

## Photometry and Radiometry, Russian Federation



VNIIOFI (Institute for Optico-Physical Measurements, Rostekhnregulirovaniye of Russia)

VNIIM (D.I. Mendeleev Institute for Metrology, Rostekhnregulirovaniye of Russia)

Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty					Comments	NMI
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?		
Luminous intensity	Tungsten source	Photometric bench and reference lamps/photometer	1	100	cd	Correlated colour temperature	2000 K to 3200 K	0.86	%	2	95%	Yes	Other kind of sources can be measured	VNIIOFI
Luminous intensity	Tungsten source	Photometric bench and reference lamps/photometer	> 100	1000	cd	Correlated colour temperature	2000 K to 3200 K	0.86	%	2	95%	Yes	Other kind of sources can be measured	VNIIOFI
Luminous intensity	Tungsten source	Photometric bench and reference lamps/photometer	> 1000	10000	cd	Correlated colour temperature	2000 K to 3200 K	0.86	%	2	95%	Yes	Other kind of sources can be measured	VNIIOFI
Illuminance responsivity, tungsten source	Illuminance meter	Photometric bench and reference lamps			A lx <sup>-1</sup>	Correlated colour temperature	2856 K	0.86	%	2	95%	Yes		VNIIOFI
						Illuminance	0.2 lx to 2000 lx							
Luminous flux	Tungsten light source	Integrating sphere	1	100	lm	Correlated colour temperature	2000 K to 3200 K	1.0	%	2	95%	Yes		VNIIOFI
Luminous flux	Tungsten light source	Integrating sphere	> 100	20000	lm	Correlated colour temperature	2000 K to 3200 K	1.0 to 2.0	%	2	95%	Yes		VNIIOFI
Illuminance	Tungsten light source	Photometric bench and reference lamps/photometer	0.1	500	lx	Correlated colour temperature	2000 K to 3200 K	0.86	%	2	95%	Yes	Other kind of sources can be measured	VNIIOFI

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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?		
Illuminance	Tungsten light source	Photometric bench and reference lamps/photometer	> 500	5000	lx	Correlated colour temperature	2000 K to 3200 K	0.86	%	2	95%	Yes	Other kind of sources can be measured	VNIIOFI
Illuminance	Tungsten light source	Photometric bench and reference lamps/photometer	> 5000	20000	lx	Correlated colour temperature	2000 K to 3200 K	0.86	%	2	95%	Yes	Other kind of sources can be measured	VNIIOFI
Illuminance	Tungsten light source	Photometric bench and reference lamps/photometer	> 20000	50000	lx	Correlated colour temperature	2000 K to 3200 K	0.86	%	2	95%	Yes	Other kind of sources can be measured	VNIIOFI
Luminance	Tungsten based source	Telephotometer and reference lamp/calibrated diffuser combination	1	100	cd m <sup>-2</sup>	Correlated colour temperature	2000 K to 3200 K	1.4	%	2	95%	Yes	Other kind of sources can be measured including light sources based on integrating sphere	VNIIOFI
Luminance	Tungsten based source	Telephotometer and reference lamp/calibrated diffuser combination	> 100	1000	cd m <sup>-2</sup>	Correlated colour temperature	2000 K to 3200 K	1.4	%	2	95%	Yes	Other kind of sources can be measured including light sources based on integrating sphere	VNIIOFI
Luminance	Tungsten based source	Telephotometer and reference lamp/calibrated diffuser combination	> 1000	10000	cd m <sup>-2</sup>	Correlated colour temperature	2000 K to 3200 K	1.4	%	2	95%	Yes	Other kind of sources can be measured including light sources based on integrating sphere	VNIIOFI

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty					Comments	NMI
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?		
Luminance responsivity	Luminance meter	Source based on integrating sphere	0.1E-03	0.1E-03	V cd <sup>-1</sup> m <sup>2</sup>	Correlated colour temperature	2856 K	1.5	%	2	95%	Yes		VNIIOFI
						Luminance	20 cd m <sup>-2</sup> to 2000 cd m <sup>-2</sup>							
Responsivity, spectral, power	Detectors	Double monochromator with solid state working standards			AW <sup>-1</sup>	Wavelength	200 nm to 240 nm	4.0	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power	< 20 mW							
Responsivity, spectral, power	Detectors	Double monochromator with solid state working standards			AW <sup>-1</sup>	Wavelength	240 nm to 380 nm	3.0	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power	< 20 mW							
Responsivity, spectral, power	Detectors	Double monochromator with solid state working standards			AW <sup>-1</sup>	Wavelength	380 nm to 405 nm	1.0	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power	< 20 mW							
Responsivity, spectral, power	Detectors	Double monochromator with solid state working standards			AW <sup>-1</sup>	Wavelength	405 nm to 920 nm	0.5	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power	< 20 mW							
Responsivity, spectral, power	Detectors	Double monochromator with solid state working standards			AW <sup>-1</sup>	Wavelength	900 nm to 1600 nm	2.0 to 4.8	%	2	95%	Yes	Type of diodes: InGaAs	VNIIOFI

