DAkkS
Deutsche
Akkreditierungsstelle

Accreditation

The Deutsche Akkreditierungsstelle attests with this **Accreditation Certificate** that the calibration laboratory

Rohde & Schwarz Meßgerätebau GmbH
Mühldorfstraße 15, 81671 München

meets the requirements according to DIN EN ISO/IEC 17025:2018 for the conformity assessment activities listed in the annex to this certificate. This includes additional existing legal and normative requirements for the calibration laboratory, including those in relevant sectoral schemes, provided they are explicitly confirmed in the annex to this certificate.

The management system requirements of DIN EN ISO/IEC 17025 are written in the language relevant to the operations of calibration laboratories and confirm generally to the principles of DIN EN ISO 9001.

This accreditation was issued in accordance with Art. 5 Para. 1 Sentence 2 of Regulation (EC) 765/2008, after an accreditation procedure was carried out in compliance with the minimum requirements of DIN EN ISO/IEC 17011 and on the basis of a review and decision of the appointed accreditation committees.

This accreditation certificate only applies in connection with the notices of 23.07.2024 with accreditation number D-K-15195-01.
It consists of this cover sheet, the reverse side of the cover sheet and the following annex with a total of 51 pages.

Registration number of the accreditation certificate: **D-K-15195-01-00**

Berlin, 23.07.2024 Dr. Florian Witt
Head of Technical Unit

Translation issued: 23.07.2024 Dr. Florian Witt
Head of Technical Unit

The certificate together with the annex reflects the status as indicated by the date of issue. The current status of any given scope of accreditation can be found in the directory of accredited bodies maintained by Deutsche Akkreditierungsstelle GmbH (www.dakks.de).

This document is a translation. The definitive version is the original German accreditation certificate.

See notes overleaf

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The Deutsche Akkreditierungsstelle GmbH (DAkkS) is the entrusted national accreditation body of the Federal Republic of Germany according to § 8 section 1 AkkStelleG in conjunction with § 1 section 1 AkkStelleGBV. DAkkS is designated as the national accreditation authority by Germany according to Art. 4 Para. 4 of Regulation (EC) 765/2008 and clause 4.7 of DIN EN ISO/IEC 17000.

Pursuant to Art. 11 section 2 of Regulation (EC) 765/2008, the accreditation certificate shall be recognised as equivalent by the national authorities within the scope of this Regulation as well as by the WTO member states that have committed themselves in bilateral or multilateral mutual agreements to recognise the certificates of accreditation bodies that are members of ILAC or IAF as equivalent.

DAkkS is a signatory to the multilateral agreements for mutual recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Co-operation (ILAC).

The up-to-date state of membership can be retrieved from the following websites:
EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.nu

Deutsche Akkreditierungsstelle

Annex to the Accreditation Certificate D-K-15195-01-00 according to DIN EN ISO/IEC 17025:2018

Valid from: **23.07.2024**

Date of issue: 23.07.2024

Holder of accreditation certificate:

Rohde & Schwarz Meßgerätebau GmbH
Mühldorfstraße 15, 81671 München

with the locations

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The calibration laboratory meets the requirements of DIN EN ISO/IEC 17025:2018 to carry out the conformity assessment activities listed in this annex. The calibration laboratory meets additional legal and normative requirements, if applicable, including those in relevant sectoral schemes, provided that these are explicitly confirmed below.

The management system requirements of DIN EN ISO/IEC 17025 are written in the language relevant to the operations of calibration laboratories and they conform to the general to the principles of DIN EN ISO 9001.

This certificate annex is only valid together with the written accreditation certificate and reflects the status as indicated by the date of issue. The current status of any given scope of accreditation can be found in the directory of accredited bodies maintained by Deutsche Akkreditierungsstelle GmbH at https://www.dakks.de.

Calibration in the fields:

Electrical quantities

DC and low frequency quantities

- **DC voltage** [a)]
- **AC voltage** [a)]
- **DC current** [a)]
- **AC current** [a)]
- **DC resistance** [a)]
- **AC/DC Transfer**
- **Capacitance** [a)]

Time and frequency

- **Time interval** [a)]
- **Frequency** [a)]

High frequency quantities

- **HF voltage** [a)]
- **HF power** [a)]
- **HF attenuation** [a)]
- **HF impedance** [a)]
- **Scattering quantities** [a)]
- **HF noise**
- **Waveform quantities** [a)]
- **Modulation quantities** [a)]
- **Antenna quantities** [a)]
- **Rise Time** [a)]

[a)] **also on-site calibration and mobile laboratory**

Permanent Laboratory, Location Memmingen

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
DC voltage Sources, Measuring instruments	1.018 V 10 V		$2 \cdot 10^{-6} \cdot U$ $1 \cdot 10^{-6} \cdot U$	*U*: Measured value
	0 V to 500 V > 500 V to 1 kV		$10 \cdot 10^{-6} \cdot U + 1\ \mu V$ $10 \cdot 10^{-6} \cdot U$	
DC current Measuring instruments	0 µA to 10 µA > 10 µA to 220 mA > 220 mA to 2.2 A		1 nA $0.1 \cdot 10^{-3} \cdot I$ $0.14 \cdot 10^{-3} \cdot I$	*I*: Measured value
Sources	0 µA to 10 µA > 10 µA to 100 mA > 100 mA to 60 A		1 nA $0.1 \cdot 10^{-3} \cdot I$ $0.2 \cdot 10^{-3} \cdot I$	
DC resistance Resistance, measuring instruments	0 Ω to 100 kΩ > 100 kΩ to 1 MΩ > 1 MΩ to 10 MΩ > 10 MΩ to 100 MΩ > 100 MΩ to 1 GΩ		$15 \cdot 10^{-6} \cdot R + 60\ \mu\Omega$ $20 \cdot 10^{-6} \cdot R + 2\ \Omega$ $60 \cdot 10^{-6} \cdot R + 0.1\ k\Omega$ $0.6 \cdot 10^{-3} \cdot R$ $5.1 \cdot 10^{-3} \cdot R$	*R*: Measured value
AC voltage Measuring instruments	1 mV to 220 V	10 Hz to < 20 Hz 20 Hz to 20 kHz > 20 kHz to 50 kHz > 50 kHz to 100 kHz	$0.40 \cdot 10^{-3} \cdot U + 8\ \mu V$ $0.21 \cdot 10^{-3} \cdot U + 2\ \mu V$ $0.20 \cdot 10^{-3} \cdot U + 2\ \mu V$ $0.50 \cdot 10^{-3} \cdot U + 2\ \mu V$	*U*: Measured value
	1 mV to 22 V	> 100 kHz to 300 kHz > 300 kHz to 500 kHz > 500 kHz to 1 MHz	$1.0 \cdot 10^{-3} \cdot U + 18\ \mu V$ $1.8 \cdot 10^{-3} \cdot U + 20\ \mu V$ $4.0 \cdot 10^{-3} \cdot U + 20\ \mu V$	
	> 22 V to Umax	> 100 kHz to 300 kHz > 300 kHz to 500 kHz > 500 kHz to 1 MHz	$1.0 \cdot 10^{-3} \cdot U + 16$ mV $5.0 \cdot 10^{-3} \cdot U + 30$ mV $8.0 \cdot 10^{-3} \cdot U + 80$ mV	Umax = $22\ 10^{6} \cdot$ V Hz/ f[Hz]
	> 220 V to 1 kV	15 Hz to 50 Hz > 50 Hz to 1 kHz	$0.40 \cdot 10^{-3} \cdot U + 2.5$ mV $0.11 \cdot 10^{-3} \cdot U + 2.5$ mV	
	1 mV to 3.5 V	10 Hz to 30 Hz > 30 Hz to 120 Hz > 120 Hz to 120 kHz > 120 kHz to 2 MHz > 2 MHz to 10 MHz > 10 MHz to 20 MHz > 20 MHz to 30 MHz > 30 MHz to 50 MHz	$3.3 \cdot 10^{-3} \cdot U + 3\ \mu V$ $1.6 \cdot 10^{-3} \cdot U + 3\ \mu V$ $1.3 \cdot 10^{-3} \cdot U + 3\ \mu V$ $1.5 \cdot 10^{-3} \cdot U + 3\ \mu V$ $3.5 \cdot 10^{-3} \cdot U + 3\ \mu V$ $11.0 \cdot 10^{-3} \cdot U + 3\ \mu V$ $25.0 \cdot 10^{-3} \cdot U + 15\ \mu V$ $40{,}0 \cdot 10^{-3} \cdot U + 15\ \mu V$	Voltage at 50 Ω
Sources	1 mV to 10 mV	10 Hz to 20 kHz > 20 kHz to 50 kHz > 50 kHz to 100 kHz > 100 kHz to 1 MHz	$0.5 \cdot 10^{-3} \cdot U + 4\ \mu V$ $0.8 \cdot 10^{-3} \cdot U + 4\ \mu V$ $5.0 \cdot 10^{-3} \cdot U + 4\ \mu V$ $12.0 \cdot 10^{-3} \cdot U + 10\ \mu V$	

Permanent Laboratory, Location Memmingen

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
AC voltage Sources	> 10 mV to 100 V	10 Hz to 20 kHz > 20 kHz to 50 kHz > 50 kHz to 100 kHz > 100 kHz to 300 kHz > 300 kHz to 1 MHz	$0.5 \cdot 10^{-3} \cdot U + 2\ \mu V$ $0.5 \cdot 10^{-3} \cdot U + 2\ \mu V$ $1.4 \cdot 10^{-3} \cdot U + 2\ \mu V$ $4.0 \cdot 10^{-3} \cdot U + 2\ \mu V$ $11.0 \cdot 10^{-3} \cdot U + 10\ \mu V$	*U*: Measured value
	> 100 V to 700 V	10 Hz to 20 Hz > 20 Hz to 50 kHz > 50 kHz to 100 kHz	$0.8 \cdot 10^{-3} \cdot U + 2\ mV$ $1.4 \cdot 10^{-3} \cdot U + 2\ mV$ $3.2 \cdot 10^{-3} \cdot U + 2\ mV$	
AC current Measuring instruments	100 µA to 220 µA	10 Hz to 20 Hz > 20 Hz to 1 kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz	$0.3 \cdot 10^{-3} \cdot I + 16\ nA$ $0.2 \cdot 10^{-3} \cdot I + 10\ nA$ $0.3 \cdot 10^{-3} \cdot I + 12\ nA$ $1.1 \cdot 10^{-3} \cdot I + 0.1\ \mu A$	*I*: Measured value
	> 220 µA to 2.2 mA	10 Hz to 20 Hz > 20 Hz to 1 kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz	$0.3 \cdot 10^{-3} \cdot I + 40\ nA$ $0.2 \cdot 10^{-3} \cdot I + 35\ nA$ $0.22 \cdot 10^{-3} \cdot I + 110\ nA$ $1.2 \cdot 10^{-3} \cdot I + 1\ \mu A$	
	> 2.2 mA to 22 mA	10 Hz to 20 Hz > 20 Hz to 1 kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz	$0.3 \cdot 10^{-3} \cdot I + 400\ nA$ $0.2 \cdot 10^{-3} \cdot I + 350\ nA$ $0.22 \cdot 10^{-3} \cdot I + 550\ nA$ $1.2 \cdot 10^{-3} \cdot I + 5\ \mu A$	
	> 22 mA to 220 mA	10 Hz to 20 Hz > 20 Hz to 1 kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz	$0.3 \cdot 10^{-3} \cdot I + 4\ \mu A$ $0.2 \cdot 10^{-3} \cdot I + 3.5\ \mu A$ $0.22 \cdot 10^{-3} \cdot I + 3.5\ \mu A$ $1.2 \cdot 10^{-3} \cdot I + 10\ \mu A$	
	> 220 mA to 2.2 A	20 Hz to 1 kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz	$0.2 \cdot 10^{-3} \cdot I + 35\ \mu A$ $0.47 \cdot 10^{-3} \cdot I + 80\ \mu A$ $7.1 \cdot 10^{-3} \cdot I + 160\ \mu A$	
	> 2.2 A to < 3 A	10 Hz to 45 Hz > 45 Hz to 1 kHz > 1kHz to 5 kHz > 5 kHz to 10 kHz	$2 \cdot 10^{-3} \cdot I + 100\ \mu A$ $0.7 \cdot 10^{-3} \cdot I + 100\ \mu A$ $6.6 \cdot 10^{-3} \cdot I + 1\ mA$ $28 \cdot 10^{-3} \cdot I + 5\ mA$	
	3 A to < 11 A	45 Hz to 100 Hz > 100 Hz to 1 kHz > 1 kHz to 5 kHz	$0.7 \cdot 10^{-3} \cdot I + 2\ mA$ $1.1 \quad 10^{-3} \cdot I + 2\ mA$ $0.3 \cdot 10^{-3} \cdot I + 16\ nA$	
Sources	100 µA to 1.2 mA	10 Hz to 20 Hz > 20 Hz to 45 Hz > 45 Hz to 10 kHz	$6.0 \cdot 10^{-3} \cdot I + 0.1\ \mu A$ $3.5 \cdot 10^{-3} \cdot I + 0.1\ \mu A$ $2.6 \cdot 10^{-3} \cdot I + 0.1\ \mu A$	

Permanent Laboratory, Location Memmingen

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
AC current Sources	> 1.2 mA to 120 mA	> 10 Hz to 20 Hz > 20 Hz to 45 Hz > 45 Hz to 10 kHz	$6.0 \cdot 10^{-3} \cdot I + 1\ \mu A$ $3.2 \cdot 10^{-3} \cdot I + 1\ \mu A$ $2.3 \cdot 10^{-3} \cdot I + 1\ \mu A$	I: Measured value
	> 120 mA to 1 A	10 Hz to 20 Hz > 20 Hz to 45 Hz > 45 Hz to 5 kHz > 5 kHz to 10 kHz	$6.0 \cdot 10^{-3} \cdot I + 1\ \mu A$ $3.3 \cdot 10^{-3} \cdot I + 1\ \mu A$ $2.7 \cdot 10^{-3} \cdot I + 1\ \mu A$ $4.7 \cdot 10^{-3} \cdot I + 1\ \mu A$	
Frequency Oscillators Measuring instruments	0.1 MHz 1 MHz 5 MHz 10 MHz		$5 \cdot 10^{-12} \cdot f$	f: Measured value U_{TRIG}: Trigger-uncertainty
	0.1 mHz to 110 GHz		$\sqrt{(1 \cdot 10^{-10} \cdot f)^2 + U_{\mathrm{TRIG}}^2}$	
Time interval	1 ns to 100 s		$\sqrt{(1\ \mathrm{ns})^2 + (1 \cdot 10^{-10} \cdot t)^2 + U_{\mathrm{TRIG}}^2}$	t: Measured value
HF-Power Sources with mismatch correction	100 µW to 10 mW	> DC to 1 MHz > 1 MHz to 50 MHz > 50 MHz to 100 MHz > 100 MHz to 2.5 GHz 2.5 GHz to 8 GHz > 8 GHz to 12.4 GHz > 12.4 GHz to 18 GHz 18 GHz to 26.5 GHz 26.5 GHz to 40 GHz 40 GHz to 50 GHz 50 GHz to 67 GHz > 67 GHz to 75 GHz 75 GHz to 95 GHz > 95 GHz to 110 GHz	$1.8 \cdot 10^{-3} \cdot P$ $2.3 \cdot 10^{-3} \cdot P$ $2.5 \cdot 10^{-3} \cdot P$ $4.0 \cdot 10^{-3} \cdot P$ $6.0 \cdot 10^{-3} \cdot P$ $7.7 \cdot 10^{-3} \cdot P$ $10 \cdot 10^{-3} \cdot P$ $5.3 \cdot 10^{-3} \cdot P$ $5.6 \cdot 10^{-3} \cdot P$ $15 \cdot 10^{-3} \cdot P$ $29 \cdot 10^{-3} \cdot P$ $32 \cdot 10^{-3} \cdot P$ $32 \cdot 10^{-3} \cdot P$ $33 \cdot 10^{-3} \cdot P$	P: Measured value PC Type-N[2)] to 18 GHz WG R220[2)] WG R320[2)] WG R400[2)] WG R620[2)] WG R620[2)] WG: R900[2)] WG: R900[2)]
HF-Power Sensors with mismatch correction	100 nW to 10 µW	> DC to 100 MHz > 100 MHz to 2.5 GHz > 2.5 GHz to 4 GHz > 4 GHz to 8 GHz > 8 GHz to 12.4 GHz > 12.4 GHz to 18 GHz > 18 GHz to 26.5 GHz > 26.5 GHz to 40 GHz	$5.8 \cdot 10^{-3} \cdot P$ $7.0 \cdot 10^{-3} \cdot P$ $8.0 \cdot 10^{-3} \cdot P$ $10 \cdot 10^{-3} \cdot P$ $13 \cdot 10^{-3} \cdot P$ $15 \cdot 10^{-3} \cdot P$ $15 \cdot 10^{-3} \cdot P$ $19 \cdot 10^{-3} \cdot P$	P: Measured value PC Type-N[2)] to 18 GHz PC-3.5[2)] to 33 GHz PC-2.92[2)] to 40 GHz PC-2.4[2)] to 50 GHz PC-1.85[2)] to 67 GHz PC-1.00[2)] to 110 GHz

Permanent Laboratory, Location Memmingen

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
HF-Power Sensors with mismatch correction	10 µW to 200 mW	> DC to 1 MHz	$3.0 \cdot 10^{-3} \cdot P$	*P*: Measured value
		> 1 MHz to 100 MHz	$3.4 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 2.5 GHz	$5.1 \cdot 10^{-3} \cdot P$	
		2.5 GHz to 8 GHz	$6.8 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 12.4 GHz	$8.4 \cdot 10^{-3} \cdot P$	
		> 12.4 GHz to 18 GHz	$11 \cdot 10^{-3} \cdot P$	
		> 18 GHz to 26.5 GHz	$14 \cdot 10^{-3} \cdot P$	
		> 26.5 GHz to 40 GHz	$17 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$21 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$33 \cdot 10^{-3} \cdot P$	
	10 µW to 125 mW	> 67 GHz to 75 GHz	$37 \cdot 10^{-3} \cdot P$	
		> 75 GHz to 95 GHz	$41 \cdot 10^{-3} \cdot P$	
		> 95 GHz to 110 GHz	$43 \cdot 10^{-3} \cdot P$	
HF-Power Sources. Measuring instruments with mismatch correction	0.2 fW to < 10 pW	> DC to 8 GHz	$21 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 20 GHz	$24 \cdot 10^{-3} \cdot P$	
	1 fW to < 10 pW	> 20 GHz to 40 GHz	$29 \cdot 10^{-3} \cdot P$	
	10 fW to < 10 pW	> 40 GHz to 50 GHz	$43 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$49 \cdot 10^{-3} \cdot P$	
	10 pW to < 100 nW	> DC to 100 MHz	$15 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 8 GHz	$17 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 20 GHz	$20 \cdot 10^{-3} \cdot P$	
		> 20 GHz to 40 GHz	$26 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$34 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$43 \cdot 10^{-3} \cdot P$	
	100 pW to < 100 uW	> 67 GHz to 75 GHz	$45 \cdot 10^{-3} \cdot P$	
		> 75 GHz to 95 GHz	$47 \cdot 10^{-3} \cdot P$	
		> 95 GHz to 110 GHz	$49 \cdot 10^{-3} \cdot P$	
	100 nW to 200 mW	> DC to 100 MHz	$10 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 8 GHz	$13 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 18 GHz	$16 \cdot 10^{-3} \cdot P$	
		> 18 GHz to 26.5 GHz	$23 \cdot 10^{-3} \cdot P$	
		> 26.5 GHz to 40 GHz	$23 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$30 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$35 \cdot 10^{-3} \cdot P$	
	100 µW to 125 mW	> 67 GHz to 75 GHz	$40 \cdot 10^{-3} \cdot P$	
		> 75 GHz to 95 GHz	$42 \cdot 10^{-3} \cdot P$	
		> 95 GHz to 110 GHz	$44 \cdot 10^{-3} \cdot P$	
without mismatch correction	> 200 mW to 20 W	> DC to 100 MHz	$11 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 4 GHz	$14 \cdot 10^{-3} \cdot P$	
	> 200 mW to 4 W	> 4 GHz to 8 GHz	$15 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 12.5 GHz	$19 \cdot 10^{-3} \cdot P$	
		> 12.5 GHz to 18 GHz	$23 \cdot 10^{-3} \cdot P$	

Permanent Laboratory, Location Memmingen

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
HF-Power	> 200 mW to 2 W	> 18 GHz to 26.5 GHz	$25 \cdot 10^{-3} \cdot P$	
Sources, Measuring	> 200 mW to 1 W	> 26.5 GHz to 40 GHz	$31 \cdot 10^{-3} \cdot P$	
instruments	> 20 W to 2 kW	> DC to 1 GHz	$24 \cdot 10^{-3} \cdot P$	
Display Linearity,	0 dB to 21 dB	> DC to 40 GHz	0.003 dB	*A*: Measured value
Tuned HF Power,	> 21 dB to 111 dB	> DC to 40 GHz	0.003 dB + 0.0002 · *A*	
Attenuation	> 111 dB to 121 dB	> DC to 40 GHz	0.03 dB	
	0 dB to 11 dB	> 40 GHz to 67 GHz	0.005 dB	
	> 11 dB to 111 dB	> 40 GHz to 67 GHz	0.005 dB + 0.0004 · *A*	
	0 dB to 21 dB	75 GHz	0.005 dB	
	0 dB to 60 dB	> 67 GHz to 110 GHz	0.03 dB + 0.001 · *A*	
	> 60 dB to 80 dB	> 67 GHz to 110 GHz	0.6 dB	
	> 80 dB to 90 dB	> 67 GHz to 110 GHz	1.8 dB	
	0 dB to 10 dB	65 GHz to < 70 GHz	0.11 dB	Free space attenuation
	0 dB to 10 dB	70 GHz to 85 GHz	0.10 dB	
HF-Transmission	- 180 ° to 180 °	> DC to 100 MHz	0.5 °	Depending on attenuation value
Phase angle φ		> 100 MHz to 10 GHz	0.7 °	
		> 10 GHz to 20 GHz	1.0 °	
		> 20 GHz to 40 GHz	1.8 °	
		> 40 GHz to 67 GHz	2.0 °	
		> 67 GHz to 110 GHz	3.0 °	
HF-Impedance	0.0 to 0.4	> DC to 10 GHz	0.0034	PC Type-N[2)]
Reflection factor	> 0.4 to 1.0	> DC to 10 GHz	$0.0015 + 0.005 \cdot \lvert\Gamma\rvert$	$\lvert\Gamma\rvert$: Magnitude of complex reflection Factor
	0.0 to 0.4	> 10 GHz to 18 GHz	0.0034	
	> 0.4 to 1.0	> 10 GHz to 18 GHz	$0.01 \cdot \lvert\Gamma\rvert$	
	0.0 to 0.4	> 18 GHz to 33 GHz	0.0065	PC-3.5[2)]
	> 0.4 to 1.0	> 18 GHz to 33 GHz	$0.001 + 0.013 \cdot \lvert\Gamma\rvert$	
	0.0 to 0.4	> 33 GHz to 40 GHz	0.011	PC-2.92[2)]
	> 0.4 to 1.0	> 33 GHz to 40 GHz	$0.005 + 0.016 \cdot \lvert\Gamma\rvert$	
	0.0 to 1.0	> DC to 2 GHz	$0.0035 + 0.0042 \cdot \lvert\Gamma\rvert^2$	PC-2.4[2)] . PC-1.85[2)]
		> 2 GHz to 10 GHz	$0.0037 + 0.0050 \cdot \lvert\Gamma\rvert^2$	
		> 10 GHz to 20 GHz	$0.0042 + 0.0069 \cdot \lvert\Gamma\rvert^2$	
		> 20 GHz to 30 GHz	$0.0055 + 0.0101 \cdot \lvert\Gamma\rvert^2$	
		> 30 GHz to 40 GHz	$0.0067 + 0.0120 \cdot \lvert\Gamma\rvert^2$	
		> 40 GHz to 50 GHz	$0.0085 + 0.0151 \cdot \lvert\Gamma\rvert^2$	
		> 50 GHz to 67 GHz	$0.0113 + 0.0183 \cdot \lvert\Gamma\rvert^2$	
	0.0 to 1.0	> DC to 2 GHz	$0.0036 + 0.0049 \cdot \lvert\Gamma\rvert^2$	PC-1.00[2)]
		> 2 GHz to 10 GHz	$0.0036 + 0.0052 \cdot \lvert\Gamma\rvert^2$	
		> 10 GHz to 20 GHz	$0.0041 + 0.0068 \cdot \lvert\Gamma\rvert^2$	
		> 20 GHz to 30 GHz	$0.0049 + 0.0095 \cdot \lvert\Gamma\rvert^2$	
		> 30 GHz to 40 GHz	$0.0056 + 0.0117 \cdot \lvert\Gamma\rvert^2$	
		> 40 GHz to 50 GHz	$0.0063 + 0.0131 \cdot \lvert\Gamma\rvert^2$	
		> 50 GHz to 67 GHz	$0.0074 + 0.0173 \cdot \lvert\Gamma\rvert^2$	
		> 67 GHz to 90 GHz	$0.0093 + 0.0213 \cdot \lvert\Gamma\rvert^2$	
		> 90 GHz to 110 GHz	$0.0122 + 0.0280 \cdot \lvert\Gamma\rvert^2$	
		> 110 GHz bis 114 GHz	$0.0142 + 0.0331 \cdot \lvert\Gamma\rvert^2$	

