

TEST REPORT

Report Number: 105183067MPK-001

Project Number: G105183067

October 11, 2022

**Testing performed on the
Verizon Connect RFID reader
Model Number: PLA-X21**

FCC ID: ZOQ-PLAX21

IC: 9734A-PLAX21

to

**FCC Part 15 Subpart C (15.209)
FCC Part 15, Subpart B
Industry Canada RSS-210 Issue 10
Industry Canada ICES-003**

For

VERIZON CONNECT, INC.

Test Performed by:

Intertek

1365 Adams Court

Menlo Park, CA 94025 USA

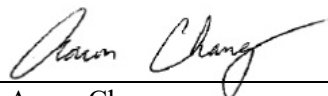
Test Authorized by:

VERIZON CONNECT, INC.

5055 North Point Parkway

Alpharetta, GA 30009 USA

Prepared by:



Aaron Chang

Date: October 11, 2022

Reviewed by:



Minh Ly

Date: October 11, 2022

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Report No. 105183067MPK-001

Equipment Under Test: Verizon Connect RFID readers
Model Number: PLA-X21
Serial Number: MPK2209221324-001

Applicant: VERIZON CONNECT, INC.
Contact: Lawrence Adelberg
Address: 5055 North Point Parkway
Alpharetta, GA 30009

Country: USA

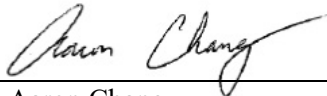
Email: Lawrence.adelberg@verizonconnect.com

Applicable Regulation: FCC Part 15 Subpart C (15.209)
FCC Part 15, Subpart B
Industry Canada RSS-210 Issue 10
Industry Canada ICES-003 Issue 6

Test Site Location: ITS – Site 1
1365 Adams Drive
Menlo Park, CA 94025

Date of Test: September 26 – 28, 2022

We attest to the accuracy of this report:



Aaron Chang
Project Engineer



Minh Ly
EMC Team Lead

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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.

2.0 General Description

2.1 Product Description

VERIZON CONNECT, INC. supplied the following description of the EUT:

HID ISO PROXII RFID cards are read and data is transferred to the VTU device via a wiring harness connection using 1WIRE/DS1990 Emulation mode. Operating Freq: 110kHz-125kHz.

Overview of the EUT

Applicant name & address	VERIZON CONNECT, INC. 5055 North Point Parkway Alpharetta, GA 30009 USA
Contact info / Email	Lawrence Adelberg / Lawrence.adelberg@verizonconnect.com
Model	PLA-X21
FCC Identifier	ZOQ-PLAX21
IC Identifier	9734A-PLAX21
Operating Frequency	110 kHz to 125 kHz
Number of Channels	1
Type of Modulation	ASK
Antenna Type	Internal Antenna

EUT receive date: September 26, 2022

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: September 26, 2022

Test completion date: September 28, 2022

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	-	-

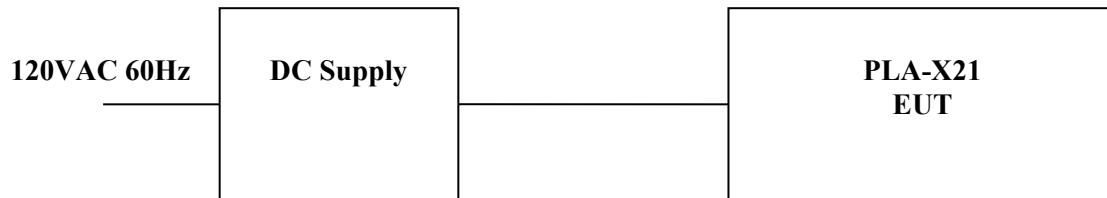
3.0 System Test Configuration

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.



S = Shielded	F = With Ferrite
U = Unshielded	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. The highest clock frequency used in the EUT was 125 kHz, hence radiated emissions was scanned up to 1 GHz.

3.4 Software Exercise Program

None

3.5 Mode of Operation during test

The Verizon Connect RFID readers was set up to continuously transmitting at 110 kHz.

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

§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 (μ V/m)

RA = Receiver Amplitude (including preamplifier) in dB (μ V)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB (1/m)

