IEC TR 62839-2

Edition 1.0 2019-01

TECHNICAL REPORT

Environmental declaration –
Part 2: Optical/copper telecom accessories products specific rules

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ENVIRONMENTAL DECLARATION –

Part 2: Optical/copper telecom accessories products specific rules

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IEC TR 62839-2 which is a technical report, has been prepared by IEC technical committee 46: Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories.

The text of this Technical Report is based on the following documents:

Enquiry draft	Report on voting
46/683/DTR	46/701/RVDTR

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62839 series, published under the general title *Environmental declaration*, 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 "http://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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

ISO 14025:2006 establishes the principles and specifies the procedures for developing Type III environmental declaration programmes and Type III environmental declarations. It specifically establishes the use of the ISO 14040 series of standards in the development of Type III environmental declaration programmes and Type III environmental declarations.

ISO 14025:2006 establishes principles for the use of environmental information, in addition to those given in ISO 14020:2000.

Type III environmental declarations as described in ISO 14025:2006 are primarily intended for use in business-to-business communication, but their use in business-to-consumer communication under certain conditions is not precluded. These environmental declarations, referred here after as PEP (product environmental footprint), follow specific set of rules and requirements specified in product category rules declarations that are referred here after as “PEP/PCR”.

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ENVIRONMENTAL DECLARATION –

Part 2: Optical/copper telecom accessories products specific rules

1 Scope

This document specifies the PSR (product specific rules) for optical/copper telecom accessories products. It covers the use, installation and end of life stages and provides methodological precisions to PEP/PCR writing for “optical/copper telecom accessories” products used for communication, data, control and command. PSR and general rules all together form the product category rules.

In the “accessories” category covered by IEC technical committees 46 and 86, there are four types of products:

- optical accessories (connectors and splices);
- balanced connectors;
- coaxial connectors;
- metallic waveguides.

This specification document is primarily intended for:

- environment and/or product managers;
- LCA (life cycle assessment) experts in companies, in charge of PEP/PCR development;
- verifiers in charge of PEP/PCR conformity assessment in accordance with the defined rules.

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 60153-2, *Hollow metallic waveguides – Part 2: Relevant specifications for ordinary rectangular waveguides*

IEC 60603-7 (all parts), *Connectors for electronic equipment*

IEC 60603-7-2,*Connectors for electronic equipment - Part 7-2: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 100 MHz*

IEC 60603-7-4, *Connectors for electronic equipment - Part 7-4: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz*

IEC 60603-7-7, *Connectors for electronic equipment - Part 7-7: Detail specification for 8-way, shielded, free and fixed connectors for data transmission with frequencies up to 600 MHz*

IEC 60603-7-51, *Connectors for electronic equipment - Part 7-51: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 500 MHz*

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IEC 60603-7-71, *Connectors for electronic equipment - Part 7-71: Detail specification for 8-way, shielded, free and fixed connectors, for data transmission with frequencies up to 1 000 MHz*

IEC 60603-7-81, *Connectors for electronic equipment - Part 7-81: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 2 000 MHz*

IEC 61169 (all parts), *Radio-frequency connectors*

IEC 61753-1, *Fibre optic interconnecting devices and passive components – Performance standard – Part 1: General and* guidance

IEEE 802.3-2015, *IEEE Standard for Ethernet*

ISO 14025:2006, *Environmental labels and declarations – Type III environmental declarations – Principles and procedures*

3 Terms and definitions

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

3.1
functional unit
quantified performance of a product system for use as a reference unit

[SOURCE: ISO 14040:2006, 3.20]

3.2
product specific rules
PSR
set of specific rules, requirements and guidelines for developing Type III environmental declarations for a product category

3.3
product category rules
PCR
set of specific rules, requirements and guidelines for developing Type III environmental declarations for one or more product categories

[SOURCE: ISO 14025:2006, 3.5]

3.4
product environmental profile
PEP
declaration indicating the environmental aspects of a product established in compliance with the PEP ecopassport program according to ISO 14025, ISO 14040 and ISO 14044

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3.5
reference product
product or product system modeled in the life cycle assessment and representative of a homogeneous environmental family

3.6
reference flow
measure of the outputs from processes in a given product system required to fulfil the function expressed by the functional unit

[SOURCE: ISO 14040:2006, 3.29]

3.7
life cycle assessment
LCA
compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle

[SOURCE: ISO 14040:2006, 3.2]

3.8
system boundary
set of criteria specifying which unit processes are part of a product system

[SOURCE: ISO 14040:2006, 3.32]

4 Optical/copper telecom accessories

Clause 4 specifies the section “Functional unit and reference flow description” of the PEP/PCR for the optical/copper telecom accessory category. It defines more precisely the functional unit for this product category.

