



Calibration Certificate

Kalibrierschein

Certificate Number 24-0060-101017-01

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
101017

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
Eingangdatum

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.

Performance

Place and Date of Calibration
Ort und Datum der Kalibrierung

Meckenheim, 2019-09-19

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

2019-09-20

Head of Laboratory
Laborleitung

Schulze

Person Responsible
Bearbeiter

Heinze

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	509916_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
Calibration kit	WR19	U10001	24-0060-U10001-02	2021-02-05

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

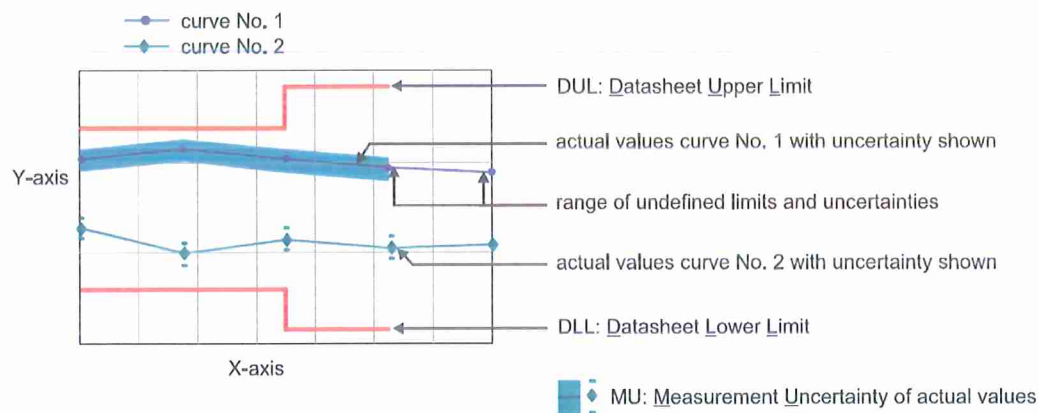
If the new product is stored under the climate conditions as specified in the data sheet upon delivery, the product's accuracy is not significantly affected within 12 month after its calibration in our factory. In this case, the recommended calibration interval starts on the date when the product is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