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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?		
						Power	< 20 mW							
Responsivity, spectral, power	UV power meters and detectors	Single grating monochromator and filter			AW <sup>-1</sup>	Wavelength	200 nm to 300 nm	8.0	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power level	2E-05 mW							
Responsivity, spectral, power	UV power meters and detectors	Single grating monochromator and filter			AW <sup>-1</sup>	Wavelength	300 nm to 400 nm	3	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power level	1E-04 mW							
Responsivity, spectral, power	UV power meters and detectors	Single grating monochromator and filter			AW <sup>-1</sup>	Wavelength	400 nm to 600 nm	0.5 to 1	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power level	3E-04 mW							
Responsivity, spectral, irradiance	UV power meters and detectors	Single grating monochromator and filter			AW <sup>-1</sup> cm <sup>2</sup>	Wavelength	200 nm to 300 nm	8.0	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power level	2E-05 mW							
Responsivity, spectral, irradiance	UV power meters and detectors	Single grating monochromator and filter			AW <sup>-1</sup> cm <sup>2</sup>	Wavelength	300 nm to 400 nm	3	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power level	1E-04 mW							
Responsivity, spectral, irradiance	UV power meters and detectors	Single grating monochromator and filter			AW <sup>-1</sup> cm <sup>2</sup>	Wavelength	400 nm to 600 nm	0.5 to 1	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power level	3E-04 mW							
Responsivity, spectral, irradiance	Detectors	Double monochromator with solid state working standards			AW <sup>-1</sup> cm <sup>2</sup>	Wavelength	200 nm to 240 nm	4.0	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power	< 20 mW							

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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?		
Responsivity, spectral, irradiance	Detectors	Double monochromator with solid state working standards			$\text{AW}^{-1}\text{cm}^2$	Wavelength	240 nm to 380 nm	3.0	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power	< 20 mW							
Responsivity, spectral, irradiance	Detectors	Double monochromator with solid state working standards			$\text{AW}^{-1}\text{cm}^2$	Wavelength	380 nm to 405 nm	1.0	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power	< 20 mW							
Responsivity, spectral, irradiance	Detectors	Double monochromator with solid state working standards			$\text{AW}^{-1}\text{cm}^2$	Wavelength	405 nm to 920 nm	0.5	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power	< 20 mW							
Responsivity, spectral, irradiance	Detectors	Double monochromator with solid state working standards			$\text{AW}^{-1}\text{cm}^2$	Wavelength	900 nm to 1600 nm	2.0 to 4.8	%	2	95%	Yes	Type of diodes: InGaAs	VNIIOFI
						Power	< 20 mW							
Responsivity, spectral, irradiance	Double monochromator with black thermal standard detectors	Monochromator versus standard detectors			$\text{AW}^{-1}\text{m}^2$	Wavelength	350 nm to 400 nm	1.0 to 1.5	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power level	< 20 $\mu\text{W}$							

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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?		
Responsivity, spectral, irradiance	Double monochromator with black thermal standard detectors	Monochromator versus standard detectors			$\text{AW}^{-1}\text{m}^2$	Wavelength	400 nm to 1000 nm	0.5 to 1	%	2	95%	Yes	Type of diodes: Si (Hamamatsu)	VNIIOFI
						Power level	< 20 $\mu\text{W}$							
Responsivity, spectral, irradiance	Double monochromator with black thermal standard detectors	Monochromator versus standard detectors			$\text{AW}^{-1}\text{m}^2$	Wavelength	1000 nm to 1700 nm	2	%	2	95%	Yes	Type of diodes: InGaAs	VNIIOFI
						Power level	< 20 $\mu\text{W}$							
Responsivity, spectral, irradiance	Double monochromator with black thermal standard detectors	Monochromator versus standard detectors			$\text{AW}^{-1}\text{m}^2$	Wavelength	1700 nm to 1800 nm	4	%	2	95%	Yes	Type of diodes: Ge	VNIIOFI
						Power level	< 20 $\mu\text{W}$							
Responsivity, solar, irradiance	General detector	Reference radiometer			$\text{V}/(\text{W}/\text{m}^2)$ or Reading/ $(\text{W}/\text{m}^2)$	Irradiance level	800 $\text{W}/\text{m}^2$ to 1000 $\text{W}/\text{m}^2$	0.15	%	2	95%	Yes	Approved on 03 October 2012	VNIIOFI
						Type of detector	pyrheliometer, radiometer							

