

Test report

Number: T251-0030/23 M2

Project file: C20221443

Date: 2023-09-28

Pages: 36

Product: Charger System Wireless

Type reference: EOE18010815, EOE18010851, EOE18010850

Ratings: 3 x 400-480 V~; 50/60 Hz; 48 A 3Ph + PE

Trademark:



Applicant: Delta Energy Systems
Tscheulinstrasse 21, 79331 Teningen, Germany

Manufacturer: Delta Energy Systems
Tscheulinstrasse 21, 79331 Teningen, Germany

Place of manufacture: Delta Slovakia s.r.o.
Priemyselná 4600/1, 01841 Dubnica nad Váhom, Slovakia

Summary of testing

Testing method: 47 CFR FCC Part 1.1307(clause (b)(1)(i)(B) and (b)(3)(ii)(B)),
KDB 447498 D01 General RF Exposure Guidance v06
KDB 680106 D01 RF Exposure Wireless Charging App v03r01

Testing location: SIQ Ljubljana
Mašera-Spasičeva ulica 10, SI-1000 Ljubljana, Slovenia

Remarks: Date of receipt of test items: 2022-07-15
Number of items tested: 1
Date of performance of tests: 2022-07-25 - 2023-02-28
The test results presented in this report relate only to the items tested.
The product complies with the requirements of the testing methods.

Tested by: Luka Tosetto

Approved by: Marjan Mak

The report shall not be reproduced except in full.



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1 GENERAL

History sheet			
Date	Report No.	Change	Revision
2023-01-11	T251-0030/23	Initial Test Report issued.	--
2023-03-17	T251-0030/23 M1	Modified initial test report due to additional measurements were made and added. Sample is identical to the one initially tested.	1.0
2023-09-28	T251-0030/23 M2	This test report substitutes previously issued test report T251-0030/23 M1, dated 2023-03-17, due to modification of the test report. Additional pictures of the test setup added.	2.0

1.1 Equipment under test

Charger System Wireless

Type: **EOE18010815, EOE18010851, EOE18010850**

Environment: Controlled / Workplace area

Assessment distance: see below table with results

FCC IDs:

For both WPB and WPP:


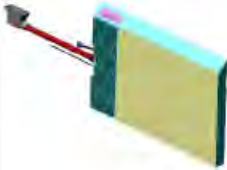


2AVWKWPU30KW

For WSU:

2AVWKWSU30KW

Device is a wireless charger for charging of electrical forklifts. It consists of Primary Box (EOE18010815) that gets power from the grid and of Primary Pad (EOE18010851) that transfers the energy. Energy is transferred in the frequency range 55 – 65 kHz. Communication between primary and secondary pad is at 13,56 MHz.

Parts device under test consists of:

Item	Part	Description	Qty
1	WPB: Wireless Primary Box (Grid connection)		1
2	WPP: Wireless Primary Pad (generating magnetic field)		1
3	Mounting device Part No. 3486388501		1
4	WSU: Wireless Secondary Unit (Vehicle side, receives magnetic field, charges Battery)		1

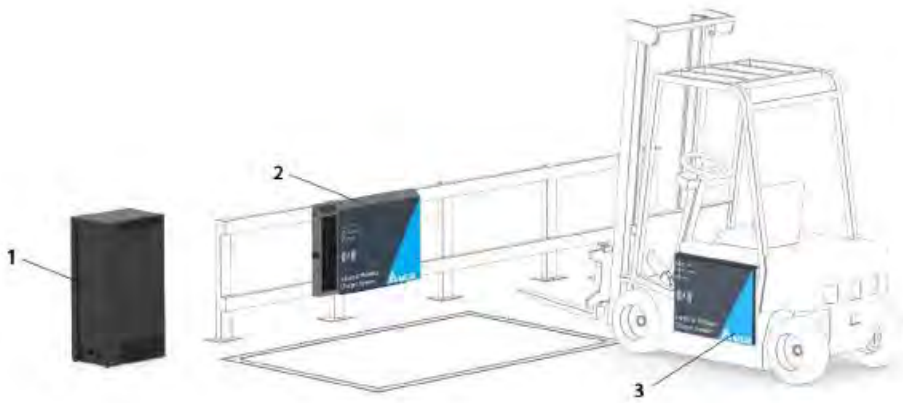
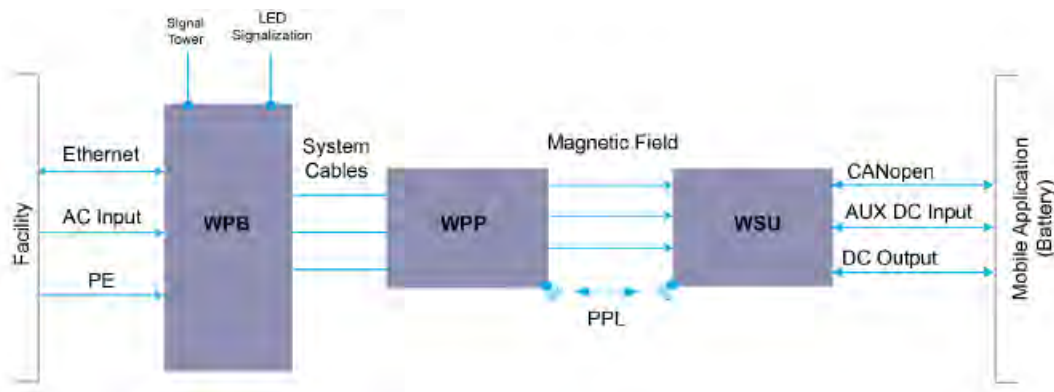


Figure. 1 WCS Subsystems (Example – Forklift)

Item	Description
1	Wireless Primary Box (WPB)
2	Wireless Primary Pad (WPP)
3	Wireless Secondary Unit (WSU)

The WCS allows the user to charge the battery of industrial vehicle wirelessly by means of a magnetic field between WPP and WSU. The magnetic field which is generated and transmitted by the WPP is received by the WSU, and then converted to direct current for charging the battery. The WCS is capable of outputting up to 30 kW for battery charging.

The magnetic field generated during the charging process can cause metal and other foreign objects to become hot. Therefore, it is important to keep the charging area free of foreign objects. The magnetic field is only emitted by the WPP when there is a WSU in the charging area.



2 ASSESSMENT PROCEDURE

RF EXPOSURE REQUIREMENTS according 680106 D01 RF Exposure Wireless Charging App v03r01

RF exposure must be evaluated with the client device(s) being charged by the primary at maximum output power. The RF exposure requirements must be determined in conjunction with the device operating characteristics, according to the mobile and portable exposure requirements in Sections 2.1091 and 2.1093 of the rules.

RF exposure compliance is determined with respect to Sections 1.1307 (c) and (d) of the FCC rules.

Evaluation is based on following conditions:

field strengths do not exceed the following reference levels:

- 83 V/m for the electric field

and

- 90 A/m for the magnetic field.

Sample has been turned on with maximum power transferred between pads. While working, communication was active. Measurement distances were set as in table below under clause 3 of this report. Marking of positions is as per below pictures.



Actual photo of the parts in combination with marked exposure measurement sides

Radiofrequency radiation exposure according 47 CFR 1.1307 clause (b)(1)(i)(B):

With respect to the limits on human exposure to RF provided in § 1.1310 of this chapter, applicants to the Commission for the grant or modification of construction permits, licenses or renewals thereof, temporary authorities, equipment authorizations, or any other authorizations for radiofrequency sources must prepare an evaluation of the human exposure to RF radiation pursuant to § 1.1310 and include in the application a statement confirming compliance with the limits in § 1.1310.

Limits:

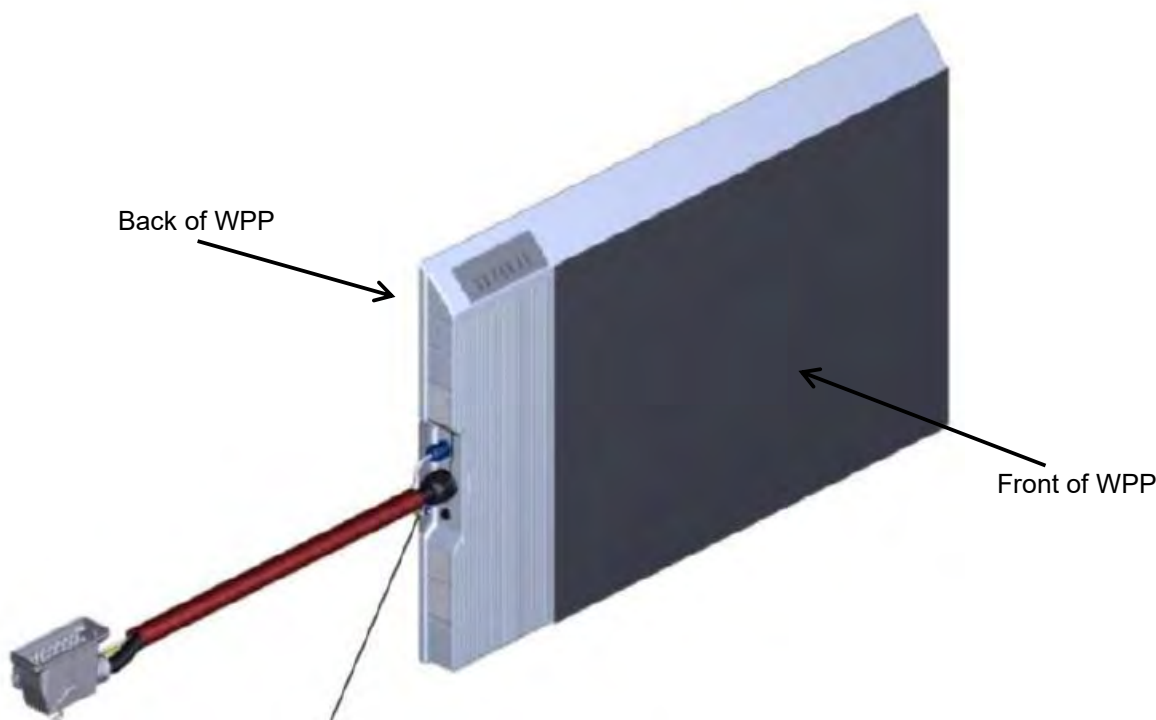
TABLE 1 - LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) 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

Measurement was done on WPP and WSU separately to show radiation exposure of both devices. Both were programmed to continuously work in communication mode only. Power transfer function has been disabled for this measurements, only 13.56 MHz communication was working and evaluated.

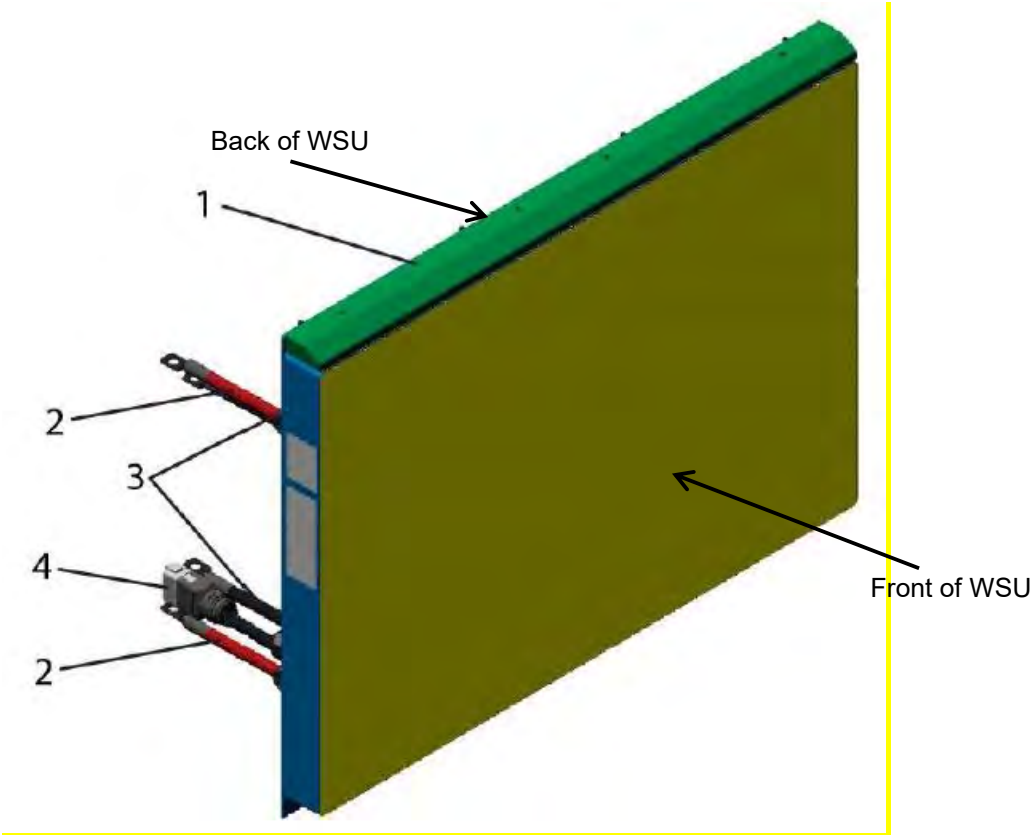
Sample has been turned on with maximum power transferred between pads. While working, communication was active.

