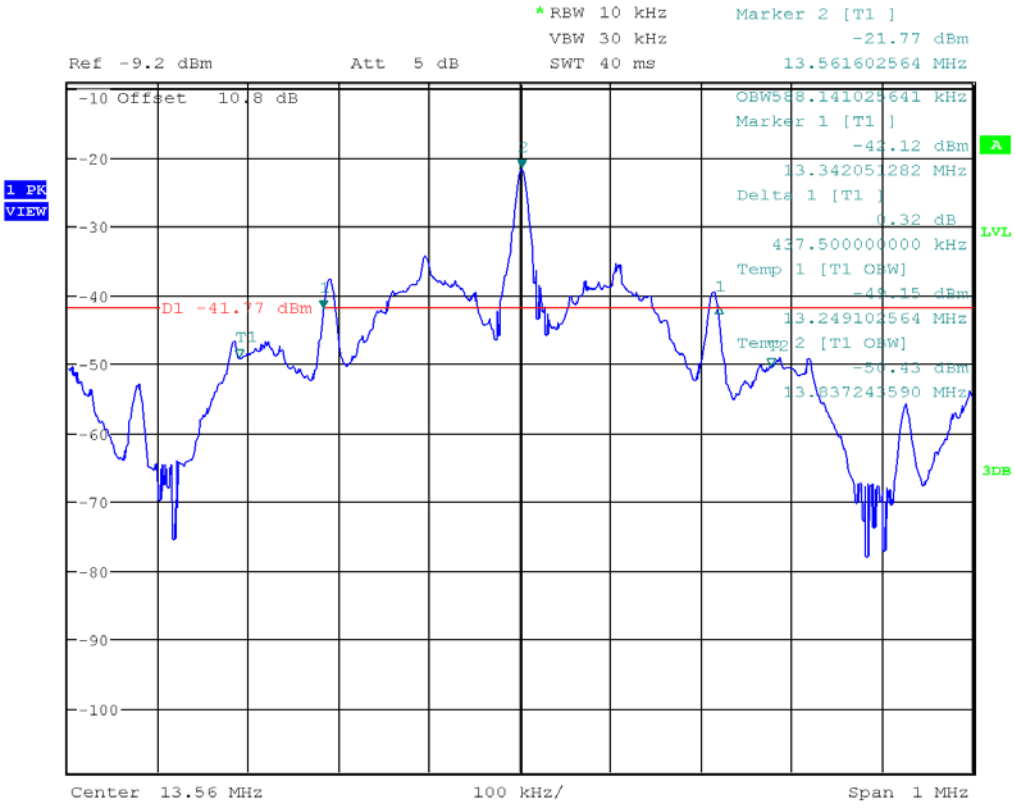
The EUT was setup to transmit in normal operating condition.

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)
13.56	437.50	588.14

-20dB & 99% Channel Bandwidth Plot



4.4 AC Line Conducted Emission
FCC Rule 15.207, FCC 15.107

4.4.1 Requirement

Frequency Band MHz	Class B Limit dB(µV)		Class A Limit dB(µV)	
	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.

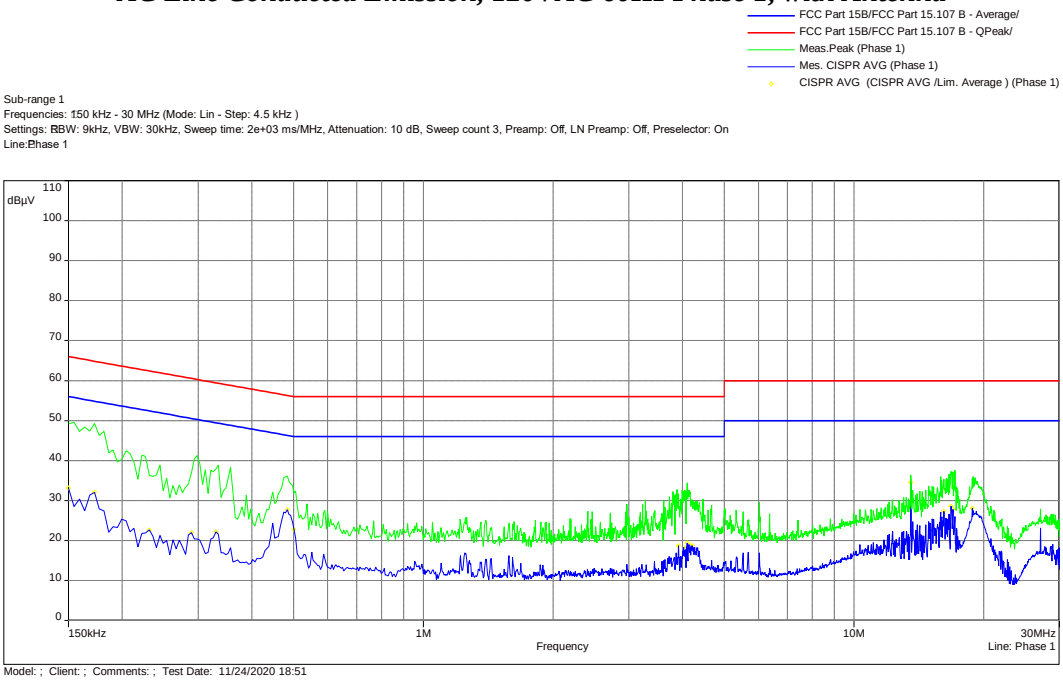
Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

EUT was placed in transmission mode then tested for conducted emissions per ANSI C63.10: 2013, ANSI C63.4-2014 to ensure the device complies with 15.207 & 15.107.

