
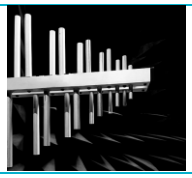
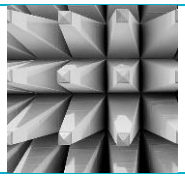

TEST REPORT

Test Report No.: 1-7639-24-01-02_TR1-R04

Deutsche Akkreditierungsstelle D-PL-12047-01-00

Testing Laboratory

cetecom advanced GmbH
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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

Molex Technologies GmbH
Mizarstraße 3
12529 Schönfeld / GERMANY

abdelnasser.farrag@molex.com

Manufacturer

Molex Technologies GmbH
Mizarstraße 3
12529 Schönfeld / GERMANY

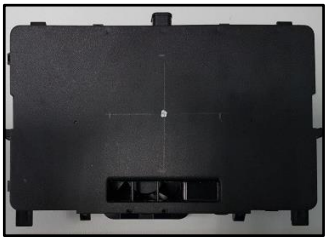
Test Standard/s

RSS - 102 Issue 6 Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

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

Test Item

Kind of test item:	Wireless Charger
Device type:	fixed device
Model name:	**WCH-PF30**
S/N serial number:	PA-01242290007
Hardware Version:	01
Software version:	01
Frequency:	127.66 kHz
Antenna:	Integrated coil
DC Supply Voltage:	13.0 ± 0.5 V
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
2025.01.03 10:12:01 +01'00'

Alexander Hnatovskiy
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Test performed:

cn=Marco Scigliano, o=cetecom advanced GmbH, ou=SCI-230601, email=Marco.Scigliano@cetecomadvanced.com, c=DE
2025.01.02 14:06:19 +01'00'

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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2.2 Application details

Date of receipt of order:	2024-07-29
Date of receipt of test item:	2024-09-16
Start of test:	2024-10-14
End of test:	2024-10-22

3 Test standard/s:

Test Standard	Version	Test Standard Description
RSS - 102 Issue 6	December 2023	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
RSS102.NS.SIM	December 2023	Section 5.3.5.3: EUT model uncertainty and validation

NOTE:
Supporting z-axis scan measurements for simulation of Nerve Stimulation evaluation according RSS102.NS.SIM section 5.3.5.3 and further requirements as defined by the customer.
The compliance evaluation of the EUT is not part of this report.

4 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

5 Test Set-up

5.1 Measurement system

5.1.1 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
• MAGPy-8H3D+E3D V2	3 kHz to 10 MHz	Magnetic Field

5.1.2 Test equipment list

	Manufacturer	Device	Type	Serial number	Last Calibration
☐	Narda	Electric and Magnetic Field Meter	NBM-550	F-0319	2023-04-12
☐	Narda	Electric and Magnetic Field Meter	NBM-520	D-1234	2021-05-10
☒	Narda	Electric and Magnetic Field Meter	ELT 400	N-0915	2023-04-20
☐	Narda	Electric Field Probe (100 kHz - 6 GHz)	EF 0691	G-0027	2023-04-12
☐	Narda	Electric Field Probe (100 MHz - 60 GHz)	EF 6092	A-0071	2021-05-10
☐	Narda	Magnetic Field Probe (300 kHz to 30 MHz)	HF 3061	D-0404	2023-04-12
☐	Narda	Electric and Magnetic Field Analyser (5 Hz – 100 kHz)	EHP-50D	230WX50108	2023-04-13
☐	Narda	Electric and Magnetic Field Analyser (5 Hz – 400 kHz)	EHP-50F	000WX60907	2023-01-18
☒	Narda	Magnetic Field Probe (1 Hz – 400 kHz)	B-Field 3cm²	C-0393	2023-04-20
☒	SPEAG	MAGPy Field Probe	MAGPy-8H3D+E3D V2 (FPGA Board: WP000009)	3079/1023	2023-10-24

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

5.1.3 Uncertainties

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

5.1.3.1 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.