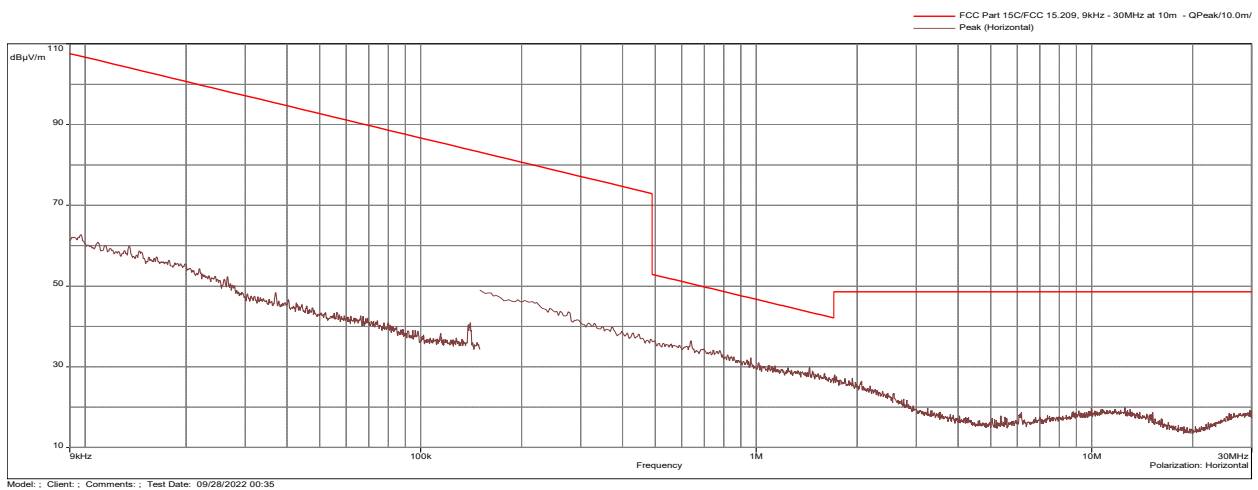
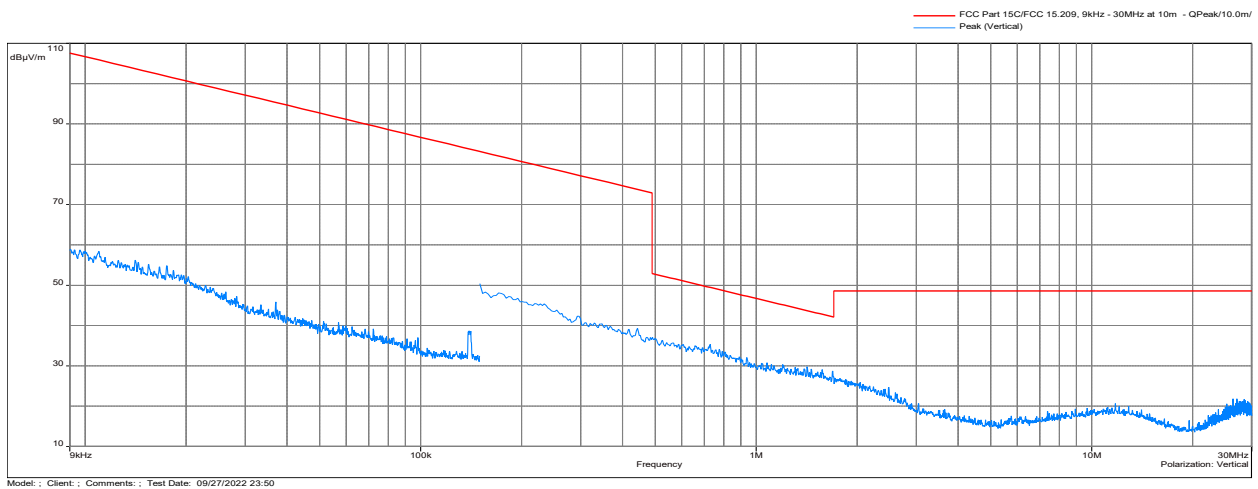
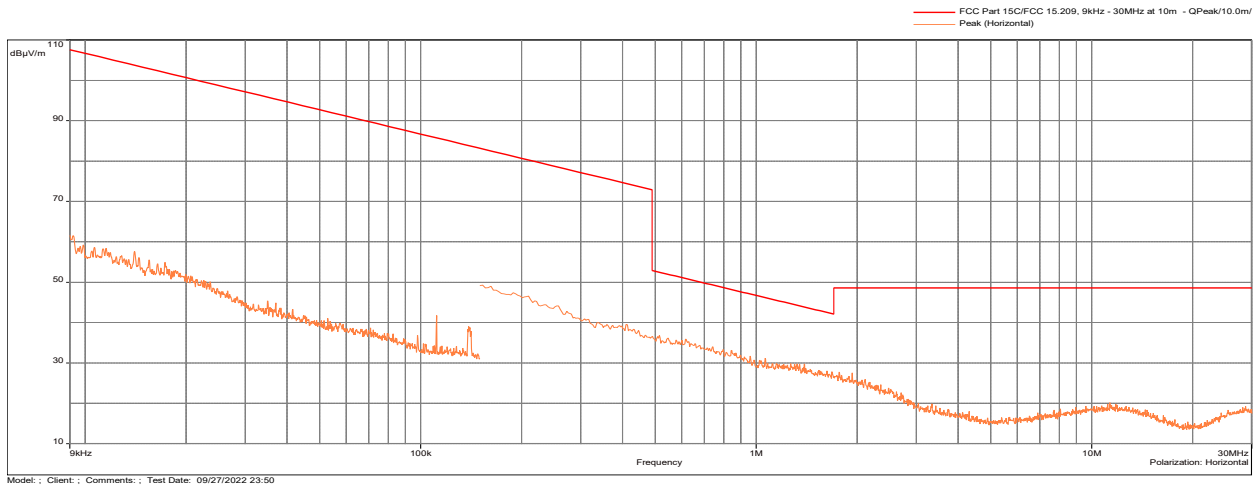
AG = Amplifier Gain in dB

