



Efficient and affordable Zero Emission logistics through
NEXT generation Electric **TRUCKs**

D5.4

Report of Vehicle-level functional verification and testing



**Co-funded by
the European Union**

NextETRUCK has received funding from the European Union
Horizon Innovation Actions programme under grant agreement No.
101056740.



Dissemination level	Sensitive (SEN) - limited under the conditions of the Grant Agreement
Work package	WP5: Components prototyping, testing and vehicle integration
Deliverable number	D5.4 Report of Vehicle-level functional verification and testing
Version	V1.1
Submission date	18/02/2026

Quality Control

	Name	Organisation	Date
Peer review 1	Zymelka, L. (Lukasz)	TNO	19/12/2025
Peer review 2	Arrinda, M. (Mikel)	CIDETEC	03/02/2026

Version history

Version	Date	Author	Summary of changes
0.1	05/03/2025	Rath, S. (Subhajeet)	First draft of document structure + chapter 1 introduction, 2 approach of 3 thematic areas
0.2	05/12/2025	Iñigo Larman	Update UC2 BARCELONA (IRIZAR)
0.3	08/12/2025	Arif Burak Çiftçi	Update UC1 ISTANBUL (FORD OT)
0.4	15/12/2025	Louis Jones	Update UC3 UK (DAF)
1.0	05/01/2026	Rath, S. (Subhajeet)	Update with feedback from Zymelka, L. (Lukasz)
1.1	03/02/2026	Rath, S. (Subhajeet)	Update with feedback from Arrinda, M. (Mikel)

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ABBREVIATIONS AND ACRONYMS

Abbreviation	Meaning
BTMS	Battery Thermal Management System
HMI	Human Machine Interface
GCM	Gross Combination Mass
HV	High Voltage
HVAC	Heating, Ventilation, and Air Conditioning
IETRUCK	Irizar Electric Truck
IoT	Internet of Things
SOC	State of Charge
UBP	Universal Battery Pack
VCU	Vehicle Control Unit
BETT	Battery Electric Truck Trial



EXECUTIVE SUMMARY

The **NextETRUCK project** aims to address key optimization challenges for future urban and suburban logistics by developing next-generation medium-duty all-electric trucks through a strongly integrated, reliable, and flexible systems-based approach. The project focuses on improving overall vehicle efficiency and total cost of ownership while enabling scalable solutions that can be replicated across different vehicle platforms and fleet operations.

Within this framework, **Task 5.4** represents the final verification stage of WP5 and focuses on **full vehicle validation** to prepare the demonstrator trucks for the demonstration phase. Building on the development, calibration, and integration activities completed in the preceding tasks, Task 5.4 ensures that all newly developed powertrain components, control strategies, and the updated E/E architecture operate correctly and cohesively at complete vehicle level.

In this task, **FORD, IRIZAR, and DAF** perform comprehensive vehicle-level verification activities, assessing system functionality, robustness, and performance under integrated operating conditions. These activities confirm that the interactions between subsystems meet the project's efficiency and reliability objectives and that the vehicles are ready for operation in real-world scenarios.



1 INTRODUCTION

1.1 About NextETRUCK

NextETRUCK is a 3-year Horizon Europe project that develops ZEV concepts tailored for regional medium freight haulage, running from 1 July 2022 until 31 December 2025.

The project aims to play a pioneering role in the decarbonisation of vehicle fleets, demonstrating next-generation e-mobility concepts. It also contributes to the development of zero-emission vehicles and ecosystems that are holistic, innovative, affordable, competitive, and synergetic.

NextETRUCK is expected to build concepts tailored for regional medium freight haulage with at least a 10% increase in energy efficiency compared to existing highest-end benchmark electric vehicles. In addition, it shall prepare concept and infrastructure demonstrators for fast charging and offer new business models to increase end-user acceptance and foster the market uptake of the project solutions.

The project's consortium consists of 19 partners from 8 countries: The Netherlands, Belgium, Germany, Spain, Greece, Australia, Turkey, United Kingdom¹. The project's coordinator is TNO (Netherlands Organization for Applied Scientific Research).

NextETRUCK shall conduct demonstrations in Istanbul, Barcelona, and UK.

1.2 Purpose of the deliverable

Deliverable D5.4 provides documentation on the vehicle-level functional verification and testing activities carried out in Work Package 5. The purpose of these activities is to verify that the integrated NextETRUCK vehicle and its subsystems operate in accordance with the defined technical requirements, system architecture, and functional specifications. The deliverable reports on the vehicle specifications and improvements over the baseline vehicle, as well as the results of the testing activities conducted to confirm correct system integration, functional behaviour, and readiness for real-world operation, including Vehicle-in-the-Loop and laboratory-based tests. D5.4 confirms that the NextETRUCK innovations, key vehicle functions, control strategies, and subsystem interactions perform as described in D7.1 Demonstration plan and processes.

1.3 Use of Artificial Intelligence Tools

Generative artificial intelligence tools were used to assist with drafting and language refinement of selected sections of this deliverable. All content has been reviewed, verified,

¹ The UK participants in this project are co-funded by the UK.



and validated by the authors, who take full responsibility for its accuracy, completeness, and compliance with applicable ethical, legal, and contractual requirements. No confidential or personal data were processed using AI tools.



2 UC1 ISTANBUL (FORD OT)

This section details the comprehensive vehicle-level functional verification and testing process conducted by Ford Otosan for the Next e-Truck. As a core component of the Next e-Truck project, the primary objective of this phase is to validate the integrated functionalities and behavior of the vehicle's critical systems across a wide spectrum of operational conditions. This process ensures that the Next e-Truck performs as intended and strictly adheres to the design and mission requirements established in Work Packages 2.1 and 3.2.

Our approach combines dynamic physical vehicle testing with advanced real-time monitoring and data acquisition techniques. This methodology enables an in-depth assessment of both hardware and software components within realistic operational environments, encompassing various driving cycles (e.g., urban, highway, mixed route), diverse load conditions (from unladen to fully laden), and critical environmental factors such as varying temperatures and road surfaces. By rigorously testing the Next e-Truck, we confirm that all system responses align with design expectations and performance targets, ultimately contributing to the successful realization of the Next e-Truck Horizon project's goals.

2.1 Vehicle Specification

The Next e-Truck, developed by Ford Otosan under the Horizon Europe framework, is an innovative Zero Emission Vehicle (ZEV) designed for regional freight and demanding urban applications, such as waste management and refrigerated transport. Configured as a 16,000 kg Gross Vehicle Mass (GVM) 4x2 truck, it is engineered to deliver a 10% gain in overall energy efficiency and a 15% improvement in thermal system efficiency. A key technical feature is its 19.5-inch wheel configuration, which is optimized for urban agility and load distribution, supported by a 444 Ah battery system that enables a maximum speed of 90 km/h.

To measure its technological advancements, the Next e-Truck is benchmarked against a standard 16-tonne electric truck architecture. A detailed comparison is provided in Table 1 below. While both vehicles share a similar 444 Ah battery architecture and 180 kW DC fast-charging capability, the Next e-Truck introduces a significant innovation: a next-generation integrated e-axle system. This replaces the baseline e-drive found in the F-Line, representing a major leap in drivetrain integration and efficiency.

Table 1. Baseline vs. Next e-Truck Technical Comparison (FORD UC)

Feature / Specification	Baseline Vehicle (Rigid e-Truck)	Next e-Truck (Ford Otosan)
Unloaded Weight (Curb Weight)	9,000 kg	6,000 kg
Useful Payload Capacity	7,000 kg	10,000 kg
Energy Consumption	116.1 kWh/100km	105.4 kWh/100km
Chassis Platform	Conventional Steel	Aluminum & Modular e-Platform



Braking System	Pneumatic (Air Brakes)	Electromechanical (Airless)
Cabin Entry	Standard Height	Lower Cabin (467mm Step)
Drivetrain Architecture	Central e-Drive	Integrated e-Axle

Despite the significant differences in platform architecture and weight specifications, both platforms maintain a high standard of safety and operational intelligence through comprehensive Advanced Driver-Assistance Systems (ADAS). This comparative framework highlights the Next e-Truck as a purpose-built solution, specifically optimized for the rigorous demands of modern, zero-emission urban and regional logistics.

2.2 Test Protocol

The validation of the Next e-Truck's performance, efficiency, and operational capabilities is conducted in strict alignment with the comprehensive test protocols defined in Deliverable 2.5 (D2.5). This framework ensures that the vehicle meets the ambitious targets set by the Horizon Europe project and effectively addresses the demands of regional freight haulage and urban applications.

Vehicle-level testing for the Next e-Truck is currently ongoing. In line with the project timeline, physical vehicle demonstrations presented in this report are strictly focused on NVH (Noise, Vibration, and Harshness) and Brake testing. These specific tests were prioritized to verify the structural and operational integrity of the new aluminum chassis and airless brake system.

Following the successful completion of these safety-critical evaluations, the verification phase will expand to cover the remaining protocols outlined in D2.5. This includes Standardized Driving Cycles for energy consumption and range evaluation, high-power charging performance tests (180 kW DC), and the validation of Advanced Driver-Assistance Systems (ADAS) in real-world traffic conditions. It should be noted that the results presented in the following subsections are derived specifically from the data recorded during the initial safety and functional control assessments.

2.3 Vehicle Level System Tests

This section documents the performance of the Vehicle Thermal Management System under the "Cabin & Battery Heating Mode." During the test, the vehicle remained primarily stationary with an ambient temperature of approximately -3.5°C. The data confirms that the system successfully reached target temperatures, actuators (pumps, compressor, heater) responded correctly to control signals, and thermal homogeneity of the battery pack was maintained.

2.3.1 Test Conditions and Environment



The testing was conducted in a controlled environment with an ambient temperature stabilizing at approximately -3.5°C . Throughout the majority of the data acquisition period, specifically from the start until the 550-second, the vehicle remained in a stationary state with a velocity of 0 km/h.

The environmental data confirms that the test conditions remained consistent, providing a reliable baseline for thermal analysis.

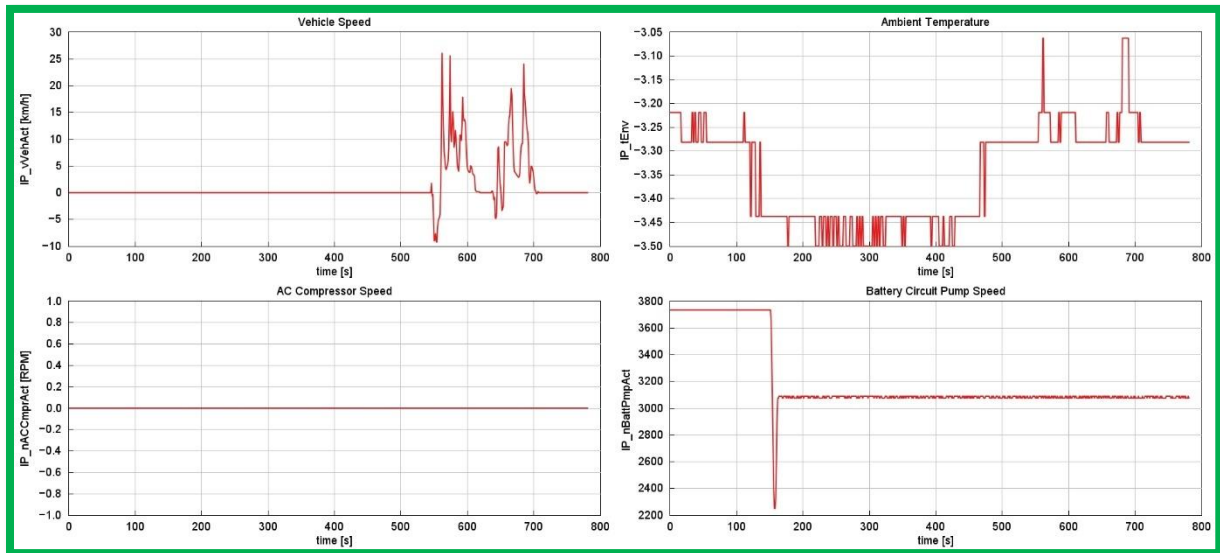


Figure 1 Recorded test data showing Vehicle Speed (top-left), Ambient Temperature (top-right), AC Compressor Speed (bottom-left), and Battery Circuit Pump Speed (bottom-right)

2.3.2 Actuator Performance and System Logic

Analysis of the component activation signals, as illustrated in Figure 1, indicates that the thermal management control logic functioned as intended for the selected heating mode. Given the activation of the Cabin and Battery Heating mode, the AC Compressor speed remained at 0 RPM throughout the entire duration of the test. This confirms that the system correctly prioritized the high-voltage heater or heat pump heating loop without engaging the compressor for cooling duties.

