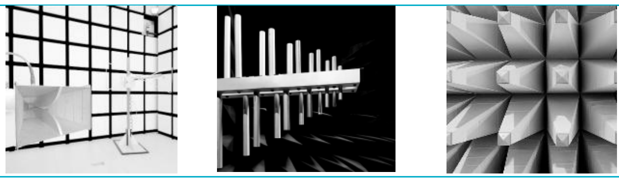

cetecom advanced

TEST REPORT

ilac-MRA

DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-00

Test Report No.: 1-7199-23-01-14_TR1-R02

Testing Laboratory

cetecom advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
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Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS).
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12047-01-00.
ISED Testing Laboratory Recognized Listing Number: DE0001
FCC designation number: DE0002

Applicant

Kistler Instrumente AG
Else-Züblin-Strasse 17
8404 Winterthur/SWITZERLAND

Phone: +41 52-224 11 11

Contact: Christian Gerber
e-mail: christian.gerber@kistler.com
Phone: +41 52 2241 677

Manufacturer

Kistler Instrumente AG
Else-Züblin-Strasse 17
8404 Winterthur/SWITZERLAND

Test Standard/s

47 CFR 1.1307	Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared.
47 CFR 2.1091	Radiofrequency radiation exposure evaluation: mobile devices.
47 CFR 2.1093	Radiofrequency radiation exposure evaluation: portable devices.
KDB 447498 D04 v01	Interim General RF Exposure Guidance: RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	Telemetric Measurement System (TMS)
Device type:	fix device
FCC ID(s):	**2AWIT-5290A, 2AWIT-5190A**
Model name:	**TMS**
Base unit:	**5290A**
Charging amplifier unit:	**5190A (only works coupled to an 5290A)**
Frequency:	see technical details
Test sample status:	identical prototype
Exposure category:	general population / uncontrolled environment

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test Report authorised:

cn=Alexander Hnatovskiy, o=cetecom advanced GmbH, ou=HNA-230601, email=alexander.hnatovskiy@cetecomadvanced.com, c=DE
2025.08.14 09:59:18 +02'00'

Alexander Hnatovskiy
Lab Manager
Radio Labs

Test performed:

cn=Marco Scigliano, o=cetecom advanced GmbH, ou=SCI-230601, email=Marco.Scigliano@cetecomadvanced.com, c=DE
2025.08.14 10:16:55 +02'00'

Marco Scigliano
Testing Manager
Radio Labs

1 Table of contents

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. cetecom advanced GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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In no case this test report can be considered as a Letter of Approval.

2.2 Application details

Date of receipt of order:	2024-04-19
Date of receipt of test item:	2025-03-10
Start of test:	2025-03-13
End of test:	2025-03-13

2.3 Statement of compliance

The EMF values found for the TMS Telemetric Measurement System (TMS) are below the maximum allowed levels according to the standards listed in section 3.

2.4 Technical details

A TMS System always consist of two units as follows.

5290 A – TMS Base unit:
The base unit provides a WPT connection to the 5190A Charge amplifier units with 125 kHz.
When no Charge amplifier is present the unit still provides the WPT field – scanning for units to couple to.

5190 A – Charge amplifier unit:
Only when properly coupled to the base unit, the charge amplifier transmits RFID data to the base unit via 13.56 MHz. As its power is provided from the base unit WPT charging, a loss of coupling will shut down the amplifier and it is not capable to send further RFID information. Thus for only the coupled status is measured.

3 Test standard/s:

Test Standard	Version	Test Standard Description
47 CFR 1.1307		Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared.
47 CFR 2.1091		Radiofrequency radiation exposure evaluation: mobile devices.
47 CFR 2.1093		Radiofrequency radiation exposure evaluation: portable devices.
KDB 447498 D04	v01	Interim General RF Exposure Guidance: RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices
FCC KDB 680106 D01	v04	Equipment authorization of WPT devices.

3.1 RF exposure limits

According to: CFR47, Subpart I - §1.1310 Radiofrequency radiation exposure limits				
Frequency Range (MHz)	**Electric Field** (V/m)	**Magnetic Field** (A/m)	**Power density** (mW/cm^2)	**Averaging time** (minutes)
Occupational / Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/ ƒ	$*900/f^2$	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100000	--	--	5	6
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
300-1500	--	--	f/1500	30
1500-100000	--	--	1.0	30

Extention of measurement range of the table to 125 kHz:

According to **FCC KDB 680106 D01 Paragraph 3 RF Exposure Requirements clause 3** the Emission-Limits in the frequency range from 100 to 300 kHz should be assessed versus the limits at 300 kHz in Table 1 of **CFR 47 – Section 1.310** as following (measurement distance shall be 20cm from the center of the probe to the top side and 15cm from the center of the probe to the edge of the device):

	E-field	H-field	B-field
Frequency	V / m	A/m	µT
0.3 – 3.0 MHz	**614**	**1.63**	2.0
3.0 – 30 MHz	**824/f** (=60.7$_{13.56MHz}$)	**2.19/f** (=0.161$_{13.56MHz}$)	--

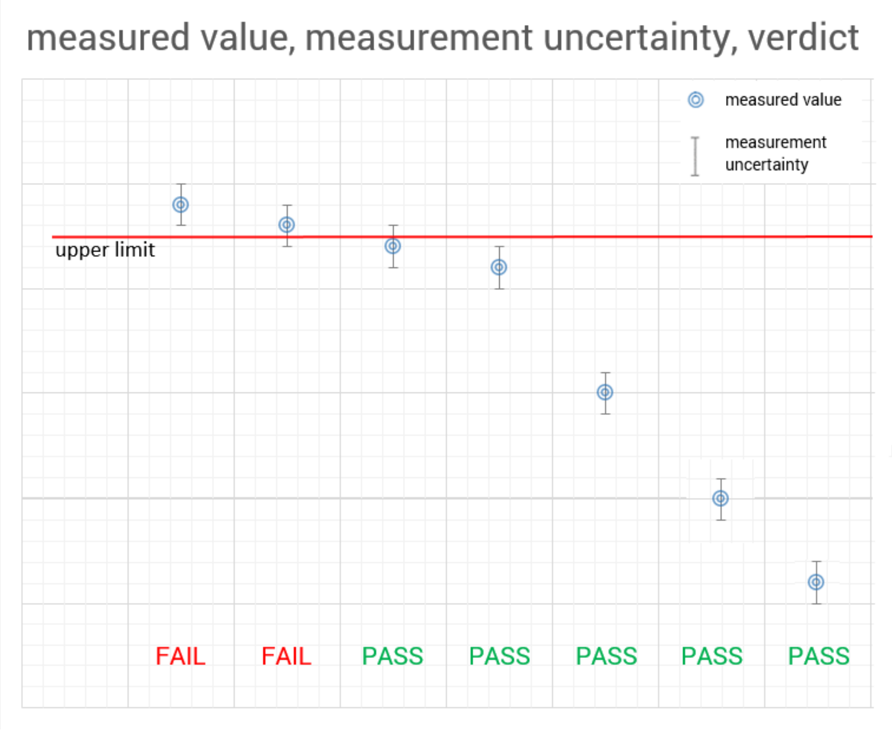
Introduction of the 50% criteria:

FCC KDB 680106 D01 Paragraph 5b(5) demands, that the aggregate H-field strengths at 15 cm surrounding the device and 20 cm above the top surface from all simultaneous transmitting coils are demonstrated to be less than 50% of the MPE limit (1.6A/m) which results in an H-Field limit of 0.815 A/m. A device that complies with the 50% criteria is deemed to comply, without any further investigation through the FCC.

	E-field	H-field	B-field
Frequency	V / m	A/m	µT
0.3 – 3.0 MHz	614	1.63	2.0
0.3 – 3.0 MHz* (50% criteria)	**307**	**0.815**	1.0

4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.
The measurement uncertainty is mentioned in this test report, see chapter 9, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."



5 Summary of Measurement Results

☒	**No deviations from the technical specifications ascertained**
☐	Deviations from the technical specifications ascertained

No relevant emissions out of the cabinet of the DUT are detected at the declared **safety distance of 20 cm** from the antenna-surface.

6 Test Environment

Ambient temperature:	20 – 24 °C
Relative humidity content:	40 – 50 %
Air pressure:	not relevant for this kind of testing
Power supply:	230 V / 50 Hz

7 Test Set-up

7.1 Measurement system

7.1.1 Broadband Electromagnetic Field Test system

A state of the art Broadband Electromagnetic Field Test system was used. The probes of the system are fitted with three sensors which measure the field strength of the X, Y and Z plane directions separately. The field strength is calculated by the instrument's processor by summing the squares of the three measured values.

The frequency range 5 Hz to 60 GHz is covered.
Depending on the used probe type Electric and Magnetic Field or Electric Field only is detectable.

• EHP-50D	5 Hz to 100 kHz	Electric and Magnetic Field
• EHP-50F	5 Hz to 400 kHz	Electric and Magnetic Field
• HF 3061	300 kHz to 30 MHz	Magnetic Field
• EF 0691	100 kHz to 6 GHz	Electric Field
• EF 6092	100 MHz to 60 GHz	Electric Field
• ELT 400 3cm²	1 Hz to 400 kHz	Magnetic Field

7.1.2 Test equipment list

	Manufacturer	Device	Type	Serial number	Last Calibration	Calibration cycle (months)
☒	Narda	Electric and Magnetic Field Meter	NBM-550	F-0319	2023-04-12	24
☒	Narda	Electric and Magnetic Field Meter	ELT 400	N-0915	2023-04-20	24
☒	Narda	Electric Field Probe (100 kHz - 6 GHz)	EF 0691	G-0027	2023-04-12	24
☒	Narda	Magnetic Field Probe (300 kHz to 30 MHz)	HF 3061	D-0404	2023-04-12	24
☒	Narda	Magnetic Field Probe (1 Hz – 400 kHz)	B-Field 3cm²	C-0393	2023-04-20	24

☒ Devices used during the test ☐ Devices not used during the test

7.1.3 Averaging

For time efficient testing an average of 8 seconds was used. With some spot checks was verified, that caused by the time structure of the measured responses, the results did not change with a 6-minute-averaging.

7.1.4 Uncertainties

The probe uncertainties stated by the manufacturer are considered to be the main relevant and dominant issues.

7.1.4.1 Typical uncertainty of HF3061

Flatness of frequency response[(a)] Calibration uncertainty not included	0/-1 dB (500 to 800 kHz) +0.1/ -0.5 dB (800 kHz to 30 MHz)	
Calibration uncertainty[(b)] @ 0.59 mW/cm² (0.125 A/m)	1.3 dB	
Linearity Referred to 0.59 mW/cm² (0.125 A/m)	±3 dB (0.017 to 0.033 A/m) ±1 dB (0.033 to 0.068 A/m) ±0.5 dB (0.068 to 3 A/m) ±1 dB (3 to 16 A/m)	±3 dB (10 to 40 µW/cm²) ±1 dB (40 to 175 µW/cm²) ±0.5 dB (175 µW/cm² to 340 mW/cm²) ±1 dB (0.34 to 10 W/cm²)
Isotropic response[(C)]	±1 dB	
Temperature response	+0.2/ -0.8 dB (±0.025 dB/K @ 10 to 50 °C)	

(a) Frequency response can be compensated for by the use of correction factors stored in the probe memory
(b) Accuracy of the fields generated to calibrate the probes
(c) Uncertainty due to varying polarization (verified by type approval test for meter with probe). Ellipse ratio included and calibrated for each probe

7.1.4.2 Typical uncertainty of EF0691

Flatness of frequency response[(a)] Calibration uncertainty not included	±1.0 dB (1 MHz to 4 GHz) ±1.5 dB (0.3 MHz to 5 GHz) -2.5 dB typ. @ 0.15 MHz	
Calibration uncertainty[(b)] @ 0.2 mW/cm² (27.5 V/m)	0.8 dB (≤ 300 MHz) 1.5 dB (300 MHz to 1.2 GHz) 1.3 dB (≥ 1.2 GHz)	
Linearity Referred to 0.2 mW/cm² (27.5 V/m)	±0.5 dB (2.2 to 316 V/m)	±0.5 dB (0.0013 to 26.5 mW/cm²)
Isotropic response[(C)]	±1 dB	
Temperature response	+0.2/ -1 dB (0 °C to 50 °C, related to 23 °C)	

(a) Frequency response can be compensated for by the use of correction factors stored in the probe memory
(b) Accuracy of the fields generated to calibrate the probes
(c) Uncertainty due to varying polarization (verified by type approval test for meter with probe). Ellipse ratio included and calibrated for each probe

7.1.4.3 Typical uncertainty of ELT 400 with B-Field 3cm² probe

Measurement uncertainty [1)]	±6% (50 Hz to 120 kHz)

[1)] The measurement uncertainty includes flatness, isotropy, absolute and linearity variations (frequency range: 1 Hz to 400 kHz or 10 Hz to 400 kHz).

