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An information model for digital product information on sustainability and circularity

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Contents

Intellectual Property Rights 5
Foreword 5
Modal verbs terminology 5
Executive summary 5
Introduction 6
1 Scope 7
2 References 7
2.1 Normative references 7
2.2 Informative references 7
3 Definition of terms, symbols and abbreviations 11
3.1 Terms 11
3.2 Symbols 14
3.3 Abbreviations 14
4 Conventions 15
5 Related regional and global DPP standards and regulation 15
5.0 General 15
5.1 Global digital sustainable product passport opportunities to achieve a circular economy 15
5.2 European digital product passport 16
5.3 United Nations Transparency Protocol - B2B Digital Product Passport 17
5.4 Other related standards 17
5.5 Alignment and complementarity 18
6 Overview of information requirements from pre-existing environmental standards 18
6.0 General 18
6.1 Quality properties of data and information 19
6.2 Product granularity and circularity information requirements 19
6.2.0 General 19
6.2.1 Granularity requirement 19
6.2.2 Precision of information details requirement 20
6.2.3 Product information requirement 20
6.2.4 Environmental information requirement 20
6.3 DPP legislative requirements 20
7 From requirements to an information model 21
7.0 General 21
7.1 Description of environmental information about a product 21
7.2 Metric 22
7.3 Evidence 22
7.4 Environmental information template about a standard 22
8 Digital information and product alignment to standards 23
8.1 Mapping of specifications to information and data: template about a standard 23
8.2 Mapping of products to information and data: description about a product 24
8.3 What digital sustainable product passport information enables 26
9 Guidance for implementation 26
Annex A (informative): Example application exercise of an information template for a standard 28
Annex B (informative): Relationship to Recommendation ITU-T L.1102 32
Annex C (informative): Related work on vocabularies and ontologies about environmental sustainability 34

Annex D (informative): The legal context and requirements for DPP in the EU 36
History 37

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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Environmental Engineering (EE).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Executive summary

The present document relates to, builds on, and complements Recommendation ITU-T L.1070 [i.43] and ETSI TS 103 881 [3] standards, which define opportunities for a global digital sustainable product passport to achieve a circular economy.

The present document defines an information model to describe environmental sustainability and circularity information details about ICT goods (products) in a digital form to be part of a digital product passport as environmental information that can be compared with information requirements in relevant environmental sustainability and circularity standards, specifically ETSI standards and Recommendations ITU-T. The information details can represent products at any time of their circular lifespan: design, manufacturing, use, hardware changes, and final recycling as e-waste. Several product-related standards can be expressed as a list of environmental information templates. The comparison of product information to standards' information templates allows for alignment verification of products to the requirements of different standards when relevant.

The aim is to complement and contribute to regional (European digital product passport) and global (UNECE B2B digital product passport) standards.

Introduction

The present document complements other standards (ITU-T Recommendations and ETSI standards) that rely on product information in the context of the digital product passport to express environmental sustainability and circularity information about ICT products and to facilitate alignment verification of ICT products to other standards. For that, the present document presents:

- Related regional and global standards and Recommendations about the digital product passport are described in clause 5.
- An overview of information requirements raised from existing environmental standards in clause 6.
- A mapping of the requirements to an information model that supports expressing environmental information about a product and environmental information templates about a standard in clause 7.
- A mapping of environmental information to digital data or represented as a table for digitalized conformance statements and checking the alignment to ICT standards in clause 7.4.
- A feasibility analysis of implementing these information items in a global DPP system in clause 9.

The present document provides a basis for expressing circularity and environmental sustainability information about products and standards for DPPs.

The present document was developed jointly by ETSI TC EE and ITU-T Study Group 5. It is published respectively by ITU and ETSI as Recommendation ITU-T L.1071 [i.44] and ETSI ES 204 082 (the present document), which are technically equivalent.

1 Scope

The present document provides a structure for collecting information items organized to represent circularity and environmental sustainability information about ICT products and product-related standards. This will facilitate alignment verification of ICT products to standards to various actors during the product lifespan up to final recycling.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found in the ETSI docbox.

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The following referenced documents are necessary for the application of the present document.

[1] Recommendation ITU-T L.361: "ID tag requirements for infrastructure and network elements management".

NOTE: Former Recommendation ITU-T L.64 renumbered as Recommendation ITU-T L.361 on 2016-02-15 without further modification and without being republished.

[2] Recommendation ITU-T L.1022: "Circular economy: Definitions and concepts for material efficiency for information and communication technology".

[3] ETSI TS 103 881: "Environmental Engineering (EE); Global digital sustainable product passport opportunities to achieve a circular economy".

[4] Recommendation ITU-T L.1100: "Procedure for recycling rare metals in information and communication technology goods".

[5] Recommendation ITU-T L.1102: "Use of printed labels for communicating information on rare metals in information and communication technology goods".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI ES 203 199: "Environmental Engineering (EE); Methodology for environmental Life Cycle Assessment (LCA) of Information and Communication Technology (ICT) goods, networks and services".

[i.2] ETSI EN 303 808: "Environmental Engineering (EE); Applicability of EN 45552 to EN 45559 methods for assessment of material efficiency aspects of ICT network infrastructure goods in the context of circular economy".

[i.3] Recommendation ITU-T L.1010: "Green battery solutions for mobile phones and other hand-held information and communication technology devices".

[i.4] Recommendation ITU-T L.1021: "Extended producer responsibility - Guidelines for sustainable e-waste management".

[i.5] Recommendation ITU-T L.1023: "Assessment method for circular scoring".

[i.6] Recommendation ITU-T L.1031: "Guideline on implementing the e-waste reduction target of the Connect 2020 Agenda".

[i.7] Recommendation ITU-T L.1061: "Circular public procurement of information and communication technologies".

[i.8] Recommendation ITU-T L.1410: "Methodology for environmental life cycle assessments of information and communication technology goods, networks and services".

[i.9] Recommendation ITU-T L.1604 (2022): "Development framework for bioeconomy in cities and communities".

[i.10] Recommendation ITU-T L.1020 (2018): "Circular economy: Guide for operators and suppliers on approaches to migrate towards circular ICT goods and networks".

[i.11] Ellen McArthur Foundation: "What is the circular economy?".

[i.12] Recommendation ITU-T X.1400 (2020): "Terms and definitions for distributed ledger technology".

[i.13] Recommendation ITU-T Q.5050 (2019): "Framework for solutions to combat counterfeit ICT devices".

[i.14] European Commission (2022): "Proposal for Ecodesign for Sustainable Products Regulation".

[i.15] OECD (2019): "Going Digital: Shaping Policies, Improving Lives". Paris: OECD Publishing. 168 pp.

[i.16] COM/2020/798 (2020): "Proposal for a Regulation of the European Parliament and of the Council concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020".

[i.17] ETSI TS 103 199 (2011): "Environmental Engineering (EE); Life Cycle Assessment (LCA) of ICT equipment, networks and services; General methodology and common requirements".

[i.18] European Commission (2024): "Commission implementing decision on a standardisation request to the European Committee for Standardisation, the European Committee for Electrotechnical Standardisation, and the European Telecommunications Standards Institute as regards digital product passports in support of Union policy on ecodesign requirements for sustainable products and on batteries and waste batteries".

[i.19] UN: Secretary-General; World Commission on Environment and Development (1987): "Report of the World Commission on Environment and Development: Our common future", New York, NY: United Nations. 374 pp.

[i.20] Recommendation ITU-T Y.4108/Y.2213 (2008): "NGN service requirements and capabilities for network aspects of applications and services using tag-based identification".

