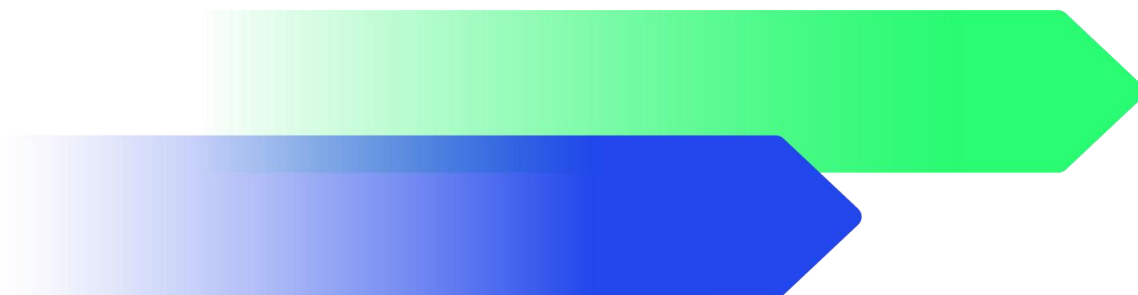


Decarbonising the Use-phase of Connected Devices

**Assessment of Product Use-phase
GHG Emissions from Electrical and
Electronic Products - Part 2:
Conformity Assessment**



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Decarbonising the Use-Phase of Connected Devices (DUCD) is an initiative of companies which aims to harness the potential of connected devices to reduce use-phase GHG emissions.

The secretariat of the DUCD is led and funded by the leading organisations Amazon, Meta, Microsoft, Samsung, and Sky, working together with Carbon Trust and the selected Consultation Partners.



DUCD Consultation Partners

EnergyTag

Electricity Maps

Green Software Foundation

GSMA

Home connectivity alliance

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Table of Contents

1. Introduction	1
1.1. Purpose of this document	1
1.2. Intended Audience	1
1.3. How to Use Part 2: Conformity Assessment	1
1.4. Documentation and Models from Reporting Organisations	2
1.5. Assurance of a Product Family	3
2. Definitions and Abbreviations.....	4
3. Product Use-Phase Energy Consumption & GHG Emissions Calculation	6
3.1. Scope	6
3.2. Pre-engagement Requirements	6
3.3. Verification Process.....	6
3.4. Verification Requirements: Product Use-Phase Energy Consumption & GHG Emissions Calculation	7
4. Demonstrating Energy Reductions.....	13
4.1. Scope	13
4.2. Pre-engagement Requirements	13
4.3. Verification Process.....	13
4.4. Verification Requirements: Energy Reduction Assessment.....	15
4.5. Verification Requirements: GHG Emissions Reduction Estimation.....	17
5. General Assurance Requirements	18
5.1. Claims resulting from Verification	18

1. Introduction

1.1. Purpose of this document

Assessment of Product Use-phase GHG Emissions from Electrical and Electronic Products - Part 2: Conformity Assessment provides requirements for the assessment of conformity of products to Part 1: Specification and Guidance where organisations have applied Part 1 to calculate the GHG emissions resulting from the use of sold or leased consumer electronics products and, where applicable, demonstrate energy reductions of the product.

By seeking assurance of conformity to Part 1: Specification and Guidance, organisations are able to publicly communicate verified annual use-phase GHG emissions and energy consumption of their products and verified annual GHG emissions and energy consumption reductions of actions taken to reduce the climate impact of their products.

Part 1: Specification and Guidance enables reporting of the total use-phase GHG emissions impact and reduction (where achieved) of all devices in use of the product being studied within the defined reporting period and geographical boundary. The GHG emissions impact or reduction represents the total emissions in that year from all active devices ever sold.

Products are often available to consumers in multiple configurations or selectable options, termed product variants, and the use of a different variant by a consumer would result in a different energy consumption. The total product use-phase GHG emissions can possibly include multiple different product variants and use in multiple different countries. Therefore, reporting of this total value should be clearly communicated as the total GHG emissions of all uses of all variants of this product within the reporting time period and geographical boundary. A per product value should not be simply calculated as an average across the number of active devices to communicate the impact of a single device to the consumer due to the potential for very diverse product variants. The data collected and produced during the assessment could be used for consumer-level communications of a single device, however, this would require the reported outcome to be specific to a particular product variant in a specific geographic area. This is not in the scope of reporting from this specification but could be achieved with careful consideration of the consumers engagement with the product.

