Radiometer Physics
A Rohde & Schwarz Company

Calibration Certificate
Kalibrierschein

Certificate Number 24-0060-101033-01
Zertifikatsnummer

Unit Data

Item
Gegenstand
Harmonic Mixer, 40 GHz to 60 GHz

Manufacturer
Hersteller
RPG

Type
Typ
RPG FS-Z60

Material Number
Materialnummer
1048.0171.02

Serial Number
Seriennummer
101033

Asset Number
Inventarnummer

Order Data

Customer
Auftraggeber

Order Number
Bestellnummer

Date of Receipt
Eingangsdatum

Performance

Place and Date of Calibration
Ort und Datum der Kalibrierung
Meckenheim, 2020-03-17

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 <u>within the data sheet specifications.</u>

Extend of Calibration Documents
Umfang des Kalibrierdokuments
2 pages Calibration Certificate
4 pages Outgoing Results

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.

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Radiometer Physics GmbH; Meckenheim

Date of Issue
Ausstellungsdatum
2020-03-20

Head of Laboratory
Laborleitung
Schulze

Person Responsible
Bearbeiter
Heinze

Radiometer Physics GmbH ● Werner-von-Siemens-Str. 4 ● 53340 Meckenheim ● Telephone national: 02225/99981-0 international: 0049 2225-99981-0
Fax: 02225/99981-99 ● Managing Director: Achim Walber, Dr. Thomas Rose ● Company's Place of Business: Meckenheim
Commercial Register No.: Bonn, HRB 10291 ● VAT Identification No.: DE 123 377 395

Calibration Method
Kalibrieranweisung

RPG-PAQA-TN-2014-002

Relative Humidity **20 % - 80 %**
Relative Luftfeuchte

Ambient 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® ZVA40	100103	0001-300467129	2021-06-13
Powersensor	R&S® NRP-Z55	140091	509915_D-K-15195-01-01_2019-05	2020-05-22
Powersensor	R&S® NRP-Z57	101423	508173_D-K-15195-01-01_2019-05	2020-05-07

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.
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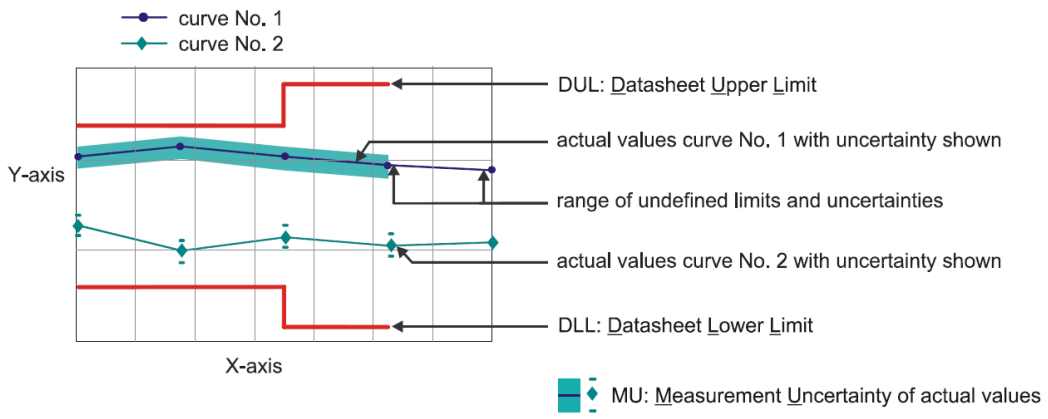
DL or DT	Data Limit for symmetrical tolerance limits
DLL	Datasheet Lower Limit
DUL	Datasheet Upper Limit
MU	Measurement Uncertainty
MLL or MLV	Measurement Uncertainty Lower Value
MUL or MUV	Measurement Uncertainty Upper Value
Nom.	Nominal Value
Dev.	Deviation
MErr.	Measurement Error
Act.	Actual Value
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



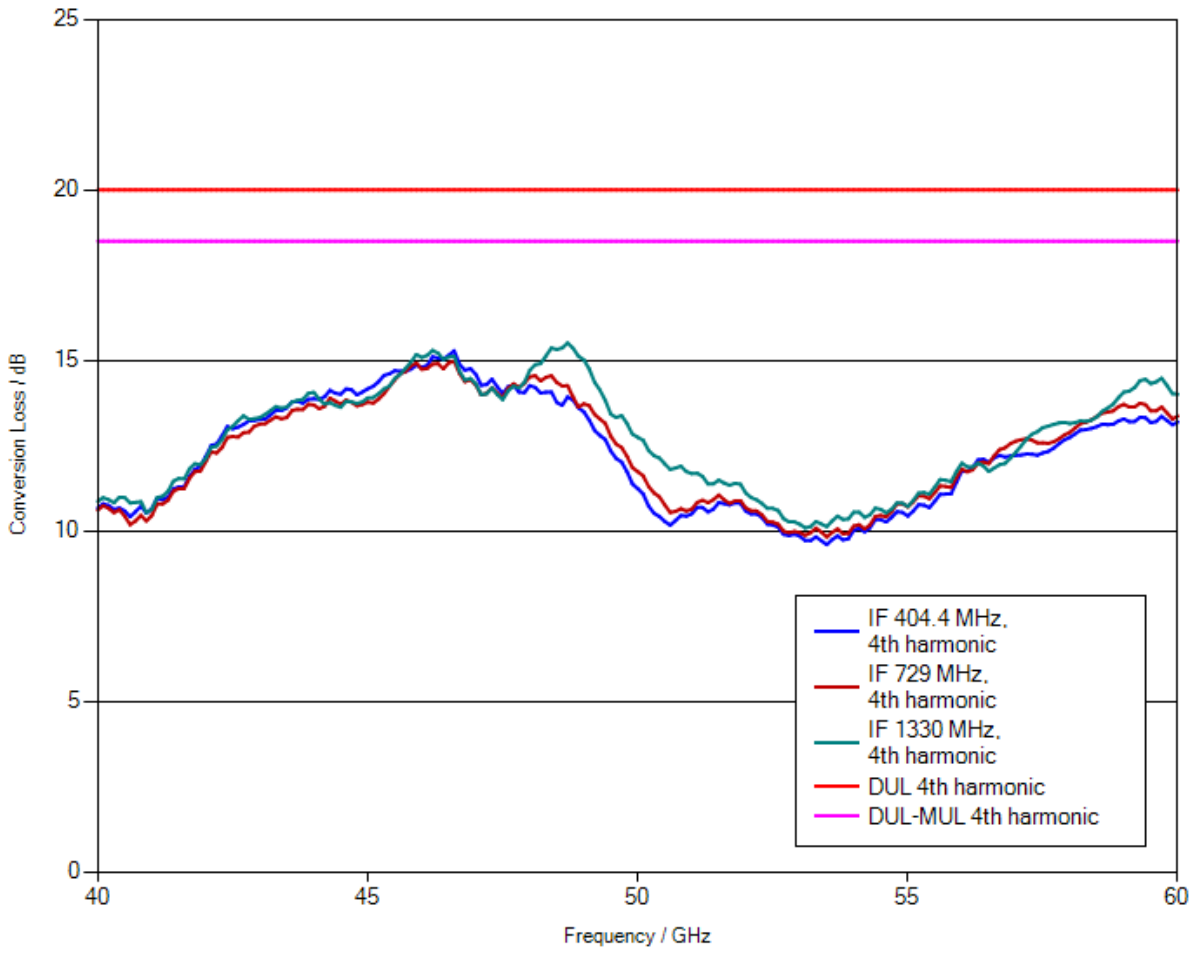
Software used for measurement

Item Type	Version	Remark
Measurement Studio Professional Edition	2013	
MixerCertification	7_13	