DCF = Distance Correction Factor

Note: FS was measured with loop antenna below 30MHz

4.1.3 Test Result

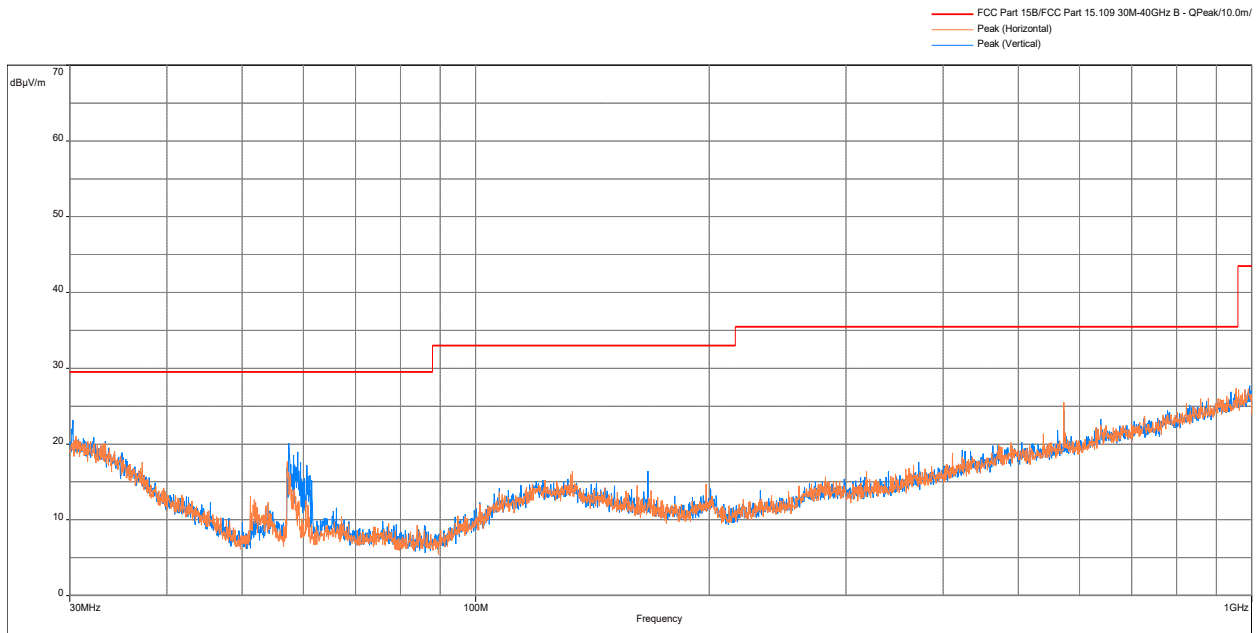
Radiated Spurious Emissions from 9 kHz to 30MHz



Frequency (MHz)	Peak FS @10m dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	Azumith deg	Comment	Correction dB
0.111535	41.79	85.75	-43.96	226	Horizontal	33.78

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

Radiated Spurious Emissions from 30 MHz to 1000 MHz



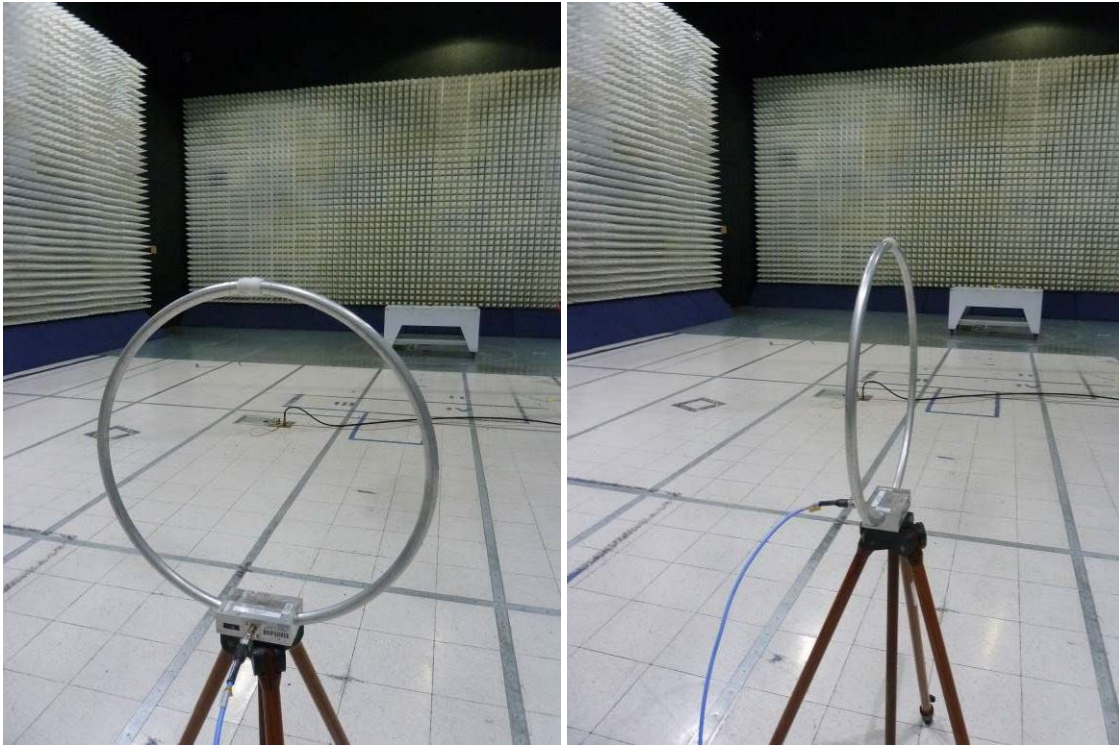
Freq (MHz)	FS@10m dB(uV/m)	Limit@10m dB(uV/m)	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Correction (dB)
30.291	23.17	29.5	-6.33	2	109.5	Vertical	-6.38
57.192	17.67	29.5	-11.83	4	205.75	Horizontal	-19.94
166.738	16.46	33	-16.54	1	0.25	Vertical	-14.52
198.101	14.75	33	-18.25	3	170.75	Horizontal	-14.05
572.715	24.4	35.5	-11.1	2	40.5	Vertical	-6.01
572.715	25.53	35.5	-9.97	3	250.75	Horizontal	-6.01

