

Test Report

Prepared for: Rivian Automotive, LLC.

Model: PT00590065-D
Serial Number: 000151

FCC ID: 2AW3A-2WWG23CC

Project No: p2410006

Test Results: Pass

To

FCC 1.1310 and KDB 680106 D01 v04

Date of Issue: February 9, 2024

On the behalf of the applicant:

Rivian Automotive, LLC.
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Attention of:

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FCC Site Reg. #US2901
ISED Site Reg. #2044A-2

Reviewed / Authorized By:



Jeremiah Darden, Principal Engineer

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Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments	Test Date
FCC				
FCC 1.1310 and KDB 680106 Section 3	MPE RF Exposure Evaluation below 4MHz	Pass	None	February 8, 2024

Statements of conformity are reported as:

- Pass - the measured value is below the acceptance limit, *acceptance limit = test limit*.
- Fail - the measured value is above the acceptance limit, *acceptance limit = test limit*.

References/Methods	Description
680106 D01 RF Exposure Wireless Charging App v04	RF EXPOSURE CONSIDERATIONS FOR LOW POWER CONSUMER WIRELESS POWER TRANSFER APPLICATIONS
ISO/IEC 17025:2017	General requirements for the Competence of Testing and Calibrations Laboratories

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	February 9, 2024	Jeremiah Darden	Original Document

EUT Description

Model:	PT00590065-D
Serial:	000151
Firmware:	Version 42
Software:	SW:23.41.01/00/04.37
Description:	<p>EUT dock receives commands over the CAN bus, relating to NFC tag detection, and enabling Wireless Power Charging. DUT is powered by LV nominal 13.5VDC from Vehicle Battery</p> <p>Mobile use 20cm or greater</p>
Additional Information:	<p>Labeling Info: FCC ID: 2AW3A-2WWG23CC</p> <p>Meets 680106 D01 RF Exposure Wireless Charging Apps v04 for Part 18 Intentional transfer by only using load modulation techniques as outlined by FCC. Power is less than 15Watts and client and source must be in direct contact with each other to initiate charging.</p> <p>Dock is designed for horizontal use within a vehicle to facilitate charging while a phone sits on the pad.</p> <p>Nominal wireless charging frequency range 120kHz-140kHz</p>
Receipt of Sample(s):	February 1, 2024
EUT Condition:	<p>Visual Damage No</p> <p>State of Development Production/Production Equivalent</p>

EUT PHOTO



Notifications

The applicant has been cautioned as to the following:

FCC KDB 680106 D01 Wireless Power Transfer v04 5 EQUIPMENT AUTHORIZATION GUIDANCE FOR PART 18 WPT DEVICES 5.1 General Considerations

This section provides authorization guidance for WPT devices authorized to operate under Part 18 of the rules. Devices certified under Part 15 shall follow the applicable procedures as for all other Part 15 devices.

Per § 18.203(a), Part 18 equipment authorization is permitted via Supplier's Declaration of Conformity (SDoC) or Certification. The policy set forth in this KDB Publication applies to both types of equipment authorization. For devices authorized under the SDoC, the responsible party must keep a copy of the test report(s) demonstrating compliance and provide it to the FCC upon request, per KDB 865664 D02. For devices authorized under grant of certification, the application shall always include an RF Exposure exhibit supporting compliance, per KDB 447498 requirement. In general, equipment authorization under Part 18 is contingent on obtaining FCC concurrence that the design features comply with applicable FCC requirements for both EMC and RF exposure. The FCC equipment authorization program recognizes that there are cases where additional information may be needed prior to grant or recognition of an authorization. This procedure is in place to ensure that present and novel WPT technologies satisfy all the applicable requirements of the FCC rules in most foreseeable operational conditions.

Regardless of whether the SDoC or certification process is used, no authorization will be considered valid unless FCC concurrence has been obtained (**unless the limited exception described in Section 5.2 applies**).