In order to define the functional unit for optical/copper telecom accessories, the manufacturer shall use the standard formulation indicated below:

To protect and link, splice or connect

- a connection point,
- during X years (reference lifetime),
- with a Y % use rate.

Lifetime and use rate correspond to the Z application as defined in Table A.1. According to the functional unit definition, production, distribution, installation and end of life stages shall be considered for the maximum capacity of the reference flow fulfilling the functional unit.

The number N of connection points depends on the reference product used in the reference flow. The reference product belongs to a family of products listed in the Scope.

Consequently, the manufacturer shall realize the life cycle assessment for the maximal capacity of the reference product and shall present the results reduced to one connection point.

NOTE 1 A connection point is available in various ways: fusion splices, mechanical splicing, connectors. The nature of these connection points will be specified in the PEP.

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NOTE 2 Storing, mixing and deriving are secondary functions of equipments and accessories for optical/copper telecom connections which are not included in the calculation of environmental impacts. Nevertheless, if necessary, these functions will be specified in the PEP.

Example of formulation of the functional unit:

« To protect and link a connection point for 30 years with a 70 % use rate for optical telecommunication application in residential building ».

5 System boundaries

5.1 General

As described in the PEP/PCR, the following life cycle stages shall be included:

- manufacturing stage,
- distribution stage,
- installation stage,
- use stage,
- end of life stage.

The following 5.2 to 5.4 complete, for installation and use stages, the respective sections of the PEP/PCR for optical/copper telecom accessories. See also Annex A for examples of lifetime and use rate.

5.2 Installation stage

Subclause 5.2 specifies section 2 “Installation stage” of the PEP/PCR for optical/copper telecom accessory category. Concerning optical/copper telecom accessories, and considering the wide range of possible installation of these products, the installation stage is excluded from the system boundaries.

This extended cut-off rule does not exclude the respect of the other requirements from the PEP/PCR, such as considering the packaging treatment, or waste from the installation stage (manufacturing, transportation and end of life of waste).

Below the environmental impact table, it shall be mentioned that the impact concerning the product installation process should be completed by the PEP user, depending on its installation scenario.

5.3 Use stage losses determined by calculation

5.3.1 Optical connection

Depending on the used connection technology, the maximum attenuation or loss (a_{cx}) specified by the manufacturers is given in Table 1.

It is considered that the power injected into the connection is 0 dBm or 1 mW and it is assumed a close connection with the laser (the most unfavorable case).

The calculation of the maximum value of the dissipated power of the connection based on the assumptions of IEC 61753-1 is made as follow:

$$P_{\text{connection}} = P_{\text{i}} \times \left(1 - 10^{\left(-a_{\text{cx}}/10\right)}\right) \quad (1)$$

where

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$P_{connection}$ is the maximum dissipated power of the connection, expressed in mW;

P_i is the power injected into the connection: 0 dBm respectively 1 mW;

a_{cx} is the maximum attenuation (loss) of the connection specified by the manufacturers and given in Table 1.

Table 1 – Data for optical connections

Technology used	Attenuation dB	Dissipated power mW
Fusion splice	0,1 dB	0,023 mW
Mechanical splicing	0,25 dB	0,056 mW
Connector	0,5 dB	0,109 mW

The energy consumed by an optical connection is then obtained by multiplying this value expressed in Watts by the reference lifetime, expressed in seconds, and the use rate.

In the case products in the reference flow support multiple types of connection technologies, the calculation shall be made by taking into account the most unfavorable technology.

For example, for a reference lifetime of 20 years and a 100 % use rate, the total energy consumed in use is:

$0{,}109 \times 10^{-3}$ [W] x 20 [years] x 365 [days] x 24 [hours] x 3 600 [seconds] = 68 748 Joules

For illustration, 68 748 Joules is the energy consumption of a bulb of 70 watts during 16 minutes.

