IEC 62343

Edition 2.0 2017-05

INTERNATIONAL STANDARD

Dynamic modules – General and guidance

IEC 62343:2017-05(en)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.180.01, 33.180.99

ISBN 978-2-8322-4296-4

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

DYNAMIC MODULES – GENERAL AND GUIDANCE

FOREWORD

International Standard IEC 62343 has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 2013. This edition constitutes a technical revision.

This edition includes the following significant technical change with respect to the previous edition: the inclusion of definitions for the wavelength selective switch.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
86C/1444/FDIS	86C/1450/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.

A list of all the 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 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- withdrawn,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.

INTRODUCTION

IEC 62343 applies to dynamic devices as defined in IEC TS 62538. This document contains general guidance for the IEC 62343 series related to dynamic devices and definitions which apply to dynamic devices. The dynamic module (DM), or device, has two distinguishing characteristics: dynamic and module.

"Dynamic" highlights the functions of the products to include "tuning, varying, switching, configuring, and other continuous optimization," often accomplished by electronics, firmware, software or their combinations. The dynamic device usually has a certain level of intelligence to monitor or measure the situation and make decisions for necessary (optimization) actions. The behaviour of dynamic modules may be characterized by transient characteristics as the dynamic module undergoes tuning, switching, configuring and other continuous optimization. Characterization of transient characteristics will be considered in individual dynamic module standards.

"Module" defines that the products covered by the standard are the integration of active and passive components (either or both), through interconnecting materials or devices. The controlling electronics can be inside or outside the optical package (that contains all or most of the optical components and interconnection). The product can look like a small printed wiring board (PWB or child-board with mounted optical module) or a small box (housing) with optical components and electronics enclosed. In the former case, it is more like an assembly (generally not packaged in a box or housing) than a module (generally packaged in a box or housing).

For historical reasons and convenience, a dynamic module or device is referred to as a dynamic module in the IEC 62343 series.

The number of dynamic modules and devices is rapidly growing as optical communications networks evolve. The following list provides some examples of the products covered by the IEC 62343 series. It should be noted that the list is not exhaustive and the products to be covered are not limited by the listed examples:

- channel gain equalizer;
- dynamic channel equalizer;
- dynamic gain tilt equalizer;
- dynamic slope equalizer;
- tuneable chromatic dispersion compensator;
- polarization mode dispersion compensator;
- reconfigurable optical add-drop multiplexer;
- switch with monitoring and controls;
- variable optical attenuator with monitoring and controls;
- optical channel monitor;
- wavelength selective switch;
- multicast optical switch.

The IEC 62343 series will cover performance templates, performance standards, reliability qualification requirements, hardware and software interfaces, and related testing methods.

The structure of the IEC 62343 series, under the general title *Dynamic modules,* is as follows:

- 62343-1 series Part 1: Performance standards
- 62343-2 series Part 2: Reliability qualification

- 62343-3 series Part 3: Performance specification templates
- 62343-4 series Part 4: Software and hardware interface standards
- 62343-5 series Part 5: Test methods
- 62343-6 series Part 6: Design guides

A complete set of standards related to a dynamic module or device should include the following:

- optical performance standards;
- reliability qualification standards;
- optical performance specification templates;
- hardware and software interface standards;
- test methods;
- technical reports.

The safety standards related to dynamic modules are mostly optical power considerations, which are covered by IEC TC 76: Optical radiation safety and laser equipment.

Only those dynamic modules for which standards are complete or in preparation are included in Clause 3. To reflect the rapidly growing market for dynamic modules, additional terms and definitions will be added in subsequent revisions as the series expands.

It should be noted that optical amplifiers could be regarded as dynamic modules. They are not included in the IEC 62343 series but are covered in their own series of IEC standards.

DYNAMIC MODULES – GENERAL AND GUIDANCE

1 Scope

IEC 62343 applies to all commercially available optical dynamic modules and devices. It describes the products covered by the IEC 62343 series, defines terminology, fundamental considerations and basic approaches.

The object of this document is to

- establish uniform requirements for operation, reliability and environmental properties of dynamic modules (DMs) to be implemented in the appropriate DM standard, and
- provide assistance to the purchaser in the selection of consistently high-quality DM products for his particular applications, as well as in the consultation of the appropriate specific DM standard(s).

This document covers performance templates, performance standards, reliability qualification requirements, hardware and software interfaces and related testing methods.

Since a dynamic module integrates an optical module/device, printed wiring board, and software/firmware, the standards developed in the series will mimic appropriate existing standards. On the other hand, since "dynamic module" is a relatively new product category, the dynamic module standards series will not be bounded by the existing practices where requirements differ.

The safety standards as related to dynamic modules are mostly optical power considerations, which is covered by IEC TC 76: Optical radiation safety and laser equipment.

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 60050-731, *International Electrotechnical Vocabulary – Chapter 731: Optical fibre communication*

IEC TR 61931, *Fibre optic – Terminology*

IEC Guide 107, *Electromagnetic compatibility – Guide to the drafting of electromagnetic compatibility publications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-731 and IEC TR 61931 and the following 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

NOTE 1 Some terms and definitions included in this document were first published in IEC 62343 (all parts). After the publication of this document, these terms and definitions will be removed from IEC 62343 (all parts) when the series is revised, and reference will be made to IEC 62343.