Simultaneously, the coolant circulation pumps exhibited nominal behaviour aligned with the system's flow requirements. Both the Cabin Pump and the Battery Circuit Pump initiated with high-speed operation to establish flow. Following a stabilization period at approximately the 160-second, the Cabin Pump speed regulated to a steady 3600 RPM, while the Battery Circuit Pump maintained a constant speed of 3100 RPM. These sustained speeds verify that the hydraulic system provided the necessary mass flow rate to distribute heat effectively to both the cabin and the battery packs.

2.3.3 Thermal Response and Heating Capacity



The efficacy of the heating system is demonstrated by the thermal response profiles shown in Figure 2. Specifically, the Heater Core Coolant Outlet Temperature data reveals a controlled, linear ramp-up beginning shortly after the pumps stabilized. The coolant temperature successfully ascended to the maximum target setpoint of 75°C. Once this target was achieved, the system maintained the temperature with high precision, showing no evidence of significant overshoot or thermal instability. The coolant temperature successfully ascended to the maximum target setpoint of 75°C. Once this target was achieved, the system maintained the temperature with high precision, showing no evidence of significant overshoot or thermal oscillation. This stability is critical for ensuring consistent cabin comfort and efficient battery conditioning.

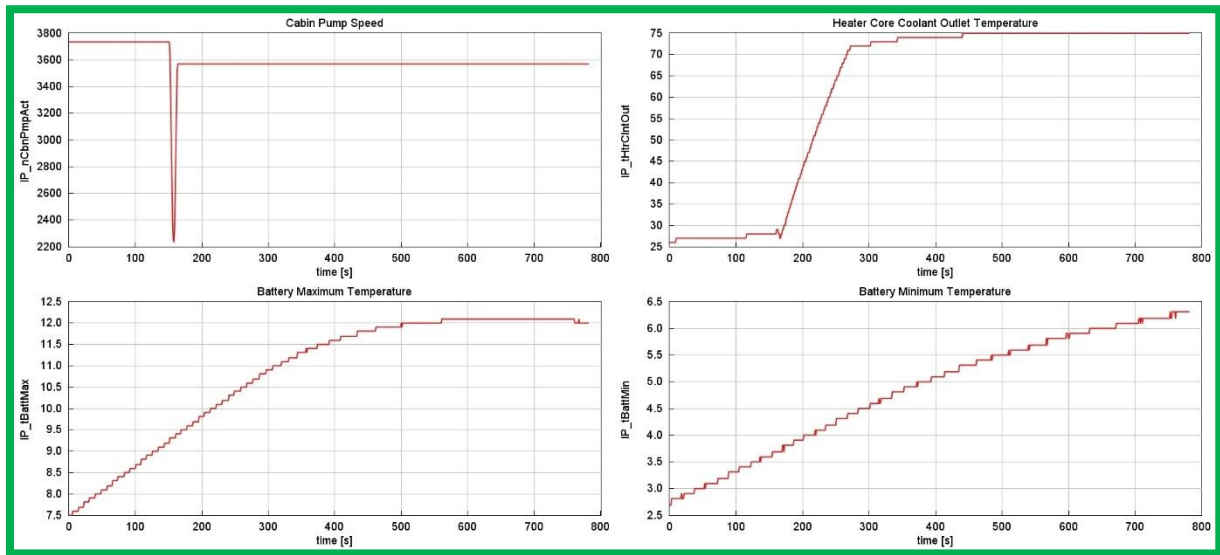


Figure 2 Thermal system response data showing Cabin Pump Speed (top-left), Heater Core Coolant Outlet Temperature (top-right), and the progression of Battery Maximum (bottom-left) and Minimum (bottom-right) Temperatures.

2.3.4 Battery Thermal Management Results

The thermal response of the high-voltage battery pack, as illustrated in the bottom panels of Figure 2, further validates the system's performance. Despite the low ambient temperature of -3.5°C, the system successfully increased the internal temperature of the battery cells. The minimum battery temperature rose from an initial value of 2.5°C to 6.5°C by the conclusion of the test. Concurrently, the maximum battery temperature increased from 7.5°C to 12.0°C. The parallel rise in both minimum and maximum temperatures indicates that the heat distribution within the pack was homogeneous, effectively mitigating the risk of thermal gradients that could degrade battery performance.

Based on the comprehensive analysis of the telemetry data, the Vehicle Thermal System operates within all design specifications during the Cabin and Battery Heating mode. The correlation between the control signals and the physical temperature responses confirms that the system logic is robust. The test is considered a pass, and the system behaviour is verified as working as expected under the tested conditions.



2.4 Results

The initial phase of the vehicle-level functional verification for the Next e-Truck has yielded successful results, particularly regarding the integration of critical thermal and control systems. Under the "Cabin & Battery Heating Mode" test conducted at an ambient temperature of -3.5°C, the vehicle demonstrated robust performance, with the thermal management control logic functioning exactly as intended. Telemetry data confirmed that the heater core coolant temperature followed a precise, linear ramp-up to the 75°C target without any significant overshoot or thermal oscillation. This stability was supported by the consistent operation of the cabin and battery circuit pumps at 3600 RPM and 3100 RPM, respectively, while the AC compressor remained inactive (0 RPM) as per the heating priority logic. Furthermore, the battery conditioning system successfully increased the internal cell temperature, raising the minimum temperature from 2.5°C to 6.5°C and the maximum from 7.5°C to 12.0°C, maintaining high thermal homogeneity across the pack.

In addition to these thermal successes, preliminary observations from the ongoing physical vehicle demonstrations indicate that the Next e-Truck is meeting the safety and functional control requirements established in Deliverable 2.5 (D2.5), specifically regarding the airless braking system and chassis NVH performance. While NVH (Noise, Vibration, and Harshness) and Brake testing are currently in progress to ensure the vehicle's structural and operational integrity, the initial records captured during these assessments align with the design expectations for a 16,000 kg GVM electric platform. These results confirm that the integrated hardware and software components operate within their specified parameters. Upon the successful conclusion of these safety-critical evaluations, the project will transition to the collection of extensive road data for broader verification. At this stage, the recorded performance of the thermal management and primary system logic is considered a pass, validating the Next e-Truck's readiness for intensive operational cycles and its ability to meet the rigorous energy efficiency goals of the Horizon Europe project.



3 UC2 BARCELONA (IRIZAR)

This section presents the vehicle level functional verification and testing carried out on the Irizar Electric Truck (IETRUCK) as part of Use Case 2. The aim of these tests is to confirm that the integrated vehicle systems operate correctly under real driving conditions, and that their performance meets the technical objectives defined in the project.

The tests evaluate the behaviour of key components such as the battery system, thermal systems, powertrain, braking system and energy consumption, while the truck is driven across representative routes. By monitoring system responses and comparing them with expected performance, the results provide assurance that the vehicle is ready for operation in its intended use case.

3.1 Vehicle Specification

This section details the specifications of the IETRUCK as part of the NextETRUCK project. It includes both the baseline configuration and the upgraded version developed through the project's work packages. The specifications build on definitions and details provided in previous deliverables, highlighting the key technical enhancements introduced to improve performance, efficiency, and sustainability.

3.1.1 Benchmark

The baseline specifications of the IRIZAR truck are defined in the following deliverables:

- **Deliverable D2.1** – Use Case, Mission and Overall Vehicle Definition provides the main reference, describing the Barcelona voluminous-waste collection use case. It defines the vehicle's mission (Section 3.2), introduces the baseline versus target vehicle concept (Section 4), and details the baseline configuration in Annex 2, including dimensions, mass distribution, driving resistance, and powertrain features.
- **Deliverable D2.2** – System Definition and Specification further refines these baseline parameters. Annex 3 expands on geometric dimensions, mass properties (gross, curb, payload), and performance-related coefficients such as aerodynamic drag and rolling resistance.

The consolidated baseline specifications are summarized in Table 2:

Table 2. Baseline IETRUCK specifications

Category	Baseline IRIZAR Truck
Mission / Context	Voluminous waste collection in Barcelona
Energy Consumption	1.10 kWh/km
Battery Capacity	170 kWh NMC
Range	150 km
Vehicle Length	8,000 mm
Vehicle Width	2,550 mm



Vehicle Height	3,700 mm
Gross Combination Mass (GCM)	20,500 kg
Payload Capacity	6,110 kg
Curb Weight	14,390 kg
Powertrain Architecture	Irizar-Jema 230 kW, fixed gear
Thermal Management	Independent HVAC and BTMS thermal loops
Charging Strategy	Overnight DC charging at 50 kW
Connectivity / Fleet Integration	Basic fleet manager
Digital Twin	Not available

3.1.2 NextETRUCK

The demo vehicle integrates several enhancements over the baseline IRIZAR truck configuration to support the NextETRUCK project objectives. These upgrades improve the vehicle's energy storage system, connectivity, data acquisition, control capabilities, and overall operational performance.

The main upgrades implemented in the demo vehicle are:

- **GEN3 battery packs:** New generation battery modules providing increased energy density, doubling the energy capacity of the baseline configuration.
- **Fleet Management System HMI:** Human Machine Interface for real time operational insight, driver interaction, and fleet level monitoring capabilities.
- **Tecnia IoT module:** Additional Internet of Things hardware enabling cloud based digital twin interaction, data streaming, and connectivity for research and cloud based analytics.
- **Datik fleet management system:** Integrated fleet monitoring platform providing telematics, route management, and performance tracking functionalities.
- **Vehicle Control Unit (VCU):** Updated central control hardware that coordinates with vehicle systems and displays information to the driver.
- **HVAC and BTMS upgrades:** Improved Heating, Ventilation and Air Conditioning system and an updated Battery Thermal Management System to a new generation that integrates both systems in a single unit, reducing weight and improving efficiency.
- **Steering system:** Enhanced steering hardware to latest generation, improving efficiency and weight reduction.

Table 3 compares the baseline truck specifications with the demo truck:

Table 3. Baseline and NextETRUCK demo specification comparison

Category	Baseline IRIZAR Truck	NextETRUCK Demo
Mission / Context	Voluminous waste collection in Barcelona	Same application but with improved efficiency, range and charging performance
Energy Consumption	1.10 kWh/km	1.00 kWh/km
Battery Capacity	170 kWh NMC	307 kWh NMC Gen 3



Range	150 km	300 km
Vehicle Length	8,000 mm	Same
Vehicle Width	2,550 mm	Same
Vehicle Height	3,700 mm	Same
Gross Combination Mass (GCM)	20,500 kg	Same
Payload Capacity	6,110 kg	5,620 kg
Curb Weight	14,390 kg	14,880 kg
Powertrain Architecture	Irizar-Jema 230 kW, fixed gear	Same
Thermal Management	Independent HVAC and BTMS thermal loops	New generation BMTS-HVAC combined in one unit; reduced weight; improved efficiency
Charging Strategy	Overnight DC charging at 50 kW	Overnight DC charging at 180 kW
Connectivity / Fleet Integration	Basic fleet manager	Full cloud integration with remote data acquisition
Digital Twin	Not available	High fidelity digital twin for thermal management and efficiency improvement

3.2 Test Protocol

This section outlines the procedures and methodologies applied during the functional testing phase, conducted through extensive road driving tests using the Irizar Electric Truck. The primary objective was to validate the functional performance and integration of key vehicle systems under real-world conditions.

The tests performed followed the guidelines defined in *D2.5-Test Catalogue*. A short description of the test and acceptance criteria has been summarized in this section as some of the acceptance criteria defined in D2.5 was pending to be defined by each OEM or some of the test conditions were impossible to achieve in public roads.

To ensure the robustness and reliability of the results, the IETRUCK was driven for over 2,000 kilometers across a variety of road types during the testing phase. This distance allowed for the thorough evaluation of system behaviour over time, including responses to thermal, electrical, and mechanical stresses that will be encountered during typical vehicle operation.

