TEST REPORT

CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Report No.: CTK-2022-01047

1. Client

◦ Name : Spigen Korea Co.,Ltd.

◦ Address : Spigen HQ-A, 446, Bongeunsa-ro, Gangnam-gu, Seoul, 06153, South Korea

◦ Date of Receipt : 2022-03-23

2. Manufacturer

◦ Name : WITS VINA CO.,LTD

◦ Address : Lot CN7, Diem Thuy Ip (A area), Hong Tien Commune, Pho Yen Town, Thai Nguyen, Province, Vietnam, 24709

3. Use of Report : For FCC & ISED Certification

4. Test Sample / Model: ArcField Wireless Charger / PF2102

5. Date of Test : 2022-03-31

6. Test Standard(method) used : FCC 47 CFR part 1 subpart I 1.1307
RSS-102 Issue 5 (2015-03)
SPR-002 Issue 1 (2016-09)

7. Testing Environment: Temp.: (23 ± 1) ℃, Humidity: (48 ± 5) % R.H.

8. Test Results : Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by Gwanyong Kim: (Signature)	Technical Manager Young-taek Lee: (Signature)

Remark. This report is not related to KOLAS accreditation and relevant regulation.

2022-04-06

Republic of KOREA **CTK Co., Ltd.**

REPORT REVISION HISTORY

Date	Revision	Page No
2022-04-06	Issued (CTK-2022-01047)	all

CONTENTS

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1. General Product Description

1.1 Client Information

Company	Spigen Korea Co.,Ltd.
Contact Point	Spigen HQ-A, 446, Bongeunsa-ro, Gangnam-gu, Seoul, 06153, South Korea
Contact Person	Name : Woo Sang-Hyup E-mail : shwoo@spigen.com Tel : +82-2-6713-6189 Fax : -

1.2 Product Information

FCC ID	2AFKNPF2102	
Certification Number ISED	24998-PF2102	
Product Description	ArcField Wireless Charger	
Basic model (HVIN)	PF2102	
FVIN	1) ABOV : SS2_20220120_4BBE 2) IDT : 102_PR1_TEST_0404	
Variant Model name	-	
Classification of WPT devices	☐	Type 1 (Interference-causing Equipment)
	☐	Type 2 (Category II Radio Apparatus)
	☒	Type 3 (Category I Radio Apparatus)
Operating Frequency	127.7 kHz (single frequency)	
Antenna type	Coil Antenna	
Type of Modulation	ASK	
Power Source	DC 9 V (Adapter & USB C type)	
RF Power setting	Referred the measuring instrument from manufacturer	

Note : the above eut information was declared by the manufacturer

1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Wireless charging tester1	Chargerlab(CHN)	KM001	-
Wireless charging tester2	Celfras(CHN)	MFJ-2000S(REV02)	-
Note Computer	HP	15-bs563TU	CND7253R6P
AC/DC Adapter	HP	HSTNN-LA40	7628011101

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2. Facility and Accreditations

2.1 Test Facility

1) The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea
2) 142, Dongbu-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Republic of Korea

2.2 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	8737A-2
KOREA	NRRA	KR0025

2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

3. Test-related content

3.1 Introduction

This document is prepared to show compliance with the RF Exposure requirements as required in §1.1310 of the FCC Rules and Regulations. The limit for Maximum Permissible Exposure (MPE), specified in FCC §1.1310, is listed in Table 1. According to FCC §1.1310: the criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b).

Table 1—Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power Density (mW/Cm^2)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*($900/f^2$)	<6
30-300	61.4	0.163	1.0	<6
300-1.500			f/300	<6
1.500-100.000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*($180/f^2$)	<30
30-300	27.5	0.073	0.2	<30
300-1.500			f/1500	<30
1.500-100.000			1.0	<30

f = frequency in MHz. * = Plane-wave equivalent power density.

Per the guidance of FCC Rule, Emissions between 9 kHz to 300 kHz should be assessed versus the limits at 300 kHz in Table 1 of Section 1.1310: 614 V/m and 1.63 A/m.