Measurement distances were set as in table below under clause 3 of this report. Marking of positions is as per below pictures.





Actual photo of the part





Actual photo of the part

Values for each configuration are listed in the following table:

Frequency (kHz)	Side of the EUT and its distance to the measuring probe	Maximum obtained value			Limit	
		E-field (V/m)	B-field (μT)	H-field (A/m)	E-field (V/m)	H-field (A/m)
55 - 65	Left of WPP at 180 mm distance ¹⁾	38.4	39.0	31.0	83	90
55 - 65	Right of WPP at 380 mm distance ¹⁾	65.8	38.0	30.2	83	90
55 - 65	Back of WPP at 260 mm distance ³⁾	67.8	60.2	47.9	83	90
55 - 65	Back of WSU at 280 mm distance ¹⁾	15.5	43.2	34.4	83	90
55 - 65	Below WPP at 347 mm distance ²⁾	75.7	41.6	33.1	83	90
55 - 65	Above WPP at 347 mm distance ²⁾	37.8	23.2	18.5	83	90

¹⁾ entire height was scanned
²⁾ entire length was scanned
³⁾ entire length and height were scanned
 Measurements presented are worst case
 Measurements performed in initial testing 2022-07-25 - 2022-10-28

Frequency (MHz)	Side of the EUT and its distance to the measuring probe	Maximum obtained value			Limit	
		E-field (V/m)	B-field (μT)	H-field (A/m)	E-field (V/m)	H-field (A/m)
13.56	Front of WPP at 200 mm distance ¹⁾	4.15	0.0174	0.0138	135.84	0.36
13.56	Back of WPP at 200 mm distance ¹⁾	4.14	0.0172	0.0137	135.84	0.36
13.56	Front of WSU at 200 mm distance ¹⁾	3.74	0.0198	0.0158	135.84	0.36
13.56	Back of WSU at 200 mm distance ¹⁾	4.90	0.0196	0.0156	135.84	0.36

¹⁾ entire height was scanned
Measurements presented are worst case
Measurements performed in initial testing 2022-07-25 - 2022-10-28

Frequency (MHz)	Side of the EUT and its distance to the measuring probe	Maximum obtained value			Limit	
		E-field (V/m)	B-field (μT)	H-field (A/m)	E-field (V/m)	H-field (A/m)
13.56	Left of WPP at 180 mm distance ¹⁾	2.17	/	0.0089	135.84	0.36
13.56	Right of WPP at 200 mm distance ¹⁾	3.13	/	0.0120	135.84	0.36
13.56	Right of WPP at 380 mm distance ¹⁾	1.74	/	0.0680	135.84	0.36
13.56	Below of WPP at 200 mm distance ¹⁾	2.00	/	0.0085	135.84	0.36
13.56	Below of WPP at 347 mm distance ¹⁾	1.61	/	0.0081	135.84	0.36
13.56	Above of WPP at 200 mm distance ¹⁾	1.91	/	0.0073	135.84	0.36
13.56	Above of WPP at 347 mm distance ¹⁾	1.02	/	0.0063	135.84	0.36
13.56	Right of WSU at 180 mm distance ¹⁾	0.28	/	0.0850	135.84	0.36
13.56	Left of WSU at 200 mm distance ¹⁾	0.51	/	0.0072	135.84	0.36
13.56	Left of WSU at 380 mm distance ¹⁾	0.21	/	0.0068	135.84	0.36
13.56	Below of WSU at 200 mm distance ¹⁾	0.33	/	0.0073	135.84	0.36
13.56	Below of WSU at 347 mm distance ¹⁾	0.28	/	0.0063	135.84	0.36
13.56	Above of WSU at 200 mm distance ¹⁾	0.75	/	0.0077	135.84	0.36
13.56	Above of WSU at 347 mm distance ¹⁾	0.57	/	0.0072	135.84	0.36

¹⁾ entire height was scanned
Measurements presented are worst case
Measurements performed in revision 1 testing 2023-02-28
H-field was measured directly, no B-field provided for this reason



Maximum simultaneous transmission contribution according 47 CFR FCC Part 1.1307(clause (b)(3)(ii)(B)):

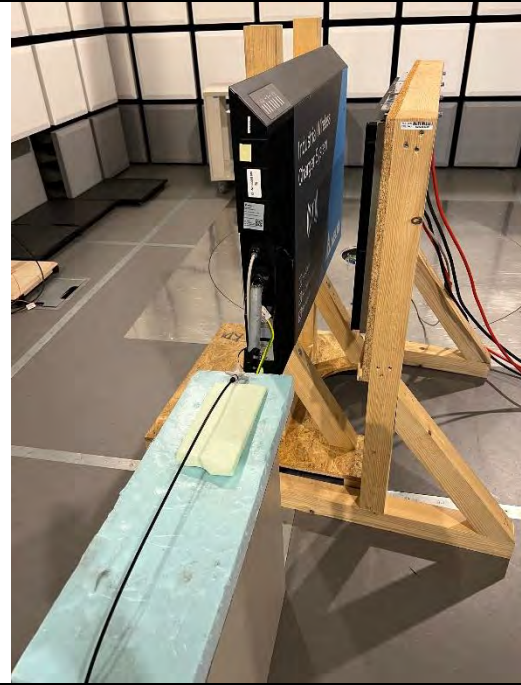
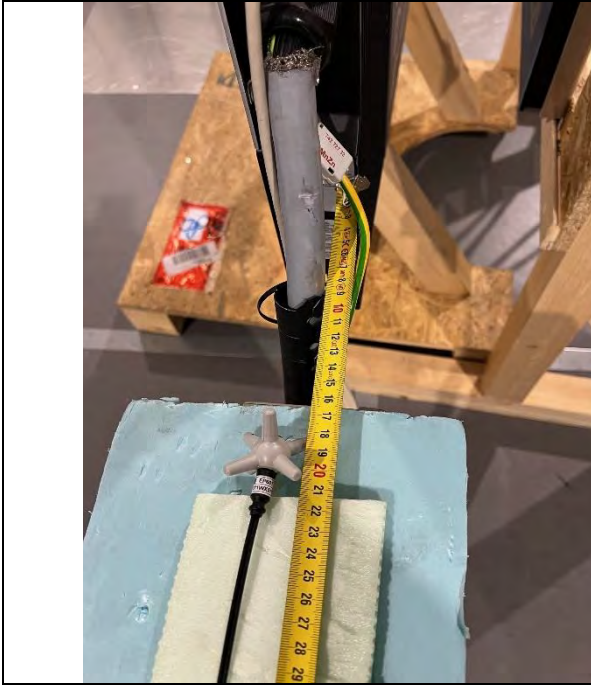
Mode	WPT	RFID	Total	Limit
Contribution (E-Field)	0.8169	0.0305	0.8474	1
Contribution (H-Field)	0.5322	0.0001	0.5323	1

Conclusion: **PASS**, safe distance from the device is at least 380 mm due to worst case measurement was found at that distance.

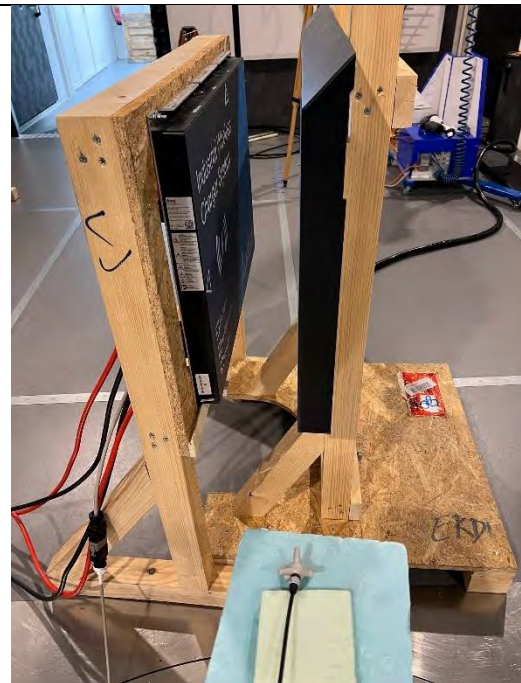
4 MEASUREMENT PHOTOS

4.1 WPT mode

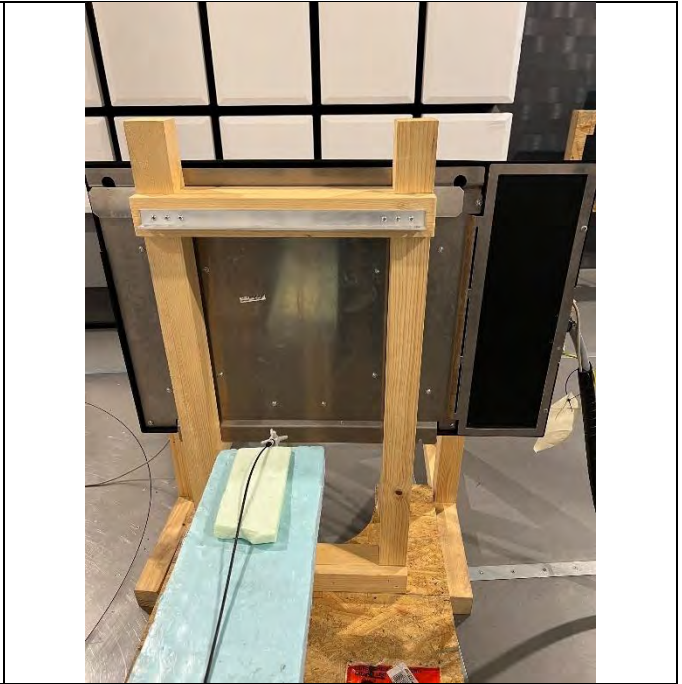
4.1.1 E-field



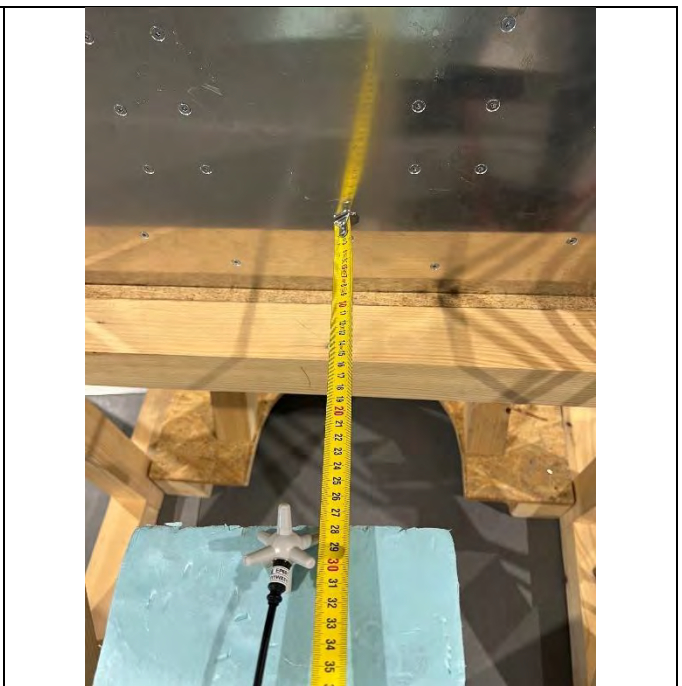
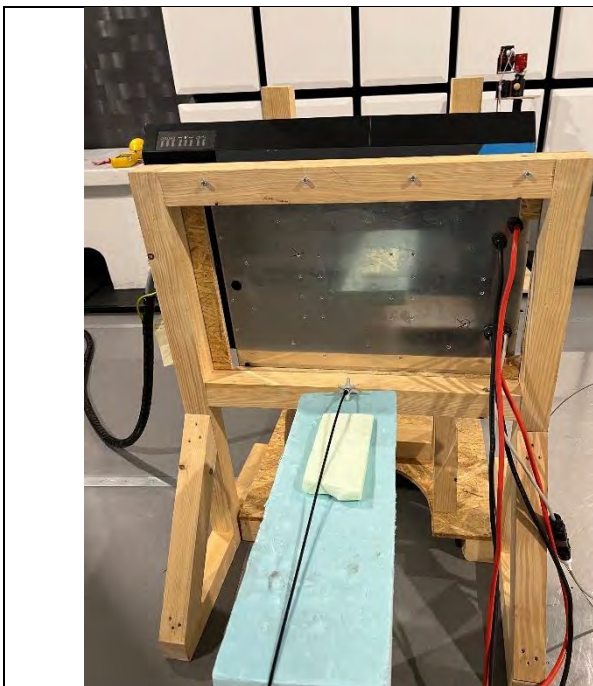
Left of WPP at 180 mm distance