3.2.1 GEN 3 HV battery test

To evaluate the performance and reliability of the HV GEN3 battery system in the Irizar electric truck, a dedicated test protocol has been defined. The protocol focuses on real-world driving



conditions and long-duration charging scenarios to assess key battery behaviours. The main objectives of the test are:

- **Voltage and State of Charge evolution:** Monitor and record the battery pack voltage and SOC throughout extended road tests. This will help assess the consistency of energy delivery, UBP and module voltage levels and SOC estimation accuracy under dynamic driving conditions.
- **Current delivery during road tests:** Measure the current output of the battery during various driving phases (acceleration, cruising, regenerative braking) to evaluate the battery's ability to meet power demands and identify any performance degradation or anomalies.
- **Long duration charging behaviour:** Conduct prolonged charging sessions using fast-charging infrastructure to observe charging curves, thermal behaviour, and any potential issues related to battery management or cell balancing over time.

All measurements will be logged using a CAN datalogger and analyzed to evaluate proper performance.

3.2.2 BTMS cooling capacity

To assess the cooling performance of the Battery Thermal Management System (BTMS) in the IETRUCK, a test under real driving conditions on public roads will be performed. This test is designed to evaluate the BTMS's ability to maintain optimal battery temperature under thermal stress conditions.

The test route will be selected to include a variety of driving profiles (urban, interurban, and uphill segments) to simulate thermal load scenarios comparable to those expected in controlled environments.

Test objectives:

- Evaluate the BTMS's capacity to regulate battery temperature during sustained operation.
- Monitor coolant temperature, pressure and battery cell temperatures.
- Assess system responsiveness to thermal load variations during dynamic driving.

Test conditions:

- Ambient temperature will be recorded throughout the test to contextualize thermal performance.
- The vehicle will be driven in different scenarios, including highway, city and steep hill routes.
- Continuous data logging of thermal parameters will be performed using the onboard monitoring system.

The results will be compared against expected performance thresholds defined by internal acceptance criteria, with particular attention to temperature stability and system reliability under real-world thermal loads.



3.2.3 HVAC cooling capacity

Objective:

Evaluate the cooling performance of the IETRUCK's HVAC system and assess its ability to maintain cabin comfort under thermally demanding conditions.

Test focus:

- Measure cabin air temperature evolution during HVAC operation.
- Monitor system response time and cooling rate under predefined thermal loads.
- Record HVAC power consumption.

Acceptance criteria:

The HVAC system must demonstrate effective cooling performance when operated under standard cooling settings for a defined duration in a controlled indoor environment. System response time, cooling rate, and power consumption will be evaluated against predefined thermal load requirements.

Note: Originally planned for a high-altitude climatic chamber, the test will be conducted in a controlled indoor space due to the unavailability of the climatic chamber, allowing for consistent monitoring of ambient conditions and repeatable test scenarios.

3.2.4 Powertrain capabilities

The powertrain performance tests were conducted on controlled roads using the IETRUCK demo vehicle to evaluate key performance metrics including boost time, gradeability at various speeds, acceleration capability, and maximum speed limits following the guidelines defined in *Deliverable 2.5 – Test Catalogue*.

Test No.65: Boost time

Objective:

Evaluate the IETRUCK's ability to sustain maximum peak power output over a defined period (boost time).

Acceptance criteria:

The vehicle must maintain maximum peak power for ≥ 10 seconds during controlled road testing with the demo vehicle.

Test No.66: High-speed gradeability

Objective:

Evaluate the vehicle's capability to maintain high-speed performance while ascending a sustained incline.

**Acceptance criteria:**

The vehicle must maintain a speed of 70 km/h while climbing a grade of $\geq 4\%$ for a minimum duration of 60 seconds during controlled road testing.

Test No.67: Low speed gradeability

Objective:

Assess the vehicle's ability to maintain low-speed performance while ascending a sustained incline.

Acceptance criteria:

The vehicle must maintain a speed of 30 km/h while climbing a grade of $\geq 7\%$ for a minimum of 5 minutes during controlled road testing with the demo vehicle. Due to real-world constraints, the test will be conducted on the best available road if a continuous 7% incline is unavailable, and results will be interpreted accordingly.

Test No.68: Medium speed gradeability

Objective:

Assess the vehicle's ability to maintain medium-speed performance while ascending a sustained incline.

Acceptance criteria:

The vehicle must maintain a speed of 50 km/h while climbing a grade of $\geq 4.2\%$ for a minimum of 30 seconds during controlled road testing with the demo vehicle. Due to real-world constraints, the test will be conducted on the best available road if a continuous 4.2% incline is unavailable, and results will be interpreted accordingly.

Test No.69: Full acceleration

Objective:

Evaluate the IETRUCK's capability to accelerate from standstill to target speed under full load conditions.

Acceptance criteria:

The vehicle at Gross Combination Mass (GCM) must accelerate from 0 km/h to 80 km/h using full throttle in ≤ 25.8 seconds during controlled road testing with the demo vehicle.

Test No.70: Maximum speed

Objective:

Verify the IETRUCK's ability to reach and sustain its maximum design speed under normal operating conditions.

Acceptance criteria:

The vehicle at Gross Combination Mass (GCM) must reach and maintain 80 km/h for 30 seconds during controlled road testing with the demo vehicle.



Test No.71: Overspeeding

Objective:

Verify that the vehicle does not exceed the defined overspeed limit under full power conditions.

Acceptance criteria:

The vehicle must not exceed 80 km/h at any point when accelerated to maximum speed during controlled road testing with the demo vehicle.

3.2.5 Braking capability

This section describes the procedures to evaluate the braking performance of the IETRUCK under different operating conditions. The tests aim to verify the durability and effectiveness of the braking system during prolonged downhill driving, ensuring compliance with safety and functional requirements.

Test No.72: Durability brake

Objective:

Assess braking system performance during prolonged downhill operation.

Acceptance Criteria:

The vehicle must maintain a constant speed of 30 km/h for 15 seconds on a 6% downhill slope using service brakes and auxiliary braking systems during controlled road testing with the demo vehicle.

3.3 Results

This section presents the outcomes of all validation tests performed on the IETRUCK. The results should confirm the functional performance of key systems under real-world conditions and demonstrate compliance with project requirements.

3.3.1 GEN 3 HV battery test

The following results summarize the performance of the GEN3 high-voltage battery system during extended driving and charging scenarios, focusing on voltage stability, SOC evolution, and thermal behavior. The GEN3 high-voltage battery system was evaluated under real-world driving and charging conditions. The following observations were recorded:

shows SOC and voltage evolution during a 2:30 hour road test demonstrating stable behavior, with SOC decreasing linearly and voltage remaining within expected limits. No anomalies or abrupt drops were detected.



Figure 4 shows current delivery across different driving phases (acceleration, cruising, max speed and regenerative braking) confirming the battery's ability to meet power demands. Peak discharge currents occurred during full acceleration, while regenerative braking provided consistent negative current values.

Figure 5 shows a fast charging session results at 55 kW. The results show smooth charging curves and balanced thermal performance. No cell imbalance or errors were observed and the Battery Management System maintained proper control throughout the process.

Conclusion:

The GEN3 battery system met all performance and reliability criteria, showing stable SOC estimation, robust current delivery, and safe charging behavior under prolonged operation.

3.3.2 BTMS cooling capacity

This section reports the BTMS performance under dynamic driving conditions, highlighting its ability to maintain battery temperatures within safe limits during thermal stress.

The BTMS demonstrated effective thermal regulation during dynamic driving conditions. Battery temperatures remained within the optimal range throughout urban, interurban, and uphill segments. Coolant temperatures and pressure values showed stable behavior, confirming proper heat exchange.

Figure 6 illustrates the battery temperature profile during the 3 hour drive test, highlighting consistent cooling performance even under thermal stress scenarios. No signs of overheating or thermal derating were observed.

Conclusion:

The BTMS met all functional requirements, ensuring reliable cooling capacity and system responsiveness under real-world conditions.

3.3.3 HVAC cooling capacity

The HVAC system was tested under controlled conditions to evaluate its ability to maintain cabin comfort during dynamic thermal loads. The system achieved rapid cooling response, reducing cabin temperature from 10 °C to 4 °C within 7 minutes.

Figure 7 illustrates the cabin temperature evolution during the test, showing a steady cooling rate and stable performance once the target temperature was reached. Power consumption remained within nominal limits, and no operational faults were detected.

Conclusion:



The HVAC system demonstrated reliable cooling capacity and energy efficiency, meeting all functional requirements for cabin climate control.

3.3.4 Powertrain capabilities

This section summarizes the tests conducted to evaluate the dynamic performance of the IETRUCK powertrain. The objective is to validate key functional aspects such as acceleration, gradeability at different speeds, maximum speed and overspeed protection.

Test No.65: Boost time

The boost time test evaluated the IETRUCK's ability to sustain maximum peak power output. The vehicle successfully maintained peak power for 10 seconds.

Figure 8 shows the recorded motor torque and speed during the boost phase, confirming stable performance without thermal derating. The truck started from a standstill and accelerated with the throttle at 100 %. The motor temperature remained within safe limits throughout the test and no deratings were triggered.

Conclusion:

The powertrain demonstrated full compliance with boost time requirements, ensuring reliable high-power capability for demanding driving conditions.

Test No. 68 and No.66: Medium and High-speed gradeability

The test assessed the IETRUCK's ability to maintain high-speed performance on a sustained incline. The test was performed in a highway uphill section with a mean slope of 5 % in a 5 km stretch as shown in Figure 9. Both medium (Test 68) and high (Test 66) speed gradeability tests were performed on this road because it met both conditions.

Figure 10 illustrates the speed and power output during the climb, confirming stable performance without torque drop or thermal derating. The vehicle successfully maintained around 70 km/h on a 5% grade for 60 seconds.

Conclusion:

The vehicle met the high-speed and medium-speed gradeability requirements, demonstrating sufficient powertrain capability for demanding interurban routes.

Test No.67: Low speed gradeability

The IETRUCK was tested to maintain 30 km/h on a 7% grade for a prolonged duration. The test was performed on a mountain road, with an average inclination of 10 % and 1.20 km as shown in Figure 11.

The vehicle successfully sustained 30 km/h during all uphill segments without torque drop or thermal derating. Battery and motor temperatures remained within safe limits, and no alarms were triggered. Figure 12 shows speed and power output during the test, confirming stable performance under high-load conditions.

**Conclusion:**

The vehicle met the low-speed gradeability requirement, demonstrating strong climbing capability for urban and hilly routes.

Test No.69: Full acceleration

The IETRUCK was tested for acceleration from standstill to 80 km/h under full load conditions. The vehicle achieved the target speed in 21 seconds, meeting the requirement of ≤ 25.8 seconds.

Figure 13 shows the acceleration curve and power output during the test, confirming smooth torque delivery and stable performance. No alarms or thermal derating occurred, and battery SOC decreased within expected limits.

Conclusion:

The vehicle successfully met the full acceleration requirement, demonstrating strong dynamic capability for urban and interurban operations.

Test No.70 and No.71: Maximum speed and overspeeding

The IETRUCK was tested to verify its ability to reach and sustain maximum design speed while ensuring compliance with overspeed protection limits. The vehicle achieved a stable maximum speed of 80 km/h, meeting the requirement of 80 km/h (actual speed limitation of the truck).

At the end of the test, the overspeed protection system functioned correctly: the vehicle speed never exceeded 85 km/h and power and torque were decreased, even under full throttle conditions. No alarms or safety faults were triggered during the test.

Figure 14 shows the speed profile and power output during the test, confirming consistent performance and proper overspeed control.

Conclusion:

The vehicle successfully met both maximum speed and overspeeding requirements, demonstrating safe and reliable high-speed capability.

3.3.5 Braking capability

The following results summarize the braking system's durability and effectiveness during prolonged downhill operation, ensuring safety and compliance with functional requirements.

Test No.72: Durability brake

The durability brake test evaluated the braking system during prolonged downhill operation simulating a 6% grade. The test was performed in a 1.20 km mountain road section with an average grade of -10 % as shown in Figure 15.

The IETRUCK maintained a constant speed of 30 km/h over the full test distance using service brakes and auxiliary braking systems. Brake performance was maintained during the entire



descent with no signs of fade or performance degradation. Battery temperature and regenerative braking functioned correctly, contributing to energy recovery during the descent. Figure 16 illustrates speed stability throughout the test and motor braking power, confirming consistent braking performance under sustained load.

