Electricity and Magnetism, Russian Federation

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty								
Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
DC voltage sources: single values	Standard cell	Difference measurement	1.018	1.018	V			Q[13, *N*], *N* is the noise in nV	nV	2	95%	No		1	VNIIM	Uncertainty depending on DUT
DC voltage sources: single values	Solid state voltage standard	Difference measurement	1.018	1.018	V			200	nV/V	2	95%	Yes		2	VNIIM	
DC voltage sources: single values	Solid state voltage standard	Difference measurement	10	10	V			Q[30, *N*], *N* is the noise in nV/V	nV/V	2	95%	Yes		3	VNIIM	Uncertainty depending on DUT
DC voltage sources: low values	Josephson voltage standard	Direct comparison	0	1	V			2	nV	2	95%	No		4	VNIIM	
DC voltage sources: low values	DC voltage source	Comparison to voltage standard and resistive divider	1.0E-04	10	V			(2E-06*U* + Q[4E-08, *N*]), *U* is the measurand in V, *N* is the noise in V	V	2	95%	No		5	VNIIM	Uncertainty depending on DUT
DC voltage sources: intermediate values	DC voltage source	Comparison to voltage standard and resistive divider	10	1000	V			2	µV/V	2	95%	Yes		6	VNIIM	
DC voltage meters: very low values	Millivoltmeter	Direct measurement	0.1	1	mV			(2E-06*U* + Q[4E-08, *N*]), *U* is the measurand in V, *N* is the noise in V	V	2	95%	No		7.1	VNIIM	Uncertainty depending on DUT
DC voltage meters: intermediate values	Millivoltmeter, voltmeter	Direct measurement	1.0E-03	10	V			(2E-06*U* + Q[4E-08, *N*]), *U* is the measurand in V, *N* is the noise in V	V	2	95%	No		7.2	VNIIM	Uncertainty depending on DUT

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DC voltage meters: intermediate values	Voltmeter	Direct measurement	10	1000	V			5	µV/V	2	95%	Yes		8	VNIIM	
DC voltage ratios: up to 1100 V	Resistive divider	Comparison to reference divider	0.01	0.1		Maximum input voltage	1000 V	0.5	µV/V	2	95%	Yes		9	VNIIM	
DC resistance standards and sources: low values	Fixed resistor	Comparison by means of Kelvin bridge and resistance ratio set	0.1	0.1	mΩ	Temperature	20 °C	10	µΩ/Ω	2	95%	Yes		10	VNIIM	Oil bath
DC resistance standards and sources: low values	Fixed resistor	Comparison by means of Kelvin bridge and resistance ratio set	1	100	mΩ	Temperature	20 °C	2	µΩ/Ω	2	95%	Yes		11	VNIIM	Oil bath
DC resistance standards and sources: low values	Fixed resistor	Comparison by means of Kelvin bridge and Hamon transfer	1	1	Ω	Temperature	20 °C	0.1	µΩ/Ω	2	95%	Yes		12	VNIIM	Oil bath
DC resistance standards and sources: intermediate values	Fixed resistor	Comparison by means of Kelvin bridge and Hamon transfer	10	1000	Ω	Temperature	20 °C	0.4	µΩ/Ω	2	95%	Yes		13	VNIIM	Oil bath
DC resistance standards and sources: intermediate values	Fixed resistor	Comparison by means of Kelvin bridge and Hamon transfer	10	10	kΩ	Temperature	20 °C	0.1	µΩ/Ω	2	95%	Yes		14	VNIIM	Oil bath

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DC resistance standards and sources: intermediate values	Fixed resistor	Comparison by means of Wheatstone bridge and Hamon transfer	100	100	kΩ	Temperature	20 °C	0.5	μΩ/Ω	2	95%	Yes		15	VNIIM	Oil bath
DC resistance standards and sources: intermediate values	Fixed resistor	Comparison by means of Wheatstone bridge and Hamon transfer	1	1	MΩ	Temperature	20 °C	1	μΩ/Ω	2	95%	Yes		16	VNIIM	Air bath
DC resistance standards and sources: high values	Fixed resistor	Comparison by means of Wheatstone bridge and Hamon transfer	10	100	MΩ	Temperature	20 °C	2	μΩ/Ω	2	95%	Yes		17	VNIIM	Air bath
DC resistance standards and sources: high values	Fixed resistor	Comparison by means of Wheatstone bridge and Hamon transfer	1	1	GΩ	Temperature	20 °C	5	μΩ/Ω	2	95%	Yes		18	VNIIM	Air bath
DC resistance standards and sources: high values	Fixed resistor	Comparison by means of Wheatstone bridge and Hamon transfer	10	10	GΩ	Temperature	20 °C	50	μΩ/Ω	2	95%	Yes		19	VNIIM	Air bath

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
DC resistance standards and sources: high values	Fixed resistor	Comparison by means of high resistance Wheatstone bridge and resistance imitator	100	1000	GΩ	Temperature	20 °C	1	mΩ/Ω	2	95%	Yes		20	VNIIM	In air
DC resistance standards and sources: standards for high current	DC shunt	Voltamperometric method	5	100	μΩ	Current	10 A to 10 kA	1	mΩ/Ω	2	95%	Yes		21	VNIIM	In air
DC resistance standards and sources: Temperature coefficient	Fixed resistor	Comparison to resistance standard	0.1	100	μΩ/Ω/K	Temperature	15 °C to 30 °C	0.05	μΩ/Ω/K	2	95%	No		22	VNIIM	Oil bath
						Resistance	< 1 MΩ									
DC resistance standards and sources: Temperature coefficient	Fixed resistor	Comparison to resistance standard	2	100	μΩ/Ω/K	Temperature	18 °C to 25 °C	1.00	μΩ/Ω/K	2	95%	No		23	VNIIM	Air bath
						Resistance	1 MΩ to 1 GΩ									
DC resistance meters: low values	Microohmmeter, multimeter	Comparison to resistance standard	1E-06	1	Ω			1E-03 to 1E-04				Yes		24	VNIIM	
DC resistance meters: intermediate values	Ohmmeter, multimeter	Comparison to resistance standard	1	1E+09	Ω			5E-05 to 1E-03				Yes		25	VNIIM	

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
DC resistance meters: high values	Megaohmmeter, gigaohmmeter, multimeter	Comparison to resistance standard	1E+09	1E+12	Ω			1E-03 to 1E-02				Yes		26	VNIIM	
DC current sources: low values	Current generator	Comparison to current standard	1E-15	1E-14	A			20 to 5	mA/A	2	95%	Yes		27	VNIIM	
DC current sources: low values	Current generator	Comparison to current standard	1E-14	1E-10	A			5 to 1	mA/A	2	95%	Yes		28	VNIIM	
DC current sources: low values	Current generator	Comparison to current standard	1E-10	1E-09	A			1 to 0.3	mA/A	2	95%	Yes		29	VNIIM	
DC current sources: low values	Current generator	Comparison to current standard	1E-09	1E-04	A			0.3 to 0.03	mA/A	2	95%	Yes		30	VNIIM	
DC current sources: intermediate values	Current generator	Comparison to voltage standard and resistance standard	1E-04	0.1	A			30 to 10	μA/A	2	95%	Yes		31	VNIIM	
DC current sources: intermediate values	Current generator	Comparison to voltage standard and resistance standard	0.1	10	A			10 to 50	μA/A	2	95%	Yes		32	VNIIM	
DC current meters: low values	Attoammeter, multimeter	Direct measurement	1E-16	1E-14	A			50 to 5	mA/A	2	95%	Yes		33	VNIIM	
DC current meters: low values	Picoammeter, multimeter	Direct measurement	1E-14	1E-10	A			5 to 1	mA/A	2	95%	Yes		34	VNIIM	
DC current meters: low values	Nanoammeter, multimeter	Direct measurement	1E-10	1E-9	A			1 to 0.3	mA/A	2	95%	Yes		35	VNIIM	

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DC current meters: low values	Nanoammeter, microammeter, multimeter	Direct measurement	1E-09	1E-04	A			0.3 to 0.03	mA/A	2	95%	Yes		36	VNIIM	
DC current meters: intermediate values	Ampermeter	Comparison by means of voltage standard and resistance standard	1E-04	0.1	A			30 to 10	μA/A	2	95%	Yes		37	VNIIM	
DC current meters: intermediate values	Ampermeter	Comparison by means of voltage standard and resistance standard	0.1	10	A			10 to 50	μA/A	2	95%	Yes		38	VNIIM	
AC resistance: real component	Fixed resistor	Transformer bridge by substitution	0.1	0.1	Ω	Frequency	1 kHz	10	μΩ/Ω	2	95%	Yes		39	VNIIM	Oil and air bath
						Temperature	20 °C									
AC resistance: real component	Fixed resistor	Transformer bridge by substitution	1	1	Ω	Frequency	1 kHz	5	μΩ/Ω	2	95%	Yes		40	VNIIM	Oil and air bath
						Temperature	20 °C									
AC resistance: real component	Fixed resistor	Transformer bridge by substitution	10	10	Ω	Frequency	1 kHz	2	μΩ/Ω	2	95%	Yes		41	VNIIM	Oil and air bath
						Temperature	20 °C									
AC resistance: real component	Fixed resistor	Transformer bridge by substitution	0.1	10	kΩ	Frequency	1 kHz	1	μΩ/Ω	2	95%	Yes		42	VNIIM	Oil and air bath
						Temperature	20 °C									

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
AC resistance: real component	Fixed resistor	Transformer bridge by substitution	100	100	kΩ	Frequency	1 kHz	1	μΩ/Ω	2	95%	Yes		43	VNIIM	Oil and air bath
						Temperature	20 °C									
AC resistance: real component	Fixed resistor	Transformer bridge by substitution	1	1	MΩ	Frequency	1 kHz	5	μΩ/Ω	2	95%	Yes		44	VNIIM	Oil and air bath
						Temperature	20 °C									
AC resistance: time constant	Fixed resistor	Transformer bridge by substitution	0.001	500	μs	Resistance	0.1 Ω	20	ns	2	95%	No		45	VNIIM	
						Frequency	1 kHz									
AC resistance: time constant	Fixed resistor	Transformer bridge by substitution	0.001	500	μs	Resistance	1 Ω	10	ns	2	95%	No		46	VNIIM	
						Frequency	1 kHz									
AC resistance: time constant	Fixed resistor	Transformer bridge by substitution	0.001	500	μs	Resistance	10 Ω to 10 kΩ	5	ns	2	95%	No		47	VNIIM	
						Frequency	1 kHz									
AC resistance: time constant	Fixed resistor	Transformer bridge by substitution	0.001	500	μs	Resistance	100 kΩ	10	ns	2	95%	No		48	VNIIM	
						Frequency	1 kHz									
AC resistance: time constant	Fixed resistor	Transformer bridge by substitution	0.001	500	μs	Resistance	1 MΩ	20	ns	2	95%	No		49	VNIIM	
						Frequency	1 kHz									
AC resistance: ac-dc difference	Fixed resistor	Transformer bridge by substitution	0.1	1	Ω	Frequency	1 kHz	2E-05		2	95%	Yes		50	VNIIM	

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AC resistance: ac-dc difference	Fixed resistor	Transformer bridge by substitution	10	1E+04	Ω	Frequency	1 kHz	1E-05		2	95%	Yes		51	VNIIM	
AC resistance: ac-dc difference	Fixed resistor	Transformer bridge by substitution	0.1	1	MΩ	Frequency	1 kHz	5E-05		2	95%	Yes		52	VNIIM	
AC resistance: resistors for high current	AC current shunt	Voltamperometric method	5	600	μΩ	Frequency	50 Hz	1	mΩ/Ω	2	95%	Yes		53	VNIIM	
						Current	100 A to 10 kA									
AC resistance: meters	LCR meter	Comparison to a resistance standard	0.1	1.0E+07	Ω	Frequency	1 kHz	1E-04		2	95%	Yes		54	VNIIM	
Capacitance: capacitance for low loss capacitors	Standard capacitor	Transformer bridge by substitution	1	1	fF	Frequency	1 kHz, 10 kHz	3	mF/F	2	95%	Yes		55	VNIIM	Oil and air bath
						Temperature	20 °C									
Capacitance: capacitance for low loss capacitors	Standard capacitor	Transformer bridge by substitution	10	10	fF	Frequency	1 kHz, 10 kHz	0.5	mF/F	2	95%	Yes		56	VNIIM	Oil and air bath
						Temperature	20 °C									
Capacitance: capacitance for low loss capacitors	Standard capacitor	Transformer bridge by substitution	0.1	0.5	pF	Frequency	1 kHz, 10 kHz	50	μF/F	2	95%	Yes		57	VNIIM	Oil and air bath
						Temperature	20 °C									

