

COMMISSION REGULATION (EU) 2021/341**of 23 February 2021****amending Regulations (EU) 2019/424, (EU) 2019/1781, (EU) 2019/2019, (EU) 2019/2020, (EU) 2019/2021, (EU) 2019/2022, (EU) 2019/2023 and (EU) 2019/2024 with regard to ecodesign requirements for servers and data storage products, electric motors and variable speed drives, refrigerating appliances, light sources and separate control gears, electronic displays, household dishwashers, household washing machines and household washer-dryers and refrigerating appliances with a direct sales function****(Text with EEA relevance)**

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to 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 ⁽¹⁾, and in particular Article 15 thereof,

Whereas:

- (1) Directive 2009/125/EC empowers the Commission to set ecodesign requirements for energy-related products.
- (2) Provisions on the ecodesign of servers and data storage products, electric motors and variable speed drives, refrigerating appliances, light sources and separate control gears, electronic displays, household dishwashers, household washing machines and household washer-dryers, and refrigerating appliances with a direct sales function were established by Commission Regulations (EU) 2019/424 ⁽²⁾, (EU) 2019/1781 ⁽³⁾, (EU) 2019/2019 ⁽⁴⁾, (EU) 2019/2020 ⁽⁵⁾, (EU) 2019/2021 ⁽⁶⁾, (EU) 2019/2022 ⁽⁷⁾, (EU) 2019/2023 ⁽⁸⁾ and (EU) 2019/2024 ⁽⁹⁾ (hereafter the ‘amended Regulations’).

⁽¹⁾ OJ L 285, 31.10.2009, p. 10.

⁽²⁾ Commission Regulation (EU) 2019/424 of 15 March 2019 laying down ecodesign requirements for servers and data storage products pursuant to Directive 2009/125/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 617/2013 (OJ L 74, 18.3.2019, p. 46).

⁽³⁾ Commission Regulation (EU) 2019/1781 of 1 October 2019 laying down ecodesign requirements for electric motors and variable speed drives pursuant to Directive 2009/125/EC of the European Parliament and of the Council, amending Regulation (EC) No 641/2009 with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products and repealing Commission Regulation (EC) No 640/2009 (OJ L 272, 25.10.2019, p. 74).

⁽⁴⁾ Commission Regulation (EU) 2019/2019 of 1 October 2019 laying down ecodesign requirements for refrigerating appliances pursuant to Directive 2009/125/EC of the European Parliament and of the Council and repealing Commission Regulation (EC) No 643/2009 (OJ L 315, 5.12.2019, p. 187).

⁽⁵⁾ Commission Regulation (EU) 2019/2020 of 1 October 2019 laying down ecodesign requirements for light sources and separate control gears pursuant to Directive 2009/125/EC of the European Parliament and of the Council and repealing Commission Regulations (EC) No 244/2009, (EC) No 245/2009 and (EU) No 1194/2012 (OJ L 315, 5.12.2019, p. 209).

⁽⁶⁾ Commission Regulation (EU) 2019/2021 of 1 October 2019 laying down ecodesign requirements for electronic displays pursuant to Directive 2009/125/EC of the European Parliament and of the Council, amending Commission Regulation (EC) No 1275/2008 and repealing Commission Regulation (EC) No 642/2009 (OJ L 315, 5.12.2019, p. 241).

⁽⁷⁾ Commission Regulation (EU) 2019/2022 of 1 October 2019 laying down ecodesign requirements for household dishwashers pursuant to Directive 2009/125/EC of the European Parliament and of the Council amending Commission Regulation (EC) No 1275/2008 and repealing Commission Regulation (EU) No 1016/2010 (OJ L 315, 5.12.2019, p. 267).

⁽⁸⁾ Commission Regulation (EU) 2019/2023 of 1 October 2019 laying down ecodesign requirements for household washing machines and household washer-dryers pursuant to Directive 2009/125/EC of the European Parliament and of the Council, amending Commission Regulation (EC) No 1275/2008 and repealing Commission Regulation (EU) No 1015/2010 (OJ L 315, 5.12.2019, p. 285).

⁽⁹⁾ Commission Regulation (EU) 2019/2024 of 1 October 2019 laying down ecodesign requirements for refrigerating appliances with a direct sales function pursuant to Directive 2009/125/EC of the European Parliament and of the Council (OJ L 315, 5.12.2019, p. 313).

- (3) In order to avoid confusion for manufacturers and national market surveillance authorities about the values to be included in technical documentation, and in relation to verification tolerances, a definition of declared values should be added in the amended Regulations.
- (4) To improve the effectiveness and credibility of the product-specific Regulations and to protect consumers, products able to detect being tested and to automatically alter their performance in test conditions with the objective of reaching a more favourable level for any of the parameters specified in these Regulations or included in the technical documentation or included in any of the documentation provided should not be allowed to be placed on the market.
- (5) The relevant product parameters should be measured or calculated using reliable, accurate and reproducible methods. Those methods should take into account recognised state-of-the-art measurement methods including, where available, harmonised standards adopted by the European standardisation bodies, as listed in Annex I to Regulation (EU) No 1025/2012 of the European Parliament and of the Council ⁽¹⁰⁾.
- (6) Products containing light sources from which these light sources cannot be removed for verification without damaging one or more of them, should be tested as light sources for compliance assessment and verification.
- (7) For electronic displays and for servers and data storage products, harmonised standards have not yet been developed, and relevant existing standards do not cover all necessary regulated parameters, notably as regards High Dynamic Range and Auto Brightness Control for electronic displays and the operating condition class for servers and data storage products. Until the adoption of harmonised standards by the European standardisation bodies for this product group, the transitional methods set out in this Regulation or other reliable, accurate and reproducible methods, which take into account the generally recognised state-of-the-art, should be used in order to ensure the comparability of measurements and calculations.
- (8) Electronic displays for professional use such as video-editing, computer-aided design, graphics or for the broadcast sector, possess enhanced performance and very specific features that, although usually involving higher energy use, should not be subject to on-mode energy efficiency requirements set for more generic products. Industrial displays designed for use in harsh operating conditions for measuring, testing or process monitoring and control have specific and high requirements, such as those for minimum ingress protection (IP) level 65 as defined in EN 60529 and should not be subject to eco-design requirements set for products designed for use in commercial or domestic environments.
- (9) Vertical static-air cabinets with non-transparent doors are professional refrigerating appliances and are defined in Commission Regulation (EU) 2015/1095 ⁽¹¹⁾, and therefore should be excluded from Regulation (EU) 2019/2024.
- (10) Further amendments should be made to improve clarity and consistency amongst the Regulations.
- (11) The measures provided for in this Regulation were discussed by the Consultation Forum in accordance with Article 18 of Directive 2009/125/EC.
- (12) Regulations (EU) 2019/424, (EU) 2019/1781, (EU) 2019/2019, (EU) 2019/2020, (EU) 2019/2021, (EU) 2019/2022, (EU) 2019/2023 and (EU) 2019/2024 should therefore be amended accordingly.
- (13) The measures provided for in this Regulation are in accordance with the opinion of the Committee established by Article 19 of Directive 2009/125/EC,

⁽¹⁰⁾ Regulation (EU) No 1025/2012 of the European Parliament and of the Council of 25 October 2012 on European standardisation, amending Council Directives 89/686/EEC and 93/15/EEC and Directives 94/9/EC, 94/25/EC, 95/16/EC, 97/23/EC, 98/34/EC, 2004/22/EC, 2007/23/EC, 2009/23/EC and 2009/105/EC of the European Parliament and of the Council and repealing Council Decision 87/95/EEC and Decision No 1673/2006/EC of the European Parliament and of the Council (OJ L 316, 14.11.2012, p. 12).

⁽¹¹⁾ Commission Regulation (EU) 2015/1095 of 5 May 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for professional refrigerated storage cabinets, blast cabinets, condensing units and process chillers (OJ L 177, 8.7.2015, p. 19).

HAS ADOPTED THIS REGULATION:

Article 1

Amendments to Regulation (EU) 2019/424

Regulation (EU) 2019/424 is amended as follows:

(1) paragraph 2 of Article 4 is replaced by the following:

‘2. For the purposes of the conformity assessment pursuant to Article 8 of Directive 2009/125/EC, the technical documentation shall contain a copy of the product information provided in accordance with point 3.4 of Annex II and the details and results of the calculations set out in Annex III and, where applicable, Annex II.2 to this Regulation.’;

(2) Article 6 is replaced by the following:

Article 6

Circumvention

The manufacturer, importer or authorised representative shall not place on the market products designed to be able to detect they are being tested (for example by recognising the test conditions or test cycle) and to react specifically by automatically altering their performance during the test with the aim of reaching a more favourable level for any of the parameters in the technical documentation or included in any documentation provided.’;

(3) Annexes I, III and IV are amended and Annex IIIa is added as set out in Annex I to this Regulation.

Article 2

Amendments to Regulation (EU) 2019/1781

Regulation (EU) 2019/1781 is amended as follows:

(1) Article 2 is amended as follows:

(a) in point (2), point (m) is replaced by the following:

‘(m) motors placed on the market before 1 July 2029 as substitutes for identical motors integrated in products placed on the market before 1 July 2021 for motors referred to in Annex I.1 (a), and before 1 July 2023 for motors referred to in Annex I.1 (b), and specifically marketed as such.’;

(b) in point (3), point (e) is inserted:

‘(e) VSDs consisting of a single cabinet, comprising VSDs which are all in conformity with this Regulation.’;

(2) Article 3 is amended as follows:

(a) point (2) is replaced by the following:

‘(2) “variable speed drive” (“VSD”) means an electronic power converter that continuously adapts the electrical power supplied to a single motor to control the motor’s mechanical power output according to the torque-speed characteristic of the load driven by the motor, by adjusting the power supply to a variable frequency and voltage supplied to the motor. It includes all protection devices and auxiliaries which are integrated in the VSD.’;

(b) point (23) is added:

‘(23) “declared values” means the values provided by the manufacturer, importer or authorised representative for the stated, calculated or measured technical parameters in accordance with Article 5, for the verification of compliance by the Member State authorities.’;

(3) Article 5 is amended as follows:

(a) paragraph 2 is replaced by the following:

‘For the purposes of the conformity assessment pursuant to Article 8 of Directive 2009/125/EC, the technical documentation of motors shall contain a copy of the product information provided in accordance with point 2 of Annex I to this Regulation, and the details and results of calculations set out in Annex II to this Regulation, and where applicable Annex I.1’;

(b) paragraph 3 is replaced by the following:

‘For the purposes of the conformity assessment pursuant to Article 8 of Directive 2009/125/EC, the technical documentation of VSDs shall contain a copy of the product information provided in accordance with point 4 of Annex I to this Regulation, and the details and results of calculations set out in Annex II to this Regulation, and where applicable Annex I.3’;

(4) Annexes I, II and III are amended as set out in Annex II to this Regulation.

Article 3

Amendments to Regulation (EU) 2019/2019

Regulation (EU) 2019/2019 is amended as follows:

(1) in Article 2, point 28 is replaced by the following:

‘28. “mobile refrigerating appliance” means a refrigerating appliance that can be used where there is no access to the mains electricity grid and that uses extra low-voltage electricity (< 120V DC) or fuel or both as the energy source for the refrigeration functionality, including a refrigerating appliance that, in addition to extra low voltage electricity or fuel, or both, can be electric mains operated via an external AC/DC converter to be purchased separately. An appliance placed on the market with an AC/DC converter is not a mobile refrigerating appliance.’;

(2) Article 6 is replaced by the following:

Article 6

Circumvention and software updates

The manufacturer, importer or authorised representative shall not place on the market products designed to be able to detect they are being tested (for example by recognising the test conditions or test cycle) and to react specifically by automatically altering their performance during the test with the aim of reaching a more favourable level for any of the parameters in the technical documentation or included in any documentation provided.

The energy consumption of the product and any of the other declared parameters shall not deteriorate after a software or firmware update when measured with the same test standard originally used for the declaration of conformity, except with explicit consent of the end-user prior to the update. No performance change shall occur as a result of rejecting the update.

A software update shall never have the effect of changing the product’s performance in a way that makes it non-compliant with the ecodesign requirements applicable for the declaration of conformity.’;

(3) the following Article 11 is added:

Article 11

Transitional compliance equivalence

If no unit belonging to the same model or equivalent models was placed on the market before 1 November 2020, the units of models placed on the market between 1 November 2020 and 28 February 2021 which comply with the provisions of this regulation shall be considered compliant with the requirements of Commission Regulation (EC) No 643/2009.’;

(4) Annexes I to IV are amended as set out in Annex III to this Regulation.