NOTE: Former Recommendation ITU-T Y.2213 renumbered as Recommendation ITU-T Y.4108 on 2016-02-05 without further modification and without being republished.

[i.21] ISO 9000:2015: "Quality management systems - Fundamentals and vocabulary".

[i.22] V. Rizos, P. Urban (2024): "Implementing the EU digital battery passport: Opportunities and challenges for battery circularity".

[i.23] Carolynn Bernier, Fatme Danash (2024): "D5.1: DPP Prototypes".

[i.24] E. Wagner et al. (2023): "D2.1: Mapping of legal and voluntary requirements and screening of emerging DPP-related pilots".

[i.25] CEN (2024) Technical Bodies, CEN/CLC/JTC 24: "Digital Product Passport - Framework and System".

[i.26] Dykstra, C. A. (1939): "The quest for responsibility", Am. Political Sci. Rev. 33(1), pp. 1-25. doi:10.2307/1949761.

[i.27] Regulation (EU) 2024/1781 of the European Parliament and of the Council of 13 June 2024 establishing a framework for setting eco-design requirements for sustainable products and repealing Directive 2009/125/EC (COM(2022)0142 - C9-0132/2022 - 2022/0095(COD)).

[i.28] ETSI GR CIM 017 (V1.1.1) (12-2022): "Context Information Management (CIM); Feasibility of NGSI-LD for Digital Twins".

[i.29] ETSI (2020): "A Guide to Writing World Class Standards".

[i.30] International Electrotechnical Commission (2023), IEC 62683 - IEC/TC 121: "Tests - Common Data Dictionary (CDD - V2.0018.0001)".

[i.31] ISO/IEC 8859-1:2003: "Information technology - 8-bit single-byte coded graphic character sets - Part 1: Latin alphabet No. 1".

[i.32] Telecommunication standardization sector of ITU (09/2020): "ITU-T Editing Guidelines".

[i.33] Luxembourg government (2021): "The Product circularity Data Sheet decoded".

[i.34] A. Kurteva (2023): "The RePlanIT ontology for Digital Product Passports of ICT".

[i.35] Schedler, A. (1999): "Conceptualizing accountability", In: Schedler, A., Diamond, L., Plattner, M.F., editors. The self-restraining state: Power and accountability in new democracies, pp. 13-28. Boulder, CO: Lynne Rienner Publishers.

[i.36] M. Sporny, L. Rosenthol (2021): "Cryptographic Hyperlinks".

[i.37] United Nations (2022): "'Zero tolerance for greenwashing', Guterres says at report launch".

[i.38] UNECE Recommendation No. 49 (2024): "Transparency at Scale (final draft)".

[i.39] UNECE (2024): "Digital Product Passport", version: 0.4.0.

[i.40] UNECE (2024): "DigitalProductPassport", version: working, Data Model of unece/DigitalProductPassport.

[i.41] Recommendation ITU-T L.1015: "Criteria for evaluation of the environmental impact of mobile phones".

[i.42] Recommendation ITU-T L.1470: "Greenhouse gas emissions trajectories for the ICT sector compatible with the UNFCCC Paris Agreement".

[i.43] Recommendation ITU-T L.1070: "Global digital sustainable product passport opportunities to achieve a circular economy".

[i.44] Recommendation ITU-T L.1071: "An information model for digital product information on sustainability and circularity".

[i.45] ISO/FDIS 59040: "Circular economy - Product circularity data sheet". .

[i.46] ISO 59010:2024: "Circular economy - Guidelines for the Transition of Business Models and Value Networks".

[i.47] ISO 59004:2024: "Circular economy - Vocabulary, principles and guidance for implementation".

[i.48] ISO 59020:2024: "Circular economy - Measuring and assessing circularity performance".

[i.49] IEC/FDIS 82474-1: "Material declarationPart 1: General requirements".

[i.50] Recommendation ITU-T L.1101: "Measurement methods to characterize rare metals in information and communication technology goods".

[i.51] Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC (consolidated version 6/6/2024).

[i.52] Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

[i.53] Regulation (EU) 2017/1369 of the European Parliament and of the Council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU.

[i.54] Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast 1/8/2024).

[i.55] Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE) (recast 8/4/2024).

[i.56] Regulation (EU) 2023/1542 of the European Parliament and of the Council of 12 July 2023 concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC.

[i.57] Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (recast).

[i.58] EN 45550:2020: "Definitions related to material efficiency", (produced by CEN).

[i.59] EN 45552:2020: "General method for the assessment of the durability of energy-related products", (produced by CEN).

[i.60] EN 45553:2020: "General method for the assessment of the ability to remanufacture energy-related products", (produced by CEN).

[i.61] EN 45554:2020: "General methods for the assessment of the ability to repair, reuse and upgrade energy-related products", (produced by CEN).

[i.62] EN 45555:2019: "General methods for assessing the recyclability and recoverability of energy-related products", (produced by CEN).

[i.63] EN 45556:2019: "General method for assessing the proportion of reused components in energy-related products", (produced by CEN).

[i.64] EN 45557:2020: "General method for assessing the proportion of recycled material content in energy-related products", (produced by CEN).

[i.65] EN 45558:2019: "General method to declare the use of critical raw materials in energy-related products", (produced by CEN).

[i.66] EN 45559:2019: "Methods for providing information relating to material efficiency aspects of energy-related products", (produced by CEN).

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the following terms apply:

accountability: equivalent to answerability, liability, and the expectation of account-giving, with the obligation to inform about (past or future) actions and decisions to justify them

NOTE: Term adapted from [i.26] and [i.35] and ETSI TS 103 881 [3].

authenticity: ability of proving an assertion, such as the identity of a computer system user

NOTE: Term adapted from ETSI TS 103 881 [3].

centralization: data, function, process, system where a single entity, or a small group, has exclusive control or responsibility

NOTE: Term adapted from ETSI TS 103 881 [3].

circular economy: economy closing the loop between different life cycles through design and corporate actions/practices that enable activities like reuse, refurbishment, remanufacture and recycling in order to use raw materials, goods and waste in a sustainable and efficient way

NOTE 1: The circular economy concept distinguishes between technical and biological cycles, the circular economy is a continuous, positive development cycle. It preserves and enhances natural capital, optimizes resource yields, and minimizes system risks by managing finite stocks and renewable flows, while reducing waste streams.

NOTE 2: Term adapted from Recommendations ITU-T L.1022 [2], ITU-T L.1020 [i.10] and L.1604 [i.9].

circularity: designing out waste and pollution, keeping products and materials in use, and regenerating natural systems

NOTE: The term is based on EMF2021[i.11].

collective product: product batch or product model with common characteristics for multiple product items

NOTE: Term adapted from ETSI TS 103 881 [3].

compliance: adherence to specified requirements

NOTE: Term adapted from Recommendation ITU-T X.1400 [i.12].

component: hardware constituent of a product that cannot be taken apart without destruction or impairment of its intended use

NOTE 1: A populated printed circuit board may be considered a component and/or a part from the perspective of the present document.

NOTE 2: Term adapted from ETSI EN 303 808 [i.2].

conformity assessment: demonstration that specified requirements relating to a product, process, system, person or body are fulfilled

NOTE: Term adapted from Recommendation ITU-T Q.5050 [i.13].

decentralization: data, function, process, system that is not centralized, controlled by a single or few entities

NOTE: Term adapted from ETSI TS 103 881 [3].

digital product passport: structured collection of product-specific data conveyed through a unique identifier

NOTE 1: Term based on European Commission document [i.14].