The uncertainty increases at the frequency band limits (10 Hz, 30 Hz, 400 kHz) to –1 dB based on the nominal frequency response.

Narda Safety Test Solutions GmbH
Sandwiesenstrasse 7 - 72793 Pfullingen - Germany
Phone: +49 7121 9732 0 - Fax: +49 7121 9732 790

UNCERTAINTY

The reported expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor k = 1.96, providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with the "Guide to the Expression of Uncertainty in Measurement" (GUM). The reported measurement uncertainty is derived from the uncertainty of the calibration procedure and the object during calibration, and makes no allowance for drift or operation under other environmental conditions.

MEASURING CONDITIONS

The calibration was performed using a continuous wave signal (CW). The magnetic flux density was set to nominal 2.5 µT.

RESULTS

Frequency Response

f	X_{nom}	RS						U
kHz	V/T	Pos. Y	Pos. YZ	Pos. Z	Pos. ZX	Pos. X	Pos. XY	%
0,052	13.72	0.9949	0.9966	1.0156	1.0149	1.0012	0.9805	0.92
0,4	105.57	0.9993	0.9992	1.0191	1.0168	1.0044	0.9835	0.57
30	7.90k	1.0030	1.0098	1.0192	1.0155	1.0059	0.9984	0.75
120	30.71k	1.0045	1.0130	1.0248	1.0247	1.0129	1.0029	0.81
400	65.24k	0.9872	0.9989	1.0169	1.0100	0.9936	0.9878	2.17

INTERPRETATION

The worst-case uncertainty of the object was calculated from the calibration results reported in the "Frequency Response" section using commonly accepted statistical rules.

Frequency Range	worst-case uncertainty U_{probe}
1 Hz to 120 kHz	2.96 %
120 kHz to 400 kHz	3.13 %

Note: As the object is purely a coil the function is not restricted at low frequencies.

The total uncertainty of the system shall be calculated using $U_{system} = \sqrt{U_{meter}^2 + U_{probe}^2}$

CERTIFICATE: 23009020-C0393-20210726-10650 PAGE 4 OF 4

7.1.5 Validation procedure

Before performing the tests the empty test chamber was checked for system immanent frequency responses. The following background signal level was detected. All levels are small enough to allow accurate proof of the limits to be considered.

Probe	Frequency Range	Magnetic Flux Density (B) in µT	Magnetical Field Strength in A/m	Electrical Field Strength in V/m	Remark
HF 3061	300 kHz – 30 MHz	0.0016	0.0013	--	
EF 0691	100 kHz – 6 GHz	--	--	0.15	
ELT 400 + 3cm²	1 – 400 kHz	0.872	0.694	--	

7.1.6 Definition of test position and distances

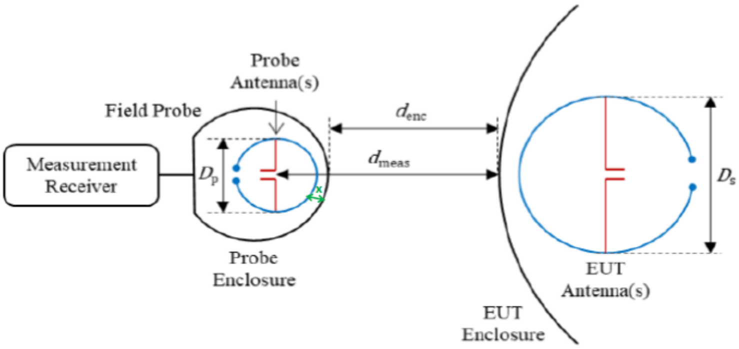
In absence of an equipment specific regulation with given test distances, all not further noted test positions were measured in “touched” mode, the probe radome touching the DUT at the defined test position.

Due to the mechanical concept of the used probe a distance between DUT surface and electrical centre of the probe antennas remains.

Probe type	Maximum distance (cm)	
	Magnetic Field	Electrical Field
HF 3061	5.5	--
EF 0691	--	3.5
ELT 400 + 3cm²	1.5	--

7.1.7 Applicable minimum distances for measurements

Based on Chapter 7.1 of RSS 102 SPR 002 for each measurement probe the applicable minimum testing distance needs to be considered as measurements with a smaller distance will not provide reliable results.



The shortest distance separating the probe and EUT antennas, denoted by d_{meas} above, is proportional to the probe antenna size requirements outlined in section 7.1.7 of RSS 102 SPR 002. x was defined as the distance between internal coil (D_p) and enclosure of probe antenna.

The following lists gives the applicable minimum distances for RSS 102 SPR 002 measurements:

Probe	Range	D_p	$d_{meas} \geq 1.7xD_p$	x distance, coil to outer enclosure	$D_{enc}@d_{meas}$	Dimension of probe (H x B x T) as specified
	kHz	[cm]	[cm]	[cm]	[cm]	[mm]
HF 3061	300 – 30 x 10^3	11.7	19.9	0.15	13.9	300 x 120 Ø
EF 0691	100 – 6 x 10^6	6.3	10.7	0.15	7.4	318 x 66 Ø
ELT 400 + 3 cm²	0.001 - 400	2.9	4.9	0.15	3.3	250 x 32 Ø

7.1.8 Anisotrophical probe behaviour management

As EMF measurements for safety and health aspects are often performed in the nearfield of a radiation source it is important to be aware of the not ideal isotropic performance of a typical probe and how to reproduce reliable results.

