

**Abschalteinrichtungen**  
**Mercedes E 350 BlueTEC 4MATIC**  
**Euro 6 Diesel-Pkw**

**Berlin, 05.11.2021**

# Mercedes E 350 BlueTEC 4MATIC, Euro 6



## Mercedes E 350 BlueTEC 4MATIC

Motorbaureihe	OM 642
Erstzulassung	01.2016
Hubraum	2.987 cm <sup>3</sup>
Leistung	190 kW
Antrieb	Diesel
Abgasnorm	EURO 6
Abgasnachbehandlung	DPF, SCR-Kat
Kilometerstand	95.708
Außentemperatur in Grad Celsius	+9 bis +17
Offizieller Wert CO <sub>2</sub> in g/km, NEFZ	164

### Vor Software Update

CO<sub>2</sub> [g/km] **214**

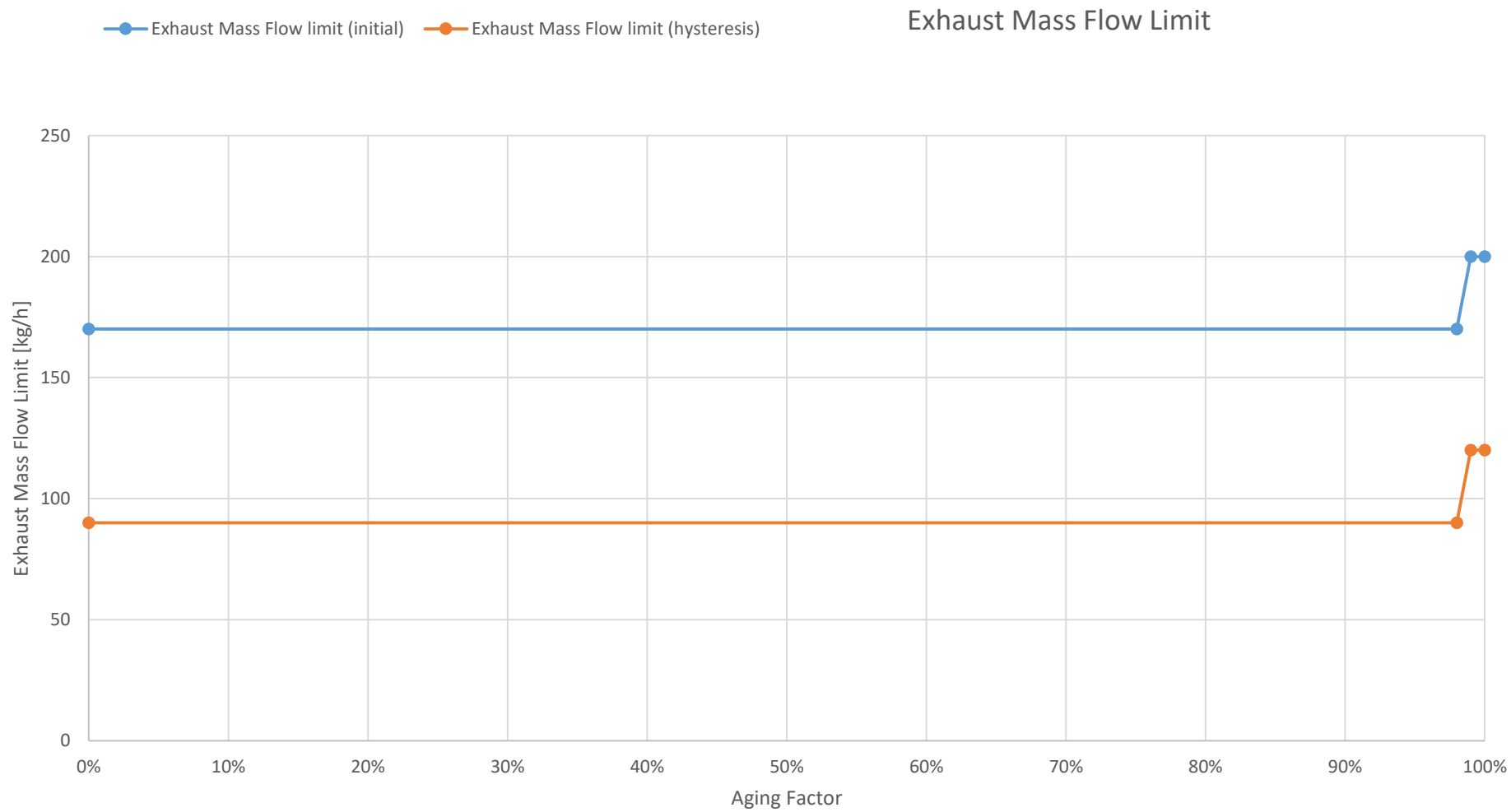
NO<sub>x</sub> [mg/km] **526**

Faktor NO<sub>x</sub>-Grenzwert **6,6**

# Mercedes E350T Emission System Analysis

Felix Domke

# Exhaust Mass Flow Limit as a function of SCR aging factor extracted from calibration data of the original software



Efficiency Correction map via SCR-Temperature and Mass Flow  
 extracted from calibration data of updated software

