MEASUREMENT CONDITIONS

Temperature: 23.8 °C	Humidity: 43.2 %	Pressure: 100.1 kPa

MEASUREMENT EQUIPMENT

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M1-11	Calibrator of power with wattmeter M3-22A	841202/ 037410	08 December 2021	3882-43	RF Power
M 568	Reference power meter	164	24 March 2022	1/111-175-20	RF Power
G4-161	Signal generator	3	12 October 2021	20-20	RF Power
MG3694C	Signal generator	133805	11 September 2021	2726-43	RF Power Frequency
V7-34	Universal voltmeter	0067787	23 September 2021	2742-42	DC Voltage
RCH3-72	Frequency meter	931200	18 September 2021	2822-43	Frequency
P6-133	Horn antenna	15005	23 September 2021	2374-43	Gain
P6-11B	Measuring horn antenna	08051	23 September 2021	2370-43	Gain

MEASUREMENT RESULTS

Distance between tested and generating antenna 2.0 m.

Table 1

Frequency, GHz	40	50	60
Power density of electromagnetic field, W/m^2	0.050	0.070	0.070
Maximum level of measured power, dBm	-14.3	-14.2	-15.8
Gain, dBi	22.3	22.8	22.8
Expanded uncertainty, dB	2.0	2.0	2.0
Antenna Factor, dB/m	40.0	41.5	43.0

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 _____

This measurement report issued in duplicate and sent to:
1. Sporton International Inc.
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

ISO 17025
ACCREDITED LABORATORY

ИСО 9001

Calibration certificate

Accreditation certificate No. **№ BY/112 5.0065** **of** **09.01.2015**

Certificate number **38-21** **Date when calibrated** **06.07.2021** **Page** 1 **of** 2

Item calibrated **Antenna QWH-EPRR00 # 1372000000**

Customer Sporton International Inc.

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. Gain 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** **06.07.2021**

MWM Lab. BSUIR, 6, P.Brovki str., Minsk, 220013, Belarus *Phone/Fax: +375 17 293-84-96/E-mail: info@mwmlab.com*

Calibration Certificate

Certificate number **38-21**

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 534	Reference power meter	161	24 March 2022	1/111-173-20	RF Power
RG4-14	Signal generator	22	12 October 2021	22-20	RF Power
G4-186	Signal generator	5	12 October 2021	21-20	RF Power
V7-34	Universal voltmeter	0067787	23 September 2021	2742-42	DC Voltage
RCH3-72	Frequency meter	931200	18 September 2021	2822-43	Frequency
P6-31A	Measuring horn antenna	35864	23 September 2021	2368-43	Gain
P6-134	Measuring horn antenna	14002	23 September 2021	2372-43	Gain

Calibration conditions

Temperature: 23.8 ºC.
Humidity: 43.2 %.
Pressure: 100.1 kPa.

Calibration results are given in the measurement report # 38-21

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	60 – 90 GHz	Corresponds
2	Antenna Gain	22.5* dBi	Corresponds (Table 1)
3	Antenna Factor	45.5 dB/m	Corresponds (Table 1)

* – Expanded uncertainty of measurements 2.0 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

MWM Lab. BSUIR, 6, P.Brovki str., Minsk, 220013, Belarus *Phone/Fax: +375 17 293-84-96/E-mail: info@mwmlab.com*

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 6, 2021

MEASUREMENT REPORT # 38-21

July 6, 2021

Customer:	Sporton International Inc.
Item calibrated:	**Antenna QWH-EPRR00 # 1372000000**
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	21.06.2021
Date of calibration:	From 21.06.2021 to 06.07.2021

MEASUREMENT CONDITIONS

Temperature: 23.8 °C	Humidity: 43.2 %	Pressure: 100.1 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 534	Reference power meter	161	24 March 2022	1/111-173-20	RF Power
RG4-14	Signal generator	22	12 October 2021	22-20	RF Power
G4-186	Signal generator	5	12 October 2021	21-20	RF Power
V7-34	Universal voltmeter	0067787	23 September 2021	2742-42	DC Voltage
RCH3-72	Frequency meter	931200	18 September 2021	2822-43	Frequency
P6-31A	Measuring horn antenna	35864	23 September 2021	2368-43	Gain
P6-134	Measuring horn antenna	14002	23 September 2021	2372-43	Gain

MEASUREMENT RESULTS

Distance between tested and generating antenna 1.5 m.

