

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

Kalibrierschein
Calibration Certificate

Kalibrierzeichen
Calibration mark

K0-0367-2023-09

Gegenstand
Object **Broadband RF Meter
with Short Stub 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

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1 Calibration Object

The "Broadband RF meter" with Short Stub Antenna is used to measure power density.

Specified Frequency Range:	18 GHz – 40 GHz
Frequency Range to be calibrated:	18 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:

Frequency	Orientation
	PS (E-Vector \perp Display)
18 GHz – 26 GHz	614 mV/m (1.0 mW/m ²)
27 GHz – 40 GHz	614 mV/m (1.0 mW/m ²)

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: 21.2 °C to 21.8 °C \pm 0.3 K
 Relative humidity: 51.1 % rel. H. to 52.3 % rel. H. \pm 2 % rel. H.

5 Uncertainty of Measurements

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

	Frequency Range		Uncertainty
	Anechoic Chamber	18 GHz – 26.5 GHz	>26.5 GHz – 40 GHz

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 .

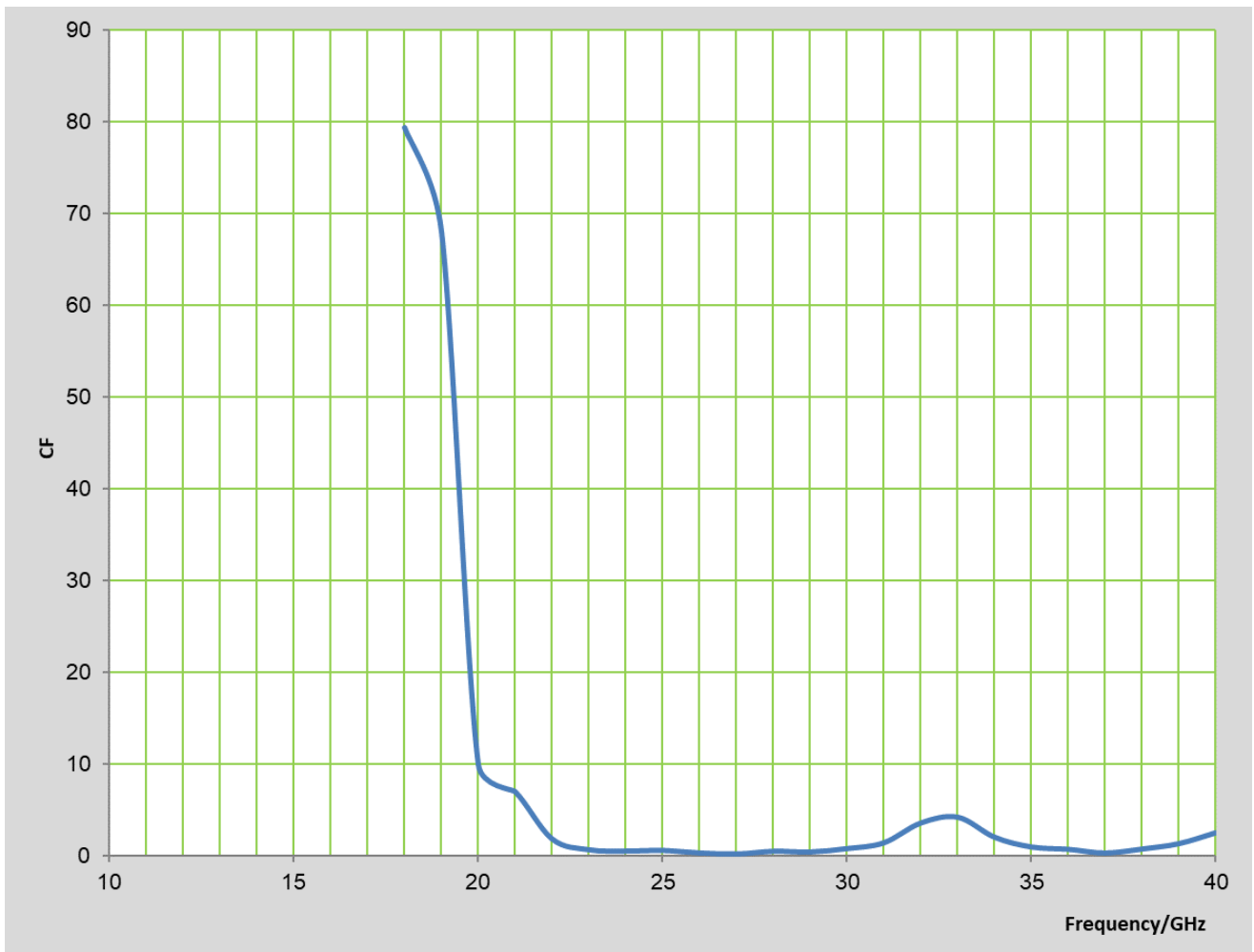
$$CF = \frac{\text{Reference power density}}{\text{Measured power density}}$$