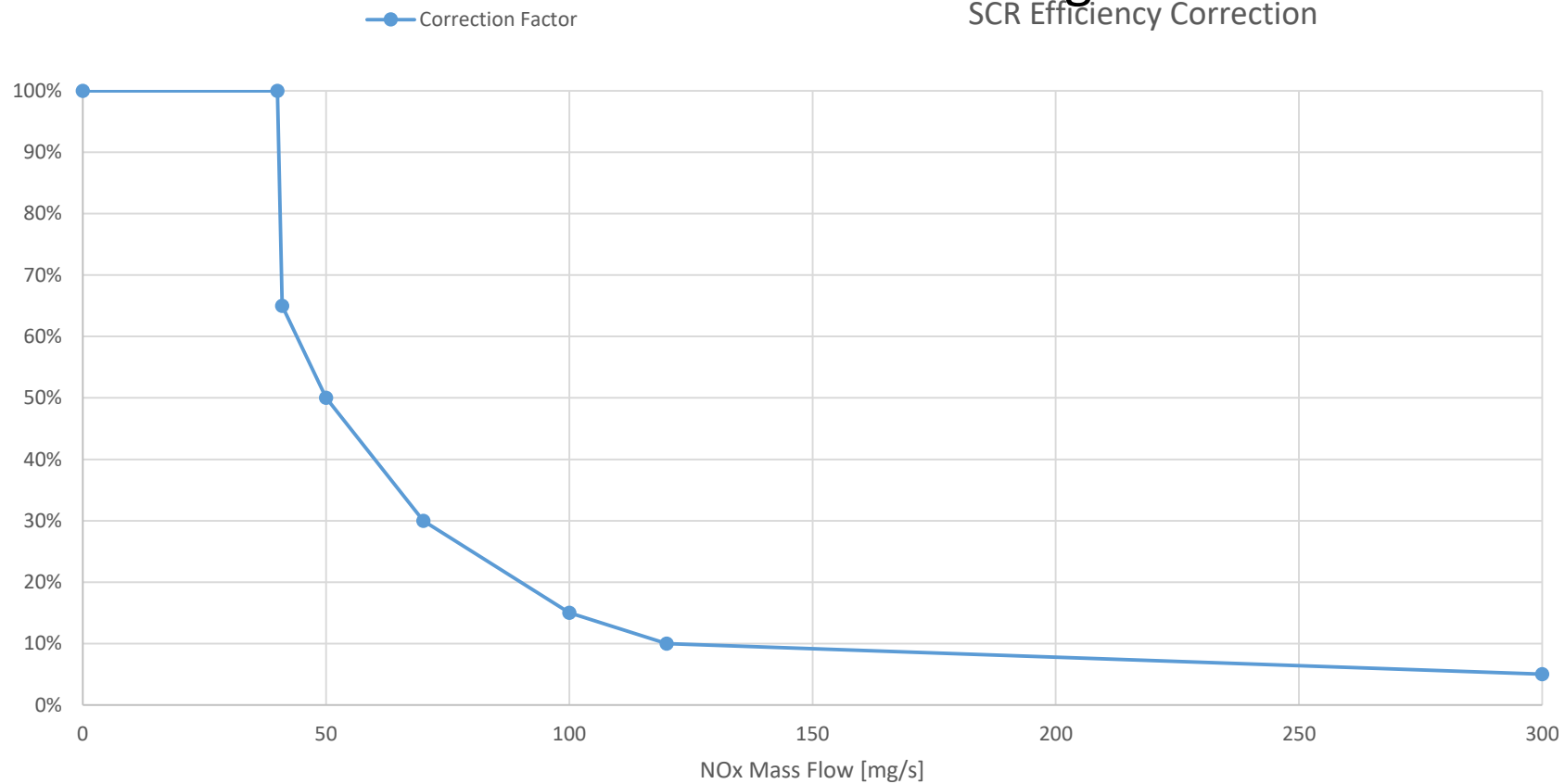
		Mass Flow [kg/h]											
		25	50	100	150	175	200	225	300	400	500	600	800
SCR Temperature [°C]	100	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
	150	20%	20%	20%	20%	20%	20%	20%	20%	10%	10%	10%	5%
	175	45%	45%	45%	45%	45%	45%	45%	25%	15%	10%	10%	5%
	200	50%	50%	50%	50%	50%	50%	50%	35%	20%	12%	10%	5%
	225	60%	60%	60%	60%	60%	60%	50%	40%	37%	33%	25%	10%
	250	75%	75%	75%	75%	75%	75%	70%	58%	55%	50%	40%	20%
	275	85%	85%	85%	85%	85%	85%	85%	75%	63%	55%	50%	25%
	300	90%	90%	90%	90%	90%	90%	90%	85%	65%	60%	60%	30%
	350	95%	95%	95%	95%	95%	95%	95%	95%	75%	60%	60%	30%
	450	95%	95%	95%	95%	95%	95%	95%	90%	75%	60%	60%	30%
	550	80%	80%	80%	80%	80%	80%	80%	80%	50%	40%	40%	20%
650	50%	50%	50%	50%	50%	50%	50%	50%	40%	20%	10%	10%	10%