Manufacturers shall use the KDB Inquiry process to obtain FCC concurrence. This KDB inquiry shall be made by selecting "Equipment Compliance Review" (ECR) as the first category and "Wireless Power Transfer" as the second category. The following information is to be included in the ECR KDB Inquiry:

- WPT operating frequency (or frequencies).
- Conducted power for each radiating structure.
- § 2.1091-Mobile or § 2.1093-Portable demonstrated scenarios of operation, including RF exposure compliance information
- Maximum distance from the WPT transmitter at which, by design, a load can be charged (including slow-charging operations)

A limited exception to the ECR submittal requirement is provided in Section 5.2. This section applies to Part 18 devices that deliver energy to their design targets through non-conducted electromagnetic coupling (thus radiated and/or inductive EM fields) at a distance no greater than one meter, measured between the closest points between the transmitting and receiving structures, and that meet all six criteria listed therein.

Section 5.3 provides guidance for Part 18 devices that deliver energy to their targets through non-conducted electromagnetic coupling at distances greater than one meter.

Test and Measurement Data

All tests and measurement data shown were performed in accordance with FCC Rule Parts: FCC 1.1310 for 2.1091 Mobile equipment.

Name of Test	FCC Section	Method Deviations/Additions
MPE RF Exposure Evaluation below 4MHz	FCC KDB 680106 D01 Wireless Power Transfer v04 Section 3.2 and FCC 1.1310	No

Standard Engineering Practices

Unless otherwise indicated, the procedures contained in the above sections were observed during testing, where applicable.

Measurement results, unless otherwise noted, are worst case measurement.

Unless otherwise indicated in the specific measurement results, the ambient temperature was maintained within the range of 10° to 40°C (50° to 104°F) and the relative humidity levels were in the range of 10% to 90%.

Environmental Conditions		
Temperature (°C)	Humidity (%)	Barometric Pressure (mbar)
22.95	35.9	967.0

Test Setup and Modes of Operation

EUT Operation during Tests

The EUT was powered by a DC vehicle/car battery and operating in a wireless charging mode. Two iPhones were placed on the EUT (one on each side). Prior to taking final results, the different coil combinations were evaluated by moving the phones to different coil zones and checking for the highest emissions at the charging frequency. Coil combinations were monitored using the manufacturers performance monitoring software running on an external laptop and connected to the EUT. Once the worse case coil positions were determined, this external laptop was disconnected from the system as to not impact the results. CAN Bus and digital functionality were still operating during testing and applicable ports were populated. The iPhone were always kept between 1-50% during testing to make sure the EUT provided maximum power to both phones.

EUT:

Qty	Description	Manufacturer	Model	S/N
1	NFC/WPT/CAN Dock	Rivian Automotive, LLC.	PT00590065-D	000151

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Marine Battery (Nominal 12VDC)	Super Start	27D0MJ	I00724
1	WPT Load/Phone	Apple	iPhone MGH3LL/A (iOS 15.5)	F18DH1BA0DXW
1	WPT Load/Phone	Apple	iPhone MGH93LL/A (iOS 16.2)	DNQK97P0DXT

Cables:

Qty	Description	Length (M)	Ferrites (Y/N)	Shielding Y/N	Shielded Hood Y/N	Termination / Connection
1	DC Cable	2.6	N	N	N	EUT to Marine Battery
1	CAN Bus Cable	1.6	N	N	N	EUT to Resistor

Software/Firmware:

Name	Description	Version	Installation Info
WPT Version	EUT Software	SW:23.41.01/00/04.37	Installed on EUT

Modifications to EUT(s) (Y/N): N

RF Exposure Evaluation

Engineer: Jeremiah Darden

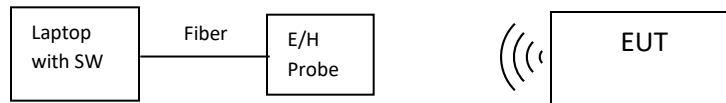
Test Date: February 9, 2024

Test Procedure

The EUT was tested using a calibrated 3axis Electric & Magnetic Field Analyzer (E/H probe) capable of measuring the EUT fundamental in the 120-140kHz range along with it's harmonics. It was placed within 20cm or less of the wireless charging pad in charging mode with a client. Multiple positions were taken and the worse case locations are reported within this report. Locations Evaluated (Top, Right, Left, Back, Front, Bottom).

