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List of offered calibration services

Measurands

The most important measurands which can be calibrated in our calibration laboratory according to ISO 17025 are:

- Antenna factor k
- Antenna gain g
- E-field strength
- H-field strength
- VSWR
- Impedance
- Attenuation
- Voltage
- Current
- Power

Frequency range

Traceability to DKD standards is provided from DC to 40 GHz. We choose a suitable number of frequency points. The points will be so close to each other that interpolation errors become insignificant. For an order it is not necessary (but possible) to instruct frequency steps. In principle all antennas and devices are calibrated in the maximum possible frequency range.

Uncertainty

The achievable measurement uncertainty depends on the calibration method, frequency range and on the calibration object and method. It is designated in each calibration certificate.

Shipment

Please choose packaging material which is suitable for the return shipment, too. In case you need any advice on how to ship we gladly help you to find a reasonable way of transport. We also collect very urgent calibration orders or larger quantities of items unpacked at your site if required.

Scope of delivery

With any calibrated item you receive:

- An ISO17025 compliant certificate of calibration with all essential information, and numerical calibration data or a graph respectively on paper.
- Electronic calibration data by E-mail on request.
- In case of re-calibration a calibration label as a reference between the calibration object and the certificate.

Calibration intervals

Usually we do not indicate calibration intervals on our certificates or labels. The calibration intervals have to be determined by the user under consideration of the individual conditions of application.

Facts that require close calibrations intervals	Facts for longer calibrations intervals
Equipment in multi level design with active components and complex electronics.	Passive equipment with uncomplex design
Frequent use	Only intermittent use
Frequent location changes	Fixed installation at one location
Many different users	Just one user
Humidity, variations in temperature, vibrations	Laboratory conditions
Highly automated measurement system without continuous supervision.	Visual inspection of the measurement system before, during and after the measurement
No plausibility check by independent method	Plausibility check by independent method
Staff with low technical knowledge or personnel just trained on one method	Staff with high technical knowledge and outstanding experience

Antenna calibration

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The calibration of broad band antennas is usually performed under quasi free space conditions according to SAE ARP-958. Pure antenna data is supplied. Influence of the measurement site or by reflections must be avoided. A reflected ray can add to the direct ray in a way that it increases or decreases the field strength of the direct ray depending on the phase difference between the 2 rays.
From a metrological point of view this should be avoided. The data supplied by us minimizes the influence of the measurement site. Quasi free space data is independent of polarization or measurement height.
The influence of a moving phase center such as at a log.-per.-antenna is taken into account during the calibration. A log.-per. antenna radiates from the tip for the high frequencies and from the end for the low frequencies. The effective distance to the test item changes with frequency. As it is not feasible to change the distance between DuT and antenna with frequency we can calibrate the antenna for a fixed distance (e.g. 3 m) referring to a fixed reference point (e.g. antenna tip or antenna center). The data supplied in this case can directly be applied for the calculation of the field strength at a fix distance from the antenna without taking any additional uncertainty caused by the phase center shift into account.
In contrast to 1 m or 3 m data we can also deliver far field data. If the distance between the antenna and the DuT is by far larger than the length of the antenna the influence of the phase center shift becomes negligible. The antenna can be considered as small compared to the measurement distance. Such data is called far field data. If far field antenna factors are used to calculate the field strength in a short distance additional uncertainty by the phase center shift must be taken into account. The shorter the distance and the longer the antenna the higher the uncertainty contribution will be.

New equipment
Basically new equipment is supplied in a condition that allows precise measurements. The antenna factor or correction value which is necessary for that purpose is delivered automatically without further surcharges. If technically required individual calibration data is automatically supplied. If this is technically not required or reasonable typical calibrations data is provided.
Here an example: The electrical characteristics of a log.-per-antenna depend essentially on its geometry. At a frequency of 100 MHz the wavelength is approximately 3 m. So an antenna element of a log.-per antenna for this frequency would be about 750 mm long. It can be manufactured with an accuracy of 0,05 mm. That means that the mechanical fabrication tolerance is about 0,0006 dB.
The uncertainty that can be reached during an antenna factor calibration is in the range of approx. 0,5 – 1,5 dB. In such a constellation the antenna will be supplied with typical data. Of course the antenna factor of such an antenna is checked prior to delivery. It will only be delivered if the data indicated in the manual matches with the delivered antenna. If due to formal requirements an individual calibration of such an antenna is required a discount of 30 % on the calibration prices listed below is applied. The discount is just valid for new antennas, i.e. the antenna and calibration have to be ordered at the same time.
Other antennas or equipment are always delivered with individual calibrations, e.g. because the wavelength is only in the range of a few mm, or active semiconductors with varying electrical properties are built in., or material characteristics vary. In such cases an individual calibration will be supplied – without additional surcharges and without an extra order.

