Berner Fachhochschule
Haute école spécialisée bernoise
Bern University of Applied Sciences

Bern University of Applied Sciences
Engineering and Information Technology

Automotive Engineering

Laboratory for IC-Engines and
Exhaust Emission Control (AFHB)
Gwerdtstrasse 5
CH-2560 Nidau
T +41 (0)32 321 66 80

www.afhb.bfh.ch
info.afhb@bfh.ch

RDE Legislation Package 4 (RDE4)

Commissioned by the Federal Office for the Environment (FOEN)

Project: Research on PEMS Testing Methodology and on Real Driving Emissions (ResRDE2) *)

BAFU contract nbr.: 19.0106.PJ / S081-0349, 3rd report, WP2

Imprint

Commissioned by:
Federal Office for the Environment (FOEN),
Air Pollution Control and Chemicals Division, CH 3003 Bern, Switzerland
The FOEN is an agency of the Federal Department of the Environment, Transport, Energy and Communications (DETEC).

Contractor:
University of applied sciences Biel-Bienne (BFH-TI)
Laboratory for IC-Engines and Exhaust Emissions Control (AFHB)
Gwerdtstrasse 5, CH 2560 Nidau, Switzerland

Authors:
D. Engelmann Dipl. Ing. TU,
Y. Zimmerli, Dipl. Ing. FH,
Ph. Wili,
M. Clénin.

Note:
This study/report was prepared under contract to the Federal Office for the Environment (FOEN).
The contractor bears sole responsibility for the content.

August 2020 R006

*) Abbreviations see at the end of report

CONTENT

1. SUMMARY

The control of real driving emissions (RDE) by means of portable emission measuring systems (PEMS) is generally an accepted way to reduce further the air pollution of traffic.
In several research activities with different PEMS open questions resulted concerning the methodology of testing and of evaluation.
Additionally, there are questions about RDE from different types of vehicles, or on different routes with varying operating conditions, with different testing apparatus and with the use of recent evaluation method.

The project ResRDE(2) considers these objectives in 5 working packages (WP).

This 3rd report presents the results of the WP2 – RDE legislation package 4 – information about the new amendments and comparisons of results evaluated according to the previous and to the new evaluation procedures.

After the performed evaluation of PEMS-RDE-results with three methods, it can be stated that the results obtained with the RDE evaluation package are very similar to the integral average results.
For the Diesel vehicle equipped with DPF the PN-values are very low and the evaluation methods are not relevant for PN.

2. OBJECTIVES OF RESRDE(2)

According to the project proposal from March 2019, the objectives of the working packages are:

WP1: Emission factors from non-driving situations with different vehicles.

Part 1: Analysis of present data

From the present data of RDE obtained with different vehicles, the specific situations of emissions like cold start, warm-up and stop&go, have to be found, analyzed and compared with the average cycle emissions.

Part 2: Reproduction of non-driving situations

It was proposed to investigate two gasoline and two Diesel passenger cars. The tests are performed in idling cold/warm, during the warm-up phase and in stop&go operation with a different portion of idling. The tests are performed on chassis dynamometer with measuring systems: CVS and PEMS (including HC_{FID} and PN).

After cold start, there are different options of operating profile to influence the warm-up phase. It is proposed to use two extreme variants: idling and high load (like highway). The cold start would be at 20-25°C. Other options of the cold start temperature are to be discussed.

To simulate the different portion of idling in stop&go operation, specific cycles have been created in order to repeat the same trials with all vehicles. Testing of stop&go operation will be carried out with warm engine.

WP2: RDE legislation package 4.

From January 2019, new amendments to the RDE-legislation were issued with new requirements of evaluation of results. It is necessary to deepen the new regulation, to perform the new evaluation procedure and to compare it with the previous one.

WP3: Extended RDE conditions – examples and comparisons of RDE for: winter/summer driving, mild/aggressive driving and altitude.

WP3(a): RDE – winter/summer – examples on two vehicles (passenger cars: Diesel, gasoline).

WP3(b): RDE with mild/aggressive driving behavior - examples on two vehicles (Diesel, gasoline).

WP3(c): RDE in “normal» legally valid circle compared with a high-altitude circle – examples on two vehicles (Diesel, gasoline).

WP4: Further comparisons of PN PEMS and GasPEMS: Horiba ↔ NM3 (CPC & NGK) examples on two vehicles (Diesel, gasoline), as well as the comparisons of data from HDV Euro VI (WVU).

The vehicles are tested with warm start on chassis dynamometer and on-road. Compared are: stationary CPC (PMP), PN PEMS Horiba, NM3 and NGK and gaseous components GasPEMS. The comparisons of results from the previous tests HDV Euro VI (WVU) are included.

WP5: RDE results on different RDE routes.

The same vehicle is measured on the test circuits of other associated institutes (EMPA, TCS, TFZ).

2.1. Research topics of present report

This 3rd report presents the results of WP2, which consists of two parts:

Part 1 – Short description of most important innovations of the RDE4 package.
Part 2 – Comparisons of RDE results obtained on two vehicles (Gasoline, Euro 5 and Diesel, Euro 6) and evaluated with both methods: RDE3 (previous method) and RDE4 (actual method).

3. INNOVATIONS OF THE RDE PACKAGE 4 (RDE4)

The RDE packages 1,2 & 3 are applied for the certification of new types of vehicles since September 2017. The 4th RDE package applies for certification since January 2019. The most important innovations and amendments of RDE4 vs. RDE3 concern:

- Specifications and calibration of PEMS components and signals, [1] App.2.
- Verification of overall trip dynamics with MAW (moving average windows), [1] App.5 and with RPA (relative positive acceleration), [1] App.7a.
- Determination of the cumulative positive elevation gain of a PEMS trip, [1] App.7b.
- Calculation of final RDE emissions, [1] App.6.
- Data exchange and reporting requirements, [1] App.8.
- Provisions for in-service-conformity (ISC), [1] Article 9.

For calculation of the final RDE emissions (App. 6) an evaluation factor (RF_K) is applied in function of the CO_2 ratio ($r_k = CO_{2\,RDE} / CO_{2\,WLTC}$). This is represented in Fig. 1 and in annex A1, [2] as well.

The CO_2 ratio r_k can be considered as “engine load factor”. If the engine, for certain reasons, converts considerably more energy in RDE than in WLTC the application of a “reduction factor RF_K” for the resulting RDE emissions takes place. For the electrified vehicles with “off-vehicle charging OVC”, the operation with/without ICE (i.e. purely electric operation) is considered (see annex A1-2).
A further important measure includes cold start / warm-up data in the evaluation.
For NO_x, the conformity factor (CF) is 1.43 from January 2020 (previously 1.5). [Remember: NTE pollutant = $CF_{pollutant}$ x Euro 6 limit value].

For reporting (App. 8) strict rules are prescribed and the manufacturers of PEMS equipment offer an appropriate protocol. Examples see: annex A2 – Horiba report for RDE3 and annex A3 – Horiba report for RDE4.
The institutions, which perform the tests and/or grant the type approval (OEM, GTAA) are obliged to provide data for the public information on internet.

Great importance was attached to the in-service-conformity (ISC) testing and reporting (article 9). The responsibility for ISC is shifted to granting type approval authorities (GTAA's), external specialized laboratories or technical services. Some additional information about ISC and fuel consumption indication is given in annex A4, [3].
Further useful links about PEMS/RDE [4-7] are given in the references in the chapter 9.

4. TESTING MATERIAL, MEANS AND METHODS

4.1 Test vehicles, fuels and lubricants

The results from two vehicles V1 (Gasoline Euro 5) and V2 (Diesel Euro 6) were used for the exemplary evaluations according to the packages RDE3 and RDE4.

The most important data of these vehicles are listed in the table1.

Name	Type		Model	Fuel		EATS	Displ.	Power	Odometer
-	-		Year	-	-	-	ccm	kW	km
V1	LDV	PC	2012	Gasoline	Euro 5a	3WC	1.596	132	36'637
V2	LDV	PC	2017	Diesel	Euro 6b	DPF+SCR	1.968	110	31'208

Table 1: Data of the vehicles used for the comparison tests.

All vehicles were operated with the Swiss market fuels and with the lubricating oils, which actually were present in each vehicle.

4.2 Test methods and instrumentation

4.2.1. Chassis dynamometer and standard test equipment

- roller dynamometer: AFHB GSA 200
- roller diameter: 502 mm
- driver conductor system: Tornado, version 3.3
- CVS dilution system: Control Sistem R03-700 with roots blower
- air conditioning in the hall automatic for intake- and dilution air
  temperature: 20 ÷ 30°C
  humidity: 5.5 – 12.2. g/kg

4.2.2. Test equipment for regulated exhaust gas emissions
(data not used in present report)

This equipment fulfils the requirements of the Swiss and European exhaust gas legislation.

- regulated gaseous components:
  exhaust gas measuring system Horiba MEXA-7100
  CO, CO_2… infrared analysers (IR)
  HCFID... flame ionisation detector for total hydrocarbons
  CH_4FID... flame ionisation detector with catalyst for only CH_4
  NO/NO_x... chemiluminescence analyser (CLA)

The dilution ratio DF in the CVS-dilution tunnel is variable and can be controlled by means of the CO_2-analysis.

4.2.3. PEMS

Most important data of the used Horiba GasPEMS are given in the table 2.

	Gas PEMS
	
Instruments	**Horiba PEMS OBS-ONE**
Exhaust concentrations	CO_2, CO, NO_x, NO_2
Measurement principle	heated NDIR*, CLD, heated line
Engine parameters	OBD
Vehicle speed & position	GPS
Exhaust flow	EFM
Ambient parameters	p, T, H
Electrical power	> 300 W (> 800 W with FID and PN)
Dimensions	500 x 500 x 500 mm + Pitot tube + heated line + batteries

* OBS one: H_2O is monitored to compensate the H_2O interference on CO and CO_2 sample cell heated to 60°C.

Table 2: Data of the applied GasPEMS

4.2.4. PN PEMS

For measurements of nanoparticles, a portable system named Horiba OBS-ONE-PN PEMS working on CPC-principle was used. For further information of the manufacturer, see annex A5.

4.3 Test procedures

The vehicles were tested on a chassis dynamometer in a WLTC cycle. The driving resistances were set for a horizontal road, according to the legal directive.
The RDE part of testing was performed on the road in real driving conditions. An example of a road trip for RDE is given in annexes A2-3 and A3-3.

The use of WLTC data in the RDE4 evaluation protocol can be found in annex A3-6 for the CO_2 characteristic curve and for the MAW normality check of the trip. In annexes A3-10 & A3-11, the CO_2-values from WLTC and the RF-factor are recorded.

5 RESULTS

Comparisons of RDE results obtained from two vehicles – V1 (Gasoline, Euro 5) and V2 (Diesel, Euro 6) – are represented in Fig. 2 for the urban part and in Fig. 3 for the entire route. The PEMS-results are evaluated according to three methods: integral average, RDE3 and RDE4.

For V1, there are two repetitions with quite a different CO-emission level. Nevertheless, the average NO_x- and PN-levels are similar in the urban part (Fig. 2). The second repetition with lower CO has in the entire route (Fig. 3) slightly higher NO_x and PN. The reasons for these emission differences can be the phases of driving with a cooler TWC, due to lower driving energy in the repetition #2. The different evaluation methods show that the emission results obtained with RDE4 are very close to the integral average results, while the results from RDE3 deviate more from the average level.

The vehicle V2 is equipped with DPF and the PN-emissions are not visible in the represented scale. In this case, the evaluation method makes no difference for PN. For the other components: CO & NO_x of the vehicle V2 can be remarked that the evaluation method of RDE4 yields similar results as the integral average method.

6 CONCLUSIONS

After the performed evaluation of PEMS-RDE-results with three methods, it can be stated that the results obtained with the RDE evaluation package are very similar to the integral average results.
For the Diesel vehicle equipped with DPF the PN-values are very low and the evaluation methods are not relevant for PN.