*Article 4***Amendments to Regulation (EU) 2019/2020**

Regulation (EU) 2019/2020 is amended as follows:

- (1) in Article 2, point 4 is replaced by the following:

‘(4) “containing product” means a product containing one or more light sources, or separate control gears, or both, including, but not limited to, luminaires that can be taken apart to allow separate verification of the contained light source(s), household appliances containing light source(s), furniture (shelves, mirrors, display cabinets) containing light source(s).’;

- (2) in Article 4(1), the second subparagraph is replaced by the following:

‘Manufacturers, importers or authorised representatives of containing products shall ensure that light sources and separate control gears can be removed without being permanently damaged for verification purposes by market surveillance authorities. The technical documentation shall provide instructions on how to do this.’;

- (3) Article 7 is replaced by the following:

‘Article 7

Circumvention and software updates

The manufacturer, importer or authorised representative shall not place on the market products designed to be able to detect they are being tested (for example, by recognising the test conditions or test cycle) and to react specifically by automatically altering their performance during the test with the aim of reaching a more favourable level for any of the parameters in the technical documentation or included in any documentation provided.

The energy consumption of the product and any of the other declared parameters shall not deteriorate after a software or firmware update when measured with the same test standard originally used for the declaration of conformity, except with explicit consent of the end-user prior to the update. No performance change shall occur as a result of rejecting the update.

A software update shall never have the effect of changing the product’s performance in a way that makes it non-compliant with the codesign requirements applicable for the declaration of conformity.’;

- (4) the following Article 12 is added:

‘Article 12

Transitional compliance equivalence

If no unit belonging to the same model or equivalent models was placed on the market before 1 July 2021, the units of models placed on the market between 1 July 2021 and 31 August 2021 which comply with the provisions of this regulation shall be considered compliant with the requirements of Commission Regulations (EC) No 244/2009, (EC) No 245/2009 and (EU) No 1194/2012.’;

- (5) Annexes I to IV are amended as set out in Annex IV to this Regulation.

*Article 5***Amendments to Regulation (EU) 2019/2021**

Regulation (EU) 2019/2021 is amended as follows:

- (1) Article 1(2) is amended as follows:

- (a) point (g) is replaced by the following:

‘(g) electronic displays that are components or sub-assemblies as defined in point 2 of Article 2 of Directive 2009/125/EC’;

- (b) the following point (h) is added:

‘(h) industrial displays.’;

(2) Article 2 is amended as follows:

(a) point (15) is replaced by the following:

‘(15) “professional display” means an electronic display designed and marketed for professional use for editing video and graphic images. Its specification shall include all of the following features:

- contrast ratio of at least 1000:1 measured at a perpendicular to the vertical plane of the screen and at least 60:1 measured at a horizontal viewing angle of at least 85° relative to that perpendicular and at least 83° from the perpendicular on a curved screen, with or without a screen cover glass;
- native resolution of at least 2,3 mega pixels;
- colour Gamut support greater or equal to 38,4 % of CIE LUV;
- colour and luminance uniformity as specified for grade 1, 2 or 3 monitors in EBU Tech. 3320, as applicable to the professional application of the display.’;

(b) the following point (21) is added:

‘(21) “industrial display” means an electronic display exclusively designed, tested and marketed for use in industrial environments for measuring, testing, monitoring or control. Its design must provide at least all the following:

- (a) operating temperatures between 0 °C and +50 °C;
- (b) operating humidity conditions between 20 % and 90 % non-condensing;
- (c) minimum level of ingress protection (IP 65) ensuring no ingress of dust and complete protection against contact (dust-tight) with no effect for water projected by a nozzle (6,3 mm) against the enclosure;
- (d) EMC immunity suitable for industrial environments.’;

(3) in Article 4, paragraph 2 is replaced by the following:

‘2. For the purposes of conformity assessment pursuant to Article 8 of Directive 2009/125/EC, the technical documentation shall contain the reason why certain, if any, plastic parts are not marked as per the exemption set out in point D(2) of Annex II, and the details and results of the calculations set out in Annexes II and III to this Regulation.’;

(4) in Article 6, the second and third paragraphs are replaced by the following:

‘The energy consumption of the product and any of the other declared parameters shall not deteriorate after a software or firmware update when measured with the same test standard originally used for the declaration of conformity, except with explicit consent of the end-user prior to the update. No performance change shall occur as a result of rejecting the update.

A software update shall never have the effect of changing the product's performance in a way that makes it non-compliant with the ecodesign requirements applicable for the declaration of conformity.’;

(5) the following Article 12 is added:

‘Article 12

Transitional compliance equivalence

If no unit belonging to the same model or equivalent models was placed on the market before 1 November 2020, the units of models placed on the market between 1 November 2020 and 28 February 2021 which comply with the provisions of this regulation shall be considered compliant with the requirements of Regulation (EC) No 642/2009.’;

(6) Annexes I to IV are amended and Annex IIIa is added as set out in Annex V to this Regulation.

*Article 6***Amendments to Regulation (EU) 2019/2022**

Regulation (EU) 2019/2022 is amended as follows:

- (1) Article 6 is replaced by the following:

'Article 6

Circumvention and software updates

The manufacturer, importer or authorised representative shall not place on the market products designed to be able to detect they are being tested (for example by recognising the test conditions or test cycle) and to react specifically by automatically altering their performance during the test with the aim of reaching a more favourable level for any of the parameters in the technical documentation or included in any documentation provided.

The energy consumption of the product and any of the other declared parameters shall not deteriorate after a software or firmware update when measured with the same test standard originally used for the declaration of conformity, except with explicit consent of the end-user prior to the update. No performance change shall occur as a result of rejecting the update.

A software update shall never have the effect of changing the product's performance in a way that makes it non-compliant with the ecodesign requirements applicable for the declaration of conformity.;

- (2) the following Article 13 is added:

'Article 13

Transitional compliance equivalence

If no unit belonging to the same model or equivalent models was placed on the market before 1 November 2020, the units of models placed on the market between 1 November 2020 and 28 February 2021 which comply with the provisions of this regulation shall be considered compliant with the requirements of Regulation (EU) No 1016/2010;

- (3) Annexes I, III and IV are amended as set out in Annex VI to this Regulation.

*Article 7***Amendments to Regulation (EU) 2019/2023**

Regulation (EU) 2019/2023 is amended as follows:

- (1) in Article 2, point 12 is replaced by the following:

'(12) "eco 40-60" means the name of the programme declared by the manufacturer, importer or authorised representative as able to clean normally soiled cotton laundry declared to be washable at 40 °C or 60 °C, together in the same washing cycle, and to which the ecodesign requirements on energy efficiency, washing efficiency, rinsing effectiveness, programme duration, maximum temperature inside the laundry and water consumption relate.;

- (2) Article 6 is replaced by the following:

'Article 6

Circumvention and software updates

The manufacturer, importer or authorised representative shall not place on the market products designed to be able to detect they are being tested (for example by recognising the test conditions or test cycle) and to react specifically by automatically altering their performance during the test with the aim of reaching a more favourable level for any of the parameters in the technical documentation or included in any documentation provided.

The energy consumption of the product and any of the other declared parameters shall not deteriorate after a software or firmware update when measured with the same test standard originally used for the declaration of conformity, except with explicit consent of the end-user prior to the update. No performance change shall occur as a result of rejecting the update.

A software update shall never have the effect of changing the product's performance in a way that makes it non-compliant with the ecodesign requirements applicable for the declaration of conformity.;

- (3) the following Article 13 is added:

'Article 13

Transitional compliance equivalence

If no unit belonging to the same model or equivalent models was placed on the market before 1 November 2020, the units of models placed on the market between 1 November 2020 and 28 February 2021 which comply with the provisions of this regulation shall be considered compliant with the requirements of Regulation (EU) No 1015/2010.;

- (4) Annexes I, III, IV and VI are amended as set out in Annex VII to this Regulation.

Article 8

Amendments to Regulation (EU) 2019/2024

Regulation (EU) 2019/2024 is amended as follows:

- (1) in Article 1(3), point (e) is replaced by the following:

'(e) corner/curved and carousel cabinets;'

- (2) Article 2, is amended as follows:

- (a) point 21 is replaced by the following:

'21. "corner/curved cabinet" means a refrigerating appliance with a direct sales function used to achieve geometrical continuity between two linear cabinets that are at an angle to each other and/or that form a curve. A corner/curved cabinet does not have a recognisable longitudinal axis or length since it consists only of a filling shape (wedge or similar) and is not designed to function as a stand-alone refrigerated unit. The two ends of the corner/curved cabinet are inclined at an angle between 30 ° and 90 °;'

- (b) point 29 is added:

'29. "carousel cabinet" means a round/circular shape supermarket cabinet which can be installed as a standalone unit or as a unit connecting two linear supermarket cabinets. Carousel cabinets can also be equipped with a turning system which makes visible the display of foodstuff at 360 °;'

- (c) point 30 is added:

'30. "supermarket cabinet" means a refrigerating appliance with a direct sales function intended for the sale and display of foodstuffs and other items in retail applications, such as in supermarkets. Beverage coolers, refrigerated vending machines, gelato-scooping cabinets and ice-cream freezers are not considered supermarket cabinets;'

- (3) Annexes I, III and IV are amended as set out in Annex VIII to this Regulation.

Article 9

Entry into force and application

This Regulation shall enter into force on the third day following that of its publication in the *Official Journal of the European Union*.

Article 1(3), Article 3(4), Article 5(6), Article 6(3), Article 7(4) and Article 8(3) shall apply from 1 May 2021. Article 2 and Article 4(4) shall apply from 1 July 2021. Article 4(1), (2) and (5) shall apply from 1 September 2021.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels, 23 February 2021.

For the Commission
The President
Ursula VON DER LEYEN

ANNEX I

Annexes I, III and IV to Regulation (EU) 2019/424 are amended and Annex IIIa is added as follows:

(1) Annex I is amended as follows:

(a) point (3) is replaced by the following:

‘(3) “motherboard” means the main circuit board of a server or a data storage product. For purposes of this regulation, the motherboard includes connectors for attaching additional boards and typically includes the following components: processor, memory, BIOS, and expansion slots;’;

(b) point (4) is replaced by the following:

‘(4) “processor” means the logic circuitry that responds to and processes the basic instructions that drive a server or a data storage product. For purposes of this regulation, the processor is the CPU of the server. A typical CPU is a physical package to be installed on the server motherboard via a socket or direct solder attachment. The CPU package may include one or more processor cores;’;

(c) point (5) is replaced by the following:

‘(5) “memory” means a part of a server or a data storage product external to the processor in which information is stored for immediate use by the processor, expressed in gigabyte (GB);’;

(d) the following point (36) is added:

‘(36) “declared values” means the values provided by the manufacturer, importer or authorised representative for the stated, calculated or measured technical parameters in accordance with Article 4, for the verification of compliance by the Member State authorities.’;

(2) in Annex III, the following second paragraph is inserted:

‘In the absence of existing relevant standards and until the publication of the references of the relevant harmonised standards in the Official Journal, the transitional testing methods set out in Annex IIIa or other reliable, accurate and reproducible methods, which take into account the generally recognised state-of-the-art, shall be used.’;

(3) the following Annex IIIa is added:

‘ANNEX IIIa

Transitional Methods

Table 1

References and qualifying notes for servers

Parameter	Source	Reference Test Method / Title	Notes
Server efficiency and server performance in active state	ETSI	ETSI EN 303470:2019	General notes on the testing with EN 303470: 2019: a. Testing shall be conducted at an appropriate EU voltage and frequency (e.g. 230v, 50Hz). b. Similar to the provision on expansion APA cards under point 2 of Annex III, the unit under test shall be tested with other types of add-in cards (for which no allowance is provided and not exercised in SERT testing) removed, when measuring the idle state power, the active state efficiency and server performance in active state (!).
Idle state power (Pidle)	ETSI	ETSI EN 303470:2019	
Maximum power	ETSI	ETSI EN 303470:2019	