This document is prepared to show compliance with the RF Exposure requirements as required in RSS-102 of the Industry Canada. The limit for Maximum Permissible Exposure (MPE), specified in ISED RSS-102, is listed in Table 4.

Table 4— RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)				
Frequency Range (MHz)	**Electric Field (V/m rms)**	**Magnetic Field (A/m rms)**	**Power Density (W/m^2)**	**Reference Period (minutes)**
0.003-10	**83**	**90**	-	Instantaneous*
0.1-10	-	**0.73/ f**	-	6**
1.1-10	87/ $f^{0.5}$	-	-	6**
10-20	27.46	0.0728	-2	6
20-48	58.07/ $f^{0.25}$	0.1540/ $f^{0.25}$	8.944/ $f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 $f^{0.3417}$	0.008335 $f^{0.3417}$	0.02619 $f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21×10^{-4} $f^{0.5}$	6.67×10^{-5} f	616000/$f^{1.2}$

Note: f is frequency in MHz.
* Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

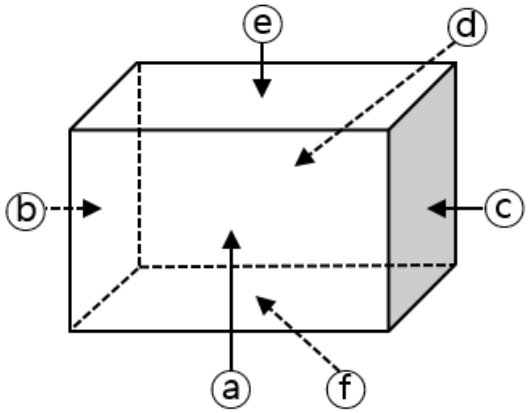
3.2 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.
Coverage factor k = 2, Confidence levels of 95 %

Description	Uncertainty
H-field	15 % (C.L. : Approx. 95 %, k = 2)
E-field	15 % (C.L. : Approx. 95 %, k = 2)

3.3 Test Set-up

3.3.1 EUT Position



Note : ⓐ : Front, ⓑ : Left, ⓒ : Right, ⓓ : Rear, ⓔ : Top, ⓕ : Bottom

3.3.2 Test configurations

In order to check all kinds of possible configurations, EUT was evaluated with appropriate client and under each charging condition as below table.

EUT Mode	Description
Charging (Transmitting mode)	charging tester setting 5 W
	charging tester setting 7.5 W
	charging tester setting 12 W
	charging tester setting 15 W
Stand-by (idle mode)	-

3.4 FCC Test-related

3.4.1 Measurement procedure

a) The measurement was investigated between the edge of the charger and center of the field

b) Maximum E-field and H-field measurements were made on each of six sides of the EUT that could come in contact with a user. six sides are defined as follows: Front (ⓐ), Left(ⓑ), Right(ⓒ), Rear(ⓓ), Top(ⓔ) and Bottom(ⓕ) Refer to the test set-up position section 2.1 above.

c) According to the guidance of KDB 680106 D01 v03 test distance was 15 cm measured from the center of the probe(s) to the edge of the device

d) Equipment approval considerations item 5.b) of KDB 680106 D01 v03

※ Equipment approval considerations (Some requirements are not met.)

(1) Power transfer frequency is less than 1 MHz.

- meet the requirements.

  DC 9 V, 127.7 kHz (single frequency)

(2) Output power from each primary coil is less than or equal to 15 watts.

- meet the requirements.

  <15 W

(3) The system may consist of more than one source primary coils, charging one or more clients. If more than one primary coil is present, the coil pairs may be powered on at the same time.

- meet the requirements.

  Magnetic induction and only single primary coil coupling secondary coil

(4) Client device is placed directly in contact with the transmitter.

- meet the requirements.

  Client device is placed directly in contact with the transmitter.

(5) Mobile exposure conditions only (portable exposure conditions are not covered by this exclusion).

- Not Applicable.

(6) The aggregate H-field strengths anywhere at or beyond 15 cm surrounding the device, and 20 cm away from the surface from all coils that by design can simultaneously transmit, and while those coils are simultaneously energized, are demonstrated to be less than 50% of the applicable MPE limit.