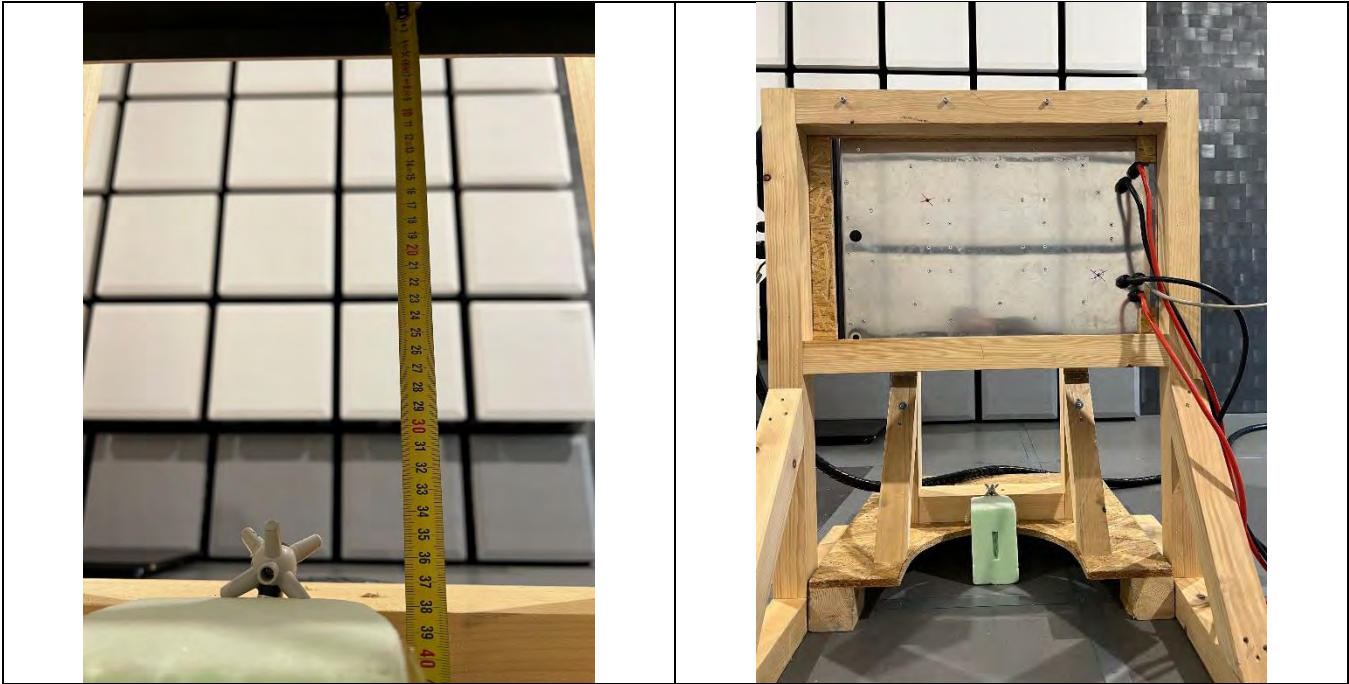
Right of WPP at 380 mm distance



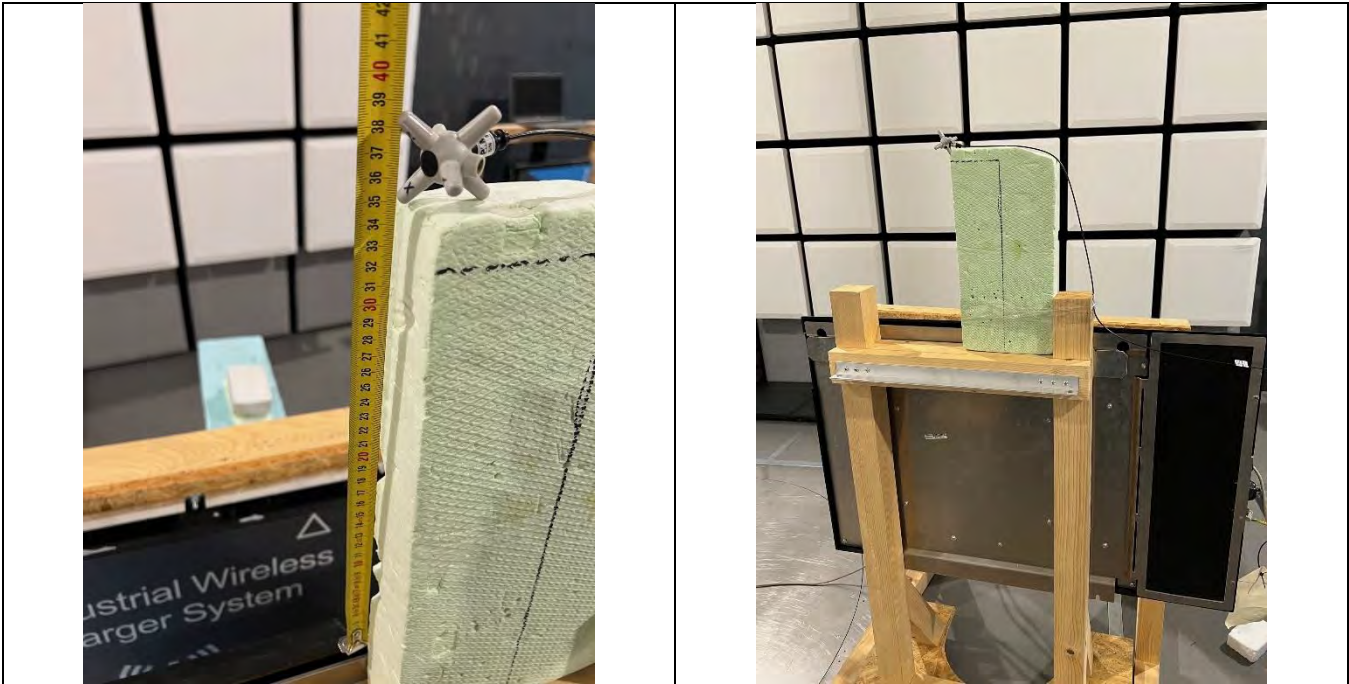
Back of WPP at 260 mm distance



Back of WSU at 280 mm distance



Below WPP at 347 mm distance

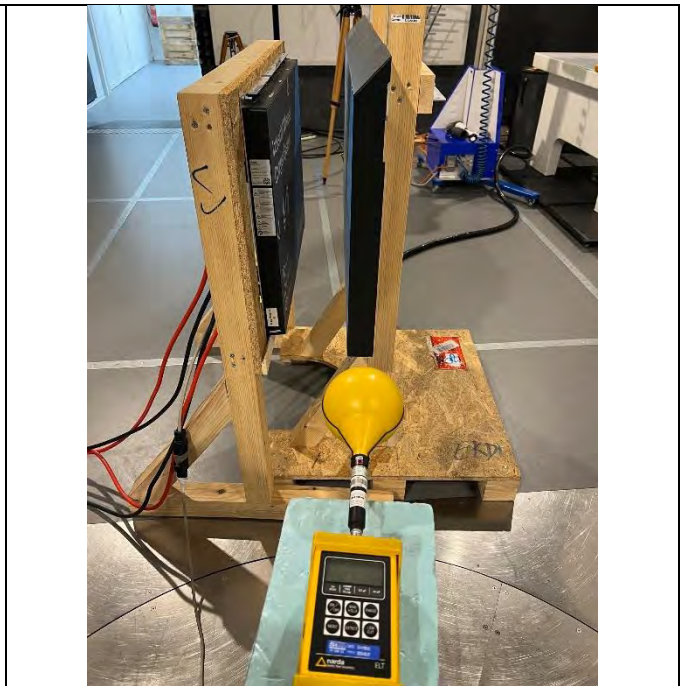


Above WPP at 347 mm distance

4.1.2 B/H-field



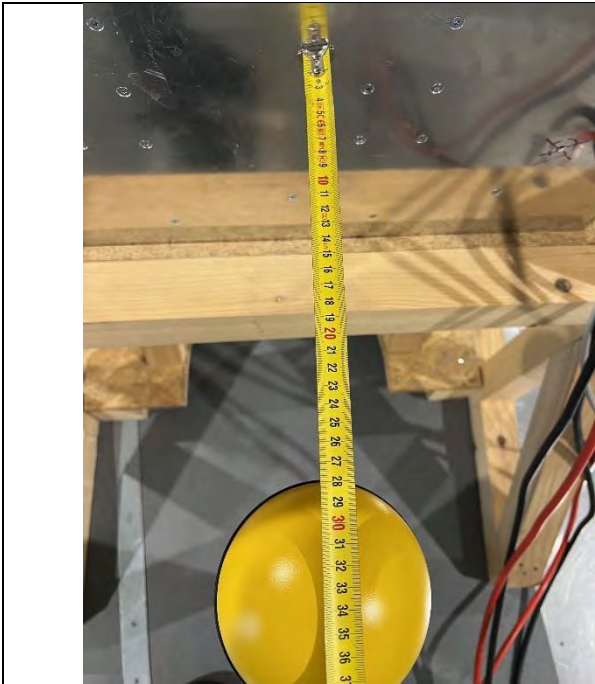
Left of WPP at 180 mm distance



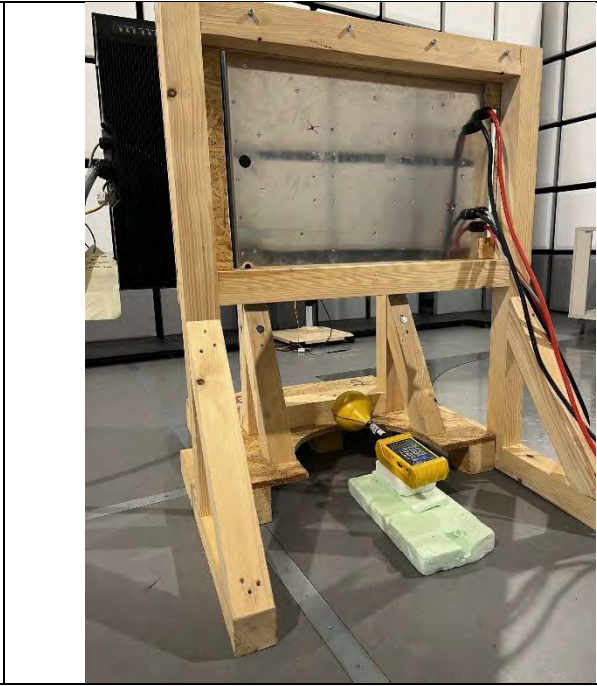
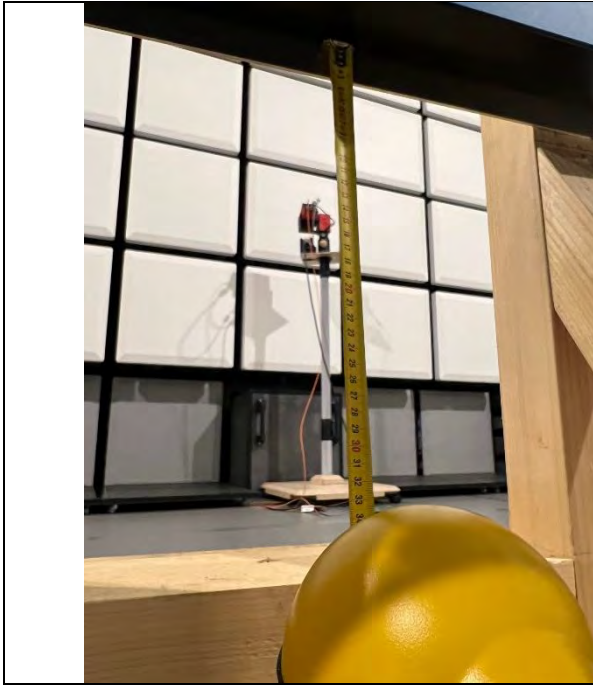
Right of WPP at 380 mm distance



