COMMISSION IMPLEMENTING DECISION (EU) 2017/1402

of 28 July 2017

on the approval of the BMW AG engine idle coasting function as an innovative technology for reducing CO_2 emissions from passenger cars pursuant to Regulation (EC) No 443/2009 of the European Parliament and of the Council

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

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

Having regard to Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emissions performance standards for new passenger cars as part of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles ([1]), and in particular Article 12(4) thereof,

Having regard to Commission Implementing Regulation (EU) No 725/2011 of 25 July 2011 establishing a procedure for the approval and certification of innovative technologies for reducing CO_2 emissions from passenger cars pursuant to Regulation (EC) No 443/2009 of the European Parliament and of the Council ([2]), and in particular Article 10(2) thereof,

Whereas:

(1) The manufacturer BMW AG (the 'Applicant') submitted an application for the approval of an engine idle coasting function as an eco-innovation on 23 June 2016. The completeness of the application was assessed in accordance with Article 4 of Implementing Regulation (EU) No 725/2011. The application was found to be complete.

(2) The application has been assessed in accordance with Article 12 of Regulation (EC) No 443/2009, Implementing Regulation (EU) No 725/2011 and the Technical Guidelines for the preparation of applications for the approval of innovative technologies pursuant to Regulation (EC) No 443/2009 ([3]). Due to the complexity of the technology, the assessment period has been extended by five months in accordance with Article 10(4) of Implementing Regulation (EU) No 725/2011, i.e. until 23 August 2017.

(3) The application refers to the BMW AG 'engine idle coasting' function to be used in BMW M1 vehicles with conventional powertrain and automatic transmission. The basic principle of this innovative technology is to decouple the combustion engine from the drivetrain and prevent deceleration caused by engine braking. The function should be automatically activated in the predominant driving mode, which is the mode automatically selected when the vehicle is switched on. Thus coasting can be used to increase the rolling distance of the vehicle in situations where no propulsion or a slow reduction of speed is needed. When 'coasting', the kinetic and potential energy of the vehicle is directly used to overcome driving resistance and, as consequence, to decrease fuel consumption. To obtain less deceleration the engine is decoupled from the drivetrain by opening a clutch. This is done automatically by the control unit of the automatic transmission. During these coasting phases the engine is running at idle speed ('engine idle coasting').

(4) The Commission approved by way of Implementing Decision (EU) 2015/1132 ([4]) an application by Porsche AG concerning a coasting function intended for use in Porsche S-segment M1 vehicles (sport coupé) only. The application by BMW AG concerning an engine idle coasting function is intended for use in BMW M1 vehicles with conventional powertrain and automatic transmission.

(5) The applicant has provided a methodology for testing the CO_2 reductions from the use of the engine idle coasting function, including a modified NEDC test cycle to offer the possibility for the vehicle to coast. To compare the vehicle fitted with engine idle coasting function with a baseline vehicle where the coasting function

([1]) OJ L 140, 5.6.2009, p. 1.
([2]) OJ L 194, 26.7.2011, p. 19.
([3]) https://circabc.europa.eu/w/browse/f3927eae-29f8-4950-b3b3-d2e700598b52
([4]) Commission Implementing Decision (EU) 2015/1132 of 10 July 2015 on the approval of the Porsche AG coasting function as an innovative technology for reducing CO2 emissions from passenger cars pursuant to Regulation (EC) No 443/2009 of the European Parliament and of the Council (OJ L 184, 11.7.2015, p. 22).

is not installed, not available in the predominant driving mode or disabled for testing purposes, both vehicles should be tested on the same modified NEDC test cycle. However, in view of the difficulties for the baseline vehicle to follow the speed-trace of the modified NEDC test cycle, the test of the baseline vehicle is performed on the standard NEDC under hot start conditions, while the modified conditions are taken into account by a conversion factor being applied for the calculation of the CO_2 savings. The determination of the conversion factor is vehicle-specific and related primarily to the powertrain hardware configuration. Based on previous studies, the conversion factor appears to lie within the range 0,96 to 0,99. The applicant has requested that the conversion factor should be set at the level of 0,98. The Commission finds however that the applicant has not provided sufficient evidence for justifying a conversion factor higher than 0,96. In view of this, it is considered appropriate to maintain the conversion factor at the lower end of the identified range, i.e. at the value of 0,960, in line with the conversion factor defined in Implementing Decision (EU) 2015/1132.