1.1 Conversion loss

LO level +13 dBm nominal
Bias 0 A

Measurement uncertainty: 1.5 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.
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1.2 Frequency response within 1 GHz

	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 4th harmonic	4 dB	2.16 dB	PASS
IF = 729 MHz, 4th harmonic	4 dB	2.04 dB	PASS
IF = 1330 MHz, 4th harmonic	4 dB	2.19 dB	PASS

Calibration Certificate
Kalibrierschein

Certificate Number 24-0090-101867-01
Zertifikatsnummer

Unit Data

Item
Gegenstand
Harmonic Mixer, 60 GHz to 90 GHz

Manufacturer
Hersteller
ROHDE & SCHWARZ

Type
Typ
R&S® FS-Z90

Material Number
Materialnummer
1048.0371.02

Serial Number
Seriennummer
101867

Asset Number
Inventarnummer

Order Data

Customer
Auftraggeber

Order Number
Bestellnummer

Date of Receipt
Eingangsdatum

Performance

Place and Date of Calibration
Ort und Datum der Kalibrierung
Meckenheim, 2019-01-10

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 <u>within the data sheet specifications.</u>

Extend of Calibration Documents
Umfang des Kalibrierdokuments
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Radiometer Physics GmbH; Meckenheim

Date of Issue
Ausstellungsdatum
2019-01-11

Head of Laboratory
Laborleitung
Schulze

Person Responsible
Bearbeiter
Heinze

Radiometer Physics GmbH ● Werner-von-Siemens-Str. 4 ● 53340 Meckenheim ● Telephone national: 02225/99981-0 international: 0049 2225-99981-0
Fax: 02225/99981-99 ● Managing Director: Achim Walber, Dr. Thomas Rose ● Company's Place of Business: Meckenheim
Commercial Register No.: Bonn, HRB 10291 ● VAT Identification No.: DE 123 377 395

Calibration Method
Kalibrieranweisung

RPG-PAQA-TN-2014-002

Relative Humidity **20 % - 80 %**
Relative Luftfeuchte

Ambient 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
Powersensor	R&S® NRP-Z58	101063	0001-300474490	2019-08-06
Calibration kit	WR12	E10001	RPG-PAQA-TN-2014-005	2019-02-01

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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

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Nom.	Nominal Value
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MErr.	Measurement Error
Act.	Actual Value
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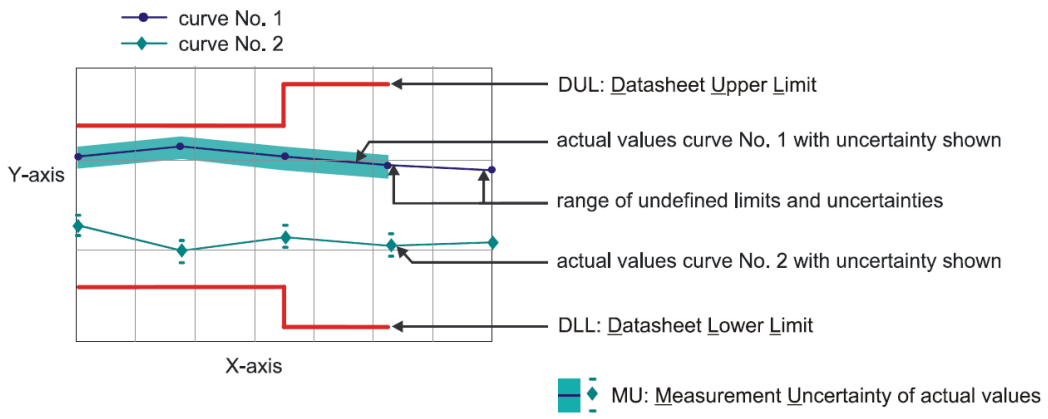
DU	Datasheet Uncertainty

Explanation of charts

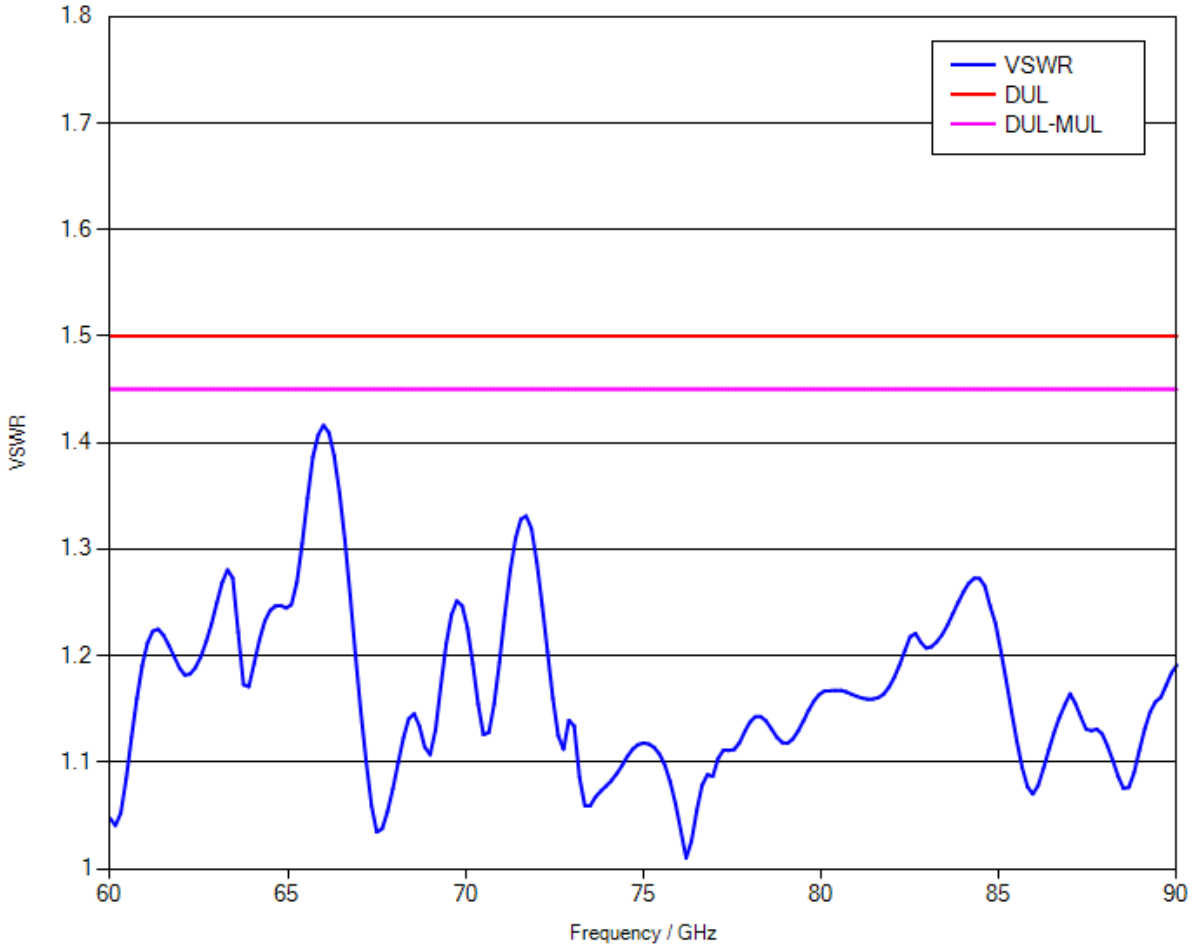


Software used for measurement

Item Type	Version	Remark
Measurement Studio Professional Edition	2013	
MixerCertification	7_09	

