



# **CITA-Appplus+ Urea Emulator Emission Tampering**

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# AD BLUE EMULATORS



<https://www.canbusemulator.com/en/>



# TEST VEHICLE

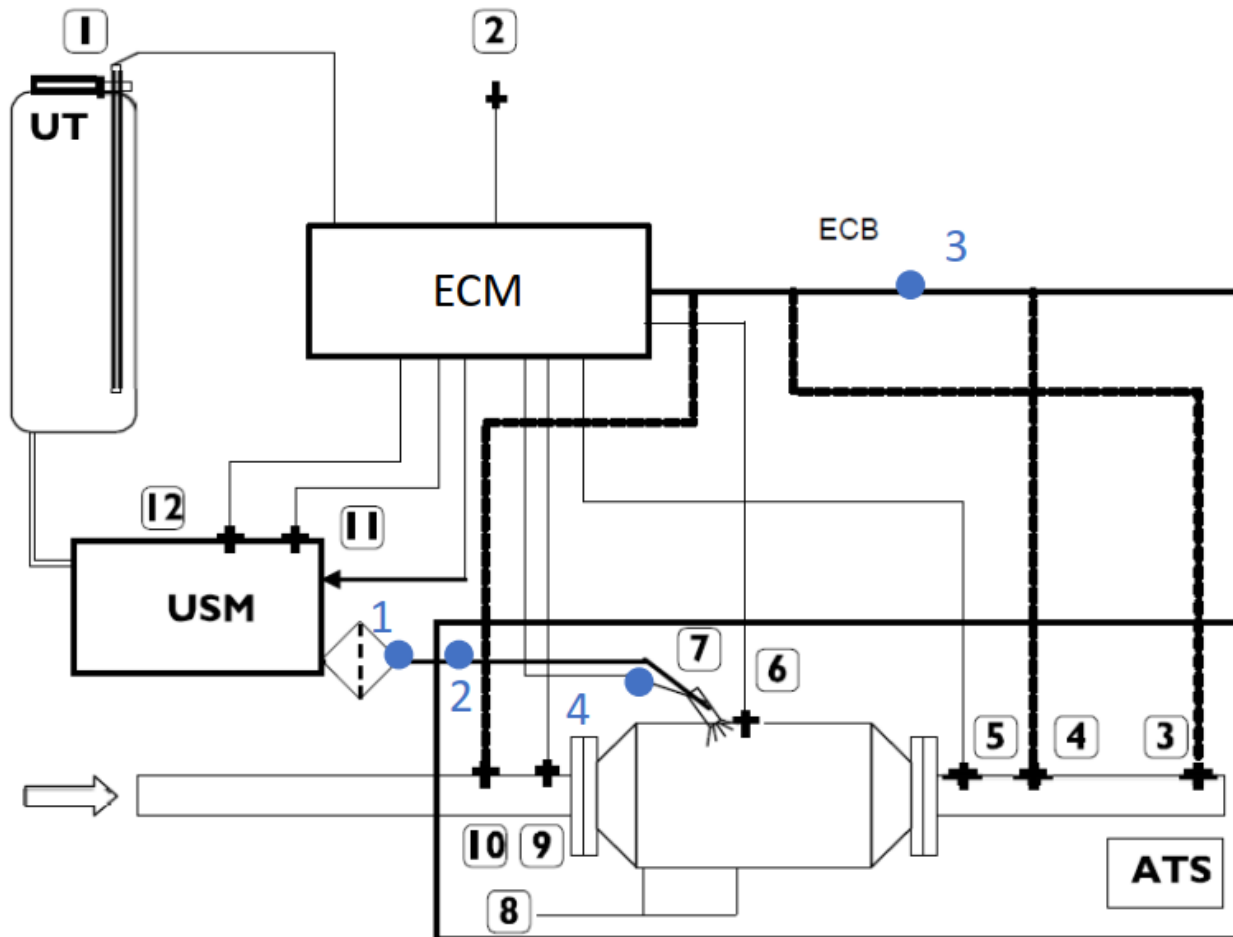


Truck	
Model	
VIN	
Engine   Fuel	Diesel Euro VI A
Test weight (kg)	38818Kg
Trailer	
VIN	VSRSP3M06ML068738
Tyres - Pressure (bar)	1 <sup>st</sup> and 2 <sup>nd</sup> axle: Bridgestone R164 160K 158L 285/65 R22,5 – 8,0 3 <sup>rd</sup> axle: Dunlop SP 244 160k 158L 285/65 R22.5 – 8,0

