

**Passive components to be used in optical fibre communication systems -
Product specifications -
Part 2-2: SC(SC2)-APC connector-type fixed optical attenuators
using IEC 60793-2 Category B1.1 singlemode fibre**

This Technical Report was approved by CENELEC on 2008-01-10.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

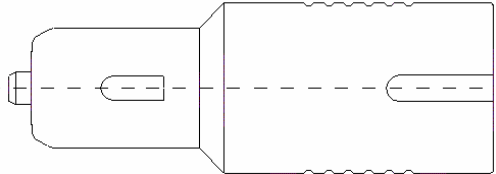
Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

This Technical Report was prepared by the Technical Committee CENELEC TC 86BXA, Fibre optic interconnect, passive and connectorised components.

The text of the draft was submitted to the vote and was approved by CENELEC as CLC/TR 50378-2-2 on 2008-01-10.

This document is a preview generated by EVS

Passive components to be used in optical fibre communication systems – Product specifications – Part 2-2: SC(SC2)-APC connector-type fixed optical attenuators using IEC 60793-2 Category B1.1 singlemode fibre			
Description		Performance	
Type:	fixed	Application:	EN 61753-1:2007 Category U ETSI ES 201 286
Style:	plug style	Attenuation:	1 dB, 5 dB, and 15 dB
Operating wavelength:	(1 260 – 1 360) nm and (1 460 – 1 625) nm	Return loss grades:	V: ≥ 60 dB
Coupling mechanism:	push pull		
Configuration:	plug-attenuator-adaptor-plug		
Fibre category:	special fibres		
References: EN 50377-4-2 ¹⁾ Connector sets and interconnect components to be used in optical fibre communication systems – Product specifications – Part 4-2: Type SC-APC simplex 8 and 9 degree terminated on IEC 60793-2 category B1.1 singlemode fibre EN 60793-2 Optical fibres – Part 2: Product specifications – General (IEC 60793-2) EN 61300 series Fibre optic interconnecting devices and passive components – Basic test and measurement procedures (IEC 61300 series) EN 61753-1 Fibre optic interconnecting devices and passive components performance standard – Part 1: General and guidance for performance standards (IEC 61753-1:2007) EN 61753-051-3 Fibre optic interconnecting devices and passive components performance standard – Part 051-3: Single-mode fibre, plug-style fixed attenuators for category U - Uncontrolled environment (IEC 61753-051-3) ETSI ES 201 286 Transmission and Multiplexing (TM); Passive optical components; Connector-type optical fixed attenuators for single-mode optical fibre communications systems; Common requirements and conformance testing ETSI EN 300 019 (series) Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment			
Outline and maximum dimensions: 			

¹⁾ At draft stage.