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narda Safety Test Solutions
an L3 Technologies Company

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

5.1.3.2 Typical uncertainty of MAGPy-8H3D+E3D V2 probe

DASY8 Uncertainty Budget for Peak H-field
according to IEC/IEEE 63184

Item	Error Description	Unc. Value (±dB)	Probab. Distr.	Div.	(c_i)	Std. Unc. (±dB)
Measurement system						
1	Amplitude calibration uncertainty	0.35	N	1	1	0.35
2	Probe anisotropy	0.6	R	$\sqrt{3}$	1	0.35
3	Probe dynamic linearity	0.2	R	$\sqrt{3}$	1	0.12
4	Probe frequency domain response	0.3	R	$\sqrt{3}$	1	0.17
5	Probe frequency linear interp. fit	0.15	R	$\sqrt{3}$	1	0.09
6	Gradient uncertainty	0.1	R	$\sqrt{3}$	1	0.06
7	Parasitic E-field sensitivity	0.1	R	$\sqrt{3}$	1	0.06
8	Detection limit	0.15	R	$\sqrt{3}$	1	0.09
9	Readout electronics	0	N	1	1	0
10	Probe positioning	0.19	N	1	1	0.19
11	Repeatability	0.1	N	1	1	0.10
12	Surface field reconstruction	0.3	N	1	1	0.3
Combined uncertainty ($k = 1$)						0.59
Expanded uncertainty ($k = 2$)						**1.33 (16.6%)**

5.1.4 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	Electrical Field Strength in V/m	Remark
MAGPy-H3D	3 kHz – 10 MHz	0.023	--	

5.1.5 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	Closest physical Test distance (cm)	
	Magnetic Field	Electrical Field
MAGPy-8H3D+E3D V2	0.75 (Sub @ lowest plane)	5.0

5.1.6 Measurement with MAGPy-8H3D+E3D probe / DASY 8 WPT-System

The DASY8 WPT-System is a complete high precision robot-based evaluation platform for demonstrating compliance of wireless power transfer (WPT) devices according to IEC PAS 63184:2021(Chapter 8 "Measurement and numerical combination methods") and enables fully automated compliance testing. [1]

It is composed of the isotropic probe MAGPy-8H3D+E3D V2, the reference amplitude and phase probe (MAGPy-RAφ V2), and the data acquisition system (MAGPy-DAS V2) mounted to the DASY8 robot via the emergency stop (MAGPy-ES). The induced electric (E-) fields and specific absorption rate (SAR) are assessed with Sim4Life's Quasi-Static EM Solver (P-EM-QS) using only the measured data. The dedicated graphical user interface (GUI) fully automates the testing workflow.

This allows for Laboratory evaluation of WPT devices and any other local electromagnetic source not requiring magnetic (H-) field volume scans exceeding 2000 x 1000 x 1500 mm^3 with a precision of ±2.0mm.

The H-field distributions can be analyzed directly, and the values are compared to the reference level, or they are converted into Maxwell field and used as excitations for determining the basic restriction quantities for further dosimetric analysis with the Magneto Quasi-Static (MQS) solver [2].

This specific solution is optimized for:

- Evaluation of H-field (3 kHz – 10 MHz)
- Demonstration of compliance (3 kHz and 4 MHz) according to IEC PAS 63184:2021 [3]

NOTE:
For this report the DASY8 WPT system was only used for its advanced positioning possibilities and accuracy to perform basic H-field measurements in the close range of the EUT. Thus for no further complex system check procedures needed to be applied. The system noise level was measured before conducting the H-field measurements on the EUT.