Measurement Studio Professional Edition
MixerCertification

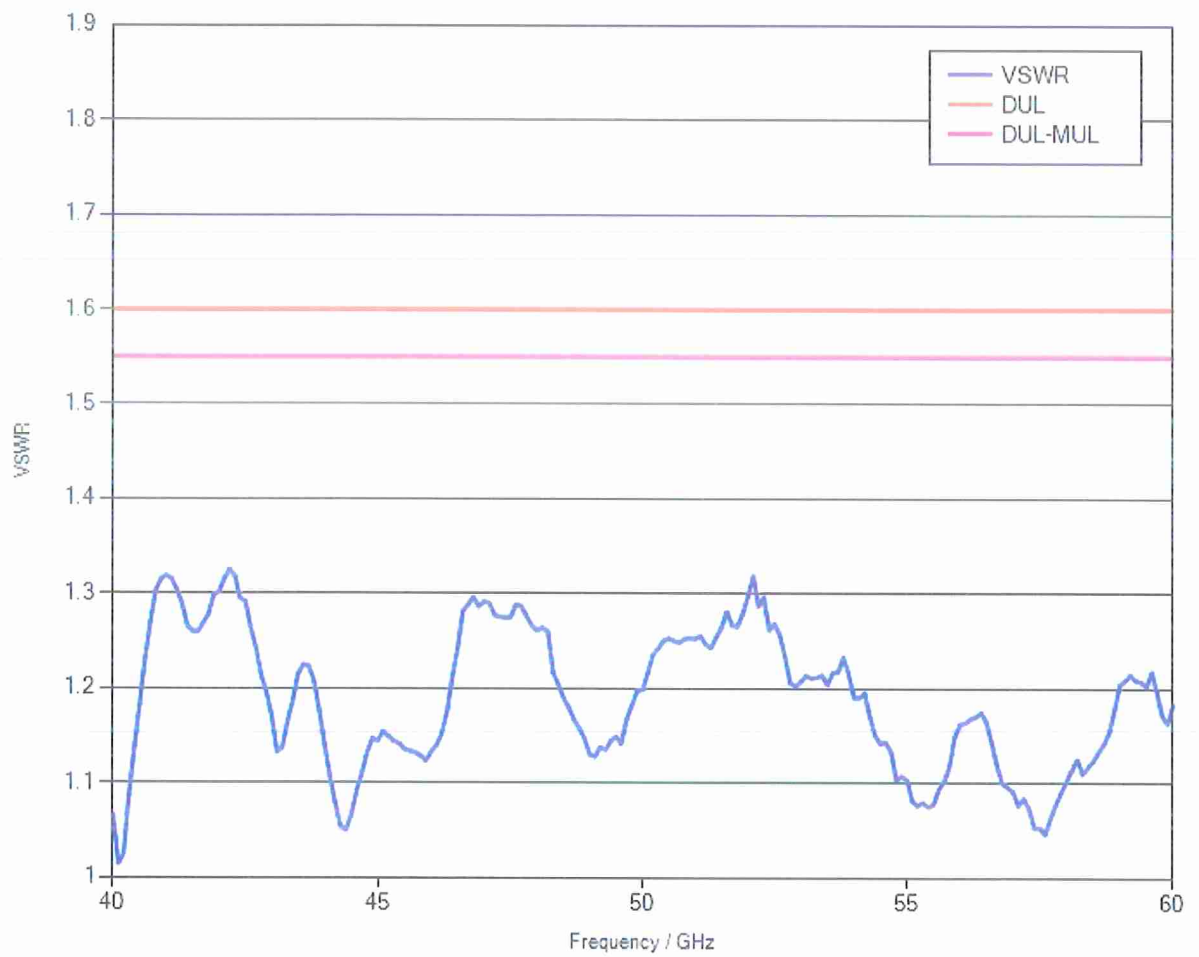
Version

2013
7_12

Remark

1.1 RF Input – VSWR

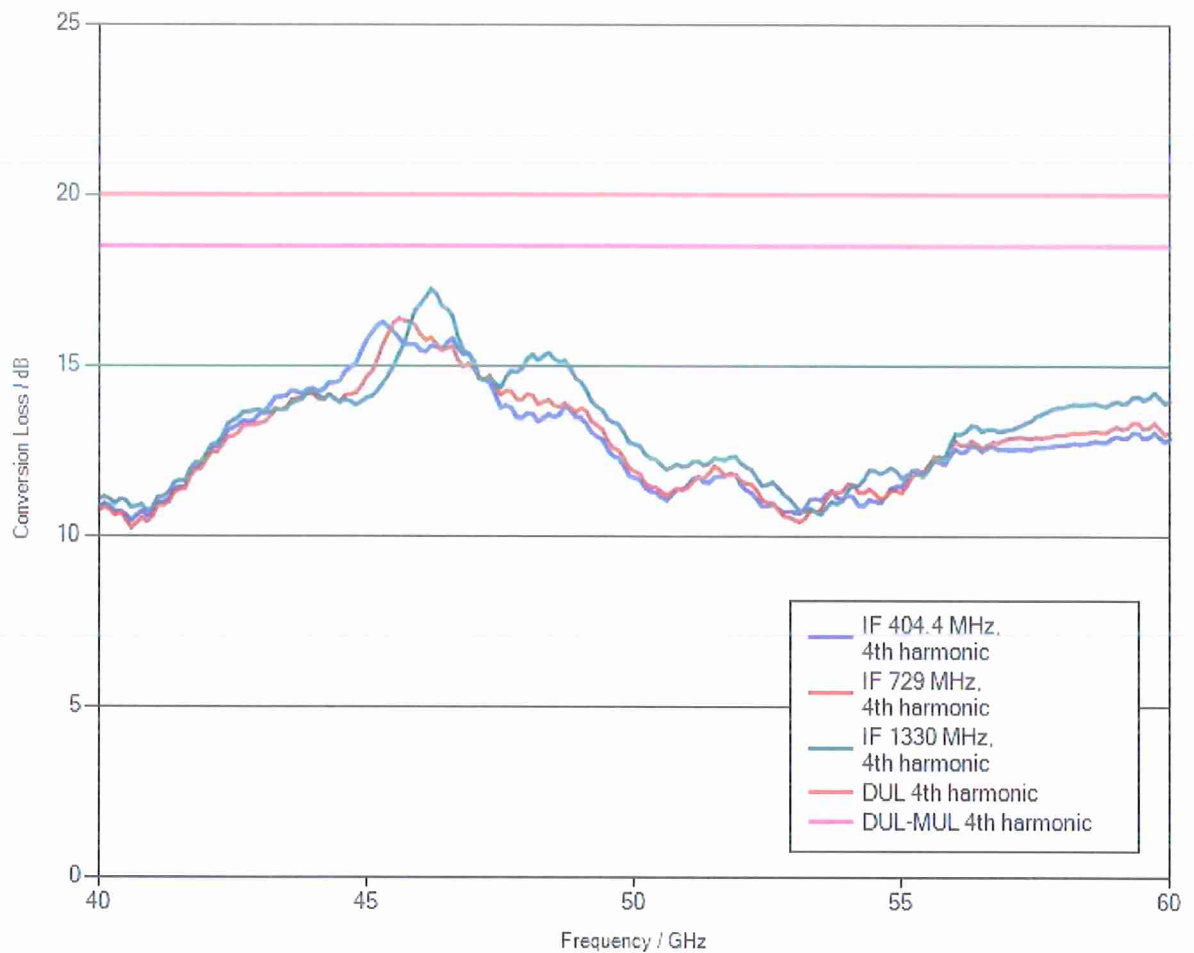
Measurement uncertainty: 0.05 (VSWR)



