

Client

Sporton
 Taoyuan

Certificate No.

MAGPy-8H3D-3059

CALIBRATION CERTIFICATE

Object

MAGPy-8H3D+E3D SN:3059
 MAGPy-DAS SN:3064

Calibration procedure(s)

QA CAL-46.v1
 Calibration Procedure for MAGPy-8H3D+E3D
 Near-field Electric and Magnetic Field Sensor System

Calibration date

April 12, 2023

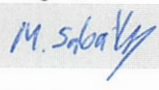
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Oscilloscope	SN: 110918	22-Oct-22 (No. 1335.8794K04)	Oct-23
Reference 20 dB Attenuator	SN: CC2552 (20x)	04-Apr-22 (No. 217-03527)	Apr-23
Type-N mismatch	SN: 310982 / 06327	04-Apr-22 (No. 217-03528)	Apr-23

Secondary Standards	ID	Check Date (in house)	Scheduled Check
Network Analyzer E5061B	SN: MY49810822	In house check: Nov-22	In house check: Nov-23
TEM Cell	SN: S6029i	In house check: Nov-22	N.A
Plate Capacitor	SN: 6028i	In house check: Nov-22	In house check: Nov-23
Resonator (160kHz)	SN: 6030i	In house check: Nov-22	In house check: Nov-23

	Name	Function	Signature
Calibrated by	Mischa Sabathy	Laboratory Engineer	
Approved by	Sven Kühn	Technical Manager	
Issued: April 12, 2023 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

Calibration Laboratory of

Schmid & Partner

Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland

Glossary

MAGPy-8H3D-E3D Magnetic Amplitude and Gradient Probe – Eight H-field Sensors, Single E-field sensor
MAGPy-DAS Magnetic Amplitude and Gradient Data Acquisition System

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1309-2013, "IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", November 2013

Methods Applied and Interpretation of Parameters

- Calibration has been performed after the adjustment of the device.
- *Linearity*: Calibration of the linearity of the field reading over the specified dynamic range at 161.75 kHz. Influence of offset voltage is included in this measurement.
- *Frequency response*: Calibration of the field reading over the specified frequency range from 3.0 kHz to 10.0 MHz.
- Receiving Pattern: Assessed for H-field polarizations ϑ , and $\phi = 0^\circ \dots 360^\circ$; $\vartheta = 90^\circ$, and $\phi = 0^\circ \dots 360^\circ$; for the XYZ sensors (in TEM-Cell at 4 kHz, 40 kHz, 400 kHz and 4 MHz).
- Receiving Pattern: Assessed for E-field polarizations ϑ , and $\phi = 0^\circ \dots 360^\circ$; $\vartheta = 90^\circ$, and $\phi = 0^\circ \dots 360^\circ$; for the XYZ sensor (in parallel plate capacitor at 4 kHz, 40 kHz, 400 kHz and 4 MHz).

Calibration Uncertainty

The calibration uncertainty is 0.7 dB for the H-field readings and 1.06 dB for the E-field readings. The calibration uncertainty is specified over the frequency range from 3.0 kHz to 10.0 MHz and a dynamic range from 0.1 A/m to 3200 A/m and from 0.08 V/m to 2000 V/m respectively.

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

Unit Type	MAGPy-8H3D+E3D (SP MGY 303 AA)	3059
	MAGPy-DAS (SE UMS 303 AB)	3064
	MAGPy FPGA Board	WP000211
Adjustment Date	Last MAGPy Adjustment	April 12, 2023
Firmware SW Version	MAGPy Firmware	Ver. 1.00
Backend SW Version	MAGPy Backend	Ver. 1.0.2
Calibration SW Version	MAGACAP	Ver. 1.0