- ▶ ANTI-TAMPERING PROVISIONS ON ECE R49.06 ANNEX 11 ALREADY APPLIED TO THIS VEHICLE

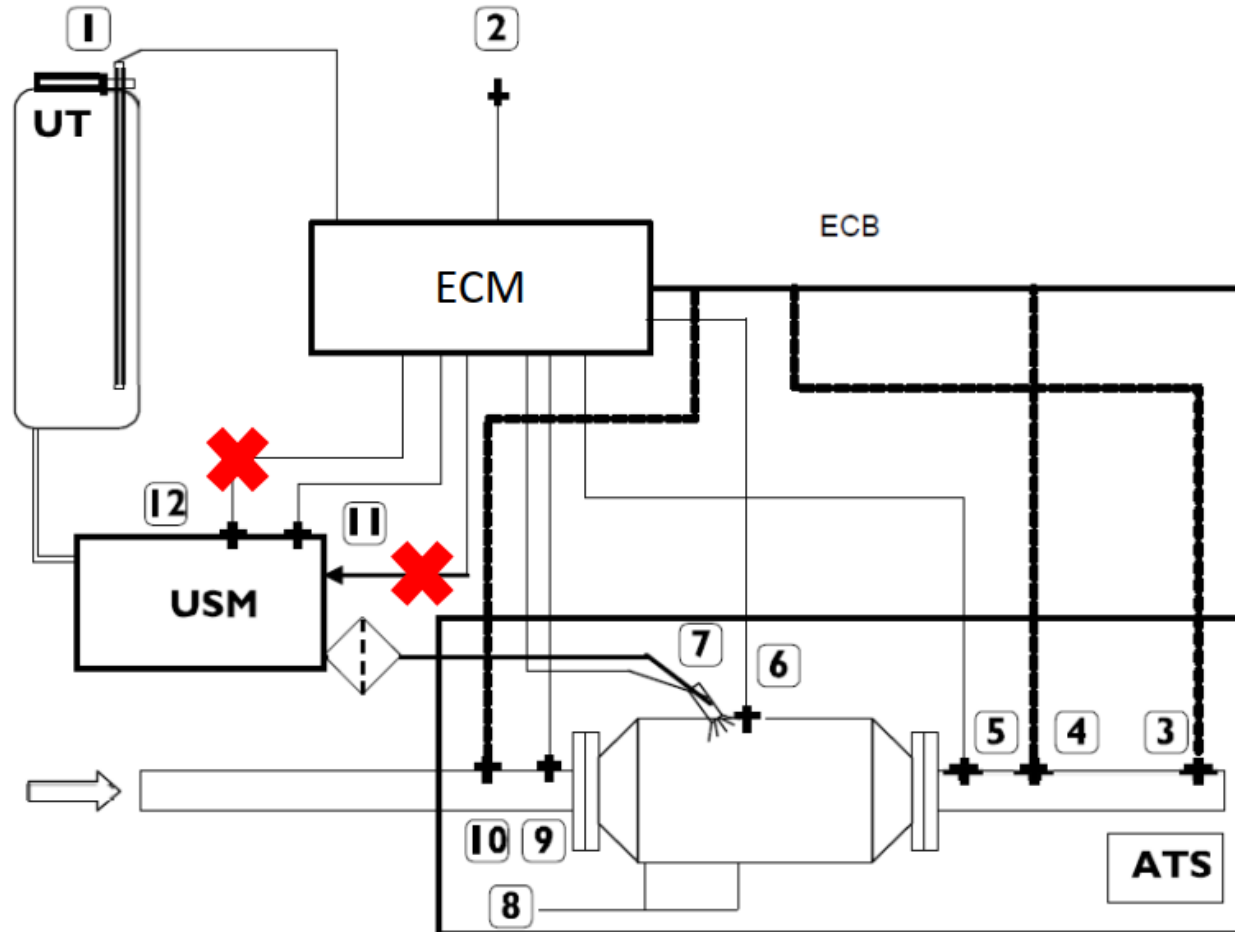


