

Product-Category Rules (PCR)
for preparing an environmental product
declaration (EPD) for
Integrated Computer
PCR 2010:1.0

Micro-Star International Company Limited

Version 1.0

2010-07-16

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1. General Information

This document is to be used as the product category rules (PCR) for integrated computer produced globally. The requirements specified in this PCR are intended to be used for EPDs certified in accordance with ISO 14025 standard. This document shall be valid until XX XX, 20XX.

This PCR was prepared by the Micro-Star International Company Limited. Representatives from major Taiwanese manufacturers of similar products and stakeholders were invited to the open consultation meeting on July 2, 2010, to participate in the discussion and review of this PCR. EDF then reviewed and approved this PCR.

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2. Company and product description

The EPD shall include information about the manufacturing company/organization. The information may include manufacturing process related information, and environmental related information, such as the environmental management system information. The information may also include special issues which the company/organization would like to emphasize, such as the products meeting certain environmental criteria, or environmental safety and health related information.

This PCR covers the integrated computers and their packaging (CPC Code 4523). This PCR is only applicable to communications between businesses and customers (B2C)*.

*B2C (Business-to-Customer) means the transaction between business and customer, including the whole transaction process, such as communicating product information to customer, delivery of product to customer and waste disposal for end-of-life product. (Product's end user)

B2B (Business-to-Business) means the transaction among businesses, covers only part of the transaction, such as purchasing, inventory control, payment, delivery, technical support. (Not considered end user of product, only the product deliverer).

2.1 Product function

Integrated computer is a desktop computer system in which the computer and computer display function as a single unit which receives its ac power through a single cable.

Based on ENERGY STAR Program's definition, the integrated desktop computers come in one of two possible forms: (1) a system where the computer display and computer are physically combined into a single unit; or (2) a system packaged as a single system where the computer display is separate but is connected to the main chassis by a dc power cord and both the computer and computer display are powered from a single power supply.

As a subset of desktop computers, integrated computers are typically designed to provide similar functionality as desktop systems, such as word processing, audio/video entertainment and other applications, for use in homes, offices, factories, restaurants and retail stores, etc.

2.2 Product components

The components of the integrated computer include:

Main components:

- CPU
- RAM
- Display Device
- Digital Storage Device (such as Hard Disk Driver)
- Motherboard
- Power Supply Unit
- Thermal Device
- Input /Output Interface Device
- Product of Chassis Parts

Other components

- Optical Disk Drive
- Network Device
- Others

The data quality requirements for the main components are described in Section 9 on

calculation rules and data quality requirements. The EPD/CFP shall also include the other components of the integrated computer, but their data quality requirements are different from those of the main components.

2.3 Product technical description

The product technical description part of the EPD shall include, but not limited to the following information:

Main components:

CPU: Processor clock frequency and cache size

RAM: Memory clock frequency and memory size.

Motherboard: CPU, chipset, I/O interface, RAM type, RAM size, clock frequency.

Display device: Type & size of display, type of display card and memory size.

Digital storage device: Type, model no. and capacity of storage device.

Power supply: Type and specifications

Thermal device: Specifications

I/O interface: Model no. and product type.

Product of chassis parts: Plastics, metals or other materials.

Other components:

Optical drive: Model no. and type.

Network device: Model no. and type (include communication or wired/wireless equipment).

Product dimensions & weight.

Expected/design life of product.

3. List of parts and banned substances

The contents of the following parts and substances in the product shall be declared:

- All parts with weight ratio (part weight/product weight) $\geq 1\%$;
- All banned substances regulated by legal, customer and environmental requirements;
- The following materials in the main components: flame retardants, lead content in solder, lead and flame retardant content in solder masking agent, and substances regulated by RoHS Directive (the latest version).

The declaration of halogen-free flame retardants, lead-free solders and no RoHS-regulated substances may only be made when appropriate evidences are

available (for example, test reports from accredited laboratories/testing facilities). The following organizations may provide accreditation for testing facilities: Taiwan Accreditation Foundation (TAF), (Asia Pacific Laboratory Accreditation Cooperation (APLAC), International Laboratory Accreditation Cooperation (ILAC) or ILAC Mutual Recognition Arrangement (ILAC MRA). For definitions of testing methodology and confirmations of regulated hazardous substances based on the accredited laboratories' product testing methods, please refer to IEC 62321 Standard.