1.2. Intended Audience

The intended audience for the conformity assessment is organisations carrying out assurance according to these requirements and organisations intending to request third-party assurance of their application of Part 1.

1.3. How to Use Part 2: Conformity Assessment

Part 2: Conformity Assessment is a supplementary document to Part 1: Specification and Guidance and must be read in conjunction to this document. There are references throughout this document to Part 1 to guide the reader to the relevant requirements for each section of the conformity assessment. Table 1 below shows how requirements in each section of the documents align.

Table 1: Requirements references from Part 2 to Part 1

Part 2:	Part 1:
3. Product Use-Phase Energy Consumption & GHG Emissions Calculation	4. Product Use-Phase Energy Consumption & GHG Emissions Calculation
3.4 Verification Requirements	Sections 3.1 – 3.3 Sections 4.1, 4.3, 4.4, 4.5
3.4.1 Eligibility	3.1. Eligible Products 3.2. Eligible Organisations
3.4.2 Boundary	3.3. Assessment Boundary
3.4.3 Telemetry data collection	4.3.1 Telemetry data 4.3.2 Telemetry data sampling 4.3.3 Telemetry data aggregation
3.4.4 Reference data collection	4.3.4 Reference data
3.4.5 Data quality and uncertainty	4.3.5 Data quality and uncertainty
3.4.6 Device energy modelling	4.4.1 Device energy model
3.4.7 Product variant grouping	4.4.2 Product variant grouping
3.4.8 Energy model evaluation	4.4.3 Energy model evaluation
3.4.9 Attributable products	4.4.4 Attributable products energy model
3.4.10 Product use-phase energy consumption	4.4.5 Product use-phase energy consumption
3.4.11 GHG emissions calculation	4.5 GHG emissions calculation
4. Demonstrating Energy Reductions	5. Demonstrating Energy Reductions
4.4 Verification Requirements: Energy Reduction Assessment	Sections 5.3 and 5.4
4.4.1 Pre-requisite requirements	5.3 Pre-requisite requirements
4.4.2 Energy reduction assessment parameters	5.4.1 Actions taken to reduce the energy consumption of the product 5.4.3 Baseline selection 5.4.3 Reference unit
4.4.3 Controlled environment testing	5.4.4 Comparison in a controlled environment
4.4.4 Confirming energy reductions occur in use	5.4.5 Confirming energy reductions occur in use
4.5 Verification Requirements: GHG Emissions Reduction Estimation	5.5 GHG Emissions Reduction Estimation

1.4. Documentation and Models from Reporting Organisations

Part 1: Specification and Guidance defines requirements for the documentation and reporting of approaches, methods, assumptions, data sources, testing, etc. and models used for calculation purposes which need to be provided for the conformity assessment. These different documents will be referred to by the titles listed below.

Section 3: Product Use-Phase Energy Consumption & GHG Emissions Calculation:

- **Product use-phase GHG emissions methodology** – Includes all required documentation as specified in section 4.
- **Use-phase energy model** – The model used to calculate the product use-phase energy consumption and GHG emissions including the device energy model and attributable products model (where applicable).

Section 4: Demonstrating Energy Reductions

- **Energy reduction assessment** – Includes all required documentation of the methodology as specified in section 5 and report of the assessment results. Where applicable, this includes the methodology used to calculate GHG emissions reduction.
- **GHG emissions reduction model** – The model used to estimate the GHG emissions reduction resulting from the energy reduction demonstrated for the product.

1.5. Assurance of a Product Family

The requirements and guidance in Part 1: Specification and Guidance are designed to be applied to a single product including any product variants. Public communications to consumers of GHG emissions or reductions associated with a product should be easily understandable to the consumer, therefore, communications shall be related to the single product and not the wider product family as this could be misleading. As referred to in Section 1.1, reporting of each product total value should be clearly communicated as the total emissions of all uses of all variants of each product in the reporting time period in the geographical boundary. A per product value, especially when considering a product family should not be simply calculated as an average due to the potential for very diverse product variants. Communications to consumers (about specific product variants in specific geographic areas) requires data specific to the product variant.

