RELEASE NOTES - EMROAD 5.96 Build 3

[DISCLAIMER]

EMROAD is a Microsoft Excel add-in for analyzing vehicle emissions data recorded with Portable Emissions Measurement Systems (PEMS). In the frame of the European legislative PEMS programs for heavy-duty vehicles (HDV), non-road mobile machinery (NRMM), and light-duty vehicles (LDV), EMROAD was developed as a research tool, primarily used to support the development of PEMS data evaluation methods for emissions legislation.

These legislative developments being completed, EMROAD was updated by the JRC to meet:

- For light-duty vehicles, the applicable methods and requirements laid down in Regulations 2016/427 (except for the Power Binning Method in Appendix 6), 2016/646 and 2017/1154.

- For heavy-duty vehicles, the applicable methods and requirements laid down in Regulations 582/2011 and 2016/1718.

EMROAD is provided free of charge and without user support. The JRC does not assume any legal liability for potentially erroneous calculation settings, incorrect emission calculations, or false interpretations of EMROAD results.

Users are kindly asked to report bugs or problems to victor.valverde-morales@ec.europa.eu (light-duty vehicles), and pierre.bonnel@ec.europa.eu and/or adolfo.perujo@ec.europa.eu (heavy-duty vehicles, non-road mobile machinery).

[INSTALLATION]

Extraction

- Unzip the EMROAD.zip file: Right-click and select "Extract Here"
- The extracted EMROAD folder contains the EMROAD add-in (EMROAD_Vx_xx_Bxx.xla), the corresponding version of the blank EMROAD template (TEMPLATE_Vx_xx.xltx) and some sub-folders (CHARTS, ENGINES, LIMITS, SETTINGS, VEHICLES)
- The entire EMROAD folder and its contents can be moved to any location. However, the contents of the EMROAD folder cannot be modified.

Add-in declaration in Microsoft Excel

- The procedure is presented for Excel 2010. Please refer to Microsoft help for the equivalent procedures under earlier or later Excel versions (e.g. 2003 or 2007, 2013, 2016)
- The procedure must be repeated each time a new version of EMROAD is used and/or if the EMROAD folder is moved.

- It is highly recommended to work only with one EMROAD version and therefore to delete and to de-activate older versions (add-ins).
- Select: File > Options > Add-ins > Manage Excel Add-ins > Go
- Browse to the EMROAD folder and select the add-in file (EMROAD_Vx_xx_Bxx.xla)
- Close and re-start Excel
- Upon restart, EMROAD appears in the Excel menu under "Add-Ins"

Installation Tip: To upgrade faster, you might only copy a new EMROAD_Vx_xx_Bxx.xla into the installation folder

[CHANGES VERSION 5.96 Build3]

Light-Duty Vehicles Real Driving Emissions (RDE)

1. Bug-fix for calculation of CO.

EMROAD version 5.96B2 had a bug in the CO calculation and both the TEST REPORT and the RDE REPORT were systematically showing 0 mg/km emissions. The bug has been corrected.

2. Updated method for the calculation of PN emissions as introduced in RDE3.

On previous versions of EMROAD, the calculation of PN emissions was done using the Exhaust Volume Flow, whereas RDE3 states that the calculation shall be done using the Exhaust Mass Flow rate together with and the tabulated value of the density of the exhaust gas (Appendix 4, Table 1). The calculation of PN emissions has been updated to follow the regulation. The values in Table 1 are fuel-dependent and those have been introduced in the code to support all possible fuel types.

3. Bug-fix for calculation of cumulative positive elevation gain.

According to RDE regulation, Appendix 7b, point 4.2 (*Screening and principle verification of data quality*), the instantaneous altitude data shall be checked for completeness. Data gaps (for example when the GPS loses the signal inside a tunnel) shall be completed by data interpolation. The correctness of interpolated data shall be verified by a topographic map. EMROAD cannot compare the altitude from the GPS with an altitude map and therefore, in previous versions, the completeness check was not performed. This led to wrong calculations of the cumulative positive elevation gain on trips with altitude gaps.

In order to overcome the issue EMROAD corrects now the original altitude signal by replacing outliers with the previous valid value. An outlier is identified as such if the difference of GPS altitude between two consecutive seconds is larger than 40 metres (value taken from point 4.2)

4. Bug-fix for extended conditions on OVC-HEV.

Pollutant emissions calculated according to Appendix 4 are divided by 1.6 under extended ambient conditions (temperature/altitude). The division was not being done for OVC-HEVs in previous versions of EMROAD. The bug has been corrected.

5. Bug-fix for weighing factor of windows during the cold start.

Appendix 5, section 6.1 establishes the method to calculate the weighing factor to be applied for each window. For all averaging windows including cold start data points (first 5 minutes or time with coolant temperature < 70 C), the weighting factor has to be set to 1. In previous EMROAD versions, the weighing factor was set to 1 for data points in the first 5 seconds. The bug has been fixed and now the weighing factors are 1 for all windows that include data points in the first 5 minutes of the trip (cold start).

Heavy-Duty Vehicles In Service Conformity (ISC)

1. Trip composition calculation upgraded to include exclusions.

From this version, for the regulatory HDV ISC the time and distance shares are calculated in the PASS-FAIL report with exclusions (i.e., including the cold start) as mentioned in Annex II 4.5.4. of PEMS legislation 582/2011.

