

# PM/PN measurement Repeatability of Compact Multi Gas Measurement System

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## <Background>

Recently the air pollution has been more serious in the world and the emission regulation for vehicles is getting quite severe. In Europe, deviation of the vehicle emission level between lab-certification base and real driving base is a subject of discussion. Due to these issues, EU is considering to introduce RDE (Real Driving Emission) regulation using PEMS (Portable Emission Measurement System). But the current PEMS has some issues in term of portability, complexity and etc.

## <Investigation method>

We develop real portable and easy handling multi gas measurement system utilizing direct insertion type exhaust OBD (On Board Diagnosis) sensors technologies. These technologies are able to measure in real time the particle matter and nitrogen oxide in the exhaust gas. (Hereafter, referred to as NTK PM sensor and NTK NOx sensor)

We have compared NTK PM sensor and NOx sensor with the reference apparatus under FTP (Federal Test Procedure) mode in order to check the repeatability.

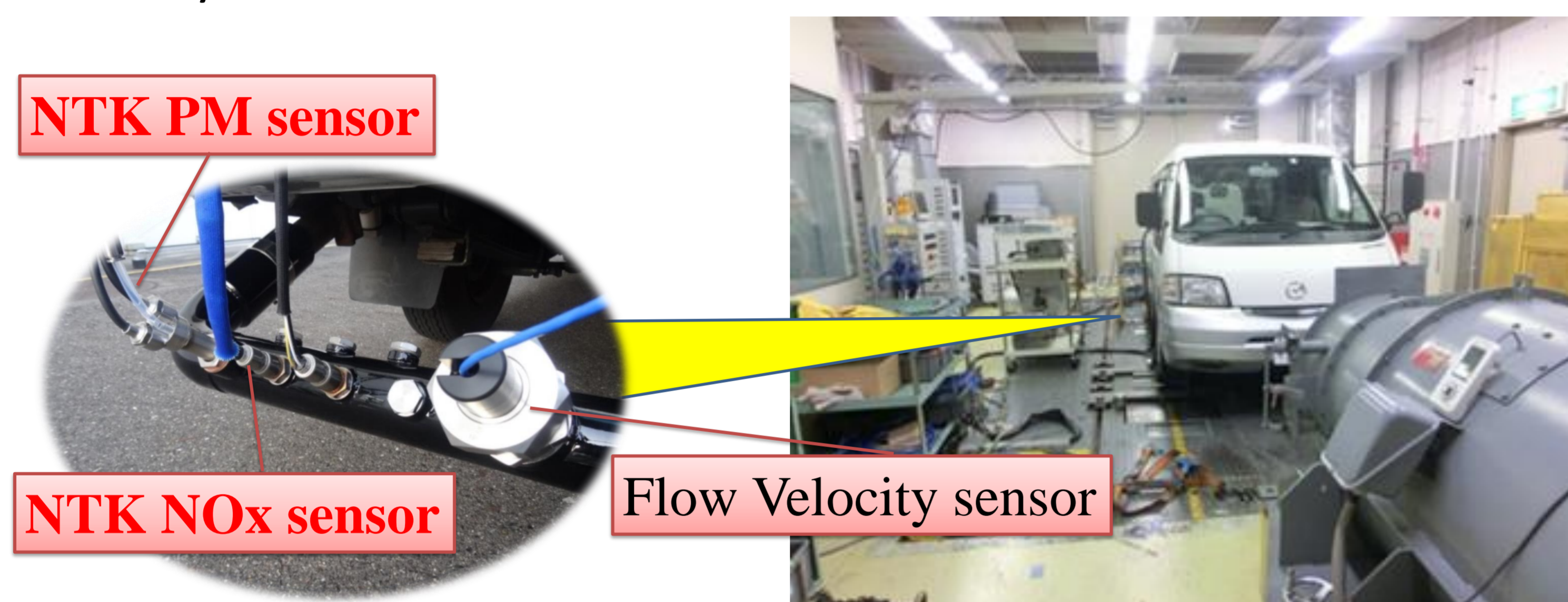
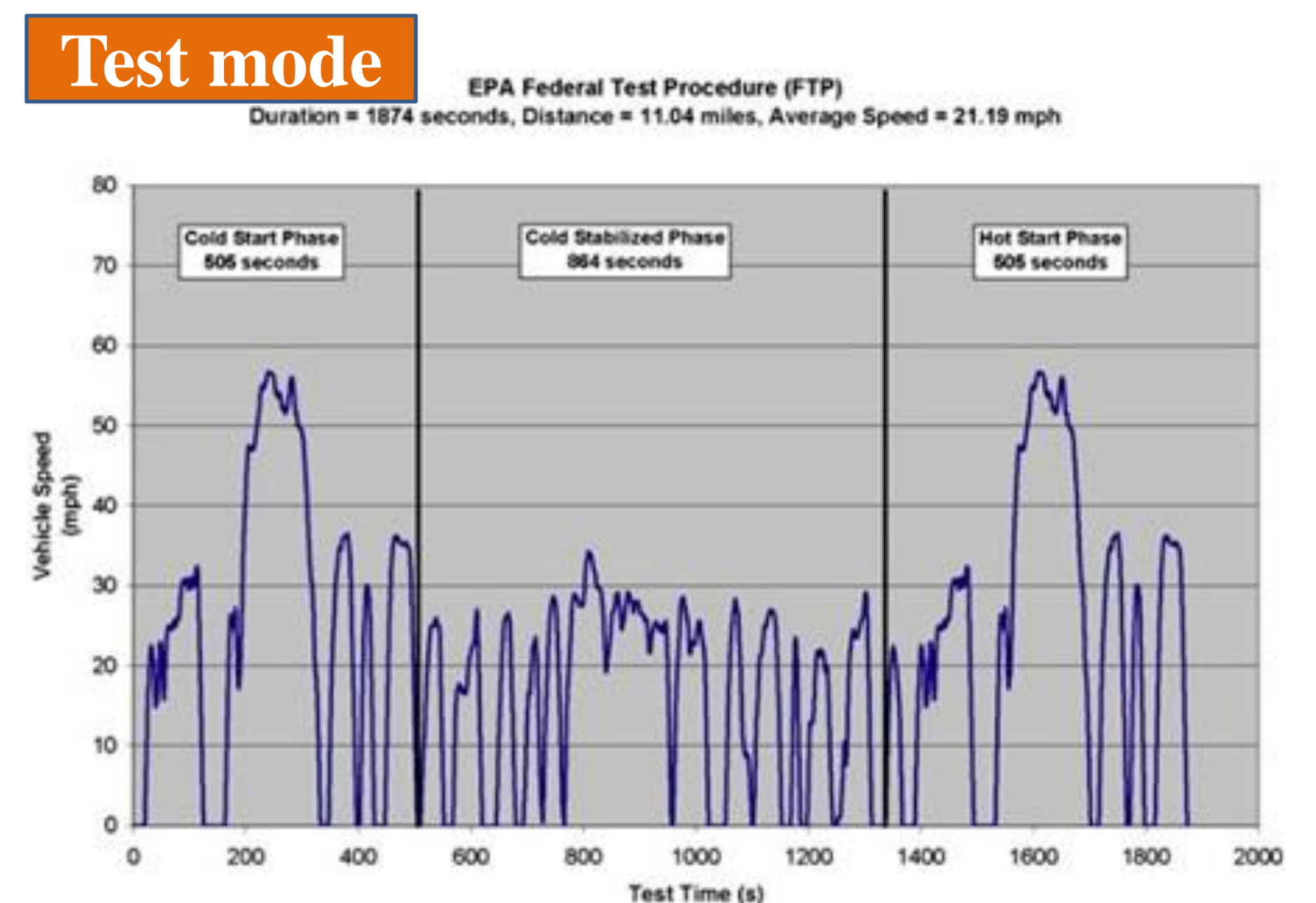


