



CALIBRATION CERTIFICATE



Kalibrierschein

Certificate Number
Zertifikatsnummer

0001A300631011

| General Data | |
|---|--|
| Item Gegenstand | FS-Z90 HARMONIC MIXER 60-90GHZ |
| Manufacturer Hersteller | ROHDE & SCHWARZ |
| Type Typ | FS-Z90 |
| Material Number Materialnummer | 1048.0371.02 |
| Serial Number Seriennummer | 101871 |
| Order Number Bestellnummer | 8800015562 20, X1008423 |
| Asset Number Inventarnummer | BX90567 |
| Customer Auftraggeber | RISE Research Institutes of Sweden AB Brinellgatan 4 504 62 Borås SE |
| Performance | |
| Place and Date of Calibration Ort und Datum der Kalibrierung | 87700 Memmingen, Rohde-und-Schwarz-Str. 1 2022-01-10 |
| 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. |
| Customers due Interval Kalibrierintervall des Kunden | |
| Extent of Calibration Document Umfang des Kalibrierdokuments | 3 Certificate 6 Outgoing Results 6 Incoming Results |
| Date of Issue Ausstellungsdatum | Approval of the certificate by Freigabe des Kalibrierscheins durch |
| 2022-01-10 | Dr. Gerhard Rösel Johannes Negele |
| |  Laboratory management Labormanagement |
| |  Person responsible Bearbeiter |

Calibration Mark Kalibrierzeichen

| |
|---------------------|
| 300631011 |
| D-K- 15195-01-00 |
| 2022-01 |

Member of Deutscher Kalibrierdienst
Mitglied im Deutschen Kalibrierdienst



This calibration certificate documents the metrological traceability to national standards, which realize the units of measurement according to the International System of Units (SI). The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates. The user is obliged to have the object recalibrated at appropriate intervals. This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates with the full name of the approval responsible person are valid without signature.

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Serial No 101871

Certificate Number 0001A300631011

Calibration Procedure

The measuring object is an RF harmonic mixer, which converts an RF signal at one frequency into a signal at another frequency (here: IF). The conversion loss was measured using a vector network analyzer. The RF output power as well as the IF input power of the corresponding ports of the VNA were traced back to a power sensor. The conversion loss is defined as the ratio of the power at the IF frequency to the power at the RF frequency with a given LO power. (IF: Intermediate frequency; LO: Local Oscillator)
The traceability is represented in the table Working Standards used.

Working Standards used

| Item | Type | Serial Number | Calibration Certificate Number | Cal. Due |
|--------------------------------|----------|---------------|--------------------------------|------------|
| Therm.Power Sensor DC-44GHz | NRP-Z55 | 140170 | 0023 D-K-15195-01-00 2020-12 | 2022-02-28 |
| Thermal Waveguide Power Sensor | NRP90TWG | 910001 | 0001A300621305 | 2022-10-31 |
| Vector Network Analyzer 4 Port | ZVA67 | 101175 | 0023 D-K-15195-01-00 2021-03 | 2022-03-31 |

Remarks



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| Environmental Conditions | | | |
|----------------------------|-------------|--------------------------|---------|
| Ambient Temperature | (23 ± 1) °C | Relative Humidity | 20%-60% |

| Comments on Measurement Results |
|---|
| <p>The measurement results in the test report stated below have been tested for compliance with the given specifications and marked if necessary. The associated uncertainty of measurement has been taken into account, if not otherwise stated. Measurement results that are not covered by the DAkkS accreditation are marked with ¹. Ref.: ILAC G8:09/2019 'Guidelines on Decision Rules and Statements of Conformity'.</p> <p>The expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor k = 2. It was determined in accordance with EA-4/02 M:2013. The true value is located in the corresponding interval with a probability of 95 %.</p> <p>In addition to the calibration results, the calibration certificate includes functional measurements that might have an influence on the measurement uncertainty of the calibration results. The functional measurement results are marked and are not intended to be used to support the further dissemination of metrological traceability. They are intended to verify the requirements on the measurement object according to manufacturer specifications and technical standards.</p> |

Outgoing Results

Designation: HARMONIC MIXER
Type: FS-Z90
Material No.: 1048.0371.02
Serial No.: 101871
Certificate No.: 0001A300631011
Referring to Test Documentation: 5038.8323.01-PB-02.00

