



NATIONAL PHYSICAL LABORATORY

Teddington Middlesex UK TW11 0LW Telephone +44 20 8977 3222

Certificate of Calibration



0478

FIBRE ATTENUATION COEFFICIENT UNIFORMITY

Single-mode fibre

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FOR:

DESCRIPTION:

~12.66 km length of single-mode optical fibre fitted with FC/UPC connectors.

IDENTIFICATION:

DATE OF
CALIBRATION:

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Reference:

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Date of issue:

Signed:

(Authorised Signatory)

Checked by:

Name:

On behalf of NPLML

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Continuation Sheet

MEASUREMENTS

The fibre was measured using a well-characterised OTDR (Optical Time Domain Reflectometer) set up as shown in the Appendix. The traces were taken with a lead-in fibre and with the end reflection of the measured fibre reduced using an FC/PC – FC/APC patchcord. A polarization state controller was used to vary the polarization state of the light entering the fibre during the course of the measurements. The fibre was measured from ends A and B and at four backscatter signal levels (obtained by inserting attenuation between the OTDR and the fibre). The traces were first corrected for the non-linearity of the OTDR, then analysed in consecutive 1.0 km sections starting 0.9 km from end A of the fibre. The measurements were taken at a temperature of 23 ± 2 °C.

RESULTS

The tables below show the distance at the start and finish of each section and the attenuation coefficient at the two wavelengths. The attenuation coefficients quoted are the mean of three values from four traces. The attenuation coefficient was calculated using a least squares analysis and a group index value of 1.46000. The values below refer to on the day measurements and do not allow for any subsequent drift.

Fibre Section relative to end A (km)		Attenuation at 1311 nm (dB.km ⁻¹)		
start	finish	From end A	From end B	Average
0.9	1.9	0.329	0.325	0.327
1.9	2.9	0.328	0.326	0.327
2.9	3.9	0.328	0.329	0.329
3.9	4.9	0.329	0.327	0.328
4.9	5.9	0.328	0.325	0.326
5.9	6.9	0.329	0.327	0.328
6.9	7.9	0.332	0.325	0.328
7.9	8.9	0.328	0.325	0.326
8.9	9.9	0.330	0.324	0.327
9.9	10.9	0.327	0.327	0.327
10.9	11.9	0.331	0.324	0.327

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Fibre Section relative to end A (km)		Attenuation at 1555 nm (dB.km ⁻¹)		
start	finish	From end A	From end B	Average
0.9	1.9	0.185	0.184	0.185
1.9	2.9	0.185	0.184	0.185
2.9	3.9	0.187	0.186	0.187
3.9	4.9	0.188	0.185	0.187
4.9	5.9	0.182	0.186	0.184
5.9	6.9	0.185	0.186	0.186
6.9	7.9	0.187	0.181	0.184
7.9	8.9	0.187	0.182	0.185
8.9	9.9	0.190	0.180	0.185
9.9	10.9	0.185	0.182	0.184
10.9	11.9	0.183	0.187	0.185

UNCERTAINTIES

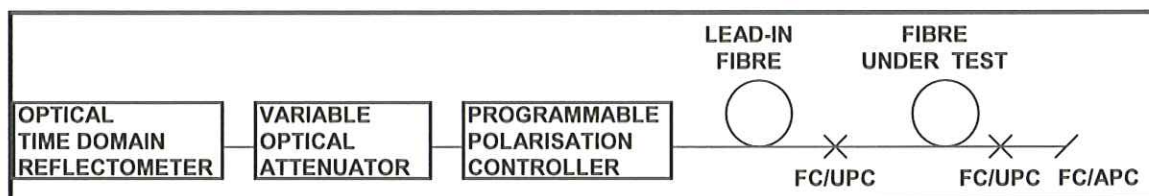
The uncertainty in the single direction value is ± 0.009 dB.km⁻¹ and the uncertainty in the bi-directional average is ± 0.006 dB.km⁻¹.

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APPENDIX



The diagram above shows the experimental set up for the calibration identifying the major components.

The measurements were made with the following OTDR settings.

Centre Wavelengths:	1311 ± 2 nm
(in Vacuum)	1555 ± 2 nm

Nominal Pulse Width:	1000 ns
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Measurement Range:	0 - 50 km
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No. of Averages:	180
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