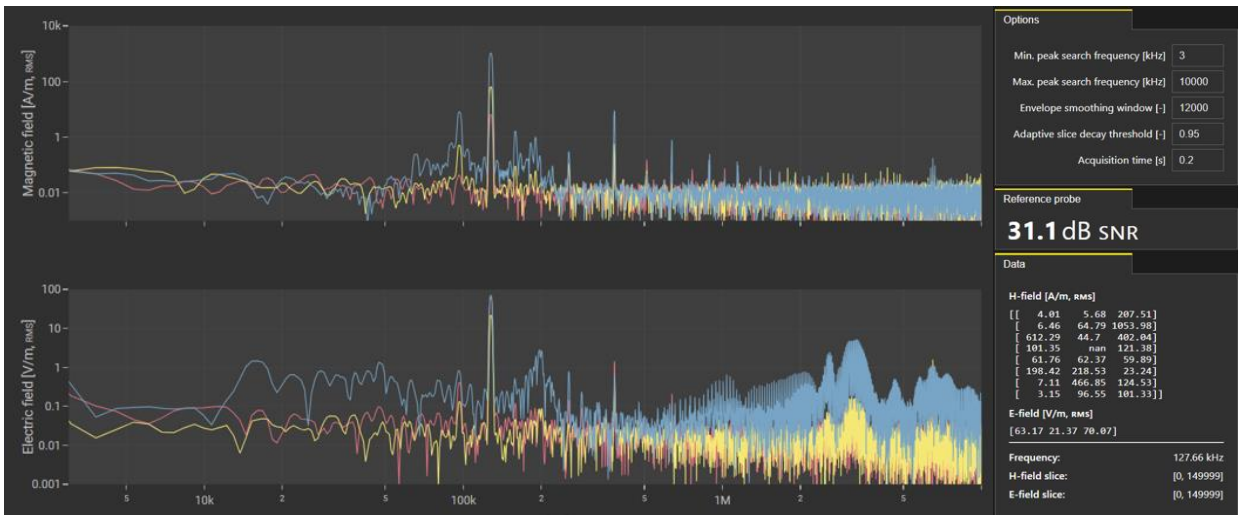
References:

[1] Assessment methods of the human exposure to electric and magnetic fields from wireless power transfer systems. Models, instrumentation, measurement and numerical methods and procedures (frequency range of 1 kHz to 30MHz), IEC PAS 63184:2021.

[2] The MQS conditions are violated above 4MHz and SPEAG recommends to use IEC/IEEE 62209-1528 for the frequency range above 4 MHz.

[3] Sim4Life, V7.2, ZMT Zurich MedTech AG, Zurich, Switzerland.