It is acknowledged that the product use-phase energy consumption and GHG emissions calculation methodology, energy model, and some reference data may be common across a product family or multiple products and that carrying out assurance of each individual product could result in repetition of effort by the assurance provider and the reporting organisation. Therefore, at the discretion of the assurance provider, assurance of a product family or multiple products may be carried out where the products share common a methodology or energy model. The assurance would provide a verification outcome for the total use-phase energy consumption and GHG emissions for each product individually.

2. Definitions and Abbreviations

Definitions in this specification

Attributable product, a product that is sold with the product, e.g. a non-integrated power adaptor.

Carbon dioxide equivalent (CO_{2e}), CO_{2e} shows the combined GHG impact of all applicable greenhouse gases if all the GHG emissions derived from CO₂, by using GWPs for conversion.

Device, the individual product unit sold or leased to the customer, therefore, the product and product variants include all of the individual device units sold by the reporting organisation

Electrical and electronic products, electric equipment intended for everyday use including consumer electronics and electrical appliances products. Please see Part 1: Section 3.1 for a list of example products.

Energy consumption factor, any characteristic that when varied can affect the energy consumption of the product, for example, time-in use would affect the energy consumption of all products.

Energy model, see "Use-phase energy model"

Geographic region, a defined geographic boundary referred to in the document for the calculation of GHG emissions resulting from electricity use for the specified region. Typically, individual countries are distinct geographic regions for electricity use (e.g. United Kingdom), however, a country may have multiple electricity grids or may provide regional location-based emission factors for more granular GHG emissions calculations.

Greenhouse gases (GHGs), gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the earth's surface, the atmosphere, and clouds.

Model evaluation, the task of assessing whether a chosen calculation model is appropriate or not.

Product, the goods that are sold or leased to the customer. A product has a defined function or set of functions, and it may be sold in a number of different variants including a variety of hardware and software configurations.

Product family, a product family is a group of related goods produced by the same company under the same brand. The product family supplies an array of products that are similar but meet slightly different needs or tastes.

Product variant, variations of the product in form and function are often available to consumers who can select from multiple configurations or options. For the purpose of this specification the product variants of interest are only those that result in a different energy consumption.

Reference data, includes any data used in the energy model that is not collected from the device in use (i.e. not telemetry data). This may include data obtained from lab testing or from secondary data sources.

Reporting organisation, any entity, public or private, such as a business, corporation, government agency non-profit organisations, institution, local authority, etc. that wishes to use this document – referred to as the "organisation"

Reporting period, the time period for which the assessment is carried out.

Telemetry data, includes data collected on devices and data transmitted from devices that is remotely collected. The data collected will be used in the energy consumption modelling (either on the device or remotely) and will include data relating to the activity of the device and its location of use. It may also include other information about the device necessary for the energy modelling, e.g. product version. (Note that the data collected by the devices may be processed on the device before transmission, both the collected data and transmitted data is considered as telemetry data).

Use-phase energy model, a mathematical representation of the product, used to simulate its energy consumption – referred to as the “energy model”.

Verification, an assurance process for evaluating a statement of historical data and information to determine if the statement is materially correct.

Abbreviations in this specification

CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
DUCD	Decarbonising the use-phase of connected devices
EU	European Union
GHG	Greenhouse gas
GWP	Greenhouse warming potential
GW	Gigawatt
GWh	Gigawatt-hour
kW	Kilowatt
kWh	Kilowatt-hour
MW	Megawatt
MWh	Megawatt-hour
USA	United States of America

3. Product Use-Phase Energy Consumption & GHG Emissions Calculation

3.1. Scope

This section defines the requirements to be conformed to by organisations that wish to verify the GHG emissions resulting from the use-phase of their product(s), according to the assessment requirements defined in Part 1: Specification and Guidance, principally for the purposes of external communication.

3.2. Pre-engagement Requirements

Before the formal verification can take place, the organisation needs to have determined and confirmed the following to the assurance provider:

- The definition of the product and a description of its functionality.
- The product variants that fall under the definition of the product and product variant groupings (where applicable) to be verified.
- The geographical area of sales and use.
- Attributable products included with the product.
- Reporting period.
- The communication claim they wish to make.

3.3. Verification Process

This section outlines the assurance process for the conformity assessment of the methodology, calculation, and results for the product annual use-phase energy consumption and GHG emissions. All verification activities take place at the end of the annual reporting period.

