

PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

**Fibre optic interconnecting devices and passive components performance standard –
Part 088-2: Non-connectorised single-mode fibre optic LAN WDM devices with
channel spacing of 800 GHz for category C – Controlled environments**



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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS PERFORMANCE STANDARD –

Part 088-2: Non-connectorised single-mode fibre optic LAN WDM devices with channel spacing of 800 GHz for category C – Controlled environments

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This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS PERFORMANCE STANDARD –

Part 088-2: Non-connectorised single-mode fibre optic LAN WDM devices with channel spacing of 800 GHz for category C – Controlled environments

1 Scope

This Publicly Available Specification (PAS) contains the minimum initial test and measurement requirements and severities which a non-connectorised single-mode fibre optic Local Area Network Wavelength Division Multiplexing (LAN WDM) device with channel spacing of 800 GHz needs to satisfy in order to be categorised as meeting the requirements of category C – Controlled environments, as defined in Annex A of IEC 61753-1. The applications of LAN WDM devices are optical MUX and DEMUX for 100GBASE-LR4 (required operating range of 2 m to 10 km) and 100GBASE-ER4 (required operating range of 2 m to 30 km) defined in IEEE Draft P802.3ba, as shown in Annex D. The requirements cover both an integrated 1 × 4 LAN WDM device and an individual 1 × 2 LAN WDM device for cascaded module construction.

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 61300 (all parts), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures*

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 – Optical power handling and damage threshold characterization*

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)*

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: Examination and measurements – Polarization dependent loss in a single-mode fibre optic device*

IEC 61300-3-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-4: Examinations and measurements – Attenuation*

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 61753-1:2007, *Fibre optic interconnecting devices and passive components performance standard – Part 1: General and guidance for performance standard*

IEC 61753-021-2, *Fibre optic interconnecting devices and passive components performance standard – Part 021-2: Grade C/3 single-mode fibre optic connectors for category C – Controlled environment*

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

ITU-T Recommendation G.692:1998, *Optical interfaces for multichannel systems with optical amplifiers*

ITU-T Recommendation G.694.1:2002, *Spectral grids for WDM applications: DWDM frequency grid*

ITU-T Recommendation G.959.1 version 10.4: June 2009, *Optical transport network physical layer interfaces*

IEEE P802.3ba D2.1: May 2009, Part 3: *Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications*

3 LAN WDM device types

3.1 LAN WDM device

A LAN WDM device is a wavelength-selective branching device which performs the function both of wavelength multiplexing and demultiplexing with DWDM channel frequency that are 231,4 THz, 230,6 THz, 229,8 THz, and 229,0 THz, where the channel frequency spacing is 800 GHz.

3.2 Integrated 1 × 4 LAN WDM device

An integrated 1 × 4 LAN WDM device single-mode fibre-pigtailed wavelength-selective branching device is shown in Figure 1. There are 1 common port (P0) and 4 input/output ports (P1-P4) corresponding to the 4 frequency channels.



Figure 1 – Configuration of integrated 1 × 4 LAN WDM device

3.3 Individual 1 × 2 LAN WDM device

An individual 1 × 2 LAN WDM device single-mode fibre-pigtailed wavelength-selective branching device is shown in Figure 2. There are 4 types of individual 1 × 2 LAN WDM devices, corresponding to the 4 frequency channels. There are 1 common port (P0) and 2 input/output ports (P1, P2). The signal of corresponding channel frequency passes through between P0 and P1. The signal of not corresponding channel frequencies passes through between P0 and P2.

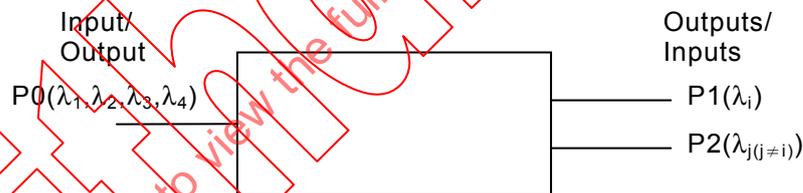


Figure 2 – Configuration of individual 1 × 2 LAN WDM device

4 Test conditions

Unless otherwise specified, all test methods are in accordance with the IEC 61300 series of standards. LAN WDM 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 under standard atmospheric conditions, unless otherwise specified. 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 ports.

