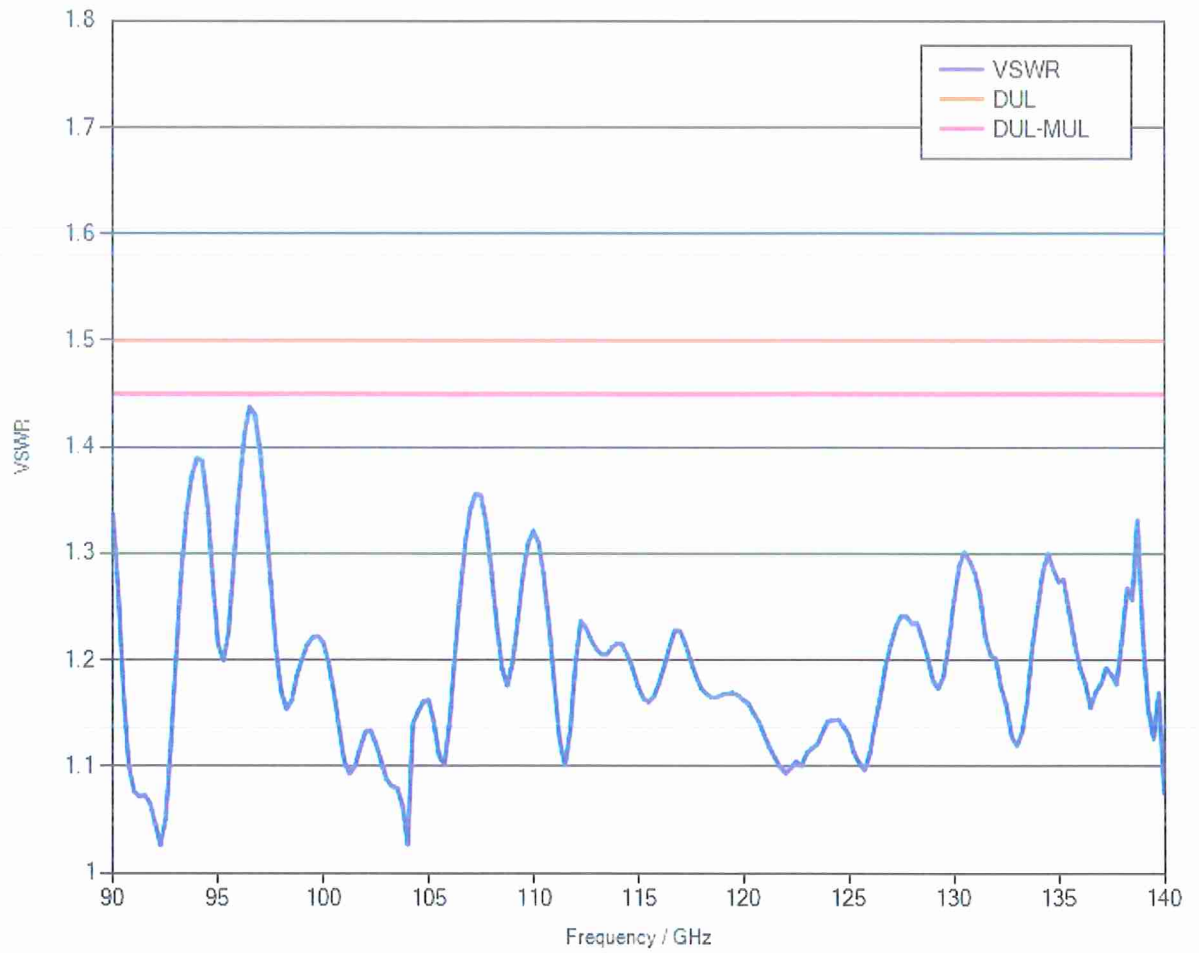


1.1 RF Input – VSWR

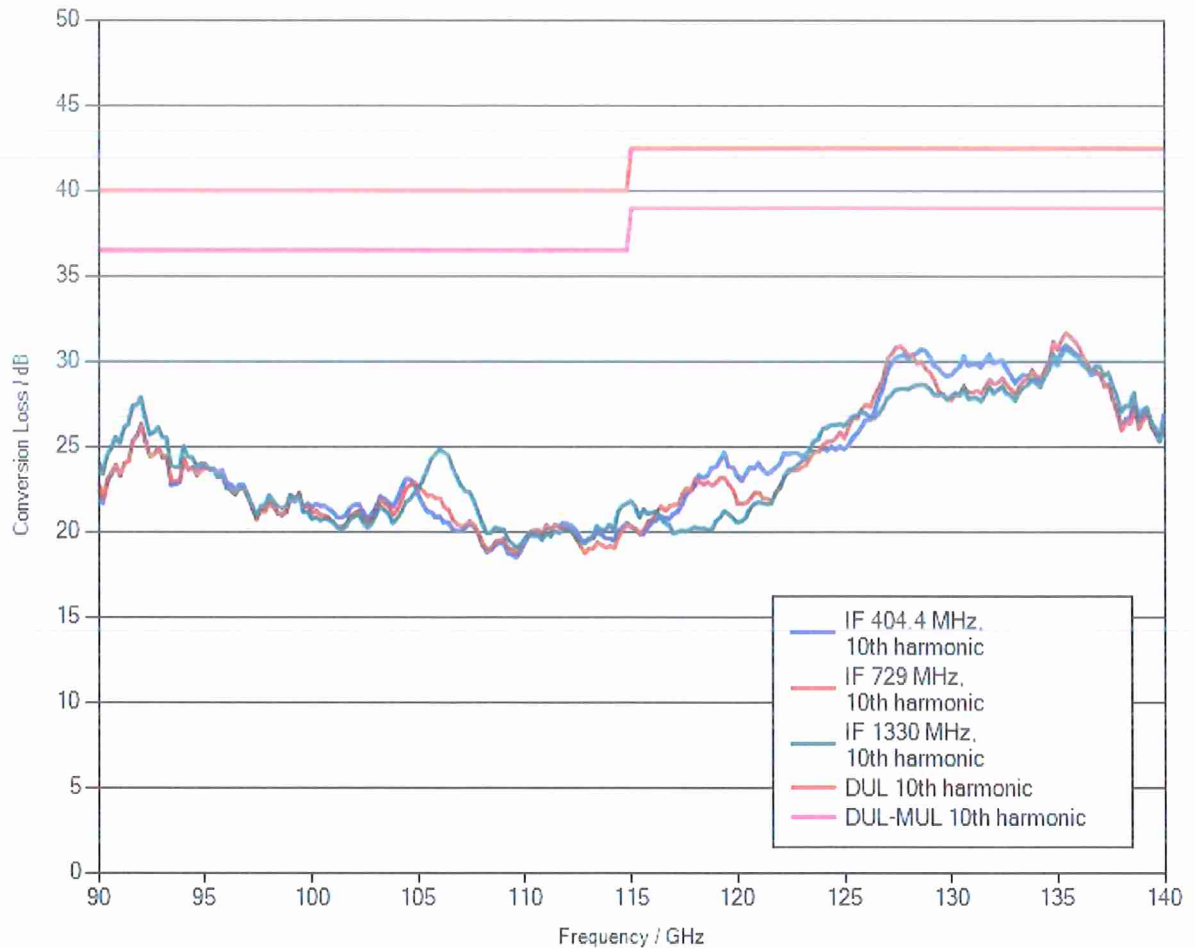
Measurement uncertainty: 0.05 (VSWR)



1.2 Conversion loss

LO level +14 dBm nominal
Bias 0 A

Measurement uncertainty: 3.5 dB



Note: Numeric calibration data can be found attached to the PDF file of the calibration certificate. Click the “paper clip” symbol to display the file.

The file has been renamed for safety reasons.

When downloading the file onto your PC, please delete the “.file” extension and unzip the data.

1.3 Frequency response within 1 GHz

	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 10th harmonic	6 dB	2.92 dB	PASS
IF = 729 MHz, 10th harmonic	6 dB	2.85 dB	PASS
IF = 1330 MHz, 10th harmonic	6 dB	2.45 dB	PASS



Calibration Certificate

Certificate Number **24-0220-101026-01**

Kalibrierschein

Zertifikatsnummer

Unit Data

Item
Gegenstand **Harmonic Mixer, 140 GHz to 220 GHz**

Manufacturer
Hersteller **RPG**

Type
Typ **RPG FS-Z220**

Material Number
Materialnummer **3593.3250.02** Serial Number
Seriennummer **101026**

Asset Number
Inventarnummer

This calibration certificate documents, that the named item is tested and measured against defined specifications. Measurement results are located usually in the corresponding interval with a probability of approx. 95% (coverage factor $k = 2$). Calibration is performed with test equipment and standards directly or indirectly traceable by means of approved calibration techniques to the PTB/DKD or other national/international standards, which realize the physical units of measurement according to the International System of Units (SI). In all cases where no standards are available, measurements are referenced to standards of the R&S laboratories. Principles and methods of calibration correspond with EN ISO/IEC 17025. This calibration certificate may not be reproduced other than in full. Calibration certificates without signatures are not valid. The user is obliged to have the object recalibrated at appropriate intervals.

