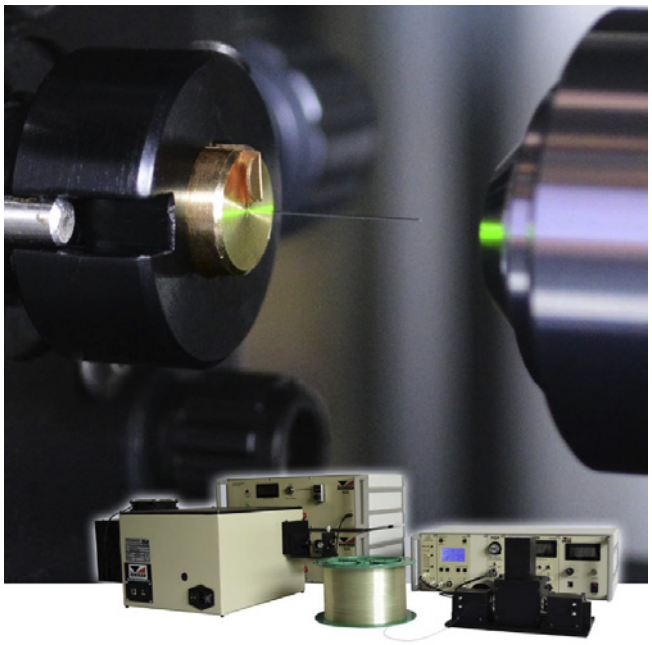
B-FSL300
Fibre spectral loss measurement system



The B-FSL300 is a reliable, turn-key solution for the measurement of fibre spectral loss. Whilst traditionally configured to cover the telecommunications wavelength band, the capability of the B-FSL300 can be extended into the ultra- violet, visible and further into the infra-red to 5000 nm and beyond.

Spectral loss is a key metric in quality control, material research and development of optical fibre used for example in single transmission and in optical amplifiers. In the B-FSL300, this parameter is evaluated using the cut-back technique, the internationally recognised reference test method offering the highest measurement accuracy[1] .

The high degree of configurational flexibility of the B-FSL300 allows the choice of light source, monochromator configuration, launch optics and detector station to allow measurements over very wide spectral range and a large range of fibre types, including silica, doped glass, plastic and photonic bandgap fibres. This system may also be used to determine fibre cut-off wavelength[2], in the measurement of mode field diameter[3] ,the determination of macrobending loss[4] and evaluation of the spectral properties of a wide range of passive WDM components such as taps and couplers.

[1] IEC 60793-1-40,"Measurement methods and test procedures - Attenuation."

[2] IEC 60793-1-44,"Measurement methods and test procedures - Cut-off wavelength"

[3] IEC 60793-1-45,"Measurement methods and test procedures - Mode field diameter"

[4] IEC 60793-1-47,"Measurement methods and test procedures - Macrobending loss

The cut-back technique

Light transmission over the spectral range of interest is measured through a long piece of fibre (typically 1-2 km long) which is then cut back by a known amount and the light transmission measurement repeated. From these two measurements and knowing the length of fibre cut-back we can determine the spectral loss (dB/km).

$$a(\lambda) = \frac{1000}{l_c} . 10. log_{10} \left(\frac{P_{short}(\lambda)}{P_{long}(\lambda)} \right)$$

Where:

$a(\lambda)$ is the fibre spectral loss (dB/km)

l_c is the cut-back length (m)

$P_{long}(\lambda)$ is the measured signal through a long piece of fibre

$P_{short}(\lambda)$ is the measured signal with above fibre cut back by l_c

Stability

Due to the sequential nature of the measurement, both optical and mechanical stability over the period of the two spectral runs is of critical importance.

For the Bentham range, optical stability is ensured by the IL1 light source, which uses a 100 W QH lamp controlled by a highly stabilised constant current power supply. This power supply is at least 10 times more stable than a normal laboratory stabilised supply.

Mechanical instability in such systems results in short or long term wander of the focussed spot over the end of the fibre at the launch end. In the Bentham system the light source and launch optics are bolted firmly to the monochromator, which is constructed from a single rigid casting.