4.4.3 Test Result

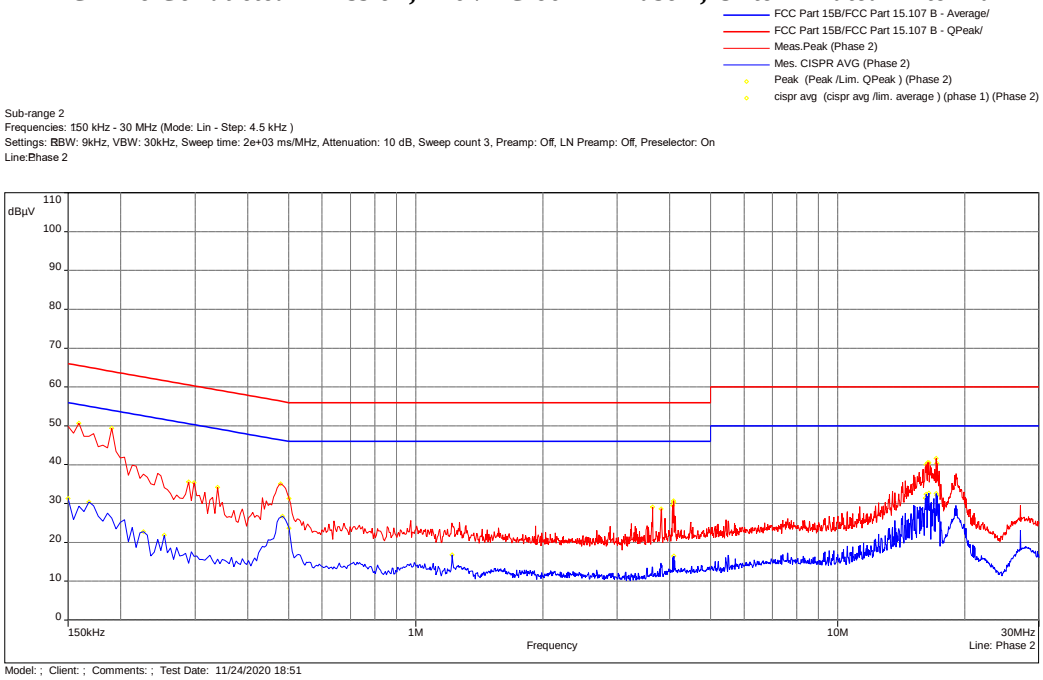
15.107 & 15.207

AC Line Conducted Emission, 120VAC 60Hz Phase 1, with Antenna



Model: ; Client: ; Comments: ; Test Date: 11/24/2020 18:51

AC Line Conducted Emission, 120VAC 60Hz Phase 2, Unterminated Antenna

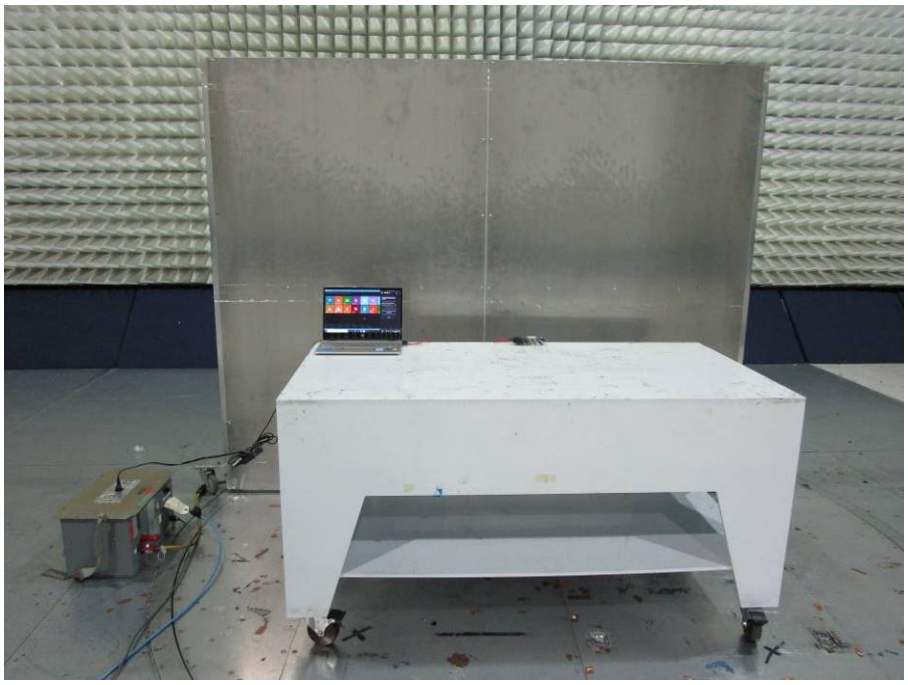


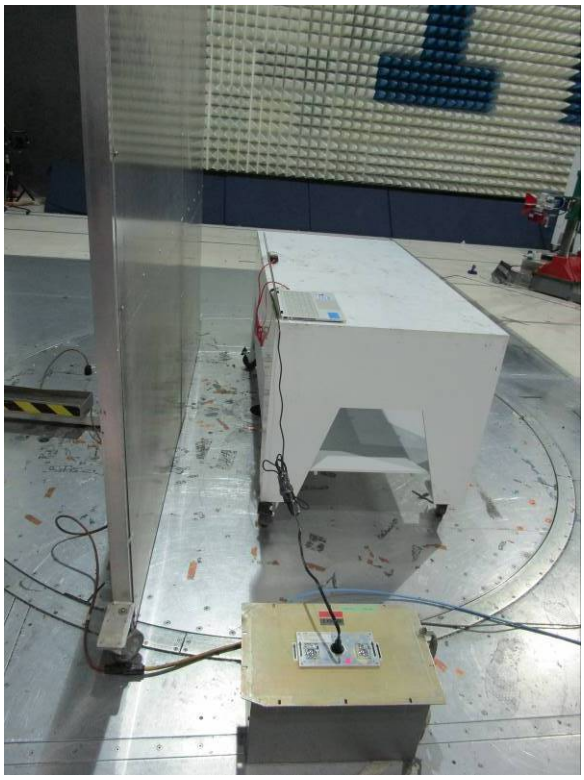
Model: ; Client: ; Comments: ; Test Date: 11/24/2020 18:51

Frequency (MHz)	Ave Level (dBµV)	QP Level (dBµV)	Ave Limit (dBuV)	QP Limit (dBuV)	Ave Margin (dB)	QP Margin (dB)	Line	Correction (dB)
0.163561	27.19	44.86	55.28	65.28	-28.10	-20.43	Phase 2	10.98
0.172837	26.72	47.13	54.84	64.84	-28.12	-17.71	Phase 1	10.97
0.482551	26.15	33.47	46.29	56.29	-20.14	-22.82	Phase 1	10.98
0.482455	25.77	33.14	46.29	56.29	-20.52	-23.14	Phase 2	10.97
0.495968	23.88	31.04	46.06	56.06	-22.18	-25.02	Phase 2	10.97