1.1 RF Input – VSWR

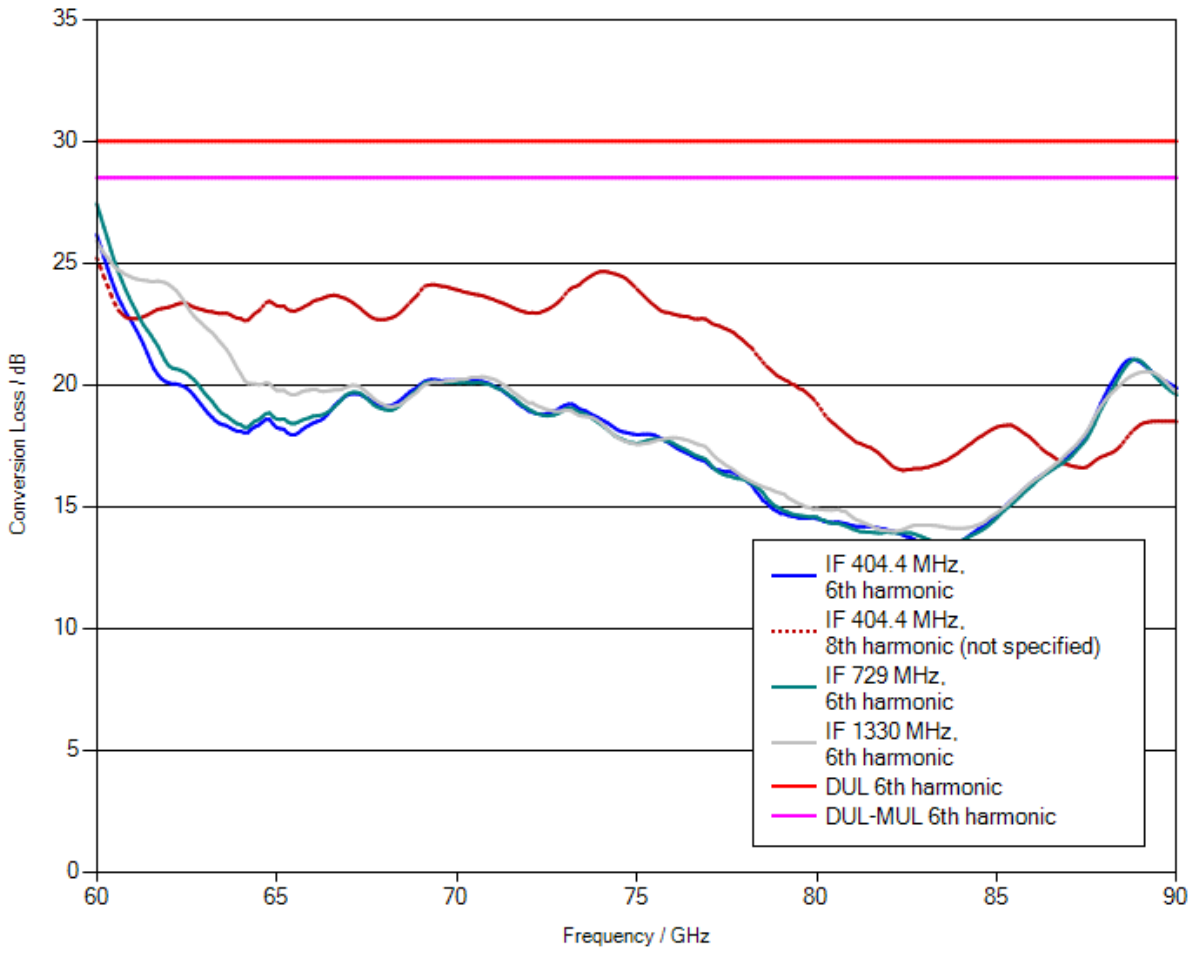
Measurement uncertainty: 0.05 (VSWR)



1.2 Conversion loss

LO level +14 dBm nominal
Bias 0 A

Measurement uncertainty: 1.5 dB



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1.3 Frequency response within 1 GHz

	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 6th harmonic	6 dB	3.42 dB	PASS
IF = 404.4 MHz, 8th harmonic	not specified	2.49 dB	not specified
IF = 729 MHz, 6th harmonic	6 dB	3.85 dB	PASS
IF = 1330 MHz, 6th harmonic	6 dB	2.01 dB	PASS

Radiometer Physics
A Rohde & Schwarz Company

Calibration Certificate
Kalibrierschein

Certificate Number 24-0140-101128-02
Zertifikatsnummer

Unit Data

Item
Gegenstand
Harmonic Mixer, 90 GHz to 140 GHz

Manufacturer
Hersteller
RPG Radiometer-Physics GmbH

Type
Typ
RPG FS-Z140

Material Number
Materialnummer
3622.0708.02

Serial Number
Seriennummer
101128

Asset Number
Inventarnummer

Order Data

Customer
Auftraggeber
Sporton International Inc.
No. 106 6F., Sec. 1, Hsin Tai Wu Rd.,
Xizhi Dist.,
000000
NEW TAIPEI CITY-000000
221- TAIWAN

Order Number
Bestellnummer
8800003072

Date of Receipt
Eingangsdatum
2020-10-06

Performance

Place and Date of Calibration
Ort und Datum der Kalibrierung
Meckenheim, 2020-10-26

Scope of Calibration
Umfang der Kalibrierung
Standard Calibration

Statement of Compliance (Incoming)
Konformitätsaussage (Anlieferung)
Defective.

Statement of Compliance (Outgoing)
Konformitätsaussage (Auslieferung)
All measured values are <u>within the data sheet specifications.</u>

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Umfang des Kalibrierdokuments
2 pages Calibration Certificate
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RPG Radiometer-Physics GmbH; Meckenheim

Date of Issue
Ausstellungsdatum
2020-10-27

Head of Laboratory
Laborleitung
Schulze

Person Responsible
Bearbeiter
Gottbehüt

RPG Radiometer-Physics GmbH ● Werner-von-Siemens-Str. 4 ● 53340 Meckenheim ● Telephone national: 02225/99981-0 international: 0049 2225-99981-0
Fax: 02225/99981-99 ● Managing Director: Achim Walber ● Company's Place of Business: Meckenheim
Commercial Register No.: Bonn, HRB 10291 ● VAT Identification No.: DE 123 377 395

Calibration Method
Kalibrieranweisung

RPG-PAQA-TN-2014-002

Relative Humidity **20 % - 80 %**
Relative Luftfeuchte

Ambient Temperature
Umgebungstemperatur

(23 $^{+7}_{-3}$) °C

Working standards used (having a significant effect on the accuracy)
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Item Gegenstand	**Type** Typ	**Serial Number** Seriennummer	**Calibration Certificate Number** Kalibrierscheinnummer	**Cal. Due** Kalibr. bis
Vector Network Analyzer	R&S® ZVA40	100103	0001-300467129	2021-06-13
Powersensor	R&S® NRP-Z55	140093	509916_D-K-15195-01-01_2019-05	2021-05-22

