IEC 62150-3

Edition 1.0 2012-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Fibre optic active components and devices – Test and measurement procedures –
Part 3: Optical power variation induced by mechanical disturbance in optical receptacles and transceiver interfaces

Composants et dispositifs actifs à fibres optiques – Procédures d'essais et de mesures –
Partie 3: Variation de puissance optique induite par des perturbations mécaniques dans les interfaces d'embases optiques et d'émetteurs-récepteurs

IEC 62150-3:2012

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you to find IEC publications by a variety of criteria (reference number, text, technical committee,…).
It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,…).
Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

IEC 62150-3

Edition 1.0 2012-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

**Fibre optic active components and devices – Test and measurement procedures –
Part 3: Optical power variation induced by mechanical disturbance in optical receptacles and transceiver interfaces**

**Composants et dispositifs actifs à fibres optiques – Procédures d'essais et de mesures –
Partie 3: Variation de puissance optique induite par des perturbations mécaniques dans les interfaces d'embases optiques et d'émetteurs-récepteurs**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX S

ICS 33.180.20 ISBN 978-2-83220-157-2

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE OPTIC ACTIVE COMPONENTS AND DEVICES – TEST AND MEASUREMENT PROCEDURES –

Part 3: Optical power variation induced by mechanical disturbance in optical receptacles and transceiver interfaces

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62150-3 has been prepared by subcommittee 86C: Fibre optic systems and active devices 86: Fibre optics.

The text of this standard is based on the following documents:

FDIS	Report on voting
86C/1061/FDIS	86C/1072/RVD

Full information on the voting for the approval of this standard 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.

The committee has decided that the contents of this publication will remain unchanged until the stability 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

FIBRE OPTIC ACTIVE COMPONENTS AND DEVICES – TEST AND MEASUREMENT PROCEDURES –

Part 3: Optical power variation induced by mechanical disturbance in optical receptacles and transceiver interfaces

1 Scope

The purpose of this part of IEC 62150 is to specify the test requirements and procedures for qualifying optical devices for sensitivity to coupled power variations induced by mechanical disturbance at the optical ports of the device. It applies to active devices with optical receptacle interfaces. In this edition, transceivers using small-form-factor connector cables (1,25 mm ferrule) for single mode fibre are specified.

It has been found that some optical transceivers and receptacles are susceptible to fibre optic cable induced stress when side forces are applied to the mated cable-connector assembly, resulting in variations in the transmitted optical power. This part of IEC 62150 defines physical stress tests to ensure that such optical connections (cable and receptacle) can continue to function within specifications.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61753 (all parts), *Fibre optic interconnecting devices and passive components performance standard*

IEC 61753-021-6, *Fibre optic interconnecting devices and passive components performance standard – Part 021-6: Grade B/2 single-mode fibre optic connectors for category O – Uncontrolled environment*

IEC 61754 (all parts), *Fibre optic connector interfaces*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

3.1.1
wiggle
mechanical disturbances that induce coupled optical power variation to the optical receptacle and transceiver interface

3.1.2
wiggle loss
variation in coupled output power (with respect to a no-load, non-rotated measurement) induced in an optical module or receptacle when the mated connector is laterally stressed.

3.2 Abbreviations

3.2.1
DUT
device under test

3.2.2
LOS
loss of signal

3.2.3
Rx
receiver

3.2.4
Tx
transmitter

4 Measurement consideration

4.1 Multiple test methods

Since the wiggle loss mechanisms are categorized into two different cases, Cases A and B, this standard defines two measurement methods, Methods A and B, as shown in Table 1. Methods A and B are applicable to the tests for the mechanical endurance of transceivers under wiggle Cases A and B, respectively.