Quantum Design EUROPE

Quantum Design GmbH
Breitwieserweg 9
D-64319 Pfungstadt

Michael Foos: +49 6157 80710 34
foos@qd-europe.com
Find your local contact at www.qd-europe.com

BENTHAM

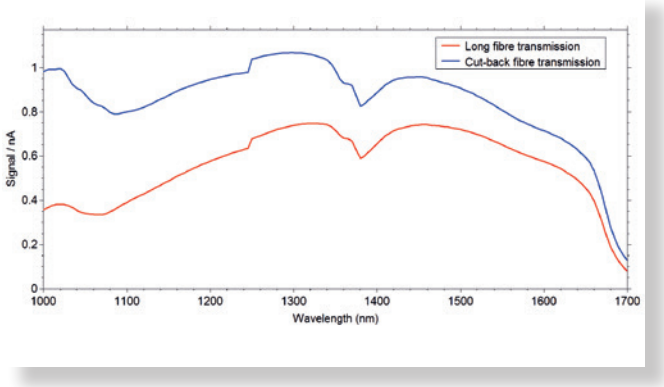
B-FSL300
Fibre spectral loss measurement system

Core benefits
- Superior optical and mechanical stability
- Modular design and high configurational flexibility
- Simple and repeatable measurement process
- Fully automated measurement and calculation of spectral attenuation

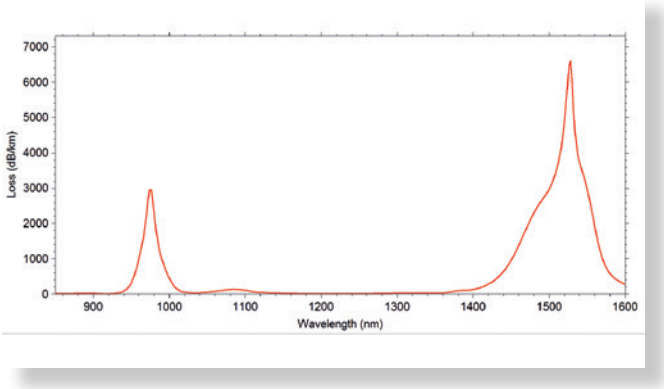
Features
- Accurately assesses fibre spectral loss
- Employs internationally recognised cut-back technique
- The wavelength band may be extended throughout UV-vis and into the IR beyond 5000 nm
- Fully-automated via PC, responsible for dB/km loss calculation as a function of wavelength
- High-precision assessment of a large range of fibre types, including silica, doped glass, plastic and photonic bandgap fibres
- Optical stability is ensured by the use of a quart tungsten halogen light source driven by a constant-current power supply
- Light source and launch optics are bolted firmly to the monochromator to negate mechanical instability over time

Reported parameters
- Fibre spectral attenuation, dB/km

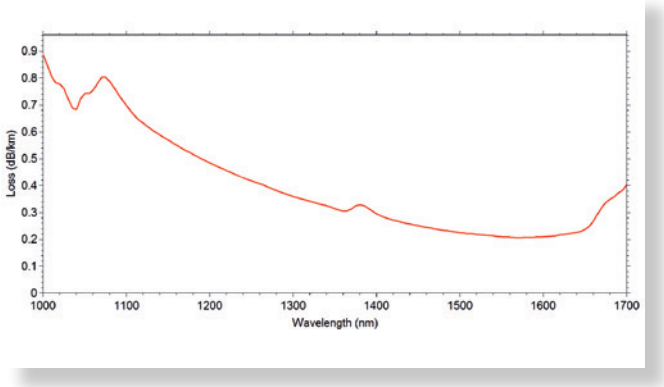
Applications
- IEC 60793-1-40:2001
- Optical fibres - part 1-40: measurement methods and test procedures - attenuation



Example long vs short transmission of fibres



Typical spectral loss of Erbium doped fibre



Typical spectral loss of SMF28

Quantum Design EUROPE

Quantum Design GmbH
Breitwieserweg 9
D-64319 Pfungstadt

Michael Foos: +49 6157 80710 34
foos@qd-europe.com
Find your local contact at www.qd-europe.com