Efficiency Correction map via SCR-Temperature and Mass Flow  
 extracted from calibration data of original software

		Mass Flow [kg/h]											
		50	75	100	150	180	200	225	250	300	500	600	700
SCR Temperature [°C]	130	9%	9%	9%	8%	8%	8%	8%	7%	7%	6%	6%	5%
	160	18%	18%	17%	17%	17%	16%	15%	15%	14%	14%	11%	8%
	180	25%	24%	23%	23%	22%	21%	20%	19%	18%	17%	15%	11%
	200	34%	33%	33%	32%	32%	31%	29%	29%	27%	24%	19%	14%
	225	60%	60%	60%	60%	60%	60%	58%	45%	38%	33%	25%	19%
	250	60%	60%	60%	60%	60%	60%	58%	55%	51%	41%	32%	25%
	280	60%	60%	60%	60%	60%	60%	60%	60%	55%	45%	36%	28%
	300	60%	60%	60%	60%	60%	60%	60%	60%	55%	45%	65%	75%
	380	60%	60%	60%	60%	60%	60%	60%	60%	55%	45%	65%	75%
	400	60%	60%	60%	60%	60%	60%	60%	60%	55%	45%	40%	35%
	480	60%	60%	60%	60%	60%	60%	60%	60%	55%	45%	40%	35%
	500	75%	75%	75%	75%	75%	75%	75%	75%	60%	45%	40%	35%

*Reading example: At a mass flow of 150 kg/h, and an SCR Catalyst temperature of 250°C, the efficiency estimation would be reduced to 60% of the original value (i.e. by factor of 0.6x).*

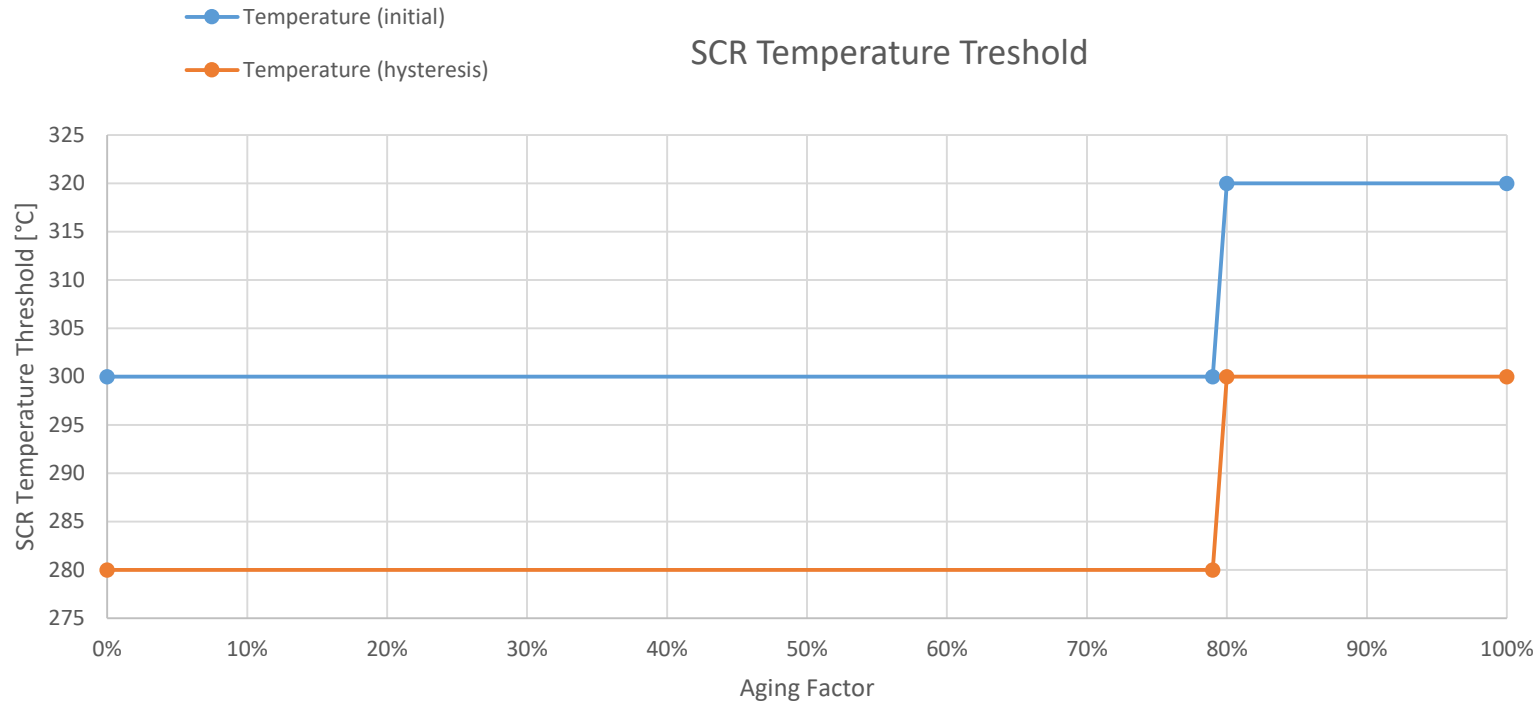
# SCR efficiency correction factor as a function of NO<sub>x</sub> mass flow extracted from calibration data of original software



## Changes via Software Update

The change to the alternative model due to NO<sub>x</sub> mass flow has been completely removed. NO<sub>x</sub> mass flow is still taken into account for calculating the expected SCR efficiency (and thereby controlling the AdBlue dosing), but the alternative model is not enforced anymore as the result of exceeding NO<sub>x</sub> emissions.