Per KDB 680106, the methods and limits under Section 3 were applied which references FCC Part 1.1310 for wireless charging devices that operate between 100kHz-300kHz. All reported readings are max held peak readings and may be applied to any 6min or 30min averaging limits as worse case results. The EUT and Accessories in this report meet all six requirements within section 5.2 of the same KDB that allows exemption from FCC Equipment Compliance Review.

Basic Test Setup



Excerpt from FCC KDB 680106 D01 v04 Section 5.2 “Part 18 Wireless Power Transfer up to One-Meter Distance”

There might be situations where the WPT RF emissions are limited enough that even operations in a “crowded” environment, where many similar WPT devices are present, do not pose significant EMC and RF exposure concerns. In this scenario, and for devices operating within a one-meter distance from the receiver, as defined above, a manufacturer will not have to submit an “Equipment Compliance Review” KDB, and receive FCC concurrence before proceeding with equipment authorization. This exception to the requirement of submitting the ECR to obtain FCC concurrence only applies when all the following criteria (1) through (6) are met:

- (1) The power transfer frequency is below 1 MHz.*
- (2) The output power from each transmitting element (e.g., coil) is less than or equal to 15 watts.*
- (3) A client device providing the maximum permitted load is placed in physical contact with the transmitter (i.e., the surfaces of the transmitter and client device enclosures need to be in physical contact)*
- (4) Only § 2.1091-Mobile exposure conditions apply (i.e., this provision does not cover § 2.1093 Portable exposure conditions).*
- (5) The E-field and H-field strengths, at and beyond 20 cm surrounding the device surface, are demonstrated to be less than 50% of the applicable MPE limit, per KDB 447498, Table 1. These measurements shall be taken along the principal axes of the device, with one axis oriented along the direction of the estimated maximum field strength, and for three points per axis or until a 1/d (inverse distance from the emitter structure) field strength decay is observed. Symmetry considerations may be used for test reduction purposes. The device shall be operated in documented worst-case compliance scenarios (i.e., the ones that lead to the maximum field components), and while all the radiating structures (e.g., coils or antennas) that by design can simultaneously transmit are energized at their nominal maximum power.*
- (6) For systems with more than one radiating structure, the conditions specified in (5) must be met when the system is fully loaded (i.e., clients absorbing maximum power available), and with all the radiating structures operating at maximum power at the same time, as per design conditions. If the design allows one or more radiating structures to be powered at a higher level while other radiating structures are not powered, then those cases must be tested as well. For instance, a device may use three RF coils powered at 5 W, or one coil powered at 15 W: in this case, both scenarios shall be tested.*

FCC 2.1091-Mobile Exposure

This is a mobile device for Desktop applications per KDB 680106 used in Uncontrolled Exposure environment.

Limits Uncontrolled Exposure
47 CFR 1.1310
Table 1, (B)

Frequency Range*	Electric Field	Magnetic Field
0.3-1.34 MHz:	Limit [V/m] = 614 / Limit	Limit [A/m] = 1.63

*Per the FCC KDB 680106 D01 v04 Section 3.2 Equipment Authorization Procedures for Devices Operating at Frequencies Below 4 MHz, limits at 0.3MHz are extended down to 0.1 MHz. Limit is reduced by 50% for "Equipment compliance Review" exemption.

Equipment and Standard Reference

Test Frequency, kHz	120-140kHz
Radiated, E-Field (dBuV/m @300m)	11.85 dBuV/m (see report p2410006 Part 18)
Antenna Type	Coil
Limit (L)	See FCC 1.1310 Table 1 Uncontrolled