4. Declared unit

The declared unit is defined as one unit of integrated computer, as the integrated computers are marketed and sold in such a unit.

5. System boundaries

The main system boundaries of the product system are business-to-consumer (B2C) in nature and are presented as follows:

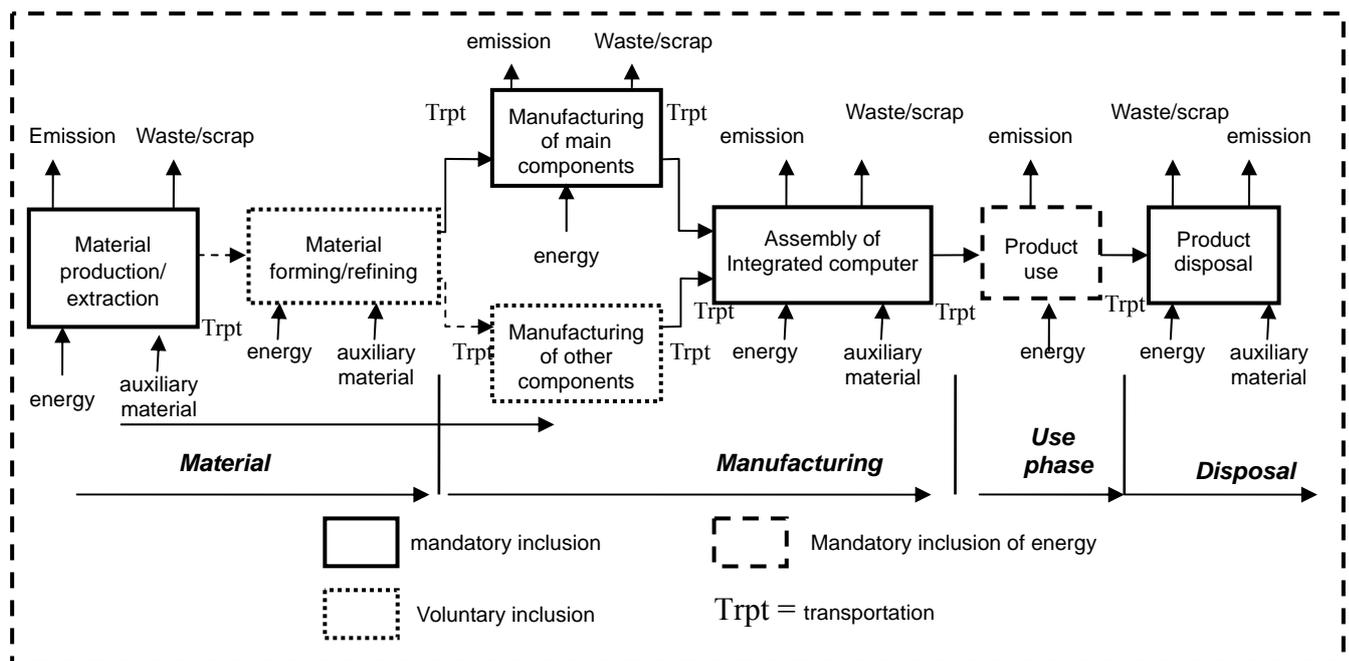


Figure 1 System boundary of the main product system

Please refer to Section 2.2 of this PCR for contents of main components and other components.

Raw materials acquisition and Manufacturing phase

The LCA shall include information for the following unit processes:

- Material extraction and manufacturing of main components and other components;
- Manufacturing of main components;
- Product assembly;
- Product packaging;
- Transportation of main components to product manufacturers;
- Transportation of components to product manufacturers.

The inclusion in the LCA the information on the material forming and refining and manufacturing of smaller parts is of the voluntary reporting nature. When voluntarily reported information is included, they shall be explained in the EPD/CFP.