# SCR temperature threshold as a function of Aging Factor extracted from ECU calibration data



It can be seen that the SCR temperature threshold rapidly changes when the aging factor reaches a particular state (internally modelled as “80%”).

## Changes to calibration data in software update

The threshold was changed from 320%/300°C to 275°C; there is no effect of SCR catalyst aging anymore. The hysteresis was changed from 20K to 15K, so the lower threshold was changed from 280°C to 265°C.



# Defeat Device #6: AdBlue average consumption

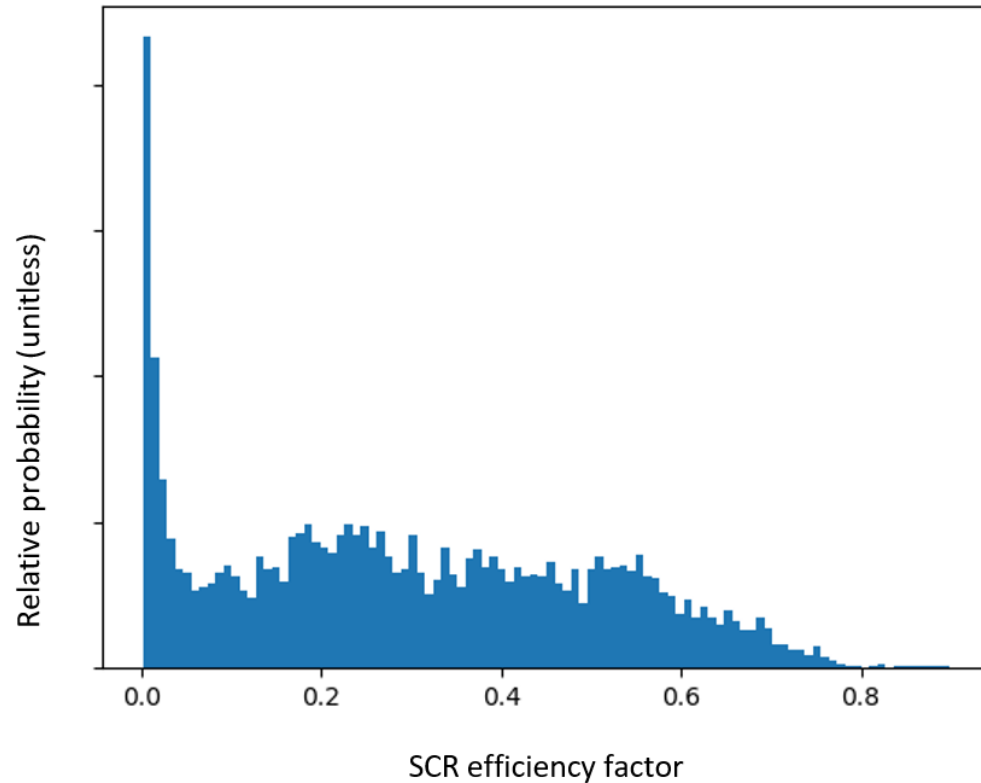
The ECU tracks the average AdBlue consumption, and will enforce a switch to the alternative model when the AdBlue average consumption exceeds 820ml/1000km.

Additionally, once switched to the alternative model, the SCR target efficiency is reduced based on the average consumption (and the accumulated NO<sub>x</sub> mass for the current driving cycle). The dominant factor is the average consumption – starting at ~800ml/1000km, the efficiency is reduced significantly, especially at higher consumption. This inherently cripples AdBlue consumption, regardless of the physical necessity of dosing larger amounts