Parameter	Source	Reference Test Method / Title	Notes	
				<p>c. In the case of servers which</p> <p>i. are not declared as being part of a server product family</p> <p>ii. are as-shipped in a configuration without all memory channels populated with the same dual in-line memory modules (DIMMs)</p> <p>a configuration with all memory channels populated with the same DIMMs shall be tested (?).</p>
Idle state power at the higher boundary temperature of the declared operating condition class	The Green Grid	Simplified high temperature idle power reporting for (EU) 2019/424 sert collection	The test shall be conducted at a temperature corresponding to the highest allowable temperature for the specific operating condition class (A1, A2, A3 or A4).	
Power Supply Efficiency	EPRI and Ecova	Generalized Test Protocol for Calculating the Energy Efficiency of Internal AC-DC and DC-DC Power Supplies Revision 6.7	Testing shall be conducted at an appropriate EU voltage and frequency (e.g. 230v, 50Hz).	
Power Supply Power Factor	EPRI and Ecova	Generalized Test Protocol for Calculating the Energy Efficiency of Internal AC-DC and DC-AC Power Supplies Revision 6.7		
Operating condition class		<p>The manufacturer has to declare the product operating condition class: A1, A2, A3 or A4. The unit under test is placed at a temperature corresponding to the highest allowable temperature for the specific operating condition class (A1, A2, A3 or A4), which the model is declared to be compliant with. The unit shall be tested with SERT (Server Efficiency Rating Tool) and run test cycle(s) for a duration of 16 hours. The unit shall be considered to comply with the declared operating condition, if SERT reports valid results (i.e. if the unit under test is in its operational state for the whole duration of the 16 hours test).</p>	<p>The unit under test shall be placed in a temperature chamber which is then elevated in temperature to the highest allowable temperature for the specific operating condition class (A1, A2, A3 or A4) at a maximum rate of change of 0.5 °C per minute. The unit under test shall be left in an idle state for 1 hour to attain a state of temperature stability prior to the start of testing.</p>	
Firmware availability		Not available		

Parameter	Source	Reference Test Method / Title	Notes
Secure data deletion	NIST	Guidelines for Media Sanitization, NIST Special Publication 800-88 - Revision 1	
Ability of the server to be disassembled		Not available	
Critical raw material (CRM) content		EN 45558:2019	

(¹) This is necessary because of the wide variation of APA cards in the market and the fact that the SERT tool does not include any worklets which exercise APAs. Therefore, SERT efficiency results for servers with the expansion APA cards or other add-in cards would not be representative of the performance/power capability of the server.

(²) In the case of servers which are declared as being part of a server product family, point 1 of Annex IV to Regulation (EU) 2019/424 foresees that the Member State authorities can test the low-end performance configuration or the high-end performance configuration and, as per definitions 21 and 22 of Annex I, these configurations shall have all memory channels populated with the same DIMM raw card design and capacity.

Table 2

References and qualifying notes for data storage products

Parameter	Source	Reference Test Method / Title	Notes
Power Supply Efficiency	EPRI and Ecova	Generalized Test Protocol for Calculating the Energy Efficiency of Internal AC-DC and DC -DC Power Supplies Revision 6.7	Testing shall be conducted at an appropriate EU voltage and frequency (e.g. 230v, 50Hz).
Power Supply Power Factor	EPRI and Ecova	Generalized Test Protocol for Calculating the Energy Efficiency of Internal AC-DC and DC -DC Power Supplies Revision 6.7	
Operating condition class	The Green Grid	"Operating condition class of data storage products"	The manufacturer, importer or authorised representative has to declare the product operating condition class: A1, A2, A3 or A4. The unit under test is placed at a temperature corresponding to the highest allowable temperature for the specific operating condition class (A1, A2, A3 or A4), which the model is declared to be compliant with.
Firmware availability		Not available	
Secure data deletion	NIST	Guidelines for Media Sanitization, NIST Special Publication 800-88 - Revision 1	
Ability of the data storage product to be disassembled		Not available	
Critical raw material (CRM) content		EN 45558:2019'	

(4) Annex IV is amended as follows:

(a) the first paragraph is replaced by:

'The verification tolerances defined in this Annex relate only to the verification by Member State authorities of the declared values and shall not be used by the manufacturer, importer or authorised representative as an allowed tolerance to establish the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means.';

- (b) in the third paragraph, the words 'When verifying' are replaced by 'As part of verifying';
 - (c) the following point 2(d) is added:

'(d) when the Member State authorities check the unit of the model, it complies with the resource efficiency requirements in point 3.3 of Annex II and the information requirements in point 3.1 or 3.2 of Annex II;'
 - (d) point 3 is replaced by the following:

'If the results referred to in points 2(a), 2(b) or 2(d) are not achieved, the model and all model configurations that are covered by the same product information (according to Annex II point 3.1(p)) shall be considered not to comply with this Regulation;'
 - (e) point 4(b) is replaced by the following:

'for models that are produced in quantities of five or more per year, the Member State authorities shall select three additional units of the same model or alternatively, in case the manufacturer, importer or authorised representative declared the server to be represented by a server product family, a unit of both the low-end performance configuration and the high-end performance configuration for testing;'
 - (f) point (5) is replaced by the following:

'(5) The model or model configuration shall be considered to comply with the applicable requirements if, for the units referred to in point 4(b), the arithmetical mean of the determined values complies with the respective verification tolerances given in Table 7;'
 - (g) point (6) is replaced by the following:

'(6) If the result referred to in point 5 is not achieved, the model and all model configurations that are covered by the same product information (according to Annex II point 3.1(p)) shall be considered not to comply with this Regulation;'
 - (h) point (7) is replaced by the following:

'(7) The Member State authorities shall provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision being taken on the non-compliance of the model according to points 3, 4(a), 6 or the second paragraph of this Annex.'
-

ANNEX II

Annexes I, II and III to Regulation (EU) 2019/1781 are amended as follows:

(1) Annex I is amended as follows:

(a) part 1 is amended as follows:

(1) in point (a), points (i) and (ii) are replaced by the following:

‘(i) the energy efficiency of three-phase motors with a rated output equal to or above 0,75 kW and equal to or below 1 000 kW, with 2, 4, 6 or 8 poles, which are not Ex eb increased safety motors, shall correspond to at least the IE3 efficiency level set out in Table 2 or in Table 3b as appropriate;

(ii) the energy efficiency of three-phase motors with a rated output equal to or above 0,12 kW and below 0,75 kW, with 2, 4, 6 or 8 poles, which are not Ex eb increased safety motors, shall correspond to at least the IE2 efficiency level set out in Table 1 or in Table 3a as appropriate;’;

(2) in point (b), points (i) and (ii) are replaced by the following:

‘(i) the energy efficiency of Ex eb increased safety motors with a rated output equal to or above 0,12 kW and equal to or below 1 000 kW, with 2, 4, 6 or 8 poles, and single-phase motors with a rated output equal to or above 0,12 kW shall correspond to at least the IE2 efficiency level set out in Table 1 or in Table 3a as appropriate;

(ii) the energy efficiency of three-phase motors which are not brake motors, Ex eb increased safety motors, or other explosion-protected motors, with a rated output equal to or above 75 kW and equal to or below 200 kW, with 2, 4, or 6 poles, shall correspond to at least the IE4 efficiency level set out in Table 3 or in Table 3c as appropriate;’;

(3) the second paragraph is replaced by the following:

‘Energy efficiency of motors, expressed in International Energy efficiency classes (IE), is set out in Tables 1 to 3c for different values of the motor rated output power P_N , at 50 Hz or 60 Hz. IE classes are determined at rated output power (P_N), rated voltage (U_N), and based on 25 °C ambient reference temperature.

For 50/60 Hz motors, the requirements above shall be met at both 50 Hz and 60 Hz at the rated output power specified for 50 Hz.

For 50Hz or 60Hz motors the requirements above shall be met at respectively 50Hz or 60Hz at the rated output power specified respectively for 50 Hz or 60 Hz.’;

(4) the following tables 3a, 3b and 3c are inserted:

Table 3a

Minimum efficiencies η_n for IE2 efficiency level at 60 Hz (%)

Rated output power P_N [kW]	Number of poles			
	2	4	6	8
0,12	59,5	64,0	50,5	40,0
0,18	64,0	68,0	55,0	46,0
0,25	68,0	70,0	59,5	52,0
0,37	72,0	72,0	64,0	58,0
0,55	74,0	75,5	68,0	62,0
0,75	75,5	78,0	73,0	66,0
1,1	82,5	84,0	85,5	75,5
1,5	84,0	84,0	86,5	82,5
2,2	85,5	87,5	87,5	84,0

Rated output power P_N [kW]	Number of poles			
	2	4	6	8
3,7	87,5	87,5	87,5	85,5
5,5	88,5	89,5	89,5	85,5
7,5	89,5	89,5	89,5	88,5
11	90,2	91,0	90,2	88,5
15	90,2	91,0	90,2	89,5
18,5	91,0	92,4	91,7	89,5
22	91,0	92,4	91,7	91,0
30	91,7	93,0	93,0	91,0
37	92,4	93,0	93,0	91,7
45	93,0	93,6	93,6	91,7
55	93,0	94,1	93,6	93,0
75	93,6	94,5	94,1	93,0
90	94,5	94,5	94,1	93,6
110	94,5	95,0	95,0	93,6
150	95,0	95,0	95,0	93,6
185	95,4	95,0	95,0	93,6
220	95,4	95,4	95,0	93,6
250	95,4	95,4	95,0	93,6
300	95,4	95,4	95,0	93,6
335	95,4	95,4	95,0	93,6
375 up to 1000	95,4	95,8	95,0	94,1

Table 3b

Minimum efficiencies η_n for IE3 efficiency level at 60 Hz (%)

Rated output power P_N [kW]	Number of poles			
	2	4	6	8
0,12	62,0	66,0	64,0	59,5
0,18	65,6	69,5	67,5	64,0
0,25	69,5	73,4	71,4	68,0
0,37	73,4	78,2	75,3	72,0
0,55	76,8	81,1	81,7	74,0
0,75	77,0	83,5	82,5	75,5
1,1	84,0	86,5	87,5	78,5
1,5	85,5	86,5	88,5	84,0
2,2	86,5	89,5	89,5	85,5
3,7	88,5	89,5	89,5	86,5

Rated output power P_N [kW]	Number of poles			
	2	4	6	8
5,5	89,5	91,7	91,0	86,5
7,5	90,2	91,7	91,0	89,5
11	91,0	92,4	91,7	89,5
15	91,0	93,0	91,7	90,2
18,5	91,7	93,6	93,0	90,2
22	91,7	93,6	93,0	91,7
30	92,4	94,1	94,1	91,7
37	93,0	94,5	94,1	92,4
45	93,6	95,0	94,5	92,4
55	93,6	95,4	94,5	93,6
75	94,1	95,4	95,0	93,6
90	95,0	95,4	95,0	94,1
110	95,0	95,8	95,8	94,1
150	95,4	96,2	95,8	94,5
185	95,8	96,2	95,8	95,0
220	95,8	96,2	95,8	95,0
250	95,8	96,2	95,8	95,0
300	95,8	96,2	95,8	95,0
335	95,8	96,2	95,8	95,0
375 up to 1000	95,8	96,2	95,8	95,0

Table 3c

Minimum efficiencies η_n for IE4 efficiency level at 60 Hz (%)

Rated output power P_N [kW]	Number of poles			
	2	4	6	8
0,12	66,0	70,0	68,0	64,0
0,18	70,0	74,0	72,0	68,0
0,25	74,0	77,0	75,5	72,0
0,37	77,0	81,5	78,5	75,5
0,55	80,0	84,0	82,5	77,0
0,75	82,5	85,5	84,0	78,5
1,1	85,5	87,5	88,5	81,5
1,5	86,5	88,5	89,5	85,5
2,2	88,5	91,0	90,2	87,5
3,7	89,5	91,0	90,2	88,5
5,5	90,2	92,4	91,7	88,5

Rated output power P_N [kW]	Number of poles			
	2	4	6	8
7,5	91,7	92,4	92,4	91,0
11	92,4	93,6	93,0	91,0
15	92,4	94,1	93,0	91,7
18,5	93,0	94,5	94,1	91,7
22	93,0	94,5	94,1	93,0
30	93,6	95,0	95,0	93,0
37	94,1	95,4	95,0	93,6
45	94,5	95,4	95,4	93,6
55	94,5	95,8	95,4	94,5
75	95,0	96,2	95,8	94,5
90	95,4	96,2	95,8	95,0
110	95,4	96,2	96,2	95,0
150	95,8	96,5	96,2	95,4
185	96,2	96,5	96,2	95,4
220	96,2	96,8	96,5	95,4
250	96,2	96,8	96,5	95,8
300	96,2	96,8	96,5	95,8
335	96,2	96,8	96,5	95,8
375 up to 1000	96,2	96,8	96,5	95,8'

- (5) the following is added before the last sentence:

‘To determine the minimum efficiency of 60 Hz motors at a rated power not provided in Tables 3a, 3b and 3c, the following rule shall be used:

The efficiency of a rated power at or above the midpoint between 2 consecutive values from the tables shall be the highest of the two efficiencies.