In general, the choices made and the underlying assumptions for the loss calculation shall be identified in the PEP and justified in the LCA report.

5.3.2 Balanced connectors

The estimation of the use stage losses of balanced connectors is illustrated for the different variants of the popular RJ45 connector according IEC 60603-7 (all parts) (see also Table 2).

The attenuation or loss (a_{cx}) specified by IEC 60603-7 (all parts) shall be used; the calculation of the maximum dissipated power of the connector is made as follow:

$$P_{connector} = P_i \times \left(1 - 10^{(-a_{cx}/10)}\right) \times Nb_{pair} \quad (2)$$

$$a_{cx} = 0{,}02 \times \sqrt{f} \quad (3)$$

where

$P_{connector}$ is the dissipated power of the balanced connector, expressed in mW;

P_i is the injected power in mW given by the standards: 14 mW;

a_{cx} is the maximum attenuation (loss) of the connection, in dB;

f is the central frequency of the relevant protocol in MHz;

Nb_{pair} is the number of the used pairs for the considered protocol.

To meet the requirements of these protocols, the connectors are divided into categories. For each category, an attenuation value is assigned according to the central frequency of the relevant protocol. This maximum attenuation by category is defined by the corresponding standard of IEC 60603-7 (all parts). Table 2 includes all the data to be used for balanced connectors complying with the reference standards (the performance standard for connectors being IEC 60603-7 (all parts) and for the protocol, IEEE 802.3).

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Table 2 – Balanced connectors

Protocol	Frequency	Category	Power consumption
100 Mbit Ethernet BP(*) = 100 MHz	31,25 MHz	Category 5 According to IEC 60603-7-2	$0{,}02\sqrt{f}$ at 31,25 MHz Injected power = 14 mW leading to 0,712 mW on 2 used pairs
1 Gbit Ethernet BP * = 250 MHz	83 MHz	Category 6 According to IEC 60603-7-4	$0{,}02\sqrt{f}$ at 83 MHz Injected power = 14 mW leading to 1,15 mW on 2 used pairs
10 Gbit Ethernet BP * = 500 MHz	441 MHz	Category 6_A According to IEC 60603-7-51	$0{,}02\sqrt{f}$ at 441 MHz Injected power = 14 mW leading to 5,162 mW on 4 used pairs
10 Gbit Ethernet BP* = 600 MHz	441 MHz	Category 7 According to IEC 60603-7-7	$0{,}02\sqrt{f}$ at 441 MHz Injected power = 14 mW leading to 5,162 mW on 4 used pairs
10 Gbit Ethernet BP* = 1 000 MHz	441 MHz	Category 7_A According to IEC 60603-7-71	$0{,}02\sqrt{f}$ at 441 MHz Injected power = 14 mW leading to 5,162 mW on 4 used pairs
40 Gbit Ethernet BP* = 2 000 MHz	1 764 MHz	Category 8.1 According to IEC 60603-7-81	$0{,}02\sqrt{f}$ at 1 764 MHz Injected power = 14 mW leading to 9,484 mW on 4 used pairs
* BP: connector bandwidth			

In general, the choices made and the underlying assumptions for the dissipated power calculation shall be identified in the PEP and justified in the LCA report.

5.3.3 Coaxial connectors

Coaxial connectors according to IEC 61169 (all parts) are considered hereby since their transmission losses (attenuation) are well known as well as their intended power. The same methodology may be applied to other coaxial connectors as soon as losses and intended power are known.

The attenuation or loss (a_{cx}) either specified by IEC 61169-XY or given by the manufacturer or estimated to be 0,08 dB for the considered frequency of the relevant connector shall be used.

It is considered that the power injected into the connector is 30 dBm or 1 W.

The calculation of the maximum dissipated power of the coaxial connector is made as follows:

$$P_{\text{connector}} = P_{\text{i}} \times \left(1 - 10^{\left(-a_{\text{cx}}/10\right)}\right) \quad (4)$$

where

$P_{\text{connector}}$ is the dissipated power of the coaxial connector, expressed in mW;

P_{i} is the power injected into the connector: 30 dBm respectively 1 W;

a_{cx} is the maximum attenuation (loss) of the connector specified by the manufacturers and given in Table 3.

