

Calibration reproducibility of optical fibers power meters

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Abstract

Calibration laboratories are required, according to ISO 17025, to continuously improve their quality management systems. To accomplish this, we assured the reproducibility of our optical fiber power meters' traceability at two specific wavelength (1310 nm and 1550 nm), by establishing the hierarchy of our instruments and by periodically checking their calibration against the primary standard. The power meters involved were: two power meters with built-in detector, two power meters with detachable detectors, a Michelson interferometer-based wavelength meter, and an optical spectrum analyzer. The primary standard calibration is traceable to the Swiss Federal Office of Metrology – METAS. In order to assess the uncertainties budget we located the primary sources of errors which are: the stability of the set-up geometry, having a standard deviation of 0.27 μW , and the dependency of the output signal on the change of the incident optical radiation state of polarization, accounting with a standard deviation of 0.75 μW (for 1310 nm). Other sources of uncertainties are the signal linearity, the optical power stability of the laser sources used in calibration systems (with a standard deviation of ± 0.0006 dB for 1310 nm and 0.0013 dB for 1550 nm), the impact of the ambient temperature variations over entire calibration set-up, and the reproducibility of the measurements results. The results of the optical power and optical power linearity calibrations, for a reference power level of 100 μW , showed that the optical fiber power meters with built-in detector are more suited for optical fiber power calibrations, the extended uncertainty had an approximate value of 0.77 % and 0.92 %, for $\lambda = 1310$ nm, and respectively $\lambda = 1550$ nm. Apart from the evaluation of the optical power calibration reproducibility we check also for all the instruments, their linearity as compared to the primary standard, in the power range from -5 dBm to -65 dBm.

Keywords: laboratory comparison, optical fibers power meters, optical power calibration, optical power linearity, uncertainties budget.