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

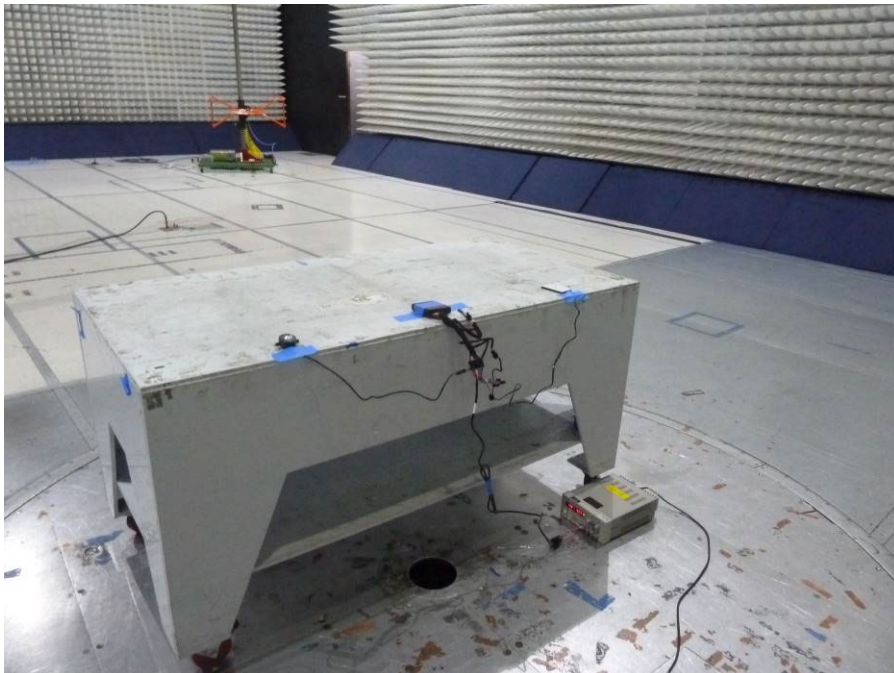
Result Complies by 4.14 dB

4.1.5 Test Configuration Photographs

The following photographs show the testing configurations used.



4.1.5 Test Configuration Photographs (Continued)



Electromagnetic Radiated Disturbance Setup Photograph

4.2 Occupied Bandwidth FCC 15.215

4.2.1 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.

4.2.2 Procedure

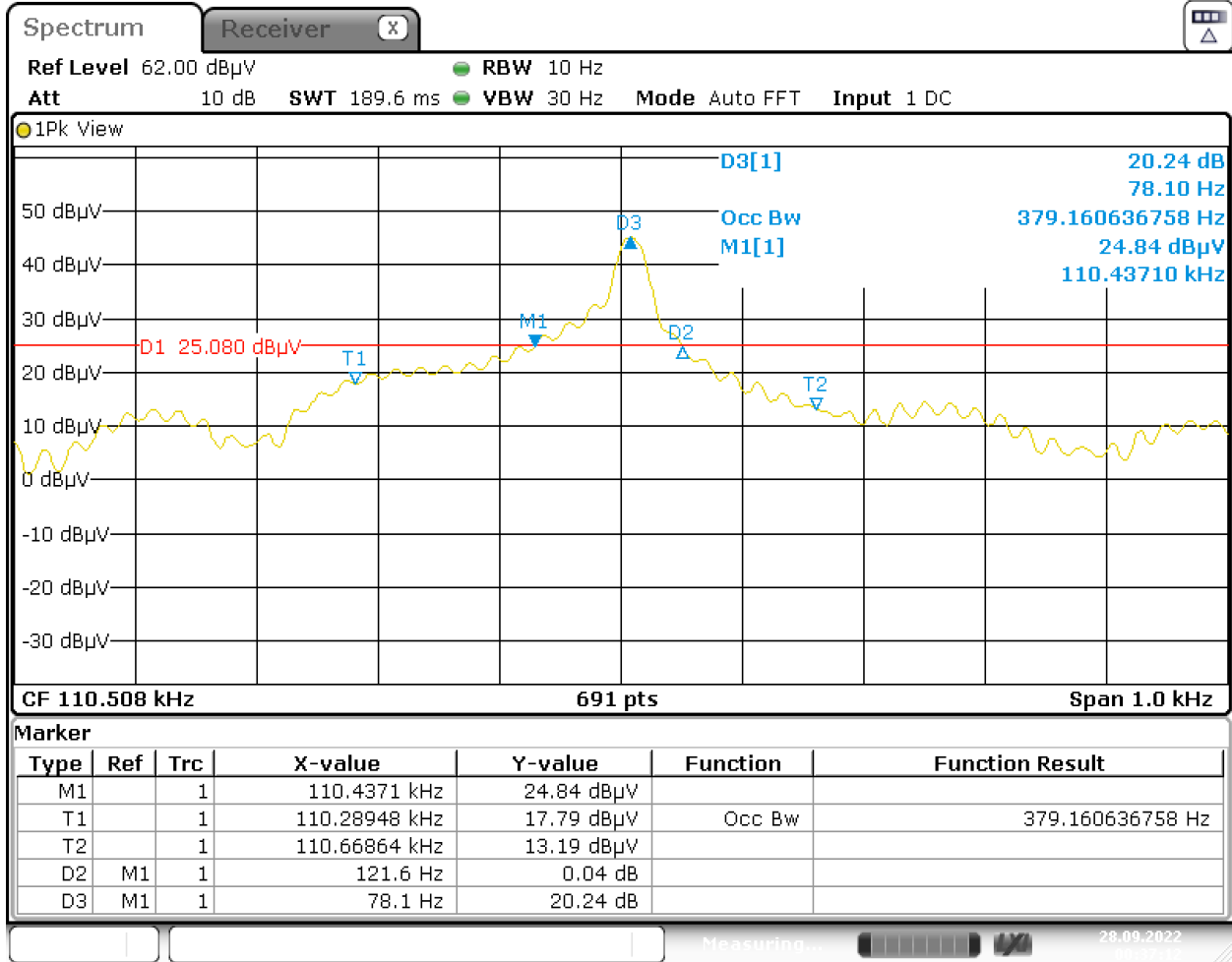
The EUT was setup to transmit in normal operating condition.

