EUROPEAN
COMMISSION

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ANNEXES 1 to 3

ANNEXES

to

Commission Implementing Regulation (EU) .../...
of XXX

laying down detailed provisions concerning the voluntary environmental labelling scheme for the estimation of the environmental performance of flights, established pursuant to Article 14 of Regulation (EU) 2023/2405 of the European Parliament and of the Council
(Flight Emissions Label)

ANNEX I

Timeline for submitting applications and for generating labels

The timeline for aircraft operators to submit applications and for the Agency to generate and distribute labels shall be the following.

Table 1

Obligation	**Timeline**
Operations of calendar year X-1, to be the basis for the information given to the Agency in accordance with Article 3(4)	01.01.X-1 to 31.12.X-1
Aircraft operators communicate to the Agency their application for the issuance of labels, in accordance with Article 3(1)	By 01.02.X
Aircraft operators report the information listed in Articles 3(3) and 3(4), in accordance with Article 3(2)	By 01.05.X
The Agency estimates the flight emissions of each flight or set of flights, generates and distributes the labels for all flights scheduled for the two upcoming scheduling periods, in accordance with Article 4(1).	By 30.06.X
Validity period of the labels for flights operated in the winter scheduling period, in accordance with Article 4(2)(a).	As of the moment of issuance by the Agency in year X and until the end of the winter scheduling period of years X to X+1, as used in the aircraft operator's schedule
Validity period of the labels for flights operated in the summer scheduling period, in accordance with Article 4(2)(b).	As of five months before the start of the summer scheduling period of year X+1 and until the end of that scheduling period, as used in the aircraft operator's schedule

ANNEX II

Methodology for estimating flight emissions

This Annex lays down the methodology and the necessary steps that the Agency shall follow for the estimation of flight emissions.

(1) CALCULATION OF LIFE CYCLE FLIGHT EMISSIONS

(1) Flight emissions shall be calculated by multiplying the estimated consumption of aviation fuels for the flight in question by the weighted average of lifecycle emissions of the aviation fuels uplifted at the departure airport. At the same time, flight emissions are equal to the sum of cabin and freight emissions.

$$E = E_c + E_f = E_{WTT} + E_{TTW} = V_{fuel} \times EC_{fuel} \times LCE_{fuel}$$

where:

E = flight emissions, in kilogrammes of carbon dioxide equivalent (kg CO_2eq),

E_c = cabin emissions, in kg CO_2eq,

E_f = freight emissions, in kg CO_2eq,

E_{WTT} = fraction of the flight emissions corresponding to well-to-tank, in kg CO_2eq,

E_{TTW} = fraction of the flight emissions corresponding to tank-to-wheel, in kg CO_2eq,

V_{fuel} = consumption of aviation fuels of the flight, in kilogrammes (kg),

EC_{fuel} = energy content of aviation fuels, 43.1 megajoule per kilogramme (MJ/kg),

LCE_{fuel} = weighted average lifecycle emissions of the aviation fuels uplifted at the departure airport, in grammes of carbon dioxide equivalent per megajoule (g CO_2eq/MJ).

(2) The average lifecycle emissions of the aviation fuels uplifted at the departure airport shall be the weighted average of the aviation fuel life cycle emissions of all batches of aviation fuels uplifted at that airport, taking into account Article 5(6):

$$LCE_{fuel} = \sum_{b=1}^{n} \frac{(LCE_b \times V_b)}{V_b}$$

where:

LCE_b =the aviation fuel lifecycle emissions of a batch ‘b’ of aviation fuels, in g CO_2eq/MJ. For conventional aviation fuels, this value shall be 89 g CO_2eq/MJ;

V_b = mass of a batch ‘b’ of aviation fuels, in kg.

(3) The estimated aviation fuel consumption of a flight shall be calculated using either of the following methods:

(a) Estimations using past operations

When primary data is available for the operations of the previous corresponding scheduling periods and tallies with the operating conditions of the scheduled flight, the estimation of aviation fuel consumption shall be calculated as the weighted average of the reported aviation fuel consumption in the *n* flights operated on the route in question:

$$V_{fuel} = \sum_{a=1}^{n} \frac{F_a}{N_a}$$

where:

F_a = aviation fuel consumption for all flights in a route, in the reporting period;

N_a = number of flights operated on that route during the reporting period.

(b) Estimation based on Breguet-Range equation

If primary data for the scheduled flights reported under Article 3(3) does not exist, is insufficient, cannot be verified or exists only for operating conditions significantly differing from those reported under Article 3(4), the estimated aviation fuel consumption shall be calculated using the Breguet-Range equation.