The efficiency of a rated power below the midpoint between 2 consecutive values from the tables shall be the lowest of the two efficiencies.’;

- (b) Part 2 is amended as follows:

- (1) in the first paragraph, point (a) is replaced by the following:

‘(a) the technical data sheet or user manual supplied with the motor, unless an internet link to that information is supplied with the product. A QR code may in addition be supplied with a link to the information.’;

- (2) in the third paragraph, the introductory wording and point (1) are replaced by the following:

‘From 1 July 2021 for motors referred to in Annex I.1 (a), and from 1 July 2023 for motors referred to in Annex I.1 (b) (i):

(1) rated efficiency (η_N) at the full, 75 % and 50 % rated load, and rated voltage(s) (U_N), determined based on 25 °C ambient reference temperature, rounded to one decimal place;’;

- (3) the eighth and ninth paragraphs are replaced by the following:

‘For motors exempt from the efficiency requirements in accordance with point 2(m) of Article 2 of this Regulation, the motor or its packaging and the documentation must clearly indicate “Motor to be used exclusively as spare part for” and the unique model identification of the product(s) for which it is intended.

For 50 Hz and 60 Hz motors, the data set out above is provided at the applicable frequency, while for 50/60 Hz motors it is sufficient to provide the data at 50 Hz, except for the rated efficiency at full load, which shall be specified at both 50Hz and 60Hz.’;

- (c) Part 4 is amended as follows:

- (1) in the first paragraph, point (a) is replaced by the following:

‘(a) the technical data sheet or user manual supplied with the VSD, unless an internet link to that information is supplied with the product. A QR code may in addition be supplied with a link to the information.’;

- (2) the fourth paragraph is replaced by the following:

‘The information referred to in points (1) and (2) as well as the year of manufacture shall be durably marked on or near the rating plate of the VSD. Where the size of the rating plate makes it impossible to mark all the information referred to in point (1) only the power losses in % of the rated apparent output power at (90;100), rounded to one decimal place, shall be marked.’;

- (2) in Annex II, part 1, the second paragraph is replaced by the following:

‘However, for the seven operating points according to Annex I.2 point (13), the losses shall be determined by either direct input-output measurement or by calculation.’;

- (3) Annex III is amended as follows:

- (a) the first paragraph is replaced by the following:

‘The verification tolerances defined in this Annex relate only to the verification by Member State authorities of the declared values and shall not be used by the manufacturer, importer or authorised representative as an allowed tolerance to establish the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means.’;

- (b) the third paragraph is replaced by the following:

‘As part of verifying that a product model complies with the requirements laid down in this Regulation pursuant to Article 3(2) of Directive 2009/125/EC the authorities of the Member States shall apply the following procedure for the requirements referred to in Annex I.’;

- (c) point (7) is replaced by the following:

‘(7) The Member State authorities shall provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision being taken on the non-compliance of the model according to points 3, 6 or the second paragraph of this Annex.’.

ANNEX III

Annexes I to IV to Regulation (EU) 2019/2019 are amended as follows

(1) in Annex I, the following point (38) is added:

‘(38) “declared values” means the values provided by the manufacturer, importer or authorised representative for the stated, calculated or measured technical parameters in accordance with Article 4, for the verification of compliance by the Member State authorities.’;

(2) in Annex II, part 2, point (f) is replaced by the following:

‘(f) For 4-star compartments, the freezing time to bring the temperature of the light load from +25 to -18 °C at an ambient temperature of 25 °C shall be such that the resulting freezing capacity complies with the requirement in Article 2, point 22.’;

(3) Annex III is amended as follows:

(a) the following paragraph is added after the first paragraph:

‘Where a parameter is declared pursuant to Article 4, its declared value shall be used by the manufacturer, importer or authorised representative for the calculations in this Annex.’;

(b) in part 1, point (h) is replaced by the following:

‘(h) the freezing capacity of a compartment is calculated as 24 times the light load weight, divided by the freezing time to bring the temperature of the light load from +25 to -18 °C at an ambient temperature of 25 °C expressed in kg/24h and rounded to one decimal place’;

(c) in part 1, the following point (j) is added:

‘(j) the light load weight for each 4-star compartment shall be:

- 3,5 kg/100 l of the volume of the 4-star compartment evaluated, rounded up to the nearest 0,5 kg; and,
- 2 kg for a 4-star compartment with a volume for which 3,5 kg/100 l leads to a value lower than 2 kg;

in the case that the refrigerating appliance includes a combination of 3- and 4-star compartments, the sum of the light load weight(s) shall be increased so that the sum of the light load weights for all the 4-star compartments shall be:

- 3,5 kg/100 l of the total volume of all 4- and 3-star compartments, rounded up to the nearest 0,5 kg; and,
- 2 kg for a total volume of all 4- and 3-start compartments for which 3,5 kg/100 l leads to a value lower than 2 kg’;

(4) in Annex IV is amended as follows:

(a) the first paragraph is replaced by the following:

‘The verification tolerances defined in this Annex relate only to the verification by Member State authorities of the declared values and shall not be used by the manufacturer, importer or authorised representative as an allowed tolerance to establish the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means.’;

(b) in the third paragraph, the words ‘When verifying’ are replaced by ‘As part of verifying’;

(c) point (2) (d) is replaced by the following:

‘(d) when the Member State authorities check the unit of the model, it complies with the requirement in the third paragraph of Article 6, the functional requirements in point 2 of Annex II, the requirements on resource efficiency in point 3 of Annex II and the information requirements in point 4 of Annex II; and’;

(d) point (7) is replaced by the following:

‘(7) The Member State authorities shall provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision being taken on the non-compliance of the model according to points 3, 6 or the second paragraph of this Annex.’;

(e) Table 6 is replaced by the following:

Table 6

Verification tolerances

Parameters	Verification tolerances
Total volume and compartment volume	The determined value ^(a) shall not be more than 3 % or 1 litre lower — whichever is the greater value — than the declared value.
Freezing capacity	The determined value ^(a) shall not be more than 10 % lower than the declared value.
E_{32}	The determined value ^(a) shall not be more than 10 % higher than the declared value.
Annual energy consumption	The determined value ^(a) shall not be more than 10 % higher than the declared value.
Internal humidity of wine storage appliances (%)	The determined value ^(a) shall not differ from the declared range by more than 10 %.
Airborne acoustical noise emission	The determined value ^(a) shall not be more than 2 dB(A) re 1 pW more than the declared value.
Temperature rise time	The determined value ^(a) shall not be more than 15 % lower than the declared value.

^(a) in the case of three additional units tested as prescribed in point 4, the determined value means the arithmetical mean of the values determined for these three additional units.’.

ANNEX IV

Annexes I to IV to Regulation (EU) 2019/2020 are amended as follows:

(1) in Annex I point (52) is replaced by the following:

‘(52) “declared values” means the values provided by the manufacturer, importer or authorised representative for the stated, calculated or measured technical parameters in accordance with Article 5, for the verification of compliance by the Member State authorities.’;

(2) Annex II is amended as follows:

(a) in point 2, table 4, the cells:

Stroboscopic effect for LED and OLED MLS	$SVM \leq 0,4$ at full-load (except for HID with $\Phi_{use} > 4$ klm and for light sources intended for use in outdoor applications, industrial applications or other applications where lighting standards allow a $CRI < 80$)
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are replaced by the following:

‘Stroboscopic effect for LED and OLED MLS	$SVM \leq 0,9$ at full-load (except for light sources intended for use in outdoor applications, industrial applications or other applications where lighting standards allow a $CRI < 80$)
	From 1 September 2024: $SVM \leq 0,4$ at full-load (except for light sources intended for use in outdoor applications, industrial applications or other applications where lighting standards allow a $CRI < 80$)’

(b) in point 3(d), point (1) is replaced by the following:

‘(1) The information specified in point 3(c)(1) of this Annex shall also be contained in the technical documentation file drawn up for the purposes of conformity assessment pursuant to Article 8 of Directive 2009/125/EC.’;

(3) Annex III is amended as follows:

(a) in point 1, point (c) is replaced by the following:

‘(c) in radiological and nuclear medicine installations that are subject to radiation safety standards as set out in Council Directive 2013/59/EURATOM (*);

(*) Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation (OJ L 13, 17.1.2014, p. 1).’;

(b) point 3 is amended as follows:

(1) point (s) is replaced by the following:

‘(s) incandescent light sources with blade contact-, metal lug-, cable-, litz wire-, metric thread-, pin base- or non-standard customised electrical interface, encasing made from quartz-glass tubes, specifically designed and exclusively marketed for industrial or professional electro-heating equipment (such as stretch blow-moulding process in PET-Industry, 3D-printing, photovoltaic and electronic manufacturing processes, drying or hardening of adhesives, inks, paints or coatings)’;

(2) point (w) is replaced by the following:

‘(w) light sources that

(1) are specifically designed and exclusively marketed for scene-lighting use in film-studios, TV-studios and locations, and photographic-studios and locations, or for stage-lighting use in theatres, during concerts or other entertainment events;

and that

(2) meet at least one of the following specifications:

- (a) LED with power ≥ 100 W and CRI > 90 ;
- (b) GES/E40, K39d socket with changeable Colour Temperature down to 1 800 K (undimmed), used with low voltage power supply;
- (c) LED with power ≥ 180 W and arranged to direct output to an area smaller than the light emitting surface;
- (d) Incandescent light source that is DWE type and has 650 W power, 120 V voltage and pressure screw terminal;
- (e) LED with power ≥ 100 W that allows the user to set different correlated colour temperatures for the emitted light;
- (f) LFL T5 with G5 cap with CRI ≥ 85 and CCT 2 900, 3 000, 3 200, 5 600 or 6 500 K;

(3) the following point (x) is added:

‘(x) incandescent DLS fulfilling all of the following conditions: E27 cap, clear envelope, power ≥ 100 W and ≤ 400 W, CCT $\leq 2\,500$ K, specifically designed and exclusively marketed for infrared heating’;

(c) the following point 5 is added:

‘5. Light sources specifically designed and exclusively marketed for use in products in the scope of Commission Regulations 2019/2023, 2019/2022, 932/2012 and 2019/2019, shall be exempt from the requirements regarding lumen maintenance factor and survival factor set out in point 2 Table 4 of Annex II, and from the lifetime information requirement set out in point 3(b)(1)(e) of Annex II.’;

(4) Annex IV is amended as follows:

(a) the first paragraph is replaced by the following:

‘The verification tolerances defined in this Annex relate only to the verification by Member State authorities of the declared values and shall not be used by the manufacturer, importer or authorised representative as an allowed tolerance to establish the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means.’;

(b) in the third paragraph, the words ‘When verifying’ are replaced by ‘As part of verifying’;

(c) point 1 is replaced by the following:

‘1. The Member State authorities shall verify one single unit of the model for points 2(a), 2(b), 2(d) and 2(e) of this Annex.

The Member State authorities shall verify 10 units of the light source model or 3 units of the separate control gear model. The verification tolerances are laid down in Table 6 of this Annex.’;

(d) point 2(c) is replaced by:

‘(c) when the authorities of the Member State test the units of the model, the determined values comply with the respective verification tolerances as given in Table 6 of this Annex, where “determined value” means the arithmetic mean over the tested units of the measured values for a given parameter or the arithmetic mean of parameter values calculated from measured values; and’;

(e) points 2(d) and (e) are added:

‘(d) when the Member State authorities check the unit of the model, they find that the manufacturer, importer or authorised representative has put in place a system that complies with the requirements in the second paragraph of Article 7; and

(e) when the Member State authorities check the unit of the model, it complies with the requirement in the third paragraph of Article 7 and the information requirements in point 3 of Annex II.’;

(f) point 3 is replaced by the following:

‘3. If the results referred to in point 2(a), (b), (c), (d) or (e) are not achieved, the model and all equivalent models shall be considered not to comply with this Regulation.’