Conclusion:

The braking system met durability requirements, ensuring safe operation and thermal stability during extended downhill conditions.

shows SOC and voltage evolution during a 2:30 hour road test demonstrating stable behavior, with SOC decreasing linearly and voltage remaining within expected limits. No anomalies or abrupt drops were detected.

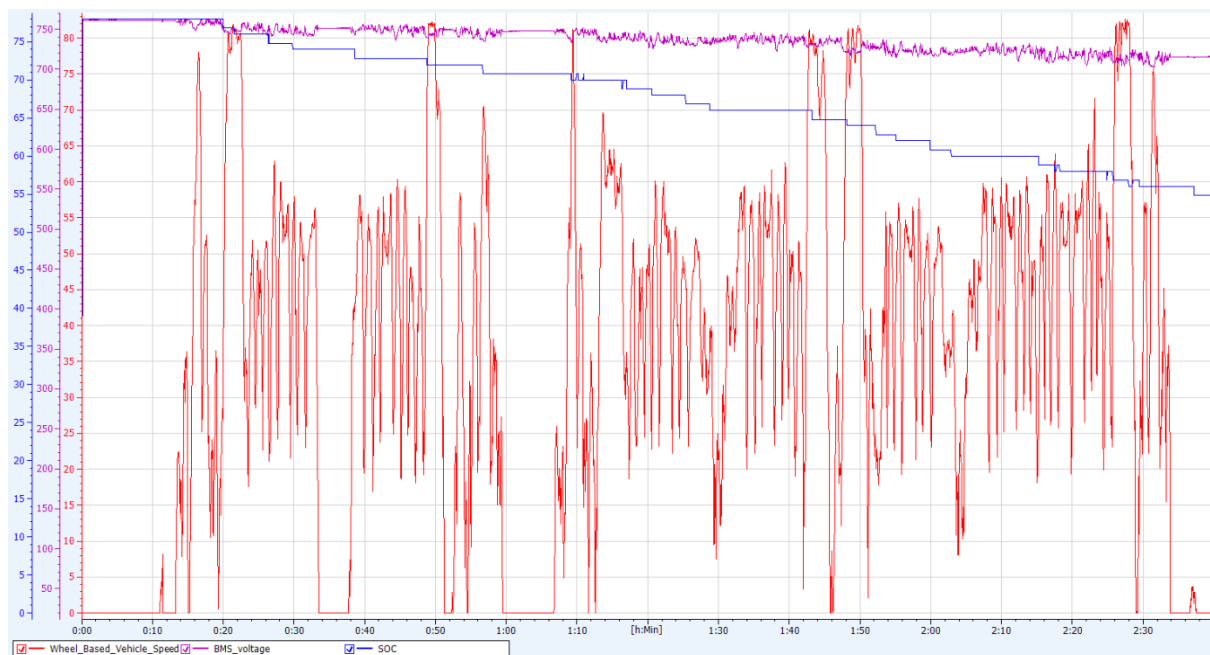


Figure 3. SOC and voltage stability in driving test

Figure 4 shows current delivery across different driving phases (acceleration, cruising, max speed and regenerative braking) confirming the battery's ability to meet power demands. Peak discharge currents occurred during full acceleration, while regenerative braking provided consistent negative current values.

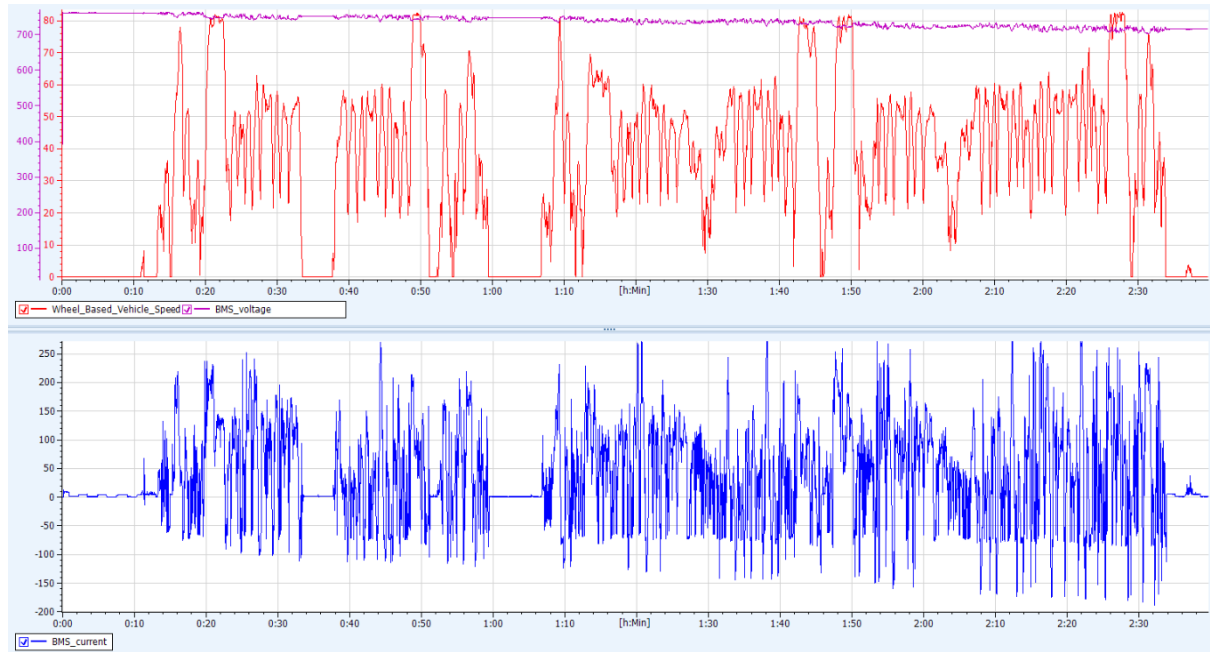


Figure 4. Current delivery during acceleration, max speed and braking scenarios

Figure 5 shows a fast charging session results at 55 kW. The results show smooth charging curves and balanced thermal performance. No cell imbalance or errors were observed and the Battery Management System maintained proper control throughout the process.

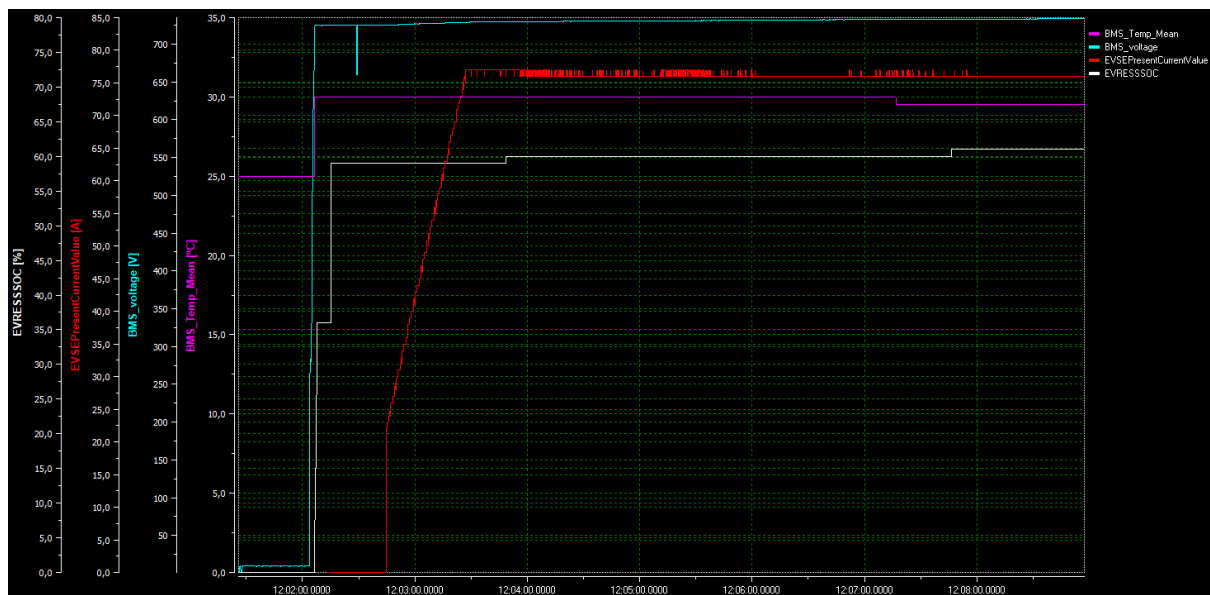


Figure 5. Fast charging test

Conclusion:

The GEN3 battery system met all performance and reliability criteria, showing stable SOC estimation, robust current delivery, and safe charging behavior under prolonged operation.



3.3.6 BTMS cooling capacity

This section reports the BTMS performance under dynamic driving conditions, highlighting its ability to maintain battery temperatures within safe limits during thermal stress.

The BTMS demonstrated effective thermal regulation during dynamic driving conditions. Battery temperatures remained within the optimal range throughout urban, interurban, and uphill segments. Coolant temperatures and pressure values showed stable behavior, confirming proper heat exchange.

Figure 6 illustrates the battery temperature profile during the 3 hour drive test, highlighting consistent cooling performance even under thermal stress scenarios. No signs of overheating or thermal derating were observed.

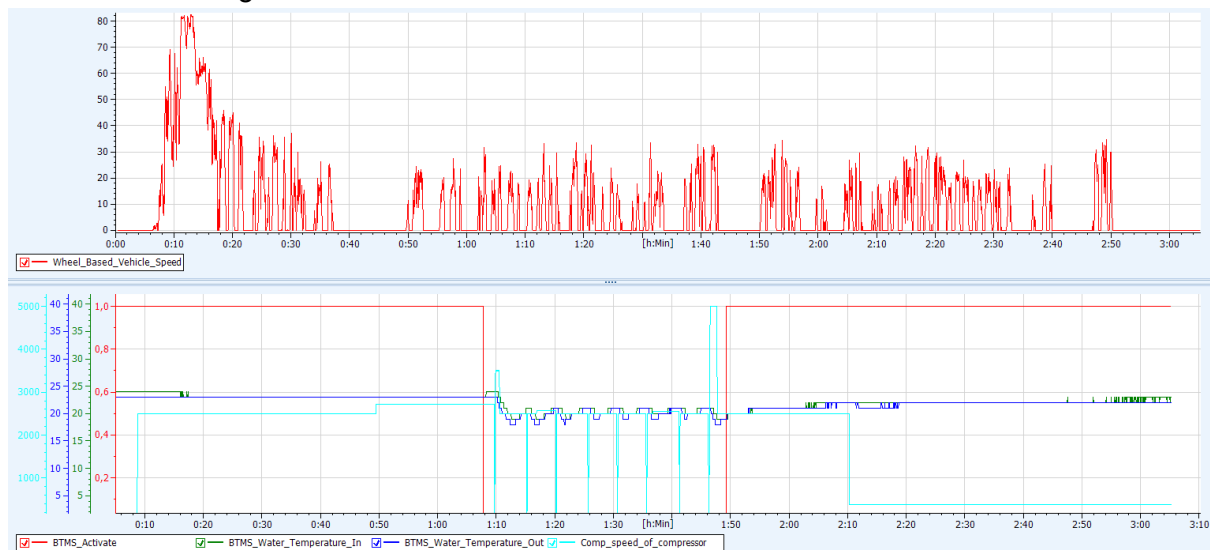


Figure 6. BTMS cooling during driving tests

Conclusion:

The BTMS met all functional requirements, ensuring reliable cooling capacity and system responsiveness under real-world conditions.

3.3.7 HVAC cooling capacity

The HVAC system was tested under controlled conditions to evaluate its ability to maintain cabin comfort during dynamic thermal loads. The system achieved rapid cooling response, reducing cabin temperature from 10 °C to 4 °C within 7 minutes.



Figure 7 illustrates the cabin temperature evolution during the test, showing a steady cooling rate and stable performance once the target temperature was reached. Power consumption remained within nominal limits, and no operational faults were detected.