1.2 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.

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, 4th harmonic	4 dB	2.04 dB	PASS
IF = 729 MHz, 4th harmonic	4 dB	2.22 dB	PASS
IF = 1330 MHz, 4th harmonic	4 dB	2.77 dB	PASS



Calibration Certificate

Certificate Number **20-837552-C**

Kalibrierschein

Zertifikatsnummer

Unit Data

Item **FS-Z90 HARMONIC MIXER 60-90GHZ**
Gegenstand

Manufacturer **ROHDE & SCHWARZ**
Hersteller

Type **FS-Z90**
Typ

Material Number **3638.2270.02** Serial Number **102037**
Materialnummer Seriennummer

Asset Number
Inventarnummer

Order Data

Customer
Auftraggeber

Order Number
Bestellnummer

Date of Receipt **2019-10-10**
Eingangsdatum

Performance

Place and Date of Calibration
Ort und Datum der Kalibrierung

Memmingen, 2019-10-10

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 within
the data sheet specifications.**

Extent of Calibration Documents
Umfang des Kalibrierdokuments

2 Pages incl. this

Ref.No. **20-837552-C**

Cal. 2019-10-10	Custom. Due Date
--------------------	------------------

ROHDE & SCHWARZ

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 and are conformant with EN ISO/IEC 17025, ANSI/NCSL Z540.1-1994 and ANSI/NCSL Z540.3-2006. The applied quality system is certified to EN ISO 9001. 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 und entsprechen EN ISO/IEC 17025, ANSI/NCSL Z540.1-1994 und ANSI/NCSL Z540.3-2006.

Das angewandte Qualitätsmanagement-System ist zertifiziert nach EN ISO 9001. Dieser Kalibrierschein darf vollständig und unverändert weiterverbreitet werden. Kalibrierscheine ohne Signifizierungen sind ungültig. Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

Rohde & Schwarz Messgerätebau GmbH

Date of Issue
Ausstellungsdatum

2019-10-10

Head of Laboratory
Laborleitung

Steigmüller

Person Responsible
Bearbeiter

Mathias Mücke

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ver9815/MB0707

Calibration Method **5038.8323.01-PB-01.03**
Kalibrieranweisung

Relative Humidity **20%-60%**
Relative Luftfeuchte

Ambient Temperature **(23 ⁺¹₋₁) °C**
Umgebungstemperatur

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
Therm.Power Sensor DC-40GHz	NRP-Z55	100221	441963-D-K-15195-01-01-2017-10	2019-10-31
Thermal Waveguide Power Sensor	NRP90TWG	910001	668325 D-K-15195-01-00 2017-06	2020-06-30
Vect. Netw. Analyzer 4PORT	ZVA67	101175	0016 D-K-15195-01-01 2018-12	2019-12-31

Conformity statements take the measurement uncertainties into account.