Test Department: 3MM-P
Name: Johannes Negele
Date: 2022-01-10

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.
 - {g} Verification of specified requirements, non-accredited measurements. Technical operations that consist of the determination of one or more characteristics to a specified procedure (formerly {f}).
- DL or DT Data Limit for symmetrical tolerance limits
 - DLL Datasheet Lower Limit
 - DUL Datasheet Upper Limit
 - MU Symmetrical Measurement Uncertainty
 - MLL or MLV Measurement Uncertainty Lower Value
 - MUL or MUV Measurement Uncertainty Upper Value
 - Nom. Nominal Value
 - Dev. Deviation
 - Act. Actual Value
 - UGB Uncertainty Guard Band: Measuring uncertainty violates the data (spec.) limit.
 - UGB1 A compliance statement may be possible where a confidence level of less than 95 % is acceptable.
 - UGB2 A non-compliance statement may be possible where a confidence level of less than 95 % is acceptable.
 - DU Datasheet Uncertainty

Explanation of charts

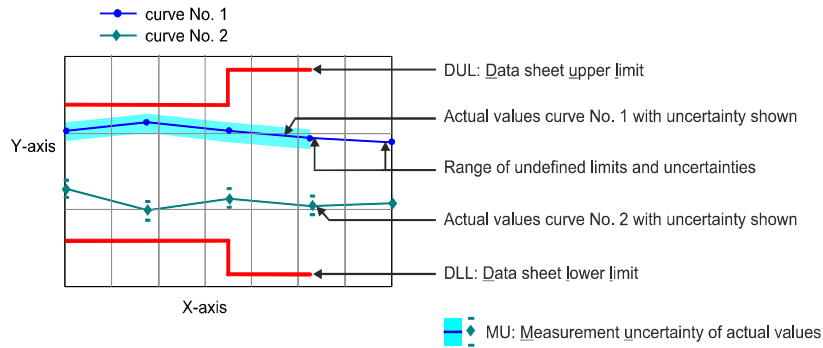


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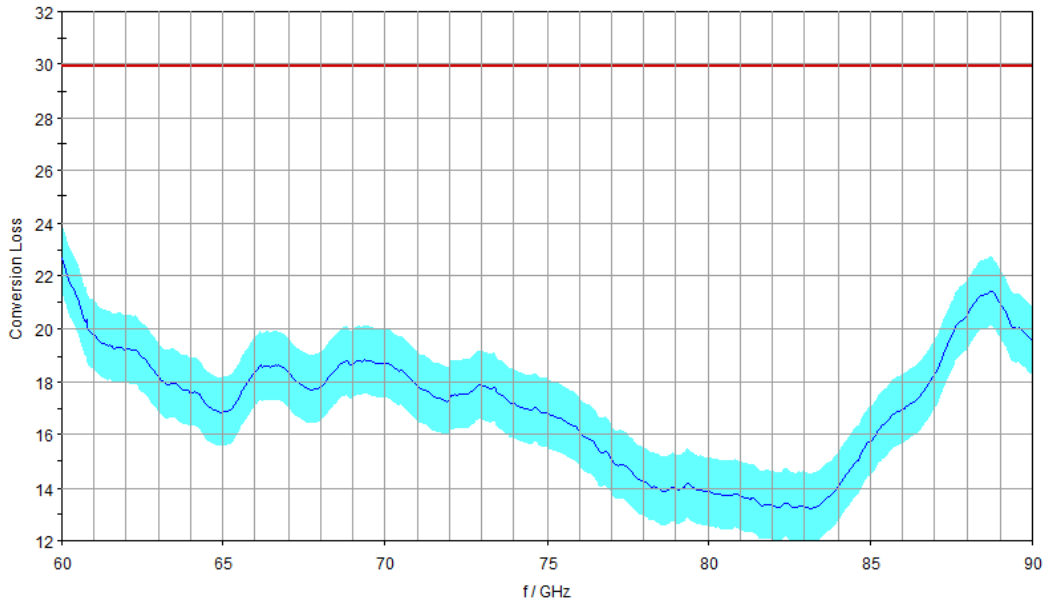
| | |
|--|---|
| Software used for measurement | 4 |
| 1. Conversion Loss (6. Harmonic) | 5 |
| 1.1 Conversion Loss (IF = 404.4 MHz) | 5 |
| 1.2 Conversion Loss (IF = 729 MHz) | 5 |
| 1.3 Conversion Loss (IF = 1330 MHz) | 6 |
| 1.4 Continuity response within 1 GHz | 6 |

| Software used for measurement | | | |
|--------------------------------------|-------------|----------------|-----------------------------|
| Item | Type | Version | Remark |
| Suite | Setup | V12.20.04 | Test Management Software G5 |
| Test Program (7012.8706.00_) | Component | V01.05 | |