Contents

1	Scope.....	5
2	Test samples	5
3	Test program	5
3.1	Spectral attenuation loss (according to EN 61300-3-5).....	5
3.2	Attenuation at 1 310 nm and 1 550 nm measured with LED source and power meter.....	5
3.3	Polarisation dependent loss (PDL) (according to EN 61300-3-2 method 1)	5
4	Test laboratories involved in this RRT	5
5	Measurement results	6
5.1	Individual test laboratory results with reference connectors.....	6
5.2	Overview of all attenuation test results.....	15
5.3	Summary of attenuation measurements results	21
5.4	Overview of PDL results.....	24
6	Mechanical interface issues with SC/APC plug style attenuators.....	24
7	Conclusions	25
Table 1 – PDL measurements from ‘Laboratory A’		7
Table 2 – PDL measurements from ‘Laboratory B’		9
Table 3 – PDL measurements from ‘Laboratory C’		10
Table 4 – PDL measurements from ‘Laboratory D’		12
Table 5 – PDL measurements from ‘Laboratory E’		14
Table 6 – Pass/fail result		21
Table 7 – Pass/fail result with relaxed performance criteria.....		21
Table 8 – Pass/fail result		22
Table 9 – Pass/fail result with relaxed performance criteria.....		22
Table 10 – LED measurements results at 1 310 nm (green colour = pass).....		23
Table 11 – LED measurements results at 1 550 nm (green colour = pass).....		23
Table 12 – SC/APC plug style attenuator behaviour analysis for different working configurations		25
Figure 1 – ‘Laboratory A’ results – Spectral measurements.....		6
Figure 2 – ‘Laboratory A’ results – LED measurements.....		7
Figure 3 – ‘Laboratory B’ results – Spectral measurements.....		8
Figure 4 – ‘Laboratory B’ results – LED measurements.....		8
Figure 5 – ‘Laboratory C’ results – Spectral measurements.....		9
Figure 6 – ‘Laboratory C’ results – LED measurements.....		10
Figure 7 – ‘Laboratory D’ results – Spectral measurements.....		11
Figure 8 – ‘Laboratory D’ results – LED measurements.....		12
Figure 9 – ‘Laboratory E’ results – Spectral measurements.....		13
Figure 10 – ‘Laboratory E’ results – LED measurements.....		14
Figure 11 – 1 dB attenuators – All laboratories results – Common reference.....		15
Figure 12 – 5 dB attenuators – All laboratories results – Common reference.....		17
Figure 13 – 15 dB attenuators – All laboratories results – Common reference.....		19
Figure 14 – Overview of PDL measurements results		24

1 Scope

This document reports the measurement results of a round robin test program carried out on SC/APC plug style fixed attenuators. The work was initiated at CENELEC CLC/TC 86BXA in November 2004 in order to get a clear understanding on the accuracy and repeatability of the spectral attenuation loss measurements on fixed attenuators.

Out of these results some recommendations are made for attenuation tolerance values that can be used in the performance standards.

2 Test samples

In total 18 SC/APC plug style fixed attenuators were collected for this round robin test:

- 6 attenuators with nominal attenuation of 1 dB (labelled 1, 2, 3, 4, 5, 6);
- 6 attenuators with nominal attenuation of 5 dB (labelled 7, 8, 9, 10, 11, 12);
- 6 attenuators with nominal attenuation of 15 dB (labelled 13, 14, 15, 16, 17, 18).

The attenuators were obtained from various suppliers. The attenuating principle of all devices is based on the use of high attenuating fibre.

The performance grade of these attenuators is defined as

- operating wavelength range: 1 260 nm - 1 360 nm and 1 460 nm - 1 580 nm,
- attenuation tolerance: 0,5 dB for attenuators ≤ 5 dB,
10 % of nominal attenuation value for attenuators > 5 dB.

3 Test program

All participating test laboratories measured spectral attenuation and polarisation dependent loss for each attenuator. For the sake of decreasing uncertainty all measurement procedures were specified in necessary details.

3.1 Spectral attenuation loss (according to EN 61300-3-5)

The measured values were reported for the discrete wavelengths in the full spectral range from 1 260 nm to 1 650 nm with 5 nm step. The spectral width was set at 2 nm. To minimize uncertainty of measured results, measuring equipment specifications and measurement procedures were clearly stated. Each test laboratory performed the measurements with 2 sets of plugs and adapters:

- measurements with common reference plugs and adapter (the same references for all the test laboratories);
- measurements with own 'Grade B' plugs and own adapter.

Estimated measurement uncertainty didn't exceed 0,1 dB for the whole measurement range.

3.2 Attenuation at 1 310 nm and 1 550 nm measured with LED source and power meter

The measurements were performed with common reference plugs at two wavelengths 1 310 nm and 1 550 nm.

3.3 Polarisation dependent loss (PDL) (according to EN 61300-3-2 method 1)

PDL was measured at 1 310 nm and 1 550 nm, with common reference plugs. Selected measurements method was "all states method". The accuracy of each PDL measurement was better than 0,1 dB.

4 Test laboratories involved in this RRT

The following laboratories were involved in this round robin test (in alphabetical order):

- Adamant Kogyo Co., Ltd. (Japan);
- Diamond (Switzerland);