Permanent Laboratory, Location Memmingen

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
HF-Impedance Reflection factor	0.0 to 1.0	50 GHz to 75 GHz	$0.01 + 0.008 \cdot \lvert\Gamma\rvert$	Connector: R620
		60 GHz to 90 GHz	$0.01 + 0.008 \cdot \lvert\Gamma\rvert$	Connector: R740
		75 GHz to 110 GHz	$0.01 + 0.008 \cdot \lvert\Gamma\rvert$	Connector: R900
	0.0 to 0.6	65 GHz to < 70 GHz	0.027	Free space impedance
	> 0.6 to 1.0	65 GHz to < 70 GHz	0.032	
	0.0 to 0.6	70 GHz to 85 GHz	0.026	
	> 0.6 to 1.0	70 GHz to 85 GHz	0.029	
HF-Impedance Phase angle	- 180 ° to 180 °	> DC to 110 GHz	$U_S \cdot 180\,°/\pi$	$U_S = \arcsin(U/\lvert\Gamma\rvert)$ *U*: Uncertainty of reflection factor
Modulation quantities	0.0 to 1.0	> DC f_m ≤ 100 kHz	$0.001 \cdot m + K$	*m*: Measurement value
Amplitude modulation		100 kHz < f_m ≤ 1 MHz	$0.002 \cdot m + K$	f_{HF} = Carrier frequency
Modulation degree *m*		1 MHz < f_m ≤ 10 MHz	$0.007 \cdot m + K$	f_m = modulation freq. $f_{HF} > 5 \cdot f_m$ [3]
Frequency modulation	10 Hz to 16 MHz	10 Hz < f_m ≤ 100 kHz	$1 \cdot 10^{-3} \cdot \Delta f + K$	Δf: Measurement value
Frequency deviation Δf		100 kHz < f_m ≤ 200 kHz	$2 \cdot 10^{-3} \cdot \Delta f + K$	$f_{HF} > 5 \cdot (f_m + \Delta f)$ [3]
		200 kHz < f_m ≤ 10 MHz	$5 \cdot 10^{-3} \cdot \Delta f + K$	
Phase modulation	(10 Hz/ f_m) rad to (16 MHz/ f_m) rad	10 Hz < f_m ≤ 100 kHz	$1 \cdot 10^{-3} \cdot \Delta\phi + K$	$\Delta\phi$: Measurement value
Phase deviation $\Delta\phi$		100 kHz < f_m ≤ 200 kHz	$2 \cdot 10^{-3} \cdot \Delta\phi + K$	$f_{HF} > 5 \cdot f_m$ [3]
		200 kHz < f_m ≤ 10 MHz	$5 \cdot 10^{-3} \cdot \Delta\phi + K$	
Waveform quantities	7 ps to 15 ps	Voltage range dependent on rise-time	4 ps	t: Measurement value
Rise time	> 15 ps to 25 ps		3 ps	
	> 25 ps to 100 ns		$40 \cdot 10^{-3} \cdot t + 2$ ps	
Pulse spectrum	0.1 µVs to 50 µVs	9 kHz to 150 kHz	$25 \cdot 10^{-3} \cdot IS$	*IS*: Measurement value
Cispr 16-1-1:2019	3 nVs to 1 µVs	150 kHz to 30 MHz	$25 \cdot 10^{-3} \cdot IS$	
	0.4 nVs to 200 nVs	30 MHz to 1 GHz	$27 \cdot 10^{-3} \cdot IS$	
Antenna factor	Depending on antenna	20 MHz to 1 GHz	0.45 dB	with ground reflection
3-Antenna method Free-field		20 MHz to < 10 GHz	0.35 dB	without ground reflection
		10 GHz to 18 GHz	0.40 dB	
		20 MHz to < 2 GHz	0.40 dB	SAE ARP958:1999
		2 GHz to 18 GHz	0.55 dB	1 m distance
Full absorber facility		20 MHz to 18 GHz	0.60 dB	
Antenna factor (ECSM)	Depending on antenna	9 kHz to 30 MHz CISPR 16-1-6:2022	1.2 dB	monopole antennas ECSM procedure
Antenna factor				loop antennas standard field procedure

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Phase noise	> -77 dBc/Hz [a]	1 Hz [b]	1.5 dB	Carrier frequency:
Oscillators	-85 Bc/Hz to -77dBc/Hz	1 Hz	2.5 dB	100 MHz to 500 MHz
Measuring instruments	> -92 dBc/Hz	3 Hz to 10 Hz	1.5 dB	
	-100 dBc/Hz to -92 dBc/Hz	3 Hz to 10 Hz	2.5 dB	[a] Phase noise to
	> -106 dBc/Hz	10 Hz to 100 Hz	1.5 dB	Carrier level in dBc/Hz
	-114 dBc/Hz to -106 dBc/Hz	10 Hz to 100 Hz	2.5 dB	
	> -136 dBc/Hz	100 Hz to 1 kHz	1.5 dB	[b] Offset frequency
	-146 dBc/Hz to -136 dBc/Hz	100 Hz to 1 kHz	2.5 dB	to carrier frequency
	> -160 dBc/Hz	1 kHz to 10 kHz	1.5 dB	
	-168 dBc/Hz to -160 dBc/Hz	1 kHz to 10 kHz	2.5 dB	
	> -167 dBc/Hz	10 kHz to 100 kHz	1.5 dB	
	-175 dBc/Hz to -167 dBc/Hz	10 kHz to 100 kHz	2.5 dB	
	> -174 dBc/Hz	100 kHz to 1 MHz	1.5 dB	
	-182 dBc/Hz to -174 dBc/Hz	100 kHz to 1 MHz	2.5 dB	
	> -186 dBc/Hz	1 MHz to 10 MHz	1.5 dB	
	-192 dBc/Hz to -186 dBc/Hz	1 MHz to 10 MHz	2.5 dB	
	> -64 dBc/Hz	1 Hz	1.5 dB	Carrier frequency
	-73 dBc/Hz to -64 dBc/Hz	1 Hz	2.5 dB	500 MHz to 1 GHz
	> -82 dBc/Hz	3 Hz to 10 Hz	1.5 dB	
	-90 dBc/Hz to -82 dBc/Hz	3 Hz to 10 Hz	2.5 dB	
	> -95 dBc/Hz	10 Hz to 100 Hz	1.5 dB	
	-103 dBc/Hz to -95 dBc/Hz	10 Hz to 100 Hz	2.5 dB	
	> -123 dBc/Hz	100 Hz to 1 kHz	1.5 dB	
	-131 dBc/Hz to -123 dBc/Hz	100 Hz to 1 kHz	2.5 dB	
	> -153 dBc/Hz	1 kHz to 10 kHz	1.5 dB	
	-161 dBc/Hz to -153 dBc/Hz	1 kHz to 10 kHz	2.5 dB	
	> -170 dBc/Hz	10 kHz to 100 kHz	1.5 dB	
	-178 dBc/Hz to -170 dBc/Hz	10 kHz to 100 kHz	2.5 dB	
	> -172 dBc/Hz	100 kHz to 1 MHz	1.5 dB	
	-180 dBc/Hz to -172 dBc/Hz	100 kHz to 1 MHz	2.5 dB	
	> -172 dBc/Hz	1 MHz to 10 MHz	1.5 dB	
	-180 dBc/Hz to -172 dBc/Hz	1 MHz to 10 MHz	2.5 dB	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Phase noise Oscillators Measuring instruments	> -55 dBc/Hz	1 Hz	1.5 dB	Carrier frequency: 1 GHz to 3 GHz
	-67 dBc/Hz to -55 dBc/Hz	1 Hz	2.5 dB	
	> -67 dBc/Hz	3 Hz to 10 Hz	1.5 dB	
	-93 dBc/Hz to -85 dBc/Hz	10 Hz to 100 Hz	2.5 dB	
	> -114 dBc/Hz	100 Hz to 1 kHz	1.5 dB	
	-122 dBc/Hz to -114 dBc/Hz	100 Hz to 1 kHz	2.5 dB	
	> -146 dBc/Hz	1 kHz to 10 kHz	1.5 dB	
	-155 dBc/Hz to -146 dBc/Hz	1 kHz to 10 kHz	2.5 dB	
	> -166 dBc/Hz	10 kHz to 100 kHz	1.5 dB	
	-174 dBc/Hz to -166 dBc/Hz	10 kHz to 100 kHz	2.5 dB	
	> -168 dBc/Hz	100 kHz to 1 MHz	1.5 dB	
	-176 dBc/Hz to -168 dBc/Hz	100 kHz to 1 MHz	2.5 dB	
	> -168 dBc/Hz	1 MHz to 10MHz	1.5 dB	
	-76 dBc/Hz to -168 dBc/Hz	1 MHz to 10 MHz	2.5 dB	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Phase noise Oscillators Measuring instruments	> -49 dBc/Hz	1 Hz	1.5 dB	Carrier frequency: 3 GHz to 6 GHz
	-57 dBc/Hz to -49 dBc/Hz	1 Hz	2.5 dB	
	> -62 dBc/Hz	3 Hz to 10 Hz	1.5 dB	
	-70 dBc/Hz to -62 dBc/Hz	3 Hz to 10 Hz	2.5 dB	
	> -76 dBc/Hz	10 Hz to 100 Hz	1.5 dB	
	-84 dBc/Hz to -76 dBc/Hz	10 Hz to 100 Hz	2.5 dB	
	> -105 dBc/Hz	100 Hz to 1 kHz	1.5 dB	
	-113 dBc/Hz to -105 dBc/Hz	100 Hz to 1 kHz	2.5 dB	
	> -138 dBc/Hz	1 kHz to 10 kHz	1.5 dB	
	-146 dBc/Hz to -138 dBc/Hz	1 kHz to 10 kHz	2.5 dB	
	> -156 dBc/Hz	10 kHz to 100 kHz	1.5 dB	
	-164 dBc/Hz to -156 dBc/Hz	10 kHz to 100 kHz	2.5 dB	
	> -158 dBc/Hz	100 kHz to 1 MHz	1.5 dB	
	-166 dBc/Hz to -158 dBc/Hz	100 kHz to 1 MHz	2.5 dB	
	> -158 dBc/Hz	1 MHz to 10 MHz	1.5 dB	
	-166 dBc/Hz to -158 dBc/Hz	1 MHz to 10 MHz	2.5 dB	
	> -54 dBc/Hz	1 Hz	1.5 dB	Carrier frequency: 6 GHz to 8 GHz
	-62 dBc/Hz to -54 dBc/Hz	1 Hz	2.5 dB	
	> -68 dBc/Hz	3 Hz to 10 Hz	1.5 dB	
	-76 dBc/Hz to -68 dBc/Hz	3 Hz to 10 Hz	2.5 dB	
	> -95 dBc/Hz	10 Hz to 100 Hz	1.5 dB	
	-103 dBc/Hz to -95 dBc/Hz	10 Hz to 100 Hz	2.5 dB	
	> -122 dBc/Hz	100 Hz to 1 kHz	1.5 dB	
	-130 dBc/Hz to -122 dBc/Hz	100 Hz to 1 kHz	2.5 dB	
	> -138 dBc/Hz	1 kHz to 10 kHz	1.5 dB	
	-146 dBc/Hz to -138 dBc/Hz	1 kHz to 10 kHz	2.5 dB	
	> -142 dBc/Hz	10 kHz to 100 kHz	1.5 dB	
	-146 dBc/Hz to -142 dBc/Hz	10 kHz to 100 kHz	2.5 dB	
	> -142 dBc/Hz	100 kHz to 1 MHz	1.5 dB	
	-150 dBc/Hz to -142 dBc/Hz	100 kHz to 1 MHz	2.5 dB	
	> -142 dBc/Hz	1 MHz to 10 MHz	1.5 dB	
	-150 dBc/Hz to -142 dBc/Hz	1 MHz to 10 MHz	2.5 dB	
Transfer function Amount	20 MHz to 50 GHz	Fourier transform of the impulse response	$2 \cdot 10^{-4} \cdot f$ / GHz + 0.02	f: frequency in GHz
Phase			$3.5 \cdot 10^{-2}$ ° $\cdot f$ / GHz + 0.75 °	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
DC voltage Sources. Measuring instruments	0 V to 500 V > 500 V to 1 kV		$10 \cdot 10^{-6} \cdot U + 1\ \mu V$ $16 \cdot 10^{-6} \cdot U$	*U*: Measured value
DC current Measuring instruments	0 µA to 10 µA > 10 µA to 220 mA > 220 mA to 2.2 A 2.2 A to 3 A > 3 A to 11 A		1 nA $0.1 \cdot 10^{-3} \cdot I$ $0.14 \cdot 10^{-3} \cdot I$ $0.41 \cdot 10^{-3} \cdot I$ $0.55 \cdot 10^{-3} \cdot I$ +500µA	*I*: Measured value
Sources	0 µA to 10 µA > 10 µA to 100 mA > 100 mA to 60 A		1 nA $0.1 \cdot 10^{-3} \cdot I$ $0.2 \cdot 10^{-3} \cdot I$	
DC resistance Resistance, measuring instruments	0 Ω to 100 kΩ > 100 kΩ to 1 MΩ > 1 MΩ to 10 MΩ > 10 MΩ to 100 MΩ > 100 MΩ to 1 GΩ		$15 \cdot 10^{-6} \cdot R + 60\ \mu\Omega$ $15 \cdot 10^{-6} \cdot R + 2\ \Omega$ $50 \cdot 10^{-6} \cdot R + 100\ k\Omega$ $0.6 \cdot 10^{-3} \cdot R$ $5.1 \cdot 10^{-3} \cdot R$	*R*: Measured value
AC voltage Measuring instruments	1 mV to 220 V	10 Hz to < 20 Hz 20 Hz to 20 kHz > 20 kHz to 50 kHz > 50 kHz to 100 kHz	$0.40 \cdot 10^{-3} \cdot U + 8\ \mu V$ $0.21 \cdot 10^{-3} \cdot U + 2\ \mu V$ $0.20 \cdot 10^{-3} \cdot U + 2\ \mu V$ $0.50 \cdot 10^{-3} \cdot U + 2\ \mu V$	*U*: Measured value
	1 mV to 22 V	> 100 kHz to 300 kHz > 300 kHz to 500 kHz > 500 kHz to 1 MHz	$1.0 \cdot 10^{-3} \cdot U + 18\ \mu V$ $1.8 \cdot 10^{-3} \cdot U + 20\ \mu V$ $4.0 \cdot 10^{-3} \cdot U + 20\ \mu V$	
	> 22 V to Umax	> 100 kHz to 300 kHz > 300 kHz to 500 kHz > 500 kHz to 1 MHz	$1.0 \cdot 10^{-3} \cdot U + 16\ mV$ $5.0 \cdot 10^{-3} \cdot U + 30\ mV$ $8.0 \cdot 10^{-3} \cdot U + 80\ mV$	$U_{max} = 22 \cdot 10^6$ V Hz/ f[Hz]
	> 220 V to 1 kV	15 Hz to 50 Hz > 50 Hz to 1 kHz	$0.40 \cdot 10^{-3} \cdot U + 2.5\ mV$ $0.11 \cdot 10^{-3} \cdot U + 2.5\ mV$	
	1 mV to 3.5 V	10 Hz to 30 Hz > 30 Hz to 120 Hz > 120 Hz to 120 kHz > 120 kHz to 2 MHz > 2 MHz to 10 MHz > 10 MHz to 20 MHz > 20 MHz to 30 MHz > 30 MHz to 50 MHz	$3.3 \cdot 10^{-3} \cdot U + 3\ \mu V$ $1.6 \cdot 10^{-3} \cdot U + 3\ \mu V$ $1.3 \cdot 10^{-3} \cdot U + 3\ \mu V$ $1.5 \cdot 10^{-3} \cdot U + 3\ \mu V$ $3.5 \cdot 10^{-3} \cdot U + 3\ \mu V$ $11.0 \cdot 10^{-3} \cdot U + 3\ \mu V$ $25.0 \cdot 10^{-3} \cdot U + 15\ \mu V$ $40.0 \cdot 10^{-3} \cdot U + 15\ \mu V$	Voltage at 50 Ω
Sources	1 mV to 10 mV	10 Hz to 20 kHz > 20 kHz to 50 kHz > 50 kHz to 100 kHz > 100 kHz to 1 MHz	$0.5 \cdot 10^{-3} \cdot U + 4\ \mu V$ $0.8 \cdot 10^{-3} \cdot U + 4\ \mu V$ $5.0 \cdot 10^{-3} \cdot U + 4\ \mu V$ $12.0 \cdot 10^{-3} \cdot U + 10\ \mu V$	
	> 10 mV to 100 V	10 Hz to 20 kHz > 20 kHz to 50 kHz > 50 kHz to 100 kHz 100 kHz to 300 kHz > 300 kHz to 1 MHz	$0.5 \cdot 10^{-3} \cdot U + 2\ \mu V$ $0.5 \cdot 10^{-3} \cdot U + 2\ \mu V$ $1.4 \cdot 10^{-3} \cdot U + 2\ \mu V$ $0.4 \cdot 10^{-3} \cdot U + 2\ \mu V$ $11 \cdot 10^{-3} \cdot U + 10\ \mu V$	*U*: Measured value Voltage at 50 Ω