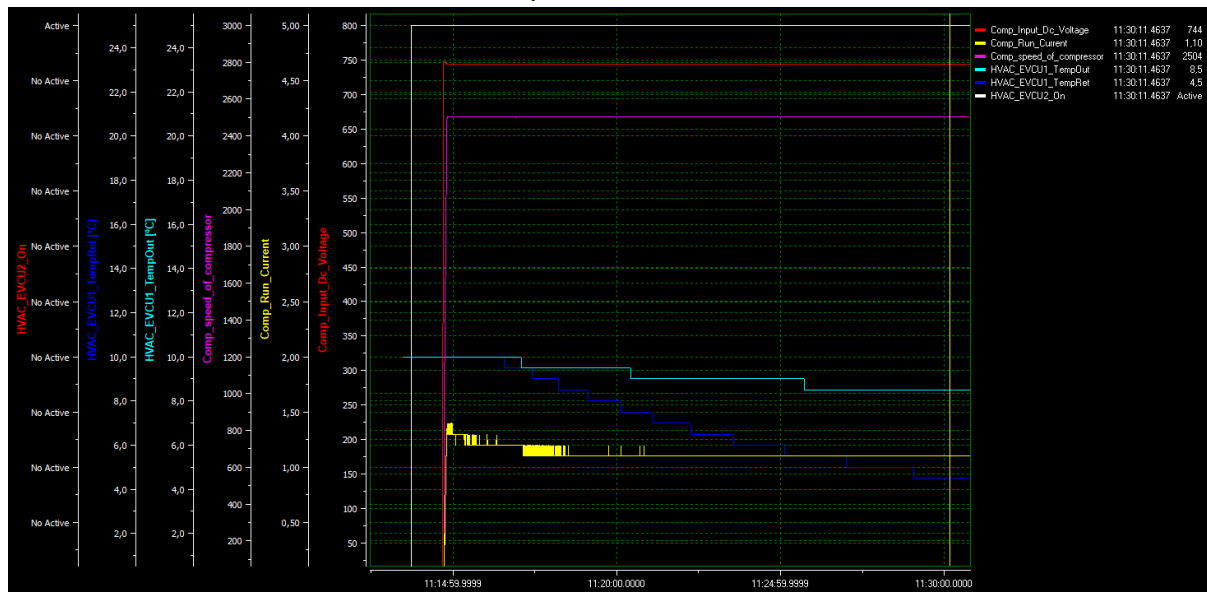


Figure 7. HCAC cooling capacity test results

Conclusion:

The HVAC system demonstrated reliable cooling capacity and energy efficiency, meeting all functional requirements for cabin climate control.

3.3.8 Powertrain capabilities

This section summarizes the tests conducted to evaluate the dynamic performance of the IETRUCK powertrain. The objective is to validate key functional aspects such as acceleration, gradeability at different speeds, maximum speed and overspeed protection.

Test No.65: Boost time

The boost time test evaluated the IETRUCK's ability to sustain maximum peak power output. The vehicle successfully maintained peak power for 10 seconds.



Figure 8 shows the recorded motor torque and speed during the boost phase, confirming stable performance without thermal derating. The truck started from a standstill and accelerated with the throttle at 100 %. The motor temperature remained within safe limits throughout the test and no deratings were triggered.

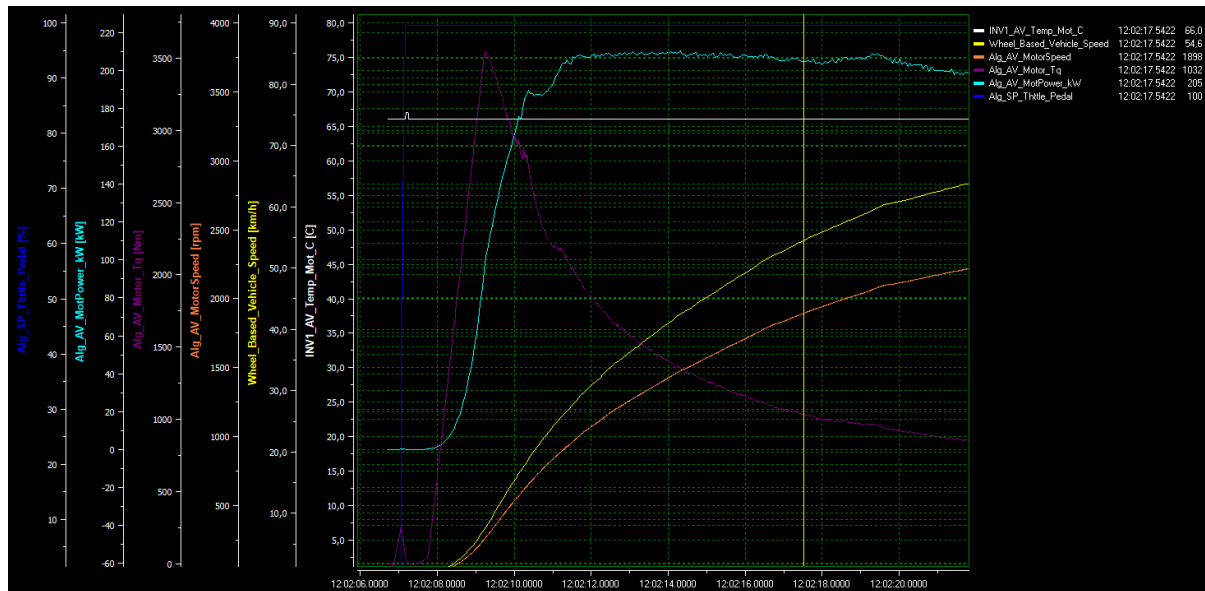


Figure 8. Boost time test results

Conclusion:

The powertrain demonstrated full compliance with boost time requirements, ensuring reliable high-power capability for demanding driving conditions.

Test No. 68 and No.66: Medium and High-speed gradeability

The test assessed the IETRUCK's ability to maintain high-speed performance on a sustained incline. The test was performed in a highway uphill section with a mean slope of 5 % in a 5 km stretch as shown in Figure 9. Both medium (Test 68) and high (Test 66) speed gradeability tests were performed on this road because it met both conditions.

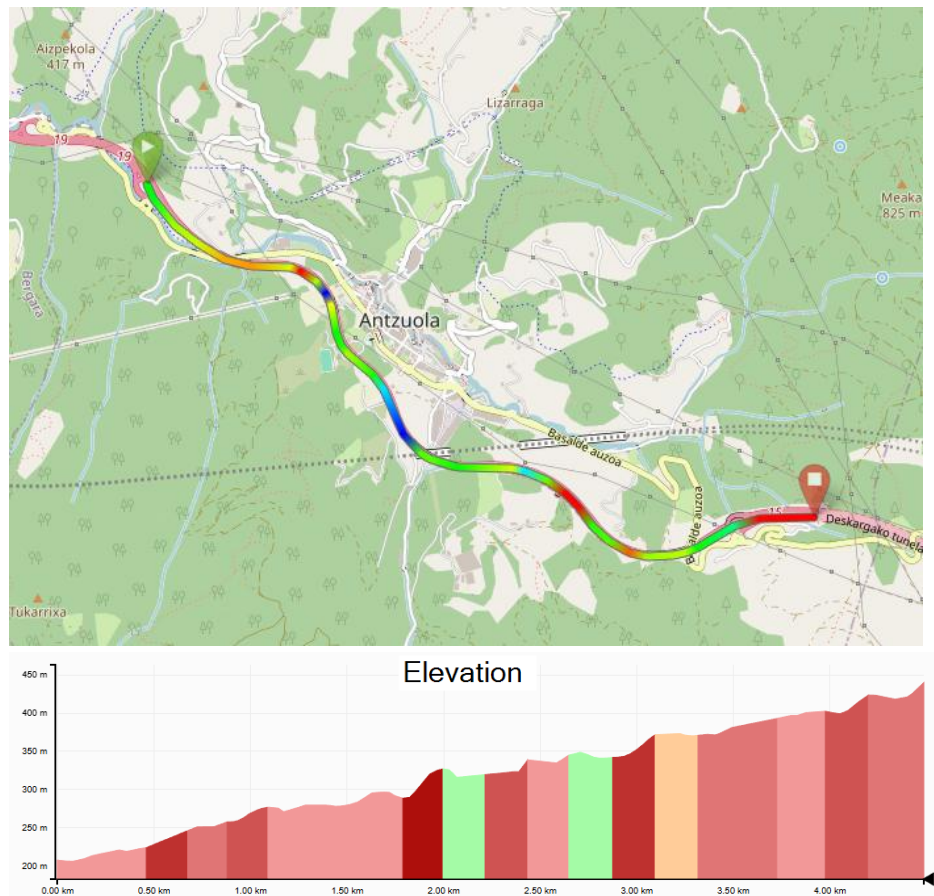


Figure 9. Elevation profile for high speed gradeability test

Figure 10 illustrates the speed and power output during the climb, confirming stable performance without torque drop or thermal derating. The vehicle successfully maintained around 70 km/h on a 5% grade for 60 seconds.

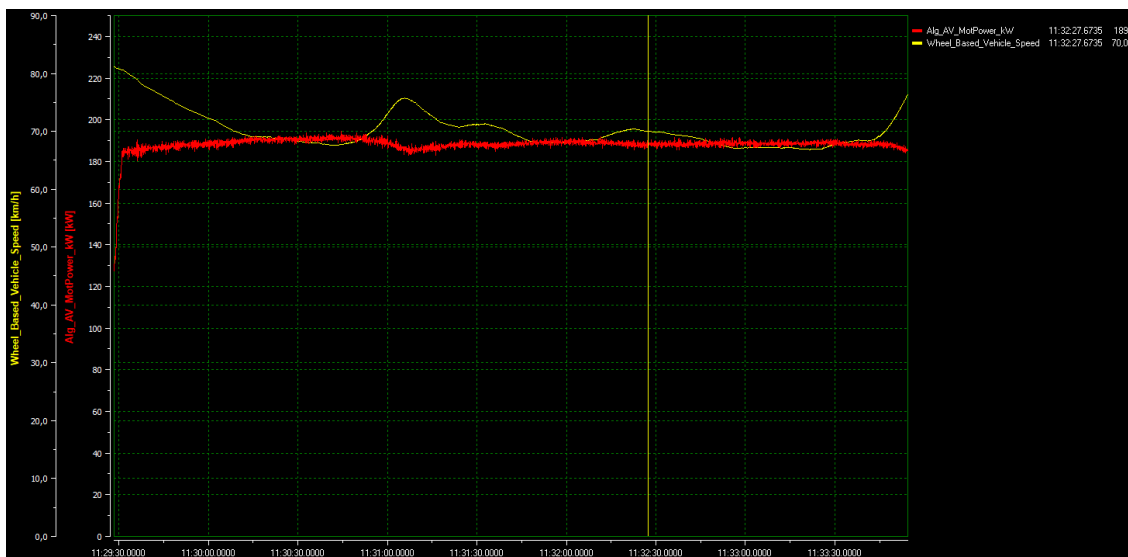


Figure 10. Speed and motor power during high and medium speed gradeability test



Conclusion:

The vehicle met the high-speed and medium-speed gradeability requirements, demonstrating sufficient powertrain capability for demanding interurban routes.

Test No.67: Low speed gradeability

The IETRUCK was tested to maintain 30 km/h on a 7% grade for a prolonged duration. The test was performed on a mountain road, with an average inclination of 10 % and 1.20 km as shown in Figure 11.

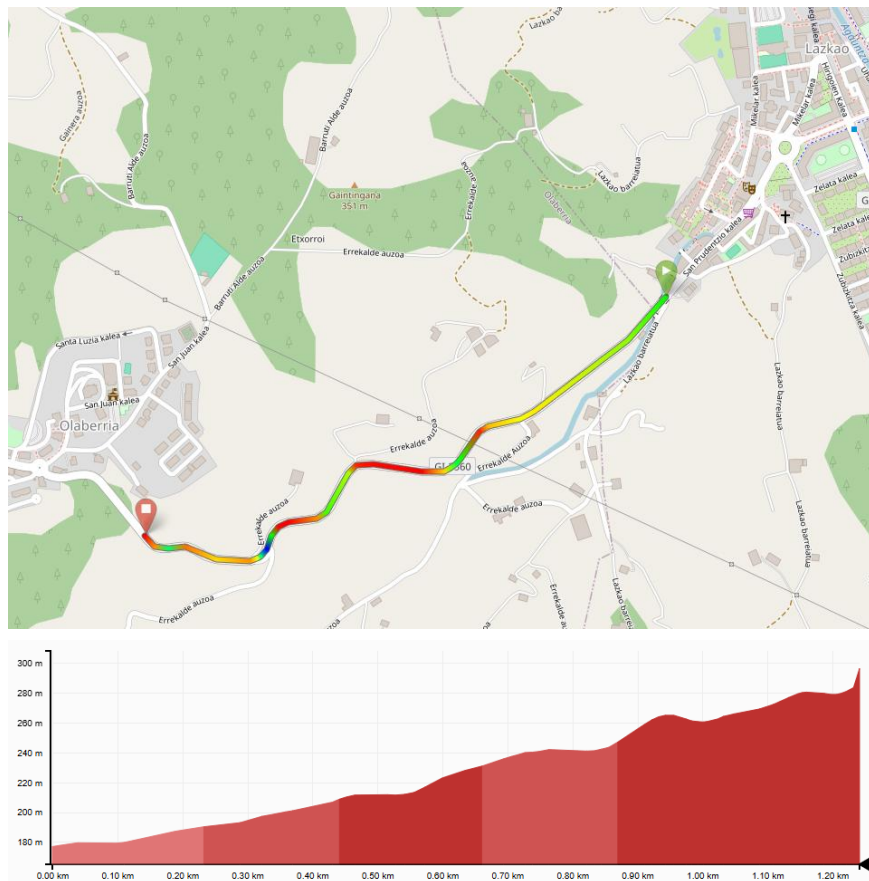


Figure 11. Elevation profile for low speed gradeability test

The vehicle successfully sustained 30 km/h during all uphill segments without torque drop or thermal derating. Battery and motor temperatures remained within safe limits, and no alarms were triggered. Figure 12 shows speed and power output during the test, confirming stable performance under high-load conditions.

