

Kalibrierstelle für Antennen und Feldsonden
Calibration Body for Antennas and Field Probes

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Kalibrierschein nach ISO/IEC 17025
Calibration Certificate according to ISO/IEC 17025

Kalibrierzeichen
Calibration mark

EH-A1651/22
0612
18.10.2022

Gegenstand <i>Object</i>	Loop Antenna
Hersteller & Typ <i>Manufacturer & Type</i>	TEKBOX TBMA6-P
Herstellernummer <i>Serial number</i>	TBMA6P220001
Auftraggeber <i>Customer</i>	TekBox Digital Solutions Vietnam Co. Ltd. Saigon Hi-Tech Park, Factory 4, 5F, Lot I-3B-1, N6 Str., Tan Phu Ward, D 9 70000 Ho Chi Minh Vietnam
Auftragsnummer <i>Order Nr.</i>	L.L7.00059.0.0-A-10043 Ext. Order No.: PO-20220928001
Anzahl der Seiten des Kalibrierscheines <i>Number of pages of the certificate</i>	1 - 4
Datum und Ort der Kalibrierung <i>Date and place of calibration</i>	18.10.2022 Seibersdorf

Akkreditierung Austria ist Vollmitglied bei der International Laboratory Accreditation Cooperation ILAC und Unterzeichner der MRAs für die Bereiche „Testing, Calibration and Inspection“.

Die Kalibrierung erfolgt auf der gesetzlichen Grundlage des Akkreditierungsgesetzes in gültiger Fassung entsprechend den Anforderungen der ÖVE/ÖNORM EN ISO/IEC 17025.

Dieser Kalibrierschein dokumentiert die Rückführbarkeit auf nationale Normale zur Darstellung der physikalischen Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).

Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

Akkreditierung Austria is a full member of the International Laboratory Accreditation Cooperation ILAC and a signatory of the MRA for "Testing, Calibration and Inspection".

The calibration is performed in accordance with the Akkreditierungsgesetz in the amended version and the requirements of ÖVE/ÖNORM EN ISO/IEC 17025.

This calibration certificate documents the traceability to national standards, which realize the physical units or measurements according to the International System of Units (SI).

The user is obliged to have the object recalibrated at appropriate intervals.

Dieser Kalibrierschein gilt ausschließlich für den kalibrierten Gegenstand und darf nur vollständig und unverändert weiterverarbeitet werden. Auszüge oder Änderungen sind unzulässig. Kalibrierscheine ohne Unterschrift haben keine Gültigkeit.

This calibration certificate is valid only for the calibrated object and may not be reproduced other than in full. Calibration certificates without signature are not valid.

Datum <i>Date</i>	Zeichnungsberechtigter <i>Authorized person</i>	Bearbeiter <i>Person responsible</i>
18.10.2022	<hr/> Patrick Preiner	<hr/> Markus Vaclav

Calibration Procedure

Calibration of the **antenna factor** is carried out according to the TEM-Cell Method described in internal process guideline LE-EH-VA-A01 (1.0). The calibration fulfils the requirements given in CISPR 16-1-6.

$H [dB\mu A/m] = V [dB\mu V] + AFH [dB/\Omega m]$	AFH	Magnetic field antenna factor
$E [dB\mu V/m] = V [dB\mu V] + AFE [dB/m]$	AFE	Electric field antenna factor
	H	Magnetic field strength
	E	Electric field strength
	V	Voltage at terminals of loop antenna

Test Equipment

Type	Identification
Network Analyzer Keysight E5061B	E0192
Cable with Ferrites	LE0389
Cable with Ferrites	LE0388
Attenuator 10 dB	LE0250
Attenuator 10 dB	LE0251
Termination resistance	LE0309
CalStan 11	E0921

Environmental Conditions

Site Temperature	24°C +/- 3°C
Site Humidity	44% +/- 10%
Control Temperature	24°C +/- 3°C
Control Humidity	44% +/- 10%

Results

Type	Description	Fig./Table
Antenna Factor H	9kHz-30MHz	1
Antenna Factor E	9kHz-30MHz	2

Accuracy of Calibration

The reported expanded 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%. The standard uncertainty of measurement has been determined in accordance with EAL Publication EA 4/02.

References

- [1] CISPR 16-1-6:2014/AMD1:2017, Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-6: Radio disturbance and immunity measuring apparatus - EMC antenna calibration
- [2] EA-4/02 M: 2022 Evaluation of the Uncertainty of Measurement in calibration