1. Conversion Loss (6. Harmonic)

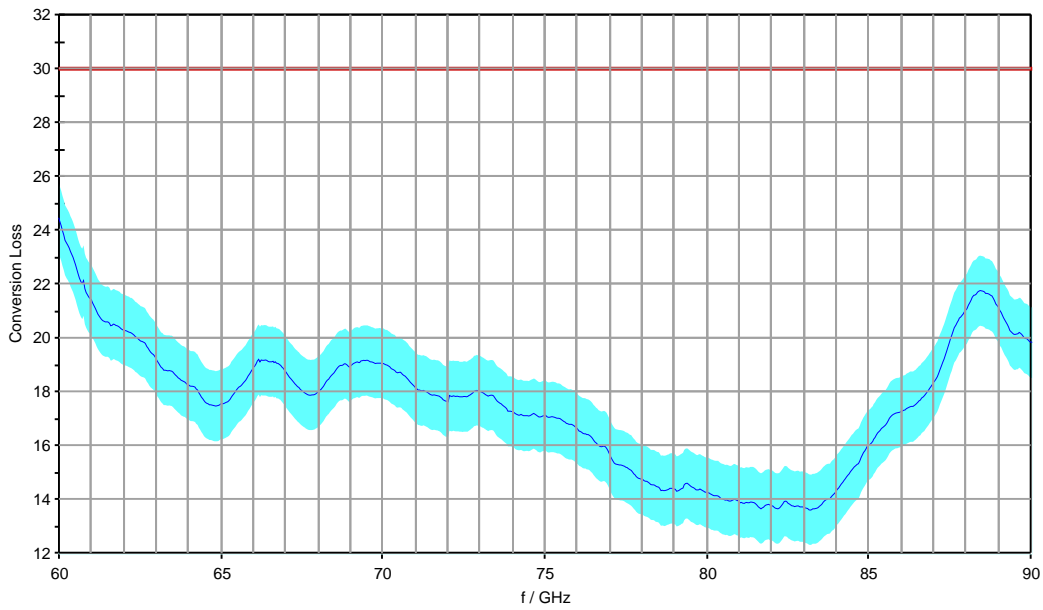
1.1 Conversion Loss (IF = 404.4 MHz)

IF = 404.4 MHz, 6. Harmonic



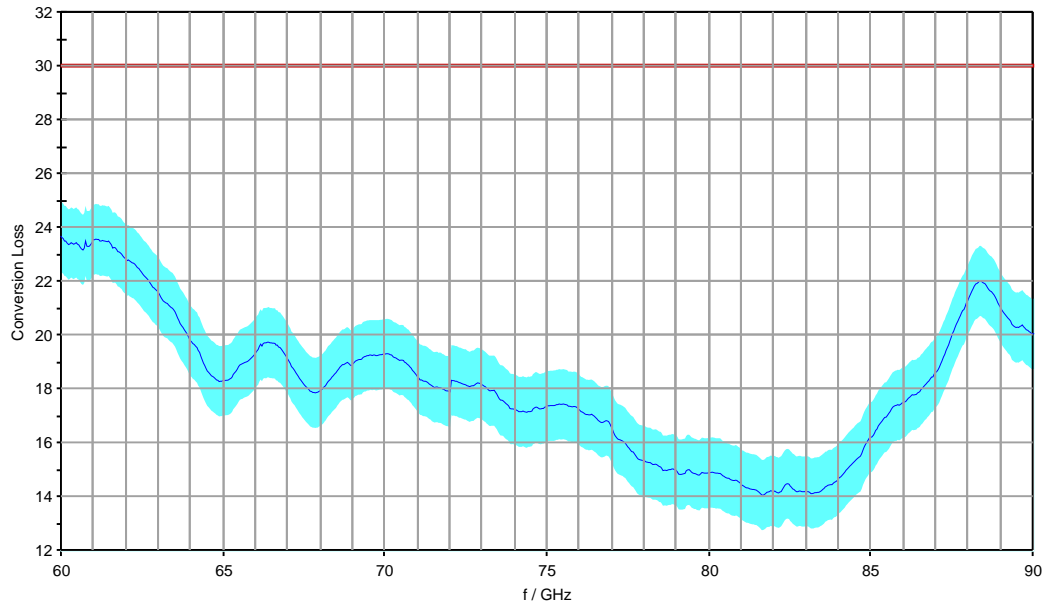
1.2 Conversion Loss (IF = 729 MHz)