Use Phase

- The time of usage is based on the ErP Directive-Lot 3 Personal Computer and Computer Monitor Final Report.
- The test procedures are based on the latest ENERGY STAR requirements for computers or other international standards on testing of energy efficiency and power management.
- The mains power source the product is being tested for, based be the main power source where the tested product is marketed.
- The TEC requirements for integrated computers should be based on the latest version of ENERGY STAR requirements for computers or other international standards.
- Based on the latest version of ENERGY STAR requirements, the TEC will be determined using the formula below: (Unit : MJ)
 $E_{TEC} = (8760/1000) * (P_{off} * T_{off} + P_{sleep} * T_{sleep} + P_{idle} * T_{idle})/3.6$
 Note: All Px are power values in watts/All Tx are Time values in % of year,
- Based on the latest ENERGY STAR requirements of ETEC for integrated computers:

	Integrated Computer (MJ)
TEC(kWh)	Category A: ≤ 41.11 Category B: ≤ 48.61 Category C: ≤ 58.06 Category D: ≤ 65.00

- Based on the latest ENERGY STAR requirements of weighting for TEC during each operational mode for integrated computers:

Integrated Computer		
	Conventional	Proxying*
T _{Off}	55%	40%
T _{Sleep}	5%	30%
T _{Idle}	40%	30%

Note: Proxying refers to a computer that maintains Full Network Connectivity as defined in Section 1 of this specification. For a system to qualify under the proxying weightings above, it must meet a non-proprietary proxying standard that has been approved by the EPA and the European Union as meeting the goals of ENERGY STAR. Such approval must be in place prior to submittal of product data for qualification.

- Based on the office/home computers' time of use during the idle/sleep/off modes as stated in the ErP Directive -Lot 3 Personal Computer and Computer Monitor Final Report, the TEC can be calculated as follows:

Weightings used in ErP Lot:

Annual mean time of office computer during Idle Mode is 2279 hours.

Office T_{idle} = (2279/8760) = 26.02%-year

Annual mean time of home computer during Idle Mode is 1582 hours.

Home T_{idle} = (1582/8760) = 18.06%-year

Annual mean time of office computer during Sleep Mode is 3196 hours.

Office T_{sleep} = (3196/8760) = 36.48%-year

Annual mean time of home computer during Sleep Mode is 2873 hours.

Home T_{sleep} = (2873/8760) = 32.80%-year

Annual mean time of office computer during Off Mode is 3285 hours.

Office T_{off} = (3285/8760) = 37.50%-year

Annual mean time of home computer during Off Mode is 4305 hours.

Home T_{off} = (4305/8760) = 49.14%-year

The formula for ErP Lot 3 TEC (**Unit: MJ**):

$$\text{Office } E_{\text{TEC}} = ((8760/1000) * (P_{\text{off}} * 0.4914 + P_{\text{sleep}} * 0.3648 + P_{\text{idle}} * 0.2602)) / 3.6$$

$$\text{Home } E_{\text{TEC}} = ((8760/1000) * (P_{\text{off}} * 0.3750 + P_{\text{sleep}} * 0.3280 + P_{\text{idle}} * 0.4914)) / 3.6$$

0.1806)/3.6

Product's energy usage scenarios are described as follows:

1. Idle Mode:

- The state in which the operating system and other software have completed loading, the machine is not asleep and is ready for use.
- Based on the ErP Directive-Lot 3 Personal Computer and Computer Monitor Final Report:
Annual mean time of office computer during Idle Mode is 2279 hours;
Annual mean time of home computer during Idle Mode is 1582 hours.
- The usage of non-commercial and non-home use personal computer, should be described in line with actual usage pattern or refer to other international standards.

2. Sleep Mode:

- Energy Star Program Requirements for Computers define Sleep Mode as:
 - A low power state that the computer is capable of entering automatically after a period of inactivity or by manual selection;
 - A computer with sleep capability can quickly “wake” in response to network connections;
 - For systems where ACPI standards are applicable, Sleep mode most commonly correlates to ACPI System Level S3 (suspend to RAM) state
- Based on the ErP Directive-Lot 3 Personal Computer and Computer Monitor Final Report:
Annual mean time of office computer during Sleep Mode is 3196 hours;
Annual mean time of home computer during Sleep Mode is 2873 hours.
- The office and home computers are shipped with the display's Sleep mode set to activate within 15 minutes of user inactivity.
- The office and home computers are shipped with a Sleep mode which is set to activate within 30 minutes of user inactivity.
- The usage of non-commercial and non-home use personal computer, should be described in line with actual usage pattern or refer to other international standards.

3. Off Mode:

- Energy Star Program Requirements for Computers define Off mode as:
 - When the computer system is switched off, but the power supply is still

connected to the main electricity supply and computer system.

— For systems where ACPI standards are applicable, Off Mode correlates to ACPI System Level S5 state.