Calibration prices for antennas:
In the calibration price table below the most frequently requested measurement distances and reference points are proposed. Other reference points and distances can be selected without additional charges. In this case please clearly indicate this in your order.

Ref. number	Description	Examples
CAL BIC 1ST SET UP	Calibration of a biconical antenna. Quasi free space antenna factor and gain. First test distance: far field, reference point: center of the bicone antenna.	VHA 9103 B w. BBA 9106, UBAA 9114 w. BBUK 9139, VUBA 9117, SBA 9119, HK116, POD16, POD618, EMCO 9104C, 3109, VBA 6106A, SAS-540
CAL LOG 1ST SET UP	Calibration of a log.-per. antenna. Quasi free space antenna factor and gain. First test distance: 3 m, reference point: center of the log.-per. antenna.	VULP 9118 A, USLP 9143, VUSLP 9111, HL223, HL040, EMCO 3148 B, 3144, 3147, UPA 6108, 6109, SAS-512
CAL LOG 2ND SET UP	Calibration of a log.-per. antenna. Quasi free space antenna factor and gain. Further test distance: 1 m, reference point: tip of the log.-	VULP 9118 A, USLP 9143, VUSLP 9111, HL223, HL040, EMCO 3148 B, 3144, 3147, UPA

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	per. antenna.	6108, 6109, SAS-512
CAL HYBR 1ST SET UP	Calibration of a hybrid or Biconilog or Logbicon antenna. Quasi free space antenna factor and gain. First test distance: 3 m, reference point: center of the hybrid antenna.	VULB 9168, VULB 9163, CBL 6111, 6112, 6141, R&S HL562, EMCO 3142, SAS-521
CAL HYBR 2ND SET UP	Calibration of a hybrid or Biconilog or Logbicon antenna. Quasi free space antenna factor and gain. Further test distance: 10 m reference point: center of the hybrid antenna.	VULB 9168, VULB 9163, CBL 6111, 6112, 6141, R&S HL562, EMCO 3142, SAS-521
CAL HORN 1ST SET UP	Calibration of a horn antenna. Quasi free space antenna factor and gain. First test distance: 1 m, reference point: front plane of the horn antenna.	BBHA 9120 D, BBHA 9120 E, EMCO 3106, 3115, 3116, 3117, R&S HF907,
CAL HORN 2ND SET UP	Calibration of a horn antenna. Quasi free space antenna factor and gain. Further test distance: 3 m, reference point: front plane of the horn antenna.	BBHA 9120 D, BBHA 9120 E, EMCO 3106, 3115, 3116, 3117, R&S HF907
CAL ROD	Calibration of the antenna factor of an active rod antenna with calibration adapter. (Distance not applicable)	VAMP 9240, VAMP 9243, EMCO 3301, R&S HFH2-Z1, HFH2-Z6
CAL LOG SPIRAL	Calibration of a conical log.-spiral antenna. Quasi free space antenna factor and gain. First test distance: 1 m, reference point: tip of the log.-spiral antenna.	HLX 0810, CLSA 0110, EMCO 3101, 3102, 3103
CAL DIPOLE FIRST	Calibration of gain and antenna factor of a half wave dipole for the first frequency. The element length is tuned to the first required frequency.	VHA 9103, UHA 9105, UHA 9125 C, VDA 6116A, EMCO 3121D
CAL DIPOLE FURTHER	Calibration of gain and antenna factor of a half wave dipole for further frequencies. The element length is tuned to the related frequency each time.	VHA 9103, UHA 9105, UHA 9125 C, VDA 6116A, EMCO 3121D
CAL UHA 9125 D	Calibration of gain and antenna factor of a half wave dipole UHA 9125 D with 6 sets of fixed length elements. Settings for total element length LE and short: LE: 140 mm Short: Removed. LE: 114 mm, Short: Removed. LE: 90 mm Short: 45 mm. LE: 72 mm Short: 36 mm. LE: 60 mm Short: 30 mm. LE: 48 mm Short: 24 mm.	UHA 9125 D
CAL VHAP/UHAP	Calibration of gain and antenna factor for a pair of 2 antennas measured in a calibration adapter, frequency range: 30-300 MHz or, 300-1000 MHz.	VHAP, UHAP, R&S HZ-12, HZ-13
CAL EFS 9218	Calibration of the antenna factor of an EFS 9218 in a Crawford cell.	EFS 9218
CAL VUFM	Calibration of an electric field probe VUFM 1670 (eventually with LCD unit VUFM 1671 or GPIB unit VUFM 1672). At 10 MHz we calibrate 15 different field strength levels that are produced by a TEM cell.	VUFM 1670, VUFM 1671, VUFM 1672
CAL 9122 LW MW KW	Calibration of a HFBA 9122 with elements in a range 100 kHz to 30 MHz in a TEM cell.	HFBA 9122
CAL MAG LOOP RX	Calibration of the magnetic antenna factor and the fictitious electric field antenna factor of an Rx loop.	FMZB 1516, HFH2-Z2, HLA 6120, EMCO 6502