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.

4.2.3 Test Results

Frequency (MHz)	-20 dB Channel Bandwidth (Hz)	99% Channel Bandwidth (Hz)
0.110	121	379

-20dB & 99% Channel Bandwidth Plot



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4.3 AC Line Conducted Emission
FCC Rule 15.207, FCC 15.107

4.3.1 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.

4.3.2 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.

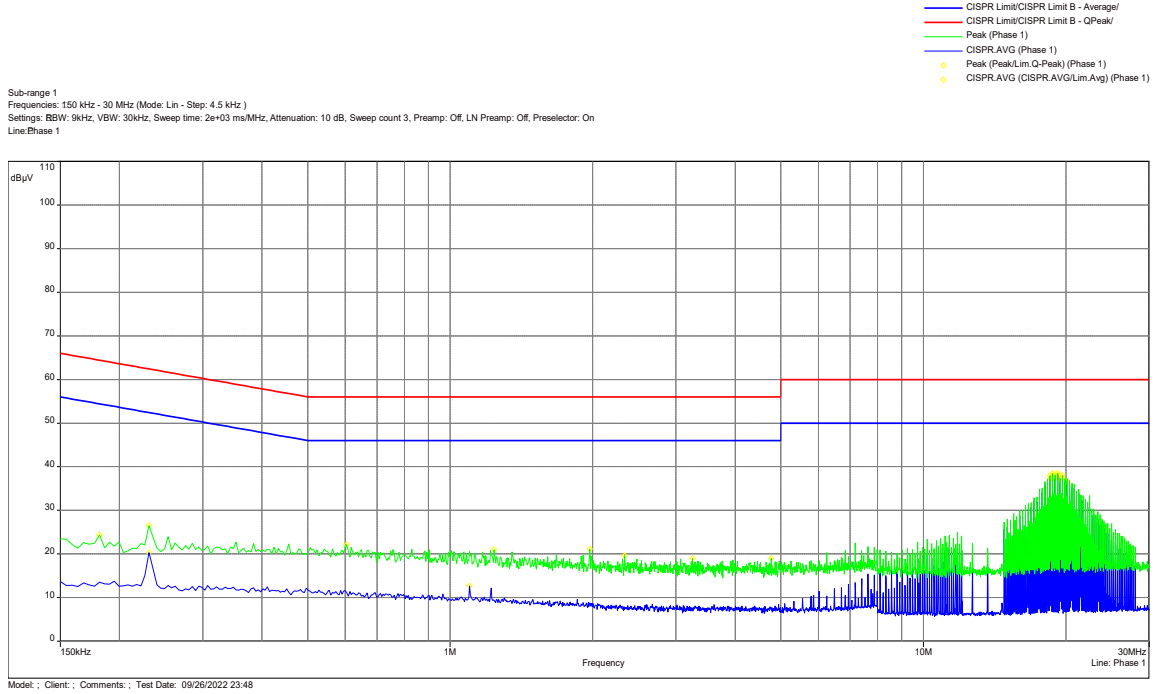
Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

EUT was placed in transmission mode then tested for conducted emissions per 15.207 to ensure the device complies with 15.207. After, the EUT RF was powered off and was measured to show compliance with the 15.107 limits.

