



Brussels, **XXX**
[...] (2020) **XXX** draft

ANNEXES 1 to 8

ANNEXES

to the

COMMISSION REGULATION (EU) .../...

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

ANNEX I

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

- (1) in Annex I, the following point (36) is added:

‘(36) 'declared values' means the values provided by the supplier for the stated, calculated or measured technical parameters in accordance with Article 4(2), for the verification of compliance by the Member State authorities.’;
- (2) in Annex III:
 - (a) 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.’;
 - (b) the following Annex IIIa is inserted:

‘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 303 470:2019	General notes on the testing with EN 303 470: 2019: a. Testing should 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 to Regulation (EU) 2019/424, 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 ¹ . c. In the case of servers which i. are not declared as being part of a server product family
Idle state power (Pidle)	ETSI	ETSI EN 303 470:2019	
Maximum power	ETSI	ETSI EN 303 470:2019 Maximum power is the highest measured power demand reported by SERT testing under any single workload and load level.	

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.

Parameter	Source	Reference Test Method / Title	Notes
			<p>i. 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 tested².</p>
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	<p>Testing should be conducted at an appropriate EU voltage and frequency (e.g. 230v, 50Hz)</p> <p>Initiatives specifying requirements for this parameter include:</p>
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	<p>a) 80 Plus programme (EPRI and Ecova)</p> <p>b) EN 50672:2017</p>
Operating condition class		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 should 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	

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.

Parameter	Source	Reference Test Method / Title	Notes
		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).	
Firmware availability		Not available	
Secure data deletion	NIST	Guidelines for Media Sanitization, NIST Special Publication 800-88 - Revision 1	Other initiatives specifying requirements for this parameter include: a) CPA Security Characteristics for Data Sanitisation - Flash Based Storage b) CPA Security Characteristic Overwriting Tools for Magnetic Media Version 2.1 c) CAS Sanitisation Requirements Version 2.0 November 2014 d) CESG - HMG IA Standard No. 5 - Secure Sanitisation Version 5.0.
Ability of the server to be disassembled		Not available	There are no specific test methods for testing this aspect but initiatives specifying requirements for this parameter for ICT equipment include: a) JRC Report "Study for a method to assess the ease of disassembly of electrical and electronic equipment", May 2016 b) JRC Report " Analysis and development of a scoring system for repair and upgrade of products ", 2019 c) COMMISSION DECISION of 2016/1371 establishing the ecological criteria for the award of the EU Ecolabel for personal, notebook and tablet computers (January 2016).
Critical raw material (CRM) content		EN 45558:2019	

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 should be conducted at an appropriate EU voltage and frequency (e.g. 230v, 50Hz) Initiatives specifying requirements for this parameter include: a) 80 Plus programme (EPRI and Ecova)
Power Supply Power Factor	EPRI and	Generalized Test Protocol for Calculating the	b) EN 50672:2017

Parameter	Source	Reference Test Method / Title	Notes
	Ecova	Energy Efficiency of Internal Ac-Dc and Dc-Dc Power Supplies Revision 6.7	
Operating condition class		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 should be tested with SNIA Emerald Power Efficiency Measurement Specification and run test cycle(s) for a duration of 16 hours. The unit shall be considered to comply with the declared operating condition, if SNIA Emerald Power Efficiency Measurement Specification reports valid results for the whole duration of the test (i.e. if the unit under test is in its operational state for the whole duration of the 16 hours test).	SNIA Emerald Power Efficiency Measurement Specification Version 2.0.2: Section 7.3 General Requirements and Definitions and Section 7.4.3: Active Test
Firmware availability		Not available	
Secure data deletion	NIST	Guidelines for Media Sanitization, NIST Special Publication 800-88 - Revision 1	Other initiatives specifying requirements for this parameter include the following: (a) CPA Security Characteristics for Data Sanitisation - Flash Based Storage; (b) CPA Security Characteristic Overwriting Tools for Magnetic Media Version 2.1; (c) CAS Sanitisation Requirements Version 2.0 November

Parameter	Source	Reference Test Method / Title	Notes
			2014; (d) CESG - HMG IA Standard No. 5 - Secure Sanitisation Version 5.0.
Ability of the data storage product to be disassembled		Not available	There are no specific test methods for testing this aspect but initiatives specifying requirements for this parameter for ICT equipment include the following: (a) JRC Report "Study for a method to assess the ease of disassembly of electrical and electronic equipment", May 2016; (b) JRC Report " Analysis and development of a scoring system for repair and upgrade of products ", 2019; (c) Commission Decision (EU) 2016/1371 ³ .
Critical raw material (CRM) content		EN 45558:2019	

’;

- (3) in Annex IV, 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.’.