# TEST INSTRUMENTATION

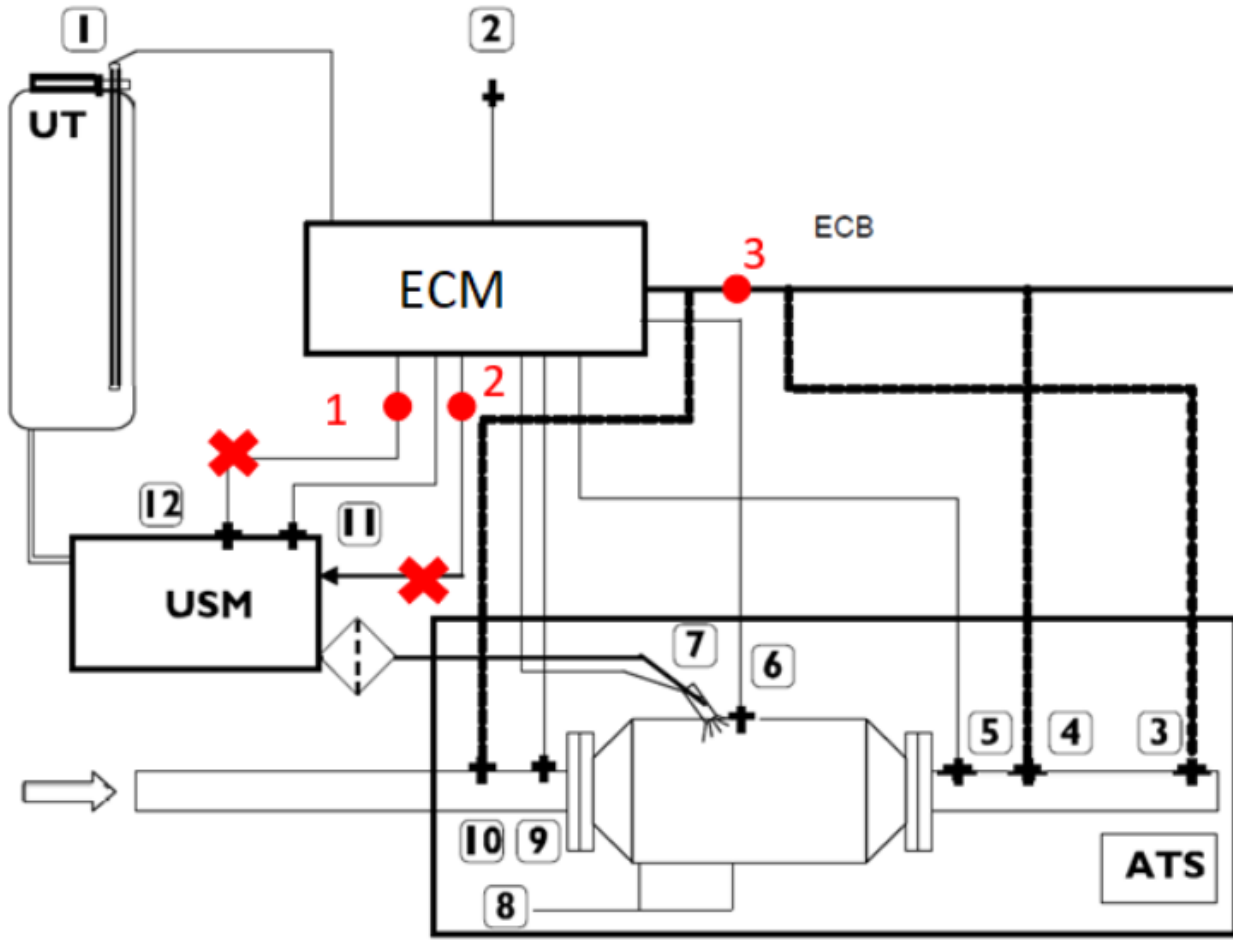


- 1 Urea mass flow (g/s).
- 2 Urea pressure sensor (kPa).
- 3 CAN\_H and CAN\_L.
- 4 Urea injector current (A).

