TEST REPORT

Report Number: 105352296MPK-001
Project Number: G105352296
April 17, 2023

Testing performed on the
Fluid Warmer System
Model Number: EFW5L

FCC ID: 2BAY2-EFW5L
IC: 30245-EFW5L

to

FCC Part 15 Subpart C (15.225)
ISED RSS-210 Issue 10

For

Microtek Medical, Inc.

Test Performed by:	Test Authorized by:
Intertek	Microtek Medical, Inc.
1365 Adams Court	13000 Deerfield Pkwy Ste 300
Menlo Park, CA 94025 USA	Milton, GA 30004 USA

Prepared by: _____ **Date:** April 17, 2023
Gilberto Gallegos Rangel

Reviewed by: _____ **Date:** April 17, 2023
Minh Ly

Report No. 105352296MPK-001	
Equipment Under Test:	Fluid Warmer System
Trade Name:	Microtek Medical, Inc.
Model Number:	EFW5L
Applicant:	Microtek Medical, Inc.
Contact:	Kasey Cockerill
Address:	Microtek Medical, Inc. 13000 Deerfield Pkwy Ste 300 Milton, GA 30004
Country:	USA
Tel. Number:	(404) 625-9305
Email:	kasey.cockerill@ecolab.com
Applicable Regulation:	FCC Part 15 Subpart C (15.225) ISED RSS-210 Issue 10
Date of Test:	February 22-24

We attest to the accuracy of this report:

Gilberto Gallegos Rangel
Project Engineer

Minh Ly
EMC Team Lead

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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] EUT utilizes an internal Antenna.

2.0 General Description

2.1 Product Description

Microtek Medical, Inc supplied the following description of the EUT:

The Fluid Warmer (EFW5L) is designed to warm and maintain the temperature of surgical solutions prior to their use.

Overview of the EUT

Model	EFW5L
FCC Identifier	2BAY2-EFW5L
IC Identifier	30245-EFW5L
Operating Frequency	13.56MHz
Number of Channels	1
Type of Modulation	ASK
Operating Temperature	-20°C to +50°C
Antenna Type	Internal Stripline/Loop Antenna
Applicant name & address	Microtek Medical, Inc. 13000 Deerfield Pkwy Ste 300 Milton, GA 30004

EUT receive date: February 22, 2023
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: February 22, 2023
Test completion date: February 24, 2023

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. 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).

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

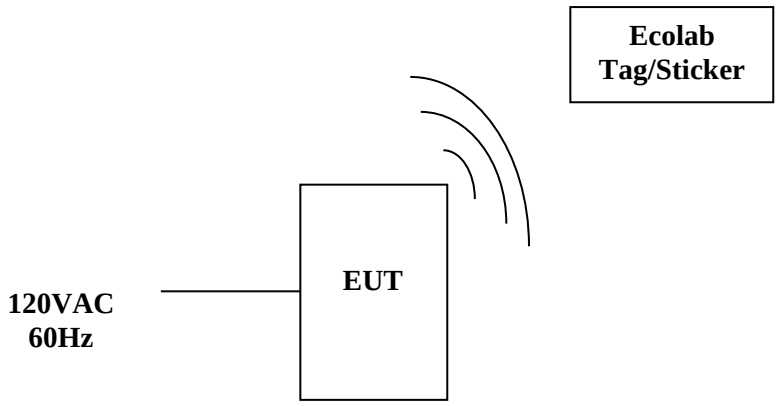
3.1 Support Equipment and description

Support Equipment		
Description	**Manufacturer**	**Model Number**
N/A		

3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	**Manufacturer**	**Model**	**Serial Number**
Fluid Warmer System	Microtek Medical, Inc.	EFW5L	EFW5EB05

3.2 Block Diagram of Test Setup (Continued)



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 and looking for tags. The highest clock frequency used in the EUT is 16MHz.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was provided by Microtek Medical, Inc.

3.5 Mode of Operation during test

The EUT was constantly broadcasting a 13.56 MHz signal while reading an RFID tag

3.6 Modifications required for Compliance

No Modifications were made e 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 performed at 10 meters. Data results below are corrected for distance at 10m. Limits were normalized to 10 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

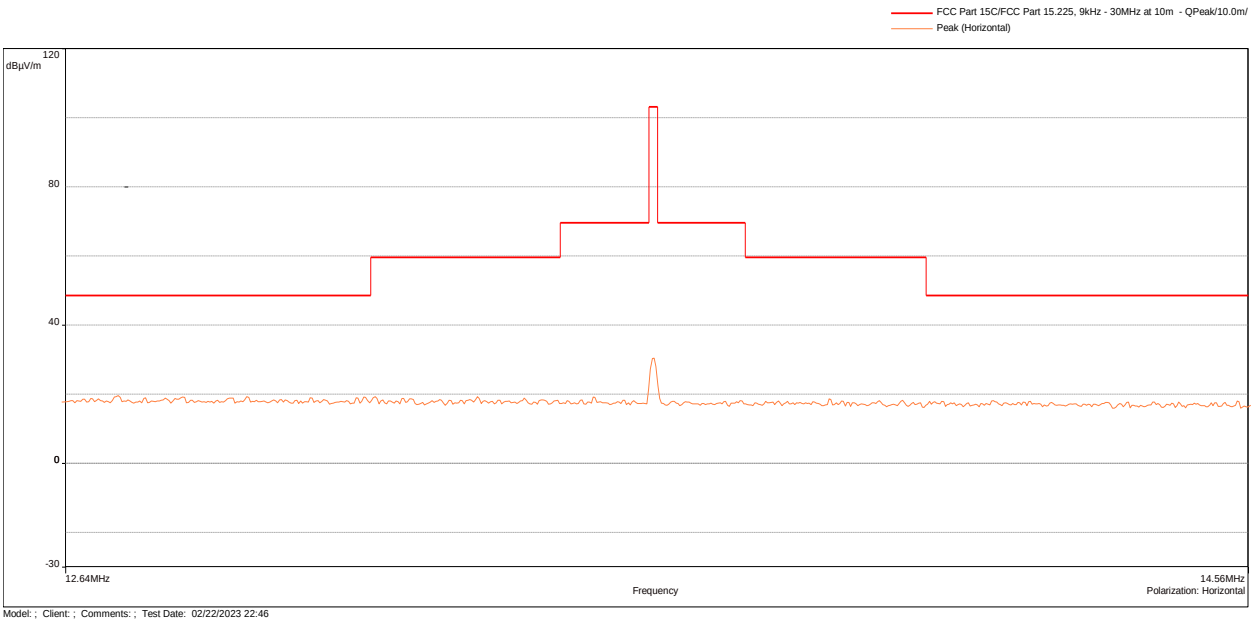
Where FS = Field Strength in dB (μV/m)

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 Results

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.