IF = 729 MHz, 6. Harmonic



1.3 Conversion Loss (IF = 1330 MHz)

IF = 1330 MHz, 6. Harmonic



1.4 Continuity response within 1 GHz

Continuity response within any 1 GHz Band, 6. Harmonic

| | DUL /dB | Continuity /dB |
|-------------------------|------------|-------------------|
| max. at IF = 404.4 MHz: | 6.0 | 2.86 |
| max. at IF = 729 MHz: | 6.0 | 3.03 |
| max. at IF = 1330 MHz: | 6.0 | 2.83 |

Incoming Results

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Explanation of charts

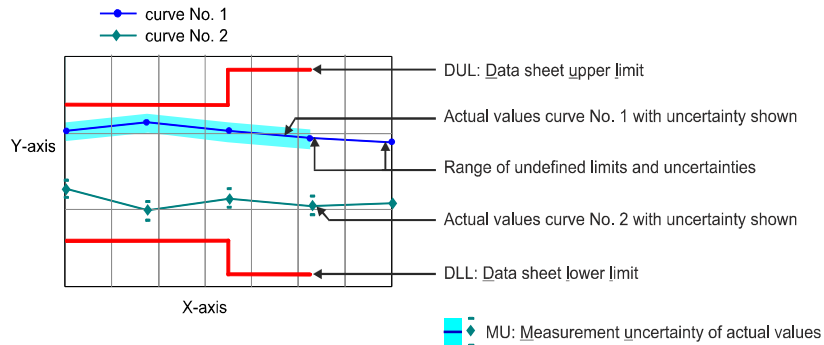


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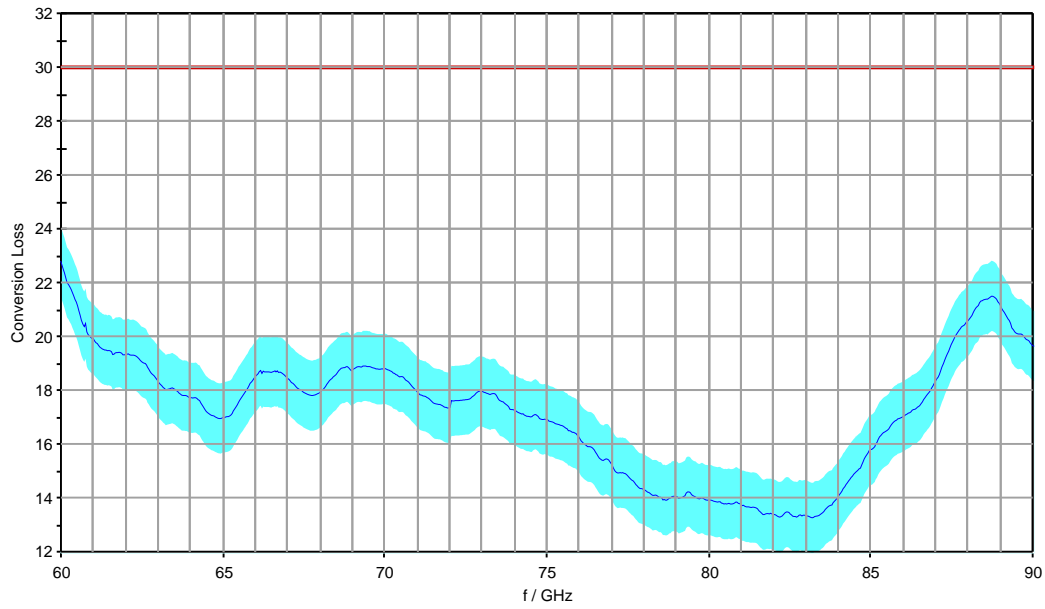
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1. Conversion Loss (6. Harmonic)

