

DETNET SOUTH AFRICA (PTY) LTD TEST REPORT

SCOPE OF WORK

EMC TESTING – CyberDet1 Radio

REPORT NUMBER

105683078MPK-001

ISSUE DATE

September 12th, 2024

REVISED DATE

N/A

PAGES

28

DOCUMENT CONTROL NUMBER

Non-Specific EMC Report Shell Rev. December 2017 MPK
© 2017 INTERTEK



TEST REPORT (FULL COMPLIANCE)

Report Number: 105683078MPK-001

Project Number: G105683078

Report Issue Date: September 12, 2024

Product Designation: CyberDet1 Radio

Standards: FCC 47CFR PT 15 SPT B

Class A

for

DETNET South Africa (PTY) LTD

Test Performed by:

Intertek
1365 Adams Court
Menlo Park, CA 94025 USA

Test Authorized by:

DETNET South Africa (PTY) LTD
Block 1B, Founder Hill Office Park
Modderfontein, 1645
Johannesburg
1645 South Africa

Report prepared by



Harshith Devaraja / EMC Engineer

Report reviewed by



Aaron Chang / EMC Team Leader

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

TABLE OF CONTENTS

1. Introduction and Conclusion	4
2. Executive Test Plan and Test Summary	4
3. Client Information, Environmental Conditions, Performance Level	6
4. Description of Equipment Under Test and Variant Models	6
5. System Setup and Method	8
6. Radiated Emissions (ANSI C63.4).....	11
7. Conducted Emissions (ANSI C63.4)	17
8. List of Test Equipment.....	24
9. Revision History	25

1. Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

2. Executive Test Plan and Test Summary

Tests were performed to the following standards per FCC Part 15 Subpart B.

Radiated Emissions

ANSI C63.4: 2014, Class A

AC Mains Conducted Emissions

ANSI C63.4: 2014, Class A

Test Plan

The EUT shall be tested according to the table below:

FCC Part 15 Subpart B Emissions Test Requirements Proposed Tests			
Basic Standard	Test Specifications	Applicable Ports	Test Mode and Configuration
ANSI C63.4	Radiated Emission	-	120Vac 60Hz
ANSI C63.4	Conducted Emission	-	120Vac 60Hz

EXECUTIVE SUMMARY

FCC Part 15 Subpart B Emissions Test Requirements Summary of Test Results			
Basic Standard	Test Specifications	Applicable Ports	Pass/Fail Comments
ANSI C63.4	Radiated Emission	-	Complies
ANSI C63.4	Conducted Emission	-	Complies

3. Client Information, Environmental Conditions, Performance Level**This EUT was tested at the request of:**

Client: DETNET SOUTH AFRICA (PTY) LTD
 Block 1B, Founder Hill Office Park
 Modderfontein, 1645 Johannesburg, South Africa

Contact: Steve Bedford
Telephone: 011 657 7609
Email: bedfords@detnet.com

4. Description of Equipment Under Test and Variant Models

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Control Equipment	Detnet	30030-02461	Q3597

Receive Date:	02/27/2024	Test Started:	02/28/2024
Received Condition:	Good	Test Completed:	02/28/2024
Type:	Production		

Description of Equipment Under Test (provided by client)
Control equipment to communicate with underground detonators.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Power	Rated Frequency	Number of Phases
Control Equipment			
44 – 59 VDC	2.5 kVA	N/A	N/A
Battery pack			
59 VDC	2.5 kVA	N/A	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	The EUT transmits an RF signal to underground detonators to give them a delay and signal to fire.

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	The test software sent periodic RF transmissions.

Variant Models:

The following variant models were not tested as part of this evaluation but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

Not Applicable.