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
AC voltage Sources	> 100 V to 700 V	10 Hz to 20 Hz > 20 Hz to 50 kHz > 50 kHz to 100 kHz	$0.8 \cdot 10^{-3} \cdot U + 2$ mV $1.4 \cdot 10^{-3} \cdot U + 2$ mV $3.2 \cdot 10^{-3} \cdot U + 2$ mV	*U*: Measured value
AC current Measuring instruments	100 µA to 220 µA	10 Hz to 20 Hz > 20 Hz to 1 kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz	$0.3 \cdot 10^{-3} \cdot I + 16$ nA $0.2 \cdot 10^{-3} \cdot I + 10$ nA $0.3 \cdot 10^{-3} \cdot I + 12$ nA $1.1 \cdot 10^{-3} \cdot I + 0.1$ µA	*I*: Measured value
	> 220 µA to 2.2 mA	10 Hz to 20 Hz > 20 Hz to 1 kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz	$0.3 \cdot 10^{-3} \cdot I + 40$ nA $0.2 \cdot 10^{-3} \cdot I + 35$ nA $0.22 \cdot 10^{-3} \cdot I + 110$ nA $1.2 \cdot 10^{-3} \cdot I + 1$ µA	
	> 2.2 mA to 22 mA	10 Hz to 20 Hz > 20 Hz to 1 kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz	$0.3 \cdot 10^{-3} \cdot I + 400$ nA $0.2 \cdot 10^{-3} \cdot I + 350$ nA $0.22 \cdot 10^{-3} \cdot I + 550$ nA $1.2 \cdot 10^{-3} \cdot I + 5$ µA	
	> 22 mA to 220 mA	10 Hz to 20 Hz > 20 Hz to 1 kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz	$0.3 \cdot 10^{-3} \cdot I + 4$ µA $0.2 \cdot 10^{-3} \cdot I + 3.5$ µA $0.22 \cdot 10^{-3} \cdot I + 3.5$ µA $0.47 \cdot 10^{-3} \cdot I + 10$ µA	
	> 220 mA to 2.2 A	20 Hz to 1 kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz	$0.2 \cdot 10^{-3} \cdot I + 35$ µA $0.47 \cdot 10^{-3} \cdot I + 80$ µA $7.1 \cdot 10^{-3} \cdot I + 160$ µA	
	> 2.2 A to < 3 A	10 Hz to 45 Hz > 45 Hz to 1 kHz > 1kHz to 5 kHz > 5 kHz to 10 kHz	$2 \cdot 10^{-3} \cdot I + 100$ µA $0.7 \cdot 10^{-3} \cdot I + 100$ µA $6.6 \cdot 10^{-3} \cdot I + 1$ mA $28 \cdot 10^{-3} \cdot I + 5$ mA	
	3 A to < 11 A	45 Hz to 100 Hz > 100 Hz to 1 kHz > 1 kHz to 5 kHz	$0.7 \cdot 10^{-3} \cdot I + 2$ mA $1.1 \cdot 10^{-3} \cdot I + 2$ mA $33 \cdot 10^{-3} \cdot I + 2$ mA	
Sources	100 µA to 1.2 mA	10 Hz to 20 Hz > 20 Hz to 45 Hz > 45 Hz to 10 kHz	$6.0 \cdot 10^{-3} \cdot I + 0.1$ µA $3.5 \cdot 10^{-3} \cdot I + 0.1$ µA $2.6 \cdot 10^{-3} \cdot I + 0.1$ µA	
	> 1.2 mA to 120 mA	> 10 Hz to 20 Hz > 20 Hz to 45 Hz > 45 Hz to 10 kHz	$6.0 \cdot 10^{-3} \cdot I + 1$ µA $3.2 \cdot 10^{-3} \cdot I + 1$ µA $2.3 \cdot 10^{-3} \cdot I + 1$ µA	
	> 120 mA to 1 A	10 Hz to 20 Hz > 20 Hz to 45 Hz > 45 Hz to 5 kHz > 5 kHz to 10 kHz	$6.0 \cdot 10^{-3} \cdot I + 1$ µA $3.3 \cdot 10^{-3} \cdot I + 1$ µA $2.7 \cdot 10^{-3} \cdot I + 1$ µA $4.7 \cdot 10^{-3} \cdot I + 1$ µA	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Capacitance	1.1 nF to < 3.3 nF	10 Hz to 3 kHz	$6 \cdot 10^{-3} \cdot C + 0.01$ nF	*C:* Measured value
	3.3 nF to < 11 nF	10 Hz to 1 kHz	$2.8 \cdot 10^{-3} \cdot C + 0.01$ nF	
	11 nF to < 33 nF	10 Hz to 1 kHz	$2.8 \cdot 10^{-3} \cdot C + 0.1$ nF	
	33 nF to < 110 nF	10 Hz to 1 kHz	$2.8 \cdot 10^{-3} \cdot C + 0.1$ nF	
	110 nF to < 330 nF	10 Hz to 1 kHz	$2.8 \cdot 10^{-3} \cdot C + 0.3$ nF	
	0.33 µF to < 1.10 µF	10 Hz to 600 Hz	$2.8 \cdot 10^{-3} \cdot C + 1$ nF	
	1.1 µF to < 11 µF	10 Hz to 300 Hz	$2.8 \cdot 10^{-3} \cdot C + 3$ nF	
	11 µF to < 33 µF	10 Hz to 120 Hz	$4.5 \cdot 10^{-3} \cdot C + 30$ nF	
	33 µF to < 110 µF	DC to 80 Hz	$5 \cdot 10^{-3} \cdot C + 100$ nF	
	110 µF to < 330 µF	DC to 80 Hz	$5 \cdot 10^{-3} \cdot C + 300$ nF	
	0.33 mF to < 1.1 mF	DC to 50 Hz	$5 \cdot 10^{-3} \cdot C + 1$ µF	
Frequency Oscillators Measuring instruments	0.1 MHz 1 MHz 5 MHz 10 MHz		$5 \cdot 10^{-12} \cdot f$	*f:* Measured value U_{TRIG}: Trigger-uncertainty
	0.1 mHz to 110 GHz		$\sqrt{(1 \cdot 10^{-10} \cdot f)^2 + U_{TRIG}^2}$	
Time period	1 ns to 100 s		$\sqrt{(1\ \text{ns})^2 + (1 \cdot 10^{-10} \cdot t)^2 + U_{TRIG}^2}$	*t:* Measured value
HF-Power HF-Power Sensors with mismatch correction	100 nW to 10 µW	> DC to 100 MHz	$5.8 \cdot 10^{-3} \cdot P$	*P:* Measured value
		> 100 MHz to 2.4 GHz	$7.0 \cdot 10^{-3} \cdot P$	PC Type-N[2] to 18 GHz
		> 2.4 GHz to 4 GHz	$8.0 \cdot 10^{-3} \cdot P$	PC-3.5[2] to 33 GHz
		> 4 GHz to 8 GHz	$10 \cdot 10^{-3} \cdot P$	PC-2.92[2] to 40 GHz
		> 8 GHz to 12.4 GHz	$13 \cdot 10^{-3} \cdot P$	PC-2.4[2] to 50 GHz
		> 12.4 GHz to 18 GHz	$15 \cdot 10^{-3} \cdot P$	PC-1.85[2] to 67 GHz
		> 18 GHz to 26.5 GHz	$15 \cdot 10^{-3} \cdot P$	PC-1.00[2] to 110 GHz
		> 26.5 GHz to 40 GHz	$19 \cdot 10^{-3} \cdot P$	
	10 µW to 200 mW	> DC to 1 MHz	$3.0 \cdot 10^{-3} \cdot P$	
		> 1 MHz to 100 MHz	$3.4 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 2.4 GHz	$5.1 \cdot 10^{-3} \cdot P$	
		2.4 GHz to 8 GHz	$6.8 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 12.4 GHz	$8.4 \cdot 10^{-3} \cdot P$	
		> 12.4 GHz to 18 GHz	$11 \cdot 10^{-3} \cdot P$	
		> 18 GHz to 26.5 GHz	$14 \cdot 10^{-3} \cdot P$	
		> 26.5 GHz to 40 GHz	$17 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$21 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$33 \cdot 10^{-3} \cdot P$	
HF-Power Sources	1 mW	50 MHz	$4.0 \cdot 10^{-3} \cdot P$	
	10 µW to 200 mW	> DC to 100 MHz	$5.0 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 1 GHz	$6.0 \cdot 10^{-3} \cdot P$	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
HF-Power Sources. Measuring instruments with mismatch correction	0.2 fW to < 10 pW	> DC to 8 GHz	$21 \cdot 10^{-3} \cdot P$	*P:* Measured value
		> 8 GHz to 20 GHz	$24 \cdot 10^{-3} \cdot P$	
	1 fW to < 10 pW	> 20 GHz to 40 GHz	$29 \cdot 10^{-3} \cdot P$	
	10 fW to < 10 pW	> 40 GHz to 50 GHz	$43 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$49 \cdot 10^{-3} \cdot P$	
	10 pW to < 100 nW	> DC to 100 MHz	$15 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 8 GHz	$17 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 20 GHz	$20 \cdot 10^{-3} \cdot P$	
		> 20 GHz to 40 GHz	$26 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$34 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$43 \cdot 10^{-3} \cdot P$	
	100 pW to < 100 uW	> 67 GHz to 75 GHz	$45 \cdot 10^{-3} \cdot P$	
		> 75 GHz to 95 GHz	$47 \cdot 10^{-3} \cdot P$	
		> 95 GHz to 110 GHz	$49 \cdot 10^{-3} \cdot P$	
	100 nW to 200 mW	> DC to 100 MHz	$10 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 8 GHz	$13 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 18 GHz	$16 \cdot 10^{-3} \cdot P$	
		> 18 GHz to 26.5 GHz	$23 \cdot 10^{-3} \cdot P$	
		> 26.5 GHz to 40 GHz	$23 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$30 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$35 \cdot 10^{-3} \cdot P$	
	10 µW to 125 mW	> 67 GHz to 75 GHz	$40 \cdot 10^{-3} \cdot P$	
		> 75 GHz to 95 GHz	$42 \cdot 10^{-3} \cdot P$	
		> 95 GHz to 110 GHz	$44 \cdot 10^{-3} \cdot P$	
without mismatch correction	> 200 mW to 20 W	> DC to 100 MHz	$11 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 4 GHz	$14 \cdot 10^{-3} \cdot P$	
	> 200 mW to 4 W	> 4 GHz to 8 GHz	$15 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 12.5 GHz	$19 \cdot 10^{-3} \cdot P$	
		> 12.5 GHz to 18 GHz	$23 \cdot 10^{-3} \cdot P$	
	> 200 mW to 2 W	> 18 GHz to 26.5 GHz	$25 \cdot 10^{-3} \cdot P$	
	> 200 mW to 1 W	> 26.5 GHz to 40 GHz	$31 \cdot 10^{-3} \cdot P$	
Display Linearity. Level distance, Attenuation	0 dB to 21 dB	> DC to 40 GHz	0.003 dB	*A*: Measured value
	> 21 dB to 111 dB	> DC to 40 GHz	0.003 dB + 0.0002 · *A*	
	> 111 dB to 121 dB	> DC to 40 GHz	0.03 dB	
	0 dB to 11 dB	> 40 GHz to 67 GHz	0.005 dB	
	> 11 dB to 111 dB	> 40 GHz to 67 GHz	0.005 dB + 0.0004 · *A*	
	0 dB to 60 dB	> 67 GHz to 110 GHz	0.03 dB + 0.001 · *A*	
	> 60 dB to 80 dB	> 67 GHz to 110 GHz	0.6 dB	
	> 80 dB to 90 dB	> 67 GHz to 110 GHz	1.8 dB	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
HF-Transmission Phase angle φ	- 180 ° to 180 °	> DC to 100 MHz > 100 MHz to 10 GHz > 10 GHz to 20 GHz > 20 GHz to 40 GHz > 40 GHz to 67 GHz > 67 GHz to 110 GHz	0.5 ° 0.7 ° 1.0 ° 1.8 ° 2.0 ° 3.0 °	Dependent on Attenuation value
HF-Impedance Reflection factor	0.0 to 0.4 > 0.4 to 1.0	> DC to 10 GHz > DC to 10 GHz	0.0034 $0.0015 + 0.005 \cdot \lvert\Gamma\rvert$	PC Type-N[2)] $\lvert\Gamma\rvert$: Magnitude of complex reflection factor PC-3.5[2)] PC-2.92[2)]
	0.0 to 0.4 > 0.4 to 1.0	> 10 GHz to 18 GHz > 10 GHz to 18 GHz	0.0034 $0.01 \cdot \lvert\Gamma\rvert$	
	0.0 to 0.4 > 0.4 to 1.0	> 18 GHz to 33 GHz > 18 GHz to 33 GHz	0.0065 $0.001 + 0.013 \cdot \lvert\Gamma\rvert$	
	0.0 to 0.4 > 0.4 to 1.0	> 33 GHz to 40 GHz > 33 GHz to 40 GHz	0.011 $0.005 + 0.016 \cdot \lvert\Gamma\rvert$	
	0.0 to 1.0	> DC to 2 GHz > 2 GHz to 10 GHz > 10 GHz to 20 GHz > 20 GHz to 30 GHz > 30 GHz to 40 GHz > 40 GHz to 50 GHz > 50 GHz to 67 GHz	$0.0035 + 0.0042 \cdot \lvert\Gamma\rvert^2$ $0.0037 + 0.0050 \cdot \lvert\Gamma\rvert^2$ $0.0042 + 0.0069 \cdot \lvert\Gamma\rvert^2$ $0.0055 + 0.0101 \cdot \lvert\Gamma\rvert^2$ $0.0067 + 0.0120 \cdot \lvert\Gamma\rvert^2$ $0.0085 + 0.0151 \cdot \lvert\Gamma\rvert^2$ $0.0113 + 0.0183 \cdot \lvert\Gamma\rvert^2$	PC-2.4[2)] . PC-1.85[2)]
	0.0 to 1.0	> DC to 2 GHz > 2 GHz to 10 GHz > 10 GHz to 20 GHz > 20 GHz to 30 GHz > 30 GHz to 40 GHz > 40 GHz to 50 GHz > 50 GHz to 67 GHz > 67 GHz to 90 GHz > 90 GHz to 110 GHz > 110 GHz to 114 GHz	$0.0036 + 0.0049 \cdot \lvert\Gamma\rvert^2$ $0.0036 + 0.0052 \cdot \lvert\Gamma\rvert^2$ $0.0041 + 0.0068 \cdot \lvert\Gamma\rvert^2$ $0.0049 + 0.0095 \cdot \lvert\Gamma\rvert^2$ $0.0056 + 0.0117 \cdot \lvert\Gamma\rvert^2$ $0.0063 + 0.0131 \cdot \lvert\Gamma\rvert^2$ $0.0074 + 0.0173 \cdot \lvert\Gamma\rvert^2$ $0.0093 + 0.0213 \cdot \lvert\Gamma\rvert^2$ $0.0122 + 0.0280 \cdot \lvert\Gamma\rvert^2$ $0.0142 + 0.0331 \cdot \lvert\Gamma\rvert^2$	PC-1.00[2)]
	0.0 to 1.0	50 GHz to 75 GHz 60 GHz to 90 GHz 90 GHz to 110 GHz	$0.01 + 0.008 \cdot \lvert\Gamma\rvert$ $0.01 + 0.008 \cdot \lvert\Gamma\rvert$ $0.01 + 0.008 \cdot \lvert\Gamma\rvert$	Connector: R620 Connector: R740 Connector: R900
HF-Impedance Phase angle	-180 ° to 180 °	> DC to 110 GHz	$U_S \cdot 180\,°/\pi$	$U_S = \arcsin(U/\lvert\Gamma\rvert)$ *U:* Uncertainty of reflection factor
Modulation quantities Amplitude modulation Modulation degree *m*	0.0 to 1.0	> DC f_m ≤ 100 kHz 100 kHz < f_m ≤ 1 MHz 1 MHz < f_m ≤ 10 MHz	$0.001 \cdot m + K$ $0.002 \cdot m + K$ $0.007 \cdot m + K$	*m*: measured value f_{HF} = Carrier frequency f_m =Modulation freq. $f_{HF} > 5 \cdot f_m$ [3)]
Frequency modulation Frequency deviation Δf	10 Hz to 16 MHz	10 Hz < f_m ≤ 100 kHz 100 kHz < f_m ≤ 200 kHz 200 kHz < f_m ≤ 10 MHz	$1 \cdot 10^{-3} \cdot \Delta f$ $2 \cdot 10^{-3} \cdot \Delta f$ $5 \cdot 10^{-3} \cdot \Delta f$	Δf: measured value $f_{HF} > 5 \cdot f_m$ [3)]

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Phase modulation Phase deviation $\Delta\phi$	(10 Hz/ f_m) rad to (16 MHz/ f_m) rad	10 Hz < f_m ≤ 100 kHz 100 kHz < f_m ≤ 200 kHz 200 kHz < f_m ≤ 10 MHz	$1 \cdot 10^{-3} \cdot \Delta\phi$ $2 \cdot 10^{-3} \cdot \Delta\phi$ $5 \cdot 10^{-3} \cdot \Delta\phi$	$\Delta\phi$: measured value $f_{HF} > 5 \cdot f_m$ [3]
Waveform quantities Rise time	7 ps to 15 ps	Voltage range dependent on rise-time	4 ps	t: measured value
	> 15 ps to 25 ps		3 ps	
	> 25 ps to 100 ns		$40 \cdot 10^{-3} \cdot t + 2$ ps	
Pulse spectrum Cispr 16-1-1:2019	0.1 µVs to 50 µVs	9 kHz to 150 kHz	$25 \cdot 10^{-3} \cdot IS$	IS: measured value
	3 nVs to 1 µVs	150 kHz to 30 MHz	$25 \cdot 10^{-3} \cdot IS$	
	0.4 nVs to 200 nVs	30 MHz to 1 GHz	$27 \cdot 10^{-3} \cdot IS$	
Phase noise	> -77 dBc/Hz [a]	1 Hz [b]	1.5 dB	Carrier frequency: 100 MHz to 500 MHz
Oscillators,	-85 dBc/Hz to -77 dBc/Hz	1 Hz	2.5 dB	
Measuring instruments	> -92 dBc/Hz	3 Hz to 10 Hz	1.5 dB	
	-100 dBc/Hz to -92 dBc/Hz	3 Hz to 10 Hz	2.5 dB	[a] Phase noise with regard to Carrier level in dBc/Hz
	> -106 dBc/Hz	10 Hz to 100 Hz	1.5 dB	
	-114 dBc/Hz to -106 dBc/Hz	10 Hz to 100 Hz	2.5 dB	
	> -136 dBc/Hz	100 Hz to 1 kHz	1.5 dB	
	-146 dBc/Hz to -136 dBc/Hz	100 Hz to 1 kHz	2.5 dB	
	> -160 dBc/Hz	1 kHz to 10 kHz	1.5 dB	
	-168 dBc/Hz to -160 dBc/Hz	1 kHz to 10 kHz	2.5 dB	[b] Offset frequency to carrier frequency
	> -167 dBc/Hz	10 kHz to 100 kHz	1.5 dB	
	-175 dBc/Hz to -167 dBc/Hz	10 kHz to 100 kHz	2.5 dB	
	> -174 dBc/Hz	100 kHz to 1 MHz	1.5 dB	
	-182 dBc/Hz to -174 dBc/Hz	100 kHz to 1 MHz	2.5 dB	
	> -186 dBc/Hz	1 MHz to 10 MHz	1.5 dB	
	-192 dBc/Hz to -186 dBc/Hz	1 MHz to 10 MHz	2.5 dB	
	-64 dBc/Hz	1 Hz [b]	1.5 dB	Carrier frequency: 500 MHz to 1 GHz
	-73 dBc/Hz to -64 dBc/Hz	1 Hz	2.5 dB	
	> -82 dBc/Hz	3 Hz to 10 Hz	1.5 dB	
	-90 dBc/Hz to -82 dBc/Hz	3 Hz to 10 Hz	2.5 dB	
	> -95 dBc/Hz	10 Hz to 100 Hz	1.5 dB	
	-103 dBc/Hz to -95 dBc/Hz	10 Hz to 100 Hz	2.5 dB	
	> -123 dBc/Hz	100 Hz to 1 kHz	1.5 dB	
	-131 dBc/Hz to -123 dBc/Hz	100 Hz to 1 kHz	2.5 dB	
	> -153 dBc/Hz	1 kHz to 10 kHz	1.5 dB	
	-161 dBc/Hz to -153 dBc/Hz	1 kHz to 10 kHz	2.5 dB	
	> -170 dBc/Hz	10 kHz to 100 kHz	1.5 dB	
	-178 dBc/Hz to -170 dBc/Hz	10 kHz to 100 kHz	2.5 dB	
	> -172 dBc/Hz	100 kHz to 1 MHz	1.5 dB	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Phase noise Oscillators, Measuring instruments	-180 dBc/Hz to -172 dBc/Hz	100 kHz to 1 MHz	2.5 dB	Carrier frequency: 500 MHz to 1 GHz
	> -172 dBc/Hz	1 MHz to 10 MHz	1.5 dB	
	-180 dBc/Hz to -172 dBc/Hz	1 MHz to 10 MHz	2.5 dB	
	-55 dBc/Hz	1 Hz	1.5 dB	Carrier frequency: 1 GHz to 3 GHz
	-67 dBc/Hz to -55 dBc/Hz	1 Hz	2.5 dB	
	> -67 dBc/Hz	3 Hz to 10 Hz	1.5 dB	
	-79 dBc/Hz to -67 dBc/Hz	3 Hz to 10 Hz	2.5 dB	
	> -85 dBc/Hz	10 Hz to 100 Hz	1.5 dB	
	-93 dBc/Hz to -85 dBc/Hz	10 Hz to 100 Hz	2.5 dB	
	> -114 dBc/Hz	100 Hz to 1 kHz	1.5 dB	
	-122 dBc/Hz to -114 dBc/Hz	100 Hz to 1 kHz	2.5 dB	
	> -146 dBc/Hz	1 kHz to 10 kHz	1.5 dB	
	-155 dBc/Hz to -146 dBc/Hz	1 kHz to 10 kHz	2.5 dB	
	> -166 dBc/Hz	10 kHz to 100 kHz	1.5 dB	
	-174 dBc/Hz to -166 dBc/Hz	10 kHz to 100 kHz	2.5 dB	
	> -168 dBc/Hz	100 kHz to 1 MHz	1.5 dB	
	-176 dBc/Hz to -168 dBc/Hz	100 kHz to 1 MHz	2.5 dB	
	> -168 dBc/Hz	1 MHz to 10 MHz	1.5 dB	
	-76 dBc/Hz to -168 dBc/Hz	1 MHz to 10 MHz	2.5 dB	
	> -49 dBc/Hz	1 Hz	1.5 dB	Carrier frequency: 3 GHz to 6 GHz
	-57 dBc/Hz to -49 dBc/Hz	1 Hz	2.5 dB	
	> -62 dBc/Hz	3 Hz to 10 Hz	1.5 dB	
	-70 dBc/Hz to -62 dBc/Hz	3 Hz to 10 Hz	2.5 dB	
	> -76 dBc/Hz	10 Hz to 100 Hz	1.5 dB	
	-84 dBc/Hz to -76 dBc/Hz	10 Hz to 100 Hz	2.5 dB	
	> -105 dBc/Hz	100 Hz to 1 kHz	1.5 dB	
	-113 dBc/Hz to -105 dBc/Hz	100 Hz to 1 kHz	2.5 dB	
	> -138 dBc/Hz	1 kHz to 10 kHz	1.5 dB	
	-146 dBc/Hz to -138 dBc/Hz	1 kHz to 10 kHz	2.5 dB	
	> -156 dBc/Hz	10 kHz to 100 kHz	1.5 dB	
	-164 dBc/Hz to -156 dBc/Hz	10 kHz to 100 kHz	2.5 dB	
	> -158 dBc/Hz	100 kHz to 1 MHz	1.5 dB	
	-166 dBc/Hz to -158 dBc/Hz	100 kHz to 1 MHz	2.5 dB	
	> -158 dBc/Hz	1 MHz to 10 MHz	1.5 dB	
	-166 dBc/Hz to -158 dBc/Hz	1 MHz to 10 MHz	2.5 dB	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
	> -54 dBc/Hz	1 Hz	1.5 dB	Carrier frequency: 6 GHz to 8 GHz
	-62 dBc/Hz to -54 dBc/Hz	1 Hz	2.5 dB	
	> -68 dBc/Hz	3 Hz to 10 Hz	1.5 dB	
	-76 dBc/Hz to -68 dBc/Hz	3 Hz to 10 Hz	2.5 dB	
	> -95 dBc/Hz	10 Hz to 100 Hz	1.5 dB	
	-103 dBc/Hz to -95 dBc/Hz	10 Hz to 100 Hz	2.5 dB	
	> -122 dBc/Hz	100 Hz to 1 kHz	1.5 dB	
	-130 dBc/Hz to -122 dBc/Hz	100 Hz to 1 kHz	2.5 dB	
	> -138 dBc/Hz	1 kHz to 10 kHz	1.5 dB	
	-146 dBc/Hz to -138 dBc/Hz	1 kHz to 10 kHz	2.5 dB	
	> -142 dBc/Hz	10 kHz to 100 kHz	1.5 dB	
	-146 dBc/Hz to -142 dBc/Hz	10 kHz to 100 kHz	2.5 dB	
	> -142 dBc/Hz	100 kHz to 1 MHz	1.5 dB	
	-150 dBc/Hz to -142 dBc/Hz	100 kHz to 1 MHz	2.5 dB	
	> -142 dBc/Hz	1 MHz to 10 MHz	1.5 dB	
	-150 dBc/Hz to -142 dBc/Hz	1 MHz to 10 MHz	2.5 dB	

[2] By the use of different connection systems the measurement uncertainty increases.

[3] *K*: Uncertainty includes typical disturbences on carrier frequencies up to 3GHz. On carrier frequencies above 3GHz, disturbences, e.g. spurious deviation, has to be determined and considered in dependence of the measurement object.