³

Commission Decision (EU) 2016/1371 of 10 August 2016 establishing the ecological criteria for the award of the EU Ecolabel for personal, notebook and tablet computers (OJ L 217, 12.8.2016, p. 9).

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:

(i) 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’;

(ii) 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.’;

(iii) 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 6 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 (UN), 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.’;

(iv) 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
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	95,4	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
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
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

’;

- (v) 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 4, 5 and 6, 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:

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

‘(a) the technical data sheet or user manual supplied with of the motor, unless a QR code is supplied with the product with a link to the information.’;

(ii) 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.’;

(iii) the eight 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 product identification or serial number 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 one frequency, except for the rated efficiency at full load, which shall be specified at both 50Hz and 60Hz.’;

(c) Part 4 is amended as follows:

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

‘(a) the technical data sheet or user manual supplied with of the motor, unless a QR code is supplied with the product with a link to the information.’;

(ii) 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) 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 supplier for the stated, calculated or measured technical parameters in accordance with Article 4.2, 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) in Annex III, part 1 is amended as follows:
 - (a) 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;’;
 - (b) 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;’;
 - (c) Table 4, footnote (b), first line, is replaced by:

‘C for combi appliances with 3- or 4-star compartments is rounded to two decimal places and determined as follows:’;
- (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) 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.’;

(c) 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 limits of the prescribed 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 % higher than the declared value.

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 supplier for the stated, calculated or measured technical parameters in accordance with Article 4.2, 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 2023: 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)
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- ’;
- (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:
 - (i) 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);’;

(ii) 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 and LFL T12 with G13 cap, with CRI ≥ 85 and CCT 2 900, 3 000, 3 200, 5 600 or 6 500 K.’;

(iii) 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’;

(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) 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.’;

- (c) 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.’.

DRAFT

ANNEX V

Annexes I to IV to Regulation (EU) 2019/2021 are amended 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 supplier for the stated, calculated or measured technical parameters in accordance with Article 4.2, 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 is amended as follows:

(a) Table 1 is replaced by the following:

‘Table 1

EEI limits for on-mode

	<i>EEI_{max}</i> for electronic displays with resolution up to HD	<i>EEI_{max}</i> for electronic displays with resolution above HD and up to UHD	<i>EEI_{max}</i> 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

’;

(b) 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.’;

(c) Section D is amended as follows:

(i) point 1 is replaced by the following:

‘1. Design for dismantling, recycling and recovery

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 of the European Parliament and of the Council (1)

on batteries and accumulators and waste batteries and accumulators, when present.

By way of derogation, displays specifically designed and exclusively marketed for outdoor use can use irreversible sealing techniques necessary for safety or durability. The technical documentation shall include the technical justification related to why the sealing has been used, as well as instructions on how to disassemble or dismantle the display for repair.

By way of derogation from the first paragraph of this point, the permanent connection between the display and the battery or accumulator is permitted under the conditions indicated in Directive 2006/66/EC

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.

This dismantling information shall include the sequence of dismantling steps, tools or technologies needed to access the targeted components.

The 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.’;

- (ii) 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 Blue-Ray), capacitors above 400 microfarads, non standardised batteries and accumulators, DVD/Blue-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 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.’;

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

‘Measurements of Standard Dynamic Range, screen luminance for Auto Brightness Control, Peak White luminance ratio shall be made as detailed in Table 1. The functioning of the forced menu shall be as detailed in Table 1, last row.