Die Konformitätsaussagen berücksichtigen die Messunsicherheiten.

Notes

Anmerkungen

Installed options are included in calibration. Depending on installed options, numbers of pages of the record are not consecutive.



Calibration Certificate

Kalibrierschein

Certificate Number 24-0140-101141-01

Zertifikatsnummer

Unit Data

Item
Gegenstand
Harmonic Mixer, 90 GHz to 140 GHz

Manufacturer
Hersteller
RPG

Type
Typ
RPG FS-Z140

Material Number
Materialnummer
3622.0708.02

Serial Number
Seriennummer
101141

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

Performance

Place and Date of Calibration
Ort und Datum der Kalibrierung

Meckenheim, 2019-09-09

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**

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.

Radiometer Physics GmbH; Meckenheim

Date of Issue
Ausstellungsdatum

2019-09-11

Head of Laboratory
Laborleitung

Schulze

Person Responsible
Bearbeiter

H. Minze

Heinze

Page (Seite) 1/2
Vers 2010-05-05/
RPG2014-02-28

Calibration Method

Kalibrieranweisung

RPG-PAQA-TN-2014-002

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

Ambient Temperature
Umgebungstemperatur

$$(23 \begin{smallmatrix} +7 \\ -3 \end{smallmatrix})^{\circ}\text{C}$$

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	509916_D-K-15195-01-01_2019-05	2020-05-22
Calibration Kit	WR8	F10001	24-0140-F10001-02	2021-01-16

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

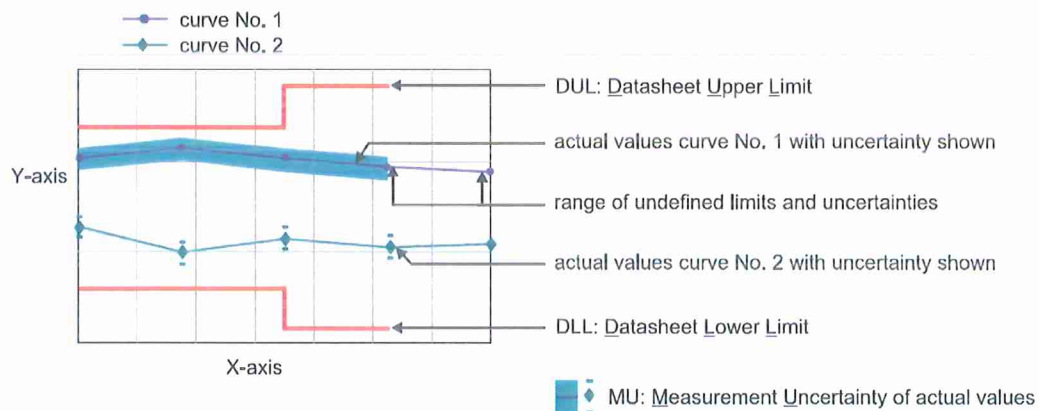
If the new product is stored under the climate conditions as specified in the data sheet upon delivery, the product's accuracy is not significantly affected within 12 month after its calibration in our factory. In this case, the recommended calibration interval starts on the date when the product is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

Outgoing Results

The following abbreviations may be used in this document

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Nom.	Nominal Value
Dev.	Deviation
MErr.	Measurement Error
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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