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Capacitance: capacitance for low loss capacitors	Standard capacitor	Transformer bridge by substitution	1	1	pF	Frequency	1 kHz, 1.6 kHz	1	µF/F	2	95%	Yes		58	VNIIM	Oil and air bath
						Temperature	20 °C									
Capacitance: capacitance for low loss capacitors	Standard capacitor	Transformer bridge by substitution	10	10	pF	Frequency	1 kHz, 1.6 kHz	0.5	µF/F	2	95%	Yes		59	VNIIM	
						Temperature	20 °C, 23 °C									
Capacitance: capacitance for low loss capacitors	Standard capacitor	Transformer bridge by substitution	100	4000	pF	Frequency	1 kHz, 10 kHz	10	µF/F	2	95%	Yes		60	VNIIM	Oil and air bath
						Temperature	20 °C									
Capacitance: capacitance for low loss capacitors	Standard capacitor	Transformer bridge by substitution	100	4000	pF	Frequency	100 kHz	0.1	mF/F	2	95%	Yes		61	VNIIM	Oil and air bath
						Temperature	20 °C									
Capacitance: capacitance for low loss capacitors	Standard capacitor	Transformer bridge by substitution	1	1000	pF	Frequency	1 MHz	0.3 to 1	mF/F	2	95%	Yes		62	VNIIM	Oil and air bath
						Temperature	20 °C									
Capacitance: dissipation factor for low loss capacitors	Fixed capacitor	Transformer bridge	1E-06	1E-04		Capacitance	1 pF to 100 pF	0.5E-06		2	95%	No		71	VNIIM	
						Frequency	1 kHz									

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Capacitance: dissipation factor for low loss capacitors	Fixed capacitor	Transformer bridge	1E-05	1E-04		Capacitance	200 pF to 1 nF	5E-06		2	95%	No		72	VNIIM	
						Frequency	1 kHz									
Capacitance: dissipation factor for low loss capacitors	Fixed capacitor	Transformer bridge	1E-05	1E-03		Capacitance	1 pF to 1 nF	5E-05		2	95%	No		77	VNIIM	
						Frequency	1 MHz									
Capacitance: capacitance for dielectric capacitors	Fixed capacitor, 1-2-3-4 sequence	Transformer or Schering bridge by substitution	0.1	40	nF	Frequency	50 Hz,1 kHz, 10 kHz, 100 kHz	0.1 to 0.2	mF/F	2	95%	Yes		63	VNIIM	Oil and air bath
						Temperature	20 °C									
Capacitance: capacitance for dielectric capacitors	Fixed capacitor, 1-2-3-4 sequence	Transformer or Schering bridge by substitution	0.1	0.4	µF	Frequency	50 Hz, 1 kHz, 10 kHz, 100 kHz	0.1 to 0.2	mF/F	2	95%	Yes		64	VNIIM	Oil and air bath
						Temperature	20 °C									
Capacitance: capacitance for dielectric capacitors	Fixed capacitor	Schering bridge by substitution	1	10	µF	Frequency	50 Hz, 1 kHz	0.2	mF/F	2	95%	Yes		65	VNIIM	Oil and air bath
Capacitance: capacitance for dielectric capacitors	Fixed capacitor	Schering bridge by substitution	1	1	µF	Frequency	10 kHz, 100 kHz	0.3 to 0.5	mF/F	2	95%	Yes		66	VNIIM	Oil and air bath

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Capacitance: capacitance for dielectric capacitors	Capacitance box	High capacitance bridge and transformed capacitance standard	0.1	1	mF	Frequency	50 Hz, 1 kHz	0.3	mF/F	2	95%	Yes		67	VNIIM	Oil and air bath
Capacitance: capacitance for dielectric capacitors	Capacitance box	High capacitance bridge and transformed capacitance standard	2	10	mF	Frequency	50 Hz, 1 kHz	1	mF/F	2	95%	Yes		68	VNIIM	Oil and air bath
Capacitance: dissipation factor dielectric capacitors	Fixed capacitor	Transformer bridge	5E-05	1E-03		Capacitance	2 nF to 10 nF	1E-05		2	95%	No		73	VNIIM	
						Frequency	1 kHz									
Capacitance: dissipation factor dielectric capacitors	Fixed capacitor	Schering bridge	5E-05	1E-03		Capacitance	20 nF to 1 µF	3E-05		2	95%	No		74	VNIIM	
						Frequency	1 kHz									
Capacitance: dissipation factor dielectric capacitors	Fixed capacitor	Schering bridge	5E-05	1E-03		Capacitance	100 pF to 1 µF	2E-05		2	95%	No		75	VNIIM	
						Frequency	50 Hz, 10 kHz									

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Capacitance: dissipation factor dielectric capacitors	Fixed capacitor	Schering bridge	5E-05	1E-03		Capacitance	10 pF to 10 nF	3E-05		2	95%	No		76	VNIIM	
						Frequency	100 kHz									
Capacitance: capacitance for transformed capacitors	Switched capacitor	High capacitance bridge and transformed capacitance standard	0.02	0.1	F	Frequency	50 Hz	10	mF/F	2	95%	Yes		69	VNIIM	Oil and air bath
Capacitance: capacitance for transformed capacitors	Switched capacitor	High capacitance bridge and transformed capacitance standard	0.1	1	F	Frequency	50 Hz	50	mF/F	2	95%	Yes		70	VNIIM	Oil and air bath
Capacitance: meters	Capacitance bridge, LCR meter	Comparison to capacitance standard and loss angle standard	1	1E+06	pF	Frequency	1 kHz	1E-04		2	95%	Yes		78	VNIIM	
Capacitance: meters	Capacitance bridge, LCR meter	Comparison to capacitance standard and loss angle standard	1E-03	1	mF	Frequency	1 kHz	1E-03		2	95%	Yes		79	VNIIM	

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty								
Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
Capacitance: meters	Capacitance bridge, LCR meter	Comparison to capacitance standard and loss angle standard	1E-05	10	mF	Frequency	50 Hz	1E-03		2	95%	Yes		80	VNIIM	
Capacitance: meters	Capacitance bridge, LCR meter	Comparison to capacitance standard and loss angle standard	1	1000	pF	Frequency	1 MHz	1E-03		2	95%	Yes		81	VNIIM	
Inductance: self inductance, low values	Fixed inductor, inductance box	Maxwell-Wien or transformer bridge, resonance comparator	1	500	µH	Frequency	1 kHz to 1 MHz	0.1 to 3	mH/H	2	95%	Yes	Matrix 4.1	82	VNIIM	Air bath
Inductance: self inductance, intermediate values	Fixed inductor, inductance box	Maxwell-Wien bridge	1	1000	mH	Frequency	40 Hz to 100 kHz	0.01 to 1	mH/H	2	95%	Yes	Matrix 4.2	88	VNIIM	Air bath
						Temperature	20 °C									
Inductance: self inductance, high values	Fixed inductor	Owen bridge	10	1E+04	H	Frequency	40 Hz to 1 kHz	1	mH/H	2	95%	Yes		96	VNIIM	Air bath
Inductance: mutual inductance	Fixed mutual inductor	Modified Maxwell-Wien bridge	0.1	1	mH	Frequency phase error	40 Hz to 10 kHz	1	mH/H	2	95%	Yes		97	VNIIM	Air bath
Inductance: mutual inductance	Fixed mutual inductor	Modified Maxwell-Wien bridge	1	100	mH	Frequency phase error	40 Hz to 10 kHz	0.1	mH/H	2	95%	Yes		98	VNIIM	Air bath

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Inductance: meters	LCR meter	Comparison to inductance standard and Q-standard	1E-06	1	H	Frequency	1 kHz	0.5	mH/H	2	95%	Yes		99	VNIIM	
Inductance: meters	LCR meter	Comparison to inductance standard and Q-standard	0.001	10	mH	Frequency	1 MHz	1	mH/H	2	95%	Yes		100	VNIIM	
Inductance: quality factor	Q standard	Maxwell-Wien bridge	1	150		Frequency	1 kHz to 100 kHz	2E-03		2	95%	Yes		101	VNIIM	
						Inductance	1.6 mH to 0.5 H									
Inductance: quality factor	Q standard	Transformer bridge, double T-bridge	100	500		Frequency	100 kHz to 1 MHz	1E-02		2	95%	Yes		102	VNIIM	
						Inductance	0.001 mH to 0.1 mH									
AC-DC voltage transfer: AC-DC transfer difference at medium voltages	AC-DC voltage transfer standard, thermal converter	Comparison with reference	0.3	10	V	Frequency	0.4 kHz to 10 kHz	3	µV/V	2	95%	Yes		103	VNIIM	
AC-DC voltage transfer: AC-DC transfer difference at medium voltages	AC-DC voltage transfer standard, thermal converter	Comparison with reference	0.3	10	V	Frequency	20 kHz	6	µV/V	2	95%	Yes		105	VNIIM	

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
AC-DC voltage transfer: AC-DC transfer difference at medium voltages	AC-DC voltage transfer standard, thermal converter	Comparison with reference	0.3	10	V	Frequency	50 kHz to 100 kHz	10	µV/V	2	95%	Yes		107	VNIIM	
AC-DC voltage transfer: AC-DC transfer difference at medium voltages	AC-DC voltage transfer standard, thermal converter	Comparison with reference	0.3	10	V	Frequency	1 MHz	30	µV/V	2	95%	Yes		108	VNIIM	
AC-DC voltage transfer: AC-DC transfer difference at higher voltages	AC-DC voltage transfer standard, thermal converter	Comparison with reference	10	1000	V	Frequency	0.4 kHz to 100 kHz	5 to 100	µV/V	2	95%	Yes	Matrix 5.1	104	VNIIM	
AC voltage up to 1000 V: sources	Multifunction calibrator, multifunction transfer standards	Thermal transfer standard, inductive divider	0.1	1000	V	Frequency	10 Hz to 1 MHz	30 to 150	µV/V	2	95%	Yes	Matrix 5.2	124	VNIIM	
AC voltage ratio, attenuation and gain: attenuation, *A*	Passive device, inductive divider	Parallel substitution	0.001	120	dB	Frequency	20 Hz to 200 kHz	0.0001 to 0.07	dB	2	95%	No	Matrix 5.3	139	VNIIFTRI	
						Impedance	50 Ω, 75 Ω, 150 Ω, 600 Ω									
AC-DC current transfer: AC-DC transfer difference	Thermal current converter plus shunt, AC-DC transfer	Comparison with reference	1E-03	30E-03	A	Frequency	20 Hz to 100 kHz	40	µA/A	2	95%	Yes		155	VNIIM	

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
AC-DC current transfer: AC-DC transfer difference	Thermal current converter	Comparison with reference	1E-03	30E-03	A	Frequency	100 kHz to 1 MHz	100	µA/A	2	95%	Yes		156	VNIIM	
AC-DC current transfer: AC-DC transfer difference	Thermal current converter	Comparison with reference	50E-03	1	A	Frequency	40 Hz to 2.5 kHz	50	µA/A	2	95%	Yes		157	VNIIM	
AC-DC current transfer: AC-DC transfer difference	Thermal current converter	Comparison with reference	50E-03	1	A	Frequency	2.5 kHz to 20 kHz	80	µA/A	2	95%	Yes		158	VNIIM	
AC-DC current transfer: AC-DC transfer difference	Thermal current converter	Comparison with reference	2.5	20	A	Frequency	40 Hz to 2.5 kHz	60	µA/A	2	95%	Yes		159	VNIIM	
AC-DC current transfer: AC-DC transfer difference	Thermal current converter	Comparison with reference	2.5	20	A	Frequency	2.5 kHz to 20 kHz	100	µA/A	2	95%	Yes		160	VNIIM	
AC power and energy: single phase, (*f* <= 400 Hz), active power	Power comparator, power meter	AC/DC transfer	0.00	6.0E+02	W	Voltage	120 V	50	µW/VA	2	95%	Yes		161	VNIIM	
						Current	5.0 A									
						Frequency	45 Hz to 55 Hz									
						Power factor	1 i/c to 0 i/c									
AC power and energy: single phase, (*f* <= 400 Hz), active energy	Power comparator, power to frequency converter	AC/DC transfer	0.00	6.0E+04	Ws	Voltage	120 V	50	µWs/VAs	2	95%	Yes		162	VNIIM	
						Current	5.0 A									