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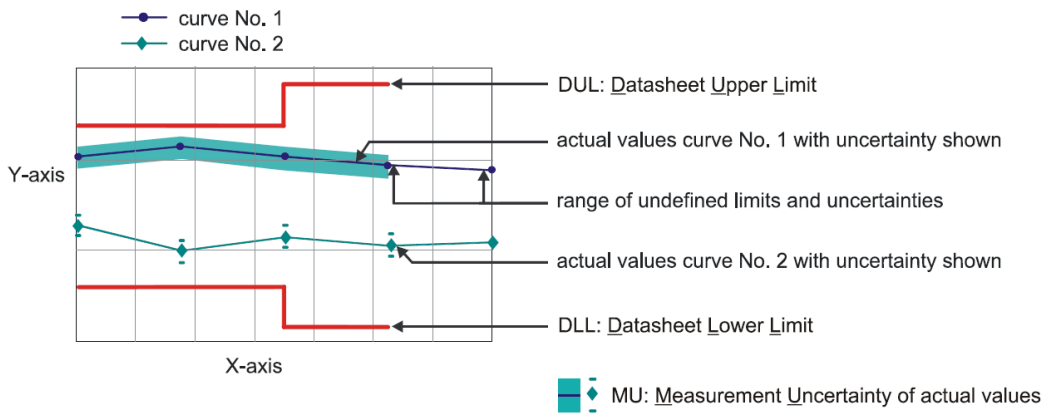
Explanation of charts



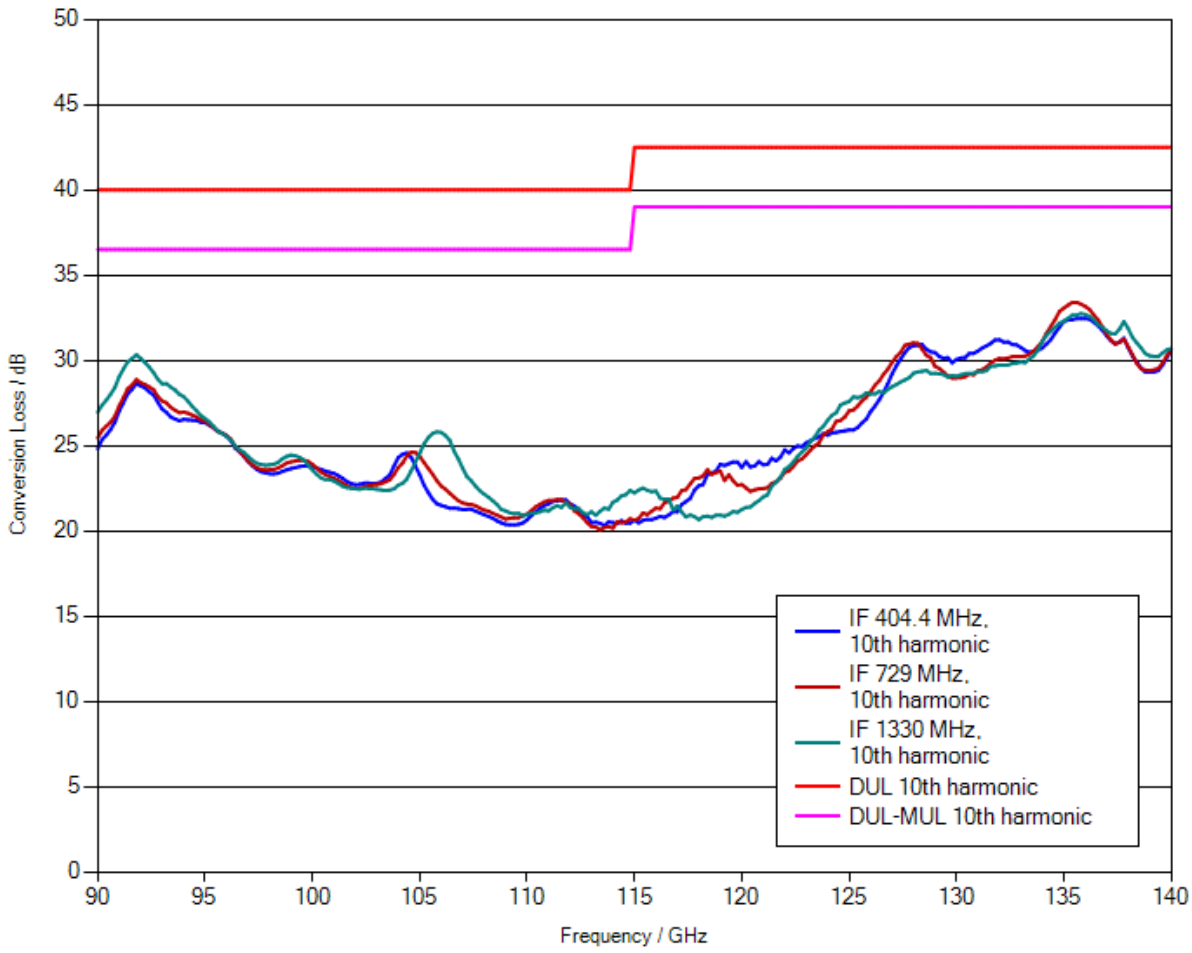
Software used for measurement

Item Type	Version	Remark
Measurement Studio Professional Edition	2013	
MixerCertification	7_14	

1.1 Conversion loss

LO level +14 dBm nominal
Bias 0 A

Measurement uncertainty: 3.5 dB



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1.2 Frequency response within 1 GHz

	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 10th harmonic	6 dB	2.1 dB	PASS
IF = 729 MHz, 10th harmonic	6 dB	1.96 dB	PASS
IF = 1330 MHz, 10th harmonic	6 dB	2.13 dB	PASS

Radiometer Physics
A Rohde & Schwarz Company

Calibration Certificate
Kalibrierschein

Certificate Number 24-0220-101008-02
Zertifikatsnummer

Unit Data

Item
Gegenstand
Harmonic Mixer, 140 GHz to 220 GHz

Manufacturer
Hersteller
RPG Radiometer-Physics GmbH

Type
Typ
RPG FS-Z220

Material Number
Materialnummer
3593.3250.02

Serial Number
Seriennummer
101008

Asset Number
Inventarnummer

Order Data

Customer
Auftraggeber

Order Number
Bestellnummer
4703008458

Date of Receipt
Eingangsdatum
2019-04-03

Performance

Place and Date of Calibration
Ort und Datum der Kalibrierung
Meckenheim, 2019-04-04

Scope of Calibration
Umfang der Kalibrierung
Standard Calibration

Statement of Compliance (Incoming)
Konformitätsaussage (Anlieferung)
All measured values are within the data sheet specifications.

Statement of Compliance (Outgoing)
Konformitätsaussage (Auslieferung)
All measured values are within the data sheet specifications.

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3 pages Incoming Results

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.

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 Werteintervall (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.