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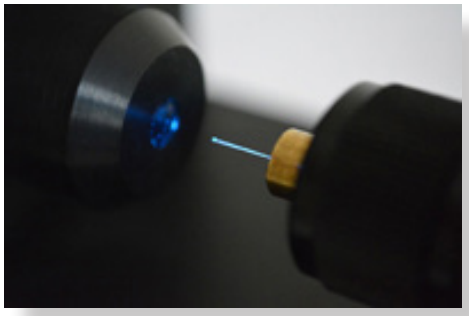
B-FSL300
Fibre spectral loss measurement system

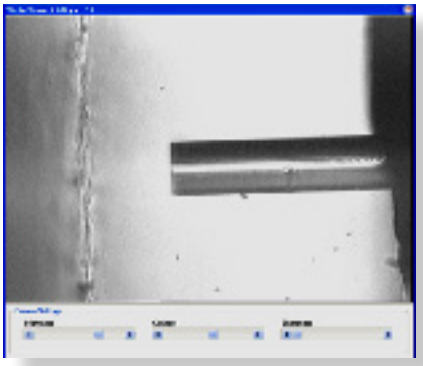
System specification
Light transmission as a function of wavelength is determined by illuminating the fibre under test with an optically chopped, monochromatic probe output from a TMc300 single monochromator, configured according to the spectral range of interest. The light source employed may include up to two lamps of xenon, quartz halogen or Nernst IR emitter. The monochromatic probe is optically chopped to improve the measured signal-to-noise ratio.

Launching light into fibre
A short focal length objective lens is used to couple a maximum of the monochromatic probe into the fibre under test. An x-y-z translation assembly is provided to optimise alignment to the fibre under test, whether the fibre is cabled or not (bare fibre, FC and SMA connectors mounts available). The launch optics/fibre mount assembly is mechanically rigid and securely mounted to the monochromator exit slit to ensure that the monochromatic probe does not misalign during measurement.