This equation estimates the overall cruise performance as follows:

$$R = \frac{V}{c} \times \frac{L}{D} \times ln\left(\frac{W_1}{W_2}\right)$$

Where:

R = distance travelled, in kilometres,

V = speed of the aircraft, in kilometres per hour,

c = thrust-specific aviation fuel consumption, in kilogrammes per hour,

L = lift force acting on the aircraft, in Newtons,

D = aerodynamic drag force acting on the aircraft, in Newtons,

ln = natural logarithm function,

W_1 = initial cruise aircraft mass, in kilogrammes,

W_2 = final cruise aircraft mass, in kilogrammes.

By rearranging the Breguet-Range equation, a ratio between an aircraft's initial and final mass can be derived, representing the aviation fuel consumption of the flight in question:

$$\frac{W_1}{W_2} = e^{\left(\frac{R \times c}{V \times \frac{L}{D}}\right)}$$

In the absence of information on each flight's landing mass, engine performance and the aerodynamic performance of the aircraft, these factors are not computed directly. The equation is further refined by regressing the factors to correlate them with observations of aviation fuel consumption. This refined equation shall be applied for each aircraft:

$$V_{fuel} = a \times \left(\frac{e^{b \times R}}{r} - 1\right)$$

where:

a= aircraft mass when landing at the airport of arrival, in kilogrammes,

$b = c/(V \times L/D)$

$$r = \frac{W_3}{W_1} = \frac{W_2}{W_0}$$

and where:

W_0 = aircraft empty mass, in kilogrammes,

W_1 = aircraft mass after climbing 3 000 ft (or 914.4 metres), in kilogrammes,

W_2 = aircraft mass after climbing to cruise, cruising, and descending to 3 000 ft (or 914.4 metres), in kilogrammes,

W_3 = aircraft mass when landing at the airport of arrival,

The coefficients a, b and r shall be determined using regression analysis, to minimise the estimated difference (L2-Norm) between the observed aviation fuel consumption and the estimated value.

(2) ALLOCATION OF LIFE CYCLE FLIGHT EMISSIONS TO CABIN AND FREIGHT

(1) Flight emissions shall be attributed to the cabin (cabin emissions, Ec) and to freight (freight emissions, Ef) on the basis of the respective apportionment of cabin and freight mass, as follows:

(a) cabin emissions (E_c)

$$E_c = E \times W_c$$

where:

E = estimated flight emissions, in kg CO_2eq;

$W_c = C_w / (F_w + C_w)$, share of the flight mass attributed to the cabin, where:

C_w = mass corresponding to the cabin (passengers and their baggage), in kg, and

F_w = mass corresponding to the freight on board of the aircraft, in kg.

(b) freight emissions (E_f)

$$E_f = E \times W_F$$

where:

$W_f = F_w/(F_w + C_w)$, share of the flight mass attributed to the cabin.

(2) Where information on the number of passengers is not reported because the conditions of the operations are different to those of previous flights, an estimated number of passengers shall be calculated on the basis of the following factors (to be given on the website established under Article 8):

$$C_w = N \times L \times P_m$$

where:

N = the number of seats available in the aircraft type, per cabin class,

L = estimated load factor of the flight, calculated using an average of L_r, L_{ao} and L_a, where

L_r = average load factor per cabin class of the aircraft operator's flights on a route,

L_{ao} = average load factor per cabin class of the aircraft operator's flights in similar routes, per cabin class,

L_a = average load factor per cabin class of the aircraft type operated by the aircraft operator, and

P_m = the mass attributed to a passenger including their baggage, which shall be 100 kg.

(3) GENERATION OF FLIGHT EMISSIONS FOR CABIN AND FREIGHT

(1) The life cycle flight emissions allocated to the cabin and freight are then further processed to generate its carbon footprint (Cfc) and its carbon efficiency (Cfe), and shall be calculated as follows:

(a) Cabin emissions

Cabin emissions footprint (C_{ef})

$C_{ef} = C_e/pax$, cabin emissions footprint per passenger, in kg CO_2eq/pax

Cabin emissions intensity (C_{ei})

$C_{ei} = C_{ef}/R$, cabin emissions efficiency per passenger-kilometre, in kg CO_2eq/pkm

where,

$R = GCD$, distance of the flight, determined using the great circle distance method (GCD), in km.