- The requirements are not met. Refer to following worst test result (For more detail, please refer to section 3.4.2)

1) The worst E-Field Strength levels at 15 cm < 50 % of the MPE E-Field Strength limit 614 V/m.

- 15 W : 3.09 V/m < 307 V/m

2) The worst H-Field Strength levels at 15 cm < 50 % of the MPE H-Field Strength limit 1.63 A/m.

- 15 W : 1.14 A/m > 0.815 A/m

3.4.2 Test Result

-Complied

The probe was positioned at the location where there is maximum field strength on each side of the EUT. The maximum E-field and H-field is reported below.

- 5 W (127.7 kHz)

E-field Measurements

Distance (cm)	Position ⓐ (V/m)	Position ⓑ (V/m)	Position ⓒ (V/m)	Position ⓓ (V/m)	Position ⓔ (V/m)	Position ⓕ (V/m)	Limit (V/m)
15	1.48	0.87	0.61	0.85	1.54	1.02	614.00

H-field Measurements

Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
15	0.60	0.37	0.20	0.30	0.47	0.20	1.63

- 7.5 W (127.7 kHz)

E-field Measurements

Distance (cm)	Position ⓐ (V/m)	Position ⓑ (V/m)	Position ⓒ (V/m)	Position ⓓ (V/m)	Position ⓔ (V/m)	Position ⓕ (V/m)	Limit (V/m)
15	2.76	1.64	0.94	1.24	2.90	1.47	614.00

H-field Measurements

Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
15	1.05	0.65	0.27	0.62	0.87	0.28	1.63

- 12 W (127.7 kHz)

E-field Measurements

Distance (cm)	Position ⓐ (V/m)	Position ⓑ (V/m)	Position ⓒ (V/m)	Position ⓓ (V/m)	Position ⓔ (V/m)	Position ⓕ (V/m)	Limit (V/m)
15	2.60	1.62	1.03	1.42	3.03	1.63	614.00

H-field Measurements

Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
15	1.10	0.75	0.28	0.54	0.77	0.28	1.63

- 15 W (127.7 kHz)

E-field Measurements

Distance (cm)	Position ⓐ (V/m)	Position ⓑ (V/m)	Position ⓒ (V/m)	Position ⓓ (V/m)	Position ⓔ (V/m)	Position ⓕ (V/m)	Limit (V/m)
15	2.74	1.72	1.09	1.32	3.09	1.91	614.00

H-field Measurements

Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
15	1.14	0.79	0.28	0.54	0.90	0.36	1.63

- idle (127.7 kHz)

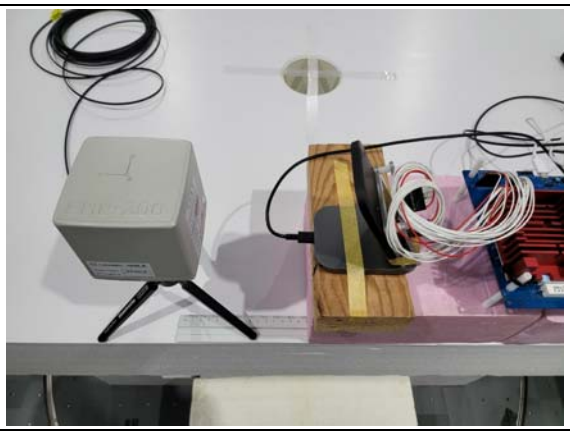
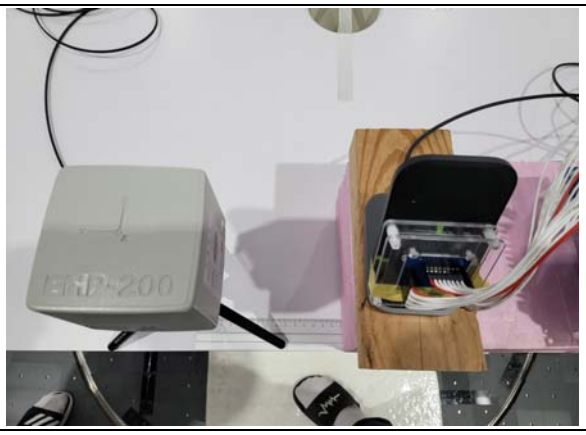
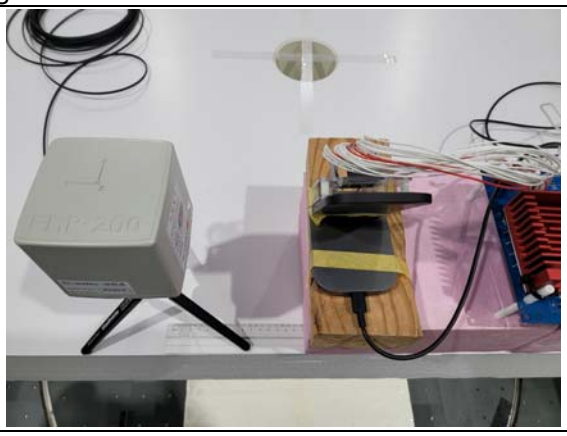
E-field Measurements