Dynamic Range

Dynamic Range, H-field, Channel 0

H-field/(A/m) Applied			H-field/(A/m) Reading			Difference/(dB)			Tolerance/(dB)
x	y	z	x	y	z	x	y	z	
0.410	0.400	0.380	0.430	0.420	0.380	0.41	0.42	0.00	±1.00
0.560	0.550	0.520	0.560	0.570	0.520	0.00	0.31	0.00	±1.00
0.770	0.750	0.710	0.760	0.760	0.710	-0.11	0.12	0.00	±1.00
1.00	0.970	0.930	1.00	0.970	0.930	0.00	0.00	0.00	±1.00
1.36	1.32	1.26	1.35	1.31	1.25	-0.06	-0.07	-0.07	±1.00
1.86	1.81	1.73	1.85	1.81	1.73	-0.05	0.00	0.00	±1.00
2.48	2.41	2.30	2.47	2.39	2.31	-0.04	-0.07	0.04	±0.20
3.30	3.21	3.06	3.29	3.22	3.07	-0.03	0.03	0.03	±0.20
4.49	4.37	4.16	4.47	4.35	4.16	-0.04	-0.04	0.00	±0.20
6.06	5.91	5.63	6.06	5.89	5.61	0.00	-0.03	-0.03	±0.20
8.14	7.92	7.56	8.13	7.92	7.55	-0.01	0.00	-0.01	±0.20
10.9	10.6	10.1	10.9	10.6	10.1	0.00	0.00	0.00	±0.20
14.7	14.3	13.6	14.7	14.3	13.6	0.00	0.00	0.00	±0.20
19.8	19.3	18.4	19.8	19.3	18.3	0.00	0.00	-0.05	±0.20
26.7	26.1	24.8	26.7	26.0	24.8	0.00	-0.03	0.00	±0.20
35.6	34.7	33.0	35.8	34.8	33.2	0.05	0.02	0.05	±0.20
48.1	46.9	44.6	48.3	47.1	44.8	0.04	0.04	0.04	±0.20
65.1	63.5	60.4	65.5	63.8	60.6	0.05	0.04	0.03	±0.20
89.5	87.2	82.9	89.2	86.9	82.7	-0.03	-0.03	-0.02	±0.20
117	114	108	117	114	108	0.00	0.00	0.00	±0.20
161	157	149	160	156	149	-0.05	-0.06	0.00	±0.20
223	217	207	222	217	206	-0.04	0.00	-0.04	±0.20
307	300	285	301	294	280	-0.17	-0.18	-0.15	±0.20
453	442	420	446	436	415	-0.14	-0.12	-0.10	±0.20
622	608	578	617	604	574	-0.07	-0.06	-0.06	±0.20
925	902	860	926	906	863	0.01	0.04	0.03	±0.20
1390	1360	1290	1410	1380	1320	0.12	0.13	0.20	±0.30
1910	1860	1770	1960	1920	1820	0.22	0.28	0.24	±0.30
3060	2990	2850	3180	3110	2960	0.33	0.34	0.33	±0.50
3680	3590	3420	3840	3760	3580	0.37	0.40	0.40	±0.50

SPEAG H-field linearity tolerance criteria¹:

- ±1.0dB for applied H-fields < 2.0 A/m
- ±0.2dB for applied H-fields ≥ 2.0 A/m and < 1000 A/m
- ±0.3dB for applied H-fields ≥ 1000 A/m and < 2000 A/m
- ±0.4dB for applied H-fields ≥ 2000 A/m and < 3000 A/m
- ±0.5dB for applied H-fields ≥ 3000 A/m

¹ Calibration uncertainty not taken into account (shared risk 50%).

Dynamic Range, H-field, Channel 1

H-field/(A/m) Applied			H-field/(A/m) Reading			Difference/(dB)			Tolerance/(dB)
x	y	z	x	y	z	x	y	z	
0.410	0.400	0.400	0.430	0.420	0.420	0.41	0.42	0.42	±1.00
0.560	0.550	0.540	0.570	0.560	0.570	0.15	0.16	0.47	±1.00
0.760	0.750	0.740	0.760	0.770	0.750	0.00	0.23	0.12	±1.00
0.990	0.980	0.970	1.00	1.00	0.960	0.09	0.18	-0.09	±1.00
1.34	1.32	1.31	1.36	1.32	1.31	0.13	0.00	0.00	±1.00
1.84	1.82	1.80	1.85	1.80	1.80	0.05	-0.10	0.00	±1.00
2.46	2.42	2.40	2.47	2.41	2.40	0.04	-0.04	0.00	±0.20
3.27	3.23	3.20	3.27	3.23	3.20	0.00	0.00	0.00	±0.20
4.44	4.38	4.34	4.44	4.39	4.35	0.00	0.02	0.02	±0.20
6.01	5.93	5.87	5.99	5.92	5.88	-0.03	-0.01	0.01	±0.20
8.06	7.95	7.88	8.05	7.96	7.89	-0.01	0.01	0.01	±0.20
10.8	10.6	10.5	10.8	10.6	10.6	0.00	0.00	0.08	±0.20
14.6	14.4	14.2	14.5	14.3	14.2	-0.06	-0.06	0.00	±0.20
19.6	19.4	19.2	19.6	19.3	19.1	0.00	-0.04	-0.05	±0.20
26.5	26.2	25.9	26.4	26.1	25.9	-0.03	-0.03	0.00	±0.20
35.3	34.8	34.5	35.4	35.0	34.6	0.02	0.05	0.03	±0.20
47.7	47.1	46.6	47.8	47.2	46.8	0.02	0.02	0.04	±0.20
64.5	63.7	63.0	64.9	64.0	63.3	0.05	0.04	0.04	±0.20
88.6	87.5	86.5	88.3	87.2	86.2	-0.03	-0.03	-0.03	±0.20
116	114	113	116	114	113	0.00	0.00	0.00	±0.20
159	157	156	159	157	155	0.00	0.00	-0.06	±0.20
221	218	216	220	218	215	-0.04	0.00	-0.04	±0.20
304	301	298	299	295	292	-0.14	-0.17	-0.18	±0.20
448	443	439	442	437	433	-0.12	-0.12	-0.12	±0.20
616	610	603	612	606	599	-0.06	-0.06	-0.06	±0.20
916	906	897	918	909	900	0.02	0.03	0.03	±0.20
1380	1360	1350	1400	1390	1370	0.12	0.19	0.13	±0.30
1890	1870	1850	1940	1920	1900	0.23	0.23	0.23	±0.30
3030	3000	2970	3150	3120	3090	0.34	0.34	0.34	±0.50
3640	3600	3570	3810	3770	3730	0.40	0.40	0.38	±0.50

SPEAG H-field linearity tolerance criteria¹:

- ±1.0dB for applied H-fields < 2.0A/m
- ±0.2dB for applied H-fields ≥ 2.0A/m and < 1000A/m
- ±0.3dB for applied H-fields ≥ 1000A/m and < 2000A/m
- ±0.4dB for applied H-fields ≥ 2000A/m and < 3000A/m
- ±0.5dB for applied H-fields ≥ 3000A/m

¹ Calibration uncertainty not taken into account (shared risk 50%).