All tests are to be carried out to validate performance over the required operating channel frequency 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.

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 test for these components does not require the use of reference components.

7 Performance requirements

7.1 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.

7.2 Test details and requirements

The requirements are given only for pigtailed DWDM devices. For connectorised components the connector performance shall be in compliance with IEC 61753-021-2.

A minimum length of fibre or cable of 1,0 m per port shall be included in all climatic and environmental test chambers. The operating wavelengths, unless otherwise specified, shall be in accordance with ITU-T Recommendations G.692 and G.694.1 (Frequency Spacing).

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Table 1 – Test details and requirements

No	Tests	Requirements	Details
A	Centre frequency	- channel 1: 231,4 THz (1 295,56 nm) - channel 2: 230,6 THz (1 300,05 nm) - channel 3: 229,8 THz (1 304,58 nm) - channel 4: 229,0 THz (1 309,14 nm)	Design information (not test item). IEC 62074-1 ITU-T Recommendation G.959.1 IEEE Draft P802.3ba
B	Channel spacing	800 GHz	Design information (not test item). IEC 62074-1 ITU-T Recommendation G.959.1 IEEE Draft P802.3ba
C	Channel frequency range	Centre frequency ± 184 GHz - channel 1: 231,584 THz – 231,216 THz (1 294,53 nm – 1 296,59 nm) - channel 2: 230,784 THz – 230,416 THz (1 299,02 nm – 1 301,09 nm) - channel 3: 229,984 THz – 229,616 THz (1 303,54 nm – 1 305,63 nm) - channel 4: 229,184 THz – 228,816 THz (1 308,09 nm – 1 310,19 nm)	Design information (not test item). IEC 62074-1 ITU-T Recommendation G.959.1 IEEE Draft P802.3ba
1	Insertion loss (IL)	Maximum allowable insertion loss over the channel frequency range: 2,0 dB (Integrated 1 \times 4 LAN WDM device) See Annex B. 0,85 dB for P0-P1 (Individual 1 \times 2 LAN WDM device) See Annex C. 0,45 dB for P0-P2 (Individual 1 \times 2 LAN WDM device) See Annex C.	IEC 61300-3-4 Condition: the insertion loss shall be determined as the worst case over all states of polarisation. Launch fibre length: $\geq 1,0$ m. The test conditions shall provide loss measurement results with measurement uncertainty of less than $\pm 0,05$ dB over the operating channel frequency range.
2	Adjacent channel isolation	Minimum allowable adjacent channel isolation over the channel frequency range: 25 dB (Integrated 1 \times 4 LAN WDM device) See Annex B. 25 dB for P0-P1 (Individual 1 \times 2 LAN WDM device) See Annex C. 14 dB for P0-P2 (Individual 1 \times 2 LAN WDM device) See Annex C.	IEC 61300-3-29 The adjacent channel isolation is specified only for DEMUX. Condition: the adjacent channel isolation shall be determined as the average case over all states of polarisation. Launch fibre length: $\geq 1,0$ m. The test conditions shall provide isolation measurement results with measurement uncertainty of less than $\pm 0,1$ dB over the operating channel frequency range.
3	Non-adjacent channel isolation	Minimum allowable non-adjacent channel isolation over the channel frequency range: 35 dB (Integrated 1 \times 4 LAN WDM device) See Annex B. 35 dB for P0-P1 (Individual 1 \times 2 LAN WDM device) See Annex C. 14 dB for P0-P2 (Individual 1 \times 2 LAN WDM device) See Annex C.	IEC 61300-3-29 The non-adjacent channel isolation is specified only for DEMUX. Condition: the non-adjacent channel isolation shall be determined as the average case over all states of polarisation. Launch fibre length: $\geq 1,0$ m. The test conditions shall provide isolation measurement results with measurement uncertainty of less than $\pm 0,1$ dB over the operating channel frequency range.
4	Return loss	Minimum allowable return loss over the channel frequency range: 40 dB Grade R	IEC 61300-3-6, IEC 61753-1 Condition: All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement. Launch fibre length: $\geq 1,0$ m.