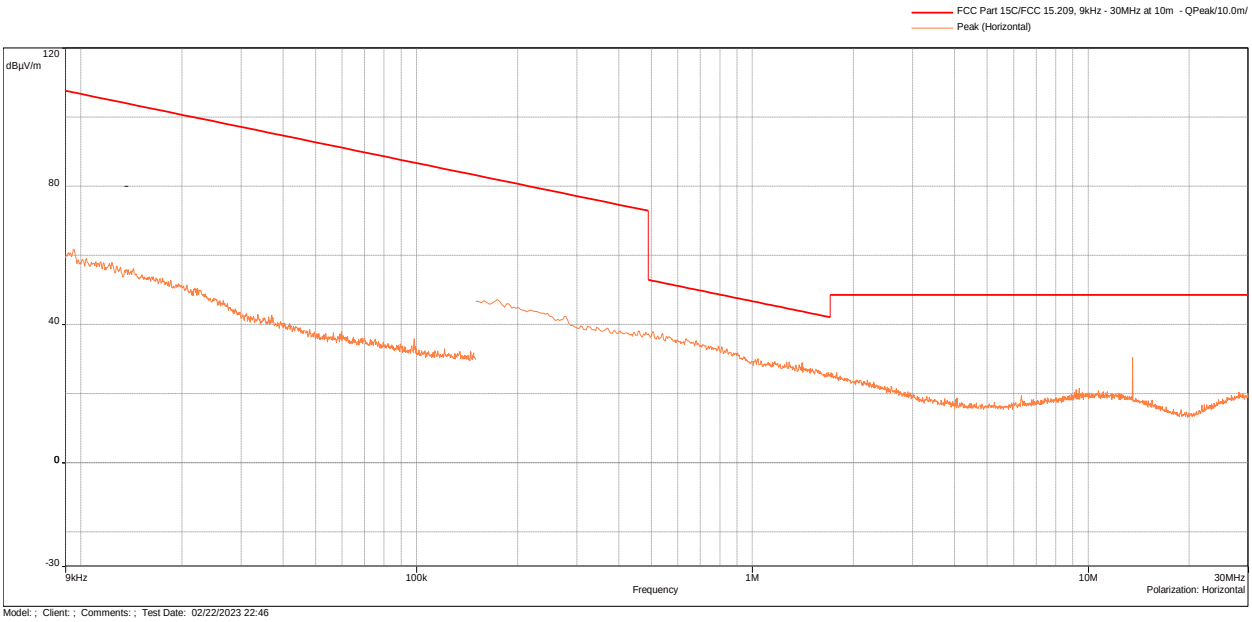


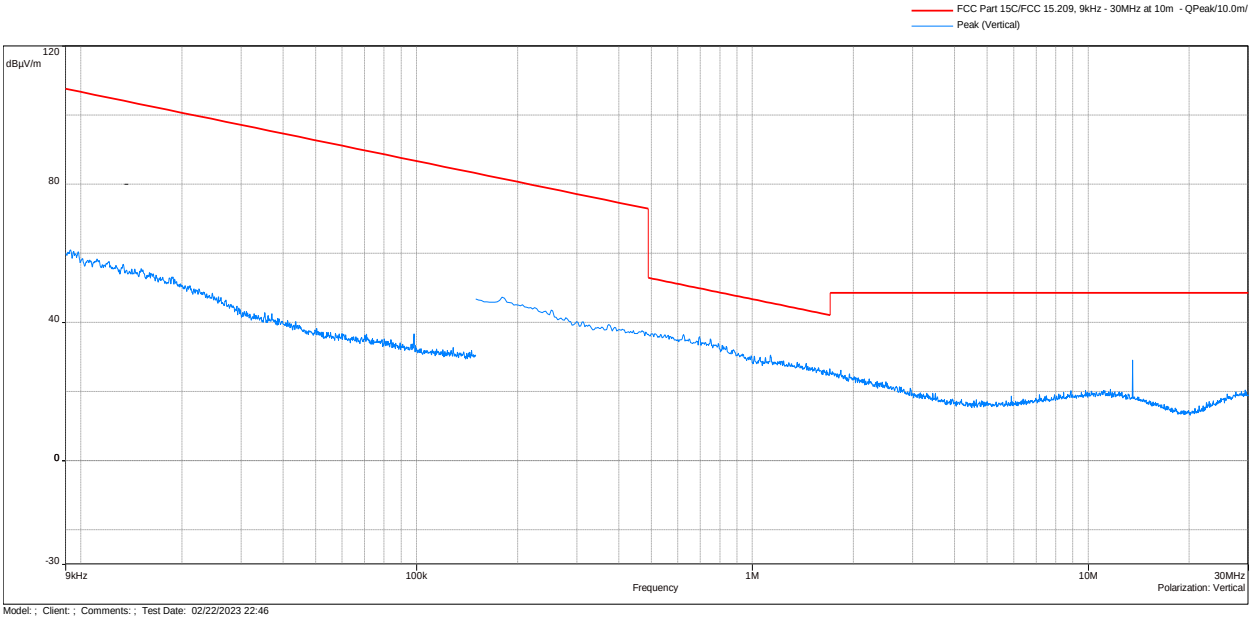
Frequency	Corrected Peak FS @10m	Limit @10m	Margin	RA@10m	Correction	Comment
(MHz)	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	
13.56	30.38	103.1	-72.72	27.87	2.51	Coaxial