Figure 1: Antenna Factor H; 9kHz-30MHz

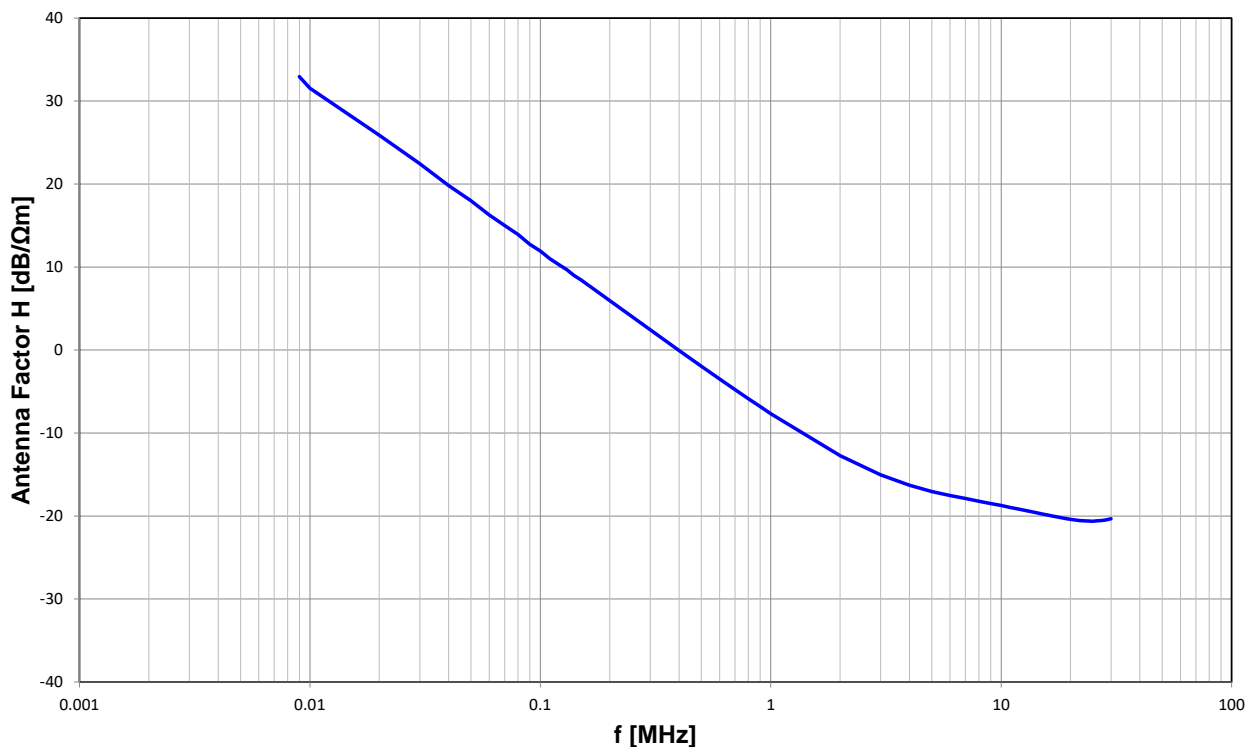


Table 1: Antenna Factor H; 9kHz-30MHz

f [MHz]	AF [dB/Ωm]	U [dB]	f [MHz]	AF [dB/Ωm]	U [dB]	f [MHz]	AF [dB/Ωm]	U [dB]
0.009	32.934	±1.20	0.400	-0.045	±1.20	13.000	-19.376	±1.20
0.010	31.540	±1.20	0.500	-1.960	±1.20	14.000	-19.560	±1.20
0.020	25.870	±1.20	0.600	-3.492	±1.20	15.000	-19.734	±1.20
0.030	22.444	±1.20	0.700	-4.772	±1.20	16.000	-19.890	±1.20
0.040	19.803	±1.20	0.800	-5.882	±1.20	17.000	-20.037	±1.20
0.050	17.970	±1.20	0.900	-6.825	±1.20	18.000	-20.173	±1.20
0.060	16.273	±1.20	1.000	-7.681	±1.20	19.000	-20.296	±1.20
0.070	14.999	±1.20	2.000	-12.731	±1.20	20.000	-20.398	±1.20
0.080	13.928	±1.20	3.000	-15.043	±1.20	21.000	-20.482	±1.20
0.090	12.754	±1.20	4.000	-16.287	±1.20	22.000	-20.549	±1.20
0.100	11.944	±1.20	5.000	-17.039	±1.20	23.000	-20.592	±1.20
0.110	10.982	±1.20	6.000	-17.525	±1.20	24.000	-20.613	±1.20
0.120	10.297	±1.20	7.000	-17.898	±1.20	25.000	-20.626	±1.20
0.130	9.694	±1.20	8.000	-18.215	±1.20	26.000	-20.626	±1.20
0.140	8.994	±1.20	9.000	-18.488	±1.20	27.000	-20.591	±1.20
0.150	8.463	±1.20	10.000	-18.736	±1.20	28.000	-20.555	±1.20
0.200	5.956	±1.20	11.000	-18.967	±1.20	29.000	-20.494	±1.20
0.300	2.441	±1.20	12.000	-19.179	±1.20	30.000	-20.423	±1.20
							-20.334	±1.20

