TEST REPORT

Report Number: 105251642MPK-004
Project Number: G105251642
December 16, 2022

Testing performed on the
AP 30 Hotstick Unit
Models: AP30-HS

FCC ID: 2A9GX-AP30HS

to

FCC Part 15 Subpart C (15.249)

For

EDM International, Inc.

Test Performed by:	**Test Authorized by:**
Intertek	EDM International, Inc.
1365 Adams Court	4001 Automation Way
Menlo Park, CA 94025 USA	Fort Collins, CO 80525 USA

Prepared by: _____ **Date:** December 16, 2022
Juan Alapizco Vega

Reviewed by: _____ **Date:** December 16, 2022
Minh Ly

VERIFICATION OF COMPLIANCE
Report No. 105251642MPK-004

Verification is hereby issued to the named APPLICANT and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below.

Equipment Under Test:	AP30 Hotstick Unit
Trade Name:	EDM International, Inc.
Model Numbers:	AP30-HS
Serial Numbers:	N/A
Applicant:	EDM International, Inc.
Contact:	Neil Hurst
Address:	EDM International, Inc. 4001 Automation Way Fort Collins, CO 80525
Country	USA
Tel. Number:	(970) 204-4001
Email:	nhusrt@edmlink.com
Applicable Regulation:	FCC Part 15 Subpart C (15.249)
Date of Test:	November 28 – December 11, 2022

We attest to the accuracy of this report:

Juan Alapizco Vega
Project Engineer

Minh Ly
Engineering Team Lead

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1.0 Summary of Tests

TEST	REFERENCE FCC Part 15C	RESULT
Field Strength of Fundamental	15.249(a)	Complies
Field Strength of Harmonics	15.249(a)	Complies
Radiated Emissions outside the band	15.249(d)	Complies
Occupied Bandwidth	15.215(c)	Complies
Line Conducted Emissions	15.207	Not applicable[1]
Antenna requirement	15.203	Complies[2]

[1]Eut is battery powered.
[2]Eut utilizes an internal antenna.

2.0 General Description

2.1 Product Description

The Equipment Under Test (EUT) is a module, model numbers AP30-HS, that contains a 914MHz carrier radio.

Information about the 914MHz carrier radio is presented below:

Applicant name & address	EDM International, Inc. 4001 Automation Way Fort Collins, CO 80525
Manufacturer name & address	EDM International, Inc. 4001 Automation Way Fort Collins, CO 80525
Model No.	AP30-HS
FCC Identifier	2A9GX-AP30HS
Frequency Range	914 MHz
Rated RF Output	93.49 dB(μV/m) at 3m
Number of Channel(s)	1
Type of Modulation	60Hz Square wave
Data Rate	60 bps for 914 MHz Channel
Antenna(s) & Gain	PCB antenna, Gain: 1.4 dBi

EUT receive date: November 28, 2022
EUT receive condition: The pre-production version of 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 28, 2022
Test completion date: December 11, 2022
The test results in this report pertain only to the item tested.

2.2 Related Submittal(s) Grants

None.

2.3 Test Methodology

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, ANSI C63.10: 2013.

2.4 Test Facility

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 CISPR 16-1 and ANSI C63.4: 2014. 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.

The A2LA certificate number for this site is 1755-01.

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 – 200 MHz	200 MHz – 1 GHz	1 GHz – 18 GHz
Radiated emissions	-	4.7	4.6	5.1 dB
AC mains conducted emissions	2.1 dB	-	-	-