7 LISTE OF FIGURES

Figures in attachment

8 ANNEXES

9 REFERENCES

[1] Commission Regulation (EU) 2017/1151 of June 1st, 2017, supplementing regulation (EC) No 715/2007; http://data.europa.eu/eli/reg/2017/1151/2020-01-25
[2] Schöggl, M.: EU-update draft RDE package 4. AVL Emission TechDay 2018, April 6th, 2018.
[3] Changes to the motor vehicle type-approval system in the European Union. Policy update ICCT- May 2018. www.theicct.org
[4] PEMS Guidance document : http://skp.jrc.cec.eu.int/skp/showPub?id=JRC109812

[5] 2017 PEMS uncertainty assessment:
http://publications.jrc.ec.europa.eu/repository/bitstream/JRC109841/kjna29138enn.pdf
[6] Questions and Answers on RDE:
https://circabc.europa.eu/sd/a/7e0496c2-67fb-4468-9755-dfd93917d38a/Q%26A%20RDE%20vs2.pdf
[7] EMROAD tool and exchange sample files:
https://circabc.europa.eu/ui/group/f4243c55-615c-4b70-a4c8-1254b5eebf61/library/79a4a9b6-4003-4e02-956d-048dcef1a169

10 ABBREVIATIONS

AFHB	Abgasprüfstelle FH Biel, CH
AGR	Abgasrückführung
CF	conformity factor
CLD	Chemiluminescence Detector
CPC	condensation particles counter
CVS	Constant Volume Sampler
DC	diffusion charging
DI	Direct Injection
DOC	Diesel Oxidation Catalyst
DPF	Diesel Particle Filter
EAER	equivalent all-electric range
EATS	exhaust aftertreatment system
ECU	Engine Control Unit
EFM	Exhaust Flow Meter
EU	European Union
FCHV	fuel cell hybrid vehicle
FCV	fuel cell vehicle
FID	Flame Ionization Detector
FOEN	Federal Office of Environment, CH
GPF	Gasoline particulate filter
GPS	Global Positioning System
GTAA	Granting Type Approval Authority
HD	Heavy Duty (utility vehicle)
HDV	Heavy Duty Vehicles
HEV	Hybrid Electric Vehicle
HV	hybrid vehicle
ICE	Internal Combustion Engine
ISC	in-service-conformity
LD	Light Duty (passenger car)
LDV	Light Duty Vehicles
MAW	Moving Average Window
NCEM	NTK Compact Emissions Meter
NDIR	Non-Dispersive Infrared
NM3	NanoMet3
NOVC	not off-vehicle charging
NTE	Not-to-exceed
OBD	On Board Diagnosis
OBS	Horiba on board system
OEM	original equipment manufacturer

OVC	off-vehicle charging
PC	passenger car
PEMS	Portable Emissions Measurement System
PEV	pure electric vehicle
PFI	port fuel injection
PMP	Particle Measuring Program of ECE GRPE
PN	Particle Number
R^2	coefficient of determination
RDE	Real Driving Emissions
ResRDE	research of RDE
RPA	Relative Positive Acceleration
SCR	Selective Catalytic Reduction
TP	tailpipe
TPA	Tailpipe Attachment
TWC	Three-way catalyst
V	vehicle
WHTC	World Heavy-Duty Transient Cycle
WLTC	World Light-Duty Transient Cycle
WP	working package
WWH-OBD	Worldwide Harmonized On-Board Diagnostics

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BAFU contract nbr.: 19.0106.PJ / S081-0349, 3rd report, WP2

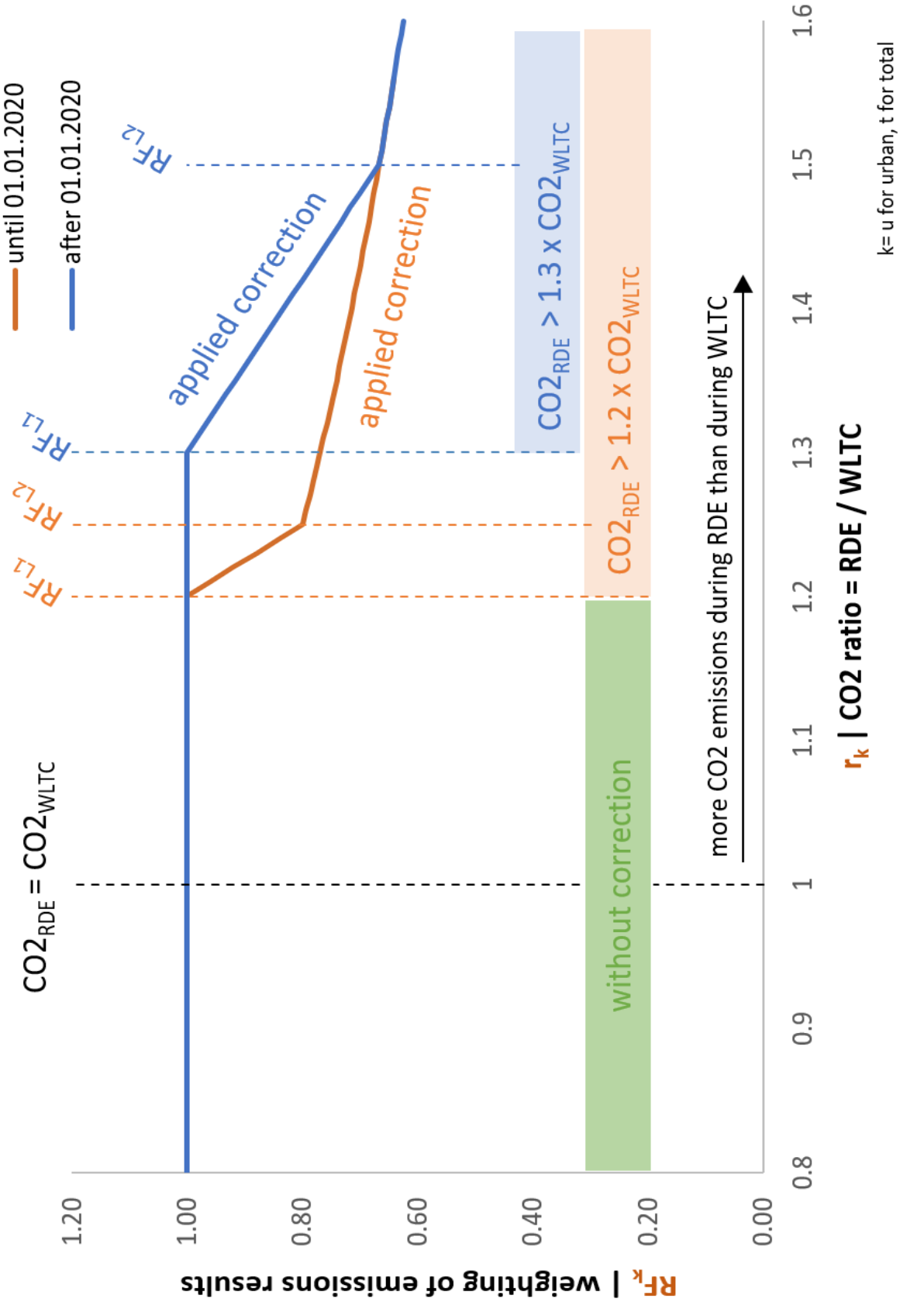
Figures

August 2020 R006

*) Abbreviations see at the end of report

On-Road Measurements

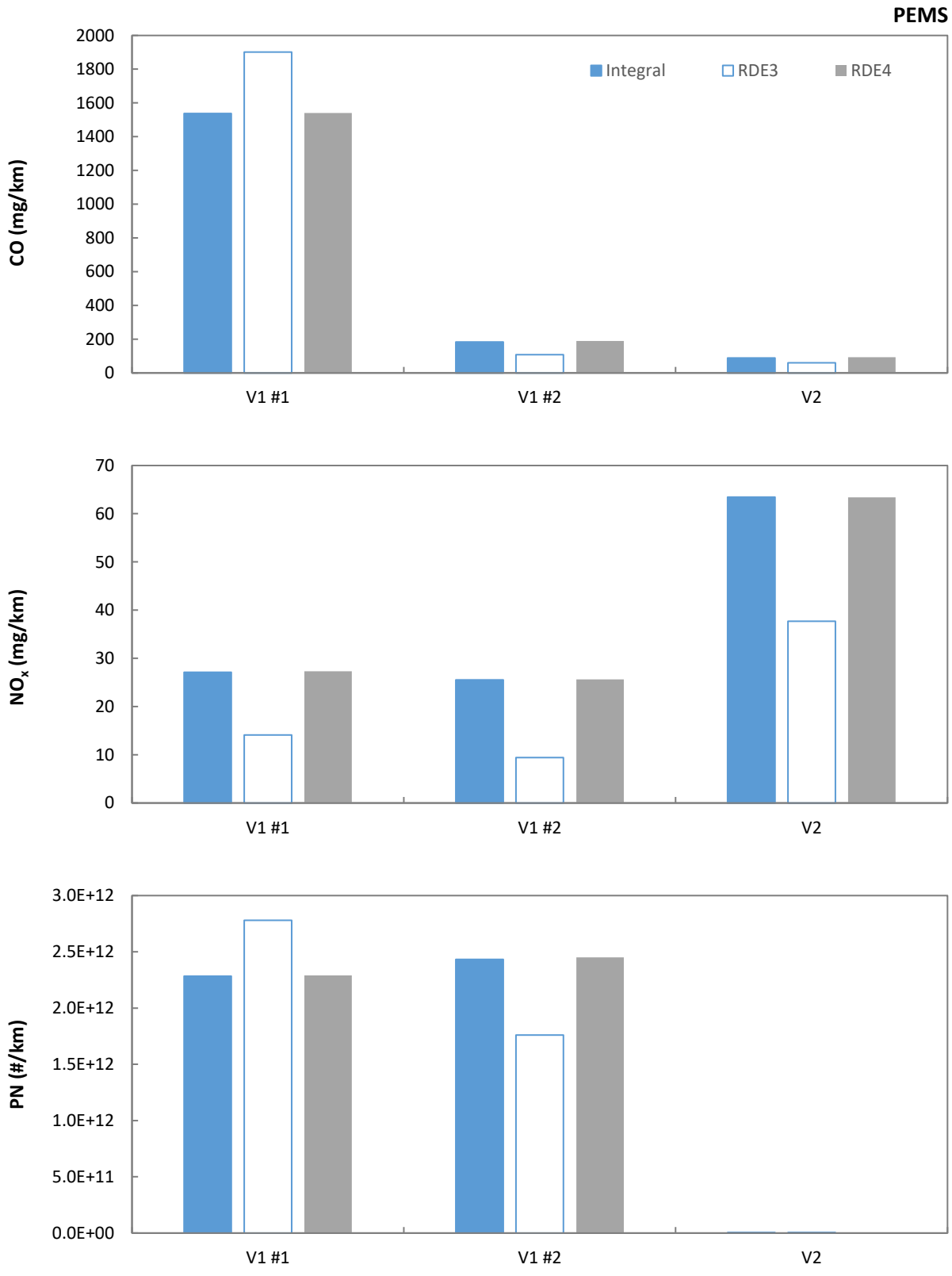
RDE Results Evaluation Factors (RF_k) vs. CO_2 Ratio (r_k) Before and After January 2020



On-Road Measurements

Comparison of Integral, RDE3 (MAW) & RDE4 Values
RDE - Urban Part

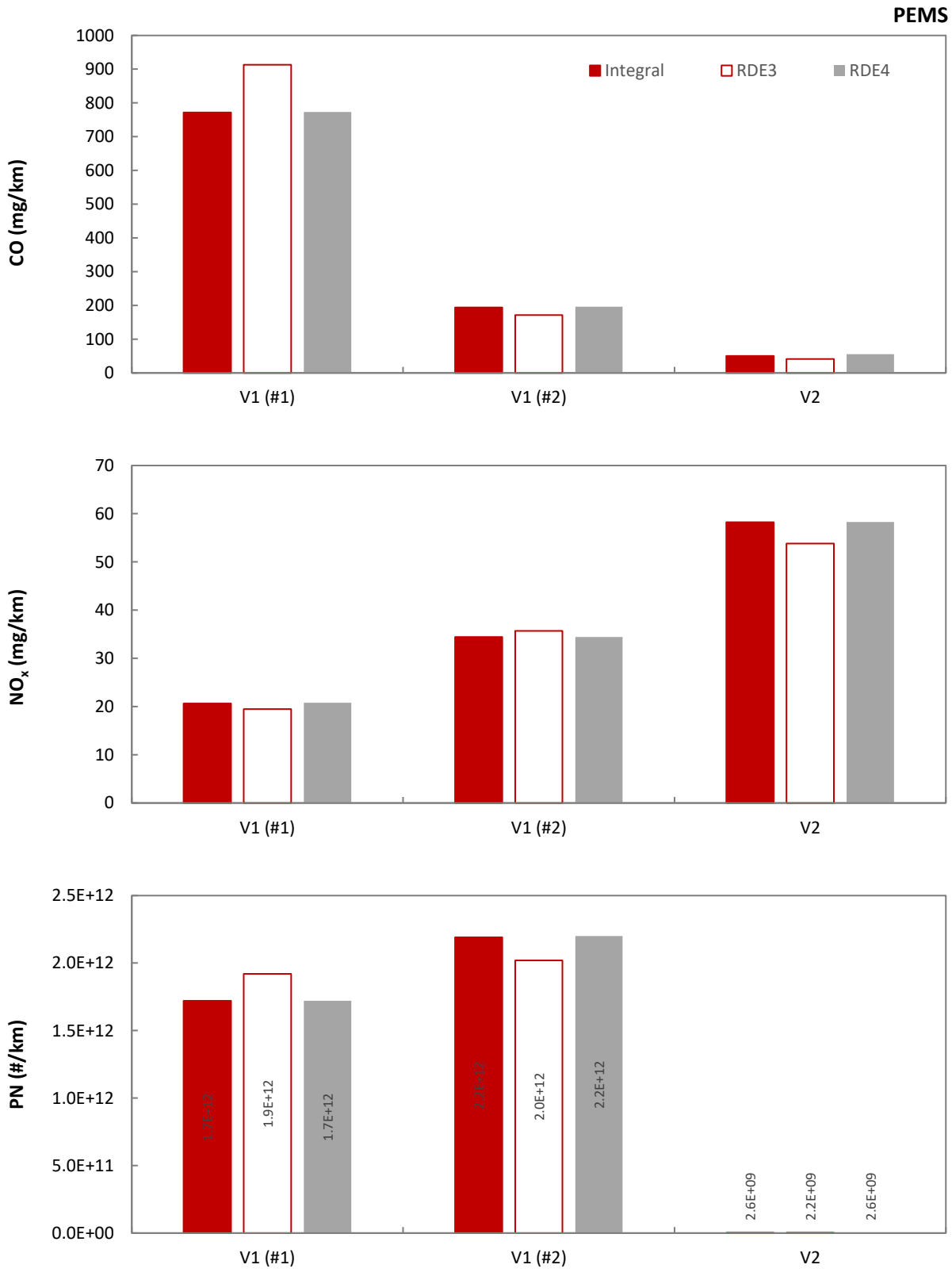
V1 (Gasoline, Euro 5), V2 (Diesel, Euro 6)



On-Road Measurements

Comparison of Integral, RDE3 (MAW) & RDE4 Values
RDE - Total Route

V1 (Gasoline, Euro 5), V2 (Diesel, Euro 6)