(6) A key element in determining the CO_2 savings is the proportion of the distance travelled by the vehicle over which the coasting function will be activated, taking into account that the coasting function may be deactivated in other driving modes than the predominant driving mode. The applicant has proposed a usage factor of 0,7 which relates the observed distance covered under coasting conditions during real world driving tests to the coasting distance under modified NEDC conditions. However, that proposed usage factor resulted as a best case value without robust supporting analysis. Based on additional analysis and taking into account the analysis made for the purpose of Implementing Decision (EU) 2015/1132, it is appropriate to consider a more conservative usage factor equal to 0,62.

(7) The case study conducted by BMW AG concerned two vehicles having the engine idle coasting technology active until 40km/h. In view of the forthcoming production of BMW models able to coast until 15km/h, the applicant has proposed an analytical method to extend the scope to also cover this longer coasting activation period. Nevertheless, the influence of the more extended coasting period upon the usage factor has not been analysed by the applicant. Therefore, it is appropriate to consider the coasting function as active at least down to 40 km/h.

(8) The information provided in the application demonstrates that the conditions defined in Articles 2 and 4 of Implementing Regulation (EU) No 725/2011 and the criteria referred to in Article 12 of Regulation (EC) No 443/2009 have been met for at least one of the two vehicles presented in the case study. Moreover, the application is supported by a verification report established by an independent and certified body in accordance with Article 7 of Implementing Regulation (EU) No 725/2011.

(9) Based on the information provided with the current application, and taking into account the experience gained from the assessment of the application on the approval of the Porsche AG coasting function in the framework of Implementing Decision (EU) 2015/1132, it has been satisfactorily demonstrated that the BMW engine idle coasting function can provide a reduction in CO_2 emissions of at least 1 g CO_2/km in accordance with Article 9 of Implementing Regulation (EU) No 725/2011 for certain BMW vehicles. It is therefore necessary for the type approval authority, to verify that the 1gCO_2/km threshold specified in Article 9 of Implementing Regulation (EU) No 725/2011 is met for the certification of the CO_2 savings from BMW vehicles fitted with engine idle coasting function.

(10) Against that background, the Commission finds that no objections should be raised as regards the approval of the innovative technology in question.

(11) The manufacturer BMW AG should, in order to have the CO_2 savings from the BMW AG engine idle coasting function certified, provide a verification report from an independent and certified body confirming the compliance of the fitted vehicle with the conditions specified in this Decision together with the application for certification to the type approval authority.

(12) For the purposes of determining the general eco-innovation code to be used in the relevant type approval documents in accordance with Annexes I, VIII and IX to Directive 2007/46/EC of the European Parliament and of the Council ([1]), the individual code to be used for the innovative technology should be specified,

([1]) Directive 2007/46/EC of the European Parliament and of the Council of 5 September 2007 establishing a framework for the approval of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles (Framework Directive) (OJ L 263, 9.10.2007, p. 1).

HAS ADOPTED THIS DECISION:

Article 1

Approval

The BMW AG engine idle coasting function, hereinafter BMW engine idle coasting function, is approved as an innovative technology within the meaning of Article 12 of Regulation (EC) No 443/2009 provided the following conditions are met:

(a) the innovative technology is fitted in BMW conventional powertrain M1 vehicles with automatic transmission equipped with the BMW engine idle coasting function automatically activated in the predominant driving mode; this is the driving mode that is always selected when the vehicle is switched on regardless of the operating mode selected when the vehicle was previously shut down; the BMW engine idle coasting function may not be deactivated in the predominant driving mode by the driver or by external interventions;

(b) the BMW engine idle coasting function is active at least down to 40km/h;

(c) for vehicles with the capacity to coast down to a speed lower than 40km/h, the BMW engine idle coasting function shall be de-activated at 40km/h for the purpose of the test set out in the Annex.

Article 2

Application for certification of CO_2 savings

The manufacturer BMW AG may apply for certification of the CO_2 savings from the BMW engine idle coasting function by reference to this Decision.

