IEC 61753-087-6

Edition 1.0 2012-02

INTERNATIONAL STANDARD

Fibre optic interconnecting devices and passive components – Performance standard –
Part 087-6: Non-connectorised single-mode bidirectional 1 310 nm upstream and 1 490 nm downstream WWDM devices for category O – Uncontrolled environment

IEC 61753-087-6:2012(E)

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It also gives information on projects, replaced and withdrawn publications.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.

IEC 61753-087-6

Edition 1.0 2012-02

INTERNATIONAL STANDARD

Fibre optic interconnecting devices and passive components – Performance standard – Part 087-6: Non-connectorised single-mode bidirectional 1 310 nm upstream and 1 490 nm downstream WWDM devices for category O – Uncontrolled environment

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE N

ICS 33.180.20

ISBN 978-2-88912-934-8

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 087-6: Non-connectorised single-mode bidirectional 1 310 nm upstream and 1 490 nm downstream WWDM devices for category O – Uncontrolled environment

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 61753-087-6 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

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

CDV	Report on voting
86B/3256/CDV	86B/3328/RVC

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.

A list of all parts of IEC 61753 series, under the general title *Fibre optic interconnecting devices and passive components – Performance standard*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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.

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

NOTICE

The reader is advised that this IEC document and Telcordia source(s) may differ, and the context and use of said material in this IEC document may differ from that of Telcordia. TELCORDIA MAKES NO REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO THE SUFFICIENCY, ACCURACY, OR UTILITY OF ANY INFORMATION OR OPINION CONTAINED HEREIN. ANY USE OF OR RELIANCE UPON SAID INFORMATION OR OPINION IS AT THE RISK OF THE USER. TELCORDIA SHALL NOT BE LIABLE FOR ANY DAMAGE OR INJURY INCURRED BY ANY PERSON ARISING OUT OF THE SUFFICIENCY, ACCURACY, OR UTILITY OF ANY INFORMATION OR OPINION CONTAINED HEREIN.

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 087-6: Non-connectorised single-mode bidirectional 1 310 nm upstream and 1 490 nm downstream WWDM devices for category O – Uncontrolled environment

1 Scope

This part of IEC 61753 contains the minimum initial performance, test and measurement requirements and severities which a fibre optic pigtailed 1 310 nm upstream and 1 490 nm downstream wide wavelength division multiplexing (WWDM) passive optical network (PON) device must satisfy in order to be categorized as meeting the requirements of category O (uncontrolled environments), as defined in Annex A of IEC 61753-1.

Annex B of this standard provides information concerning the function of the 1 310 nm upstream and 1 490 nm downstream WWDM.

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 60793-2-50, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

IEC 61300-2-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-1: Tests – Vibration (sinusoidal)*

IEC 61300-2-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-4: Tests – Fibre/cable retention*

IEC 61300-2-5, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-5: Tests – Torsion*

IEC 61300-2-9, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-9: Tests – Shock*

IEC 61300-2-14, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-14: Tests – Optical power handling and damage threshold characterization*

IEC 61300-2-19, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-19: Tests – Damp heat (steady state)*

IEC 61300-2-22, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-22: Tests – Change of temperature*

IEC 61300-2-42, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-42: Tests – Static side load for connectors*

IEC 61300-2-44, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-44: Tests – Flexing of the strain relief of fibre optic devices*

IEC 61300-2-48, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-48: Tests – Temperature-humidity cycling*

IEC 61300-3-2, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-2: Examination and measurements – Polarization dependent loss in a single-mode fibre optic device*

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

IEC 61300-3-7, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-7: Examinations and measurements – Wavelength dependence of attenuation and return loss of single mode components*

IEC 61300-3-20, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-20: Examinations and measurements – Directivity of fibre optic branching devices*

IEC 61753-1, *Fibre optic interconnecting devices and passive components performance standard – Part 1: General and guidance for performance standards*

IEC 62074-1, *Fibre optic interconnecting devices and passive components – Fibre optic WDM devices – Part 1: Generic specification*

3 Test

Unless otherwise specified, all test methods are in accordance with IEC 61300 series standards. Each test defines the number of samples to be evaluated. The samples shall have pigtails of single-mode fibres as per IEC 60793-2-50 type B 1.1, B 1.3 or B 6 in either coated fibres (primary and secondary) or reinforced cable format. All measurements shall be carried out at standard atmosphere condition defined in IEC 61300-1, unless otherwise stated.

All tests shall be carried out over the operating wavelength ranges of 1 260 nm to 1 360 nm, 1 480 nm to 1 500 nm, unless otherwise specified.