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

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

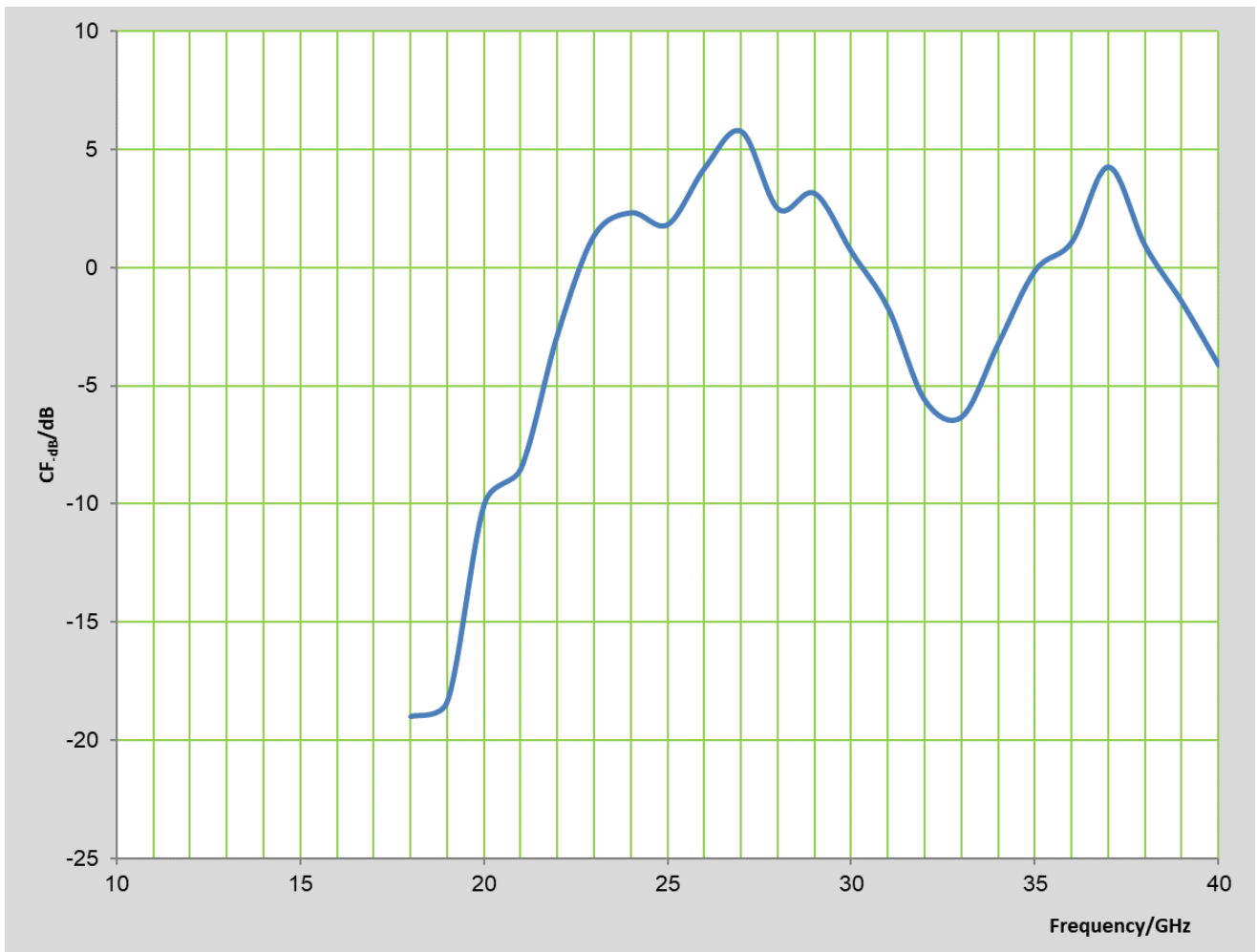
7.1.1 Correction Factor versus Frequency at Orientation PS

Frequency	CF	Frequency	CF	Frequency	CF	Frequency	CF
18.000 GHz	79.40	24.000 GHz	0.58	30.000 GHz	0.86	36.000 GHz	0.78
19.000 GHz	68.06	25.000 GHz	0.65	31.000 GHz	1.48	37.000 GHz	0.37
20.000 GHz	10.01	26.000 GHz	0.38	32.000 GHz	3.64	38.000 GHz	0.81
21.000 GHz	7.05	27.000 GHz	0.26	33.000 GHz	4.28	39.000 GHz	1.40
22.000 GHz	1.90	28.000 GHz	0.56	34.000 GHz	2.09	40.000 GHz	2.58
23.000 GHz	0.73	29.000 GHz	0.48	35.000 GHz	1.03		