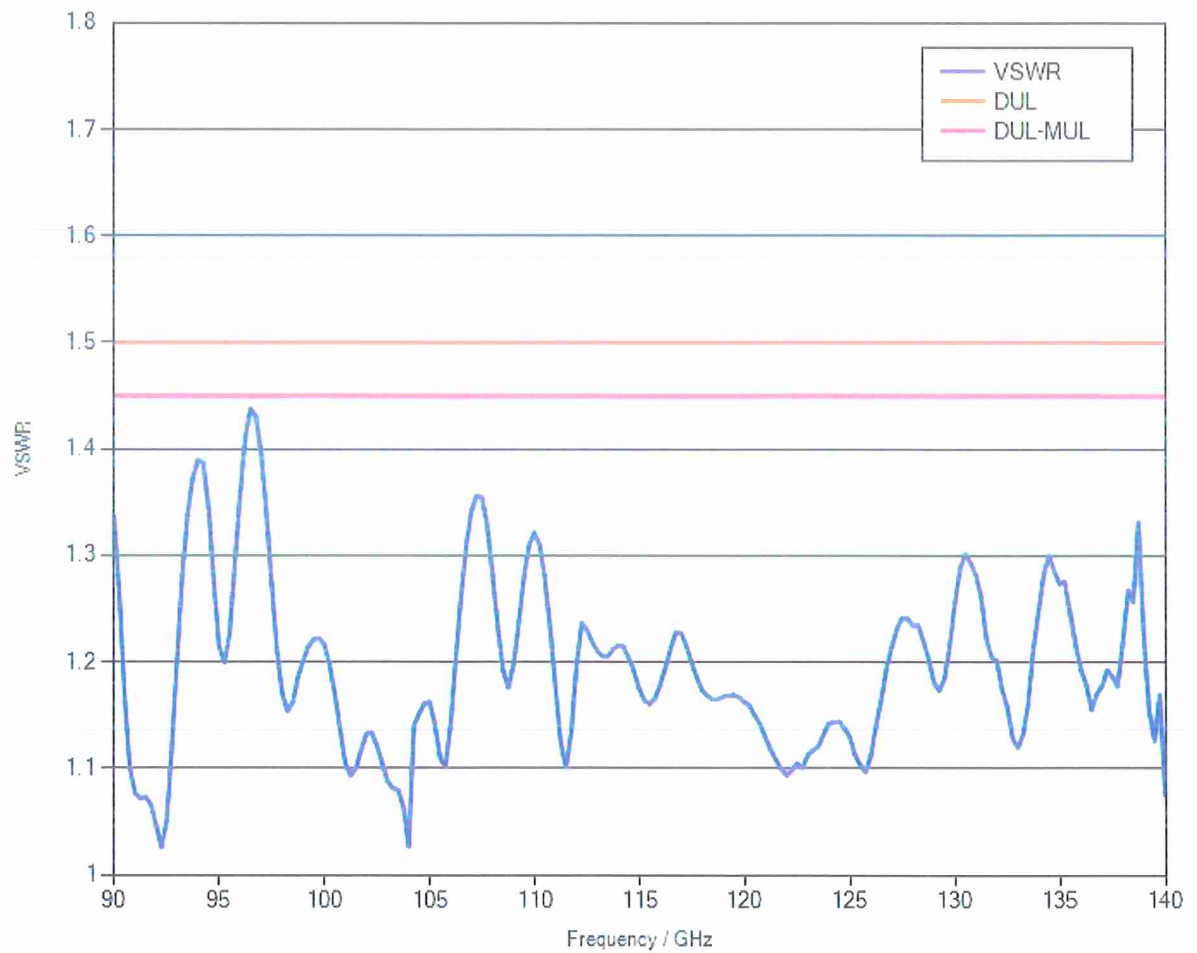
Explanation of charts



Software used for measurement**Item Type**Measurement Studio Professional Edition
MixerCertification**Version**2013
7_12**Remark**

1.1 RF Input – VSWR

Measurement uncertainty: 0.05 (VSWR)