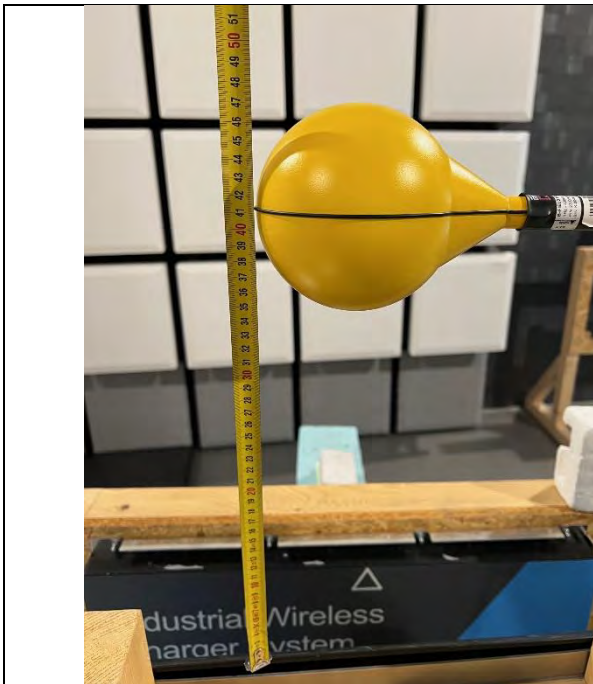
Back of WPP at 260 mm distance



Back of WSU at 280 mm distance



Below WPP at 347 mm distance



Above WPP at 347 mm distance



4.2 RFID mode with WPT turned off

4.2.1 E-field



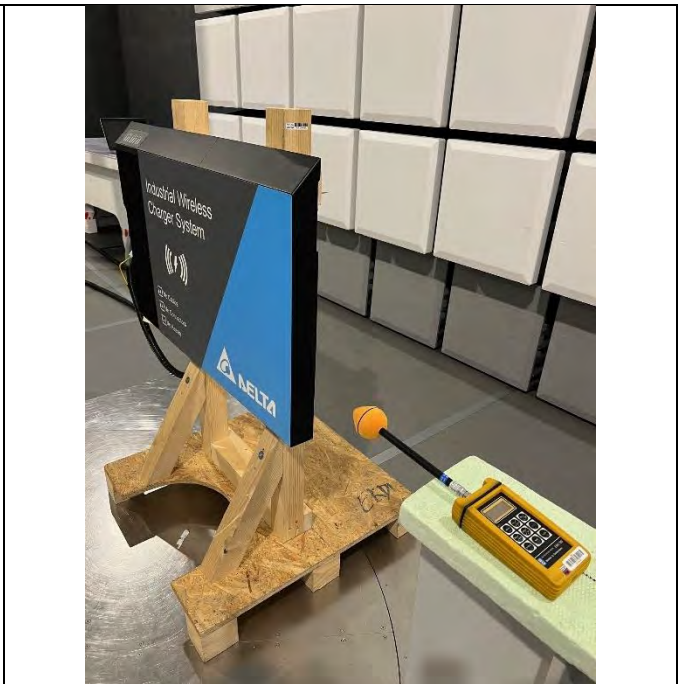
Front of WPP at 200 mm distance



Back of WPP at 200 mm distance



Left of WPP at 180 mm distance



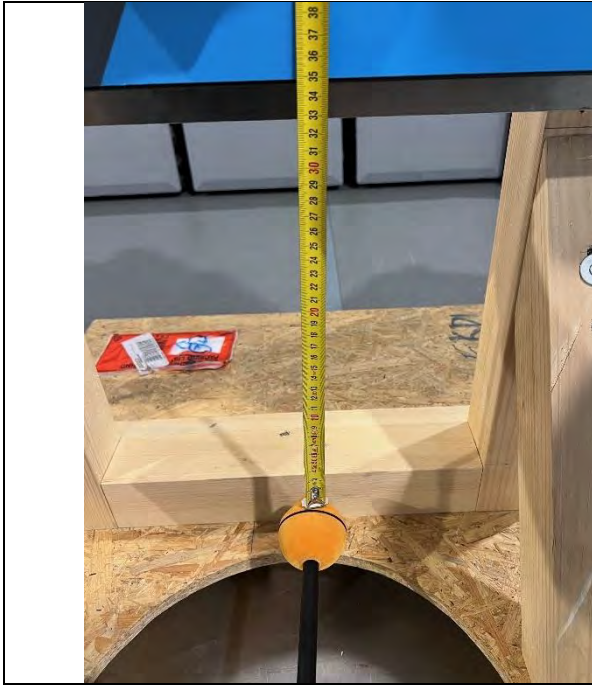
Right of WPP at 200 mm distance



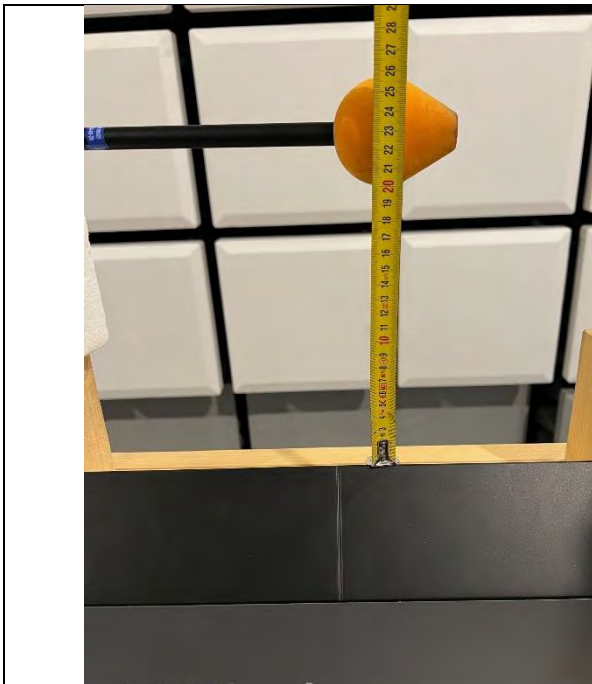
Right of WPP at 380 mm distance



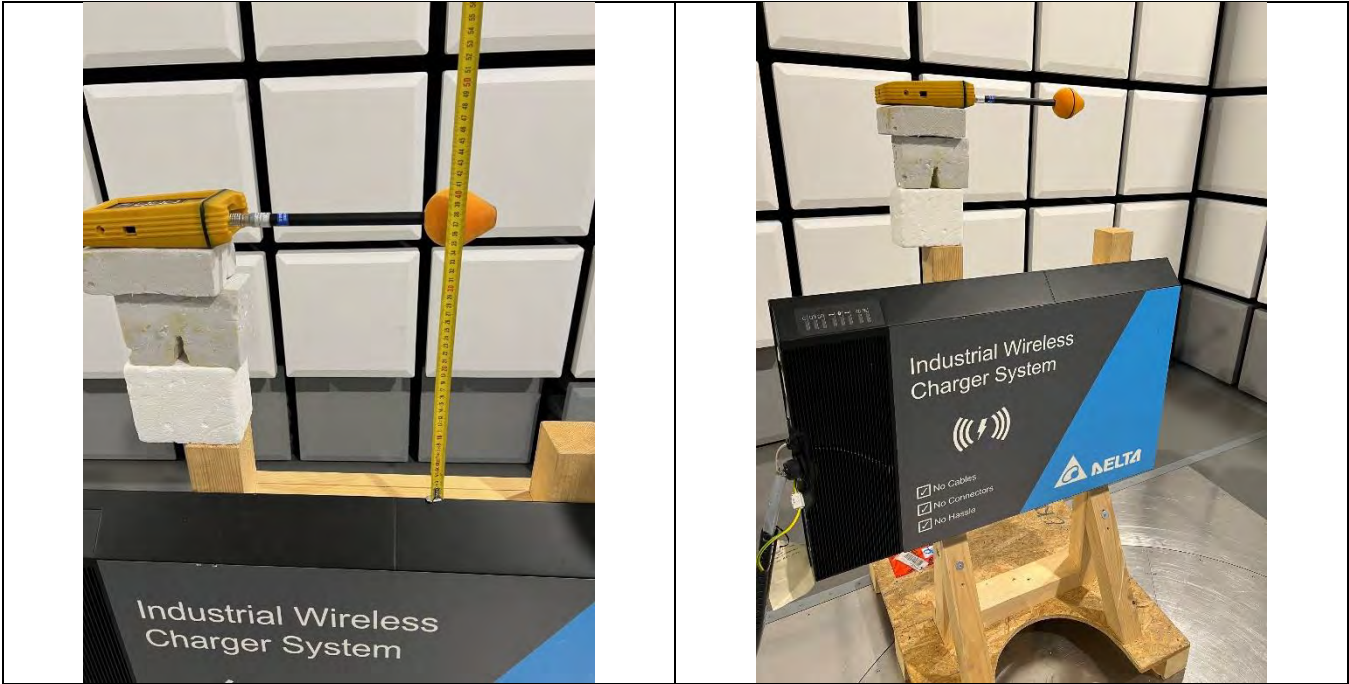