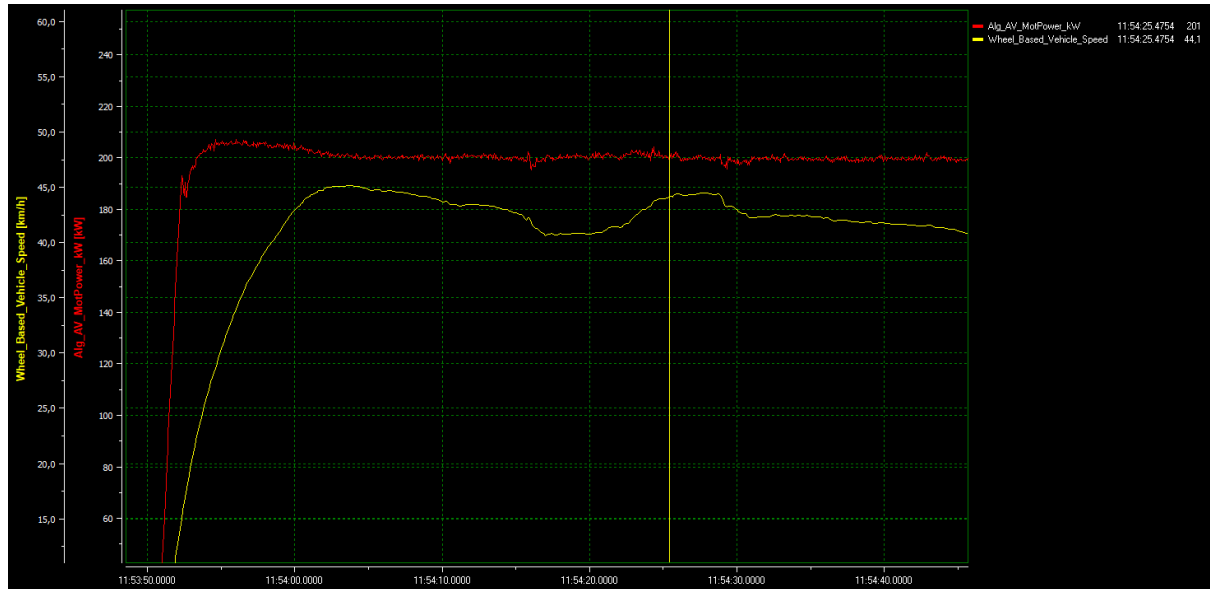


Figure 12. Speed and motor power during low speed gradeability test

Conclusion:

The vehicle met the low-speed gradeability requirement, demonstrating strong climbing capability for urban and hilly routes.

Test No.69: Full acceleration

The IETRUCK was tested for acceleration from standstill to 80 km/h under full load conditions. The vehicle achieved the target speed in 21 seconds, meeting the requirement of ≤ 25.8 seconds.

Figure 13 shows the acceleration curve and power output during the test, confirming smooth torque delivery and stable performance. No alarms or thermal derating occurred, and battery SOC decreased within expected limits.



Figure 13. Speed and motor power during full acceleration test



Conclusion:

The vehicle successfully met the full acceleration requirement, demonstrating strong dynamic capability for urban and interurban operations.

Test No.70 and No.71: Maximum speed and overspeeding

The IETRUCK was tested to verify its ability to reach and sustain maximum design speed while ensuring compliance with overspeed protection limits. The vehicle achieved a stable maximum speed of 80 km/h, meeting the requirement of 80 km/h (actual speed limitation of the truck).

At the end of the test, the overspeed protection system functioned correctly: the vehicle speed never exceeded 85 km/h and power and torque were decreased, even under full throttle conditions. No alarms or safety faults were triggered during the test.

Figure 14 shows the speed profile and power output during the test, confirming consistent performance and proper overspeed control.

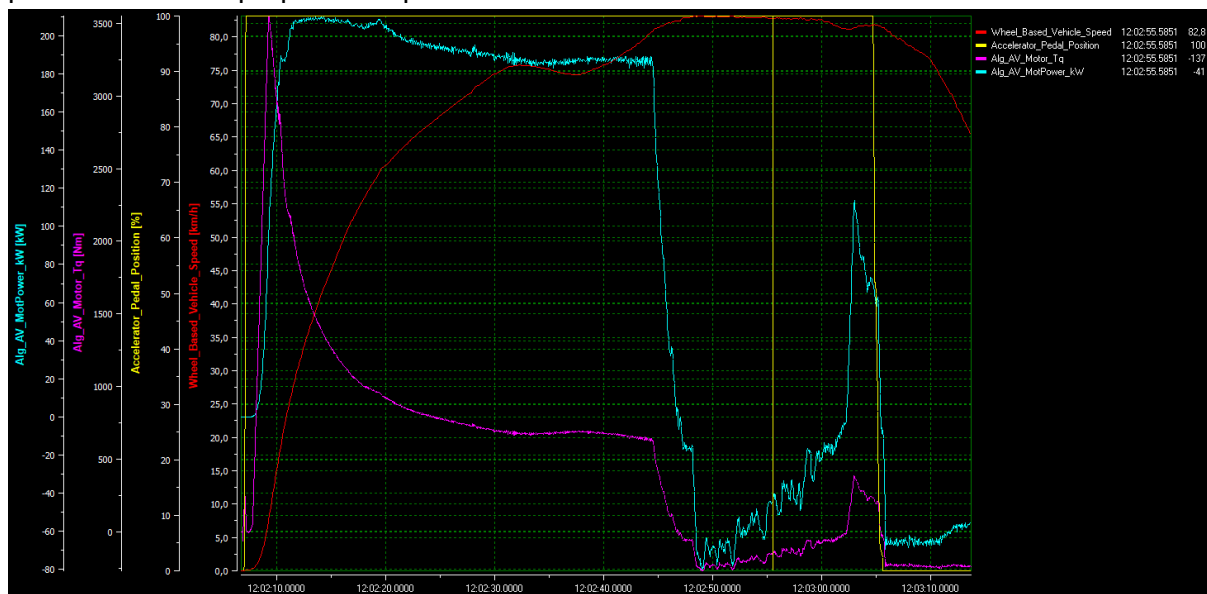


Figure 14. Accelerator pedal, speed, motor torque and power during full acceleration test

Conclusion:

The vehicle successfully met both maximum speed and overspeeding requirements, demonstrating safe and reliable high-speed capability.

3.3.9 Braking capability

The following results summarize the braking system's durability and effectiveness during prolonged downhill operation, ensuring safety and compliance with functional requirements.

Test No.72: Durability brake



The durability brake test evaluated the braking system during prolonged downhill operation simulating a 6% grade. The test was performed in a 1.20 km mountain road section with an average grade of -10 % as shown in Figure 15.

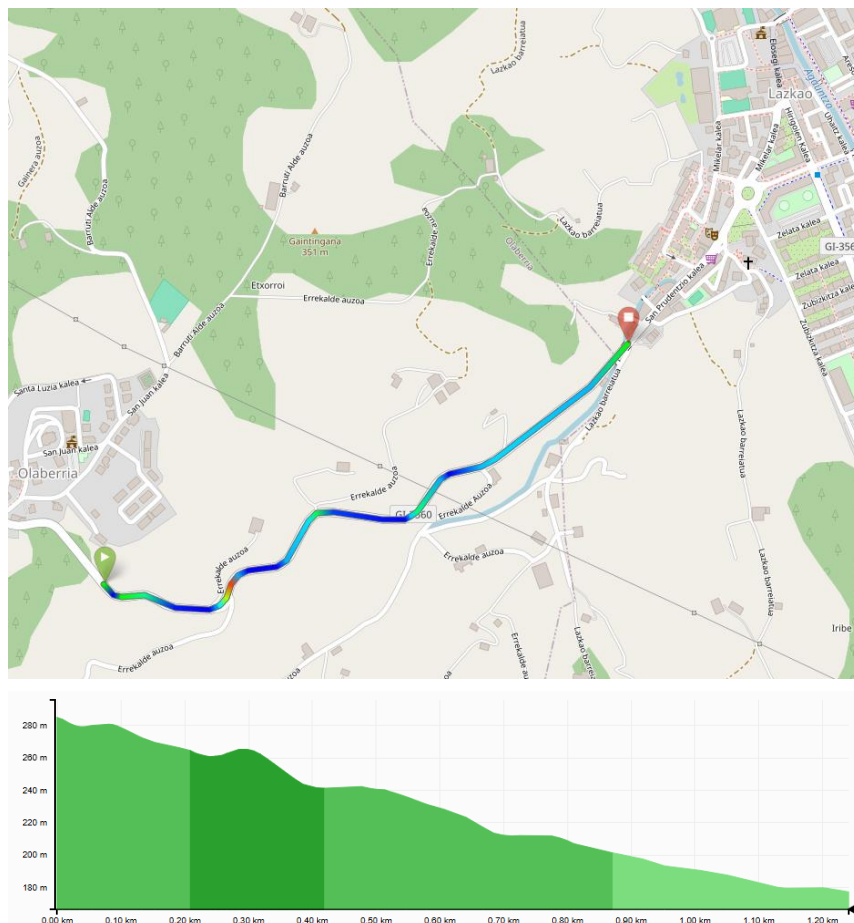


Figure 15. Elevation profile for durability brake test

The IETRUCK maintained a constant speed of 30 km/h over the full test distance using service brakes and auxiliary braking systems. Brake performance was maintained during the entire descent with no signs of fade or performance degradation. Battery temperature and regenerative braking functioned correctly, contributing to energy recovery during the descent. Figure 16 illustrates speed stability throughout the test and motor braking power, confirming consistent braking performance under sustained load.

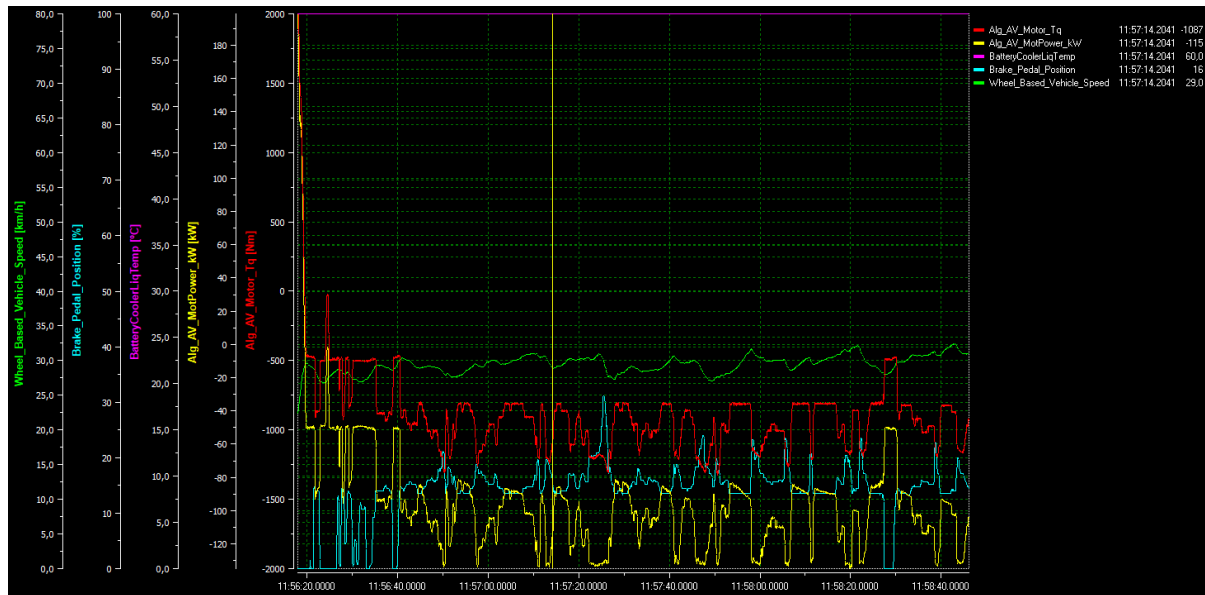


Figure 16. Brake pedal, speed, motor torque and power during durability brake test

Conclusion:

The braking system met durability requirements, ensuring safe operation and thermal stability during extended downhill conditions.