NOTE 2: Term adapted from ETSI TS 103 881 [3].

digitalization: use of digital technologies and data as well as interconnection that results in new or changes to existing activities

NOTE: Term adapted from [i.15].

e-waste: electrical or electronic equipment that is waste, including all components, sub-assemblies and consumables that are part of the equipment at the time the equipment becomes waste

NOTE 1: The terms e-waste and Waste Electrical and Electronic Equipment (WEEE) are used interchangeably.

NOTE 2: Term adapted from Recommendation ITU-T L.1031 [i.6].

economic operator: manufacturer, authorized representative, importer, distributor, fulfilment service provider, or any legal person with legal responsibility concerning manufacture

NOTE: Adapted and modified from [i.16] and ETSI TS 103 881 [3].

environmental information: information related to environmental aspects, eco-design and circularity of ICT goods

NOTE 1: Environmental information, in general, is a much wider concept than what is defined here; however, for the present document, the term "environmental information" is defined in the context of information to be presented in the Digital Product Passport.

NOTE 2: This can be part of a sustainability claim in the context of UNECE B2B DPP [i.39] and Recommendation No. 49 [i.38].

extended producer responsibility: policy principle to promote total life cycle environmental improvements of product systems by extending the responsibility of the manufacturers of the product to various parts of the entire life cycle of the product, and especially to the take-back, recycling and final disposal of the product

NOTE: Term adapted from Recommendation ITU-T L.1021 [i.4].

global digital sustainable product passport: subset of a digital product passport, global in regional scope, focused on environmental sustainability aspects

NOTE: Term adapted from ETSI TS 103 881 [3].

ICT goods: tangible goods deriving from or making use of technologies devoted to or concerned with:

- the acquisition, storage, manipulation (including transformation), management, movement, control, display, switching, interchange, transmission or reception of a diversity of data;
- the development and use of the hardware, software, and procedures associated with this delivery; and
- the representation, transfer, interpretation, and processing of data among persons, places, and machines, noting that the meaning assigned to the data is preserved during these operations

NOTE 1: ETSI TS 103 199 [i.17] uses the word "equipment" instead.

NOTE 2: Term adapted from Recommendation ITU-T L.1410 [i.8] or the technically aligned ETSI ES 203 199 [i.1].

ID tag: physical object which stores one or more identifiers and optionally application data such as name, title, price, address, etc.

NOTE: Term adapted from Recommendation ITU-T Y.4108/Y.2213 [i.20].

identity: ability of indicating a person or thing's identity, authentication is the process of verifying that identity

NOTE: Term adapted from ETSI TS 103 881 [3].

individual product: product item

NOTE: Term adapted from ETSI TS 103 881 [3].

information accessibility: ability to access and benefit from information to the widest range of actors and situations

NOTE: Term adapted from ETSI TS 103 881 [3].

information composability: ability to combine and assemble self-contained and stateless information components, as with structured linked data

NOTE: Term adapted from ETSI TS 103 881 [3].

information confidentiality: set of rules or a promise to limits access or places restrictions on certain types of information

NOTE: Term adapted from ETSI TS 103 881 [3].

information privacy: relationship between the collection and dissemination of data

NOTE: Term adapted from ETSI TS 103 881 [3].

information transparency: clarity about relevant details, needed for a decision or an assessment

NOTE: Term adapted from ETSI TS 103 881 [3].

information verifiability: ability to review, inspect, audit, test to establish, document, confirm the veracity of an assertion

NOTE: Term adapted from ETSI TS 103 881 [3].

integrity: maintenance of, and the assurance of, data accuracy and consistency

NOTE: Term adapted from ETSI TS 103 881 [3].

intermediate product: product that requires further manufacturing or transformation such as mixing, coating or assembling to make it suitable for end-users

NOTE: Term adapted from [i.14].

modular product: product that, in a container, includes module(s) (component product(s)) that can easily be replaced or added

NOTE: Term adapted from ETSI TS 103 881 [3].

product: any physical good that is placed on the market or put into service

NOTE 1: ICT goods are ICT products.

NOTE 2: Term adapted from EC2022 [i.14].

product batch: subset of a specific model composed of all products produced in a specific manufacturing plant at a specific moment in time

NOTE: Term adapted from [i.18].

product item: single unit of a model

NOTE: Term adapted from [i.18].

product model: version of a product of which all units share the same technical characteristics and the same model identifier

NOTE: Term adapted from [i.18].

product operator: any actor that can transform and supply modified products and therefore can supply the information a digital product passport conveys about them, as a result of manufacture or other operations

NOTE 1: These other operations could be: packaging, configuration, maintenance, repair, upgrade, refurbishment, remanufacturing or recycling.

NOTE 2: Term adapted from ETSI TS 103 881 [3].

refurbishment: industrial process which produces a product from used products without any changes influencing safety, original performance, purpose or type of the product

NOTE 1: New and/or used parts can be used during refurbishment.

NOTE 2: The term is based on ETSI EN 303 808 [i.2] and Recommendation ITU-T L.1023 [i.5].

remanufacturing: industrial process which produces a product from used products or used parts where at least one change is made which influences the safety, original performance, purpose or type of the product

NOTE 1: The product created by the remanufacturing process may be considered a new product when placing on the market.

NOTE 2: The term is based on ETSI EN 303 808 [i.2] and Recommendation ITU-T L.1023 [i.5].

repair: process of returning a faulty product to a condition where it can fulfil its intended use

NOTE: Term adapted from Recommendation ITU-T L.1022 [2].

risk: combination of the probability of occurrence of harm and the severity of that harm limited to human health or safety of persons, to property or to the environment

NOTE: Term adapted from [i.16].

supply chain due diligence: obligations of the economic operator which places a product on the market, in relation to its management system, risk management, third party verifications by notified bodies and disclosure of information with a view to identifying and addressing actual and potential risks linked to the sourcing, processing and trading of the raw materials required for product manufacturing

NOTE: Term adapted from Recommendation ITU-T L.1061 [i.7].

sustainability claim: specific statement or assertion about a product, made with a structured data format, regarding its sustainability, providing details about the metrics, thresholds, and evidence supporting the claim

NOTE: Term adapted from [i.40].

sustainable development: development that meets the needs of the present without compromising the ability of future generations to meet their needs

NOTE: Term adapted from [i.19].

tag-based identification: process of specifically identifying a physical or logical object from other physical or logical objects by using identifiers stored on an ID tag

NOTE: Term adapted from [i.20].

traceability: ability to trace the history, application or location of that which is under consideration

NOTE: Term adapted from [i.21].

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

B2B	Business to Business
B2C	Business to Consumer
CFP	Carbon Footprint of Products
CLP	Classification, Labelling and Packaging
DPP	Digital Product Passport
ESG	Environmental, Social and Governance

ESPR	Ecodesign for Sustainable Products Regulation
ETSI	European Telecommunications Standards Institute
EU	European Union
e-waste	Electrical and electronic waste
FAIR	Findable, Accessible, Interoperable, and Reusable
GDSPP	Global Digital Sustainable Product Passport
ICT	Information and Communication Technology
ID	Identifier
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
ITU	International Telecommunication Union
JSON-LD	JavaScript Object Notation for Linked Data
PBB	PolyBrominated Biphenyls
PBDE	PolyBrominatedDiphenyl Ethers
PCB	Print Circuit Board
PCDS	Product Circularity Data Sheet
REACH	Registration, Evaluation, Authorization and Restriction of Chemicals
SoC	Substances of Concern
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNTP	United Nations Transparency Protocol
URI	Uniform Resource Identifier
W3C®	World-wide-web Consortium
WEEE	Waste Electrical and Electronic Equipment

4 Conventions

Generally, ETSI standards use the term "ICT goods" instead of "ICT products". However, considering the present document is about the Digital Product Passport, both terms are used interchangeably. Hence, the term "products" should be considered synonymous to the term "goods" in the present document.