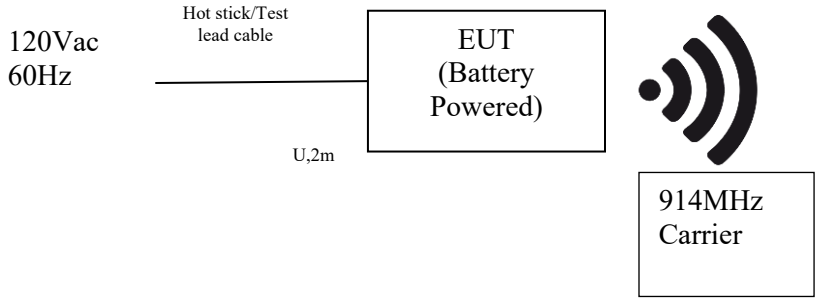
3.0 System Test Configuration

3.1 Support Equipment and description

Description	Model No./ Part No.	Serial No.
Hotstick Unit sensor	AP30 Hotstick	FUJK001
Test Lead	N/A	Not Labeled

3.2 Block Diagram of Test Setup

Internal Radio Model: 2A9GX



S = Shielded **U** = Unshielded	**F** = With Ferrite **M** = Meter

3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT is attached to peripherals and they are connected and operational (as typical as possible). The EUT is wired to transmit full-power. During testing, all cables are manipulated to produce worst-case emissions. The black cable (test lead) connected to the EUT is set up for powering up purposes which was shown not to affect emissions.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

3.5 Mode of operation during test

During the test the EUT was set to transmit the modulated signal with 100% duty cycle.

3.6 Modifications required for Compliance

No modifications were installed by Intertek during compliance testing in order to bring the product 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 Transmitter Radiated Emissions
FCC Rules: 15.249, 15.209

Requirements

§15.249(a) The Field Strength of emissions at a distance of 3 meters shall not exceed the following levels:

94 dB(μV/m) for fundamental frequency,
54 dB(μV/m) for harmonics.

Emissions radiated outside of the specified frequency band, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits in 15.209, whichever is the lesser attenuation.

§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

Procedure

Radiated emission measurements were performed from 9 kHz to 10 GHz according to the procedure described in ANSI C63.10. Spectrum Analyzer Resolution Bandwidth is 200Hz or greater for frequencies 9kHz to 30MHz, 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz. Above 1000 MHz Peak and Average measurements were performed.

The EUT is placed on a plastic turntable that is 80 cm in height for below 1000MHz and 1.5m in height for above 1GHz. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The 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 3 meters for frequencies above 1 GHz and at 10 meters for frequencies below 1 GHz.

Measurements made from 1 GHz to 18GHz had a 2.4-2.5GHz notch filter in place. A preamp was used from 30MHz to 26GHz. All measurements were made with a Peak Detector and compared to QP limits for 30MHz – 1GHz and Average limits for 1GHz – 26GHz.

Radiated measurements were performed on both horizontal and vertical orientation of the EUT. Data is presented with the worst-case configuration (the configuration which resulted in the highest emission levels).

Correlation measurements were performed below 30MHz between 10m ALSE and Open Field site according to FCC KDB 414788 D01 Radiated Test Site v01r01 section 2. All readings were within the acceptable tolerance.

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 with a sample calculation is as follows:

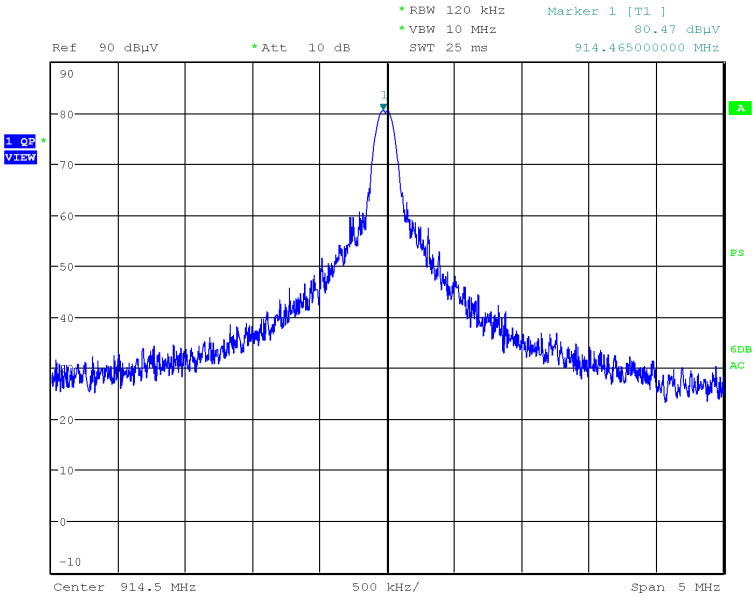
FS = RA + AF + CF – AG; if measurement is performed at a distance other than specified in the rule, a Distance Correction Factor (DCF) shall be added.