4.099686	11.96	22.35	46.00	56.00	-34.04	-33.65	Phase 1	11.22
13.56138	27.70	35.59	50.00	60.00	-22.30	-24.41	Phase 1	11.25
16.2291	21.80	32.38	50.00	60.00	-28.20	-27.62	Phase 2	11.33
16.4411	21.87	32.69	50.00	60.00	-28.13	-27.31	Phase 2	11.36
16.80886	17.34	30.32	50.00	60.00	-32.66	-29.68	Phase 1	11.40
17.12804	20.49	32.53	50.00	60.00	-29.51	-27.47	Phase 2	11.43
18.82074	24.71	30.01	50.00	60.00	-25.29	-29.99	Phase 1	11.48

Result	**Complies** by 17.71 dB

4.3.4 Test Configuration Photographs





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

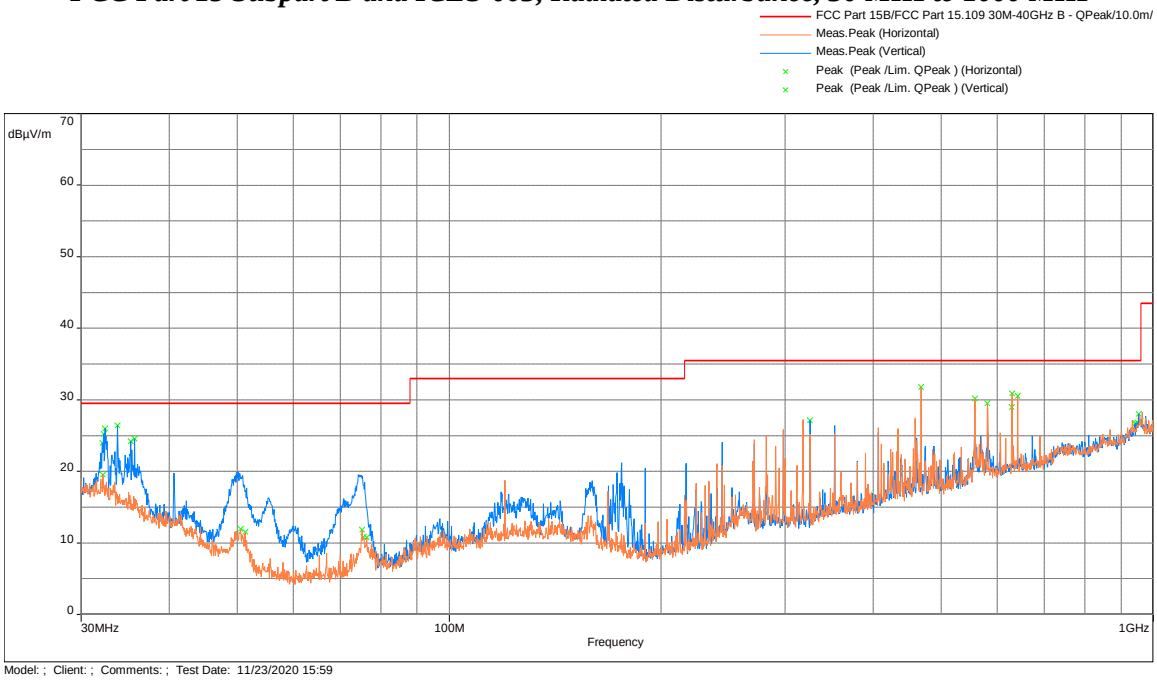
Radiated measurements were taken. 120 kHz resolution bandwidth was used from 30 MHz - 1 GHz. 1 MHz resolution bandwidth was used for measurements done above 1 GHz. All plots are corrected for cable loss, antenna factor, and preamp.