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Annexes

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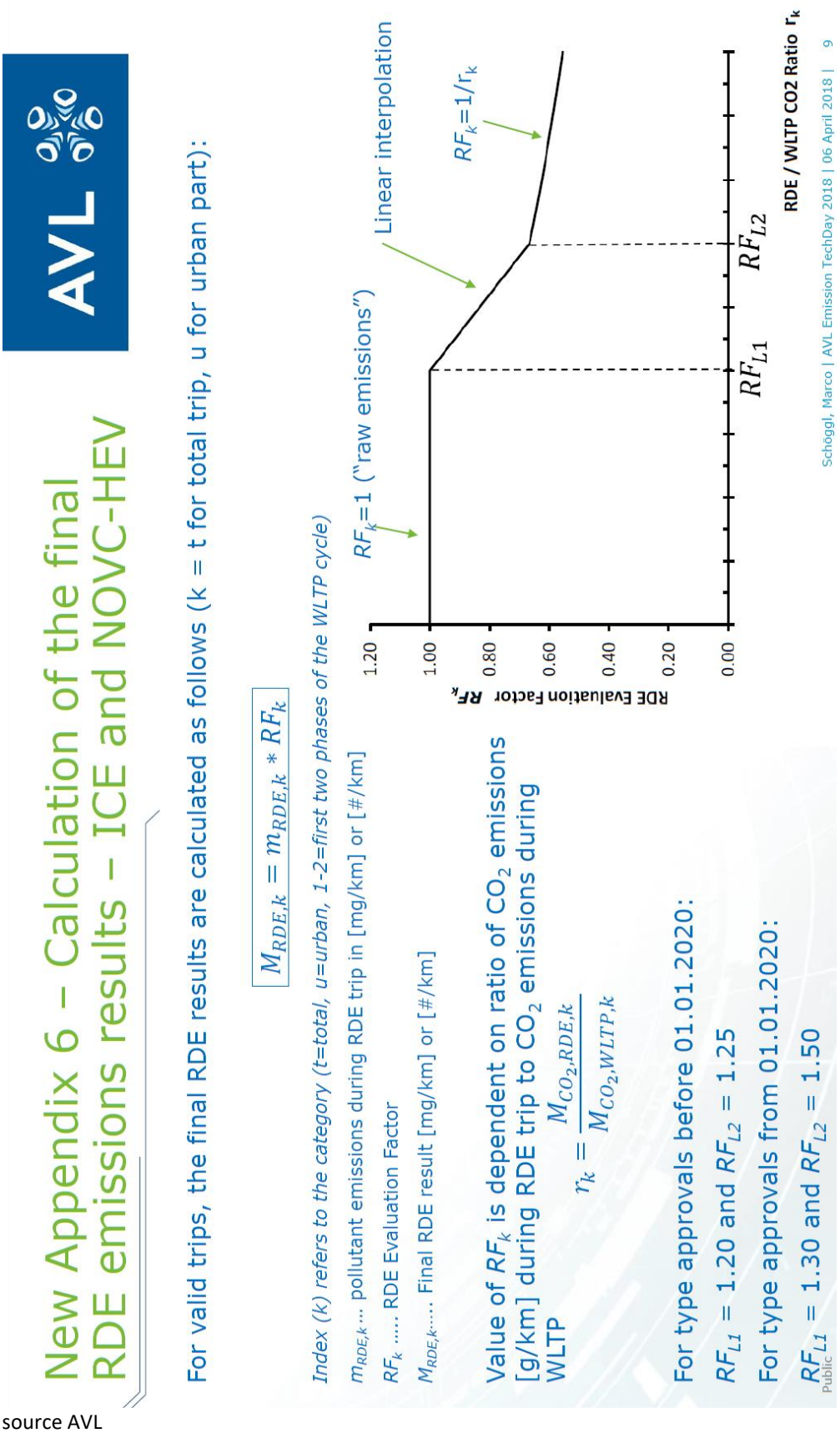
*) Abbreviations see at the end of report

RDE4 New Appendix G – Calculation of the final RDE emissions results

(NOVC-HEV: not off-vehicle charging hybrid electric vehicle)



source AVL

RDE4 New Appendix G – Calculation of the final RDE emissions results

(OVC-HEV: off-vehicle charging hybrid electric vehicle)

source AVL

New Appendix 6 – Calculation of the final RDE emissions results – OVC-HEV

For valid trips, the final RDE results are calculated as follows (k = t for total trip, u for urban part):

$$M_{RDE,k} = m_{RDE,k} * RF_k$$

Index (k) refers to the category (t=total, u=urban, 1-2=first two phases of the WLTP cycle)

$m_{RDE,k}$... pollutant emissions during RDE trip in [mg/km] or [#/km]

RF_k ..... RDE Evaluation Factor

$M_{RDE,k}$..... Final RDE result [mg/km] or [#/km]

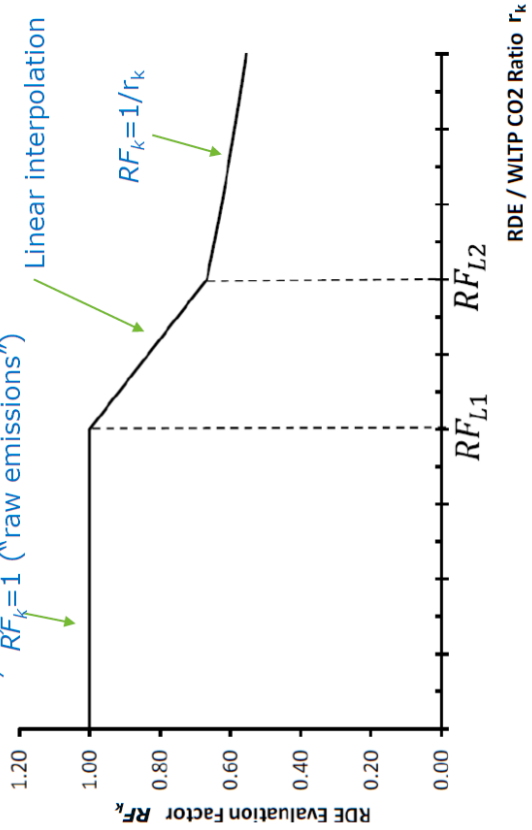
Value of RF_k is dependent on ratio of CO_2 emissions [g/km] during RDE trip to CO_2 emissions during WLTP (charge sustaining mode)

$$r_u = \frac{M_{CO_2,RDE,u}}{M_{CO_2,WLTP-CS,1-2}} * \frac{0.70}{IC_u} \qquad r_t = \frac{M_{CO_2,RDE,t}}{M_{CO_2,WLTP-CS,t}} * \frac{0.85}{IC_t}$$

$$IC_k = \frac{d_{ICE,k}}{d_{ICE,k} + d_{EV,k}}$$

$d_{ICE,k}$... Distance driven [km] with ICE on for OVC-HEV during RDE

$d_{EV,k}$ ... Distance driven [km] with ICE off for OVC-HEV during RDE



For type approvals before 01.01.2020: RF_{L1} = 1.20 and RF_{L2} = 1.25
For type approvals from 01.01.2020: RF_{L1} = 1.30 and RF_{L2} = 1.50

Public

HORIBA
Automotive Test Systems

Test Information Report

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Test Information

Vehicle

Vehicle ID	
Engine ID	
Vehicle Age [months]	0
Vehicle Condition	Cold Start
Drive Mode	Eco
Disable Safety System	None
Idle Stop Function	ON
Air Conditioner	ON
Vehicle Test Mass [kg]	0
Starting Odometer [km]	31208
Ending Odometer [km]	31304
Max. Soak Temp. [degC]	0.0
Min. Soak Temp. [degC]	0.0
Last 3h Temp.	Moderate
Tire Pressure (Front) [kPa]	0.00
Tire Pressure (Rear) [kPa]	0.00
Tire Tread Depth (Front) [mm]	0.00
Tire Tread Depth (Rear) [mm]	0.00
Bodywork Type	StationWagon
Wheel Drive Mode	FR
DeNOx System	N
Catalytic Converter Type	Y
Particulate Trap Type	Y
Manufacturer	VW
Model Year	2017
Vehicle Payload [kg]	515.00
Front Tire Size	205/60 R 16
Rear Tire Size	
Transmission	Automatic
Number of Gears	6

Engine

Family	5
Fuel Type	Diesel
Fuel Supply System	DI
Ignition Type	DI
Combustion Efficiency [%]	0.00
Model	TOURAN TDI 2.0
Model Year	2017
Engine Displacement [L]	1.968
Number of Cylinders	4
Engine Rated Power [kW]	110
Engine Peak Torque [Nm]	0
Idle Speed [rpm]	850
Min. BSFC [g/kWh]	0
Motor Power [kW]	0

Fuel

Fuel Name	Diesel
Fuel Type	Diesel
	Euro6_Diesel_B7
Fuel Used	Market

Power Correction Factor

Torque (Reference Fuel / Market Fuel)	1.000000

Analyzer

PEMS Manufacturer	HORIBA, Ltd.
PEMS Serial Number	BRV11F0G
PEMS Type	OBS-ONE
PEMS Power Supply	Lead
GA Manufacturer	HORIBA, Ltd.
GA Serial Number	BRV11F0G
GA Analyzer Type	NDIR(CO/CO2), CLD(NO/NOx), FID(THC/CH4)
PN Manufacturer	HORIBA, Ltd.
PN Serial Number	
PN Analyzer Type	CPC
PM Manufacturer	HORIBA, Ltd.
PM Serial Number	
PM Analyzer Type	Filter Gravimetric Method, Diffusion Charging Method
PM Filter ID	
EFM Manufacturer	HORIBA, Ltd.
EFM Sensor Type	Pitot Tube
EFM Tube Data 1	Type BL - 160109BL
EFM Tube Data 2	

HORIBA
Automotive Test Systems

Emission Report

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Emission

	Total Mass	Unit	Mass / Distance	Unit	Mass / Work	Unit	Conc. Max.	Conc. Ave.	Unit
CO	4.824	g	0.05034	g/km	---	g/kWh	0.8112	0.003422	vol%
CO2	1.352E4	g	141.1	g/km	---	g/kWh	13.50	5.737	vol%
THC	0.2111	g	0.002203	g/km	---	g/kWh	170.4	4.203	ppmC
CH4	-0.03818	g	-3.984E-4	g/km	---	g/kWh	150.4	0.2103	ppmC
NMHC	0.2486	g	0.002594	g/km	---	g/kWh	88.59	3.966	ppmC
NO (*1)	5.459	g	0.05696	g/km	---	g/kWh	625.6	15.95	ppm
NO2 (*2)	0.1224	g	0.001278	g/km	---	g/kWh	19.90	0.4519	ppm
NOx	5.581	g	0.05824	g/km	---	g/kWh	608.8	16.40	ppm
NOxCorre	—	g	---	g/km	---	g/kWh	---	—	ppm
PM	—	g	---	g/km	---	g/kWh	— (*3)	— (*3)	mm/cm3
PN	2.44E11	#	2.55E9	#/km	---	#/kWh	4.71E5 (*3)	2.63E3 (*3)	#/cm3

Fuel Economy	5.4	L/100km

(*1) : NO mass is calculated with u_gas of NOx.
(*2) : NO2 mass is subtracted NO mass from NOx mass.
NO and NOx mass are calculated with u_gas of NOx.
(*3) : at 0degC

Trip Summary

	Max.	Ave.	Unit
Vehicle Speed (GPS)	124.7	48.1	km/h
Eng. Speed	2647	1245	rpm
Eng. Torque	---	---	Nm
Eng. Power	0.0	0.0	kW

Total Distance	95.833	km
Total Work	0.000	kWh

Total Trip Duration	1:59:34	h:min:s
Stop Duration	11:57	min:s
Number of Stop	21	#
Trip Maximum Speed	124.71	km/h
Min. Coolant Temp	273.2	K
Max. Coolant Temp	366.2	K

Trip Condition

	Min.	Max.	Ave.	Unit
Temperature	287.8	298.8	289.7	K
R.H.	33.8	80.5	65.4	%
Pressure	95.1	96.5	96.1	kPa
Altitude	424.9	544.1	463.4	m

HORIBA
Automotive Test Systems

Positive Elevation Gain Report

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

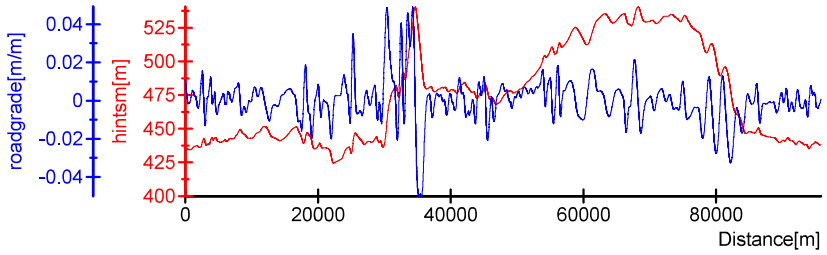
Result

		Value	Unit
Cumulative Positive Elevation Gain		377.2	m/100km
Cumulative Positive Elevation Gain (Urban)		512.0	m/100km
Difference at the start (GPS, MAP)		1.8	m

Summary

	Value	Unit
Cumulative Positive Elevation	361.5	m
Cumulative Positive Elevation (Urban)	203.6	m
Cumulative Elevation	4.9	m
Cumulative Elevation (Urban)	102.6	m
Start Altitude	433.0	m
End Altitude	440.0	m
Max Altitude	544.1	m
Min Altitude	424.9	m
Total Distance	95.8	km
Total Distance (Urban)	39.8	km
Cumulative Distance on Corrected Interval	1.7	km

Interpolated Data



HORIBA
Automotive Test Systems

Drift Check Report

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Drift Check Result

Zero

	Unit	Pre	Post	Abs. Diff.	Criteria	Judge
CO	ppm	-2.41	-13.65	11.24	≦ 75	PASS
CO2	ppm	-45.23	-77.60	32.38	≦ 2000	PASS
NO	ppm	0.10	0.09	0.01	—	—
NOx	ppm	0.20	-0.37	0.57	≦ 5	PASS
THC	ppmC	-0.14	-0.85	0.70	≦ 10	PASS
CH4	ppmC	-0.59	-2.64	2.05	≦ 10	PASS