Where FS = Field Strength in dB(μV/m)
RA = Receiver Amplitude (including preamplifier) in dB(μV); AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB; AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB(μV) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(μV/m). This value in dB(μV/m) was converted to its corresponding level in μV/m.
RA = 52.0 dB(μV)
AF = 7.4 dB(1/m)
CF = 1.6 dB
AG = 29.0 dB
FS = 52.0+7.4+1.6-29.0 = 32 dB(μV/m).
Level in μV/m = Common Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m.

Test Result
Compliant.

Radiated emissions at 914 MHz, Horizontal Polarization



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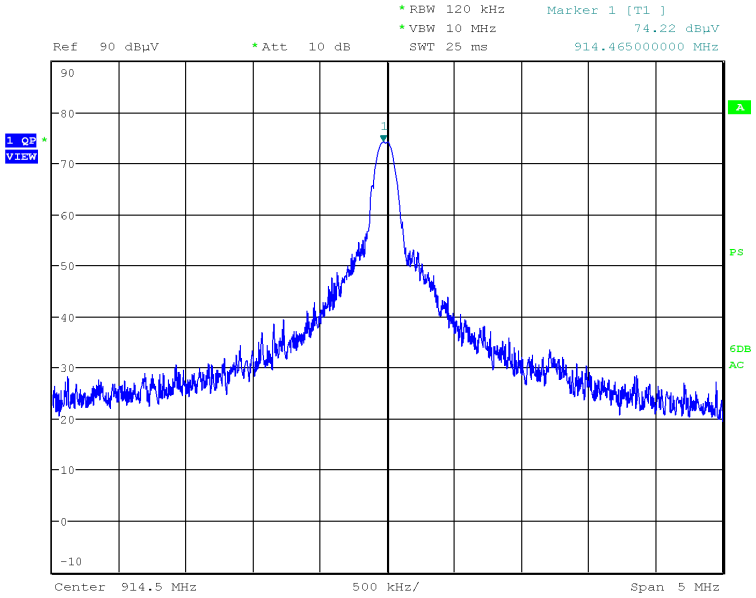
Radiated emissions at 914 MHz, Vertical Polarization