5. System Setup and Method

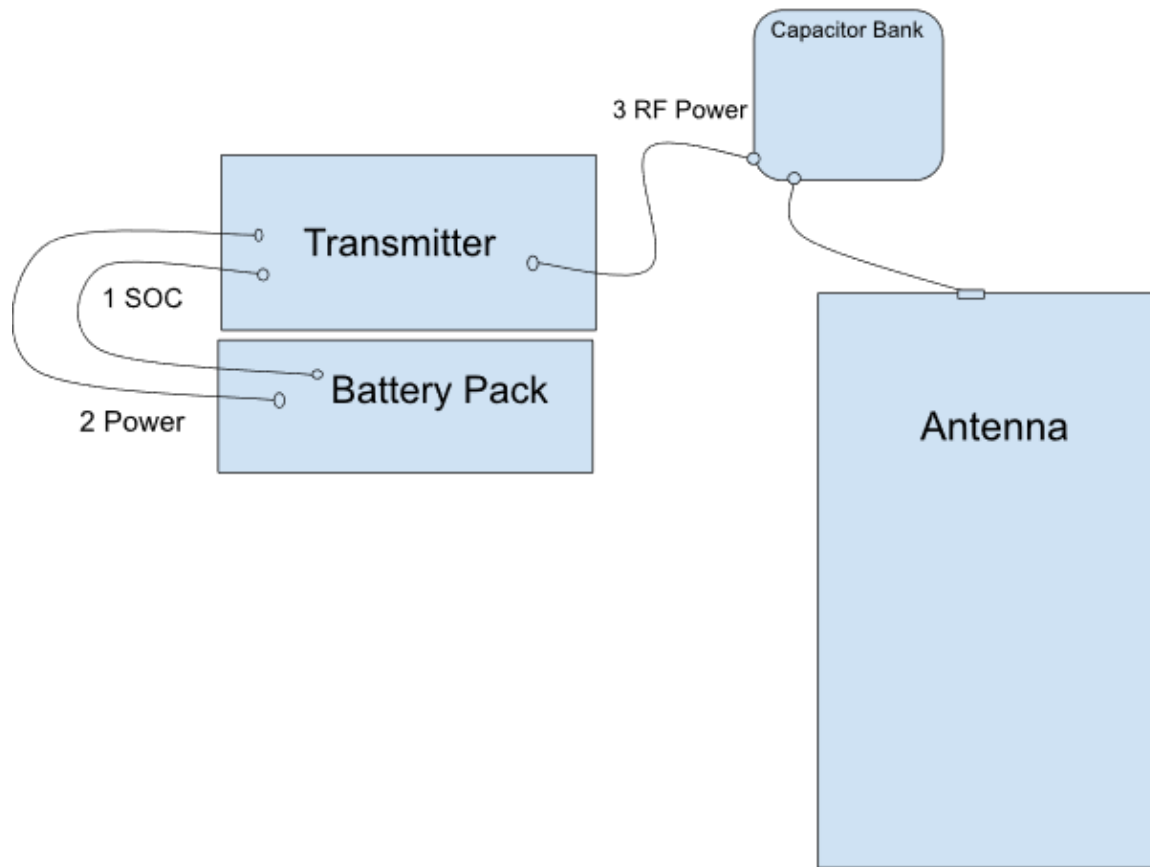
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	State of Charge	0.5.	Yes	No	Circular Metal
2	Power	0.5	Yes	No	Circular Metal
3	RF Power	10m	Yes	Yes	Circular Metal

Support Equipment				
ID	Description	Manufacturer	Model Number	Serial Number
A	Battery pack	Detnet	US3000C	K220002C32270095
B	Capacitor Bank	Unknown	Unknown	Unknown
C	Antenna	Unknown	Unknown	Unknown

5.1 Method

Configuration as required by ANSI C63.4.

5.2 EUT Block Diagram



5.3 Justification

The highest clock frequency used is 16MHz, hence the radiated emissions were performed up to 1GHz for FCC15 Subpart B.

5.4 Modifications Required for Compliance

No modifications were installed by Intertek to achieve compliance.

5.5 EUT Performance Criteria and Monitoring

Not applicable.