Table 1 – Multiple test methods

Test methods	Applicable to	Example of parameters to be included
Method A	Wiggle Case A: test for optical transceivers used with patchcord terminated to connectors which meet interface standards (IEC 61754 series)	Test procedure, test fixture, test jumper, test load
Method B	Wiggle Case B: test for optical transceivers used with patchcord terminated to connectors which meet both interface standards (IEC 61754 series) and performance standards (IEC 61753 series)	Test procedure, test fixture, test jumper, test load

4.2 Two wiggle loss mechanisms

4.2.1 Rationale for two different wiggle loss test methods

Some optical transceivers and receptacles are susceptible to fibre optic cable induced stress when forces are applied to the mated cable-connector assembly. Depending on the structure of fibre-optic connectors, two different points of action for the receptacle cause two different types of wiggle loss.

The intention of Method A is to help ensure that the transceiver port design is robust enough to work with a variety of cables that meet interface standards available in the field. The intention of Method B is to ensure port designs are robust enough to endure potential side loads during operation and installation with cables of known performance.

To guarantee the mechanical robustness of optical transceivers under wiggle Case A and/or B, transceiver suppliers and users can adopt both Methods A and B if necessary, or can choose either Method A or B by the mutual agreement.

4.2.2 Case A: Point of action for the ferrule

When the ferrule floating tolerance is insufficient (see Annex D), external side forces applied to the patchcord can cause deformation of the sleeve of the receptacle by ferrule bending moment. This causes variations in the transmitted optical power of transceivers. In this case, the mechanical robustness of transceivers depends on the sleeve, receptacle port, and optical sub-assembly design. There are also some patchcords which have insufficient ferrule floating tolerance as this is not specified in interface standards.

4.2.3 Case B: Point of action for the plug housing

When the ferrule floating tolerance is sufficient, external forces applied to the patchcord causes deformation of the receptacle housing by plug bending moment. This causes variations in the transmitted optical power of transceivers. In this case, the mechanical endurance of transceivers depends on the design of receptacle housings. Sufficient ferrule floating tolerance can be guaranteed by performance standards of patchcords as specified in Annex C, Method B.

5 Test method A

5.1 Apparatus

5.1.1 Apparatus

An example of the test apparatus is shown in Figure 1. Details of the elements are given in the following sections. Measurement wavelength is in accordance with the wavelength of transceiver specifications, and the test data is obtained at room temperature.

The exact details of the test fixture will depend on the type of device under test. For example, if an optical transceiver is being evaluated, a test board capable of securing and powering up the transceiver may be used. In this case, it is centre mounted to the spindle of a rotation mechanism so that it can be rotated symmetrically over 360°.

5.1.2 Test cord

In order to simulate the wiggle loss mechanism of Case A, specially designed test patchcords called "simulated wiggle test cords" are used in Method A. Detail specifications of the simulated wiggle test cord are defined in Annex C.

In Figure 1, the test cord is connected to the transceiver under test. The test jumper has a weight applied to the end of test cord to stress the connection to the device-under-test (DUT). The test cord is connected to a power meter at the other end to record the transmitted power variations.

5.1.3 Power meter

The power meter is used to measure variations in the coupled power from the device under test. It is set up to record the maximum peak-to-peak excursions in power level normalized around the initial no load measurement. In the case of Test Method A, the following measurement set-up is recommended. Both the rotation mechanism (e.g., stepper motor) and power meter are interfaced to a computer for control and data logging purposes. Ideally, the controller's software can manipulate direction of rotation, speed and step increments of the stepper motor. During the 360° continuous rotation, the instrumentation should be capable of collecting data at least one data point for every 2,5 degrees of rotation, which equates to a response time of better than 100 milliseconds for the measuring instrumentation.