Order Data

Customer
Auftraggeber

Order Number
Bestellnummer

Date of Receipt
Eingangsdatum

Dieser Kalibrierschein dokumentiert, dass der genannte Gegenstand nach festgelegten Vorgaben geprüft und gemessen wurde. Die Messwerte lagen im Regelfall mit einer Wahrscheinlichkeit von annähernd 95% im zugeordneten Wertintervall (Erweiterte Messunsicherheit mit $k = 2$). Die Kalibrierung erfolgte mit Messmitteln und Normalen, die direkt oder indirekt durch Ableitung mittels anerkannter Kalibriertechniken rückgeführt sind auf Normale der PTB/DKD oder anderer nationaler/internationaler Standards zur Darstellung der physikalischen Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI). Wenn keine Normale existieren, erfolgt die Rückführung auf Bezugsnormale der R&S-Laboratorien. Grundsätze und Verfahren der Kalibrierung beziehen sich auf EN ISO/IEC 17025. Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Kalibrierscheine ohne Unterschriften sind ungültig. Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

Performance

Place and Date of Calibration
Ort und Datum der Kalibrierung

Meckenheim, 2019-04-09

Scope of Calibration
Umfang der Kalibrierung

Standard Calibration

Statement of Compliance
(Incoming)
Konformitätsaussage
(Anlieferung)

New device

Statement of Compliance
(Outgoing)
Konformitätsaussage
(Auslieferung)

All measured values are within the data sheet specifications.

Extend of Calibration Documents
Umfang des Kalibrierdokuments

**2 pages Calibration Certificate
5 pages Outgoing Results**

Radiometer Physics GmbH; Meckenheim

Date of Issue
Ausstellungsdatum

Head of Laboratory
Laborleitung

Person Responsible
Bearbeiter

2019-04-12

Schulze

Grossmindorf

Page (Seite) 1/2
Vers2010-05-05/
RPG2014-02-28

Calibration Method
Kalibrieranweisung

RPG-PAQA-TN-2014-002

Relative Humidity 20 % - 80 %
Relative LuftfeuchteAmbient Temperature
Umgebungstemperatur(23 ⁺⁷_{.3}) °C

Working standards used (having a significant effect on the accuracy) Verwendete Gebrauchsnormale (mit signifikantem Einfluss auf die Genauigkeit)				
Item Gegenstand	Type Typ	Serial Number Seriennummer	Calibration Certificate Number Kalibrierscheinnummer	Cal. Due Kalibr. bis
Vector Network Analyzer	R&S® ZVA67	101097	20-300432406	2020-07-21
Powersensor	R&S® NRP-Z55	140093	20-300426315	2019-05-17

UGB1 A compliance statement may be possible where a confidence level of less than 95 % is acceptable.
Die Bestätigung der Konformität ist möglich, sofern ein Grad des Vertrauens von weniger als 95 % akzeptabel ist.

UGB2 A non-compliance statement may be possible where a confidence level of less than 95 % is acceptable.
Die Bestätigung der Nicht-Konformität ist möglich, sofern ein Grad des Vertrauens von weniger als 95 % akzeptabel ist.

Ref.: ILAC-G8:03/2009 'Guidelines on the Reporting of Compliance with Specification'.

