The European Commission’s science and knowledge service

Joint Research Centre
EU Real Driving Emissions Regulation
Analysis of PEMS data: EU-EMROAD Tool

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April 2019
Outline

• EMROAD – Introduction and short History

• Main principles and features

• EU Regulatory calculations

• Useful features for the RDE IWG
Introduction

• EMROAD is a Microsoft Excel add-in for analysing 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.

• EMROAD was updated by the JRC to fulfil:
  • For light-duty vehicles, the applicable methods and requirements are laid down in Regulations 2016/427 and amendments (2016/646, 2017/1147 and 2018/1832).
  • For heavy-duty vehicles, the applicable methods and requirements are laid down in Regulations 582/2011 and amendments.
  • For non-road mobile machinery, the applicable methods and requirements are laid down in Regulations 2017/655.
Short History

- **2005-2009 [Versions 1 to 3]:** Support to PEMS legislative developments for PEMS heavy-duty engines In-Service Conformity

- **2009-2011 [Versions 4 & 5]:** Added support to PEMS legislative developments for NRMM engines In-Service Monitoring

- **2012-2018 [Versions 5.6 to 5.96]:** Added support to PEMS legislative developments for Light-Duty Vehicles Real Driving Emissions (RDE)

- **2019+ [Version 6 BETA]:** Reference calculation tool for HDV, NRMM and LDV EU PEMS based regulations.
  - Adding golden data files to benchmark other calculations tools
  - Added support of official RDE data exchange files (EXF) containing vehicle info and analyzers verification data
Main principles

- EMROAD is a Microsoft Excel add-in, importing and processing PEMS data in a pre-defined template

- EMROAD PEMS data files generated by the main PEMS instruments on the market (AVL, HORIBA, SENSORS) and Exchange Files (EXF, as soon as available from instrument providers)

- EMROAD uses the reference units set by the EU Regulations

- EMROAD is able to conduct:
  - Regulatory calculations (Calculation settings according to the chose Regulation)
  - Advanced calculations (Advanced users, step-by-step functions, not supported)
Main principles

- EMROAD Template
Main principles - Sequence

- Testing to be conducted in accordance with the chosen rules (e.g. Regulation)
- Data screening shall verify that the mandatory parameters are present and of sufficient quality (e.g. it includes the test equipment verifications)
- Preliminary data screening is not within the EMROAD perimeter but EMROAD might detect flaws in the data (or crash ;-))
Main principles - Sequence

- All types of PEMS instruments data files, or custom
- EU data exchange files (EXF) also containing analyzers checks and vehicle information according to EU-RDE requirements
- Custom Upload Settings
- Uploads the data to the TEST DATA worksheets and converts the data to the EU reference units

TESTING, DATA SCREENING

Upload PEMS data to EMROAD Template

Input Calculation Settings

Run Calculation

Checks results and reports
Main principles - Sequence

- Upload PEMS data to EMROAD Template
- Input Calculation Settings
- Run Calculation
- Checks results and reports

- EU-Regulatory (LDV, HDV, NRMM) with simplified interfaces
- Non-regulatory calculations (advanced, not supported)
- Possibility to run step-by-step (advanced, not supported)

EU-RDE-LDV Settings interface
Main principles - Sequence

1. Upload PEMS data to EMROAD Template
2. Input Calculation Settings
3. Run Calculation
4. Checks results and reports
5. - EU-Regulatory or advanced
Main principles - Sequence

1. Upload PEMS data to EMROAD Template
2. Input Calculation Settings
3. Run Calculation
4. Checks results and reports

- Instantaneous emissions and MAW results in CALCULATED data
- Integrated and average values (no regulatory processing)
- EU-Regulatory (RDE REPORT for LDV, PASS-FAIL REPORT FOR HDV and NRMM): verification of emissions and all parameters for test validity

Example: EU-RDE-LDV Report
Application to RDE-IWG

- Possibility to input regional settings
  - Speed binning values defining the speed based conditions (e.g. low, high speed)
  - MAW Speed binning values
  - Altitude and temperature values for moderate and extended conditions
  - Shape of the CO2 characteristic curve for MAW calculations
  - Conformity factors
RDE-IWG

• RDE specific values might be reported upon request in the RDE REPORT worksheet

• Current version: 6, open for BETA testers and EU Regulatory calculations

• The tool is available in the CIRCABC group "New light duty test procedures: WLTP, MAC, ...", in the section "RDE-LDV Reference documents and tools".

• Access to this section is open to all and does not require any registration or membership: https://circabc.europa.eu/w/browse/79a4a9b6-4003-4e02-956d-048dcef1a169

• Release of functions useful for the RDE IWG in May