IEC 61753-081-2

Edition 2.0 2014-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic interconnecting devices and passive components – Performance standard –
Part 081-2: Non-connectorized single-mode fibre optic middle-scale 1 × N DWDM devices for category C – Controlled environments

Dispositifs d'interconnexion et composants passifs à fibres optiques – Norme de performance –
Partie 081-2: Dispositifs DWDM 1 × N de milieu d'échelle à fibres optiques unimodales, non connectorisés, pour catégorie C – Environnements contrôlés

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 081-2: Non-connectorized single-mode fibre optic middle-scale 1 × N DWDM devices for category C – Controlled environments

FOREWORD

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International Standard IEC 61753-081-2 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 2009 and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

– to add passband ripple as a test item;
– to revise details to be specified and the formats of Tables 2, 3 and 4;
– to add IEC 61300-3-38 as a normative reference.

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This bilingual version (2015-12) corresponds to the monolingual English version, published in 2014-04.

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

CDV	Report on voting
86B/3646/CDV	86B/3720/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.

The French version of this standard has not been voted upon.

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 standards*, can be found on the IEC website.

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

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 081-2: Non-connectorized single-mode fibre optic middle-scale 1 × N DWDM devices for category C – Controlled environments

1 Scope

This part of IEC 61753 contains the minimum initial test and measurement requirements and severities which a fibre optic middle-scale 1 × N (16 ≤N ≤64) DWDM (dense wavelength division multiplexing) device with channel spacing of 50 GHz, 100 GHz or 200 GHz needs to satisfy in order to be categorized as meeting the requirements of category C – Controlled environment. The requirements are given for the DWDM devices with Gaussian passband profile and flat-top passband profile. The requirements cover devices with single-mode non-connectorized pigtails and no circuit board.

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 60793-2-50:2012, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

IEC 60794-2-50, *Optical fibre cables – Part 2-50: Indoor cables – Family specification for simplex and duplex cables for use in terminated cable assemblies*

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 61300-2-9, *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 – High optical power*

IEC 61300-2-17, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-17: Tests – Cold*

IEC 61300-2-18, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-18: Tests – Dry heat – High temperature endurance*

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

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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 61300-3-2, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-2: Examinations and measurements – Polarization dependence of attenuation in a 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 61300-3-20, *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 61300-3-29, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-29: Examinations and measurements – Measurement techniques for characterizing the amplitude of the spectral transfer function of DWDM components*

IEC 61300-3-32, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-32: Examinations and measurements – Polarization mode dispersion measurement for passive optical components*

IEC 61300-3-38, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-38: Examinations and measurements – Group delay, chromatic dispersion and phase ripple*

IEC 61753-021-2, *Fibre optic interconnecting devices and passive components performance standard – Part 021-2: Fibre optic connectors terminated on single mode fibre for category C –Controlled environment*

IEC 62074-1, *Fibre optic WDM devices – Part 1: Generic specification*

ITU-T Recommendation G series – Supplement 39, *Optical system design and engineering considerations*

ITU-T Recommendation G.692, *Optical interfaces for multichannel systems with optical amplifiers*

ITU-T Recommendation G.694.1, *Spectral grids for WDM applications: DWDM frequency grid*

3 Terms and definitions

For the purposes of this document, the following terms and definitions, as well as those given in IEC 62074-1, apply.

3.1
middle-scale 1 × N DWDM device
wavelength-selective branching device which performs the function both of a wavelength multiplexer and demultiplexer with DWDM channel spacing of 50 GHz, 100 GHz or 200 GHz and a number of channels (N) equalling 16 ~ 64

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3.2
type A (Gaussian passband profile)
middle-scale 1 × N DWDM device whose passband profile is Gaussian shape

3.3
type B (Flat-top passband profile)
middle-scale 1 × N DWDM device whose passband profile is flat-top shape

4 Test conditions – General

Unless otherwise specified, all test methods shall be in accordance with the IEC 61300 series. The samples shall be terminated onto single-mode fibres as per IEC 60793-2-50:2012 category B1.1 or B1.3 or B6 in either coated fibres (primary and secondary) or reinforced cable format as per IEC 60794-2-50. DWDM devices used for each test are intended to be previously unstressed new samples but may also be selected from previously used samples, if desired. All measurements shall be carried out at normal room temperature, unless otherwise stated. If the device is provided with an active temperature control, this shall be set at the set-point specified by the manufacturer.