Dynamic Range, H-field, Channel 2

H-field/(A/m) Applied			H-field/(A/m) Reading			Difference/(dB)			Tolerance/(dB)
x	y	z	x	y	z	x	y	z	
0.420	0.400	0.400	0.440	0.410	0.420	0.40	0.21	0.42	±1.00
0.570	0.550	0.550	0.560	0.560	0.560	-0.15	0.16	0.16	±1.00
0.790	0.750	0.750	0.770	0.770	0.760	-0.22	0.23	0.12	±1.00
1.03	0.980	0.980	1.02	0.990	0.960	-0.08	0.09	-0.18	±1.00
1.39	1.33	1.33	1.38	1.32	1.30	-0.06	-0.07	-0.20	±1.00
1.90	1.82	1.83	1.89	1.80	1.80	-0.05	-0.10	-0.14	±1.00
2.54	2.42	2.43	2.51	2.41	2.42	-0.10	-0.04	-0.04	±0.20
3.37	3.23	3.23	3.36	3.23	3.22	-0.03	0.00	-0.03	±0.20
4.59	4.39	4.39	4.58	4.37	4.37	-0.02	-0.04	-0.04	±0.20
6.20	5.94	5.94	6.19	5.92	5.92	-0.01	-0.03	-0.03	±0.20
8.32	7.96	7.98	8.31	7.96	7.95	-0.01	0.00	-0.03	±0.20
11.1	10.6	10.6	11.1	10.6	10.6	0.00	0.00	0.00	±0.20
15.0	14.4	14.4	15.0	14.3	14.4	0.00	-0.06	0.00	±0.20
20.3	19.4	19.4	20.2	19.3	19.4	-0.04	-0.04	0.00	±0.20
27.3	26.2	26.2	27.3	26.1	26.2	0.00	-0.03	0.00	±0.20
36.4	34.9	34.9	36.5	35.0	35.0	0.02	0.02	0.02	±0.20
49.2	47.2	47.1	49.3	47.3	47.3	0.02	0.02	0.04	±0.20
66.6	63.8	63.8	66.9	64.2	64.0	0.04	0.05	0.03	±0.20
91.4	87.7	87.6	91.1	87.4	87.3	-0.03	-0.03	-0.03	±0.20
120	115	114	119	114	114	-0.07	-0.08	0.00	±0.20
164	158	158	164	157	157	0.00	-0.06	-0.06	±0.20
228	219	218	227	218	218	-0.04	-0.04	0.00	±0.20
314	301	301	308	296	296	-0.17	-0.15	-0.15	±0.20
463	444	444	456	438	438	-0.13	-0.12	-0.12	±0.20
636	611	610	631	607	607	-0.07	-0.06	-0.04	±0.20
945	907	908	948	911	912	0.03	0.04	0.04	±0.20
1420	1370	1370	1450	1390	1390	0.18	0.13	0.13	±0.30
1950	1870	1870	2000	1930	1930	0.22	0.27	0.27	±0.30
3130	3010	3010	3250	3130	3130	0.33	0.34	0.34	±0.50
3760	3610	3610	3930	3780	3780	0.38	0.40	0.40	±0.50

SPEAG H-field linearity tolerance criteria¹:

- ±1.0dB for applied H-fields < 2.0 A/m
- ±0.2dB for applied H-fields ≥ 2.0 A/m and < 1000 A/m
- ±0.3dB for applied H-fields ≥ 1000 A/m and < 2000 A/m
- ±0.4dB for applied H-fields ≥ 2000 A/m and < 3000 A/m
- ±0.5dB for applied H-fields ≥ 3000 A/m

¹ Calibration uncertainty not taken into account (shared risk 50%).