(b) Freight emissions

Freight emissions footprint (F_{ef})

$F_{ef} = F_e/F_w$, freight emissions footprint per tonne of freight, in kg CO_2eq/t

Freight emissions intensity (F_{ei})

$F_{ei} = F_{ef}/R$, freight emissions efficiency per tonne-kilometre, in g CO2eq/tkm

(4) ADJUSTMENT OF CABIN EMISSIONS FOR CABIN CLASSES

(1) Where aircraft operators report the seating area of each aircraft in each aircraft configuration, it shall be used in the first instance to calculate what cabin class multiplier to apply.

$$Factor_{Class\ A} = \left[\frac{Area_{Class\ A}}{Area_{Class\ Lowest}}\right]$$

(2) If the information referred to in the previous point is not available, the multiplication factors set out in Table 1 shall be applied.

Table 1

Cabin class multiplication factors

Cabin class	Based on seating area	Default values	
		4 cabin classes Wide-body	4 cabin classes Narrow-body
Economy (e)	1.00	1.00	1.00
Premium Economy (pe)	$Area_{pe}/Area_e$	1.50	1.00

Business (b)	$Area_b/Area_e$	4.00	1.50
First (f)	$Area_f/Area_e$	5.00	1.50

(3) As cabin emissions will cover all passengers on a flight regardless of the cabin they are seated in, the lowest class passenger equivalent shall be calculated on the basis of the lowest cabin class equivalent of space taken up by a ticket class.

$$LCEqPax = \sum (Pax_{Class} \times Factor_{Class})$$

$$CO_{2_{Class}} = \left[\frac{Cabin\ CO_2}{LCEqPax}\right] \times Factor_{Class}$$

ANNEX III

Templates for displaying labels

1. The label logotype shall comply with the following requirements:

(a) The logotype must be the following, which shall be displayed depending on the colour of the background behind it, to ensure the accessibility and user-friendliness of the design.

(a) The principal version of the logotype to be used whenever feasible shall be:

(b) The logotype version to be used against dark backgrounds shall be:

(c) The logotype to be used against light-coloured backgrounds only if the principal version is not visible enough such as due to lack of contrast shall be:

(b) If enough space, the word ‘Verified’ must accompany the label logotype on the right. It must be stylised in Calibri bold and always in the user’s language:

(a) The principal version of the logotype to be used whenever feasible shall be:

(b) The logotype version to be used against dark backgrounds shall be:

(c) The logotype to be used against light-coloured backgrounds only if the principal version is not visible enough such as due to lack of contrast shall be:

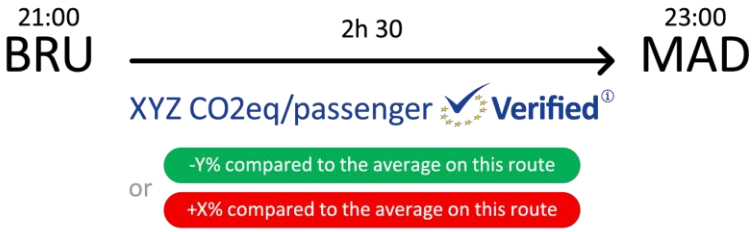
(c) The colour of the label logotype and the accompanying text must be:

(i) blue #034EA2;

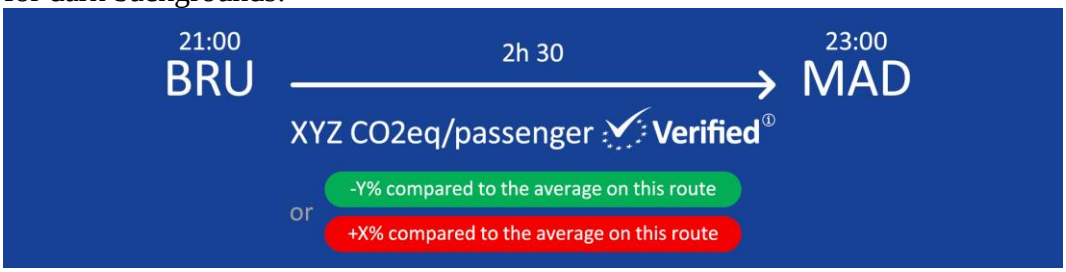
(ii) yellow #FFCB04.