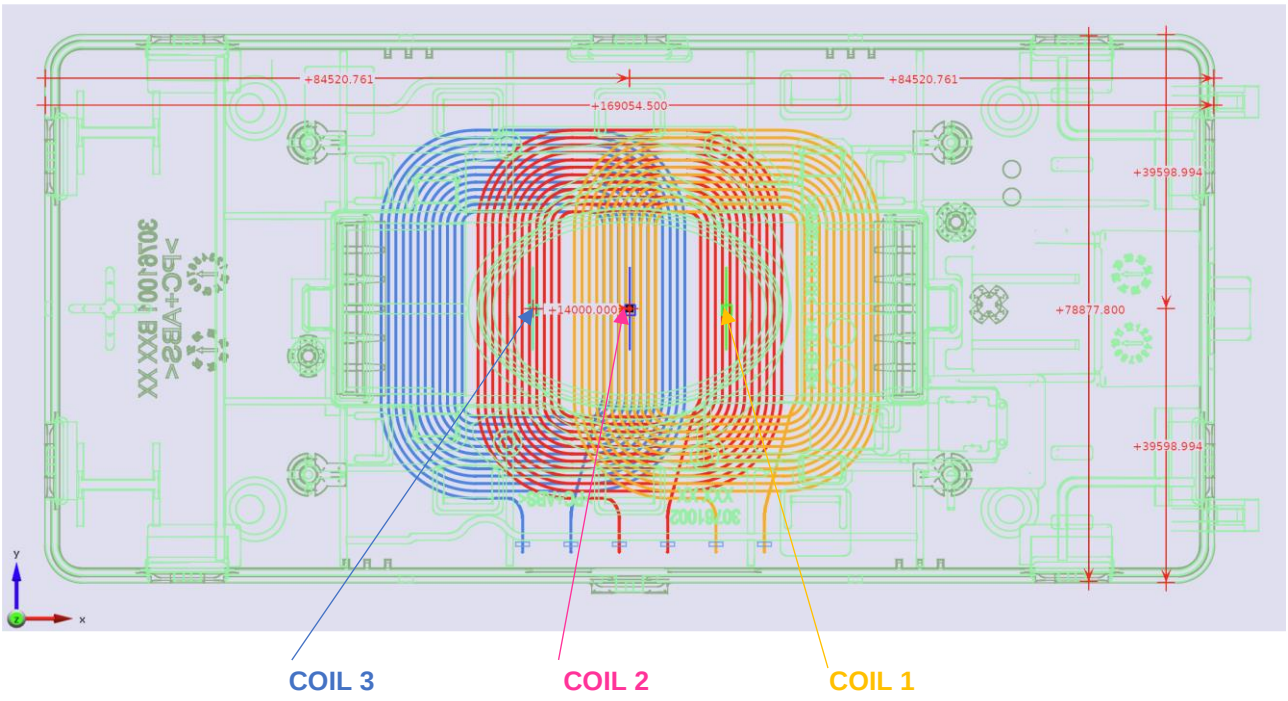
5.2 Spectrum measurement



Frequency: 127.66 kHz

5.3 Test results – Pre-Test defining worst case coil

The manufacturer delivered a configurable sample in which the coil voltage was adjustable and measureable to perform the testing with identical currents on each of the three coils separately. The coil with the greatest magnetic field distribution was used for the line measurement in chapter 4.4.



Pretest results: (touch with ELT 400 + 3cm² probe)

The voltage setting aimed to meet a value of 37300mV.

Test results of pre-test:		
Coil:	**Peak H-Field [µT]**	Coil Voltage:
Coil 1	1214	37380
Coil 2	1220	37380
Coil 3	**1229**	**37364**

Note: Test results with probe touch at maximum field position (internal test distance of 3cm² probe is 1.5cm)

5.4 Test results – Line measurement on Coil 3 (stand-alone)

STEP 1:
Positioning the probe centered above the position for the desired line as shown in the pictures (Annex A) to have a clear defined starting position for the measurement. Using offsets and a special procedure that was provided by the system manufacturer to align one of the 4 lower plane probes with the desired position and perform the vertical line measurement.

NOTE: An offset of 1mm was added as the EUT surface was a little bent.

STEP 2:
After the line measurement from the surface of the EUT to a sufficient height (perpendicular), the data need to be extracted and conveyed to the tables shown on the following pages, to have a usable presentation for the results. All system relevant offsets and clearance factors for robot movements are already compensated, that means that the following tables give the final results and correlations between distances and measured H-field strengths.

.

TEST RESULTS:

distance between sensor and EUT-surface [mm]	H – field RMS [A/m]	$H_{Previous}/H_{Actual}$ < 6dB[1)]	H_{Max} > 10 · H_{Actual}[2)]
8.5	1055.99	--	--
9.5	975.39	TRUE	FALSE
10.5	903.03	TRUE	FALSE
11.5	833.66	TRUE	FALSE
12.5	773.81	TRUE	FALSE
13.5	716.56	TRUE	FALSE
14.5	660.23	TRUE	FALSE
15.5	610.38	TRUE	FALSE
16.5	566.15	TRUE	FALSE
17.5	524.16	TRUE	FALSE
18.5	486.30	TRUE	FALSE
19.5	451.24	TRUE	FALSE
20.5	419.72	TRUE	FALSE
21.5	389.86	TRUE	FALSE
22.5	363.47	TRUE	FALSE
23.5	338.34	TRUE	FALSE
24.5	315.58	TRUE	FALSE
25.5	294.31	TRUE	FALSE
26.5	275.36	TRUE	FALSE
27.5	257.31	TRUE	FALSE
28.5	240.86	TRUE	FALSE
29.5	225.48	TRUE	FALSE
30.5	211.32	TRUE	FALSE
31.5	198.11	TRUE	FALSE
32.5	186.27	TRUE	FALSE
33.5	174.84	TRUE	FALSE
34.5	164.477	TRUE	FALSE
35.5	154.776	TRUE	FALSE
36.5	145.793	TRUE	FALSE
37.5	137.360	TRUE	FALSE
38.5	129.711	TRUE	FALSE
48.5	74.976	TRUE	TRUE
58.5	46.599	TRUE	TRUE
68.5	30.456	TRUE	TRUE
78.5	20.746	TRUE	TRUE
88.5	14.824	TRUE	TRUE
98.5	10.928	TRUE	TRUE
108.5	8.265	TRUE	TRUE
118.5	6.252	TRUE	TRUE
128.5	4.962	TRUE	TRUE
138.5	4.064	TRUE	TRUE
148.5	3.401	TRUE	TRUE
158.5	2.880	TRUE	TRUE
168.5	2.356	TRUE	TRUE
178.5	1.930	TRUE	TRUE
188.5	1.561	TRUE	TRUE
198.5	1.310	TRUE	TRUE
208.5	1.069	TRUE	TRUE
218.5	0.908	TRUE	TRUE
228.5	0.791	TRUE	TRUE
238.5	0.662	TRUE	TRUE

Test Frequency: 127.66 kHz

[1)] The column shows if the deviation from the actual measurement point to the previous measured one is less than 6dB.

[2)] The column shows if ten times the actual value is less than the highest measured H-field.

[*)] MAGPy probe touching the surface of the EUT

NOTE: For test positions see photo documentation (Annex A).