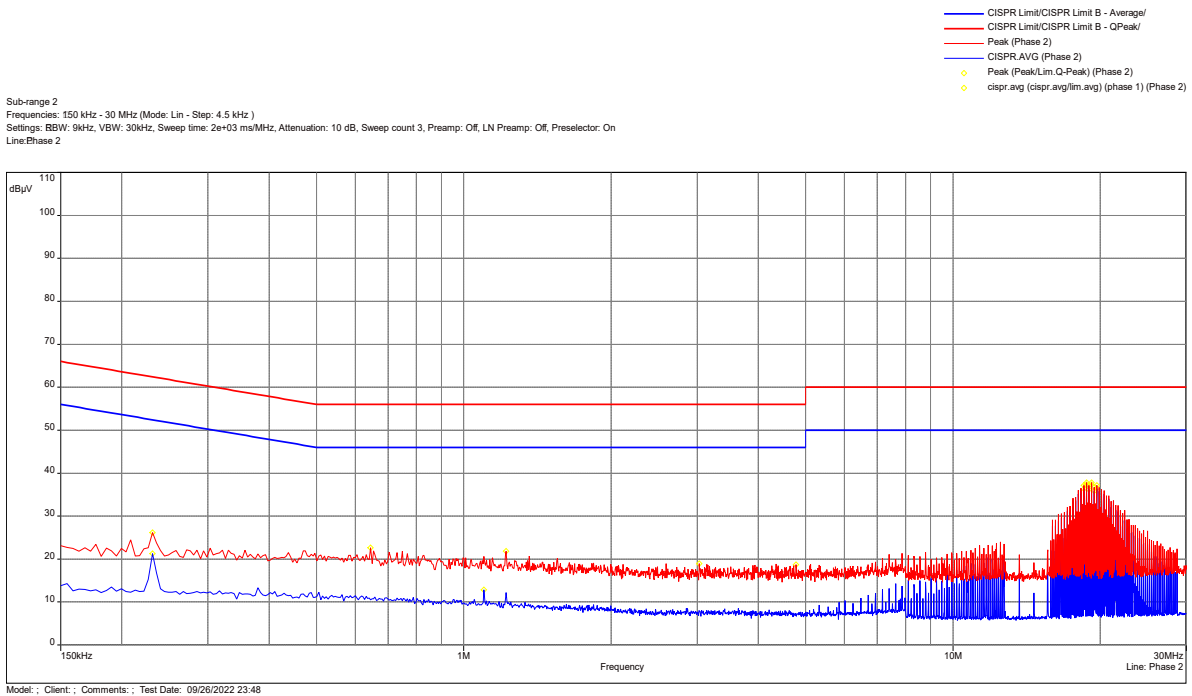
4.3.3 Test Result

15.107 & 15.207

AC Line Conducted Emission, 120VAC 60Hz Phase 1



AC Line Conducted Emission, 120VAC 60Hz Phase 2

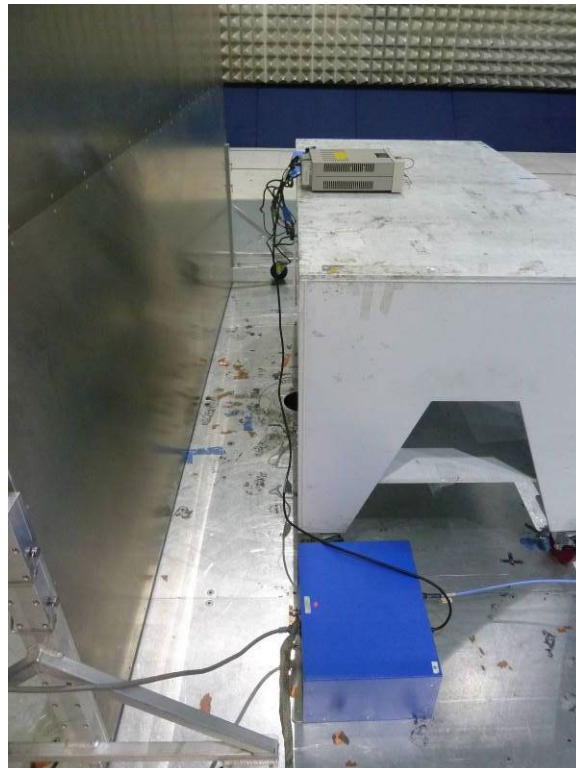
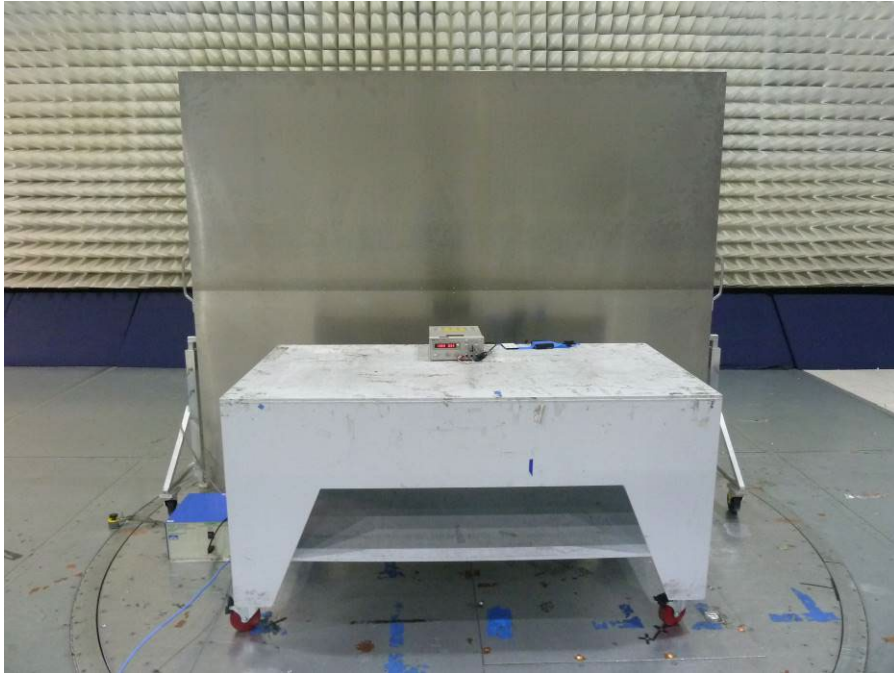


4.3.3 Test Result (Continued)

Frequency (MHz)	Q-Peak (dBμV)	Limit Q-Peak (dBμV)	Margin (dB)	Line	Correction (dB)
0.605	22.18	56	-33.82	Phase 1	10.54
0.645	22.6	56	-33.4	Phase 2	10.54
1.221	21.8	56	-34.2	Phase 2	10.57
1.973	21.16	56	-34.84	Phase 1	10.6
18.519	38.01	60	-21.99	Phase 1	10.96
18.519	37.14	60	-22.86	Phase 2	10.96
18.749	38.49	60	-21.51	Phase 1	10.96
18.749	37.8	60	-22.2	Phase 2	10.96
18.983	38.1	60	-21.9	Phase 1	10.97
18.983	37.18	60	-22.82	Phase 2	10.97
19.212	38.56	60	-21.44	Phase 1	10.97
19.212	37.83	60	-22.17	Phase 2	10.97
19.442	37.47	60	-22.53	Phase 1	10.97
19.442	36.76	60	-23.24	Phase 2	10.97
19.676	38.06	60	-21.94	Phase 1	10.98
19.676	37.13	60	-22.87	Phase 2	10.98