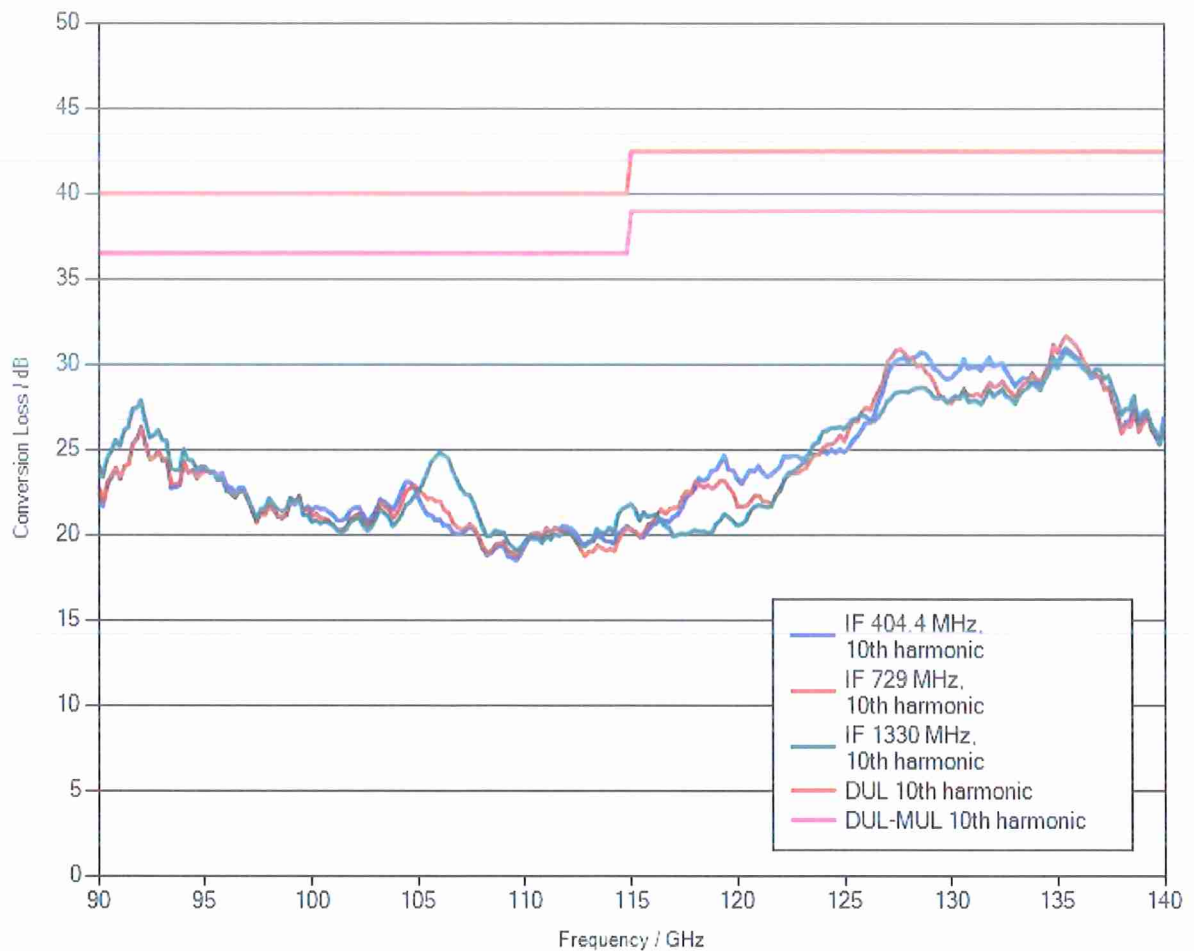


1.2 Conversion loss

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

Kalibrierschein

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

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

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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