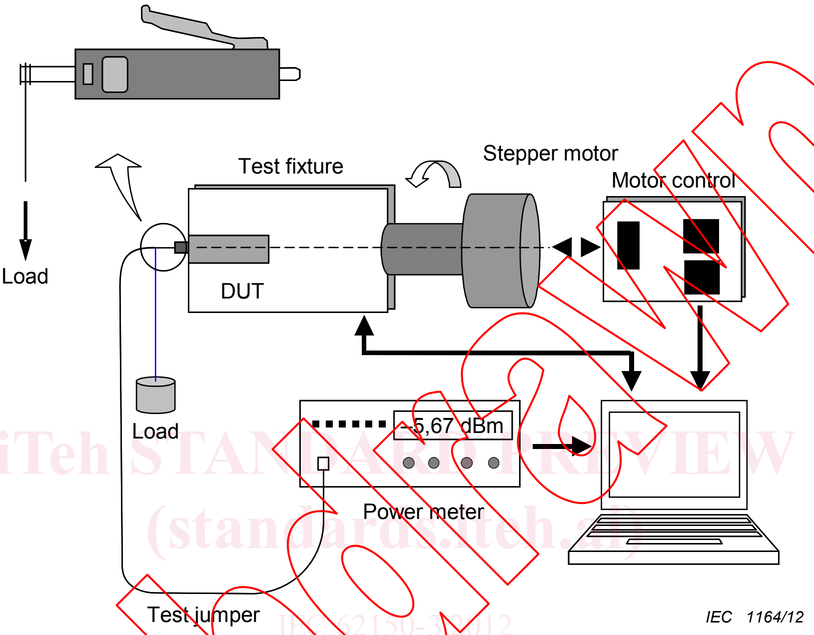
5.1.4 Test load

The test load or weight should be applied in the end of the test cord. The test load is defined in Annex A.

5.2 Test procedures for Tx interfaces

5.2.1 Test procedures

The test is conducted with a suitable fixture, as illustrated in Figure 1. This example utilizes an optical transceiver (Tx) port or other "connectorized" optical source. The simulated wiggle test cord (fibre cord and connector) is flexed at the point of entry to the connector on the DUT by applying a load in the form of a weight to the fibre while rotating the test fixture. The test is conducted as follows.



NOTE The details of the loading point are described in Annex C.

Figure 1 – Equipment setup of Method A for Tx interfaces

5.2.2 Set up

Mount the connector/optical assembly as shown in Figure 1 and connect the simulated wiggle test cord from the device's output port/Tx port to the power meter. If the DUT contains more than one port (for example a Tx port and an Rx port in the case of a transceiver), only one port should be analyzed at a time. Hence only a single simulated wiggle test cord should be connected to the device at any given time.

5.2.3 Initial measurement

Without applying any load and without rotating the fixture, measure and record the output power of the DUT when mounted in the fixture. The power meter should be reset at this point so that all measurements are normalized around this output level.

5.2.4 Apply load and rotate

Next apply the appropriate load to the simulated wiggle test cord as shown in Figure 1.

The fixture / DUT to which the load is attached is to rotate both clockwise and anti-clockwise. Allow for a settling time of 10 0073 after the load is attached or disturbed and before and after each rotation.

With a 360° rotation at a speed of 4 rpm (or less), record the power meter readings after the clockwise and anti-clockwise rotations have completed.

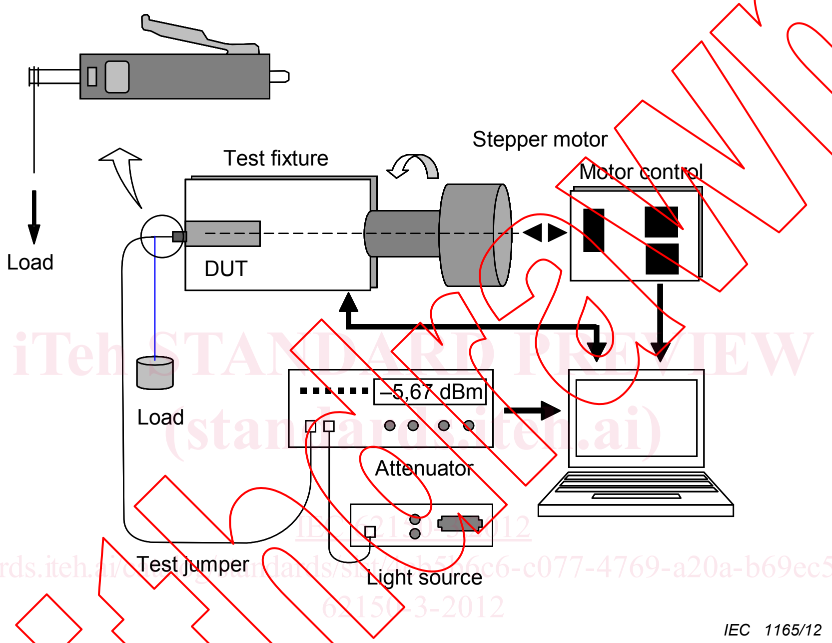
5.2.5 Wiggle loss

The wiggle loss is defined as the maximum peak-to-peak delta of the measured power during the loading process of 5.2.4 including initial measurement value of 5.2.3.

