TECHNICAL REPORT

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Fibre optic communication system design guides –

Part 8: Calculating dispersion penalty from measured time-resolved chirp data

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CONTENTS

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FOREWORD

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IEC 61282-8, which is a technical report, has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
86C/686/DTR	86C/721/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61282 series, published under the general title *Fibre optic communication system design guides,* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

Dispersion penalty is a commonly used parameter of laser transmitters and is usually included as a specification for transmitters designed for 2,5 Gb/s and higher data rates. The value of the dispersion penalty is a function of the interaction of laser chirp, spectral width and fibre dispersion and will depend on the particular type of fibre.

Because the type and length of the fibre specified for a particular transmitter is fixed, the dispersion penalty is determined by the temporal characteristics of the transmitter chirp, which include the spectral characteristics of the laser.

As developers and manufacturers of laser transmitters are attempting to go to higher rates and longer distances, they are finding that chirp is limiting their ability to achieve a required dispersion penalty. Direct measurement of dispersion penalty requires two BER measurements over a reference receiver input range that yields BER values typically from 10^{-4} to 10^{-12}. This is typically a long measurement. Measuring time-resolved chirp (TRC) and calculating dispersion penalty can be a considerably shorter measurement.

This technical report describes the procedure for calculating dispersion penalty from TRC data.

FIBRE OPTIC COMMUNICATION SYSTEM DESIGN GUIDES –

Part 8: Calculating dispersion penalty from measured time-resolved chirp data

1 Scope

This part of IEC 61282 provides definitions of dispersion penalty and other related penalties. It describes the direct measurement of these penalties using a *BER* test set and the calculation of the penalties from time-resolved chirp (TRC) data. Annex A provides the theory for power penalty calculations.

The calculations are valid for all types of single longitudinal mode (SLM) laser transmitters intended for use in telecommunications applications at data rates of 2,5 Gbit/s and higher with NRZ modulation format. These include but are not limited to directly modulated DFB lasers, DFB lasers with integrated electro-absorption modulators, and DFB lasers with external Mach-Zehnder modulators. This technique is not suitable for multiple longitudinal mode (MLM) lasers or LEDs.

Chromatic dispersion induced power penalty values in this technical report are characteristics of the transmitter, which is considered to be the device-under-test (DUT). Other power penalty sources, such as nonlinear effects and amplifier noise are not covered by this document.

Since dispersion penalty for a transmission link depends on the transmitter, receiver and fibre, the dispersion penalty parameter for a transmitter is based on a specified fibre dispersion and receiver characteristic, which should be reported with the test results.

2 Normative references

The following referenced documents are indispensable for the application 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.

IEC 61280-2-8, *Fibre optic communication subsystem test procedures – Digital systems – Part 2-8: Determination of low BER using Q-factor measurements*

IEC 61280-2-10, *Fibre optic communication subsystem test procedures – Digital systems – Part 2-10: Time-resolved chirp and alpha-factor measurement of laser transmitters*

ITU-T Recommendation G.957, *Optical interfaces for equipments and systems relating to the synchronous digital hierarchy*