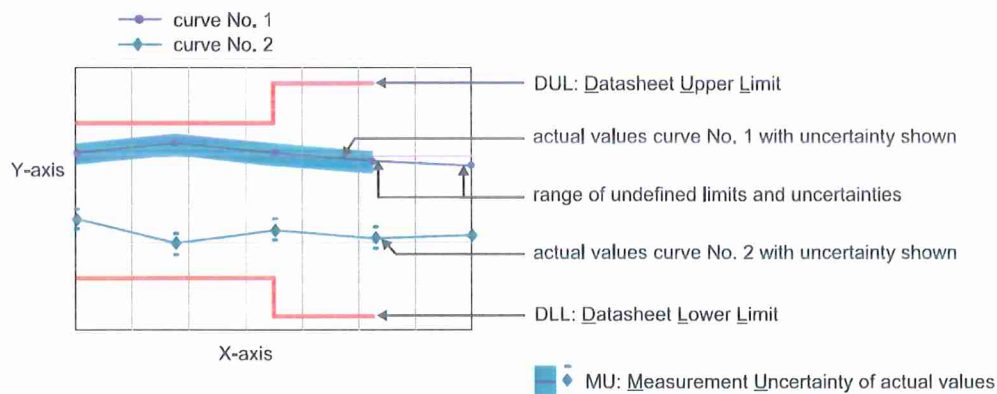
Page (Seite) 1/2
Vers2010-05-05/
RPG2014-02-28

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.
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DU	Datasheet Uncertainty

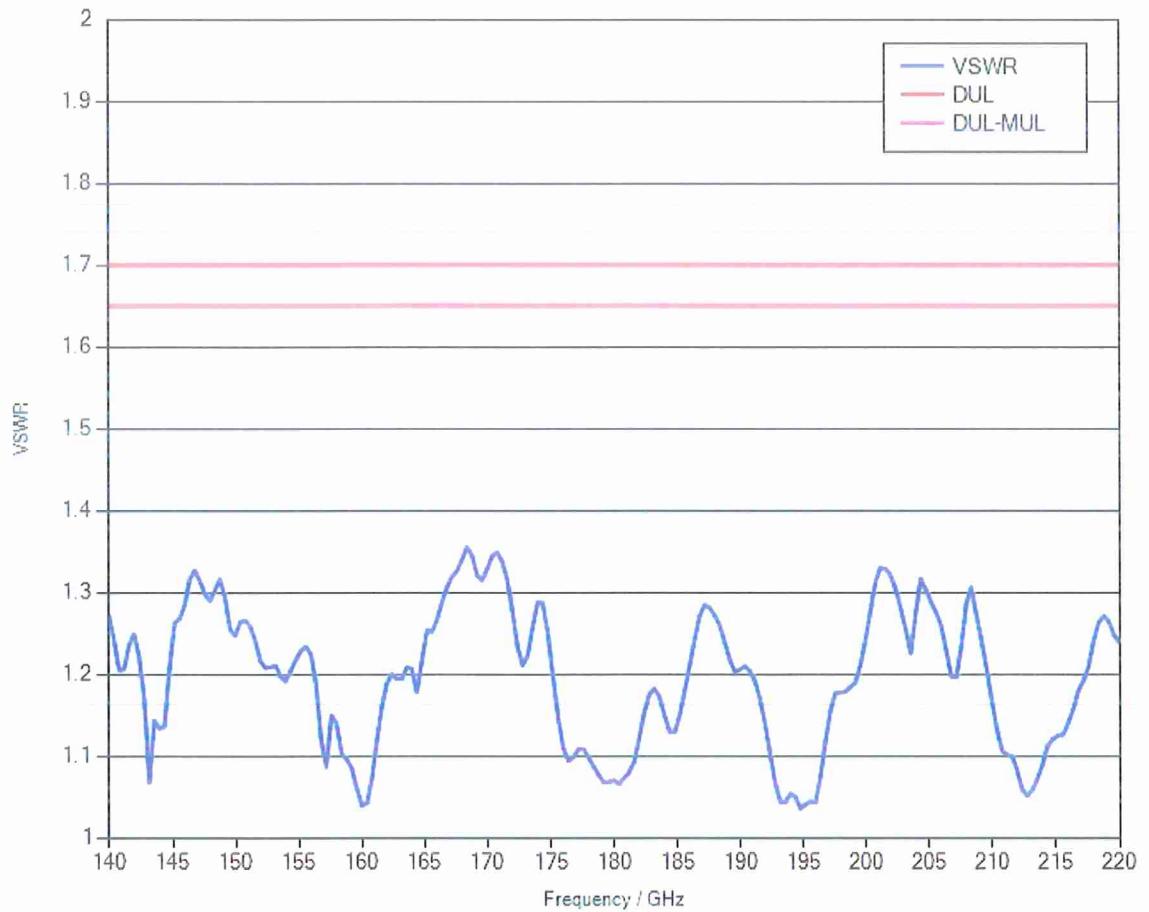
Explanation of charts



Software used for measurement**Item Type**Measurement Studio Professional Edition
MixerCertification**Version**2013
7_12**Remark**