Dynamic Range, H-field, Channel 3

H-field/(A/m) Applied			H-field/(A/m) Reading			Difference/(dB)			Tolerance/(dB)
x	y	z	x	y	z	x	y	z	
0.420	0.410	0.390	0.420	0.430	0.390	0.00	0.41	0.00	±1.00
0.570	0.550	0.530	0.560	0.580	0.540	-0.15	0.46	0.16	±1.00
0.780	0.760	0.730	0.780	0.750	0.730	0.00	-0.12	0.00	±1.00
1.01	0.980	0.950	1.03	0.980	0.950	0.17	0.00	0.00	±1.00
1.37	1.33	1.28	1.39	1.34	1.28	0.13	0.07	0.00	±1.00
1.88	1.83	1.76	1.89	1.82	1.77	0.05	-0.05	0.05	±1.00
2.50	2.43	2.34	2.50	2.43	2.36	0.00	0.00	0.07	±0.20
3.33	3.24	3.11	3.33	3.24	3.14	0.00	0.00	0.08	±0.20
4.53	4.41	4.23	4.51	4.38	4.23	-0.04	-0.06	0.00	±0.20
6.12	5.96	5.72	6.09	5.94	5.73	-0.04	-0.03	0.02	±0.20
8.22	7.99	7.68	8.19	8.02	7.71	-0.03	0.03	0.03	±0.20
11.0	10.7	10.2	10.9	10.7	10.3	-0.08	0.00	0.08	±0.20
14.8	14.4	13.9	14.8	14.4	13.9	0.00	0.00	0.00	±0.20
20.0	19.5	18.7	19.9	19.4	18.7	-0.04	-0.04	0.00	±0.20
27.0	26.3	25.2	26.9	26.3	25.2	-0.03	0.00	0.00	±0.20
36.0	35.0	33.6	36.1	35.2	33.7	0.02	0.05	0.03	±0.20
48.6	47.4	45.4	48.7	47.5	45.6	0.02	0.02	0.04	±0.20
65.8	64.1	61.4	66.1	64.4	61.6	0.04	0.04	0.03	±0.20
90.3	88.0	84.3	90.1	87.7	84.1	-0.02	-0.03	-0.02	±0.20
118	115	110	118	115	110	0.00	0.00	0.00	±0.20
162	158	152	162	158	151	0.00	0.00	-0.06	±0.20
225	219	210	224	219	210	-0.04	0.00	0.00	±0.20
310	302	290	304	297	285	-0.17	-0.15	-0.15	±0.20
457	446	427	451	440	422	-0.11	-0.12	-0.10	±0.20
628	613	588	624	609	584	-0.06	-0.06	-0.06	±0.20
934	911	874	937	914	877	0.03	0.03	0.03	±0.20
1410	1370	1320	1430	1390	1340	0.12	0.13	0.13	±0.30
1930	1880	1800	1980	1930	1850	0.22	0.23	0.24	±0.30
3090	3020	2900	3210	3110	3010	0.33	0.26	0.32	±0.50
3710	3620	3480	3890	3740	3640	0.41	0.28	0.39	±0.50

SPEAG H-field linearity tolerance criteria¹:

- ±1.0dB for applied H-fields < 2.0 A/m
- ±0.2dB for applied H-fields ≥ 2.0 A/m and < 1000 A/m
- ±0.3dB for applied H-fields ≥ 1000 A/m and < 2000 A/m
- ±0.4dB for applied H-fields ≥ 2000 A/m and < 3000 A/m
- ±0.5dB for applied H-fields ≥ 3000 A/m

¹ Calibration uncertainty not taken into account (shared risk 50%).

Dynamic Range, H-field, Channel 4

H-field/(A/m) Applied			H-field/(A/m) Reading			Difference/(dB)			Tolerance/(dB)
x	y	z	x	y	z	x	y	z	
0.420	0.410	0.400	0.430	0.430	0.400	0.20	0.41	0.00	±1.00
0.570	0.560	0.550	0.580	0.570	0.550	0.15	0.15	0.00	±1.00
0.770	0.760	0.750	0.770	0.770	0.740	0.00	0.11	-0.12	±1.00
1.01	0.990	0.970	0.990	0.990	0.970	-0.17	0.00	0.00	±1.00
1.36	1.35	1.32	1.35	1.34	1.33	-0.06	-0.06	0.07	±1.00
1.87	1.85	1.81	1.86	1.84	1.81	-0.05	-0.05	0.00	±1.00
2.49	2.46	2.41	2.48	2.44	2.42	-0.03	-0.07	0.04	±0.20
3.32	3.28	3.21	3.31	3.27	3.21	-0.03	-0.03	0.00	±0.20
4.51	4.45	4.36	4.49	4.45	4.37	-0.04	0.00	0.02	±0.20
6.10	6.03	5.89	6.06	6.00	5.90	-0.06	-0.04	0.01	±0.20
8.18	8.08	7.91	8.15	8.08	7.92	-0.03	0.00	0.01	±0.20
10.9	10.8	10.6	10.9	10.8	10.6	0.00	0.00	0.00	±0.20
14.8	14.6	14.3	14.7	14.6	14.3	-0.06	0.00	0.00	±0.20
19.9	19.7	19.3	19.9	19.6	19.2	0.00	-0.04	-0.05	±0.20
26.9	26.6	26.0	26.8	26.5	25.9	-0.03	-0.03	-0.03	±0.20
35.8	35.4	34.6	35.9	35.5	34.7	0.02	0.02	0.03	±0.20
48.4	47.9	46.7	48.5	47.9	46.9	0.02	0.00	0.04	±0.20
65.5	64.8	63.2	65.8	65.1	63.5	0.04	0.04	0.04	±0.20
89.9	88.9	86.8	89.6	88.7	86.5	-0.03	-0.02	-0.03	±0.20
118	116	114	117	116	113	-0.07	0.00	-0.08	±0.20
162	160	156	161	159	156	-0.05	-0.05	0.00	±0.20
224	222	217	223	221	216	-0.04	-0.04	-0.04	±0.20
309	306	299	303	300	293	-0.17	-0.17	-0.18	±0.20
455	450	440	449	445	434	-0.12	-0.10	-0.12	±0.20
625	620	605	621	617	601	-0.06	-0.04	-0.06	±0.20
930	920	900	932	926	903	0.02	0.06	0.03	±0.20
1400	1390	1360	1420	1410	1380	0.12	0.12	0.13	±0.30
1920	1900	1860	1970	1960	1910	0.22	0.27	0.23	±0.30
3080	3050	2980	3200	3180	3100	0.33	0.36	0.34	±0.50
3700	3660	3580	3870	3840	3750	0.39	0.42	0.40	±0.50