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Table 3 – Example of losses in coaxial connector

Connector	Attenuation dB	Dissipated power mW
IEC 61169-54	0,05 dB	
Example	0,05 dB at 1 GHz	11,5 mW

The energy consumed by a coaxial connector is then obtained by multiplying this value expressed in Watts by the effective power, then by the reference lifetime, expressed in seconds, and the use rate.

For example, for a reference lifetime of 20 years and a 100 % use rate, the total energy consumed in use is:

11,5 x10^{-3} [W] x 20 [years] x 365 [days] x 24 [hours] x 3 600 [seconds] = 7,25 MJ

For illustration, 7,25 MJ is the energy consumption of a bulb of 70 Watts during 29 hours.

In general, the choices made and the underlying assumptions for the loss calculation shall be identified in the PEP and justified in the LCA report.

5.3.4 Metallic waveguides

The attenuation or loss (a_{cx}) specified by IEC 60153-2 for the lower recommended frequency of the relevant waveguide shall be used.

It is considered that the power injected into the waveguide is 30 dBm or 1 W.

The calculation of the maximum dissipated power of the waveguide is made as follows:

$$P_{waveguide} = P_i \times \left(1 - 10^{\left(-\frac{a_{cx} \times L}{10}\right)}\right) \quad (5)$$

where

$P_{waveguide}$ is the dissipated power of the metallic waveguide expressed in mW;

P_i is the power injected into the connector: 30 dBm respectively 1 W;

a_{cx} is the metallic waveguide attenuation or loss expressed in dB/m specified by the manufacturers and given in Table 4;

L is the length of the metallic waveguide.

Table 4 – Example of losses in waveguides

Waveguide	Attenuation dB/m	Dissipated power mW/m
R6 (AL)	0,024 dB/m	5,5 mW/m
R58(AL)	0,069 dB/m	16 mW/m

The energy consumed by a length L of waveguide is then obtained by multiplying this value expressed in Watts by the reference lifetime, expressed in seconds, and the use rate.

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For example, for a length of 1 m of waveguide and for a reference lifetime of 20 years and a 100 % use rate, the total energy consumed in use is:

$5,5 \times 10^{-3}$ [W] x 20 [years] x 365 [days] x 24 [hours] x 3 600 [seconds] = 3,47 MJ

For illustration, 3,47 MJ is the energy consumption of a bulb of 70 Watts during 14 hours.

In general, the choices made and the underlying assumptions for the dissipated power calculation shall be identified in the PEP and justified in the LCA report.

5.4 End of life stage

Subclause 5.4 supplements chapter of “End of life stage” of the “product category rules” for the optical/copper telecom accessories product category by setting the processes to be considered in the study of the end of life stage.

To ensure PEP comparability, end of life steps to be taken into account are:

- the separation between the accessory and the connected cable;
- transportation, assuming local transport as described in the “product category rules”;
- landfilling of materials as described in the “product category rules”.

As for the installation stage, considering the wide range of possible removal processes of these products, the removal processes and/or dismantling of cables are excluded from the PEP perimeter. The impact of removal shall be carried out by the PEP user, considering the product use features.

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Annex A
(informative)

Applications

Table A.1 shows areas of applications and the corresponding lifetime and use rate used for the calculations of the dissipated power.

Table A.1 – Table of applications

Areas applications	Applications	Lifetime years	Use rate %	Used time years
Infrastructures				
	Railway networks	30	100	30
	Telecom networks (fixed and mobile phones)	20	100	20
Industrial applications	Oil, gas and petrochemicals	30	100	30
	Handling	10	50	5
	Automation	5	100	5
	Nuclear	40	100	40
	Wind turbines	20	30	6
	Photovoltaic power plants	10	50	5
	Airports	20	100	20
Onboard systems	Civil aeronautics	15	80	12
	Shipbuilding and marine	30	80	24
	Rolling stock	30	50	15
	Automotives (cars and trucks)	10	10	1
Building	Residential/tertiary/industrial	30	70	21
	Data centers	10	100	10
	LAN: residential	10	17	1,7
	LAN: tertiary	10	25	2,5
	LAN: industrial (factories, warehouses)	10	100	10

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