결재	작성	검토	확인

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

Client UL Korea

Certificate No: V-Coil50/400-1014_Oct22

CALIBRATION CERTIFICATE

Object	V-Coil50/400 - SN: 1014
Calibration procedure(s)	QA CAL-47.v1 Calibration Procedure for MAGPy Validation Source
Calibration date:	October 6, 2022

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
MAGPy-H3D/DAS	SN: 1017/1017	20-Jun-21 (MAGPy-H3D-1017)	Dec-22

Secondary Standards	ID #	Check Date (in house)	Scheduled Check

	Name	Function	Signature
Calibrated by:	Jingtian Xi	Project leader	
Approved by:	Niels Kuster	Quality Manager	

Issued: October 7, 2022

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Glossary:
V-Coil50/400 system check and validation source

Calibration is Performed According to the Following Standards:

- Internal procedure QA CAL-47-Calibration procedure for sources from 3 kHz to 10 MHz

Additional Documentation:

a) DASY8 Module WPT Manual

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* The verification sources are switched on for at least 10 minutes. The current in time domain is measured prior and after the measurement with the oscilloscope to verify that harmonics can be neglected. Then the current is measured with the voltmeter and an FFT analysis of the time domain signal is performed to derive the amplitude of the fundamental current component (see the Appendix for the conversion).
- *Source Positioning:* The Validation Source is placed in the center of the platform such that the device surface is parallel to phantom surface. Initial probe location is the center of the coil and the distance of the probe tip to the surface of <0.1mm is verified using mechanical gauge.
- *H-field distribution:* H field is measured in the volume above the Validation Source in a rectilinear grid of 7mm x 7mm x 7mm.
- *H-field at 2mm and Induced Values at 2mm:* The H-field and the induced field and current quantities at the surface inside the infinite the virtual half space phantom ($\varepsilon_r = 4.34 \times 10^3$, $\sigma = 0.355$ S/m) at the distance of 2mm from the surface are reconstructed quantities.

Calibrated Quantity

- The calibration quantities are induced peak E-field (2mm cube average), induced peak E-field (5mm line average), induced peak current density (1cm^2 area average), induced peak spatial SAR (1g and 10g averaged) at 2mm (+/-0.1) from the surface or 4.7 mm from the physical coil (PCB thickness = 1.7 mm, surface film thickness = 1.0 mm).

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

Object model	V-Coil50/400	1014
	Frequency	400 kHz
Probe model	MAGPy-H3D	1017
	MAGPy-DAS	1017
	MAGPy FPGA Board	WP000029
Software version	cDASY6 Module WPT	1.2.0.8
	Notebook GUI	1.2.5
	Sim4Life	6.2.0.4280
Scan setup	Type	Dynamic
	Grid size	X: 7.00 mm, Y: 7.00 mm, Z: 7.00 mm

Calibrated Parameters: 400 kHz

Distance of the Virtual Phantom from the Surface	**Peak H-field (A/m)**	**Unc. (k=2) (dB)**	**Induced peak current density, 1cm² area avg. (A/m²)**	**Induced peak E-field(V/m)**		**peak spatial SAR (mW/kg)**		**Unc. (k=2) (dB)**
				2mm cube avg.	**5mm line avg.**	**1g avg.**	**10g avg.**	
2.00 mm	245	1.23	1.36	4.57	4.68	3.82	1.86	1.59

Appendix (Additional assessments outside the scope of SCS 0108)

Total current measurement

	U (V)	I (A, = 2×U)
Total current (RMS)	0.4042	0.8084

Current spectrum measurement

Frequency (kHz)	Measured power (dBm)	Power coverted (W)	U (V) (R = 50 Ω)	I (A)	$I_{normalized}$ (A)
400	5.15	3.27E-03	0.4046	0.8091	0.7748
800	-28.06	1.56E-06	0.0088	0.0177	0.0169
1200	-28.19	1.52E-06	0.0087	0.0174	0.0167

Measurement report

cDASY6 Module WPT Measurement Report

Device under test

Model / Manufacturer:
V-Coil50/400 SPEAG

Serial number:
1014

Dimensions:

Measurement scenario:
Source calibration

Hardware setup

DASY version:
cDASY6 Module WPT, 1.2.0.8

Notebook version:
1.2.5

Probe model / serial number:
Single Probe with reference / WP000029

Scan setup

Type:
Dynamic

Resolution:
X: 7.00 mm, Y: 7.00 mm, Z: 7.00 mm

Dimensions:
X: 119.00 mm, Y: 119.00 mm, Z: 56.00 mm

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Measurement results

Maximum H-field:
158.56 A/m (rms)

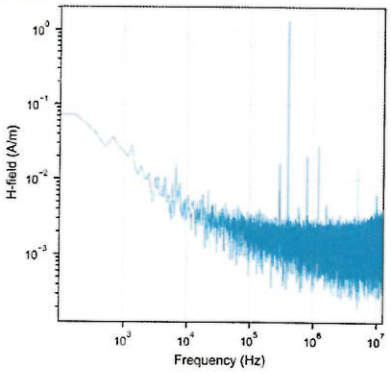
Location of maximum relative to DUT:
X: 0.00 m, Y: 0.00 m, Z: 7.00 mm

Maximum H-field (x, y, z):
133.11 A/m, 132.52 A/m, 223.26 A/m

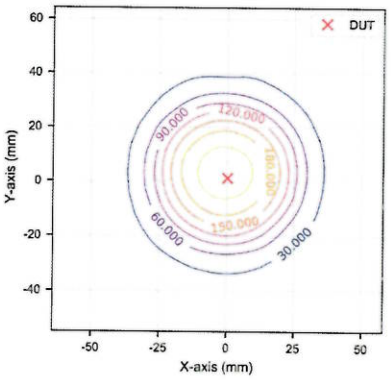
Peak frequency:
400.12 kHz (median)

Distance to -20.0 dB boundary:
39.60 mm

H-field magnitude at maximum



H-field magnitude at lowest plane



Induced quantities in the anatomical model

(f = 400.00 MHz, σ = 0.358 S/m, reconstruction error = 6.7%)

Spacing (mm)	Peak Hinc (A/m, rms)	Peak Eind (V/m, rms)		Peak Jind (A/m^2, rms)	psSAR (mW/kg)		
		Cube avg.	Line avg.	Surface avg.	1g avg.	10g avg.	-20 dB radius (mm)
2.00	245	4.57	4.68	1.36	3.82	1.86	38.5

Standard compliance evaluation

Spacing (mm)	ICNIRP 2020 (dB)			ICNIRP 1998 (dB)			IEEE 2019 (dB)			FCC 2020 (dB)			HC Code 6 (dB)		
	Peak Hinc (RL)	Peak Eind (BR)	psSAR (BR)	Peak Hinc (RL)	Peak Jind (BR)	psSAR (BR)	Peak Hinc (RL)	Peak Eind (BR)	psSAR (BR)	Peak Hinc (RL)	Peak Eind (BR)	psSAR (BR)	Peak Hinc (RL)	Peak Eind (BR)	psSAR (BR)
2.00	47.6	-16.2	-18.1	64.2	10.3	-18.1	30.2	-19.3	-18.1	56.1	-15.7	-14.0	64.2	-15.7	-14.0

Standard compliance evaluation (coverage factor-adjusted)

(Coefficients w_{Hinc} = 3.0, w_{Eind} = 2.0, w_{Jind} = 1.0, w_{SARavg} = 1.0, w_{SARmax} = 1.0)

Spacing (mm)	ICNIRP 2020 (dB)		ICNIRP 1998 (dB)		IEEE 2019 (dB)		FCC 2020 (dB)		HC Code 6 (dB)	
	Peak Eind (BR)	psSAR (BR)	Peak Jind (BR)	psSAR (BR)	Peak Eind (BR)	psSAR (BR)	Peak Eind (BR)	psSAR (BR)	Peak Eind (BR)	psSAR (BR)
2.00	-8.90	-19.3	8.03	-19.3	-15.6	-19.3	-8.47	-15.2	-8.47	-15.2

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