References to the term **sustainability** or (verifiable) **claim** in the present document should be understood in terms of environmental and circularity sustainability.

The appearance of requirement phrases or keywords in an annex or in material explicitly marked as informative is interpreted as having no normative intent.

5 Related regional and global DPP standards and regulation

5.0 General

The present document provides a basis or complement to other product-centric DPP-related standards and regulations. The most relevant are introduced next.

5.1 Global digital sustainable product passport opportunities to achieve a circular economy

ETSI TS 103 881 [3] provides an overview of global and common opportunities to represent environmental sustainability details about digital technology products, ICT goods, as GDSPP. It defines and specifies the following regarding DPPs:

- A DPP as a structured collection of product-related information, represented in digital format as digital data.
- A global scope.

- Its applicability to convey and provide information in the raw material acquisition, production, use, and end-of-life treatment lifecycle stages to product operators, buyers, and users, assess the sustainability impact, and support market surveillance of ICT products.
- A criterion and a non-exhaustive list of product types to consider.
- The benefits of collecting and maintaining product information.
- The required principles and required generic properties of digital product information in DPPs.
- Criteria about the level of product's detail in terms of breadth, precision or granularity of identification.
- What constitutes a product and classes of products (verticals).
- Options to customize and change product information by the product operators involved as products evolve.
- The feasibility of implementing these opportunities and the DPP system architectural implications are determined according to the product-level scope of DPPs, either the product model (collective), product batch (collective), or individual product item.
- It does not define which items should be included in the DPP for all or different product families or the targets, limits, or specific requirements a product has to meet.

The present document builds on that to focus on how environmental sustainability and circularity information can be presented in a way which is aligned with relevant standards.

5.2 European digital product passport

The EU ESPR [i.27] is an EU regulation that specifies high-level information requirements and considers what information a DPP (EU DPP) could provide for the following aspects:

- product durability, reliability, reusability, upgradability, reparability;
- possibility of maintenance and refurbishment;
- presence of Substance of Concern (SoC);
- energy use/efficiency and resource use/efficiency;
- recycled content;
- possibility of remanufacturing, recycling, material recovery;
- environmental impacts, including carbon footprint and environmental footprint;
- generation of waste materials.

Product category-specific details are to be detailed in separate legislative acts, such as the battery regulation in 2023 [i.14] or the electronic products regulation expected by 2030.

Specifically, ESPR has included eight technical topics and a list of essential requirements in the European Commission standardization request on DPP [i.18], with expected results by the end of 2025:

1) unique identifiers;
2) data carriers;
3) links between physical product and digital representation, look-up mechanism;
4) access rights management;
5) interoperability (technical, semantic, organization), including data exchange protocols and formats and data processing (introduction, modification, update);
6) data storage and data persistence;

7) data authentication, reliability, integrity;

8) data security and privacy.

5.3 United Nations Transparency Protocol - B2B Digital Product Passport

UNECE proposes UNTP [i.38] (UNECE Recommendation 49), a lightweight B2B digital product passport that contains only the minimum sufficient Environmental, Social and Governance (ESG) metrics for digitalization in the supply chain of diverse product categories. It also considers techniques like separating facts (e.g. factory energy) from assessing those facts against different conformity criteria.

According to [i.39]: *"The digital product passport (DPP) is issued by the shipper of goods and is the carrier of **product and sustainability information** for every serialised product item (or product batch) that is shipped between actors in the value chain. It is deliberately **simple and lightweight** and is designed to carry the minimum necessary data at the **granularity** needed by the receiver of goods - such as the scope 3 emissions in a product shipment. The passport contains links to **conformity credentials** which add trust to the ESG claims in the passport. The passport also contains links to **traceability events** which provide the "glue" to follow the linked-data trail (subject to confidentiality constraints) from finished product back to raw materials. The UNTP DPP does not conflict with national regulations such as the EU DPP. In fact, it can usefully be conceptualised as the **upstream B2B feedstock** that provides the data and evidence needed for the issuing of high quality national level product passports."*

In the present document, the terminology, vocabulary and data model proposed by UNTP [i.38] (UNECE Recommendation 49) are adopted for harmonization with a broader scope standard.

5.4 Other related standards

There are standards that complement, are related and offer further guidance or specifications to a DPP:

- The ISO Product Circularity Data Sheet (PCDS) project [i.33] by ISO/TC323 as ISO/FDIS 59040 [i.45] regarding the structured presentation of data related to the circularity of products to provide transparency and comparability of product circularity information, ISO 59010 [i.46] as "Circular economy - Guidelines for the Transition of Business Models and Value Networks", ISO 59004 [i.47] as "Circular economy - Vocabulary, principles and guidance for implementation", and ISO 59020 [i.48] as "Circular economy - Measuring and assessing circularity performance".

- EN 45550 [i.58], EN 45552 [i.59], EN 45553 [i.60], EN 45554 [i.61], EN 45555 [i.62], EN 45556 [i.63], EN 45557 [i.64], EN 45558 [i.65] and EN 45559 [i.66]: about circular aspects of energy-related products, and their applicability in [i.2] for the assessment of material efficiency aspects of ICT network infrastructure goods in the context of the circular economy.

- Recommendation ITU-T L.1022 [2] with guidance and provisions to circular economy aspects, parameters, metrics and indicators for ICT goods applicable in the present document. It describes the importance of the availability of proper information and support by the manufacturer for the customer using the goods, as well as reporting related to material efficiency aspects.

- Recommendation ITU-T L.64 (renumbered as Recommendation ITU-T L.361 [1]) on ID tag requirements for infrastructure and network elements management, and Recommendation ITU-T Y.4108/Y.2213 [i.20] on tag-based identification.

- Recommendation ITU-T L.1102 [5] describes printed label methods to provide information on the disclosure of rare metals information contained in ICT goods to consumers and recyclers. It covers:

  - an overview of printed label symbology methods;

  - recommendations for printed label methods for rare metals in ICT goods;

  - a communication process for printed labels providing information on rare metals in ICT goods.

  The relationship of this standard to a DPP is described in detail in Annex B.

- IEC 82474-1 [i.49] on material declaration concerns the declaration of materials, substances, and components used in products, particularly in electronics. It aims to improve the transparency of material content. This standard is crucial for manufacturers and suppliers to comply with environmental regulations and support electronic product recycling and disposal processes.

- Recommendation ITU-T L.1100 [4] on disclosure of rare metals information to consumers and recyclers (related to Recommendation ITU-T L.1102 [5]): it provides a vocabulary and classification scheme about common rare metals by groups and elements and a recommended procedure to collect from suppliers in the production stage the information about the amount of rare metals used in ICT goods to consumers and recyclers, and the feasibility of their recovery to be provided to recyclers to ensure an efficient recycling process.

- Recommendation ITU-T L.1101 [i.50] on measurement methods to characterize rare metals, related to Recommendations ITU-T L.1100 [4] on the need to provide rare metal information from ICT goods manufacturers and L.1102 [5] on the use of printed labels for communicating information on rare metals in ICT goods.

The goals and structure of these structured collections of product-specific data conveyed through a unique identifier contribute to the specification of DPPs. These and other standards contribute to a more sustainable and transparent approach to providing comprehensive and harmonized digital information about products in all steps of their circular life.