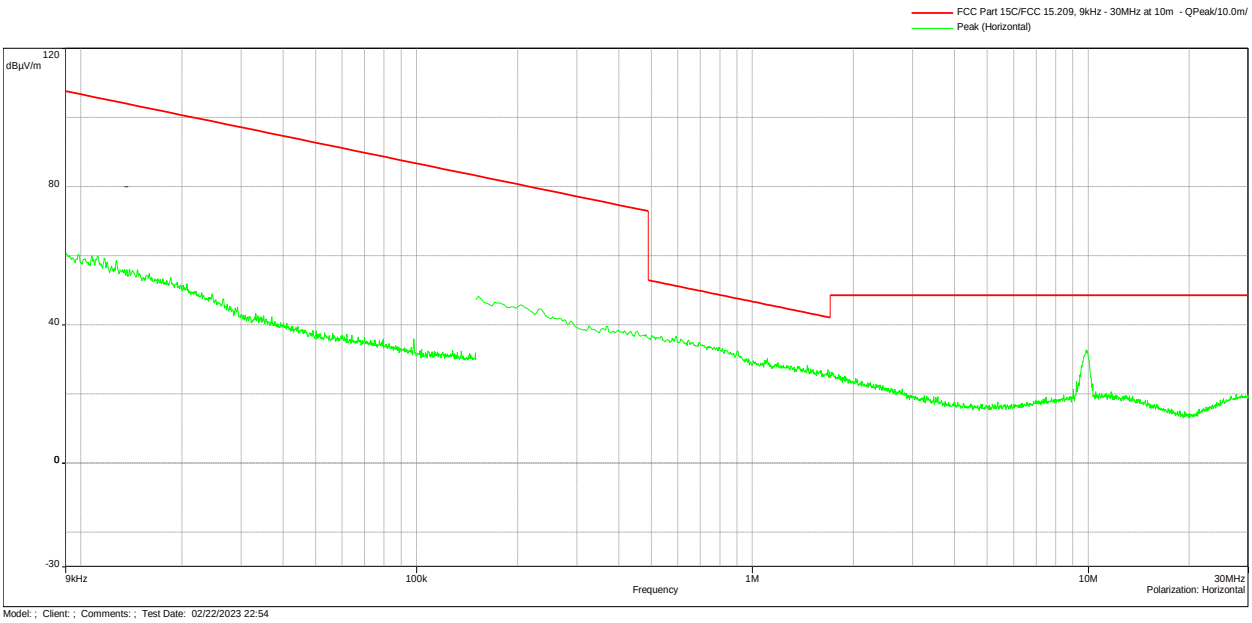
Note: Correction = AF+CF–AG
Limit @10m = 20log(FS @30m) + 40log(30/10)