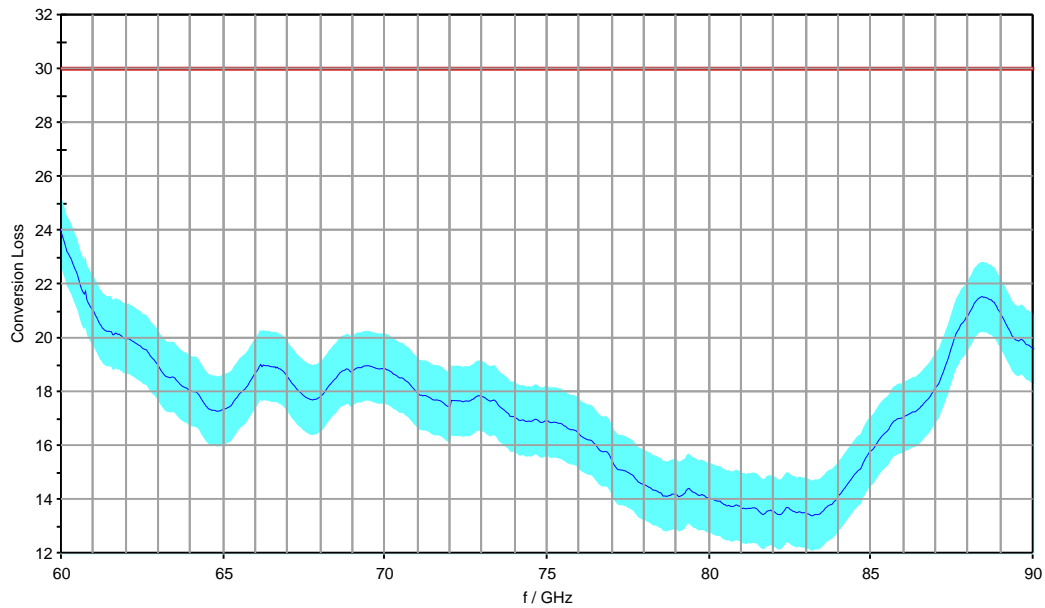
1.1 Conversion Loss (IF = 404.4 MHz)

IF = 404.4 MHz, 6. Harmonic



1.2 Conversion Loss (IF = 729 MHz)

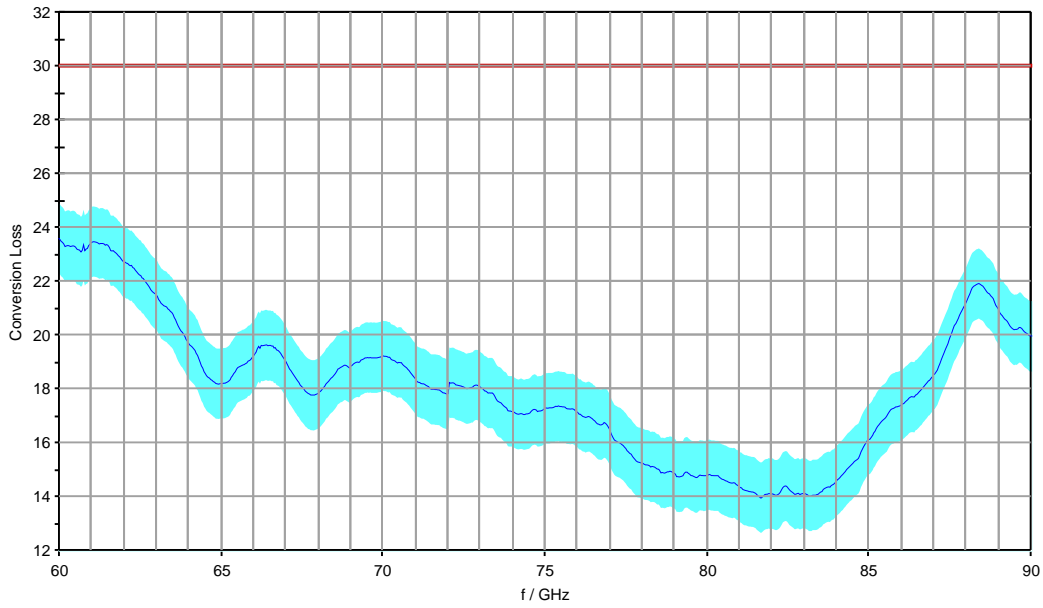
IF = 729 MHz, 6. Harmonic



Incoming Results

1.3 Conversion Loss (IF = 1330 MHz)

IF = 1330 MHz, 6. Harmonic



1.4 Continuity response within 1 GHz

Continuity response within any 1 GHz Band, 6. Harmonic

| | DUL /dB | Continuity /dB |
|-------------------------|---------|----------------|
| max. at IF = 404.4 MHz: | 6.0 | 2.87 |
| max. at IF = 729 MHz: | 6.0 | 2.97 |
| max. at IF = 1330 MHz: | 6.0 | 2.83 |

Incoming Results