6. Radiated Emissions (ANSI C63.4)

6.1 Method

Tests are performed in accordance with ANSI C63.4.

TEST SITE: 10 m ALSE

10 m 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 C63.4:2014. 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.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	U _{CISPR}
Radiated Emissions, 10m	30-200 MHz	4.7 dB	6.3 dB
Radiated Emissions, 10m	200-1000 MHz	4.6 dB	6.3 dB

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 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation:

The field strength is calculated by adding the Antenna Factor and Cable Factor, then subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

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

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

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

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

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

$$UF = 10^{(NF/20)}$$

Where: UF = Net Reading in μ V
NF = Net Reading in dB μ V

Example:

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

6.2 Test Equipment Used

See Section 8.0 for specific equipment used for this test.

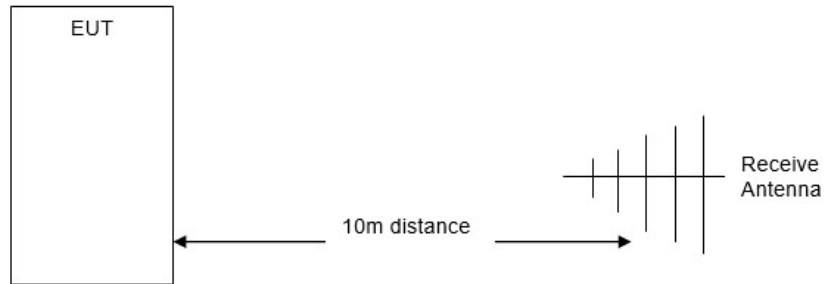
Software Utilized:

Name	Manufacturer	Version
BAT-EMC	NEXIO	3.20.0.23

6.3 Result

The sample tested was found to **comply**.

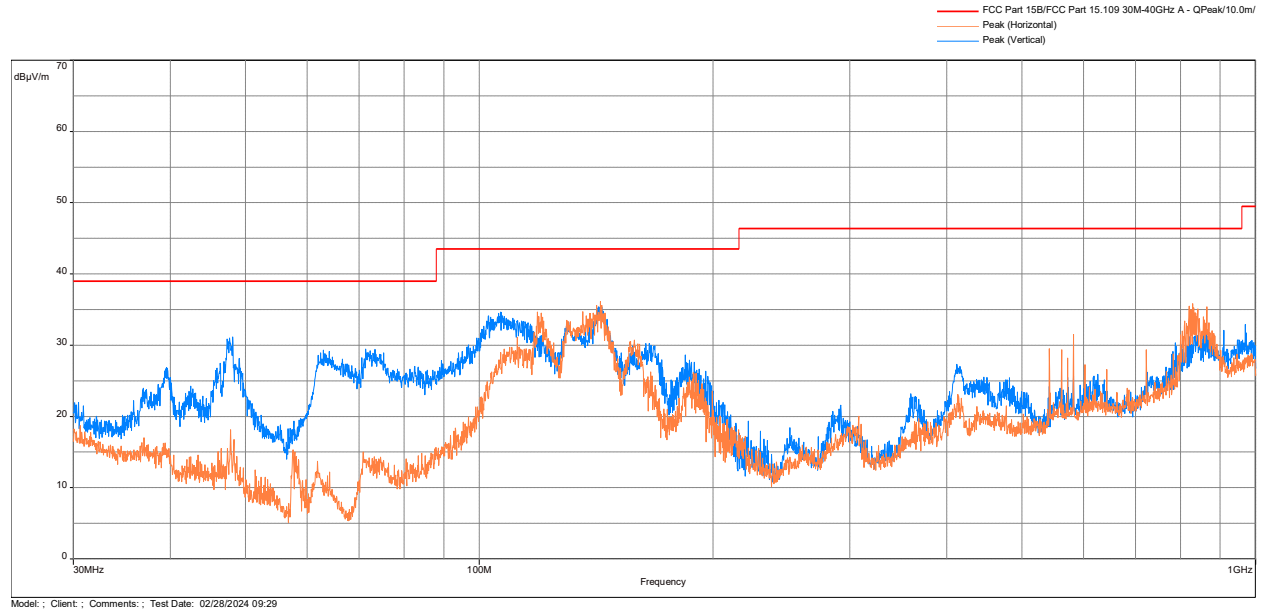
6.4 Test Setup Diagram



6.5 Plot/Data

The EUT met the radiated disturbance requirements of FCC Part 15 Subpart B for a class A Device.