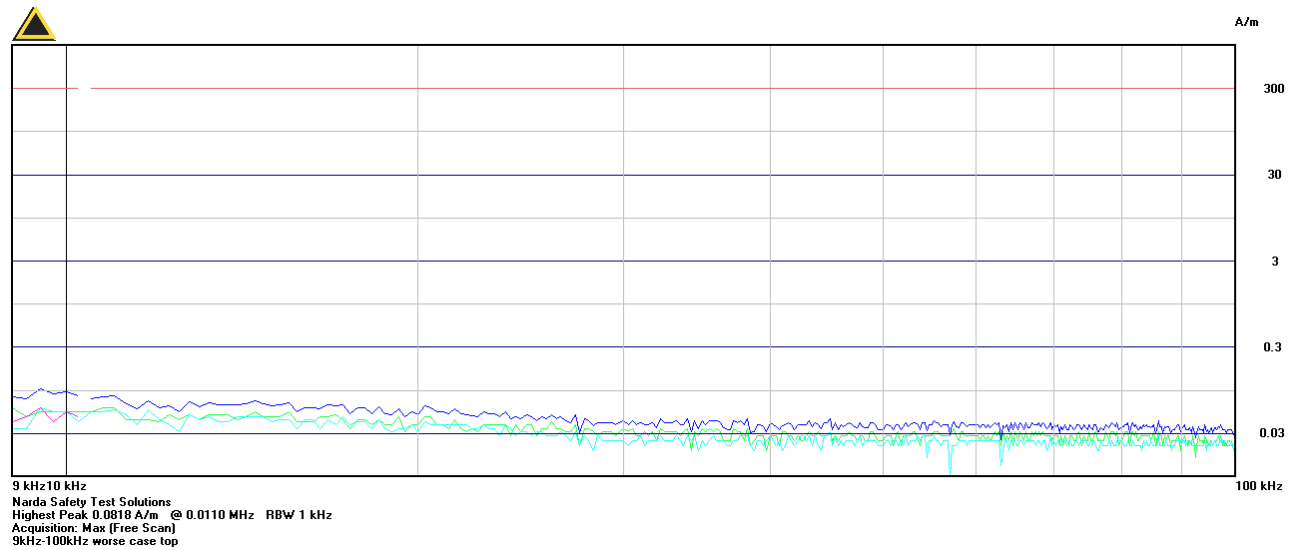
Test Data Summary

Magnetic Measured Value @ 20cm distance	Limit (L)	50% Limit (L)
0.56 A/m	1.63 A/m	.82 A/m

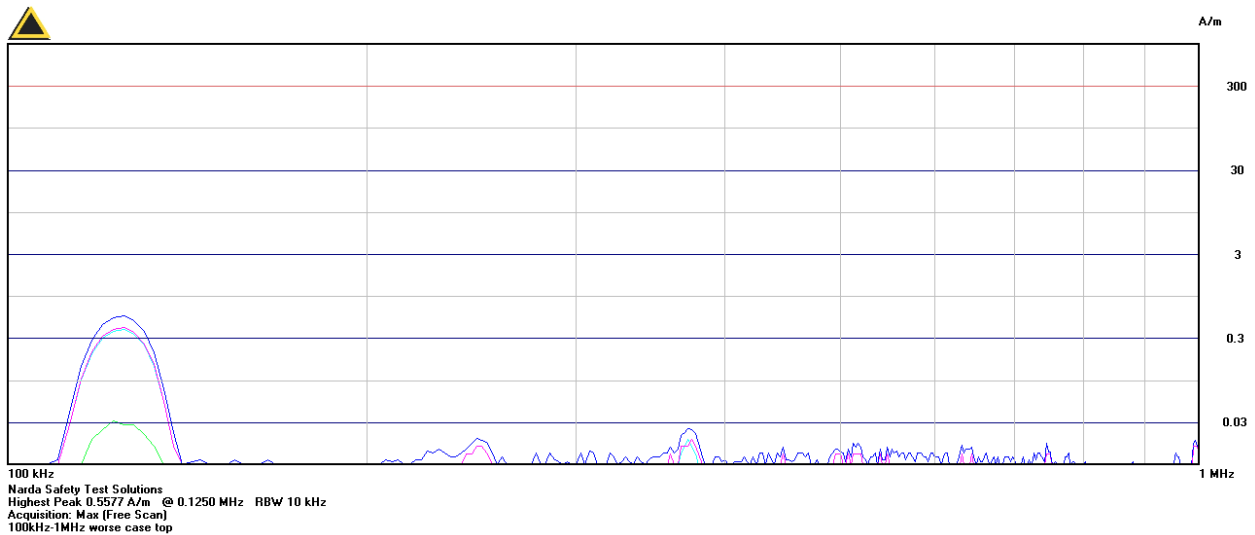
Electric Measured Value @ 20cm distance	Limit (L)	50% Limit (L)
0.84	614 V/m	307 V/m