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

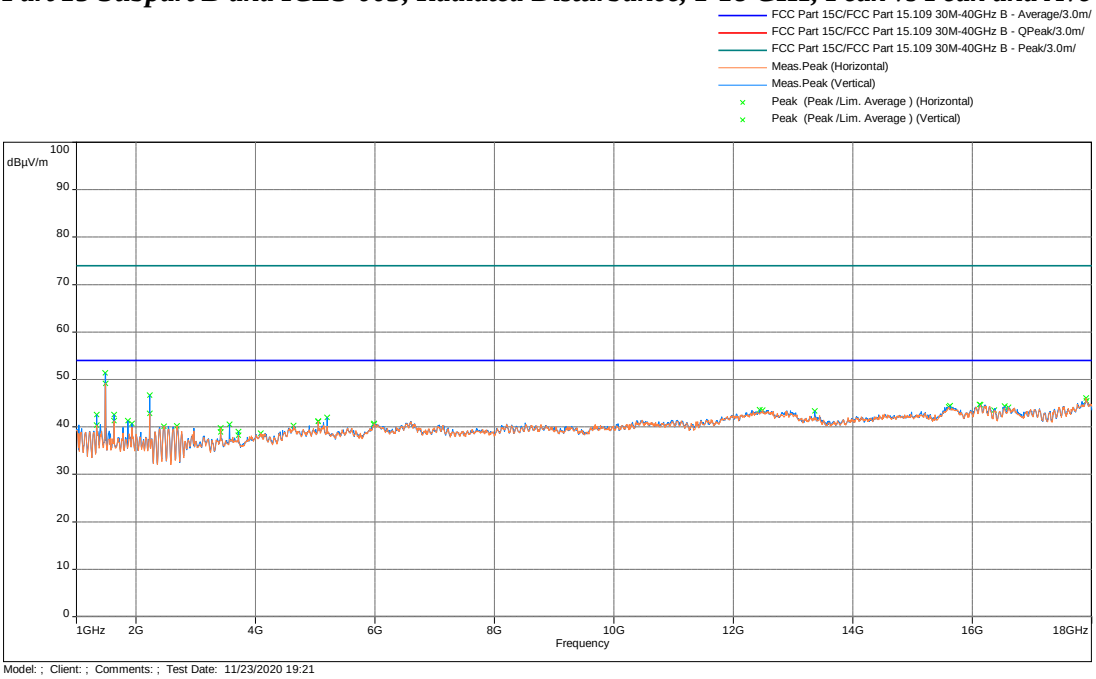
FCC Part 15 Subpart B and ICES-003, Radiated Disturbance, 30 MHz to 1000 MHz



Freq (MHz)	FS @10m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
33.783	26.40	29.50	-3.10	55.75	2.02	Vertical	37.21	-10.81
32.425	25.97	29.50	-3.53	224.75	2.02	Vertical	36.18	-10.21
468.0197	31.79	35.50	-3.71	159.50	1.98	Horizontal	40.61	-8.82
629.945	30.91	35.50	-4.59	247.50	0.98	Horizontal	36.41	-5.50
642.0377	30.53	35.50	-4.97	328.00	2.98	Horizontal	35.92	-5.39
557.971	30.17	35.50	-5.33	164.00	2.98	Horizontal	36.00	-5.83

Note: FS = RA + Correction
Correction = AF + CF – Preamp

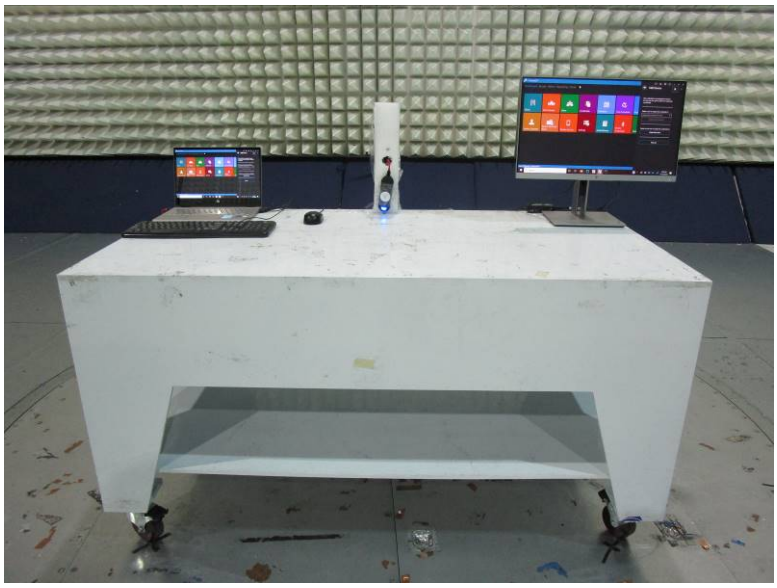
FCC Part 15 Subpart B and ICES-003, Radiated Disturbance, 1-18 GHz, Peak vs Peak and Ave limit,