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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?		
Irradiance, spectral	Tungsten lamp	Spectral irradiance reference source	1E+04	3E+06	W/m <sup>3</sup>	Wavelength range	250 nm to 300 nm	3.0 to 1.5, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 5 nm							
Irradiance, spectral	Tungsten lamp	Spectral irradiance reference source	1E+05	2E+07	W/m <sup>3</sup>	Wavelength range	300 nm to 350 nm	1.5 to 1.0, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 5 nm							
Irradiance, spectral	Tungsten lamp	Spectral irradiance reference source	5E+05	2E+08	W/m <sup>3</sup>	Wavelength range	350 nm to 500 nm	1.0	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 5 nm							

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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?		
Irradiance, spectral	Tungsten lamp	Spectral irradiance reference source	1E+06	2E+09	W/m <sup>3</sup>	Wavelength range	500 nm to 850 nm	1.0 to 0.8, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 5 nm							
Irradiance, spectral	Tungsten lamp	Spectral irradiance reference source	1E+07	2E+09	W/m <sup>3</sup>	Wavelength range	850 nm to 1000 nm	0.8 to 1.1, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 5 nm							
Irradiance, spectral	Tungsten lamp	Spectral irradiance reference source	1E+07	2E+09	W/m <sup>3</sup>	Wavelength range	1000 nm to 1100 nm	1.1 to 1.4, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 5 nm							

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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?		
Irradiance, spectral	Tungsten lamp	Spectral irradiance reference source	1E+07	2E+09	W/m <sup>3</sup>	Wavelength range	1100 nm to 1400 nm	1.4 to 1.8, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 10 nm							
Irradiance, spectral	Tungsten lamp	Spectral irradiance reference source	1E+07	2E+09	W/m <sup>3</sup>	Wavelength range	1400 nm to 1600 nm	1.8 to 1.6, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 10 nm							
Irradiance, spectral	Tungsten lamp	Spectral irradiance reference source	1E+07	1E+09	W/m <sup>3</sup>	Wavelength range	1600 nm to 2000 nm	1.6	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 20 nm							

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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?		
Irradiance, spectral	Tungsten lamp	Spectral irradiance reference source	5E+06	5E+08	W/m <sup>3</sup>	Wavelength range	2000 nm to 2500 nm	1.6 to 2.0, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 20 nm							
Radiance, spectral	Tungsten lamp	Spectral irradiance reference source	1E+05	1E+11	W/(m <sup>3</sup> sr)	Wavelength range	220 nm to 350 nm	2.5 to 1.5, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 3 nm							
Radiance, spectral	Tungsten lamp	Spectral radiance reference source	1E+06	1E+12	W/(m <sup>3</sup> sr)	Wavelength range	350 nm to 800 nm	1.5 to 0.7, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 3 nm							

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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?		
Radiance, spectral	Tungsten lamp	Spectral radiance reference source	1E+08	1E+12	W/(m <sup>3</sup> sr)	Wavelength range	800 nm to 1100 nm	0.7	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIIOFI
						Bandwidth	< 3 nm							
Radiance, spectral	Tungsten lamp	Spectral radiance reference source	1E+08	1E+12	W/(m <sup>3</sup> sr)	Wavelength range	1100 nm to 1600 nm	0.7 to 1.0, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIIOFI
						Bandwidth	< 5.5 nm							
Radiance, spectral	Tungsten lamp	Spectral radiance reference source	1E+08	1E+11	W/(m <sup>3</sup> sr)	Wavelength range	1600 nm to 2000 nm	0.9	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIIOFI
						Bandwidth	< 11 nm							

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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?		
Radiance, spectral	Tungsten lamp	Spectral radiance reference source	1E+08	1E+11	W/(m <sup>3</sup> sr)	Wavelength range	2000 nm to 2500 nm	1.1	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 11 nm							
Radiance, spectral	Deuterium lamp	Spectral radiance reference source	3.5E+06	2.0E+10	W/(m <sup>3</sup> sr)	Wavelength range	220 nm to 250 nm	5.0 to 4.0, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 2 nm							
Radiance, spectral	Deuterium lamp	Spectral radiance reference source	1.5E+07	8.0E+09	W/(m <sup>3</sup> sr)	Wavelength range	250 nm to 300 nm	4.0 to 3.5, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 2 nm							