FCC Part 15 Subpart B Radiated Disturbance 30 – 1000 MHz



Frequency (MHz)	QP (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
47.632	29.43	39	-9.57	1	54.75	Vertical	-17.75
106.523	31.66	43.5	-11.84	1.08	237	Vertical	-16.29
71.698	26.97	39	-12.03	1.88	52	Vertical	-20.61
118.927	30.60	43.5	-12.90	3.8	127.5	Horizontal	-15.25
143.348	29.93	43.5	-13.57	3.91	94.75	Horizontal	-15.28
135.901	29.80	43.5	-13.70	4	105.25	Horizontal	-15.04

Result:	Complies by 9.57 dB
----------------	----------------------------

Intertek

REPORT NUMBER: 105683078MPK-001

Issued: September 12, 2024

Test Personnel:	<u>Amar Kacel</u>	Test Date:	<u>02/28/2024</u>
Supervising/ Reviewing Engineer: (Where Applicable)	<u></u>	Limit Applied:	<u>Class A</u>
Product Standard:	<u>FCC Part 15 Subpart B,</u>		
Input Voltage:	<u>120Vac 60Hz</u>		
Pretest Verification w/ Ambient Signals or BB Source:	<u>BB Source</u>	Ambient Temperature:	<u>24 °C</u>
		Relative Humidity:	<u>50 %</u>
		Atmospheric Pressure:	<u>30 in Hg</u>

Deviations, Additions, or Exclusions: None

7. Conducted Emissions (ANSI C63.4)

7.1 Method

Tests are performed in accordance with ANSI C63.4.

TEST SITE: 10 m ALSE

10 m 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 C63.4:2014.

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

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	U _{CISPR}
AC Line Conducted Emissions	150 kHz – 30 MHz	2.1 dB	3.4 dB

As shown in the table above our conducted 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 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation:

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where:

- NF = Net Reading in dB μ V
- RF = Reading from receiver in dB μ V
- LF = LISN or ISN Correction Factor in dB
- CF = Cable Correction Factor in dB
- AF = Attenuator Loss Factor in dB

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

$$UF = 10^{(NF/20)}$$

Where:

- UF = Net Reading in μ V
- NF = Net Reading in dB μ V

Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$
$$UF = 10^{(49.1 \text{ dB}\mu\text{V}/20)} = 285.1 \text{ }\mu\text{V/m}$$

7.2 Test Equipment Used

See Section 8.0 for specific equipment used for this test.

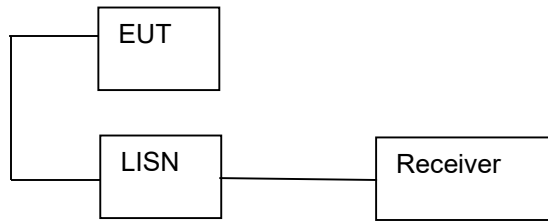
Software Utilized:

Name	Manufacturer	Version
BAT-EMC	NEXIO	3.20.0.23

7.3 Result

The sample tested was found to **comply**.