The application for certification shall be accompanied by a verification report from an independent and certified body confirming the compliance of the fitted vehicle with the conditions set out in Article 1 and that the CO_2 savings threshold of 1gCO_2/km specified in Article 9 of Implementing Regulation (EU) No 725/2011 is met.

Article 3

Certification of CO_2 savings

The reduction in CO_2 emissions from the use of the BMW engine idle coasting function referred to in Article 1 shall be determined using the methodology set out in the Annex.

Article 4

Eco-innovation code

The eco-innovation code No 23 shall be entered into the type approval documentation where reference is made to this Decision in accordance with Article 11(1) of Implementing Regulation (EU) No 725/2011.

Article 5

Entry into force

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

Done at Brussels, 28 July 2017.

For the Commission

The President

Jean-Claude JUNCKER

ANNEX

Methodology to determine the CO_2 savings of the use of the BMW engine idle coasting function

1. INTRODUCTION

In order to determine the CO_2 savings that can be attributed to the use of the BMW engine idle coasting function, it is necessary to specify the following:

(1) The test vehicles;

(2) The testing procedure to determine the CO_2 emission of the eco-innovative vehicle under modified testing conditions;

(3) The testing procedure to be followed to determine the CO_2 emission of the baseline vehicle under type approval hot start conditions;

(4) The calculation of the CO_2 savings;

(5) The calculation of the statistical margin.

2. SYMBOLS, PARAMETERS AND UNITS

Latin symbols

C_{CO_2} — CO_2 savings [g CO_2/km];

CO_2 — Carbon dioxide;

c — Conversion parameter;

B_{MC} — Arithmetic mean of the CO_2 emissions of the baseline technology vehicle under modified testing conditions [gCO_2/km];

E_{MC} — Arithmetic mean of the CO_2 emission of the eco-innovation technology vehicle under modified testing conditions [gCO_2/km];

$B_{TA_{hot}}$ — Arithmetic mean of the CO_2 emission of the baseline vehicle under type approval hot start conditions [gCO_2/km];

B_{TA} — Arithmetic mean of the CO_2 emission of the baseline vehicle under type approval testing conditions [gCO_2/km];

E_{TA} — Arithmetic mean of the CO_2 emission of the eco-innovation technology vehicle under type approval testing conditions [gCO_2/km];

RCD_{RW} — Relative coasting distance under real world conditions [%];

RCD_{mNEDC} — Relative coasting distance under modified testing conditions [%];

UF — Usage factor of the coasting technology, which is 0,62 for the BMW engine idle coasting technology. This value is representative only of the BMW fleet;

$s_{C_{CO_2}}$ — Statistical margin of the total CO_2 savings [gCO_2/km];

$s_{B_{TA_{hot}}}$ — Standard deviation of the arithmetic mean of the CO_2 emission of the baseline vehicle under type approval hot start conditions [gCO_2/km];

$s_{E_{MC}}$ — Standard deviation of the arithmetic mean of the CO_2 emission of the eco-innovation vehicle under modified testing conditions [gCO_2/km];

s_{UF} — Standard deviation of the arithmetic mean of the usage factor.

Subscripts

RW — Real-world conditions

TA — Type approval conditions

B — Baseline

3. THE TEST VEHICLES

The test vehicles shall fulfil the following specifications:

(a) Eco-innovative vehicle: a vehicle with the innovative technology installed and active in the predominant driving mode as defined in Article 1(a);

(b) Baseline vehicle: a vehicle with the innovative technology deactivated or not installed or not available in the predominant driving mode. If it is not possible to deactivate the technology, it has to be assured that the BMW engine idle coasting function is not activated during the dynamometer testing procedure.

4. DETERMINATION OF THE CO_2 EMISSION OF THE ECO-INNOVATIVE VEHICLE UNDER MODIFIED TESTING CONDITIONS (E_{MC})

The emissions of CO_2 and fuel consumption of the Eco-innovative vehicles have to be measured in accordance with Annex 6 of UN/ECE Regulation No 101 (Method of measuring emissions of carbon dioxide and fuel consumption of vehicles powered by an internal combustion engine only). The following procedures and test conditions shall be modified:

4.1. **Preconditioning of the vehicle**

In order to reach the hot testing conditions of the powertrain, one or more complete preconditioning NEDC tests shall be performed.