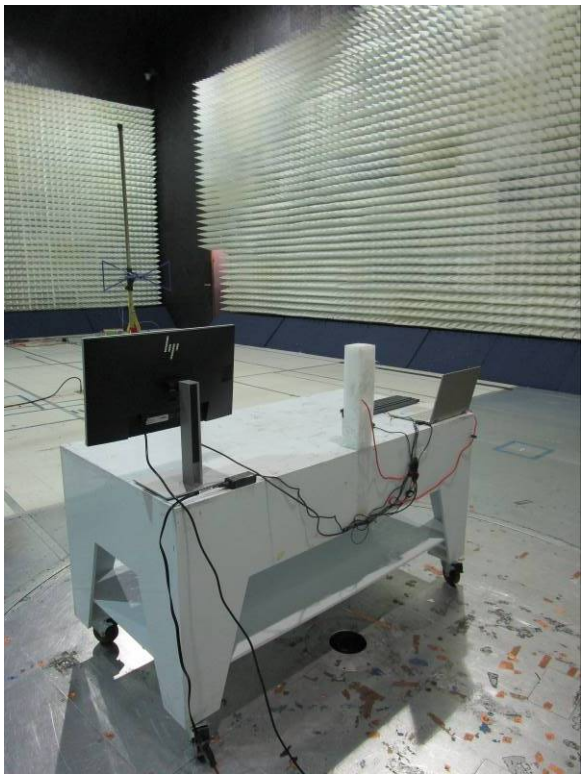


Freq (MHz)	FS @3m dB(uV/m)	Limit dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
1484.986	48.41	54	-5.59	204.75	1.47	Vertical	63.39	-14.99
2226.833	46.7	54	-7.30	233.00	1.00	Vertical	58.79	-12.09

Result	**Complies** by 3.10 dB

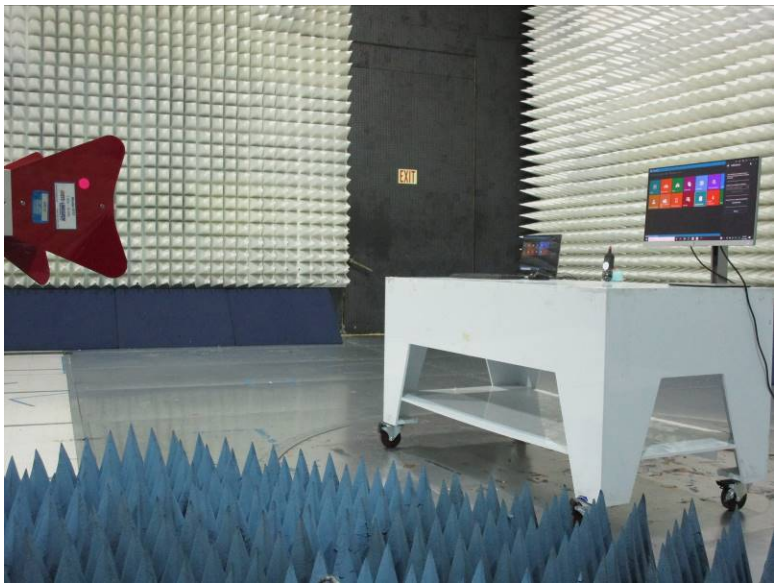
4.5.4 Test Configuration Photographs





Electromagnetic Radiated Disturbance Setup Photograph

4.1.5 Test Configuration Photographs (Continued)



Electromagnetic Radiated Disturbance Setup Photograph

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 Test Receiver	Rohde and Schwarz	ESU	ITS 01375	12	06/16/21
Spectrum Analyzer	Rohde and Schwarz	FSU	ITS 00913	12	03/26/21
Passive Loop Antenna	EMCO	6512	ITS 001598	12	11/03/21
Pre-Amplifier	Sonoma	310	ITS 00942	12	03/15/21
BI-Log Antenna	Antenna Research	LPB-2513	ITS 00355	12	04/24/21
Horn Antenna	ETS-Lindgren	3117-PA	ITS 01636	12	01/17/21
Horn Antenna	ETS Lindgren	3116C	ITS 01376	12	04/15/21
Pre-Amplifier	Miteq	TTA1840-35-S-M	ITS 01393	12	03/02/21
Notch Filter	Micro-Tronics	BRM50702	ITS 01166	12	05/14/21
Loop Sensor	Solar Electronics	7334-1	ITS 001608	12	11/10/21
RF Cable	Megaphase	EMC1-K1K1-236	ITS 01537	12	04/17/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 01330	12	05/09/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 00465	12	08/16/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 01470	12	08/16/21
LISN	FCC	FCC-LISN-50-50-M-H	ITS 00552	12	12/12/20

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
BAT-EMC	Nexio	3.19.1.19	Proxess Nov12 Radiated Emissions.bpp

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewer Initials	Date	Change
1.0 / G104444452	HH	KV	December 08, 2020	Original document

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)	Ucispr
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 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

A1.2 Test Equipment Used:

See Section 5.0 for specific equipment used for this test

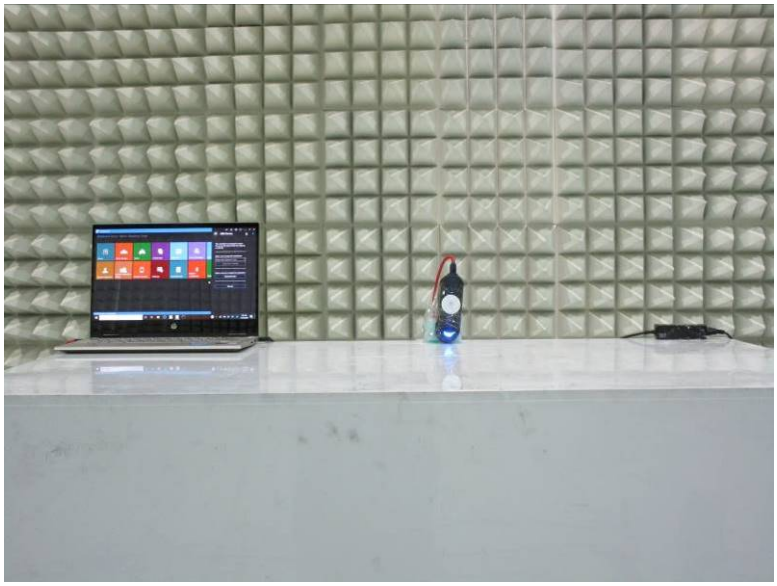
Software Utilized:

Name	Manufacturer	Version
BAT-EMC	NEXIO	3.19.1.19

A1.3 Result:

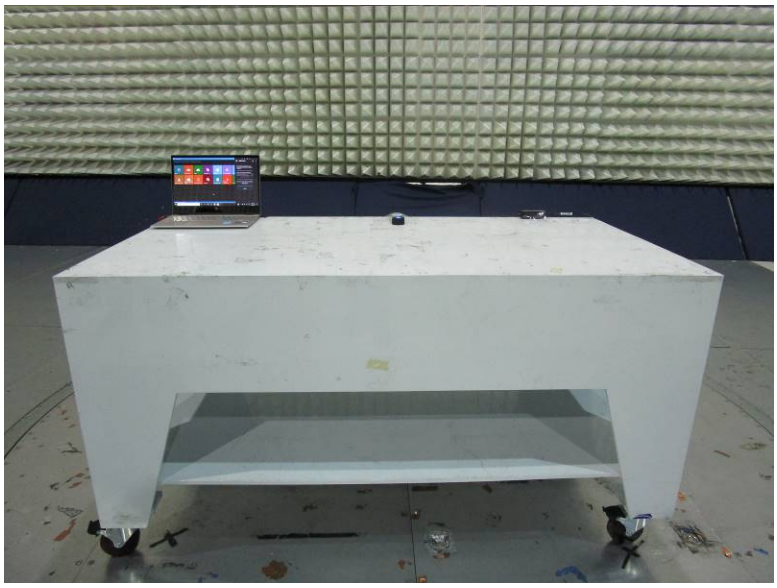
The sample tested was found to comply.

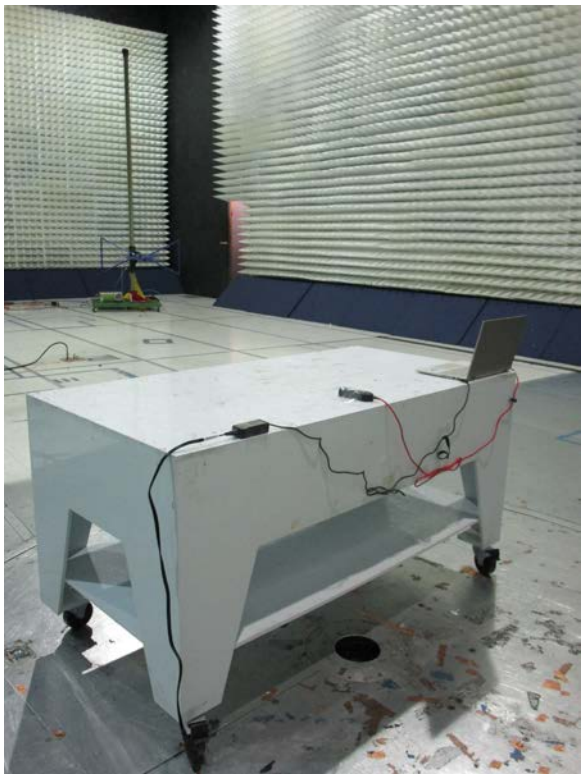
A1.4 Photographs:



Electromagnetic Radiated Disturbance Setup Photograph

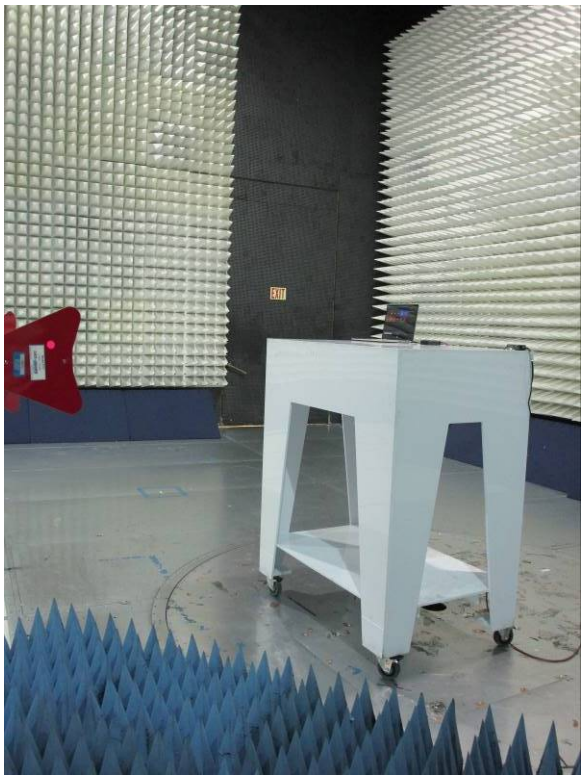
A1.4 Test Configuration Photographs (Continued)