NOTE 2 The terms and definitions listed in Clause 3 refer to the meaning of the terms and definitions used in the specifications of DMs. Only those parameters listed in the appropriate performance standard in IEC 62343-1 (all parts) and performance specification templates in IEC 62343-3 (all parts) are intended to be specified.

NOTE 3 The list of parameter definitions of DMs given in Clause 3 is divided into subclauses by the type of DM.

3.1 General terms and definitions

3.1.1
optical dynamic device
optical device designed to monitor and control dynamically some characteristics of one or more optical signals, by means of suitable electronic controls, in order to improve or to maintain definite performances of the system in which it is intended to be inserted

Note 1 to entry: Said characteristics may include optical paths, optical intensities, spectral characteristics, polarization states, dispersion, etc.

Note 2 to entry: Optical dynamic devices may comprise optical active and optical passive elements or components.

Note 3 to entry: The control/response time of optical dynamic devices is much larger than the signal time characteristics and typically may range from few microseconds to tens of seconds.

[SOURCE: IEC TS 62538:2008, 2.1.1]

3.1.2
optical module
packaged integration of optical components and/or elements, accomplishing defined functionality, typically repairable and re-workable

[SOURCE: IEC TS 62538:2008, 2.2.5, modified – The notes to entry have been omitted.]

3.2 Dynamic module terms and definitions

3.2.1
channel
signal at wavelength, λ, that corresponds to ITU grid (ITU-T Recommendation G.694.1) within the range of operating wavelength range

[SOURCE: IEC 62343-3-3:2014, 3.4]

3.2.2
operating wavelength range
specified range of wavelengths from λ_{imin} to λ_{imax} about a nominal operating wavelength λ_{I}, within which a dynamic optical module is designed to operate with a specified performance

3.2.3
channel frequency range
frequency range within which a device is expected to operate with a specified performance

Note 1 to entry: For a particular nominal channel central frequency, f_{nomi}, this frequency range is from $f_{\mathrm{imin}} = (f_{\mathrm{nomi}} - \Delta f_{\mathrm{max}})$ to $f_{\mathrm{imax}} = (f_{\mathrm{nomi}} + \Delta f_{\mathrm{max}})$, where Δf_{max} is the maximum channel central frequency deviation.

3.2.4
channel spacing
centre-to-centre difference in frequency (or wavelength) between adjacent channels in a device

3.3 Dynamic channel equalizer (DCE) terms and definitions

3.3.1
dynamic channel equalizer
DCE
device capable of transforming, by internal or external automatic control, a multichannel input signal with time-varying averaged powers into an output signal in which all working channel powers are nominally equal or are set for a required level of pre-emphasis

Note 1 to entry: This device may also provide the extinction of one or more of the input channels.

3.3.2
channel non-uniformity
difference between the powers of the channel with the most power (in dBm) and the channel with the least power (in dBm)

Note 1 to entry: This applies to a multichannel signal across the operating wavelength range.

Note 2 to entry: Channel non-uniformity is expressed in dB.

3.3.3
in-band extinction ratio
within the operating wavelength range, the difference between the minimum power of the non-extinguished channels (in dBm) and the maximum power of the extinguished channels (in dBm)

Note 1 to entry: In-band extinction ratio is expressed in dB.

3.3.4
out-of-band attenuation
attenuation of channels that fall outside of the operating wavelength range

Note 1 to entry: Out-of-band attenuation is expressed in dB.

3.3.5
ripple
peak-to-peak difference in insertion loss within a channel frequency (or wavelength) range

3.3.6
channel response time
elapsed time it takes a device to transform a channel from a specified initial power level to a specified final power level desired state, when the resulting output channel non-uniformity tolerance is met, measured from the time the actuation energy is applied or removed

3.4 Tuneable dispersion compensator (TDC) or dynamic chromatic dispersion compensator (DCDC) terms and definitions

3.4.1
tuneable dispersion compensator
TDC
dynamic chromatic dispersion compensator
DCDC
two-port in-line device that is capable of transforming, by internal or external automatic control, an input signal with time-varying dispersion into an output signal in which an output channel dispersion value is set for a required level of value

3.4.2
insertion loss ripple
maximum peak-to-peak variation of the insertion loss within a channel frequency (or wavelength) range

3.4.3
dispersion tuning time
longest elapsed time it takes a module to change a dispersion setting from an arbitrary initial dispersion value to a desired final dispersion value, when the resulting dispersion target tolerance is met

3.5 Dynamic gain tilt equalizer (DGTE) terms and definitions

3.5.1
dynamic spectral equalizer
DSE
two port in-line dynamic module that converts an input signal with time-varying spectral shape into an output signal in which spectral shape is nominally flat, or is set for a required spectral shape for pre-emphasis

3.5.2
dynamic gain tilt equalizer
DGTE
dynamic spectral equalizer used in an optical amplifier that converts input signals with time-varying gain tilt into output signals in which gain tilt is nominally flat, or is set for a required gain tilt

3.5.3
dynamic gain tilt range
difference between the maximum and minimum deviation of attenuation over operating wavelength range, to which the dynamic gain tilt equalizer can be set

3.5.4
positive slope type
type of DGTE for which dynamic gain tilt range can be set for positive gain tilt

3.5.5
negative slope type
type of DGTE for which dynamic gain tilt range can be set for negative gain tilt

3.5.6
both slope type
type of DGTE to which dynamic gain tilt range can be set for both positive and negative gain tilt