Bellow WPP at 200 mm distance



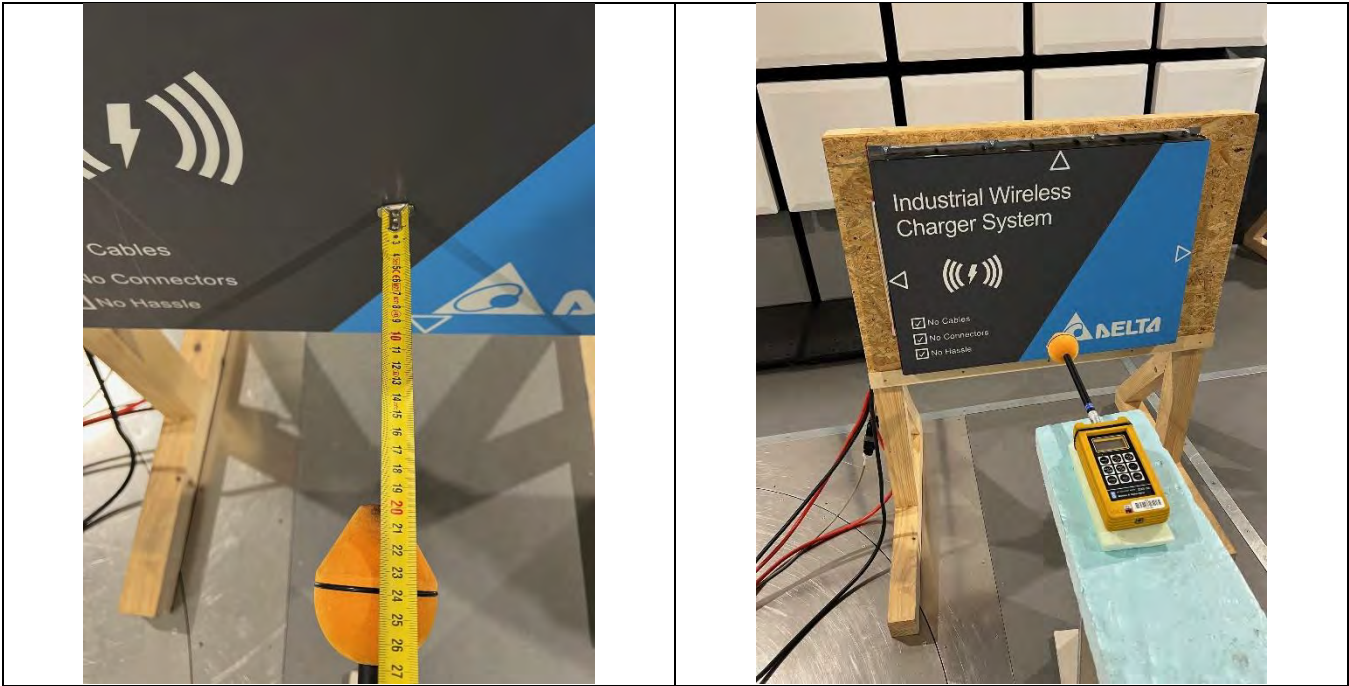
Bellow WPP at 347 mm distance



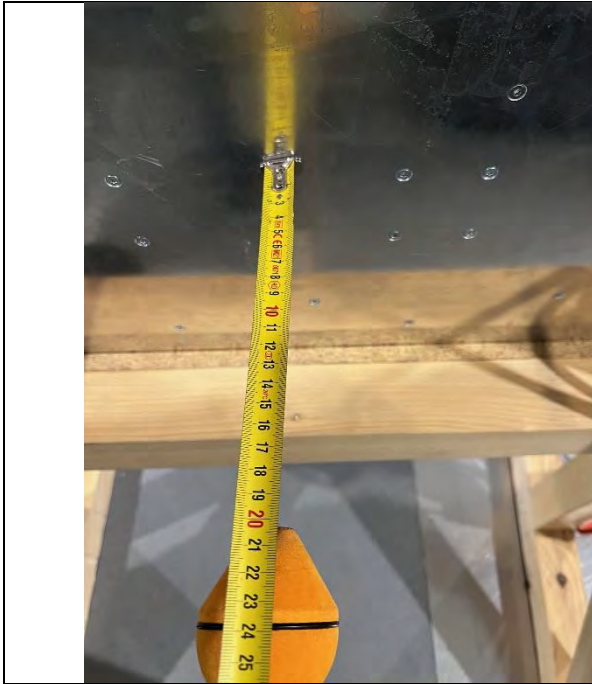
Above WPP at 200 mm distance



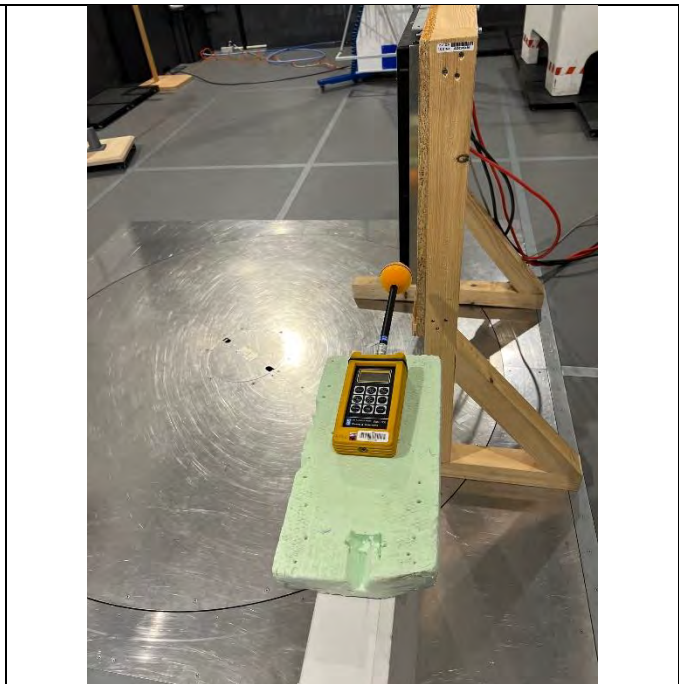
Above WPP at 347 mm distance



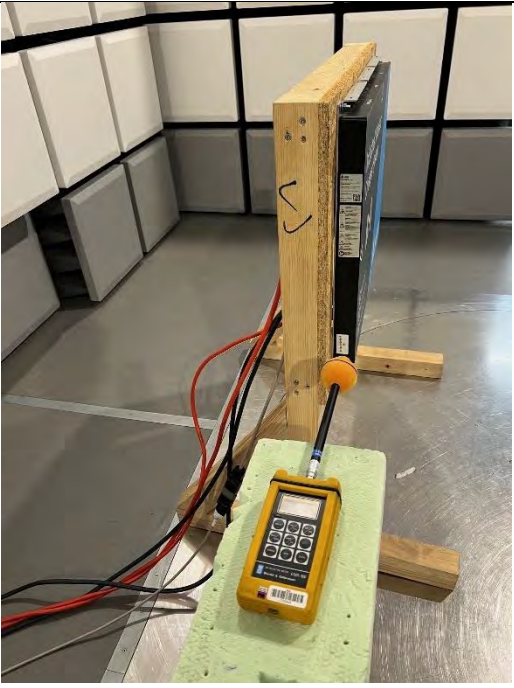
Front of WSU at 200 mm distance



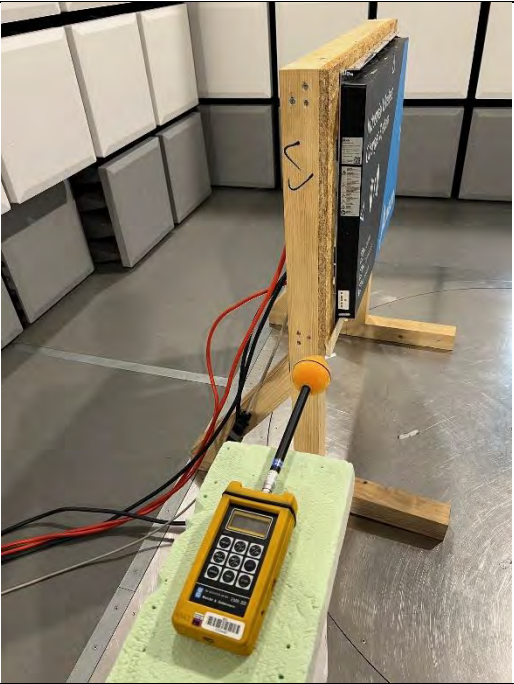
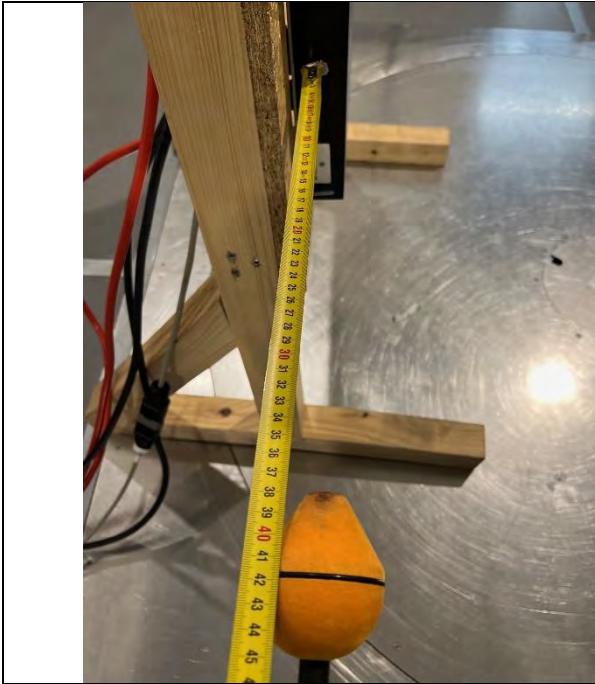
Back of WSU at 200 mm distance



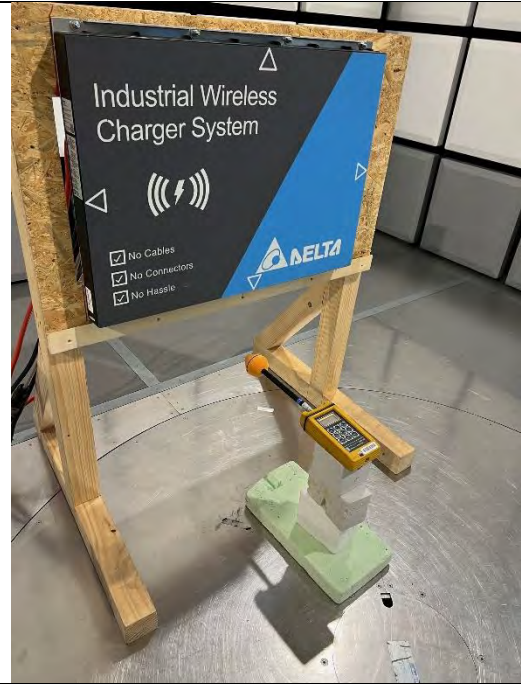
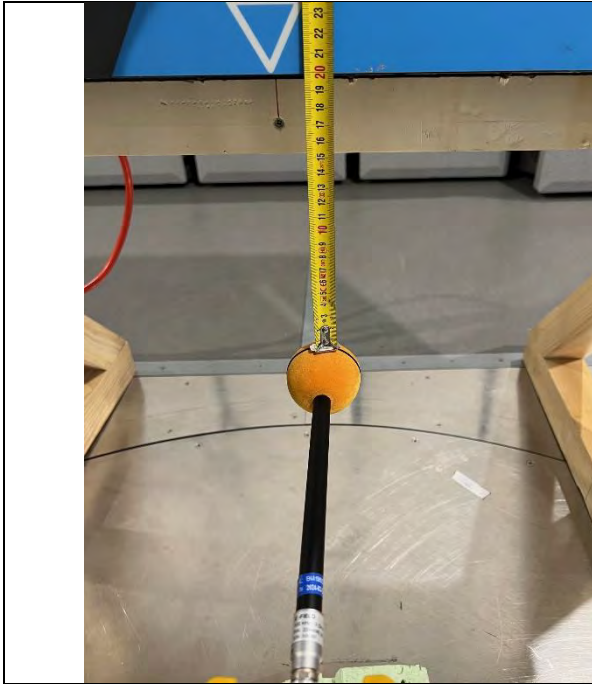
Right of WSU at 180 mm distance