(g) point 4 is replaced by the following:

‘(4) The Member State authorities shall provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision being taken on the non-compliance of the model according to points 3 or the second paragraph of this Annex.’;

(h) in Table 6, the verification tolerance for ‘Flicker [Pst LM] and stroboscopic effect [SVM]’ is replaced by the following:

‘The determined value shall not exceed the declared value by more than 0,1.’.

ANNEX V

Annexes I to IV to Regulation (EU) 2019/2021 are amended and Annex IIIa is added as follows:

(1) Annex I is amended as follows:

(a) point 5 is replaced by the following:

‘(5) “microLED display” means an electronic display where individual pixels are lit using microscopic LED technology;’;

(b) the following points (38), (39) and (40) are added:

‘(38) “declared values” means the values provided by the manufacturer, importer or authorised representative for the stated, calculated or measured technical parameters in accordance with Article 4, for the verification of compliance by the Member State authorities.

(39) “HD resolution” means 1920 x 1080 pixels or 2 073 600 pixels;

(40) “UHD resolution” means 3840 x 2160 pixels or 8 294 400 pixels.’;

(2) Annex II, point A.1 is amended as follows:

(a) After the last sentence before table 1, the following paragraph is added:

‘The declared values of the on mode power ($P_{measured}$) and screen area (A) as listed in Table 5 of Annex VI of delegated Regulation 2019/2013 shall be used for the calculation of EEI.’;

(b) Table 1 is replaced by the following:

Table 1

EEI limits for on-mode

	EEI_{max} for electronic displays with resolution up to HD	EEI_{max} for electronic displays with resolution above HD and up to UHD	EEI_{max} for electronic displays with resolution above UHD and for MicroLED displays
1 March 2021	0,90	1,10	n.a.
1 March 2023	0,75	0,90	0,90’

(c) Section C is amended as follows:

The last paragraph of point 2 is replaced by the following:

‘Networked electronic displays shall comply with the requirements for networked standby mode with the reactivation trigger device connected to the network and ready to activate a trigger instruction when required to.

With networked standby mode disabled, networked electronic displays shall comply with the requirements of standby mode.’;

(d) Section D is amended as follows:

(1) point 1 is replaced by the following:

‘1. Design for dismantling, recycling and recovery

(a) Manufacturers, importers or their authorised representatives shall ensure that joining, fastening or sealing techniques do not prevent the removal, using commonly available tools, of the components indicated in point 1 of Annex VII of Directive 2012/19/EU on WEEE or in Article 11 of Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators, when present.

(b) The derogations indicated in Article 11 of Directive 2006/66/EC about permanent connection between the electronic display and the battery or accumulator apply.

- (c) Manufacturers, importers or their authorised representatives shall, without prejudice to point 1 of Article 15 of Directive 2012/19/EU, make available, on a free-access website, the dismantling information needed to access any of the products components referred to in point 1 of Annex VII of Directive 2012/19/EU.
- (d) This dismantling information shall include the sequence of dismantling steps, tools or technologies needed to access the targeted components.
- (e) This end of life information shall be available until at least 15 years after the placing on the market of the last unit of a product model.;

(2) in point 5, point (a)(1) is replaced by the following:

‘(1) manufacturers, importers or authorised representatives of electronic displays shall make available to professional repairers at least the following spare parts: internal power supply, connectors to connect external equipment (cable, antenna, USB, DVD and Blu-Ray), capacitors above 400 microfarads, batteries and accumulators, DVD/Blu-Ray module if applicable and HD/SSD module if applicable for a minimum period of seven years after placing the last unit of the model on the market.;

(3) Annex III is modified as follows:

(a) the following paragraph is added after the first paragraph:

‘Where a parameter is declared pursuant to Article 4, its declared value shall be used by the manufacturer, importer or authorised representative for the calculations in this Annex.

In the absence of existing relevant standards and until the publication of the references of the relevant harmonised standards in the Official Journal, the transitional testing methods set out in Annex IIIa or other reliable, accurate and reproducible methods, which take into account the generally recognised state-of-the-art, shall be used.;

(b) at the end of the Annex, the following is inserted:

‘Measurements of Standard Dynamic Range, High Dynamic Range, screen luminance for Automatic Brightness Control, Peak White luminance ratio and other luminance measurements shall be made as detailed in Table 3a.

Table 3a

References and qualifying notes

	Notes
P_{measured} Standard dynamic range (SDR) on-mode, “normal”	<p>Power measurement notes (See Annex IIIa for informative notes regarding the testing of Displays with a standardised DC input or a non-removable battery providing the primary power. For the purposes of these Transitional Measurement Methods a standardised DC input is solely one compatible with the various forms of USB power delivery.</p> <p>Video Signals Notes The 10-minute Dynamic Broadcast video sequence described in existing relevant standards shall be replaced with an updated 10-minute Dynamic Broadcast video sequence. This is available for download at: https://circabc.europa.eu/ui/group/1582d77c-d930-4c0d-b163-4f67e1d42f5b/library/23ab249b-6ebc-4f45-9b0e-df07bc61a596?p=1&n=10&sort=modified_DESC. Two files are available, in SD and HD. They are respectively titled “SD Dynamic Video Power.mp4”, and “HD Dynamic Video Power.mp4”. SD resolution is made available for the limited types of display that cannot accept or display higher resolution standards. The HD resolution file is used for all other display resolutions since this closely matches the average picture level (APL) of the current IEC HD dynamic broadcast dynamic test sequence described in existing relevant standards. Upscaling from HD to higher native resolution shall be performed by the Unit Under Test (UUT) and not by an external device. Where upscaling has to be performed by an external device the full details of the device and the signal interface with the UUT shall be recorded.</p>

	Notes
	<p>The data signal from the downloaded file storage system to the UUT digital signal interface shall be confirmed to provide peak white and full black video levels. If the file playback system has special picture optimisation features (e.g. deep blacks or enhanced colour processing) these shall be disabled. For repeatability of measurement purposes, the details of the file storage and playback system shall be recorded as well as the type of digital interface with the UUT (e.g. HDMI, DVI etc.) The power measurement $P_{measured}$ is an average value from the full 10-minute length of the dynamic test sequence, taken with ABC disabled.</p>
<p>$P_{measured}$ High dynamic range (HDR) on-mode “normal” (auto mode switching to HDR)</p>	<p>No existing relevant standard is published so far.</p> <p>Following the $P_{measured}$ (SDR) dynamic test sequence measurement two HDR dynamic test sequences shall be played.</p> <p>These 5-minute sequences are rendered in HD resolution only, in the common HDR standards of HLG and HDR10. Upscaling from HD to a higher native display resolution shall be performed by the UUT and not an external device. Where upscaling has to be performed by an external device the full details of the device and the signal interface with the UUT shall be recorded.</p> <p>These files are available for download at: https://circabc.europa.eu/ui/group/1582d77c-d930-4c0d-b163-4f67e1d42f5b/library/38df374d-f367-4b72-93d6-3f48143ad661? p=1&n=10&sort=modified_DESC and have identical programme content. The files are respectively titled “HDR-HLG Power.mp4” and “HDR_HDR10 Power.mp4”</p> <p>It is essential that the UUT switch to the HDR display mode is confirmed in the picture settings menu before power data is logged. The integrated power measurement for each sequence (P_{av}) shall be summed and halved for the calculation of the label HDR energy efficiency class and label HDR power declaration.</p> <p>If the UUT cannot be tested in one of these HDR formats, this shall be noted and the power declared shall be the P_{av} measured for the HDR format that is supported.</p> <p>An ABC allowance does not apply in HDR display mode.</p> <p>$P_{measured\ HDR} = 0.5 * (P_{av\ HLG} + P_{av\ HDR10})$</p> <p>If one of these HDR display modes is not supported, the measured numerical value of ($P_{av\ HLG}$) or ($P_{av\ HDR10}$) as appropriate, shall be used for Label VII and Label VIII declarations.</p>
<p>Screen Luminance Measurement for automatic brightness control (ABC) control characteristics evaluation and any other peak white luminance measurement requirement.</p>	<p>No existing relevant standards can be used.</p> <p>A new variant of the “box and outline” dynamic test pattern providing a dynamic format with colour shall be used for all peak white display luminance measurements and not the 3-bar black and white pattern.</p> <p>A set of these variant dynamic test patterns, which combine the box and outline format and VESA L10 to L80 white measurement box format shall be used as described in Section 1.2.4. of Annex IIIa and are available for download at: https://circabc.europa.eu/ui/group/1582d77c-d930-4c0d-b163-4f67e1d42f5b/library/4f4b47a4-c078-49c4-a859-84421fc3cf5e? p=1&n=10&sort=modified_DESC. They are contained in the subfolders labelled SD, HD and UHD. Each subfolder contains eight peak white dynamic test patterns from L10 to L80. A resolution may be chosen according to the native resolution and signal compatibility of the UUT. The selection of a pattern with the appropriate resolution shall be based upon a) the minimum required white box dimensions for correct operation of the contact luminance measuring instrument and b) the fact that no power limiting effect exhibited by the UUT (large areas of white may result in a reduction of peak white levels). Any upscaling shall be performed by the UUT and not an external device. The data signal from the downloaded file storage system to the UUT digital signal interface shall be confirmed to provide peak white and full black video levels and have no other video enhancement processing (e.g. deep blacks / colour enhancement) Both the storage system and signal interface type shall be noted. For displays tested using a USB, or USB compatible data interface with the feature of power delivery, both the UUT and USB connected signal source shall operate from their own power source with the data path only connected..</p>

	Notes
Measurements related to ABC for “Allowances and adjustments for the purposes of the EEI calculation and functional requirements”	The methodology for ABC ambient light source set-up and luminance control as specified in existing standards shall not be used for the purposes of ABC related measurements for this regulation. The methodology to be used is detailed in <i>Section 1.2.5. of Annex IIIa</i> .
Peak white luminance ratio	No existing relevant standards can be used. The “box and outline” dynamic test pattern selected for the ABC peak white luminance measurements (<i>Annex III.a Section 1.2.4</i>) shall be used to measure the peak white luminance of the “normal configuration” with ABC on. If this is less than 150 cd/m ² for monitors or 220 cd/m ² for other display products, then a further measurement shall be made of the peak white luminance of the brightest pre-set configuration in the user menu (not the shop configuration). ABC need not be on for the luminance ratio measurements but the status of the ABC (on or off) shall apply to both measurements. Where ABC is on, the illuminance shall be 100lux for both measurements. Care shall be taken to ensure that the dynamic test pattern selected for peak white luminance measurement in the “normal configuration” does not cause luminance instability in the brightest pre-set configuration. A smaller peak white box pattern shall be selected for both measurements if instability occurs.
General notes	The following test standards provide important supporting information for the specification of test equipment and the required testing conditions relevant to measurement and testing guidance given in this Annex. EN 50564:2011 EN 50643:2018 EN 62087-1:2016 EN 62087- 2:2016 EN 62087-3:2016 EN IEC 62680 series of standards 2013 to 2020 IEC TR 63274 ED1:2020 (Advisory technical report on HDR testing requirements)’

(4) the following Annex IIIa is inserted:

‘ANNEX IIIa

Transitional methods

1. ADDITIONAL ELEMENTS FOR MEASUREMENTS AND CALCULATIONS

Table 3b

Test equipment requirements and UUT (*) configuration

Description of Equipment	Capabilities	Additional Capabilities and Characteristics
Power Measuring	Defined in relevant standard	Data logging function
Luminance Measuring Device (LMD)	Defined in relevant standard	Contact probe type with data logging function
Illuminance Measuring Device (IMD)	Defined in relevant standard	Data logging function

Description of Equipment	Capabilities	Additional Capabilities and Characteristics
Signal Generation Equipment	Defined in relevant standard	See Relevant Notes in <i>Annex III Table 3a</i> . References and qualifying notes
Light Source (Projector)	Shall provide an illuminance at the ABC sensor of less than 12 lux and up to 150 lux for TVs and monitors and up to 20,000 lux for Digital Signage Display from a minimum distance of approximately 1.5 m from ABC sensor	Solid state lamp engine (LED, Laser or LED /Laser combination). Colour gamut of projector shall be equal to or better than REC 709. Tilting Mounting platform allowing precise alignment of projector beam. This may be combined with or replaced by a built in Optical alignment feature.
Light Source (dimmable LED Lamp)	As specified in Section 1.2.1	
Computer for simultaneous data logging on common timescale	At least 3 appropriate ports allowing interface with power, luminance and illuminance measuring devices.	USB and Thunderbolt ports are considered to be appropriate ports
Computer with slide show and or picture editing application interfaced with projector	Application allowing projection of full-frame white image slides with simultaneous control over colour temperature and luminance (grey) level	

(*) Unit Under Test

1.1. Summary of order of testing

1. Setup UUT on a stand identifying location of Auto Brightness Control (ABC) sensor where applicable and position display luminance and ambient light measuring instruments.
2. Run through initial setup confirming correct implementation of forced menu warnings and default settings of "normal configuration".
3. Mute Audio where applicable.
4. Continue warm-up of sample while setting up test equipment and identifying peak white dynamic test pattern providing stable display luminance and power measurement.
5. If the ABC allowance is claimed, determine the illumination range and the ABC latency required for the sample. Profile the ABC of display luminance between 100 lux and 12 lux ambient light levels and measure on-mode power reduction between those limits. To provide detailed profiling of the ABC influence on power and display luminance, the ambient illumination range may be divided into several steps from just above the 100 lux illumination datum point (e.g. 120 lux) through 60 lux, 35 lux and 12 lux to the darkest level allowed by the test environment. For Digital Signage Displays (DSD) additional profiling may be recorded up to daylight illuminance levels of 20 000 lux for data gathering for future reviews of the Regulation.
6. Measure peak luminance in the normal configuration. If this is less than 150 cd/m² for a monitor or 220 cd/m² for other display types, also measure the peak luminance of the brightest pre-set configuration in the user menu (not the shop configuration).