Table 1 (continued)

No	Tests	Requirements	Details
5	Directivity	Maximum allowable directivity over the channel frequency range: 50 dB Grade U	IEC 61300-3-20, IEC 61753-1 Condition: All ports not under test shall be terminated to avoid unwanted reflections contributing to the measurement. Launch fibre length: $\geq 1,0$ m.
6	Polarisation dependent loss (PDL)	Maximum allowable PDL over the channel frequency range: 0,5 dB	IEC 61300-3-2 The allowable PDL combination applies to all combination of input and output ports. Launch fibre length: $\geq 1,0$ m.
7	Optical power handling and damage threshold characterisation	During the test the insertion loss limits of test no. 1 shall be met. Moreover, during and on completion of the test, the insertion loss shall be within $\pm 0,5$ dB of original value under ambient environmental conditions. On completion of the test the adjacent channel isolation limits of test no. 2 shall be met. On completion of the test the non-adjacent channel isolation limits of test no. 3 shall be met. On completion of the test the return loss limits of test no. 4 shall be met.	IEC 61300-2-14 Source type: LD Total input power to be applied: +15,5 dBm Test duration: 30 min Test results should be obtained under attenuation measurement uncertainty of less than $\pm 0,1$ dB. Test results should be obtained under return loss measurement uncertainty of less than ± 1 dB
8	Cold	During the test the insertion loss limits of test no. 1 shall be met. Moreover, during and on completion of the test, the insertion loss shall be within $\pm 0,5$ dB of original value under ambient environmental conditions. On completion of the test the adjacent channel isolation limits of test no. 2 shall be met. On completion of the test the non-adjacent channel isolation limits of test no. 3 shall be met. On completion of the test the return loss limits of test no. 4 shall be met.	IEC 61300-2-17 Temperature: $-10^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Duration of exposure: 96 h Preconditioning procedure: Before test, devices under test (DUTs) shall be maintained at room temperature condition for 2 h. During the test the insertion loss value shall be measured at a maximum interval of 1 h. Recovery procedure: After test, DUTs shall be maintained at room temperature condition for 2 h.
9	High temperature endurance	During the test the insertion loss limits of test no. 1 shall be met. Moreover, during and on completion of the test, the insertion loss shall be within $\pm 0,5$ dB of original value under ambient environmental conditions. On completion of the test the adjacent channel isolation limits of test no. 2 shall be met. On completion of the test the non-adjacent channel isolation limits of test no. 3 shall be met. On completion of the test the return loss limits of test no. 4 shall be met.	IEC 61300-2-18 Temperature: $+60^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Humidity is not controlled. Duration of exposure: 96 h Preconditioning procedure: Before test, DUTs shall be maintained in room temperature condition for 2 h. During the test the insertion loss value shall be measured at a maximum interval of 1 h. Recovery procedure: After test, DUTs shall be maintained in room temperature condition for 2 h.

Table 1 (continued)