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CAL HFS HMDA	Calibration of a magnetic field probe like HMDA 1545, FMZB 15xx series or HFS 1546 in a calibration adapter or in a TEM cell.	HMDA 1545, FMZB 1538, HFS 1546
CAL FESP	Calibration of a monitor loop: The conversion factor from magnetic field strength to voltage across 50 Ohm is determined. For a radiating loop the conversion factor from current to magnetic field strength in a certain distance is determined.	FESP 5133, FESP 5132, FESP 5134, FESP 5133-7/41, F-304, F-305, 7605, 7606
CAL HHS	Calculation of the conversion factor from current to magnetic field (coil factor) in the center of a square or circular pair of Helmholtz coils if the geometry is known. Additionally measurement of the coil factor.	HHS 5204-36, HHS 5204-12, HHS 5215, HHS 5218, 6402, 6404
CAL HFCD HXYZ	Calibration of the conversion factor in dBOhm of the transmission between a calibration dipole and a large 3 dimensional van Veen loop antenna acc. EN 55016-1-4:2007 + A1:2008 C.4 for 3 perpendicular directions.	HXYZ 9170, HFCD 9171, HM020, HM020Z3, RF-300
CAL DAF BIC	Calibration of the Dual antenna factor of a pair of biconical antennas acc. to the 2-antenna-method. The sum of the antenna factors of the pair is determined and divided by 2. Test distance: 3 m between the centers of the biconical antennas. Quasi free space conditions.	A pair of VHBB 9124 with BBA 9106, a pair of HK116
CAL DAF LOG	Calibration of the Dual antenna factor of a pair of log.-per.-antennas acc. to the 2-antenna-method. The sum of the antenna factors of the pair is determined and divided by 2. Test distance: 3 m between the centers of the log.-per.-antennas. Quasi free space conditions.	A pair of VULP 9118 A, A pair of VUSLP 9111
CAL SITE REF	Calibration of the site reference based on the antenna combination of a small biconical antenna as Tx and a hybrid antenna as Rx antenna 30-1000 MHz in a distance of 3 m form the center of the hybrid antenna for validation of a fully anechoic chamber acc. to CISPR16-1-4.	UBAA 9114 or UBAA 9115 w. elements BBUK 9139 with VULB 9168 or VULB 9163 or CBL 6111 or EMCO 3142 or HL562
CAL CROSS POLAR	Calibration of the cross polarisation rejection and the internal cross polarisation decoupling of a dual polarized antenna.	XSLP 9142, VULX 9163, XSLP 9143, BBHX 9120 E, BBHX 9120 LF, 3164-05, 3164-06, 3164-08
CAL VSWR	Calibration of the VSWR at the antenna connector.	All antennas and many other devices
CAL PATTERN FIRST	Recording the directional pattern of an antenna in E-plane and H-plane for the first frequency.	SBA 9112, SBA 9113, SBA 9119, POD16, POD618
CAL PATTERN FURTHER	Recording the directional pattern of an antenna for any further frequency.	SBA 9112, SBA 9113, SBA 9119, POD16, POD618

Calibration prices for conducted measurands

Cal BBV	Calibration of the gain of a broadband preamplifier.	BBV 9742, BBV 9718, PAM-0118, TS-PR1, TS-PR3, TS-PR7
CAL CABLE	Calibration of the attenuation of a coaxial cable or an attenuator.	AK 9513, AK 9515 G, Sucoflex 104, RG223
CAL VTSD	Calibration of the attenuation of a pulse limiter.	VTSD 9561 F, VTSD 9561 D, PL-01, ESH3-Z2
CAL SY 9501	Calibration of the attenuation between 2 ea SY 9501	SY 9501
CAL TK	Calibration of the insertion loss of a HF voltage probe	TK 9420, SHC, ESH2-Z3
CAL V-LISN 1	Calibration of the magnitude of the impedance	NSLK 8127, ENV216, ESH3-Z5,

