

TECHNICAL REPORT

**Dynamic modules –
Part 6-12: Design guidelines – Survey results on performance specifications for
 $1 \times N$ wavelength selective switches**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

DYNAMIC MODULES –

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IEC TR 62343-6-12 has been prepared by subcommittee 86C: Fibre optic systems and active devices of IEC technical committee 86: Fibre optics. It is a Technical report.

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

Draft	Report on voting
86C/1823/DTR	86C/1829/RVDTR

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

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 62343 series, published under the general title *Dynamic modules*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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- withdrawn,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

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INTRODUCTION

A wavelength selective switch (WSS) is a dynamic module (DM) which is predominantly used in reconfigurable optical add-drop multiplexers (ROADMs) in DWDM networks to switch a signal at a particular wavelength from a given input fibre to a selected output fibre. WSS modules can have multiple input ports and multiple output ports. Until recently, however, most commercial WSS modules were $1 \times N$ (or $N \times 1$) switches, with just a single input port and a plurality of output ports, or when operated in reverse, with a plurality of input ports and just a single output port. This document, therefore, focusses on the performance specifications for $1 \times N$ WSS's.

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DYNAMIC MODULES –

Part 6-12: Design guidelines – Survey results on performance specifications for $1 \times N$ wavelength selective switches

1 Scope

This part of IEC 62343, which is a Technical Report, reports the results of a recently conducted survey on performance specifications for $1 \times N$ wavelength selective switches. This information is intended to provide a framework for the preparation of performance specification standards for wavelength selective switches. The purpose of this document is to provide guidelines for performance values of the specification items listed in IEC 62343-3-3.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 62343:2023, *Dynamic modules – General and guidance*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 62343:2023 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Survey results

4.1 Survey contents

The survey asked participants for proposals of specification values to be used in standardizing the performance characterization of $1 \times N$ wavelength selective switches (WSSs), including but not limited to the items listed in the performance specification template of IEC 62343-3-3. The participants were encouraged to propose values for additional items to be standardized, so as to better characterize the performance of WSSs. It was not required for the respondent to be directly related to the production, development or application of WSSs.

4.2 Survey conditions

The survey was distributed to 18 companies, including suppliers and users of WSSs. It asked the participants to provide values for each specification item listed in the performance specification template of IEC 62343-3-3. The survey was conducted between October 2018 and January 2019.

4.3 Analysis of responses

After reviewing the responses from the survey, it was decided to classify them into two separate groups, which are referred to as group A and group B. Table 1 summarizes the responses. The results are displayed separately for each group and item.

Table 1 – Analysed results of performance specifications

No.	Test parameter	Unit	Group A	Group B
1	Operating wavelength	nm	1 528,578 to 1 567,337	1 528,578 to 1 566,928
2	Number of ports		11	2 and 4
3	Number of channels		129	1 to 128
4	Channel spacing	GHz	Flexible	Flexible
5	Channel frequency range IEC 62074-1	GHz	ITU-T G.694.1 ± 15	ITU-T G.694.1 ± 12,5
6	Insertion loss IEC 61300-3-29, IEC 62074-1	dB	≤ 7	≤ 6,5
7	Insertion loss uniformity IEC 61300-3-29	dB	≤ 1,5	≤ 1
8	Passband ripple IEC 61300-3-29	dB	≤ 0,5	≤ 0,8
9-1	0.5-dB passband width IEC 61300-3-29, IEC 62074-1	GHz	≥ 30	≥ 25
9-2	1-dB passband width IEC 61300-3-29, IEC 62074-1	GHz	-	≥ 27,5
9-3	3-dB passband width IEC 61300-3-29, IEC 62074-1	GHz	≥ 40	≥ 30
10	Return loss IEC 61300-3-6	dB	≥ 30	≥ 30
11	Adjacent channel crosstalk IEC 61300-3-29, IEC 62074-1	dB	-	≥ 30
12	Non-adjacent channel crosstalk IEC 61300-3-29, IEC 62074-1	dB	-	≥ 40
13	Total channel crosstalk IEC 61300-3-29, IEC 62074-1	dB	-	≥ 27
14	Transient crosstalk IEC 62343-5-2	dB	-	≥ 20
15	Channel blocking attenuation IEC 61300-3-7	dB	≥ 30	≥ 40
16	Attenuation without power IEC 61300-3-7	dB	≥ 40	≥ 20
17	Variable attenuation range IEC 61300-3-7	dB	20	15
18	Variable attenuation resolution	dB	0,1	0,1
19	Attenuation accuracy IEC 61300-3-14	dB	≤ 1	≤ 0,5
20	Response time for attenuation	ms	-	≤ 1 000

No.	Test parameter	Unit	Group A	Group B
21	Out of band attenuation IEC 61290-7-1	dB	≥ 25	≥ 15
22	Switching time IEC 61300-3-21	ms	≤ 1	≤ 1
23	Polarization dependent loss IEC 61300-3-2, IEC 62074-1	dB	≤ 0,8	≤ 0,8
24	Polarization mode dispersion IEC 61300-3-32, IEC 62074-1	ps	≤ 0,5	≤ 1
25	Group delay ripple IEC 61300-3-38	ps	≤ 10	≤ 10
26	Phase ripple IEC 61300-3-38	rad	-	-
27	Chromatic dispersion IEC 61300-3-38	ps/nm	-10 to 10	-10 to 10
28	Maximum input power (single channel) IEC 61300-2-14	dBm	≤ 15	≤ 10
29	Maximum input power (single port) IEC 61300-2-14	dBm	≤ 30	≤ 25
30	Storage temperature (range)	°C	-40 to +85	-40 to +85
31	Storage humidity	RH%	≤ 90	≤ 90
32	Operating case temperature	°C	-5 to +70	-
33	Operating humidity	RH %	≤ 85	≤ 90
34	Temperature control	(Equipped or not)	Equipped	Equipped
35	Supply voltage	V	5	3,3 / 5 / 15
36	Power consumption	W	40	18
37	Module size	mm	185 × 110 × 25	165 × 110 × 20
38	Fibre type IEC 60793-2-50		B-652.B B-657	B-652.B
39	Pigtail fibre length	m	1	1
40	Pigtail fibre buffer diameter	µm	250	250
41	Optical connector		LC	LC
42	Optical connector labelling		Colour code	C, 1,2,3,4
43	Electrical interface		No description	HIROSE DF11-18DP-2DSA
44	Communication interfaces		No description	RS-232C

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IEC 61300-2-14, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-14: Tests – High optical power*

IEC 61300-3-2, *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 61300-3-14, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-14: Examinations and measurements – Error and repeatability of the attenuation settings of a variable optical attenuator*

IEC 61300-3-21, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-21: Examinations and measurements – Switching time*

IEC 61300-3-29, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-29: Examinations and measurements – Spectral transfer characteristics of DWDM devices*

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 62343-3-3, *Dynamic modules – Performance specification templates – Wavelength selective switches*

IEC 62343-5-2, *Dynamic modules – Part 5-2: Test methods – 1 x N fixed-grid WSS – Dynamic crosstalk measurement*

IEC TR 62343-6-4, *Dynamic modules – Design guides – Part 6-4: Reconfigurable optical add/drop multiplexer*

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

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