4 UC3 UK (DAF)

DAF will be deploying 2 vehicles within the Turners of Soham fleet. This will be through one of their operators – Matthew Kibbles. Throughout the 6 month demonstration, DAF will be comparing their new XB product against the LF product that was utilised through the BETT (Battery Electric Truck Trial) trial, but also comparing how different operational variables impact vehicle performance – such as driver, route and weather.

4.1 Vehicle Specification

This section details the specifications of the DAF trucks as part of the NextETRUCK project. It includes both the baseline configuration and the upgraded version developed through the project's work packages

4.1.1 Benchmark

The benchmark trucks were DAF electric LFs deployed through the BETT (Battery Electric Truck Trial), supported by Cenex (<https://bett.cenex.co.uk/>). These vehicles were deployed into a number of NHS and local council fleets, with the aggregated performance and range achieved below.



Headline Benchmark Specification

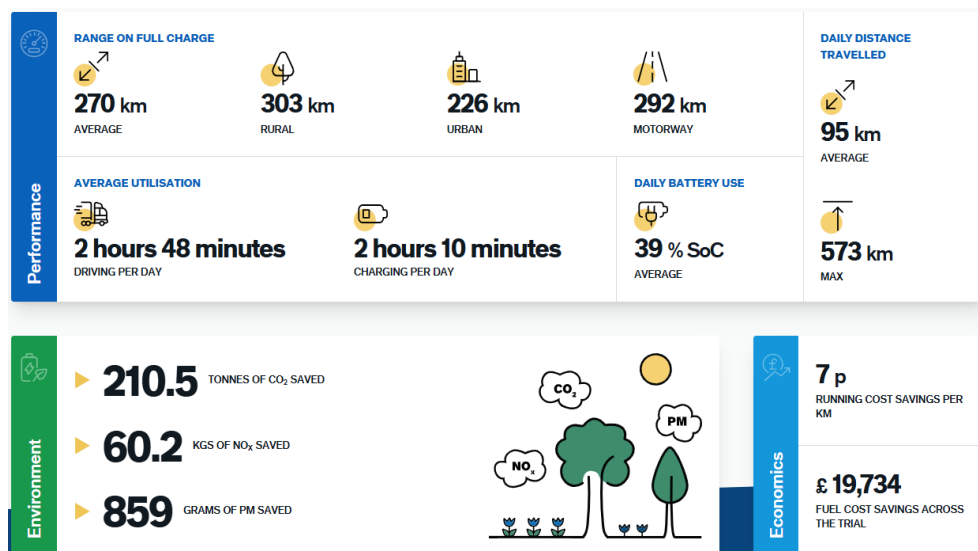
- DAF Electric LF 19t
- 282kWh Battery (88% usable)
- 150kW DC and 22kW AC charging
- 260kW eMotor
- 6 year battery warranty

BETT Results

The BETT results were published online via the above link, in order to support the wider industry in transitioning to electrification. Some of the key headline numbers were as follows:

- Average range achieved: 270km
 - Rural: 303km
 - Urban: 226km
 - Motorway: 292km
- Maximum daily distance travelled: 573km
- Average driving time per day: 2:48 hours
- Average charging time per day: 2:10 hours

This data provides a benchmark of performance, through which we will compare during the NexteTRUCK project.



4.1.2 NextETRUCK

Through the NextETruck project, the new generated electric DAF XBs will be deployed, and compared against both the performance achieved through the BETT trial, as well as observing how operational variables influence vehicle performance.

Headline NextETruck Vehicle Specification



- DAF Electric XB 19t
- 6.25m wheelbase
- 282kWh Battery (88% usable)
- 150kW DC and 22kW AC charging
- Curtainsider body
- 190kW eMotor
- ADAS systems – including lane departure warning, side & turn assist, drowsiness detection
- PACCAR Connect
- 8 year battery warranty
- 1.5t Tuckunder taillift

4.2 Test Protocol

The DAF NextETruck vehicles are Whole Vehicle Type Approved, so have undertaken a number of testing regimes to achieve this status. Whole Vehicle Type Approval is a certification to confirm vehicles meet safety regulations before sale. All specific tests are included within deliverable 2.5.

A number of the key items and certifications are listed here:

- Whole Vehicle Type Approval Certificate of Conformity
 - This certification confirms that the vehicle is type approved.
- Brake Rolling Road Test
 - Before leaving the production facility, the vehicle was tested using a rolling brake test, to simulate real world conditions to ensure the vehicle's brakes worked effectively.
- UNR13 Brake Approval
 - This certification confirms that the vehicle complies to the UNECE Regulation 13 international standard for braking systems.
- UNR10 EMC Approval
 - This certification confirms that the vehicle complies to the UNECE Regulation 10 international standard for electromagnetic compatibility.
- UNR100 Electric Vehicle Approval
 - This certification confirms that the vehicle complies to the UNECE Regulation 100 international safety standard for electric vehicle drivetrains.
- UNR156 Software Management Approval
 - This certification confirms that the vehicle complies to the UNECE Regulation 156 international standard for Software Update Management Systems
- Further test protocol taken from deliverable 2.5:
- 3.1.1.1 – Verification of Digital Twin (DT) functionality
 - Description: The purpose of this is to verify the functionality of the digital twin using data feed directly from the battery system
 - Acceptance Criteria: Successful data feed from battery into the digital twin
- 3.2.1.1 – Telemetry
 - Description: The purpose of this test is to confirm telemetry connectivity for further change planning & fleet management
 - Acceptance Criteria: Successful addition of truck to PANION's system
- 3.2.1.3 – Fleet management – vehicle tracking and planned operations



- Description: The purpose of this test is to confirm the complete data set presence together with planned operations for the fleet
- Acceptance Criteria: If all recorder data will be accurate enough to supervise the fleet operations and charge plan executions (correct vehicle identification, location +/- 10km, SoC +/- 1%, odometer values +/- 1km)
- 3.3.1.2 – Vehicle Driving Range
 - Description: The purpose of this test is check the vehicle's driving range in a test
 - Acceptance Criteria: 300km range completed
- 3.3.2.1 – Commissioning test of project-related functionalities
 - Description: The purpose of this test is to verify that the required vehicle features developed in NextETRUCK are present in the prototype vehicles
 - Acceptance Criteria: Commencement of vehicle demonstrator and vehicle specification
- 3.3.3.1 – Digital Twins Validation for Energy Characterisation
 - Description: The purpose of this test is to ensure, that the digital twins accurately represent the energy consumption characteristics of the baseline and target vehicles, which will aid Test No. 62 in identifying energy-savings It is an important part of Task 4.4 ("Virtual verification on components, vehicle and fleet concepts") and a precondition for using the results of Test No. 62 in Task 8.2 ("Validation")
 - Acceptance Criteria: An acceptable tolerance of +/- 5% in real world characteristics vs digital twin
- 3.3.3.5 – Vehicle Driving Range
 - Description: The purpose of this test is to demonstrate the vehicle's functionality and performance in real-world conditions in logistics
 - Acceptance Criteria: Real world range achieved of 300km

4.3 Results

The NextETRUCK vehicles are whole vehicle type approved, and have gone through a series of testing to support homologation. Whilst the demonstration results are consolidated, the vehicles have a simulated range and performance taken from the 'Vehicle CO2 emissions and fuel consumption – Customer information file', which indicate that the vehicles will evidence improved performance throughout the NextETRUCK demonstration.

Simulation tests taken from Vehicle CO2 emissions and fuel consumption – Customer information file:

- **Long Haul Simulation**
 - Total Vehicle Weight: 14 t
 - kWh/km: 1.876kWh/km
 - Range: 233.5 km
- **Municipal Utility Simulation**
 - Total Vehicle Weight: 16.728 t
 - kWh/km: 2.554 kWh/km
 - Range: 171.5 km
- **Regional Delivery Simulation**
 - Total Vehicle Weight: 14.228 t
 - kWh/km: 1.21 kWh/km
 - Range: 362 km
- **Urban Delivery Simulation**
 - Total Vehicle Weight: 14.228 t



- kWh/km: 0.9865 kWh/km
- Range: 443.8 km
- **Weighted Results Simulation**
 - Average Payload: 3.18 t
 - Range: 364.9 km

Test results taken from deliverable 2.5:

- 3.1.1.1 – Verification of Digital Twin (DT) functionality
 - Result: To be completed by TNO in conjunction with DAF NV
- 3.2.1.1 – Telemetry
 - Result: To be captured during the demonstration
- 3.2.1.3 – Fleet management – vehicle tracking and planned operations
 - Result: To be captured during the demonstration
- 3.3.1.2 – Vehicle Driving Range
 - Result: Simulated range of 364.9 km from Customer Information File to be verified by demonstration (Annex 1)
- 3.3.2.1 – Commissioning test of project-related functionalities
 - Result: Whole vehicle type approval certification (Annex 1)
- 3.3.3.1 – Digital Twins Validation for Energy Characterisation
 - Result: To be captured during the demonstration
- 3.3.3.5 – Vehicle Driving Range
 - Result: Simulated range of 364.9 km from Customer Information File to be verified by demonstration (Annex 1)

Conclusion:

In conclusion, the NextETRUCK DAF vehicles have undertaken a rigorous testing procedure to achieve Whole Vehicle Type Approval, with some of those tests referenced above and certifications included within Annex 1. The vehicle specification and results from the BETT trial provide a set of results to compare the XB electric vehicles against, with the simulated results indicating that this will be a positive improvement, through a simulated range of 364.9km, versus an average range achieved of 270km within the BETT trial. There are considerable variables involved in vehicle range and performance, and through the demonstration period, these variables will be tweaked in order to observe the impact that this has on range. This will create a clear recommendation and toolkit for operators to support them with optimising electric HGVs when in operation.

Through the demonstration period, which will commence in February 2026, further tests will be completed with the vehicles in service, in order to meet the acceptance criteria detailed above.



5 CONCLUSION

This deliverable documents the successful vehicle-level functional verification and testing conducted within Work Package 5 for the NextETRUCK project. The results confirm that the demonstrators for **Ford Otosan (Istanbul)**, **Irizar (Barcelona)**, and **DAF (UK)** operate in accordance with technical requirements and project performance targets.

The verification utilized a balanced approach to account for individual use case timelines: Ford and Irizar focused on extensive physical road and system testing, while DAF's readiness, following its later integration, is evidenced through comprehensive Whole Vehicle Type Approval and simulation data.

Key outcomes from the verification tests and simulation include:

- **Thermal Management & HVAC:** Ford Otosan verified stable heating performance at -3.5°C with no thermal oscillation. Irizar demonstrated rapid cabin cooling (10°C to 4°C in 7 minutes) and stable battery thermal regulation during dynamic driving.
- **Powertrain & Performance:** Irizar confirmed compliance across all powertrain metrics, including sustaining peak boost power for 10 seconds and maintaining target speeds on inclines up to 10%. DAF's powertrain is certified under international electrical safety (UNR100) and electromagnetic (UNR10) standards.
- **Energy & Range:** Irizar's GEN3 battery system showed stable SOC depletion and robust current delivery during 2.5-hour road trials. DAF's simulation data projects a weighted average range of 364.9 km, representing an improvement over the 270 km trial benchmark.
- **Braking & Safety:** Ford Otosan verified the operational integrity of its new airless braking system. Irizar maintained constant speed on steep downhill descents (-10% grade) without brake fade. DAF confirmed safety via UNR13 Brake Approval and successful rolling road tests.