7. Measure the on-mode power using the SDR dynamic broadcast video sequence with ABC disabled. Measure the on-mode power using the HDR dynamic broadcast video sequences confirming that HDR mode has been triggered (confirmed by display notification at start of HDR playback and / or change in normal configuration picture settings).

8. Measure the power requirement of low power and off modes and the time required by the automatic power down functions to take effect.

1.2. Details of testing

1.2.1. UUT (display) and measuring instrument set up

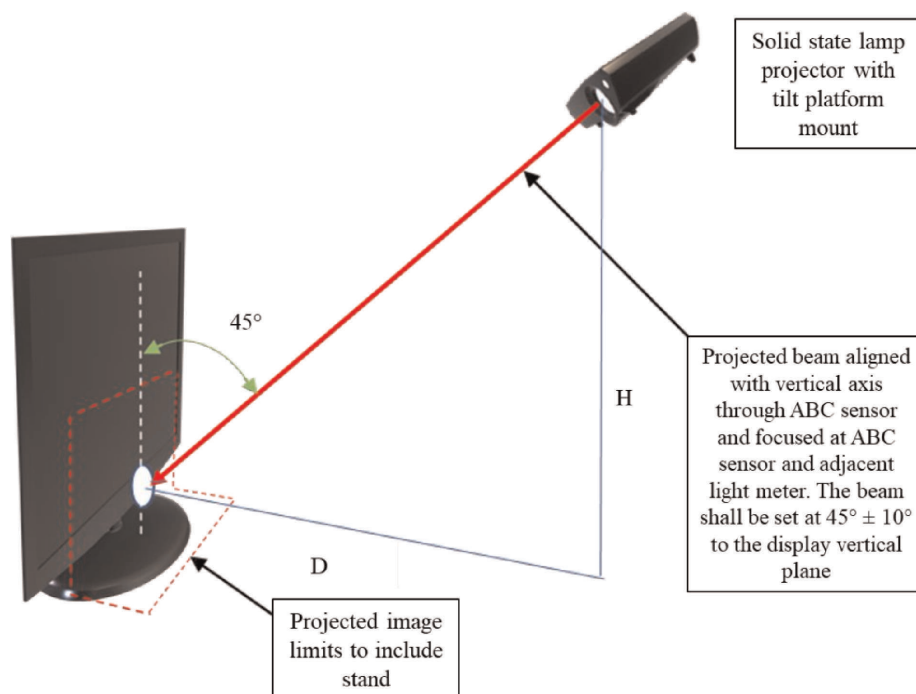


Figure 1: Physical set up of Display and ambient light source

If ABC function is available and the UUT is supplied with a stand this shall be attached to the display part and the UUT placed on a horizontal table or platform of at least 0,75 metres height covered in a black low reflectivity material (typical materials are felt, fleece or canvas theatrical backdrop). All parts of the stand shall remain exposed. Displays intended primarily for wall mounting shall be frame mounted for ease of access with the lower edge of the display at least 0,75 metres from the floor. The floor surface under the display and up to 0,5 metres in front of the display must not be highly reflective and ideally covered in black, low reflectivity material.

The physical location of the UUT ABC sensor shall be determined and measured coordinates of that location, relative to a fixed point outside the UUT, noted. The distances H and D as well as the projector beam angle (see Figure 1) shall be noted to aid repeatability of measurements. Depending on, the light source illuminance level requirements the distances H & D shall normally be equal ± 5 mm and measure between 1,5 m to 3 m. For the projector beam angle adjustment, a black slide with a small white centre box can be used to focus at the ABC sensor and provide a narrow beam of light for angular measurement. If an ABC sensor is designed to work optimally with an illuminance beam angle outside the 45° recommended, this preferred angle may be employed and the details recorded. Where a non-contact (distant location) luminance meter is used with a low beam angle for the light source, care shall be taken to ensure that the source is not reflected in the area of the display used for luminance measurement.

An illuminance meter shall be mounted as close as possible to the ABC sensor, taking precautions to avoid reflections of ambient light from the meter casing entering the sensor. This may be achieved by various methods in combination, including shrouding the illuminance meter in black felt and facilitating an adjustable mechanical mounting which does not allow the meter casing to protrude beyond the front of the ABC sensor.

The following proven procedure is recommended for an accurate and repeatable logging of ABC sensor illuminance levels with a minimum of mechanical mounting challenges. This procedure allows correction for any illuminance error introduced by the practical impossibility of mounting the illuminance meter at exactly the same physical position as the ABC sensor for simultaneous illumination. The procedure thus allows simultaneous illumination of the ABC sensor and illumination meter without physical disturbance of the UUT and meter after set-up. With appropriate logging software, the required step changes in illuminance can be synchronised to on-mode power measurement and display luminance measurement to automatically log and profile the ABC.

The illuminance meter shall be located a few centimetres away from the ABC sensor to ensure that direct reflections of the projector beam, from the meter casing, cannot enter the ABC sensor. The illuminance meter detector horizontal axis shall be on the same horizontal axis as the ABC sensor with the meter vertical axis strictly parallel to the display vertical plane. The physical coordinates of the meter mounting point relative to the fixed external point used to record the physical location of the ABC sensor shall be measured and noted.

The projector shall be mounted in a position with the axis of its projected beam in line with a vertical plane perpendicular to the display surface and running through the vertical axis of the ABC sensor (see Figure 1). The projector platform height, tilt and distance from the UUT shall be adjusted to allow a full frame peak white projected image to focus on an area covering the ABC sensor and illuminance meter whilst delivering the maximum ambient illumination level (lux) required at the sensor for testing. In this context it shall be noted that some Digital Signage Displays have ABC operative in ambient light conditions from up to 20 000 lux to below 100 lux.

The contact luminance meter for display luminance measurement shall be rigged to align with the centre of the UUT screen.

The projected illuminance image overlapping the horizontal surface below the UUT display shall not extend beyond the vertical plane of the display unless a reflective stand encroaches into a larger forward area than this, in which case the edge of the image shall be aligned with the extremities of the stand (see Figure 1). The top horizontal edge of the projected image shall not be less than 1 cm below the lower edge of the contact luminance meter shroud. This may be achieved by optical adjustment or the physical positioning of the projector, within the constraints of the required 45° beam angle and the required maximum illuminance at the ABC sensor.

With the UUT and illuminance meter position coordinates noted and the projector producing a stable illuminance within the range to be measured (normally stability is achieved a few minutes from switch-on with solid state lamp engines) the UUT shall be moved sufficiently to allow the illuminance meter front face and detector centre to be aligned with the physical position coordinates noted for the UUT ABC sensor. The illuminance measured at this point shall be noted and the meter returned to its original set-up position along with the UUT. The illuminance shall be measured again at the set-up position. The percentage difference between the illuminance measured at the two test positions (if any) may be applied in final reporting as a correction factor to all further illuminance measurements (this correction factor does not change with illuminance level). This provides an accurate data set for the illuminance at the ABC sensor even though the lux measuring instrument is not situated at that point and allows the simultaneous plotting of display luminance, power and illuminance to accurately profile the ABC.

No further physical changes shall be made to the test set up.

Unlike televisions, digital signage displays may have more than one ambient light sensor. For testing purposes, the technician shall determine a single sensor to be utilised in the test, eliminating the other light sensors by obscuring them with opaque tape. Unwanted sensors may also be disabled if control is provided to do so. In most instances the most suitable sensor to use would be a front-facing one. Measurement methods for digital signage displays with multiple light sensors may be explored further as a test method refinement to be qualified in a harmonised standard.

For test laboratories preferring to use a dimmable lamp source instead of a projector light source in the described test set up, the following lamp specification shall apply and the measured lamp characteristics recorded.

The light source used for illuminating the ABC sensor to specific illuminance levels shall use a dimmable LED reflector lamp and shall have a diameter of $90 \text{ mm} \pm 5 \text{ mm}$. The rated beam angle of the lamp shall be $40^\circ \pm 5^\circ$. The rated correlated colour temperature (CCT) shall be $2700 \text{ K} \pm 300 \text{ K}$ throughout the illuminance range 12 lux to the peak illuminance required for testing. The rated colour rendering index (CRI) shall be 80 ± 3 . The front surface of the lamp shall be clear (i.e., not coloured or coated with a spectrum modifying material) and may have a smooth or granular front surface; when shined against a uniform white surface, the diffusion pattern shall appear smooth to the naked eye. The lamp assembly shall not modify the spectrum of the LED source, including the IR and UV bands. The characteristics of the light shall not vary across the full range of dimming required for the ABC testing.

1.2.2. *Check of correct implementation of “normal configuration” and energy impact warnings.*

A power meter shall be connected to the UUT for observation purposes and at least one video signal source provided. During this test the persistence of ABC in all other pre-set configurations, except “shop configuration” shall be confirmed.

1.2.3. *Audio Setting*

An input signal shall be provided containing audio and video (the 1 kHz tone on the SDR video power test material is ideal) The sound volume setting shall be reduced to a zero-display indication, or a mute control activated. It must be confirmed that activation of the mute control has no effect on “normal configuration” picture parameters.

1.2.4. *Identifying the peak white luminance pattern for peak white luminance measurements*

When a UUT displays a peak white pattern, the display may quickly dim within the first few seconds and gradually dim until stable. This makes it impossible to measure, in a consistent and repeatable way, power and luminance values, immediately after the image is displayed. In order to have repeatable measurements, some level of stability must be achieved. Testing on displays using current technology indicates that 30 seconds shall be sufficient time to allow for luminance stability of a peak white image. As a practical observation, this time window also allows for any on-screen status display to disappear.

Current display products often have built-in electronics and display drive software to protect the display power supply from being over-driven and the screen from suffering persistence (burn-in) by limiting total power to the screen. This can result in a limited luminance and limited power consumption when displaying, for example a large area of white dynamic test pattern.

In this test methodology, the measurement of peak luminance is made while displaying a 100% white dynamic test pattern, but the area of white is empirically limited to avoid the triggering of protection mechanisms. The appropriate dynamic test pattern is determined by displaying the range of eight “box and outline” dynamic test patterns based on VESA “L” dynamic test patterns from smallest (L 10) to largest (L 80), while recording power and screen luminance. A graph of power and screen luminance vs L pattern shall assist in determining if and when display drive limiting is occurring. For example, if power consumption is increasing from L 10 to L 60, while luminance is either increasing or constant (not decreasing) then those patterns are not appearing to cause limiting. If dynamic test pattern L 70 indicates no increase in power consumption or luminance (where there was an increase in previous L patterns), this would indicate that limiting is occurring at L 70 or between L 60 and L 70. It may also be that limiting has occurred between L 50 and L 60 and the graphed points at L 60 were in fact sloping downward. Therefore, the largest pattern where we are sure no limiting occurs is L 50 and this is the correct pattern to use for the peak luminance measurement. Where a luminance ratio has to be declared, the selection of the luminance pattern shall be made in the brightest pre-set setting. If the UUT is known to have display luminance drive characteristics which do not allow the selection of an optimum, peak-white-luminance dynamic test pattern by the above selection procedure the following simplified selection process may be employed. For displays equal to or greater than 15,24 cm (6 inches) and less than 30,48 cm (12 inches) diagonally, the L 40 PeakLumMotion signal shall be used. For displays greater than or equal to 30,48 cm (12 inches) diagonally, the L 20 PeakLumMotion signal shall be used. The dynamic peak white luminance dynamic test pattern selected by either procedure shall be declared and used for all luminance testing.