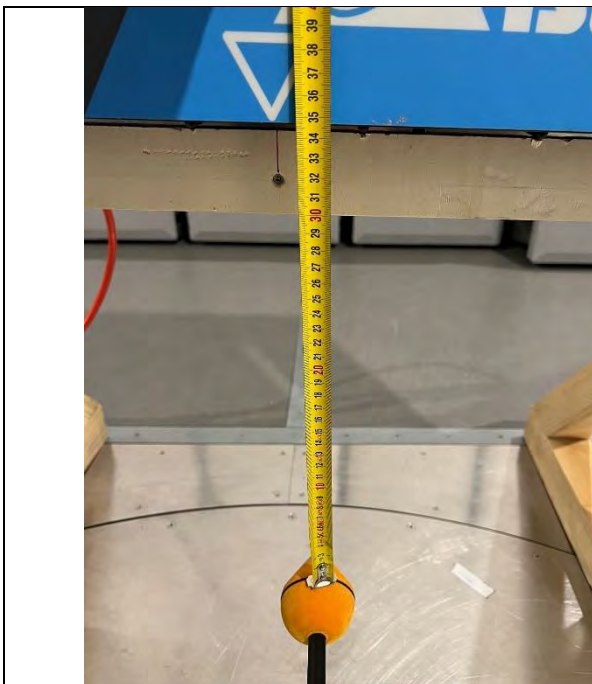
Left of WSU at 200 mm distance



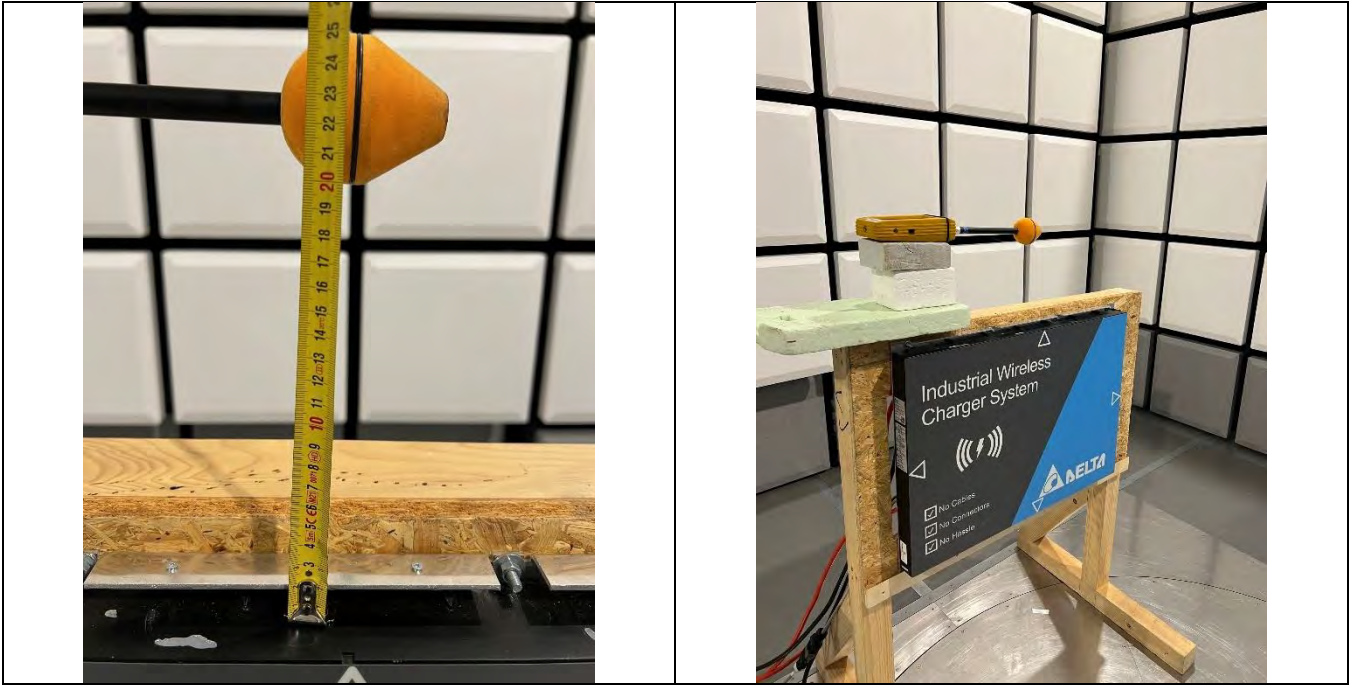
Left of WSU at 380 mm distance



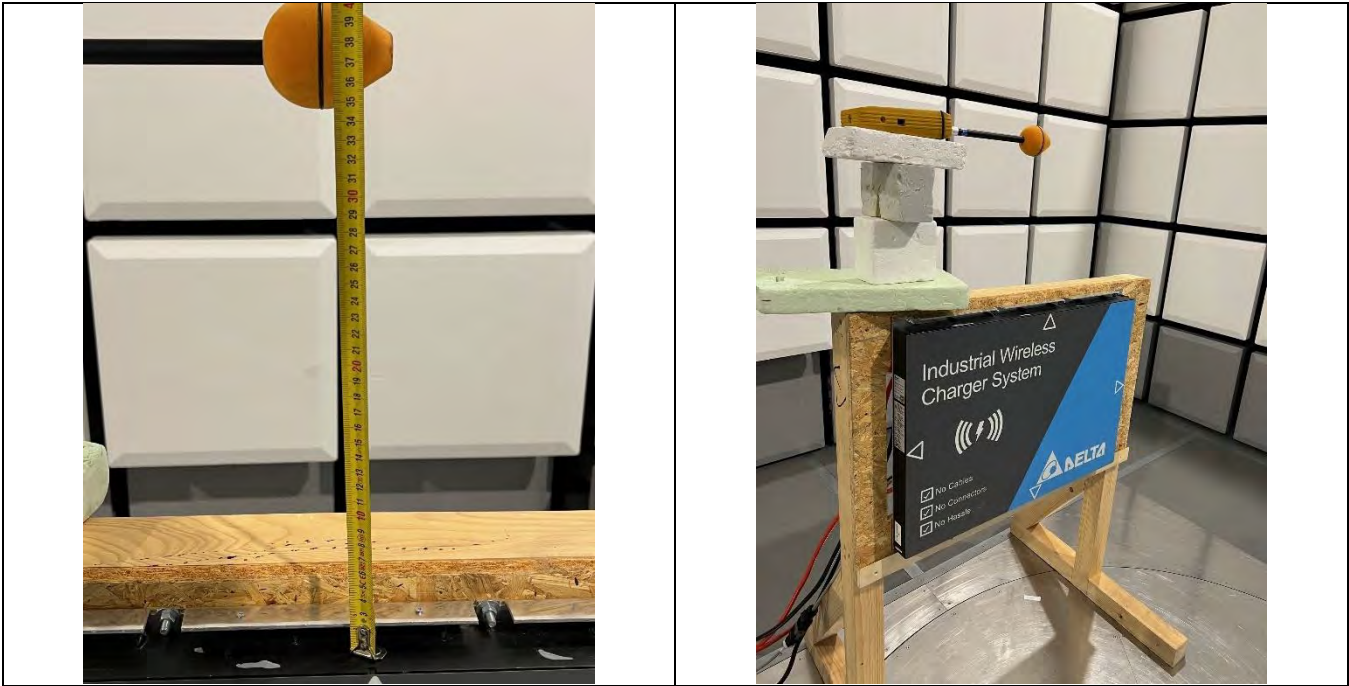
Bellow WSU at 200 mm distance



Bellow WSU at 347 mm distance



Above WSU at 200 mm distance



Above WSU at 347 mm distance

4.2.2 B/H-field



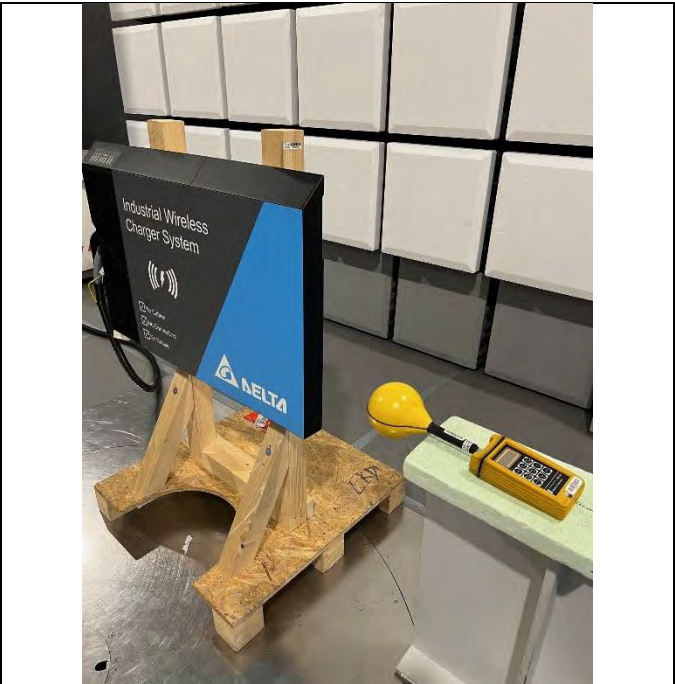
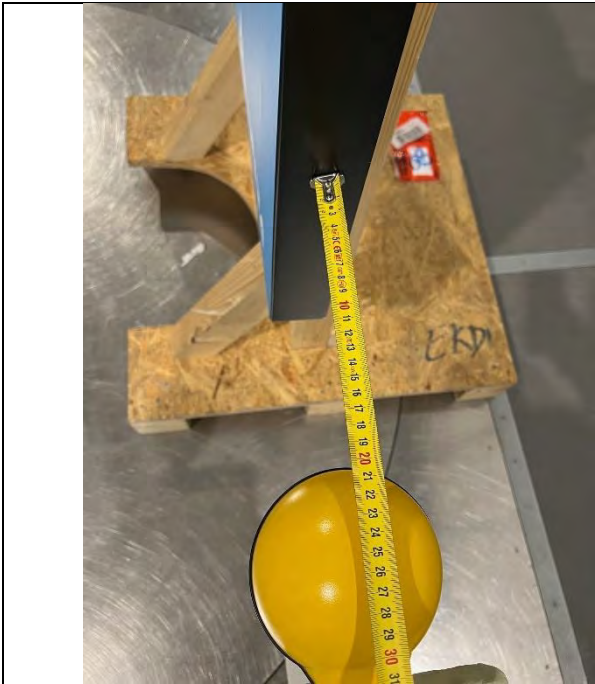
Front of WPP at 200 mm distance



