



CH-3003 Bern-Wabern, 12. January 2016

Measurement Services

Photonics Laboratory

Valid from: 01.01.2016

Our laboratory performs high accuracy calibrations of your standards and measuring instruments, which are commonly used in the optical fibre and in the photonics domains. Our measurement results are traceable to national standards and thus to internationally supported realizations of the SI units.

The services listed in this catalogue correspond to our standard measurement capabilities. Other services, with e.g. reduced measurement uncertainty or with an extended measurement range, are possible and may be discussed directly with the responsible expert. In addition, our competent lab team is available for consultation and assisting in finding solutions to special requests.

Measurement uncertainty

The measurement uncertainties are supplied for information only and can be evaluated only after the measurements being completed. They contain contributions originating from the measurement standard, from the calibration method, from the environmental conditions and from the device under test. The indicated uncertainty of measurement is stated as the combined standard uncertainty multiplied by a coverage factor $k = 2$. The measured value (y) and the associated uncertainty (U) represent the interval ($y \pm U$) which contains the value of the measured quantity with a probability of approximately 95 %. The uncertainty is estimated following the guidelines of the ISO.

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1. Fiber-optic measurement instruments

1.1. Powermeter

Quantity	Optical power, singlemode -10 dBm
Uncertainty	0.7 %
Procedure	Comparison to reference detectors
Parameters	Wavelength: 1310 nm, 1550 nm
Extend of service	Calibration performed at one wavelength
Quantity	Optical Power, singlemode
Extend of service	Additional calibration at another wavelength or power level
Quantity	Optical power, multimode -10 dBm
Uncertainty	1.1 %
Procedure	Comparison to reference detectors
Parameters	Wavelength: 850 nm
Extend of service	Calibration performed at one wavelength
Quantity	Optical power, multimode
Extend of service	Additional calibration at another wavelength or power level
Quantity	Linearity, singlemode
Uncertainty	0.6 %
Procedure	Comparison to reference detectors or superposition technique
Parameters	Optical power: -5 dBm up to -65 dBm; wavelength: 1310 nm, 1550 nm
Extend of service	Calibration performed at one wavelength
Quantity	Linearity, singlemode
Extend of service	Additional calibration at another wavelength
Quantity	Linearity, singlemode high power
Uncertainty	1.5 %
Procedure	Comparison to reference detectors
Parameters	Optical power : 9 dBm up to -5 dBm; wavelength: 1550 nm
Extend of service	Calibration performed at 1550 nm
Quantity	Linearity, multimode
Uncertainty	0.7 %
Procedure	Comparison to reference detectors
Parameters	Optical power: -5 dBm up to -65 dBm; wavelength: 850 nm, 1330 nm
Extend of service	Calibration performed at one wavelength
Quantity	Linearity, multimode
Extend of service	Additional calibration at another wavelength
Quantity	Polarisation dependency
Uncertainty	0.7 %
Procedure	Polarisation scrambling
Parameters	Wavelength: 1310 nm, 1550 nm
Extend of service	Calibration performed at one wavelength
Quantity	Polarisation dependency
Extend of service	Additional calibration at another wavelength
Quantity	Spectral Responsivity SM 1300 nm to 1800 nm
Uncertainty	0.8 %
Procedure	Comparison with reference detectors
Extend of service	Calibration in the specified wavelength range with 10 nm steps

Quantity	Spectral Responsivity MM 700 nm to 1250 nm
Uncertainty	0.9 %
Procedure	Comparison with reference detectors
Extend of service	Calibration in the specified wavelength range with 10 nm steps

1.2. Attenuator

Quantity	Linearity, singlemode
Uncertainty	0.6 %
Procedure	Comparison to reference detector, according to IEC 61300-3-14
Parameters	Power level: -5 dBm up to -65 dBm

Quantity	Linearity, multimode
Uncertainty	0.7 %
Procedure	Comparison to a reference detector
Parameters	Power level: -5 dBm up to -65 dBm

1.3. I.L. and R.L. measuring instrument

Quantity	Insertion and Return Loss
Procedure	Simultaneous measurement

1.4. Optical switch

Quantity	Channel Crosstalk, repeatability
Uncertainty	0.1 %

1.5. Light source

Quantity	Optical power level -5 dBm up to -70 dBm
Uncertainty	0.9 %
Procedure	Comparison to reference detectors
Parameters	Wavelength: 850 nm, 1310 nm, 1550 nm
Extend of service	Calibration performed at one wavelength

Quantity	Optical Power
Extend of service	Additional calibration at another wavelength