1.2.5. *Determination of ABC ambient light control range and latency of ABC action.*

For the purposes of Regulation (EU) 2019/2021, an ABC power allowance is provided in the EEI declaration if the ABC control characteristic meets specific requirements of display luminance control between ambient light levels of 100 lux and 12 lux with datum points of 60 lux and 35 lux. The change in display luminance between 100 lux and 12 lux ambient light change must provide at least 20 % decrease in display power requirement for conformance with the regulation ABC power allowance. The dynamic luminance “L” dynamic test pattern used to assess ABC luminance control conformance may also be simultaneously used to assess the power reduction conformance.

For digital signage displays, a much wider range of ABC control with illuminance change may apply and the test methodology described here may be extended to gather data for future revisions of the Regulation.

1.2.5.1 ABC Latency Profiling

The latency of the ABC control function is the time delay between the ambient light change sensed at the ABC detector and the resulting change in UUT display luminance. Testing data has shown that this delay can be as long as 60 seconds and this must be taken into account when profiling ABC control. For latency estimation, the 100 lux slide (see 1.2.5.2), at a stable display luminance condition, is switched to the 60 lux slide and the time interval required to achieve a stable lower display luminance level recorded. At the lower stable luminance level, the 60 lux slide is switched to the 100 lux slide and the time interval to achieve a stable higher luminance level noted. The higher value of time interval is the one used for latency with a discretionary 10 seconds added. This is saved as the slide show projection period for each slide.

1.2.5.2 Light Source Illumination Control

For ABC profiling, a peak white dynamic test pattern as identified in 1.2.4 is displayed on the UUT, as the brightness of the light source is altered from white through a range of grey slides to simulate ambient illumination changes. For illumination level control the first slide grey transparency is altered to achieve the starting point of the profiling (e.g. 120 lux) by measuring the lux level at the illuminance meter. The slide is saved and copied. A new grey transparency level is set for the copy to the required datum point of 100 lux and the slide saved and copied. The process is repeated for the datum points of 60 lux, 35 lux and 12 lux. A black (0 % transparency) illuminance slide can be added here for data plotting symmetry and the datum point slides copied and introduced in ascending illumination order back to 120 lux.

1.2.5.3 Light Source Colour Temperature Control

A further requirement is to set a colour temperature for the white point of the projected light to ensure repeatability of test data if a different projector light source is used for verification purposes. For this test methodology a white point colour temperature of 2700K \pm 300K is specified for consistency with ABC methodology in earlier test standards.

This white point is readily set in any major computer application for slide creation by the use of a suitable colour solid fill (e.g. Red/Orange) and transparency adjustment. With these tools the normally colder projector white point may be adjusted to the 2700K suggested, by altering the transparency of the selected colour whilst measuring colour temperature via a function of the illuminance meter. Once the required temperature is achieved it is applied to all slides.

1.2.5.4 Data Recording

The power consumption, screen luminance and illuminance at the ABC sensor are measured and logged during the slide show. This data must correlate with time. Data points for three parameters must be logged in order to relate power consumption, to screen luminance and illuminance of the ABC sensor. Any number of slides can be created between datum points for high granularity of data within the constraints of available test time duration.

For DSD designed to operate in a wide range of ambient lighting conditions the operating range of the ABC control over display luminance can be manually established with the black transparency control operating on a single projected slide of peak white pre-set to the required colour temperature. The recommended pre-set configuration of the DSD for a wide range of ambient light operating conditions shall be selected from the user menu. At a stable display luminance point the projected slide shall be switched from 0 % to 100 % black transparency to establish the latency period. This shall then be applied to slide grey transparency steps from black to a point where no change occurs in display luminance to establish the operating range of the ABC. A slide show can then be created in the granularity required to profile that range.

1.2.6. *Display luminance measurements*

With ABC enabled and 100 lux ambient light level measured at the illuminance meter, the UUT shall display the selected peak white luminance pattern (*see* 1.2.4) at a stable luminance. For Regulation conformance, luminance measurement shall confirm that the display luminance level is 220 cd/m² or more for all display categories other than monitors. For monitors, a conformance level of 150 cd/m² or more is required. For displays without ABC or devices that do not claim the ABC allowance, measurements may be made without the ambient light part of the test rig.

For those displays which by design intention have a declared display peak white luminance level, in the normal configuration, of less than the conformance requirement of 220 cd/m² or 150 cd/m², as applicable, a further peak white measurement shall be made in the pre-set viewing configuration providing the highest measured peak white luminance. For Regulation conformance the calculated ratio of the normal viewing configuration peak white luminance measurement and the highest peak white luminance measurement shall be 65 % or greater. This is declared as the "luminance ratio".

For those UUT with ABC that can be switched off a further Conformance test shall be conducted in the normal configuration. The stabilised peak white luminance pattern shall be displayed in the measured 100 lux ambient illumination condition. It shall be confirmed that the UUT power requirement, measured with ABC on, is the same as or less than the power requirement measured at a stabilised luminance with ABC off. If the measured power is not the same, the mode which yields the highest measured power shall be used for on mode power.

1.2.7. *Measurement of on-mode power*

For each of the UUT powering systems covered below, SDR power shall be measured in the normal configuration, using the HD version of the 10 minute "SDR dynamic video power test" file, unless input signal compatibility is restricted to SD. The file source and UUT input interface shall be confirmed to be capable of delivering full black and full white video data levels. Any upscaling of HD video resolution to the native resolution of the UUT display must be processed by the UUT and not an external device where the UUT allows this. If an external device must be used to achieve upscaling to the native resolution of the UUT then details of that device and its interface with the UUT shall be recorded. The power declaration is the average power determined during the playback of the full 10-minute file.

HDR power, where the function applies, is measured using the two 5-minute HDR files "HDR-HLG power" and "HDR-HDR10 power". If one of these HDR modes is not supported, HDR power shall be declared on the supported mode.

Test instrumentation characteristics and test conditions as detailed in relevant standards apply to all power testing.

Product warm up with current UUT display technology need not be protracted and is most conveniently conducted with the dynamic peak white luminance dynamic test pattern identified in section 1.2.4 above. When power readings are stable with the UUT displaying this pattern power measurements with the SDR and HDR dynamic video power test files may commence.

Where a product has ABC, this shall be switched off. If it cannot be switched off the product shall be tested in the 100 lux measured ambient light conditions described in section 1.2.5 above.

For UUT intended for use on AC mains including those using a standardised DC input but with an external power supply (EPS) provided packaged with the UUT, on-mode power shall be measured at the AC supply point.

- (a) For UUT with a standardised DC input (only USB-compatible power delivery standards apply) power measurement shall be made at the DC input. This is facilitated by a USB break out unit (BOU) which maintains the data path of the supply connector and UUT DC input but interrupts the power delivery path to allow current measurement and Voltage measurement inputs to the power meter. The USB BOU power meter combination must be fully tested to ensure that their design and maintenance condition do not interfere with the cable impedance sensing function of some USB power delivery standards. The power recorded via the USB BOU shall be the power $P_{measured}$ declared for the on-mode power measurement declaration (Ecodesign and Labelling in SDR mode and HDR mode).
- (b) For unusual UUT covered by the definitions of the Regulation but designed to operate from an internal battery which cannot be bypassed or removed for the required power testing the following methodology is proposed. The caveats for EPS and standardised DC input detailed above apply in the choice of AC or DC input power declaration.

For the purposes of the methodology the following qualifications apply:

Fully charged battery: Point during charging when according to the manufacturer's instructions, by indicator or time period the product does not need to be charged anymore. Visual profiling of this point shall be made for subsequent reference with a graphical representation of the power meter charging log made with power measurements of 1 second granularity in a 30-minute period before and after the fully charged point.

Fully discharged battery: A point in on-mode, with the UUT disconnected from an external power source, where the display switches off automatically (not through auto standby functions) or ceases to function while displaying an image.

If there is no indicator or no stated charge time period the battery shall be fully discharged. The battery shall then be recharged with all display user-controlled functions off. The power input against time with a data granularity no less than one reading per second shall be automatically logged. Where the log shows the start of a low power flat line battery maintenance mode or the start of a very low power period with spaced bursts of power, the time logged to that point from the start of the charge cycle of the battery, shall be regarded as the basic charge time.

Preparation of battery: Any unused Li-ion batteries shall be fully charged and fully discharged once, prior to conducting the first test on a UUT. All other unused battery chemistry/technology types shall be fully charged and fully discharged three times, prior to conducting the first test on the UUT.

Method

Set up UUT for all the relevant testing as described in this testing methodology document. For the choice of AC or DC power measurement declaration, apply the caveats on powering above.

All dynamic test sequences involving power measurement for regulation conformance and declaration shall be performed with the product battery fully charged and the external power source disconnected. The fully charged condition shall be confirmed by the power meter log charging profile graph. The product shall be switched to the measurement mode required and the dynamic test sequence started immediately. After the dynamic test sequence is completed the product shall be switched off and a logged charging sequence commenced. When the charging log profile indicates a fully charged condition, the average power recorded from the logged start of charging to the logged start of the fully charged condition is used to calculate the power to be recorded for the Regulation requirement.

Standby, networked standby and off modes (if applicable) will require long periods of battery loading to provide good data repeatability from the recharge average power (e.g. 48 hours for off or standby and 24 hours for networked standby)

For luminance measurement and ABC luminance profiling the external power source can remain connected.

For the ABC power reduction test, the appropriate dynamic peak luminance sequence shall be continuously played for 30 minutes in a 12 lux ambient light condition. The battery shall be immediately recharged and the average power noted. The same shall be repeated for the 100 lux ambient condition and the difference between the average recharge powers confirmed to be 20 % or more.

For the SDR power declaration the appropriate 10-minute SDR dynamic power measurement sequence shall be played 3 times sequentially and the average battery recharge power requirement logged ($P_{measured}$ (SDR) = recharge energy /total playback time). For the HDR power declaration each of the two five-minute HDR dynamic power measurement files shall be played three times in quick succession and the average battery recharge power requirement logged ($P_{measured}$ (HDR) = recharge energy /total playback time).

1.2.8. Measure power requirement of low power and off modes

Test instrumentation and test conditions as detailed in relevant standards apply to all low power and off mode power testing. The AC or DC power measuring caveats of 1.2.7 above apply and the special test procedure for battery powered displays covered in 1.2.7 shall be used where applicable.;

(5) Annex IV is amended as follows:

(a) the first paragraph is replaced by the following:

‘The verification tolerances defined in this Annex relate only to the verification by Member State authorities of the declared values and shall not be used by the manufacturer, importer or authorised representative as an allowed tolerance to establish the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means.’;

(b) the third paragraph is replaced by the following:

‘As part of verifying that a product model complies with the requirements laid down in this Regulation pursuant to Article 3(2) of Directive 2009/125/EC the authorities of the Member States shall apply the following procedure for the requirements referred to in Annex I.’;

(c) in point 1.8, the following paragraph is added:

‘The requirements of Annex II, D.4. shall be deemed to be complied with if:

- The determined value for HFRs identified in Directive 2011/65/EU does not exceed the relevant maximum concentration values defined in Annex II of Directive 2011/65/EU; and
- For other HFRs, the determined value for any homogenous material does not exceed 0,1 % by weight of halogen content. Where the determined value for any homogenous material exceeds 0,1 % by weight of halogen content, the model may still be considered compliant where documentary checks or any other appropriate, reproducible methods show that the halogen content is not attributable to flame retardant.’;

(d) in point 2, the third paragraph is replaced by the following:

‘The Member State authorities shall provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision being taken on the non-compliance of the model.’;

(e) the fifth row of Table 3 is replaced by the following:

‘Visible screen diagonal in centimetres	The determined value (*) shall not be lower than the declared value by more than 1 cm’
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ANNEX VI

Annexes I, III and IV to Regulation (EU) 2019/2022 are amended as follows:

(1) in Annex I, the following point (19) is added:

‘(19) “declared values” means the values provided by the manufacturer, importer or authorised representative for the stated, calculated or measured technical parameters in accordance with Article 4, for the verification of compliance by the Member State authorities.’;

(2) Annex III is amended as follows:

(a) the following paragraph is added after the first paragraph:

‘Where a parameter is declared pursuant to Article 4, its declared value shall be used by the manufacturer, importer or authorised representative for the calculations in this Annex.’;

(b) points 2, 3 and 4 are replaced by the following:

‘2. CLEANING PERFORMANCE INDEX

For the calculation of the cleaning performance index (I_C) of a household dishwasher model, the cleaning performance of the eco programme is compared to the cleaning performance of a reference dishwasher.