Table 1

Frequency, GHz	60	75	90
Power density of electromagnetic field, W/m^2	0.125	0.128	0.156
Maximum level of measured power, dBm	-14.2	-15.3	-16.2
Gain, dBi	21.8	22.5	22.4
Expanded uncertainty, dB	2.0	2.0	2.0
Antenna Factor, dB/m	44.0	45.2	46.9

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 _____

This measurement report issued in duplicate and sent to:
1. Sporton International Inc.
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

ISO 17025
ACCREDITED LABORATORY

Calibration certificate

Accreditation certificate No. **№ BY/112 5.0065** **of** **09.01.2015**

Certificate number **39-21** **Date when calibrated** **06.07.2021** **Page** 1 **of** 2

Item calibrated **Antenna QWH-FPRR00 # 1011500008**

Customer Sporton International Inc.

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. Gain 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** **06.07.2021**

MWM Lab. BSUIR, 6, P.Brovki str., Minsk, 220013, Belarus *Phone/Fax: +375 17 293-84-96/E-mail: info@mwmlab.com*

Calibration Certificate

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
RG4-14	Signal generator	22	12 October 2021	22-20	RF Power
G4-161m	Signal generator	282	12 October 2021	23-20	RF Power
V7-34	Universal voltmeter	0067787	23 September 2021	2742-42	DC Voltage
RCH3-72	Frequency meter	931200	18 September 2021	2822-43	Frequency
P6-31A	Measuring horn antenna	35864	23 September 2021	2368-43	Gain
P6-32	Measuring horn antenna	115671	23 September 2021	2369-43	Gain

Calibration conditions

Temperature: 23.8 ºC.
Humidity: 43.2 %.
Pressure: 100.1 kPa.

Calibration results are given in the measurement report # 39-21

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	90 – 140 GHz	Corresponds
2	Antenna Gain	22.5* dBi	Corresponds (Table 1)
3	Antenna Factor	49.5 dB/m	Corresponds (Table 1)

* – Expanded uncertainty of measurements 2.2 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 6, 2021

MEASUREMENT REPORT # 39-21

July 6, 2021

Customer:	Sporton International Inc.
Item calibrated:	**Antenna QWH-FPRR00 # 1011500008**
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	21.06.2021
Date of calibration:	From 21.06.2021 to 06.07.2021

MEASUREMENT CONDITIONS

Temperature: 23.8 °C	Humidity: 43.2 %	Pressure: 100.1 kPa

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
RG4-14	Signal generator	22	12 October 2021	22-20	RF Power
G4-161m	Signal generator	282	12 October 2021	23-20	RF Power
V7-34	Universal voltmeter	0067787	23 September 2021	2742-42	DC Voltage
RCH3-72	Frequency meter	931200	18 September 2021	2822-43	Frequency
P6-31A	Measuring horn antenna	35864	23 September 2021	2368-43	Gain
P6-32	Measuring horn antenna	115671	23 September 2021	2369-43	Gain

MEASUREMENT RESULTS

Distance between tested and generating antenna 1.0 m.

Table 1

Frequency, GHz	90	115	140
Power density of electromagnetic field, W/m^2	0.283	0.344	0.312
Maximum level of measured power, dBm	-14.1	-14,6	-17.1
Gain, dBi	21.9	22.7	22.4
Expanded uncertainty, dB	2.0	2.2	2.2
Antenna Factor, dB/m	47.4	48,7	50,8

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 _____

This measurement report issued in duplicate and sent to:
1. Sporton International Inc.
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

ISO 17025
ACCREDITED LABORATORY

Calibration certificate

Accreditation certificate No. **№ BY/112 5.0065** **of** **09.01.2015**

Certificate number **40-21** **Date when calibrated** **06.07.2021** **Page** 1 **of** 2

Item calibrated **Antenna QWH-GPRR00 # QWH-GPRR00-01**

Customer Sporton International Inc.

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. Gain 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** **06.07.2021**

MWM Lab. BSUIR, 6, P.Brovki str., Minsk, 220013, Belarus *Phone/Fax: +375 17 293-84-96/E-mail: info@mwmlab.com*