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
DC voltage Sources, Measuring instruments	1 V; 1.018 V 10 V		$2 \cdot 10^{-6} \cdot U$ $1 \cdot 10^{-6} \cdot U$	U: Measured value
	0 V to 1 kV > 1 kV to 10 kV > 10 kV to 20 kV > 20 kV to 30 kV		$3 \cdot 10^{-6} \cdot U + 0.2\ \mu V$ $0.1 \cdot 10^{-3} \cdot U$ $6 \cdot 10^{-3} \cdot U$ $22 \cdot 10^{-3} \cdot U$	
DC current Measuring instruments	1 µA to 10 A > 10 A to 200 A		$10 \cdot 10^{-6} \cdot I$ $0.2 \cdot 10^{-3} \cdot I$	I: Measured value
Direct resistance Resistance, measuring instruments	1 Ω 10 kΩ 0.1 mΩ to < 1 mΩ 1 mΩ to < 1 Ω 1 Ω to 100 kΩ > 100 kΩ to 1 MΩ > 1 MΩ to 10 MΩ > 10 MΩ to 100 MΩ > 100 MΩ to 1 GΩ > 1 GΩ to 10 GΩ		$2 \cdot 10^{-6} \cdot R$ $2 \cdot 10^{-6} \cdot R$ $50 \cdot 10^{-6} \cdot R$ $10 \cdot 10^{-6} \cdot R$ $3 \cdot 10^{-6} \cdot R$ $5 \cdot 10^{-6} \cdot R$ $30 \cdot 10^{-6} \cdot R$ $0.1 \cdot 10^{-3} \cdot R$ $0.2 \cdot 10^{-3} \cdot R$ $2 \cdot 10^{-3} \cdot R$	R: Measured value
Measuring instruments	0 Ω to 20 Ω > 20 Ω to 100 kΩ > 100 kΩ to 1 MΩ > 1 MΩ to 10 MΩ > 10 MΩ to 100 MΩ > 100 MΩ to 1 GΩ > 1 GΩ to 10 GΩ		$3 \cdot 10^{-6} \cdot R + 20\ \mu\Omega$ $3 \cdot 10^{-6} \cdot R$ $5 \cdot 10^{-6} \cdot R$ $30 \cdot 10^{-6} \cdot R$ $0.1 \cdot 10^{-3} \cdot R$ $0.5 \cdot 10^{-3} \cdot R$ $5 \cdot 10^{-3} \cdot R$	
AC voltage and AC/DC Transfer Sources. Measuring instruments	1 mV to < 220 V	10 Hz to < 20 Hz 20 Hz to < 40 Hz 40 Hz to 20 kHz > 20 kHz to 50 kHz > 50 kHz to 100 kHz	$0.2 \cdot 10^{-6} \cdot U + 0.5\ \mu V$ $75 \cdot 10^{-6} \cdot U + 0.5\ \mu V$ $35 \cdot 10^{-6} \cdot U + 0.5\ \mu V$ $70 \cdot 10^{-6} \cdot U + 0.5\ \mu V$ $0.1 \cdot 10^{-3} \cdot U + 1\ \mu V$	U: Measured value
	1 mV to 70 V	> 100 kHz to 300 kHz	$0.2 \cdot 10^{-3} \cdot U + 1.5\ \mu V$	
	1 mV to 22 V	> 300 kHz to 1 MHz	$1.1 \cdot 10^{-3} \cdot U + 4\ \mu V$	
	220 V to 1000 V	10 Hz to < 20 Hz 20 Hz to < 40 Hz 40 Hz to 20 kHz > 20 kHz to 50 kHz > 50 kHz to 100 kHz	$0.2 \cdot 10^{-3} \cdot U$ $0.1 \cdot 10^{-3} \cdot U$ $41 \cdot 10^{-6} \cdot U$ $0.14 \cdot 10^{-3} \cdot U$ $0.5 \cdot 10^{-3} \cdot U$	
	> 1 kV to 7 kV	45 Hz to 60 Hz	$2 \cdot 10^{-3} \cdot U$	
	1 mV to 7 V	1 MHz to 2 MHz > 2 MHz to 10 MHz > 10 MHz to 20 MHz > 20 MHz to 30 MHz	$0.6 \cdot 10^{-3} \cdot U + 2\ \mu V$ $1.0 \cdot 10^{-3} \cdot U + 2.5\ \mu V$ $1.5 \cdot 10^{-3} \cdot U + 4\ \mu V$ $3.5 \cdot 10^{-3} \cdot U + 8\ \mu V$	Voltage at 50 Ω
	0.1 V to 2 V	> 50 MHz to 100 MHz > 100 MHz to 200 MHz > 200 MHz to 300 MHz > 300 MHz to 500 MHz > 500 MHz to 1 GHz	$4 \cdot 10^{-3} \cdot U$ $5 \cdot 10^{-3} \cdot U$ $7 \cdot 10^{-3} \cdot U$ $10 \cdot 10^{-3} \cdot U$ $15 \cdot 10^{-3} \cdot U$	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
AC current and AC/DC-Transfer	1 mA to 10 A	10 Hz to < 10 kHz	$0.1 \cdot 10^{-3} \cdot I$	I: Measured value
AC current	> 10 A to 200 A	20 Hz to 45 Hz	$3 \cdot 10^{-3} \cdot I$	
Sources		> 45 Hz to 5 kHz	$2 \cdot 10^{-3} \cdot I$	
Measuring instruments		> 5 kHz to 20 kHz	$5 \cdot 10^{-3} \cdot I$	
Capacitance	1 nF	1 kHz	$30 \cdot 10^{-6} \cdot C$	C: Measured value substitution method
	0.1 pF to < 1 pF	50 Hz to < 100 Hz	$0.1 \cdot C$	direct measurement with brige
		100 Hz to < 200 Hz	$10 \cdot 10^{-3} \cdot C$	
		200 Hz to < 1 kHz	$1 \cdot 10^{-3} \cdot C$	
		1 kHz to 10 kHz	$0.4 \cdot 10^{-3} \cdot C$	
	1 pF to < 10 pF	50 Hz to < 100 Hz	$10 \cdot 10^{-3} \cdot C$	
		100 Hz to < 1 kHz	$1 \cdot 10^{-3} \cdot C$	
		1 kHz to 10 kHz	$0.15 \cdot 10^{-3} \cdot C$	
	10 pF to 100 pF	50 Hz to < 1 kHz	$0.5 \cdot 10^{-3} \cdot C$	
		1 kHz to 10 kHz	$0.1 \cdot 10^{-3} \cdot C$	
	100 pF to < 50 nF	50 Hz to 10 kHz	$0.1 \cdot 10^{-3} \cdot C$	
	50 nF to 200 nF	50 Hz to < 1 kHz	$0.1 \cdot 10^{-3} \cdot C$	
		1 kHz to 10 kHz	$0.4 \cdot 10^{-3} \cdot C$	
	200 nF to < 1 µF	50 Hz to 1 kHz	$0.1 \cdot 10^{-3} \cdot C$	
		> 1 kHz to 5 kHz	$0.5 \cdot 10^{-3} \cdot C$	
		> 5 kHz to 10 kHz	$2 \cdot 10^{-3} \cdot C$	
	1 µF to 5 µF	50 Hz to 1 kHz	$0.1 \cdot 10^{-3} \cdot C$	
		> 1 kHz to 2 kHz	$0.4 \cdot 10^{-3} \cdot C$	
		> 2 kHz to 5 kHz	$3 \cdot 10^{-3} \cdot C$	
		> 5 kHz to 10 kHz	$10 \cdot 10^{-3} \cdot C$	
	5 µF to 10 µF	50 Hz to 1 kHz	$0.2 \cdot 10^{-3} \cdot C$	
		> 1 kHz to 2 kHz	$0.8 \cdot 10^{-3} \cdot C$	
		> 2 kHz to 5 kHz	$5 \cdot 10^{-3} \cdot C$	
		> 5 kHz to 10 kHz	$20 \cdot 10^{-3} \cdot C$	
	10 µF to 100 µF	50 Hz to 1 kHz	$3 \cdot 10^{-3} \cdot C$	
Frequency	0.1 MHz		$5 \cdot 10^{-12} \cdot f$	f: Measured value
Oscillators	1 MHz			U_{TRIG}: Trigger-uncertainty
Measuring instruments	5 MHz			
	10 MHz			
	0.1 mHz to 110 GHz		$\sqrt{(1 \cdot 10^{-10} \cdot f)^2 + U_{\mathrm{TRIG}}^2}$	
Time interval	1 ns to 10 000 s		$\sqrt{(1\ \mathrm{ns})^2 + (1 \cdot 10^{-10} \cdot t)^2 + U_{\mathrm{TRIG}}^2}$	t: Measured value

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
HF-Power HF-Power Sensors with mismatch correction	100 nW to 10 µW	> DC to 100 MHz	$5.8 \cdot 10^{-3} \cdot P$	*P*: Measured value
		> 100 MHz to 2.4 GHz	$7.0 \cdot 10^{-3} \cdot P$	PC Type-N[2)] to 18 GHz
		> 2.4 GHz to 4 GHz	$8.0 \cdot 10^{-3} \cdot P$	PC-3.5[2)] to 33 GHz
		> 4 GHz to 8 GHz	$10 \cdot 10^{-3} \cdot P$	PC-2.92[2)] to 40 GHz
		> 8 GHz to 12.4 GHz	$13 \cdot 10^{-3} \cdot P$	PC-2.4[2)] to 50 GHz
		> 12.4 GHz to 18 GHz	$15 \cdot 10^{-3} \cdot P$	PC-1.85[2)] to 67 GHz
		> 18 GHz to 26.5 GHz	$15 \cdot 10^{-3} \cdot P$	PC-1.00[2)] to 110 GHz
		> 26.5 GHz to 40 GHz	$19 \cdot 10^{-3} \cdot P$	
	10 µW to 200 mW	> DC to 1 MHz	$3.0 \cdot 10^{-3} \cdot P$	
		> 1 MHz to 100 MHz	$3.4 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 2.4 GHz	$5.1 \cdot 10^{-3} \cdot P$	
		> 2.4 GHz to 8 GHz	$6.8 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 12.4 GHz	$8.4 \cdot 10^{-3} \cdot P$	
		> 12.4 GHz to 18 GHz	$11 \cdot 10^{-3} \cdot P$	
		> 18 GHz to 26.5 GHz	$14 \cdot 10^{-3} \cdot P$	
		> 26.5 GHz to 40 GHz	$17 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$21 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$33 \cdot 10^{-3} \cdot P$	
Sources	1 mW	50 MHz	$4.0 \cdot 10^{-3} \cdot P$	
	10 µW to 200 mW	> DC to 100 MHz	$5.0 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 1 GHz	$6.0 \cdot 10^{-3} \cdot P$	
Sources. Measuring instruments with mismatch correction	0.2 fW to < 10 pW	> DC to 8 GHz	$21 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 20 GHz	$24 \cdot 10^{-3} \cdot P$	
	1 fW to < 10 pW	> 20 GHz to 40 GHz	$29 \cdot 10^{-3} \cdot P$	
	10 fW to < 10 pW	> 40 GHz to 50 GHz	$43 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$49 \cdot 10^{-3} \cdot P$	
	10 pW to < 100 nW	> DC to 100 MHz	$15 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 8 GHz	$17 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 20 GHz	$20 \cdot 10^{-3} \cdot P$	
		> 20 GHz to 40 GHz	$26 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$34 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$43 \cdot 10^{-3} \cdot P$	
	100 pW to < 100 uW	> 67 GHz to 75 GHz	$45 \cdot 10^{-3} \cdot P$	
		> 75 GHz to 95 GHz	$47 \cdot 10^{-3} \cdot P$	
		> 95 GHz to 110 GHz	$49 \cdot 10^{-3} \cdot P$	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
HF-Power Sources. Measuring instruments with mismatch correction	100 nW to 200 mW	> DC to 100 MHz	$10 \cdot 10^{-3} \cdot P$	*P*: Measured value
		> 100 MHz to 8 GHz	$13 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 18 GHz	$16 \cdot 10^{-3} \cdot P$	
		> 18 GHz to 26.5 GHz	$23 \cdot 10^{-3} \cdot P$	
		> 26.5 GHz to 40 GHz	$23 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$30 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$35 \cdot 10^{-3} \cdot P$	
	10 µW to 125 mW	> 67 GHz to 75 GHz	$40 \cdot 10^{-3} \cdot P$	
		> 75 GHz to 95 GHz	$42 \cdot 10^{-3} \cdot P$	
		> 95 GHz to 110 GHz	$44 \cdot 10^{-3} \cdot P$	
	> 200 mW to 20 W	> DC to 100 MHz	$11 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 4 GHz	$14 \cdot 10^{-3} \cdot P$	
	> 200 mW to 4 W	> 4 GHz to 8 GHz	$15 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 12.5 GHz	$19 \cdot 10^{-3} \cdot P$	
		> 12.5 GHz to 18 GHz	$23 \cdot 10^{-3} \cdot P$	
	> 200 mW to 2 W	> 20 GHz to 26.5 GHz	$25 \cdot 10^{-3} \cdot P$	
	> 200 mW to 1 W	> 26.5 GHz to 40 GHz	$31 \cdot 10^{-3} \cdot P$	
without mismatch correction	> 20 W to 2 kW	> DC to 1 GHz	$24 \cdot 10^{-3} \cdot P$	
	> 20 W to 500 W	> 1 GHz to 4 GHz	$30 \cdot 10^{-3} \cdot P$	
	> 4 W to 500 W	> 4 GHz to 10 GHz	$30 \cdot 10^{-3} \cdot P$	
	> 4 W to 100 W	> 10 GHz to 18 GHz	$40 \cdot 10^{-3} \cdot P$	
	> 2 kW to 10 kW	> DC to 1 GHz	$41 \cdot 10^{-3} \cdot P$	
Display Linearity Level distance, Attenuation	0 dB to 21 dB	> DC to 40 GHz	0.003 dB	*A*: Measured value
	> 21 dB to 111 dB	> DC to 40 GHz	0.003 dB + 0.0002 · *A*	
	> 111 dB to 121 dB	> DC to 40 GHz	0.03 dB	
	0 dB to 11 dB	> 40 GHz to 67 GHz	0.005 dB	
	> 11 dB to 111 dB	> 40 GHz to 67 GHz	0.005 dB + 0.0004 · *A*	
	0 dB to 60 dB	> 67 GHz to 110 GHz	0.03 dB + 0.001 · *A*	
	> 60 dB to 80 dB	> 67 GHz to 110 GHz	0.6 dB	
	> 80 dB to 90 dB	> 67 GHz to 110 GHz	1.8 dB	
HF-Transmission Phase angle φ	- 180 ° to 180 °	> DC to 100 MHz	0.5 °	Dependent on Attenuation value
		> 100 MHz to 10 GHz	0.7 °	
		> 10 GHz to 20 GHz	1.0 °	
		> 20 GHz to 40 GHz	1.8 °	
		> 40 GHz to 67 GHz	2.0 °	
		> 67 GHz to 110 GHz	3.0 °	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
HF-Impedance Reflection factor	0.0 to 0.4 > 0.4 to 1.0	> DC to 10 GHz > DC to 10 GHz	0.0034 0.0015 + 0.005 · |Γ|	PC Type-N[2)] |Γ|: Magnitude of complex reflection factor PC-3.5[2)]
	0.0 to 0.4 > 0.4 to 1.0	> 10 GHz to 18 GHz > 10 GHz to 18 GHz	0.0034 0.01 · |Γ|	
	0.0 to 0.4 > 0.4 to 1.0	> 18 GHz to 33 GHz > 18 GHz to 33 GHz	0.0065 0.001 + 0.013 · |Γ|	
	0.0 to 0.4 > 0.4 to 1.0	> 33 GHz to 40 GHz > 33 GHz to 40 GHz	0.011 0.005 + 0.016 · $\|\Gamma\|^2$	PC-2.92[2)]
	0.0 to 1.0	> DC to 2 GHz > 2 GHz to 10 GHz > 10 GHz to 20 GHz > 20 GHz to 30 GHz > 30 GHz to 40 GHz > 40 GHz to 50 GHz > 50 GHz to 67 GHz	0.0035 + 0.0042 · $\|\Gamma\|^2$ 0.0037 + 0.0050 · $\|\Gamma\|^2$ 0.0042 + 0.0069 · $\|\Gamma\|^2$ 0.0055 + 0.0101 · $\|\Gamma\|^2$ 0.0067 + 0.0120 · $\|\Gamma\|^2$ 0.0085 + 0.0151 · $\|\Gamma\|^2$ 0.0113 + 0.0183 · $\|\Gamma\|^2$	PC-2.4[2)]. PC-1.85[2)]
	0.0 to 1.0	> DC to 2 GHz > 2 GHz to 10 GHz > 10 GHz to 20 GHz > 20 GHz to 30 GHz > 30 GHz to 40 GHz > 40 GHz to 50 GHz > 50 GHz to 67 GHz > 67 GHz to 90 GHz > 90 GHz to 110 GHz > 110 GHz to 114 GHz	0.0036 + 0.0049 · $\|\Gamma\|^2$ 0.0036 + 0.0052 · $\|\Gamma\|^2$ 0.0041 + 0.0068 · $\|\Gamma\|^2$ 0.0049 + 0.0095 · $\|\Gamma\|^2$ 0.0056 + 0.0117 · $\|\Gamma\|^2$ 0.0063 + 0.0131 · $\|\Gamma\|^2$ 0.0074 + 0.0173 · $\|\Gamma\|^2$ 0.0093 + 0.0213 · $\|\Gamma\|^2$ 0.0122 + 0.0280 · $\|\Gamma\|^2$ 0.0142 + 0.0331 · $\|\Gamma\|^2$	PC-1.00[2)]
	0.0 to 1.0	50 GHz to 75 GHz 60 GHz to 90 GHz 75 GHz to 110 GHz	0.01 + 0.008 · |Γ| 0.01 + 0.008 · |Γ| 0.01 + 0.008 · |Γ|	Connector: R620 Connector: R740 Connector: R900
HF-Impedance Phase angle φ	- 180 ° to 180 °	> DC to 110 GHz	U_S · 180 °/π	U_S = arcsin(U/|Γ|) *U:* Uncertainty of reflection factor
Modulation quantities Amplitude modulation Modulation degree *m*	0.01 to 1.0	> DC f_m ≤ 100 kHz 100 kHz < f_m ≤ 1 MHz 1 MHz < f_m ≤ 10 MHz	0.001 · *m* + *K* 0.002 · *m* + *K* 0.007 · *m* + *K*	*m*: Measured value f_{HF} = Carrier frequency f_m = Modulation freq. $f_{HF} > 5 \cdot f_m$ [3)]
Frequency modulation Frequency deviation Δf	10 Hz to 16 MHz	10 Hz < f_m ≤ 100 kHz 100 kHz < f_m ≤ 200 kHz 200 kHz < f_m ≤ 10 MHz	$1 \cdot 10^{-3} \cdot \Delta f + K$ $2 \cdot 10^{-3} \cdot \Delta f + K$ $5 \cdot 10^{-3} \cdot \Delta f + K$	Δf: Measured value $f_{HF} > 5 \cdot (f_m + \Delta f)$ [3)]
Phase modulation Phase deviation $\Delta\phi$	(10 Hz/ f_m) rad to (16 MHz/ f_m) rad	10 Hz < f_m ≤ 100 kHz 100 kHz < f_m ≤ 200 kHz 200 kHz < f_m ≤ 10 MHz	$1 \cdot 10^{-3} \cdot \Delta\phi + K$ $2 \cdot 10^{-3} \cdot \Delta\phi + K$ $5 \cdot 10^{-3} \cdot \Delta\phi + K$	$\Delta\phi$: Measured value $f_{HF} > 5 \cdot (f_m + \Delta\phi)$ [3)]

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Rise time	200 ps to 1 s	1 mV to 100 V in 50 Ω	$20 \cdot 10^{-3} \cdot t + (50\ \text{ps})^2/t$	t: Measured value
	2 ns to 1 s	100 V to 5 kV in 50 Ω	$20 \cdot 10^{-3} \cdot t + (0.3\ \text{ns})^2/t$	e.g. Burst according to EN 61000-4-4 :2013
	3 ns to 1 s	100 V to 8 kV in 1 kΩ	$20 \cdot 10^{-3} \cdot t + (0.5\ \text{ns})^2/t$	
	10 ns to 1 s	100 V to 15 kV with HV-Probe	$20 \cdot 10^{-3} \cdot t + (2.2\ \text{ns})^2/t$	e.g. Surge according to EN 61000-4-5:2019
	20 ns to 10 µs	1 mA to 5 kA with current transformer	$20 \cdot 10^{-3} \cdot t + (5\ \text{ns})^2/t$	
	0.7 ns to 500 ns	1 A to 150 A with ESD-Target	$30 \cdot 10^{-3} \cdot t$	ESD according to EN 61000-4-2:2009
Pulse duration Repetition time Burst duration Burst period	0.5 ns to 10 s 1 ns to 10 s 5 ns to 10 s 5 ns to 10 s		$2 \cdot 10^{-3} \cdot t + 10\ \text{ps} + \delta t_{\text{TRIG}}$	δt_{TRIG}: Triggeruncertainty
Pulse voltage	10 mV to 500 V	200 ps ≤ Δt ≤ 1 s at 50 Ω	$20 \cdot 10^{-3} \cdot U$, $\Delta t \geq 20$ ns	U: Measured value Δt: Pulse duration
	10 V to 5 kV 10 V to 8 kV	2,5 ns ≤ Δt ≤ 1 s at 50 Ω 2,5 ns ≤ Δt ≤ 1 s at 1 kΩ	$30 \cdot 10^{-3} \cdot U$, $\Delta t < 20$ ns	e.g. Burst according to EN 61000-4-4:2013
	10 V to 15 kV	10 ns ≤ Δt ≤ 1 s, high resistance		e.g. Surge according to EN 61000-4-5:2019
Pulse current	1 A to 5 kA	20 ns ≤ Δt ≤ 10 ms	$20 \cdot 10^{-3} \cdot I$	I: Measured value
ESD-current pulse	1 A to 150 A	Current peak	$40 \cdot 10^{-3} \cdot I$	I: Measured value
	0.2 A to 150 A	Current grid values after 30 ns and 60 ns	$25 \cdot 10^{-3} \cdot I$	Calibration with Target according to EN 61000-4-2:2009
Pulse spectrum	0.1 µVs to 50 µVs 3 nVs to 1 µVs 0.4 nVs to 200 nVs	9 kHz to 150 kHz 150 kHz to 30 MHz 30 MHz to 1 GHz	$25 \cdot 10^{-3} \cdot IS$ $25 \cdot 10^{-3} \cdot IS$ $27 \cdot 10^{-3} \cdot IS$	IS: Measured value CISPR 16-1-1:2019
Antenna factor (ECSM)	Depending on antenna	9 kHz to 30 MHz CISPR 16-1-6:2022	1.2 dB	monopole antennas ECSM procedure
Antenna factor				loop antennas standard field procedure