During measurements the following steps are performed to get always the highest possible field strength result and validate that the measured results are always the worst case scenario with the highest energy emitted by the source.

Step 1: Finding the position of the highest radiated field source with a basic probe orientation.
Step 2: Turning the probe to all possible orientations to find the orientation that delivers the maximum field strength.

7.2 Test results

For considering worst-case conditions all measurements were performed at smallest possible distance from the device under test. Limits shown in the tables below are the lowest ones within the wideband frequency ranges of the field probes applied.

Averaging was not performed as compliance to 20cm safety distance could already be shown with overrated peak evaluation.

Test positions see photo documentation (Annex A).

Test Cases base unit and charge amplifier unit in coupled or standalone mode:

- WPT stand-alone (TMS Base unit)
- WPT coupled (TMS Base Unit + Charge amplifier unit)
- RFID from TMS Charge amplifier unit (only coupled)

7.2.1 Test results – WPT stand-alone (TMS Base Unit)

Stand-alone/ uncoupled125 kHz								
test position	distance to probe centre (cm)	B (µT)	H (A/m)	Limit (A/m)	Probe	E (V/m)	Limit (V/m)	Probe
WC	touch*	200.3	159.4	**1.63**	**ELT400/3cm²**	**5.0**	**614**	**EF0691**
WC	10	1.4	1.1	**1.63**		0.9	**614**	
WC	**20**	**1.0**	**0.8**	**1.63**		--	**614**	
NOISE	≥ 20	1.0	0.8	**1.63**		0.5	**614**	

Table 1: Test results E-/ H-f@125 kHz, peak values (max hold)

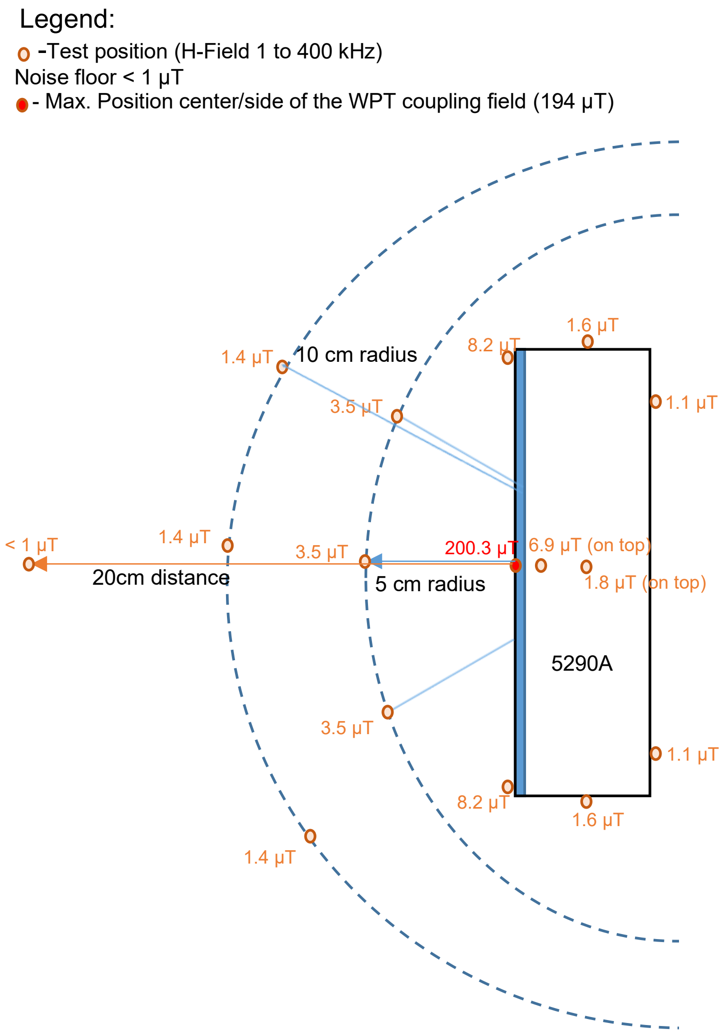
*) the internal distance between the outer housing and calibrated measurement position of the probes are as shown in the following table:

Probe:	**Internal Distance:**
ELT400/3cm²	1.5 cm
EF 0691	3.5 cm

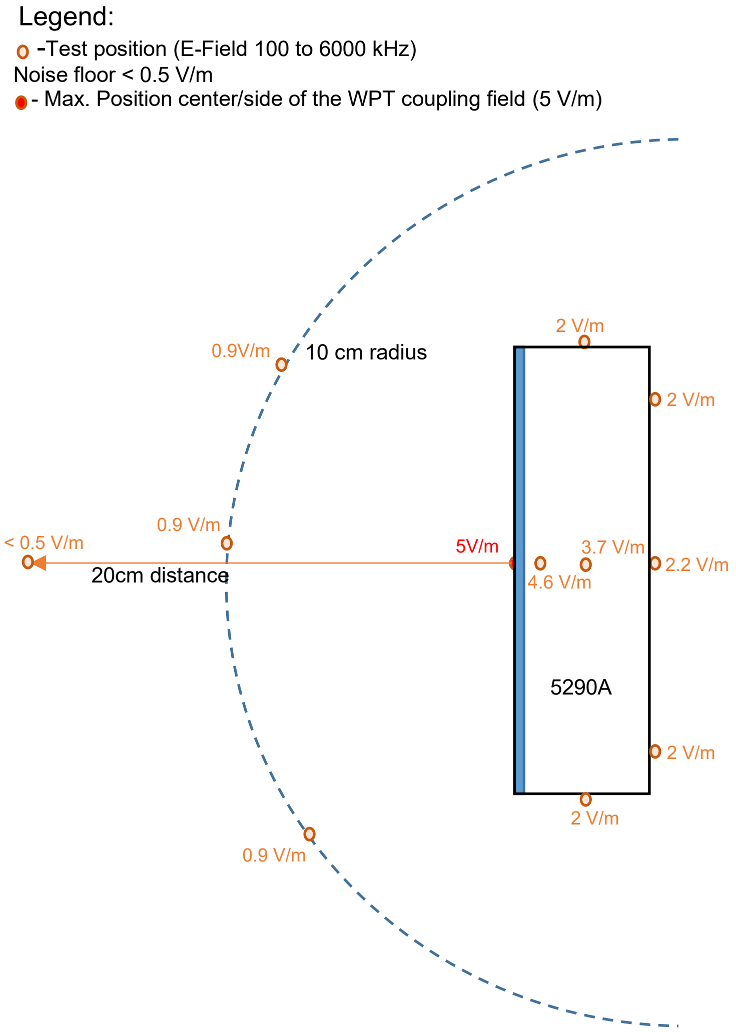
FULLMILLMENT of the 50% Criteria for chapter 7.2.1:
☒ yes ☐ no

At the declared safety distance of 20cm H-Field is below 0.815 A/m and E-field is below 307 V/m, thus for the EUT is deemed to comply without any further investigation through FCC.