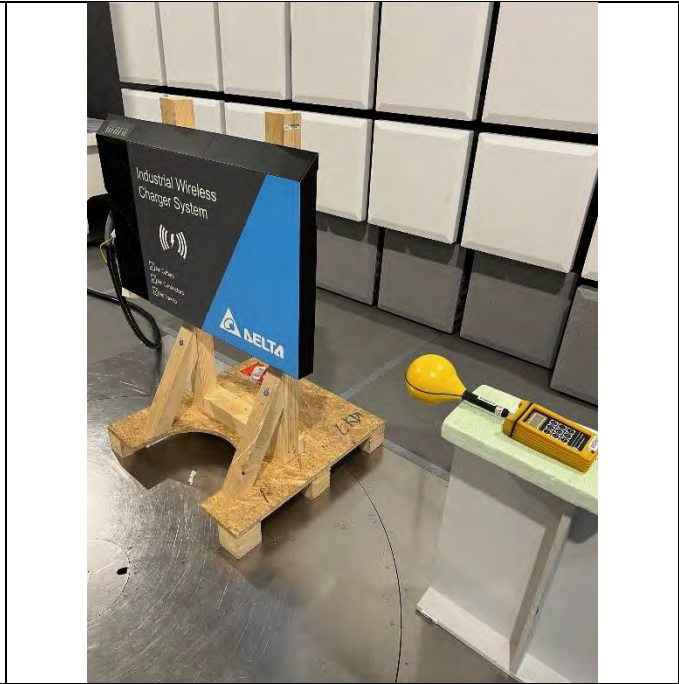
Back of WPP at 200 mm distance



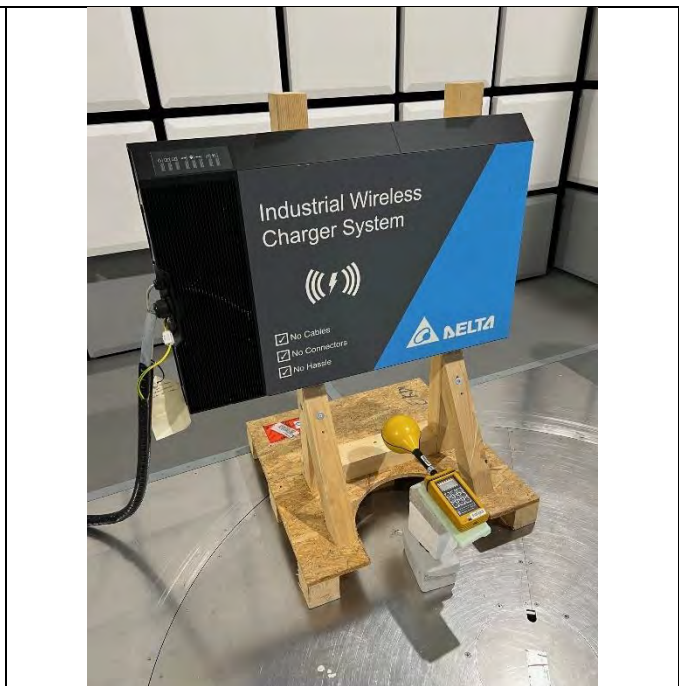
Left of WPP at 180 mm distance



Right of WPP at 200 mm distance



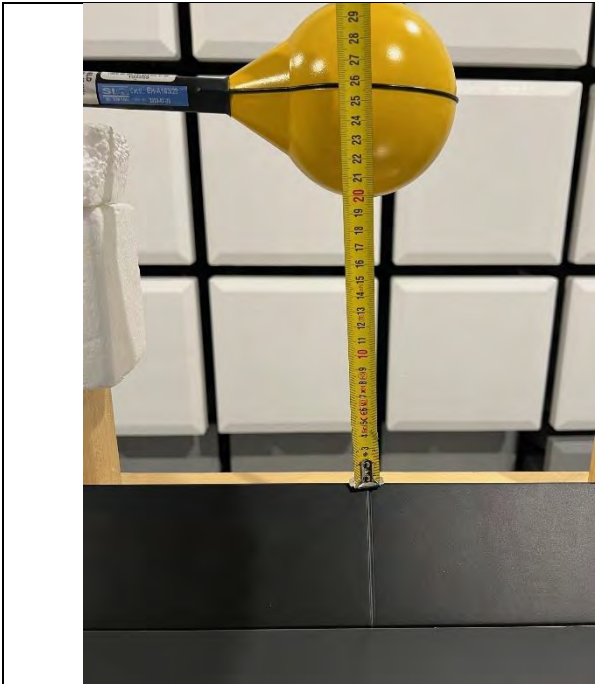
Right of WPP at 380 mm distance



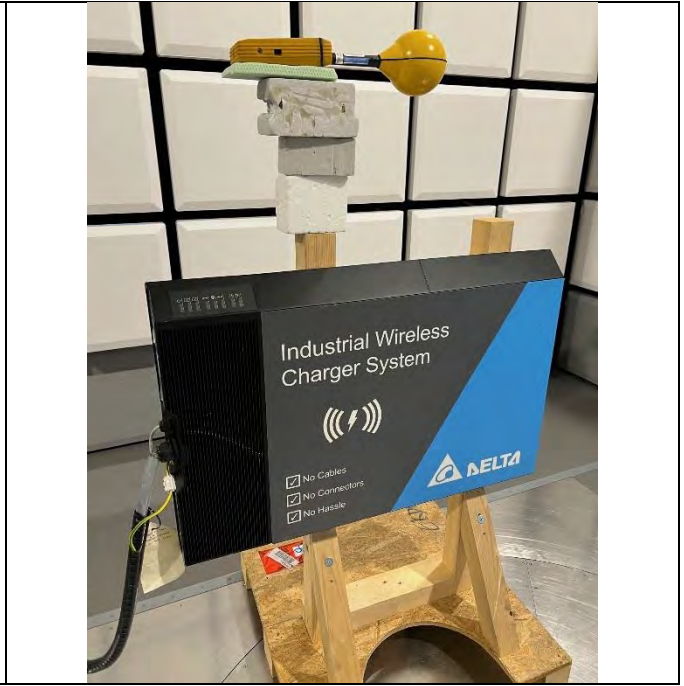
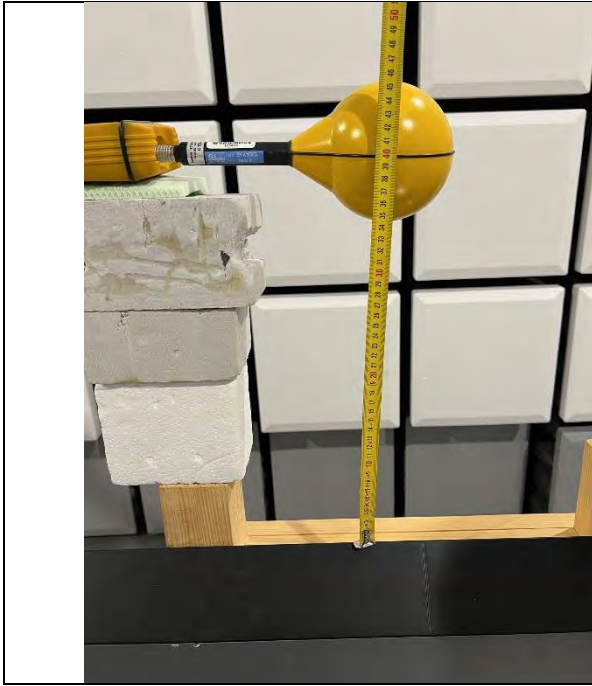
Bellow WPP at 200 mm distance



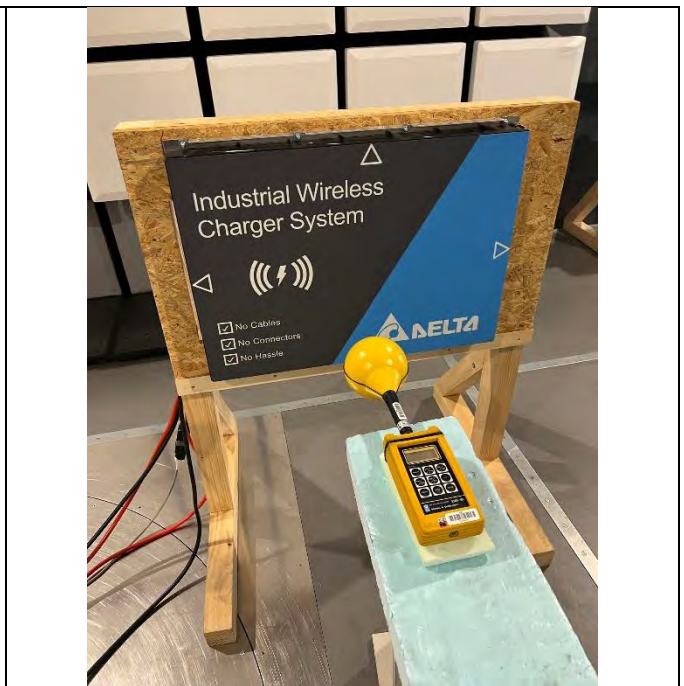
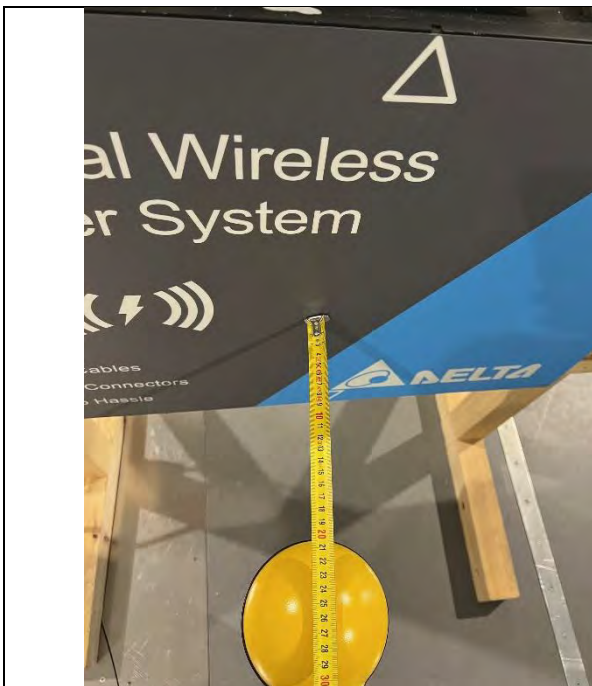
Bellow WPP at 347 mm distance