Magnetic Emissions

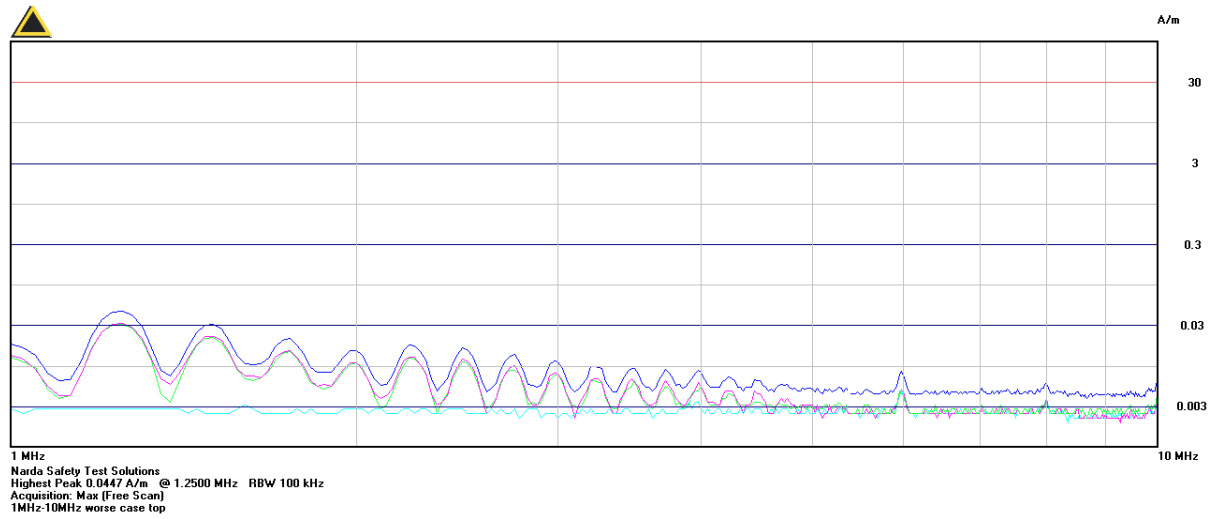
Wireless Charging-Charging Phones – Worse Case Location (9kHz-100kHz)



Wireless Charging-Charging Phones – Worse Case Location (100kHz – 1MHz)

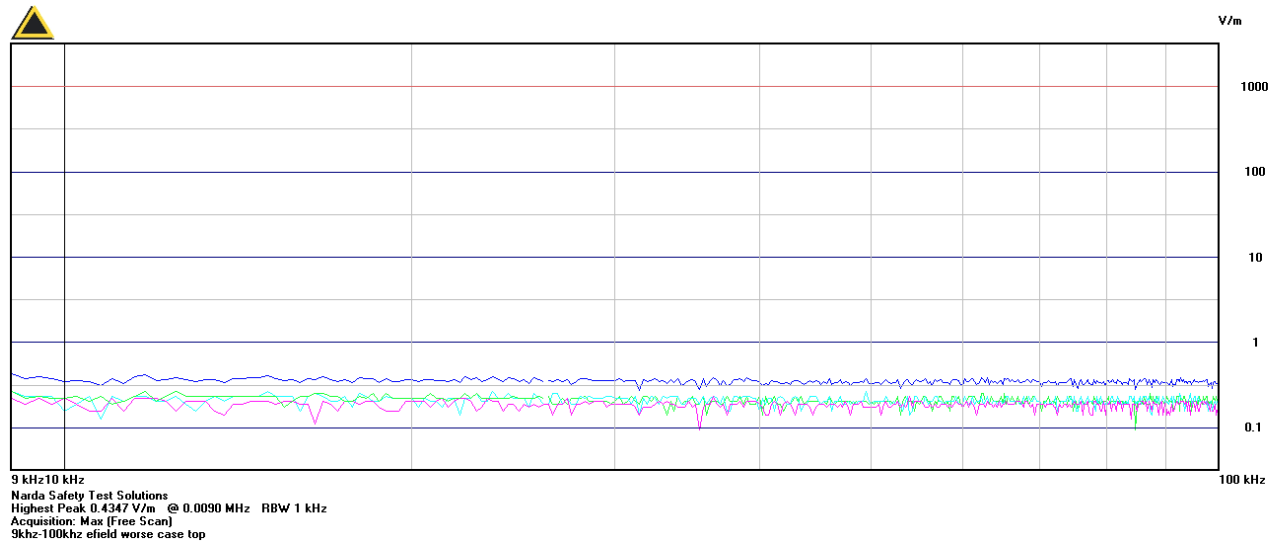


Wireless Charging-Charging Phones – Worse Case Location (1MHz-10MHz)