Table 1
References and qualifying notes

	Notes
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	Notes
<p>P_{measured}</p> <p>Standard dynamic range (SDR) on-mode, “normal”</p>	<p>Power measurement notes (See Section 1.3.7 of 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 [link to be updated]. 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. It is recommended that 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 test sequence described in existing relevant standards . Upscaling from HD to higher native resolution must 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 must 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 should be disabled. For repeatability of measurement purposes, the file storage and playback system should be detailed as well as the type of digital interface with the UUT (e.g. HDMI, DVI etc.) The power measurement <i>P_{measured}</i> is an average value from the full 10-minute length of the test pattern, taken with ABC disabled.</p>
<p>P_{measured}</p> <p>High dynamic range (HDR) on-mode “normal” (auto mode switching to HDR)</p>	<p>No existing relevant standards can be used. Following the <i>P_{measured}</i> (SDR) test sequence measurement two HDR test sequences shall be played. 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 must be performed by the UUT and not an external device. 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 [link to be updated] and have identical programme content. The files are respectively titled “HDR-HLG Power.mp4” and “HDR_HDR10 Power.mp4” 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 (<i>P_{av}</i>) should be summed and halved for the calculation of the label HDR energy efficiency class and label HDR power declaration. An ABC allowance does not apply in HDR display mode. (Regulation (EU) 2019/2013 Annex III. 1. Label VII & VIII): Viz: Label VII, <i>P_{measured}</i> for HDR EEI label = 0.5 * (<i>P_{av}</i> HLG + <i>P_{av}</i> HDR10) Label VIII declaration, kWh/1000h = 0.5 * (<i>P_{av}</i> HLG + <i>P_{av}</i> HDR10)</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. A new variant of the “box and outline” 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. A set of these variant 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 1.3.4. of Annex IIIa and may be downloaded at: https://circabc.europa.eu/ui/group/1582d77c-d930-4c0d-b163-4f67e1d42f5b/library/4f4b47a4-c078-49c4-a859-84421fc3cf5e?p=1 [link to be updated] They are contained in a sub folders labelled SD, HD and UHD. Each sub folder has eight peak white 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 pattern within the appropriate resolution should be based upon a) the minimum required white box dimensions for correct operation of the contact luminance measuring instrument and b) such that no power limiting effect is exhibited by the UUT (large areas of white may result in a reduction of peak white levels) Any upscaling must 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 must 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 should be noted. For displays tested using the USB-C interface, the host machine shall not have a battery and must operate on its own ac power source (e.g. desktop computer, Blu-ray player, etc.).</p>
<p>Measurements related to ABC for “Allowances and adjustments</p>	<p>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. A preferred methodology is detailed in Section 1.3.5. of Annex IIIa.</p>

	Notes
for the purposes of the EEI calculation and functional requirements”	
Peak white luminance ratio	No existing relevant standards can be used. The “box and outline” test pattern selected for the ABC peak white luminance measurements (<i>Section 2.3.4</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 must be made of the peak white luminance of the brightest pre-set configuration in the user menu (not the retail setting). ABC need not be on for the luminance ratio measurements but the status of the ABC (on or off) must apply to both measurements. Where ABC is on, the illuminance should be 100lux for both measurements. Care should be taken to ensure that the test pattern selected for peak white luminance measurement in the “normal configuration” does not cause luminance instability (<i>see section 2.3.4</i>) in the brightest pre-set configuration. A smaller peak white box pattern should be selected for both measurements if instability occurs.
Forced Menu and set-up menus	A UUT set up flow chart evaluating conformity with the set-up requirements of the regulation is shown in <i>Section 1.1</i> of Annex IIIa

;

(4) the following Annex IIIa is inserted:

‘ANNEX IIIa Transitional Methods

1. ADDITIONAL ELEMENTS FOR MEASUREMENTS AND CALCULATIONS

Table 1
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
Signal Generation Equipment	Defined in relevant standard	See Relevant Notes in 2. References
Light Source (Projector)	Illuminance at ABC sensor of at least 20,000 lux	Solid state lamp engine (LED, Laser or LED /Laser) Tilting Mounting platform allowing precise alignment of projector beam. This may be combined with or replaced by a built in Optical alignment feature.
Computer for simultaneous data logging on common timescale	At least 3 appropriate ports allowing interface with power, luminance and illuminance	

	measuring devices.	
Computer with slide show and or picture editing application interfaced with projector	Application allowing projection of full white image with simultaneous control over colour temperature and luminance level	

Figure 1: Example of a compliant menu and warning implementation

1.1. Summary of Order of testing

1. Setup UUT on a stand identifying location of 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” (see Figure 1)
3. Mute Audio where applicable.
4. Continue warm-up of sample while setting up test equipment and identifying peak white test pattern providing stable display luminance and power measurement.
5. If ABC is available and 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.
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 retail demonstration 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

