steep GmbH ♦ Lise-Meitner-Straße 6 ♦ D-85521 Ottobrunn

Kalibrierschein
Calibration Certificate

Kalibrierzeichen
Calibration mark

K0-0368-2023-09

Gegenstand *Object*	**Broadband RF Meter with Horn Antenna**
Hersteller *Manufacturer*	**Save Living Technologies**
Typ *Type*	**Safe and Sound Pro mmWave**
Fabrikate/Serien-Nr. *Serial number*	**n.a.**
Auftraggeber *Customer*	**Save Living Technologies Inc.** **7 Clair road W, P.O.Box 27051** **Guelph, Ontario N1L 0A6** **Canada**
Auftragsnummer *Order No.*	**K0-23008**
Anzahl der Seiten des Kalibrierscheines *Number of pages of the certificate*	**5**
Datum der Kalibrierung *Date of calibration*	**11.09.2023**

Die Kalibrierung erfolgt durch Vergleich mit Bezugsnormalen bzw. Bezugsnormalmess-einrichtungen, die in einem akkreditierten Kalibrierlabor kalibriert und damit rückführbar auf die nationalen Normale zur Darstellung der physikalischen Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI) sind.

Die Kalibrierung erfolgte in Übereinstimmung mit den Normen DIN EN ISO/IEC 17025 und ISO 9001.

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

The calibration is performed by comparison with reference standards or standard measuring equipment, which are calibrated by an accredited calibration laboratory and thus are traceable to the national measurement standards for the realization of the physical units according to the International system of Units (SI).

The calibration is performed according to the standards DIN EN ISO/IEC 17025 and ISO 9001.

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

Die angegebenen Meßwerte gelten zum Zeitpunkt der Kalibrierung. Kalibrierscheine ohne Unterschrift haben keine Gültigkeit.
The measured values are valid for the moment of calibration. Calibration certificates without signature are not valid.

Datum der Ausstellung *Date of issue*	Freigabe des Kalibrierscheins durch *Approval of the certificate of calibration by*	Bearbeiter *Person in charge*
12.09.2023	Florian Gegg	Peter Ruster

Tel.: +49 (0) 89 4449-1700. Fax.: +49 (0) 89 4449-24165. e-mail: Kalibrierlabor@steep.de

1 Calibration Object

The ”Broadband RF meter” with Horn Antenna is used to measure power density.

Specified Frequency Range:	24 GHz – 40 GHz
Frequency Range to be calibrated:	24 GHz – 40 GHz

The measured values are read from the display on the Meter.

The calibration is only valid in the described configuration and under the conditions mentioned in the calibration certificate. Prior to calibration an optical and an electrical inspection was performed, no damage was found.

2 Calibration Setup

The probe was calibrated with the following field strength:

	Orientation
Frequency	PS (E-Vector ⊥ Display)
24 GHz – 26 GHz	194 mV/m (100 µW/m²)
27 GHz – 40 GHz	194 mV/m (100 µW/m²)

3 Measuring devices

Measuring Equipment	**Type**	**Manufacturer**	**K.-No.**	**Traceability**
Signalgenerator	E8257D	Agilent	1012	K1012-2022-04
Horn Antenna	QSH20S20RA	Q-par Angus	7014	K7014-2022-01
Horn Antenna	QSH22K20RA	Q-par Angus	7015	K7015-2022-01

Other for testing used instruments and tools subject to the requirements and calibration / maintenance cycles of the EMV test laboratories.

4 Environmental Conditions

Ambient temperature: 21.7 °C to 23.4 °C ±0.3 K
Relative humidity: 57.2 % rel. H. to 58.3 % rel. H. ±2 % rel. H.

5 Uncertainty of Measurements

Depending on the frequency, the expanded uncertainty is calculated as follows

	Frequency Range			Uncertainty
Anechoic Chamber	24 GHz	–	26.5 GHz	27 %
	>26.5 GHz	–	40 GHz	30 %

The reported expanded uncertainties are based on a standard uncertainty multiplied by a Coverage factor k=2, providing a level of confidence of approximately 95%.
The uncertainty evaluation has been carried out in accordance with EA-04/02 „Expression of the Uncertainty of Measurement in Calibration“.

6 Calibration Method

The calibration is based on accredited methods; the reference field respectively reference power density was determined by calibrated generator power.

7 Calibration Result

7.1 Frequency Response

The ratio of the reference power density to the measured power density is stated as the correction factor *CF*.