Figure 2: Antenna Factor E; 9kHz-30MHz

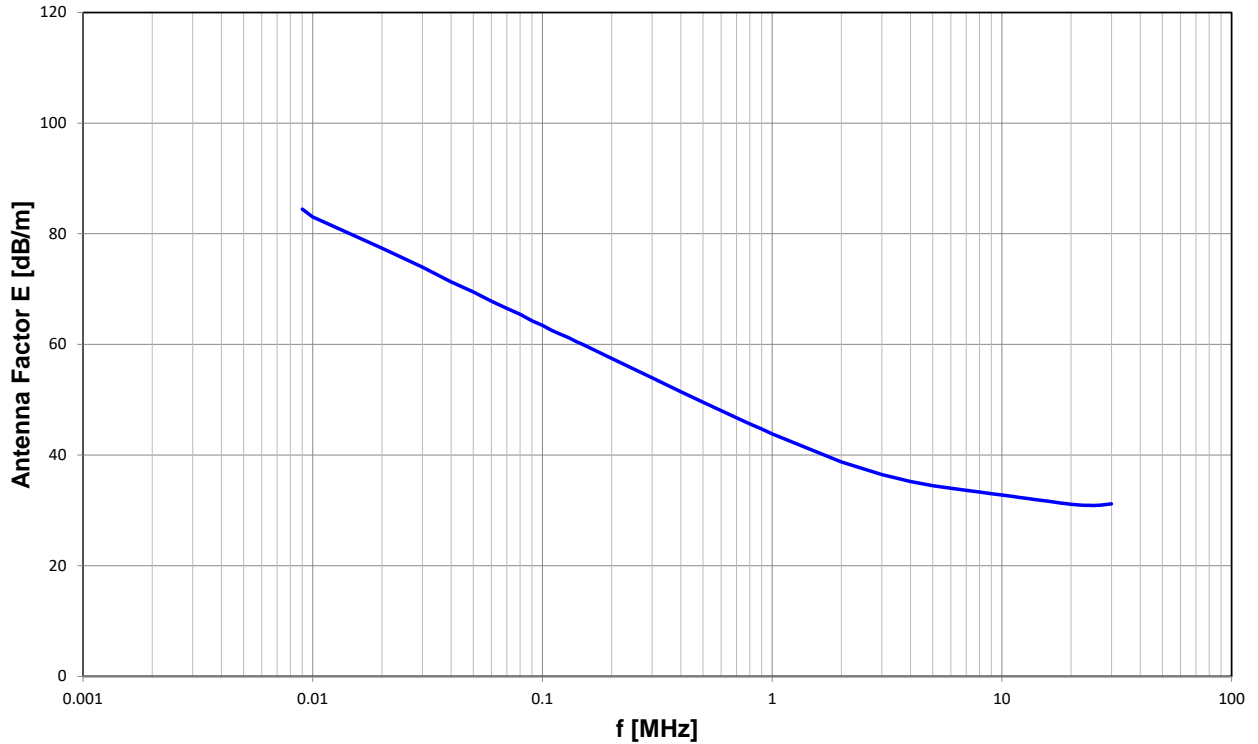


Table 2: Antenna Factor E; 9kHz-30MHz

f [MHz]	AF [dB/m]	U [dB]	f [MHz]	AF [dB/m]	U [dB]	f [MHz]	AF [dB/m]	U [dB]
0.009	84.45	±1.20	0.500	49.56	±1.20	15.000	31.79	±1.20
0.010	83.06	±1.20	0.600	48.03	±1.20	16.000	31.63	±1.20
0.020	77.39	±1.20	0.700	46.75	±1.20	17.000	31.48	±1.20
0.030	73.96	±1.20	0.800	45.64	±1.20	18.000	31.35	±1.20
0.040	71.32	±1.20	0.900	44.70	±1.20	19.000	31.22	±1.20
0.050	69.49	±1.20	1.000	43.84	±1.20	20.000	31.12	±1.20
0.060	67.79	±1.20	2.000	38.79	±1.20	21.000	31.04	±1.20
0.070	66.52	±1.20	3.000	36.48	±1.20	22.000	30.97	±1.20
0.080	65.45	±1.20	4.000	35.23	±1.20	23.000	30.93	±1.20
0.090	64.27	±1.20	5.000	34.48	±1.20	24.000	30.91	±1.20
0.100	63.46	±1.20	6.000	33.99	±1.20	25.000	30.89	±1.20
0.110	62.50	±1.20	7.000	33.62	±1.20	26.000	30.93	±1.20
0.120	61.82	±1.20	8.000	33.31	±1.20	27.000	30.97	±1.20
0.130	61.21	±1.20	9.000	33.03	±1.20	28.000	31.03	±1.20
0.140	60.51	±1.20	10.000	32.78	±1.20	29.000	31.10	±1.20
0.150	59.98	±1.20	11.000	32.55	±1.20	30.000	31.19	±1.20
0.200	57.48	±1.20	12.000	32.34	±1.20			
0.300	53.96	±1.20	13.000	32.14	±1.20			
0.400	51.47	±1.20	14.000	31.96	±1.20			