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
						Frequency	45 Hz to 55 Hz									
						Power factor	1 i/c to 0 i/c									
						Time	1 s to 100 s									
AC power and energy: single phase, (*f* <= 400 Hz), active power	Power meter	Thermal converter. Direct comparison	0.25	2.0E+04	W	Voltage	50 V to 400 V	100	µW/VA	2	95%	Yes		163	VNIIM	
						Current	0.01 A to 50 A									
						Frequency	45 Hz to 55 Hz									
						Power factor	1.0 i/c to 0.5 i/c									
AC power and energy: single phase, (*f* <= 400 Hz), active energy	Energy meter	Thermal converter. Direct comparison	0.25	2.0E+06	Ws	Voltage	50 V to 400 V	100	µWs/VAs	2	95%	Yes		164	VNIIM	
						Current	0.01 A to 50 A									
						Frequency	45 Hz to 55 Hz									
						Power factor	1.0 i/c to 0.5 i/c									
						Time	1 to 100 s									
AC power and energy: single phase, (*f* <= 400 Hz), reactive power	Power meter	Direct comparison. Calculation of active and apparent power	0.25	2.0E+04	var	Voltage	50 V to 400 V	200	µvar/VA	2	95%	Yes		165	VNIIM	
						Current	0.01 A to 50 A									

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
						Frequency	45 Hz to 55 Hz									
						Power factor	1.0 i/c to 0.5 i/c									
AC power and energy: single phase, (f <= 400 Hz), reactive energy	Energy meter	Direct comparison. Calculation of active and apparent energy	0.25	2.0E+06	vars	Voltage	50 V to 400 V	400	µvars/VAs	2	95%	Yes		166	VNIIM	
						Current	0.01 A to 50 A									
						Frequency	45 Hz to 55 Hz									
						Power factor	1.0 i/c to 0.5 i/c									
						Time	1 s to 100 s									
AC power and energy: three phase, active power	Power meter	Direct comparison	0.25	2.0E+04	W	Voltage	50 V to 400 V	100	µW/VA	2	95%	Yes		167	VNIIM	Range values per phase
						Current	0.01 A to 50 A									
						Frequency	45 Hz to 55 Hz									
						Power factor	1.0 i/c to 0.5 i/c									
AC power and energy: three phase, active energy	Energy meter	Direct comparison	0.25	2.0E+06	Ws	Voltage	50 V to 400 V	150	µWs/VAs	2	95%	Yes		168	VNIIM	Range values per phase
						Current	0.01 A to 50 A									
						Frequency	45 Hz to 55 Hz									

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
						Power factor	1.0 i/c to 0.5 i/c									
						Time	1 s to 100 s									
AC power and energy: three phase, reactive power	Power meter	Direct comparison	0.25	2.0E+04	var	Voltage	50 V to 400 V	300	µvar/VA	2	95%	Yes		169	VNIIM	Range values per phase
						Current	0.01 A to 50 A									
						Frequency	45 Hz to 55 Hz									
						Power factor	1.0 i/c to 0.5 i/c									
AC power and energy: three phase, reactive energy	Energy meter	Direct comparison	0.25	2.0E+06	vars	Voltage	50 V to 400 V	400	µvars/VA s	2	95%	Yes		170	VNIIM	Range values per phase
						Current	0.01 A to 50 A									
						Frequency	45 Hz to 55 Hz									
						Power factor	1.0 i/c to 0.5 i/c									
						Time	1 s to 100 s									
High DC voltage: high voltage meters	DC kilovoltmeter, dedicated set-up for high voltage	Differential voltage meter, set of calibrated Zener diode chains	1	100	kV	Temperature	20 °C to 30 °C	5E-05		2	95%	Yes		171	VNIIMS	
						Relative humidity	40% to 80%									

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
High DC voltage: high voltage meters	Dedicated set-up for high voltage	Comparison by means of differential voltage meter and set of calibrated Zener diode chains	100	400	kV	Temperature	20 °C to 30 °C	2E-04		2	95%	Yes		172	VNIIMS	
						Relative humidity	40% to 80%									
High DC voltage: high voltage meters	Dedicated set-up for high voltage	Comparison by means of differential voltage meter and set of calibrated Zener diode chains	400	800	kV	Temperature	20 °C to 30 °C	3E-04		2	95%	Yes		173	VNIIMS	
						Relative humidity	40% to 80%									
High DC voltage: ratios	High voltage resistive divider	Measurement by means of differential voltage meter, set of calibrated Zener diode chains, DC voltmeter	1	100000		Voltage	1 kV to 800 kV	7E-05 to 3E-04		2	95%	Yes		174	VNIIMS	
High voltage impedance: capacitance	Compressed gas capacitor	Comparison with reference	10	1000	pF	Voltage	1 kV to 350 kV	1.5E-04 to 1.0E-03		2	95%	Yes		175	VNIIMS	
						Frequency	50 Hz									

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
High voltage impedance: dissipation factor	Compressed gas capacitor	Comparison with reference	5E-05	1E-03		Frequency	50 Hz	5E-05		2	95%	No		176	VNIIMS	
AC high voltage: peak values	AC high voltage meter, dedicated set-up for high voltage measurements (resistive and capacitive dividers)	Comparison with reference system	1	350	kV	Frequency	50 Hz	5E-04		2	95%	Yes		177	VNIIMS	
AC high voltage: peak values	AC high voltage meter, dedicated set-up for high voltage measurements (resistive and capacitive dividers)	Comparison with reference system	1	800	kV	Frequency	50 Hz	1E-03		2	95%	Yes		178	VNIIMS	
AC high voltage: ratio error	High voltage transformer, voltage transformer bridge	Current comparator bridge and compressed gas capacitors	0	0.02		Voltage	1 kV to 350 kV	2E-04 to 5E-04		2	95%	Yes		179	VNIIMS	
						Frequency	50 Hz									
						Ratio	10 to 10000									
AC high voltage: ratio: phase displacement	High voltage transformer, voltage transformer bridge	Current comparator bridge and compressed gas capacitors	5E-05	1E-03	rad	Voltage	1 kV to 350 kV	5E-05	rad	2	95%	No		180	VNIIMS	
						Frequency	50 Hz									

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
						Ratio	10 to 10000									
Pulsed high voltage and current: lightning impulse voltage parameters	Lightning impulse voltage measurement set-up, impulse calibrator, digital recorder	Comparison by means of differential voltage meter and set of calibrated Zener diode chains	50	2000	V	Impulse shape	according to IEC 60060	1E-03 to 2E-03		2	95%	Yes		181	VNIIMS	
Pulsed high voltage and current: lightning impulse voltage parameters	Lightning impulse voltage measurement set-up	Comparison by means of differential voltage meter and set of calibrated Zener diode chains	1	50	kV	Impulse shape	according to IEC 60060	3E-03		2	95%	Yes		182	VNIIMS	
Pulsed high voltage and current: lightning impulse voltage parameters	Lightning impulse voltage measurement set-up	Comparison with reference measuring system	50	1500	kV	Impulse shape	according to IEC 60060	5E-03		2	95%	Yes		183	VNIIMS	
Pulsed high voltage and current: lightning impulse time parameters	Lightning impulse voltage measurement set-up, impulse calibrator, digital recorder	Comparison with reference measuring system	0.8	60	µs	Peak voltage value	10 V to 500 kV	5E-02		2	95%	Yes		184	VNIIMS	
						Impulse shape	according to IEC 60060									

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
Pulsed high voltage and current: switching impulse voltage parameters	Switching impulse voltage measurement set-up, impulse calibrator, digital recorder	Differential voltage meter, set of calibrated Zener diode-transistor chains	50	2000	V	Impulse shape	according to IEC 60060	0.5E-03 to 2E-03		2	95%	Yes		185	VNIIMS	
Pulsed high voltage and current: switching impulse voltage parameters	Switching impulse voltage measurement set-up	Differential voltage meter, set of calibrated Zener diode chains	1	800	kV	Impulse shape	according to IEC 60060	3E-03		2	95%	Yes		186	VNIIMS	
Pulsed high voltage and current: switching impulse time parameters	Switching impulse voltage measurement set-up, impulse calibrator, digital recorder	Comparison with reference measuring system	100	2500	µs	Peak voltage value	1 kV to 500 kV	3E-02		2	95%	Yes		187	VNIIMS	
High AC current: ratio error	Current transformer	Comparison with reference standard	0	0.02	A/A	Frequency	50 Hz	5 to 15	µA/A	2	95%	Yes	Matrix 8.6.1	188	UNIIM	Approved on 09 March 2015
						Primary current range	0.5 A to 50000 A									
						Secondary current	1 A, 5A									
High AC current ratio:phase displacement	Current transformer	Comparison with reference standard	0	2E-02	rad	Frequency	50 Hz	5 to 15	µrad	2	95%	No	Matrix 8.6.2	190	UNIIM	Approved on 09 March 2015
						Primary current range	0.5 A to 50000 A									

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						Secondary current	1 A, 5 A									
Current and voltage waveform: voltage harmonic distortion	Signal generator, distortion meter, level meter	Measurement by means of spectrum analyzer, selective voltmeter	1E-05	1E-03		Frequency	20 Hz to 20 kHz	3E-02 to 10E-02		2	95%	Yes		191	VNIIFTRI	
Current and voltage waveform: voltage harmonic distortion	Signal generator, distortion meter, level meter	Measurement by means of spectrum analyzer, selective voltmeter	1E-04	1E-03		Frequency	20 Hz to 120 kHz	1E-02 to 5E-02		2	95%	Yes		192	VNIIFTRI	
Current and voltage waveform: voltage harmonic distortion	Signal generator, distortion meter, level meter	Measurement by means of spectrum analyzer, selective voltmeter	1E-03	1		Frequency	20 Hz to 200 kHz	3E-02		2	95%	Yes		193	VNIIFTRI	
Electric field below 50 kHz: electrostatic field strength	E-field meter	E-field generator. Direct measurement	0.1	10	kV/m			2.5E-02 to 5E-02		2	95%	Yes		194	VNIIFTRI	
Electric field below 50 kHz: electrostatic field strength	E-field meter	E-field generator. Direct measurement	0.01	500	kV/m			5E-02 to 12E-02		2	95%	Yes		195	VNIIFTRI	
Electric field below 50 kHz: electrostatic field strength	E-field generator	E-field generator. Comparison with comparator	0.01	200	kV/m			4E-02		2	95%	Yes		196	VNIIFTRI	

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
Electric field below 50 kHz: electric field strength	E-field meter	E-field generator. Direct measurement	0.5	250	V/m	Frequency	5 Hz to 20 kHz	5E-02 to 12E-02		2	95%	Yes		197	VNIIFTRI	
Electric field below 50 kHz: electric field strength	E-field generator	E-field generator. Comparison with comparator	0.5	250	V/m	Frequency	5 Hz to 20 kHz	4E-02		2	95%	Yes		198	VNIIFTRI	
Electric field below 50 kHz: electric field strength	E-field meter	E-field generator. Direct measurement	0.5	100	V/m	Frequency	20 Hz to 20 kHz	2.5E-02 to 5E-02		2	95%	Yes		199	VNIIFTRI	
Electric field below 50 kHz: electric field strength	E-field meter	E-field generator. Direct measurement	0.002	100	kV/m	Frequency	50 Hz	5E-02 to 12E-02		2	95%	Yes		200	VNIIFTRI	
Electric field below 50 kHz: electric field strength	E-field generator	E-field generator. Comparison with comparator	0.002	100	kV/m	Frequency	50 Hz	4E-02		2	95%	Yes		201	VNIIFTRI	
Electric field below 50 kHz: electric field strength	E-field meter	E-field generator. Direct measurement	0.02	5	kV/m	Frequency	50 Hz	2E-02 to 5E-02		2	95%	Yes		202	VNIIFTRI	
Magnetic fields below 50 kHz: magnetic flux	Fluxmeter	Comparison with reference standard	1E-05	1E-02	Wb	field stability per 10 min	1.5E-03	5E-03		2	95%	Yes		203	VNIIM	