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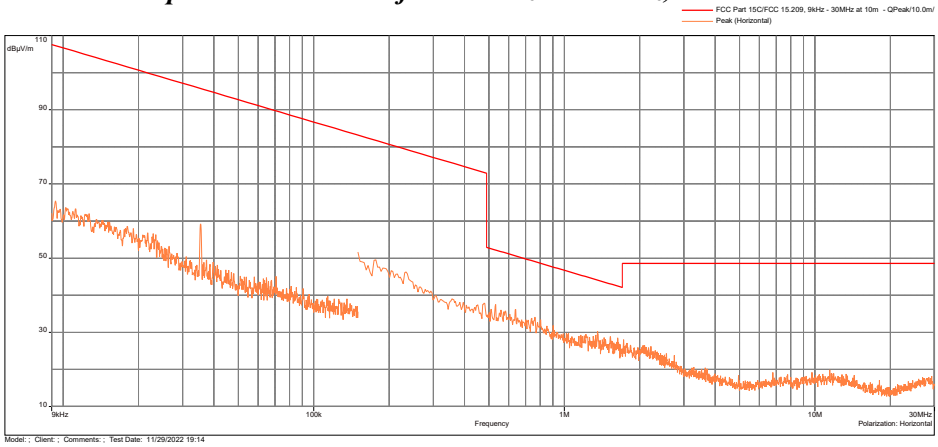
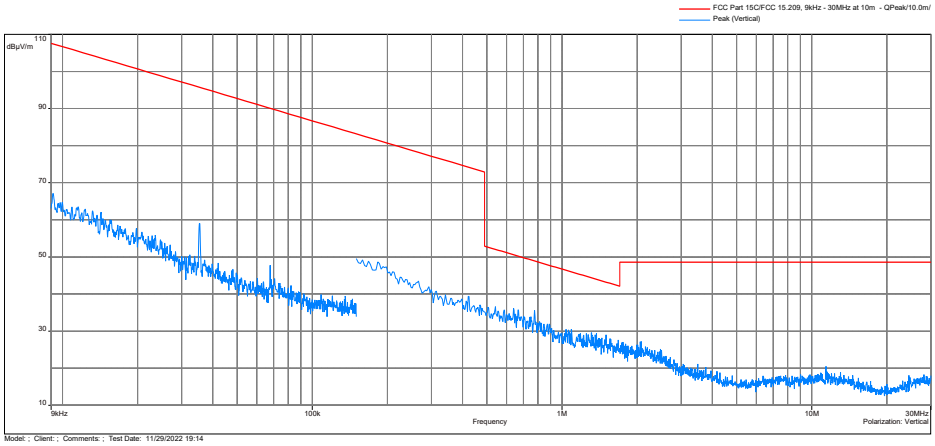
Test Data Summary – Radiated Field Strength Measurement						
Frequency (MHz)	**Fundamental Field Strength dB(µV/m) @3m**	**Limit @3m dB(µV/m)**	**Margin (dB)**	**Polarity**	**Correction Factor (dB)**	**Results**
914.5	93.63	94.0	-0.37	Horizontal	13.16	Pass
914.5	87.38	94.0	-6.62	Vertical	13.16	Pass

Note: A correction factor of 10.5 dB was used to convert from 10m to 3m Field Strength read. This factor is already reflected in the correction factor column above.

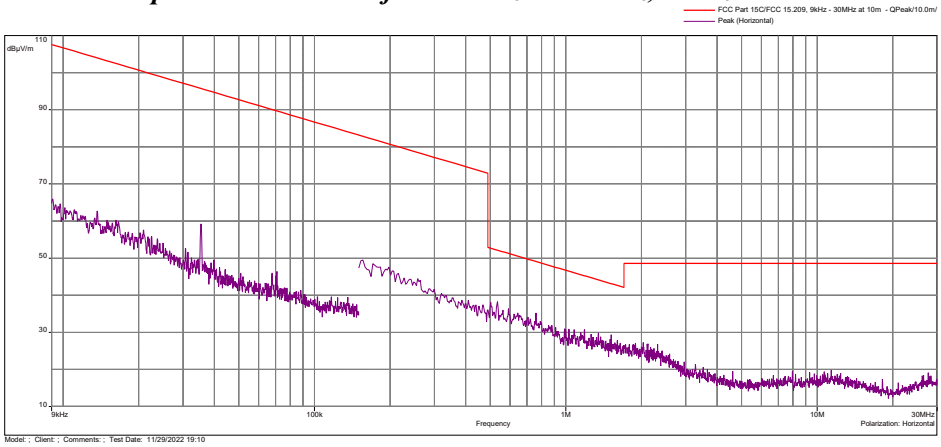
15.209 Radiated Spurious Emissions from 9 kHz to 30MHz, Parallel Antenna / X-Axis