Notes
Anmerkungen

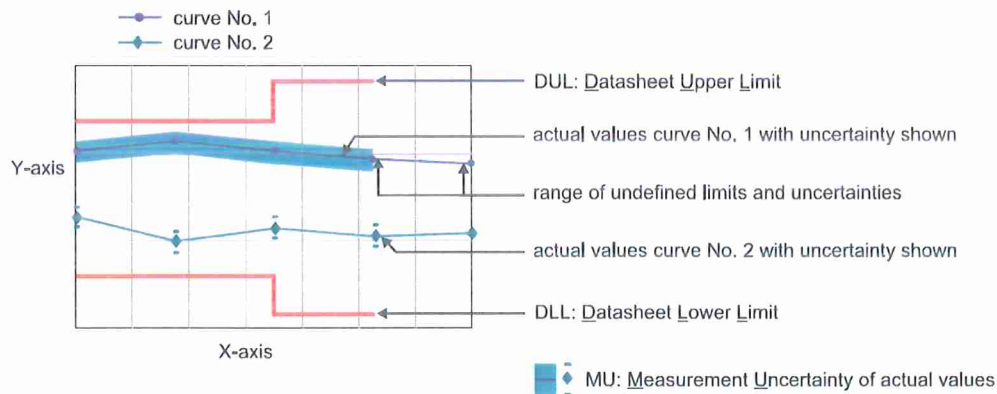
If the new product is stored under the climate conditions as specified in the data sheet upon delivery, the product's accuracy is not significantly affected within 12 month after its calibration in our factory. In this case, the recommended calibration interval starts on the date when the product is actually put into operation.

Outgoing Results

The following abbreviations may be used in this document

{a}	No measurement uncertainty stated because the errors always add together. So it is sure that a measurement result evaluated as "PASS" is pass.
{b}	The measurement uncertainty depends on the measurement result. The stated measurement uncertainty is valid for the close area around the specification. Measurement results outside the close area have a higher measurement uncertainty but are within the specification.
{c}	Functional test, therefore no measurement uncertainty is stated.
{d}	Typical value, refer to performance test.
{e}	The measurement uncertainty is taken into account when setting the measuring system.
DL or DT	Data Limit for symmetrical tolerance limits
DLL	Datasheet Lower Limit
DUL	Datasheet Upper Limit
MU	Measurement Uncertainty
MLL or MLV	Measurement Uncertainty Lower Value
MUL or MUV	Measurement Uncertainty Upper Value
Nom.	Nominal Value
Dev.	Deviation
MErr.	Measurement Error
Act.	Actual Value
UGB	Uncertainty Guard Band: Measuring uncertainty violates the data (spec.) limit.
UGB1	Measurement results marked as UGB1 show conformity with a probability of >50 %and <95 %.
UGB2	Measurement results marked as UGB2 show non-conformity with a probability of >50 %and <95 %.
DU	Datasheet Uncertainty