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Magnetic fields below 50 kHz: magnetic flux per unit current	Magnetic flux coil	Comparison with reference standard	1E-04	1E-02	Wb/A			1E-03		2	95%	Yes		204	VNIIM	
Magnetic fields below 50 kHz: DC magnetic flux density	Magnetic flux density meter, magnetometer	Direct comparison	1E-07	1E-05	T	Field stability per 10 min	0.01 nT	0.05	nT	2	95%	No		205	VNIIM	
						Field inhomogeneity at centre region +/- 30 cm	0.01 nT									
Magnetic fields below 50 kHz: DC magnetic flux density	Magnetic flux density meter, magnetometer	Direct comparison	1E-05	1E-04	T	Field stability per 10 min	0.01 nT	0.03	nT	2	95%	No		206	VNIIM	
						Field inhomogeneity at centre region +/- 30 cm	0.01 nT									
Magnetic fields below 50 kHz: DC magnetic flux density	Magnetic flux density meter, magnetometer	Direct comparison	1E-04	1E-03	T	Field stability per 1 min	0.1 nT	0.3	nT	2	95%	No		207	VNIIM	
						Field inhomogeneity at centre region +/- 1 cm	0.2 nT									

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
Magnetic fields below 50 kHz: DC magnetic flux density	Magnetic flux density meter, magnetometer	Direct comparison	1E-03	1E-01	T	Relative field inhomogeneity at centre region +/- 1 cm	1E-04	2E-04		2	95%	Yes		208	VNIIM	
						Relative field stability per 1 min	1E-04									
Magnetic fields below 50 kHz: DC magnetic flux density	Field generators, NMR magnetometers	Electromagnet or field coil, NMR magnetometer. Direct measurements or comparision	0.05	2.0	T	Relative field inhomogeneity at centre region +/- 1 cm	1E-05	5E-05		2	95%	Yes		209	VNIIFTRI	
						Relative field stability per 10 min	1E-05									
Magnetic fields below 50 kHz: DC magnetic flux density	Field generators, Hall probes and magnetometers	Electromagnet or field coil, Hall magnetometer. Direct measurements or comparision	0.05	2.0	T	Relative field inhomogeneity at centre region +/- 1 cm	5E-04	3E-03		2	95%	Yes		210	VNIIFTRI	
						Relative field stability per 10 min	5E-04									
Magnetic fields below 50 kHz: AC magnetic flux density	AC magnetometer	Direct comparison	1E-07	1E-03	T	Frequency	0.1 Hz to 20 kHz	2E-03		2	95%	Yes		211	VNIIM	

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
Magnetic fields below 50 kHz: AC magnetic flux density	AC magnetometers	Electromagnet or field coil, comparison with pick-up coil	1E-03	1.0	T	Frequency	20 Hz to 200 Hz	3E-03		2	95%	Yes		212	VNIIFTRI	
						Relative field inhomogeneity at centre region +/- 1 cm	1.0E-03									
						Relative field stability per 10 min	1.0E-03									
Magnetic fields below 50 kHz: turn area	Pick up coil	Comparison with reference standard	1E-03	1E-01	Wb/T	Frequency	20 Hz to 20 kHz	1E-02		2	95%	Yes		213	VNIIM	
Magnetic fields below 50 kHz: turn area	Pick up coil	Comparison with reference standard	1E-01	20	Wb/T	Frequency	20 Hz to 20 kHz	1E-03		2	95%	Yes		214	VNIIM	
Magnetic fields below 50 kHz: DC magnetic flux density per unit current	Field coil	Comparison with reference standard	1E-05	1E-03	T/A	Field stability per 10 min	3E-07	1E-05		2	95%	Yes		215	VNIIM	
Magnetic fields below 50 kHz: DC magnetic flux density per unit current	Field coil	Comparison with reference standard	1E-03	5E-02	T/A			1E-04		2	95%	Yes		216	VNIIM	

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
Magnetic fields below 50 kHz: AC magnetic flux density per unit current	Field coil	Comparison with reference standard	1E-05	1E-03	T/A	Frequency	20 Hz to 20 kHz	3E-03		2	95%	Yes		217	VNIIM	
Magnetic fields below 50 kHz: magnetic field gradient	Gradiometer	Comparison with reference standard	1E-06	3	T/m	Frequency	0 Hz to 500 Hz	3E-02		2	95%	Yes		218	VNIIM	
Magnetic fields below 50 kHz: magnetic field gradient per unit current	Magnetic field gradient coil	Comparison with reference standard	1E-03	1	T/(A m)	Frequency	0 Hz to 500 Hz	1.5E-02		2	95%	Yes		219	VNIIM	
Electromagnetic fields above 50 kHz: electric field strength	E-field meter	E-field generator. Direct measurement	1	50	V/m	Frequency	50 kHz to 30 MHz	6E-02 to 12E-02		2	95%	Yes		220	VNIIFTRI	
Electromagnetic fields above 50 kHz: electric field strength	E-field meter	E-field generator. Direct measurement	1	20	V/m	Frequency	300 MHz to 1 GHz	4E-02 to 6E-02		2	95%	Yes		221	VNIIFTRI	
Electromagnetic fields above 50 kHz: electric field strength	TEM-field generator	E-field generator. Comparison with comparator	1	10	V/m	Frequency	10 kHz to 300 MHz	4E-02 to 6E-02		2	95%	Yes		222	VNIIFTRI	

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
Electromagnetic fields above 50 kHz: electric field strength	E-field meter	E-field meter. Immediate comparison	0.2	10	V/m	Frequency	30 MHz to 1 GHz	3.5E-02		2	95%	Yes		223	VNIIFTRI	
Electromagnetic fields above 50 kHz: electric field strength	E-field generator	E-field generator. Comparison with comparator	1	140	V/m	Frequency	10 kHz to 300 MHz	6E-02		2	95%	Yes		224	VNIIFTRI	
Electromagnetic fields above 50 kHz: electric field strength	E-field generator	E-field generator. Comparison with comparator	0.5	20	V/m	Frequency	10 kHz to 30 MHz	3E-02		2	95%	Yes		225	VNIIFTRI	
Electromagnetic fields above 50 kHz: electric field strength	E-field generator	E-field generator. Comparison with comparator	5E-04	5	V/m	Frequency	0.3 kHz to 200 kHz	6E-02		2	95%	Yes		226	VNIIFTRI	
Electromagnetic fields above 50 kHz: magnetic field strength	H-field generator, field meter	H-field generator with standard loops	5E-07	1E-03	A/m	Frequency	10 kHz to 30 MHz	3E-02 to 5E-02		2	95%	Yes		227	VNIIFTRI	
Electromagnetic fields above 50 kHz: magnetic field strength	H-field generator	TEM-field generator. Comparison with comparator	0.5	20	A/m	Frequency	10 kHz to 30 MHz	6E-02 to 10E-02		2	95%	Yes		228	VNIIFTRI	
Electromagnetic fields above 50 kHz: magnetic field strength	H-field meter	TEM-field generator. Direct measurement	0.03	1	A/m	Frequency	30 MHz to 1 GHz	8E-02		2	95%	Yes		229	VNIIFTRI	

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
Electromagnetic fields above 50 kHz: power flux density	Power flux density meter, field probe	Comparison with reference standard	0.1	10	W/m^2	Frequency	0.3 GHz to 40 GHz	12E-02		2	95%	Yes		230	VNIIFTRI	
Electromagnetic fields above 50 kHz: power flux density	Power flux density meter, field probe	Comparison with reference standard	0.1	10	W/m^2	Frequency	40 GHz to 178.4 GHz	25E-02		2	95%	Yes		231	VNIIFTRI	
Electromagnetic fields above 50 kHz: power flux density	Power flux density meter, field probe	Comparison with reference standard	0.1	100	W/m^2	Frequency	0.3 GHz to 40 GHz	8E-02		2	95%	Yes		232	VNIIFTRI	
Electromagnetic fields above 50 kHz: power flux density	Power flux density meter, field probe	Comparison with reference standard	0.1	100	W/m^2	Frequency	40 GHz to 178.4 GHz	8E-02		2	95%	Yes		233	VNIIFTRI	
RF power: absolute power on coaxials	Power meter	Power transfer	1E-15	1E-05	W	Frequency	0.01 GHz to 18 GHz	1.2E-02 to 12E-02		2	95%	Yes		234	VNIIFTRI	
						Connector type	N									
RF power: absolute power on coaxials	Power meter, power source	Power transfer	0.01	10	mW	Frequency	0.01 GHz to 18 GHz	0.8E-02 to 1.2E-02		2	95%	Yes		235	VNIIFTRI	
						Connector type	N									
RF power: absolute power on coaxials	Power meter, power source	Power transfer with attenuator	1E-07	100	mW	Frequency	50 MHz to 2 GHz	2.0E-02		2	95%	Yes		236	VNIIFTRI	
						Connector type	75 Ω (BNC)									

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
RF power: absolute power on coaxials	Power meter, power source	Power transfer with attenuator	1E-04	100	W	Frequency	50 MHz to 1 GHz	2.0E-02		2	95%	Yes		237	VNIIFTRI	
						Connector type	N									
RF power: absolute power on coaxials	Power meter, power source	Power transfer with attenuator	1E-04	10	W	Frequency	2.6 GHz to 12 GHz	1.3E-02		2	95%	Yes		238	VNIIFTRI	
						Connector type	N									
RF Power: absolute power on waveguides	Power meter	Power transfer	0.01	10	mW	Frequency	5.64 GHz to 37.5 GHz	0.8E-02 to 1.2E-02		2	95%	Yes		239	VNIIFTRI	
						Waveguide dimensions	35/15 mm, 23/10 mm, 16/8 mm, 11/5.5 mm, 7.2/3.4 mm									
RF Power: absolute power on waveguides	Power meter	Power transfer	1E-15	1E-05	W	Frequency	5.64 GHz to 37.5 GHz	1.2E-02 to 12E-02		2	95%	Yes		240	VNIIFTRI	
						Waveguide dimensions	35/15 mm, 23/10 mm, 16/8 mm, 11/5.5 mm, 7.2/3.4 mm									
RF Power: absolute power on waveguides	Power meter	Power transfer	0.01	100	W	Frequency	2.59 GHz to 12.05 GHz	1.5E-02 to 2.5E-02		2	95%	Yes		241	VNIIFTRI	

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						Waveguide dimensions	72/34 mm, 48/24 mm, 35/15 mm, 23/10 mm									
RF Power: absolute power on waveguides	Power meter, power source	Power transfer	1E-04	10	W	Frequency	3.2 GHz to 4.8 GHz	1E-02		2	95%	Yes		242	VNIIFTRI	
						Waveguide dimensions	58/25mm									
RF power: calibration factor on coaxials	Power sensor: thermistor mount, thermoelectric mount	Power transfer	0.8	1	W/W	Frequency	0.01 GHz to 4 GHz	0.4E-02 to 0.6E-02		2	95%	Yes		243	VNIIFTRI	
						Connector type	N									
RF power: calibration factor on coaxials	Power sensor: thermistor mount, thermoelectric mount	Power transfer	0.8	1	W/W	Frequency	4 GHz to 8 GHz	0.6E-02 to 0.8E-02		2	95%	Yes		244	VNIIFTRI	
						Connector type	N									
RF power: calibration factor on coaxials	Power sensor: thermistor mount, thermoelectric mount	Power transfer	0.8	1	W/W	Frequency	8 GHz to 12 GHz	0.8E-02 to 1.0E-02		2	95%	Yes		245	VNIIFTRI	
						Connector type	N									