5.5 Alignment and complementarity

Regarding standards and regulation, the EU CIRPASS project has explored the DPP concept considering the interoperability among the above standards and others; the EU DPP in clause 5.2, and UNTP DPP in clause 5.3; as well as the role of the semantic web to link data and metadata; the reuse of existing and developing cross-sectoral, sectoral and circular economy data models, vocabularies and ontologies [i.23].

The present document builds on and aligns with these and other product-centred or related standards and regulation, aiming for complementarity and harmonization.

For that, the present document focuses on an information model that brings digital information details as information in accordance with existing standards and regulation.

6 Overview of information requirements from pre-existing environmental standards

6.0 General

A set of international standards provides guidance and the framework to implement circularity across the lifecycle of ICT goods. Several of these define and use metrics and target values (reference values) about products, specifically ICT goods, which, represented in a DPP, would facilitate checking alignment with these standards. These metrics and values have different requirement levels:

- According to ITU-T editing guidelines [i.32], the "shall" and "must" clauses in a Recommendation express mandatory, when necessary, to give the Recommendation meaning and effect. Compliance with a Recommendation is achieved only when all mandatory provisions are met.

- ETSI writing guidelines [i.29] define the following requirement words in clauses: "shall" as a mandatory requirement; "should" as a recommendation, desirable but not mandatory; and "may" as optional.

Annex A of Recommendation ITU-T L.1070 [i.43] and ETSI TS 103 881 [3] provide a list of related work, standards and data sources concerning environmental sustainability, including:

- ITU-T Recommendations (and ETSI standards) are classified in terms of lifecycle stages, as Table A.1.

- The PCDS taxonomy and vocabulary about circularity properties of products.

- Information and data sources on regional and global environmental agreements, as Table A.2.

Several of these standards and agreements propose or rely on a set of information items and reference values defining requirements for checking product alignment, conformity assessment or standards compliance.

The present document proposes a method for mapping these standards into a set of information items that, included in a DPP, would allow checking alignment with different standards when relevant.

6.1 Quality properties of data and information

The expected quality of the data has been described in detail in ETSI TS 103 881 [3] as a way to render environmental and sustainability-related information useful and reliable at the product level and in aggregate terms for volume trade (B2B) or statistical purposes. It describes several desirable and required principles and data quality properties that shall be applied.

NOTE 1: Required principles: Digitalization; data findability, accessibility, interoperability, and reusability; usefulness; accuracy; inclusivity; transparency; accountability; standardization, information privacy; information protection.

NOTE 2: Data quality properties: accessibility; persistency; authenticity; identifiability; composability; integrity; verifiability; traceability (about products).

These desirable principles and required data quality properties shall be considered when raising DPP requirements and defining environmental information in DPP in accordance with respective standards.

6.2 Product granularity and circularity information requirements

6.2.0 General

The following are product-centric requirements deriving from ETSI TS 103 881 [3], aligned and complementary to related standards.

6.2.1 Granularity requirement

The definition of the product raises a requirement on specifying granularity: either an individual distinguished (serialized) item, batch, or model. These items can be an integrated product or a separate part (battery, display module).

As described in ETSI TS 103 881 [3], a DPP and therefore any sustainability information shall refer to the following not exhaustive list of ICT product types:

- Individual ICT product: such as a serialized or customized individual ICT product item.
- Collective ICT product: an ICT product batch or model with common characteristics for multiple product items.
- Modular ICT product: an ICT product that combines a container product (e.g. rack, chassis) with included modules (ICT products) that can easily be replaced or added.
- Replaceable parts (products) such as batteries, display modules, or consumables like print cartridges.
- Accessory products such as cables and keyboards.

Choices on granularity (precision), updates (latency) of identification and level of detail (breadth) regarding a DPP depend on product characteristics and agreements across actors. In the case of the EU DPP, these agreements can be reflected in EU delegated acts for a product category. In the case of the UNTP DPP, choices are defined by the minimum necessary data granularity needed by the receiver of goods. Similarly, checking product alignment or conformity assessment to specific standards may require specific choices.

Products develop along a (forward) supply chain as a result of exchanges as sales involving different businesses (B2B) until a final product is placed on the market, sold to product owners, users or consumers (B2C) and put into service. While the UNTP DPP focuses on the B2B interactions in the supply chain, the EU DPP considers the last few steps before a product is placed on the market and the circular product life involving the reverse supply chain about reuse, remanufacturing and ending as e-waste at end-of-life. Therefore, both DPP concepts are complementary, as described in clause 5.5. The support DPP can provide to reflect reverse supply chain decisions that can result in unique, customized or individualized ICT products is key to product circularity.

6.2.2 Precision of information details requirement

Products may have relevant changes after modification, such as upgrade, repair, refurbishment, remanufacturing, or recovery. This is particularly relevant for circular ICT goods.

While new or remanufactured consumer or industrial ICT products are produced in large quantities with identical features, therefore represented by a DPP in common, customized (modified) products as a result of reconfiguration, repair, refurbishment, incorporating new, modified or second-hand pieces tend to acquire unique characteristics and may require environmental sustainability information in a DPP to accurately reflect the unique environmental characteristics of these individual product items.

Related to service requirements and capabilities defined by ETSI TS 103 881 [3], while model information can be fixed at design time (launch certificate), batch information can be fixed at manufacturing time (birth certificate), but product information can be extended by changes over the lifespan (as a new of specific DPP supplement for that individual product item), and may be updated like a tachograph or digital twin (e.g. counters, events, metrics) [i.28] and eventually when declared as e-waste.

6.2.3 Product information requirement

The requirements for the granularity of environmental sustainability information and about what is a product unit in clause 6.2.1, and for precision and about how products can change and differentiate over their lifespan in clause 6.2.2, have implications for product identification and identifiers. However, product identification is out of the scope of the present document and should be built on the results of the CEN/CENELEC JTC 24 activities following the standardization request from the EC [i.25].

6.2.4 Environmental information requirement

Environmental information, including details about environmental sustainability, eco-design and circularity aspects of products, shall be expressed in a B2B DPP as sustainability verifiable claims [i.40], as developed in clause 7.1.

Environmental information, mapped as B2B DPP claims, includes values expressed in units of measure (metrics), as developed in clause 7.2.

According to the information verifiability quality in ETSI TS 103 881 [3], B2B DPP claims can include information in accordance with relevant standards to assess the veracity of environmental information in the corresponding sustainability claims (as introduced in clause 6.1, developed in clause 7.3).

A standard including product-related environmental information requirements can be translated into a set of claim templates that can be represented in tabular form. Comparing the set of information/claim templates about a standard with the set of information/claim instances about a product in a DPP can help check product alignment with that standard. For instance, this can facilitate supply chain due diligence [i.7] in circular public procurement.

These clauses are consistent and follow the proposed [i.39].

NOTE: Inspired by the COP 27 statement by Secretary General Guterres that the UN [i.19] has "Zero Tolerance for Greenwashing" [i.37].

6.3 DPP legislative requirements

Certain information items may be mandatory for existing and potentially upcoming legal, legislative, regulatory compliance or business conformity. Addressing the regional scope and legislative requirements on environmental sustainability information in a DPP, some of which are introduced in clause 5, are complementary to and outside the scope of the present document.

Annex D describes the legal context and requirements for DPP in the EU.

7 From requirements to an information model

7.0 General

The previous requirements translate into an information model that enables the expression of environmental information, conformity statements or claims about the environmental sustainability and circularity capabilities of ICT products.

The leading general (common) attributes to consider are as follows in Table 1.