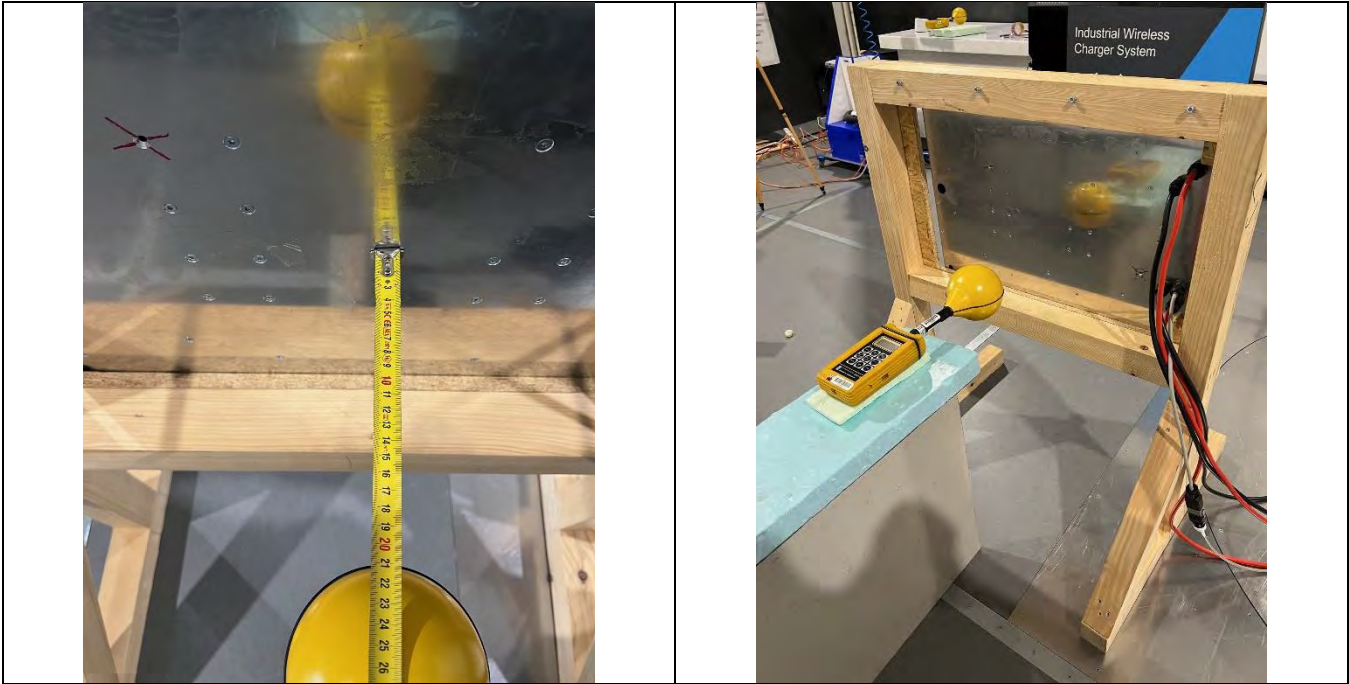
Above WPP at 200 mm distance



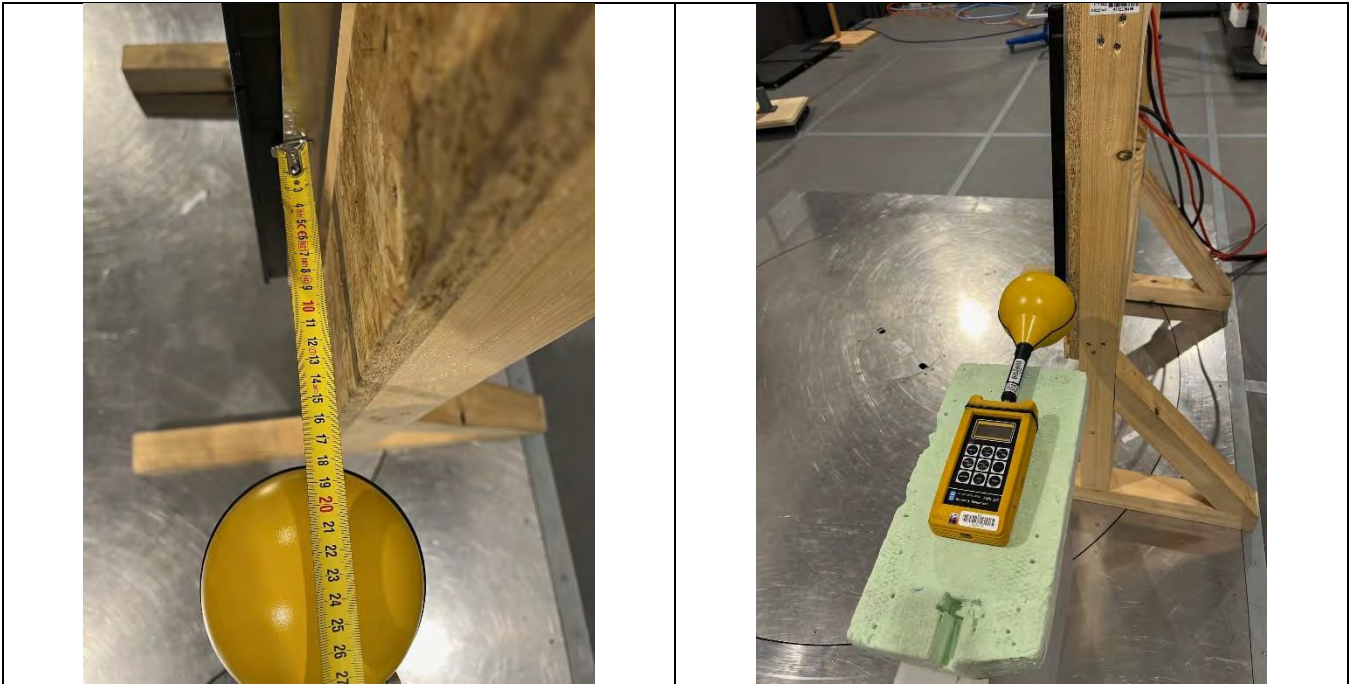
Above WPP at 347 mm distance



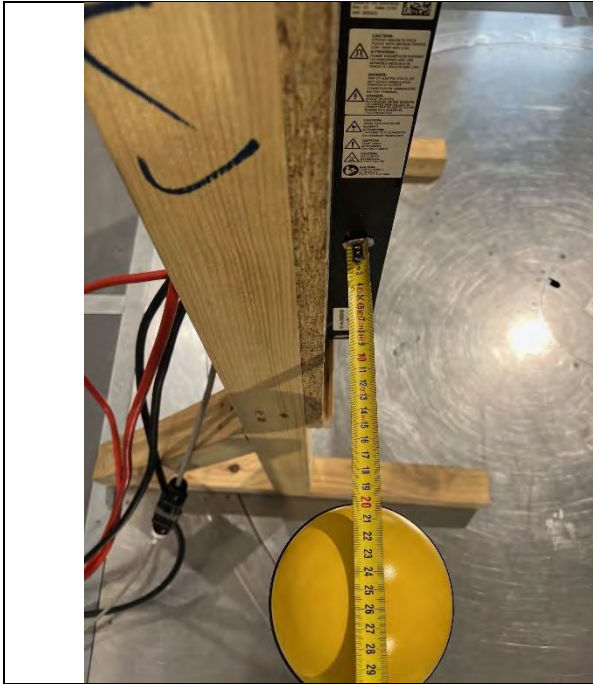
Front of WSU at 200 mm distance



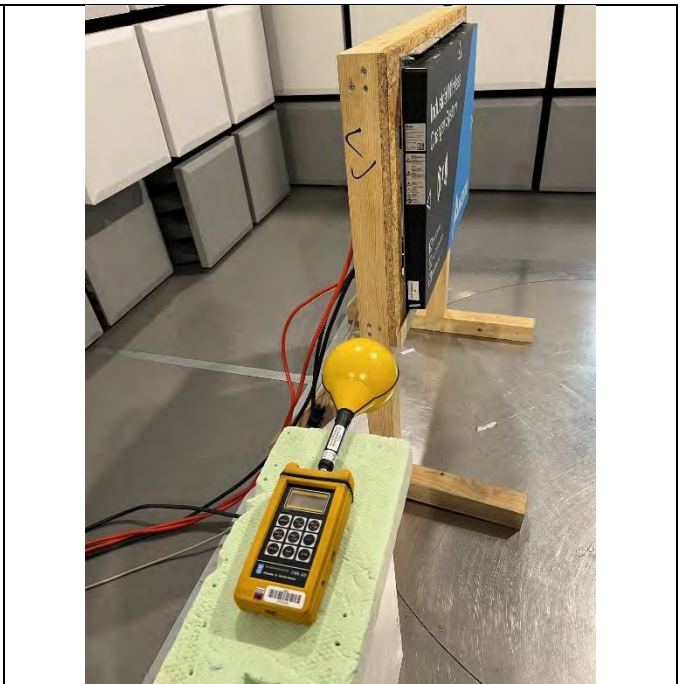
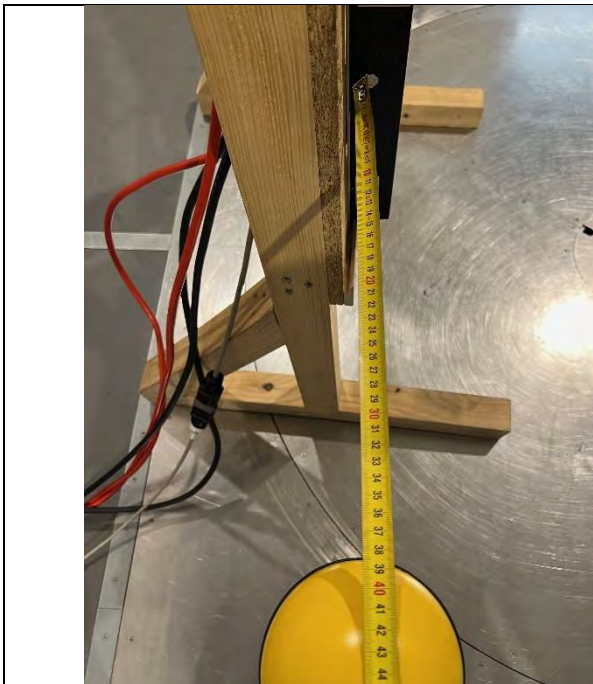
Back of WSU at 200 mm distance



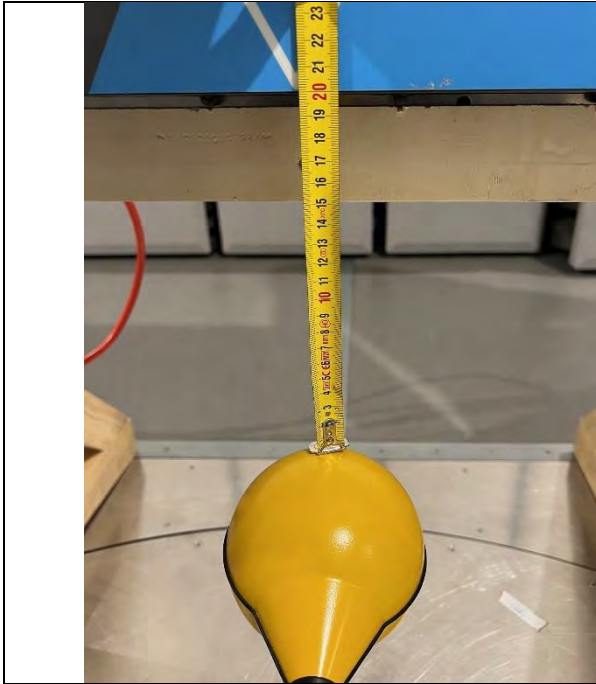
Right of WSU at 180 mm distance



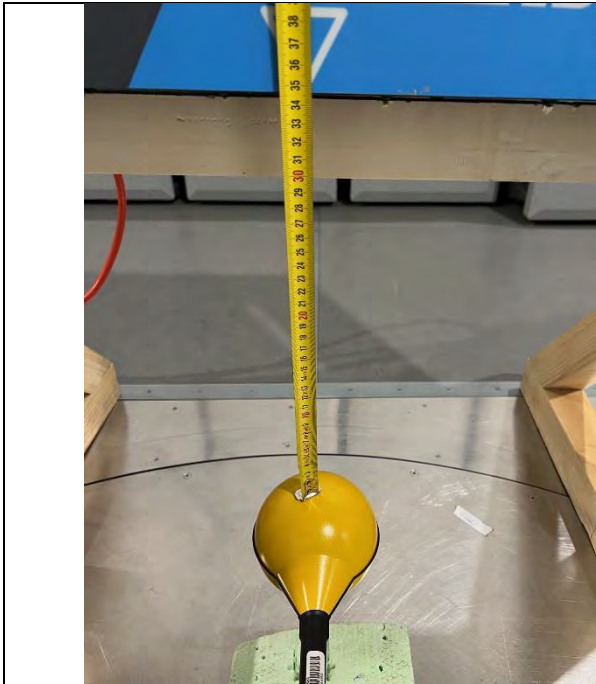
Left of WSU at 200 mm distance



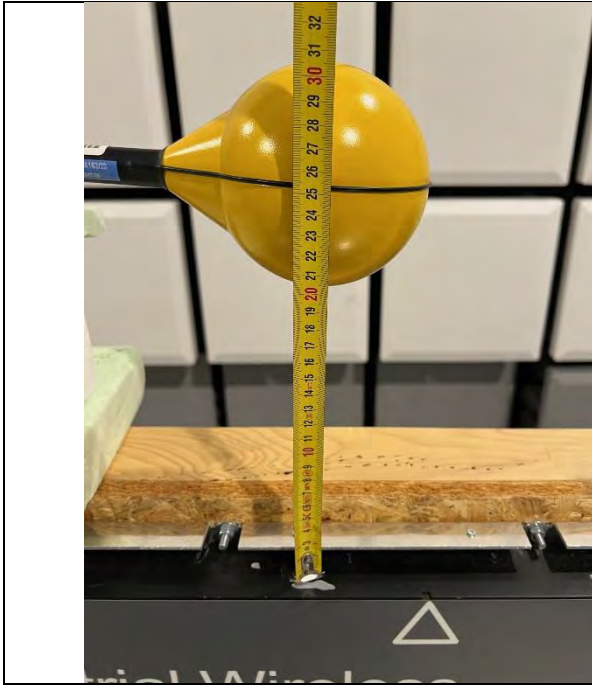
Left of WSU at 380 mm distance



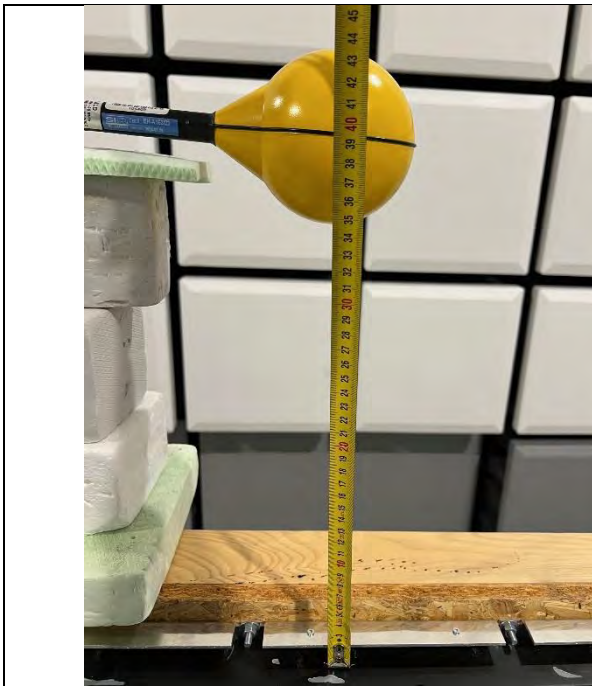
Bellow WSU at 200 mm distance



Bellow WSU at 347 mm distance



Above WSU at 200 mm distance



Above WSU at 347 mm distance



5 EQUIPMENT LIST

Equipment	Manufacturer	Type	SIQ Number	Last calibration date	Last due date
SAC 1	Comtest Engineering	SAC 3m	109071	N/A	N/A
Isotropic magnetic field probe	Narda	ELT-400	105147	2022-09	2024-03
Isotropic magnetic field probe	W&G	EMR-300	103446	2022-09	2024-03
Electric Field Probe	PMM	EP-602	/	2022-10	2024-04