Step 1: Submissions of documentation for review

The reporting organisation shall submit the Product use-phase GHG emissions methodology and the Use-phase energy model to the assurance provider. This model shall present the results, data, and conclusions completely, accurately, and transparently in sufficient detail with clear application of the methods, assumptions, and limitations detailed in the Product use-phase GHG emissions methodology.

In case provision of access for the assurance provider to the Use-phase energy model is not practically feasible, it is the responsibility of the reporting organisation to provide alternative verifiable evidence and the responsibility of the assurance provider to ensure that adequate evidence is obtained to provide a verification statement. Other documentation may be necessary on request of the assurance provider

Step 2: Conformity assessment

The assurance provider will use the documentation provided to verify whether the Product use-phase GHG emissions methodology and the Use-phase energy model have been created and calculated in accordance with the requirements defined in Part 1: Specification and Guidance.

Interviews are not a required verification procedure but can be a convenient method to collect evidence. The DUCD specification does not mandate interviews and instead allows the assurance provider to use professional judgment to determine whether it is necessary to perform further investigation of procedures for significant elements of the energy consumption and GHG emissions calculation. Such judgment should be recorded in the assurance documentation.

Interviews: In most circumstances, interviews are an effective and efficient method of collecting evidence. They may be used to:

- Explain any evidence provided
- Demonstrate the testing undertaken
- View data collection procedures

Step 3: Issuance of opinion of the verification

Where the requirements have been satisfactorily met the assurance provider shall issue the relevant verification assurance documentation:

- A letter of assurance, detailing the parameters of the assessment and assessment outcome.
- A certificate of assurance, verifying that the product has been assessed and found as having met the relevant requirements criteria (including the requirements of this document) and that the calculated energy consumption and GHG emissions results have been calculated correctly.

Step 4: Repeat verification on an annual basis

Verification occurs for the reporting period (up to a maximum of 12 months) and is therefore expected to repeat annually throughout the product lifetime. To reduce the assurance effort necessary of repeat verifications the Product use-phase GHG emission methodology is only required to be reviewed every two years. Therefore in interim years following a full verification the previous year, the verification only requires submission of the Use-phase energy model.

3.4. Verification Requirements: Product Use-Phase Energy Consumption & GHG Emissions Calculation

3.4.1. Eligibility

- The product description shall meet the requirements in Part 1: Section 3.1.
- The reporting organisation shall meet the requirements in Part 1: Section 3.2.

3.4.2. Boundary

- A qualitative review of the methodology shall determine the product boundary to be in accordance with requirements in Part 1: Section 3.3. The organisation shall evidence this in the methodology by ensuring:
 - The product description is clear and there is no ambiguity to consumers what product the calculated use-phase GHG emissions are relating to.
 - The product and all product variants defined in the documentation are described with enough clarity to establish qualification as a single product, with an equivalent function, under the same level of control by the reporting organisation, and with the same customer use-case.
 - Any attributable products have been documented and described.
 - The emissions boundary of the assessment shall use a full life-cycle emissions factor for electricity, i.e. including both:
 - Direct use-phase electricity GHG emissions, and
 - Upstream GHG emissions associated with use-phase electricity consumption.
 - The geographical boundary for the assessment is defined. Where a global boundary is not used, the description shall include a list of countries or regions from which a list of countries can be inferred.
 - The reporting period for the results is clearly stated and is a maximum of 12 consecutive months (one year).
 - Where a period of less than 12 months is reported, due to product launch / retirement during the organisations reporting cycle, the results shall clearly report the reduced time period.

3.4.3. Telemetry data collection

- A qualitative review of the methodology and the energy model shall determine the telemetry data collected fulfils the product boundary and is in accordance with requirements in Part 1: Section 4.3.1. The organisation shall evidence this both the methodology and the model by ensuring:
 - Telemetry data collection from devices can be demonstrated in the documentation of the data collection process and the modelling to have collected data for the full time **each device** is in use without the use of extrapolation to increase temporal coverage. (*Note: Extrapolation is allowed to increase coverage from a sample of active devices to the full number of active devices*)
 - The telemetry data collection time period shall match the reporting period.
 - Telemetry data has been collected according to the requirements for:
 - Device usage frequency and usage intensity,
 - Information to determine the product specification,
 - The number of active devices,
 - The geographic regions where use has occurred.