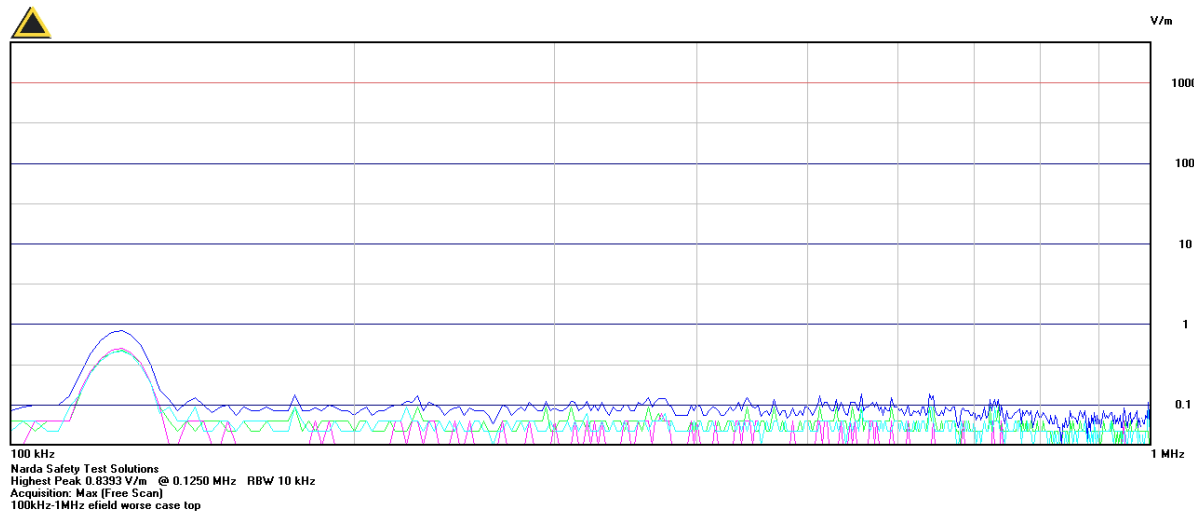


Electric Emissions

Wireless Charging-Charging Phones – Worse Case Location (9kHz – 100kHz)

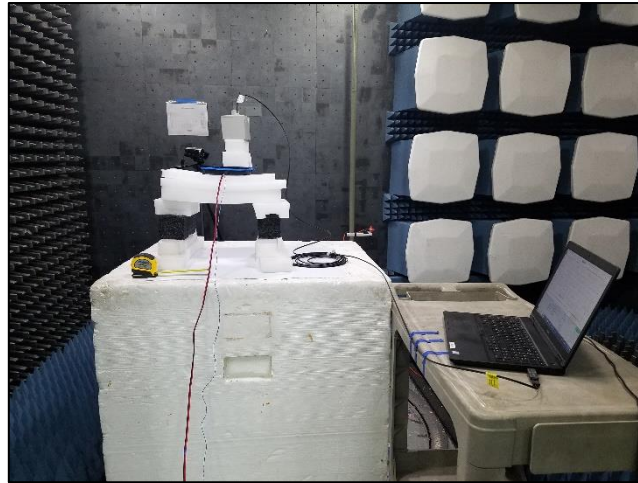


Wireless Charging-Charging Phones – Worse Case Location (100kHz-1MHz)