The requirements apply to every combination of input and output port.

All tests shall be carried out to validate performance over the required operating wavelength range. As a result, single or multiple spectral bands may be chosen for the qualification and differing target specifications may be assigned to each spectral band.

The following Table 1 is intended to provide guidance on the wavelength ranges of the various spectral bands. It is not intended for specification. Values of operating wavelength used in performance verification shall be defined in the manufacturer's specification.

Table 1 – Spectral bands for single-mode systems [a]

Band	Descriptor	Range nm
O-band	Original	1 260 to 1 360
E-band	Extended	1 360 to 1 460
S-band	Short wavelength	1 460 to 1 530
C-band	Conventional	1 530 to 1 565
L-band	Long wavelength	1 565 to 1 625
U-band	Ultralong wavelength	1 625 to 1 675

[a] Taken from ITU-T G-series Recommendations – Supplement 39, *Optical system design and engineering considerations*

5 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.

6 Reference components

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

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7 Performance requirements

7.1 Dimensions

Dimensions shall comply with those given in appropriate manufacturers' drawings.

7.2 Test details and requirements

The device is equipped with no circuit-board including a temperature controller. The requirements are given only for pigtailed DWDM devices. For connectorized components, the connector performances shall be in compliance with IEC 61753-021-2.

A minimum length of fibre or cable of 2,0 m per port shall be included in all climatic and environmental tests. The operating wavelengths, unless otherwise specified, shall be in accordance with ITU-T Recommendation G.692 and G.694.1. Where devices with wavelength spaced channels have to be considered, the conversion should refer to vacuum wavelength.

Table 2 – Test and requirements for type A (Gaussian passband profile)

No	Tests	Requirements	Details	
1A	Number of channels: N	16 ≤ N ≤64	Operating wavelength: NOTE:	ITU-T grid or custom design Design information (not test item)
2A	Channel frequency range	Channel central frequency ± 0,125 × Δf where Δf is the channel spacing	Channel central frequency: NOTE:	ITU-T grid or custom design Design information (not test item) ITU-T Recommendation G.694.1
3A	Attenuation (insertion loss) IEC 61300-3-29	≤ 4,3 dB (channel n° ≤ 24) ≤ 4,8 dB (channel n° > 24) Maximum allowable insertion loss over the channel frequency range	Launch fibre length: Measurement uncertainty: NOTE:	≥ 2,0 m ± 0,05 dB The insertion loss is determined as the worst case over all states of polarization
4A	Channel non-uniformity IEC 61300-3-29	≤ 1,0 dB (channel n°. ≤24) ≤ 1,5 dB (channel n° >24) Maximum allowable channel non-uniformity of insertion losses	Launch fibre length: Measurement uncertainty: NOTE:	≥ 2,0 m ± 0,05 dB The channel non-uniformity shall be determined as the worst case over all states of polarization
5A	1 dB passband width IEC 61300-3-29	≥ 0,25 × Δf where Δf is the channel spacing. Minimum allowable 1 dB passband width (centred at the channel frequency)	Launch fibre length: Measurement uncertainty: NOTE:	≥ 2,0 m ± 0,01 × Δf The 1 dB passband width shall be determined as the worst case over all states of polarization
6A	3 dB passband width IEC 61300-3-29	≥ 0,5 × Δf where Δf is the channel spacing Minimum allowable 3 dB passband width (centred at the channel frequency)	Launch fibre length: Measurement uncertainty: NOTE:	≥ 2,0 m ± 0,01 × Δf The 3 dB passband width is determined as the worst case over all states of polarization

