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Environmental Engineering (EE);
Method for environmental performance scoring of smartphones

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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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Introduction

In 2019, ITU-T Study Group 5 Question 7 (Q7) published Recommendation ITU-T L.1015 [i.1] "Criteria for evaluation of the environmental impact of mobile phones". Recommendation ITU-T L.1015 contains many relevant indicators related to the environmental impacts of mobile phones, but no standardised scoring methodology. Additional documents of relevance produced by Q7 include scoring methods for environmental health and safety performance of true wireless stereo headphones (Recommendation ITU-T L.1016 [i.3]) and circularity performance scoring for ICT goods (Recommendation ITU-T L.1023 [i.2] in 2020 and just recently an update in 2023).

ETSI TC EE Working Group M-ICT "Environmental matters associated with Mobile ICT Devices" is dedicated exactly to the intended scope and purpose of these kinds of scoring methods.

European and international markets are in need of a standardized scoring method for the environmental performance of smartphones which goes beyond just reparability criteria and can provide a more robust foundation for non-LCA based Green Claims. Features of such a method include:

- Additional indicators to differentiate best performing products that reach beyond regulatory requirements.

- Definition of weightings to combine all indicators into a single score.

Environmental impact calculations for smartphones - e.g. using Life Cycle Assessment (LCA) - are made in different ways and therefore absolute numbers (e.g. kg CO2e) calculated in different ways cannot currently be compared. Still, the ability to use LCA is very important in order to identify and reduce the environmental impact footprint of individual products.

The present document was developed jointly by the European Telecommunications Standards Institute Technical Committee Environmental Engineering (ETSI TC EE) and ITU-T Study Group 5. It is published as Recommendation ITU-T L.1017 [i.15] and ETSI ES 204 079 (the present document), which are technically equivalent, by ITU and ETSI, respectively.

1 Scope

The objective of the present document is to provide a standardized method to assess the environmental performance of smartphones. A method to arrive at an aggregate score reflecting the overall environmental performance is defined which takes into account material efficiency and Life Cycle Assessment (LCA) aspects. The following attributes of a smartphone are evaluated:

- Durability.
- Reparability, reusability and upgradeability.
- Recyclability and recoverability.
- Use of hazardous or restricted substances.
- Use of recycled materials.
- Packaging and Accessories.
- Environmental impacts.

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 at https://docbox.etsi.org/Reference/.

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 necessary for the application of the present document.

[1] IEC 60529 :1989+AMD1:1999+AMD2:2013 CSV Consolidated version: "Degrees of protection provided by enclosures (IP Code)".

[2] IEC 60068-2-31:2008: "Environmental testing - Part 2-31: Tests - Test Ec: Rough handling shocks, primarily for equipment-type specimens".

[3] IEC 61960-3:2017: "Secondary cells and batteries containing alkaline or other non-acid electrolytes - Secondary lithium cells and batteries for portable applications - Part 3: Prismatic and cylindrical lithium secondary cells and batteries made from them".

[4] EN ISO 6769:2022: "Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys" (produced by CEN).

[5] EN 45554:2020: "Material efficiency aspects for products in scope of Ecodesign legislation" (produced by CEN).

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

[7] ISO 14040: "Environmental management -- Life cycle assessment -- Principles and framework".

[8] ETSI ES 203 199 (V1.3.1) (02-2015): "Environmental Engineering (EE); Methodology for environmental Life Cycle Assessment (LCA) of Information and Communication Technology (ICT) goods, networks and services".

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] Recommendation ITU-T L.1015 (2019): "Criteria for evaluation of the environmental impact of mobile phones".

[i.2] Recommendation ITU-T L.1023 (2023): "Assessment method for circularity performance scoring".

[i.3] Recommendation ITU-T L.1016 (2022): "Method for evaluation of the environmental health and safety performance of true wireless stereo headphones".

[i.4] Commission Regulation (EU) 2023/1670 of 16 June 2023 laying down ecodesign requirements for smartphones, mobile phones other than smartphones, cordless phones and slate tablets pursuant to Directive 2009/125/EC of the European Parliament and of the Council and amending Commission Regulation (EU) 2023/826.

[i.5] Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE).

[i.6] 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.

[i.7] 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.

[i.8] 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.9] Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC.

[i.10] Globally harmonized system of classification and labelling of chemicals (GHS) - United Nations.

[i.11] IEC 61249-2-21:2003: "Materials for printed boards and other interconnecting structures - Part 2-21: Reinforced base materials, clad and unclad - Non-halogenated epoxide woven E-glass reinforced laminated sheets of defined flammability (vertical burning test), copper-clad".

[i.12] Compatibility of polymers for recycling are described in Pahl, G., Beitz, W., Engineering design: A systematic Approach. Great Britain: Springer-Verlag London Limited, 1996.