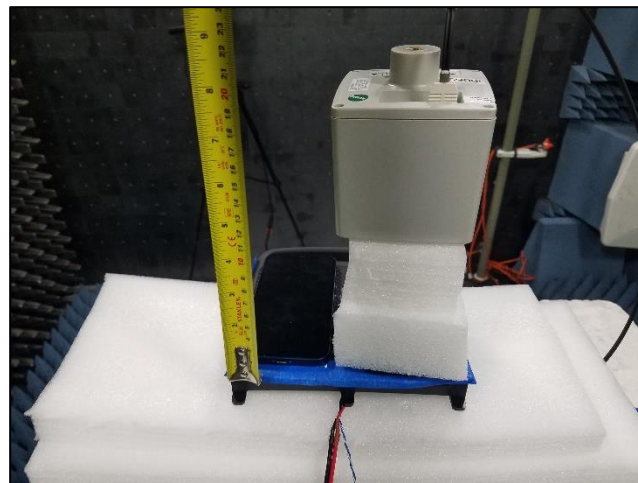


Electric/Magnetic RF Exposure Test Setup Photos

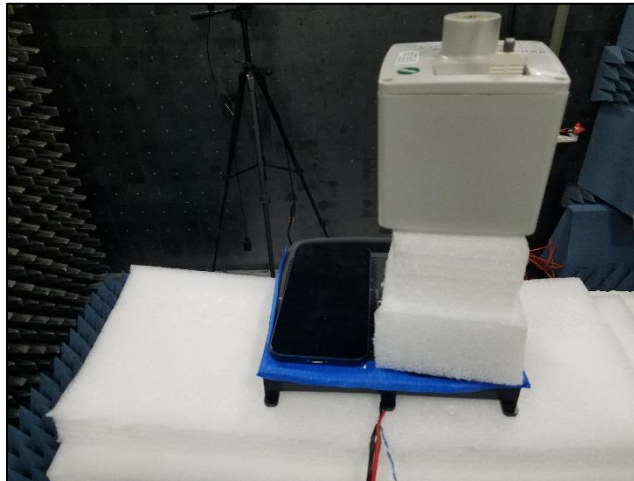
General Setup



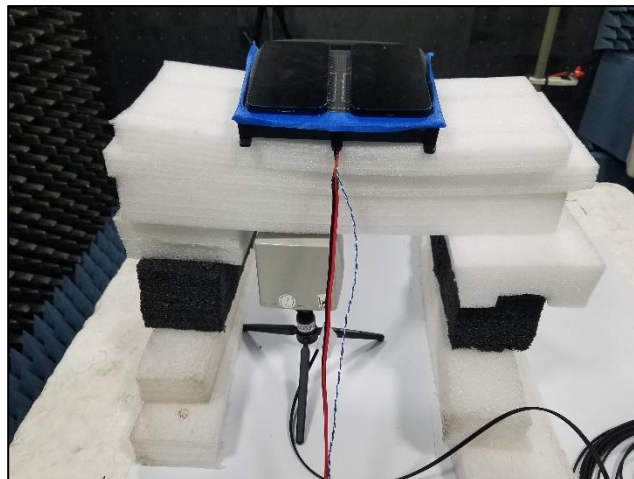
20cm Reference



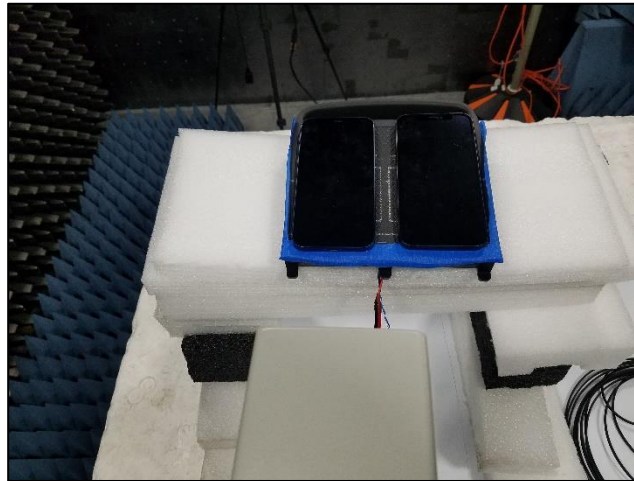
Charging (Top - worse case position)