Annex A: Photo documentation

Photo 1: DASY 8 WPT set up

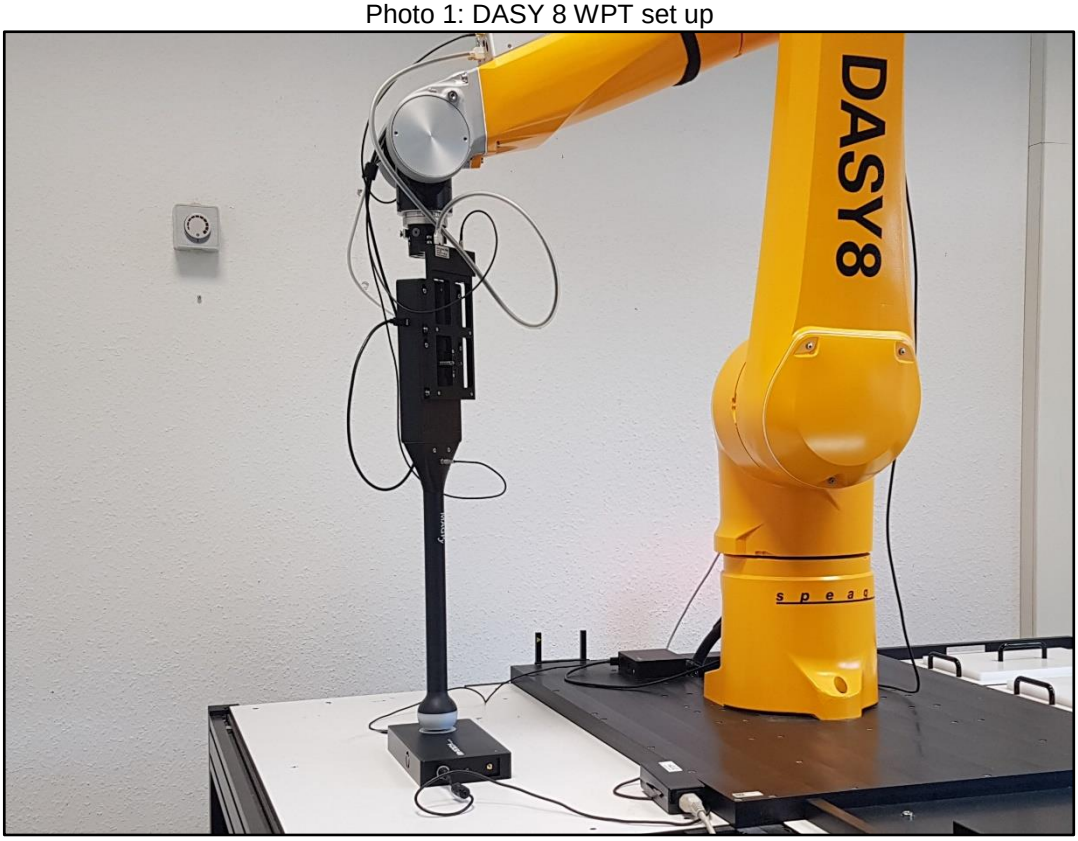


Photo 2: EUT - Topside view

Photo 3: EUT – Bottom side view

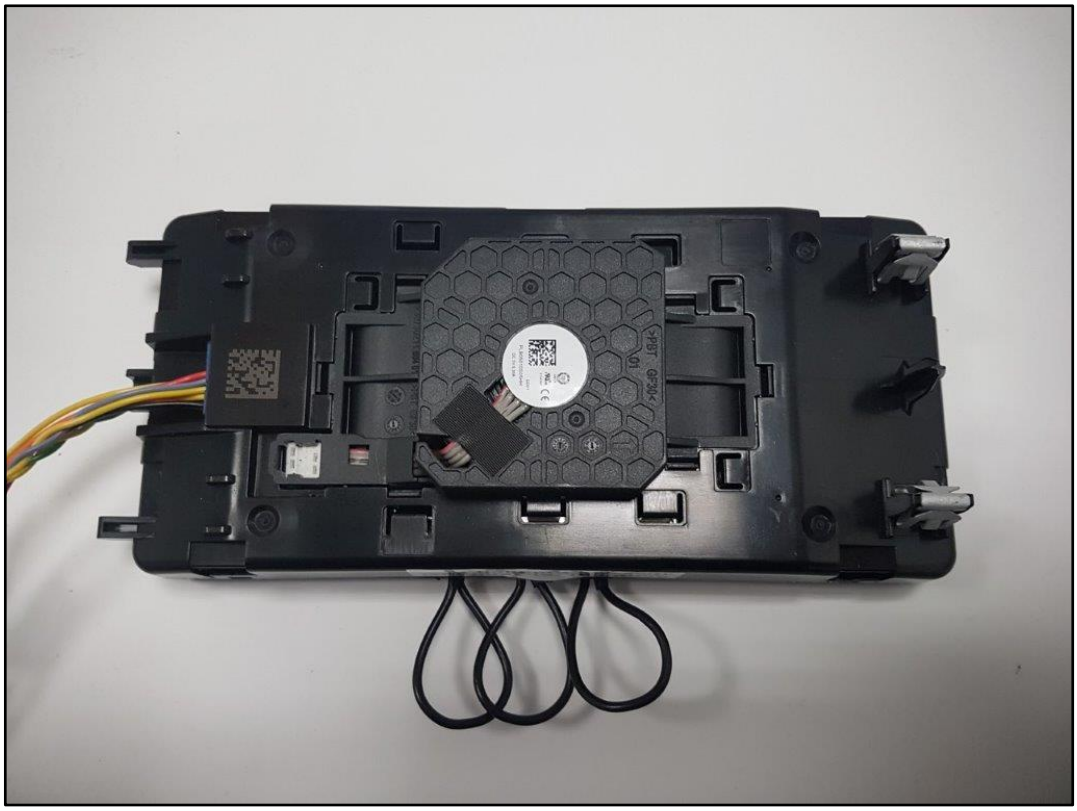


Photo 4: EUT – Side view (Connector)