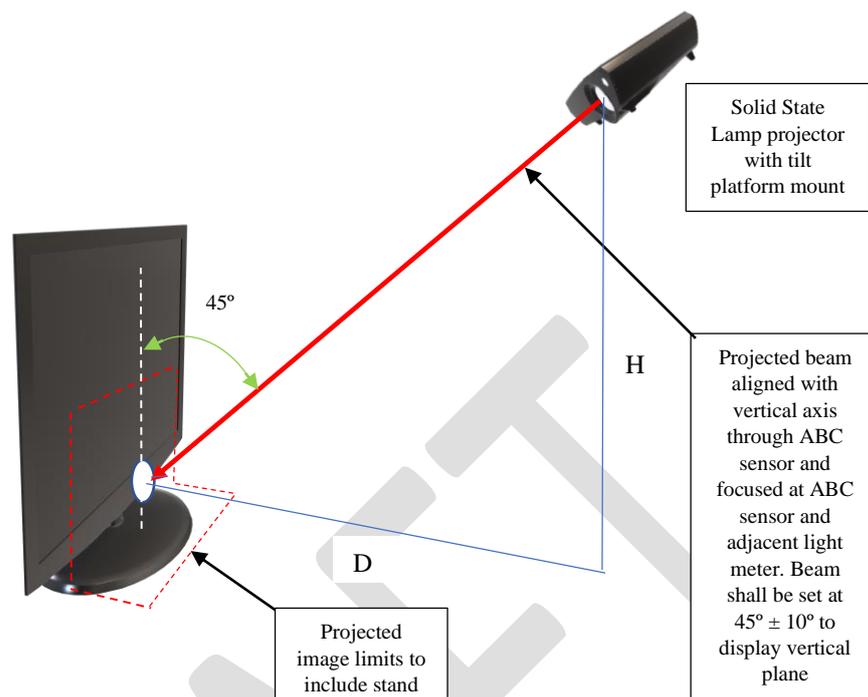


Figure 2. Physical set up of Display and ambient light source

If ABC function is available and the UUT is supplied with a stand this should be attached to the display part and the UUT placed on a horizontal table or platform covered in a black low reflectivity material of at least 0.75 meters height from the floor (typical materials are felt, fleece or canvas theatrical backdrop). All parts of the stand should remain exposed. Displays intended primarily for wall mounting should be frame mounted for ease of access with the lower edge of the display at least 0.75 meters from the floor. The floor surface under the display and up to 0.5 meter 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 should 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 2) should be noted to aid repeatability of measurements. 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.

An illuminance meter should 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 should 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 should 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 should be measured and noted.

The projector should 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 2*) The projector platform height, tilt and distance from the UUT should 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 should be noted that some Digital Signage Displays (DSD) 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 should be rigged to align with the centre of the UUT screen.

The projected illuminance image overlapping the horizontal surface below the UUT display should 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 should be aligned with the extremities of the stand (see *Figure 2*). The top horizontal edge of the projected image should 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 should 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 should be noted and the meter returned to its original set-up position along with the UUT. The illuminance should 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 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 should be made to the test set up.

Unlike televisions, DSD's can 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 DSD's with multiple light sensors may be explored further as a test method refinement to be qualified in a harmonised standard.

1.2.2. Check of correct implementation of "normal configuration" and energy impact warnings.

The configuration and operating mode flow chart for this testing exercise is shown in *Figure 1*: A power meter should 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 "retail mode" should be confirmed.

1.2.3. Audio Setting

An input signal should be provided containing audio and video (the 1kHz tone on the SDR video power test material is ideal) The sound volume setting should 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 should 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 test pattern.

In this test methodology, the measurement of peak luminance is made while displaying a 100% white test pattern, but the area of white is empirically limited to avoid the triggering of protection mechanisms. The appropriate test pattern is determined by displaying the range of eight "box and outline" dynamic test patterns based on VESA "L" test patterns from smallest (L10) to largest (L80), while recording power and screen luminance. A graph of power and screen luminance vs L pattern should assist in determining if and when display drive limiting is occurring. For example, if power consumption is increasing from L10 to L60, while luminance is either increasing or constant (not decreasing) then those patterns are not appearing to cause limiting. If test pattern L70 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 L70 or between L60 and L70. It may also be that limiting has occurred between L50 and L60 and the graphed points at L60 were in fact

sloping downward. Therefore, the largest pattern where we are sure no limiting occurs is L50 and this is the correct pattern to use for the peak luminance measurement.

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

For the purposes of the 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 100lux and 12 lux ambient light change must provide a 20% decrease in display power requirement for conformance with a regulation power allowance. The dynamic luminance “L” test pattern used to assess ABC luminance control conformance may also be simultaneously used to assess the power reduction conformance.