15.209 Radiated Spurious Emissions from 9 kHz to 30MHz, Perpendicular Antenna / Y-Axis

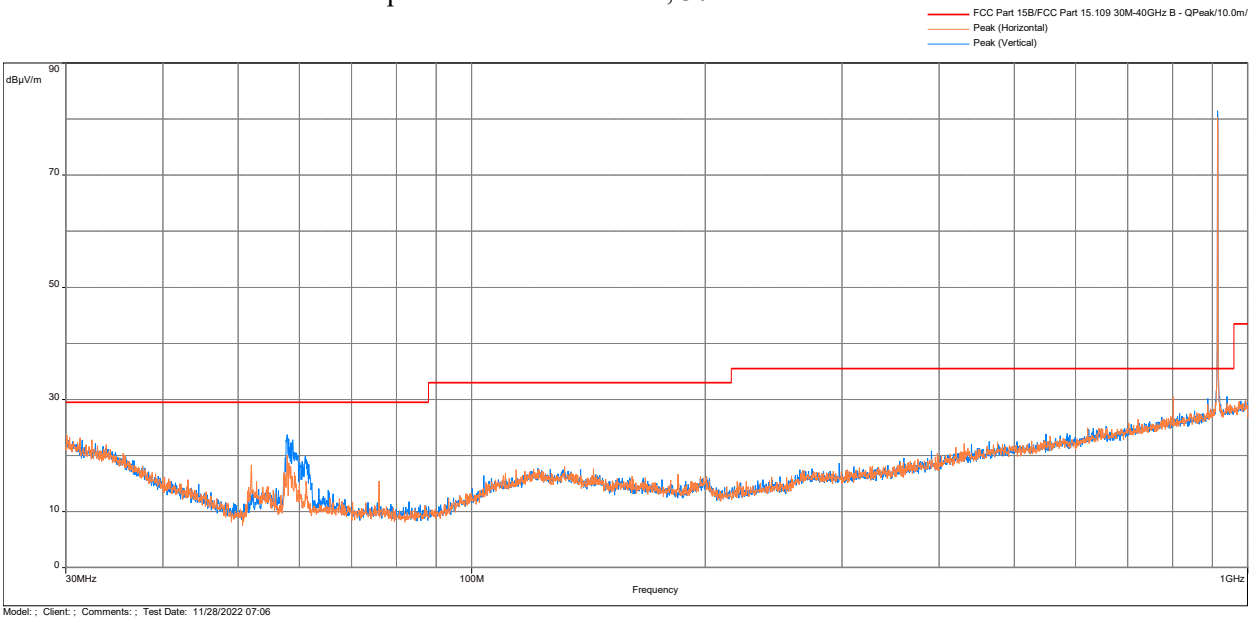


15.209 Radiated Spurious Emissions from 9 kHz to 30MHz, Horizontal Antenna / Z-Axis



Transmitter Radiated Emissions below 1GHz

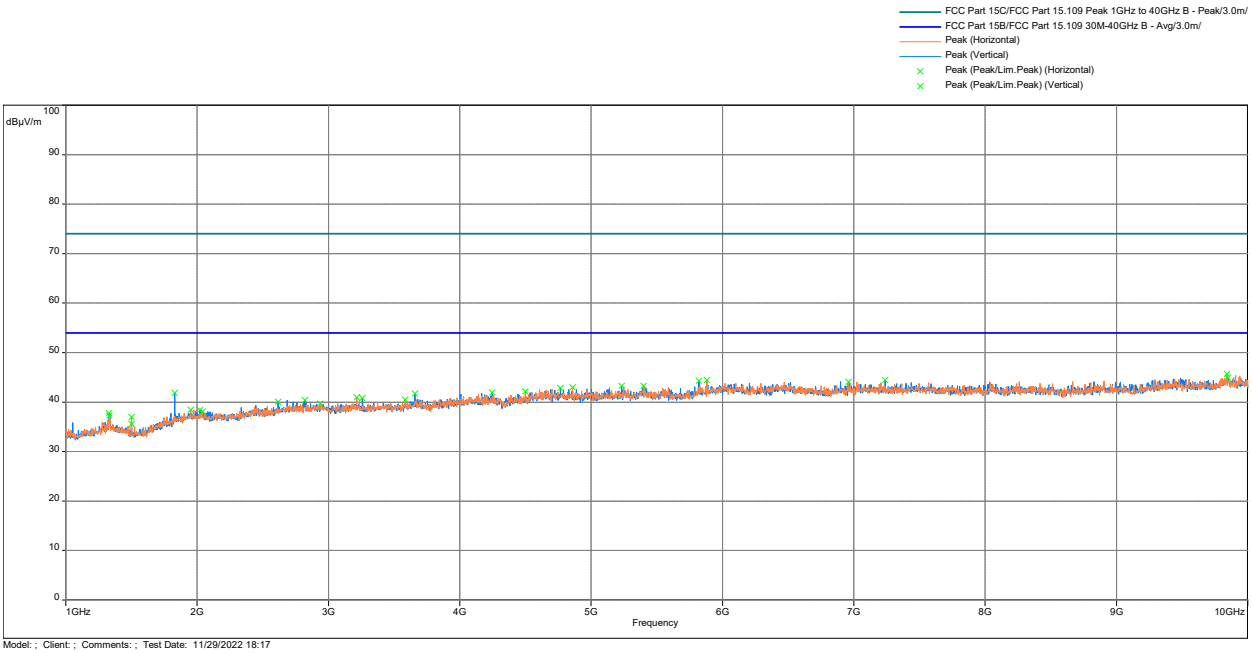
Spurious Emissions Data, 30MHz to 1MHz



Frequency (MHz)	FS@10m (dBµV/m)	Limit@10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