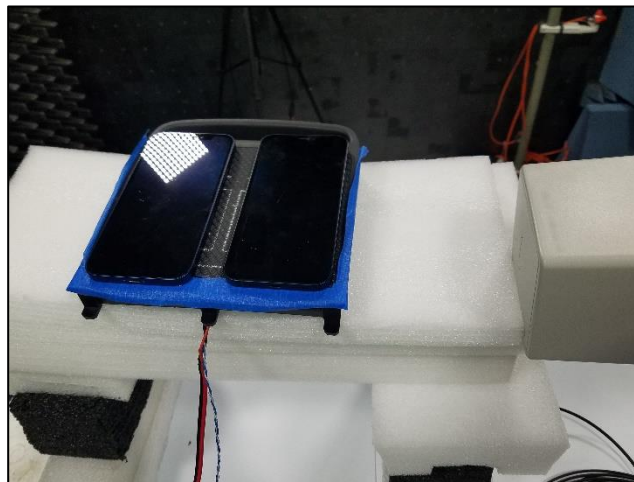
Charging (Bottom)



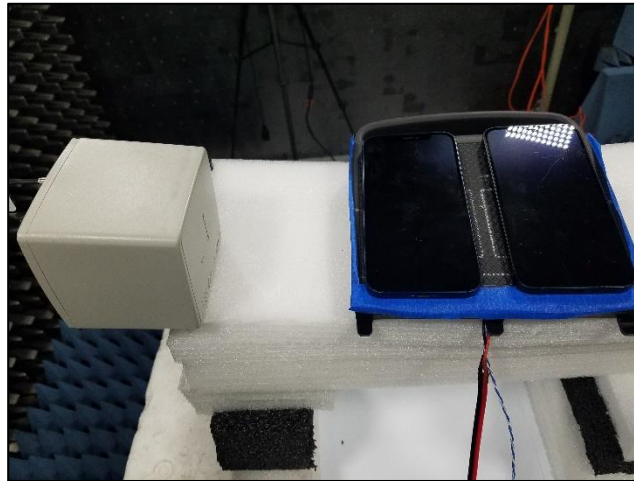
Charging (back)



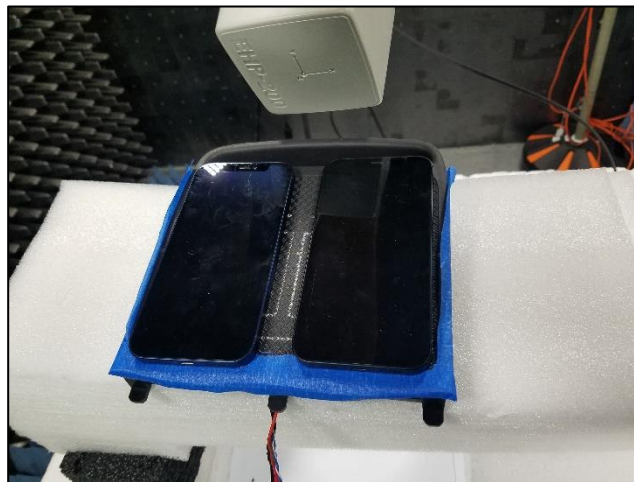
Charging (right)



Charging (left)



Charging (front)



Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
temperature/humidity/pressure probe	Omega Engineering, Inc.	iBTHX-W-5	i00630	02/14/23	02/14/24
temperature/humidity/pressure probe	Omega Engineering, Inc.	iBTHX-W-5	i00631	02/14/23	02/14/24
Multimeter	Fluke	179	i00488	06/19/23	06/19/24
E&H field analyzer, 9kHz-30MHz	Narda	EHP-200A	I00539	10/13/23	10/13/25

Measurement Uncertainty

Measurement Uncertainty for Compliance Testing is listed in the table below.

Measurement	U_{lab}
Radio Frequency	$\pm 3.3 \times 10^{-8}$
RF Power, conducted	± 1.5 dB
RF Power Density, conducted	± 1.0 dB
Conducted Emissions	± 1.8 dB
Radiated Emissions 9kHz-30MHz	± 3.6 dB
Radiated Emissions 30MHz-1000MHz	± 4.25 dB
Radiated Emissions – 1GHz-18GHz	± 4.5 dB
Temperature	± 1.5 deg C
Humidity	± 4.3 %
DC voltage	± 0.20 VDC
AC Voltage	± 1.2 VAC

The reported expanded uncertainty $\pm U_{lab}$ (dB) has been estimated at a 95% confidence level ($k=2$) U_{lab} is less than or equal to U_{EMC} therefore;

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit.
- Non-Compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

END OF TEST REPORT