- Based on the ErP Directive-Lot 3 Personal Computer and Computer Monitor Final Report:

Annual mean time of office computer during Off Mode is 3285 hours ;

Annual mean time of home computer during Off Mode is 4305 hours.

- The usage of non-commercial and non-home use personal computer should be described in line with actual usage pattern or refer to other international standards.

Recycling/end of life

The reporting of recycling information (such as recycling and dis-assembly report and information on recycling channels) is mandatory in the EPD/CFP.

5.1 Specification of different boundary settings

Boundary in time

The validity period for the LCA results presented in the LCA report shall be defined.

Boundary towards nature

If the manufacturing processes are located within Taiwan, the waste categories as defined in Taiwan's Waste Disposal Act shall be adopted. If the processes are located in other countries, equivalent legal requirements shall be considered.

The natural boundary of the system shall describe the boundary where the materials and energy resources flow from nature into the system, and where the water and air emissions and waste are released out of the system.

Only the waste which is required to be disposed of needs to be considered; landfilling process does not need to be included. If the waste will be treated through water treatment or incineration, these processes need to be included.

Boundaries in the life cycle

The boundaries in the product life cycle are described in Figure 1. The construction of the site and infrastructure, as well as the production of manufacturing equipment and activities of the workers, do not need to be included.

Boundaries towards other technical systems

Boundaries towards other technical systems describe the inputs of material and other components towards other systems, as well as outputs of materials towards other systems. For the inputs of recycled materials and energy towards the product manufacturing phase, the transportation between the recycling process and use of recycled materials shall be included in the data set. For the production of recyclable products during the manufacturing phase, the transportation towards the recycling process shall be included.

(Note: Further explanations are provided in Section 7 on open-loop recycling)

Boundaries regarding geographical coverage

The manufacturing phase may cover manufacturing processes located on any sites around the world. For processes located in a specific region, the data used should be representative of the region. The data for the main components shall be the specific regional data for the region where the process takes place (see Section 9). For ease of comparison, no matter where the emissions are generated, the same parameters should be used for life cycle impact assessment (see Section 10).

6. Cut-off rules

For any impact category, if the sum of various impacts from a specific process/activity is less than 1% of the impact equivalent in that category, such a process/activity may be neglected during the inventory analysis. But the accumulated impact of neglected process/activity may not exceed 5%. Constituents and materials omitted from the LCA shall be documented.

(Note: This judgment for this “1% Rule” is based on the environment relevance assessment of material input to the system, and does not consider special and exceptional environmental impacts.)

7. Allocation rules

The main allocation rules shall be valid for the entire product system. For other secondary processes, other allocation rules may be defined; however, the use of these rules should be justified. Product-specific information should be preferentially collected in order to avoid the need for allocation. While selecting allocation rules, the following principles are recommended.

- Multi-output: The allocations are based on the changes in the resource consumption and pollutant emissions (for example, adopted quantity allocation for some main component, or surface allocation for some components), following the changes in the studied system’s output product or function or economical relationship.
- Multi-input: The allocation is based on actual relationship. For example, the manufacturing process’s emissions may be affected by the change in waste flow input.
- Open loop recycling: For the input of recycled materials or energy during the

manufacturing phase of the product system, the transportation between the recycling process and the recycling to material use shall be included in the dataset. For the product which shall be recycled during the manufacturing phase, the transportation towards the recycling process shall be included.

Notes:

- *Allocation may be avoided through avoidance of dividing processes, for example as described in Section 6.3 of ISO/TR 14049; or through expansion of system boundary (for example as described in Section 6.4), so that the amended system shares the same product exchanges as the original system.*

8. Units

The base units and derived units of the International System of Units (SI, *Système International d'unités*) shall be used preferentially.

The following units shall be used:

Power & energy units:

- power unit: W
- energy unit: J

Specification units:

- length unit: m
- capacity unit: m³
- area unit: m²
- weight unit: kg

If necessary, prefixes may be used before the SI units.