Distance (cm)	Position ⓐ (V/m)	Position ⓑ (V/m)	Position ⓒ (V/m)	Position ⓓ (V/m)	Position ⓔ (V/m)	Position ⓕ (V/m)	Limit (V/m)
15	0.63	0.47	0.54	0.42	0.72	0.42	614.00

H-field Measurements

Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
15	0.26	0.22	0.22	0.22	0.22	0.25	1.63

3.4.3 Test Setup Photos

Front	Near
	
Left	**Right**
	
Top	**Bottom**
	

The above test setup picture was taken while testing 15 W.

3.5 ISED Test-related

3.5.1 Measurement procedure

Measurement procedure (Measurement Method When the RBW of the Measurement Probe is Greater Than the 99% OBW or When Using a Broadband Probe)

a) Set the measurement frequency of the measurement probe to the fundamental frequency of the device under test.

b) Set the span to encompass the entire emission bandwidth

c) Set the RBW greater than the 99% OBW of the fundamental emission.

Note : This step is not required for a broadband measurement probe that integrates the entire frequency range.

d) Set the detector to Peak and trace display to Max-Hold.

e) Allow the spectrum to fill; for pulsing devices this may require an increased monitoring period.

f) Using a marker, set it to the maximum level of the spectral envelope

g) Repeat steps (b) to (f) while scanning a parallel plane at the measurement distance on each side of the device to find the peak level.

h) Repeat steps (b) to (g) for any frequencies where the field value is greater than -20 dBc below the maximum level identified.

※ Equipment approval considerations (Some requirements are not met.)

(1) Wireless power transfer frequency is below 1 MHz.

- meet the requirements.
DC 9 V, 127.7 kHz (single frequency)

(2) Output power from each primary coil (i.e. transmitter coil in the WPT source device) is Less than or equal to 5 W.

- The requirements are not met. output of each primary coil exceeds 5W.

(3) The WPT device is only capable of wireless power transfer between one source and one Client at a time. This includes WPT systems with multiple primary coils (i.e. in the WPT source) as long as they only allow wireless power transfer to take place through a single pair of coils at any given time (one in the source and the other in the client). It also includes WPT systems where the source may use two or more overlapping smaller coils to form a fixed charging/powering zone, as long as they only allow wireless power transfer to take place between this zone and a single client device.

- meet the requirements.
Magnetic induction and only single primary coil coupling secondary coil

(4) The WPT client device is placed in direct contact with or docked onto the WPT source.
- meet the requirements. Client device is placed directly in contact with the transmitter.

(5) The maximum coupling surface area of the WPT source is less than or equal to 400 cm^2
- meet the requirements. Less than 400 cm^2.

(6) The total leakage fields from all simultaneous transmitting coils are proven to be less than 30% of the applicable Health Canada's Safety Code 6 limits for uncontrolled environments, as set out in RSS-102, at 10 cm from the WPT system in all directions. The total leakage fields shall be calculated or measured based on actual and typical WPT clients of types selected such that they provide worst-case conditions. For WPT source devices with multiple fixed wireless power transfer zones that are only capable of powering/charging one client at a time, this requirement shall be met separately for each zone.