4.1.3 Test Result (Continued)

Radiated Spurious Emissions from 9 kHz to 30MHz



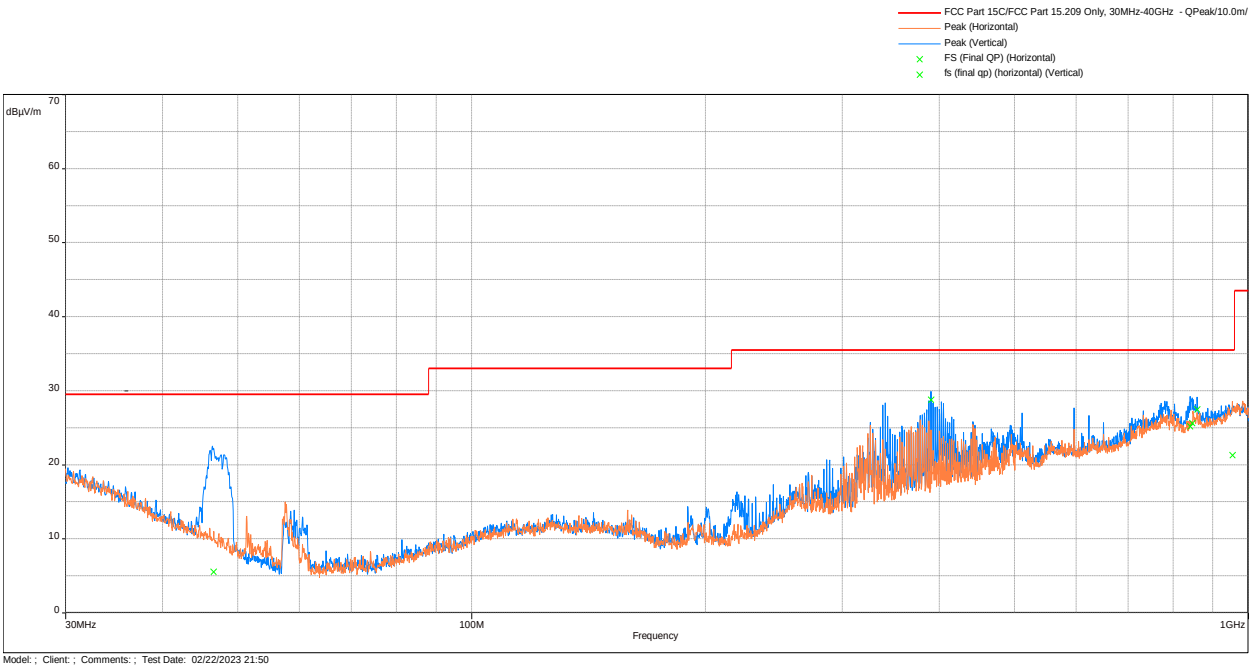




Model: ; Client: ; Comments: ; Test Date: 02/22/2023 22:54

4.1.3 Test Result (Continued)

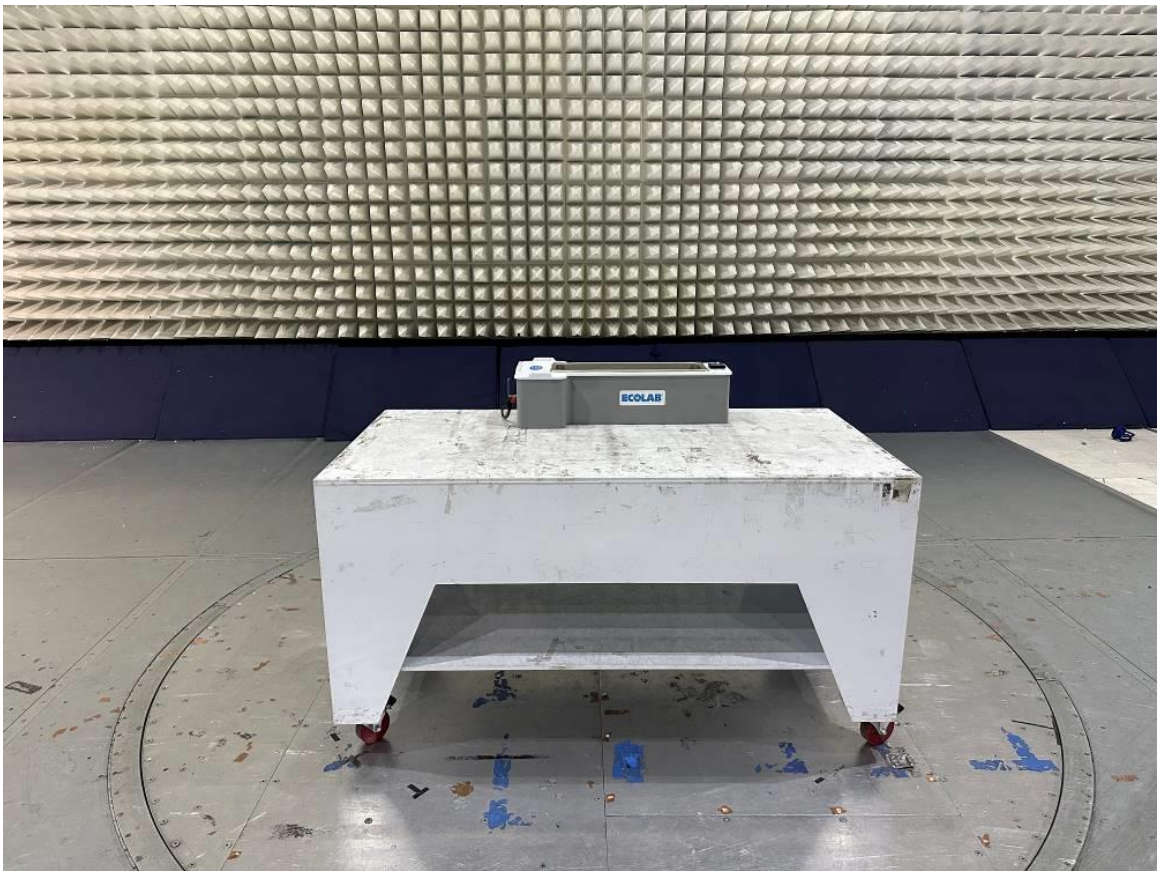
Radiated Spurious Emissions from 30 MHz to 1000 MHz