Detailed H-field distribution:



Detailed E-field distribution:



7.2.2 Test results – WPT coupled (TMS Base Unit + Charge Amplifier Unit)

coupled125 kHz								
test position	distance to probe centre (cm)	B (µT)	H (A/m)	Limit (A/m)	Probe	E (V/m)	Limit (V/m)	Probe
WC	touch*	5.7	4.5	**5**	**ELT400/3cm²**	**4.68**	**87**	**EF0691**
NOISE	**≥ 20**	**1.0**	**0.8**	**5**		0.5	**87**	

Table 2: Test results E-/ H-f@125 kHz, peak values (max hold)

*) the internal distance between the outer housing and calibrated measurement position of the probes are as shown in the following table:

Probe:	**Internal Distance:**
ELT400/3cm²	1.5 cm
EF 0691	3.5 cm

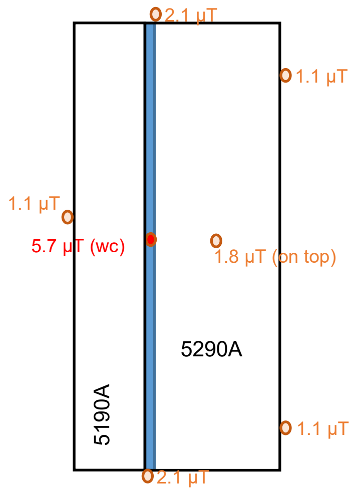
FULLMILLMENT of the 50% Criteria for chapter 7.2.2:
☒ yes ☐ no

At the declared safety distance of 20cm H-Field is below 0.815 A/m and E-field is below 307 V/m, thus for the EUT is deemed to comply without any further investigation through FCC.

Detailed H-field distribution:

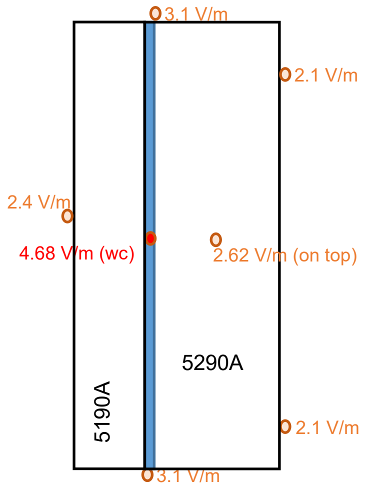
Legend:

o -Test position (H-Field 1 to 400 kHz)
Noise floor < 1 µT
● - Max. Position top side of the WPT coupling field gap (5.7 µT)



Detailed E-field distribution:

Legend:
o -Test position (E-Field 100 to 6000 kHz)
Noise floor < 0.5 V/m
● - Max. Position top side of the WPT coupling field gap (4.68 V/m)



7.2.3 Test results – RFID from TMS Charge Amplifier Unit (only coupled)

Coupled 13.56 MHz							
test position	distance to probe centre (cm)	H (A/m)	Limit (A/m)	Probe	E (V/m)	Limit (V/m)	Probe
WC	touch*	0.0206	**0.161**	HF3061	**4.68**	**60.7**	EF0691
NOISE	**≥ 20**	**0.0045**	**0.161**		0.5	**60.7**	

Table 3: Test results E-/ H-f@13.56 MHz, peak values (max hold)

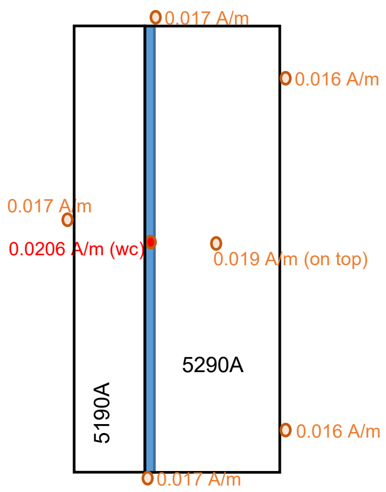
*) the internal distance between the outer housing and calibrated measurement position of the probes are as shown in the following table:

Probe:	Internal Distance:
HF 3061	5.5 cm
EF 0691	3.5 cm

Detailed H-field distribution:

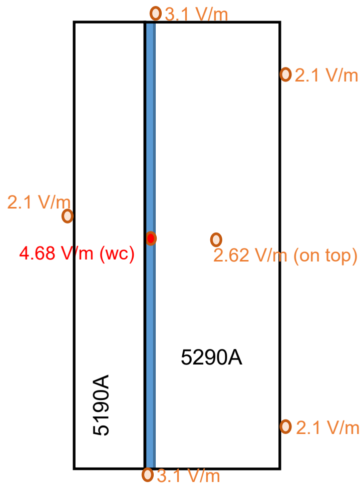
Legend:

o -Test position (H-Field 300 kHz to 30 MHz)
Noise floor: 4cm distance 0.06 A/m / 20cm distance 0.0045 A/m
● - Max. Position top side of the WPT coupling field gap (0.0206 A/m)



Detailed E-field distribution:

Legend:
o -Test position (E-Field 100 to 6000 kHz)
Noise floor < 0.5 V/m
● - Max. Position top side of the WPT coupling field gap (4.68 V/m)



7.3 Final verdict

No relevant emissions out of the cabinet of the DUT are detected at the declared **safety distance of 20 cm** from the antenna-surface.