No	Tests	Requirements	Details
10	Damp heat (steady state)	<p>During the test the insertion loss limits of test no. 1 shall be met. Moreover, during and on completion of the test, the insertion loss shall be within $\pm 0,5$ dB of original value under ambient environmental conditions.</p> <p>On completion of the test the adjacent channel isolation limits of test no. 2 shall be met.</p> <p>On completion of the test the non-adjacent channel isolation limits of test no. 3 shall be met.</p> <p>On completion of the test the return loss limits of test no. 4 shall be met.</p>	<p>IEC 61300-2-19</p> <p>Temperature: - $+40^{\circ}\text{C} \pm 2^{\circ}\text{C}$</p> <p>Relative humidity: 93 % $+2\%$ to -3%</p> <p>Duration of exposure: 96 h</p> <p>Preconditioning procedure: Before test, DUTs shall be maintained in room temperature condition for 2 h.</p> <p>During the test the insertion loss value shall be measured at a maximum interval of 1 h.</p> <p>Recovery procedure: After test, DUTs shall be maintained in room temperature condition for 2 h.</p>
11	Change of temperature	<p>During the test the insertion loss limits of test no. 1 shall be met. Moreover, during and on completion of the test, the insertion loss shall be within $\pm 0,5$ dB of original value under ambient environmental conditions.</p> <p>On completion of the test the adjacent channel isolation limits of test no. 2 shall be met.</p> <p>On completion of the test the non-adjacent channel isolation limits of test no. 3 shall be met.</p> <p>On completion of the test the return loss limits of test no. 4 shall be met.</p>	<p>IEC 61300-2-22</p> <p>High temperature: - $+60^{\circ}\text{C} \pm 2^{\circ}\text{C}$</p> <p>Low temperature: - $10^{\circ}\text{C} \pm 2^{\circ}\text{C}$</p> <p>Humidity is not controlled.</p> <p>Duration at extreme temperatures: 1 h</p> <p>Temperature rate of change: $1^{\circ}\text{C}/\text{min}$</p> <p>Number of cycles: 5</p> <p>Preconditioning procedure: Before test, DUTs shall be maintained in room temperature condition for 2 h.</p> <p>During the test the Insertion Loss value shall be measured at a maximum interval of 30 min.</p> <p>Recovery procedure: After test, DUTs shall be maintained in room temperature condition for 2 h.</p>
12	Vibration (sinusoidal)	<p>On completion of the test the insertion loss limits of test no. 1 shall be met.</p> <p>On completion of the test the adjacent channel isolation limits of test no. 2 shall be met.</p> <p>On completion of the test the non-adjacent channel isolation limits of test no. 3 shall be met.</p> <p>On completion of the test the return loss limits of test no. 4 shall be met.</p>	<p>IEC 61300-2-1</p> <p>Frequency range: 10 Hz to 55 Hz</p> <p>Endurance duration per axis: 30 min</p> <p>Number of axes: Three orthogonal</p> <p>Number of sweeps: 15</p> <p>Vibration amplitude: 0,75 mm</p> <p>Method of mounting: The DUT shall be mounted rigidly to the mounting fixture.</p>

Table 1 (continued)

No	Tests	Requirements	Details
13	Fibre/cable retention	<p>On completion of the test the insertion loss limits of test no. 1 shall be met.</p> <p>On completion of the test the adjacent channel isolation limits of test no. 2 shall be met.</p> <p>On completion of the test the non-adjacent channel isolation limits of test no. 3 shall be met.</p> <p>On completion of the test the return loss limits of test no. 4 shall be met.</p>	<p>IEC 61300-2-4</p> <p>Magnitude & rate of application of the tensile load:</p> <p>10 N ± 1 N at a speed of 5 N/s for reinforced cables.</p> <p>5 N ± 0,5 N at a speed of 0,5 N/s for coated fibres.</p> <p>Duration of the test: 120 s at 10 N and 60 s at 5 N (maintaining the load)</p> <p>Point of application of tensile load: 0,3 m from the exit point of the fibre / cable from the DUT.</p> <p>Method of mounting: The sample shall be rigidly mounted such that the load is only applied to the fibre/cable retention mechanism.</p>
14	Shock	<p>On completion of the test the insertion loss limits of test no. 1 shall be met.</p> <p>On completion of the test the adjacent channel isolation limits of test no. 2 shall be met.</p> <p>On completion of the test the non-adjacent channel isolation limits of test no. 3 shall be met.</p> <p>On completion of the test the return loss limits of test no. 4 shall be met.</p>	<p>IEC 61300-2-9</p> <p>Shock: 500 G</p> <p>Number of axis: 6</p> <p>Number of shock: 2 per axis</p> <p>Duration: 1 ms duration</p> <p>Pulse: half sine</p>
15	Static side load	<p>On completion of the test the insertion loss limits of test no. 1 shall be met.</p> <p>On completion of the test the adjacent channel isolation limits of test no. 2 shall be met.</p> <p>On completion of the test the non-adjacent channel isolation limits of test no. 3 shall be met.</p> <p>On completion of the test the return loss limits of test no. 4 shall be met.</p>	<p>IEC 61300-2-42</p> <p>1 N for 1 h for reinforced cable.</p> <p>0,2 N for 5 min for coated fibres</p> <p>Two mutually perpendicular directions.</p>