Table 1: Mapping of environmental information in the present document to the B2B DPP data model

Environmental sustainability information model	B2B DPP data model
environmental information item/instance	sustainability claim
informed value	claimed value
criteria source	criteria reference
reference value	benchmark value
source of the reference value	benchmark reference

7.1 Description of environmental information about a product

Following the [i.40] schema, addressing the requirement specified in clause 6.2.4, environmental sustainability information about a product (given its identifier as described in clause 6), also referred to as a **product-related information** can be mapped to B2B DPP **claim data** instances, shall include the following data properties: (environmental information terms in *italics*, B2B DPP data model terms in **bold**).

- **Topic**, as a code or name from a list or vocabulary.

NOTE: The relationship to ontologies and vocabularies about environmental sustainability is explored in Annex C.

- Source specification (**standard or regulation**) and the specific **criteria** *source*/**criteria reference** within the standard or regulation against which the claim is made, both as a document/resource reference (URI).
- *Informed values*/**claimed values** as a metric: one or more actual values of environmental information.
- Conformity, with details about, when relevant:
  - A reference *value*/**benchmark value** against which the claimed value can be assessed;
  - A *source of the reference value*/**benchmark reference** to evidence to support the benchmark value as an URI;
  - An indicator (logic: boolean) of **conformance** that expresses whether or not this product has achieved compliance against the criteria; and
  - A reference to **conformity evidence**, as a URI pointing to the evidence supporting the environmental information, such as a verifiable document/credential.

Logical, non-numerical claims based on presence, absence, or meeting a condition can be expressed as a Boolean value.

Following the proposals from the CIRPASS project about linked data and vocabularies [i.23] and UNTP [i.40]:

- A topic relates to the concept of machine-readable vocabularies, considered in both the EU DPP and UNTP DPP.

- Document/resource references usually take the form of a URI, leading to an online document that can be accessed according to access permissions.
- Verifiable documents usually take the form of (W3C) verifiable credentials, but other formats for evidence are possible.
- Unit code expresses the unit of measure according to ISO/IEC standards.

7.2 Metric

Following the schema of [i.40], a metric shall include the following data properties: (environmental information terms in *italics*, B2B DPP data model terms in **bold**):

- **Name**, a human-readable name for this metric.
- **Value**, a numerical value representing the measurement or evaluation outcome of the *information*/claim.
- **Unit measure code**, a code expressing the unit of measure (following existing standards, e.g. ISO/IEC).
- Range of **accuracy**, a numeric value to express percentage (optional).

7.3 Evidence

Following the proposals from the CIRPASS project about linked data and vocabularies [i.23] and UNTP [i.40] and addressing clause 6.1, an evidence to support environmental information shall include the following data properties:

- **Format** code of the evidence: document, verifiable credential, website, etc.
- **Credential reference**: immutable URI, such as a hashlink URI [i.36], to avoid post-issue tampering.
- **Assurance level** of the evidence: self-declaration, third party, accredited auditor, etc.

7.4 Environmental information template about a standard

As raised in clause 6.2.4, a standard including conformity requirements can be translated into an information template with set of claim data items. These items are referred to as a **standard-related claim**, shall include the following data properties: (environmental information terms in *italics*, B2B DPP data model terms in **bold**):

- **topic**, as a code or name from a list or vocabulary.
- Source specification (**standard or regulation**) and the specific **criteria** *source*/**criteria reference** against which the claim is made, both as a document/resource reference (URI).
- Conformity, with details about, when relevant:
  - A reference *value*/**benchmark metric** against which the claimed value can be assessed.
  - A **requirement level**: mandatory, desirable, optional.
  - A description of the **expected evidence** to show and support conformity.
  - An optional **description** of the rationale of this template item.

8 Digital information and product alignment to standards

8.1 Mapping of specifications to information and data: template about a standard

A standard or Recommendation can be expressed as a template or table with a list of environmental information items. The set of information/claim items in a template represents the criteria for meeting conformity requirements in a standard. See Annex A in ETSI TS 103 881 [3] for a list of related ETSI and ITU-T standards. Each row in a specific table for a standard (e.g. Recommendation ITU-T L.1015 [i.41]) corresponds to one information/claim template item.

This set can be digitalized (e.g. following a linked-data model such as JSON-LD as proposed by [i.40]) or represented as a table as follows in Table 2.

Table 2: Environmental information template about a standard

Topic	Standard or regulation	Source/Criteria reference	Reference/Benchmark metric				Requirement level on the reference standard	Expected evidence	Description
Code/name from vocabulary	Source URI	Criteria URI	Name	Value	Unit	Accuracy			

NOTE: In case of multiple possible reference values which define different categories (for example, EU energy labels for consumer devices, which have energy efficiency categories from A to G), the categorization can be indicated, for example, in "Environmental information"/"Reference value". For example "EU energy label category B" and the "Environmental information"/"Source for the reference value" could provide the pointer to the energy label category.

An example of use is in Table 3. Annex A provides an example application exercise for validation.

Table 3: An example of an environmental information template item about a standard

Topic	Standard or regulation	Source/Criteria reference	Reference/Benchmark metric				Requirement level on the reference standard	Expected evidence	Description
Code/name from vocabulary	Source URI	Criteria URI	Name	Value	Unit	Accuracy			
Low halogen electronics: electronics.halogen	Recommendation ITU-T L.1015	https://www.itu.int/rec/T-REC-L.1015/#PCB-chl	PCB and accessories, chlorine: electronics.halogen.chlorine	900	ppm	empty	Mandatory (see note)	Evidence PCB and accessories meet requirement	PCB and accessories < 900 ppm chlorine
NOTE: Either mandatory, recommended, optional.									

8.2 Mapping of products to information and data: description about a product

A DPP of a product with a given identifier can include a set of product-related information instances of environmental information templates. These can be compared to the information templates associated with a standard to assess the matching of a product to the requirements of a standard.

An environmental information instance table about a product in Table 4, with example values for a given example product in Table 5.

Table 4: Environmental information table about a product

Topic	Standard or regulation	Criteria reference	Environmental information / claimed values (Metric)				Conformity					Rationale
Code/name from vocabulary	Source URI	Criteria URI	Name	Value	Unit	Accuracy	Reference/ Benchmark value	Source for the reference value / Benchmark reference to evidence to value	Conformance indicator (boolean)	Expected evidence	Reference to conformity evidence	Description

Table 5: An example of an environmental information table about a product

Topic	Standard or regulation	Criteria reference	Environmental information / Claimed values (Metric)			Conformity						Rationale
Code/name from vocabulary	Source URI	Criteria URI	Name	Value	Unit	Accuracy	Reference/ Benchmark value	Source for the reference value / Benchmark reference to evidence to value	Conformance indicator (boolean)	Expected evidence	Reference to conformity evidence	Description
Low halogen electronics: electronics. halogen	Recommendation ITU-T L.1015	https://www.itu.int/rec/T-REC-L.1015/#PCB-chl	PCB and accessories, chlorine: electronics. halogen.chlorine	100	ppm	empty	900	https://x.int/standard-about-benchmark-value	true	Evidence PCB and accessories meet requirements	https://manufact.com/DPP1/electronics.chlorine	PCB and accessories < 900 ppm chlorine

The specification of an evidence document is outside the scope of the present document. More details are introduced in clause 7.3, according to the more generic [i.40] standard.

Items in Table 4 collects potential information to be presented in the DPP based on UNECE Recommendation 49 (UNTP B2B DPP) [i.38]. The relevancy of the items depends on several aspects, such as the type of the product.