Annex A: Photo documentation

Photo 1: EUT - 5190A+5290A (coupled)

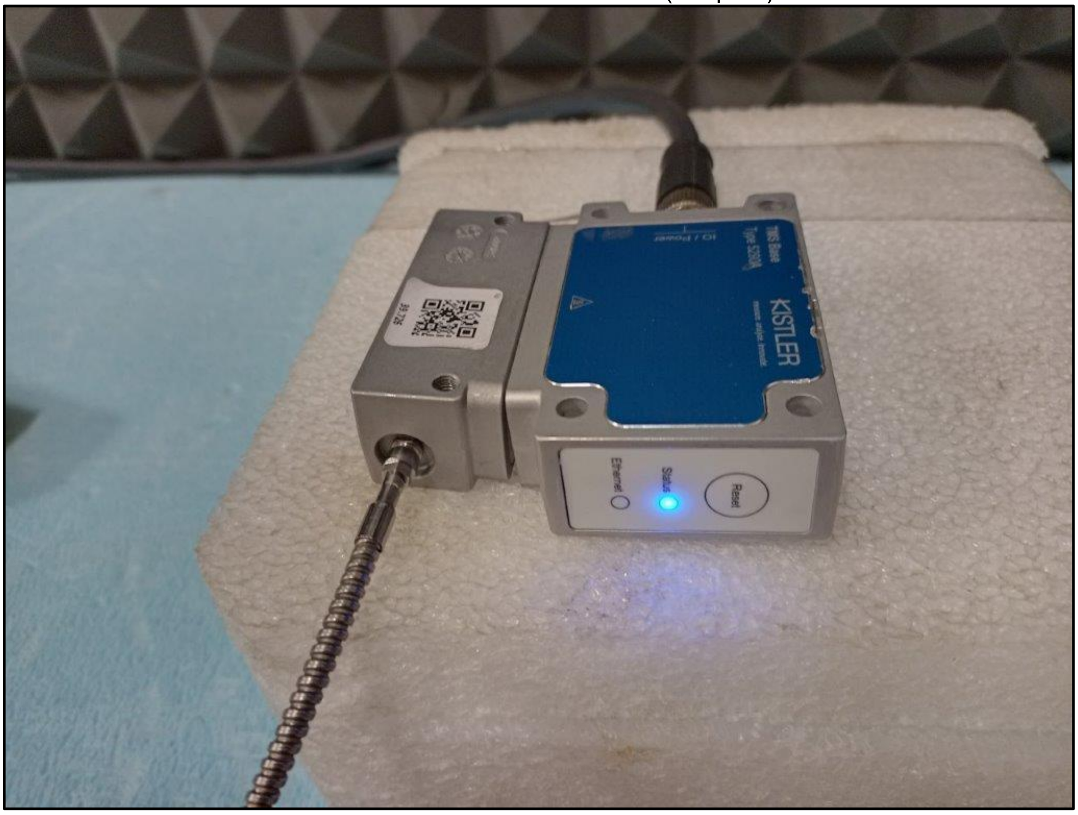


Photo 2: EUT - 5190A+5290A (not coupled/ error-state / standalone for 5290A 125kHz)

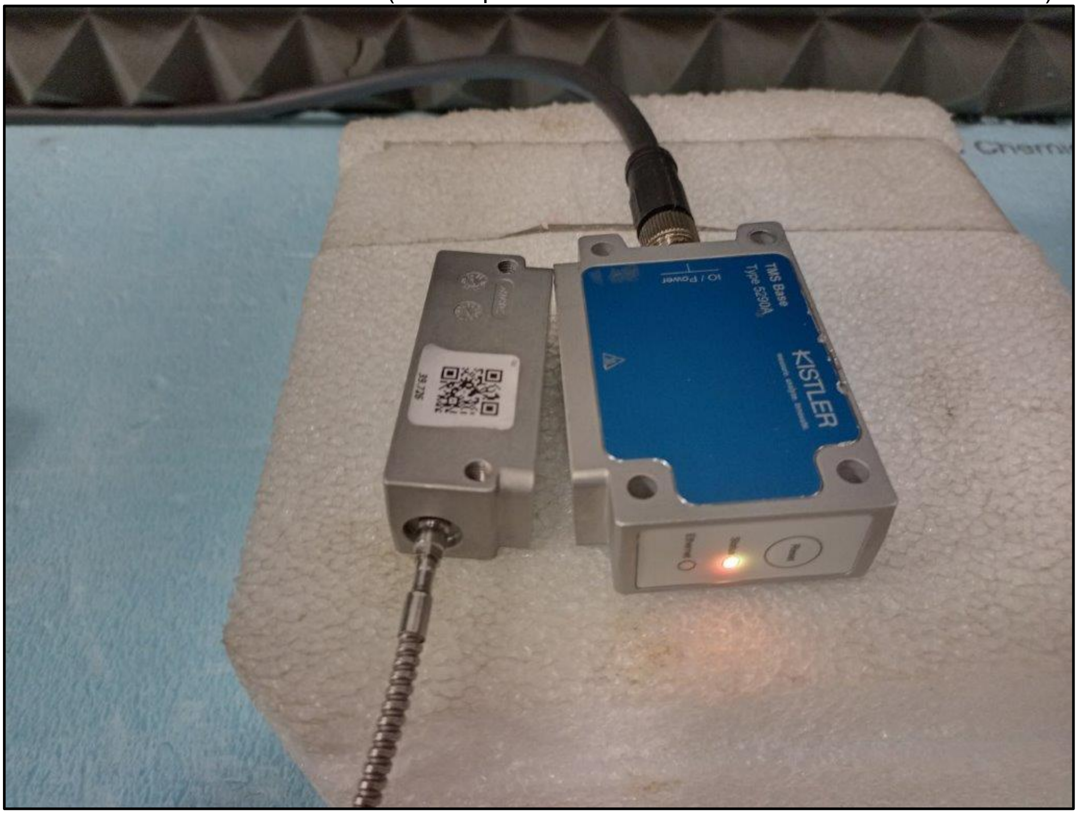


Photo 3: Test Position - Noise < 1µT already at 10 to 20 cm distance (ELT400 3cm² probe)

Photo 4: Test Position - WC- H- field strength (ELT400 3cm² probe, touch)