NOTE 1 310 nm and 1 490 nm are the nominal or centre wavelengths, stated for the ranges 1 260 nm to 1 360 nm and 1 480 nm to 1 500 nm as defined in ITU-T Recommendations G.983.3 and G.984.2 and IEEE standard 802.3ah-2004.

4 Test report

Fully documented test reports and supporting evidence shall be prepared and be available for inspection as evidence that the tests have been carried out and complied with.

5 Performance requirements

5.1 Reference components

The testing for these components does not require the use of reference components.

5.2 Dimensions

Dimensions shall comply with either an appropriate IEC interface standard or with those given in appropriate manufacturers' drawings, where the IEC interface standard does not exist or cannot be used.

5.3 Sample size, sequencing and grouping

Sample sizes for the tests are defined in Annex A of this document.

Test groups and test sequences shall be performed in sequential order as shown in Annex A.

The test sequence shown in Annex A shall be followed.

5.4 Test details and requirements

Table 1 gives test details and requirements.

Table 1 – Test details and requirements

No.	Test	Requirement	Details	
1	**Insertion loss (Attenuation)** IEC 61300-3-7	≤ 0,8 dB Insertion loss shall be met over the operating wavelength ranges.	Launch patchcord length: Source type: Launch conditions: Measurement uncertainty:	≥ 2 m Unpolarised The wavelength of the source shall be longer than cut-off wavelength of the fibre. Test results shall be obtained under measurement uncertainty of ± 0,1 dB.
2	**Wavelength Isolation** IEC 61300-3-7	≥ 20 dB between wavelength ranges 1 260 nm to 1 360 nm and 1 480 nm to 1 500 nm;	Launch patchcord length: Source type: Launch conditions: Measurement uncertainty:	≥ 2 m Unpolarised The wavelength of the source shall be longer than cut-off wavelength of the fibre. Test results shall be obtained under measurement uncertainty of ± 1 dB.
3	**Directivity** IEC 61300-3-20	≥ 50 dB Directivity shall be met over the operating wavelength ranges.	Source type: Measurement uncertainty: Other requirements:	Laser diode (LD) Test results shall be obtained under measurement uncertainty of ± 1 dB. All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement. The directivity shall be measured between any pair of input or output ports.

Table 1 (*continued*)

No.	Test	Requirement	Details	
4	**Return Loss** IEC 61300-3-6	≥ 50 dB Grade U	Source type: Measurement wavelenght: Measurement uncertainty: Other requirements:	Laser diode (LD) 1 310 nm ± 20 nm, 1 490 nm ± 10 nm. Test results shall be obtained under measurement uncertainty of ± 1 dB. All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement.
5	**Polarisation Dependent Loss (PDL)** IEC 61300-3-2	≤ 0,2 dB Polarisation dependent loss shall be met over the operating wavelength ranges.	Launch patchcord length: Source type: Measurement uncertainty:	≥ 2 m Laser diode (LD) Test results shall be obtained under measurement uncertainty of ± 0,05 dB.
6	**Optical Power Handling And Damage Threshold Characterization** IEC 61300-2-14 method 2	≥ 300 mW (sum of power at the two wavelength ranges at the same time) During and on completion of the test the insertion loss limits of test No. 1 shall be met. After the test the isolation limits of test No. 2 shall be met. During and on completion of the test the return loss limits of test No. 4 shall be met.	Source type: Max. power to be applied at wavelength ranges 1 480 nm to 1 500 nm and 1 260 nm to 1 360 nm: Power increments: Test duration: Measurement uncertainty:	Laser diode (LD) 300 mW (~ + 25 dBm) 3 dB 0,5 h at each power level. Test results shall be obtained under insertion loss measurement uncertainty of ± 0,1 dB. Test results shall be obtained under return loss measurement uncertainty of ± 1 dB.
7	**Damp Heat (Steady State)** IEC 61300-2-19	During and on completion of the test the insertion loss limits of test No. 1 shall be met. After the test the isolation limits of test No. 2 shall be met. During and on completion of the test the return loss limits of test No. 4 shall be met.	Temperature: Humidity: Duration of the exposure: Maximum sampling interval during the test: Measurements required:	+ 75 °C ± 2 °C 90 % RH ± 5 % RH 168 h 1 h Insertion loss shall be measured before, during and after the test. Return loss shall be measured before, during and after the test.