(d) The primary display referred to in point 2 shall comply with the following layout:

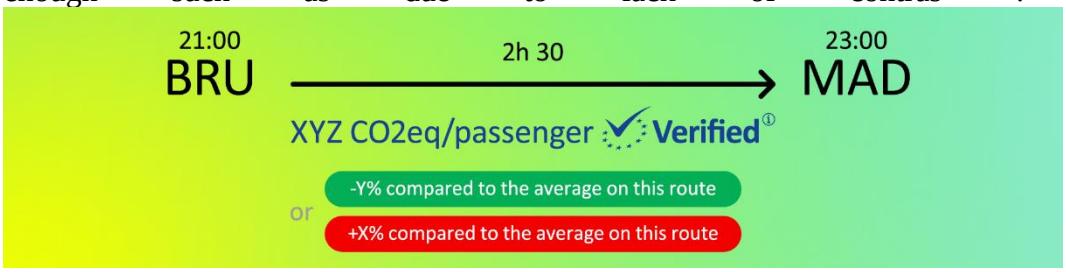
(a) whenever feasible:



(b) for dark backgrounds:

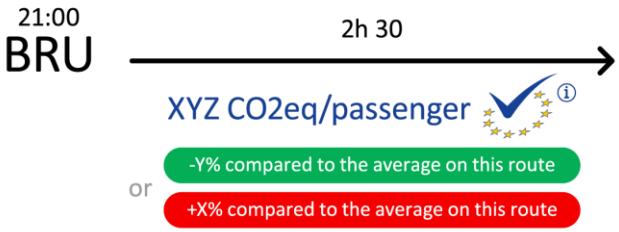


(c) for light-coloured backgrounds only if the principal version is not visible enough such as due to lack of contras :

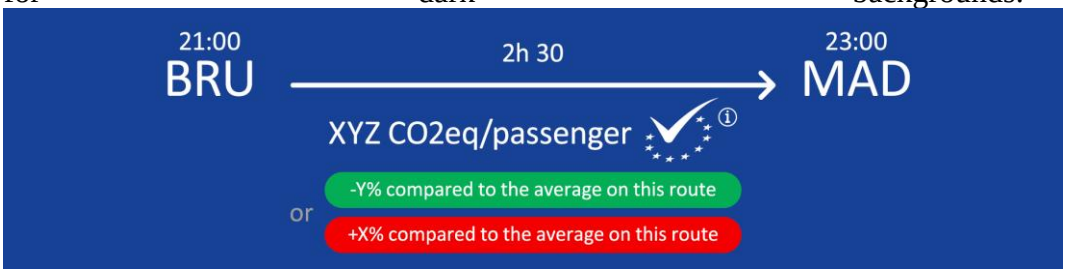


(e) Whenever there is insufficient space to comply with the requirements of the previous paragraph, the primary display shall comply with the following:

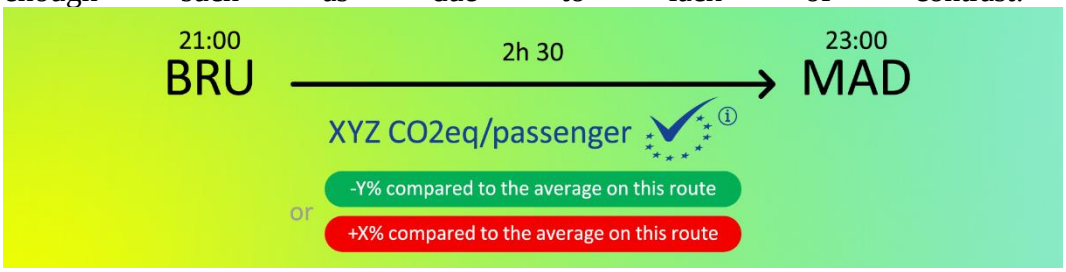
(a) whenever feasible:



(b) for dark backgrounds:

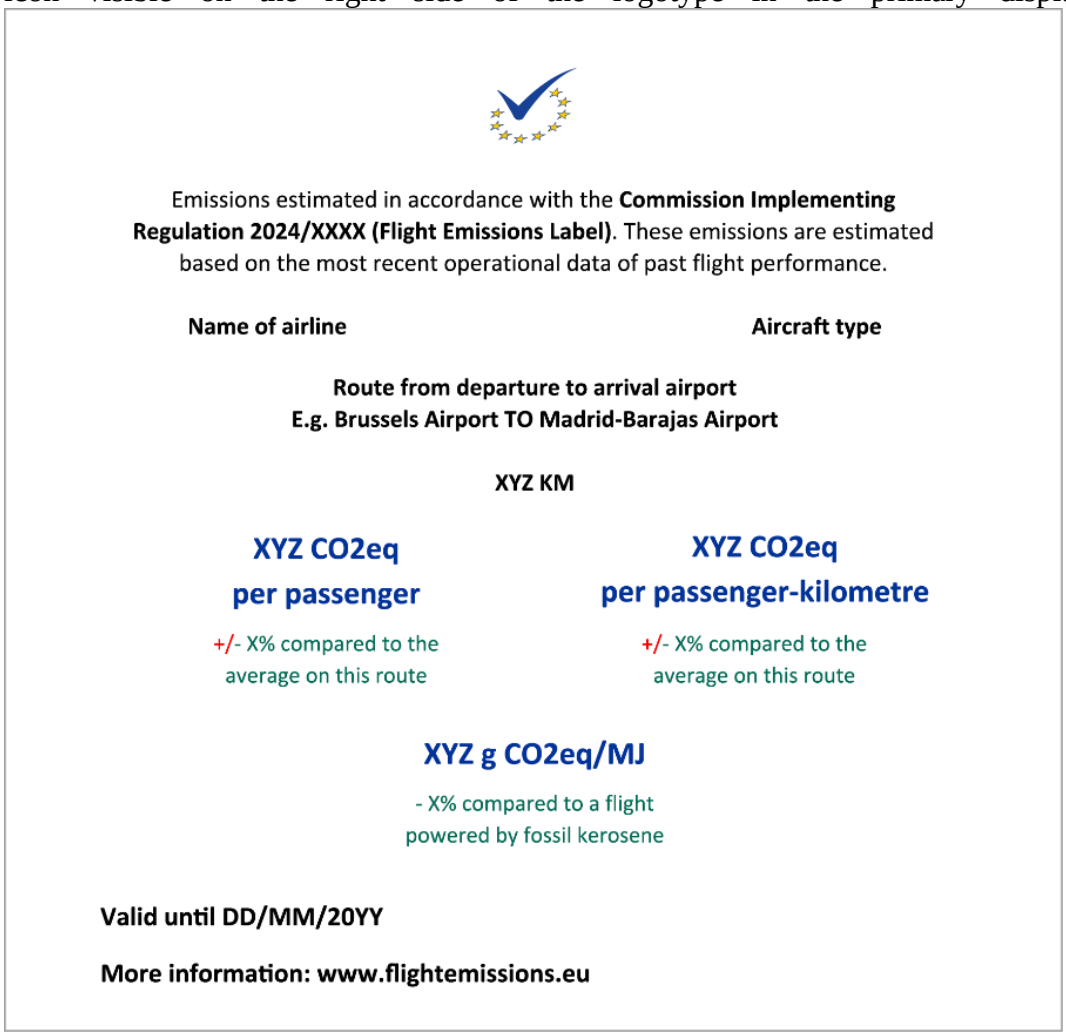


(c) for light-coloured backgrounds only if the principal version is not visible enough such as due to lack of contrast:



(f) The secondary display referred to in point 3 shall comply with the following layout and it shall appear when hovering over or when clicking on the information (“i”)

icon visible on the right side of the logotype in the primary display:



(g) The label shall be referred to as the ‘Flight Emissions Label’;

2. The following information shall always be included in the primary display of the label alongside the logotype:

(a) for passenger flights, the expected cabin emissions per passenger for the cabin selected by the passenger, measured in kg CO_{2eq}/pax. When flying with infants aged up to 24 months on the lap of an adult using an infant seat belt, the expected cabin emissions per passenger shall be those of the adult only;

(b) for all-cargo flights, having regard to Article 9, the expected freight emissions per tonne, measured in kg CO2eq/t;

(c) a small-scale version of the label logotype, as set out in point 1(b);

(d) the relative difference, in percentage, between the emissions listed in subpoints (a) or (b) and the average emissions of the aircraft operators operating the route in question who requested labels for that route;

(e) an icon, stylised as an information (“i”) icon, to open the secondary display.

3. The following additional information shall be included in the secondary display of the label:

(a) the name of the aircraft operator;

(b) the route, defined by the departure and arrival airport names;

(c) the route distance, in kilometres;

(d) for passenger flights, the cabin emissions per passenger-kilometre, measured in kg CO_{2eq}/passenger-kilometre;

(e) for all-cargo flights, having regard to Article 9, the freight emissions per tonne-kilometre, measured in kg CO_{2eq}/tonne-kilometre;

(f) the average aviation fuel life cycle emissions used to estimate the flight emissions listed in points 2(a) and 3(d) or 2(b) and 3(e), measured in g CO_2eq/MJ, as well as the average relative difference, in percentage, between them and the average lifecycle emissions of the aviation fuels of all aircraft operators operating the same route who requested labels for that route. A green colour may be used to indicate a negative difference and a red colour to indicate a positive difference compared to the average;

(g) the validity period of the label, including its last day of validity;

(h) A hyperlink to the website established under Article 8, stylised as flightemissions.eu.

4. The label's display shall comply with the following technical specifications during its validity period:

(a) it shall be displayed in a machine-readable and accessible format;

(b) the information in the label's primary display shall not require passenger interaction to be displayed;

(c) the label's font type (Calibri bold) and size used shall be clear and legible;