2. Bug-fix for calculation of CO.

EMROAD version 5.96B2 had a bug in the CO calculation and both the TEST REPORT and the PASS/FAIL REPORT were systematically showing 0 emissions/ CF. The bug has been corrected.

[CHANGES VERSION 5.96 Build2]

Light-Duty Vehicles Real Driving Emissions (RDE)

1. Correction for zeroing negative instantaneous mass emissions.

According to RDE regulation, Appendix 4, Section 11, "*If applicable, negative instantaneous emission values shall enter all subsequent data evaluations.*" In previous versions, EMROAD was zeroing negative emissions. It has been fixed so that negative instantaneous emissions enter subsequent emissions calculations.

2. Correction of vehicle Stop periods definition in EMROAD.

In previous versions EMROAD indicated stop when the vehicle speed is **lower or equal** to 1 km/h whereas regulation states "*Stop periods, defined as vehicle speed of **less than** 1 km/h*". The vehicle stop definition has been amended to follow the regulation.

3. Update EMROAD to RDE3 long idling periods requirements.

EMROAD was eliminating 180 seconds after individual idles of > 180 s (as per RDE2). EMROAD has been updated to fulfil RDE3 requirements by allowing individual idles up to 300 consecutive seconds without subsequent emission data elimination. If an individual stop is longer than 300 seconds then the test is voided.

4. Adjust Internal Combustion engine off to RDE3.

RDE3 indicates that 2/3 of the following conditions should occur simultaneously to consider the ICE off:

- engine speed < 50 rpm

- exhaust mass flow < 3 kg/h

- exhaust mass flow < 15% of exhaust mass flow at idle

EMROAD has been updated to indicate ICE off in agreement with RDE3.

In order to identify the exhaust mass flow at idle the following approach is used in EMROAD:

4.1. Identify all stop periods of duration enough to allow the exhaust mass flow to stabilise (stop > 10 seconds) and once the engine is warm → EFM vector.

4.2. Remove from the EFM vector the first 5 seconds of each individual stop to allow the stabilization of the flow.

4.3. Remove from the EFM vector the seconds in which, the exhaust mass flow < 3kg/h. This step removes from the analysis the EFM recording that corresponds to the operation of the start/stop systems.

4.4. After step 4.3:

- if the length of the EFM vector is 0, it is assumed that the vehicle is operating a start/stop system and therefore the exhaust mass flow at idle EMF_idle = 0

- If the length of the EFM vector is not null, EMF_idle = averaged exhaust mass flow of the EFM vector.

4.5. Calculate 15% of the identified exhaust mass flow at idle: 15EMF_idle = 0.15* EMF_idle

5. ICE off for NOVC-HEVs

Bug correction for properly calculating and reporting ICE off & distance driven in electric mode for NOVC-HEV as it was previously done only for OVC-HEV.

6. Properly set P1, P2, P3 vehicle speed to meet regulation

In previous EMROAD versions, the average speed of WLTC phases (low, high, and extra-high) used to build the CO_2 reference curve were not exactly those established in the regulation (minor difference, though). EMROAD uses now the regulated speeds: P1, P2, P3 vehicle speed are 19 - 56.6 - 92.3 km/h, respectively.

7. Improve aesthetics of CO_2 graph of the RDE REPORT tab

In previous EMROAD versions, the CO_2 graph of the RDE REPORT tab was not using a linear regression for the CO_2 curve as indicated in the regulation. A linear regression is now used for segments P1P2 and P2P3.

8. Bugfix v*apos95

Correction of v*apos95 when average speed is above 74.6 km/h is 0,0742*average speed +18,9**6**6. (was 18.9**9**6).

9. Harmonize kelvins to Celsius transformation

In different parts of the EMROAD code, the transformation from kelvins to Celsius was done using either -273.15, -273.16, -273. Now, all transformations are fixed to [°C] = [K] − 273.15

[CHANGES VERSION 5.96 Build1]

Light-Duty Vehicles Real Driving Emissions (RDE)

Included:

- Bug fixes;

- Modification of RDE report layout to better show urban and total RDE results

- NOVC-HEV calculations;

- Trip and MAW verifications for N2 vehicles.

[CHANGES VERSION 5.95 Build2]

Light-Duty Vehicles Real Driving Emissions (RDE)

Included:

- Bug fixes;

- Forward MAW calculation;

- Cold start inclusion: MAW weighing function set to 1 for all the windows including cold start data.

[CHANGES VERSION 5.95 Build1]

For all applications:

- Updated templates numbered as 5.95. Use of older templates will require a reformatting (automated when prompt)

1. Light-Duty Vehicles Real Driving Emissions (RDE)

- Elements to comply with the 2nd and 3rd RDE packages and in particular the inclusion of cold start emissions in the calculations;

- Bug fix for the calculation of trip characteristics.

2. Heavy-Duty Vehicles In Service Conformity (ISC)

- Elements to comply with 2016/1718 and in particular the trip requirements, the vehicle conditioning and the (10%) power threshold

3. Non-Road Mobile Machinery In Service Monitoring (ISM)

- Elements to address Stage V In-Service Monitoring tests.