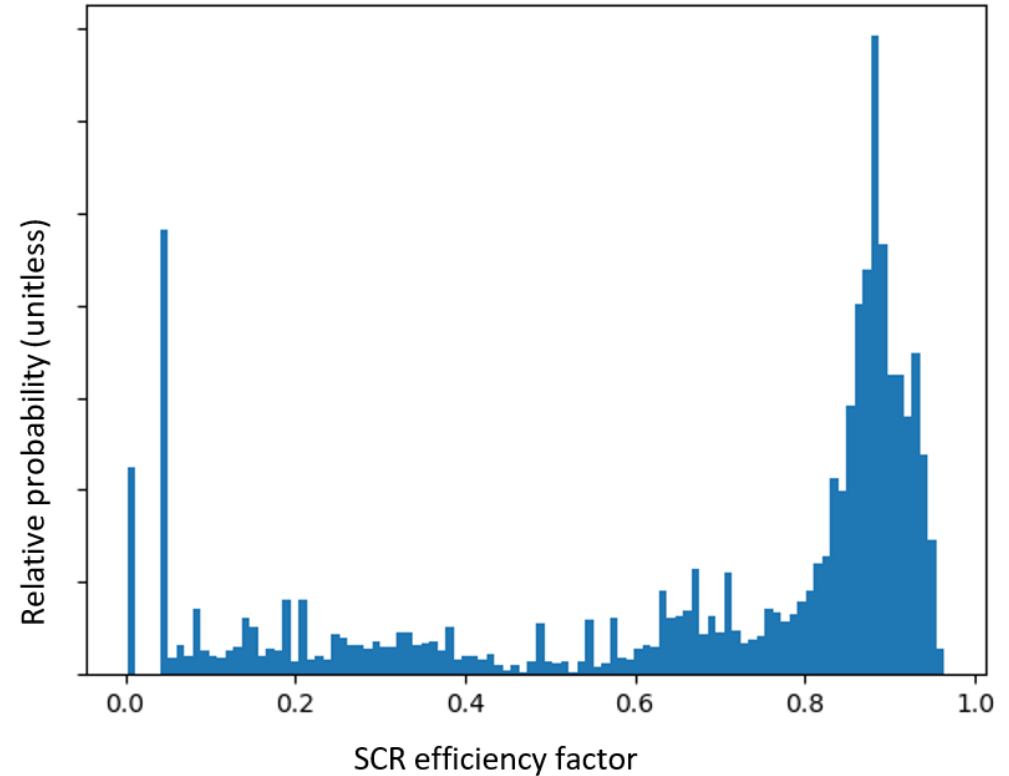
## Changes via Software Update

This mechanism has been removed completely

# Distribution of SCR efficiency with original and updated software



original software



updated software

## 1. Effect on AdBlue consumption

The increased efficiency comes, however, with the cost of increased