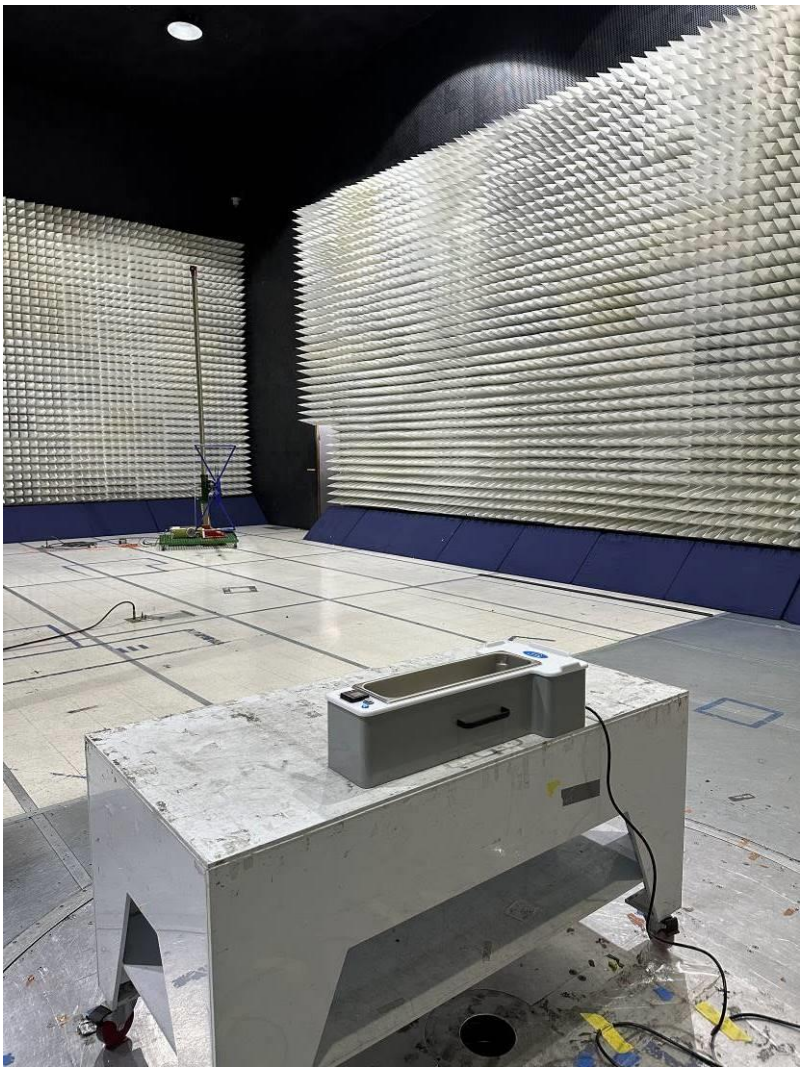


Frequency (MHz)	Peak (dBµV/m)	Lim. QPeak (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Polarity	Correction (dB)
390.317	28.8	35.5	-6.7	3.48	113.75	Vertical	-9.38
859.0972	27.47	35.5	-8.03	1.83	350	Vertical	0.16
846.6036	25.6	35.5	-9.9	3.35	108	Vertical	-0.06
841.5009	25.19	35.5	-10.31	3.24	103.75	Vertical	-0.15
953.9762	21.29	35.5	-14.21	3.08	68	Horizontal	2.58
46.5084	5.56	29.5	-23.94	3.92	280.75	Vertical	-16.71

4.1.4 Test Configuration Photographs

The following photographs show the testing configurations used.





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 ±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.

4.2.3 Test Results

Voltage (AC)	Temperature (C)	Measured Frequency (Hz)	Deviation from Reference (Hz)	Deviation (%)
120	50	13560473	17	0.000125
120	40	13560466	24	0.000176
120	30	13560474	16	0.000117
120	20	13560490	0	0.00000
120	10	13560509	19	0.00014
120	0	13560526	36	0.000265
120	-10	13560530	40	0.000294
120	-20	13560524	34	0.00025
Voltage (AC)	**Temperature (C)**	**Measured Frequency (Hz)**	**Deviation from Reference (Hz)**	**Deviation (%)**
102	20	13560484	6	0.0000442
138	20	13560482	8	0.0000589

Nominal Frequency @ 20C, 120VAC: 13560490 Hz

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

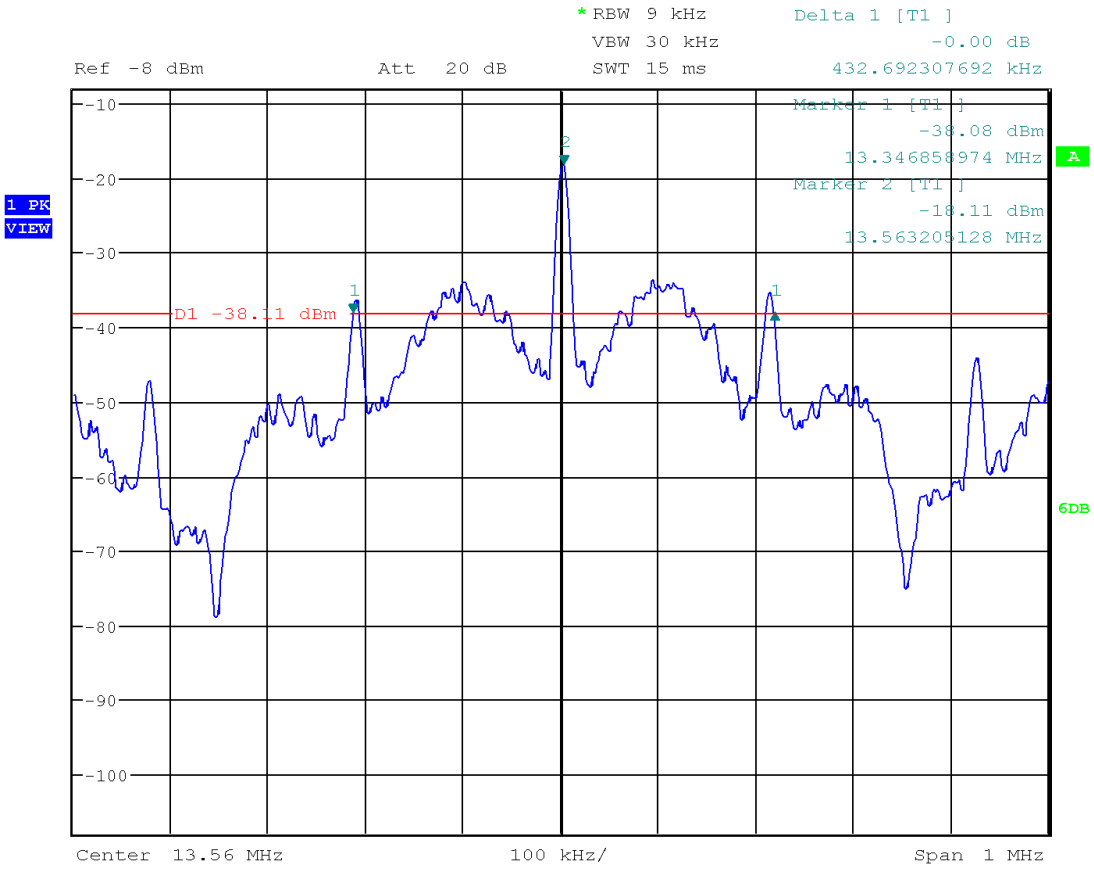
The EUT was setup to transmit in normal operating condition.