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
DC voltage meters	0 V to 2.2 V		$5 \cdot 10^{-6} \cdot U + 1.5\ \mu V$	U: Measured value
	> 2.2 V to 22 V		$5 \cdot 10^{-6} \cdot U$	
	> 22 V to 1100 V		$10 \cdot 10^{-6} \cdot U$	
sources	0 mV to 100 mV		$5 \cdot 10^{-6} \cdot U + 1.5\ \mu V$	
	> 0.1 V to 1 V		$10 \cdot 10^{-6} \cdot U + 1\ \mu V$	
	> 1 V to 10 V		$10 \cdot 10^{-6} \cdot U + 1\ \mu V$	
	> 10 V to 100 V		$10 \cdot 10^{-6} \cdot U + 30\ \mu V$	
	> 100 V to 1000 V		$12 \cdot 10^{-6} \cdot U + 100\ \mu V$	
DC current meters and sources	0.1 µA to 1.0 µA		$21 \cdot 10^{-6} \cdot I + 40$ pA	I: Measured value
	> 1.0 µA to 10 µA		$21 \cdot 10^{-6} \cdot I + 120$ pA	
	> 10 µA to 100 µA		$21 \cdot 10^{-6} \cdot I + 1$ nA	
	> 100 µA to 1.0 mA		$21 \cdot 10^{-6} \cdot I + 6$ nA	
	> 1.0 mA to 10 mA		$21 \cdot 10^{-6} \cdot I + 60$ nA	
	> 10 mA to 100 mA		$36 \cdot 10^{-6} \cdot I + 0.6\ \mu A$	
	> 100 mA to 1.0 A		$110 \cdot 10^{-6} \cdot I + 10\ \mu A$	
	> 100 mA to 1.0 A		$5 \cdot 10^{-5} \cdot I$	
	> 1 A to 20 A		$7 \cdot 10^{-5} \cdot I$	
Only sources	> 20 A to 100 A		$7 \cdot 10^{-5} \cdot I$	
DC resistance meters	1 Ω		$0.11 \cdot 10^{-3} \cdot R$	R: Measured value
	1.9 Ω		$0.11 \cdot 10^{-3} \cdot R$	
	10 Ω		$27 \cdot 10^{-6} \cdot R$	
	19 Ω		$27 \cdot 10^{-6} \cdot R$	
	100 Ω		$12 \cdot 10^{-6} \cdot R$	
	190 Ω		$12 \cdot 10^{-6} \cdot R$	
	1 kΩ		$9.9 \cdot 10^{-6} \cdot R$	
	1.9 kΩ		$10 \cdot 10^{-6} \cdot R$	
	10 kΩ		$9.9 \cdot 10^{-6} \cdot R$	
	19 kΩ		$10 \cdot 10^{-6} \cdot R$	
	100 kΩ		$13 \cdot 10^{-6} \cdot R$	
	190 kΩ		$13 \cdot 10^{-6} \cdot R$	
	1 MΩ		$23 \cdot 10^{-6} \cdot R$	
	1.9 MΩ		$25 \cdot 10^{-6} \cdot R$	
	10 MΩ		$47 \cdot 10^{-6} \cdot R$	
	19 MΩ		$57 \cdot 10^{-6} \cdot R$	
	100 MΩ		$0.14 \cdot 10^{-3} \cdot R$	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
DC Resistance sources and meters	0 Ω to 100 kΩ		$15 \cdot 10^{-6} \cdot R + 60\ \mu\Omega$	R: Measured value
	> 100 kΩ to 1 MΩ		$20 \cdot 10^{-6} \cdot R + 2\ \Omega$	
	>1 MΩ to 10 MΩ		$60 \cdot 10^{-6} \cdot R + 0.1\ k\Omega$	
	> 10 MΩ to 100 MΩ		$0.6 \cdot 10^{-3} \cdot R$	
	> 100 MΩ to 1 GΩ		$5.1 \cdot 10^{-3} \cdot R$	
AC voltage meters	2 mV to 220 V	10 Hz to < 20 Hz	$0.40 \cdot 10^{-3} \cdot U + 8\ \mu V$	U: Measured value
	2 mV to 22 mV	20 Hz to < 40 Hz	$0.15 \cdot 10^{-3} \cdot U + 5\ \mu V$	
		40 Hz to 20 kHz	$0.15 \cdot 10^{-3} \cdot U + 4\ \mu V$	
		> 20 kHz to 50 kHz	$0.21 \cdot 10^{-3} \cdot U + 4\ \mu V$	
		> 50 kHz to 100 kHz	$0.50 \cdot 10^{-3} \cdot U + 6\ \mu V$	
		> 100 kHz to 300 kHz	$1.0 \cdot 10^{-3} \cdot U + 15\ \mu V$	
		> 300 kHz to 500 kHz	$1.8 \cdot 10^{-3} \cdot U + 20\ \mu V$	
		> 500 kHz to 1 MHz	$4.0 \cdot 10^{-3} \cdot U + 20\ \mu V$	
	22 mV to 220 mV	20 Hz to < 40 Hz	$0.15 \cdot 10^{-3} \cdot U + 6\ \mu V$	
		40 Hz to 20 kHz	$0.20 \cdot 10^{-3} \cdot U + 5\ \mu V$	
		> 20 kHz to 50 kHz	$0.21 \cdot 10^{-3} \cdot U + 8\ \mu V$	
		> 50 kHz to 100 kHz	$0.50 \cdot 10^{-3} \cdot U + 18\ \mu V$	
		> 100 kHz to 300 kHz	$1.0 \cdot 10^{-3} \cdot U + 18\ \mu V$	
		> 300 kHz to 500 kHz	$1.8 \cdot 10^{-3} \cdot U + 20\ \mu V$	
		> 500 kHz to 1 MHz	$4.0 \cdot 10^{-3} \cdot U + 20\ \mu V$	
	220 mV to 2.2 V	20 Hz to < 40 Hz	$0.1 \cdot 10^{-3} U + 15\ \mu V$	
		40 Hz to 20 kHz	$0.1 \cdot 10^{-3} U + 8\ \mu V$	
		> 20 kHz to 50 kHz	$0.1 \cdot 10^{-3} U + 10\ \mu V$	
		> 50 kHz to 100 kHz	$0.15 \cdot 10^{-3} \cdot U + 30\ \mu V$	
		> 100 kHz to 300 kHz	$0.5 \cdot 10^{-3} \cdot U + 80\ \mu V$	
		> 300 kHz to 500 kHz	$1.3 \cdot 10^{-3} \cdot U + 200\ \mu V$	
		> 500 kHz to 1 MHz	$2.0 \cdot 10^{-3} \cdot U + 300\ \mu V$	
	2.2 V to 22 V	20 Hz to < 40 Hz	$0.10 \cdot 10^{-3} \cdot U + 150\ \mu V$	
		40 Hz to 20 kHz	$0.10 \cdot 10^{-3} \cdot U + 50\ \mu V$	
		> 20 kHz to 50 kHz	$0.10 \cdot 10^{-3} \cdot U + 100\ \mu V$	
		> 50 kHz to 100 kHz	$0.15 \cdot 10^{-3} \cdot U + 200\ \mu V$	
		> 100 kHz to 300 kHz	$0.50 \cdot 10^{-3} \cdot U + 600\ \mu V$	
		> 300 kHz to 500 kHz	$1.3 \cdot 10^{-3} \cdot U + 2\ mV$	
		> 500 kHz to 1 MHz	$2.7 \cdot 10^{-3} \cdot U + 3.5\ mV$	
	22 V to 220 V	20 Hz to < 40 Hz	$0.15 \cdot 10^{-3} \cdot U + 1.5\ mV$	
		40 Hz to 20 kHz	$0.10 \cdot 10^{-3} \cdot U + 0.6\ mV$	
		> 20 kHz to 50 kHz	$0.10 \cdot 10^{-3} \cdot U + 1\ mV$	
		> 50 kHz to 100 kHz	$0.50 \cdot 10^{-3} \cdot U + 3\ mV$	
	> 22 V to U_{MAX}	> 100 kHz to 300 kHz	$1.8 \cdot 10^{-3} \cdot U + 16\ mV$	U_{MAX}: $22 \cdot 10^{6} \cdot V\ Hz / f\ [Hz]$
		> 300 kHz to 500 kHz	$5.0 \cdot 10^{-3} \cdot U + 40\ mV$	
		> 500 kHz to 1 MHz	$8.0 \cdot 10^{-3} \cdot U + 80\ mV$	
	> 220 V to 1 kV	15 Hz to 50 Hz	$0.40 \cdot 10^{-3} \cdot U + 2.5\ mV$	
		> 50 Hz to 1 kHz	$0.11 \cdot 10^{-3} \cdot U + 2.5\ mV$	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
AC voltage meters	2 mV to 3.5 V	10 Hz to 30 Hz	$3.3 \cdot 10^{-3} \cdot U + 3\ \mu V$	U: Measured value
		> 30 Hz to 120 Hz	$1.6 \cdot 10^{-3} \cdot U + 3\ \mu V$	
		> 120 Hz to 120 kHz	$1.3 \cdot 10^{-3} \cdot U + 3\ \mu V$	
		> 120 kHz to 2 MHz	$1.5 \cdot 10^{-3} \cdot U + 3\ \mu V$	
		> 2 MHz to 10 MHz	$3.5 \cdot 10^{-3} \cdot U + 3\ \mu V$	
		> 10 MHz to 20 MHz	$11.0 \cdot 10^{-3} \cdot U + 3\ \mu V$	
		> 20 MHz to 30 MHz	$25.0 \cdot 10^{-3} \cdot U + 15\ \mu V$	
	2 mV to 10 mV	1 Hz to < 40 Hz	$0.35 \cdot 10^{-3} \cdot U + 3\ \mu V$	
		40 Hz to 1 kHz	$0.21 \cdot 10^{-3} \cdot U + 1.3\ \mu V$	
		> 1 kHz to 20 kHz	$0.35 \cdot 10^{-3} \cdot U + 1.3\ \mu V$	
		> 20 kHz to 50 kHz	$1.0 \cdot 10^{-3} \cdot U + 2\ \mu V$	
		> 50 kHz to 100 kHz	$1.0 \cdot 10^{-3} \cdot U + 6\ \mu V$	
		> 100 kHz to 300 kHz	$12.0 \cdot 10^{-3} \cdot U + 10\ \mu V$	
	> 10 mV to 100 mV	1 Hz to < 40 Hz	$0.10 \cdot 10^{-3} \cdot U + 4\ \mu V$	
		40 Hz to 1 kHz	$0.10 \cdot 10^{-3} \cdot U + 2\ \mu V$	
		> 1 kHz to 20 kHz	$0.2 \cdot 10^{-3} \cdot U + 2\ \mu V$	
		> 20 kHz to 50 kHz	$0.35 \cdot 10^{-3} \cdot U + 2\ \mu V$	
		> 50 kHz to 100 kHz	$1.0 \cdot 10^{-3} \cdot U + 2\ \mu V$	
		> 100 kHz to 300 kHz	$3.5 \cdot 10^{-3} \cdot U + 10\ \mu V$	
		> 300 kHz to 1 MHz	$10 \cdot 10^{-3} \cdot U + 10\ \mu V$	
	> 100 mV to 1 V	1 Hz to < 40 Hz	$0.10 \cdot 10^{-3} \cdot U + 40\ \mu V$	
		40 Hz to 1 kHz	$0.10 \cdot 10^{-3} \cdot U + 20\ \mu V$	
		> 1 kHz to 20 kHz	$0.2 \cdot 10^{-3} \cdot U + 20\ \mu V$	
		> 20 kHz to 50 kHz	$0.35 \cdot 10^{-3} \cdot U + 20\ \mu V$	
		> 50 kHz to 100 kHz	$1.0 \cdot 10^{-3} \cdot U + 20\ \mu V$	
		> 100 kHz to 300 kHz	$3.5 \cdot 10^{-3} \cdot U + 100\ \mu V$	
		> 300 kHz to 1 MHz	$10 \cdot 10^{-3} \cdot U + 100\ \mu V$	
	> 1 V to 10 V	1 Hz to < 40 Hz	$0.10 \cdot 10^{-3} \cdot U + 400\ \mu V$	
		40 Hz to 1 kHz	$0.10 \cdot 10^{-3} \cdot U + 200\ \mu V$	
		> 1 kHz to 20 kHz	$0.2 \cdot 10^{-3} \cdot U + 200\ \mu V$	
		> 20 kHz to 50 kHz	$0.35 \cdot 10^{-3} \cdot U + 200\ \mu V$	
		> 50 kHz to 100 kHz	$1.0 \cdot 10^{-3} \cdot U + 200\ \mu V$	
		> 100 kHz to 300 kHz	$3.5 \cdot 10^{-3} \cdot U + 1\ mV$	
		> 300 kHz to 1 MHz	$10 \cdot 10^{-3} \cdot U + 1\ mV$	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
AC voltage sources	> 10 V to 100 V	1 Hz to < 40 Hz	$0.21 \cdot 10^{-3} \cdot U + 30$ mV	U: Measured value
		40 Hz to 1 kHz	$0.21 \cdot 10^{-3} \cdot U + 2$ mV	
		> 1 kHz to 20 kHz	$0.21 \cdot 10^{-3} \cdot U + 2$ mV	
		> 20 kHz to 50 kHz	$0.35 \cdot 10^{-3} \cdot U + 2$ mV	
		> 50 kHz to 100 kHz	$1.3 \cdot 10^{-3} \cdot U + 2$ mV	
		> 100 kHz to 300 kHz	$4.0 \cdot 10^{-3} \cdot U + 10$ mV	
		> 300 kHz to 1 MHz	$15 \cdot 10^{-3} \cdot U + 10$ mV	
	> 100 V to 700 V	1 Hz to < 40 Hz	$0.45 \cdot 10^{-3} \cdot U + 40$ mV	
		40 Hz to 1 kHz	$0.45 \cdot 10^{-3} \cdot U + 20$ mV	
		> 1 kHz to 20 kHz	$0.65 \cdot 10^{-3} \cdot U + 20$ mV	
		> 20 kHz to 50 kHz	$1.3 \cdot 10^{-3} \cdot U + 20$ mV	
		> 50 kHz to 100 kHz	$3.1 \cdot 10^{-3} \cdot U + 20$ mV	
AC current meters	100 µA to 220 µA	10 Hz to 20 Hz	$0.3 \cdot 10^{-3} \cdot I + 16$ nA	I: Measured value
		> 20 Hz to 1 kHz	$0.2 \cdot 10^{-3} \cdot I + 10$ nA	
		> 1 kHz to 5 kHz	$0.3 \cdot 10^{-3} \cdot I + 12$ nA	
		> 5 kHz to 10 kHz	$1.1 \cdot 10^{-3} \cdot I + 0.1$ µA	
	> 220 µA to 2.2 mA	10 Hz to 20 Hz	$0.3 \cdot 10^{-3} \cdot I + 50$ nA	
		> 20 Hz to 1 kHz	$0.2 \cdot 10^{-3} \cdot I + 35$ nA	
		> 1 kHz to 5 kHz	$0.22 \cdot 10^{-3} \cdot I + 110$ nA	
		> 5 kHz to 10 kHz	$1.2 \cdot 10^{-3} \cdot I + 1$ µA	
	> 2.2 mA to 22 mA	10 Hz to 20 Hz	$0.3 \cdot 10^{-3} \cdot I + 400$ nA	
		> 20 Hz to 1 kHz	$0.2 \cdot 10^{-3} \cdot I + 350$ nA	
		> 1 kHz to 5 kHz	$0.22 \cdot 10^{-3} \cdot I + 550$ nA	
		> 5 kHz to 10 kHz	$1.2 \cdot 10^{-3} \cdot I + 5$ µA	
	> 22 mA to 220 mA	10 Hz to 20 Hz	$0.3 \cdot 10^{-3} \cdot I + 4$ µA	
		> 20 Hz to 1 kHz	$0.2 \cdot 10^{-3} \cdot I + 3.5$ µA	
		> 1 kHz to 5 kHz	$0.22 \cdot 10^{-3} \cdot I + 4.5$ µA	
		> 5 kHz to 10 kHz	$1.2 \cdot 10^{-3} \cdot I + 10$ µA	
	> 220 mA to 2.2 A	20 Hz to 45 Hz	$0.26 \cdot 10^{-3} \cdot I + 40$ µA	
		> 45 Hz to 5 kHz	$0.47 \cdot 10^{-3} \cdot I + 160$ µA	
		> 5 kHz to 10 kHz	$7.1 \cdot 10^{-3} \cdot I + 160$ µA	
	2.2 A to 11 A	45 Hz to 5 kHz	$0.92 \cdot 10^{-3} \cdot I + 2$ mA	
		> 5 kHz to 10 kHz	$3.6 \cdot 10^{-3} \cdot I + 2$ mA	
sources	100 µA to 1 mA	10 Hz to 20 Hz	$4.0 \cdot 10^{-3} \cdot I + 0.22$ µA	
		> 20 Hz to 45 Hz	$1.5 \cdot 10^{-3} \cdot I + 0.22$µA	
		> 45 Hz to 5 kHz	$0.35 \cdot 10^{-3} \cdot I + 0.2$µA	
		> 45 Hz to 10 kHz	$0.7 \cdot 10^{-3} \cdot I + 0.2$ µA	
	> 1 mA to 10 mA	> 10 Hz to 20 Hz	$4.0 \cdot 10^{-3} \cdot I + 2.2$ µA	
		> 20 Hz to 45 Hz	$1.5 \cdot 10^{-3} \cdot I + 2.2$ µA	
		> 45 Hz to 5 kHz	$0.35 \cdot 10^{-3} \cdot I + 2$ µA	
		> 5 kHz to 10 kHz	$0.7 \cdot 10^{-3} \cdot I + 2$ µA	
	> 10 mA to 100 mA	10 Hz to 20 Hz	$4.0 \cdot 10^{-3} \cdot I + 22$ µA	
		> 20 Hz to 45 Hz	$1.5 \cdot 10^{-3} \cdot I + 22$ µA	
		> 45 Hz to 5 kHz	$0.35 \cdot 10^{-3} \cdot I + 20$ µA	
		> 5 kHz to 10 kHz	$0.7 \cdot 10^{-3} \cdot I + 20$ µA	
	> 100 mA to 1 A	10 Hz to 20 Hz	$4.0 \cdot 10^{-3} \cdot I + 220$ µA	
		> 20 Hz to 45 Hz	$1.6 \cdot 10^{-3} \cdot I + 220$ µA	
		> 45 Hz to 5 kHz	$1 \cdot 10^{-3} \cdot I + 220$ µA	
		> 5 kHz to 10 kHz	$3 \cdot 10^{-3} \cdot I + 220$ µA	
	> 1 A to 11 A	50 Hz to 120 Hz	$2.3 \cdot 10^{-3} \cdot I + 450$ µA	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
RF-Power Sensors with mismatch correction	100 nW to 10 µW	8 kHz to 100 MHz	$5.8 \cdot 10^{-3} \cdot P$	*P*: Measured value
		> 100 MHz to 2.4 GHz	$7.0 \cdot 10^{-3} \cdot P$	
		> 2.4 GHz to 4 GHz	$8.0 \cdot 10^{-3} \cdot P$	
		> 4 GHz to 8 GHz	$10 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 12.4 GHz	$13 \cdot 10^{-3} \cdot P$	
		> 12.4 GHz to 18 GHz	$15 \cdot 10^{-3} \cdot P$	
		> 18 GHz to 26.5 GHz	$15 \cdot 10^{-3} \cdot P$	
		> 26.5 GHz to 40 GHz	$19 \cdot 10^{-3} \cdot P$	
	10 µW to 200 mW	8 kHz to 1 MHz	$3.0 \cdot 10^{-3} \cdot P$	
		> 1 MHz to 100 MHz	$3.4 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 2.4 GHz	$5.1 \cdot 10^{-3} \cdot P$	
		> 2.4 GHz to 8 GHz	$6.8 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 12.4 GHz	$8.4 \cdot 10^{-3} \cdot P$	
		> 12.4 GHz to 18 GHz	$11 \cdot 10^{-3} \cdot P$	
		> 18 GHz to 26.5 GHz	$14 \cdot 10^{-3} \cdot P$	
		> 26.5 GHz to 40 GHz	$17 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$21 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$33 \cdot 10^{-3} \cdot P$	
RF-Power Sources and meters with mismatch correction	0.2 fW to < 10 pW	8 kHz to 8 GHz	$21 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 20 GHz	$24 \cdot 10^{-3} \cdot P$	
	1 fW to < 10 pW	> 20 GHz to 40 GHz	$29 \cdot 10^{-3} \cdot P$	
	10 fW to < 10 pW	> 40 GHz to 50 GHz	$43 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$49 \cdot 10^{-3} \cdot P$	
	10 pW to < 100 nW	8 kHz to 100 MHz	$15 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 8 GHz	$17 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 20 GHz	$20 \cdot 10^{-3} \cdot P$	
		> 20 GHz to 40 GHz	$26 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$34 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$43 \cdot 10^{-3} \cdot P$	
RF-Power Sources and meters with mismatch correction	100 nW to 200 mW	8 kHz to 100 MHz	$10 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 8 GHz	$13 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 18 GHz	$16 \cdot 10^{-3} \cdot P$	
		> 18 GHz to 26.5 GHz	$23 \cdot 10^{-3} \cdot P$	
		> 26.5 GHz to 40 GHz	$23 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$30 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$35 \cdot 10^{-3} \cdot P$	
Sources and meters without mismatch correction	> 200 mW to 20 W	8 kHz to 100 MHz	$11 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 4 GHz	$14 \cdot 10^{-3} \cdot P$	
	> 200 mW to 4 W	> 4 GHz to 8 GHz	$15 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 12.5 GHz	$19 \cdot 10^{-3} \cdot P$	
		> 12.5 GHz to 18 GHz	$23 \cdot 10^{-3} \cdot P$	
	> 200 mW to 2 W	> 18 GHz to 26.5 GHz	$25 \cdot 10^{-3} \cdot P$	
	> 200 mW to 1 W	> 26.5 GHz to 40 GHz	$31 \cdot 10^{-3} \cdot P$	
	> 20 W to 2 kW	> 8 kHz to 1 GHz	$24 \cdot 10^{-3} \cdot P$	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
RF-Power ratio Sources and meters	> 0 dB to 0.1 dB > 0 dB to 70 dB > 70 dB to 120 dB	8 kHz to 67 GHz	0.005 dB 0.05 dB 0.09 dB	
Only Meters	> 0 dB to 21 dB > 21 dB to 30 dB > 30 dB to 40 dB > 40 dB to 50 dB > 50 dB to 60 dB > 60 dB to 70 dB > 70 dB to 80 dB > 80 dB to 90 dB > 90 dB to 100 dB > 100 dB to 110 dB > 110 dB to 120 dB	50 MHz to 1 GHz	0.005 dB 0.010 dB 0.012 dB 0.013 dB 0.014 dB 0.015 dB 0.016 dB 0.017 dB 0.018 dB 0.019 dB 0.020 dB	
RF-Attenuation Step attenuator	> 0 dB to 0.1 dB > 0.1 dB to 20 dB > 20 dB to 40 dB > 40 dB to 60 dB > 60 dB to 80 dB > 80 dB to 90 dB	10 MHz to 200 MHz	0.007 dB 0.010 dB 0.014 dB 0.016 dB 0.019 dB 0.023 dB	
Meters	> 0 dB to 0.1 dB > 0.1 dB to 20 dB > 20 dB to 40 dB > 40 dB to 60 dB > 60 dB to 80 dB > 80 dB to 90 dB	10 MHz to 200 MHz	0.010 dB 0.020 dB 0.023 dB 0.024 dB 0.027 dB 0.030 dB	
Scattering quantities Reflection coefficient (S_{11}) Magnitude	0.0 to 0.2 > 0.2 to 1.0	> 9 kHz to 10 GHz	0.0035 $0.0035 + 0.0039 \cdot \lvert S_{11} \rvert^2$	
	0.0 to 0.2 > 0.2 to 1.0	> 10 GHz to 18 GHz	0.0041 $0.0041 + 0.0040 \cdot \lvert S_{11} \rvert^2$	
	0.0 to 0.2 > 0.2 to 1.0	> 18 GHz to 30 GHz	0.0059 $0.0059 + 0.0055 \cdot \lvert S_{11} \rvert^2$	
	0.0 to 0.2 > 0.2 to 1.0	> 30 GHz to 40 GHz	0.0070 $0.0070 + 0.0050 \cdot \lvert S_{11} \rvert^2$	
	0.0 to 0.2 > 0.2 to 1.0	> 40 GHz to 50 GHz	0.0092 $0.0092 + 0.0088 \cdot \lvert S_{11} \rvert^2$	
	0.0 to 0.2 > 0.2 to 1.0	> 50 GHz to 60 GHz	0.012 $0.012 + 0.011 \cdot \lvert S_{11} \rvert^2$	
	0.0 to 0.2 > 0.2 to 1.0	> 60 GHz to 67 GHz	0.012 $0.012 + 0.014 \cdot \lvert S_{11} \rvert^2$	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Phase	- 180 ° to 180 °	> 8 kHz to 67 GHz	180°/π · U_S	U_S = arcsin(U(S_{II}^2)/||S_{II}|^2|)
Transmission (S_{IJ}) Magnitude and phase	0 to 30 dB	> 9 kHz to 100 kHz	0.05 dB, 0.4°	Measurement uncertainty (in dB) and as phase displacement (in °)
	> 30 dB to 40 dB		0.07 dB, 0.5°	
	> 40 dB to 50 dB		0.12 dB, 0.8°	
	> 50 dB to 60 dB		0.32 dB, 2.1°	
	> 60 dB to 80 dB		0.32 dB + 0.13 · (S_{IJ} [dB] - 60 dB)	
	0 to 30 dB	> 100 kHz to 50 MHz	0.05 dB, 0.4°	
	> 30 dB to 40 dB		0.06 dB, 0.4°	
	> 40 dB to 50 dB		0.09 dB, 0.6°	
	> 50 dB to 60 dB		0.19 dB, 1.3°	
	> 60 dB to 80 dB		0.19 dB + 0.076 · (S_{IJ} [dB] - 60 dB)	
	0 to 30 dB	> 50 MHz to 200 MHz	0.05 dB, 0.4°	
	> 30 dB to 40 dB		0.06 dB, 0.4°	
	> 40 dB to 60 dB		0.08 dB, 0.6°	
	> 60 dB to 80 dB		0.32 dB, 2.1°	
	> 80 dB to 90 dB		1.0 dB	
	0 to 30 dB	> 200 MHz to 20 GHz	0.04 dB, 0.9°	
	> 30 dB to 40 dB		0.06 dB, 0.9°	
	> 40 dB to 60 dB		0.07 dB, 0.9°	
	> 60 dB to 80 dB		0.15 dB, 1.3°	
	> 80 dB to 90 dB		0.32 dB	
	0 to 30 dB	> 20 GHz to 40 GHz	0.06 dB, 1.3°	
	> 30 dB to 40 dB		0.08 dB, 1.3°	
	> 40 dB to 60 dB		0.09 dB, 1.3°	
	> 60 dB to 80 dB		0.33 dB, 2.5°	
	> 80 dB to 90 dB		0.96 dB	
	0 to 30 dB	> 40 GHz to 50 GHz	0.11 dB, 1.7°	
	> 30 dB to 40 dB		0.12 dB, 1.7°	
	> 40 dB to 60 dB		0.13 dB, 1.7°	
	> 60 dB to 80 dB		0.34 dB, 2.7°	
	> 80 dB to 90 dB		0.96 dB	
	0 to 30 dB	> 50 GHz to 67 GHz	0.15 dB, 2.2°	
	> 30 dB to 40 dB		0.16 dB, 2.3°	
	> 40 dB to 60 dB		0.20 dB, 2.4°	
	> 60 dB to 90 dB		0.20 dB + 0.09 · (S_{IJ} [dB] - 60 dB)	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Modulation quantities Sources and meters Amplitude modulation Modulation degree m	0 to 1.0	f_m ≤ 100 kHz	$0.001 \cdot m + 2.5 \cdot 10^{-5}$	
		100 kHz < f_m ≤ 1 MHz	$0.002 \cdot m + 5 \cdot 10^{-5}$	
		1 MHz < f_m ≤ 10 MHz	$0.007 \cdot m + 3 \cdot 10^{-4}$	m: Measured value
Frequency modulation Frequency deviation Δf	10 Hz to 16 MHz	10 Hz < f_m ≤ 100 kHz	$1 \cdot 10^{-3} \cdot \Delta f + K$	Δf: Measured value K: Contribution of noise
		100 kHz < f_m ≤ 200 kHz	$2 \cdot 10^{-3} \cdot \Delta f + K$	
		200 kHz < f_m ≤ 10 MHz	$5 \cdot 10^{-3} \cdot \Delta f + K$	
Phase modulation Phase deviation $\Delta\phi$	10 Hz / f_m to 16 MHz / f_m	10 Hz < f_m ≤ 100 kHz	$1 \cdot 10^{-3} \cdot \Delta\phi + K$	$\Delta\phi$: Measured value
		100 kHz < f_m ≤ 200 kHz	$2 \cdot 10^{-3} \cdot \Delta\phi + K$	
		200 kHz < f_m ≤ 10 MHz	$5 \cdot 10^{-3} \cdot \Delta\phi + K$	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Waveform quantities				
CISPR Pulse		CISPR 16-1-1:2019		
Impulse area (*IS*)	0.1 µVs to 50 µVs	9 kHz to 150 kHz	$35 \cdot 10^{-3} \cdot IS$	*IS*: Measured value
Meters	3 nVs to 1 µVs	150 kHz to 30 MHz	$35 \cdot 10^{-3} \cdot IS$	
	0.4 nVs to 200 nVs	30 MHz to 1 GHz	$36 \cdot 10^{-3} \cdot IS$	
	0.4 nVs to 200 nVs	1 GHz to < 8 GHz	$13 \cdot 10^{-3} \cdot IS$	
	0.4 nVs to 200 nVs	8 GHz to 18 GHz	$15 \cdot 10^{-3} \cdot IS$	
Relative Response Ratio	0.1 µVs to 200 nVs	9 kHz to 18 GHz	0.55 %	
Rise time		EN 61000-4-4:2013		
DC pulse generator	200 ps to 1 s	1 mV to 100 V in 50 Ω	$20 \cdot 10^{-3} \cdot t + (50\ \text{ps})^2/t$	*t*: Measured value
	2 ns to 1 s	100 V to 5 kV in 50 Ω	$20 \cdot 10^{-3} \cdot t + (0.3\ \text{ns})^2/t$	
	3 ns to 1 s	100 V to 8 kV in 1 kΩ	$20 \cdot 10^{-3} \cdot t + (0.5\ \text{ns})^2/t$	
		EN 61000-4-5:2019		
	10 ns to 1 s	100 V to 15 kV	$20 \cdot 10^{-3} \cdot t + (2.2\ \text{ns})^2/t$	
	20 ns to 10 µs	1 mA to 5 kA	$20 \cdot 10^{-3} \cdot t + (5\ \text{ns})^2/t$	
		EN 61000-4-2:2009		
	0.7 ns to 500 ns	1 A to 150 A	$30 \cdot 10^{-3} \cdot t$	
RF pulse generator	0.5 ns to 20 ns	100 MHz to 67 GHz	1 ns	
Pulse duration	0.5 ns to 10 s		$2 \cdot 10^{-3} \cdot t + 10\ \text{ps} + \delta t_{TRIG}$	δt_{TRIG}: Trigger uncertainty
Repetition time	1 ns to 10 s			
Burst duration	5 ns to 10 s			
Burst period	5 ns to 10 s			