3.5.7
slope linearity
maximum deviation of attenuation between the spectral shape by dynamic gain tilt equalizer and linear slope over the operating wavelength range

3.5.8
response time
longest elapsed time it takes a dynamic gain tilt equalizer to change a gain tilt setting from an arbitrary initial gain tilt value to a desired final gain tilt value, when the resulting gain tilt target tolerance is met

3.6 Optical channel monitor (OCM) terms and definitions

3.6.1
input channel plan
entire set of ITU channels on which the optical channel monitor is reporting

3.6.2
input channel frequency spacing tolerance
centre-to-centre difference in frequency (or wavelength) between adjacent channels in a device

3.6.3
input channel power dynamic range
full range of input power per channel between the saturation and sensitivity limits

3.6.4
input channel non-uniformity
difference (in dB) between the powers of the channel with the most power (in dBm) and the channel with the least power (in dBm) during one measurement within the response time

Note 1 to entry: This applies to a multichannel signal across the operating wavelength range.

3.6.5
input adjacent channel non-uniformity
difference between the powers of adjacent channels present during one measurement within the response time

Note 1 to entry: This applies to a multichannel signal across the operating wavelength range.

Note 2 to entry: In-band extinction ratio is expressed in dB.

3.6.6
input channel non-uniformity for channel identification
difference between the powers of the channel with the most power and the channel with the least power during one measurement within the response time for positively identifying all channels present and not falsely identifying channels that are not present

Note 1 to entry: This applies to a multichannel signal across the operating wavelength range.

Note 2 to entry: In-band extinction ratio is expressed in dB.

3.6.7
input adjacent channel non-uniformity for channel identification
difference between the powers of adjacent channels present during one measurement within the response time for positively identifying all channels present and not falsely identifying channels that are not present

Note 1 to entry: This applies to a multichannel signal across the operating wavelength range.

Note 2 to entry: In-band extinction ratio is expressed in dB.

3.6.8
input total band power dynamic range for channel measurements
full range of input total band power between the saturation or sensitivity limits of channel measurements

3.6.9
input total band power dynamic range for total band power measurements
full range of input total band power between the saturation or sensitivity limits of total band power measurements

3.6.10
input optical signal-noise ratio (OSNR) dynamic range
full range of input OSNR per channel within which the power, total band power and OSNR measurements remain within their respectively specified error limits

3.6.11
input channels bit rates
list of bit rates to which any channel may be modulated

3.6.12
reference measurement bandwidth
integration bandwidth of the optical power measurement

3.6.13
noise equivalent bandwidth
integration bandwidth of the optical noise measurement

3.6.14
channel power absolute error
maximum difference between the measured channel power and the calibrated reference channel power, within the specified measurement integration bandwidth, during one measurement within the response time, specified over all input and operating ranges

3.6.15
channel power relative error
maximum variation of the channel power absolute error, during one measurement within the response time, specified over all input and operating ranges

3.6.16
channel power variability
maximum variation of the channel power absolute error over the repeatability time interval at a given input and operating condition, specified over all input and operating ranges

3.6.17
channel power resolution interval
smallest increment of the reported channel power measurement value

3.6.18
channel power polarization dependent error
maximum power measurement difference over all polarization states at a given input and operating condition, during one measurement within the response time, specified over all input and operating ranges

3.6.19
total band power absolute error
difference between the measured total power and the calibrated total power reference, each integrated over the frequency band, during one measurement within the response time, specified over all input and operating ranges

3.6.20
total band power relative error
maximum variation of the total band absolute error, during one measurement within the response time, specified over all input and operating ranges

3.6.21
total band power variability
maximum variation of the total band power absolute error over the repeatability time interval at given input and operating conditions, specified over all input and operating ranges

3.6.22
total band power resolution interval
smallest increment of the reported total band power measurement value

3.6.23
frequency absolute error
maximum difference between the measured frequency and the calibrated reference frequency, during one measurement within the response time, specified over all input and operating ranges

3.6.24
frequency relative error
maximum variation of the frequency absolute error, during one measurement within the response time, specified over all input and operating ranges

3.6.25
frequency variability
maximum variation of the frequency absolute error over the repeatability time interval at given input and operating conditions, specified over all input and operating ranges

3.6.26
frequency resolution interval
smallest increment of the reported frequency measurement value

3.6.27
frequency polarization dependent error
maximum frequency measurement difference over all polarization states at given input and operating conditions, during one measurement within the response time, specified over all input and operating ranges

3.6.28
OSNR absolute error
maximum difference between the measured and the calibrated reference OSNR, during one measurement within the response time, specified over all input and operating ranges

3.6.29
OSNR relative error
maximum variation of the OSNR absolute error, during one measurement within the response time, specified over all input and operating ranges

3.6.30
OSNR variability
maximum variation of the OSNR absolute error over the repeatability time interval at given input and operating conditions, specified over all input and operating ranges

3.6.31
OSNR resolution interval
smallest increment of the reported OSNR measurement value

3.6.32
OSNR polarization dependent error
maximum OSNR measurement difference over all polarization states at given input and operating conditions, during one measurement within the response time, specified over all input and operating ranges

3.6.33
back reflection
fraction of the optical signal reflected at the input optical port over the entire band, specified over all input and operating ranges

3.6.34
response time
time required to perform the specified measurements for all channels and transfer these values over the communications interface to the external controller that issues a measurement request, specified over all input and operating ranges

3.6.35
repeatability time interval
minimum time interval over which a given measurement repeatability is performed

3.7 Wavelength selective switch (WSS) terms and definitions

3.7.1
wavelength selective switch
WSS
dynamic module with one or more input ports and one or more output ports, which is mainly used in a reconfigurable optical add drop multiplexer (ROADM) system to switch each wavelength signal on each input port independently to its required output port in dense wavelength division multiplexing (DWDM) networks

Note 1 to entry: It is electrically controlled with software.