Span

	Unit	Pre	Post	Abs. Diff.	Criteria	Judge	Abs. %RS	Criteria	Judge	Overall
CO	ppm	5015.28	5002.97	12.31	≦ 75	PASS	0.25 %	≦ 2 %	PASS	PASS
CO2	ppm	120965.10	120991.30	26.20	≦ 2000	PASS	0.02 %	≦ 2 %	PASS	PASS
NO	ppm	1498.74	1505.21	6.48	—	—	0.43 %	—	--	—
NOx	ppm	1498.71	1496.72	1.99	≦ 5	PASS	0.13 %	≦ 2 %	PASS	PASS
THC	ppmC	359.43	358.79	0.64	≦ 10	PASS	0.18 %	≦ 2 %	PASS	PASS
CH4	ppmC	359.00	357.10	1.90	≦ 10	PASS	0.53 %	≦ 2 %	PASS	PASS

HORIBA
Automotive Test Systems

Event Report （1）

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

No.	Date and time	Status	Message
1	2020/06/09 15:28:30.596	Information	Test : Start
2	2020/06/09 15:28:30.660	Information	Test : Initialize Start
3	2020/06/09 15:28:43.086	Information	Phase 0: CAL Start
4	2020/06/09 15:37:11.676	Information	Phase 0: CAL Finished
5	2020/06/09 15:37:11.681	Information	Test : Initialize Finished
6	2020/06/09 15:46:17.115	Information	Phase 1: Sampling Start
7	2020/06/09 17:45:57.587	Information	Phase 1: Sampling Finished
8	2020/06/09 17:51:42.419	Information	Phase 1: Drift Check Start
9	2020/06/09 18:01:11.047	Information	Phase 1: Drift Check Finished
10	2020/06/09 18:01:28.883	Information	Test : Save Result Started

OBS-ONE Post Processing v3.1.0

Template ID : Event_ENG.TDR

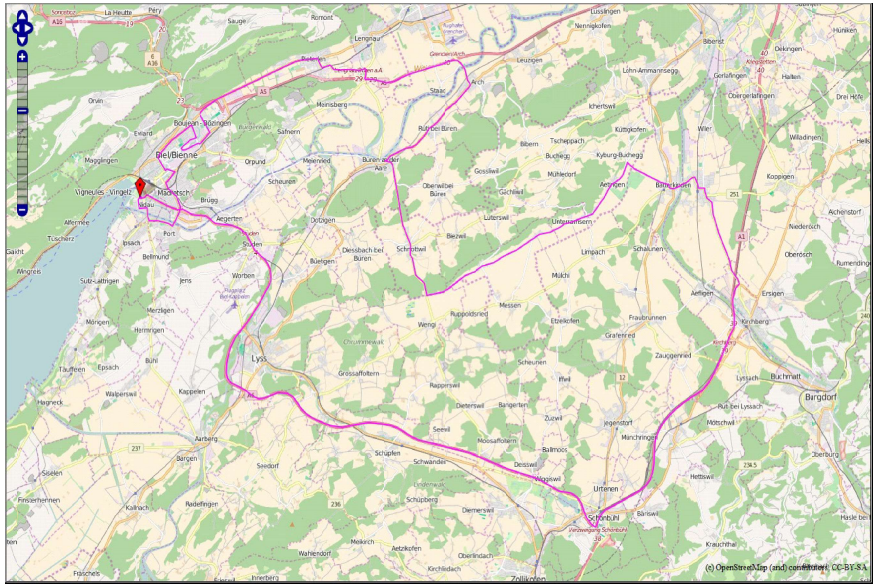
Report ID : 20200713221212_G

HORIBA
Automotive Test Systems

Driving Report

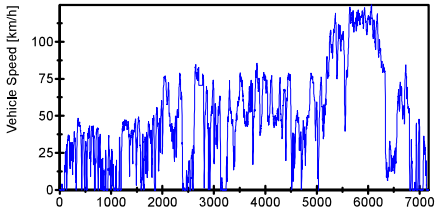
Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Map



Trip

	Value	Unit
Total Trip Distance	95.833	km
Total Trip Duration	1:59:34	h:min:s
Trip Average Speed	48.1	km/h



OBS-ONE Post Processing v3.1.0

Template ID : Driving_ENG.TDR

Report ID : 20200713221212_B

HORIBA
Automotive Test Systems

EU-LDV 3rd

Window (LDV CO2) Report

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Test Completeness

		Urban		Rural		Motorway	Unit
Window	-	1704	-	3506	-	812	#
Ratio		28.3		58.2	*	13.5	%
Criteria	-	15.0	-	15.0	-	15.0	%

Result
FAIL

Test Normality

		Urban		Rural		Motorway	Unit
Primary Number	-	1704	-	3359	-	453	#
Primary Rate		100.0		95.8		55.8	%

Result
PASS

	Lower	Upper	Unit
Primary Tolerance	25.0	25.0	%

NTE Result

		Urban	Rural	Motorway		Total	Unit	Unified	Mgas / Emission Limit Urban	Mgas / Emission Limit Total
CO	-	60.3	43.1	21.0	-	41.7	mg/km	-	0.12	0.08
THC	-	4.1	1.1	0.7	-	2.0	mg/km	-	---	---
NMHC	-	3.0	2.1	2.0	-	2.4	mg/km	-	---	---
CH4	-	1.2	-1.0	-1.3	-	-0.4	mg/km	-	---	---
NOx		37.7	61.2	63.0		53.8	mg/km	PASS	0.47	0.67
PN		3.65E9	1.98E9	8.90E8		2.19E9	#/km	PASS	0.01	0.00

	Urban	Rural	Motorway	Unit
hk	-14.0	-5.8	-24.9	%
ht	-14.9	%		

HORIBA
Automotive Test Systems

EU-LDV 3rd

Trip Composition (LDV CO2) Report

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

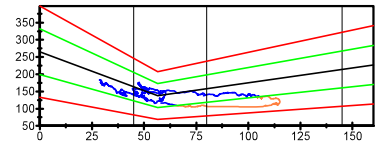
Trip

		Ave. Speed	Unit		Distance	Unit		Distance Ratio	Unit
Urban		29.5	km/h		39.8	km		41.5	%
Rural	-	72.9	km/h		28.9	km		30.2	%
Motorway	-	109.3	km/h		27.1	km		28.3	%
Total				-	95.8	km			

Max. Speed		124.7	km/h

		Positive Acceleration	Unit		v・apos_95	Unit		RPA	Unit
Urban		1826	#		7.9	m2/s3		0.1615	m/s2
Rural		492	#		11.6	m2/s3		0.0958	m/s2
Motorway		324	#		12.1	m2/s3		0.0839	m/s2

		Duration	Unit
Urban	-	80:50	min:s
Rural	-	23:50	min:s
Motorway	-	14:54	min:s
Total	-	119:34	min:s



Characteristic_Speed_Curve[km/h]

Stop

	Duration	Unit			Unit
Stop Time	11:57	min:s	Stop Time Share		14.8	%
—	---	—	Number of Stop	-	21	#
—	---	—	Longest Stop Time		72	s

Motorway

		Value	Unit
Over Min. Speed Time		12:18	min:s
Excess Speed Time	-	0:00	min:s
Excess Speed Time Ratio		0.0	%

Ambient Conditions

		Value	Unit
Maximum Altitude		544.1	m
Difference Altitude (Start, End)		7.0	m
Minimum Temperature		287.8	K
Maximum Temperature		298.8	K

OBS-ONE Post Processing v3.1.0

Template ID : EU-LDV 3rd WindowLDVCO2_3rd_ENG.TDR

Report ID : 20200713221238_A

HORIBA
Automotive Test Systems

EU-LDV 3rd

Trip Composition (LDV CO2) Report

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Cold Start

		Value	Unit
Duration	-	300.0	s
Duration (Engine on)	-	300.0	s
First Idling Duration		4.0	s
Stop Duration		11.0	s
Average Speed		27.30	km/h
Maximum Speed		48.40	km/h

GPS

		Value	Unit
GPS Total Trip Distance	-	95.8	km
Reference Total Trip Distance	-	95.8	km
Abs. Total Trip Distance Deviation		0.1	%
GPS Invalid Longest Time		74.0	s
GPS Invalid Total Time		89.0	s

HORIBA
Automotive Test Systems

Parameter Report (Emission) (1)

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Basic Calc. Parameter

Pitot Parameter		Data Correction	
Tube Data 1		Drift Correction	OFF
Pitot Type & Serial No	Type BL - 160109BL	Time Alignment	OFF
Tube Data 2		Gain & Offset	OFF
Pitot Type & Serial No	—	Band Filtering	OFF
Exhaust Parameter		Hangup Correction Parameter	OFF
H/C	1.850	Used Type	—
O/C	0.000	Value	—
S/C	0.000	Dry<->Wet Convert	Inactive
N/C	0.000	Humidity Correction Parameter	
Density [kg/m3] (at 0 degC)	1.2943	NOx	OFF
Fuel Parameter		Combustion System	—
H/C	1.850	Data Source	
O/C	0.000	Sampling Rate	1Hz
S/C	0.000	OBD Protocol	ISO15765_4_11
N/C	0.000	Exhaust Flow	PF_ExhaustFlowRate
Fuel Mass Fraction [g/g]	0.866	Calc. Type	
Density [kg/L] at 15 degC	0.8300	Mass Calculation Method	Density
Lower Heating Value [kJ/kg]	431000.00	Exhaust Mass Flow Rate	
Ambient Air			From Exhaust Volume Flow Rate
Density [kg/m3] (at 0 degC)	1.2930	Power	FromEnergy
Engine Parameter		Engine Reference Torque	
Combustion Efficiency [%]	0.00		—
PM Parameter		Work	FromEnergy
Conversion Factor [---]	—	Position Information	
Tare Weight [mg]	0.0000	Altitude	GPS_Altitude
Loaded Weight [mg]	0.0000	Latitude	GPS_Latitude
Device Delay Time		Longitude	GPS_Longitude
MEXA Transformation Time [s]	6.1	Signal Type	GPS
PTFM Transformation Time [s]	0.2	Vehicle Speed	
PFPM Transformation Time [s]	0.0	Speed Channel	GPS_VehicleSpeed
PFPN Transformation Time [s]	5.0	Signal Type	GPS

HORIBA
Automotive Test Systems

Parameter Report (Emission) (2)

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Basic Calc. Parameter

Linear Interpolation

Vehicle Speed

Correction	Active
Signal Status Channel	
MeasData_1Hz/GPS_GPSStatus	

Position Data

Correction	Active
Signal Status Channel	
MeasData_1Hz/GPS_GPSStatus	

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Automotive Test Systems

EU-LDV 3rd

Parameter Report (MAW LDV CO2)

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Window Method Parameter

Package	3rd
Reference Quantity	
CO2 [g]	3522.10
Low Speed CO2 [g/km]	185.60
High Speed CO2 [g/km]	125.60
Ex-High Speed CO2 [g/km]	160.90
Criteria	Regulation
Evaluation of Trip	
Urban [%]	15.00
Rural [%]	15.00
Motorway [%]	15.00
CO2 Characteristic Curve	
Primary Tolerance [%]	25.00
Secondary Tolerance [%]	50.00
Speed Threshold	
Urban Max. Speed [km/h]	45.00
Rural Max. Speed [km/h]	80.00
Motorway Max. Speed [km/h]	145.00
All Window Valid Ratio [%]	50
CF Limit	
Use Temporary CF	OFF
CO	—
THC	—
NMHC	—
CH4	—
NOx	1.50
PN	1.50
Emission Limit Setting	
Selected Emission Limit	WLTC-CI-M
CO [mg/km]	500
THC [mg/km]	—
NMHC [mg/km]	—
CH4 [mg/km]	—
NOx [mg/km]	80
PM [mg/km]	4.5
PN [#/km]	6.0E11

Ambient Conditions		
Division of the Extended Area		ON
700	< Altitude <=	1300
-2	<= Temperature <	3
30	< Temperature <=	35
Condition of Trip		Moderate
Pre-condition (3hours average) is Extended		OFF
Cold Start (Not Exclude from Analysis)		
Until Coolant Temp. for the first time [degC]		ON
		70
After Engine Start [min]		ON
		5
Vehicle Stop		
Zero Vehicle Ground Speed [km/h]		ON
		1
Engine Stop (Not Excluded from Analysis)		
Engine Speed [rpm]		ON
		50
Exh. Mass Flow Rate [kg/h]		ON
		3.00
Exh. Mass Flow Rate Drops		ON
Ratio [%]		15
State Exh. Mass Flow Rate [kg/h]		0.00

HORIBA
Automotive Test Systems

EU-LDV 3rd

Trip Parameter Report (MAW LDV)

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Trip Composition Parameter

GPS Consistency Check	
Longest Invalid Time [s]	120
Total Invalid Time [s]	300
Difference of Total Trip Distance [%]	4
Reference Vehicle Speed [km/h]	
MeasData_1Hz/OBD_VehicleSpeed	
Urban Max. Speed [km/h]	60
Rural Max. Speed [km/h]	90
Motorway Min. Speed [km/h]	90
Motorway Max. Speed [km/h]	145
Excess Speed Limit [km/h]	15
Urban Req'd [%]	34
Rural Req'd [%]	33
Motorway Req'd [%]	33
Approximately [%]	10
Urban Req'd Lower [%]	29
Urban Min. Distance [km]	16
Rural Min. Distance [km]	16
Motorway Min. Distance [km]	16
Trip Duration [min]	
90 - 120	
Altitude Channel	
Correction_1/Altitude_Correct	
Difference (Start, End) [m]	100
Dynamics	
T4253 Hanning Filter	
Active (Acceleration Resolution)	
Acceleration Resolution [m/s2]	0.01
Positive Acceleration [m/s2]	0.1
Number of Positive Acceleration	150

v*apos	
Urban [m2/s3]	18.4536
Rural [m2/s3]	24.3494
Motorway [m2/s3]	27.0727
RPA	
Urban [m/s2]	0.1283
Rural [m/s2]	0.0589
Motorway [m/s2]	0.0250
Urban	
Average Speed [km/h]	
15 - 40	
Stop Rate [%]	
6 - 30	
Stop Period Time [s]	10
Longest Stop Time Limit [s]	300
Motorway	
Excess Speed Time Rate [%]	3
Min. Driving Speed [km/h]	100
Min. Driving Time [min]	5
Min. Reach Speed [km/h]	110
Cold Start	
Min. Average Speed [km/h]	15
Max. Average Speed [km/h]	40
Maximum Speed Limit [km/h]	60
First Idling Duration Limit [s]	15
Stop Duration Limit [s]	90