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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?		
Radiance, spectral	Deuterium lamp	Spectral radiance reference source	1.0E+05	6.0E+11	W/(m <sup>3</sup> sr)	Wavelength range	300 nm to 400 nm	3.5 to 4.5, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 2 nm							
Radiant intensity, spectral	Tungsten lamp	Reference source	2E+03	1E+06	W/(m sr)	Wavelength range	250 nm to 300 nm	3.0 to 1.5, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 5 nm							
Radiant intensity, spectral	Tungsten lamp	Reference source	2E+04	1E+07	W/(m sr)	Wavelength range	300 nm to 350 nm	1.5 to 1.0, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 5 nm							

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Radiant intensity, spectral	Tungsten lamp	Reference source	1E+05	1E+08	W/(m sr)	Wavelength range	350 nm to 500 nm	1.0	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 5 nm							
Radiant intensity, spectral	Tungsten lamp	Reference source	2E+05	1E+09	W/(m sr)	Wavelength range	500 nm to 850 nm	1.0 to 0.8, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 5 nm							
Radiant intensity, spectral	Tungsten lamp	Reference source	2E+06	1E+09	W/(m sr)	Wavelength range	850 nm to 1000 nm	0.8 to 1.1, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 5 nm							

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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?		
Radiant intensity, spectral	Tungsten lamp	Reference source	2E+06	1E+09	W/(m sr)	Wavelength range	1000 nm to 1100 nm	1.1 to 1.4, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIIOFI
						Bandwidth	< 5 nm							
Radiant intensity, spectral	Tungsten lamp	Reference source	2E+06	1E+09	W/(m sr)	Wavelength range	1100 nm to 1400 nm	1.4 to 1.8, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIIOFI
						Bandwidth	< 10 nm							
Radiant intensity, spectral	Tungsten lamp	Reference source	2E+06	1E+09	W/(m sr)	Wavelength range	1400 nm to 1600 nm	1.8 to 1.6, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIIOFI
						Bandwidth	< 10 nm							

**Photometry and Radiometry, Russian Federation**



**VNIOFI (Institute for Optico-Physical Measurements, Rostekhnregulirovaniye of Russia)**

**VNIIM (D.I. Mendeleev Institute for Metrology, Rostekhnregulirovaniye of Russia)**

Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty					Comments	NMI
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?		
Radiant intensity, spectral	Tungsten lamp	Reference source	2E+06	1E+09	W/(m sr)	Wavelength range	1600 nm to 2000 nm	1.6	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 20 nm							
Radiant intensity, spectral	Tungsten lamp	Reference source	1E+06	2E+08	W/(m sr)	Wavelength range	2000 nm to 2500 nm	1.6 to 2.0, varies with wavelength	%	2	95%	Yes	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Bandwidth	< 20 nm							
Transmittance regular, spectral	Filter or material	Reference spectrometer	1	94	%	Wavelength	380 nm to 1000 nm	0.05	%	2	95%	No		VNIOFI
						Bandwidth	1.5 nm to 20 nm							
Distribution temperature	Tungsten lamp	Reference lamp	1200	3200	K			5.0 to 19.0 varies with measurand	K	2	95%	No	Approved on 03 October 2012	VNIOFI
Correlated color temperature	Tungsten lamp	Reference lamp	1800	3200	K			5.0 to 15.0 varies with measurand	K	2	95%	No	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI

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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?		
Correlated color temperature response	Color temperature meters	Reference source			reading/K	Type of source	tungsten lamps	10.0 to 20.0	K	2	95%	No	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						CCT range	1800 K to 3200 K							
Correlated color temperature response	Color temperature meters	Reference source			reading/K	Type of source	discharge lamps, displays and LEDs	10.0 to 50.0, varies with CCT and source	K	2	95%	No	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						CCT range	2300 K to 8000 K							
Colour, emitted, colour space: x, y	General source	Spectroradiometer	0	0.9		Bandwidth	5 nm	0.001 to 0.0005 varies with measurand		2	95%	No	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIOFI
						Type of source	tungsten lamps							

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty					Comments	NMI
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?		
Colour, emitted, colour space: x, y	General source	Spectroradiometer	0	0.9		Bandwidth	1 nm to 5 nm	0.005 to 0.0005 varies with measurand		2	95%	No	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIIOFI
						Type of source	discharge lamps, displays, LEDs							
Colour, emitted, colour space: u, v	General source	Spectroradiometer	0	0.9		Bandwidth	5 nm	0.001 to 0.0005 varies with measurand		2	95%	No	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIIOFI
						Type of source	tungsten lamps							
Colour, emitted, colour space: u, v	General source	Spectroradiometer	0	0.9		Bandwidth	1 nm to 5 nm	0.005 to 0.0005 varies with measurand		2	95%	No	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIIOFI
						Type of source	discharge lamps, displays, LEDs							