Note 2 to entry: Optical paths through the WSS operate bi-directionally thus ports can be configured as either input or output ports.

Note 3 to entry: Each wavelength signal can be independently attenuated.

[SOURCE: IEC 62343-4-1:2016, 3.1.1, modified – Note 2 to entry has been replaced by a new note.]

3.7.2
insertion loss
IL
value of the reduction in optical power at a particular wavelength between the two conducting ports

Note 1 to entry: It is the reduction in optical power between an input and output port of a module expressed in decibels.

$$IL = -10 \log_{10} (P_{out}/P_{in})$$

where

P_{in} is the optical power launched into input port;

P_{out} is the optical power received from the output port.

[SOURCE: IEC 62343-3-3:2014, 3.7]

3.7.3
insertion loss uniformity
difference between the maximum and minimum insertion loss at the output for a specified set of input ports

[SOURCE: IEC 62343-3-3:2014, 3.8]

3.7.4
insertion loss ripple
maximum peak-to-peak variation of the insertion loss within a channel frequency (or wavelength) range

[SOURCE: IEC 62343-3-3:2014, 3.9]

3.7.5
X-dB passband width

width of a channel centred about the channel central wavelength within which the optical attenuation is within *X* dB

Note 1 to entry: The terms "operating wavelength range" or "channel passband" are used and have the same meaning as passband for DWDM devices. The *X*-dB bandwidth is defined through the spectral dependence of a_{ij} (where $i \neq j$) as the minimum wavelength range centred about the operating wavelength λ_h within which the variation of a_{ij} is less than *X* dB. The minimum wavelength range is determined considering thermal wavelength shift, polarization dependence and long-term aging shift (refer to Figure 1 below).

Note 2 to entry: It is recommended that the passband width be specified as 0,5 dB, 1 dB and 3 dB (*X* = 0,5, 1 and 3).

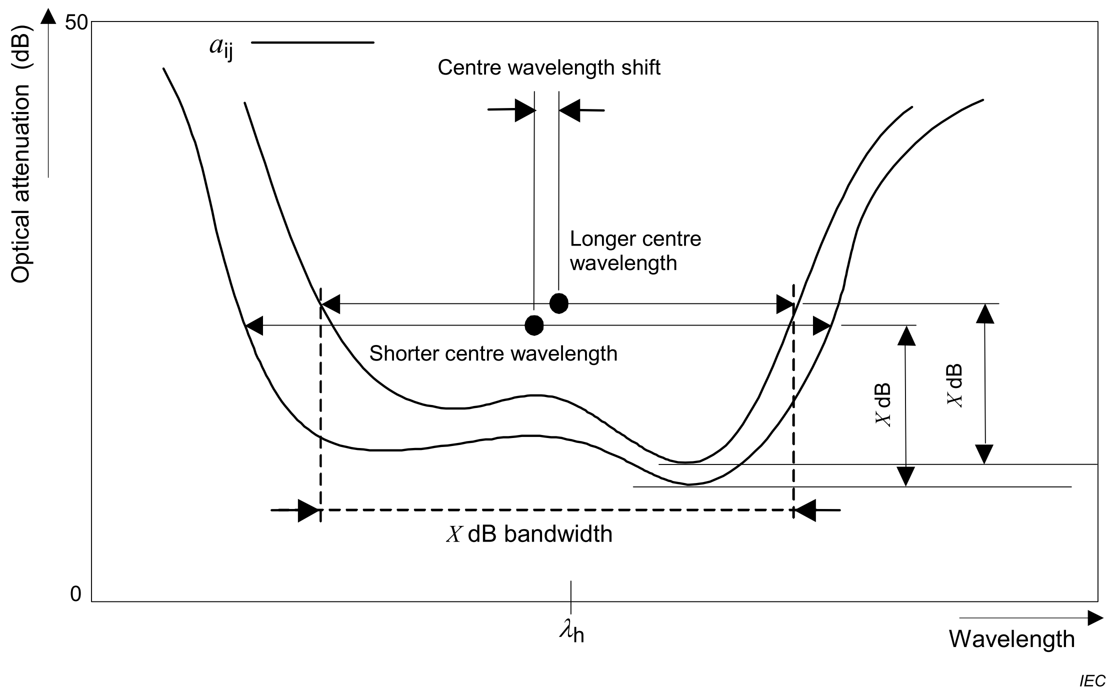


Figure 1 – Illustration of *X*-dB bandwidth

[SOURCE: IEC 62343-3-3:2014, 3.10]

3.7.6
return loss

RL

fraction of input power that is returned from any port of a module expressed in decibels and defined in this equation at the particular wavelength between two conducting ports

$$RL = -10 \log_{10} (P_{refl}/P_{in})$$

where

P_{in} is the optical power launched into port;

P_{refl} is the optical power received back from the same port.