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Pulse voltage		EN 61000-4-4:2013		
	10 mV to 500 V	200 ps ≤ Δt ≤ 1 s	$20 \cdot 10^{-3} \cdot U$	U: Measured value
	10 V to 8 kV	2.5 ns ≤ Δt ≤ 1 s	$30 \cdot 10^{-3} \cdot U$	Δt: Pulse duration
		EN 61000-4-5:2019		
	10 V to 15 kV	10 ns ≤ Δt ≤ 1 s	$30 \cdot 10^{-3} \cdot U$	
Pulse current		EN 61000-4-2:2009		
	0.2 A to 150 A	10 ns ≤ Δt ≤ 10 ms	$25 \cdot 10^{-3} \cdot I$	I: Measured value
	1 A to 150 A	0.5 ns ≤ Δt ≤ 10 ns	$40 \cdot 10^{-3} \cdot I$	
	1 A to 5 kA	20 ns ≤ Δt ≤ 10 ms	$20 \cdot 10^{-3} \cdot I$	
Voltage division factor		EN 55016-1-2:201		
	0 dB to 30 dB	9 kHz to 250 MHz	0.10 dB	
Complex impedance Z		EN 55016-1-2:2019		
Magnitude	0.2 Ω to 70 Ω	9 kHz to 10 MHz	$0.17\ \Omega + 0.08 \cdot 10^{-3} \cdot \lvert Z\rvert^2/\Omega$	Z: Measured value
	35 Ω to 70 Ω	> 10 MHz to 30 MHz	$0.22\ \Omega + 0.12 \cdot 10^{-3} \cdot \lvert Z\rvert^2/\Omega$	
	30 Ω to 80 Ω	> 30 MHz to 230 MHz	$0.7\ \Omega + 0.18 \cdot 10^{-3} \cdot \lvert Z\rvert^2/\Omega$	
	> 120 Ω to 180 Ω	150 kHz to 24 MHz	$0.5\ \Omega + 0.05 \cdot 10^{-3} \cdot \lvert Z\rvert^2/\Omega$	
	> 100 Ω to 220 Ω	> 24 MHz to 80 MHz	$0.7\ \Omega + 0.07 \cdot 10^{-3} \cdot \lvert Z\rvert^2/\Omega$	
	> 30 Ω to 220 Ω	> 80 MHz to 300 MHz	$1.8\ \Omega + 0.1 \cdot 10^{-3} \cdot \lvert Z\rvert^2/\Omega$	
Phase	-180° to 180°		$180°/\pi \cdot U_S$	U_S = arcsin($U(\lvert Z\rvert)/\lvert Z\rvert$)
Frequency oscillators, measuring instruments	0.1 MHz, 1 MHz, 2MHz, 2.5 MHz, 5 MHz, 10 MHz		$5 \cdot 10^{-12} \cdot f$	f: Measured value U_{REP}: Repeatability-uncertainty t: Measured value
Time interval	1 Hz to 67 GHz		$\sqrt{(1 \cdot 10^{-10} \cdot f)^2 + U_{REP}^2}$	
	$1 \cdot 10^{-9}$ s to $1.8 \cdot 10^{+5}$ s		$\sqrt{1\ \text{ns}^2 + (1 \cdot 10^{-10} \cdot t)^2 + U_{REP}^2}$	

On-site calibration and mobile laboratory, Location Köln

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Direct voltage Sources, Measuring instruments	0 V to 500 V 500 V to 1000 V > 1 kV to 10 kV > 10 kV to 20 kV > 20 kV to 30 kV		$10 \cdot 10^{-6} \cdot U + 1\ \mu V$ $16 \cdot 10^{-6} \cdot U$ $2 \cdot 10^{-3} \cdot U$ $6 \cdot 10^{-3} \cdot U$ $22 \cdot 10^{-3} \cdot U$	*U*: Measured value
Direct current, sources Measuring instruments	1 µA to 1 A > 1 A to 200 A		$0.1 \cdot 10^{-3} \cdot I + 1\ nA$ $0.2 \cdot 10^{-3} \cdot I$	*I*: Measured value
Direct resistance Resistance, measuring instruments	0 Ω to 100 kΩ > 100 kΩ to 1 MΩ > 1 MΩ to 10 MΩ > 10 MΩ to 100 MΩ > 100 MΩ to 1 GΩ		$15 \cdot 10^{-6} \cdot R + 60\ \mu\Omega$ $20 \cdot 10^{-6} \cdot R + 2\ \Omega$ $60 \cdot 10^{-6} \cdot R + 0.1\ k\Omega$ $0.6 \cdot 10^{-3} \cdot R$ $5.1 \cdot 10^{-3} \cdot R$	*R*: Measured value
AC voltage Measuring instruments	1 mV to 220 V	10 Hz to < 20 Hz 20 Hz to 20 kHz > 20 kHz to 100 kHz	$0.4 \cdot 10^{-3} \cdot U + 4\ \mu V$ $0.2 \cdot 10^{-3} \cdot U + 4\ \mu V$ $0.5 \cdot 10^{-3} \cdot U + 10\ \mu V$	*U:* Measured value
	> 200 to 1000 V	50 Hz to 1 kHz	$0.2 \cdot 10^{-3} \cdot U$	
	1 mV to 10 V	100 kHz to 1 MHz	$2 \cdot 10^{-3} \cdot U + 5\ \mu V$	Voltage at 50 Ω
	1 mV to 3.5 V	> 1 MHz to 10 MHz > 10 MHz to 20 MHz > 20 MHz to 50 MHz	$2.5 \cdot 10^{-3} \cdot U + 6\ \mu V$ $4 \cdot 10^{-3} \cdot U + 6\ \mu V$ $10 \cdot 10^{-3} \cdot U + 20\ \mu V$	
Voltage sources	1 mV to 100 V	10 Hz to 20 kHz > 20 kHz to 50 kHz > 50 kHz to 100 kHz	$0.5 \cdot 10^{-3} \cdot U + 3\ \mu V$ $0.7 \cdot 10^{-3} \cdot U + 3\ \mu V$ $1.5 \cdot 10^{-3} \cdot U + 5\ \mu V$	*U:* Measured value
	1 mV to 10 V	100 kHz to 1 MHz	$11 \cdot 10^{-3} \cdot U + 10\ \mu V$	
	> 100 V to 1000 V	10 Hz to 20 kHz > 20 kHz to 50 kHz > 50 kHz to 100 kHz	$0.8 \cdot 10^{-3} \cdot U$ $1.5 \cdot 10^{-3} \cdot U$ $3.2 \cdot 10^{-3} \cdot U$	
	> 1 kV to 7 kV	45 Hz to 60 Hz	$2 \cdot 10^{-3} \cdot U$	
HF-Voltage	0.5 V to 3 V	100 kHz to 30 MHz	$10 \cdot 10^{-3} \cdot U$	*U*: Measured value
	0.5 V to 2 V	30 MHz to 100 MHz > 100 MHz to 500 MHz > 500 MHz to 1 GHz	$10 \cdot 10^{-3} \cdot U$ $20 \cdot 10^{-3} \cdot U$ $30 \cdot 10^{-3} \cdot U$	
AC current Measuring instruments	1 mA to 220 mA	20 Hz to 1 kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz	$0.4 \cdot 10^{-3} \cdot I$ $0.5 \cdot 10^{-3} \cdot I$ $3.0 \cdot 10^{-3} \cdot I$	*I:* Measured value
	> 220 mA to 2.2 A	20 Hz to 1 kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz	$0.4 \cdot 10^{-3} \cdot I$ $0.8 \cdot 10^{-3} \cdot I$ $7.7 \cdot 10^{-3} \cdot I$	

On-site calibration and mobile laboratory, Location Köln

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
AC current Current sources	1 mA to 120 mA	20 Hz to 45 Hz 45 Hz to 20 kHz	$3.0 \cdot 10^{-3} \cdot I$ $2.0 \cdot 10^{-3} \cdot I$	
	> 120 mA to 1A	20 Hz to 45 Hz > 45 Hz to 5 kHz > 5 kHz to 20 kHz	$3.0 \cdot 10^{-3} \cdot I$ $2.5 \cdot 10^{-3} \cdot I$ $4.5 \cdot 10^{-3} \cdot I$	
	> 1 A bis 200 A	10 Hz to 20 Hz > 20 Hz to 5 kHz > 5 kHz to 20 kHz	$3{,}0 \cdot 10^{-3} \cdot I$ $2{,}0 \cdot 10^{-3} \cdot I$ $5{,}0 \cdot 10^{-3} \cdot I$	
Capacitance	100 pF to <1 nF	1 kHz to 10 kHz	$1.5 \cdot 10^{-3} \cdot C$	*C*: Measured value
	1 nF to 1 µF	50 Hz to 10 kHz	$1.0 \cdot 10^{-3} \cdot C$	
	> 1 µF to 10 µF	50 Hz to 1 kHz	$1.0 \cdot 10^{-3} \cdot C$	
	> 1 µF to 10 µF	> 1 kHz to 10 kHz	$3 \cdot 10^{-3} \cdot C$	
	> 10 µF to 100 µF	50 Hz to 1 kHz	$3 \cdot 10^{-3} \cdot C$	
HF-Power	100 nW to 10 µW	> DC to 100 MHz	$5.8 \cdot 10^{-3} \cdot P$	*P*: Measured value

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
HF-Power Sensors with mismatch correction		> 100 MHz to 2.4 GHz	$7.0 \cdot 10^{-3} \cdot P$	PC Type-N[2)] to 18 GHz
		> 2.4 GHz to 4 GHz	$8.0 \cdot 10^{-3} \cdot P$	PC-3.5[2)] to 33 GHz
		> 4 GHz to 8 GHz	$10 \cdot 10^{-3} \cdot P$	PC-2.92[2)] to 40 GHz
		> 8 GHz to 12.4 GHz	$13 \cdot 10^{-3} \cdot P$	PC-2.4[2)] to 50 GHz
		> 12.4 GHz to 18 GHz	$15 \cdot 10^{-3} \cdot P$	PC-1.85[2)] to 67 GHz
		> 18 GHz to 26.5 GHz	$15 \cdot 10^{-3} \cdot P$	PC-1.00[2)] to 110 GHz
		> 26.5 GHz to 40 GHz	$19 \cdot 10^{-3} \cdot P$	
	10 µW to 200 mW	> DC to 1 MHz	$3.0 \cdot 10^{-3} \cdot P$	
		> 1 MHz to 100 MHz	$3.4 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 2.4 GHz	$5.1 \cdot 10^{-3} \cdot P$	
		2.4 GHz to 8 GHz	$6.8 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 12.4 GHz	$8.4 \cdot 10^{-3} \cdot P$	
		> 12.4 GHz to 18 GHz	$11 \cdot 10^{-3} \cdot P$	
		> 18 GHz to 26.5 GHz	$14 \cdot 10^{-3} \cdot P$	
		> 26.5 GHz to 40 GHz	$17 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$21 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$33 \cdot 10^{-3} \cdot P$	
HF-Power Sources. Measuring instruments with mismatch correction	10 µW to 200 mW	> DC to 100 MHz	$5.0 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 1 GHz	$6.0 \cdot 10^{-3} \cdot P$	
	0.2 fW to < 10 pW	> DC to 8 GHz	$21 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 20 GHz	$24 \cdot 10^{-3} \cdot P$	
	1 fW to < 10 pW	> 20 GHz to 40 GHz	$29 \cdot 10^{-3} \cdot P$	
	10 fW to < 10 pW	> 40 GHz to 50 GHz	$43 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$49 \cdot 10^{-3} \cdot P$	
	10 pW to < 100 nW	> DC to 100 MHz	$15 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 8 GHz	$17 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 20 GHz	$20 \cdot 10^{-3} \cdot P$	
		> 20 GHz to 40 GHz	$26 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$34 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$43 \cdot 10^{-3} \cdot P$	
	100 pW to < 100 µW	> 67 GHz to 75 GHz	$45 \cdot 10^{-3} \cdot P$	
		> 75 GHz to 90 GHz	$47 \cdot 10^{-3} \cdot P$	
		> 90 GHz to 110 GHz	$49 \cdot 10^{-3} \cdot P$	
	100 pW to 200 mW	> DC to 100 MHz	$10 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 8 GHz	$13 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 18 GHz	$16 \cdot 10^{-3} \cdot P$	
		> 18 GHz to 40 GHz	$23 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$21 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$33 \cdot 10^{-3} \cdot P$	
	100 µW to 125 mW	> 67 GHz to 75 GHz	$40 \cdot 10^{-3} \cdot P$	
		> 75 GHz to 90 GHz	$42 \cdot 10^{-3} \cdot P$	
		> 90 GHz to 110 GHz	$44 \cdot 10^{-3} \cdot P$	
	> 200 mW to 20 W	> DC to 100 MHz	$11 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 4 GHz	$14 \cdot 10^{-3} \cdot P$	