7.4 Test Setup Diagram

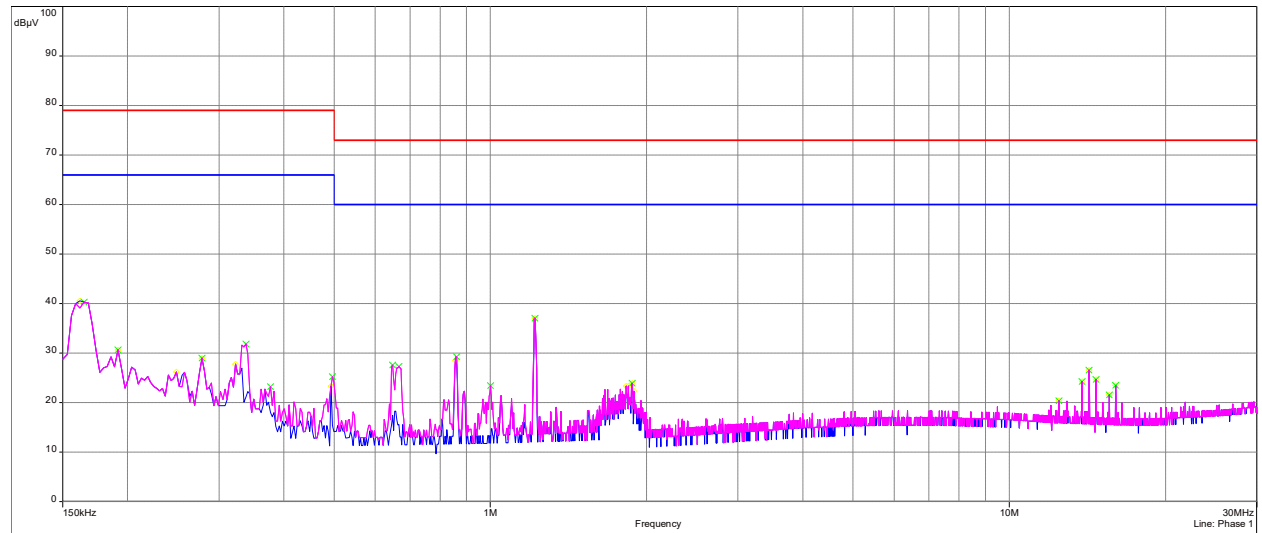


7.5 Plot/Data

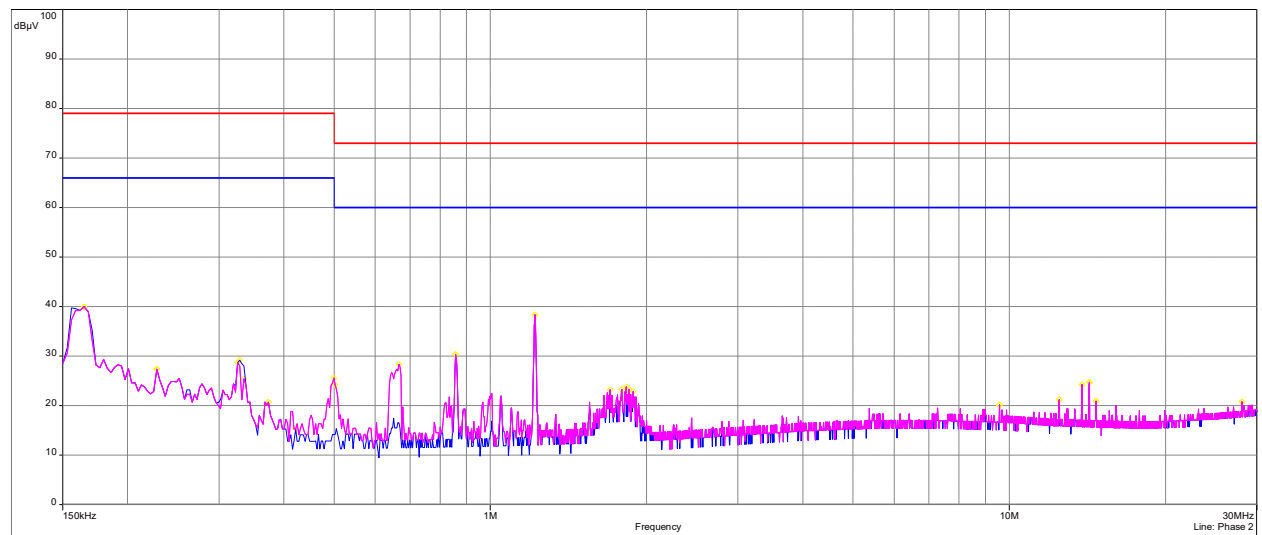
The EUT met the conducted disturbance requirements for FCC Part 15 Subpart B for a Class A Device.