[SOURCE: IEC 62343-3-3:2014, 3.11]

3.7.7
adjacent channel crosstalk

crosstalk restricted to the channels immediately adjacent to the (channel) wavelength number associated with output port

Note 1 to entry: Adjacent channel crosstalk is a negative value in dB (see Figure 2 below).

Note 2 to entry: The adjacent channel crosstalk is different from adjacent channel isolation. In Figure 2, an up pointing arrow shows positive, a down-pointing arrow negative. Generally, there are two adjacent channel crosstalks for the shorter wavelength (higher frequency) side and a longer wavelength (lower frequency) side.

Note 3 to entry: The term crosstalk and isolation are often used with almost the same in meaning. Care should be taken not to confuse crosstalk and isolation. Crosstalk is defined so that for wavelength selective branching devices, the value of the ratio between the optical power of the specified signal and the specified noise is a negative value in dB. The crosstalk is defined for each output port. Crosstalk for wavelength selective branching devices is defined for a DEMUX (1 × N *x* wavelength divison multiplexing (WDM) device). The crosstalk for port *o* to port *j* is the subtraction from the insertion loss of port *i* to *o* (conducting port pair) to the isolation of port *j* to *o* (isolated port pair). For wavelength selective branching devices having three of more ports, the crosstalk should be specified as the maximum value of the crosstalk for each output port in dB.

[SOURCE: IEC 62343-3-3:2014, 3.12, modified – The admitted term "adjacent channel isolation" has been deleted, the definition and notes have been rephrased, and Figure 2 has been deleted.]

3.7.8
adjacent channel isolation
isolation restricted to the channels immediately adjacent to the (channel) wavelength number associated with output port

Note 1 to entry: Adjacent channel isolation is a positive value in dB (see Figure 2, below).

Note 2 to entry: The adjacent channel isolation is different from adjacent channel crosstalk. In Figure 2, an up pointing arrow shows positive, a down-pointing arrow negative. Generally, there are two adjacent channel isolations for the shorter wavelength (higher frequency) side and a longer wavelength (lower frequency) side.

Note 3 to entry: The term crosstalk and isolation are often used with almost the same in meaning. Care should be taken not to confuse crosstalk and isolation. Isolation is the minimum value of a_{ij} (where $i \neq j$) within isolation wavelength range for isolated port pair. Isolation is positive value in dB.

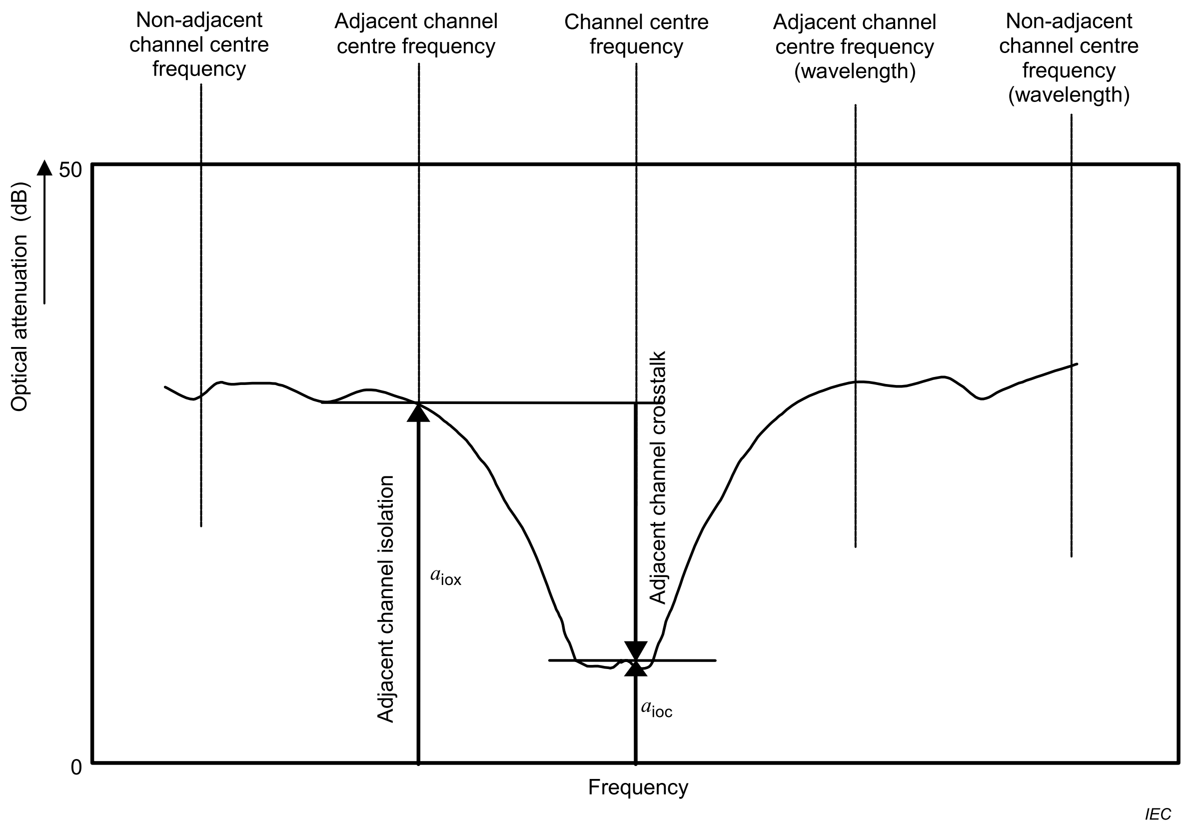


Figure 2 – Illustration of adjacent channel crosstalk and adjacent channel isolation

[SOURCE: IEC 62343-3-3:2014, 3.12, modified – The preferred term "adjacent channel crosstalk" has been deleted, the definition and Note 1 have been rephrased, and Note 3 has been replaced by a new note.]