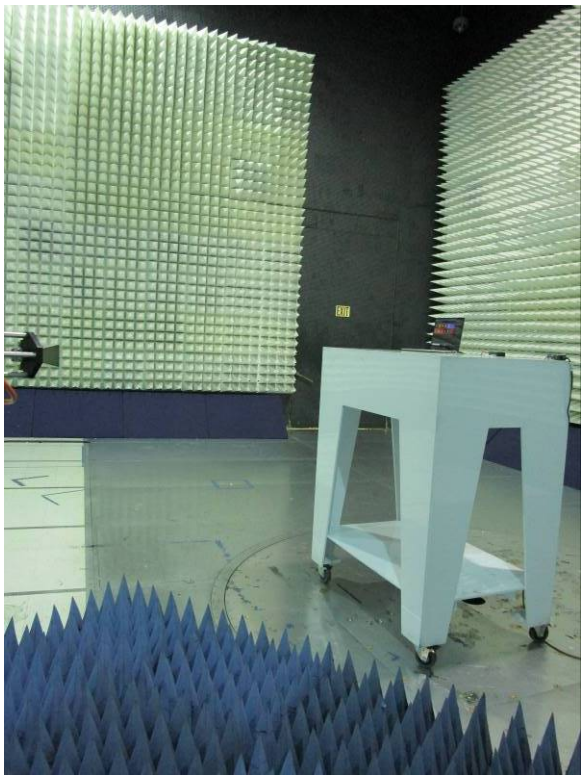




Electromagnetic Radiated Disturbance Setup Photograph

A1.4 Test Configuration Photographs (Continued)