Photo: During the test

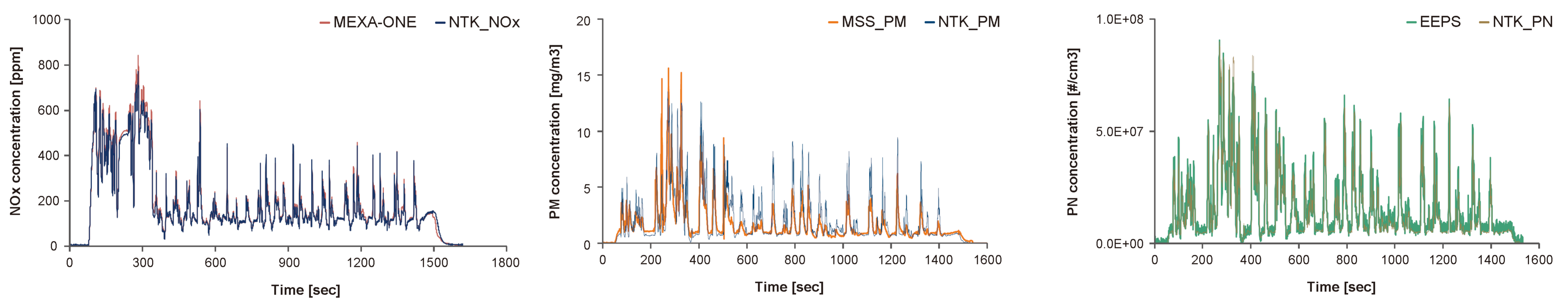


EPA Federal Test Procedure (From EPA homepage)

## <Result>

NTK PM sensor's principle is a diffusion charging method then it can measure PM and PN. Fig.1 and Fig.2 show real time measurement waveforms of NTK PM sensor and PM and PN references apparatuses (AVL MSS and TSI EEPS). Real time PM and PN waveforms of NTK PM sensor show almost the same behavior with references apparatuses. (Considering difference of each exhaust gas traveling time, waveform is adjusted to lap each data.) We test 3 times and good repeatability data were observed.

Fig.3 shows the real time measurement of NTK NOx sensor and the reference apparatus (HORIBA MEXA-ONE). Real time NOx output is almost overlapped with the reference apparatus and its repeatability is observed under multiple tests.



## <Conclusion>

1. Direct insertion type exhaust OBD (On Board Diagnosis) sensors technologies can measure amount of PM, PN and NOx in the exhaust gas in real time.
2. Good repeatability is confirmed by comparison with reference apparatuses (MSS, EEPS and MEXA-ONE).



Measurement system (Meter body)

Items	Specifications
Output parameters	PM/PN, NOx/O <sub>2</sub> /O <sub>2</sub>
Power supply	DC10-32V or AC100-240V(50/60Hz)
Weight	12kg (Main Unit + PM module + NOx module + UEGO module)
Size	W340×D280×H270mm
Output single	CAN (ISO11898), Analog
Data recording	USB memory
External I/F	OBDII, USB, GPS
OBD	Failure mode detection ( Sensor wire failure, Power failure etc.)
Filter	None, 0.1Hz, 0.5Hz, 1Hz, 5Hz, 10Hz (Selectable)
Sampling	10ms, 50ms, 100ms, 1000ms (Selectable)
Storage temperature	-30 to 65degC
Operation temperature	-20 to 55degC



Photo: Meter body