Quantity	Optical power stability -5 dBm up to -70 dBm
Uncertainty	0.1 %
Procedure	Measurement with a reference powermeter
Parameters	Wavelength: 850 nm up to 1650 nm
Extend of service	Long term stability (2 hours) at one wavelength

Quantity	Power stability
Extend of service	Additional calibration at another wavelength

Quantity	Optical spectrum, broadband source from 600 nm to 1700 nm
Uncertainty	10 pm
Procedure	Measurement with a reference spectrum analyser
Extend of service	Spectrum, peak or mean wavelength, spectral width

Quantity	Optical spectrum, broadband source
Extend of service	Additional calibration at another wavelength

Quantity	Peak wavelength, narrowband sources from 600 nm to 1700 nm
Uncertainty	1 pm
Procedure	Measurement with a reference wavemeter
Extend of service	Calibration at one wavelength
Quantity	Peak wavelength, narrowband source
Extend of service	Additional calibration at another wavelength
Quantity	Encircled Flux
Uncertainty	1 %
Procedure	According to IEC 61280-1-4, Ed. 2.0
Parameters	Wavelength (850 nm, 1300 nm)
Extend of service	Calibration of the modal distribution at one wavelength

1.6. Optical spectrum Analyser (OSA)

Quantity	Wavelength 633 nm, 1267 nm to 1365 nm, 1450 nm to 1641nm
Uncertainty	10 pm
Procedure	Comparison to a reference-wavemeter
Extend of service	Calibration in one wavelength domain by 5 nm steps
Quantity	Wavelength
Extend of service	Calibration in one additional wavelength domain
Quantity	Spectrum of the internal reference source
Quantity	Optical power -10 dBm
Uncertainty	0.7 %
Procedure	Comparison to reference detectors
Parameters	Wavelength: 1310 nm, 1550 nm
Extend of service	Calibration performed at one wavelength
Quantity	Optical power
Extend of service	Additional calibration at another wavelength
Quantity	Polarisation dependancy
Uncertainty	0.7 %
Procedure	Polarisation scrambling
Parameters	Wavelength: 1310 nm, 1550 nm
Extend of service	Calibration performed at one wavelength

1.7. Optical wavemeter

Quantity	Wavelength 1267 nm to 1365 nm, 1450 nm to 1641 nm
Uncertainty	0.4 pm
Procedure	Compariosn to a reference-wavemeter
Extend of service	Calibration in one wavelength domain by 5 nm steps
Quantity	Wavelength
Extend of service	Additional calibration in another wavelength domain
Quantity	Wavelength at 1542.383712 nm or at 633 nm
Procedure	Comparison to stabilized Reference lasers
Extend of service	Long term stability (2 hours)

1.8. Optical time domain reflectometer (OTDR)

Quantity	Deviation of the attenuation scale
Procedure	Comparison to a reference fibre
Parameters	Wavelength: 1300 nm, 1550 nm
Extend of service	Calibration performed with one set of parameters
Quantity	Deviation of the attenuation scale
Procedure	Comparison to a reference fibre
Parameters	Wavelength: 1300 nm, 1550 nm
Extend of service	Supplementary calibration performed with another set of parameters
Quantity	Distance scale deviation
Procedure	Comparison to a reference ring resonator
Parameters	Wavelength: 1300 nm, 1550 nm
Extend of service	Calibration performed with one set of parameters
Quantity	Distance scale deviation
Procedure	Comparison to a reference ring resonator
Parameters	Wavelength: 1300 nm, 1550 nm
Extend of service	Supplementary calibration performed with another set of parameters

1.9. PMD measurement system

Quantity	PMD, non mode coupled 0.3 ps
Uncertainty	0.05 ps
Procedure	Comparison to a reference waveplate
Parameters	Wavelength domain: 1300 nm, 1500 nm
Extend of service	Calibration in one wavelength domain

2. Optical fibres and components

2.1. Optical fibre

Quantity	Spectral attenuation, singlemode
Uncertainty	0.03 dB
Procedure	Cut-back, according to IEC 60793-1-40
Parameters	Wavelength: 900 nm up to 1700 nm; Spectral width: 5 nm
Extend of service	Wavelength step: 5 nm
Quantity	Chromatic dispersion
Uncertainty	Dispersion (ps/nm/km): 1 %
Procedure	Phase shift
Parameters	Wavelength: 1267 nm to 1365 nm; 1450 nm to 1641 nm
Extend of service	Calibration of the chromatic dispersion in one spectral domain
Quantity	Chromatic dispersion
Uncertainty	Dispersion slope (ps/nm/nm//km): 1 %, zero disp. wavelength: 60 pm
Procedure	Phase shift
Parameters	Wavelength: 1267 nm to 1365 nm; 1450 nm to 1641 nm
Extend of service	Calibration of the zero dispersion wavelength and of the dispersion slope