HORIBA
Automotive Test Systems

Test Information Report

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Test Information

Vehicle

Vehicle ID	
Engine ID	
Vehicle Age [months]	0
Vehicle Condition	Cold Start
Drive Mode	Eco
Disable Safety System	None
Idle Stop Function	ON
Air Conditioner	ON
Vehicle Test Mass [kg]	0
Starting Odometer [km]	31208
Ending Odometer [km]	31304
Max. Soak Temp. [degC]	0.0
Min. Soak Temp. [degC]	0.0
Last 3h Temp.	Moderate
Tire Pressure (Front) [kPa]	0.00
Tire Pressure (Rear) [kPa]	0.00
Tire Tread Depth (Front) [mm]	0.00
Tire Tread Depth (Rear) [mm]	0.00
Bodywork Type	StationWagon
Wheel Drive Mode	FR
DeNOx System	N
Catalytic Converter Type	Y
Particulate Trap Type	Y
Manufacturer	VW
Model Year	2017
Vehicle Payload [kg]	515.00
Front Tire Size	205/60 R 16
Rear Tire Size	
Transmission	Automatic
Number of Gears	6

Engine

Family	5
Fuel Type	Diesel
Fuel Supply System	DI
Ignition Type	DI
Combustion Efficiency [%]	0.00
Model	TOURAN TDI 2.0
Model Year	2017
Engine Displacement [L]	1.968
Number of Cylinders	4
Engine Rated Power [kW]	110
Engine Peak Torque [Nm]	0
Idle Speed [rpm]	850
Min. BSFC [g/kWh]	0
Motor Power [kW]	0

Fuel

Fuel Name	Diesel
Fuel Type	Diesel
	Euro6_Diesel_B7
Fuel Used	Market

Power Correction Factor

Torque (Reference Fuel / Market Fuel)	1.000000

Analyzer

PEMS Manufacturer	HORIBA, Ltd.
PEMS Serial Number	BRV11F0G
PEMS Type	OBS-ONE
PEMS Power Supply	Lead
GA Manufacturer	HORIBA, Ltd.
GA Serial Number	BRV11F0G
GA Analyzer Type	NDIR(CO/CO2), CLD(NO/NOx), FID(THC/CH4)
PN Manufacturer	HORIBA, Ltd.
PN Serial Number	
PN Analyzer Type	CPC
PM Manufacturer	HORIBA, Ltd.
PM Serial Number	
PM Analyzer Type	Filter Gravimetric Method, Diffusion Charging Method
PM Filter ID	
EFM Manufacturer	HORIBA, Ltd.
EFM Sensor Type	Pitot Tube
EFM Tube Data 1	Type BL - 160109BL
EFM Tube Data 2	

HORIBA
Automotive Test Systems

Emission Report

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Emission

	Total Mass	Unit	Mass / Distance	Unit	Mass / Work	Unit	Conc. Max.	Conc. Ave.	Unit
CO	4.824	g	0.05034	g/km	---	g/kWh	0.8112	0.003422	vol%
CO2	1.352E4	g	141.1	g/km	---	g/kWh	13.50	5.737	vol%
THC	0.2111	g	0.002203	g/km	---	g/kWh	170.4	4.203	ppmC
CH4	-0.03818	g	-3.984E-4	g/km	---	g/kWh	150.4	0.2103	ppmC
NMHC	0.2486	g	0.002594	g/km	---	g/kWh	88.59	3.966	ppmC
NO (*1)	5.459	g	0.05696	g/km	---	g/kWh	625.6	15.95	ppm
NO2 (*2)	0.1224	g	0.001278	g/km	---	g/kWh	19.90	0.4519	ppm
NOx	5.581	g	0.05824	g/km	---	g/kWh	608.8	16.40	ppm
NOxCorre	—	g	---	g/km	---	g/kWh	---	—	ppm
PM	—	g	---	g/km	---	g/kWh	— (*3)	— (*3)	mm/cm3
PN	2.44E11	#	2.55E9	#/km	---	#/kWh	4.71E5 (*3)	2.63E3 (*3)	#/cm3

Fuel Economy	5.4	L/100km

(*1) : NO mass is calculated with u_gas of NOx.
(*2) : NO2 mass is subtracted NO mass from NOx mass.
NO and NOx mass are calculated with u_gas of NOx.
(*3) : at 0degC

Trip Summary

	Max.	Ave.	Unit
Vehicle Speed (GPS)	124.7	48.1	km/h
Eng. Speed	2647	1245	rpm
Eng. Torque	---	---	Nm
Eng. Power	0.0	0.0	kW

Total Distance	95.833	km
Total Work	0.000	kWh

Total Trip Duration	1:59:34	h:min:s
Stop Duration	11:57	min:s
Number of Stop	—	#
Trip Maximum Speed	124.71	km/h
Min. Coolant Temp	273.2	K
Max. Coolant Temp	366.2	K

Trip Condition

	Min.	Max.	Ave.	Unit
Temperature	287.8	298.8	289.7	K
R.H.	33.8	80.5	65.4	%
Pressure	95.1	96.5	96.1	kPa
Altitude	424.9	544.1	463.4	m

HORIBA
Automotive Test Systems

Drift Check Report

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Drift Check Result

Zero

	Unit	Pre	Post	Abs. Diff.
CO	ppm	-2.41	-13.65	11.24
CO2	ppm	-45.23	-77.60	32.38
NO	ppm	0.10	0.09	0.01
NOx	ppm	0.20	-0.37	0.57
THC	ppmC	-0.14	-0.85	0.70
CH4	ppmC	-0.59	-2.64	2.05

Span

	Unit	Pre	Post	Abs. Diff.	Abs. %RS
CO	ppm	5015.28	5002.97	12.31	0.25 %
CO2	ppm	120965.10	120991.30	26.20	0.02 %
NO	ppm	1498.74	1505.21	6.48	0.43 %
NOx	ppm	1498.71	1496.72	1.99	0.13 %
THC	ppmC	359.43	358.79	0.64	0.18 %
CH4	ppmC	359.00	357.10	1.90	0.53 %

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Automotive Test Systems

Event Report （1）

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

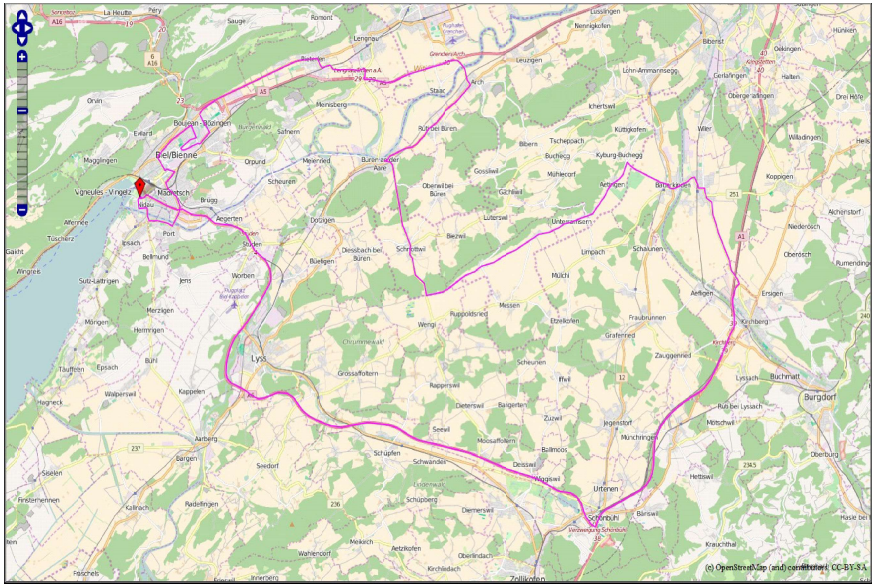
No.	Date and time	Status	Message
1	2020/06/09 15:28:30.596	Information	Test : Start
2	2020/06/09 15:28:30.660	Information	Test : Initialize Start
3	2020/06/09 15:28:43.086	Information	Phase 0: CAL Start
4	2020/06/09 15:37:11.676	Information	Phase 0: CAL Finished
5	2020/06/09 15:37:11.681	Information	Test : Initialize Finished
6	2020/06/09 15:46:17.115	Information	Phase 1: Sampling Start
7	2020/06/09 17:45:57.587	Information	Phase 1: Sampling Finished
8	2020/06/09 17:51:42.419	Information	Phase 1: Drift Check Start
9	2020/06/09 18:01:11.047	Information	Phase 1: Drift Check Finished
10	2020/06/09 18:01:28.883	Information	Test : Save Result Started

HORIBA
Automotive Test Systems

Driving Report

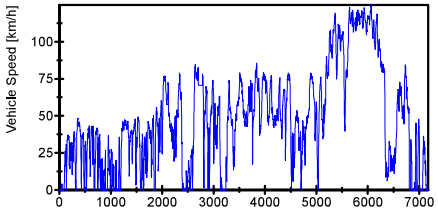
Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Map



Trip

	Value	Unit
Total Trip Distance	95.833	km
Total Trip Duration	1:59:34	h:min:s
Trip Average Speed	48.1	km/h



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Template ID : Driving_ENG.TDR

Report ID : 20200713215820_B

HORIBA
Automotive Test Systems

EU-LDV 4th

RDE Summary Report

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Ambient Conditions

	Unit	Value	Condition
Max. Altitude	m	544.1	Moderate
Min. Temp.	degC	14.6	Moderate
Max. Temp.	degC	25.4	

[ ] : Extended

GPS

	Unit	Value
Total Trip Dist. Deviation	%	0.1
GPS Invalid Longest Time	s	74
GPS Invalid Total Time	s	89

Stop

	Unit	Value
First Idling Duration	s	4
Longest Stop Duration	s	72
Total Stop Duration	s	614
Stop Ratio in Urban	%	13.0

Motorway

	Unit	Value
Maximum Speed	km/h	124.7
Duration (> 100 km/h)	min:s	12:18
Duration Share (> 145 km/h)	%	0.0

Cumulative Positive Elevation Gain (CPE Gain)

	Unit	Value
Altitude Diff. (End - Start)	m	0.6
Altitude Diff. (GPS - MAP)	m	6.0
CPE Gain (Total Trip)	m/100km	375.4
CPE Gain (Urban)	m/100km	509.2

Cold Start

	Unit	Value
Total Stop Duration	s	11
Average Speed	km/h	27.3
Maximum Speed	km/h	48.4

Analyzer Check

	Drift Check		Span Check		
	Zero	Span	99th x0.9	Max. Meas.	> Span
CO	Pass	Pass	118.9 ppm	8112.0 ppm	0.1 %
CO2	Pass	Pass	103255.0 ppm	134962.3 ppm	0.4 %
NOx	Pass	Pass	166.1 ppm	608.8 ppm	0.0 %
NO	—	—	164.9 ppm	625.6 ppm	0.0 %
THC	Pass	Pass	43.4 ppm	170.4 ppm	0.0 %
CH4	Pass	Pass	13.2 ppm	150.4 ppm	0.0 %

Trip Composition

	Unit	Urban	Rural	Motorway
Duration	min:s	78:50	23:50	14:54
Distance	km	39.7	28.9	27.1
Dist. Share	%	41.5	30.2	28.3
Ave. Speed	km/h	30.2	72.9	109.3

Total Duration	min:s	117:34

Dynamics

	Unit	Urban	Rural	Motorway
Positive Count	#	1822	492	324
v*apos_[95]	m2/s3	7.930	11.626	12.141
RPA	m/s2	0.162	0.096	0.084

MAW

	Unit	Urban	Rural	Motorway
Valid Window	%	100.0	97.8	65.1

Final Emission

		w/o Ki		w/ Ki	
	Unit	Urban	Total Trip	Urban	Total Trip
CO	mg/km	93.276	55.910	93.276	55.910
NOx	mg/km	63.390	58.262	63.390	58.262
PN	#/km	5.28E9	2.55E9	5.28E9	2.55E9

