CITA-Applus+ Urea Emulator
Emission Tampering

January 13th, 2022

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AD BLUE EMULATORS

https://www.canbusemulator.com/en/
**TEST VEHICLE**

- **Model:** [Redacted]
- **VIN:** [Redacted]
- **Engine:** [Redacted]
- **Fuel:** Diesel Euro VI A
- **Test weight (kg):** 38818 Kg

<table>
<thead>
<tr>
<th>Trailer</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIN</td>
</tr>
</tbody>
</table>
| Tyres - Pressure (bar) | 1st and 2nd axle: Bridgestone R164 160K 158L 285/65 R22.5 – 8.0  
3rd 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 VEHICLE

1 Level and temperature Adblue sensor
2 Humidity sensor
3 NH3 Sensor
4 After catalyst NOx sensor
5 After catalyst temperature sensor
6 Before SCR temperature sensor
7 Urea injector
8 DPF deltaP sensor
9 Before catalyst temperature sensor
10 Before catalyst NOx sensor
11 Adblue temperature sensor
12 Adblue pressure sensor

USM: Urea Supply Module
ECM: Engine Control Module
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
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

### Performance Metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test duration</td>
<td>(s)</td>
<td>9.700</td>
</tr>
<tr>
<td>Distance</td>
<td>(km)</td>
<td>194</td>
</tr>
<tr>
<td>Average speed</td>
<td>(km/h)</td>
<td>75.00</td>
</tr>
<tr>
<td>Maximum altitude</td>
<td>(m)</td>
<td>577.0</td>
</tr>
<tr>
<td>Medium altitude</td>
<td>(m)</td>
<td>344.0</td>
</tr>
<tr>
<td>Minimum altitude</td>
<td>(m)</td>
<td>129.0</td>
</tr>
</tbody>
</table>
# RESULTS

**OBD VALIDATION**

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

---

## Step 1

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

<table>
<thead>
<tr>
<th>Route</th>
<th>Date</th>
<th>Time</th>
<th>Emulator installed?</th>
<th>Driven mileage (km)</th>
<th>Driven hours (h)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 5</td>
<td>13/04/2021</td>
<td>16:49</td>
<td>Yes</td>
<td>239.6</td>
<td>3.65</td>
<td>No MILs present and no counters increased.</td>
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<tr>
<td>Route 6</td>
<td>14/04/2021</td>
<td>18:26</td>
<td>Yes</td>
<td>237.75</td>
<td>3.46</td>
<td>No MILs present and no counters increased.</td>
</tr>
</tbody>
</table>
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

► **NOx** 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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