Explanation of charts

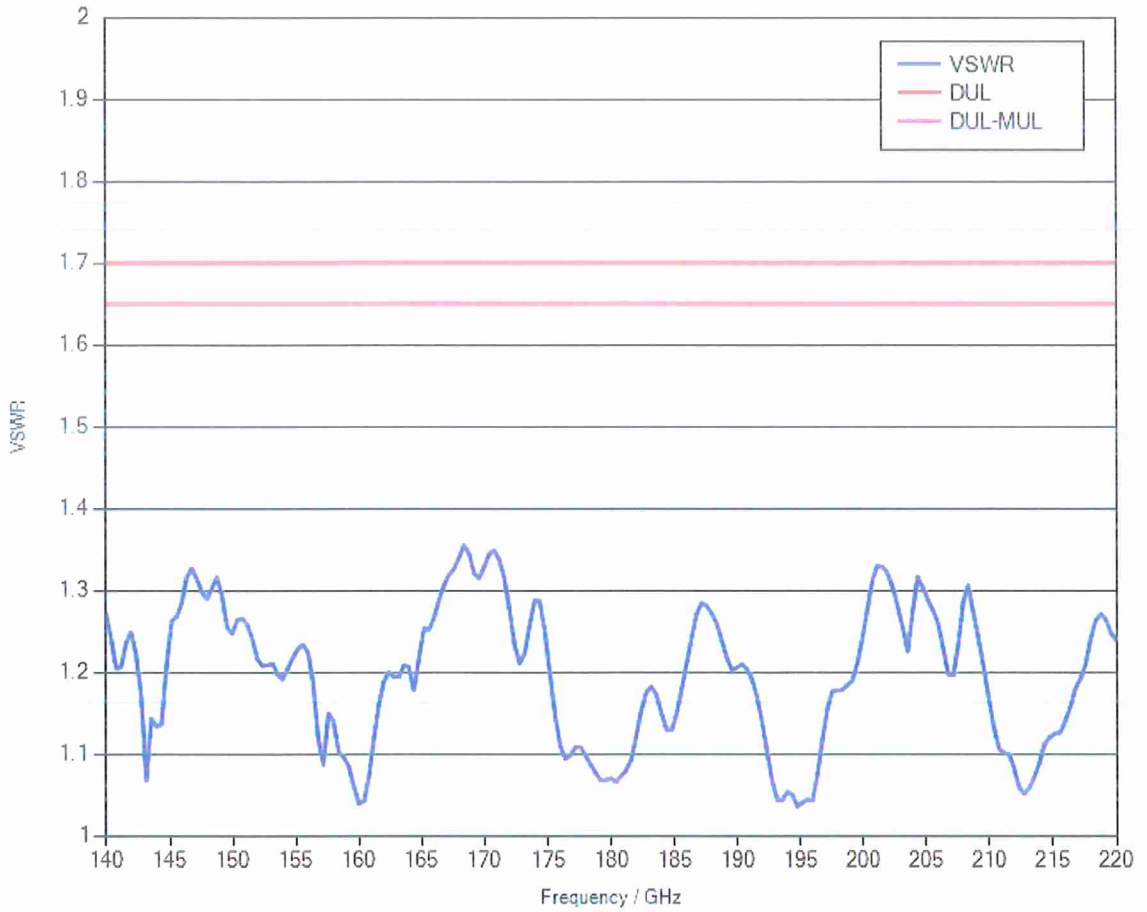


Software used for measurement

Item Type	Version	Remark
Measurement Studio Professional Edition	2013	
MixerCertification	7_12	

1.1 RF Input – VSWR

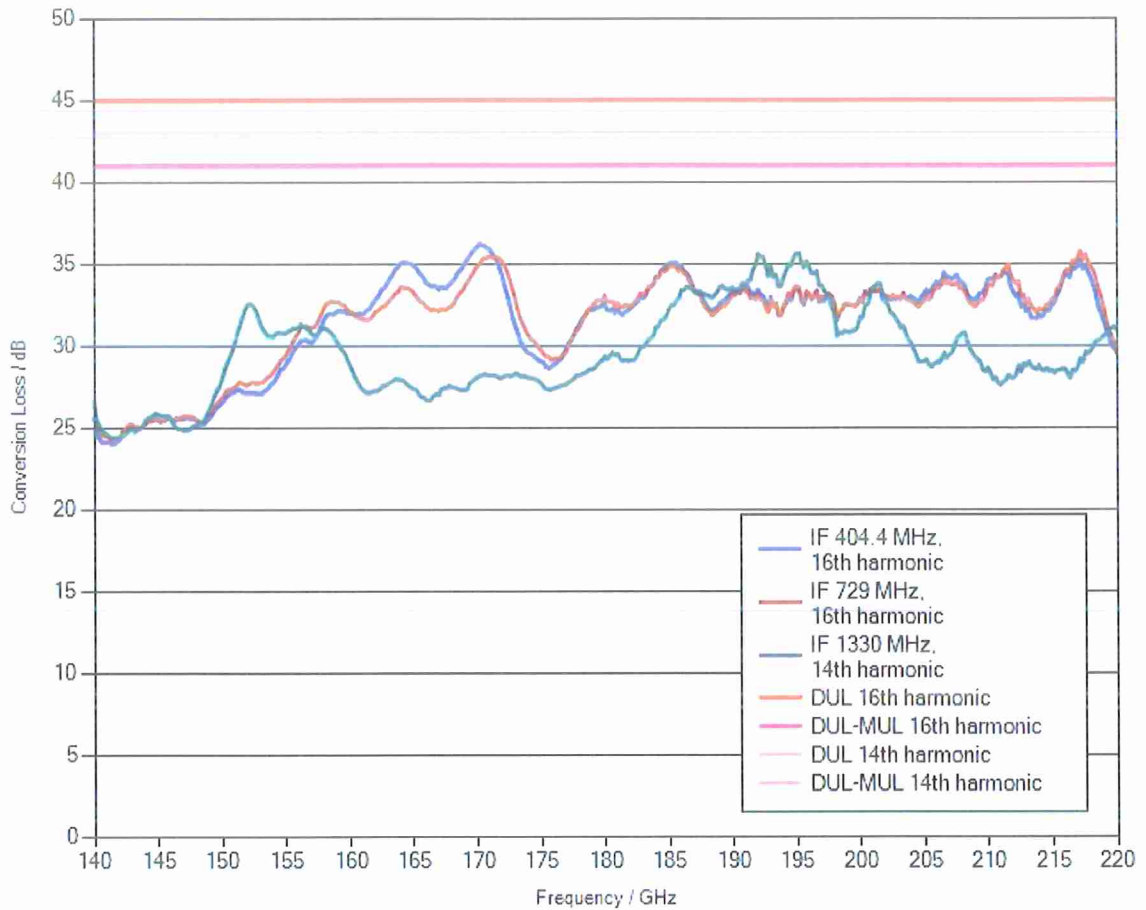
Measurement uncertainty: 0.05 (VSWR)