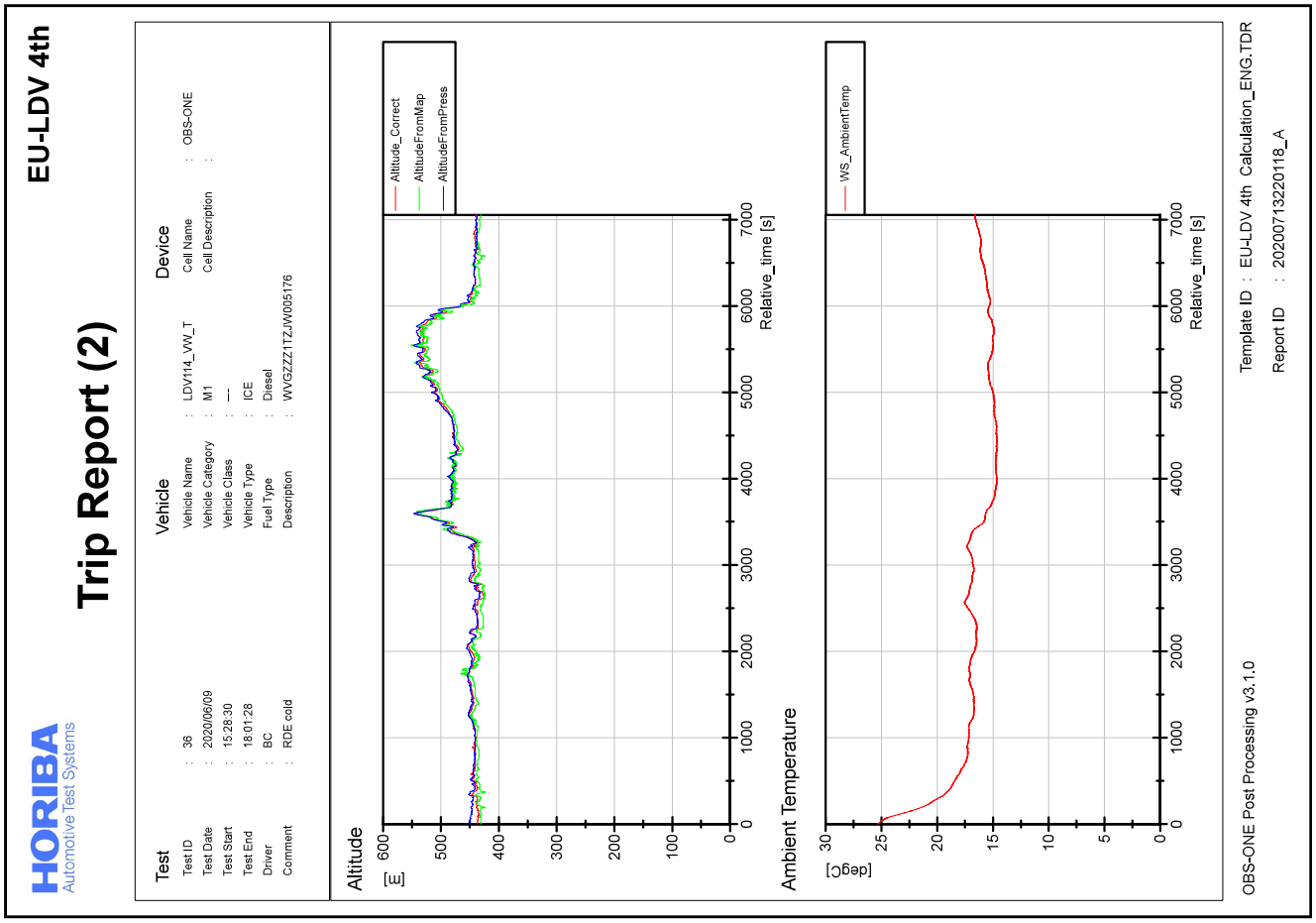
Green : Pass

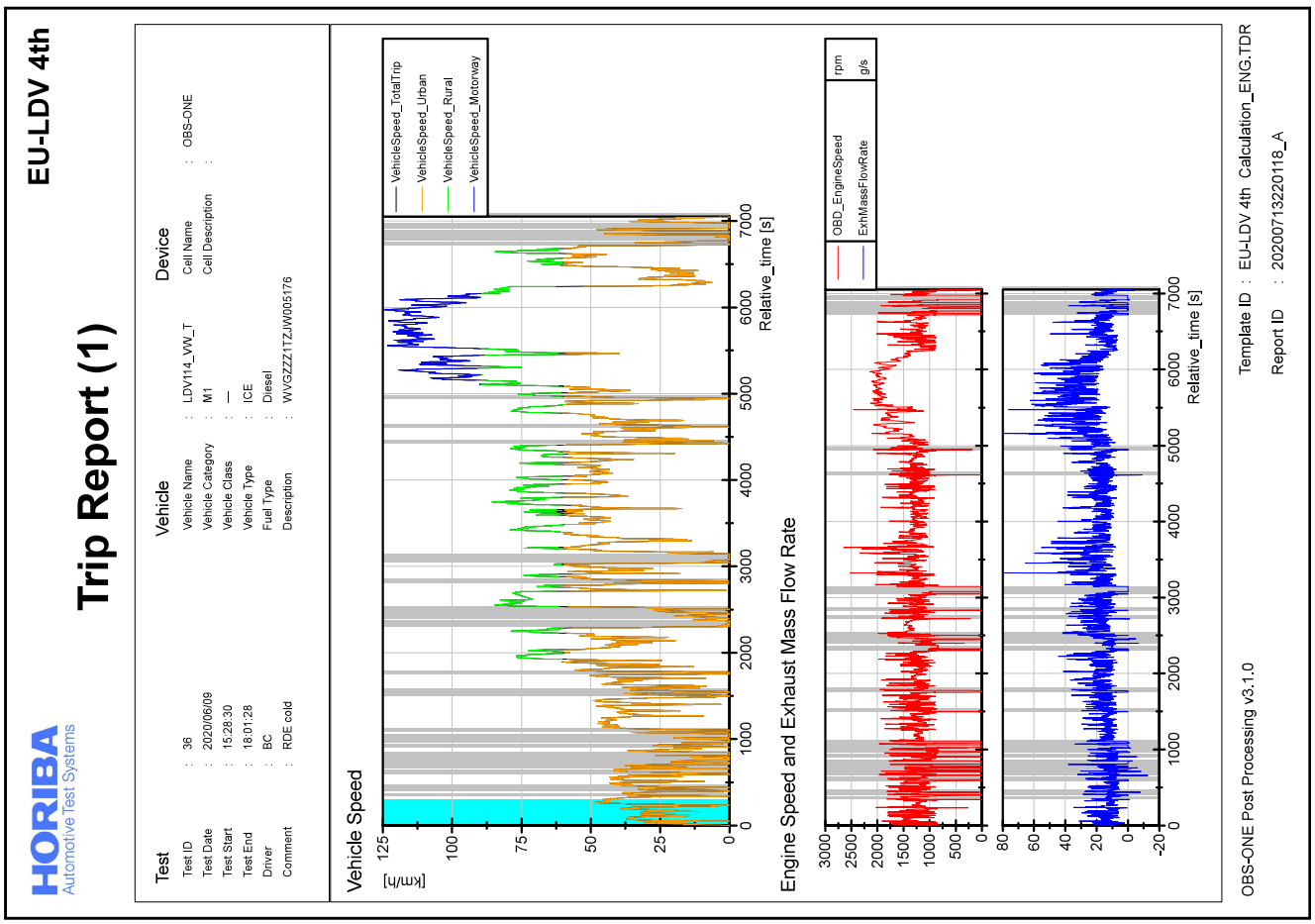
Red : Fail

OBS-ONE Post Processing v3.1.0

Template ID : EU-LDV 4th Summary_ENG.TDR

Report ID : 20200713220118_A


HORIBA
Automotive Test Systems
EU-LDV 4th
Trip Report (2)
Test
Test ID : 36
Test Date : 2020/06/09
Test Start : 15:28:30
Test End : 18:01:28
Driver : BC
Comment : RDE cold
Vehicle
Vehicle Name : LDV114_VW_T
Vehicle Category : M1
Vehicle Class : —
Vehicle Type : ICE
Fuel Type : Diesel
Description : WVGZZZ1TZJW005176
Device
Cell Name : OBS-ONE
Cell Description :
Altitude
[m]
Altitude_Correct
AltitudeFromMap
AltitudeFromPress
Relative_time [s]
Ambient Temperature
[degC]
WS_AmbientTemp
Relative_time [s]
OBS-ONE Post Processing v3.1.0
Template ID : EU-LDV 4th Calculation_ENG.TDR
Report ID : 20200713220118_A


HORIBA
Automotive Test Systems
EU-LDV 4th
Trip Report (1)
Test
Test ID : 36
Test Date : 2020/06/09
Test Start : 15:28:30
Test End : 18:01:28
Driver : BC
Comment : RDE cold
Vehicle
Vehicle Name : LDV114_VW_T
Vehicle Category : M1
Vehicle Class : —
Vehicle Type : ICE
Fuel Type : Diesel
Description : WVGZZZ1TZJW005176
Device
Cell Name : OBS-ONE
Cell Description :
Vehicle Speed
[km/h]
VehicleSpeed_TotalTrip
VehicleSpeed_Urban
VehicleSpeed_Rural
VehicleSpeed_Motorway
Relative_time [s]
Engine Speed and Exhaust Mass Flow Rate
OBD_EngineSpeed
rpm
ExhMassFlowRate
g/s
Relative_time [s]
OBS-ONE Post Processing v3.1.0
Template ID : EU-LDV 4th Calculation_ENG.TDR
Report ID : 20200713220118_A

HORIBA
Automotive Test Systems

EU-LDV 4th

Trip Evaluation Report (1)

Test		Vehicle		Device	
Test ID : 36		Vehicle Name : LDV114_VW_T		Cell Name : OBS-ONE	
Test Date : 2020/06/09		Vehicle Category : M1		Cell Description :	
Test Start : 15:28:30		Vehicle Class : —			
Test End : 18:01:28		Vehicle Type : ICE			
Driver : BC		Fuel Type : Diesel			
Comment : RDE cold		Description : WVGZZZ1TZJW005176			

Ambient Conditions

	Unit	Average	Minimum	Maximum	Condition
Altitude	m	463.9	424.9	544.1	Moderate
Ambient Temp.	degC	16.4	14.6	25.4	Moderate

[ ] : Extended

Criteria

	Unit	Moderate	Extended	Void
Altitude	m	<= 700	700 <, <= 1300	1300 <
Minimum Ambient Temp.	degC	0 <=	-7 <=, < 0	< -7
Maximum Ambient Temp.	degC	<= 30	30 <, <= 35	35 <

Condition Prior to The Test

Last 3h Temp.	Moderate

Trip Composition

	Unit	Urban	Rural	Motorway	Total Trip	Criteria
Duration	min:s	78:50	23:50	14:54	117:34	90-120
Distance	km	39.7	28.9	27.1	95.8	>= 16, >= 16, >= 16
Distance Share	%	41.5	30.2	28.3	—	29-44, 23-43, 23-43
Average Speed	km/h	30.2	72.9	109.3	48.9	15-40

GPS

	Unit	Value	Criteria
GPS Total Trip Distance	km	95.8	—
Reference Total Trip Distance	km	95.7	—
Abs. Total Trip Distance Deviation	%	0.1	<= 4
GPS Invalid Longest Time	s	74	<= 120
GPS Invalid Total Time	s	89	<= 300

Judge Pass : Green Fail : Red

HORIBA
Automotive Test Systems

EU-LDV 4th

Trip Evaluation Report (2)

Test		Vehicle		Device	
Test ID : 36		Vehicle Name : LDV114_VW_T		Cell Name : OBS-ONE	
Test Date : 2020/06/09		Vehicle Category : M1		Cell Description :	
Test Start : 15:28:30		Vehicle Class : ---			
Test End : 18:01:28		Vehicle Type : ICE			
Driver : BC		Fuel Type : Diesel			
Comment : RDE cold		Description : WVGZZZ1TZJW005176			

Elevation

	Unit	Value	Criteria
Altitude Difference (End - Start)	m	0.6	<= 100 in Abs.
Altitude Difference (GPS - MAP)	m	6.0	<= 40 in Abs.
Positive Elevation Gain (Total Trip)	m/100km	375.4	< 1200
Positive Elevation Gain (Urban)	m/100km	509.2	< 1200

Stop

	Unit	Value	Criteria
First Idling Duration	s	4	<= 15
Longest Stop Duration	s	72	<= 300
Total Stop Duration	s	614	—
Stop Ratio in Urban	%	13.0	6-30

Motorway

	Unit	Value	Criteria
Maximum Speed	km/h	124.7	110-160
Duration (> 100 km/h)	min:s	12:18	>= 5
Duration (> 145 km/h)	min:s	0:00	—
Duration (> 145 km/h) Share	%	0.0	<= 3

Cold Start

	Unit	Value	Criteria
Duration	s	300	—
Total Stop Duration	s	11	<= 90
Average Speed	km/h	27.3	15-40
Maximum Speed	km/h	48.4	<= 60

Hot Start

	Unit	Value	Criteria
Coolant Temperature at Start Point	degC	---	—
Oil Temperature at Start Point	degC	---	—

Judge Pass : Green Fail : Red

OBS-ONE Post Processing v3.1.0

Template ID : EU-LDV 4th Calculation_ENG.TDR

Report ID : 20200713220118_A

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Automotive Test Systems

EU-LDV 4th

Dynamics Report (1)

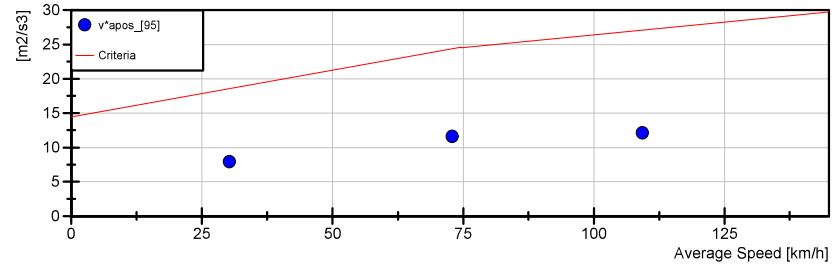
Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Dynamics

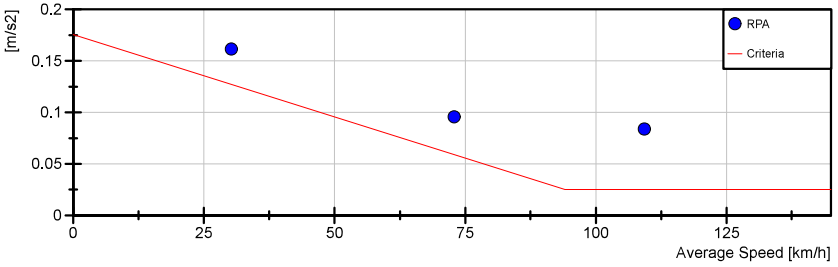
	Unit	Urban	Rural	Motorway
Data Count	#	4730	1430	894
Positive Data Count	#	1822	492	324
Criteria	#	>= 100	>= 100	>= 100
Average Speed	km/h	30.25	72.86	109.25
v*apos_[95]	m2/s3	7.930	11.626	12.141
Criteria	m2/s3	<= 18.553	<= 24.349	<= 27.073
RPA	m/s2	0.162	0.096	0.084
Criteria	m/s2	>= 0.127	>= 0.059	>= 0.025