The I_C is calculated as follows and rounded to three decimal places:

$$I_C = \exp (\ln I_C)$$

and

$$\ln I_C = (1/n) \times \sum_{i=1}^n \ln (C_{T,i}/C_{R,i})$$

where:

$C_{T,i}$ is the cleaning performance of the eco programme of the household dishwasher under test for one test run (i), rounded to three decimal places;

$C_{R,i}$ is the cleaning performance of the reference dishwasher for one test run (i), rounded to three decimal places;

n is the number of test runs.

3. DRYING PERFORMANCE INDEX

For the calculation of the drying performance index (I_D) of a household dishwasher model, the drying performance of the eco programme is compared to the drying performance of the reference dishwasher.

The I_D is calculated as follows and rounded to three decimal places:

$$I_D = \exp (\ln I_D)$$

and

$$\ln I_D = (1/n) \times \sum_{i=1}^n \ln(I_{D,i})$$

where:

$I_{D,i}$ is the drying performance index of the eco programme of the household dishwasher under test for one test run (i);

n is the number of combined cleaning and drying test runs.

The $I_{D,i}$ is calculated as follows and rounded to three decimal places:

$$\ln I_{D,i} = \ln (D_{T,i} / D_{R,t})$$

where:

$D_{T,i}$ is the average drying performance score of the eco programme of the household dishwasher under test for one test run (i), rounded to three decimal places;

$D_{R,t}$ is the target drying score of the reference dishwasher, rounded to three decimal places.

4. LOW POWER MODES

Where applicable, the power consumption of the off mode (P_o), standby mode (P_{sm}) and delay start (P_{ds}) are measured, expressed in W, and rounded to two decimal places.

During measurements of the power consumption in low power modes, the following shall be checked and recorded:

the display or not of information;

the activation or not of a network connection.';

(3) Annex IV is amended as follows:

(a) the first paragraph is replaced by the following:

'The verification tolerances defined in this Annex relate only to the verification by Member State authorities of the declared values and shall not be used by the manufacturer, importer or authorised representative as an allowed tolerance to establish the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means.';

(b) in the third paragraph, the words 'When verifying' are replaced by 'As part of verifying';

(c) Point 2(d) is replaced by the following:

'(d) when the Member States authorities check the unit of the model, it complies with the requirements in the third paragraph of Article 6, the programme requirements in point 1, resource efficiency requirements in point 5 and information requirements in point 6 of Annex II; and';

(d) Point 7 is replaced by the following:

'(7) The Member State authorities shall provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision being taken on the non-compliance of the model according to points 3, 6 or the second paragraph of this Annex.'.

ANNEX VII

Annexes I, III, IV and VI to Regulation (EU) 2019/2023 are amended as follows:

(1) in Annex I, the following point (29) is added:

‘(29) “declared values” means the values provided by the manufacturer, importer or authorised representative for the stated, calculated or measured technical parameters in accordance with Article 4, for the verification of compliance by the Member State authorities.’;

(2) Annex III is amended as follows:

(a) the following paragraph is added after the first paragraph:

‘Where a parameter is declared pursuant to Article 4, its declared value shall be used by the manufacturer, importer or authorised representative for the calculations in this Annex.’;

(b) point 2 is replaced by the following:

‘2. WASHING EFFICIENCY INDEX

The washing efficiency index of household washing machines and of the washing cycle of household washer-dryers (I_w) and the washing efficiency index of the complete cycle of household washer-dryers (J_w) shall be calculated using harmonised standards the reference numbers of which have been published for this purpose in the Official Journal of the European Union, or other reliable, accurate and reproducible methods, which take into account the generally recognised state-of-the-art, and rounded to three decimal places.’;

(c) in point 5, the first paragraph of point (2) is replaced by the following:

‘For household washer-dryers with a rated washing capacity lower than or equal to 3 kg, the weighted water consumption of the wash and dry cycle is the water consumption at rated capacity and rounded to the nearest integer.’;

(d) point 6 is replaced by the following:

‘6. REMAINING MOISTURE CONTENT

The weighted remaining moisture content after washing (D) of a household washing machine and of the washing cycle of a household washer-dryer is calculated in percentage as follows, and is rounded to one decimal place:

$$D = \left[A \times D_{full} + B \times D_{\frac{1}{2}} + C \times D_{\frac{1}{4}} \right]$$

where:

D_{full} is the remaining moisture content for the eco 40-60 programme at rated washing capacity, in percentage and rounded to two decimal places;

$D_{1/2}$ is the remaining moisture content of the eco 40-60 programme at half of the rated washing capacity in percentage and rounded to two decimal places;

$D_{1/4}$ is the remaining moisture content of the eco 40-60 programme at a quarter of the rated washing capacity in percentage and rounded to two decimal places;

A, B and C are the weighting factors as described in point 1.1(c).’;

(e) point 8 is replaced by the following:

‘8. LOW POWER MODES

Where applicable, the power consumption of the off mode (P_o), standby mode (P_{sm}) and delay start (P_{ds}) are measured, expressed in W, and rounded to two decimal places.

During measurements of the power consumption in low power modes, the following shall be checked and recorded:

- the display or not of information;
- the activation or not of a network connection.

If a household washing machine or a household washer-dryer provides for a wrinkle guard function, this operation shall be interrupted by opening the household washing machine or household washer-dryer door, or any other appropriate intervention 15 minutes before the measurement of power consumption.;

(3) Annex IV is amended as follows:

(a) the first paragraph is replaced by the following:

‘The verification tolerances defined in this Annex relate only to the verification by Member State authorities of the declared values and shall not be used by the manufacturer, importer or authorised representative as an allowed tolerance to establish the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means.’;

(b) in the third paragraph, the words ‘When verifying’ are replaced by ‘As part of verifying’;

(c) point 2(d) is replaced by the following:

‘(d) when the Member State authorities check the unit of the model, it complies with the requirements in the third paragraph of Article 6, the programme requirements in points 1 and 2, resource efficiency requirements in point 8 and information requirements in point 9 of Annex II; and’;

(d) point (7) is replaced by the following:

‘(7) the Member State authorities shall provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision being taken on the non-compliance of the model according to points 3, 6 or the second paragraph of this Annex.’;

(e) Table 1 is replaced by the following:

‘Table 1

Verification tolerances

Parameter	Verification tolerances
$E_{W,full}$, $E_{W,1/2}$, $E_{W,1/4}$, $E_{WD,full}$, $E_{WD,1/2}$	The determined value (*) shall not exceed the declared value of $E_{W,full}$, $E_{W,1/2}$, $E_{W,1/4}$, $E_{WD,full}$ and $E_{WD,1/2}$, respectively, by more than 10 %.
Weighted energy consumption (E_W and E_{WD})	The determined value (*) shall not exceed the declared value of E_W and E_{WD} , respectively, by more than 10 %.
$W_{W,full}$, $W_{W,1/2}$, $W_{W,1/4}$, $W_{WD,full}$, $W_{WD,1/2}$	The determined value (*) shall not exceed the declared value of $W_{W,full}$, $W_{W,1/2}$, $W_{W,1/4}$, $W_{WD,full}$ and $W_{WD,1/2}$, respectively, by more than 10 %.
Weighted water consumption (W_W and W_{WD})	The determined value (*) shall not exceed the declared value of W_W and W_{WD} , respectively, by more than 10 %.
Washing efficiency index (I_W and J_W) at all relevant loads	The determined value (*) shall not be less than the declared value of I_W , and J_W , respectively by more than 8 %.
Rinsing effectiveness (I_R and J_R) at all relevant loads	The determined value (*) shall not exceed the declared value of I_R and J_R , respectively by more than 1,0 g/kg.
Duration of the eco 40-60 programme (t_W) at all relevant loads	The determined value (*) of the programme duration shall not exceed the declared value of t_W by more than 5 % or by more than 10 minutes, whichever is the smaller.

Duration of the wash and dry cycle (t_{WD}) at all relevant loads	The determined value (*) of the cycle duration shall not exceed the declared value of t_{WD} by more than 5 % or by more than 10 minutes, whichever is the smaller.
Maximum temperature inside the laundry (T) during the washing cycle at all relevant loads	The determined value (*) shall not be less than the declared value of T by more than 5 K and it shall not exceed the declared value of T by more than 5 K.
Weighted remaining moisture content after washing (D)	The determined value (*) shall not exceed the declared value of D by more than 10 %.
Final moisture content after drying at all relevant loads	The determined value (*) shall not exceed 3,0 %.
Spin speed (S) at all relevant loads	The determined value (*) shall not be less than the declared value of S by more than 10 %.
Power consumption in off mode (P_o)	The determined value (*) of power consumption P_o shall not exceed the declared value by more than 0,10 W.
Power consumption in standby mode (P_{sm})	The determined value (*) of power consumption P_{sm} shall not exceed the declared value by more than 10 % if the declared value is higher than 1,00 W, or by more than 0,10 W if the declared value is lower than or equal to 1,00 W.
Power consumption in delay start (P_{ds})	The determined value (*) of power consumption P_{ds} shall not exceed the declared value by more than 10 % if the declared value is higher than 1,00 W, or by more than 0,10 W if the declared value is lower than or equal to 1,00 W.
(*) In the case of three additional units tested as prescribed in point 4, the determined value means the arithmetical mean of the values determined for these three additional units.;	

(4) in Annex VI point (h) is replaced by the following:

‘(h) the remaining moisture content after washing is calculated as the weighted average, according to each drum’s rated capacity;’.

ANNEX VIII

Annexes I, III and IV to Regulation (EU) 2019/2024 are amended as follows:

(1) in Annex I, point (22) is replaced by the following:

‘(22) “declared values” means the values provided by the manufacturer, importer or authorised representative for the stated, calculated or measured technical parameters in accordance with Article 4, for the verification of compliance by the Member State authorities.’;

(2) Annex III is amended as follows:

(a) the following text is added after the first paragraph:

‘Where a parameter is declared pursuant to Article 4, its declared value shall be used by the manufacturer, importer or authorised representative for the calculations in this Annex.’;

(b) in Table 5, part (a), the following lines are added:

Vertical and combined supermarket refrigerator cabinets	M0	$\leq + 4$	$\geq - 1$	n.a.	1,30
Horizontal supermarket refrigerator cabinets	M0	$\leq + 4$	$\geq - 1$	n.a.	1,13’

(c) the first note at the end of table 5 is replaced as follows:

‘(*) For multi-temperature vending machines, T_V shall be the average of T_{V1} (the maximum measured product temperature in the warmest compartment) and T_{V2} (the maximum measured product temperature in the coldest compartment), rounded to one decimal.’;

(3) Annex IV is amended as follows:

(a) the first paragraph is replaced by the following:

‘The verification tolerances defined in this Annex relate only to the verification by Member State authorities of the declared values and shall not be used by the manufacturer, importer or authorised representative as an allowed tolerance to establish the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means.’;

(b) in the third paragraph, the words ‘When verifying’ are replaced by ‘As part of verifying’;

(c) point 2(d) is replaced by the following :

‘(d) when the Member States authorities check the unit of the model, it complies with the requirements in the third paragraph of Article 6, the resource efficiency in point 2 of Annex II and the information requirements in point 3 of Annex II; and’;

(d) point (7) is replaced by the following:

‘(7) The Member State authorities shall provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision being taken on the non-compliance of the model according to points 3, 6 or the second paragraph of this Annex.’.