SPEAG H-field linearity tolerance criteria¹:

- ±1.0dB for applied H-fields < 2.0 A/m
- ±0.2dB for applied H-fields ≥ 2.0 A/m and < 1000 A/m
- ±0.3dB for applied H-fields ≥ 1000 A/m and < 2000 A/m
- ±0.4dB for applied H-fields ≥ 2000 A/m and < 3000 A/m
- ±0.5dB for applied H-fields ≥ 3000 A/m

¹ Calibration uncertainty not taken into account (shared risk 50%).

Dynamic Range, H-field, Channel 5

H-field/(A/m) Applied			H-field/(A/m) Reading			Difference/(dB)			Tolerance/(dB)
x	y	z	x	y	z	x	y	z	
0.420	0.410	0.410	0.420	0.420	0.420	0.00	0.21	0.21	±1.00
0.570	0.560	0.560	0.550	0.570	0.570	-0.31	0.15	0.15	±1.00
0.780	0.760	0.770	0.760	0.770	0.780	-0.23	0.11	0.11	±1.00
1.01	1.00	1.00	1.01	0.990	1.01	0.00	-0.09	0.09	±1.00
1.37	1.35	1.36	1.39	1.34	1.38	0.13	-0.06	0.13	±1.00
1.88	1.85	1.87	1.89	1.86	1.88	0.05	0.05	0.05	±1.00
2.51	2.46	2.48	2.52	2.48	2.50	0.03	0.07	0.07	±0.20
3.34	3.28	3.31	3.34	3.30	3.33	0.00	0.05	0.05	±0.20
4.53	4.46	4.49	4.54	4.47	4.50	0.02	0.02	0.02	±0.20
6.13	6.03	6.08	6.14	6.04	6.08	0.01	0.01	0.00	±0.20
8.22	8.09	8.16	8.23	8.13	8.16	0.01	0.04	0.00	±0.20
11.0	10.8	10.9	11.0	10.8	10.9	0.00	0.00	0.00	±0.20
14.9	14.6	14.7	14.8	14.6	14.7	-0.06	0.00	0.00	±0.20
20.0	19.7	19.9	20.0	19.7	19.9	0.00	0.00	0.00	±0.20
27.0	26.6	26.8	26.9	26.6	26.8	-0.03	0.00	0.00	±0.20
36.0	35.4	35.7	36.1	35.6	35.8	0.02	0.05	0.02	±0.20
48.7	47.9	48.2	48.7	48.0	48.4	0.00	0.02	0.04	±0.20
65.8	64.8	65.2	66.2	65.2	65.5	0.05	0.05	0.04	±0.20
90.4	89.0	89.5	90.1	88.7	89.2	-0.03	-0.03	-0.03	±0.20
118	116	117	118	116	117	0.00	0.00	0.00	±0.20
163	160	161	162	160	160	-0.05	0.00	-0.05	±0.20
225	222	223	225	221	223	0.00	-0.04	0.00	±0.20
310	306	308	305	301	302	-0.14	-0.14	-0.17	±0.20
457	451	454	451	445	448	-0.11	-0.12	-0.12	±0.20
629	620	624	625	616	620	-0.06	-0.06	-0.06	±0.20
934	921	928	938	925	931	0.04	0.04	0.03	±0.20
1410	1390	1400	1430	1410	1420	0.12	0.12	0.12	±0.30
1930	1900	1920	1980	1960	1970	0.22	0.27	0.22	±0.30
3090	3050	3080	3220	3170	3200	0.36	0.34	0.33	±0.50
3720	3670	3700	3890	3830	3860	0.39	0.37	0.37	±0.50

SPEAG H-field linearity tolerance criteria¹:

- ±1.0dB for applied H-fields < 2.0 A/m
- ±0.2dB for applied H-fields ≥ 2.0 A/m and < 1000 A/m
- ±0.3dB for applied H-fields ≥ 1000 A/m and < 2000 A/m
- ±0.4dB for applied H-fields ≥ 2000 A/m and < 3000 A/m
- ±0.5dB for applied H-fields ≥ 3000 A/m

¹ Calibration uncertainty not taken into account (shared risk 50%).