AdBlue consumption. The average AdBlue consumption with the old software was determined as 0.75l/1000km, with the updated software, much higher values of 1.61l/1000km (>2X) are observed.

# Summary

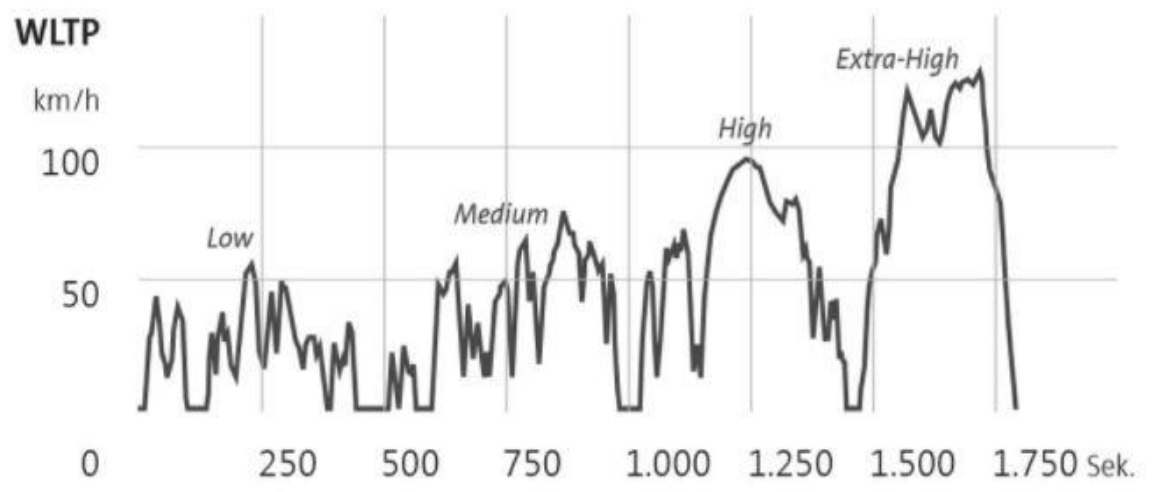
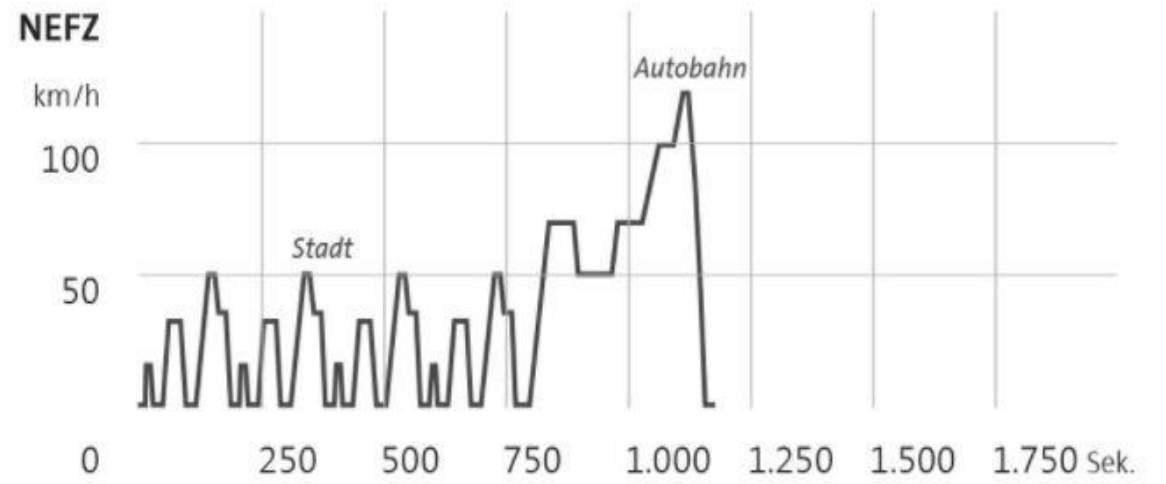
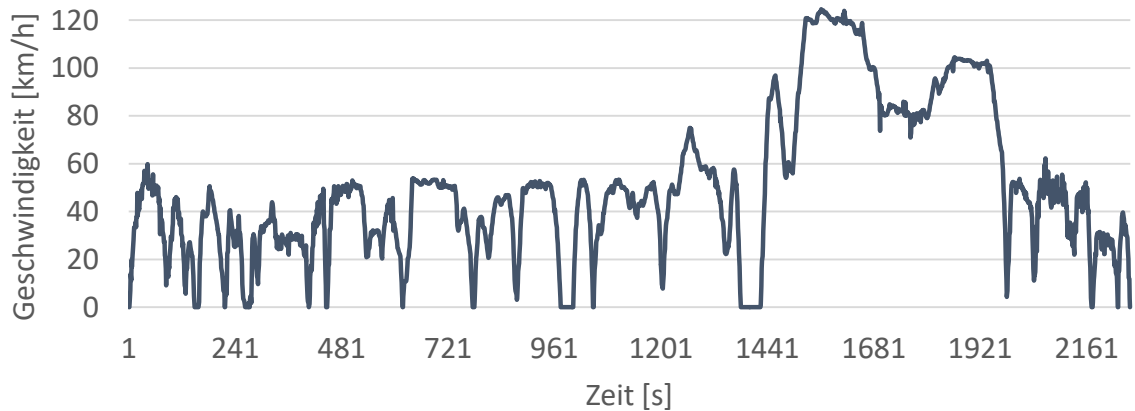
## 1.SCR:

- SCR Temperature limit was removed, SCR aging dependency was removed, effective limit changed from 300°C to 275°C.
- Exhaust mass flow limit was removed as switch condition completely, efficiency correction map was improved to allow operation in alternative mode while maintaining high SCR efficiency
- NO<sub>x</sub> mass flow limit was removed as switch condition, removed efficiency correction in alternative model based on NO<sub>x</sub> mass flow.
- Air temperature dependency was removed.
- "Restart-Protection" was removed.
- Both the switch as well as efficiency correction based on AdBlue consumption were removed.
- **EGR:**
- EGR reduction based on engine start and maximum temperature was removed.
- EGR reduction when engine is hot and idling has been removed; EGR is still limited at very high and low temperatures, but no longer special-cases idling.

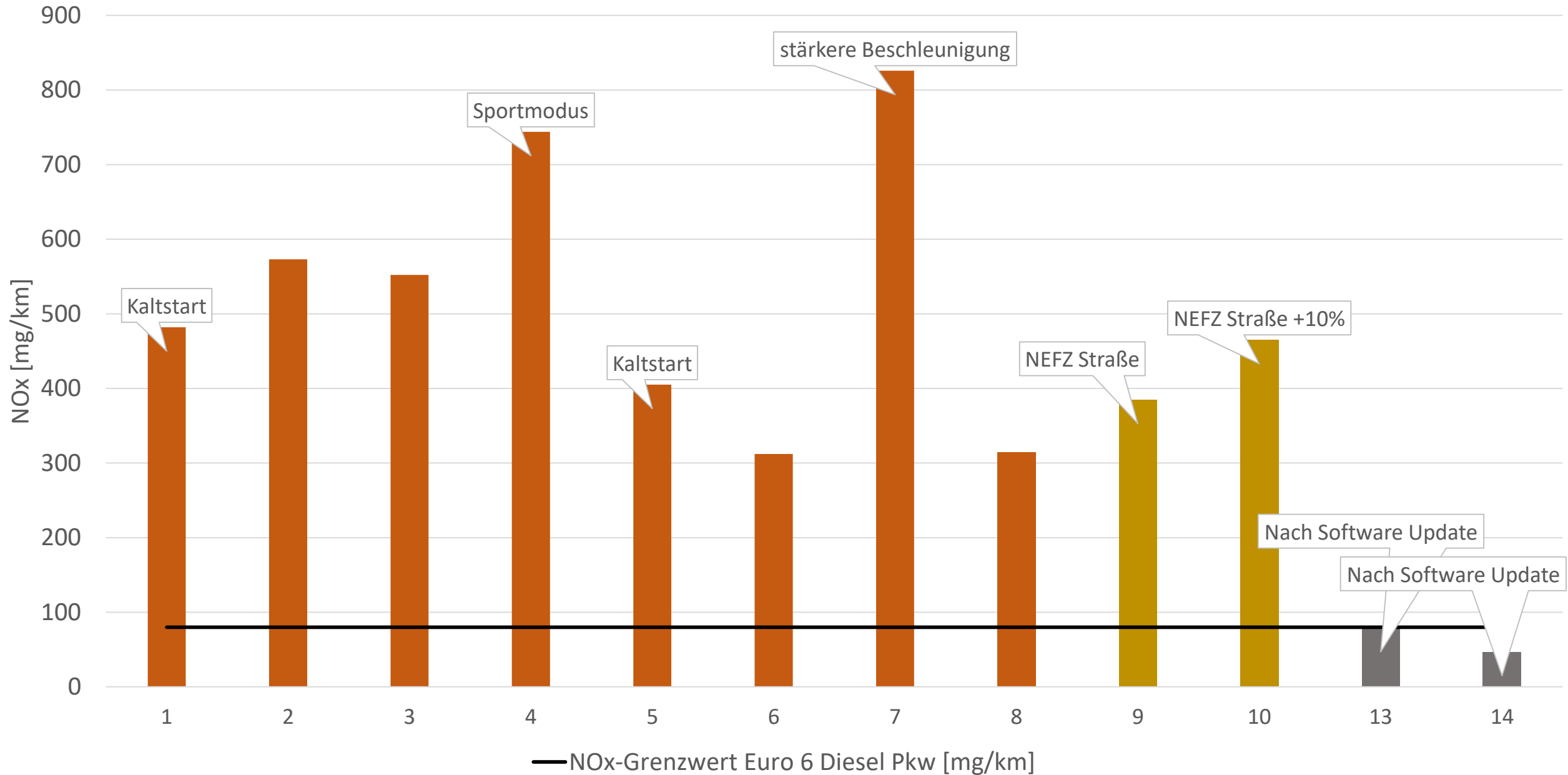
**All defeat devices that have been identified have been removed in the updated software**