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RF power: calibration factor on coaxials	Power sensor: thermistor mount, thermoelectric mount	Power transfer	0.8	1	W/W	Frequency	12 GHz to 18 GHz	0.8E-02 to 1.2E-02		2	95%	Yes		246	VNIIFTRI	
						Connector type	N									
RF power: calibration factor on coaxials	Power sensor: thermistor mount	Six port	0.8	1	W/W	Frequency	0.6 GHz to 18 GHz	0.4E-02 to 0.8E-02		2	95%	Yes		247	VNIIFTRI	
						Connector type	N									
RF power: calibration factor on coaxials	Power sensor: thermistor mount	Power transfer	0.8	1	W/W	Frequency	0.033 GHz to 3 GHz	0.5E-02 to 1.0E-02		2	95%	Yes		248	VNIIFTRI	
						Coaxial dimensions, impedance	16/4.6 mm, 75 Ω									
RF power: calibration factor on coaxials	Power sensor: thermistor mount	Power transfer	0.8	1	W/W	Frequency	0.03 GHz to 4 GHz	0.5E-02 to 1.0E-02		2	95%	Yes		249	VNIIFTRI	
						Coaxial dimensions, impedance	16/6.95 mm, 50 Ω									
RF power: calibration factor on coaxials	Power sensor: thermistor mount	Power transfer	0.8	1	W/W	Frequency	4 GHz to 7 GHz	(0.8 to 1.0)E-02		2	95%	Yes		250	VNIIFTRI	
						Coaxial dimensions, impedance	16/6.95 mm, 50 Ω									

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RF power: calibration factor on coaxials	Power sensor: thermistor mount	Power transfer	0.8	1	W/W	Frequency	0.01 GHz to 4 GHz	0.5E-02 to 1.0E-02		2	95%	Yes		251	VNIIFTRI	
						Connector type	SMA									
RF power: calibration factor on coaxials	Power sensor: thermistor mount	Power transfer	0.8	1	W/W	Frequency	4 GHz to 8 GHz	(0.6 to 1.0)E-02		2	95%	Yes		252	VNIIFTRI	
						Connector type	SMA									
RF power: calibration factor on coaxials	Power sensor: thermistor mount	Power transfer	0.8	1	W/W	Frequency	8 GHz to 12 GHz	(0.8 to 1.2)E-02		2	95%	Yes		253	VNIIFTRI	
						Connector type	SMA									
RF power: calibration factor on coaxials	Power sensor: thermistor mount	Power transfer	0.8	1	W/W	Frequency	12 GHz to 18 GHz	1.2E-02 to 1.5E-02		2	95%	Yes		254	VNIIFTRI	
						Connector type	SMA									
RF power: calibration factor on coaxials	Power sensor: thermistor mount	Power transfer	0.8	1	W/W	Frequency	18 GHz to 26 GHz	1.5E-02 to 1.8E-02		2	95%	Yes		255	VNIIFTRI	
						Connector type	SMA									
RF power: calibration factor on waveguides	Power sensor: thermistor mount	Power transfer	0.8	1	W/W	Frequency	5.64 GHz to 17.44 GHz	0.5E-02 to 0.9E-02		2	95%	Yes		256	VNIIFTRI	

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						Waveguide dimensions	35/15 mm, 23/10 mm, 16/8 mm									
RF power: calibration factor on waveguides	Power sensor: thermistor mount	Power transfer	0.8	1	W/W	Frequency	16.7 GHz to 37.5 GHz	0.9E-02 to 1.2E-02		2	95%	Yes		257	VNIIFTRI	
						Waveguide dimensions	11/5.5 mm, 7.2/3.4 mm									
RF power: calibration factor on waveguides	Power sensor: thermistor mount	Power transfer	0.8	1	W/W	Frequency	37.5 GHz to 53 GHz	1.4E-02 to 1.7E-02		2	95%	Yes		258	VNIIFTRI	
						Waveguide dimensions	5.2/2.6 mm									
RF power: calibration factor on waveguides	Power sensor: thermistor mount	Power transfer	0.8	1	W/W	Frequency	53 GHz to 78 GHz	1.7E-02 to 2.0E-02		2	95%	Yes		259	VNIIFTRI	
						Waveguide dimensions	3.6/1.8 mm									
RF power: non-CW power	Waveguide pulse power sensor	Power transfer, sampling	1E-04	20	W	Frequency	5.64 GHz to 12.05 GHz	1.5E-02		2	95%	Yes		260	VNIIFTRI	
						Waveguide dimensions	35/15 mm, 23/10 mm									
RF power: non-CW power	Waveguide pulse power sensor	Power transfer, sampling	1E-04	0.02	W	Frequency	12.05 GHz to 37.5 GHz	1.5E-02		2	95%	Yes		261	VNIIFTRI	
						Waveguide dimensions	16/8 mm, 11/5.5 mm, 7.2/3.4 mm									

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty								
Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
Scalar RF reflection coefficient and attenuation: reflection coefficient on waveguides	Passive one-port devices	Tuned reflectometer	3.0E-03	2.0E-01		Frequency	5.64 GHz to 78.3 GHz	0.001 to 0.005		2	95%	No		262	VNIIFTRI	
						Waveguide dimensions	35/15 mm, 23/10 mm, 16/8 mm, 11/5.5 mm, 7.2/3.4 mm, 5.2/2.6 mm, 3.6/1.8 mm									
Scalar RF reflection coefficient and attenuation: reflection coefficient on waveguides	Passive one-port devices	Tuned reflectometer	2.0E-01	9.5E-01		Frequency	5.64 GHz to 78.3 GHz	0.005 to 0.02		2	95%	No		263	VNIIFTRI	
						Waveguide dimensions	35/15 mm, 23/10 mm, 16/8 mm, 11/5.5 mm, 7.2/3.4 mm, 5.2/2.6 mm, 3.6/1.8 mm									
Scalar RF reflection coefficient and attenuation: attenuation on coaxials, *A*	Passive device, amplifier	IF series substitution	0.01	120	dB	Frequency	50 kHz to 37.5 GHz	0.0005 to 0.4	dB	2	95%	No	Matrix 11.1	264	VNIIFTRI	

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
						Impedance	50 Ω, 75 Ω, 150 Ω									
						Reflection coefficient	< 0.005									
Scalar RF reflection coefficient and attenuation: attenuation on waveguides, *A*	Passive device, amplifier	IF parallel substitution	0.01	120	dB	Frequency range	5.64 GHz to 37.5 GHz	0.003 to 0.4	dB	2	95%	No	Matrix 11.2	284	VNIIFTRI	
						Reflection coefficient	<= 0.01									
Scalar RF reflection coefficient and attenuation: attenuation on waveguides	Passive device, amplifier	IF parallel substitution	0.03	30	dB	Frequency range	37.5 GHz to 178.3 GHz	0.03	dB	2	95%	No		296	VNIIFTRI	
						Reflection coefficient	<= 0.01									
Scalar RF reflection coefficient and attenuation: attenuation on waveguides	Passive device, amplifier	IF parallel substitution	> 30	50	dB	Frequency range	37.5 GHz to 178.3 GHz	0.05	dB	2	95%	No		297	VNIIFTRI	
						Reflection coefficient	<= 0.01									
Scalar RF reflection coefficient and attenuation: attenuation on waveguides	Passive device, amplifier	IF parallel substitution	> 50	60	dB	Frequency range	37.5 GHz to 178.3 GHz	0.15	dB	2	95%	No		298	VNIIFTRI	

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
						Reflection coefficient	<= 0.01									
Scalar RF reflection coefficient and attenuation: attenuation on waveguides	Passive device, amplifier	IF parallel substitution	> 60	70	dB	Frequency range	37.5 GHz to 178.3 GHz	0.25	dB	2	95%	No		299	VNIIFTRI	
						Reflection coefficient	<= 0.01									
Scattering parameters: reflection coefficient (Sii) on coaxials, real and imaginary	Passive one- and two-port devices	Network analyzer with RF substitution	-1	1		Frequency range	100 kHz to 100 MHz	0.003		2	95%	No		300	SNIIM	Types of connectors II (16 mm), VIII (16 mm) and III (7 mm) under the Russian national standard 13317
						Connector type	PC-14, type-N, type II (16 mm), type VIII (16 mm), type III (7 mm)									
						Impedance	50 Ω									
Scattering parameters: reflection coefficient (Sii) on coaxials, real and imaginary	Passive one- and two-port devices	Network analyzer with RF substitution	-1	1		Frequency range	100 kHz to 100 MHz	0.004		2	95%	No		304	SNIIM	

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
						Connector type	PC-3.5									
						Impedance	50 Ω									
Scattering parameters: reflection coefficient (Sii) on coaxials, real and imaginary	Passive one- and two-port devices	Network analyzer with RF substitution	-1	1		Frequency range	100 kHz to 100 MHz	0.006		2	95%	No		306	SNIIM	
						Connector type	PC-2.4									
						Impedance	50 Ω									
Scattering parameters: reflection coefficient (Sii) on coaxials, real and imaginary	Passive one- and two-port devices	Network analyzer with RF substitution	-1	1		Frequency range	100 MHz to 8 GHz	0.002		2	95%	No		314	SNIIM	
						Connector type	PC-14									
						Impedance	50 Ω									
Scattering parameters: reflection coefficient (Sii) on coaxials, real and imaginary	Passive one- and two-port devices	Network analyzer with RF substitution	-1	1		Frequency range	100 MHz to 18 GHz	0.003		2	95%	No		316	SNIIM	Type III (7 mm) of connector under the Russian national standard 13317
						Connector type	type-N, type III (7mm)									
						Impedance	50 Ω									

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
Scattering parameters: reflection coefficient (Sii) on coaxials, real and imaginary	Passive one- and two-port devices	Network analyzer with RF substitution	-1	1		Frequency range	100 MHz to 26 GHz	0.004		2	95%	No		318	SNIIM	
						Connector type	PC-3.5									
						Impedance	50 Ω									
Scattering parameters: reflection coefficient (Sii) on coaxials, real and imaginary	Passive one- and two- port devices	Network analyzer with RF substitution	-1	1		Frequency range	100 MHz to 37.5 GHz	0.006		2	95%	No		320	SNIIM	
						Connector type	PC-2.4									
						Impedance	50 Ω									
Scattering parameters: reflection coefficient (Sii) on coaxials, real and imaginary	Passive one- and two-port devices	Network analyzer with RF substitution	-1	1		Frequency range	100 MHz to 3 GHz	0.002		2	95%	No		322	SNIIM	Type of connector under the Russian national standard 13317
						Connector type	Type VIII, 16 mm									
						Impedance	75 Ω									

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
Scattering parameters: reflection coefficient (Sii) on coaxials, real and imaginary	Passive one- and two-port devices	Network analyzer with RF substitution	-1	1		Frequency range	100 MHz to 7 GHz	0.002		2	95%	No		324	SNIIM	Type of connector under the Russian national standard 13317
						Connector type	Type II, 16 mm									
						Impedance	50 Ω									
Scattering parameters: reflection coefficient (Sii) on waveguides, real and imaginary	Passive device	Network analyzer with RF substitution	-1	1		Frequency range	2.14 GHz to 17.44 GHz	0.002		2	95%	No		328	VNIIFTRI	
						Waveguide dimensions	90/45 mm, 72/34 mm, 48/24 mm, 35/15 mm, 23/10 mm, 16/8 mm									
Scattering parameters: reflection coefficient (Sii) on waveguides, real and imaginary	Passive device	Network analyzer with RF substitution	-1	1		Frequency range	17.44 GHz to 37.5 GHz	0.003		2	95%	No		332	VNIIFTRI	
						Waveguide dimensions	11/5.5 mm, 7.2/3.4 mm									