Measurements were made with the loop antenna in close proximity of the EUT. Following the procedures of ANSI 63.10, 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	432.69	536.05

20-dB Channel Bandwidth



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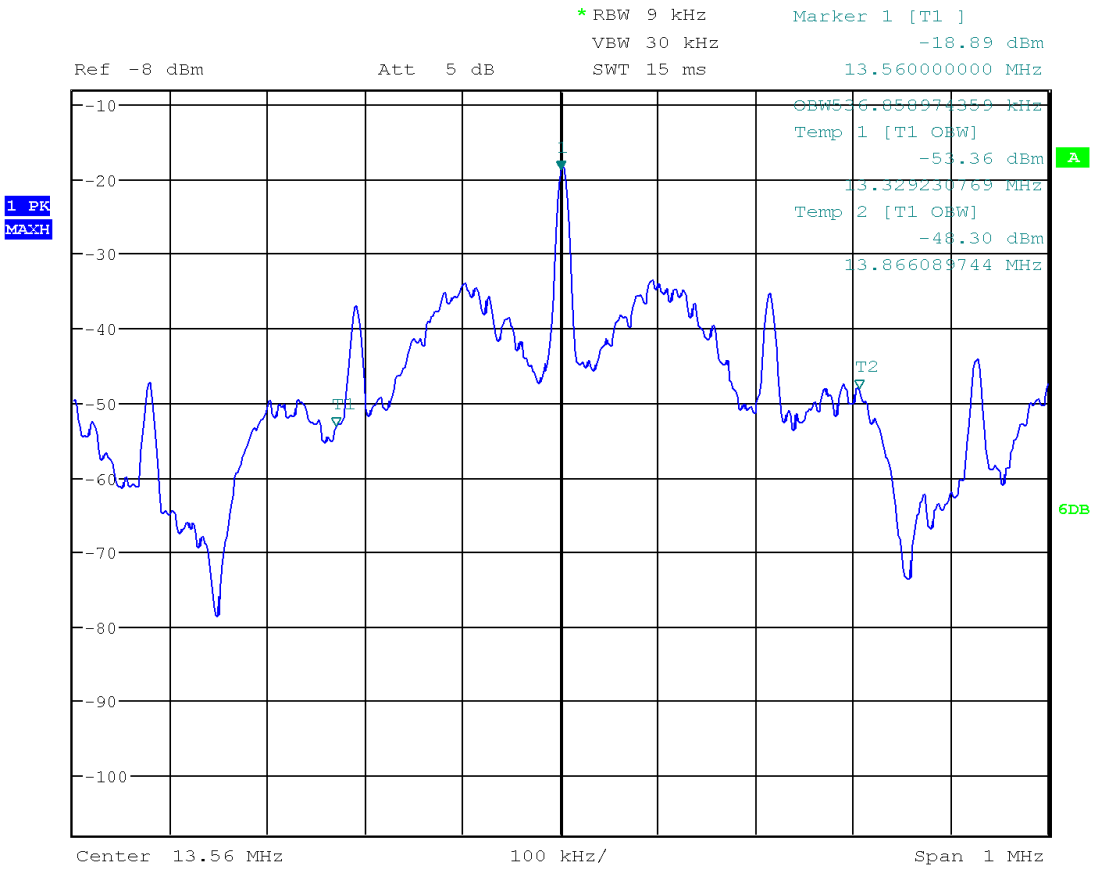
4.3.3 Test Results (Continued)

99% Channel Bandwidth



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4.4 AC Line Conducted Emission
FCC Rule 15.207

4.4.1 Requirement

Frequency Band MHz	15.207 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.*

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.

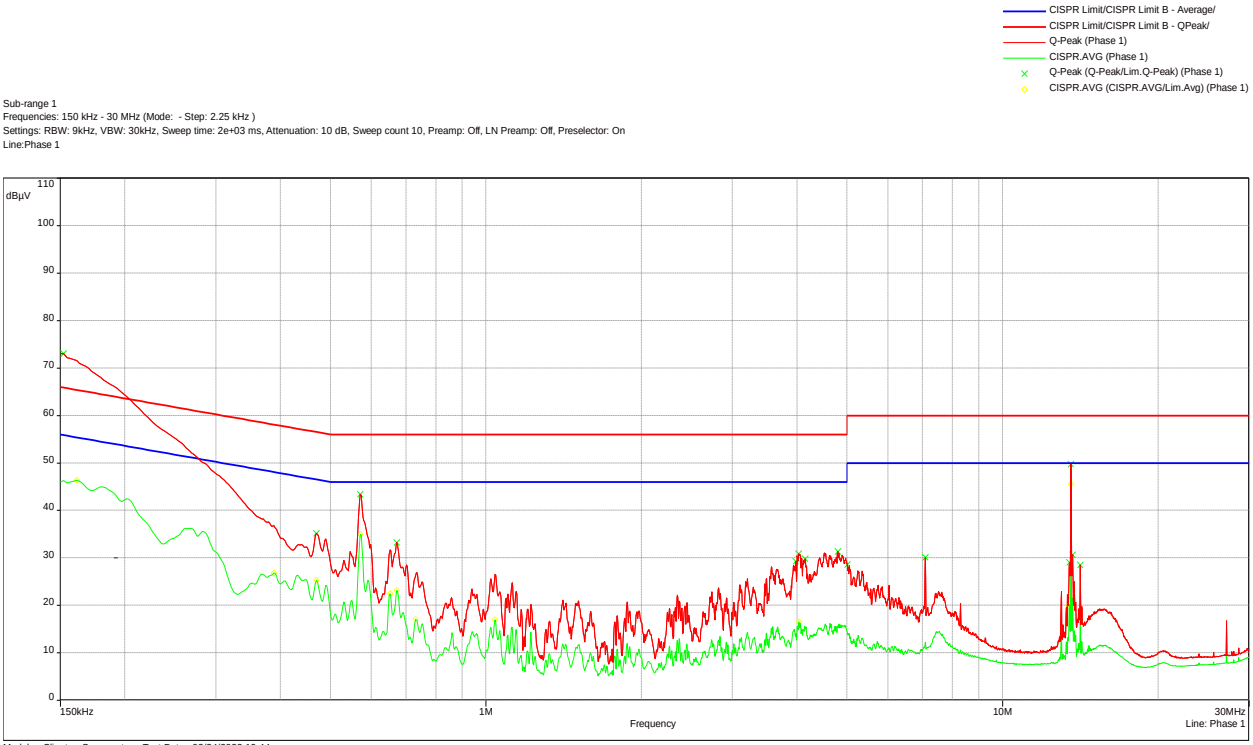
EUT was placed in transmission mode then tested for conducted emissions per 15.207 to ensure the device complies with 15.207 outside the transmitter fundamental emissions band. After, the EUT antenna is removed from the EUT and only the fundamental emission band was measured to show that the fundamental emission band is in compliance with the 15.207 limits.