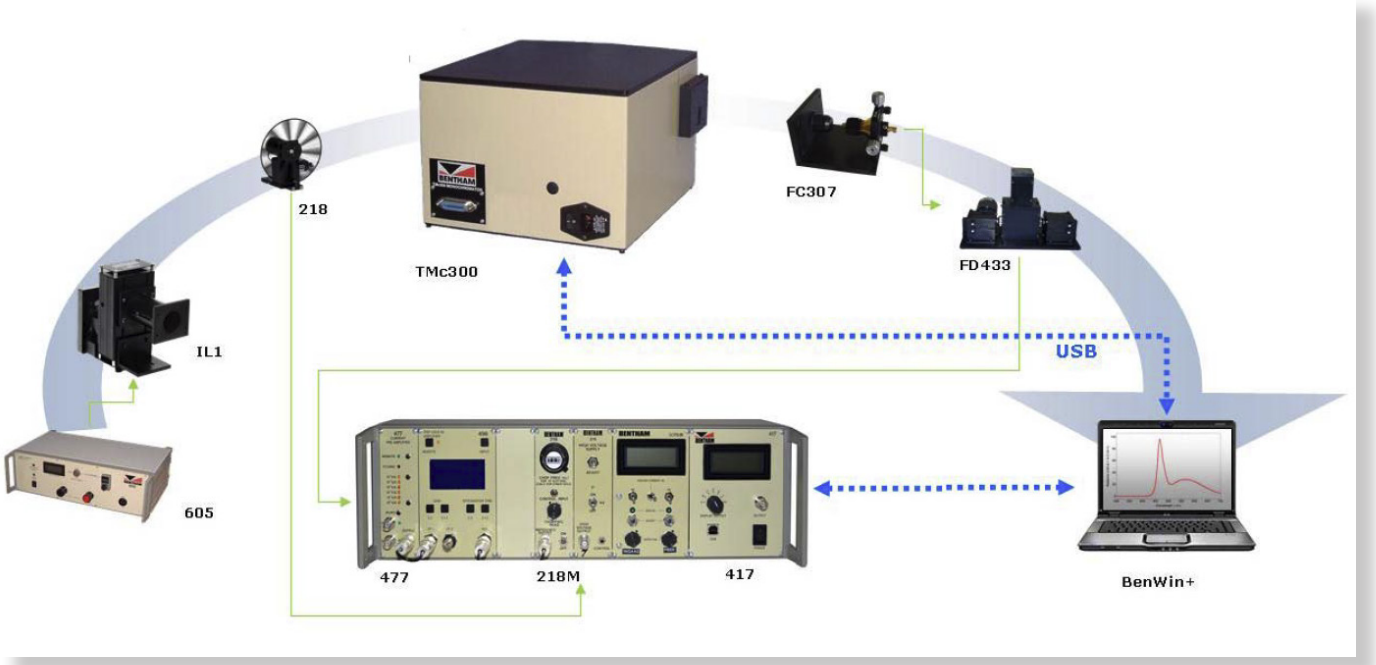


Detector station
A range of single and dual detector stations are available with microscope or CMOS-camera based viewer to inspect the condition of the cleaved cut-back fibre. The detector output is coupled to a fully automated DSP lock-in amplifier for signal recovery.

Software control
All measurements with this system are driven from our proprietary Windows software, BenWin+, allowing full control of the B-FSL300 system.



Where the detector station is fitted with a CMOS camera, the fibre condition can be viewed through BenWin+.



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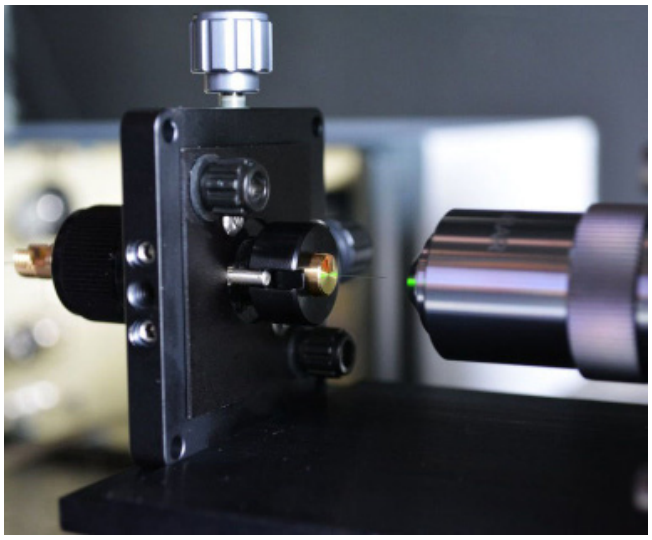
Specification		
Spectral range of monochromatic probe	Light source	Diffraction gratings
	IL1: 350-2500 nm	T312ROU5: 350-1200 nm
	IL7: 300-1100 nm	T30831U2: 500-1800 nm
	ILD-QH-IR-CHOP: 350-5000 nm	T306R1U6: 800-2500 nm
		T303R3U0: 1500-5500 nm
Typical spectral data interval	5 nm	
Typical spectral bandwidth (FWHM)	5 nm	
Spectral range of detector station	Si: 350-1100 nm	
	InGaAs: 800-1700 nm	
	InGaAs_EX_TE: 800-2500 nm	
	PbSe_TE: 1500-5000 nm	
Wavelength accuracy	T312R0U5 ± 0.2 nm	
	T30831U2: ± 0.3 nm	
	T306R1U6: ± 0.4 nm	
	T303R3U0: ± 0.8 nm	
Computer requirements	OS: Windows 7 + (32-/64-bit)	
	Minimum hard disk space: approx. 100 MB	
	Minimum RAM: 2 GB	
	3 x USB 2.0 ports	
Services requirements	5 x 110/220 V AC mains sockets, 600 VA total	



Ordering information	
B-FSL300_Si	The B-FSL300 fibre spectral attenuation spectrometer with Si detector (350-1100 nm)
B-FSL300_InGaAs	The B-FSL300 fibre spectral attenuation spectrometer with InGaAs detector (800-1700 nm)
B-FSL300_InGaAs_EX	The B-FSL300 fibre spectral attenuation spectrometer with extended InGaAs detector(800-2500 nm)
B-FSL300_PbSe	The B-FSL300 fibre spectral attenuation spectrometer with PbSe detector (1500-5000 nm)
B-FSL300_Dual_Si_InGaAs	The B-FSL300 fibre spectral attenuation spectrometer with dual Si and InGaAs detectors (350-1700 nm)

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