30.097	23.68	29.5	-5.82	2.01	264.5	Horizontal	27.19	-3.51
58.841	22.81	29.5	-6.69	4	214.5	Vertical	39.77	-16.96
32.425	22.8	29.5	-6.7	4	0	Horizontal	28.46	-5.66
31.487	22.75	29.5	-6.75	1.97	0	Vertical	27.77	-5.02
30.258	22.69	29.5	-6.81	1.97	103.25	Vertical	26.4	-3.71
58.518	22.33	29.5	-7.17	4	168.5	Vertical	39.29	-16.96

Transmitter Radiated Emissions above 1GHz

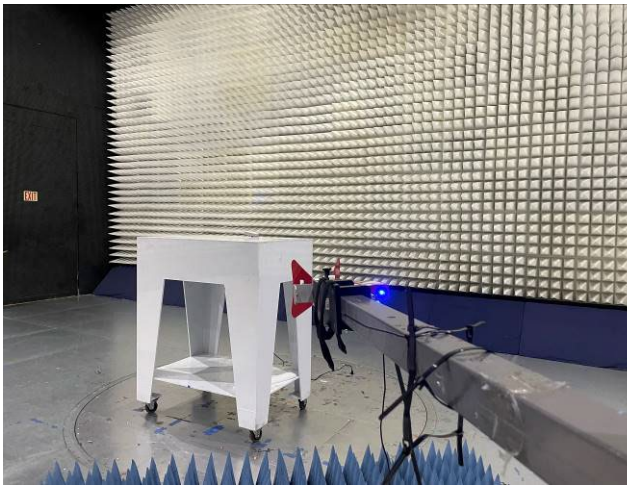
Spurious Emissions, 1GHz to 10GHz, Peak scan vs Peak and Avg limits