Equipment setup for conducted disturbance tests followed.

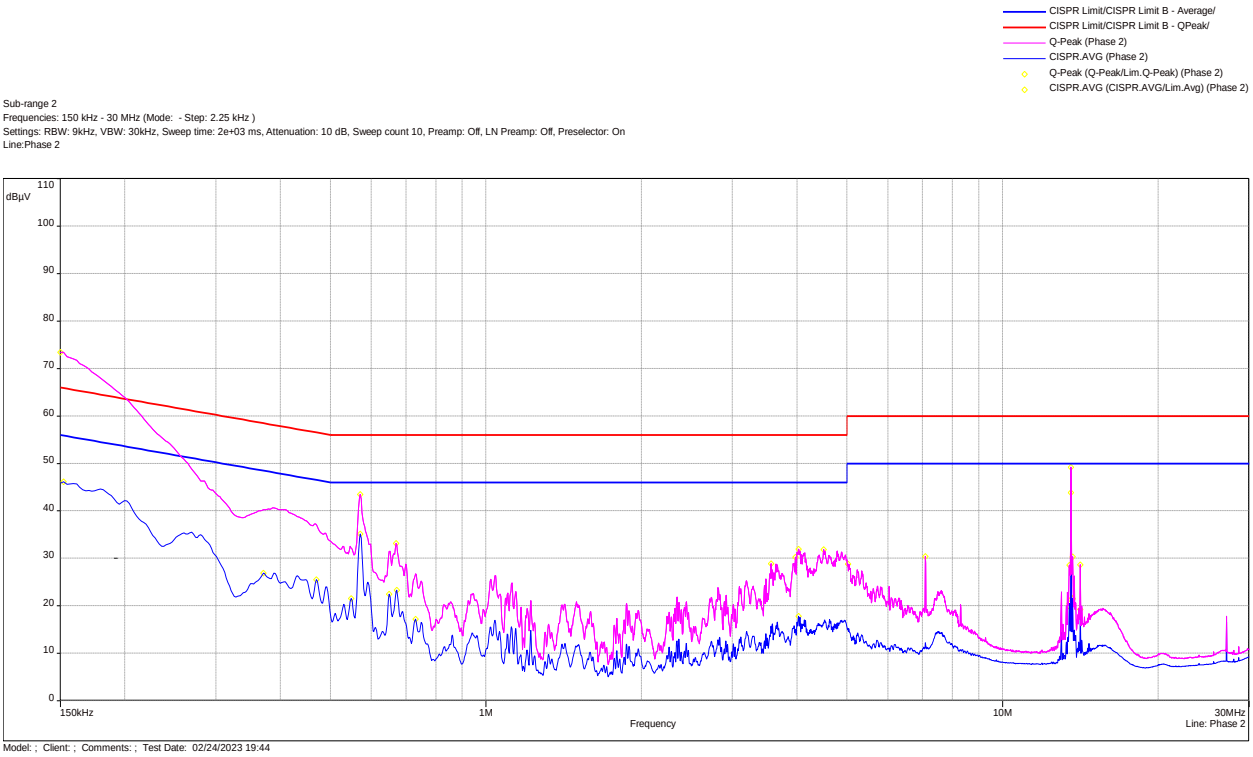
4.4.3 Test Result

Measured with RFID Antenna

Line 1



Line 2



4.4.3 Test Result (Continued)

Quasi-Peak Table					
Frequency (MHz)	Q.Peak (dBµV)	Limit (dBµV)	Margin (dB)	Comment	Correction (dB)
13.56	49.7	60	-10.3	Phase 1	11.14
13.56	49.23	60	-10.77	Phase 2	11.17
0.57075	43.47	56	-12.53	Phase 2	10.81
0.57075	43.39	56	-12.61	Phase 1	10.81
0.4695	35.12	56.52	-21.4	Phase 1	10.83
0.672	33.23	56	-22.77	Phase 1	10.81
0.66975	33.13	56	-22.87	Phase 2	10.81
4.0245	31.93	56	-24.07	Phase 2	10.96
4.50375	31.83	56	-24.17	Phase 2	10.99
4.79625	31.35	56	-24.65	Phase 1	10.99
4.029	30.87	56	-25.13	Phase 1	10.95
3.97275	30.26	56	-25.74	Phase 2	10.96
4.1505	29.83	56	-26.17	Phase 1	10.96
3.97725	29.25	56	-26.75	Phase 1	10.95
3.56325	28.86	56	-27.14	Phase 2	10.94
13.65675	30.67	60	-29.33	Phase 1	11.15
7.08675	30.43	60	-29.57	Phase 2	11.05
13.66125	30.32	60	-29.68	Phase 2	11.18
7.08225	30.1	60	-29.9	Phase 1	11.04
13.4655	29.01	60	-30.99	Phase 1	11.14
5.019	28.82	60	-31.18	Phase 2	11.01
14.1315	28.67	60	-31.33	Phase 2	11.18
13.461	28.61	60	-31.39	Phase 2	11.17