**Abgasmessungen des Emissions-Kontroll-Instituts  
an einem Mercedes E 350 BlueTEC 4MATIC  
Euro 6 Diesel-Pkw**

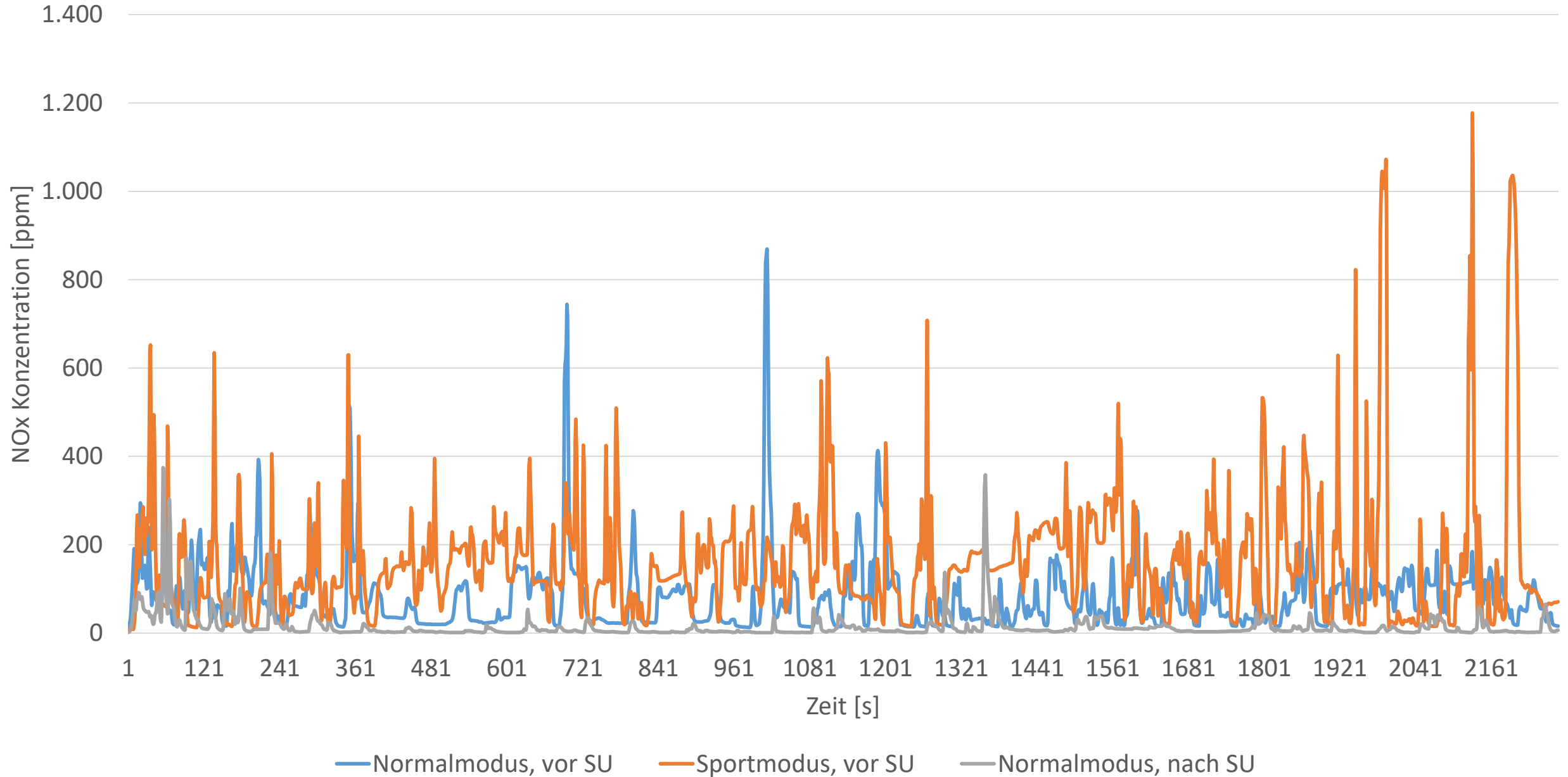
# EKI-Teststrecke PEMS-Messungen



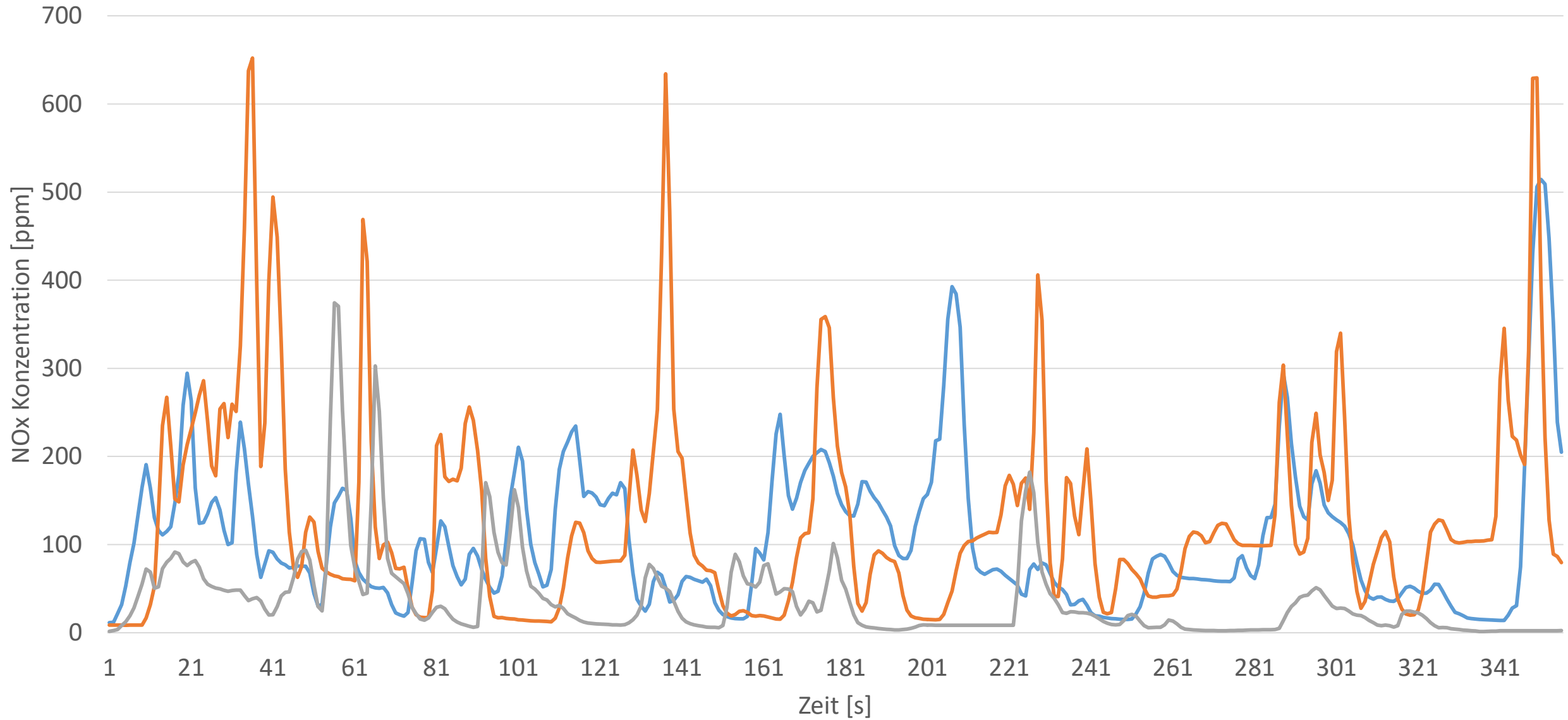
# Mercedes E 350 BlueTEC 4MATIC, Euro 6



# NO<sub>x</sub>-Konzentration Mercedes E 350 BlueTEC 4MATIC



# NO<sub>x</sub>-Konzentration Mercedes E 350 BlueTEC 4MATIC



— Normalmodus, vor SU    — Sportmodus, vor SU    — Normalmodus, nach SU



# NO<sub>x</sub> kumuliert, Mercedes E 350 BlueTEC 4MATIC