Annex A
(normative)

Sample size

The number of samples to be evaluated for each test is defined in the sample size column.

Table A.1 – Number of samples for each test

No	Tests	Sample size
1	Insertion loss	12
2	Adjacent channel isolation	12
3	Non-adjacent channel Isolation	12
4	Return loss	12
5	Directivity	12
6	Polarisation dependent loss (PDL)	12
7	Optical power handling and damage threshold characterisation	6
8	Cold	6
9	High temperature endurance	6
10	Damp heat (steady state)	6
11	Change of temperature	6
12	Vibration (sinusoidal)	6
13	Fibre/cable retention	6
14	Shock	6
15	Static side load	6

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Annex B (informative)

Logarithmic transfer matrix for an integrated 1 × 4 LAN WDM device

IL_{P_1} is a maximum insertion loss between P0 and P1.

IL_{P_2} is a maximum insertion loss between P0 and P2.

IL_{P_3} is a maximum insertion loss between P0 and P3.

IL_{P_4} is a maximum insertion loss between P0 and P4.

Unit is dB.

**Table B.1 – Frequency range of channel 1: 231,584 THz – 231,216 THz
(1 294,53 nm – 1 296,59 nm)**

	P0	P1	P2	P3	P4
P0	> 40	< 2,0	> 25+ IL_{P_2}	> 35+ IL_{P_3}	> 35+ IL_{P_4}
P1	< 2,0	> 40	> 50	> 50	> 50
P2	> 25+ IL_{P_2}	> 50	> 40	> 50	> 50
P3	> 35+ IL_{P_3}	> 50	> 50	> 40	> 50
P4	> 35+ IL_{P_4}	> 50	> 50	> 50	> 40

**Table B.2 – Frequency range of channel 2: 230,784 THz – 230,416 THz
(1 299,02 nm – 1 301,09 nm)**

	P0	P1	P2	P3	P4
P0	> 40	> 25+ IL_{P_1}	< 2,0	> 25+ IL_{P_3}	> 35+ IL_{P_4}
P1	> 25+ IL_{P_1}	> 40	> 50	> 50	> 50
P2	< 2,0	> 50	> 40	> 50	> 50
P3	> 25+ IL_{P_3}	> 50	> 50	> 40	> 50
P4	> 35+ IL_{P_4}	> 50	> 50	> 50	> 40

**Table B.3 – Frequency range of channel 3: 229,984 THz – 229,616 THz
(1 303,54 nm – 1 305,63 nm)**

	P0	P1	P2	P3	P4
P0	> 40	> 35+ IL_{P_1}	> 25+ IL_{P_2}	< 2,0	> 25+ IL_{P_4}
P1	> 35+ IL_{P_1}	> 40	> 50	> 50	> 50
P2	> 25+ IL_{P_2}	> 50	> 40	> 50	> 50
P3	< 2,0	> 50	> 50	> 40	> 50
P4	> 25+ IL_{P_4}	> 50	> 50	> 50	> 40

**Table B.4 – Frequency range of channel 4: 229,184 THz – 228,816 THz
(1 308,09 nm – 1 310,19 nm)**

	P0	P1	P2	P3	P4
P0	> 40	> 35+IL _{P1}	> 35+IL _{P2}	> 25+IL _{P3}	< 2,0
P1	> 35+IL _{P1}	> 40	> 50	> 50	> 50
P2	> 35+IL _{P2}	> 50	> 40	> 50	> 50
P3	> 25+IL _{P3}	> 50	> 50	> 40	> 50
P4	< 2,0	> 50	> 50	> 50	> 40

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Annex C (Informative)

Logarithmic transfer matrix for an individual 1 × 2 LAN WDM device

IL_{P1} is a maximum insertion loss between P0 and P1.