5.3 Test procedures for Rx interfaces and optical receptors

5.3.1 Test procedures

In the case of Rx interfaces or optical receptors (for example a transceiver Rx connector test or where the DUT does not contain a light source), the DUT is mounted in a test fixture as shown in Figure 2, with one of the following test methods applied.



NOTE The details of the loading point are described in Annex C

Figure 2 – Equipment setup of Method A for Rx interfaces and optical receptors

5.3.2 LOS indicator method

a) Adjust the input power to the receptacle to find the LOS (Loss-of- Signal) threshold.

b) Increase the input power by 1,5 dB.

c) Apply the relevant load specified in Annex A (Table A.1) and rotate the test fixture from 0° to 360° with continuous motion in the clockwise and counter clockwise directions.

d) If LOS is detected, then the device fails the test. If no LOS is detected, the device passes.

5.3.3 Receiver optical power monitor method

The receiver optical power monitor method can be implemented on transceivers or other optical receptors that support digital diagnostic monitoring. The robustness of the optical port to wiggle is determined by monitoring changes in the received optical power reported by the digital diagnostics.

a) Set the input power to the receiver to a level at which the receiver power monitor is in its most accurate range.

b) Apply the relevant load specified in Appendix A (Table A.1) and rotate the test fixture from 0° to 360° with continuous motion in the clockwise and counter clockwise directions while monitoring the digital diagnostics for receiver optical power.

c) Record the maximum change in receiver optical power in dB. Wiggle loss is defined as the maximum peak-to-peak delta of the measured power during the measurement from a) through b).

6 Test method B

6.1 Apparatus

6.1.1 Apparatus

An example of the test apparatus is shown in Figure 3. Details of the elements are given in the following sections. Measurement wavelength is in accordance with the wavelength of transceiver specifications, and the test data is obtained under room temperature.

6.1.2 Test fixture and rotation mechanism

The exact details of the test fixture will depend on the type of device under test. For example, if an optical transceiver is being evaluated, a test board capable of securing and powering up the transceiver may be used. In this case, it is centre mounted to the spindle of a rotation mechanism so that it can be rotated symmetrically over 360°. In case of Test Method B, the rotation function is not absolutely necessary if the test fixture enables the measurement at every 90° interval around the spindle. (0°, 90°, 180°, 270°)

6.1.3 Test cord

In order to simulate the wiggle loss mechanism of Case B, normal patchcords which satisfy both interface standards (IEC 61754 series) and performance standards (IEC 61753 series) were used in Method B.

In Figure 3, the test cord is connected to the transceiver under test. The test jumper has a weight applied in the end of test cord to stress the connection to the device-under-test (DUT). The test cord is connected to a power meter at the other end to record the transmitted power variations.

6.1.4 Power meter

The power meter is used to measure variations in the coupled power from the device under test. It is set up to record the maximum peak-to-peak excursions in power level normalized around the initial no load measurement.

6.1.5 Test load

The test load or weight shall be applied in the end of the test cord. The test load is defined in Annex A.

6.2 Test procedures for Tx interfaces

6.2.1 Test procedures

The test is conducted with a suitable fixture, as illustrated in Figure 3. This example utilizes an optical transceiver (Tx) port or other "connectorized" optical source. The standard test cord (fibre cord and connector) is flexed at the point of entry to the connector on the DUT by applying a load in the form of a weight to the fibre while rotating the test fixture. The continuous rotation mechanism is not absolutely necessary if the test fixture enables the measurement at each of the 90° directions around the spindle. (0°, 90°, 180°, 270°). The test is conducted as follows.