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### Off-Cycle Emissions of Particle Number from Gasoline and DPF diesel passenger cars in extremely low temperature and high-load conditions

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## **Off-cycle Emissions**

- Evaluation of emissions in real-world conditions is important to improve air quality
- Real Driving Emissions (RDE) tests have been adopted for certification from 2017

Objective Evaluating SPN23, SPN10 and other emissions in off-cycle condition from passenger cars certificated in Japan with Chassis dynamometer WLTP-Cycle 140 Japanese test cycle for certification 120  $\mathbb{W}$ Vehicle Speed (km/h) 100 **Emissions:** 80 in Ex-Hi mode (High load condition) 60 In cold start test below 0 °C (Low temperature) 20Mid Low 1000 1500 Ex-Hi 500 Hi Time (sec) Off-cycle for

Japanese cars

### "Kei" car

There is a small car category peculiar in Japan called "Kei" cars.

Kei cars are identified by yellow license plates.

#### **Requirement for Kei cars**

Maximum Engine displacement: 0.66 L

Maximum Car size:  $3.4m (L) \times 1.48m(W) \times 2.0m(H)$ 

Maximum capacity: 4 persons or 350kg

**Total Kei car sales:** 

#### **Advantage of Kei cars**

Cheaper tax and highway fare

No restrictions in traffic rules

Total car sales in Japan: 4,448,340

1,652,522 (37.1%)









## **Experimental Setups and Tested Cars**



#### **Tested Cars (High speed)**







Kei		SUV	Diesel
Eng.	G-PFI	G-PFI	D-DPF/SCR
Disp.	0.65L	1.98L	2.75L
GVW	1.12ton	1.85ton	3.16ton

VPR : Volatile Particle Remover
PND : Particle Number Dilutor
CS : Catalytic Stripper
PNC #: Particle Number Counter for SPN#



# **Emissions from Diesel**



## Emissions in various outside temperature conditions Mode total <sup>5</sup> 1. <sup>co</sup> Profiles (WLTP 3Phase) small

Temp. (°C)



## Conclusion

High speed and low ambient temperature off-cycle emissions from gasoline and diesel passenger cars have been evaluated

#### **Gasoline cars**

- Enrichment control leads to increased CO and PN (mainly below 23 nm) emissions
- Enrichment control appeared in high speed with small engine and warming up process in low ambient temperature

#### No difference between MPI and GDI cars

- **Diesel cars** 
  - **Passive regeneration** leads to increased NOx and PN (mainly below 23 nm)





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# Thank you