1.2 Conversion loss

LO level +13 dBm nominal
 Bias 0 A

Measurement uncertainty: 4 dB



Note: Numeric calibration data can be found attached to the PDF file of the calibration certificate. Click the “paper clip” symbol to display the file.

The file has been renamed for safety reasons. When downloading the file onto your PC, please delete the “.file” extension and unzip the data.

1.3 Frequency response within 1 GHz

	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 16th harmonic	6 dB	3.02 dB	PASS
IF = 729 MHz, 16th harmonic	6 dB	3.2 dB	PASS
IF = 1330 MHz, 14th harmonic	6 dB	2.76 dB	PASS



Appendix D. Calibration certificate of Standard Gain Horn

Antennas

Calibration Laboratory of Microwave Measuring Equipment
of MWMLab



ISO 17025
ACCREDITED LABORATORY

Calibration certificate



Accreditation certificate No. № BY/112 5.0065 of 09.01.2015


Certificate number 25-20 Date when calibrated 10.07.20 Page 1 of 2

Item calibrated Antenna QWH-UPRR00 # 01

Customer SPORTON INTERNATIONAL (SHENZHEN) INC.
1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan
Shenzhen, 518055, People's Republic of China

Method of calibration GOST 20271.1, MK KL 8.2-16

All measurements are traceable to the SI units which are realized by national measurement standards of NMI and state standards of RF. Conversion loss measurements above 178 GHz are to confirm operation functionality and traceable only to MWMLab standards and OML. This certificate shall not be reproduced, except in full. Any publication extracts from the calibration certificate requires written permission of the issuing calibration laboratory of microwave measuring equipment.

Authorising signature  / **Technical manager** **Date of issue** 10.07.20

Calibration Certificate

Certificate number **25-20**

Page 2 of 2

Calibration is performed by using

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 546	Reference power meter	163	24 March 2022	1/111-174-20	RF Power
M 568	Reference power meter	164	24 March 2022	1/111-175-20	RF Power
G4-161	Signal generator	3	10 July 2020	22-19	RF Power
G4-186	Signal generator	5	10 July 2020	23-19	RF Power
V7-34	Universal voltmeter	0067787	27 September 2020	1994-42	DC Voltage
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-133	Horn antenna	15005	23 September 2021	2374-43	Gain

Calibration conditions

Temperature: 22.5 °C.
Humidity: 43.0 %.
Pressure: 101.0 kPa.

Calibration results are given in the measurement report # 25-20

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	40 – 60 GHz	Corresponds
2	Antenna Gain	22.6* dBi	Corresponds (Table 1)
3	Antenna Factor	41.5 dB/m	Corresponds (Table 1)

* – Expanded uncertainty of measurements 2.5 dB.

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Signature of the person who has performed calibration



/ Engineer

**Calibration Laboratory of
Microwave Measuring Equipment**

Accreditation certificate

No. BY/112 5.0065

Address: 6, P. Brovki str., Minsk

220013, Belarus

Phone/Fax: +375 17 2938496



Technical Manager

July 10, 2020

MEASUREMENT REPORT # 25-20

July 10, 2020

Customer:	SPORTON INTERNATIONAL (SHENZHEN) INC. 1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan Shenzhen, 518055, People's Republic of China
Item calibrated:	Antenna QWH-UPRR00 # 01
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	09.06.2020
Date of calibration:	From 09.06.2020 to 10.07.2020

MEASUREMENT CONDITIONS

Temperature: 22.5 °C	Humidity: 43 %	Pressure: 101.0 kPa
----------------------	----------------	---------------------

MEASUREMENT EQUIPMENT

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 546	Reference power meter	163	24 March 2022	1/111-174-20	RF Power
M 568	Reference power meter	164	24 March 2022	1/111-175-20	RF Power
G4-161	Signal generator	3	10 July 2020	22-19	RF Power
G4-186	Signal generator	5	10 July 2020	23-19	RF Power
V7-34	Universal voltmeter	0067787	27 September 2020	1994-42	DC Voltage
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-133	Horn antenna	15005	23 September 2021	2374-43	Gain

MEASUREMENT RESULTS

Distance between tested and generating antenna 2 m.