Table 6 provides an example of a compact table when some of the items in Table 4 are not relevant from conformance point-of-view (e.g. reference value and conformity evidence).

Table 6: Example of a simple compact environmental information table about a product

Topic: Code/name from vocabulary	Source	Name	Value	Unit	Description
Recycled content: steel	Recommendation ITU-T L.1015, EN 45557, ISO 14021:2016	Recycled content: steel	30	%	Assessment based on EN 45557

8.3 What digital sustainable product passport information enables

Digitalizing the process to declare environmental information requirements in a standard and environmental information about characteristics of a product can be used for transparency or ensuring compliance of products to standards, including ETSI standards and ITU-T Recommendations.

Environmental information verifiability in product-related information can confirm the veracity of assertions about sustainability and circularity related to data quality principles and properties in e.g. ETSI TS 103 881 [3].

Expressing the requirements of a standard as an environmental information template that can match environmental information instances that can be represented as UNTP B2B DPP claims facilitates comparing DPPs to these standard-related claim templates to confirm the veracity of assertions about a product with respect to a standard.

The alignment of the present document, with specific requirements related to ICT goods (products) and standards, to the more generic [i.40] standard, which defines DPP claim data in coordination with the EU DPP definition, facilitates global harmonisation of DPP information.

9 Guidance for implementation

The feasibility of implementation is related to the detailed specification of the EU DPP legislation and supporting standards, as well as the UNTP DPP standard. Both initiatives consider the inclusion of environmental information, among other information items.

The EU CIRPASS project has explored the DPP concept considering the interoperability among the above standards and the role of supporting digital technology to represent and implement them. That includes the role of an open web, decentralized identifiers, verifiable credentials, the semantic web, the reuse of existing and developing environmental and circularity data models, vocabularies and ontologies [i.23].

The CIRPASS project has collected information about several partial EU DPP and UNTP B2B DPP pilot systems and experiments that confirm the feasibility of the underlying information and system architecture [i.24].

The publication of environmental information template sets describing the requirements of standards about products, including verifiability details, complemented with the availability of DPPs, will help automate product alignment checking to these standards and avoid greenwashing risk with environmental information unrelated to standards.

The role of governments in defining regional or product category-specific information requirements for DPPs, including proposed or required vocabularies in product information is independent, not affected by the present document. For instance, the EU DPP for electronics, when regulated by a product-specific delegated act, or equivalent legislative process in other regions, will result in a proposed product-related vocabulary with a set of associated information elements proposed and required for any DPP in that region.

For the assessment of target goals such as ITU Connect 2030, Recommendation ITU-T L.1470 [i.42], or net-zero, DPPs and the included environmental information would allow for more precise, automated, and less costly accounting and assessments.

The UNTP DPP allows to express additional environmentally relevant details that are also considered in the EU DPP, such as:

- Material provenance is about the origin or source of raw materials in a product, including the country of origin and the mass fraction.
- Parties are entities such as organizations or companies that manufacture products.
- The facility which manufactured the product.

The present document does not specify interoperability requirements for different implementations of DPP systems, as discussed in [i.22] for battery passports.

Annex A (informative): Example application exercise of an information template for a standard

From the list in Annex A of ETSI TS 103 881 [3] on "Related work, standards and data sources concerning environmental sustainability", this annex presents an example application exercise to define a set of environmental sustainability and circularity information templates that correspond to an environmental standard in that list.

Table A-1 is a validation exercise to demonstrate the ability to develop an information template to facilitate checking product alignment or conformity to a standard, so the requirement words used inside the example table, such as "mandatory", have to be considered related to the example only and are not mandatory or a requirement of the present document. As said before, the present document does not intend to prescribe the information model of any DPP regulation but just define the mapping of a specific standard to a set of information templates. The chosen standard ETSI TS 103 881 [i.3] is about green battery solutions. *This example does not intend to be comprehensive: not all requirements are included for brevity.*

Table A-1

Topic	Standard or regulation	Source/Criteria reference	Reference/Benchmark metric				Requirement level on the reference standard	Expected evidence	Description
Code/name from vocabulary	**Source URI**	**Criteria URI**	**Name**	**Value**	**Unit**	**Accuracy**			
Environmental compliance: pollution	Recommendation ITU-T L.1010	https://www.itu.int/rec/T-REC-L.1010/#EC:P1	Contain toxic materials	False	Bool	*empty*	Mandatory	A 'green battery' has a list of banned and/or restricted materials with material content and disclosure thresholds based upon the weight percentage of similar homogeneous material in the component	Requirements of restricted substances established by national regulations apply to the green battery pack electronics (excluding battery chemistry)
Environmental compliance: pollution	Recommendation ITU-T L.1010	https://www.itu.int/rec/T-REC-L.1010/#EC:P2	Contain toxic materials	False	Bool	*empty*	Mandatory	Idem Regional: EU RoHS, China Management Methods, Korea RoHS	Idem
Environmental compliance: toxic materials	Recommendation ITU-T L.1010	https://www.itu.int/rec/T-REC-L.1010/#EC:T	Polluting the environment during production	False	Bool	*empty*	Mandatory	Idem	Idem

Topic	Standard or regulation	Source/Criteria reference	Reference/Benchmark metric				Requirement level on the reference standard	Expected evidence	Description
Code/name from vocabulary	**Source URI**	**Criteria URI**	**Name**	**Value**	**Unit**	**Accuracy**			
Environmental compliance: banned/restricted materials	Recommendation ITU-T L.1010	https://www.itu.int/rec/T-REC-L.1010/#EC:BM1	maximum concentration values tolerated by weight in homogeneous materials of: lead, mercury, hexavalent chromium, Polybrominated Biphenyls (PBB) and Polybrominated diphenyl Ethers (PBDE)	0,1	%	*empty*	Mandatory	Idem	Idem
Environmental compliance: banned/restricted materials	Recommendation ITU-T L.1010	https://www.itu.int/rec/T-REC-L.1010/#EC:BM2	maximum concentration values tolerated by weight in homogeneous materials of cadmium	0,01	%	*empty*	Mandatory	Idem Regional: EU REACH	Using green batteries in mobile phones and other hand-held ICT equipment
International Safety	IEC 60950-1	https://www.itu.int/rec/T-REC-L.1010/#IS1	Conformity	True	Bool	*empty*	Recommended	The battery has to be randomly tested with the ICT terminal to check for safety conformance	The lifetime of the battery is calculated in 'cycles'. The period of the cycle includes a charging and discharging process

Topic	Standard or regulation	Source/Criteria reference	Reference/Benchmark metric				Requirement level on the reference standard	Expected evidence	Description
Code/name from vocabulary	**Source URI**	**Criteria URI**	**Name**	**Value**	**Unit**	**Accuracy**			
Lifetime requirement (reliability)	Recommendation ITU-T L.1010	https://www.itu.int/rec/T-REC-L.1010/#LR1	reliability	500	cycle	*empty*	Mandatory	A green battery has to withstand a minimum of 500 charge/discharge cycles (100 % depth of discharge (DoD)) and retain at least 80 % of its initial capacity specified by the manufacturer as described e.g. in IEC 61960 with less than 10 % cell/pack swelling	

Annex B (informative): Relationship to Recommendation ITU-T L.1102

Recommendation ITU-T L.1102 [5] describes ways to store information about rare metals in ICT goods. This information predates and can be seen now as a subset of a DPP.

It specifies a vocabulary, information, and data model about rare metals in products. It specifies that certain information is encoded in the QR data carrier itself to facilitate the decision to recycle a particular element from this ICT good.