- Where data sampling is used,
 - the sampling rate can be demonstrated to meet the minimum sampling rate specified for the product, or each product variant group, and
 - it can be demonstrated that data has been collected on the total number of active devices (i.e. all devices that are not part of the sample must at least communicate that they are on/in-use to be able to assess the total number of active devices)
- Data aggregation only applies sum totals and does not employ averaging or other kinds of transformation that could skew the data.

3.4.4. Reference data collection

- A qualitative review shall determine that appropriate lab testing has been undertaken to measure reference data for the product or each product variant group according to requirements in Part 1: Section 4.3.4 or that suitable reference data has been obtained from research. The organisation shall evidence this by providing:
 - Lab test report / results of the reference data collected and the associated test conditions for the product or for each product variant group. This should include visible evidence such as screenshots or pictures of the lab test results.
 - Lab test methodology that describes the selected test scenario(s) and justifies the test conditions as representative for the energy consumption factors identified to significantly impact energy consumption and adherence to the conservative principle.
 - Assessment of the volume and quality of testing to be statistically significant and consideration of the complexity of the product being tested. The assurance provider shall decide what is reasonable and sufficient.
 - Justification for any other source of reference data (e.g. similar product or research) to show that it is a suitable proxy for the product and will not significantly affect the accuracy of the energy model.

3.4.5. Data quality and uncertainty

- A qualitative review shall determine that the organisation's assessment of the data quality and uncertainty is robust, the approach is clearly documented, and meet the requirements in Part 1: Section 4.3.5.
- Where data quality is poor, or uncertainty is high, the organisation shall include reference to the limitation in external reporting supporting information.

3.4.6. Device energy modelling

- A qualitative review of the methodology shall determine the approach used to be reasonable and in accordance with requirements in Part 1: Section 4.4.1. The organisation shall evidence this by including in the methodology:
 - A clear description outlining the modelling approach, it is recommended to include a diagram or flowchart illustrating the steps for the overall energy consumption calculation.

- A list of the identified energy consumption factors including what characteristics they relate to (product specification, product use, or external environment), and a description of how each factor is accounted for in the model (excluded, assessed by telemetry data, or estimated).
- A list of energy consumption factors that are excluded from the energy model on the basis of significance and the supporting assessment.
- A description of the telemetry data used and how they will be used in the energy model.
- A description of the reference data used, how they will be used in the energy model, how it was obtained including sources and justifications of use (if necessary).
- An energy modelling method demonstrating:
 - How the telemetry data and reference data are used to calculate energy consumption of the product.
 - How the energy model accounts for identified factors affecting the energy consumption relating to the product specification, including how the energy consumption of different product variants has been accounted for.
 - How the energy model accounts for identified factors affecting the energy consumption relating to product use, including how the effect of different operational modes and/or variable tasks inducing power consumption has been accounted for.
 - How the energy model accounts for identified factors affecting the energy consumption relating to the external environment.
 - The assumptions used in the energy model and why they are applicable.
- A review of the energy model shall determine that the documented approach has been correctly applied and is likely to provide materially correct results.

3.4.7. Product variant grouping

- A qualitative review of the methodology shall determine that grouping requirements in Part 1: Section 4.4.2 have been met. The organisation shall evidence this by including in the methodology:
 - Details and justifications for the product variant grouping including,
 - List of all variants per group and the factor(s) that differentiate their energy consumption.
 - Average power consumption of each variant (Modelled or tested).
 - The approach used to estimate the power consumption of each product variant (e.g. modelling, lab testing, etc.).
 - Evidence of testing / modelling to demonstrate the average power consumption of product variants under a standardised test condition.
 - Justification of groupings, particularly where groupings include variants with greater than 10% difference in average power consumption have been selected.
 - Explanation of how the energy model uses the power consumption of the highest consuming variant for each product variant group.

- A review of the energy model shall determine that the documented product variant grouping approach has been correctly applied.

3.4.8. Energy model evaluation

- A qualitative review that appropriate energy model evaluation has been undertaken to verify the adherence to requirements in Part 1: Section 4.4.3. The organisation shall evidence this by providing:
 - A report demonstrating a conclusion on the validity of the energy model based on a comparison of energy consumptions predicted by the energy model output with the results obtained from lab testing for the product. This should include a description of the statistical evaluation method(s), the analysis of the results, and visible evidence such as screenshots or pictures of the lab test and energy calculation results.
 - Lab test methodology that describes the selected test scenario(s) and justifies the test conditions as representative of customer use considering all factors identified to affect energy consumption of the product and adherence to the conservative principle.
 - Assessment of the volume and quality of testing to be statistically significant and consideration of the complexity of the product being tested. The assurance provider shall decide what is reasonable and sufficient.