Judge Pass : Green Fail : Red

v*apos_[95]



RPA



OBS-ONE Post Processing v3.1.0

Template ID : EU-LDV 4th Calculation_ENG.TDR

Report ID : 20200713220118_A

HORIBA
Automotive Test Systems

EU-LDV 4th

Dynamics Report (2)

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

MAW Statistics

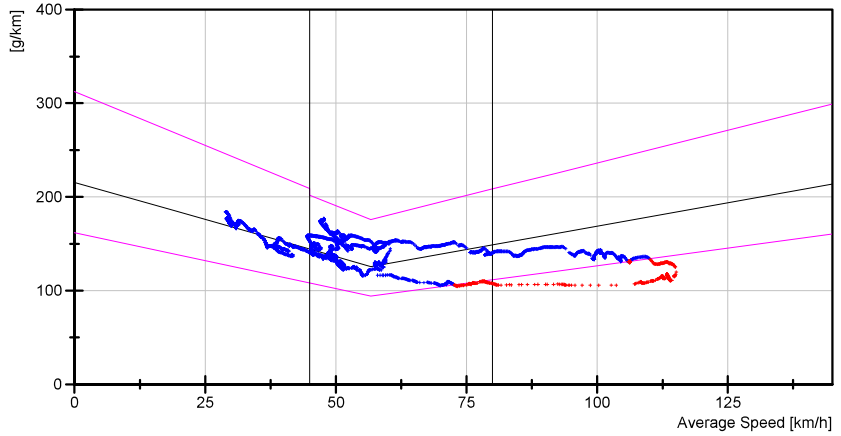
	Unit	Urban	Rural	Motorway	Total	Over
Upper Tol1(H)	#	0	0	0	0	0
Inside Tol1	#	1371	3250	526	5147	0
Lower Tol1(L)	#	0	72	282	354	0
Total	#	1371	3322	808	5501	0
Valid Window Ratio	%	100.0	97.8	65.1	93.6	0.0
Criteria	%	>= 50	>= 50	>= 50	—	—

Judge Pass : Green Fail : Red

Tolerance

	Unit	Urban	Rural	Motorway
Tol1(H)	%	45	40	40
Tol1(L)	%	25	25	25

MAW CO2 Characteristic Curve



OBS-ONE Post Processing v3.1.0

Template ID : EU-LDV 4th Calculation_ENG.TDR

Report ID : 20200713220118_A

HORIBA
Automotive Test Systems

EU-LDV 4th

Final Emission Report (1)

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Total Mass

	Unit	Urban	Rural	Motorway	Total Trip
CO	g	3.707	1.121	0.5291	5.357
CO2	kg	6.830	3.399	3.298	13.53
NOx	g	2.519	1.687	1.376	5.582
NO	g	2.444	1.670	1.345	5.460
NO2	g	0.09550	0.02894	0.03586	0.1603
THC	g	0.1682	0.02181	0.02127	0.2113
CH4	g	0.05389	0.000909	0.000134	0.05493
NMHC	g	0.1478	0.04780	0.05334	0.2489
PN	#	2.10E11	1.55E10	1.89E10	2.44E11

Distance Specific Mass

	Unit	Urban	Rural	Motorway	Total Trip
CO	mg/km	93.28	38.74	19.50	55.91
CO2	g/km	171.9	117.4	121.6	141.2
NOx	mg/km	63.39	58.30	50.71	58.26
NO	mg/km	61.51	57.70	49.58	56.98
NO2	mg/km	2.403	1.000	1.322	1.673
THC	mg/km	4.232	0.7535	0.7840	2.205
CH4	mg/km	1.356	0.03139	0.004936	0.5733
NMHC	mg/km	3.718	1.652	1.966	2.598
PN	#/km	5.28E9	5.36E8	6.97E8	2.55E9

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Automotive Test Systems

EU-LDV 4th

Final Emission Report (2)

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Evaluation Factor

	Urban	Total Trip
rk	1.05	0.93
ICk	—	—
RFk	1.00	1.00

Final Emission

	Unit	Final Emission		NTE Pollutant
		Urban	Total Trip	
CO	mg/km	93.276	55.910	—
CO2	g/km	171.856	141.174	—
NOx	mg/km	63.390	58.262	114.40
NO	mg/km	61.510	56.980	—
NO2	mg/km	2.403	1.673	—
THC	mg/km	4.232	2.205	—
CH4	mg/km	1.356	0.573	—
NMHC	mg/km	3.718	2.598	—
PN	#/km	5.28E9	2.55E9	9.00E11

Final Emission (w/ Ki)

	Unit	Final Emission		NTE Pollutant
		Urban	Total Trip	
CO	mg/km	93.276	55.910	—
NOx	mg/km	63.390	58.262	114.40
PN	#/km	5.28E9	2.55E9	9.00E11

Judge Pass : Green Fail : Red

OBS-ONE Post Processing v3.1.0

Template ID : EU-LDV 4th Calculation_ENG.TDR

Report ID : 20200713220118_A

HORIBA
Automotive Test Systems

EU-LDV 4th

Concentration Report

Test		Vehicle		Device	
Test ID	: 36	Vehicle Name	: LDV114_VW_T	Cell Name	: OBS-ONE
Test Date	: 2020/06/09	Vehicle Category	: M1	Cell Description	:
Test Start	: 15:28:30	Vehicle Class	: —		
Test End	: 18:01:28	Vehicle Type	: ICE		
Driver	: BC	Fuel Type	: Diesel		
Comment	: RDE cold	Description	: WVGZZZ1TZJW005176		

Concentration (Average)

	Unit	Urban	Rural	Motorway	Total Trip
CO	ppm	42.03	28.17	9.502	35.10
CO2	vol%	5.437	6.670	6.597	5.834
NOx	ppm	14.03	23.24	20.19	16.68
NO	ppm	13.53	22.94	19.71	16.22
NO2	ppm	0.5063	0.3003	0.4862	0.4620
THC	ppmC	5.470	1.706	1.732	4.233
CH4	ppmC	1.005	-1.257	-1.657	0.2093
NMHC	ppmC	4.337	3.123	3.599	3.998
PN	N#/m3	3.65E9	5.52E8	7.01E8	2.65E9

Exhaust

	Unit	Urban	Rural	Motorway	Total Trip
Ave. Mass Flow Rate	g/s	14.44	21.80	33.93	18.40
Ave. Temperature	degC	81.34	103.5	133.8	92.50
Max. Temperature	degC	144.7	146.9	154.4	154.4

Span Gas

	Unit	Span Gas	99th x0.9 <= Span	Max. Meas. <= 2x Span	Ratio (> Span) <= 1%
CO	ppm	5030	118.9	8112.0	0.1 %
CO2	ppm	120800	103255.0	134962.3	0.4 %
NOx	ppm	1498	166.1	608.8	0.0 %
NO	ppm	1498	164.9	625.6	0.0 %
THC	ppmC	359.4	43.4	170.4	0.0 %
CH4	ppmC	359	13.2	150.4	0.0 %

Judge Pass : Green Fail : Red

HORIBA
Automotive Test Systems

EU-LDV 4th

Drift Check Report

Test		Vehicle		Device	
Test ID	: 36	Vehicle Name	: LDV114_VW_T	Cell Name	: OBS-ONE
Test Date	: 2020/06/09	Vehicle Category	: M1	Cell Description	:
Test Start	: 15:28:30	Vehicle Class	: —		
Test End	: 18:01:28	Vehicle Type	: ICE		
Driver	: BC	Fuel Type	: Diesel		
Comment	: RDE cold	Description	: WVGZZZ1TZJW005176		

Drift Check Result

Zero Drift

	Unit	Pre	Post	Abs. Diff.	Criteria
CO	ppm	-2.41	-13.65	11.24	<= 75
CO2	ppm	-45.23	-77.60	32.38	<= 2000
NOx	ppm	0.20	-0.37	0.57	<= 5
NO	ppm	0.10	0.09	0.01	—
THC	ppmC	-0.14	-0.85	0.70	<= 10
CH4	ppmC	-0.59	-2.64	2.05	<= 10

Span Drift

	Unit	Pre	Post	Abs. Diff.	Criteria	Abs. %RS	Criteria	Overall
CO	ppm	5015.28	5002.97	12.31	<= 75	0.25 %	<= 2 %	Pass
CO2	ppm	120965.10	120991.30	26.20	<= 2000	0.02 %	<= 2 %	Pass
NOx	ppm	1498.71	1496.72	1.99	<= 5	0.13 %	<= 2 %	Pass
NO	ppm	1498.74	1505.21	6.48	—	0.43 %	—	—
THC	ppmC	359.43	358.79	0.64	<= 10	0.18 %	<= 2 %	Pass
CH4	ppmC	359.00	357.10	1.90	<= 10	0.53 %	<= 2 %	Pass

Judge Pass : Green Fail : Red

HORIBA
Automotive Test Systems

Parameter Report (Emission) (1)

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Basic Calc. Parameter

Pitot Parameter		Data Correction	
Tube Data 1		Drift Correction	OFF
Pitot Type & Serial No	Type BL - 160109BL	Time Alignment	OFF
Tube Data 2		Gain & Offset	OFF
Pitot Type & Serial No	—	Band Filtering	OFF
Exhaust Parameter		Hangup Correction Parameter	OFF
H/C	1.850	Used Type	—
O/C	0.000	Value	—
S/C	0.000	Dry<->Wet Convert	Inactive
N/C	0.000	Humidity Correction Parameter	
Density [kg/m3] (at 0 degC)	1.2943	NOx	OFF
Fuel Parameter		Combustion System	—
H/C	1.850	Data Source	
O/C	0.000	Sampling Rate	1Hz
S/C	0.000	OBD Protocol	ISO15765_4_11
N/C	0.000	Exhaust Flow	PF_ExhaustFlowRate
Fuel Mass Fraction [g/g]	0.866	Calc. Type	
Density [kg/L] at 15 degC	0.8300	Mass Calculation Method	Density
Lower Heating Value [kJ/kg]	431000.00	Exhaust Mass Flow Rate	From Exhaust Volume Flow Rate
Ambient Air		Power	FromEnergy
Density [kg/m3] (at 0 degC)	1.2930	Engine Reference Torque	—
Engine Parameter		Work	FromEnergy
Combustion Efficiency [%]	0.00	Position Information	
PM Parameter		Altitude	GPS_Altitude
Conversion Factor [—]	—	Latitude	GPS_Latitude
Tare Weight [mg]	0.0000	Longitude	GPS_Longitude
Loaded Weight [mg]	0.0000	Signal Type	GPS
Device Delay Time		Vehicle Speed	
MEXA Transformation Time [s]	6.1	Speed Channel	GPS_VehicleSpeed
PTFM Transformation Time [s]	0.2	Signal Type	GPS
PFPM Transformation Time [s]	0.0		
PFPN Transformation Time [s]	5.0		

HORIBA
Automotive Test Systems

Parameter Report (Emission) (2)

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Basic Calc. Parameter

Linear Interpolation	
Vehicle Speed	
Correction	Active
Signal Status Channel	
MeasData_1Hz/GPS_GPSStatus	
Position Data	
Correction	Active
Signal Status Channel	
MeasData_1Hz/GPS_GPSStatus	

OBS-ONE Post Processing v3.1.0

Template ID : EU-LDV 4th Parameter_ENG.TDR

Report ID : 20200713220118_C

HORIBA
Automotive Test Systems

EU-LDV 4th

Parameter Report (1)

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Regulatory Calculation Parameter

Package	4th
Source Data	1Hz
Regulation	ON
Type Approval	
Information	
Type Approval Date	2020/2/8
Vehicle	New Type
Vehicle Category	M1
Vehicle Class	—
Definitions	
Ambient Conditions	ON
Use value before application date.	OFF
Upper	
700 < Altitude [m] <= 1300	
30 < Temperature [degC] <= 35	
Lower	
-7 <= Temperature [degC] < 0	
Division of the extended area	1.6
Cold Start	
Maximum Duration [s]	ON
	300
Until Coolant Temp. for the first time [degC]	ON
	70
Vehicle Stop	
Vehicle Speed [km/h]	1
ICE Stop	
Engine Speed [rpm]	ON
	50
Exhaust Mass Flow Rate [kg/h]	ON
	3
Exhaust Mass Flow Rate [%]	ON
	15
Exhaust Mass Flow Rate at Idling [kg/h]	
	0

Trip Requirements	
Test Condition	Cold Start
GPS Consistency Check	
Longest Invalid Time [s]	120
Total Invalid Time [s]	300
Difference of Total Trip Distance [%]	4
Urban	
Vehicle Speed [km/h]	60
Distance [km]	16
Distance Share [%]	29-44
Average Speed [km/h]	15-40
Stop Time Ratio [%]	6-30
Longest Stop Duration [s]	300
Rural	
Vehicle Speed [km/h]	90
Distance [km]	16
Distance Share [%]	23-43
Motorway	
Vehicle Speed [km/h]	90
Distance [km]	16
Distance Share [%]	23-43
Excess Speed [km/h]	145-160
Excess Speed Duration [%]	3
Maximum Speed [km/h]	110
Driving Speed [km/h]	100
Driving Duration [min]	5
Cold Start	
Average Speed [km/h]	15-40
Maximum Speed [km/h]	60
Total Stop Duration [s]	90
Total Trip	
Duration [min]	90-120
First Idling Duration [s]	15

HORIBA
Automotive Test Systems

EU-LDV 4th

Parameter Report (2)

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Regulatory Calculation Parameter