IL_{P2} is a maximum insertion loss between P0 and P2.

Unit is dB.

Type 1

**Table C.1.1 – Frequency range of channel 1: 231,584 THz – 231,216 THz
(1 294,53 nm – 1 296,59 nm)**

	P0	P1	P2
P0	> 40	< 0,85	> 14 + IL_{P2}
P1	< 0,85	> 40	> 50
P2	> 14 + IL_{P2}	> 50	> 40

**Table C.1.2 – Frequency range of channel 2: 230,784 THz – 230,416 THz
(1 299,02 nm – 1 301,09 nm)**

	P0	P1	P2
P0	> 40	> 25 + IL_{P1}	< 0,45
P1	> 25 + IL_{P1}	> 40	> 50
P2	< 0,45	> 50	> 40

**Table C.1.3 – Frequency range of channel 3: 229,984 THz – 229,616 THz
(1 303,54 nm – 1 305,63 nm)**

	P0	P1	P2
P0	> 40	> 35 + IL_{P1}	< 0,45
P1	> 35 + IL_{P1}	> 40	> 50
P2	< 0,45	> 50	> 40

**Table C.1.4 – Frequency range of channel 4: 229,184 THz – 228,816 THz
(1 308,09 nm – 1 310,19 nm)**

	P0	P1	P2
P0	> 40	> 35 + IL_{P1}	< 0,45
P1	> 35 + IL_{P1}	> 40	> 50
P2	< 0,45	> 50	> 40

Type 2

**Table C.2.1 – Frequency range of channel 1: 231,584 THz – 231,216 THz
(1 294,53 nm – 1 296,59 nm)**

	P0	P1	P2
P0	> 40	> 25+IL _{P1}	< 0,45
P1	> 25+IL _{P1}	> 40	> 50
P2	< 0,45	> 50	> 40

**Table C.2.2 – Frequency range of channel 2: 230,784 THz – 230,416 THz
(1 299,02 nm – 1 301,09 nm)**

	P0	P1	P2
P0	> 40	< 0,85	> 14 +IL _{P2}
P1	< 0,85	> 40	> 50
P2	> 14 +IL _{P2}	> 50	> 40

**Table C.2.3 – Frequency range of channel 3: 229,984 THz – 229,616 THz
(1 303,54 nm – 1 305,63 nm)**

	P0	P1	P2
P0	> 40	> 25+IL _{P1}	< 0,45
P1	> 25+IL _{P1}	> 40	> 50
P2	< 0,45	> 50	> 40

**Table C.2.4 – Frequency range of channel 4: 229,184 THz – 228,816 THz
(1 308,09 nm – 1 310,19 nm)**

	P0	P1	P2
P0	> 40	> 35+IL _{P1}	< 0,45
P1	> 35+IL _{P1}	> 40	> 50
P2	< 0,45	> 50	> 40

Type 3

**Table C.3.1 – Frequency range of channel 1: 231,584 THz – 231,216 THz
(1 294,53 nm – 1 296,59 nm)**

	P0	P1	P2
P0	> 40	> 35+IL _{P1}	< 0,45