3.4.9. Attributable products

- A qualitative review of the methodology shall determine that an appropriate method has been applied to include the energy consumption of attributable products of the relevant product according to requirements in Part 1: Section 4.4.4 **Error! Reference source not found.**. The organisation shall evidence this by including in the methodology:
 - A summary of their calculation approach and assumptions used.
 - An estimation of the materiality of the attributable product energy consumption as compared to the energy consumption of the device.
 - Supporting evidence of any lab testing, energy modelling, or similar of the attributable product necessary for the calculation, if requested by the assurance provider (e.g. the adaptor's manufacturer's stated average fixed loss and their methodology).
- A review of the energy model shall determine that the documented modelling approach for attributable products has been correctly applied.

3.4.10. Product use-phase energy consumption

- A qualitative review of the methodology shall determine that an appropriate method has been applied to calculate the total energy consumption of the product according to requirements in Part 1: Section 4.4.5. The organisation shall evidence this by including in the methodology:
 - A description of their total energy consumption calculation approach for the product including how the total energy consumption per geographic region is calculated.

- Where extrapolation is used, the method applied to extrapolate the energy consumption of the sampled devices to the remaining devices of the product or within each product variant group.
- A review of the energy model shall determine that the total use-phase energy consumption has been correctly calculated according to the documented methodology and requirements in Part 1: Section 4.4.5 for each geographic region where use has occurred. The review shall determine that:
 - Each geographic region total use-phase energy consumption has been calculated for all active devices and attributable products that are defined within the boundary and in-use within the reporting period, for the full period of their use.
 - Each geographic region total use-phase energy consumption for active devices of the product, includes all product variants defined within the boundary.
 - The reported energy consumptions have been calculated according to the units of analysis defined in Part 1: Section 4.1.
 - The energy model uses appropriate software in a transparent and robust way. This can be either Microsoft Excel or specific energy model software. In all cases, the reporting organisation is required to demonstrate that this specification was applied correctly.

3.4.11. GHG emissions calculation

- A qualitative review of the methodology shall determine that an appropriate method has been applied to calculate the total GHG emissions of the product according to requirements in Part 1: Section 4.5. The organisation shall evidence this by including in the methodology:
 - The approach for calculating the GHG emissions for each device according to the geographic region where the device energy consumption is known to have occurred.
 - A description of the calculation approach where device energy consumption occurs in multiple geographic regions throughout the reporting period.
- A review of the energy model shall determine that the total use-phase GHG emissions have been correctly calculated according to the documented methodology and requirements in Part 1: Section 4.5 for each geographic region where use has occurred. The review shall determine that:
 - The GHG emissions calculated include all greenhouse gasses converted to CO₂ equivalent GHG emissions (CO₂e), using a 100-year global warming potential (GWP).
 - The latest Intergovernmental Panel on Climate Change (IPCC) GWP values should be used by preference, but previous IPCC values may be used if necessary.
 - Full life cycle GHG emissions are calculated for the energy consumption of each active device and attributable products.
 - The GHG emissions have been calculated separately for each geographic region where device energy consumption is known to have occurred.
 - The energy model calculates and reports GHG emissions according to the units of analysis defined in Part 1: Section 4.1.

4. Demonstrating Energy Reductions

4.1. Scope

This section defines the requirements to be conformed to by organisations who wish to verify a use-phase energy consumption reduction of their product and (optionally) the resulting GHG emissions reduction, according to the assessment requirements defined in Part 1: Specification and Guidance, principally for the purposes of external communication.

4.2. Pre-engagement Requirements

Before the formal verification can take place, the organisation shall have determined and confirmed the following to the assurance provider:

- The product use-phase energy consumption and resulting GHG emissions results, calculation method, and energy model shall have been verified in accordance with the requirements defined in Part 1: Specification and Guidance as per section 3 and remain unchanged, including:
 - The defined product, product variants or product variant groupings.
 - The calculation method and energy model.
 - The boundary of the assessment.
- Whether verification of a GHG emissions reduction as a result of the energy reduction is required.
- What communication claim they wish to make.