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty					Comments	NMI
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?		
Colour, emitted, colour space: u', v'	General source	Spectroradiometer	0	0.9		Bandwidth	5 nm	0.001 to 0.0005 varies with measurand		2	95%	No	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIIOFI
						Type of source	tungsten lamps							
Colour, emitted, colour space: u', v'	General source	Spectroradiometer	0	0.9		Bandwidth	1 nm to 5 nm	0.005 to 0.0005 varies with measurand		2	95%	No	Other types of source can also be measured with uncertainty evaluated for specific sources Approved on 03 October 2012	VNIIOFI
						Type of source	discharge lamps, displays, LEDs							
Radiance, total	Black body source	Black body sources at H <sub>2</sub> O fixed point temperature and total radiation comparator	100.39	100.39	W/(sr m <sup>2</sup> )	Distribution temperature	273.16 K	1.5	%	2	95%	Yes	Approved on 12 February 2008	VNIIM
						Cavity aperture diameter	> 8 mm							
						Pressure	1.33E-03 Pa							
						Wavelength range	0.8 µm to 14 µm							

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty					Comments	NMI
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?		
Radiance, total	Black body source	Black body sources at Ga fixed point temperature and total radiation comparator	151.82	151.82	W/(sr m <sup>2</sup> )	Distribution temperature	302.9146 K	1.5	%	2	95%	Yes	Approved on 12 February 2008	VNIIM
						Cavity aperture diameter	> 8 mm							
						Wavelength range	0.3 μm to 50 μm							
Radiance, total	Black body source	Black body sources at In fixed point temperature and total radiation comparator	615.03	615.03	W/(sr m <sup>2</sup> )	Distribution temperature	429.7485 K	1.5	%	2	95%	Yes	Approved on 12 February 2008	VNIIM
						Cavity aperture diameter	> 8 mm							
						Wavelength range	0.3 μm to 50 μm							
Radiance, total	Black body source	Black body sources at Sn fixed point temperature and total radiation comparator	1173.5	1173.5	W/(sr m <sup>2</sup> )	Distribution temperature	505.078 K	1.5	%	2	95%	Yes	Approved on 12 February 2008	VNIIM
						Cavity aperture diameter	> 8 mm							
						Wavelength range	0.3 μm to 50 μm							

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty					Comments	NMI
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?		
Radiance, total	Black body source	Black body sources at Zn fixed point temperature and total radiation comparator	4151.1	4151.1	W/(sr m <sup>2</sup> )	Distribution temperature	692.677 K	1.5	%	2	95%	Yes	Approved on 12 February 2008	VNIIM
						Cavity aperture diameter	> 8 mm							
						Wavelength range	0.3 μm to 50 μm							
Radiance, total	Black body source	Black body sources at Al fixed point temperature and total radiation comparator	13691	13691	W/(sr m <sup>2</sup> )	Distribution temperature	933.473 K	1.5	%	2	95%	Yes	Approved on 12 February 2008	VNIIM
						Cavity aperture diameter	> 8 mm							
						Wavelength range	0.3 μm to 50 μm							
Radiance, total	Black body source	Black body sources at Cu fixed point temperature and total radiation comparator	61283	61283	W/(sr m <sup>2</sup> )	Distribution temperature	1357.77 K	1.5	%	2	95%	Yes	Approved on 12 February 2008	VNIIM
						Cavity aperture diameter	> 8 mm							
						Wavelength range	0.3 μm to 50 μm							

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Calibration or Measurement Service			Measurand Level or Range			Measurement Conditions/Independent Variable		Expanded Uncertainty					Comments	NMI
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?		
Radiance, total	Black body source	Set of the black body sources at variable temperature and total radiation comparator	40	130	W/(sr m <sup>2</sup> )	Distribution temperature	220 K to 290 K	1.5 to 3.0	%	2	95%	Yes	Approved on 12 February 2008	VNIIM
						Cavity aperture diameter	> 8 mm							
						Pressure	1.33E-03 Pa							
						Wavelength range	0.8 μm to 14 μm							
Radiance, total	Black body source	Set of the black body sources at variable temperature and total radiation comparator	130	61000	W/(sr m <sup>2</sup> )	Distribution temperature	290 K to 1360 K	1.5 to 3.0	%	2	95%	Yes	Approved on 12 February 2008	VNIIM
						Cavity aperture diameter	> 8 mm							
						Wavelength range	0.3 μm to 50 μm							