4.2. **Dynamometer road load determination**

The dynamometer road load determination shall be carried out on a single-roll dynamometer as follows:

(a) Bring the vehicle to operating temperature following the preconditioning procedure referred to in point 4.1;

(b) Determine the dynamometer road load according to the standard operating procedures defined in the UN/ECE Regulation No 83 ([1]).

4.3. **Definition of the Coast Down Curve**

The determination of the coast down curve in coasting mode is carried out on a single-roll dynamometer as described in the following compulsory steps:

(a) Bring the vehicle to operating temperature following the preconditioning procedure referred to in point 4.1;

(b) Execute a coast down in coasting mode from an initial speed of not less than 120 km/h to either a standstill or to the lowest possible coasting speed.

4.4. **Generation of the modified NEDC profile (mNEDC):**

The speed profile of the mNEDC shall be generated as follows:

4.4.1. *Assumptions*

(a) The test sequence is composed of an urban cycle made of four elementary urban cycles and an extra-urban cycle;

(b) All acceleration ramps are identical to the NEDC-profile;

([1]) Regulation No 83 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of vehicles with regard to the emission of pollutants according to engine fuel requirements (OJ L 42, 15.2.2012, p. 1).

(c) All constant speed levels are identical to the NEDC-profile;

(d) The deceleration values when the BMW engine idle coasting function is deactivated are equal to the ones within the NEDC-profile;

(e) The speed and time tolerances shall be in accordance with paragraph 1.4 of Annex 7 to UN/ECE Regulation No 101.

4.4.2. *Constraints*

(a) The deviation from the NEDC profile shall be minimised and the overall distance must comply with the NEDC specified tolerances;

(b) The distance at the end of each deceleration phase of the mNEDC-profile shall be equal to the distances at the end of each deceleration phase of the NEDC-profile;

(c) For all phases of acceleration, constant velocity and deceleration, standard NEDC tolerances shall be applied;

(d) During coasting phases the internal combustion engine is decoupled and no active correction of the vehicles velocity trajectory is permitted.

4.4.3. *System boundaries*

(a) Lower speed limit for coasting:

The coasting mode shall be disabled at a coasting speed of 40 km/h by engaging the brake. At this point, a coast down curve is followed by a deceleration ramp as described for the NEDC-profile (v_{min} in Figure 1);

(b) Minimal stop time:

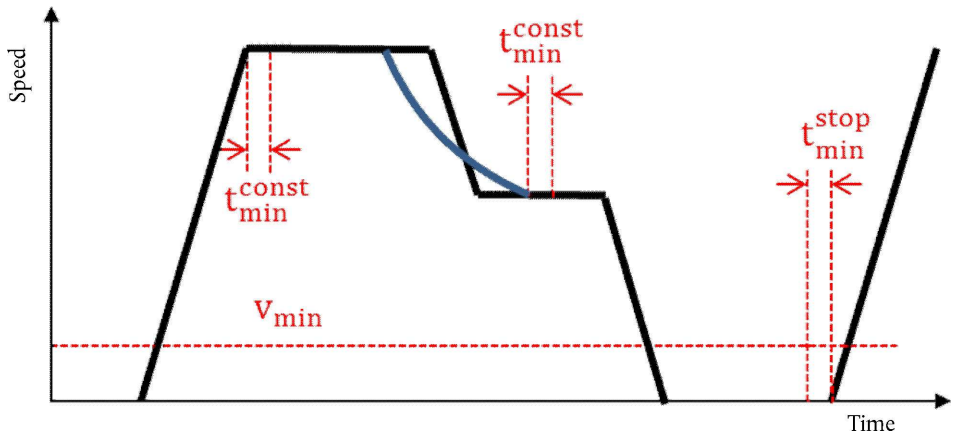
The minimum time after every coasting deceleration to a standstill or constant speed phase is 2 seconds (t_{min}^{stop} in Figure 1);

(c) Minimum time for constant speed phases:

The minimum time for constant speed phases after acceleration or coasting deceleration is 2 seconds (t_{min}^{const} in Figure 1). For technically justified reasons this value may be increased.