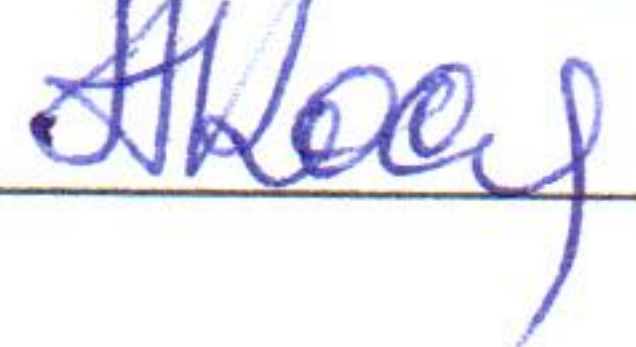
Table 1

Frequency, GHz	40	50	60
Power density of electromagnetic field, W/m ²	0.049	0.067	0.072
Maximum level of measured power, dBm	-14.7	-14.4	-15.2
Gain, dBi	21.9	22.7	23.3
Expanded uncertainty, dB	2.5	2.5	2.5
Antenna Factor, dB/m	40.4	41.5	42.5

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Engineer

Quality Manager

This measurement report issued in duplicate and sent to:

1. SPORTON INTERNATIONAL (SHENZHEN) INC. 1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan Shenzhen, 518055, People's Republic of China

2. Calibration Laboratory of Microwave Measuring Equipment

Duplication of Measurement report (complete or partial) must be authorized by the laboratory.

Calibration Laboratory of Microwave Measuring Equipment
of MWMLab



Calibration certificate

ISO 17025
ACCREDITED LABORATORY



Accreditation certificate No. № BY/112 5.0065 of 09.01.2015

Certificate number 31-20 Date when calibrated 10.07.20 Page 1 of 2

Item calibrated Antenna QWH-EPRR00 # 1012700010

Customer SPORTON INTERNATIONAL (SHENZHEN) INC.
1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan
Shenzhen, 518055, People's Republic of China

Method of calibration GOST 20271.1, MK KL 8.2-16

All measurements are traceable to the SI units which are realized by national measurement standards of NMI and state standards of RF. Conversion loss measurements above 178 GHz are to confirm operation functionality and traceable only to MWMLab standards and OML. This certificate shall not be reproduced, except in full. Any publication extracts from the calibration certificate requires written permission of the issuing calibration laboratory of microwave measuring equipment.

Authorising signature



/ Technical manager Date of issue 10.07.20

Calibration Certificate

Certificate number **31-20**

Page 2 of 2

Calibration is performed by using

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 546	Reference power meter	163	24 March 2022	1/111-175-20	RF Power
M 534	Reference power meter	161	24 March 2022	1/111-173-20	RF Power
G4-186	Signal generator	5	10 July 2020	23-19	RF Power
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power
V7-34	Universal voltmeter	0067787	27 September 2020	1994-42	DC Voltage
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-134	Measuring horn antenna	14002	23 September 2021	2372-43	Gain
P6-31A	Measuring horn antenna	35864	23 September 2021	2368-43	Gain

Calibration conditions

Temperature: 22.5 °C.
Humidity: 43.0 %.
Pressure: 101.0 kPa.

Calibration results are given in the measurement report # 31-20

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	60 – 90 GHz	Corresponds
2	Antenna Gain	22.6* dBi	Corresponds (Table 1)
3	Antenna Factor	45.0 dB/m	Corresponds (Table 1)

* – Expanded uncertainty of measurements 2.5 dB.

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Signature of the person who has performed calibration



/ Engineer

**Calibration Laboratory of
Microwave Measuring Equipment**

Accreditation certificate

No. BY/112 5.0065

Address: 6, P. Brovki str., Minsk

220013, Belarus

Phone/Fax: +375 17 2938496



MEASUREMENT REPORT # 31-20

July 10, 2020

Customer:	SPORTON INTERNATIONAL (SHENZHEN) INC. 1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan Shenzhen, 518055, People's Republic of China
Item calibrated:	Antenna QWH-EPRR00 # 1012700010
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	09.06.2020
Date of calibration:	From 09.06.2020 to 10.07.2020