BS EN 62343:2013

BSI Standards Publication

Dynamic modules — General and guidance

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National foreword

This British Standard is the UK implementation of EN 62343:2013. It is identical to IEC 62343:2013.

The UK participation in its preparation was entrusted by Technical Committee GEL/86, Fibre optics, to Subcommittee GEL/86/3, Fibre optic systems and active devices.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Dynamic modules - General and guidance

(IEC 62343:2013)

Modules dynamiques - Généralités et lignes directrices (CEI 62343:2013)

Dynamische Module - Allgemeines und Leitfaden (IEC 62343:2013)

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Foreword

The text of document 86C/1055/CDV, future edition 1 of IEC 62343, prepared by SC 86C "Fibre optic systems and active devices" of IEC TC 86 "Fibre optics" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62343:2013.

The following dates are fixed:

– latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2014-04-10
– latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2016-07-10

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The text of the International Standard IEC 62343:2013 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61290	NOTE	Harmonised as EN 61290 (series).
IEC 61291	NOTE	Harmonised as EN 61291 (series).
IEC 61300	NOTE	Harmonised as EN 61300 (series).
IEC 61753	NOTE	Harmonised as EN 61753 (series).
IEC 62342-2	NOTE	Harmonised as EN 62342-2.
IEC 62343-3-1:2010	NOTE	Harmonised as EN 62343-3-1:2010 (not modified).
IEC 62343-5	NOTE	Harmonised as EN 62343-5 (series).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60050-731	-	International Electrotechnical Vocabulary (IEV) - Chapter 731: Optical fibre communication	-	-
IEC/TR 61931	-	Fibre optic - Terminology	-	-
IEC 62343-1	series	Dynamic modules - Performance standards	EN 62343-1	series
IEC 62343-3	series	Dynamic modules - Performance specification templates	EN 62343-3	series
IEC Guide 107	-	Electromagnetic compatibility - Guide to the drafting of electromagnetic compatibility publications	-	-

CONTENTS

INTRODUCTION

This International Standard applies to dynamic devices as defined in IEC/TS 62538. It contains general guidance for the IEC 62343 series related to dynamic devices, and definitions which apply to dynamic devices. The dynamic module, 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-X 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-X 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.

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

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-X series, but are covered in their own series of IEC standards.

DYNAMIC MODULES – GENERAL AND GUIDANCE

1 Scope and object

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

The object of this standard is to

- establish uniform requirements for operation, reliability and environmental properties of DMs to be implemented in the appropriate DM standard,
- 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 standard 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, 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 60050-731, *International Electrotechnical Vocabulary – Chapter 731: Optical fibre communication*

IEC/TR 61931, *Fibre optic – Terminology*

IEC 62343-1 (all parts), *Dynamic modules – Optical performance standards*

IEC 62343-3 (all parts), *Dynamic modules – Optical performance specification templates*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

The definitions listed in this clause refer to the meaning of the terms used in the specifications of DMs. Only those parameters listed in the appropriate performance standard in the IEC 62343-1 series and performance specification templates in the IEC 62343-3 series are intended to be specified.

The list of parameter definitions of DMs, given in this clause, is divided into subclauses by the type of DM. See also IEC 60050-731and IEC/TR 61931.

3.1 General terms

3.1.1
optical dynamic device

optical device which is 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, definition 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, definition 2.2.5, modified – the Notes to entry in the source have been omitted]

3.2 Dynamic module terms

The following definitions apply to all dynamic modules

3.2.1
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

3.2.2
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, fnomi, this frequency range is from $f_{imin} = (f_{nomi} - \Delta f_{max})$ to $f_{imax} = (f_{nomi} + \Delta f_{max})$, where Δf_{max} is the maximum channel central frequency deviation.

3.2.3
channel spacing
centre-to-centre difference in frequency (or wavelength) between adjacent channels in a device

3.3 Dynamic channel equalizer (DCE) terms

The following definitions apply to the dynamic channel equalizer

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.

[SOURCE: IEC 62343-3-1:2010, definition 3.5]

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.

[SOURCE: IEC 62343-3-1:2010, definition 3.2, modified – Additional information with respect to applicability has been transferred to Note 1 to entry; Note 2 to entry is additional]

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

[SOURCE: IEC 62343-3-1:2010, definition 3.6, modified – Information relating to the units (dBm) now appears in the form of Note 1 to entry]

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.

[SOURCE: IEC 62343-3-1:2010, definition 3.8, modified – Information relating to the units (dB) now appears in the form of Note 1 to entry]

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

[SOURCE: IEC 62343-3-1:2010, definition 3.9]

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

[SOURCE: IEC 62343-3-1:2010, definition 3.3]

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

The following definitions apply to the tuneable dispersion compensator (TDC) or dynamic chromatic dispersion compensator (DCDC)

3.4.1
tuneable dispersion compensator
dynamic chromatic dispersion compensator
TDC (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

The following definitions apply to the dynamic gain tilt equalizer (DGTE)

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

The following definitions apply to the optical channel monitor (OCM)

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 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

4 Abbreviations

DCDC	dynamic chromatic dispersion compensator
DCE	dynamic channel equalizer
DGTE	dynamic gain tilt equalizer
DM	dynamic module
DSE	dynamic spectral equalizer
EMC	electromagnetic compatibility
ESD	electrostatic discharge
OCM	optical channel monitor
OSNR	optical signal-to-noise ratio
PWB	printed wiring board
TDC	tuneable dispersion compensator

5 Preparation of standards

5.1 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.

5.2 Product definition

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

5.3 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.

5.4 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.

5.5 Requirements

The performance requirements that must 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.

5.6 Sample size

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

5.7 Sample definition

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

5.8 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.

5.9 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.

5.10 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.

5.11 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.

6 Electromagnetic compatibility (EMC) requirements

The devices and assemblies addressed by the present standard 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. Guidance to the drafting of such EMC requirements is provided in IEC Guide 107. Guidance for electrostatic discharge (ESD) is still under study.

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IEC 61753 (all parts), *Fibre optic interconnecting devices and passive components*

IEC 62343-2, *Dynamic modules – Reliability qualification*

IEC 62343-3-1:2010, *Dynamic modules – Part 3-1: Performance specification templates – Dynamic channel equalizers*

IEC 62343-4[1] series, *Dynamic modules – Hardware and software interface standards*

IEC 62343-5 series, *Dynamic modules – Test methods*

IEC/TR 62343-6 series, *Dynamic modules – Test reports*

IEC/TS 62538:2008, *Categorization of optical devices*

ITU-T Recommendation G.692: *Transmission media characteristics – Characteristics of optical components and sub-systems*

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[1] Under consideration.

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