For DSD, 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 2.3.5.2), at a stable display luminance condition, is switched to the 60lux 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 test pattern as identified in 2.3.4 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 $2800\text{ °K} \pm 300\text{ °K}$ 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 2800 °K 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 should be selected from the user menu. At a stable display luminance point the projected slide should be switched from 0 % to 100 % black transparency to establish the latency period. This should 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 should display the selected peak white luminance pattern (*see 2.3.4*) at a stable luminance. For Regulation conformance, luminance measurement should 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 should 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 should be conducted. in the normal configuration. The stabilised peak white luminance pattern should be displayed in the measured 100 lux ambient illumination condition. It should 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.

1.2.7. Measurement of on-mode power

For each of the UUT powering systems covered in a), b) and c) below, SDR power should 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 should 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. 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”.

Test instrumentation 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 test pattern identified in section 1.3.4 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 should be switched off. If it cannot be switched off the product should be tested in the 100-lux measured ambient light conditions described in section 1.3.5 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 should be measured at the AC supply point.

- (a) For UUT with a standardised DC input (only USB power delivery standards apply) power measurement should 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. For the on-mode power measurement declaration (Ecodesign and labelling, $P_{measured}$) in SDR mode and HDR mode is the power recorded via the USB BOU.
- (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 in a) and b) 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 should 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 should be fully discharged. The battery should 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 should 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, should 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 in a) and b) above.

All test sequences involving power measurement for regulation conformance and declaration should be performed with the product battery fully charged and the external power source disconnected. The fully charged condition should be confirmed by the power meter log charging profile graph. The product should be switched to the measurement mode required and the test sequence started immediately. After the test sequence is completed the product should 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 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 ABC energy conformance (20 % power reduction test) the appropriate dynamic peak luminance sequence should be continuously played for 30 minutes in a 12 lux ambient light condition. The battery should be immediately recharged and the average power noted. The same should 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 should be played 3 times sequentially and the average battery recharge power requirement logged ($P_{measured}$ (SDR) Watts = recharge energy Watt hours /total playback time in hours).

For the HDR power declaration each of the two five-minute HDR dynamic power measurement files should be played three times in quick succession and

the average battery recharge power requirement logged ($P_{measured}$ (HDR) Watts = recharge energy Watt hours /total playback time hours).

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 2.3.7 a) and b) above apply and the special test procedure for battery powered displays covered in 2.3.7 c) must be applied 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) in point 2, the third paragraph 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.’;

(c) 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
--	---

’;

(d) the last row of Table 3 are replaced by the following:

Maximum concentration values tolerated of halogenated flame retardants in enclosure and stand	The determined value for any homogeneous material shall not exceed 0,1 % by weight of bromine, 0,1 % by weight of fluorine and 0,1 % by weight of chlorine attributable to flame retardant.
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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 supplier for the stated, calculated or measured technical parameters in accordance with Article 4.2, for the verification of compliance by the Member State authorities.’;

- (2) in Annex III, 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. The measured values are 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) 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 supplier for the stated, calculated or measured technical parameters in accordance with Article 4.2, for the verification of compliance by the Member State authorities.’;

- (2) Annex III is amended as follows:

- (a) 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.’;

- (b) 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.’;

- (c) 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:

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

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).’;

- (d) 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. The measured values are 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 energy 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) 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.’;

(c) Table 1 is replaced by the following:

Table
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 , respectively E_{WD} , 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 , respectively W_{WD} , by more than 10 %.
Washing efficiency	The determined value (*) shall not be less than the declared value of I_W , respectively J_W , by

index (I_W and J_W)	more than 8 %.
Rinsing effectiveness (I_R and J_R)	The determined value (*) shall not exceed the declared value of I_R , respectively J_R , by more than 1,0 g/kg.
Duration of the eco 40-60 programme (t_W)	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})	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	The determined value shall not be less than the declared values 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	The determined value (*) shall not exceed 3,0 %.
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;’.

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ANNEX VIII

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

- (1) in Annex I, the following point (26) is added:

‘(26) ‘declared values’ means the values provided by the supplier for the stated, calculated or measured technical parameters in accordance with Article 4.2, for the verification of compliance by the Member State authorities.’;

- (2) in Annex III, Table 5, the following is added:

Category	Temperature class	Highest temperature of warmest M-package (°C)	Lowest temperature of coldest M-package (°C)	Highest temperature of all M-packages (°C)	Value for C
Vertical and combined supermarket cabinet	M0	$\leq + 4$	$\geq - 1$	n.a.	1,30
Horizontal supermarket cabinet	M0	$\leq + 4$	$\geq - 1$	n.a.	1,13

’;

- (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) 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.’.