On-site calibration and mobile laboratory, Location Köln

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
HF-Power Sources. Measuring instruments with mismatch correction	> 200 mW to 4 W	> 4 GHz to 8 GHz	$15 \cdot 10^{-3} \cdot P$	*P*: Measured value
		> 8 GHz to 12.5 GHz	$19 \cdot 10^{-3} \cdot P$	
		> 12.5 GHz to 18 GHz	$23 \cdot 10^{-3} \cdot P$	
	> 200 mW to 2 W	> 18 GHz to 26.5 GHz	$25 \cdot 10^{-3} \cdot P$	
	> 200 mW to 1 W	> 26.5 GHz to 40 GHz	$31 \cdot 10^{-3} \cdot P$	
without mismatch correction	> 20 W to 2 kW	> DC to 1 GHz	$24 \cdot 10^{-3} \cdot P$	
	> 20 W to 500 W	> 1 GHz to 4 GHz	$30 \cdot 10^{-3} \cdot P$	
	> 4 W to 500 W	> 4 GHz to 10 GHz	$30 \cdot 10^{-3} \cdot P$	
	> 4 W to 100 W	> 10 GHz to 18 GHz	$40 \cdot 10^{-3} \cdot P$	
	> 2 kW to 10 kW	> DC to 250 MHz	$41 \cdot 10^{-3} \cdot P$	
Display Linearity	0 dB to 21 dB	> DC to 40 GHz	0.003 dB	*A*: Measured value
Level distance, Attenuation	> 21 dB to 111 dB	> DC to 40 GHz	0.003 dB + 0.0002 · *A*	
	> 111 dB to 121 dB	> DC to 40 GHz	0.03 dB	
	0 dB to 11 dB	> 40 GHz to 67 GHz	0.005 dB	
	> 11 dB to 111 dB	> 40 GHz to 67 GHz	0.005 dB + 0.0004 · *A*	
	0 dB to 60 dB	> 67 GHz to 110 GHz	0.03 dB + 0.001 · *A*	
	> 60 dB to 80 dB	> 67 GHz to 110 GHz	0.6 dB	
	> 80 dB to 90 dB	> 67 GHz to 110 GHz	1.8 dB	
HF-Transmission Phase angle φ	-180 ° to 180 °	> DC to 100 MHz	0.5 °	Dependent on Attenuation value
		> 100 MHz to 10 GHz	0.7 °	
		> 10 GHz to 20 GHz	1.0 °	
		> 20 GHz to 40 GHz	1.8 °	
		> 40 GHz to 67 GHz	2.0 °	
		> 67 GHz to 110 GHz	3.0 °	
HF-Impedance Reflection factor	0.0 to 0.4	> DC to 10 GHz	0.0034	PC Type-N[2)]
	> 0.4 to 1.0	> DC to 10 GHz	0.0015 + 0.005 · |Γ|	|Γ|: Magnitude of complex reflection factor
	0.0 to 0.4	> 10 GHz to 18 GHz	0.0034	
	> 0.4 to 1.0	> 10 GHz to 18 GHz	0.01 · |Γ|	
	0.0 to 0.4	> 18 GHz to 26.5 GHz	0.0065	PC-3.5[2)]
	> 0.4 to 1.0	> 18 GHz to 26.5 GHz	0.001 + 0.013 · |Γ|	
	0.0 to 0.4	> 26.5 GHz to 40 GHz	0.011	PC-2.92[2)]
	> 0.4 to 1.0	> 26.5 GHz to 40 GHz	0.005 + 0.016 · |Γ|	
	0.0 to 1.0	> DC to 2 GHz	$0.0035 + 0.0042 \cdot \lvert\Gamma\rvert^2$	PC-2.4[2)]. PC-1.85[2)]
		> 2 GHz to 10 GHz	$0.0037 + 0.0050 \cdot \lvert\Gamma\rvert^2$	
		> 10 GHz to 20 GHz	$0.0042 + 0.0069 \cdot \lvert\Gamma\rvert^2$	
		> 20 GHz to 30 GHz	$0.0055 + 0.0101 \cdot \lvert\Gamma\rvert^2$	
		> 30 GHz to 40 GHz	$0.0067 + 0.0120 \cdot \lvert\Gamma\rvert^2$	
		> 40 GHz to 50 GHz	$0.0085 + 0.0151 \cdot \lvert\Gamma\rvert^2$	
		> 50 GHz to 67 GHz	$0.0113 + 0.0183 \cdot \lvert\Gamma\rvert^2$	

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Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
HF-Impedance Reflection factor	0.0 to 1.0	> DC to 2 GHz > 2 GHz to 10 GHz > 10 GHz to 20 GHz > 20 GHz to 30 GHz > 30 GHz to 40 GHz > 40 GHz to 50 GHz > 50 GHz to 67 GHz > 67 GHz to 90 GHz > 90 GHz to 110 GHz > 110 GHz to 114 GHz	$0.0036 + 0.0049 \cdot \lvert\Gamma\rvert^2$ $0.0036 + 0.0052 \cdot \lvert\Gamma\rvert^2$ $0.0041 + 0.0068 \cdot \lvert\Gamma\rvert^2$ $0.0049 + 0.0095 \cdot \lvert\Gamma\rvert^2$ $0.0056 + 0.0117 \cdot \lvert\Gamma\rvert^2$ $0.0063 + 0.0131 \cdot \lvert\Gamma\rvert^2$ $0.0074 + 0.0173 \cdot \lvert\Gamma\rvert^2$ $0.0093 + 0.0213 \cdot \lvert\Gamma\rvert^2$ $0.0122 + 0.0280 \cdot \lvert\Gamma\rvert^2$ $0.0142 + 0.0331 \cdot \lvert\Gamma\rvert^2$	Connector[2]: PC-1.00
	0.0 to 1.0	50 GHz to 75 GHz 60 GHz to 90 GHz 90 GHz to 110 GHz	$0.01 + 0.008 \cdot \lvert\Gamma\rvert$ $0.01 + 0.008 \cdot \lvert\Gamma\rvert$ $0.01 + 0.008 \cdot \lvert\Gamma\rvert$	Connector: R620 Connector: R740 Connector: R900
HF-Impedance Phase angle φ	-180 ° to 180 °	> DC to 110 GHz	$U_S \cdot 180\,°/\pi$	$U_S = \arcsin(U/\lvert\Gamma\rvert)$ *U:* Uncertainty of reflection factor
Frequency	0.1 MHz 1 MHz 5 MHz 10 MHz	Messzeit > 120 min	$1 \cdot 10^{-11} \cdot f$	*f:* Measured value U_{TRIG}: Trigger-uncertainty
	0.1 mHz to 110 GHz	Messzeit > 5 min	$\sqrt{(1 \cdot 10^{-10} \cdot f)^2 + U_{\mathrm{TRIG}}^2}$	
Time interval	1 ns to 10 000 s		$\sqrt{(1\ \mathrm{ns})^2 + (1 \cdot 10^{-10} \cdot t)^2 + U_{\mathrm{TRIG}}^2}$	
Modulation quantities Amplitude modulation Modulation degree *m*	0.01 to 1.0	> DC f_m ≤ 100 kHz 100 kHz < f_m ≤ 1 MHz 1 MHz < f_m ≤ 10 MHz	$0.002 \cdot m + K$ $0.005 \cdot m + K$ $0.02 \cdot m + K$	*m*: Measured value f_{HF} = Carrier frequency f_m = Modulation freq. $f_{HF} > 5 \cdot f_m$[3]
Frequency modulation Frequency deviation Δf	10 Hz to 16 MHz	10 Hz < f_m ≤ 100 kHz 100 kHz < f_m ≤ 200 kHz 200 kHz < f_m ≤ 10 MHz	$1 \cdot 10^{-3} \cdot \Delta f + K$ $2 \cdot 10^{-3} \cdot \Delta f + K$ $5 \cdot 10^{-3} \cdot \Delta f + K$	Δf: Measured value $f_{HF} > 5 \cdot (f_m + \Delta f)$ [3]
Phase modulation Phase deviation $\Delta\phi$	(10 Hz/ f_m) rad to (16 MHz/ f_m) rad	10 Hz < f_m ≤ 100 kHz 100 kHz < f_m ≤ 200 kHz 200 kHz < f_m ≤ 10 MHz	$1 \cdot 10^{-3} \cdot \Delta\phi + K$ $2 \cdot 10^{-3} \cdot \Delta\phi + K$ $5 \cdot 10^{-3} \cdot \Delta\phi + K$	$\Delta\phi$: Measured value $f_{HF} > 5 \cdot (f_m + \Delta\phi)$ [3]

On-site calibration and mobile laboratory, Location Köln

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Waveform quantities Rise time	200 ps to 1 s	1 mV to 100 V in 50 Ω	$20 \cdot 10^{-3} \cdot t + (50\ \text{ps})^2/t$	t: Measured value
	2 ns to 1 s	100 V to 5 kV in 50 Ω	$20 \cdot 10^{-3} \cdot t + (0.3\ \text{ns})^2/t$	e.g. Burst according to EN 61000-4-4:2013
	3 ns to 1 s	100 V to 8 kV in 1 kΩ	$20 \cdot 10^{-3} \cdot t + (0.5\ \text{ns})^2/t$	
	10 ns to 1 s	100 V to 15 kV. with HV-Probe	$20 \cdot 10^{-3} \cdot t + (2.2\ \text{ns})^2/t$	e.g. Surge according to EN 61000-4-5:2019
	20 ns to 10 µs	1 mA to 5 kA with current transformer	$20 \cdot 10^{-3} \cdot t + (5\ \text{ns})^2/t$	
	0.7 ns to 500 ns	1 A to 150 A with ESD-Target	$30 \cdot 10^{-3} \cdot t$	ESD according to EN 61000-4-2:2009
Pulse duration	0.5 ns to 10 s		$2 \cdot 10^{-3} \cdot t + 10\ \text{ps} + \delta t_{TRIG}$	δt_{TRIG}: Trigger uncertainty
Repetition time	1 ns to 10 s			
Burst duration	5 ns to 10 s			
Burst period	5 ns to 10 s			
Pulse voltage	10 mV to 500 V	200 ps ≤ Δt ≤ 1 s at 50 Ω	$20 \cdot 10^{-3} \cdot U$. $\Delta t \geq 20$ ns	U: Measured value Δt: Pulse duration
	10 V to 5 kV	2.5 ns ≤ Δt ≤ 1 s at 50 Ω	$30 \cdot 10^{-3} \cdot U$. $\Delta t < 20$ ns	e.g. Burst according to EN 61000-4-4:2013
	10 V to 8 kV	2.5 ns ≤ Δt ≤ 1 s at 1 kΩ		
	10 V to 15 kV	10 ns ≤ Δt ≤ 1 s, high resistance		e.g. Surge according to EN 61000-4-5:2019
Pulse current	1 A to 5 kA	20 ns ≤ Δt ≤ 10 ms	$20 \cdot 10^{-3} \cdot I$	I: Measured value
ESD-current pulse	1 A to 150 A	Current peak	$40 \cdot 10^{-3} \cdot I$	I: Measured value Calibration with Target according to EN 61000-4-2:2009
	1 A to 150 A	Current grid values after 30 ns und 60 ns	$25 \cdot 10^{-3} \cdot I$	
Pulse spectrum	0.1 µVs to 50 µVs	9 kHz to 150 kHz	$25 \cdot 10^{-3} \cdot IS$	IS: Measured value CISPR 16-1-1:2019
	3 nVs to 1 µVs	150 kHz to 30 MHz	$25 \cdot 10^{-3} \cdot IS$	
	0.4 nVs to 200 nVs	30 MHz to 1 GHz	$27 \cdot 10^{-3} \cdot IS$	
Antenna factor (ECSM)	Depending on antenna	9 kHz to 30 MHz CISPR 16-1-6:2022	1.2 dB	monopole antennas ECSM procedure
Antenna factor				loop antennas standard field procedure

On-site calibration, Location Madrid

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
DC voltage meters	0 V to 2.2 V		$5 \cdot 10^{-6} \cdot U + 1.5\ \mu V$	U: Measured value
	> 2.2 V to 22 V		$5 \cdot 10^{-6} \cdot U$	
	> 22 V to 1100 V		$10 \cdot 10^{-6} \cdot U$	
sources	0 mV to 100 mV		$5 \cdot 10^{-6} \cdot U + 1.5\ \mu V$	
	> 0.1 V to 1 V		$10 \cdot 10^{-6} \cdot U + 1\ \mu V$	
	> 1 V to 10 V		$10 \cdot 10^{-6} \cdot U + 1\ \mu V$	
	> 10 V to 100 V		$10 \cdot 10^{-6} \cdot U + 30\ \mu V$	
	> 100 V to 1000 V		$12 \cdot 10^{-6} \cdot U + 100\ \mu V$	
DC current meters and sources	0.1 µA to 1.0 µA		$21 \cdot 10^{-6} \cdot I + 40\ pA$	I: Measured value
	> 1.0 µA to 10 µA		$21 \cdot 10^{-6} \cdot I + 120\ pA$	
	> 10 µA to 100 µA		$21 \cdot 10^{-6} \cdot I + 1\ nA$	
	> 100 µA to 1.0 mA		$21 \cdot 10^{-6} \cdot I + 6\ nA$	
	> 1.0 mA to 10 mA		$21 \cdot 10^{-6} \cdot I + 60\ nA$	
	> 10 mA to 100 mA		$36 \cdot 10^{-6} \cdot I + 0.6\ \mu A$	
	> 100 mA to 1.0 A		$110 \cdot 10^{-6} \cdot I + 10\ \mu A$	
	> 100 mA to 1.0 A		$5 \cdot 10^{-5} \cdot I$	
	> 1 A to 20 A		$7 \cdot 10^{-5} \cdot I$	
Only sources	> 20 A to 100 A		$7 \cdot 10^{-5} \cdot I$	
DC resistance meters	1 Ω		$0.11 \cdot 10^{-3} \cdot R$	R: Measured value
	1.9 Ω		$0.11 \cdot 10^{-3} \cdot R$	
	10 Ω		$27 \cdot 10^{-6} \cdot R$	
	19 Ω		$27 \cdot 10^{-6} \cdot R$	
	100 Ω		$12 \cdot 10^{-6} \cdot R$	
	190 Ω		$12 \cdot 10^{-6} \cdot R$	
	1 kΩ		$9.9 \cdot 10^{-6} \cdot R$	
	1.9 kΩ		$10 \cdot 10^{-6} \cdot R$	
	10 kΩ		$9.9 \cdot 10^{-6} \cdot R$	
	19 kΩ		$10 \cdot 10^{-6} \cdot R$	
	100 kΩ		$13 \cdot 10^{-6} \cdot R$	
	190 kΩ		$13 \cdot 10^{-6} \cdot R$	
	1 MΩ		$23 \cdot 10^{-6} \cdot R$	
	1.9 MΩ		$25 \cdot 10^{-6} \cdot R$	
	10 MΩ		$47 \cdot 10^{-6} \cdot R$	
	19 MΩ		$57 \cdot 10^{-6} \cdot R$	
	100 MΩ		$0.14 \cdot 10^{-3} \cdot R$	

On-site calibration, Location Madrid

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
DC Resistance sources and meters	0 Ω to 100 kΩ		$15 \cdot 10^{-6} \cdot R + 60\ \mu\Omega$	R: Measured value
	> 100 kΩ to 1 MΩ		$20 \cdot 10^{-6} \cdot R + 2\ \Omega$	
	>1 MΩ to 10 MΩ		$60 \cdot 10^{-6} \cdot R + 0.1\ k\Omega$	
	> 10 MΩ to 100 MΩ		$0.6 \cdot 10^{-3} \cdot R$	
	> 100 MΩ to 1 GΩ		$5.1 \cdot 10^{-3} \cdot R$	
AC voltage meters	2 mV to 220 V	10 Hz to < 20 Hz	$0.40 \cdot 10^{-3} \cdot U + 8\ \mu V$	U: Measured value
	2 mV to 22 mV	20 Hz to < 40 Hz	$0.15 \cdot 10^{-3} \cdot U + 5\ \mu V$	
		40 Hz to 20 kHz	$0.15 \cdot 10^{-3} \cdot U + 4\ \mu V$	
		> 20 kHz to 50 kHz	$0.21 \cdot 10^{-3} \cdot U + 4\ \mu V$	
		> 50 kHz to 100 kHz	$0.50 \cdot 10^{-3} \cdot U + 6\ \mu V$	
		> 100 kHz to 300 kHz	$1.0 \cdot 10^{-3} \cdot U + 15\ \mu V$	
		> 300 kHz to 500 kHz	$1.8 \cdot 10^{-3} \cdot U + 20\ \mu V$	
		> 500 kHz to 1 MHz	$4.0 \cdot 10^{-3} \cdot U + 20\ \mu V$	
	22 mV to 220 mV	20 Hz to < 40 Hz	$0.15 \cdot 10^{-3} \cdot U + 6\ \mu V$	
		40 Hz to 20 kHz	$0.20 \cdot 10^{-3} \cdot U + 5\ \mu V$	
		> 20 kHz to 50 kHz	$0.21 \cdot 10^{-3} \cdot U + 8\ \mu V$	
		> 50 kHz to 100 kHz	$0.50 \cdot 10^{-3} \cdot U + 18\ \mu V$	
		> 100 kHz to 300 kHz	$1.0 \cdot 10^{-3} \cdot U + 18\ \mu V$	
		> 300 kHz to 500 kHz	$1.8 \cdot 10^{-3} \cdot U + 20\ \mu V$	
		> 500 kHz to 1 MHz	$4.0 \cdot 10^{-3} \cdot U + 20\ \mu V$	
	220 mV to 2.2 V	20 Hz to < 40 Hz	$0.1 \cdot 10^{-3}\ U + 15\ \mu V$	
		40 Hz to 20 kHz	$0.1 \cdot 10^{-3}\ U + 8\ \mu V$	
		> 20 kHz to 50 kHz	$0.1 \cdot 10^{-3}\ U + 10\ \mu V$	
		> 50 kHz to 100 kHz	$0.15 \cdot 10^{-3} \cdot U + 30\ \mu V$	
		> 100 kHz to 300 kHz	$0.5 \cdot 10^{-3} \cdot U + 80\ \mu V$	
		> 300 kHz to 500 kHz	$1.3 \cdot 10^{-3} \cdot U + 200\ \mu V$	
		> 500 kHz to 1 MHz	$2.0 \cdot 10^{-3} \cdot U + 300\ \mu V$	
	2.2 V to 22 V	20 Hz to < 40 Hz	$0.10 \cdot 10^{-3} \cdot U + 150\ \mu V$	
		40 Hz to 20 kHz	$0.10 \cdot 10^{-3} \cdot U + 50\ \mu V$	
		> 20 kHz to 50 kHz	$0.10 \cdot 10^{-3} \cdot U + 100\ \mu V$	
		> 50 kHz to 100 kHz	$0.15 \cdot 10^{-3} \cdot U + 200\ \mu V$	
		> 100 kHz to 300 kHz	$0.50 \cdot 10^{-3} \cdot U + 600\ \mu V$	
		> 300 kHz to 500 kHz	$1.3 \cdot 10^{-3} \cdot U + 2\ mV$	
		> 500 kHz to 1 MHz	$2.7 \cdot 10^{-3} \cdot U + 3.5\ mV$	
	22 V to 220 V	20 Hz to < 40 Hz	$0.15 \cdot 10^{-3} \cdot U + 1.5\ mV$	
		40 Hz to 20 kHz	$0.10 \cdot 10^{-3} \cdot U + 0.6\ mV$	
		> 20 kHz to 50 kHz	$0.10 \cdot 10^{-3} \cdot U + 1\ mV$	
		> 50 kHz to 100 kHz	$0.50 \cdot 10^{-3} \cdot U + 3\ mV$	
	> 22 V to U_{MAX}	> 100 kHz to 300 kHz	$1.8 \cdot 10^{-3} \cdot U + 16\ mV$	U_{MAX}: $22 \cdot 10^{6} \cdot V\ Hz / f\ [Hz]$
		> 300 kHz to 500 kHz	$5.0 \cdot 10^{-3} \cdot U + 40\ mV$	
		> 500 kHz to 1 MHz	$8.0 \cdot 10^{-3} \cdot U + 80\ mV$	
	> 220 V to 1 kV	15 Hz to 50 Hz	$0.40 \cdot 10^{-3} \cdot U + 2.5\ mV$	
		> 50 Hz to 1 kHz	$0.11 \cdot 10^{-3} \cdot U + 2.5\ mV$	

On-site calibration, Location Madrid

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
AC voltage meters	2 mV to 3.5 V	10 Hz to 30 Hz	$3.3 \cdot 10^{-3} \cdot U + 3\ \mu V$	*U*: Measured value
		> 30 Hz to 120 Hz	$1.6 \cdot 10^{-3} \cdot U + 3\ \mu V$	
		> 120 Hz to 120 kHz	$1.3 \cdot 10^{-3} \cdot U + 3\ \mu V$	
		> 120 kHz to 2 MHz	$1.5 \cdot 10^{-3} \cdot U + 3\ \mu V$	
		> 2 MHz to 10 MHz	$3.5 \cdot 10^{-3} \cdot U + 3\ \mu V$	
		> 10 MHz to 20 MHz	$11.0 \cdot 10^{-3} \cdot U + 3\ \mu V$	
		> 20 MHz to 30 MHz	$25.0 \cdot 10^{-3} \cdot U + 15\ \mu V$	
	2 mV to 10 mV	1 Hz to < 40 Hz	$0.35 \cdot 10^{-3} \cdot U + 3\ \mu V$	
		40 Hz to 1 kHz	$0.21 \cdot 10^{-3} \cdot U + 1.3\ \mu V$	
		> 1 kHz to 20 kHz	$0.35 \cdot 10^{-3} \cdot U + 1.3\ \mu V$	
		> 20 kHz to 50 kHz	$1.0 \cdot 10^{-3} \cdot U + 2\ \mu V$	
		> 50 kHz to 100 kHz	$1.0 \cdot 10^{-3} \cdot U + 6\ \mu V$	
		> 100 kHz to 300 kHz	$12.0 \cdot 10^{-3} \cdot U + 10\ \mu V$	
	> 10 mV to 100 mV	1 Hz to < 40 Hz	$0.10 \cdot 10^{-3} \cdot U + 4\ \mu V$	
		40 Hz to 1 kHz	$0.10 \cdot 10^{-3} \cdot U + 2\ \mu V$	
		> 1 kHz to 20 kHz	$0.2 \cdot 10^{-3} \cdot U + 2\ \mu V$	
		> 20 kHz to 50 kHz	$0.35 \cdot 10^{-3} \cdot U + 2\ \mu V$	
		> 50 kHz to 100 kHz	$1.0 \cdot 10^{-3} \cdot U + 2\ \mu V$	
		> 100 kHz to 300 kHz	$3.5 \cdot 10^{-3} \cdot U + 10\ \mu V$	
		> 300 kHz to 1 MHz	$10 \cdot 10^{-3} \cdot U + 10\ \mu V$	
	> 100 mV to 1 V	1 Hz to < 40 Hz	$0.10 \cdot 10^{-3} \cdot U + 40\ \mu V$	
		40 Hz to 1 kHz	$0.10 \cdot 10^{-3} \cdot U + 20\ \mu V$	
		> 1 kHz to 20 kHz	$0.2 \cdot 10^{-3} \cdot U + 20\ \mu V$	
		> 20 kHz to 50 kHz	$0.35 \cdot 10^{-3} \cdot U + 20\ \mu V$	
		> 50 kHz to 100 kHz	$1.0 \cdot 10^{-3} \cdot U + 20\ \mu V$	
		> 100 kHz to 300 kHz	$3.5 \cdot 10^{-3} \cdot U + 100\ \mu V$	
		> 300 kHz to 1 MHz	$10 \cdot 10^{-3} \cdot U + 100\ \mu V$	
	> 1 V to 10 V	1 Hz to < 40 Hz	$0.10 \cdot 10^{-3} \cdot U + 400\ \mu V$	
		40 Hz to 1 kHz	$0.10 \cdot 10^{-3} \cdot U + 200\ \mu V$	
		> 1 kHz to 20 kHz	$0.2 \cdot 10^{-3} \cdot U + 200\ \mu V$	
		> 20 kHz to 50 kHz	$0.35 \cdot 10^{-3} \cdot U + 200\ \mu V$	
		> 50 kHz to 100 kHz	$1.0 \cdot 10^{-3} \cdot U + 200\ \mu V$	
		> 100 kHz to 300 kHz	$3.5 \cdot 10^{-3} \cdot U + 1\ mV$	
		> 300 kHz to 1 MHz	$10 \cdot 10^{-3} \cdot U + 1\ mV$	