Figure 1

NEDC profile with system boundaries for coasting mode



4.5. **Number of tests**

The complete test procedure on the test bench shall be repeated at least three times. The arithmetic mean of the CO_2 emissions from the eco-innovation vehicle (E_{MC}) and the respective standard deviation of the arithmetic mean ($s_{E_{MC}}$) shall be calculated.

5. DETERMINATION OF THE CO_2 EMISSIONS OF THE BASELINE VEHICLE UNDER TYPE APPROVAL HOT START CONDITIONS ($B_{TA_{hot}}$)

The emissions of CO_2 and fuel consumption of the baseline vehicles have to be measured in accordance with Annex 6 of UN/ECE Regulation No 101 (Method of measuring emissions of carbon dioxide and fuel consumption of vehicles powered by an internal combustion engine only). The following procedures and test conditions shall be modified:

5.1. **Preconditioning of the vehicle**

In order to reach the hot testing conditions of the powertrain, one or more complete preconditioning NEDC tests shall be performed.

5.2. **Number of tests**

The complete test procedure under type approval hot start conditions on the test bench shall be repeated at least three times. The arithmetic means of the CO_2 emission from the baseline vehicle ($B_{TA_{hot}}$) and the respective standard deviation of the arithmetic mean ($s_{B_{TA_{hot}}}$) shall be calculated.

6. CALCULATION OF THE CO_2 SAVINGS

To calculate the CO_2 savings of the innovative technology the following formula shall be used:

Formula 1:

$$C_{CO_2} = \left[(B_{MC} - E_{MC}) - (B_{TA} - E_{TA})\right] \cdot UF$$

Where,

C_{CO_2}: CO_2 savings [gCO_2/km];

B_{MC}: Arithmetic mean of the CO_2 emissions of the baseline technology vehicle under modified testing conditions [gCO_2/km];

E_{MC}: Arithmetic mean of the CO_2 emission of the eco-innovation technology vehicle under modified testing conditions [gCO_2/km];

B_{TA}: Arithmetic mean of the CO_2 emission of the baseline vehicle under type approval testing conditions [gCO_2/km];

E_{TA}: Arithmetic mean of the CO_2 emission of the eco-innovation technology vehicle under type approval testing conditions [gCO_2/km];

UF: Usage factor of the BMW engine idle coasting function is 0,62.

If it is demonstrated that the innovative technology is not active under the type approval testing conditions, the Formula 1 may be simplified as follows:

Formula 2:

$$C_{CO_2} = (B_{MC} - E_{MC}) \cdot UF$$

To determine B_{MC}, the same modified testing conditions shall be followed by a vehicle which does not have the BMW engine idle coasting function.

It shall be assumed that the baseline vehicle is able to perform a sailing curve (line 2' in Figure 2) without disconnecting the engine from the wheels, although with lower efficiency than a vehicle fitted with a BMW engine idle coasting function (i.e. able to disconnect the engine from the wheels).

Figure 2

Sailing curve for baseline vehicle

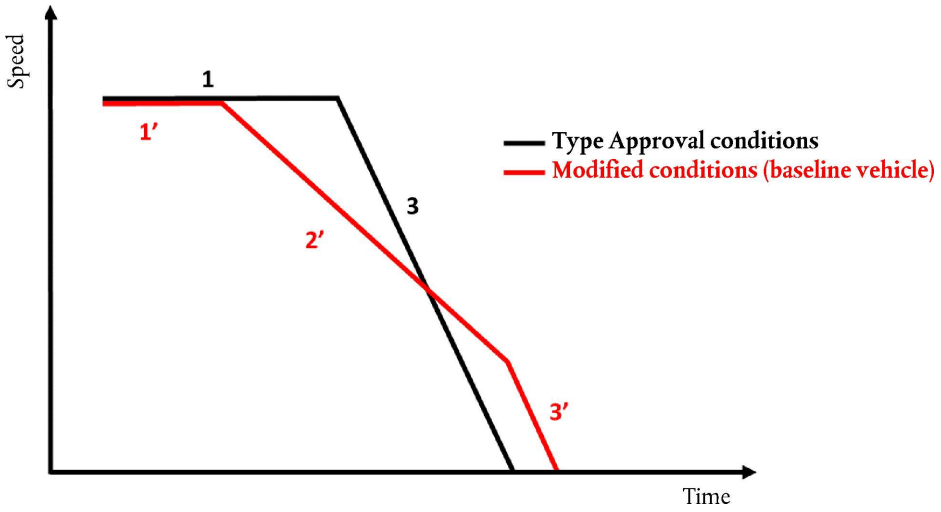


Figure 2 illustrates that during the deceleration phases of the type approval (3) and the modified (2' + 3') testing conditions no fuel is used (cut-off) by the baseline vehicle.