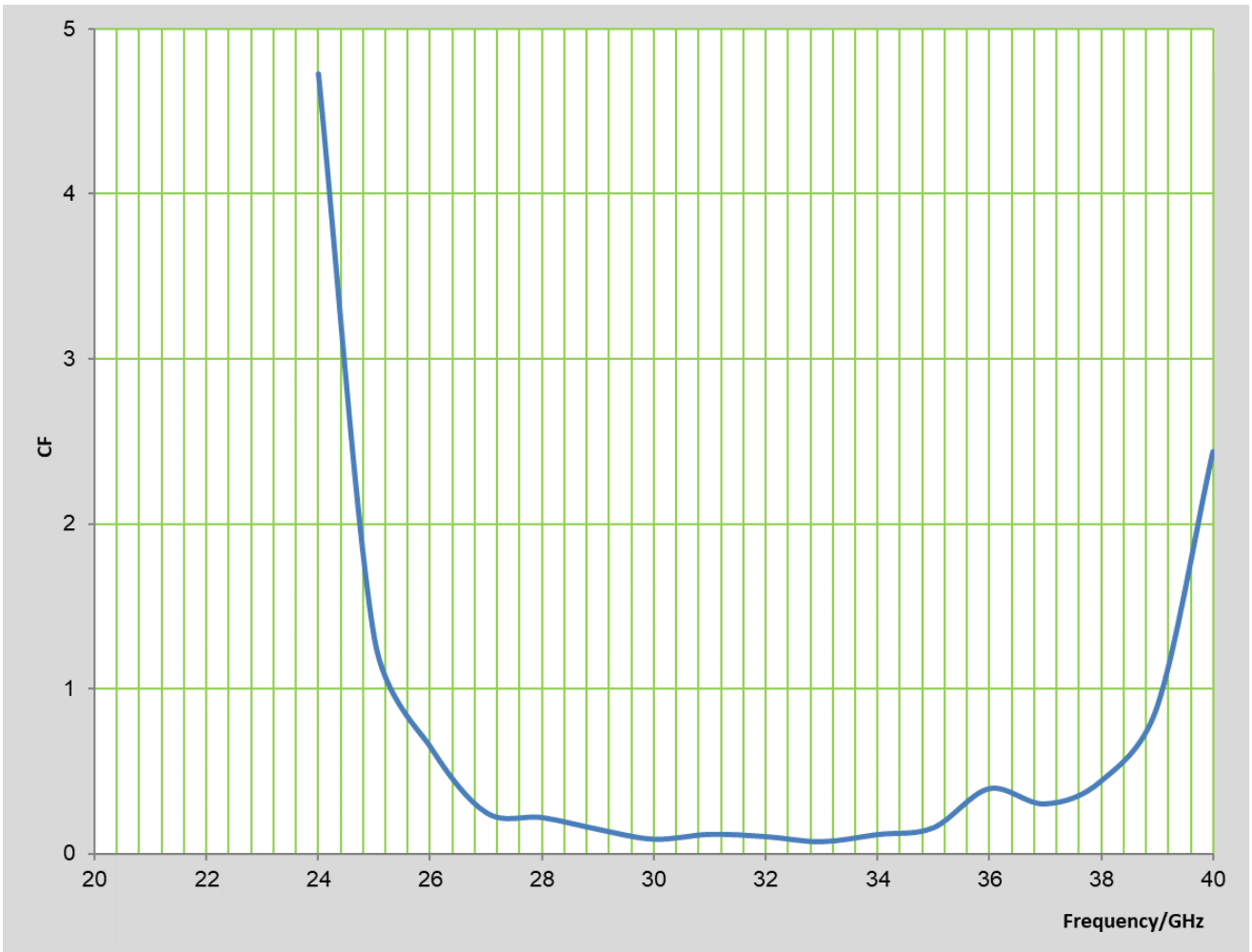
$$CF = \frac{Reference\ power\ density}{Measured\ power\ density}$$

The correction factor CF_{-dB} is calculated from the correction factor *CF*.

$$\frac{CF_{-dB}}{dB} = -10\log_{10}(CF)$$

7.1.1 Correction Factor versus Frequency at Orientation PS

Frequency	CF	Frequency	CF	Frequency	CF	Frequency	CF
24.000 GHz	4.73	29.000 GHz	0.15	34.000 GHz	0.12	39.000 GHz	0.89
25.000 GHz	1.31	30.000 GHz	0.09	35.000 GHz	0.16	40.000 GHz	2.44
26.000 GHz	0.65	31.000 GHz	0.12	36.000 GHz	0.40		
27.000 GHz	0.25	32.000 GHz	0.11	37.000 GHz	0.31		
28.000 GHz	0.22	33.000 GHz	0.08	38.000 GHz	0.44		



7.1.2 Correction Factor versus Frequency at Orientation PS

Frequency	CF_{-dB}/dB	Frequency	CF_{-dB}/dB	Frequency	CF_{-dB}/dB	Frequency	CF_{-dB}/dB
24.000 GHz	-6.75	29.000 GHz	8.20	34.000 GHz	9.23	39.000 GHz	0.50
25.000 GHz	-1.17	30.000 GHz	10.38	35.000 GHz	7.94	40.000 GHz	-3.87
26.000 GHz	1.85	31.000 GHz	9.18	36.000 GHz	4.00		
27.000 GHz	5.97	32.000 GHz	9.70	37.000 GHz	5.15		
28.000 GHz	6.52	33.000 GHz	11.18	38.000 GHz	3.53		

Ende des Kalibrierscheins
End of the calibration certificate