

# Zero Emission Bus Certificate

<b>Customer:</b> EVM Ltd				<b>DYNAMOMETER SETTINGS</b>		
<b>Customer Address:</b>	Norman House, 15 Stephenson Way, Crawley, RH101TN	<b>Telematics Capability</b>	Yes	<b>Test Weight</b>	4638	kg
<b>Test Purpose:</b>	Zero Emission Bus Testing	<b>Maximum Speed (km/h)</b>	80 km/h	<b>F°</b>	-73.65	N
<b>Vehicle Manufacturer:</b>	EVM	<b>Seated Capacity</b>	13	<b>F<sup>1</sup></b>	-0.0397	N/kmh
<b>Vehicle Model Name:</b>	Novus	<b>Passenger Capacity</b>	15	<b>F<sup>2</sup></b>	0.08246	N/kmh <sup>2</sup>
<b>Powertrain Technology:</b>	Battery Electric	<b>Declared Unladen Weight (kg)</b>	4120	<b>Equivalent test passengers</b>	6.5	passengers
<b>Powertrain Configuration:</b>	Direct Drive	<b>Gross Weight (kg)</b>	5500	<b>Measured Unladen Weight</b>	4196	kg
<b>Zero Emission Heating:</b>	Heat Pump	<b>GVW Check</b>	OK	<b>Number of consecutive tests completed</b>	4	Tests
<b>Battery Specification</b>		<b>Charging and Refuelling Capability</b>		<b>Hydrogen Specification</b>		
<b>Battery Manufacturer</b>	N/A	<b>Plug Type</b>	CCS2 / AC Type 2	<b>Fuel Cell Manufacturer</b>	N/A	
<b>Battery Chemistry</b>	NMC	<b>Max Charge Capability (kW)</b>	70kW / 22 kW	<b>Fuel Cell Power Rating (kW)</b>	N/A	
<b>Battery Installed Capacity (kWh)</b>	115	<b>Charger Compatibility</b>	DC / AC	<b>Hydrogen Storage Capacity (kg)</b>	N/A	
<b>Battery Usable Capacity (kWh)*</b>	92	<b>Charge time from 20-80% SOC**</b>	2-6 hours	<b>Hydrogen Storage Pressure (bar)</b>	N/A	

\* Recommended manufacturer guideline, subject to warranty

\*\* Based on manufacturer estimate

Declared fuel, properties and source plus carbon conversion factors						
<b>Well-to-Tank Factor: Electricity</b>	80.92	g CO <sub>2e</sub> / MJ	<b>Fuel Provider</b>	UK market standard	WTT evidence	Zemo Calculated
<b>Well-to-Tank Factor: Hydrogen</b>	N/A	g CO <sub>2e</sub> / MJ	<b>Capacity of Tanker (kg)</b>	N/A	Fuel Type / Pathway	UK Grid Electricity
<b>Energy Density Hydrogen</b>	120	MJ / kg	<b>Transport Distance of Hydrogen (km)</b>	N/A	Energy Source	N/A

Emissions and Energy consumption results from approved test facility - Average 4 tests										
Test Phase	HC (g/km)	CO (g/km)	NOx (g/km)	PM (g/km)	CO <sub>2</sub> (g/km)	CH <sub>4</sub> (g/km)*	N <sub>2</sub> O (g/km)*	Total Energy Consumption (kWh)	Vehicle Energy Consumption (kWh/km)	Grid Electrical Energy Consumption (kWh/ 100km)
Outer Urban	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.56	0.40	54.79
Inner Urban	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.35	0.55	75.34
Rural	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.11	0.29	39.73
LBC Average	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.90	0.44	60.27
<b>UK BUS Average</b>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.02	0.37	50.68

Zero Emissions (Z.E.) Range: Energy consumption and charging efficiency					
<b>Test Charger Used</b>	22 kW	<b>Total measured energy consumed on vehicle (kWh)<sup>1</sup></b>	30.00	<b>Max ZE Range at 100% SOC (km)</b>	249
<b>Hydrogen Energy Over Test (kWh)</b>	N/A	<b>Measured grid energy during charging (kWh)</b>	41.00	<b>Max ZE Range at 80% SOC (km)</b>	199
<b>Hydrogen Delivered to Vehicle (kg)</b>	N/A	<b>Grid-to-Wheel efficiency (%)<sup>2</sup></b>	73%	<b>Test Distance Travelled (km)</b>	80

<sup>1</sup> Total measured energy may include energy used during the 23 minute warmup, this is needed for charge efficiency calculation.

<sup>2</sup> Grid to Wheel efficiency represents the total energy losses between the grid and the wheels of the bus.

Calculated total Well-to-Wheel GHG CO <sub>2</sub> equivalent emissions over test					Data Generated by (On behalf of Test facility):	Date:
Test Phase	Fuel Energy (MJ / km)	Fuel WTT*GHG Emissions (g CO <sub>2e</sub> / km)	Electrical Energy (MJ / km)	Electricity WTT* GHG Emissions (g CO <sub>2e</sub> / km)	Data Approved by:	Date:
Outer Urban	N/A	N/A	1.97	159.62		
Inner Urban	N/A	N/A	2.71	219.48		
Rural	N/A	N/A	1.43	115.73		
LBC Average	N/A	N/A	2.17	175.59		
<b>UK BUS Average</b>	N/A	N/A	1.82	147.65		

Zero Emission Bus Certificate Summary			
Test Vehicle		Average Euro VI Diesel Equivalent	
<b>Greenhouse Gas Emissions: Well-to-Wheel</b>	147.7 g CO <sub>2e</sub> / km	<b>Average Diesel GHG Emissions Equivalent</b>	621 g CO <sub>2e</sub> / km
<b>WTW CO<sub>2</sub> per passenger km (@ Max Pass Capacity)</b>	9.8 g CO <sub>2e</sub> /pass km	<b>WTW CO<sub>2</sub> per passenger km (@ Max Pass Capacity)</b>	41.4 g CO <sub>2e</sub> /pass km
Overall Zero Emission Bus Performance			
<b>WTW GHG saving</b>	473.6 g CO <sub>2e</sub> / km	<b>Maximum Theoretical Zero Emission Range (km)</b>	248.6
<b>% WTW GHG saving</b>	76% g CO <sub>2e</sub> / km	<b>Vehicle Energy Consumption (kWh/ km)</b>	0.37
<b>Approved as Zero Emission Bus? (50% GHG saving or more)</b>		<b>YES</b>	

\* WTT : Well-to-Tank

\*\* TTW : Tank-to-Wheel

\*\*\* WTW : Well-to Wheel

<b>COMMENTS:</b> Current measured from positive and negative terminals was combined to give final result. This was advised as the method to assume for measurement losses through shielded cabling by customer. This assumes exactly 50% of current was able to be measured by each amp	<b>Heating Requirement</b>	Cell	Lower Saloon	Upper Saloon
	<b>Target Temperatures ±2 (°C) :</b>	10	17	17
	<b>Average Temperatures across testing (°C)</b>	9.98	20.90	N/A

**Test Numbers:** 20220329\_1533, 20220329\_1646, 20220329\_1919, 20220329\_2021

Certificate approved by:	Aug 2, 2022	Certificate Approved by:  Daniel Hayes 02.08.22
On behalf of Bus manufacturer		On behalf of DfT / Zemo Partnership