Quantity	Chromatic dispersion
Extend of service	Additional calibration in another spectral domain
Quantity	Optical length of a singlemode fibre 0.1 m up to 100 km
Uncertainty	$0.005 \text{ m} + 1 \cdot 10^{-5} \cdot L$
Procedure	Transit time, according to IEC 60793-1-22 and IEC 61746
Parameters	Wavelength: 1310 nm, 1550 nm
Extend of service	Calibration performed at one wavelength
Quantity	Optical length of a singlemode fibre
Extend of service	Additional calibration performed at another wavelength
Quantity	Optical fibre length, multimode 0.5 m up to 3 km
Uncertainty	$0.01 \text{ m} + 5.8 \cdot 10^{-4} \cdot L$
Procedure	Transit time, according to IEC 60793-1-22 and IEC 61746
Parameters	Wavelength: 850 nm, 1310 nm
Extend of service	Calibration performed at one wavelength
Quantity	Optical length of a multimode fibre
Extend of service	Additional calibration at another wavelength

2.2. Passive components

Quantity	Curvature radius, undercut and apex offset
Uncertainty	Curvature radius: 0.075 mm, undercut: 0.6 nm, apex offset: 5 μm
Procedure	Interferometric measurement
Extend of service	Following quantities are calibrated: curvature radius, undercut and apex offset
Quantity	Insertion and Return Loss IL: 0 dB to -30 dB, RL: 0dB to -50 dB
Procedure	According to IEC 61300-3-6, Ed. 3.0, Method 1
Quantity	Insertion and Return Loss
Procedure	According to IEC 60874-1
Extend of service	Additional calibration
Quantity	Encircled Flux (EF)
Procedure	Near field measurement with NIR camera
Parameters	Wavelength: 850 nm, 1300 nm

3. Reference materials

3.1. Chromatic dispersion reference fibre

Quantity	Chromatic dispersion
Uncertainty	Dispersion (ps/nm/km): 1 %, dispersion slope (ps/nm/nm/km): 1 %, zero disp. wavelength: 60 pm
Procedure	Phase shift, according to IEC 60793-1-42 and IEC 61744
Parameters	Fibre type: G652, G653, G655, DCF
Extend of service	The artefact is mounted in an instrument case and is fitted with two FC-PC or FC-APC chassis connectors

3.2. Optical length reference fibre

Quantity	Optical fiber length 0.4 m up to 100 km
Uncertainty	0.04 m @ L = 0.4 m, 17 m @ L = 100 km
Procedure	Transit time, according to IEC 60793-1-22 and IEC 61746
Parameters	Fibre type: singlemode or multimode
Extend of service	The artefact is mounted in an instrument case

3.3. Spectral attenuation reference fibre

Quantity	Spectral attenuation
Uncertainty	0.03 dB
Procedure	Cut-back, according to IEC 60793-1-40
Parameters	Wavelength: 900 nm up to 1700 nm; resolution: 5 nm
Extend of service	The Reference Fibre is delivered in a protective case

3.4. Artefact for the calibration of OTDR

Quantity	Artefact for the calibration of the attenuation
Procedure	This reference material allows to calibrate the attenuation scale of a singlemode OTDR.
Extend of service	The artefact is mounted in an instrument case and is fitted with 2 FC-PC bulkhead connectors

Quantity	Artefact for the calibration of the distance
Procedure	This reference material is based on a ring resonator structure and allows to calibrate the distance scale of a singlemode OTDR.
Extend of service	The artefact is mounted in an instrument case

3.5. Reference fibre for the effective group index of refraction

Quantity	Effective group index of refraction
Uncertainty	$U_{n_{eff}} (k=2): 0.0005$
Procedure	Phase shift, according to IEC 60793-1-42 and IEC 61744
Parameters	Fibre type: G652, G653, G655, DCF
Extend of service	The artefact is mounted in an instrument case and is fitted with two FC-PC or FC-APC chassis connectors

3.6. Reference fibre for the backscattering coefficient

Quantity	Backscatter coefficient C (dB)
Uncertainty	UC (k=2): 0.2 dB
Procedure	According to IEC 61746-1, Ed. 1.0, Annex G.3
Parameters	Fibre type: G652, G653, G655, DCF
Extend of service	The artefact is mounted in an instrument case and is fitted with two FC-PC or FC-APC chassis connectors

3.7. Reflectance standard

Quantity	Reflectance (dB)
Uncertainty	UC (k=2): 0.2 dB up to 2 dB
Parameters	Reference value: -3 dB up to -50 dB
Extend of service	The artefact is mounted in an instrument case and is fitted with one FC-APC chassis connector