Dynamic Range, H-field, Channel 6

H-field/(A/m) Applied			H-field/(A/m) Reading			Difference/(dB)			Tolerance/(dB)
x	y	z	x	y	z	x	y	z	
0.410	0.410	0.410	0.410	0.430	0.410	0.00	0.41	0.00	±1.00
0.550	0.560	0.550	0.560	0.580	0.550	0.16	0.30	0.00	±1.00
0.760	0.770	0.760	0.760	0.800	0.750	0.00	0.33	-0.12	±1.00
0.990	1.00	0.990	0.990	1.02	0.970	0.00	0.17	-0.18	±1.00
1.33	1.35	1.34	1.34	1.35	1.32	0.07	0.00	-0.13	±1.00
1.83	1.86	1.84	1.84	1.85	1.81	0.05	-0.05	-0.14	±1.00
2.44	2.47	2.45	2.44	2.47	2.42	0.00	0.00	-0.11	±0.20
3.25	3.29	3.26	3.22	3.31	3.23	-0.08	0.05	-0.08	±0.20
4.41	4.47	4.43	4.39	4.47	4.39	-0.04	0.00	-0.08	±0.20
5.97	6.05	5.99	5.96	6.03	5.95	-0.01	-0.03	-0.06	±0.20
8.01	8.11	8.04	8.00	8.12	8.00	-0.01	0.01	-0.04	±0.20
10.7	10.8	10.7	10.7	10.8	10.7	0.00	0.00	0.00	±0.20
14.5	14.7	14.5	14.4	14.6	14.5	-0.06	-0.06	0.00	±0.20
19.5	19.8	19.6	19.5	19.7	19.5	0.00	-0.04	-0.04	±0.20
26.3	26.7	26.4	26.2	26.6	26.4	-0.03	-0.03	0.00	±0.20
35.0	35.6	35.2	35.2	35.6	35.3	0.05	0.00	0.02	±0.20
47.4	48.1	47.5	47.5	48.2	47.7	0.02	0.02	0.04	±0.20
64.1	65.0	64.3	64.4	65.4	64.5	0.04	0.05	0.03	±0.20
88.0	89.3	88.3	87.7	89.1	88.0	-0.03	-0.02	-0.03	±0.20
115	117	115	115	117	115	0.00	0.00	0.00	±0.20
158	161	159	158	160	158	0.00	-0.05	-0.05	±0.20
219	223	220	219	222	220	0.00	-0.04	0.00	±0.20
302	307	304	297	302	298	-0.15	-0.14	-0.17	±0.20
445	452	447	439	446	442	-0.12	-0.12	-0.10	±0.20
612	622	615	608	619	612	-0.06	-0.04	-0.04	±0.20
910	924	915	913	928	919	0.03	0.04	0.04	±0.20
1370	1390	1380	1390	1420	1400	0.13	0.19	0.12	±0.30
1880	1910	1890	1930	1960	1940	0.23	0.22	0.23	±0.30
3010	3060	3030	3130	3190	3160	0.34	0.36	0.36	±0.50
3620	3680	3640	3790	3850	3820	0.40	0.39	0.42	±0.50

SPEAG H-field linearity tolerance criteria¹:

- ±1.0dB for applied H-fields < 2.0 A/m
- ±0.2dB for applied H-fields ≥ 2.0 A/m and < 1000 A/m
- ±0.3dB for applied H-fields ≥ 1000 A/m and < 2000 A/m
- ±0.4dB for applied H-fields ≥ 2000 A/m and < 3000 A/m
- ±0.5dB for applied H-fields ≥ 3000 A/m

¹ Calibration uncertainty not taken into account (shared risk 50%).

Dynamic Range, H-field, Channel 7

H-field/(A/m) Applied			H-field/(A/m) Reading			Difference/(dB)			Tolerance/(dB)
x	y	z	x	y	z	x	y	z	
0.410	0.410	0.390	0.430	0.430	0.400	0.41	0.41	0.22	±1.00
0.560	0.550	0.530	0.580	0.560	0.530	0.30	0.16	0.00	±1.00
0.770	0.760	0.730	0.790	0.750	0.710	0.22	-0.12	-0.24	±1.00
1.00	0.980	0.950	1.00	0.990	0.930	0.00	0.09	-0.18	±1.00
1.35	1.33	1.29	1.33	1.35	1.28	-0.13	0.13	-0.07	±1.00
1.85	1.83	1.77	1.83	1.84	1.77	-0.09	0.05	0.00	±1.00
2.47	2.44	2.35	2.46	2.45	2.34	-0.04	0.04	-0.04	±0.20
3.28	3.25	3.13	3.26	3.26	3.12	-0.05	0.03	-0.03	±0.20
4.46	4.41	4.25	4.43	4.42	4.26	-0.06	0.02	0.02	±0.20
6.03	5.97	5.75	6.00	5.98	5.74	-0.04	0.01	-0.02	±0.20
8.09	8.00	7.72	8.06	8.03	7.72	-0.03	0.03	0.00	±0.20
10.8	10.7	10.3	10.8	10.7	10.3	0.00	0.00	0.00	±0.20
14.6	14.4	13.9	14.6	14.4	13.9	0.00	0.00	0.00	±0.20
19.7	19.5	18.8	19.7	19.5	18.8	0.00	0.00	0.00	±0.20
26.6	26.3	25.4	26.6	26.3	25.3	0.00	0.00	-0.03	±0.20
35.4	35.0	33.8	35.5	35.2	33.9	0.02	0.05	0.03	±0.20
47.9	47.4	45.6	48.0	47.5	45.8	0.02	0.02	0.04	±0.20
64.8	64.1	61.7	65.1	64.4	61.9	0.04	0.04	0.03	±0.20
88.9	88.1	84.7	88.7	87.8	84.4	-0.02	-0.03	-0.03	±0.20
116	115	111	116	115	110	0.00	0.00	-0.08	±0.20
160	158	153	159	158	152	-0.05	0.00	-0.06	±0.20
222	220	211	221	219	210	-0.04	-0.04	-0.04	±0.20
305	303	291	300	297	286	-0.14	-0.17	-0.15	±0.20
450	446	429	444	440	423	-0.12	-0.12	-0.12	±0.20
618	613	591	614	609	586	-0.06	-0.06	-0.07	±0.20
919	911	878	922	914	881	0.03	0.03	0.03	±0.20
1380	1370	1320	1410	1390	1340	0.19	0.13	0.13	±0.30
1900	1880	1810	1950	1930	1860	0.23	0.23	0.24	±0.30
3040	3020	2910	3160	3140	3020	0.34	0.34	0.32	±0.50
3660	3630	3500	3830	3790	3660	0.39	0.37	0.39	±0.50

