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Consideration on the use of OTDRs to measure return loss of single-mode optical fibre connections

Examen de l'utilisation de la réflectométrie optique dans le domaine temporel (OTDR) pour la mesure de l'affaiblissement de réflexion des connexions en unimodal

Überlegungen zur Verwendung von OTDRs zur Messung der Rückflussdämpfung von Einmoden-LWL-Verbindungen

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European foreword

This document (CLC/TR 50682:2018) has been prepared by CLC/TC 86BXA "*Fibre optic interconnect, passive and connectorised components*".

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Introduction

The introduction of new types of optical fibre (i.e. ITU-T G.657, EN 60793-2-50 B6 type) and the differences between manufacturers' products cause a spread of up to 3 dB in the backscatter values (Bs) of available telecommunications single mode fibre. The variation in this parameter can lead to large differences in measured return loss (RL) of connections. This can give issues in field measurement where the fibre type and manufacturer may be unknown and the Bs may not be updated for each measurement in the OTDR.

To evaluate the real impact of this spread of backscatter vales on return loss measurement, a Round Robin Test (RRT) was designed by CLC TC86BXA in 2015. "Black-box" connections (i.e. closed boxes with a connection of two plugs and fibre with similar or different B_s values) were circulated for testing in 2016 and 2017 around several laboratories. The result of this Round Robin is intended to contribute to future specification of return loss requirements on optical components.

1 Scope

The purpose of this document is to describe a round robin on return loss of single mode optical fibre connections. This includes the description of the samples, the test procedures and test instrumentation, results and conclusions.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 61300-3-6:2009, *Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Part 3-6: Examinations and measurements - Return loss*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
return loss
RL
ratio of the power (Pi) incident on, or entering, the DUT to the total power reflected (Pr) by the DUT, expressed in decibels

3.2
backscatter value
B_s
backscattering level of the OTDR trace is a constant (K) that includes both the Rayleigh backscattering of the fibre and the OTDR pulse duration

4 Description of Samples

The Device Under Test (DUT) was an optical fibre-to-fibre connection, protected by a box, making the connection inaccessible to the user. The patch cords used in the DUTs were provided by different manufacturers to ensure a mix of fibres. The plugs in the connection were either SC/APC or SC/PC style which were terminated on single fibre cable 50 m in length, and the free ends were terminated with SC/APC plugs in order to create input/output ports. All the combinations were chosen in order to have a connection RL between 55 dB and 60 dB. Some of these connections were made by mixing fibres with similar B_S and others using different B_S.

Ten DUTs (black boxes) were made in total. The samples were packed and transported in such a way as to minimize performance changes during the round robin test and retested at the end of the RRT.

In Table 1, the fibre manufacturers, fibre types and mode field diameters (MFD) of the samples used in the RRT are listed, together with the backscatter values at 1 310 nm and 1 550 nm. It can be noted that the difference among B_S values is higher at 1 310 nm (~ 2,6 dB), than at 1 550 nm (~ 0,7 dB).