Table 1 (*continued*)

No.	Test	Requirement	Details	
8	**Vibration** IEC 61300-2-1	After the test the insertion loss limits of test No. 1 shall be met. After the test the isolation limits of test No. 2 shall be met. After the test the return loss limits of test No. 4 shall be met.	Frequency range: Constant vibration amplitude: Number of cycles (10 Hz – 55 Hz -10 Hz): Frequency change: Number of axes: Measurements required:	10 Hz – 55 Hz 1,52 mm 15 1 octave/min 3 orthogonal Insertion loss shall be measured before and after the test. Return loss shall be measured before and after the test.
9	**Shock** IEC 61300-2-9	After the test the insertion loss limits of test No. 1 shall be met. After the test the isolation limits of test No. 2 shall be met. After the test the return loss limits of test No. 4 shall be met.	Acceleration force: Number of axes: Duration shock: Pulse: Number of shocks: Measurements required:	5 000 m/s² 3 main axes, perpendicular on each other 1 ms Half sine 2 per axis and direction (two in each direction) Insertion loss shall be measured before and after the test. Return loss shall be measured before and after the test.
10	**Change Of Temperature** IEC 61300-2-22	During and on completion of the test the insertion loss limits of test No. 1 shall be met. After the test the isolation limits of test No. 2 shall be met. During and on completion of the test the return loss limits of test No. 4 shall be met.	High temperature: Low temperature: Number of cycles: Rate of temperature change: Duration at extreme temperatures: Maximum sampling interval during the test: Measurements required:	+ 75 °C ± 2 °C - 40 °C ± 2 °C 10 1 °C/min 1 h 0,5 h Insertion loss shall be measured before, during and after the test. Return loss shall be measured before, during and after the test.

Table 1 (*continued*)

No.	Test	Requirement	Details	
11	**Temperature humidity cycling** IEC 61300-2-48	During and on completion of the test the insertion loss limits of test No. 1 shall be met. After the test the isolation limits of test No. 2 shall be met. During and on completion of the test the return loss limits of test No. 4 shall be met.	High temperature: Low temperature: Humidity at high temperature: Number of cycles: Rate of temperature change: Duration at extreme temperatures: Maximum sampling interval during the test: Measurements required:	+ 85 °C ± 2 °C - 40 °C ± 2 °C 85 % RH ± 5 % RH 42 1 °C/min 1 h 0,5 h Insertion loss shall be measured before, during and after the test. Return loss shall be measured before, during and after the test.
12	**Flexing Of The Strain Relief Of Fibre Optic Devices** IEC 61300-2-44	After the test the insertion loss limits of test No. 1 shall be met. After the test the isolation limits of test No. 2 shall be met. After the test the return loss limits of test No. 4 shall be met.	Magnitude of the load: Load application point: Number of cycles: Measurements required:	5,0 N ± 0,5 N for reinforced cable, 2,0 N ± 0,2 N for primary and secondary coated fibres 0,2 m from end of device 10 Insertion loss shall be measured before and after the test. Return loss shall be measured before and after the test.
13	**Torsion/Twist** IEC 61300-2-5	After the test the insertion loss limits of test No. 1 shall be met. After the test the isolation limits of test No. 2 shall be met. After the test the return loss limits of test No. 4 shall be met.	Magnitude of the load: Number of cycles: Measurements required	5,0 N ± 0,5 N for reinforced cable, 2,0 N ± 0,2 N for primary and secondary coated fibres 30 Insertion loss shall be measured before and after the test. Return loss shall be measured before and after the test.

Table 1 (*continued*)

No.	Test	Requirement	Details	
14	**Static Side Load** IEC 61300-2-42	After the test the insertion loss limits of test No. 1 shall be met. After the test the isolation limits of test No. 2 shall be met. After the test the return loss limits of test No. 4 shall be met.	Magnitude of the load: Load application point: Number of axes: Load rate: Duration of the load: Measurements required:	5,0 N ± 0,5 N for reinforced cable, 2,3 N ± 0,1 N for primary and secondary coated fibres 0,3 m from the end of device 2 mutually perpendicular directions 0,5 N/s 5s at 5,0 N for reinforced cable, 5s at 2,3 N for primary and secondary coated fibres Insertion loss shall be measured before and after the test. Return loss shall be measured before and after the test.
15	**Fibre/Cable Retention** IEC 61300-2-4	After the test the insertion loss limits of test No. 1 shall be met. After the test the isolation limits of test No. 2 shall be met. After the test the return loss limits of test No. 4 shall be met.	Magnitude of the load: Load application point: Load rate: Duration of the load: Measurements required:	10 N ± 1 N for reinforced cable 5,0 N ± 0,5 N for primary and secondary coated fibres 0,3 m from the end of device 0,5 N/s 120 s at 10 N 60 s at 5 N Insertion loss shall be measured before and after the test. Return loss shall be measured before and after the test.