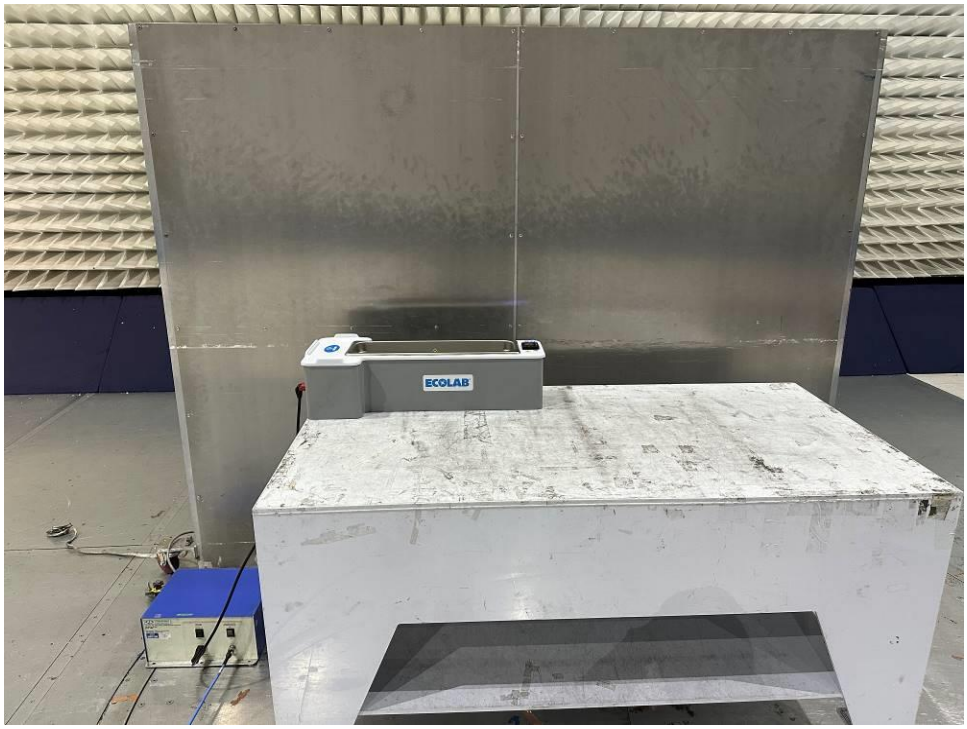
4.4.3 Test Result (Continued)

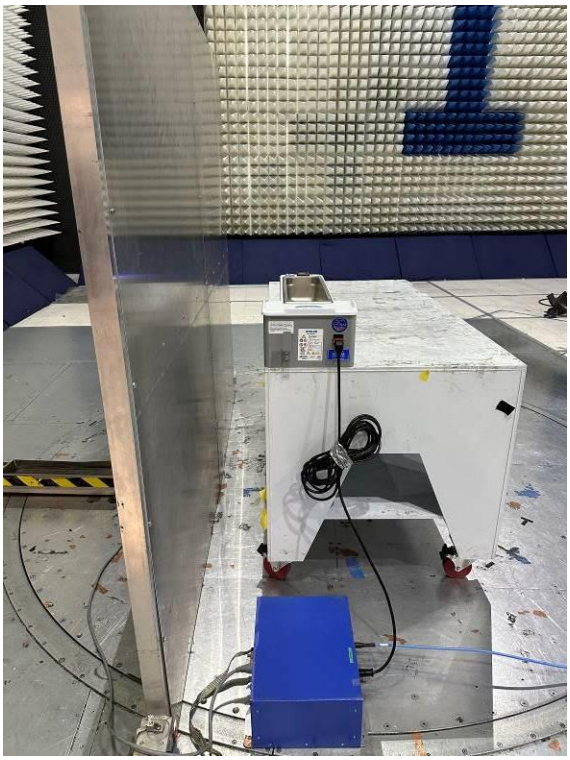
Average Table					
Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Comment	Correction (dB)
13.56	45.51	50	-4.49	Phase 1	11.14
13.56	43.85	50	-6.15	Phase 2	11.17
0.16125	46.39	55.4	-9.01	Phase 1	11.22
0.15225	46.17	55.88	-9.7	Phase 2	11.24
0.57075	35.18	46	-10.82	Phase 2	10.81
0.57075	34.97	46	-11.03	Phase 1	10.81
0.4695	25.53	46.52	-20.99	Phase 2	10.83
0.4695	25.3	46.52	-21.22	Phase 1	10.83
0.3885	26.78	48.1	-21.31	Phase 1	10.84
0.3705	26.89	48.49	-21.6	Phase 2	10.86
0.672	23.31	46	-22.69	Phase 2	10.81
0.672	23.19	46	-22.81	Phase 1	10.81
0.65175	22.43	46	-23.57	Phase 1	10.81
0.6495	22.43	46	-23.57	Phase 2	10.81
0.54825	21.55	46	-24.45	Phase 2	10.82
4.02675	17.8	46	-28.2	Phase 2	10.96
13.641	21.63	50	-28.37	Phase 2	11.18
13.641	21.5	50	-28.5	Phase 1	11.15
13.66125	21.45	50	-28.55	Phase 2	11.18
0.7305	17.18	46	-28.82	Phase 2	10.8
13.66125	21.12	50	-28.88	Phase 1	11.15
0.7305	17	46	-29	Phase 1	10.8

Note: The low frequency emission at 150kHz – 200kHz is determined to be from unintentional emission which the product meets class A requirement.

4.4.4 Test Configuration Photographs

The following photographs show the testing configurations used.





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 Interval	Cal Due
EMI Test Receiver	Rohde & Schwarz	ESR7	ITS 01607	12	11/17/2023
30-1000MHz Bi-log Antenna	Teseq	CBL 6111D	ITS 01650	12	10/27/2023
9kHz-1GHzPre-Amplifier	Sonoma Instruments	310N	ITS 00415	12	05/03/2023
150kHz to 30MHz LISN	COM-POWER	LIN-115A	ITS 01284	12	07/18/2023
Spectrum Analyzer	Rohde & Schwarz	FSU	ITS 00913	12	05/23/2023
Loop Sensor	Solar Electronics	7334-1	ITS 001608	12	05/17/2023
9kHz-30MHz Loop Antenna (Passive)	ETS Lindgren	6512	ITS 01573	12	11/21/2023
10kHz-40GHz RF CABLE 1 METER	MEGA PHASE	TM40-K1K1-59	ITS 01157	12	07/21/2023
Environmental Test Chamber	Thermotron	F-158-CHM-15-15	ITS 01027	12	07/21/2023

Verified before use

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewer Initials	Date	Change
1.0 / G105352296	GGR	ML	April 17, 2023	Original document

END OF REPORT