1.1 RF Input – VSWR

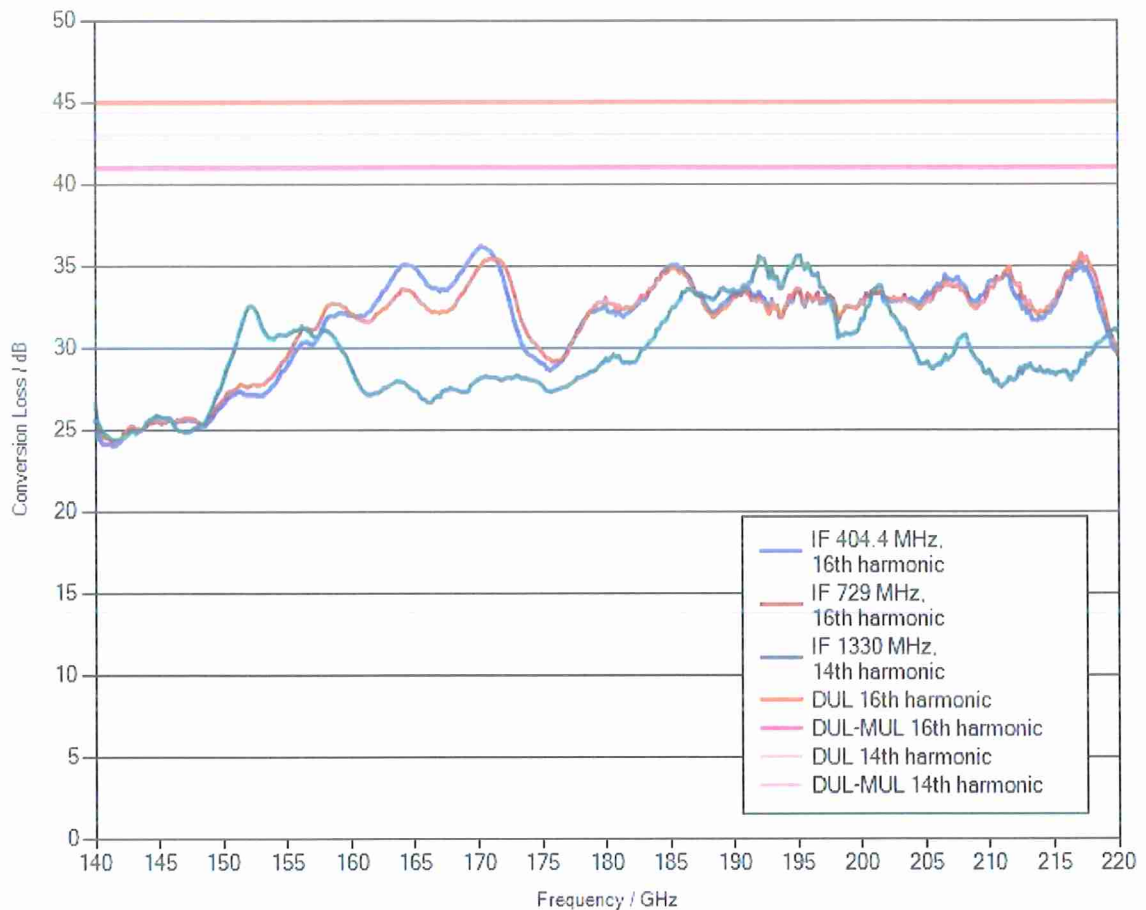
Measurement uncertainty: 0.05 (VSWR)



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