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
Scattering parameters: transmission coefficient (Sij) on coaxials, real and imaginary	Passive device	Network analyzer with RF substitution	-1	1		Frequency range	100 MHz to 8 GHz	0.002		2	95%	No		334	SNIIM	
						Connector type	PC-14									
						Impedance	50 Ω									
Scattering parameters: transmission coefficient (Sij) on coaxials, real and imaginary	Passive device	Network analyzer with RF substitution	-1	1		Frequency range	100 MHz to 18 GHz	0.003		2	95%	No		336	SNIIM	Type III (7 mm) of connector under the Russian national standard 13317
						Connector type	type-N, type III (7mm)									
						Impedance	50 Ω									
Scattering parameters: transmission coefficient (Sij) on coaxials, real and imaginary	Passive device	Network analyzer with RF substitution	-1	1		Frequency range	100 MHz to 26 GHz	0.005		2	95%	No		338	SNIIM	
						Connector type	PC-3.5									
						Impedance	50 Ω									

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
Scattering parameters: transmission coefficient (Sij) on coaxials, real and imaginary	Passive device	Network analyzer with RF substitution	-1	1		Frequency range	100 MHz to 3 GHz	0.003		2	95%	No		340	SNIIM	Type of connector under the Russian national standard 13317
						Connector type	Type VIII									
						Impedance	75 Ω									
Scattering parameters: transmission coefficient (Sij) on coaxials, real and imaginary	Passive device	Network analyzer with RF substitution	-1	1		Frequency range	100 MHz to 7 GHz	0.003		2	95%	No		342	SNIIM	Type of connector under the Russian national standard 13317
						Connector type	Type II									
						Impedance	50 Ω									
Noise: noise temperature in coaxials	Noise source	Comparison with noise temperature standard, radiometer	77	100000	K	Frequency	2 MHz to 1 GHz	16 to 24	mK/K	2	95%	Yes		346	VNIIFTRI	
						Connector type	50 Ω, type N									
Noise: noise temperature in coaxials	Noise source	Comparison with noise temperature standard, radiometer	77	100000	K	Frequency	1 GHz to 18 GHz	8 to 16	mK/K	2	95%	Yes		347	VNIIFTRI	
						Connector type	50 Ω, type N									

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
Noise: noise temperature in waveguides	Noise source	Comparison with noise temperature standard, radiometer	77	100000	K	Frequency	12.05 GHz to 18 GHz	14	mK/K	2	95%	Yes		348	VNIIFTRI	
						Waveguide dimensions	16/8 mm									
Noise: noise temperature in waveguides	Noise source	Comparison with noise temperature standard, radiometer	77	100000	K	Frequency	17.44 GHz to 37.5 GHz	16 to 20	mK/K	2	95%	Yes		349	VNIIFTRI	
						Waveguide dimensions	11/5.5 mm, 7.2/3.4 mm									
Noise: noise temperature in waveguides	Noise source	Comparison with noise temperature standard, radiometer	77	100000	K	Frequency	37.5 GHz to 53.57 GHz	32 to 40	mK/K	2	95%	Yes		350	VNIIFTRI	
						Waveguide dimensions	5.2/2.6 mm									
Noise: noise temperature in waveguides	Noise source	Comparison with noise temperature standard, radiometer	77	100000	K	Frequency	53.57 GHz to 118.11 GHz	50	mK/K	2	95%	Yes		351	VNIIFTRI	
						Waveguide dimensions	3.6/1.8 mm, 2.4/1.2 mm									
Noise: noise temperature in waveguides	Noise source	Comparison with noise temperature standard, radiometer	77	100000	K	Frequency	118.11 GHz to 178.3 GHz	100	mK/K	2	95%	Yes		352	VNIIFTRI	
						Waveguide dimensions	1.6/0.8 mm									

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
Noise: radio brightness temperature	Wide aperture noise radiometer	Radiometer	78	500	K	Frequency	18 GHz to 118 GHz	20	mK/K	2	95%	Yes		353	VNIIFTRI	
						Aperture	0.05 m to 0.45 m									
Noise: spectral radiance in free space	Wide aperture noise radiometer	Radiometer	3E-19	2.2E-15	W/ (m^2 sr Hz)	Frequency	18 GHz to 118 GHz	2E-02		2	95%	Yes		354	VNIIFTRI	
						Aperture	0.05 m to 0.45 m									
Antenna properties: antenna factor	Antenna dipole, reference value for the unit: 1 m^{-1}	E-field meter, comparison with reference	6	30	dB	Frequency	26 MHz to 300 MHz	1	dB	2	95%	No		355	VNIIFTRI	
						Impedance	50 Ω									
Antenna properties: antenna factor	Antenna dipole, reference value for the unit: 1 m^{-1}	E-field meter, comparison with reference	18	32	dB	Frequency	300 MHz to 1 GHz	1.5	dB	2	95%	No		356	VNIIFTRI	
						Impedance	50 Ω									
Antenna properties: antenna factor	Log periodic antenna, reference value for the unit: 1 m^{-1}	E-field meter, comparison with reference	4	26	dB	Frequency	80 MHz to 1GHz	2.5	dB	2	95%	No		357	VNIIFTRI	
						Impedance	50 Ω									
Antenna properties: antenna gain	Horn antenna	Standard antenna method	10	25	dB	Frequency	1.0 GHz to 18.0 GHz	0.35 to 1	dB	2	95%	No		358	VNIIFTRI	
						Coaxial dimensions	7/3.04 mm									
Antenna properties: antenna gain	Horn antenna	Standard antenna method	10	25	dB	Frequency	1.0 GHz to 26.5 GHz	0.5 to 1.5	dB	2	95%	No		359	VNIIFTRI	

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
						Coaxial dimensions	3.5/1.52 mm									
Antenna properties: antenna gain	Horn antenna	Three antenna method, extrapolation range	10	21	dB	Frequency	2.59 GHz to 3.94 GHz	0.25	dB	2	95%	No		360	VNIIFTRI	
						Waveguide dimensions	72/34 mm									
Antenna properties: antenna gain	Horn antenna	Three antenna method, extrapolation range	10	22	dB	Frequency	3.94 GHz to 5.64 GHz	0.25	dB	2	95%	No		361	VNIIFTRI	
						Waveguide dimensions	35/15 mm									
Antenna properties: antenna gain	Horn antenna	Three antenna method, extrapolation range	10	23	dB	Frequency	5.64 GHz to 8.24 GHz	0.25	dB	2	95%	No		362	VNIIFTRI	
						Waveguide dimensions	48/24 mm									
Antenna properties: antenna gain	Horn antenna	Three antenna method, extrapolation range	10	24	dB	Frequency	8.24 GHz to 12.05 GHz	0.20	dB	2	95%	No		363	VNIIFTRI	
						Waveguide dimensions	23/10 mm									
Antenna properties: antenna gain	Horn antenna	Three antenna method, extrapolation range	10	24	dB	Frequency	12.05 GHz to 17.44 GHz	0.20	dB	2	95%	No		364	VNIIFTRI	

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						Waveguide dimensions	16/8 mm									
Antenna properties: antenna gain	Horn antenna	Three antenna method, extrapolation range	20	30	dB	Frequency	16.7 GHz to 25.86 GHz	0.25	dB	2	95%	No		365	VNIIFTRI	
						Waveguide dimensions	11/5.5 mm									
Antenna properties: antenna gain	Horn antenna	Three antenna method, extrapolation range	20	30	dB	Frequency	25.86 GHz to 37.5 GHz	0.15	dB	2	95%	No		366	VNIIFTRI	
						Waveguide dimensions	7.2/3.4 mm									
Antenna properties: antenna gain	Horn antenna	Three antenna method, extrapolation range	20	30	dB	Frequency	37.5 GHz to 53.57 GHz	0.15	dB	2	95%	No		367	VNIIFTRI	
						Waveguide dimensions	5.2/2.6 mm									
Antenna properties: antenna gain	Horn antenna	Three antenna method, extrapolation range	20	30	dB	Frequency	53.57 GHz to 78.3 GHz	0.15	dB	2	95%	No		368	VNIIFTRI	
						Waveguide dimensions	3.6/1.8 mm									
Antenna properties: antenna gain	Horn antenna	Three antenna method, extrapolation range	25	35	dB	Frequency	78.3 GHz to 118 GHz	0.15	dB	2	95%	No		369	VNIIFTRI	

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						Waveguide dimensions	2.4/1.2 mm									
Antenna properties: antenna gain	Reflector antenna	Compact range	30	45	dB	Frequency	16.7 GHz to 118 GHz	0.3	dB	2	95%	No		370	VNIIFTRI	
						Waveguide dimensions	11/5.5 mm, 7.2/3.4 mm, 5.2/2.6 mm, 3.6/1.8 mm, 2.4/1.2 mm									
Signal and pulse characteristics: pulse amplitude	Oscilloscope, pulse and function generator: pulse amplitude, *a*	Calibrated test set for pulse characteristics	-100	100	V	Duration of pulse	30 ns to 10 ms	(3E-03 + 1E-03*a*), *a* in V	V	2	95%	No		371	VNIIFTRI	
Signal and pulse characteristics: pulse amplitude	Oscilloscope, pulse and function generator: pulse amplitude, *a*	Calibrated wideband sample oscilloscope	-1	1	V	Duration of pulse	50 ps to 10 µs	0.01*a*, *a* in V	V	2	95%	No		372	VNIIFTRI	
Signal and pulse characterictics: pulse time parameters: duration of pulse and duration of front	Pulse generator: duration, τ	Calibrated test set for pulse characteristics	5	1E+07	ns	Amplitude of pulse	-100 V to 100 V	(0.01 + 0.01τ), τ in ns	ns	2	95%	No		373	VNIIFTRI	

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
Signal and pulse charactericticts: pulse time parameters: duration of pulse and duration of front	Pulse generator: duration, τ	Calibrated wideband sample oscilloscope	20	1E+06	ps	Amplitude of pulse	-1 V to 1 V	$(1 + 0.01\tau)$, τ in ps	ps	2	95%	No		374	VNIIFTRI	
Signal and pulse parameters: pulse time parameters	Oscilloscope: risetime, τ	Calibrated step pulse generator	15	50	ps	Amplitude of pulse	- 0.2 V to 0.2 V	1.5	ps	2	95%	No		375	VNIIFTRI	
Signal and pulse parameters: pulse time parameters	Oscilloscope: risetime, τ	Calibrated step pulse generator	50	10000	ps	Amplitude of pulse	- 30 V to 30 V	$(10.0 + 0.01\tau)$, τ in ps	ps	2	95%	No		376	VNIIFTRI	
Signal and pulse parameters: FM modulation	Modulation meter, spectrum analyzer, jitter meter	Electronic counter method	0.01	1500	kHz	Frequency	0.1 MHz to 1000 MHz	$(0.002f + 10)$, f is frequency deviation in Hz	Hz	2	95%	No		377	VNIIFTRI	
Signal and pulse charactericticts: harmonic content	Signal generator, spectrum analyser, distortion meter	Direct measurement	- 40	0	dB	Frequency	1 MHz to 1000 MHz	2.5	dB	2	95%	Yes		378	VNIIFTRI	
RF voltage and current: RF-DC difference	Thermal voltage converter	Comparison with reference	0.1	10	V	Frequency	1 MHz to 10 MHz	0.1 to 0.5	mV/V	2	95%	Yes		379	VNIIM	

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
RF voltage and current: RF-DC difference	Thermal voltage converter	Comparison with reference	0.1	10	V	Frequency	10 MHz to 30 MHz	0.2 to 1.5	mV/V	2	95%	Yes		380	VNIIM	
RF voltage and current: RF-DC difference	Thermal voltage converter	Comparison with reference	0.1	1	V	Frequency	30 MHz to 100 MHz	1 to 6	mV/V	2	95%	Yes		381	VNIIM	
RF voltage and current: RF-DC difference	Thermal voltage converter	Comparison with reference	0.1	1	V	Frequency	100 MHz to 300 MHz	2 to 10	mV/V	2	95%	Yes		382	VNIIM	
RF voltage and current: RF-DC difference	Thermal voltage converter	Comparison with reference	0.1	1	V	Frequency	300 MHz to 600 MHz	3 to 12	mV/V	2	95%	Yes		383	VNIIM	
RF voltage and current: RF-DC difference	Thermal voltage converter	Comparison with reference	0.1	1	V	Frequency	600 MHz to 1000 MHz	4 to 20	mV/V	2	95%	Yes		384	VNIIM	
RF voltage and current: RF-DC difference	Thermal voltage converter	Comparison with reference	0.1	1	V	Frequency	1000 MHz to 2000 MHz	8 to 40	mV/V	2	95%	Yes		385	VNIIM	
RF voltage and current: RF voltage meters	RF voltmeter	Direct measurement, voltage ratio measurement	0.01	1	mV	Frequency	100 kHz to 10 MHz	15	mV/V	2	95%	Yes		386	VNIIM	