10⁹ = giga, symbol “G”

10⁶ = mega, symbol “M”

10³ = kilo, symbol “k”

10⁻² = centi, symbol “c”

10⁻³ = milli, symbol “m”

10⁻⁶ = micro, symbol “μ”

10⁻⁹ = nano, symbol “n”

9. Calculation rules and data quality requirements

- Site specific data (for example, specific factory data or transportation data for a specific manufacturing process) shall be used for the main components. If other types of information are used, description of the information and rationale for using the information shall be provided.
- Generic data may be used in the manufacturing process for the minor (not main) components of the integrated computers. Generic data may also be used for the production of bulk materials (see Appendix I for sources of generic data). For example, when bulk raw materials are purchased from the spot market or waste is processed during waste processing; when suppliers refuse to provide specific data; or when even if generic data are used in place of specific data, there is only minor impacts to the results. The general rule is that if generic data are used in place of specific data, their combined contribution for all life cycle phases shall not be greater than 20% of total impacts for each impact category. However, for some specific products, there may be exception.
- The data shall be representative for the average of a specific year.

Date quality requirements for the manufacturing phase:

- Site specific data shall be used for the production of main assembly and main components.
- The electricity mix for the manufacturing phase should be site specific data. If site specific data cannot be obtained, the official electricity mix for the country where the site is located may be used as approximate value. The electricity mix should be documented.
- For the definition of hazardous waste, the definition as defined in Taiwan's Waste Disposal Act should be used for sites located in Taiwan. For sites located outside Taiwan, legal requirements for the host country shall be observed.
- For the transportation of suppliers, the transportation modes and distances used by the suppliers shall be considered.

10. Parameters to be declared in the EPD

For the manufacturing phase, the following parameters shall be declared:

Energy Use

MJ

Resource Use

Use of non-renewable resources:

- without energy content
- with energy content

Use of renewable resources:

- without energy content
- with energy content

Impact equivalents expressed as potential environmental impacts

-Global warming	kg CO ₂ equivalent
-Ozone depletion	kg CFC-11 equivalent
-Acidification	kg SO ₂ equivalent
-Photochemical oxidant formation	kg C ₂ H ₄ equivalent
-Eutrophication	kg PO ₄ ³⁻ equivalent

For the Use Phase

If the products are used by end-users, the power consumption during On Mode and Off Mode shall be provided.

If the product is equipped with a main switch, the power consumption from the power supply during the power off mode shall be considered.

The following power and energy units shall be preferentially used: power units, kW or W; energy unit, kWh.

Additional information

Recyclable materials (optional)

Information on secondary materials (optional)

Waste (classification):

- Hazardous waste as defined in Taiwan's Waste Disposal Act. Follow host countries' laws for sites outside Taiwan.
- Other waste.

- Plastic parts marking

Where technologically possible, the plastic parts of the integrated computer weighing $\geq 25\text{g}$ shall be marked in accordance with the ISO 11469 and ISO 1043 Part 1/2/3/4, SPI or other international standard label to facilitate their identification and recovery at the end of life.

- Plastic packaging materials marking

The Plastic packaging materials must be labeled on the parts with SPI or other international standards for ease of sorting.

11. Recycling information

The recycling information shall include information such as dis-assembly instructions, which parts/components are suitable for recycling (such as metal cases) or not suitable for recycling (for example, the information requirements for the final product manufacturers contained in the WEEE Directive may also be included in the integrated computer's EPD).

When practical, information for the parts which can not be recycled and therefore should be disposed of properly during the end-of-life phase may also be included.

12. Other environmental information (Optional)

The EPD may cover information including technology adopted, site of product manufacturing and assembly, as well as information on other working environment, health and risk-related aspects.

If this PCR is to be used for product carbon footprint declaration purpose, in the declaration, information regarding commitment on GHG reduction shall be included, and the commitment shall be ensured to be measurable, reportable and verifiable. In addition, the awards, commendations or certifications (such as QC08000 IECQ HSPM) in the environmental or energy conservation areas may also be reported.

13. Information about the certification

The information on PCR review, EPD verification and verification organization shall be included.

EPD Certification is valid until 2010-__-__

According to the Requirements for the international EPD system. General Programme Instructions, version 1 (2008) – www.environdec.com

The PCR review for _____ (PCR 2010:) was administered by the Environment and Development Foundation and carried out by an LCA expert panel chaired by Dr. Ning Yu (ningyu@edf.org.tw)
Independent verification of the declaration, according to ISO 14025:2006

Internal External

Third party verifier : Environment and Development Foundation in Taiwan.

Accredited by :

Name:

Title:

Organization:

Signature:_____

Name:

Title:

Organization:

Signature:_____

Name:

Title:

Organization:

Signature:_____

Environmental declarations from different programmes may not be comparable.