Radiometer Physics GmbH; Meckenheim

Date of Issue
Ausstellungsdatum
2019-04-04

Head of Laboratory
Laborleitung
Schulze

Person Responsible
Bearbeiter
Gottbehuet

Radiometer Physics GmbH ● Werner-von-Siemens-Str. 4 ● 53340 Meckenheim ● Telephone national: 02225/99981-0 international: 0049 2225-99981-0
Fax: 02225/99981-99 ● Managing Director: Achim Walber, Dr. Thomas Rose ● Company's Place of Business: Meckenheim
Commercial Register No.: Bonn, HRB 10291 ● VAT Identification No.: DE 123 377 395

Calibration Method
Kalibrieranweisung

RPG-PAQA-TN-2014-002

Relative Humidity **20 % - 80 %**
Relative Luftfeuchte

Ambient 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

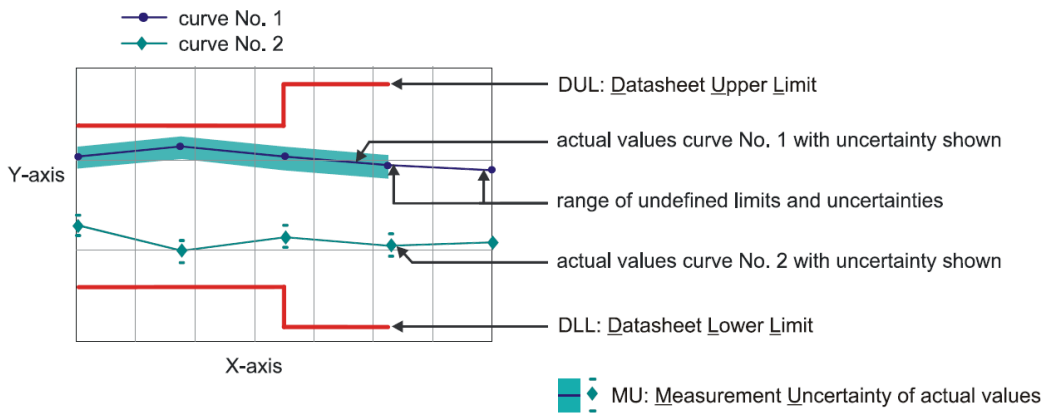
If the new product is stored under the climate conditions as specified in the data sheet upon delivery, the product's accuracy is not significantly affected within 12 month after its calibration in our factory. In this case, the recommended calibration interval starts on the date when the product is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