3.7.9
non-adjacent channel crosstalk
crosstalk restricted to each of the channels not immediately adjacent to the channel associated with output port

Note 1 to entry: The non-adjacent channel crosstalk is different from non-adjacent channel isolation. In Figure 3, up-pointing arrow shows positive, down-pointing arrow negative.

[SOURCE: IEC 62343-3-3:2014, 3.13, modified – The admitted term "non-adjacent channel isolation" has been deleted, the definition has been rephrased and Figure 3 has been deleted.

3.7.10
non-adjacent channel isolation
isolation restricted to each of the channels not immediately adjacent to the channel associated with output port

Note 1 to entry: The non-adjacent channel isolation is different from non-adjacent channel crosstalk. In Figure 3, up-pointing arrow shows positive, down-pointing arrow negative.

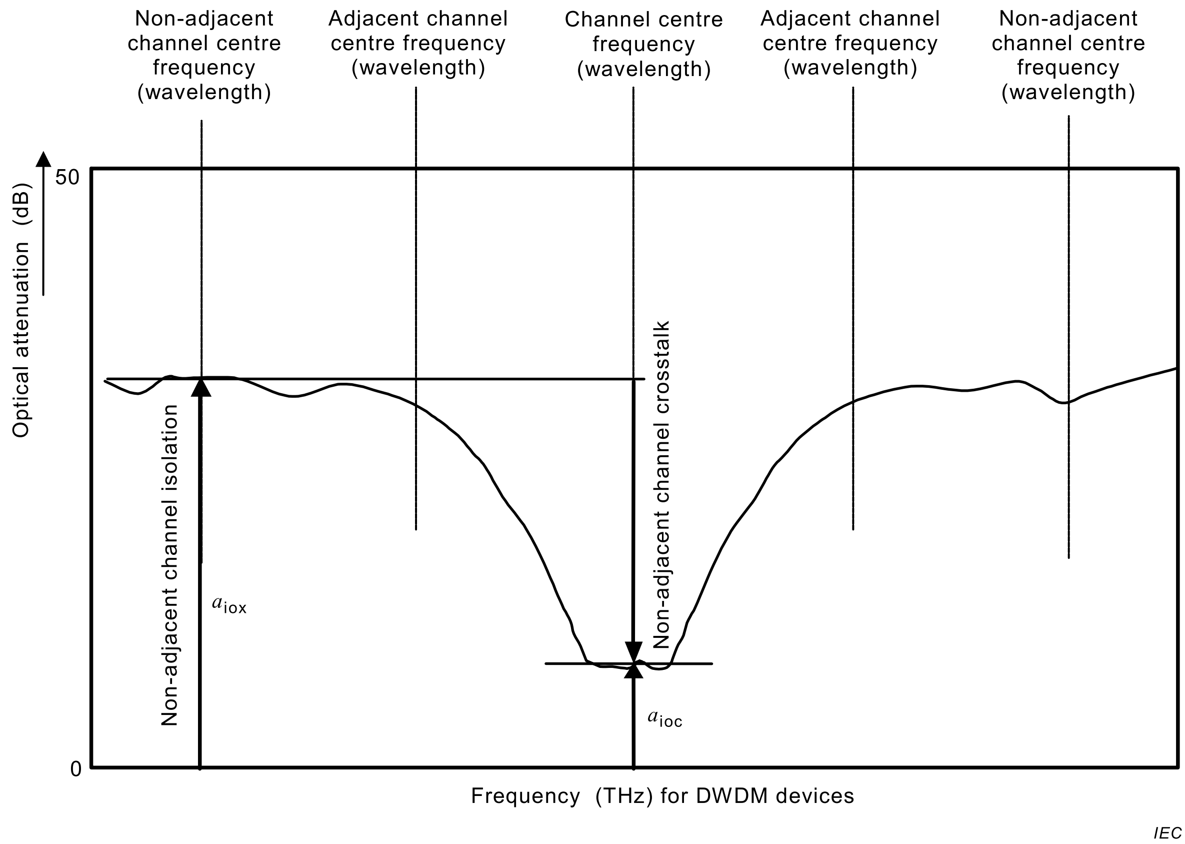


Figure 3 – Illustration of non-adjacent channel crosstalk

[SOURCE: IEC 62343-3-3:2014, 3.13, modified – The preferred term "non-adjacent channel crosstalk" has been deleted, and the definition and note have been rephrased.]

3.7.11
total channel crosstalk
total channel isolation
cumulative isolation due to the contributions at all the isolation wavelengths (frequencies) and transfer matrix coefficient for ports i and j, t_{ij} for any two ports i and j (where $i \neq j$). It is the ratio defined as

$$XT_{\text{tot}} = -10 \times \text{Log}_{10}\left[\frac{t_{ij}(\lambda_h)}{\sum_{k(k \neq h)}^{N} t_{ij}(\lambda_k)}\right]$$

where

N is the number of channels of the device;

λ_h is the nominal operating wavelength (frequency) for the two of ports, i and j;

λ_k are the nominal isolation wavelengths (frequencies) for the same pair of ports.