# TEST OBD VALIDATION



# TEST AD BLUE EMULATOR



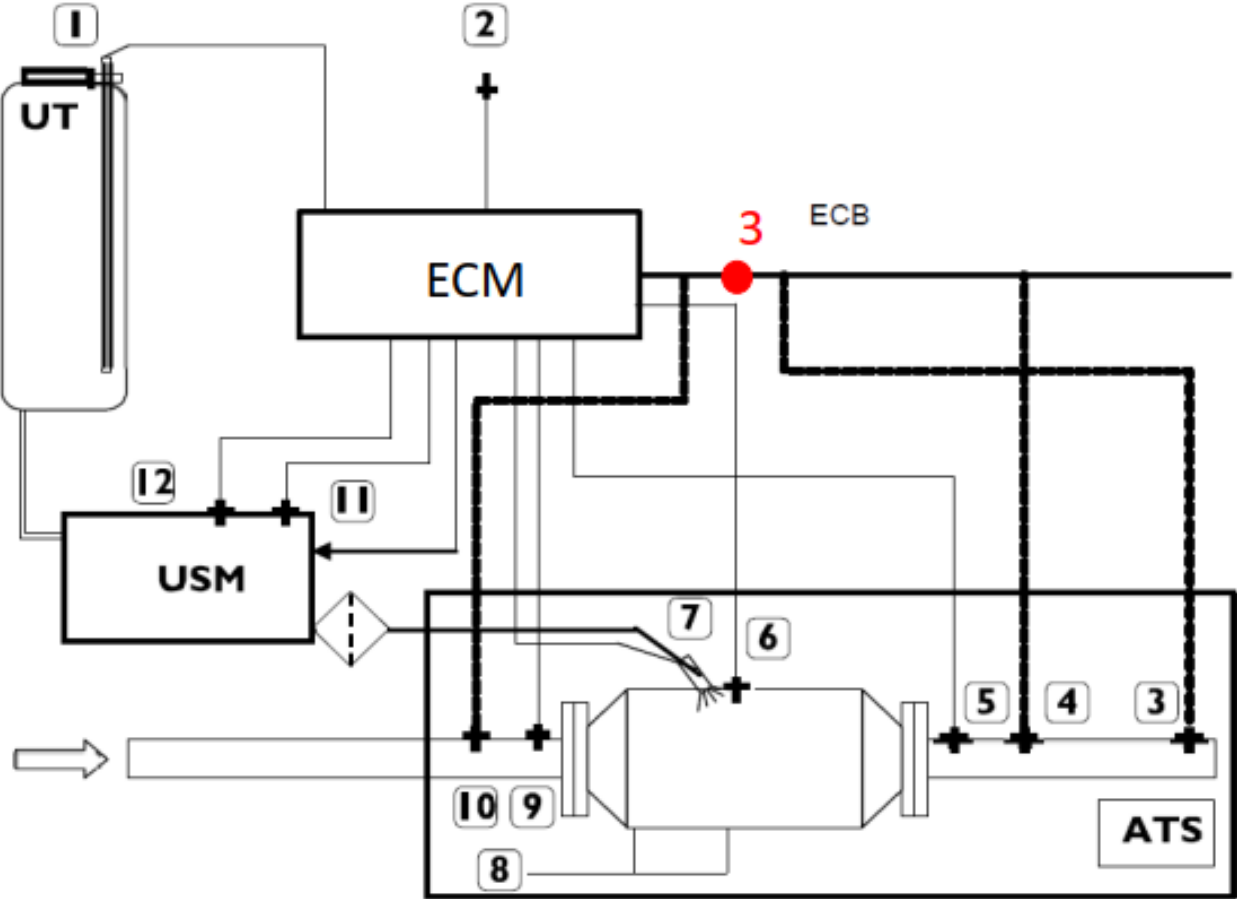
## Urea emulator installation connection points:

- 1 Urea pressure sensor signal, ○
- 2 Urea pump control signal. ●
- 3 CAN\_H and CAN\_L ● and ●
- Vehicle 24V Fuse ●
- Vehicle GND ●





# TEST AD BLUE PARALEL MODE



INCA - Urea pressure sensor signal, ○

INCA – Urea pump control signal. ●

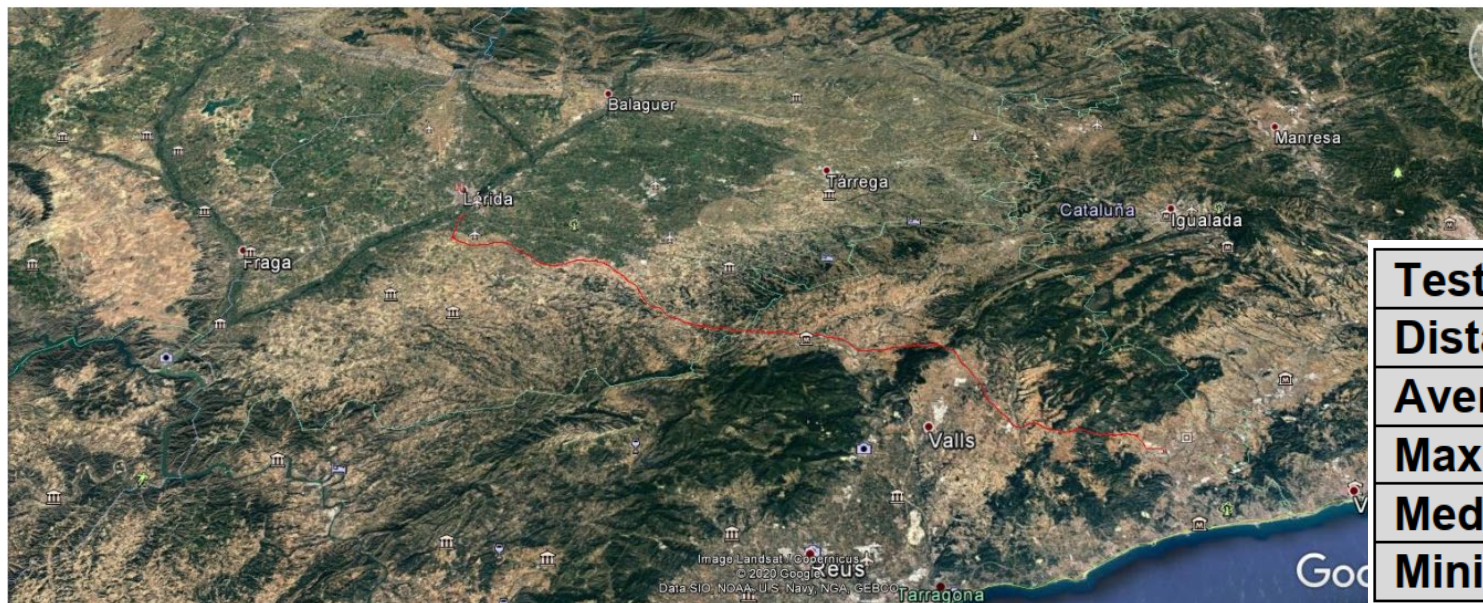
3 CAN\_H and CAN\_L ● and ●

Vehicle 24V Fuse ●

Vehicle GND ●



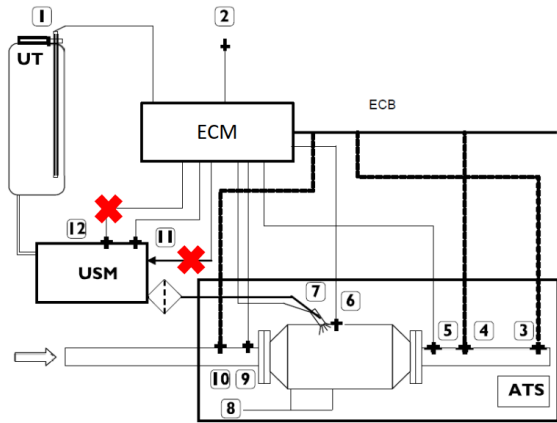
# TEST ROUTE



<b>Test duration</b>	<b>(s)</b>	9.700
<b>Distance</b>	<b>(km)</b>	194
<b>Average speed</b>	<b>(km/h)</b>	75.00
<b>Maximum altitude</b>	<b>(m)</b>	577,0
<b>Medium altitude</b>	<b>(m)</b>	344,0
<b>Minimum altitude</b>	<b>(m)</b>	129,0



# RESULTS OBD VALIDATION



- ▶ MIL ACTIVATED AND COUNTER INCREASES
- ▶ TORQUE REDUCTION AFTER 10 HOURS
- ▶ 2 DTC PRESENT
  - DTC2012 = P208B Reductant Pump "A" Control Performance/Stuck Off
  - DTC2012 = P208A Reductant Pump "A" Control Circuit/Open
- ▶ VEHICLE BEHAVES AS EXPECTED