Dynamics and Elevation Gain	
Dynamics	
Positive Acceleration [m/s2]	0.1
Required Positive Data Count	100
v*apos Criteria	
	Standard
Elevation Gain	
Maximum Altitude Difference [m]	
GPS and MAP	40
Start and End	100
Maximum Positive Elevation Gain [m/100km]	
for Total Trip	1200
for Urban	1200
MAW	
Reference Quantity	
Average Speed [km/h]	
Low	18.882
Medium	39.5
High	56.664
Extra High	91.997
Distance [km]	
Low	3.11
Medium	4.76
High	7.18
Extra High	8.27
CO2 Emission [g/km]	
Low	185.6
Medium	149.8
High	125.6
Extra High	160.9
WLTC Total CO2 Mass [g]	
	3522.10
Distance Specific Total CO2 Mass [g/km]	
	151.00

Reference Points	
P1	Low
P2	High
P3	Extra High
Criteria	
Maximum Window Speed [km/h]	
Urban	45
Rural	80
Motorway	145
Tol1 High [%]	
Urban	45
Rural	40
Motorway	40
Tol1 Low for all speed bin [%]	25
Maximum Tol1 High for HEV [%]	50
Valid Window Ratio [%]	50
Data Exclusion	
Vehicle Speed [km/h]	ON
	1

HORIBA
Automotive Test Systems

EU-LDV 4th

Parameter Report (3)

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Regulatory Calculation Parameter

- Final Emission
  - Result Evaluation Factor
    - Use value before 2020/1/1. : OFF
    - RF L1 Parameter : 1.3
    - RF L2 Parameter : 1.5
    - Factor for OVC-HEV : 0.85
  - Ki Factor
    - Use OBS Value : ON
    - Ki Usage : none
    - Ki
      - CO : 0
      - NOx : 0
      - PN : 0
  - NTE Emission Limits
    - Emission Limits : WLTC-CI-M
      - CO [mg/km] : 500
      - NOx [mg/km] : 80
      - PN [#/km] : 6.0E11
    - Conformity Factor
      - Use Temporary Conformity Factor. : OFF
      - CO : —
      - NOx : 1.43
      - PN : 1.50
    - NTE Pollutant
      - CO [mg/km] : —
      - NOx [mg/km] : 114.40
      - PN [#/km] : 9.00E11

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Automotive Test Systems

EU-LDV 4th

Parameter Report (4)

Test			Vehicle			Device		
Test ID	:	36	Vehicle Name	:	LDV114_VW_T	Cell Name	:	OBS-ONE
Test Date	:	2020/06/09	Vehicle Category	:	M1	Cell Description	:	
Test Start	:	15:28:30	Vehicle Class	:	—			
Test End	:	18:01:28	Vehicle Type	:	ICE			
Driver	:	BC	Fuel Type	:	Diesel			
Comment	:	RDE cold	Description	:	WVGZZZ1TZJW005176			

Regulatory Calculation Parameter

- Channels
  - Ambient Temperature [degC] : MeasData_1Hz/WS_AmbientTemp
  - Ambient Pressure [kPa] : MeasData_1Hz/WS_AmbientPressure
  - Latitude [deg] : Correction_1/Latitude_Correct
  - Longitude [deg] : Correction_1/Longitude_Correct
  - Altitude [m] : Correction_1/Altitude_Correct
  - Vehicle Speed [km/h] : Correction_1/VehicleSpeed_Correct
  - Reference Vehicle Speed [km/h] : MeasData_1Hz/OBD_VehicleSpeed
  - Engine Speed [rpm] : MeasData_1Hz/OBD_EngineSpeed
  - Engine Coolant Temperature [degC] : MeasData_1Hz/OBD_EngineCoolantTemp
  - Engine Oil Temperature [degC] : —
  - Exhaust Mass Flow Rate [g/s] : MASS_1/ExhaustFlow_MASS_1
  - CO MASS [g/s] : MASS_1/CO_MASS_1
  - CO2 MASS [g/s] : MASS_1/CO2_MASS_1
  - NOx MASS [g/s] : MASS_1/NOx_MASS_1
  - NO MASS [g/s] : MASS_1/NO_MASS_1
  - NO2 MASS [g/s] : MASS_1/NO2_MASS_1
  - THC MASS [g/s] : MASS_1/THC_MASS_1
  - CH4 MASS [g/s] : MASS_1/CH4_MASS_1
  - NMHC MASS [g/s] : MASS_1/NMHC_MASS_1
  - PN [#/s] : MASS_1/PN_Inst_1

OBS-ONE Post Processing v3.1.0

Template ID : EU-LDV 4th Parameter_ENG.TDR
Report ID : 20200713220118_C

ICCT information about ISC and fuel metering

IN-SERVICE CONFORMITY TESTING

As part of the amendment, a minimum number of in-service conformity (ISC) checks[16] of vehicles was introduced to be performed by the granting type approval authority. Today, ISC checks are entirely in the hands of car manufacturers, and they are only carried out for air pollutant emissions, not for CO_2. Part of this responsibility will now shift to the respective type-approval authorities, which will perform WLTP and RDE tests (the latter only for NO_X and particulate number emissions), in addition to the WLTP tests carried out by manufacturers. The granting type approval authority must gather all relevant information on possible emission non-compliances relevant for deciding which ISC families to check in a particular year. The number of compulsory annual ISC checks level is set to 5% of PEMS families or a minimum of two families per manufacturer. This is significantly lower than the 20% that stakeholders, such as environmental NGOs, were originally asking for.[17] In addition to the granting type approval authorities, ISC checks can be performed by other type approval authorities, or commissioned by any third party, provided that an accredited laboratory or designated technical service carries out the testing on their behalf. All parties shall report the results in an electronic platform to coordinate in-service conformity testing.

The ISC procedure is based on a sequential sampling method. A sample of vehicles pulled from the same vehicle family are tested consecutively until a “pass” or “fail” decision is reached. The revised ISC requirements aim to strike a balance between tighter requirements for passing an ISC check and limiting the testing burden. As a result, the maximum number of vehicles to decide whether an ISC check is passed is reduced from 20 to 10 vehicles of a vehicle family. At the same time, the thresholds for failing an ISC check are lowered. For instance, a vehicle family for which 50% of the vehicles are likely to fail the test, under the current system, would still have a more than 75% probability to pass the ISC check. Under the new system, with the same percentage of vehicles failing the test, the probability to pass the ISC would only be slightly above 50% (Figure 3).

[16] In comparison to ISC checks, the scope of market surveillance testing—as introduced by the revised type approval framework directive, is wider, including not only emissions but also safety testing, making use not only of laboratory and PEMS testing but also remote sensing as well as on-board measurements. Market surveillance checks can also serve as a pre-screening of vehicle models that will then be selected for more in-depth ISC testing.

[17] Transport & Environment, “Letter to TCMV members: European Commission’s proposal regarding the RDE 4th package & WLTP 2nd act,” April 2018. Retrieved from https://www.transportenvironment.org/sites/te/files/publications/2018_04_TE_letter_TCMV_members_vote_for_RDE_4_and_WLTP_2.pdf

CHANGES TO THE MOTOR VEHICLE TYPE-APPROVAL SYSTEM IN THE EUROPEAN UNION

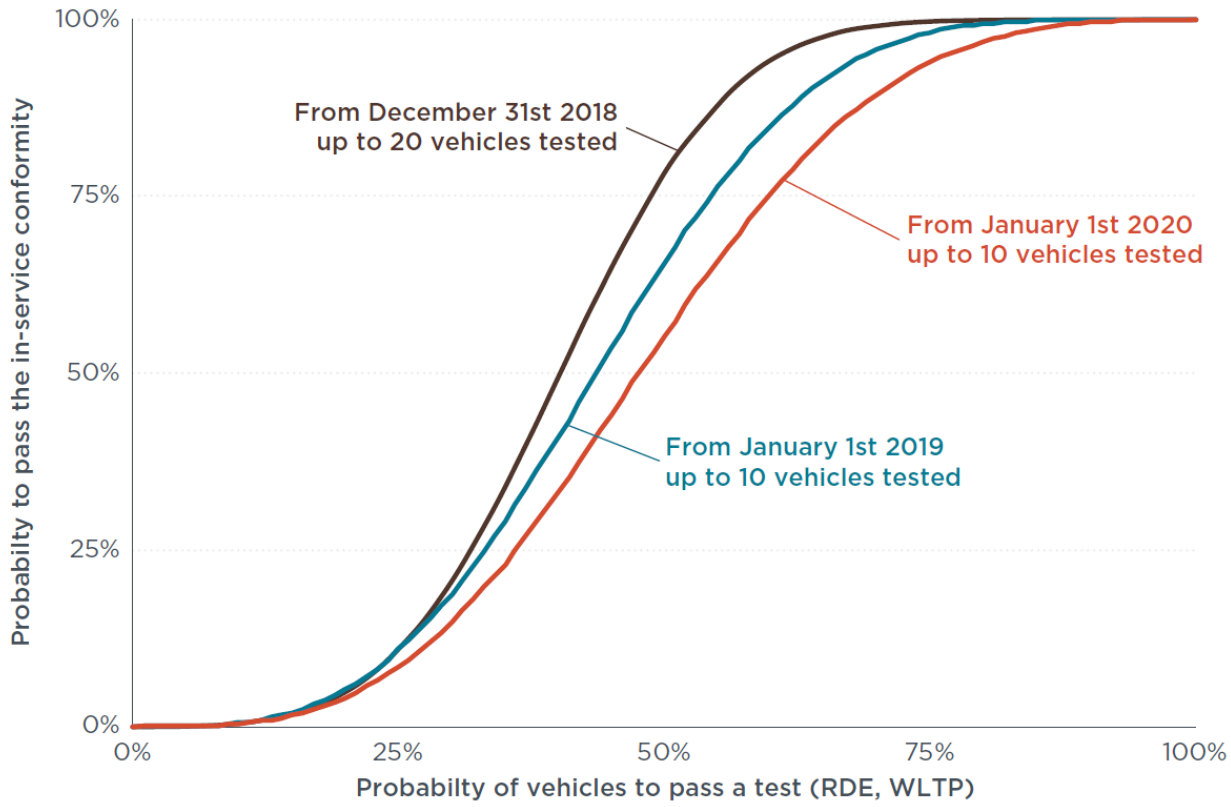


Figure 3. Comparison of the outcome of new statistical procedures. The probability to pass the ISC check is reduced when vehicles have a significant chance to fail the WTLP or RDE test. Evaporative and low temperature tests have a shorter sampling plan and are only voluntary.

FUEL CONSUMPTION METERS

From January 2020 onwards for new vehicle types, and one year later for all new vehicles, manufacturers have to determine on-board the instantaneous as well as the lifetime fuel consumption of each vehicle—the so-called fuel consumption meter. In addition, the electric energy consumption for plug-in electric vehicles will have to be recorded, however only for the lifetime of the vehicle, not the instantaneous consumption. The accuracy of the data recorded will have to be within ±5%, i.e. if tested in a WLTP test, the fuel consumption meter reading shall not deviate more than 5% from the vehicle's fuel consumption determined by the laboratory equipment. While vehicle manufacturers are widely applying fuel consumption meters for internal data collection purposes already today, in the future all interested parties will be able to access the recorded data via the on-board diagnostics (OBD) interface of the vehicle. How the fuel consumption meter readings of individual vehicles will be systematically collected, aggregated and analyzed by the European Commission will be addressed in future regulations.

Real Driving Measurements

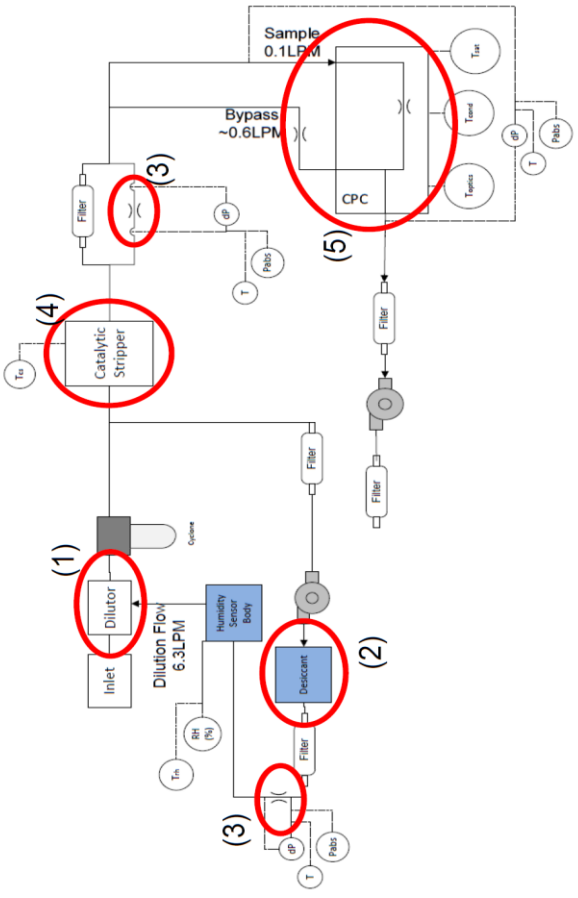
PN-PEMS Flow Schematics

HORIBA OBS ONE PN

PN counting on the road: OBS-ONE-PN

- HORIBA considered the specific requirements for measurements on the road in the development of the OBS-ONE-PN

(1) First dilution directly at the sample probe
(2) Dilution air is dried by a desiccant
(3) Flow control for both passive dilutors is realized by orifices (no MFCs)
(4) Evaporation tube is replaced by a catalytic stripper
(5) A bypassed CPC is introduced for the OBS-ONE-PN. This CPC is designed for mobile applications taking into account the specific requirements related to inclination (→ CPC design), the concentration range (→ bypass), vibration stability (→ bypass, CPC design and wick optimization), temperature control and spill issues (→ soaked CPC wick only, no reservoir)



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AECC Technical Seminar on RDE PN

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Real Driving Measurements

PN-PEMS Flow Schematics

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