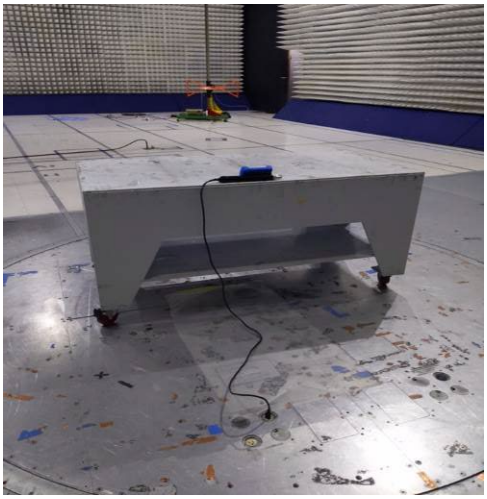


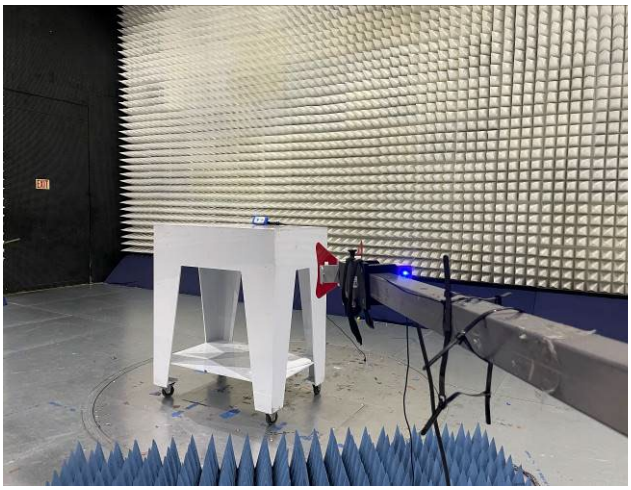
Final Measurements								
Frequency (MHz)	**FS@3m (dBµV/m)**	**Limit@3m (dB(uV/m))**	**Margin (dB)**	**Azimuth (deg)**	**Height (m)**	**Polarity**	**RA@3m (dBuV)**	**Correction (dB)**
5880.7	43.46	54	-10.54	267.5	3.76	Horizontal	49.56	-6.1
1829.033	41.84	54	-12.16	332.5	2.16	Vertical	55.74	-13.9

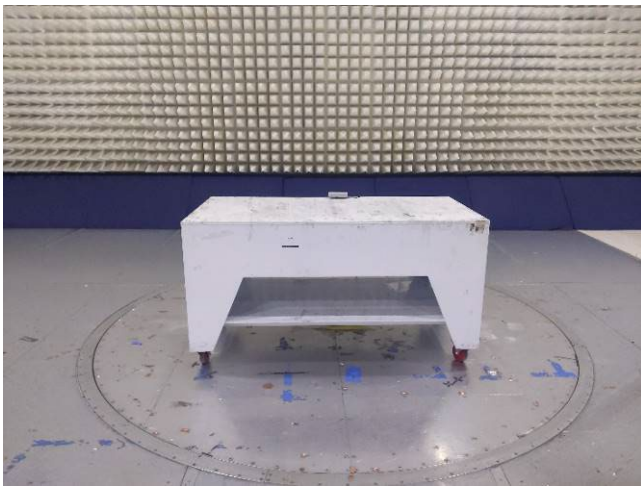
Test setup photographs

The following photographs show the testing configurations used.









4.2 Occupied Bandwidth
FCC Rules: 15.215(c)

Requirements

§15.215(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, 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.