Note 1 to entry: Total channel crosstalk is also expressed by total channel isolation as in the following equation:

$$XT_{\text{tot}} = a_{ij}(\lambda_h) - I_{\text{tot}}$$

Note 2 to entry: Total channel crosstalk is a negative value in dB. For a WDM device, total channel crosstalk shall be specified as the maximum value of total channel crosstalk of all channels.

[SOURCE: IEC 62343-3-3:2014, 3.14]

3.7.12
transient crosstalk
transient isolation/transient directivity
crosstalk that is attributed to both channel crosstalk (due to same wavelength and/or other wavelengths) and port isolation, predicted to change during switching operation in WSS module

Note 1 to entry: Hitless operation means that there is no influence on other performance during switching operation.

[SOURCE: IEC 62343-3-3:2014, 3.15]

3.7.13
channel blocking attenuation
attenuation value when a particular channel is set in the blocking state (possible maximum attenuation)

[SOURCE: IEC 62343-3-3:2014, 3.16]

3.7.14
attenuation without power
attenuation value when electric power for driving the attenuation is not supplied

[SOURCE: IEC 62343-3-3:2014, 3.17]

3.7.15
variable attenuation range
attenuation value that can be changed with channel-by-channel independently controlled by driving circuit with software

[SOURCE: IEC 62343-3-3:2014, 3.18]

3.7.16
variable attenuation resolution
resolution of the setting of attenuation value

[SOURCE: IEC 62343-3-3:2014, 3.19]

3.7.17
attenuation accuracy
precision of attenuation value when once set by driving circuit with software and includes the point of view of both repeatability and stability in the timeframe

Note 1 to entry: This is important when used in open loop operation.

[SOURCE: IEC 62343-3-3:2014, 3.20]

3.7.18
response time for attenuation
elapsed time to change the attenuation value of any channel from an initial value to the desired value, measured from the time the actuation energy is applied

[SOURCE: IEC 62343-3-3:2014, 3.21]

3.7.19
out-of-band attenuation
minimum attenuation (in dB) of channels that fall outside of the operating wavelength range

[SOURCE: IEC 62343-3-3:2014, 3.22]

3.7.20
switching time
$\boldsymbol{t_s}$
time necessary for switching from isolated state to conducting state, defined as follows:

$$t_s = t_l + t_r + t_b$$

where

t_l is latency time;

t_r is rise time;

t_b is bounce time

Note 1 to entry: When switching from conducting state to isolated state, switching time (t_s') is defined as follows:

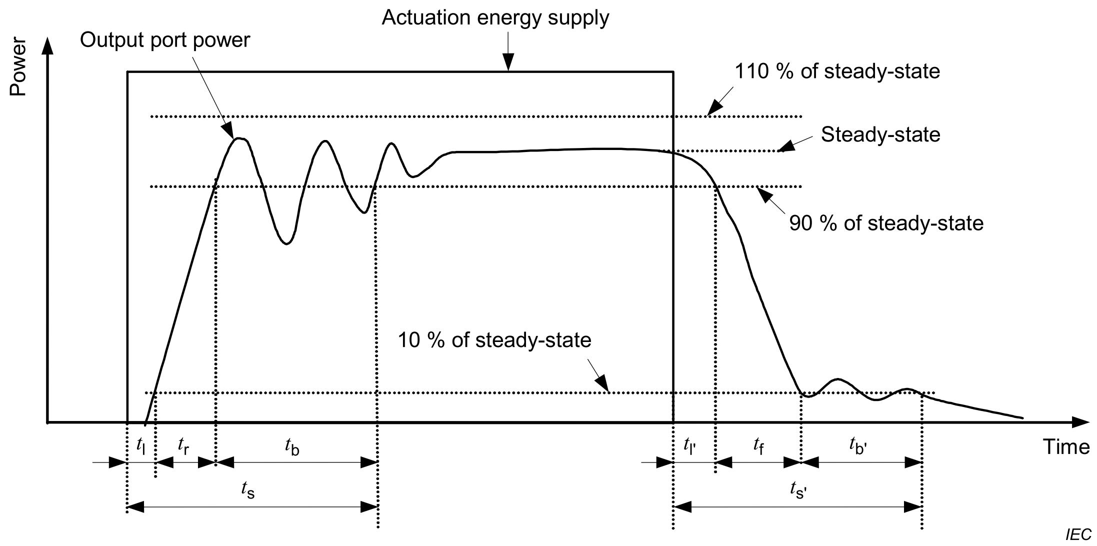
$$t_s' = t_l' + t_f + t_b'$$

where

t_l' is latency time;

t_f is fall time;

t_b' is bounce time.



where

t_s, $t_{s'}$ is the switching time;

t_l, $t_{l'}$ is the latency time;

t_r is the rise time;

t_f is the fall time;

t_b, $t_{b'}$ is the bounce time.

Figure 4 – Illustration of latency time, rise time, fall time, bounce time, and switching time

Note 2 to entry: If, for any reason, the steady-state power of the isolated state is not zero, all the power levels leading to the definitions of latency time, rise time, fall time, bounce time, and thus of switching time, should be normalized subtracting from them the steady-state power of the isolated state, before applying such definitions.