FCC Part 15 Subpart B Conducted Disturbance @ 120 Vac 60 Hz

Sub-range 1
Frequencies: 150 kHz - 30 MHz (Analyser mode) 10001 Points
Settings: RBW: 9kHz, VBW: 30kHz, Sweep time: 2e+03 ms, Attenuation: 10 dB, Sweep count 10, Preamp: Off, LN Preamp: Off, Preset: On
Line: Phase 1



Sub-range 2
Frequencies: 150 kHz - 30 MHz (Analyser mode) 10001 Points
Settings: RBW: 9kHz, VBW: 30kHz, Sweep time: 2e+03 ms, Attenuation: 10 dB, Sweep count 10, Preamp: Off, LN Preamp: Off, Preset: On
Line: Phase 2



Q-Peak/Lim.Q-Peak (36)					
Frequency (MHz)	Q-Peak (dBμV)	Lim.Q-Peak (dBμV)	Q-Peak-Lim.Q-Peak (dB)	Line	Correction (dB)
1.219	38.31	73	-34.69	Phase 2	10.62
1.219	37.04	73	-35.96	Phase 1	10.62
0.165	40.28	79	-38.72	Phase 1	10.55
0.165	39.95	79	-39.05	Phase 2	10.55
0.857	30.33	73	-42.67	Phase 2	10.6
0.860	29.26	73	-43.74	Phase 1	10.6
0.666	28.35	73	-44.65	Phase 2	10.59
0.648	27.55	73	-45.45	Phase 1	10.59
0.666	27.3	73	-45.7	Phase 1	10.59
14.254	26.55	73	-46.45	Phase 1	10.96
0.338	31.79	79	-47.21	Phase 1	10.56
14.257	24.72	73	-48.28	Phase 2	10.96
14.696	24.66	73	-48.34	Phase 1	10.97
0.192	30.62	79	-48.38	Phase 1	10.55
13.806	24.25	73	-48.75	Phase 1	10.95
13.812	24.25	73	-48.75	Phase 2	10.95
0.502	24.14	73	-48.86	Phase 2	10.58
1.875	23.88	73	-49.12	Phase 1	10.65
1.828	23.83	73	-49.17	Phase 2	10.65
16.033	23.48	73	-49.52	Phase 1	10.99
1.001	23.38	73	-49.62	Phase 1	10.6
1.851	23.35	73	-49.65	Phase 2	10.65
0.278	28.97	79	-50.03	Phase 1	10.56
0.326	28.72	79	-50.28	Phase 2	10.56
15.585	21.57	73	-51.43	Phase 1	10.98
0.228	27.38	79	-51.62	Phase 2	10.55
12.475	21.17	73	-51.83	Phase 2	10.93
14.702	20.88	73	-52.12	Phase 2	10.97
28.069	20.8	73	-52.2	Phase 2	11.14
12.469	20.34	73	-52.66	Phase 1	10.93
9.580	20.15	73	-52.85	Phase 2	10.88
0.499	25.59	79	-53.41	Phase 2	10.58
0.335	25.43	79	-53.57	Phase 2	10.56
0.496	25.25	79	-53.75	Phase 1	10.58
0.377	23.2	79	-55.8	Phase 1	10.57
0.374	20.7	79	-58.3	Phase 2	10.57