Overall, these activities validate that the innovative solutions developed in the project are technically sound, safe, and ready for the real-world demonstration. The verified performance improvements, particularly in energy efficiency, thermal management, and drivability, confirm the effectiveness of the innovative solutions and their readiness for demonstration and further exploitation.



6 REFERENCES

- D2.1 – Use Case, Mission and Overall Vehicle Definition
- D2.2 – System Definition and Specification
- D2.5 – Test Catalogue
- D7.1 – Demonstration plan and processes



7 ANNEX 1: TEST CERTIFICATIONS

Whole Vehicle Type Approval Certificate of Conformity

CERTIFICATE OF CONFORMITY (Great Britain) complete vehicles MODEL A1 - PART 1

	The undersigned hereby certifies that the vehicle	Jan Saenen. Principal Engineer - Leyland
0.1.	Make (Trade name of manufacturer)	DAF
0.2.	Type - Variant - Version	L2EN3 - AE190SEZZZZ - EDA190AMLRSPUZUE190ZZ
0.2.1.	Commercial name(s)	XB Electric 19T
0.2.3.	Identifiers (if applicable)	N/A
0.2.3.1.	Interpolation family's identifier	N/A
0.2.3.2.	ATCT family's identifier	N/A
0.2.3.3.	PEMS family's identifier	N/A
0.2.3.4.	Roadload family's identifier	N/A
0.2.3.5.	Roadload Matrix family's identifier (if applicable):	N/A
0.2.3.6.	Periodic regeneration family's identifier	N/A
0.2.3.7.	Evaporative test family's identifier:	N/A
0.4.	Vehicle category	N3
0.5.	Company name and address of manufacturer	DAF Trucks N.V. Hugo v.d. Goeslaan 1, 5643 TW Eindhoven, The Netherlands
0.6.	Location and method of attachment of the statutory plates	on Type Plate mounted on left hand door aperture, glued
	Location of the vehicle identification number	Near to front axle in RH main girder adjacent
0.9.	Name and address of the manufacturers representative (if any)	Leyland Trucks Ltd Croston Road Leyland PR26 6LZ, Lancashire, United Kingdom
0.10.	Vehicle identification number	XLRAEL3E00L554931
	conforms in all respects to the type described in approval issued on	g11*2018/858*00549*05 2025-03-26
	and can be permanently registered in countries.	vehicle for left-hand traffic metric and imperial unit speedometer and odometer
0.11.	Date of manufacture of the vehicle	2025-11-08
Leyland, 2025-11-08		

Brake Rolling Road Test

RESULTS 01-Nov-2025 09:27:59

BARCODE ID: L554931

STATION: Brake Rolling Road Tester 1

VIN Source :Auto

Vehicle Info :LF-MY24 : 56 : FA : EBS3_4S-4M : 4X2 : HOD_RHD

SEQUENCE: Abs RESULT: PASS

SEQUENCE: ~~RR_ReverseTest~~ RESULT: PASS

SEQUENCE: ~~RR_StartInhibit~~ RESULT: PASS

SEQUENCE: ~~RR_DynoTests~~ RESULT: PASS

TESTING PASS
Total Duration 10m 16s



UNR13 Brake Approval

Work Order Number: VCA026486-7

ANNEX XVIII

INFORMATION DOCUMENT No. E11*13R11/18*7303*01 Rev.01

PURSUANT TO ANNEX 1 TO COUNCIL DIRECTIVE 70/156/EEC RELATING TO
EC TYPE APPROVAL OF A VEHICLE WITH RESPECT TO THE
BRAKING EQUIPMENT OF MOTOR VEHICLES

(Directive 71/320/EEC as last amended by Directive 2002/78/EC)

The following information, if applicable, must be supplied in triplicate and must include a list of contents. Any drawings must be supplied in appropriate scale and in sufficient detail on size A4 format. Photographs, if any, shall show sufficient detail

If the systems, components or separate technical units have electronic controls, information concerning their performance shall be supplied

0. GENERAL

- 0.1. Make (trade name of manufacturer): DAF
- 0.2. Type: L2EN3
- 0.3. Means of identification of type, if marked on the vehicle: Type marked on VIN plate
- 0.3.1 Location of that marking: VIN plate fixed to left hand door aperture
- 0.4 Category of vehicle: N₃
- 0.5 Name and address of applicant: DAF Trucks NV
Hugo v.d. Goeslaan 1
5643 TW Eindhoven
The Netherlands
- 0.8 Address of assembly plant: Leyland Trucks Ltd.
Croston Road
Leyland
Lancs PR26 6LZ
UK

Page 1
E11*13R11/18*7303*01 Rev.01



UNR10 EMC Approval



Work Order Number VCA026950-1

ANNEX 2A

INFORMATION DOCUMENT No. E11*10R06/03*11848*02 Rev.01

The following information shall be supplied in triplicate and shall include a list of contents. Any drawings shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail. If the systems, components or separate technical units have electronic controls, information concerning their performance must be supplied.

General		
1.0	Make (trade name of manufacturer):	DAF
2.0	Type:	L?EN?
3.0	Category of vehicle:	N ₂ , N ₃
3.1	Commercial name(s) if available	XB Electric ??t
4.0	Name and address of manufacturer:	DAF Trucks NV Hugo vd Goeslaan 1 5643 TW Eindhoven The Netherlands
5.0	If applicable, name and address of manufacturer's representative:	Leyland Trucks Ltd. Croston Road Leyland Lancs PR26 6LZ UK

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E11*10R06/03*11848*02 Rev.01



UNR100 Electric Vehicle Approval



THE UNITED KINGDOM VEHICLE APPROVAL AUTHORITY

COMMUNICATION CONCERNING APPROVAL GRANTED¹⁴ APPROVAL EXTENDED¹⁴
APPROVAL REFUSED¹⁴ APPROVAL WITHDRAWN¹⁴ PRODUCTION DEFINITELY
DISCONTINUED¹⁴ OF A VEHICLE TYPE WITH REGARD TO ITS ELECTRICAL SAFETY
PURSUANT TO REGULATION NO. 100.03



Approval No: E11*100R03/03*1215*02

1. Trade name or mark of the vehicle: DAF Trucks
2. Vehicle type: L7EN?
3. Vehicle category: N2 and N3
4. Manufacturer's name and address:
DAF Trucks NV
Hugo vd Goeslaan 1
5600 PT Eindhoven
The Netherlands
5. If applicable, name and address of manufacturer's representative: Not applicable
6. Description of the vehicle:
 - 6.1. REESS type: Olivine-type lithium iron phosphate and graphite. H Pack 456 Ah, C Pack 346 Ah
 - 6.1.1. The approval number of the REESS or description of the REESS:
C Pack: E11*100R03/03*0851*00
H Pack: E11*100R03/03*0883*00
 - 6.2. Working voltage: H Pack: 700.8; C Pack: 689.85
 - 6.3. Propulsion system (e.g. hybrid, electric): Electric

VCA021582-1

An executive agency of the Department for Transport
May 2025 Revision 4
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UNR156 Software Management Approval



Kraftfahrt-Bundesamt
DE-24932 Flensburg



MITTEILUNG

ausgestellt von:

Kraftfahrt-Bundesamt

über die Erweiterung einer Genehmigung eines Fahrzeugtyps nach der UN-Regelung Nr. 156 einschließlich Änderung Nr. 00 Ergänzung 00

COMMUNICATION

issued by:

Kraftfahrt-Bundesamt

concerning the extension of an approval of a vehicle type, pursuant to Regulation No. 156 including amendment No. 00 supplement 00

Genehmigungsnummer: E1*156R00/00*0026*01

Approval number:

Grund für die Erweiterung: Siehe Liste der Änderungen
Reason for extension: See list of modifications

1. Marke (Handelsname des Herstellers):
Make (trade name of manufacturer):
DAF
2. Typ:
Type:
SW-UPD-01

Handelsbezeichnung(en):
General commercial description(s):
Vehicle Series XB / XBC
3. Merkmal zur Typidentifizierung, falls am Fahrzeug vorhanden:
Means of identification of type, if marked on the vehicle:
Fahrgestellnummer
VIN-code
- 3.1 Anbringungsstelle dieses Merkmals:
Location of that marking:
Fahrgestellnummer rechts am Fahrgestell in der Nähe der Vorderachse
VIN-Code in RH-side chassis near Front-axle

Vehicle CO2 emissions and fuel consumption – Customer Information file



2. CO2 emissions and fuel consumption of the vehicle

		Payload low		Payload Representative	
2.1. Simulation parameters					
2.1.1.	Mission profile	Long Haul			
2.1.2.	Payload	1900	kg	14000	kg
2.1.4.	Total vehicle mass in simulation	17128	kg	29228	kg
2.2.	Average speed	79,7	km/h	77,8	km/h
2.3.	Fuel and energy consumption results				
2.3.9.	Energy consumption	1,625	kWh/km	1,876	kWh/km
2.3.10.	Energy consumption	0,8555	kWh/t-km	0,134	kWh/t-km
2.3.12.	Energy consumption	0,01644	kWh/m³-km	0,01896	kWh/m³-km
2.5.	Electric ranges				
2.5.1.	Actual charge depleting range	269,4	km	233,5	km
2.5.2.	Equivalent all electric range	269,4	km	233,5	km
2.5.3.	Zero CO2 emissions range	269,4	km	233,5	km
2.1. Simulation parameters					
2.1.1.	Mission profile	Municipal Utility			
2.1.2.	Payload	600	kg	3000	kg
2.1.4.	Total vehicle mass in simulation	14328	kg	16728	kg
2.2.	Average speed	9,3	km/h	9,3	km/h
2.3.	Fuel and energy consumption results				
2.3.9.	Energy consumption	2,485	kWh/km	2,554	kWh/km
2.3.10.	Energy consumption	4,142	kWh/t-km	0,8512	kWh/t-km
2.3.12.	Energy consumption				
2.5.	Electric ranges				
2.5.1.	Actual charge depleting range	176,2	km	171,5	km
2.5.2.	Equivalent all electric range	176,2	km	171,5	km
2.5.3.	Zero CO2 emissions range	176,2	km	171,5	km
2.1. Simulation parameters					
2.1.1.	Mission profile	Regional Delivery			
2.1.2.	Payload	900	kg	4400	kg
2.1.4.	Total vehicle mass in simulation	10728	kg	14228	kg
2.2.	Average speed	61,1	km/h	61,1	km/h
2.3.	Fuel and energy consumption results				
2.3.9.	Energy consumption	1,114	kWh/km	1,21	kWh/km
2.3.10.	Energy consumption	1,238	kWh/t-km	0,2749	kWh/t-km
2.3.12.	Energy consumption	0,02256	kWh/m³-km	0,02449	kWh/m³-km
2.5.	Electric ranges				
2.5.1.	Actual charge depleting range	393	km	362	km
2.5.2.	Equivalent all electric range	393	km	362	km
2.5.3.	Zero CO2 emissions range	393	km	362	km
2.1. Simulation parameters					
2.1.1.	Mission profile	Urban Delivery			
2.1.2.	Payload	900	kg	4400	kg
2.1.4.	Total vehicle mass in simulation	10728	kg	14228	kg
2.2.	Average speed	26,7	km/h	26,6	km/h
2.3.	Fuel and energy consumption results				
2.3.9.	Energy consumption	0,8655	kWh/km	0,9865	kWh/km
2.3.10.	Energy consumption	0,9616	kWh/t-km	0,2242	kWh/t-km
2.3.12.	Energy consumption	0,01752	kWh/m³-km	0,01997	kWh/m³-km
2.5.	Electric ranges				
2.5.1.	Actual charge depleting range	505,9	km	443,8	km
2.5.2.	Equivalent all electric range	505,9	km	443,8	km
2.5.3.	Zero CO2 emissions range	505,9	km	443,8	km

Only the performances relevant to the missions required by the regulation are reported.

2.6.	Weighted results		
2.6.1.	Specific CO2 emissions		
2.6.2.	Specific electric energy consumption	0,3839	kWh/t-km
2.6.3.	Average payload value	3,18	t
2.6.7.	Actual charge depleting range	364,9	km
2.6.8.	Equivalent all electric range	364,9	km
2.6.9.	Zero CO2 emission range	364,9	km