Step	Date	Time	Emulator installed? (Y/N)	Driven mileage (km)	Driven hours (h)	Comments	Reagent quality counter (h)	Reagent consumption counter (h)	Dosing counter (h)	EGR valve counter (h)	Monitoring system counter (h)	NOx Warning System	Level One Inducement	Ad Blue ON?	Torque reduction? (Y/N)	MILON?
0	08/04/2021	8:00	No	0	0	Original Conditions	0h	0h	0h	0h	0h	Inactive	Inactive	YES	NO	NO
1	08/04/2021	13:52	No	239.12	3.52	USM Isolated	0h	0h	0-3h	0h	0h	Active	Inactive	NO	NO	NO
2	08/04/2021	18:19	No	271.58	4.56	USM Isolated	0h	0h	3-7h	0h	0h	Active	Inactive	NO	NO	NO
3	09/04/2021	13:03	No	134.64	2.28	USM Isolated - Torque reduction 10h	0h	0h	7-10h	0h	0h	Active	Active	NO	YES	YES
4	09/04/2021	17:26	No	101.2	1.71	USM Isolated - Torque reduction	0h	0h	10-12h	0h	0h	Active	Active	NO	YES	YES

# RESULTS AD BLUE EMULATOR



- ▶ NO MIL ACTIVATED NOR COUNTERS STARTED
- ▶ NO TORQUE REDUCTION
- ▶ COMPLETE UREA SYSTEM OVERRIDE
  - ▶ NO UREA INJECTED
- ▶ ON BOARD NOx SENSORS DETECTED EMISSIONS INCREASE TO CLOSE TO THE REGULATION LIMITS