Frequency (MHz)	Avg (dBμV)	Limit Avg (dBμV)	Margin (dB)	Line	Correction (dB)
0.231	20.29	52.41	-32.12	Phase 1	10.52
0.231	21.23	52.41	-31.18	Phase 2	10.52
1.100	12.66	46	-33.34	Phase 1	10.56
1.100	12.83	46	-33.17	Phase 2	10.56
18.519	37.32	50	-12.68	Phase 1	10.96
18.519	36.32	50	-13.68	Phase 2	10.96
18.749	37.97	50	-12.03	Phase 1	10.96
18.749	37.29	50	-12.71	Phase 2	10.96
18.983	37.31	50	-12.69	Phase 1	10.97
18.983	36.19	50	-13.81	Phase 2	10.97
19.212	37.28	50	-12.72	Phase 2	10.97
19.212	38.1	50	-11.9	Phase 1	10.97
19.442	35.88	50	-14.12	Phase 2	10.97
19.676	37.51	50	-12.49	Phase 1	10.98
19.676	36.43	50	-13.57	Phase 2	10.98
20.139	36.58	50	-13.42	Phase 1	10.98

4.3.4 Test Configuration Photographs



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

4.4.1 Test Limit

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

Frequency (MHz)	Class A at 10m dB(μ V/m)	Class B at 3m dB(μ V/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

4.4.2 Procedures

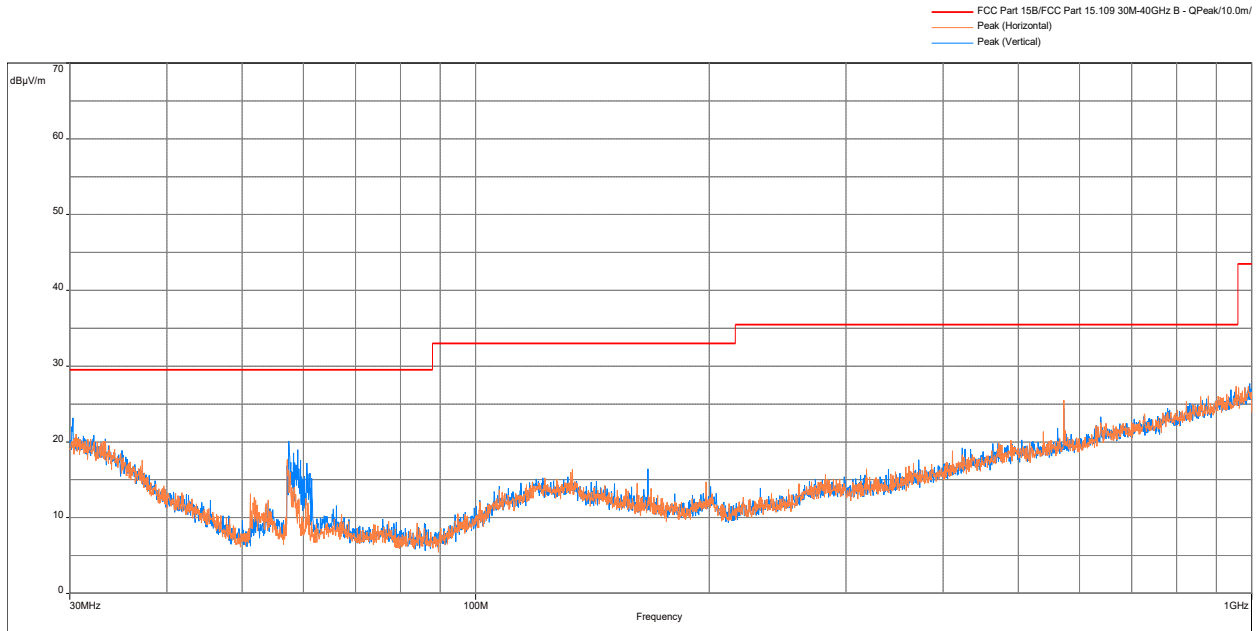
Radiated measurements were taken. 120 kHz resolution bandwidth was used from 30 MHz - 1 GHz. 1 MHz resolution bandwidth was used for measurements done above 1 GHz. All plots are corrected for cable loss, antenna factor, and preamp.

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.