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Table 2 *(continued)*

No	Tests	Requirements	Details	
7A	Passband ripple IEC 61300-3-29	≤ 1,5 dB Maximum insertion loss variation within the channel frequency range	Launch fibre length: Measurement uncertainty: NOTE:	≥ 2,0 m ± 0,05 dB The passband ripple is determined as the worst case over all states of polarization.
8A	Adjacent channel crosstalk IEC 61300-3-29	≤ –25 dB Maximum allowable adjacent channel crosstalk over the channel frequency range	Launch fibre length: Measurement uncertainty: NOTE:	≥ 2,0 m ± 0,1 dB The adjacent channel crosstalk is specified only for demultiplexer. The adjacent channel crosstalk is determined as the worst case over all states of polarization
9A	Non-adjacent channel crosstalk IEC 61300-3-29	≤ –30 dB Maximum allowable non-adjacent channel crosstalk over the channel frequency range	Launch fibre length: Measurement uncertainty: NOTE:	≥ 2,0 m ± 0,1 dB The non-adjacent channel crosstalk is specified only for demultiplexer. The non-adjacent channel crosstalk is determined as the worst case over all states of polarization
10A	Total channel crosstalk IEC 61300-3-29	≤ –22 dB (channel n° ≤40) ≤ –20 dB (channel n° >40) Maximum allowable total channel crosstalk value	Launch fibre length: Measurement uncertainty: NOTE:	≥ 2,0 m ± 0,1 dB The total channel crosstalk is specified only for demultiplexer. The total channel crosstalk is determined as the worst case over all states of polarization
11A	Polarization dependent loss (PDL) IEC 61300-3-2	≤ 0,4 dB Maximum allowable PDL over the channel frequency range	Launch fibre length: Measurement uncertainty: NOTE:	≥ 2,0 m ± 0,05 dB The allowable PDL combination applies to all combination of input and output ports
12A	Polarization mode dispersion (PMD) IEC 61300-3-32	≤ 0,5 ps Maximum allowable PMD over the channel frequency range	Launch fibre length: Measurement uncertainty: NOTE:	≥.2,0 m ±.0,1 dB The allowable PMD combination applies to all combination of input and output ports.

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Table 2 *(continued)*

No	Tests	Requirements	Details	
13A	Chromatic dispersion (CD) IEC 61300-3-38	≤ 20 ps/nm for 100 GHz channel spacing ≤ 60 ps/nm for 50 GHz channel spacing Maximum allowable CD over the channel frequency range (absolute value)	Launch fibre length: Measurement uncertainty: NOTE:	≥ 2,0 m ± 1 ps The allowable CD combination applies to all combination of input and output ports.
14A	Return loss IEC 61300-3-6	≥ 40 dB Minimum allowable return loss	Launch fibre length: Measurement uncertainty: NOTE:	≥ 2,0 m ± 1 dB All ports not under test is terminated to avoid unwanted reflections contributing to the measurement.
15A	Directivity IEC 61300-3-20	≥ 40 dB Minimum allowable directivity	Launch fibre length: Measurement uncertainty: NOTE:	≥ 2,0 m ± 1 dB All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement. The directivity is measured between any pair of input or output ports
16A	High optical power IEC 61300-2-14	Before and after the test, the limits of insertion loss and return loss of test 3A and 14A shall be met. During the test, the insertion loss change is monitored. During and after the test, the insertion loss change shall be within ±0,3 dB of the initial value. During the test, the return loss change is monitored. The sum of the initial value and the change of the return loss shall be within the value defined at test 14A	Optical power: Wavelength: Duration of the optical power exposure: Temperature: Relative humidity: Input port: Measurement uncertainty:	300 mW 1 550 nm 30 min 60 °C ± 2° C $93\ ^{+2}_{-3}$ % RH Single input port ± 0,05 dB for insertion loss measurement ± 1 dB for return loss measurement

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