SPEAG H-field linearity tolerance criteria¹:

- ±1.0dB for applied H-fields < 2.0 A/m
- ±0.2dB for applied H-fields ≥ 2.0 A/m and < 1000 A/m
- ±0.3dB for applied H-fields ≥ 1000 A/m and < 2000 A/m
- ±0.4dB for applied H-fields ≥ 2000 A/m and < 3000 A/m
- ±0.5dB for applied H-fields ≥ 3000 A/m

¹ Calibration uncertainty not taken into account (shared risk 50%).

Dynamic Range, E-field, Channel 0

E-field/(V/m) Applied			E-field/(V/m) Reading			Difference/(dB)			Tolerance/(dB)		
x	y	z	x	y	z	x	y	z	x	y	z
0.420	0.240	0.100	0.420	0.240	0.070	0.00	0.00	-3.10	±5.00	±5.00	±5.00
0.580	0.320	0.140	0.580	0.320	0.140	0.00	0.00	0.00	±5.00	±5.00	±5.00
0.790	0.440	0.190	0.780	0.430	0.220	-0.11	-0.20	1.27	±5.00	±5.00	±5.00
1.03	0.570	0.250	1.04	0.580	0.240	0.08	0.15	-0.35	±5.00	±5.00	±5.00
1.39	0.770	0.330	1.40	0.780	0.310	0.06	0.11	-0.54	±5.00	±5.00	±5.00
1.91	1.06	0.460	1.90	1.05	0.450	-0.05	-0.08	-0.19	±5.00	±5.00	±5.00
2.55	1.41	0.610	2.55	1.41	0.600	0.00	0.00	-0.14	±1.00	±5.00	±5.00
3.39	1.88	0.810	3.40	1.90	0.820	0.03	0.09	0.11	±1.00	±5.00	±5.00
4.61	2.56	1.11	4.62	2.57	1.10	0.02	0.03	-0.08	±1.00	±1.00	±5.00
6.24	3.46	1.50	6.25	3.46	1.46	0.01	0.00	-0.23	±1.00	±1.00	±5.00
8.36	4.64	2.01	8.40	4.68	1.95	0.04	0.07	-0.26	±1.00	±1.00	±1.00
11.2	6.19	2.68	11.2	6.21	2.61	0.00	0.03	-0.23	±1.00	±1.00	±1.00
15.1	8.38	3.63	15.2	8.39	3.55	0.06	0.01	-0.19	±1.00	±1.00	±1.00
20.4	11.3	4.89	20.5	11.3	4.74	0.04	0.00	-0.27	±1.00	±1.00	±1.00
27.5	15.3	6.60	27.6	15.3	6.46	0.03	0.00	-0.19	±1.00	±1.00	±1.00
36.7	20.3	8.79	37.0	20.5	8.65	0.07	0.09	-0.14	±1.00	±1.00	±1.00
49.6	27.5	11.9	50.0	27.7	11.7	0.07	0.06	-0.15	±1.00	±1.00	±1.00
67.1	37.2	16.1	67.8	37.6	15.8	0.09	0.09	-0.16	±1.00	±1.00	±1.00
92.1	51.1	22.1	92.2	51.2	21.6	0.01	0.02	-0.20	±1.00	±1.00	±1.00
120	66.8	28.9	121	67.0	28.2	0.07	0.03	-0.21	±1.00	±1.00	±1.00
166	91.9	39.7	166	92.0	38.8	0.00	0.01	-0.20	±1.00	±1.00	±1.00
230	127	55.0	230	127	53.8	0.00	0.00	-0.19	±1.00	±1.00	±1.00
317	176	75.8	317	177	74.9	0.00	0.05	-0.10	±1.00	±1.00	±1.00
466	259	112	441	248	111	-0.48	-0.38	-0.08	±1.00	±1.00	±1.00
642	356	153	610	343	153	-0.44	-0.32	0.00	±1.00	±1.00	±1.00
953	529	228	915	515	231	-0.35	-0.23	0.11	±1.00	±1.00	±1.00
1440	796	344	1400	786	352	-0.24	-0.11	0.20	±1.00	±1.00	±1.00
1970	1090	470	1930	1090	488	-0.18	0.00	0.33	±1.00	±1.00	±1.00
3160	1750	755	3140	1770	754	-0.06	0.10	-0.01	±1.00	±1.00	±1.00
3790	2100	907	3800	2140	913	0.02	0.16	0.06	±1.00	±1.00	±1.00

SPEAG E-field linearity tolerance criteria¹:

±5.0dB for applied E-field < 2 V/m

±1.0dB for applied E-field ≥ 2 V/m

¹ Calibration uncertainty not taken into account (shared risk 50%).