[SOURCE: IEC 62343-3-3:2014, 3.23, modified – The symbol "t_s" has been added as second preferred term, and the definition has been rephrased.]

3.7.21
polarization dependent loss
PDL
maximum variation of insertion loss due to a variation of the state of polarization (SOP) over all the SOPs

[SOURCE: IEC 62343-3-3:2014, 3.24]

3.7.22
polarization mode dispersion
PMD
change in the shape and RMS width of a pulse due to the average delay of the travelling time between the two principal states of polarization (PSP), differential group delay (DGD), and/or to the waveform distortion for each PSP

Note 1 to entry: PMD, together with polarization dependent loss (PDL) and polarization dependent gain (PDG), when applicable, may introduce waveform distortion leading to unacceptable bit error increase.

[SOURCE: IEC 62343-3-3:2014, 3.25]

3.7.23
group delay ripple
maximum peak-to-peak variation of the group delay approximated by a desired function as wavelength (or frequency), typically a linear fit, within a channel wavelength (or frequency) range

[SOURCE: IEC 62343-3-3:2014, 3.26]

3.7.24
phase ripple
maximum peak-to-peak variation in measured phase spectrum when compared to a quadratic fit within a channel wavelength (or frequency) range

Note 1 to entry: Phase ripple (unit: radian) is calculated as the product of a peak-to-peak group delay ripple (unit: s) and a period of group delay ripple (unit: Hz). Refer to IEC 61300-3-38.

[SOURCE: IEC 62343-3-3:2014, 3.27]

3.7.25
chromatic dispersion
group delay difference between two closely spaced wavelengths inside an optical signal going through a pair of conducting ports of a DWDM device

Note 1 to entry: It corresponds to the difference between the arrival times of these two closely spaced wavelengths. Chromatic dispersion is defined as the variation (first order derivative) of this group delay over a range of wavelengths especially over the channel operating wavelength range at the given time, temperature, pressure and humidity. It is expressed in terms of units of ps/nm or ps/GHz and it is a predictor of the broadening of a pulse transmitted through the module.

[SOURCE: IEC 62343-3-3:2014, 3.28]

3.7.26
maximum input power
<single chanel> allowable optical power which causes no damage by the optical power such as degradation of adhesive or fibre fuse as for a particular channel

[SOURCE: IEC 62343-3-3:2014, 3.29]

3.7.27
maximum input power
<single port> allowable optical power, which causes no damage by the optical power such as degradation of adhesive or fibre fuse as for a particular port

[SOURCE: IEC 62343-3-3:2014, 3.30]

4 Preparation of standards

4.1 General

In the preparation of a performance standard, the following items shall be considered and instructions pertaining to them included:

- product definition;
- tests;
- details;
- requirements;
- sample size;

- sample definition;
- groupings/sequences;
- pass/fail criteria;
- reference product definition;
- performance standard test report.

4.2 Product definition

The product to which the performance standard relates shall be clearly defined.

4.3 Tests

The tests to be carried out on the product in order for it to meet the performance standard shall be clearly defined. No ambiguity or options shall be allowed.

The test method to be used shall be clearly defined for each test. Wherever possible, the test method shall be selected from IEC referenced tests. Where this is not possible, other test methods may be defined. If an undefined test method is used, the test method and details to be specified shall be included in the appropriate annex of the performance standard.

4.4 Details

Details to be considered shall be given for all tests and measurements presented in a performance standard. These should be directly related to the requirements specified for a product location within an operating or service environment to which the performance standard is intended to correspond. No ambiguity or options shall be allowed.

4.5 Requirements

The performance requirements that shall be satisfied in order for the product to comply with the performance standard shall be specified for each test and/or measurement. No ambiguities shall be allowed.

4.6 Sample size

The sample size for each test shall be defined in an annex of the performance standard.

4.7 Sample definition

The sample to be tested shall be defined in the relevant performance standard.

4.8 Groupings/sequences

Test groups and test sequences shall be defined in the appropriate annex of the performance standard as required by the user, user group or manufacturer. The number of samples for each test group shall also be defined in the annex.

4.9 Pass/fail criteria

The pass/fail criteria shall be unambiguously stated for each test within the performance standard. No deviation or exceptions shall be allowed.

4.10 Reference product definition

Where a performance standard requires the use of a reference product or component, the reference product shall be clearly defined in the appropriate annex of the performance standard.

4.11 Performance standard test report

Conformance to a performance standard shall be supported by a test report. The test report shall clearly demonstrate that the tests were carried out in accordance with the requirements of the performance standard and provide full details of the tests together with a pass/fail declaration. All test and measurement requirements shall be satisfied before a component may be declared to be in compliance with the performance standard.

The failure of any product to comply with a particular test or sequence of tests shall be reported in the performance standard test report. An analysis of the cause of the failure shall be undertaken and any corrective actions taken shall be described.

If no design changes are made to the product, the test or test sequence where the failure occurred shall be rerun with the results of both tests reported.

If design changes are made, another complete performance standard test programme shall be undertaken. Any tests previously completed successfully shall be repeated with new samples.

5 Electromagnetic compatibility (EMC) requirements

The devices and assemblies addressed by this document shall comply with suitable requirements for electromagnetic compatibility (in terms of both emission and immunity), depending on particular usage/environment in which they are intended to be installed or integrated. IEC Guide 107 shall be used for the drafting of such EMC requirements. Guidance for electrostatic discharge (ESD) is still under study.

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