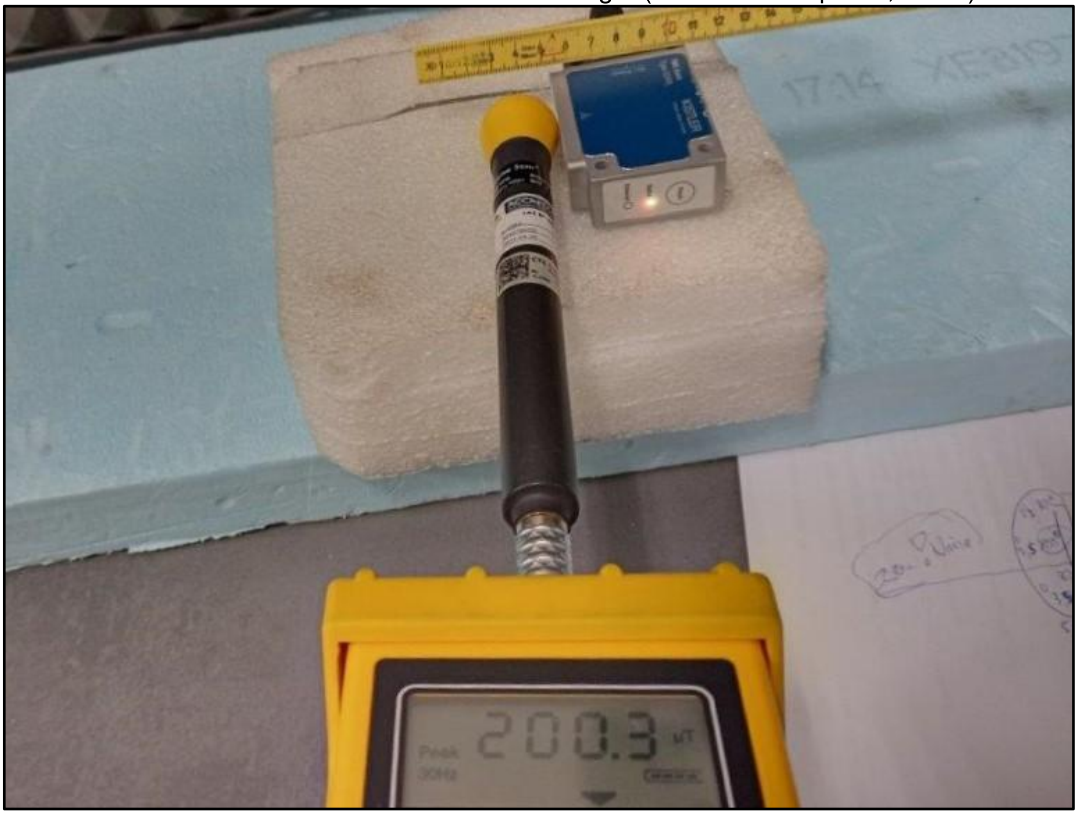


Photo 5: Test Position - WC- H- field top side of the WPT coupling field gap (ELT400 3cm² probe, touch)

Photo 6: Test Position - WC- E- field at side of the WPT coupling field, stand-alone (EF0691 probe, touch)

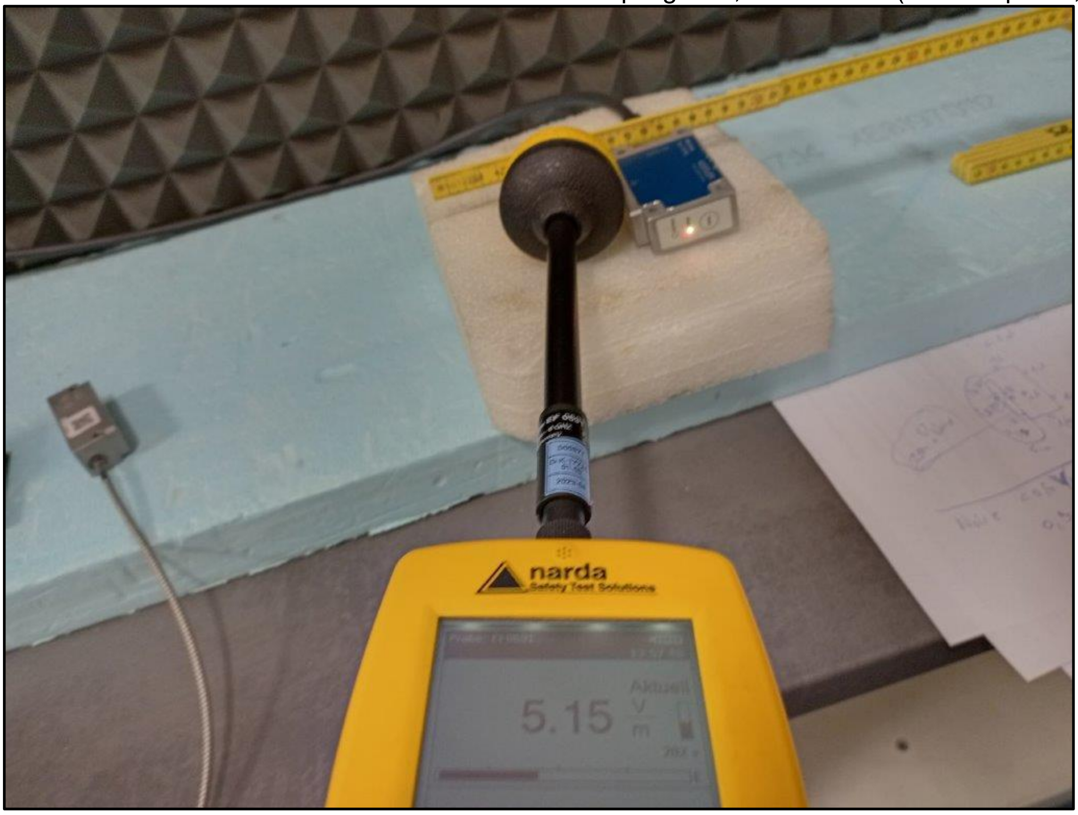


Photo 7: Test Position - E- field at left side of the coupled devices (EF0691 probe, touch)