Recommendation ITU-T L.1102 [5] covers and recommends printed label methods using QR codes and data encoded in plain text in accordance with [i.31]. QR codes have limited data storage capacity, and plain text is a simple but limited encoding method limited to the alphabet used. These digitalization methods could be updated to align with e.g. ETSI TS 103 881 [3], EU-DPP and UNTP B2B DPP. These provide evolved product identification generation, reading, resolution, data encoding and decoding, and verification methods.

The first type of information Recommendation ITU-T L.1102 [5] specifies, presented below, is information on the manufacturing and certification history of the ICT good itself and can be mapped to the UNTP B2B DPP data classes [i.39].

Table B-1

Recommendation ITU-T L.1102 [5]		UNTP B2B DPP properties, types and data classes
Manufacturer	The producer of merchandise for use or sale using labour and machines, tools, chemical and biological processing, or formulation	Product.manufacturer (Party type)
Model name	Name of the product given by manufacturer	Product.ModelName (text type)
Model number	An identifier of a product given by its manufacturer	Product.productIdentifier, Product.batchIdentifier, Product.itemIdentifier (Identifier type)
Certification authority	A witness that is an authority about the model and its quality. This authority confirms that the quality of the product is in accordance with a defined set of standards	Evidence.assuranceLevel (Code type) Claim class
Certification number	A number to indicate production quality	Evidence class
Issue date	The date on which the quality was assessed and the certificate was issued	ProductPassport.issuedBy (Party type)

For the other type of information to be encoded, tables such as those shown as examples in Annex B of Recommendation ITU-T L.1100 [4] may be distinguished according to element composition such as "Alkaline earth metal", "Iron group" or "High fusion point metal" and may also contain the following information.

Table B-2

Recommendation ITU-T L.1102 [5]		UNTP B2B DPP properties, types and data classes
Part name	Technical name of the individual part of the ICT good	Not covered as such.
Manufacturer information	Includes company name, production country, etc.	Product.manufacturer (Party type), Product.manufacturedAt (Facility type)
Total number of elements	How many elements are present in this specific ICT good	Not covered as such.
Unit of measurement	Defined and adopted by convention or by law and is used as a standard for measurement of the same physical quantity	Measure.Unit (Code type)
Composition of the elements by groups: "1. Alkaline earth", "2. Metalloid", "3. Iron group", "4. Boron group", "5. High fusion point metal", "6. Rare earth", "7. Platinum group", "8. Others"	The quantity of each element present in the good. This information is categorized into different groups of elements and is based on each element's specific chemical and physical properties. For each element group, rare metals information is required to include the element name, the quantity and the unit (wt%, ‰, ppm, ppb, ppt).	Material.materialType (Classification type), Material.massFraction (Numeric type), Material.recycled (Indicator type), Material.hazardous (Indicator type)

These and other information items can be expressed as information templates about a standard, and environmental information instances about products as described in the present document.

Annex C (informative): Related work on vocabularies and ontologies about environmental sustainability

NOTE: This is based on analysis and results from the CIRPASS Project [i.23].

The RePlanIT project [i.34] presents an effort towards an ontology and vocabulary which interrelates and synchronizes data sharing in the materials, ICT and CE domains. The ontology's main application is for building dynamic digital product passports of ICT devices that support FAIR ICT data sharing and sustainable human and machine decision-making. The ontology aims at the DPP, and beyond technical information items (e.g. serial number or hardware components), it considers sustainability-related information items such as "SustainabilityIndicator", "hasWarranty", "hasMaterial Composition" and "Sensor" data such as "ElectricCurrentSensor" or "EnergyConsumption" to measure energy consumption.

The IEC common data dictionary [i.30], is working towards embedding sustainability aspects in the data model. For instance, branch ACC005 of "Environmental aspects" considers three categories: "Material declaration", "Material efficiency", and "Environmental impact".

"0112/2///62683#ACC081 - Material declaration" includes:

- 0112/2///62683#ACE010 - number of material declarations
- 0112/2///62683#ACG088 - declarable substance (Ref: 0112/2///62683#ACF088 - declarable substance)
- 0112/2///61360_4#ACA000 - Material declaration information (Ref: 0112/2///62683#ACE011 - material declaration information)
- 0112/2///62683#ACE013 - restricted substance control
- 0112/2///62683#ACC072 - conformity attestation (Ref: 0112/2///62683#ACF018 - Conformity attestation)
- 0112/2///62683#ACE009 - certificate of conformity
- 0112/2///62683#ACE007 - conformity assessment party
- 0112/2///61360_4#ADA099 - declaration of conformity
- 0112/2///61360_4#ADA093 - conformance statement

Material efficiency includes:

- 0112/2///62683#ACE014 - recyclability rate
- 0112/2///62683#ACE015 - recoverability rate
- 0112/2///62683#ACG072 - durability (Ref: 0112/2///62683#ACF072 - durability)
- 0112/2///62683#ACE016 - recycled content
- 0112/2///62683#ACE020 - reused component

"0112/2///62683#ACC083 - Environmental impact" includes:

- 0112/2///62683#ACE021 - number of life cycle assessment sets of impacts
- 0112/2///62683#ACG073 - lifecycle assessment conditions (Ref: 0112/2///62683#ACF073 - lifecycle assessment conditions)
- 0112/2///62683#ACG074 - environmental declaration (Ref: 0112/2///62683#ACF074 - environmental declaration)
- 0112/2///62683#ACG078 - lifecycle impact by phase (Ref: 0112/2///62683#ACF078 - lifecycle impact by phase)

For instance, one item in "Environmental impact" is:

Code:	0112/2///62683#ACE036
Version:	001
Revision:	01
IRDI:	0112/2///62683#ACE036#001
Preferred name:	global warming potential <of a product>
Synonymous name:	equivalents carbon footprint of a product
Short name:	GWP 100
Definition:	sum of GHG emissions and GHG removals in a product system, expressed as CO_2 equivalents and based on a life cycle assessment using the single impact category of climate change
Note:	NOTE 1: A CFP can be disaggregated into a set of figures identifying specific GHG emissions and removals. A CFP can also be disaggregated into the stages of the life cycle. NOTE 2: The results of the quantification of the CFP are documented in the CFP study report expressed in mass of CO_2e per functional unit.
Primary unit:	kg

Annex D (informative): The legal context and requirements for DPP in the EU

In the EU context, the ESPR [i.27] includes horizontal product information requirements with few exclusions. It further refers to information requirements in other existing legislation.

Below, the legal areas shown in the table above are specified in more detail by the title of the legal act including its abbreviation and are clustered per sector and legal area.

Cross-sectorial legislation:

- "REACH" Regulation 1907/2006 [i.51], concerning the registration, evaluation, authorization and restriction of chemicals.
- "CLP" Regulation 1272/2008 [i.52], concerning the classification, labelling and packaging of substances and mixtures.
- Textiles, electronics sector: "Ecodesign" Regulation 2024/1781 [i.27], concerning ecodesign requirements for sustainable products.

Electronics legislation:

- "Ecodesign" Directive 2009/125 [i.57], establishing a framework for setting of ecodesign requirements for energy-related products.
- "Energy Labelling" Regulation 2017/1369 [i.53], setting a framework for energy labelling.
- "RoHS" Directive 2011/65 [i.54], concerning the restriction of the use of certain hazardous substances in electrical and electronic equipment.
- "WEEE" Directive 2012/19 [i.55], concerning waste electrical and electronic equipment.

Battery legislation:

- "Battery" Regulation 2023/1542 [i.56], concerning batteries and waste batteries.

History

Document history		
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