4.4.3 Test Results

FCC Part 15 Subpart B, Radiated Disturbance, 30 MHz to 1000 MHz

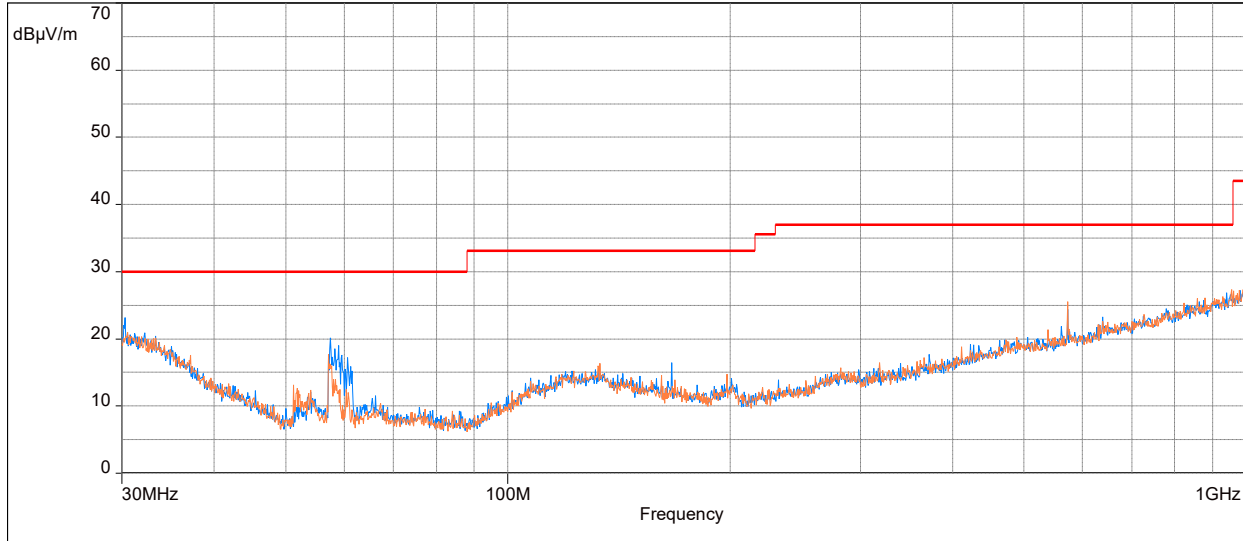


Freq (MHz)	FS@10m dB(uV/m)	Limit@10m dB(uV/m)	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Correction (dB)
30.291	23.17	29.5	-6.33	2	109.5	Vertical	-6.38
57.192	17.67	29.5	-11.83	4	205.75	Horizontal	-19.94
166.738	16.46	33	-16.54	1	0.25	Vertical	-14.52
198.101	14.75	33	-18.25	3	170.75	Horizontal	-14.05
572.715	24.4	35.5	-11.1	2	40.5	Vertical	-6.01
572.715	25.53	35.5	-9.97	3	250.75	Horizontal	-6.01

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

ICES-003, Radiated Disturbance, 30 MHz to 1000 MHz

— ICES-003/ICES 30M-40GHz B - QPeak/10.0m/
— Peak (Horizontal)
— Peak (Vertical)



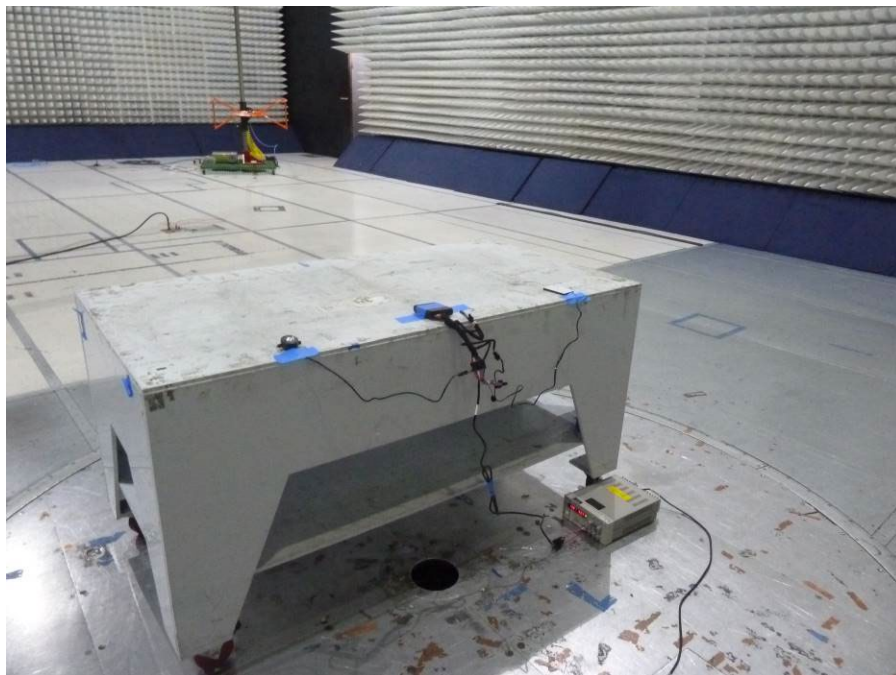
Model: ; Client: ; Comments: ; Test Date: 09/26/2022 23:23

Freq (MHz)	FS@10m dB(uV/m)	Limit@10m dB(uV/m)	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Correction (dB)
30.291	23.17	30	-6.83	2	109.5	Vertical	-6.38
57.192	17.67	30	-12.33	4	205.75	Horizontal	-19.94
166.738	16.46	33.1	-16.64	0.99	0.25	Vertical	-14.52
198.101	14.75	33.1	-18.35	3	170.75	Horizontal	-14.05
572.715	24.4	37	-12.6	2	40.5	Vertical	-6.01
572.715	25.53	37	-11.47	3	250.75	Horizontal	-6.01

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

Results Complies by 6.33 dB

4.4.4 Test Configuration Photographs



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 Receiver	Rohde and Schwarz	ESR	ITS 01607	12	11/19/22
EMI Receiver	Rohde and Schwarz	ESU40	ITS 00961	12	03/10/23
Pre-Amplifier	Sonoma Instrument	310N	ITS 01714	12	11/19/22
BI-Log Antenna	SunAR RF Motion	JB1	ITS 01577	12	02/10/23
Passive Loop Antenna	EMCO	6512	ITS 01598	12	06/23/23
RF Cable	TRU Corporation	TRU CORE 300	ITS 01462	12	09/19/23
RF Cable	TRU Corporation	TRU CORE 300	ITS 01465	12	09/19/23
RF Cable	TRU Corporation	TRU CORE 300	ITS 01470	12	09/19/23
RF Cable	TRU Corporation	TRU CORE 300	ITS 01342	12	09/19/23
RF Cable	Mega Phase	EMC1-K1K1-236	ITS 01537	12	09/19/23

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
BAT-EMC	Nexio	3.20.0.23	Verizon.bpp

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewer Initials	Date	Change
1.0 / G105183067	AC	ML	October 11, 2022	Original document