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}
18.000 GHz	-19.00	24.000 GHz	2.34	30.000 GHz	0.68	36.000 GHz	1.10
19.000 GHz	-18.33	25.000 GHz	1.84	31.000 GHz	-1.72	37.000 GHz	4.28
20.000 GHz	-10.00	26.000 GHz	4.23	32.000 GHz	-5.61	38.000 GHz	0.93
21.000 GHz	-8.48	27.000 GHz	5.78	33.000 GHz	-6.31	39.000 GHz	-1.45
22.000 GHz	-2.78	28.000 GHz	2.50	34.000 GHz	-3.20	40.000 GHz	-4.11
23.000 GHz	1.40	29.000 GHz	3.16	35.000 GHz	-0.11		



Ende des Kalibrierscheins
End of the calibration certificate



Keysight Technologies Malaysia Sdn Bhd (463532-M)
Bayan Lepas Free Industrial Zone
11900 Penang, Malaysia
Keysight Approved Calibration Provider #71456



5962-0476

Certificate of Calibration

Certificate No: EQ243122-6045767-1

Manufacturer: Keysight Technologies

Model No: U8488A

Options Installed With Specifications: 100

Description: USB Thermocouple Power Sensor

Serial No: MY62330009

Date of Calibration: 05-SEP-2022

Temperature: (23 ± 3) °C

Procedure: AE-P-W10891

Humidity: (40 to 70)% RH

This certifies that the equipment has been calibrated using applicable Keysight Technologies procedures in compliance with a quality management system registered to ISO 9001:2015.

As Received Conditions: Factory tested. No incoming data available.

Action Taken:

- No corrective actions were necessary.

As Shipped Conditions: The measured values of the equipment were observed in specification at the points tested.

Remarks or special requirements:

For inquiries regarding this calibration please contact Keysight Technologies at the above address.

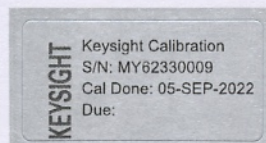
Notes:

1) This calibration report shall not be reproduced, except in full.

Traceability Information: Measurements are traceable to the International System of Units (SI) via national metrology institutes (www.keysight.com/find/NMI) that are signatories to the CIPM Mutual Recognition Arrangement.

Print Date: 06-SEP-2022

Khairul Razmi Bin Zayzan
Quality Manager
Keysight Calibration Provider #71456





Keysight Technologies Malaysia Sdn Bhd (463532-M)
Bayan Lepas Free Industrial Zone
11900 Penang, Malaysia
Keysight Approved Calibration Provider #71456



5962-0476

Certificate of Calibration

Certificate No: EQ243122-6045767-1

Calibration Equipment Used

Date Used: Date equipment used in this calibration

<u>Model Number</u>	<u>Model Description</u>	<u>Equipment ID</u>	<u>Date Used</u>	<u>Cal Due Date</u>
E8361C	Microwave vector network analyzer, 10 MHz to 67 GHz	P0789	05-SEP-2022	08-APR-2023
E5071C	ENA Series Network analyzer	PC7387	05-SEP-2022	11-OCT-2022
N4694A	1.85mm Electronic Cal Kit	P0702	05-SEP-2022	27-DEC-2022
85056A	2.4mm Calibration Kit	P7114	05-SEP-2022	15-APR-2023
E4417A	Pk Pwr Mtr Dual Chn	P0224	05-SEP-2022	07-OCT-2022
N8488A	Average Power Sensor	P0740	05-SEP-2022	03-NOV-2022
E8257D	PSG analog signal generator	PC7398	05-SEP-2022	14-SEP-2022
11667C	Power Splitter	P0736	05-SEP-2022	28-APR-2023
N8488A	Average Power Sensor	P0825	05-SEP-2022	27-JUN-2023
E4419B	Dual Chn Pwr Meter	P0607	05-SEP-2022	23-OCT-2022
N5230A	PNA-L network analyzer	P0370	05-SEP-2022	28-AUG-2023
E4438C	ESG vector signal generator	PA0053	05-SEP-2022	25-OCT-2022
8481A	Power Sensor	P0751	05-SEP-2022	26-OCT-2022
N5222A	PNA Network Analyzer	PA0100	05-SEP-2022	15-SEP-2022
E4417A	Pk Pwr Mtr Dual Chn	PB7358	05-SEP-2022	30-MAR-2023