

MEASUREMENT CONDITIONS

Temperature: 22.5 °C	Humidity: 43 %	Pressure: 101.0 kPa
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MEASUREMENT EQUIPMENT

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 546	Reference power meter	163	24 March 2022	1/111-175-20	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

MEASUREMENT RESULTS

Distance between the testing and generating antennas was 1.8 m at 60-75 GHz and 1.5 m at 90 GHz.

Table 1

Frequency, GHz	60	75	90
Power density of electromagnetic field, W/m ²	0.063	0.081	0.121
Maximum level of measured power, dBm	-16.6	-16.9	-16.7
Gain, dBi	22.4	23.0	23.0
Expanded uncertainty, dB	2.5	2.5	2.5
Antenna Factor, dB/m	43.4	44.7	46.3

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 32-20 Date when calibrated 10.07.20 Page 1 of 2

Item calibrated Antenna QWH-FPRR00 # 1011500009

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 **32-20**

Page 2 of 2

Calibration is performed by using

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 523	Reference power meter	162	24 March 2022	1/111-172-20	RF Power
M 534	Reference power meter	161	24 March 2022	1/111-173-20	RF Power
G4-161m	Signal generator	282	10 July 2020	25-19	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
P6-32	Measuring horn antenna	115671	23 September 2021	2369-43	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 # 32-20

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	90 – 140 GHz	Corresponds
2	Antenna Gain	22.6* dBi	Corresponds (Table 1)
3	Antenna Factor	48.5 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 # 32-20

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-FPRR00 # 1011500009
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
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MEASUREMENT EQUIPMENT

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 523	Reference power meter	162	24 March 2022	1/111-172-20	RF Power
M 534	Reference power meter	161	24 March 2022	1/111-173-20	RF Power
G4-161m	Signal generator	282	10 July 2020	25-19	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
P6-32	Measuring horn antenna	115671	23 September 2021	2369-43	Gain
P6-31A	Measuring horn antenna	35864	23 September 2021	2368-43	Gain

MEASUREMENT RESULTS

Distance between the testing and generating antennas was 1.5 m at 90-115 GHz and 1.2 m at 140 GHz.

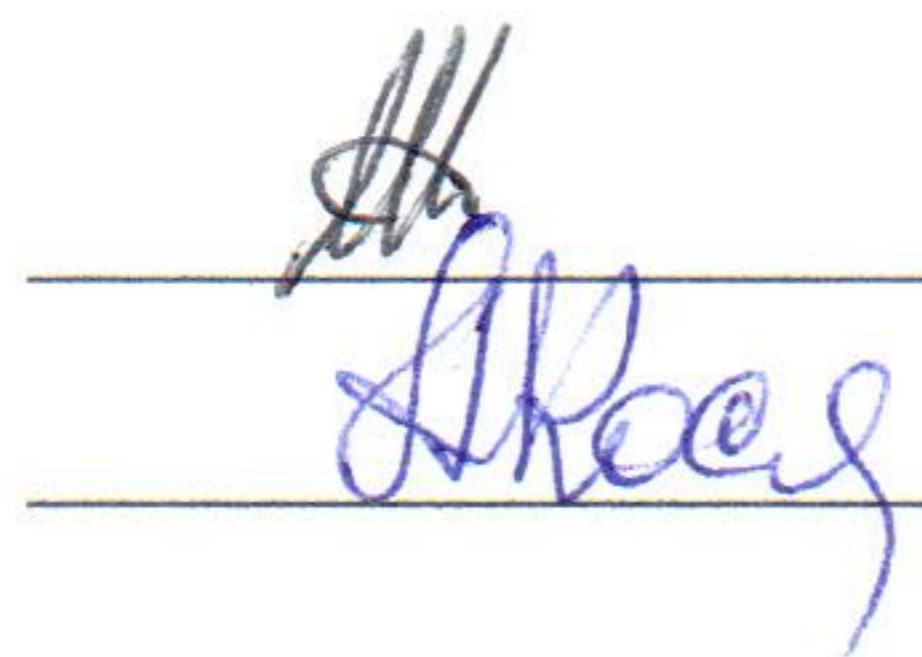
Table 1

Frequency, GHz	90	115	140
Power density of electromagnetic field, W/m ²	0.125	0.174	0.212
Maximum level of measured power, dBm	-17.2	-17.5	-17.9
Gain, dBi	22.4	22.8	23.2
Expanded uncertainty, dB	2.5	2.5	2.5
Antenna Factor, dB/m	46.9	48.6	50.0