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	at DuT terminals (BNC terminated with 50 Ohm) and calibration of the transmission from the DuT terminals to BNC according to EN 55016-1-2:2004 + A1:2005.	NSLK 8126, ESH2-Z5, NSLK 8128, ENV4200, NNLK 8129, NNLK 8130, NNBM 8125, NNBM 8126 D, ESH3-Z6, NNBL 8226
CAL V-LISN 2	Additionally to CAL V-LISN 1: Calibration of the phase of the impedance at DuT terminals and calibration of the isolation between mains terminals and DuT terminals or BNC connector respectively acc. to EN 55016-1-2:2004 + A2:2006.	NSLK 8127, ENV216, ESH3-Z5, NSLK 8126, ESH2-Z5, NSLK 8128, ENV4200, NNLK 8129, NNLK 8130
CAL ISN 1	Transmission EuT to BNC, AE to BNC @ EuT open, AE to BNC @ EuT shorted. Common mode (asymmetrical) impedance at EuT terminals, BNC terminated with 50 Ohm.	NTFM 8131, NTFM 8132, NTFM 8136
CAL ISN 2	Longitudinal Conversion Loss LCL at the EuT Terminals	NTFM 8132, NTFM 8136
CAL CDN Z	Calibration of the impedance of a CDN.	L801M2, L801AF2,L 801S8
CAL CDN K	Calibration of the k-factor of a CDN additionally to its impedance.	L801M2, L801AF2, L801S8
CAL EM 101 ATT/DECOU	Calibration of an EM 101: Attenuation N-connector-EuT-cable and decoupling (absorber effectiveness).	EM 101, F-2031, KEMZ 801
CAL CVP	Calibration of the insertion loss of a capacitive voltage probe CVP 9222.	CVP 9222, CVP 2200
CAL SW	Calibration of the transfer impedance or the insertion loss of a current clamp.	SW 9602, SW 9605, F-33-2, EZ-17
CAL FTC 101	Calibration of the insertion loss in a 50 Ohm System in a jig	FTC-101
CAL IGLK/IGU	Calibration of an IGLK 2914 or IGU 2912.	IGU 2912, IGLK 2914
CAL IGUF	Calibration of an IGUF 2910.	IGUF 2910
CAL IGUU	Calibration of a pulse generator IGUU 2916. Output level of the main and aux.-generator across 50 Ohm at Quasi peak detection in all bands.	IGUU 2916, IGUU 2918
CAL KU 9616	Calibration of the attenuation of a KU 9616 or a KU 9618.	KU 9616, KU 9618
CAL MDS 1	Calibration of the insertion loss acc. to CISPR 16-1-3 Ed. 2.0 in large jig with secondary absorbing device and calculation of the Clamp Factor CForig, which is finally needed for correction purposes during disturbance power measurements. Please send the MDS 21, the coaxial cable and the 6 dB attenuator. The attenuation of cable and attenuator will then be taken into account.	MDS 21, Kyoritsu KT-10, AMZ 41A
CAL MDS 22	Calibration of the insertion loss in the calibration jig.	MDS 22
CAL MG	Calibration of the output level of a tracking generator vs. frequency.	MG 1522
CAL REC A,B	Calibration of an EMI receiver Band A and B. Calibration of the available detectors Quasi Peak, Peak, Average, CAV and CRMS at sine or pulse signals. Step attenuator calibration, passband selectivity and random noise.	FCKL 1528, ESH2
CAL REC C,D,E	Calibration of an EMI receiver Band C and D (and E). Calibration of the available detectors Quasi Peak, Peak, Average, CAV and CRMS at sine or pulse signals. Step attenuator calibration, passband selectivity and random noise.	FCVU 1534, ESV

CAL REC A,B,C,D,E	Calibration of an EMI receiver Band A, B, C, D and E. Calibration of the available detectors Quasi Peak, Peak, Average, CAV and CRMS at sine or pulse signals. Step attenuator calibration, passband selectivity and random noise.	FCLE 1535, ESCS30
CAL SG	Calibration of the voltage level across 50 Ohm of a spectrum generator SG 9301.	SG 9301, SG 9302