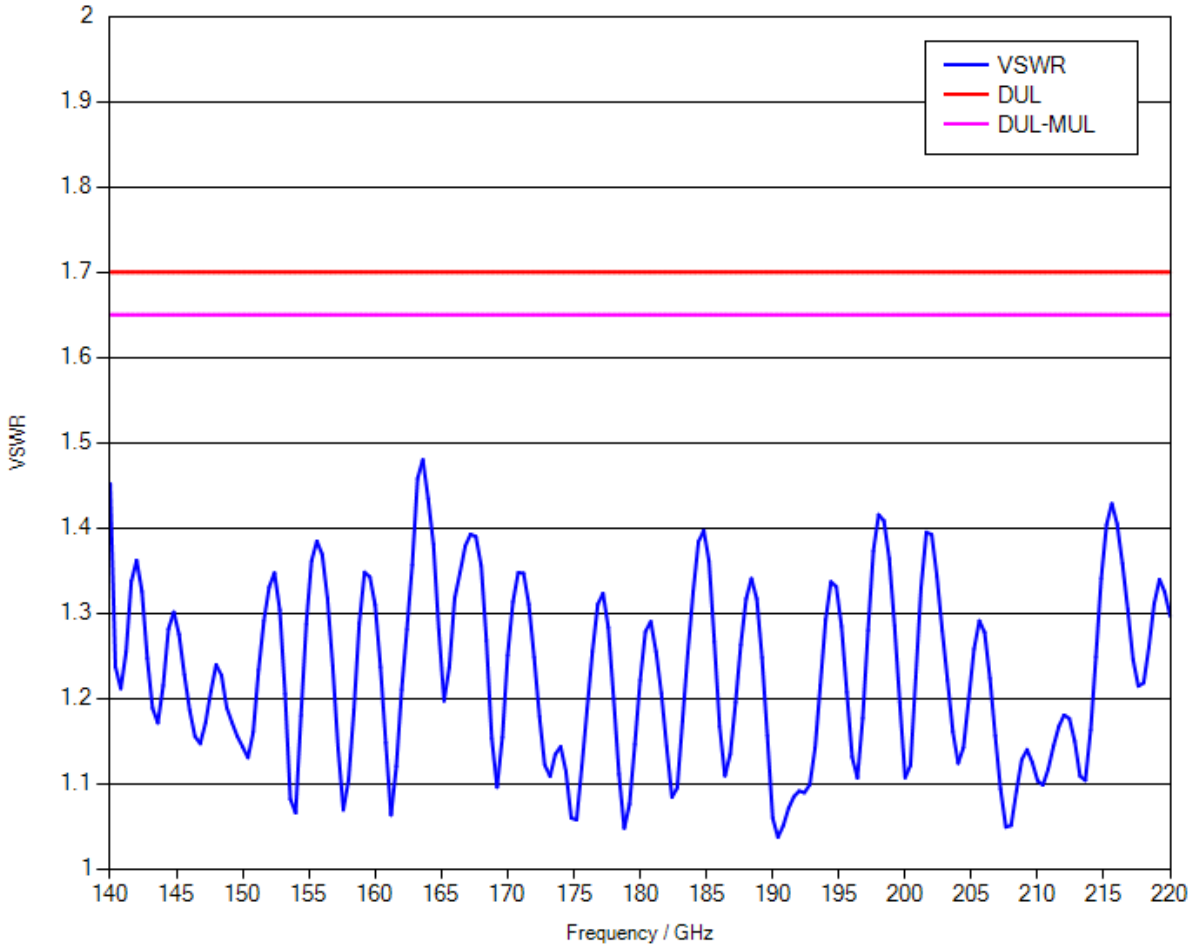


Software used for measurement

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

1.1 RF Input – VSWR

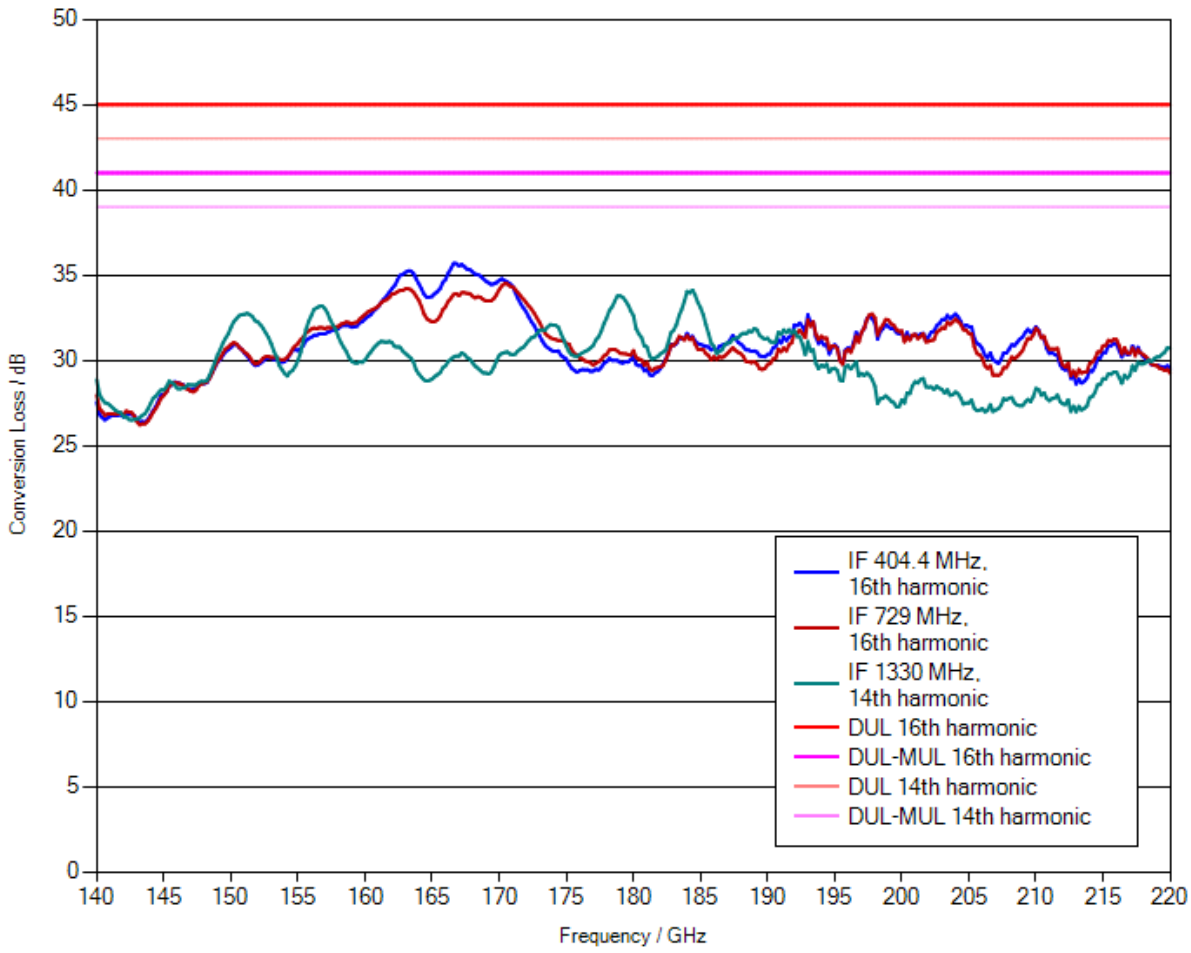
Measurement uncertainty: 0.05 (VSWR)



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

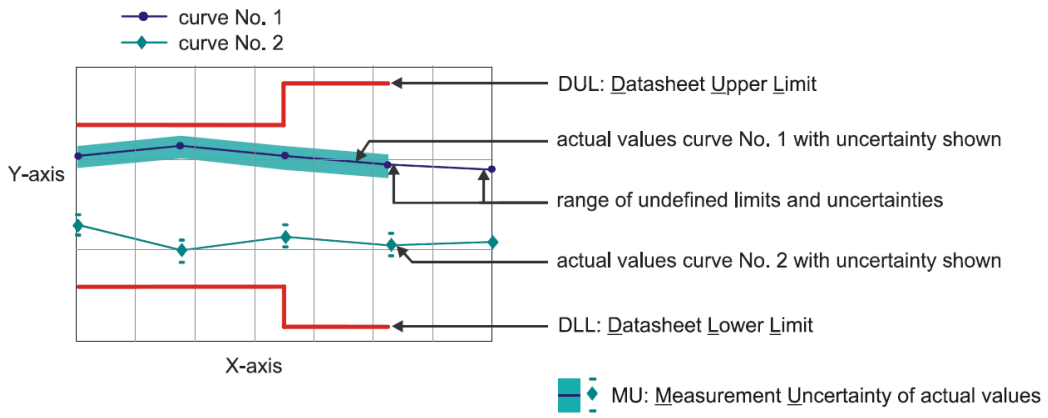
	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 16th harmonic	6 dB	1.83 dB	PASS
IF = 729 MHz, 16th harmonic	6 dB	1.88 dB	PASS
IF = 1330 MHz, 14th harmonic	6 dB	2.64 dB	PASS

1 Incoming 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



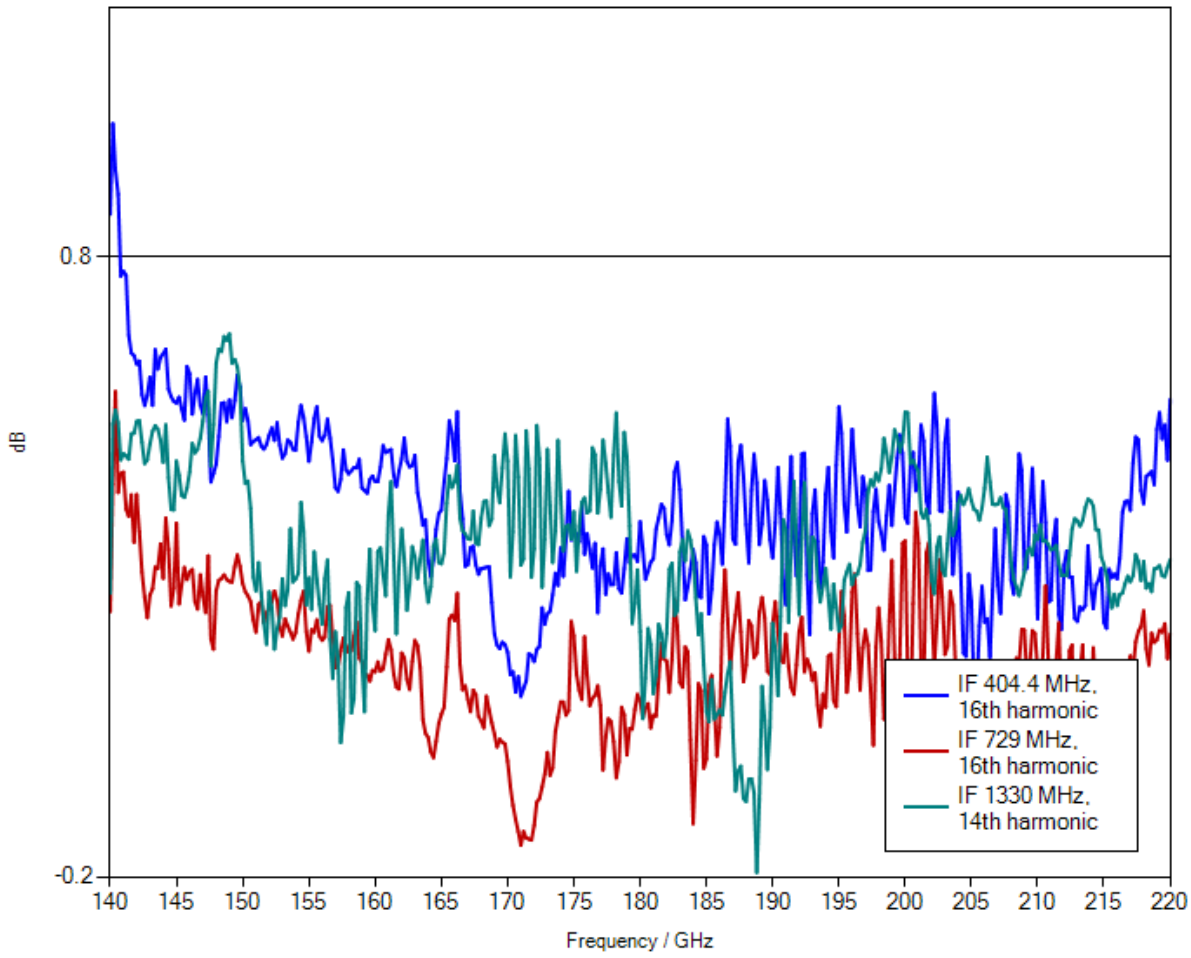
Incoming Report

Software used for measurement

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

Incoming Report

1.1 Deviation between actual and previous conversion loss



Incoming Report

Calibration Laboratory of Microwave Measuring Equipment
of MWM lab

ISO 17025
ACCREDITED LABORATORY

Calibration certificate

Accreditation certificate No. **№ BY/112 02.5.0.0065** **of** **09.01.2015**

Certificate number **25-18** **Date when calibrated** 08/17/2018 **Page** 1 **of** 2