P1	> 35+IL _{P1}	> 40	> 50
P2	< 0,45	> 50	> 40

**Table C.3.2 – Frequency range of channel 2: 230,784 THz – 230,416 THz
(1 299,02 nm – 1 301,09 nm)**

	P0	P1	P2
P0	> 40	> 25+IL _{P1}	< 0,45
P1	> 25+IL _{P1}	> 40	> 50
P2	< 0,45	> 50	> 40

**Table C.3.3 – Frequency range of channel 3: 229,984 THz – 229,616 THz
(1 303,54 nm – 1 305,63 nm)**

	P0	P1	P2
P0	> 40	< 0,85	> 14 +IL _{P2}
P1	< 0,85	> 40	> 50
P2	> 14 +IL _{P2}	> 50	> 40

**Table C.3.4 – Frequency range of channel 4: 229,184 THz – 228,816 THz
(1 308,09 nm – 1 310,19 nm)**

	P0	P1	P2
P0	> 40	> 25+IL _{P1}	< 0,45
P1	> 25+IL _{P1}	> 40	> 50
P2	< 0,45	> 50	> 40

Type 4**Table C.4.1 – Frequency range of channel 1: 231,584 THz – 231,216 THz
(1 294,53 nm – 1 296,59 nm)**

	P0	P1	P2
P0	> 40	> 35+IL _{P1}	< 0,45
P1	> 35+IL _{P1}	> 40	> 50
P2	< 0,45	> 50	> 40

**Table C.4.2 – Frequency range of channel 2: 230,784 THz – 230,416 THz
(1 299,02 nm – 1 301,09 nm)**

	P0	P1	P2
P0	> 40	> 35+IL _{P1}	< 0,45
P1	> 35+IL _{P1}	> 40	> 50
P2	< 0,45	> 50	> 40

**Table C.4.3 – Frequency range of channel 3: 229,984 THz – 229,616 THz
(1 303,54 nm – 1 305,63 nm)**

	P0	P1	P2
P0	> 40	> 25+IL _{P1}	< 0,45
P1	> 25+IL _{P1}	> 40	> 50
P2	< 0,45	> 50	> 40

**Table C.4.4 – Frequency range of channel 4: 229,184 THz – 228,816 THz
(1 308,09 nm – 1 310,19 nm)**

	P0	P1	P2
P0	> 40	< 0,85	> 14 +IL _{P2}
P1	< 0,85	> 40	> 50
P2	> 14 +IL _{P2}	> 50	> 40

Annex D (informative)

General information for applications of integrated 1 × 4 LAN WDM devices

The applications of integrated 1 × 4 LAN WDM devices are optical MUX and DEMUX for 100GBASE-LR4 and 100GBASE-ER4 defined in IEEE Draft P802.3ba, as shown in Figure D.1.

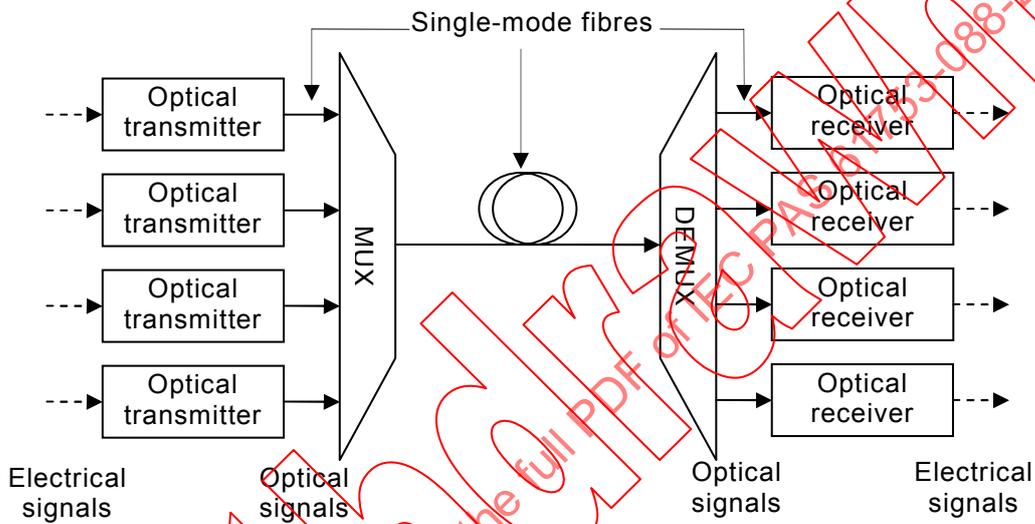


Figure D.1 → Block diagram for 100GBASE-LR4 and 100GBASE-ER4 transmit/receive paths