Frequency Response

Frequency Response, H-field, Channel 0

f/(Hz)	H-field/(A/m) Applied			H-field/(A/m) Reading			Difference/(dB)			Tolerance/(dB)
	x	y	z	x	y	z	x	y	z	
3000	1.49	1.49	1.49	1.48	1.49	1.49	-0.06	0.00	0.00	±0.3
3200	1.49	1.49	1.48	1.48	1.50	1.49	-0.06	0.06	0.06	±0.3
4000	1.48	1.48	1.48	1.48	1.48	1.48	0.00	0.00	0.00	±0.3
5200	1.47	1.47	1.47	1.47	1.47	1.46	0.00	0.00	-0.06	±0.3
6600	1.46	1.46	1.46	1.46	1.47	1.46	0.00	0.06	0.00	±0.3
8200	1.45	1.45	1.45	1.45	1.45	1.45	0.00	0.00	0.00	±0.3
9000	1.45	1.45	1.44	1.46	1.44	1.44	0.06	-0.06	0.00	±0.3
10600	4.39	4.31	4.30	4.38	4.33	4.28	-0.02	0.04	-0.04	±0.3
13400	4.41	4.37	4.36	4.42	4.37	4.36	0.02	0.00	0.00	±0.3
17000	4.41	4.36	4.35	4.42	4.37	4.35	0.02	0.02	0.00	±0.3
21400	4.43	4.38	4.37	4.45	4.38	4.37	0.04	0.00	0.00	±0.3
27200	4.43	4.38	4.37	4.43	4.38	4.37	0.00	0.00	0.00	±0.3
34400	4.42	4.39	4.38	4.43	4.39	4.38	0.02	0.00	0.00	±0.3
40000	4.42	4.38	4.38	4.42	4.38	4.38	0.00	0.00	0.00	±0.3
43600	4.41	4.38	4.37	4.41	4.38	4.37	0.00	0.00	0.00	±0.3
55400	4.39	4.36	4.36	4.40	4.37	4.33	0.02	0.02	-0.06	±0.3
70000	4.38	4.35	4.35	4.40	4.36	4.35	0.04	0.02	0.00	±0.3
88800	4.37	4.34	4.33	4.37	4.34	4.33	0.00	0.00	0.00	±0.3
112400	4.36	4.33	4.32	4.36	4.33	4.33	0.00	0.00	0.02	±0.3
142400	4.33	4.31	4.30	4.34	4.32	4.31	0.02	0.02	0.02	±0.3
161750	4.32	4.29	4.29	4.32	4.30	4.29	0.00	0.02	0.00	±0.3
180400	4.30	4.28	4.28	4.32	4.29	4.28	0.04	0.02	0.00	±0.3
228400	4.27	4.25	4.24	4.28	4.26	4.25	0.02	0.02	0.02	±0.3
289400	4.23	4.21	4.21	4.24	4.22	4.21	0.02	0.02	0.00	±0.3
366400	4.19	4.17	4.17	4.20	4.17	4.17	0.02	0.00	0.00	±0.3
400000	4.17	4.15	4.15	4.18	4.15	4.15	0.02	0.00	0.00	±0.3
464000	4.14	4.12	4.12	4.15	4.13	4.12	0.02	0.02	0.00	±0.3
587800	4.10	4.08	4.08	4.11	4.09	4.08	0.02	0.02	0.00	±0.3
744200	4.05	4.03	4.03	4.06	4.04	4.03	0.02	0.02	0.00	±0.3
942600	4.03	4.02	4.01	4.05	4.03	4.02	0.04	0.02	0.02	±0.3
1193600	4.00	3.99	3.99	4.02	4.00	4.00	0.04	0.02	0.02	±0.3
1511600	3.99	3.98	3.98	4.01	3.98	3.98	0.04	0.00	0.00	±0.3
1914400	3.98	3.96	3.96	3.98	3.96	3.96	0.00	0.00	0.00	±0.3
2424400	3.96	3.94	3.94	3.97	3.95	3.94	0.02	0.02	0.00	±0.3
3070200	3.94	3.92	3.92	3.95	3.92	3.92	0.02	0.00	0.00	±0.3
3888000	3.89	3.87	3.87	3.89	3.87	3.87	0.00	0.00	0.00	±0.3
4000000	3.88	3.86	3.86	3.89	3.88	3.87	0.02	0.04	0.02	±0.3
4923800	3.81	3.80	3.80	3.82	3.80	3.80	0.02	0.00	0.00	±0.3
6235400	3.69	3.67	3.67	3.69	3.68	3.67	0.00	0.02	0.00	±0.3
7896400	3.57	3.55	3.55	3.58	3.58	3.56	0.02	0.07	0.02	±0.3
10000000	3.44	3.42	3.42	3.43	3.43	3.42	-0.03	0.03	0.00	±0.3

SPEAG H-field frequency response tolerance criteria¹:
±0.3dB for applied H-fields at calibration points from 3kHz to 10MHz

¹ Calibration uncertainty not taken into account (shared risk 50%).