CISPR.AVG/Lim.Avg (35)					
Frequency (MHz)	CISPR.AVG (dBμV)	Lim.Avg (dBμV)	CISPR.AVG-Lim.Avg (dB)	Line	Correction (dB)
1.21863	38.31	60	-21.69	Phase 2	10.62
1.21863	37.04	60	-22.96	Phase 1	10.62
0.16194	40.57	66	-25.43	Phase 1	10.55
0.164925	39.95	66	-26.05	Phase 2	10.55
0.857445	30.33	60	-29.67	Phase 2	10.6
0.857445	28.55	60	-31.45	Phase 1	10.6
14.25413	26.55	60	-33.45	Phase 1	10.96
14.25711	24.72	60	-35.28	Phase 2	10.96
14.69591	24.66	60	-35.34	Phase 1	10.97
0.19179	30.62	66	-35.38	Phase 1	10.55
13.80638	24.25	60	-35.75	Phase 1	10.95
13.81235	24.25	60	-35.75	Phase 2	10.95
1.87533	23.88	60	-36.12	Phase 1	10.65
16.03319	23.48	60	-36.52	Phase 1	10.99
1.84548	23.35	60	-36.65	Phase 1	10.65
1.82757	23.33	60	-36.67	Phase 1	10.65
1.79175	23.29	60	-36.71	Phase 2	10.65
1.7022	23.19	60	-36.81	Phase 2	10.64
0.3291	29.17	66	-36.83	Phase 2	10.56
0.278355	28.97	66	-37.03	Phase 1	10.56
1.884285	22.86	60	-37.14	Phase 2	10.65
1.818615	22.79	60	-37.21	Phase 2	10.65
1.890255	22.31	60	-37.69	Phase 1	10.65
0.32313	27.75	66	-38.25	Phase 1	10.56
15.58544	21.57	60	-38.43	Phase 1	10.98
0.22761	27.38	66	-38.62	Phase 2	10.55
12.47507	21.17	60	-38.83	Phase 2	10.93
14.70188	20.88	60	-39.12	Phase 2	10.97
28.06871	20.8	60	-39.2	Phase 2	11.14
12.4691	20.34	60	-39.66	Phase 1	10.93
0.248505	26.17	66	-39.83	Phase 1	10.55
9.579615	20.15	60	-39.85	Phase 2	10.88
0.493275	23.31	66	-42.69	Phase 1	10.58
0.373875	20.7	66	-45.3	Phase 2	10.57
0.421635	15.28	66	-50.72	Phase 2	10.57

Result:	Complies by 21.69 dB
----------------	-----------------------------

Test Personnel:	<u>Amar Kacel</u>	Test Date:	<u>02/28/2024</u>
Supervising/ Reviewing Engineer: (Where Applicable)	<u></u>	Limit Applied:	<u>Class A</u>
Product Standard:	<u>FCC Part 15 Subpart B,</u>		
Input Voltage:	<u>120Vac 60Hz</u>		
Pretest Verification w/ Ambient Signals or BB Source:	<u>BB Source</u>	Ambient Temperature:	<u>24 °C</u>
		Relative Humidity:	<u>50 %</u>
		Atmospheric Pressure:	<u>30 in Hg</u>

Deviations, Additions, or Exclusions: None

8. List of Test Equipment

Emissions Test Equipment List

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
EMI Receiver	Rohde and Schwarz	ESR7	ITS 01607	12	10/18/2024
Pre-amp	Sonoma	310N	ITS 00415	12	05/23/2025
30MHz-2GHz Bi-Log Antenna	SunAR RF Motion	JB1	ITS 01577	12	02/28/2025
150kHz to 30MHz LISN	COM-POWER	LIN-115A	ITS 01285	12	07/26/2025
10 Meter Chamber	Radio Frequency Shielded System	Panashield	ITS 00984	12	09/22/2026

9. Revision History

Revision Level	Date	Report Number	Prepared by	Reviewed by	Notes
1	09/12/2024	105683078MPK-001	HD	AC	Original Issue

END OF REPORT