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



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ISO 17025
ACCREDITED LABORATORY

Calibration certificate



Accreditation certificate No. № BY/112 5.0065 of 09.01.2015

Certificate number 34-20 Date when calibrated 10.07.20 Page 1 of 2

Item calibrated Antenna QWH-GPRR00 # 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

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Authorising signature



/ Technical manager **Date of issue 10.07.20**

Calibration Certificate

Certificate number **34-20**

Page 2 of 2

Calibration is performed by using

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 523	Reference power meter	162	24 March 2022	1/111-172-20	RF Power
M 514	Reference power meter	165	24 March 2022	1/111-176-20	RF Power
02	Frequency multiplier	02	23 January 2020	02-19	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
P6-32	Measuring horn antenna	115671	23 September 2021	2369-43	Gain

Calibration conditions

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

Calibration results are given in the measurement report # 34-20

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	140 – 220 GHz	Corresponds
2	Antenna Gain	22.6* dBi	Corresponds (Table 1)
3	Antenna Factor	52.5 dB/m	Corresponds (Table 1)

* – Expanded uncertainty of measurements 3.0 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 # 34-20
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-GPRR00 # 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
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MEASUREMENT EQUIPMENT

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
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M 514	Reference power meter	165	24 March 2022	1/111-176-20	RF Power
02	Frequency multiplier	02	23 January 2020	02-19	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
P6-32	Measuring horn antenna	115671	23 September 2021	2369-43	Gain

MEASUREMENT RESULTS

Distance between the testing and generating antennas was 1 m at 140 GHz, 0.6 m at 180 GHz and 0.3 m at 220 GHz.

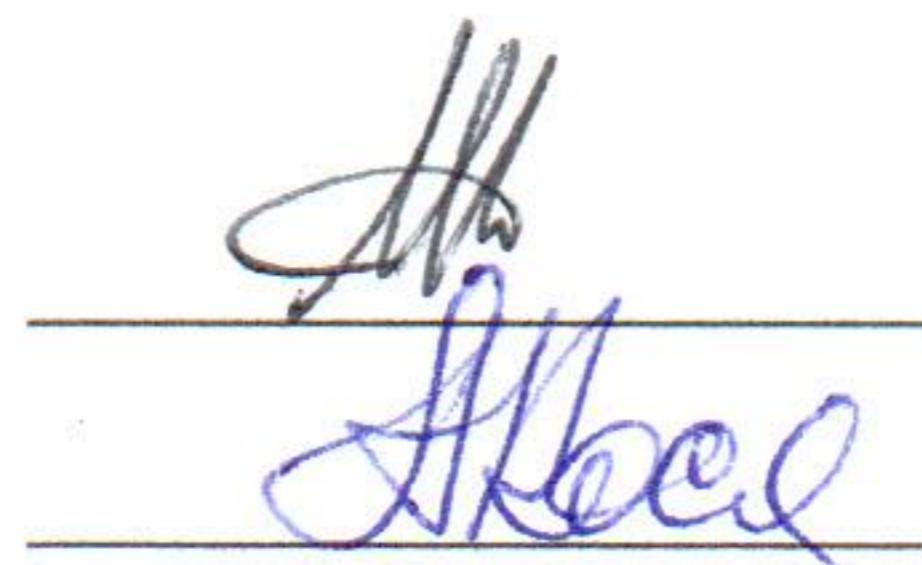
Table 1

Frequency, GHz	140	180	220
Power density of electromagnetic field, W/m ²	0.311	0.369	0.327
Maximum level of measured power, dBm	-17.1	-18.1	-20.2
Gain, dBi	22.3	22.8	22.9
Expanded uncertainty, dB	2.5	3.0	3.0
Antenna Factor, dB/m	50.8	52.5	54.2

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



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