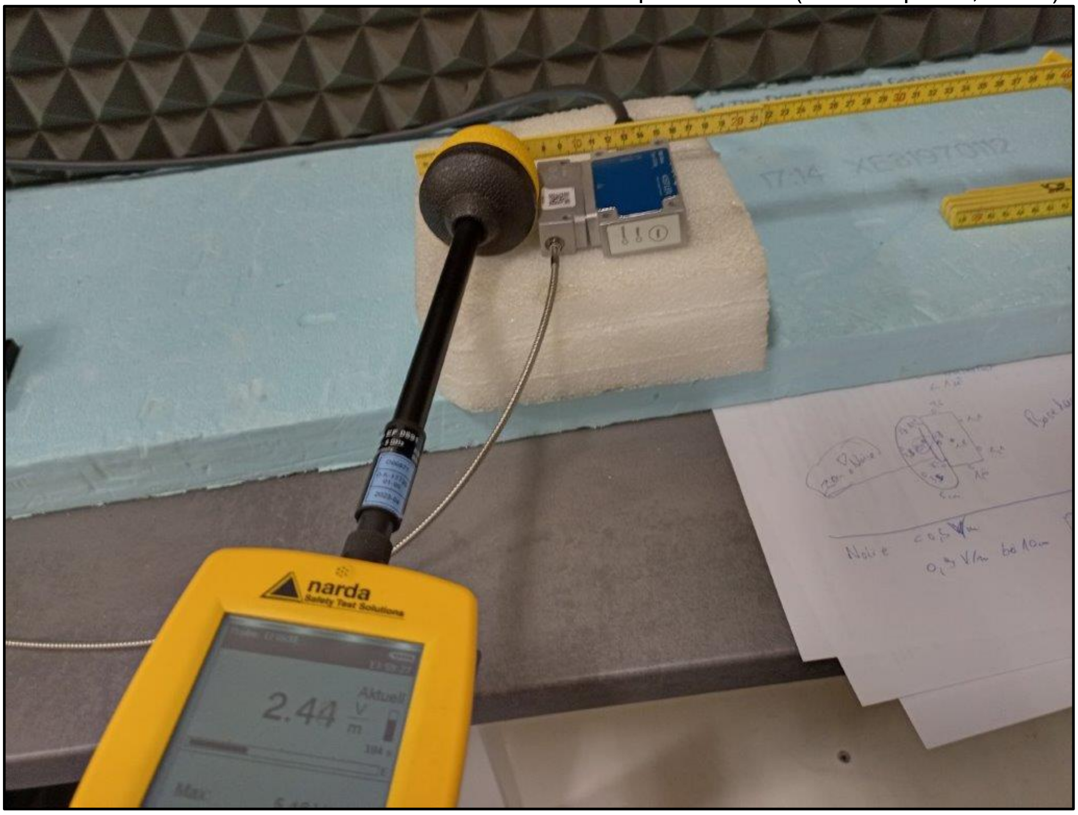
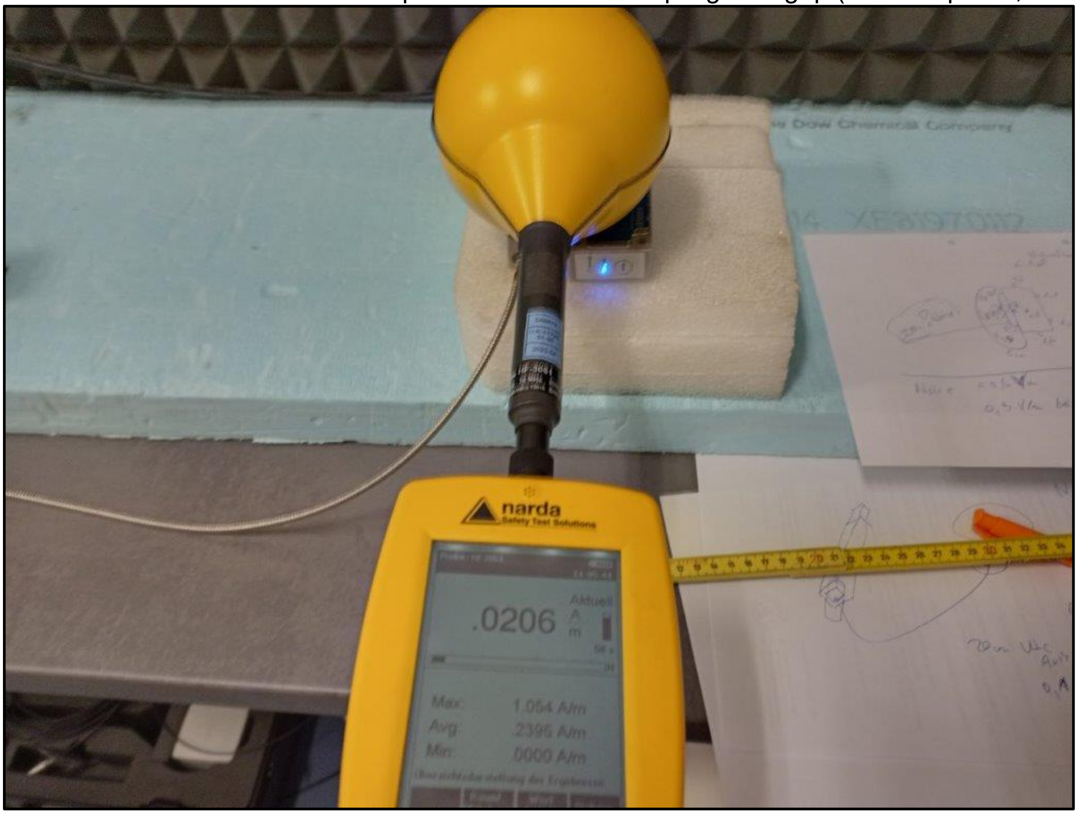


Photo 8: Test Position - H- field at top side of the WPT coupling field gap (HF6091 probe, touch)



Annex B: Document History

Version	Applied Changes	Date of Release
-R01	Initial Release	2025-04-28
-R02	Corrected test item on the page 1	2025-08-14

Annex C: Further Information

Glossary

DUT - Device under Test
EUT - Equipment under Test
N/A - not applicable
S/N - Serial Number