4.3. Verification Process

This section outlines the assurance process for the conformity assessment of the demonstration of the use-phase energy consumption reduction of the product and (optionally) the resulting GHG emissions reduction product use-phase GHG emissions. All verification activities take place at the end of the annual reporting period.

Step 1: Submissions of documentation for review

The reporting organisation shall submit the Energy reduction assessment and, where verification is requested for the resulting GHG emissions reductions, the GHG emissions reduction model and GHG emissions reduction report to the assurance provider. This shall include:

- Documentation demonstrating achievement of the pre-requisite requirements.
- Documentation detailing the actions taken to reduce the energy consumption of the product, the baseline selection, and the reference unit.
- Report(s) from the controlled environment testing (including any models and calculations).
- Report from the confirmation of energy reductions occurring in use assessment.

- The GHG emissions reduction calculation methodology, GHG emissions reduction model, and results (where a calculated GHG emissions reduction is to be verified).

In case provision of access for the assurance provider to the models / calculations is practically not feasible, it is the responsibility of the reporting organisation to provide alternative verifiable evidence and the responsibility of the assurance provider to make sure that enough assurance is obtained to provide a verification statement. Other documentation necessary may be necessary on request of the assurance provider. The documentation shall present all information, results, data, and conclusions completely, accurately, and transparently in sufficient detail with clear application of the methods, assumptions, and limitations. The assurance provider shall use these documents to verify whether

- a. the product use-phase energy reduction, and
- b. the calculated GHG emissions reductions (where requested),

have been calculated in accordance with the requirements of this specification.

Step 2: Conformity assessment

The assurance provider will use these data to verify whether the documentation and evidence provided demonstrate that the Energy reduction assessment and, where requested, the resulting GHG emissions reductions have been carried out and calculated in accordance with the requirements defined in Part 1: Specification and Guidance.

Interviews are not a required verification procedure but can be a convenient method to collect evidence. The DUCD specification does not mandate interviews and instead allows the assurance provider to use professional judgment to determine whether it is necessary to perform further investigation of procedures for significant elements of the energy consumption and GHG emissions calculation. Such judgment should be recorded in the assurance documentation.

Interviews: In most circumstances, interviews are an effective and efficient method of collecting evidence. They may be used to:

- Explain any evidence provided
- Demonstrate the testing undertaken
- View data collection procedures

Step 3: Issuance of opinion of the verification

Where the requirements have been satisfactorily met the assurance provider shall issue the relevant verification assurance documentation:

- A letter of assurance, detailing the parameters of the assessment and assessment outcome.
- A certificate of assurance, verifying that the product has been assessed and found as having met the relevant requirements criteria (including the requirements of this document) and that the calculated energy consumption and GHG emissions results have been calculated correctly.

Step 4: Repeat verification on an annual basis

Verification occurs for the reporting period (up to a maximum of 12 months) and is therefore expected to repeat annually throughout the product lifetime. To reduce the assurance effort necessary of repeat verifications the following activities are only required to be reviewed every two years:

- Achievement of the pre-requisite requirements.
- Review of documentation detailing the actions taken to reduce the energy consumption of the product, the baseline selection, and the reference unit.
- Review of the controlled environment testing report(s).
- Review of the GHG emissions reduction calculation methodology

Therefore in interim years following a full verification the previous year, the verification only requires:

- Review of the confirmation of energy reductions occurring in use assessment.
- Review of the GHG emissions reduction model and results (where a calculated GHG emissions reduction is to be verified).

4.4. Verification Requirements: Energy Reduction Assessment

4.4.1. Pre-requisite requirements

- A qualitative review of the documentation shall determine that the pre-requisite requirements have been met according to Part 1: Section 5.3. The organisation shall evidence this by providing:
 - Product energy efficiency standard achievement and certification where applicable
 - Confirmation that the maximum allowed power consumption for the product has been achieved against the specified standard. (Only for European products that fall under the scope of [Energy-efficient products - European Commission \(europa.eu\)](https://ec.europa.eu/energy-efficient-products/))

4.4.2. Energy reduction assessment parameters

- A qualitative review of the documentation shall determine that the energy reduction assessment is in accordance with Part 1: Sections 5.4.1, 5.4.2, and 5.4.3, The organisation shall evidence this by including in the methodology:
 - A description of the energy reduction action(s) taken detailing the energy saving action(s) and any justification for meeting the criteria in Part 1: Section 5.4.1.
 - Documentation describing the baseline selected for the energy reductions assessment, including,
 - Baseline type A / B with a justification for the selection according to the requirements in Part 1: Section 5.4.2.
 - For baseline A, a description of the comparator product, a comparison of the baseline functionality compared to the product, and the ability for substitution explained.