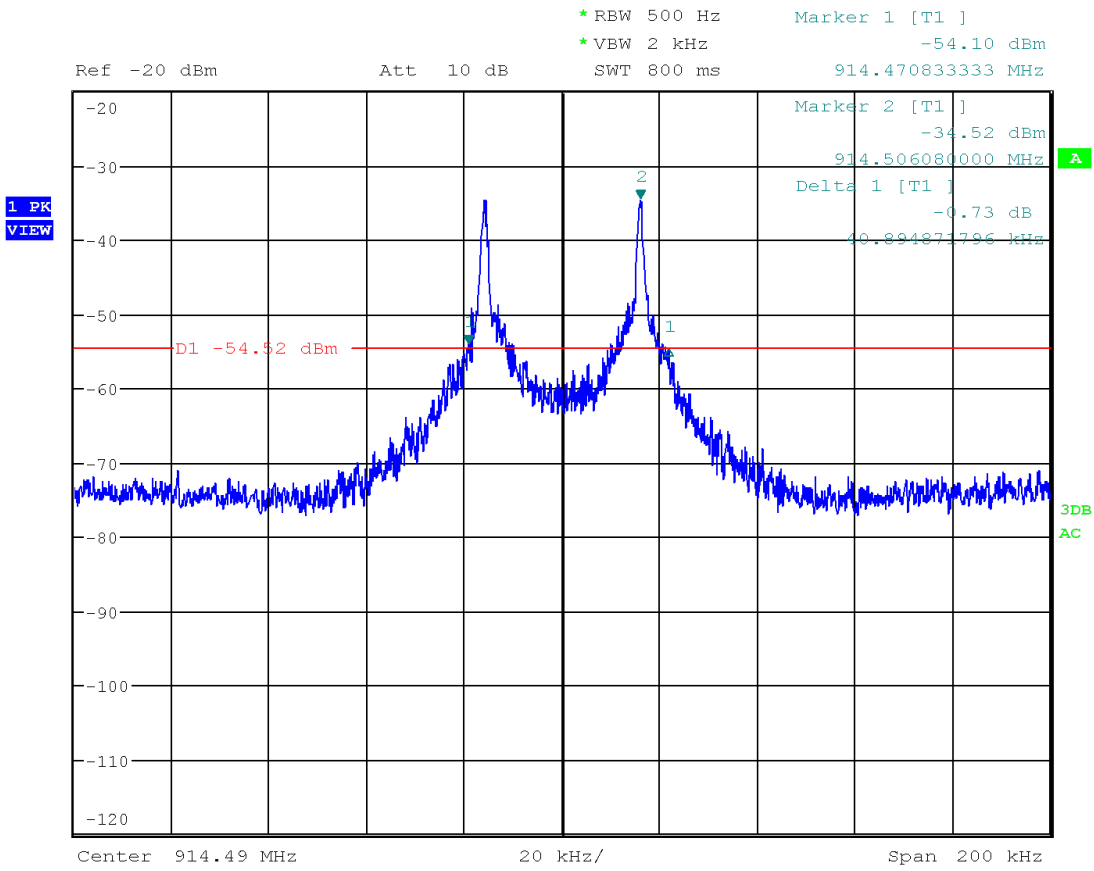
Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer (SA). For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 20 dB lower than PEAK level. The 20 dB bandwidth was determined from where the channel output spectrum intersected the marker delta.

Test Results

Frequency MHz	**20-dB bandwidth kHz**
914	40.894

Plot 1: 914MHz 20dB Bandwidth



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4.3 Line Conducted Emissions
FCC Rules: 15.207; IC Rules: RSS-Gen
FCC Rules: 15.107; IC Rules: ICES 003

Requirements

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

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

Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide 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.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.4:2014.

Test Result

Not applicable. The EUT is battery operated.

5.0List of Test Equipment

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

Equipment	Manufacturer	Model/Type	Asset #	Cal Int	Cal Due
30MHz-2GHz Bi-Log	SunAR RF Motion	JB1	01577	12	02/10/2023
1-18GHz 2 meter RF	TRU Corp.	TRU Core 300	01330	12	08/25/2023
1-40GHz RF Cable (SMA	MEGAPHASE	EMC1-K1K1-20	01889	12	03/11/2023
1-18GHz Horn Antenna	ETS Lindgren	3117-PA	01325	12	11/19/23
9kHz-1GHz Pre-amplifier	Sonoma Instrument	310N	01713	12	02/17/2023
1-40GHz RF Cable	Mega PHASE	TM40-K1K1-59	01655	12	01/11/2023
1GHz to 40GHz RF Cable	MEGAPHASE	EMC1-K1K1-236	01484	12	06/27/2023
EMI Test Receiver 40GHz	Rohde & Schwarz	ESU40	00961	12	03/10/2023
10m Chamber	Panashield	10 Meter Chamber	00984	12	#

No Calibration required

5.0 Document History

Revision/ Job Number	Writer Initials	Reviewer Initials	Date	Change
1.0 / G105251642	JAV	ML	December 16, 2022	Original document