- The requirements are not met. Refer to following worst test result (For more detail, please refer to section 3.5.2 & 3.5.3)

- Frequency range : 0.003-10 MHz

1) The worst E-Field Strength levels at 10 cm < 30 % of the MPE E-Field Strength limit 83 V/m.
   - 15 W : 9.40 V/m < 24.90 V/m

2) The worst H-Field Strength levels at 10 cm < 30 % of the MPE H-Field Strength limit 90 A/m.
   - 12 W : 3.22 A/m < 27.0 A/m

- Frequency range : 0.1-10 MHz

1) The worst H-Field Strength levels at 10 cm < 30 % of the MPE H-Field Strength limit 5.72 A/m (frequency 127.7 kHz).
   - 12 W : 3.22 A/m > 1.72 A/m

3.5.2 Test Result (0.003-10 MHz)

-Complied

The probe was positioned at the location where there is maximum field strength on each side of the EUT. The E-field and H-field is reported below.

- 5 W (127.7 kHz)

E-field Measurements

Distance (cm)	Position ⓐ (V/m)	Position ⓑ (V/m)	Position ⓒ (V/m)	Position ⓓ (V/m)	Position ⓔ (V/m)	Position ⓕ (V/m)	Limit (V/m)
10	3.83	1.96	1.41	1.97	2.25	2.14	83

H-field Measurements

Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
10	1.49	0.93	0.48	0.64	0.71	0.38	90

- 7.5 W (127.7 kHz)

E-field Measurements

Distance (cm)	Position ⓐ (V/m)	Position ⓑ (V/m)	Position ⓒ (V/m)	Position ⓓ (V/m)	Position ⓔ (V/m)	Position ⓕ (V/m)	Limit (V/m)
10	6.80	3.76	2.72	3.85	7.49	3.32	83

H-field Measurements

Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
10	2.88	1.72	0.71	1.29	1.67	0.54	90

- 12 W (127.7 kHz)

E-field Measurements

Distance (cm)	Position ⓐ (V/m)	Position ⓑ (V/m)	Position ⓒ (V/m)	Position ⓓ (V/m)	Position ⓔ (V/m)	Position ⓕ (V/m)	Limit (V/m)
10	7.39	4.06	2.73	3.83	7.77	4.71	83

H-field Measurements

Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
10	3.22	2.06	0.99	1.26	1.74	0.68	90

- 15 W (127.7 kHz)

E-field Measurements

Distance (cm)	Position ⓐ (V/m)	Position ⓑ (V/m)	Position ⓒ (V/m)	Position ⓓ (V/m)	Position ⓔ (V/m)	Position ⓕ (V/m)	Limit (V/m)
10	7.48	3.90	3.26	4.35	9.40	4.56	83

H-field Measurements

Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
10	3.10	2.04	1.20	1.54	1.73	0.67	90

- idle (127.7 kHz)

E-field Measurements

Distance (cm)	Position ⓐ (V/m)	Position ⓑ (V/m)	Position ⓒ (V/m)	Position ⓓ (V/m)	Position ⓔ (V/m)	Position ⓕ (V/m)	Limit (V/m)
10	3.33	0.97	1.02	1.62	5.23	1.10	83

H-field Measurements

Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
10	1.15	0.55	0.34	0.62	0.50	0.40	90

3.5.3 Test Result (0.1-10 MHz)

-Complied

The probe was positioned at the location where there is maximum field strength on each side of the EUT. The H-field is reported below.

- 5 W (127.7 kHz)

H-field Measurements

Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
10	1.49	0.93	0.48	0.64	0.71	0.38	5.72

- 7.5 W (127.7 kHz)

H-field Measurements

Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
10	2.88	1.72	0.71	1.29	1.67	0.54	5.72

- 12 W (127.7 kHz)

H-field Measurements

Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
10	3.22	2.06	0.99	1.26	1.74	0.68	5.72

- 15 W (127.7 kHz)