In order to determine the CO_2 emissions of the baseline vehicle under the modified conditions (B_{MC}), those emissions shall be calculated based on the CO_2 emissions of the baseline vehicle determined under type approval hot start conditions using a conversion parameter (c-factor) which takes into account the effect of the modified testing conditions in accordance with the following Formula 3:

Formula 3:

$$c = \frac{B_{MC}}{B_{TA_{hot}}}$$

As consequence, Formula 2 becomes:

Formula 4:

$$C_{CO_2} = (c \cdot B_{TA_{hot}} - E_{MC}) \cdot UF$$

Where,

c: Conversion parameter which is 0,960;

$B_{TA_{hot}}$: Arithmetic mean of the CO_2 emission of the baseline vehicle under type approval hot start conditions [gCO_2/km];

E_{MC}: Arithmetic mean of the CO_2 emission of the eco-innovation vehicle under modified testing conditions [gCO_2/km];

UF: Usage factor of the coasting technology for the BMW technology which is 0,62; this value is representative only for the BMW fleet.

7. CALCULATION OF THE STATISTICAL MARGIN

The statistical margin in the results of the testing methodology is to be quantified. The statistical margin of the total CO_2 saving shall not exceed 0,5 g CO_2/km as expressed in the following Formula 5:

Formula 5:

$$s_{C_{CO_2}} \leq 0{,}5\ gCO_2/km$$

Where,

$s_{C_{CO_2}}$: Statistical margin of the total CO_2 savings [g CO_2/km].

The statistical margin shall be calculated in accordance with the following Formula 6:

Formula 6

$$s_{C_{CO_2}} = \sqrt{\left(c \cdot UF \cdot s_{B_{TA_{hot}}}\right)^2 + \left(-UF \cdot s_{E_{MC}}\right)^2 + \left[\left(c \cdot B_{TA_{hot}} - E_{MC}\right) \cdot s_{UF}\right]^2}$$

Where,

$s_{C_{CO_2}}$: Statistical margin of the total CO_2 savings [g CO_2/km];

c: Conversion parameter which is 0,960;

$B_{TA_{hot}}$: Arithmetic mean of the CO_2 emission of the baseline vehicle under type approval hot start conditions [gCO_2/km];

$s_{B_{TA_{hot}}}$: Standard deviation of the arithmetic mean of the CO_2 emission of the baseline vehicle under modified testing conditions [gCO_2/km];

E_{MC}: Arithmetic mean of the CO_2 emission of the eco-innovation vehicle under modified testing conditions [gCO_2/km];

$s_{E_{MC}}$: Standard deviation of the arithmetic mean of the CO_2 emission of the eco-innovation vehicle under modified testing conditions [gCO_2/km];

UF: Usage factor of the BMW engine idle coasting function which is 0,62; this value is representative only for the BMW fleet;

s_{UF}: Standard deviation of the arithmetic mean of the usage factor, which is 0,019; this value is representative only for the BMW fleet.

8. DEMONSTRATION THAT THE MINIMUM THRESHOLD OF 1gCO_2/KM IS EXCEEDED IN A STATISTICALLY SIGNIFICANT WAY

In order to demonstrate that the 1 gCO_2/km threshold is exceeded in a statistically significant way, the following Formula shall be used:

Formula 7

$$MT = 1\ gCO_2/km \leq C_{CO_2} - s_{C_{CO_2}}$$

Where,

MT: Minimum threshold [gCO_2/km];

C_{CO_2}: CO_2 savings [gCO_2/km];

$s_{C_{CO_2}}$: Statistical margin of the total CO_2 savings [gCO_2/km].

Where the CO_2 emission savings, as a result of the calculation using Formula 4 are below the threshold specified in Article 9(1) of Implementing Regulation (EU) No 725/2011, the second subparagraph of Article 11(2) of that Regulation shall apply.