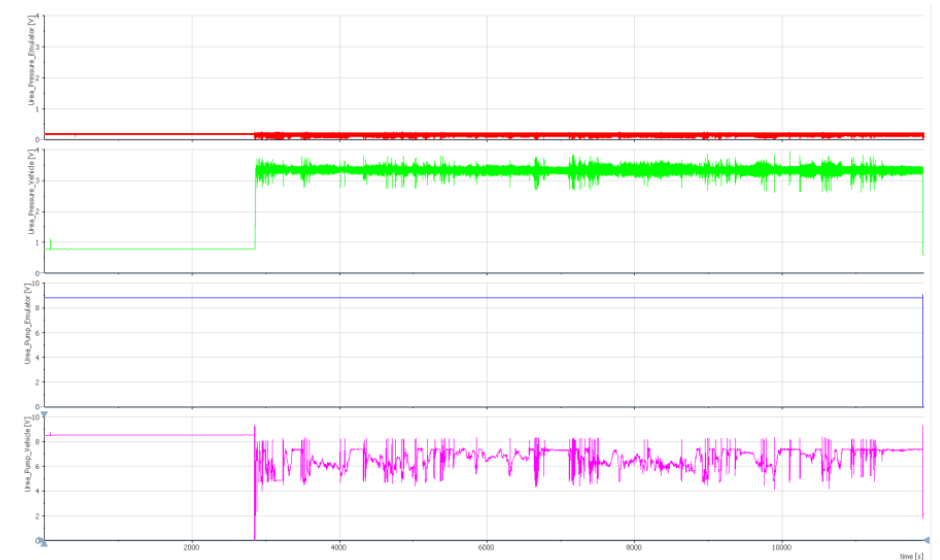


Route	Date	Time	Emulator installed? (Y/N)	Driven mileage (km)	Driven hours (h)	Comments
Route 5	13/04/2021	16:49	Yes	239.6	3.65	No MILs present and no counters increased.
Route 6	14/04/2021	18:26	Yes	237.75	3.46	No MILs present and no counters increased.

# RESULTS PARALEL MODE



- ▶ THE EMULATOR USES CAN MESSAGES TO DETECT VEHICLE IGNITION
- ▶ CONTROL AND ACTUATOR SIGNALS ARE REPLACED BY **CONSTANT VOLTAGES**
- ▶ THE USM IS FEED WITH FAKE MAX INJECTION PRESSURE
- ▶ THE PUMP IS REQUIRED NOT TO INJECT





# RESULTS DEVICE EVALUATION



- ▶ THE SYSTEM **COMPLETELY AVOIDS** THE **UREA** INJECTION
- ▶ THE SYSTEM **AVOIDS** ANY **DTC, MIL** OR **INDUCEMENT MODE** ACTIVATION
- ▶ **NO<sub>x</sub>** EMISSIONS **INCREASED** AROUND **400%** IN THE TEST
- ▶ AD BLUE **SAVINGS** ADDED TO AROUND **15€/200 KM**
- ▶ DEVICE **PAYBACK** IS AROUND **2 DAYS** FOR AN INTERNATIONAL TRUCK
- ▶ **SAVINGS** AROUND **60€ PER DAY**



# CONCLUSIONS



- ▶ **EXPERIENCE SHOWS THAT TECHNOLOGY PROGRESS WILL CHALLENGE ANY TAMPERING PROTECTION BY DESIGN IN FEW MONTHS**
- ▶ **CURRENT ANTI-TAMPERING PROVISIONS SHOULD BE IMPROVED**
- ▶ **TO PREVENT TAMPERING, WE NEED TO IMPROVED TAMPERING PROOF DESIGNS AND TO FACILITATE TAMPERING DETECTION**
- ▶ **IWG ON ANTI-TAMPERING AND WHOLE LIFE-CYCLE OF THE VEHICLE SHOULD BE CONSIDERED**





# Thank you for your attention!

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