On-site calibration, Location Madrid

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
AC voltage sources	> 10 V to 100 V	1 Hz to < 40 Hz	$0.21 \cdot 10^{-3} \cdot U + 30$ mV	*U*: Measured value
		40 Hz to 1 kHz	$0.21 \cdot 10^{-3} \cdot U + 2$ mV	
		> 1 kHz to 20 kHz	$0.21 \cdot 10^{-3} \cdot U + 2$ mV	
		> 20 kHz to 50 kHz	$0.35 \cdot 10^{-3} \cdot U + 2$ mV	
		> 50 kHz to 100 kHz	$1.3 \cdot 10^{-3} \cdot U + 2$ mV	
		> 100 kHz to 300 kHz	$4.0 \cdot 10^{-3} \cdot U + 10$ mV	
		> 300 kHz to 1 MHz	$15 \cdot 10^{-3} \cdot U + 10$ mV	
	> 100 V to 700 V	1 Hz to < 40 Hz	$0.45 \cdot 10^{-3} \cdot U + 40$ mV	
		40 Hz to 1 kHz	$0.45 \cdot 10^{-3} \cdot U + 20$ mV	
		> 1 kHz to 20 kHz	$0.65 \cdot 10^{-3} \cdot U + 20$ mV	
		> 20 kHz to 50 kHz	$1.3 \cdot 10^{-3} \cdot U + 20$ mV	
		> 50 kHz to 100 kHz	$3.1 \cdot 10^{-3} \cdot U + 20$ mV	
AC current meters	100 µA to 220 µA	10 Hz to 20 Hz	$0.3 \cdot 10^{-3} \cdot I + 16$ nA	*I*: Measured value
		> 20 Hz to 1 kHz	$0.2 \cdot 10^{-3} \cdot I + 10$ nA	
		> 1 kHz to 5 kHz	$0.3 \cdot 10^{-3} \cdot I + 12$ nA	
		> 5 kHz to 10 kHz	$1.1 \cdot 10^{-3} \cdot I + 0.1$ µA	
	> 220 µA to 2.2 mA	10 Hz to 20 Hz	$0.3 \cdot 10^{-3} \cdot I + 50$ nA	
		> 20 Hz to 1 kHz	$0.2 \cdot 10^{-3} \cdot I + 35$ nA	
		> 1 kHz to 5 kHz	$0.22 \cdot 10^{-3} \cdot I + 110$ nA	
		> 5 kHz to 10 kHz	$1.2 \cdot 10^{-3} \cdot I + 1$ µA	
	> 2.2 mA to 22 mA	10 Hz to 20 Hz	$0.3 \cdot 10^{-3} \cdot I + 400$ nA	
		> 20 Hz to 1 kHz	$0.2 \cdot 10^{-3} \cdot I + 350$ nA	
		> 1 kHz to 5 kHz	$0.22 \cdot 10^{-3} \cdot I + 550$ nA	
		> 5 kHz to 10 kHz	$1.2 \cdot 10^{-3} \cdot I + 5$ µA	
	> 22 mA to 220 mA	10 Hz to 20 Hz	$0.3 \cdot 10^{-3} \cdot I + 4$ µA	
		> 20 Hz to 1 kHz	$0.2 \cdot 10^{-3} \cdot I + 3.5$ µA	
		> 1 kHz to 5 kHz	$0.22 \cdot 10^{-3} \cdot I + 4.5$ µA	
		> 5 kHz to 10 kHz	$1.2 \cdot 10^{-3} \cdot I + 10$ µA	
	> 220 mA to 2.2 A	20 Hz to 45 Hz	$0.26 \cdot 10^{-3} \cdot I + 40$ µA	
		> 45 Hz to 5 kHz	$0.47 \cdot 10^{-3} \cdot I + 160$ µA	
		> 5 kHz to 10 kHz	$7.1 \cdot 10^{-3} \cdot I + 160$ µA	
	2.2 A to 11 A	45 Hz to 5 kHz	$0.92 \cdot 10^{-3} \cdot I + 2$ mA	
		> 5 kHz to 10 kHz	$3.6 \cdot 10^{-3} \cdot I + 2$ mA	
sources	100 µA to 1 mA	10 Hz to 20 Hz	$4.0 \cdot 10^{-3} \cdot I + 0.22$ µA	
		> 20 Hz to 45 Hz	$1.5 \cdot 10^{-3} \cdot I + 0.22$µA	
		> 45 Hz to 5 kHz	$0.35 \cdot 10^{-3} \cdot I + 0.2$µA	
		> 45 Hz to 10 kHz	$0.7 \cdot 10^{-3} \cdot I + 0.2$ µA	
	> 1 mA to 10 mA	> 10 Hz to 20 Hz	$4.0 \cdot 10^{-3} \cdot I + 2.2$ µA	
		> 20 Hz to 45 Hz	$1.5 \cdot 10^{-3} \cdot I + 2.2$ µA	
		> 45 Hz to 5 kHz	$0.35 \cdot 10^{-3} \cdot I + 2$ µA	
		> 5 kHz to 10 kHz	$0.7 \cdot 10^{-3} \cdot I + 2$ µA	
	> 10 mA to 100 mA	10 Hz to 20 Hz	$4.0 \cdot 10^{-3} \cdot I + 22$ µA	
		> 20 Hz to 45 Hz	$1.5 \cdot 10^{-3} \cdot I + 22$ µA	
		> 45 Hz to 5 kHz	$0.35 \cdot 10^{-3} \cdot I + 20$ µA	
		> 5 kHz to 10 kHz	$0.7 \cdot 10^{-3} \cdot I + 20$ µA	
	> 100 mA to 1 A	10 Hz to 20 Hz	$4.0 \cdot 10^{-3} \cdot I + 220$ µA	
		> 20 Hz to 45 Hz	$1.6 \cdot 10^{-3} \cdot I + 220$ µA	
		> 45 Hz to 5 kHz	$1 \cdot 10^{-3} \cdot I + 220$ µA	
		> 5 kHz to 10 kHz	$3 \cdot 10^{-3} \cdot I + 220$ µA	
	> 1 A to 11 A	50 Hz to 120 Hz	$2.3 \cdot 10^{-3} \cdot I + 450$ µA	

On-site calibration, Location Madrid

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
RF-Power Sensors with mismatch correction	100 nW to 10 µW	8 kHz to 100 MHz	$5.8 \cdot 10^{-3} \cdot P$	*P*: Measured value
		> 100 MHz to 2.4 GHz	$7.0 \cdot 10^{-3} \cdot P$	
		> 2.4 GHz to 4 GHz	$8.0 \cdot 10^{-3} \cdot P$	
		> 4 GHz to 8 GHz	$10 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 12.4 GHz	$13 \cdot 10^{-3} \cdot P$	
		> 12.4 GHz to 18 GHz	$15 \cdot 10^{-3} \cdot P$	
		> 18 GHz to 26.5 GHz	$15 \cdot 10^{-3} \cdot P$	
		> 26.5 GHz to 40 GHz	$19 \cdot 10^{-3} \cdot P$	
	10 µW to 200 mW	8 kHz to 1 MHz	$3.0 \cdot 10^{-3} \cdot P$	
		> 1 MHz to 100 MHz	$3.4 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 2.4 GHz	$5.1 \cdot 10^{-3} \cdot P$	
		> 2.4 GHz to 8 GHz	$6.8 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 12.4 GHz	$8.4 \cdot 10^{-3} \cdot P$	
		> 12.4 GHz to 18 GHz	$11 \cdot 10^{-3} \cdot P$	
		> 18 GHz to 26.5 GHz	$14 \cdot 10^{-3} \cdot P$	
		> 26.5 GHz to 40 GHz	$17 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$21 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$33 \cdot 10^{-3} \cdot P$	
RF-Power Sources and meters with mismatch correction	0.2 fW to < 10 pW	8 kHz to 8 GHz	$21 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 20 GHz	$24 \cdot 10^{-3} \cdot P$	
	1 fW to < 10 pW	> 20 GHz to 40 GHz	$29 \cdot 10^{-3} \cdot P$	
	10 fW to < 10 pW	> 40 GHz to 50 GHz	$43 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$49 \cdot 10^{-3} \cdot P$	
	10 pW to < 100 nW	8 kHz to 100 MHz	$15 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 8 GHz	$17 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 20 GHz	$20 \cdot 10^{-3} \cdot P$	
		> 20 GHz to 40 GHz	$26 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$34 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$43 \cdot 10^{-3} \cdot P$	
RF-Power Sources and meters with mismatch correction	100 nW to 200 mW	8 kHz to 100 MHz	$10 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 8 GHz	$13 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 18 GHz	$16 \cdot 10^{-3} \cdot P$	
		> 18 GHz to 26.5 GHz	$23 \cdot 10^{-3} \cdot P$	
		> 26.5 GHz to 40 GHz	$23 \cdot 10^{-3} \cdot P$	
		> 40 GHz to 50 GHz	$30 \cdot 10^{-3} \cdot P$	
		> 50 GHz to 67 GHz	$35 \cdot 10^{-3} \cdot P$	
Sources and meters without mismatch correction	> 200 mW to 20 W	8 kHz to 100 MHz	$11 \cdot 10^{-3} \cdot P$	
		> 100 MHz to 4 GHz	$14 \cdot 10^{-3} \cdot P$	
	> 200 mW to 4 W	> 4 GHz to 8 GHz	$15 \cdot 10^{-3} \cdot P$	
		> 8 GHz to 12.5 GHz	$19 \cdot 10^{-3} \cdot P$	
		> 12.5 GHz to 18 GHz	$23 \cdot 10^{-3} \cdot P$	
	> 200 mW to 2 W	> 18 GHz to 26.5 GHz	$25 \cdot 10^{-3} \cdot P$	
	> 200 mW to 1 W	> 26.5 GHz to 40 GHz	$31 \cdot 10^{-3} \cdot P$	
	> 20 W to 2 kW	> 8 kHz to 1 GHz	$24 \cdot 10^{-3} \cdot P$	

On-site calibration, Location Madrid

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
RF-Power ratio	> 0 dB to 0.1 dB		0.005 dB	
Sources and meters	> 0 dB to 70 dB	8 kHz to 67 GHz	0.05 dB	
	> 70 dB to 120 dB		0.09 dB	
Only Meters	> 0 dB to 21 dB	50 MHz to 1 GHz	0.005 dB	
	> 21 dB to 30 dB		0.010 dB	
	> 30 dB to 40 dB		0.012 dB	
	> 40 dB to 50 dB		0.013 dB	
	> 50 dB to 60 dB		0.014 dB	
	> 60 dB to 70 dB		0.015 dB	
	> 70 dB to 80 dB		0.016 dB	
	> 80 dB to 90 dB		0.017 dB	
	> 90 dB to 100 dB		0.018 dB	
	> 100 dB to 110 dB		0.019 dB	
	> 110 dB to 120 dB		0.020 dB	
RF-Attenuation	> 0 dB to 0.1 dB	10 MHz to 200 MHz	0.007 dB	
Step attenuator	> 0.1 dB to 20 dB		0.010 dB	
	> 20 dB to 40 dB		0.014 dB	
	> 40 dB to 60 dB		0.016 dB	
	> 60 dB to 80 dB		0.019 dB	
	> 80 dB to 90 dB		0.023 dB	
Meters	> 0 dB to 0.1 dB	10 MHz to 200 MHz	0.010 dB	
	> 0.1 dB to 20 dB		0.020 dB	
	> 20 dB to 40 dB		0.023 dB	
	> 40 dB to 60 dB		0.024 dB	
	> 60 dB to 80 dB		0.027 dB	
	> 80 dB to 90 dB		0.030 dB	

On-site calibration, Location Madrid

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Scattering quantities				
Reflection coefficient (S_{11}) Magnitude	0.0 to 0.2	> 9 kHz to 10 GHz	0.0035	
	> 0.2 to 1.0		$0.0035 + 0.0039 \cdot \lvert S_{11} \rvert^2$	
	0.0 to 0.2	> 10 GHz to 18 GHz	0.0041	
	> 0.2 to 1.0		$0.0041 + 0.0040 \cdot \lvert S_{11} \rvert^2$	
	0.0 to 0.2	> 18 GHz to 30 GHz	0.0059	
	> 0.2 to 1.0		$0.0059 + 0.0055 \cdot \lvert S_{11} \rvert^2$	
	0.0 to 0.2	> 30 GHz to 40 GHz	0.0070	
	> 0.2 to 1.0		$0.0070 + 0.0050 \cdot \lvert S_{11} \rvert^2$	
	0.0 to 0.2	> 40 GHz to 50 GHz	0.0092	
	> 0.2 to 1.0		$0.0092 + 0.0088 \cdot \lvert S_{11} \rvert^2$	
	0.0 to 0.2	> 50 GHz to 60 GHz	0.012	
	> 0.2 to 1.0		$0.012 + 0.011 \cdot \lvert S_{11} \rvert^2$	
	0.0 to 0.2	> 60 GHz to 67 GHz	0.012	
	> 0.2 to 1.0		$0.012 + 0.014 \cdot \lvert S_{11} \rvert^2$	

On-site calibration, Location Madrid

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Phase	- 180 ° to 180 °	> 8 kHz to 67 GHz	180°/π · U_S	U_S = arcsin(U(S_{II}^2)/(|S_{II}|^2))
Transmission (S_{IJ}) Magnitude and phase	0 to 30 dB	> 9 kHz to 100 kHz	0.05 dB, 0.4°	Measurement uncertainty in dB and as phase displacement in °
	> 30 dB to 40 dB		0.07 dB, 0.5°	
	> 40 dB to 50 dB		0.12 dB, 0.8°	
	> 50 dB to 60 dB		0.32 dB, 2.1°	
	> 60 dB to 80 dB		0.32 dB + 0.13 · (S_{IJ} [dB] - 60 dB)	
	0 to 30 dB	> 100 kHz to 50 MHz	0.05 dB, 0.4°	
	> 30 dB to 40 dB		0.06 dB, 0.4°	
	> 40 dB to 50 dB		0.09 dB, 0.6°	
	> 50 dB to 60 dB		0.19 dB, 1.3°	
	> 60 dB to 80 dB		0.19 dB + 0.076 · (S_{IJ} [dB] - 60 dB)	
	0 to 30 dB	> 50 MHz to 200 MHz	0.05 dB, 0.4°	
	> 30 dB to 40 dB		0.06 dB, 0.4°	
	> 40 dB to 60 dB		0.08 dB, 0.6°	
	> 60 dB to 80 dB		0.32 dB, 2.1°	
	> 80 dB to 90 dB		1.0 dB	
	0 to 30 dB	> 200 MHz to 20 GHz	0.04 dB, 0.9°	
	> 30 dB to 40 dB		0.06 dB, 0.9°	
	> 40 dB to 60 dB		0.07 dB, 0.9°	
	> 60 dB to 80 dB		0.15 dB, 1.3°	
	> 80 dB to 90 dB		0.32 dB	
	0 to 30 dB	> 20 GHz to 40 GHz	0.06 dB, 1.3°	
	> 30 dB to 40 dB		0.08 dB, 1.3°	
	> 40 dB to 60 dB		0.09 dB, 1.3°	
	> 60 dB to 80 dB		0.33 dB, 2.5°	
	> 80 dB to 90 dB		0.96 dB	
	0 to 30 dB	> 40 GHz to 50 GHz	0.11 dB, 1.7°	
	> 30 dB to 40 dB		0.12 dB, 1.7°	
	> 40 dB to 60 dB		0.13 dB, 1.7°	
	> 60 dB to 80 dB		0.34 dB, 2.7°	
	> 80 dB to 90 dB		0.96 dB	
	0 to 30 dB	> 50 GHz to 67 GHz	0.15 dB, 2.2°	
	> 30 dB to 40 dB		0.16 dB, 2.3°	
	> 40 dB to 60 dB		0.20 dB, 2.4°	
	> 60 dB to 90 dB		0.20 dB + 0.09 · (S_{IJ} [dB] - 60 dB)	

On-site calibration, Location Madrid

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Modulation quantities				
Sources and meters				
Amplitude modulation				
Modulation degree m	0 to 1.0	f_m ≤ 100 kHz	$0.001 \cdot m + 2.5 \cdot 10^{-5}$	
		100 kHz < f_m ≤ 1 MHz	$0.002 \cdot m + 5 \cdot 10^{-5}$	
		1 MHz < f_m ≤ 10 MHz	$0.007 \cdot m + 3 \cdot 10^{-4}$	m: Measured value
Frequency modulation	10 Hz to 16 MHz	10 Hz < f_m ≤ 100 kHz	$1 \cdot 10^{-3} \cdot \Delta f + K$	Δf: Measured value
Frequency deviation Δf		100 kHz < f_m ≤ 200 kHz	$2 \cdot 10^{-3} \cdot \Delta f + K$	
		200 kHz < f_m ≤ 10 MHz	$5 \cdot 10^{-3} \cdot \Delta f + K$	
Phase modulation	10 Hz / f_m to 16 MHz / f_m	10 Hz < f_m ≤ 100 kHz	$1 \cdot 10^{-3} \cdot \Delta\phi + K$	$\Delta\phi$: Measured value
Phase deviation $\Delta\phi$		100 kHz < f_m ≤ 200 kHz	$2 \cdot 10^{-3} \cdot \Delta\phi + K$	
		200 kHz < f_m ≤ 10 MHz	$5 \cdot 10^{-3} \cdot \Delta\phi + K$	
Waveform quantities				
CISPR Pulse		CISPR 16-1-1:2019		
Impulse area (IS)	0.1 µVs to 50 µVs	9 kHz to 150 kHz	$35 \cdot 10^{-3} \cdot IS$	IS: Measured value
Meters	3 nVs to 1 µVs	150 kHz to 30 MHz	$35 \cdot 10^{-3} \cdot IS$	
	0.4 nVs to 200 nVs	30 MHz to 1 GHz	$36 \cdot 10^{-3} \cdot IS$	
	0.4 nVs to 200 nVs	1 GHz to < 8 GHz	$13 \cdot 10^{-3} \cdot IS$	
	0.4 nVs to 200 nVs	8 GHz to 18 GHz	$15 \cdot 10^{-3} \cdot IS$	
Relative Response Ratio	0.1 Hz to 1 MHz	9 kHz to 18 GHz	0.55 %	
Rise time		EN 61000-4-4:2013		
DC pulse generator	200 ps to 1 s	1 mV to 100 V in 50 Ω	$20 \cdot 10^{-3} \cdot t + (50\ \text{ps})^2/t$	t: Measured value
	2 ns to 1 s	100 V to 5 kV in 50 Ω	$20 \cdot 10^{-3} \cdot t + (0.3\ \text{ns})^2/t$	
	3 ns to 1 s	100 V to 8 kV in 1 kΩ	$20 \cdot 10^{-3} \cdot t + (0.5\ \text{ns})^2/t$	
		EN 61000-4-5:2019		
	10 ns to 1 s	100 V to 15 kV	$20 \cdot 10^{-3} \cdot t + (2.2\ \text{ns})^2/t$	
	20 ns to 10 µs	1 mA to 5 kA	$20 \cdot 10^{-3} \cdot t + (5\ \text{ns})^2/t$	
		EN 61000-4-2:2009		
	0.7 ns to 500 ns	1 A to 150 A	$30 \cdot 10^{-3} \cdot t$	
RF pulse generator	0.5 ns to 20 ns	100 MHz to 67 GHz	1 ns	
Pulse duration	0.5 ns to 10 s		$2 \cdot 10^{-3} \cdot t + 10\ \text{ps} + \delta t_{TRIG}$	δt_{TRIG}: Trigger uncertainty
Repetition time	1 ns to 10 s			
Burst duration	5 ns to 10 s			
Burst period	5 ns to 10 s			

On-site calibration, Location Madrid

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Pulse voltage		EN 61000-4-4:2013		
	10 mV to 500 V	200 ps ≤ Δt ≤ 1 s	$20 \cdot 10^{-3} \cdot U$	U: Measured value
	10 V to 8 kV	2.5 ns ≤ Δt ≤ 1 s	$30 \cdot 10^{-3} \cdot U$	Δt: Pulse duration
	10 V to 15 kV	EN 61000-4-5:2019 10 ns ≤ Δt ≤ 1 s	$30 \cdot 10^{-3} \cdot U$	
Pulse current		EN 61000-4-2:2009		
	0.2 A to 150 A	10 ns ≤ Δt ≤ 10 ms	$25 \cdot 10^{-3} \cdot I$	I: Measured value
	1 A to 150 A	0.5 ns ≤ Δt ≤ 10 ns	$40 \cdot 10^{-3} \cdot I$	
	1 A to 5 kA	20 ns ≤ Δt ≤ 10 ms	$20 \cdot 10^{-3} \cdot I$	
Voltage division factor		EN 55016-1-2:2019		
	0 dB to 30 dB	9 kHz to 250 MHz	0.10 dB	
Complex impedance Z Magnitude		EN 55016-1-2:2019		
	0.2 Ω to 70 Ω	9 kHz to 10 MHz	$0.17\ \Omega + 0.08 \cdot 10^{-3} \cdot \lvert Z\rvert^2/\Omega$	Z: Measured value
	35 Ω to 70 Ω	> 10 MHz to 30 MHz	$0.22\ \Omega + 0.12 \cdot 10^{-3} \cdot \lvert Z\rvert^2/\Omega$	
	30 Ω to 80 Ω	> 30 MHz to 230 MHz	$0.7\ \Omega + 0.18 \cdot 10^{-3} \cdot \lvert Z\rvert^2/\Omega$	
	> 120 Ω to 180 Ω	150 kHz to 24 MHz	$0.5\ \Omega + 0.05 \cdot 10^{-3} \cdot \lvert Z\rvert^2/\Omega$	
	> 100 Ω to 220 Ω	> 24 MHz to 80 MHz	$0.7\ \Omega + 0.07 \cdot 10^{-3} \cdot \lvert Z\rvert^2/\Omega$	
	> 30 Ω to 220 Ω	> 80 MHz to 300 MHz	$1.8\ \Omega + 0.1 \cdot 10^{-3} \cdot \lvert Z\rvert^2/\Omega$	
Phase	-180° to 180°		$180°/\pi \cdot U_S$	U_S = arcsin($U(\lvert Z\rvert)/\lvert Z\rvert$)
Frequency oscillators, measuring instruments	0.1 MHz, 1 MHz, 2MHz, 2.5 MHz, 5 MHz, 10 MHz		$5 \cdot 10^{-11} \cdot f$	f: Measured value
Time interval	1 Hz to 67 GHz		$\sqrt{(1 \cdot 10^{-10} \cdot f)^2 + U_{\mathrm{REP}}^2}$	U_{REP}: Repeatability-uncertainty
	$1 \cdot 10^{-9}$ s to $1.8 \cdot 10^{+5}$ s		$\sqrt{1\ \mathrm{ns}^2 + (1 \cdot 10^{-10} \cdot t)^2 + U_{\mathrm{REP}}^2}$	t: Measured value

Abbreviations used:

CISPR	Comité international spécial des perturbations radioélectriques
CMC	Calibration and measurement capabilities
DIN	German institute for standardization