[i.13] 2019/771/EU: "Directive (EU) 2019/771 of the European Parliament and of the Council of 20 May 2019 on certain aspects concerning contracts for the sale of goods, amending Regulation (EU) 2017/2394 and Directive 2009/22/EC, and repealing Directive 1999/44/EC".

[i.14] NIST Special Publication 800-88: " Guidelines for Media Sanitization".

[i.15] Recommendation ITU-T L.1017: "Method for environmental performance scoring of smartphones".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

environmental aspect: element of an organization's activities or solutions that determines the environmental impact

NOTE: The Durability, 3RU and Use of hazardous and restricted substances outlined in this Recommendation are examples of environmental aspects.

environmental assessment: evaluation and interpretation of results and impacts from an environmental measurement

environmental indicator: metric used to measure one or more environmental aspects

NOTE: The D_n, $3RU_n$ and HR_n outlined in this Recommendation (e.g. D1) are examples of environmental indicators.

environmental measurement: process to help determine the environmental performance through collection, calculation or compilation of data or information

environmental performance: degree to which a set of environmental aspects align with the principles for a circular economy and low environmental impact

NOTE: The Environmental Performance Scores obtained by the framework outlined in this Recommendation are examples of environmental performance.

3.2 Symbols

Void.

3.3 Abbreviations

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

BAT	Battery
BC	Back Cover
BUT	mechanical Button
DA	Display Assembly
EC	External Charging port
EIE	Environment Impact Evaluation
FFC	Front Facing Camera
FM	Folding Mechanism
FSC	Forest Stewardship Council®
IPxx	Ingress Protection
LCA	Life Cycle Assessment
MIC	Microphone
PA	Packaging and Accessories
PEFC	Programme for the Endorsement of Forest Certification schemes
RCM	Recycled Materials
RFC	Rear Facing Camera
RoHs	Restriction of Hazardous substances
RR	Recyclability and Recoverability
RRU	Repairability, Reusability, Upgradeability
SPK	Speaker
TS	Total environment performance Score

4 Methodology

The environmental performance of smartphones can be evaluated by addressing material efficiency and through consideration of life cycle assessment of environmental impacts.

The environmental performance of smartphones in terms of material efficiency can be evaluated by analysing three impact groups: durability (clause 6.1), repairability, reusability, upgradeability (clause 6.2) and material impacts (clause 6.3). The material impacts impact group consists of five aspects:

i) recyclability and recoverability;

ii) use of hazardous or restricted substances;

iii) use of recycled materials;

iv) packaging and accessories; and

v) environmental impact.

The total environmental performance score is calculated as follows:

$$TS_x = \frac{\mathrm{D+RRU+M}}{3} \quad (1)$$

where:

- *TS* = Total Environmental Performance Score
- *x* = Smartphone model
- *D* = Aggregated score for the aspect Durability (see clause 6.1)
- RRU = Aggregated Score for the aspect Repairability, Reusability, Upgradeability (see clause 6.2)
- M = Aggregated Score for the aspect Material impacts (see clause 6.3)

The aggregated score for Durability is calculated as an average of the maximum possible durability indicators as follows:

$$D = \frac{\sum_i D_i}{5i} \quad (2)$$

where:

- *D* = Aggregated score for the aspect Durability (see clause 6.1)
- D_i = Score for Durability indicator *i*
- *i* = number of included Durability indicators

The aggregated score for Repairability, Reusability, Upgradeability is calculated an average of the maximum possible indicators as follows:

$$RRU = \frac{\sum_i RRU_i}{5i} \quad (3)$$

where:

- *RRU* = Aggregated score for the aspect Repairability, Reusability, Upgradeability (see clause 6.2)
- RRU_i = Score for Repairability, Reusability, Upgradeability indicator *i*
- *i* = number of included Repairability, Reusability, Upgradeability indicators

The aggregated score for Material impacts is calculated as an average of the maximum possible indicators as follows:

$$M = \frac{\sum_i RR_i + \sum_i HR_i + \sum_i RCM_i + \sum_i PA_i + \sum_i EIE_i}{5i} \quad (4)$$

where:

- M = Aggregated score for the aspect Material impact (see clause 6.3)
- RR_i = Score for Recyclability and Recoverability indicator i (see clause 6.3.1)
- HR_i = Score for Hazardous and Restricted substances indicator i (see clause 6.3.2)
- RCM_i = Score for Recycled Materials indicator i (see clause 6.3.3)
- PA_i = Score for Packaging and Accessories indicator i (see clause 6.3.4)
- EIE_i = Score for Environmental Impact indicator i (see clause 6.3.5)
- i = number of included Material impacts indicators

5 Conformance with regulations

To help users of the present document with designing new smartphones, indicators based on legal requirements in the EU are listed in Table A.1 in Annex A.

NOTE: At the time of writing, the Level 1 of the respective indicators in the following clauses match the EU minimum regulatory requirements as displayed in Annex A.

6 Material efficiency and environmental impact aspects

6.1 Durability

Table 1 lists the requirements for the evaluation of the Durability aspect (D) of smartphones.