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
RF voltage and current: RF voltage meters	RF voltmeter	Direct measurement, voltage ratio measurement	1	100	mV	Frequency	100 kHz to 10 MHz	5	mV/V	2	95%	Yes		387	VNIIM	
RF voltage and current: RF voltage meters	RF voltmeter	Direct measurement, voltage ratio measurement	0.01	1	mV	Frequency	10 MHz to 100 MHz	18	mV/V	2	95%	Yes		388	VNIIM	
RF voltage and current: RF voltage meters	RF voltmeter	Direct measurement, voltage ratio measurement	1	100	mV	Frequency	10 MHz to 100 MHz	12	mV/V	2	95%	Yes		389	VNIIM	
RF voltage and current: RF voltage meters	RF voltmeter	Direct measurement	0.1	10	V	Frequency	1 MHz to 10 MHz	0.15 to 0.5	mV/V	2	95%	Yes		390	VNIIM	
RF voltage and current: RF voltage meters	RF voltmeter	Direct measurement	0.1	10	V	Frequency	10 MHz to 30 MHz	0.3 to 0.7	mV/V	2	95%	Yes		391	VNIIM	
RF voltage and current: RF voltage meters	RF voltmeter	Direct measurement	0.1	10	V	Frequency	30 MHz to 50 MHz	0.5 to 1	mV/V	2	95%	Yes		392	VNIIM	
RF voltage and current: RF voltage meters	RF voltmeter	Direct measurement	0.1	10	V	Frequency	50 MHz to 100 MHz	0.7 to 1.5	mV/V	2	95%	Yes		393	VNIIM	

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
RF voltage and current: RF current	Current generator	Comparison with reference thermoelectric, photoelectric convertors and electrodynamic comparator	0.001	1	A	Frequency	100 kHz to 1000 MHz	0.2 to 10	mA/A	2	95%	Yes		394	VNIIFTRI	
RF voltage and current: RF current	Current generator	Electrodynamic ammeter	1	100	A	Frequency	100 kHz to 300 MHz	0.5 to 10	mA/A	2	95%	Yes		395	VNIIFTRI	
Lumped impedance/admittance: inductance	Fixed inductor,1-2-3-5 sequence, two and four terminal connection	HF inductance comparator	0.01	2	µH	Frequency	3 MHz, 10 MHz	(0.3 to 1)E-02		2	95%	Yes		396	SNIIM	
Lumped impedance/admittance: inductance	Fixed inductor, two and four terminal connection	HF inductance comparator	0.1	0.1	µH	Frequency	100 MHz	0.5E-02		2	95%	Yes		397	SNIIM	
Lumped impedance/admittance: inductance	Fixed inductor, two and four terminal connection	HF inductance comparator	0.1	0.2	µH	Frequency	30 MHz	2.5E-03		2	95%	Yes		398	SNIIM	
Lumped impedance/admittance: inductance	Fixed inductor,1-2-3-5 sequence, two and four terminal connection	HF inductance comparator	3	20	µH	Frequency	3 MHz	1.0E-03 to 1.5E-03		2	95%	Yes		399	SNIIM	

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
Lumped impedance/admittance: capacitance	Standard capacitor	Direct comparison with reference standard	1000	2000	pF	Frequency	1 MHz to 3 MHz	1E-03		2	95%	Yes		400	SNIIM	
Lumped impedance/admittance: capacitance	Standard capacitor	Direct comparison with reference standard	3000	3000	pF	Frequency	3 MHz	2E-03		2	95%	Yes		401	SNIIM	
Lumped impedance/admittance: capacitance	Standard capacitor	Direct comparison with reference standard	1	5	pF	Frequency	1 MHz to 100 MHz	1E-03 to 2E-03		2	95%	Yes		402	SNIIM	
Lumped impedance/admittance: capacitance	Standard capacitor	Direct comparison with reference standard	10	30	pF	Frequency	1 MHz to 30 MHz	4E-04 to 5E-04		2	95%	Yes		403	SNIIM	
Lumped impedance/admittance: capacitance	Standard capacitor	Direct comparison with reference standard	10	30	pF	Frequency	30 MHz to 100 MHz	0.5E-03 to 2E-03		2	95%	Yes		404	SNIIM	
Lumped impedance/admittance: capacitance	Standard capacitor	Direct comparison with reference standard	50	200	pF	Frequency	1 MHz to 10 MHz	3E-04 to 6E-04		2	95%	Yes		405	SNIIM	
Lumped impedance/admittance: capacitance	Standard capacitor	Direct comparison with reference standard	50	200	pF	Frequency	30 MHz	1E-03 to 2E-03		2	95%	Yes		406	SNIIM	

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
Lumped impedance/admittance: capacitance	Standard capacitor	Direct comparison with reference standard	300	3000	pF	Frequency	1 MHz to 3 MHz	1.5E-04 to 5E-04		2	95%	Yes		407	SNIIM	
Lumped impedance/admittance: capacitance	Standard capacitor	Direct comparison with reference standard	300	1000	pF	Frequency	10 MHz	0.6E-03 to 1E-03		2	95%	Yes		408	SNIIM	
Lumped impedance/admittance: Q-factor for objects of inductive nature	Q-standard: two- and four-terminal connection	Transformer bridge	1	100		Frequency of 1-3-10 sequence	1 kHz to 100 kHz	0.5E-02 to 2E-02		2	95%	Yes		409	SNIIM	
Lumped impedance/admittance: Q-factor: capacitor	Q-standard: coaxial and two-terminal connection	Bridge method	100	1000		Frequency	1 MHz to 10 MHz	2E-02 to 5E-02		2	95%	Yes		410	SNIIM	
						capacitance	120 pF, 250 pF, 500 pF									
Lumped impedance/admittance: Q-factor: inductor	Q-standard: coaxial and two-terminal connection	Bridge method	15	600		Frequency	0.05 MHz to 30 MHz	0.6E-02 to 1E-02		2	95%	Yes		411	SNIIM	
						Resonant capacitance	100 pF, 40 pF									

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
Lumped impedance/admittance: Q-factor: inductor	Q-standard: coaxial and two-terminal connection	Bridge method	15	450		Frequency	30 MHz to 300 MHz	2E-02 to 5E-02		2	95%	Yes		412	SNIIM	
						Resonant capacitance	100 pF, 45 pF, 25 pF, 12 pF									
Dielectric properties: relative permittivity: real part	Solid materials	Transformer bridge	2	7		Frequency	1 kHz to 1 MHz	1E-04		2	95%	Yes		413	VNIIM	
						Thickness	1 mm to 5 mm									
Dielectric properties: relative permittivity: real part	Solid materials	Transformer bridge	10	80		Frequency	1 kHz to 1 MHz	1E-03		2	95%	Yes		414	VNIIM	
						Thickness	1 mm to 5 mm									
Dielectric properties: relative permittivity: real part	Solid materials	Two terminal resonance cell and network analyzer	2	60		Frequency	1 MHz to 80 MHz	1E-02 to 2E-02		2	95%	Yes		415	SNIIM	
Dielectric properties: relative permittivity: real part	Solid materials	Coaxial resonator of variable length and network analyzer	1.2	20		Frequency	0.2 GHz to 1 GHz	0.5E-02 to 1E-02		2	95%	Yes		416	SNIIM	

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Quantity	Instrument or Artifact	Instrument Type or Method	Minimum value	Maximum value	Units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	Matrix Uncertainty	Service provider	NMI Internal Service Identifier	Comments
Dielectric properties: relative permittivity: real part	Solid materials (films with thickness of 0.02 mm to 2 mm)	Toroidal resonator with lumped capacitance	2	30		Frequency	0.2 GHz to 2 GHz	1E-02 to 5E-02		2	95%	Yes		417	SNIIM	
Dielectric properties: relative permittivity: real part	Solid materials of small volumes	Variable length coaxial resonator, network analyzer	50	4000		Frequency	0.5 GHz to 4 GHz	1E-02 to 3E-02		2	95%	Yes		418	SNIIM	
						Temperature	-50 °C to 200 °C									
						Voltage	up to 1 kV									
Dielectric properties: relative permittivity: real part	Solid materials	Cavity resonator, circular waveguide and network analyzer	1.2	400		Frequency	1 GHz to 18 GHz	0.1E-02 to 0.5E-02		2	95%	Yes		419	SNIIM	This service is also provided by VNIIFTRI
Dielectric properties: relative permittivity: real part	Solid materials	Cavity resonator, circular waveguide and network analyzer	1.2	400		Frequency	1 GHz to 18 GHz	0.1E-02 to 0.5E-02		2	95%	Yes		419	VNIIFTRI	This service is also provided by SNIIM
Dielectric properties: relative permittivity: real part	Liquid materials	Three terminal cell and bridge	1	3		Frequency	10 Hz to10 MHz	0.5E-03 to 1E-03		2	95%	Yes		420	VNIIFTRI	
						Temperature	288 K to 323 K									

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
Dielectric properties: relative permittivity: real part	Liquid materials	Three terminal cell and bridge	1	40		Temperature	1 kHz, 5 kHz, 10 kHz	0.1E-02 to 0.5E-02		2	95%	Yes		421	VNIIFTRI	
						Frequency	288 K to 323 K									
Dielectric properties: relative permittivity: real part	Solid materials	Three terminal system on speciment and bridge	1	100		Frequency	10 Hz to 10 MHz	0.1E-02 to 1E-02		2	95%	Yes		422	VNIIFTRI	
Dielectric properties: relative permittivity: real part	Solid materials	Open resonator	1.2	20		Frequency	37 GHz to 78 GHz	0.5E-02 to 2E-02		2	95%	Yes		423	VNIIFTRI	
Dielectric properties: relative permittivity: real part	Solid materials	Dielectric resonator	2	100		Frequency	18 GHz to 37 GHz	0.2E-02 to 1E-02		2	95%	Yes		424	VNIIFTRI	
						Temperature	90 K to 400 K									
Dielectric properties: dielectric loss tangent: tan*d*	Solid materials	Transformer bridge	1E-05	1E-03		Capacitance	1 pF to 100 pF	1E-05		2	95%	No		425	VNIIM	
						Frequency	1 kHz to 1 MHz									
Dielectric properties: dielectric loss tangent: tan*d*	Solid materials	Circular waveguide and network analyzer	1E-05	0.01		Frequency	1 GHz to 18 GHz	(0.1 + 5E-06/tan*d*)		2	95%	Yes		426	SNIIM	

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
Dielectric properties: dielectric loss tangent: tan*d*	Solid materials (films with thickness of 0.02 mm to 2 mm)	Toroidal resonator with lumped capacitance	1E-04	0.1		Frequency	0.2 GHz to 2 GHz	5E-02 to 20E-02		2	95%	Yes		427	SNIIM	
Dielectric properties: dielectric loss tangent: tan*d*	Solid materials	Variable length coaxial resonator, network analyzer	1E-03	0.1		Frequency	0.2 GHz to 1 GHz	(0.1 + 2E-04/tan*d*)		2	95%	Yes		428	SNIIM	
Dielectric properties: dielectric loss tangent: tan*d*	Solid materials of small volumes	Coaxial resonator of variable length and network analyzer	1E-03	1		Frequency	0.5 GHz to 4 GHz	(0.2 + 1E-04/tan*d*)		2	95%	Yes		429	SNIIM	
Dielectric properties: dielectric loss tangent: tanδ	Solid materials	Two terminal resonant cell and network analyzer	1E-04	0.1		Frequency	1 MHz to 80 MHz	(0.1 + 1E-05/tanδ)		2	95%	Yes		430	SNIIM	
Dielectric properties: dielectric loss tangent: tan*d*	Solid materials	Two terminal cell and Q-meter	5E-05	1E-01		Frequency	100 kHz, 1 MHz, 10 MHz	5E-02 to 10E-02		2	95%	Yes		431	VNIIFTRI	
Dielectric properties: dielectric loss tangent: tan*d*	Solid materials	Cavity resonator, dielectric resonator	1E-06	1E-03		Frequency	9.36 GHz, 18 GHz to 37 GHz	5E-02 to 20E-02		2	95%	Yes		432	VNIIFTRI	
						Temperature	90 K to 400 K									
Dielectric properties: dielectric loss tangent: tan*d*	Solid materials	Open resonator	2E-05	1E-03		Frequency	37 GHz to 78 GHz	5E-02 to 20E-02		2	95%	Yes		433	VNIIFTRI	