- For baseline B, a description of the hypothetical baseline, details of the difference(s) that are represented by the baseline and justification of how these align to the energy saving action(s) introduced in the product.
- A description of the reference unit used as the basis for comparison.

4.4.3. Controlled environment testing

- A review shall determine that appropriate lab testing has been undertaken to assess that the energy reduction is achieved as result of changes made by a comparison between the product and the baseline according to requirements in Part 1: Section 5.4.4. The organisation shall evidence this by providing:
 - Lab report results demonstrating the change in the value of the reference unit (e.g. change in average power consumption) between the product and the baseline for all required test scenarios under the same test conditions.
 - Where product variant grouping is applied evidence must be supplied for all variant groups.
 - Evidence should include visible evidence such as screenshots or pictures of the lab test and energy calculation results.
 - Lab report methodology that includes:
 - Descriptions of the selected representative, best-case, and worst-case test scenarios, and justifications for the test conditions for each.
 - Where a hypothetical baseline is used, the approach used to prepare a device for lab testing to represent the hypothetical baseline.
 - The number of devices tested should be statistically significant to ensure reliability of the test results. The assurance provider shall decide what is reasonable and sufficient.

4.4.4. Confirming energy reductions occur in use

- A review of the assessment shall determine that the average power consumption of the product in use is between minimum and maximum expected average power consumption defined from the controlled environment testing.
 - Where product variants have been grouped, this has been achieved for each group.
 - The minimum and maximum average power consumption limits shall be assessed to have been correctly defined.
- The assessment shall demonstrate that the actual average power consumption in use for the product or product variant group has been calculated:
 - According to the calculation requirements in Part 1: Section 5.4.5
 - Using telemetry data collected from active devices that:
 - Corresponds to the reporting period for the use-phase of the product.

- Has been collected and processed in accordance with data collection requirements in Part 1: Section 4.3.

4.5. Verification Requirements: GHG Emissions Reduction Estimation

- A qualitative review of the GHG emissions reduction calculation methodology shall determine that an appropriate method has been applied to estimate the product use-phase energy reduction and resulting GHG emissions reduction. The organisation shall evidence this by including in the methodology:
 - The method used to estimate the product use-phase GHG emissions reduction and how it accurately represents the action(s) described in Part 1: Section 5.4.1.
 - A description of how the actual energy consumption data of each device is used in the estimation.
 - A description of how the expected energy consumption of the baseline is estimated.
 - How different factors affecting the energy consumption of the product and hence the possible energy reduction have been accounted for.
 - How the operational conditions necessary for the reduction to occur or any conditions that can prevent the reduction from occurring are applied in the estimation.
 - The assumptions used in the calculation and why they are applicable.
 - How different product variant groups have been accounted for.
 - How different geographical locations have been accounted for.
- A review of the GHG emissions reduction model shall determine that the total use-phase GHG emissions reduction has been correctly calculated according to the documented methodology for each geographic region where use has occurred, including:
 - The GHG emissions calculated include all greenhouse gasses converted to CO₂ equivalent GHG emissions (CO₂e), using a 100-year global warming potential (GWP).
 - The latest Intergovernmental Panel on Climate Change (IPCC) GWP values should be used by preference, but previous IPCC values may be used if necessary.
 - Full life cycle GHG emissions are calculated for the energy consumption of each active device and attributable products according to the requirements in Part 1: Section 4.5.
 - The GHG emissions have been calculated separately for each geographic region where device energy consumption is known to have occurred.
 - The energy model calculates and reports GHG emissions according to the units of analysis defined in Part 1: Section 4.1.

5. General Assurance Requirements

5.1. Claims resulting from Verification

The purpose of this verification is for organisations to communicate that the use-phase GHG emissions of their product have been calculated accurately and in accordance with *Part 1: Specification and Guidance* using activity data collected from devices in use during the reporting period.

- Claims shall be reviewed and agreed by both the organisation and assurance provider.
- Claims shall only be communicated once the verification process is completed.

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