H-field Measurements

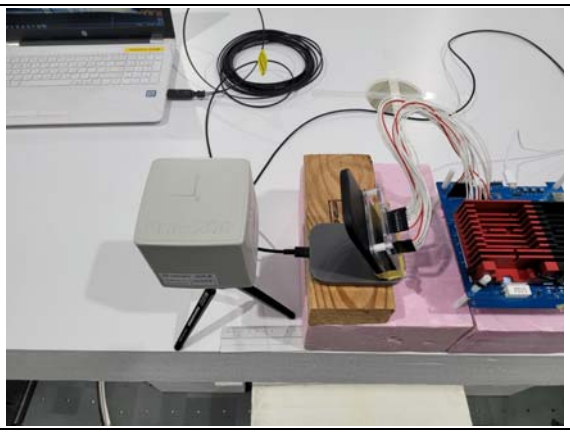
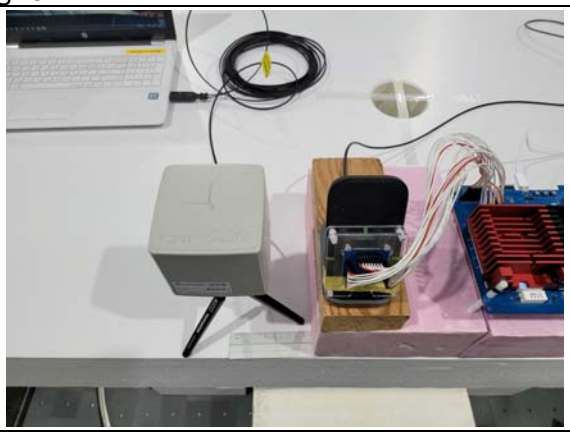
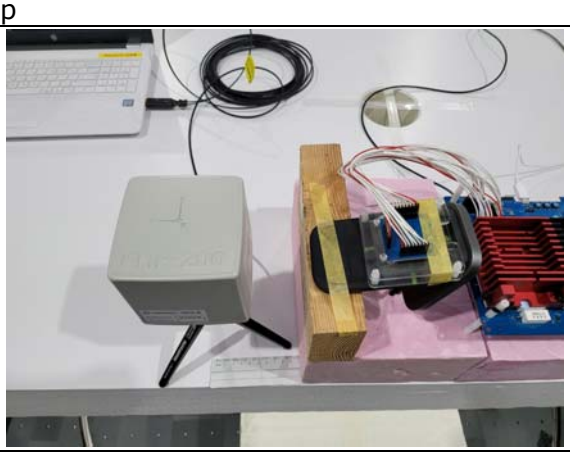
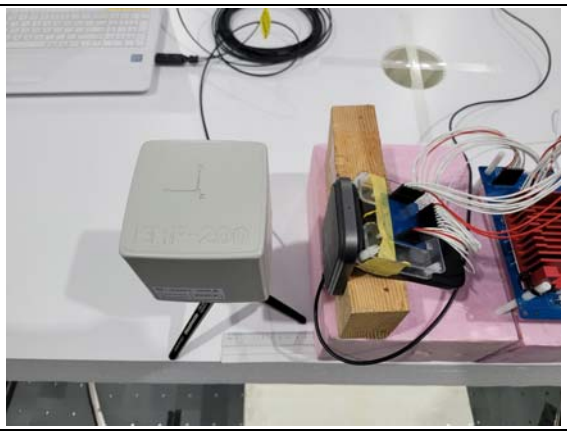
Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
10	3.10	2.04	1.20	1.54	1.73	0.67	5.72

- idle (127.7 kHz)

H-field Measurements

Distance (cm)	Position ⓐ (A/m)	Position ⓑ (A/m)	Position ⓒ (A/m)	Position ⓓ (A/m)	Position ⓔ (A/m)	Position ⓕ (A/m)	Limit (A/m)
10	1.15	0.55	0.34	0.62	0.50	0.40	5.72

3.5.4 Test Setup Photos

Front	Rear
	
Left	**Right**
	
Top	**Bottom**
	

The above test setup picture was taken while testing 15 W.

4. APPENDIX A – Test Equiment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Electric and Magnetic Field Analyzer	Narda S.T.S	EHP-200AC	170WX91010	2021-10-27	2022-10-27

-END-