Item calibrated Antenna QWH-UPRR00 # 923600007
Description of measurement standard / measuring instrument / identification

Customer Sporton International Inc.
No. 52, HwaYa 1st Road, HwaYa Technology Park, Kwei-Shan District, TaoYuan City 333, Taiwan, R.O.C.
Name of the customer, address

Method of calibration GOST 20271.1, MK KL 8.2-16
Name of the method / identification

All measurements are traceable to the SI units which are realized by national measurement standards of NMI and state standards of RF. 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 M. Svirid/ Technical manager **Date of issue** 08/17/2018
Name and position

Calibration Certificate

Certificate number **25-18**

Calibration is performed by using

#	Measuring equipment	Serial number
1	Wattmeter M 568	164
2	Wattmeter M 546	163
3	Signal generator G4-186	5
4	Signal generator G4-161	3
5	Voltmeter V7-34	0067787
6	Frequency meter RCH3-72	931200
7	Horn antenna P6-133	15005

Calibration conditions

Temperature: 22.5 °C.
Humidity: 44.0 %.
Pressure: 99.9 kPa.

Calibration results are given in the Measuring report # 25-18.

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	40 – 60 GHz	Corresponds (Table 1)
2	Waveguide Interface	WR-19	Corresponds
3	Antenna Gain	24 dB	Corresponds (Table 1)
4	Antenna Factor	42 dB/m	Corresponds (Table 1)

Signature of the person who has performed calibration

M. Kasperovich/ Engineer
Name and function

Calibration Laboratory of
Microwave Measuring Equipment
Accreditation certificate
No. BY/112 02.5.0.0065
Address: 6, P. Brovki str., Minsk
220027, Belarus
Phone/Fax: +375 17 2938496

Technical Manager

_____ M. Svirid

August 17, 2018

MEASURING REPORT # 25-18

August 17, 2018

Customer:	Sporton International Inc. No. 52, HwaYa 1st Road, HwaYa Technology Park, Kwei-Shan District, TaoYuan City 333, Taiwan, R.O.C.
Item calibrated:	**Antenna QWH-UPRR00 # 923600007**
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	07/20/2018
Date of calibration:	From 07/23/2018 to 08/17/2018

MEASURING CONDITIONS

Temperature: 22.5 °C	Humidity: 44 %	Pressure: 99.9 kPa

MEASURING EQUIPMENT

#	Measuring equipment	Serial number
1	Wattmeter M 568	164
2	Wattmeter M 546	163
3	Signal generator G4-186	5
4	Signal generator G4-161	3
5	Voltmeter V7-34	0067787
6	Frequency meter RCH3-72	931200
7	Horn antenna P6-133	15005

MEASURING RESULTS

Distance between the testing and generating antennas was 2 m.

Table 1

Frequency, GHz	40	50	60
Input power, mW	10.0	10.0	10.0
Power density of electromagnetic field, W/m^2	0.049	0.067	0.072
Maximum level of measured power, μW	36.56	37.07	31.98
Gain, dB	22.2	22.8	23.5
Antenna factor, dB/m	40.0	41.4	42.3
Expanded uncertainty, dB	2.1	2.1	2.1

Engineer _____ M. Kasperovich

Quality Manager _____ A. Kostrikin

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

Calibration Laboratory of Microwave Measuring Equipment
of MWM lab

ISO 17025
ACCREDITED LABORATORY

Calibration certificate

Accreditation certificate No. **№ BY/112 02.5.0.0065** **of** **09.01.2015**

Certificate number **28-18** **Date when calibrated** 08/17/2018 **Page** 1 **of** 2

Item calibrated **Antenna QWH-EPRR00 # 784600034**

Description of measurement standard / measuring instrument / identification

Customer Sporton International Inc.
No. 52, HwaYa 1st Road, HwaYa Technology Park, Kwei-Shan District, TaoYuan City 333, Taiwan, R.O.C.

Name of the customer, address

Method of calibration GOST 20271.1, MK KL 8.2-16

Name of the method / identification

All measurements are traceable to the SI units which are realized by national measurement standards of NMI and state standards of RF. 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 M. Svirid/ Technical manager **Date of issue** 08/17/2018

Name and position

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 **28-18**

Calibration is performed by using

#	Measuring equipment	Serial number
1	Wattmeter M 534	161
2	Wattmeter M 546	163
3	Signal generator G4-186	5
4	Signal generator RG4-14	22
5	Voltmeter V7-34	0067787
6	Frequency meter RCH3-72	931200
7	Horn antenna P6-134	14002
8	Horn antenna P6-31A	35864

Calibration conditions

Temperature: 22.5 °C.
Humidity: 44.0 %.
Pressure: 99.9 kPa.

Calibration results are given in the Measuring report # 28-18.

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	60 – 90 GHz	Corresponds (Table 1)
2	Waveguide Interface	WR-12	Corresponds
3	Antenna Gain	24 dB	Corresponds (Table 1)
4	Antenna Factor	45 dB/m	Corresponds (Table 1)

Signature of the person who has performed calibration

M. Kasperovich/ Engineer
Name and function

Calibration Laboratory of
Microwave Measuring Equipment
Accreditation certificate
No. BY/112 02.5.0.0065
Address: 6, P. Brovki str., Minsk
220027, Belarus
Phone/Fax: +375 17 2938496

Technical Manager

_____ M. Svirid

August 17, 2018

MEASURING REPORT # 28-18

August 17, 2018

Customer:	Sporton International Inc. No. 52, HwaYa 1st Road, HwaYa Technology Park, Kwei-Shan District, TaoYuan City 333, Taiwan, R.O.C.
Item calibrated:	**Antenna QWH-EPRR00 # 784600034**
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	07/20/2018
Date of calibration:	From 07/23/2018 to 08/17/2018

MEASURING CONDITIONS

Temperature: 22.5 °C	Humidity: 44 %	Pressure: 99.9 kPa

MEASURING EQUIPMENT

#	Measuring equipment	Serial number
1	Wattmeter M 534	161
2	Wattmeter M 546	163
3	Signal generator G4-186	5
4	Signal generator RG4-14	22
5	Voltmeter V7-34	0067787
6	Frequency meter RCH3-72	931200
7	Horn antenna P6-134	14002
8	Horn antenna P6-31A	35864

MEASURING 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
Input Power, mW	10.0	10.0	8.0
Power density of electromagnetic field, W/m^2	0.063	0.081	0.121
Maximum level of measured power, μW	21.44	21.84	26.14
Gain, dB	22.3	23.3	23.9
Antenna Factor, dB/m	43.5	44.5	45.4
Expanded uncertainty, dB	2.1	2.1	2.1

Engineer _____ M. Kasperovich

Quality Manager _____ A. Kostrikin

This Measuring report issued in duplicate and sent to:
1. Sporton International INC.
Address: No. 52, HwaYa 1st Road, HwaYa Technology Park, Kwei-Shan District, TaoYuan City 333, Taiwan, R.O.C.
2. Calibration Laboratory of Microwave Measuring Equipment
Duplication of Measuring report (complete or partial) must be authorized by the laboratory.