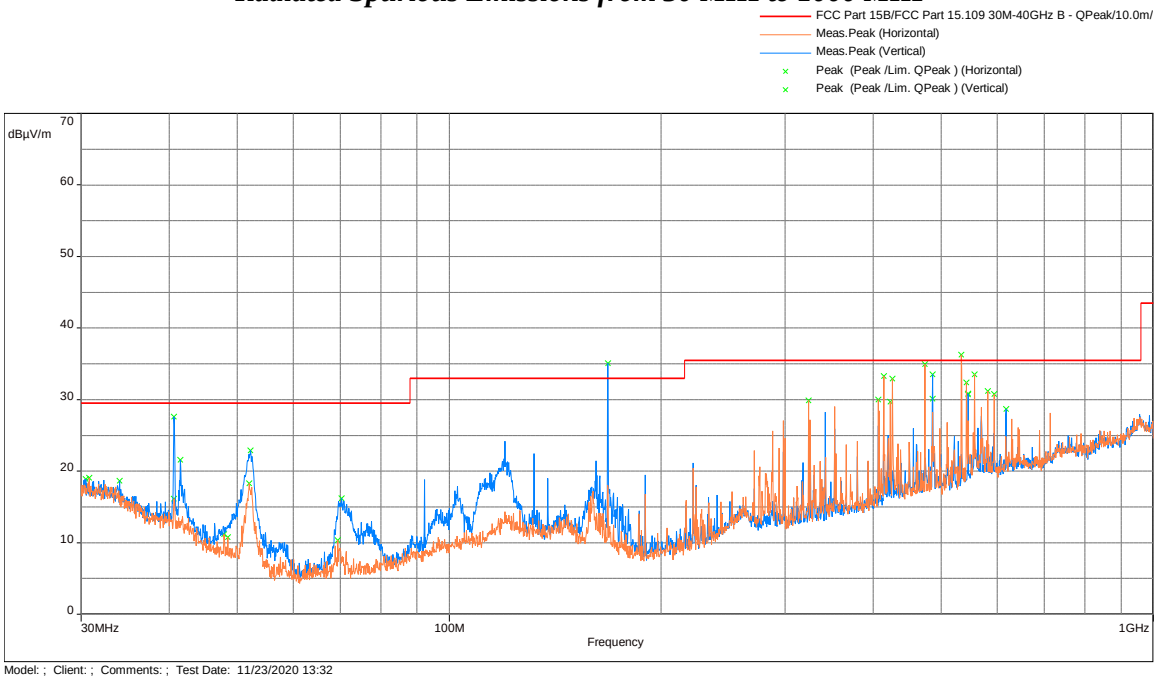




Electromagnetic Radiated Disturbance Setup Photograph

A1.5 Test Data

Radiated Spurious Emissions from 30 MHz to 1000 MHz

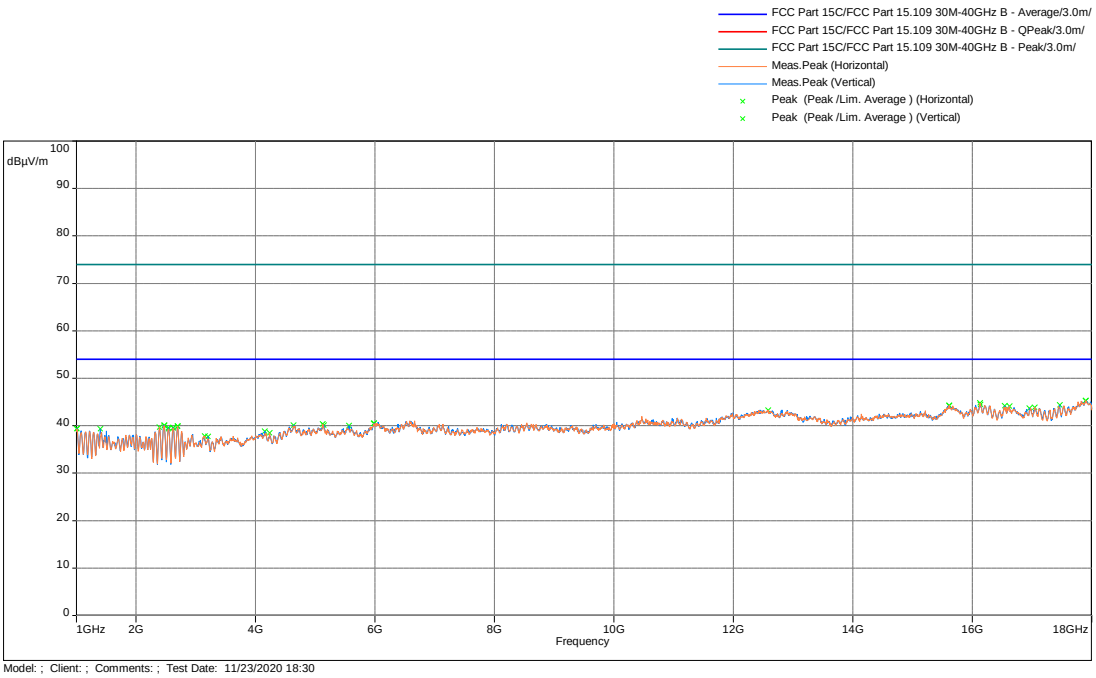


Freq (MHz)	FS @10m dB(uV/m)	Limit@10m dB(uV/m)	Margin (dB)	Azimuth (Deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
168.0003	29.24	33.00	-3.76	32.50	1.28	Vertical	46.31	-17.07
474.0029	31.09	35.50	-4.41	155.00	1.37	Horizontal	39.80	-8.71
533.9866	31.57	35.50	-3.93	273.75	1.64	Horizontal	39.52	-7.95
40.67	27.62	29.50	-1.88	40.50	1.02	Vertical	41.97	-14.35
557.5183	33.53	35.50	-1.97	37.50	2.98	Horizontal	39.36	-5.83
486.0617	33.49	35.50	-2.01	35.50	1.02	Vertical	41.98	-8.49

Note: FS = RA + Correction

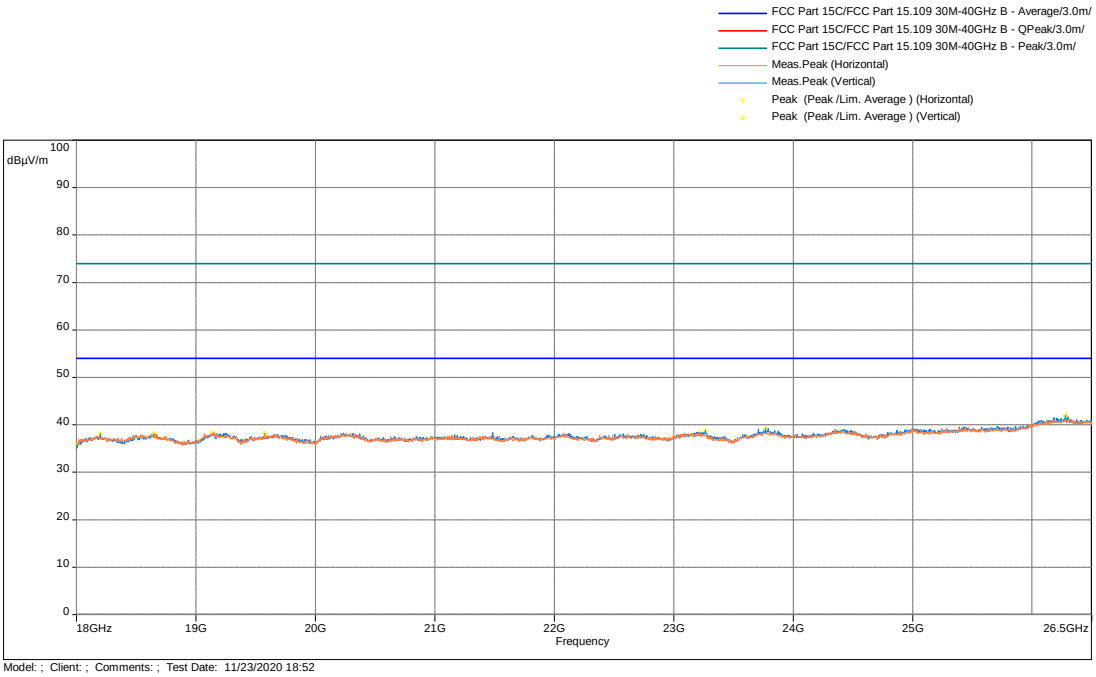
Correction = AF + CF – Preamp

Radiated Spurious Emissions from 1-18 GHz, Peak vs Peak and Ave limit



Model: ; Client: ; Comments: ; Test Date: 11/23/2020 18:30

Radiated Spurious Emissions from 18-26.5 GHz, Peak vs Peak and Avg limit



Model: ; Client: ; Comments: ; Test Date: 11/23/2020 18:52

Result	**Complies** by 1.88 dB

Note: Measurements were performed at Vertical and Horizontal orientations of the EUT. The worst- case data was presented above.

END OF REPORT