14. References

The EPD shall make reference to the following documents:

- EPD General Program Instructions, Version 1.0 (2008-02-29), The International EPD Cooperation, downloadable from <http://www.gednet.org/>;
- Relevant PCR documents;
- The underlying LCA report.

When available, the following documents shall also be referenced:

- Other documents and recycling instructions which verify and complement the EPD.

Appendix I – Generic Data Sources to Refer to

For processes located within Taiwan, Taiwan generic data or the data published by the commercial, industrial and energy competent authorities of the Republic of China (ROC) government, may be used. However, for other regions (such as EU), if there are more relevant generic data available, these data should be used instead.

When data from the following generic databases are used, the most current and updated data should be used:

Material	Database	Published
LCA Database in Taiwan	DoITPro	2008
Steel	IISI (International Iron and Steel Institute)	1998
Copper	ICA (International Copper Association)	1998
Copper semi products	ICA (International Copper Association) + IME (Institut für Metallhüttenwesen und Elektrometallurgi, Aachen)	1998 1995
Electricity	ETH (Eidgenössische Technische Hochschule) Data combined with IEA (International Energy Agency) statistics 1998	1996
Aluminum	EAA (European Aluminum Association)	2000
Plastics (and some chemicals)	APME (Association of Plastics Manufacturers in Europe)	1993-1998
Electronic components	EIME (Environmental Information and Management Explorer) EcoBilan	1998-2000
Energy	Boustead model 5.0	2007
Industrial processes	Ecoinvent 2nd edition	2007
Energy	ETH ESU 96	2004
Packaging materials, transport, waste treatments	BUwAL 250, 2nd edition	2004

Appendix II – Reporting Format for the EPD

This appendix provides guidance information for the titles of sections, types of data and required information to be reported in the mandatory reporting part of the EPD. As a generic reporting template, the following titles and sub-titles are recommended:

(Refer to the PCR manual for the section numbering, the information in Italics are the recommended data/information for inclusion)

Introductory part

Each EPD should have an introduction part on the top part of the EPD which includes the following information:

- *Company/organization name*
- *Product name*
- *EPD registration number*

Description of the company/organization and product/service

Company/Organization

- *Description of company/organization*
- *Description of overall working environment, existing quality system and environmental management system*

Product and services (see Section 2)

- *Product's main applications*
- *Description of product specification, manufacturing process, manufacturing sites (if there are several sites)*
- *For product's environmental performance aspects, characteristics which may improve the usefulness of product*
- *Other types of relevant information, for example, special manufacturing processes with special advantages to the environment*

List of materials and chemical substances

- *Content declaration (see Section 3)*

Presentation of the environmental performance

- *Outline of the LCA methodology, for example, period of LCA, functional units, system boundaries (graphical presentation), cut-off and allocation rules, and data sources.*

Manufacturing phase (see Section 10)

Use phase (see Section 10)

- *Geographical region for product delivery*
- *Transportation data*
- *End-of-life information*

Information about Company and Certification Organization

Recycling information (see Section 11)

Other environmental information (see Section 12)

Information regarding certification

- *Names of certification and verification organizations*
- *Validity of certification certificates*
- *Compliance with legal and relevant requirements*

References (see Section 13)

- *relevant PCR documents*
- *EPD Requirements, Version 1.0 (2008-02-29)*
- *Underlying LCA study*
- *other supporting documents for LCA information*
- *Other relevant documents regarding company/organization's environmental activities*

Appendix III Abbreviations

Acronyms	Common Name
PCR	Product Category Rule
EPD	Environmental Product Declaration
RoHS	The Restriction of the use of certain Hazardous Substances in electrical and electronic equipment
TAF	Taiwan Accreditation Foundation
APLAC	Asia Pacific Laboratory Accreditation Cooperation
ILAC	International Laboratory Accreditation Cooperation
ILAC MAR	International Laboratory Accreditation Cooperation Mutual Recognition Arrangement
Trpt	Transportation
CPU	Central Processing Unit
RAM	Random Access Memory
HDD	Hard Disk Driver
ODD	Optical Disk Driver
LCA	Life Cycle Assessment
ErP	Energy Related Product
WEEE	The Waste Electrical and Electronic Equipment Directive
SPI	Society of the Plastics Industry
ISO	International Organization for Standardization
CFP	Carbon Footprint of Product
ACPI	Advanced Configuration & Power Interface
TEC	<u>Typical Energy Consumption</u>