Calibration Laboratory of Microwave Measuring Equipment
of MWM lab

ISO 17025
ACCREDITED LABORATORY

Calibration certificate

Accreditation certificate No. **№ BY/112 02.5.0.0065** **of** **09.01.2015**

Certificate number **30-18** **Date when calibrated** 08/17/2018 **Page** 1 **of** 2

Item calibrated **Antenna QWH-FPRR00 # 923800008**

Description of measurement standard / measuring instrument / identification

Customer Sporton International Inc.
No. 52, HwaYa 1st Road, HwaYa Technology Park, Kwei-Shan District, TaoYuan City 333, Taiwan, R.O.C.

Name of the customer, address

Method of calibration GOST 20271.1, MK KL 8.2-16

Name of the method / identification

All measurements are traceable to the SI units which are realized by national measurement standards of NMI and state standards of RF. 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 M. Svirid/ Technical manager **Date of issue** 08/17/2018

Name and position

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

#	Measuring equipment	Serial number
1	Wattmeter M 523	162
2	Wattmeter M 534	161
3	Voltmeter V7-34	0067787
4	Frequency meter RCH3-72	931200
5	Signal generator RG4-14	22
6	Signal generator G4-161	282
7	Antenna P6-31A	35864
8	Antenna P6-32	115671

Calibration conditions

Temperature: 22.5 °C.
Humidity: 44.0 %.
Pressure: 99.9 kPa.

Calibration results are given in the Measuring report # 30-18.

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	90 – 140 GHz	Corresponds (Table 1)
2	Waveguide Interface	WR-8	Corresponds
3	Antenna Gain	24 dB	Corresponds (Table 1)
4	Antenna Factor	48 dB/m	Corresponds (Table 1)

Signature of the person who has performed calibration

M. Kasperovich/ Engineer
Name and function

Calibration Laboratory of
Microwave Measuring Equipment
Accreditation certificate
No. BY/112 02.5.0.0065
Address: 6, P. Brovki str., Minsk
220027, Belarus
Phone/Fax: +375 17 2938496

Technical Manager

_____ M. Svirid

August 17, 2018

MEASURING REPORT # 30-18

August 17, 2018

Customer:	Sporton International Inc. No. 52, HwaYa 1st Road, HwaYa Technology Park, Kwei-Shan District, TaoYuan City 333, Taiwan, R.O.C.
Item calibrated:	**Antenna QWH-FPRR00 # 923800008**
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	07/20/2018
Date of calibration:	From 07/23/2018 to 08/17/2018

MEASURING CONDITIONS

Temperature: 22.5 °C	Humidity: 44 %	Pressure: 99.9 kPa

MEASURING EQUIPMENT

#	Measuring equipment	Serial number
1	Wattmeter M 523	162
2	Wattmeter M 534	161
3	Voltmeter V7-34	0067787
4	Frequency meter RCH3-72	931200
5	Signal generator RG4-14	22
6	Signal generator G4-161	282
7	Antenna P6-31A	35864
8	Antenna P6-32	115671

MEASURING 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
Input Power, mW	8.0	8.0	5.0
Power density of electromagnetic field, W/m^2	0.125	0.174	0.212
Maximum level of measured power, μW	18.03	20.22	21.08
Gain, dB	22.1	23.3	24.4
Antenna Factor, dB/m	47.2	48.1	48.8
Expanded uncertainty, dB	2.1	2.2	2.2

Engineer _____ M. Kasperovich

Quality Manager _____ A. Kostrikin

This Measuring report issued in duplicate and sent to:
1. Sporton International INC.
Address: No. 52, HwaYa 1st Road, HwaYa Technology Park, Kwei-Shan District, TaoYuan City 333, Taiwan, R.O.C.
2. Calibration Laboratory of Microwave Measuring Equipment
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Calibration Laboratory of Microwave Measuring Equipment
of MWM lab

ISO 17025
ACCREDITED LABORATORY

Calibration certificate

Accreditation certificate No. **№ BY/112 02.5.0.0065** **of** **09.01.2015**

Certificate number **35-18** **Date when calibrated** 08/17/2018 **Page** 1 **of** 2

Item calibrated **Antenna QWH-GPRR00 # 923900001**

Description of measurement standard / measuring instrument / identification

Customer Sporton International Inc.
No. 52, HwaYa 1st Road, HwaYa Technology Park, Kwei-Shan District, TaoYuan City 333, Taiwan, R.O.C.

Name of the customer, address

Method of calibration GOST 20271.1, MK KL 8.2-16

Name of the method / identification

All measurements are traceable to the SI units which are realized by national measurement standards of NMI and state standards of RF. 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 M. Svirid/ Technical manager **Date of issue** 08/17/2018

Name and position

Calibration Certificate

Certificate number **35-18**

Calibration is performed by using

#	Measuring equipment	Serial number
1	Wattmeter M 523	162
2	Wattmeter M 514	165
3	Signal generator RG4-14	4
4	Voltmeter V7-34	0067787
5	Frequency meter RCH3-72	931200
6	Frequency multiplier	02
7	Horn antenna P6-32	115671
8	Horn antenna 2P1	138421

Calibration conditions

Temperature: 22.5 °C.
Humidity: 44.0 %.
Pressure: 99.9 kPa.

Calibration results are given in the Measuring report # 35-18.

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	140 – 220 GHz	Corresponds (Table 1)
2	Waveguide Interface	WR-5	Corresponds
3	Antenna Gain	24 dB	Corresponds (Table 1)
4	Antenna Factor	52 dB/m	Corresponds (Table 1)

Signature of the person who has performed calibration

M. Kasperovich/ Engineer

Name and function

Calibration Laboratory of
Microwave Measuring Equipment
Accreditation certificate
No. BY/112 02.5.0.0065
Address: 6, P. Brovki str., Minsk
220027, Belarus
Phone/Fax: +375 17 2938496

Technical Manager

_____ M. Svirid

August 17, 2018

MEASURING REPORT # 35-18
August 17, 2018

Customer:	Sporton International Inc. No. 52, HwaYa 1st Road, HwaYa Technology Park, Kwei-Shan District, TaoYuan City 333, Taiwan, R.O.C.
Item calibrated:	**Antenna QWH-GPRR00 # 923900001**
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	07/20/2018
Date of calibration:	From 07/23/2018 to 08/17/2018

MEASURING CONDITIONS

Temperature: 22.5 °C	Humidity: 44 %	Pressure: 99.9 kPa

MEASURING EQUIPMENT

#	Measuring equipment	Serial number
1	Wattmeter M 523	162
2	Wattmeter M 514	165
3	Signal generator RG4-14	4
4	Voltmeter V7-34	0067787
5	Frequency meter RCH3-72	931200
6	Frequency multiplier	02
7	Horn antenna P6-32	115671
8	Horn antenna 2P1	138421

MEASURING 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
Input power, mW	5.0	2.0	2.0
Power density of electromagnetic field, W/m^2	0.311	0.369	0.327
Maximum level of measured power, μW	18.15	16.71	11.42
Gain, dB	22.0	23.1	23.7
Antenna factor, dB/m	51.1	52.2	53.4
Expanded uncertainty, dB	2.2	2.3	2.5

Engineer _____ M. Kasperovich

Quality Manager _____ A. Kostrikin

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