Annex A
(normative)

Sample size, sequencing and grouping

Test groups and sequences shall be performed in sequential order. The samples are sourced as defined in Table A.1.

Table A.1 – Sample size and sequencing of tests

Sequence number	Test	Sample size	Test from which samples are sourced	Group
1	Insertion loss	12	New	1
2	Wavelength Isolation	12	1	
3	Directivity	12	2	
4	Return Loss	12	3	
5	Polarization Dependent Loss	12	4	
6	Optical Power Handling And Damage Threshold Characterization	12	5	
7	Damp Heat (Steady State)	12	6	
8	Vibration	12	7	
9	Shock	12	8	
10	Change Of Temperature	12	9	
11	Temperature Humidity Cycling	12	10	
12	Flexing Of The Strain Relief Of Fibre Optic Devices	12	11	
13	Torsion/Twist	12	12	
14	Static Side Load	12	13	
15	Fibre/Cable Retention	12	14	

Annex B
(informative)

General information for 1 310 nm upstream and 1 490 nm downstream PON WWDM device

The 1 310 nm upstream and 1 490 nm downstream PON WWDM devices are used inside the PON for facilitating the transport of downstream traffic from the central office (CO) optical line terminal (OLT) with the upstream signal from the optical network unit (ONU) installed at the premises. They can also be used to combine and separate the downstream and upstream traffic at the customer for the ONU with individual transmitters and receivers as optical network terminals (ONT).

These multiplex and demultiplex the voice and data similar to Figure B.1:

– 1 310 nm channel for Data/Voice upstream

– 1 490 nm channel for Data/Voice downstream

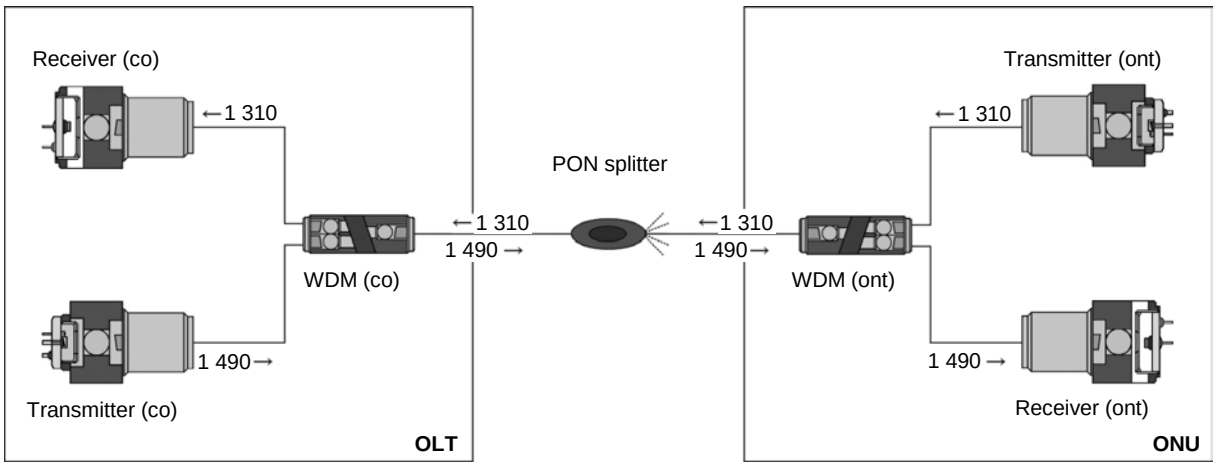

Figure B.1 – Example for 1 490 nm downstream and 1 310 nm upstream WWDM at central office and customer side

NOTE Typically the device in the OLT is subjected to Category C as the OLT is used inside the CO. Depending whether the ONU is installed inside or outside the premises, the device is subjected to either Category C or Category O.

Bibliography

ITU-T Recommendation G.983.3, *A broadband optical access system with increased service capability by wavelength allocation*

ITU-T Recommendation G.984.2, *Gigabit-capable Passive Optical Networks (G-PON): Physical Media Dependent (PMD) layer specification*

ITU-T Recommendation G.671, *Transmission characteristics of optical components and subsystems*

IEEE Std 802.3ah.-2004, *IEEE Standard for Local and metropolitan area networks – Specific requirements – Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications Amendment: Media Access Control Parameters, Physical Layers, and Management Parameters for Subscriber Access Networks*

_____

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

3, rue de Varembé
PO Box 131
CH-1211 Geneva 20
Switzerland

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