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Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
Soft magnetic sheet and powder materials: specific total power loss	Electrical sheet steel, Epstein, ring and single sheet sample	Wattmetric method	1.0E-01	2.00E+02	W/kg	Frequency	50 Hz to 200 kHz	4.4E-03 to 8.0E-03		2	95%	Yes	Matrix 12.3.1	442	UNIIM	Approved on 15 March 2016
Soft magnetic bulk material: permeability	Ring, cylinder samples	Two terminal coaxial cell and T-bridge	1.5	100		Frequency range	1 MHz to 200 MHz	1E-02 to 3E-02		2	95%	Yes		434	SNIIM	
Feebly magnetic, paramagnetic and diamagnetic material: DC magnetic susceptibility	Cylinder, rod samples	Gouy set or quartz magnetometer	1E-07	1E-02		In accordance with IEC 60404-5		3E-02		2	95%	Yes		435	VNIIM	
Hard magnetic material: remanent magnetic flux density	Cylinder, rectangular parallelepiped samples	Electromagnet, histeresigraph	0.002	2	T	In accordance with IEC 60404-5		1E-03 to 5E-03		2	95%	Yes		436	VNIIFTRI	
Hard magnetic material: coercive magnetic field strength H_{CB}	Cylinder, rectangular parallelepiped samples	Electromagnet, histeresigraph	1	1000	kA/m	In accordance with IEC 60404-5		0.3E-02 to 1E-02		2	95%	Yes		437	VNIIFTRI	
Hard magnetic material: coercive field strength H_{CJ}	Cylinder, rectangular parallelepiped samples	Electromagnet, histeresigraph	1000	2300	kA/m	In accordance with IEC 60404-5		0.3E-02 to 1E-02		2	95%	Yes		438	VNIIFTRI	

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty								
Quantity	**Instrument or Artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**Units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**Matrix Uncertainty**	**Service provider**	**NMI Internal Service Identifier**	**Comments**
Hard magnetic material: maximum energy product $(BH)_{max}$	Cylinder, rectangular parallelepiped samples	Electromagnet, histeresigraph	5	500	kJ/m^3	In accordance with IEC 60404-5		0.5E-02 to 2E-02		2	95%	Yes		439	VNIIFTRI	
Hard magnetic material: magnetic moment	Permanent magnetic material, unidirectional magnetized: *M*	Magnetic moment sensing coil and fluxmeter	0.01	1000	Am^2			0.3E-02 to 1E-02		2	95%	Yes		440	VNIIFTRI	
Hard magnetic material: magnetic moment	Cylinder samples	Magnetic moment sensing coil and fluxmeter	1E-03	20	Am^2			1E-02		2	95%	Yes		441	VNIIM	

Electricity and Magnetism, Russian Federation

VNIIM (All-Russian D.I. Mendeleyev Research Institute for Metrology, Rosstandart)

Uncertainty matrix: Matrix 4.1

Inductance: self inductance, low values. Internal identifier: 82

	1 kHz	1 kHz to 100 kHz	100 kHz to 1 MHz
1 µH to 5 µH	-	3	2
10 µH to 50 µH	0.5	1	1
0.1 mH to 0.5 mH	0.1	0.5	-

The expanded uncertainties given in this table are expressed in mH/H.

Electricity and Magnetism, Russian Federation

VNIIM (All-Russian D.I. Mendeleyev Research Institute for Metrology, Rosstandart)

Uncertainty matrix: Matrix 4.2

Inductance: self inductance, intermediate values. Internal identifier: 88

	40 Hz to 100 Hz	1 kHz	10 kHz	100 kHz
1 mH to 5 mH	-	0.1	0.5	0.5
10 mH	-	0.01	-	-
10 mH to 100 mH	-	0.3	-	1
0.1 H to 1 H	0.5	0.1	-	-

The expanded uncertainties given in this table are expressed in mH/H.

Electricity and Magnetism, Russian Federation

VNIIM (All-Russian D.I. Mendeleyev Research Institute for Metrology, Rosstandart)

Uncertainty matrix: Matrix 5.1

AC/DC voltage transfer: AC/DC transfer difference at higher voltages. Internal identifier: 104

	0.4 kHz to 10 kHz	20 kHz	50 kHz	100 kHz
10 V to 30 V	5	8	10	10
30 V to 100 V	8	10	15	20
100 V to 300 V	12	12	20	30
300 V to 500 V	15	15	30	50
500 V to 1000 V	15	20	40	100

The expanded uncertainties given in this table are expressed in μV/V.

Electricity and Magnetism, Russian Federation

VNIIM (All-Russian D.I. Mendeleyev Research Institute for Metrology, Rosstandart)

Uncertainty matrix: Matrix 5.2

AC voltage up to 1000 V: sources. Internal identifier: 124

	10 Hz	10 kHz to 50 kHz	50 kHz to 100 kHz	100 kHz to 1 MHz
0.1 V to 0.3 V	150	150	150	150
0.3 V to 1 V	30	30	30	50
1 V to 10 V	50	30	30	60
10 V to 30 V	50	50	40	-
30 V to 100 V	50	50	50	-
100 V to 300 V	50	50	80	-
300 V to 500 V	80	80	100	-
500 V to 1000 V	90	90	150	-

The expanded uncertainties given in this table are expressed in μV/V.

Electricity and Magnetism, Russian Federation

VNIIFTRI (Institute for Physical-Technical and Radiotechnical Measurements, Rosstandart)

Uncertainty matrix: Matrix 5.3

AC voltage ratio, attenuation and gain: attenuation. Internal identifier: 139

	20 Hz to 10 kHz	50 kHz to 55 kHz	100 kHz	200 kHz
0.001 dB to 40 dB	1E-04 + 1E-05*A*	2E-04 + 2E-05*A*	2E-04 + 2.5E-05*A*	3E-04 + 3E-05*A*
40 dB to 60 dB	5E-04 + 2.5E-05(*A* - 40)	1E-03 + 3E-05(*A* - 40)	1.2E-03 + 4E-05(*A* - 40)	1.5E-03 + 7E-05(*A* - 40)
60 dB to 100 dB	1E-03 + 1E-04(*A* - 60)	1.6E-03 + 1E-04(*A* - 60)	2E-03 + 1.2E-04(*A* - 60)	3E-03 + 1.7E-04(*A* - 60)
100 dB to 120 dB	5E-03 + 1E-03(*A* - 100)	5.6E-03 + 1.5E-03(*A* - 100)	7E-03 + 1.7E-03(*A* - 100)	1E-02 + 3E-03(*A* - 100)

The expanded uncertainties given in this table are expressed in dB.

Electricity and Magnetism, Russian Federation

VNIIFTRI (Institute for Physical-Technical and Radiotechnical Measurements, Rosstandart)

Uncertainty matrix: Matrix 11.1

Scalar RF reflection coefficient and attenuation: attenuation on coaxials. Internal identifier: 264

	50 kHz to 100 MHz	100 MHz to 1.1 GHz	1.1 GHz to 12 GHz	12 GHz to 17.85 GHz	17.85 GHz to 37.5 GHz
0.01 dB to 40 dB	0.5E-03 + 1.3E-05*A*	1E-03 + 1.5E-04*A*	3E-03 + 3E-04*A*	5E-03 + 3E-04*A*	1E-03*A*
40 dB to 60 dB	1E-03 + 0.5E-04(*A* - 40)	1E-03 + 1.5E-04*A*	3E-03 + 3E-04*A*	5E-03 + 3E-04*A*	1E-03*A*
60 dB to 80 dB	2E-03 + 1.5E-04(*A* - 60)	1E-02 + 2.5E-04(*A* - 60)	2.1E-02 + 4E-04(*A* - 60)	2.3E-02 + 5E-04(*A* - 60)	1E-03*A*
80 dB to 90 dB	5E-03 + 7.5E-04(*A* - 80)	1.5E-02 + 1E-03(*A* - 80)	3E-02 + 3.5E-03(*A* - 80)	3.3E-02 + 5E-03(*A* - 80)	0.13
90 dB to 100 dB	5E-03 + 7.5E-04(*A* - 80)	1.5E-02 + 1E-03(*A* - 80)	3E-02 + 3.5E-03(*A* - 80)	3.3E-02 + 5E-03(*A* - 80)	0.4
100 dB to 120 dB	-	3.5E-02 + 6E-03(*A* - 100)	1E-01 + 1E-02(*A* - 100)	1.3E-01 + 1.3E-02(*A* - 100)	-

The expanded uncertainties given in this table are expressed in dB.

Electricity and Magnetism, Russian Federation

VNIIFTRI (Institute for Physical-Technical and Radiotechnical Measurements, Rosstandart)

Uncertainty matrix: Matrix 11.2

Scalar RF reflection coefficient and attenuation: attenuation on waveguides. Internal identifier: 284

	5.64 GHz to 12.05 GHz	12.05 GHz to 17.44 GHz	17.44 GHz to 37.5 GHz
0.01 dB to 60 dB	3E-03 + 3E-04*A*	5E-03 + 3E-04*A*	1E-03*A*
60 dB to 80 dB	2.1E-02 + 4E-04(*A* - 60)	2.3E-02 + 5E-04(*A* - 60)	1E-03*A*
80 dB to 90 dB	3E-02 + 3.5E-03(*A* - 80)	3.3E-02 + 5E-03(*A* - 80)	0.13
90 dB to 100 dB	3E-02 + 3.5E-03(*A* - 80)	3.3E-02 + 5E-03(*A* - 80)	0.4
100 dB to 120 dB	1E-01 + 1E-02(*A* - 100)	1.3E-01 + 1.3E-02(*A* - 100)	-

The expanded uncertainties given in this table are expressed in dB.

Electricity and Magnetism, Russian Federation

UNIIM (Ural Scientific Research Institute for Metrology, Rosstandart)

Uncertainty matrix: Matrix 8.6.1

High AC current: ratio error. Internal identifier: 188

Ratio error	
Primary current range	Expanded uncertainty
0.5 A to 5 A	10 + 0.005ε
5 A to 500 A	5 + 0.005ε
500 A to 10 kA	10 + 0.005ε
10 kA to 50 kA	15 + 0.005ε

ε - ratio error of the current transformer, expressed in μA/A
The expanded uncertainties given in this table are expressed in μA/A.

Electricity and Magnetism, Russian Federation

UNIIM (Ural Scientific Research Institute for Metrology, Rosstandart)

Uncertainty matrix: Matrix 8.6.2

High AC current ratio:phase displacement. Internal identifier: 190

Phase displacement	
Primary current range	Expanded uncertainty
0.5 A to 5 A	10 + 0.005δ
5 A to 500 A	5 + 0.005δ
500 A to 10 kA	10 + 0.005δ
10 kA to 50 kA	15 + 0.005δ

δ - phase displacement of the current transformer, expressed in µrad
The expanded uncertainties given in this table are expressed in µrad.

Electricity and Magnetism, Russian Federation

UNIIM (Ural Scientific Research Institute for Metrology, Rosstandart)

Uncertainty matrix: Matrix 12.3.1

High AC current ratio:phase displacement. Internal identifier: 442

Shape of the sample	Frequency range (Hz)	Relative expanded uncertainty, k = 2
Epstein samples, ring samples	50 to 1000	4.4E-03
Epstein samples, ring samples	1000 to 200000	7.1E-03
Single sheet samples (measurements with field coils)	50 to 60	4.6E-03
Single sheet samples (measurements with exemplary resistance)	50 to 60	8.0E-03