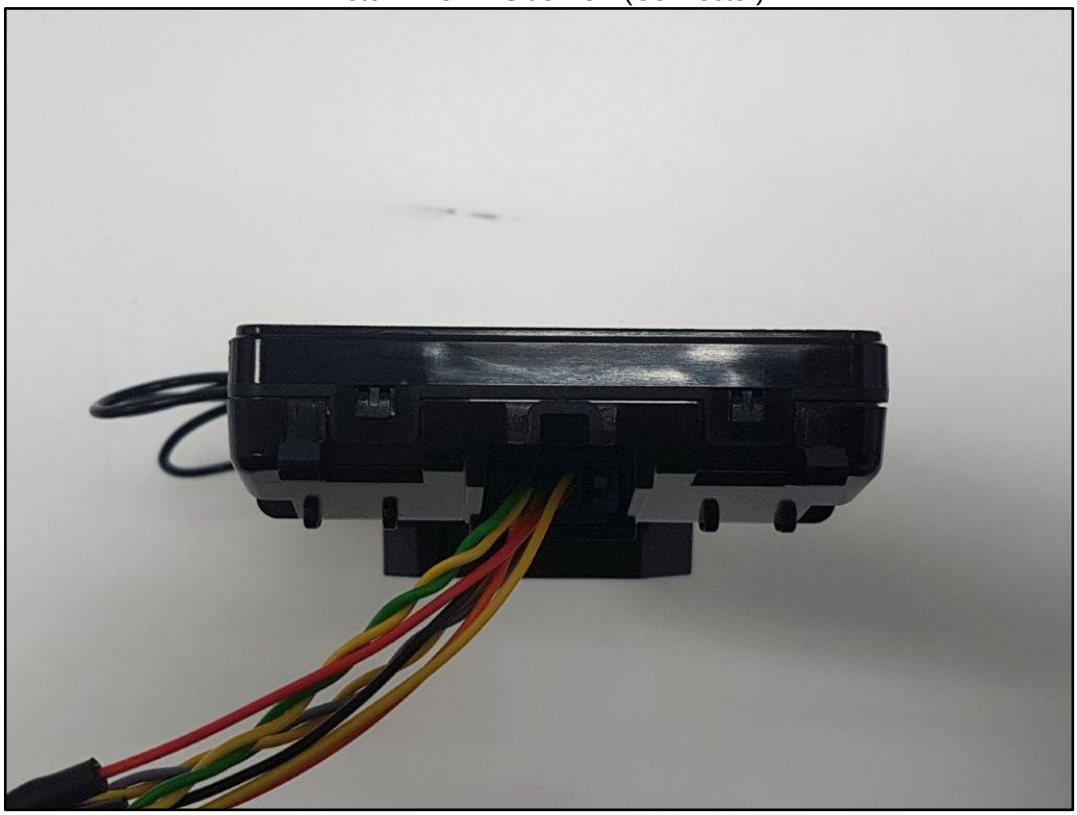


Photo 5: Test pictures - Setting probe to the centre of the coil 3

Photo 6: Test pictures - Setting probe to the centre of the coil 3

Photo 7: Test pictures – Setting probe to the centre of the coil (1mm offset, as EUT surface is bent)

Annex B: Calibration parameters

Calibration parameters are described in the additional document:
1-7639-24-01-02_TR1-A101-R01_Caldata

Annex C: Document History

Version	Applied Changes	Date of Release
	Initial Release	2024-10-25
-R02	Editorial changes	2024-11-28
-R03	Added system calibration data for WPT.	2024-12-13
-R04	Corrected errors in results table in chapter 5.4.	2025-01-02

Annex D: Further Information

Glossary

DUT	-	Device under Test
EUT	-	Equipment under Test
HW	-	Hardware
S/N	-	Serial Number
SW	-	Software