

# AQ-SPEC

## Air Quality Sensor Performance Evaluation Center

### Evaluation Summary

#### Sensor Description

Manufacturer/Model:

Elitech  
Temtop P20

Pollutants:

PM<sub>2.5</sub> mass concentration

Time Resolution:

5 min.

Type: Optical



- Overall, the Temtop P20 sensors showed moderate to high accuracy (68% to 87%) over the PM<sub>2.5</sub> mass concentration range tested. The Temtop P20 sensors underestimated PM<sub>2.5</sub> measurements from FEM T640x in the laboratory experiments at 20 °C and 40% RH.
- The Temtop P20 sensors showed high precision for all test combinations (PM concentrations, T and RH) for PM<sub>2.5</sub> mass concentrations
- The Temtop P20 sensors showed low intra-model variability in the field evaluation (IDs: 1, 2, and 3) and moderate intra-model variability in the laboratory evaluation (IDs: 2 and 3).
- Data recovery for all units was ~ 90-100% in the field evaluation and 100% in the laboratory evaluation.
- For PM<sub>2.5</sub>, Temtop P20 sensors showed weak to strong correlations with the FEM T640 from the field ( $0.41 < R^2 < 0.88$ ). The Temtop P20 sensors showed very strong correlations with the FEM T640x in the laboratory evaluations ( $R^2 > 0.99$  for PM<sub>2.5</sub>).
- The same three Temtop P20 units were tested both in the field (1<sup>st</sup> stage of testing) and in the laboratory (2<sup>nd</sup> stage of testing), but only Unit IDs 2 and 3 operated properly and were able to log data during the laboratory evaluation.

### Field Evaluation Highlights

- Deployment period 08/26/2020 to 10/21/2020: the three Temtop P20 sensors showed weak to strong correlations with the corresponding T640 PM<sub>2.5</sub> mass concentrations.
- The units exhibited low intra-model variability and data recovery for PM<sub>2.5</sub> was ~90-100% from all units.

5-min mean, T640

PM<sub>2.5</sub>:  $0.41 < R^2 < 0.88$

#### Additional Information

Field evaluation report:

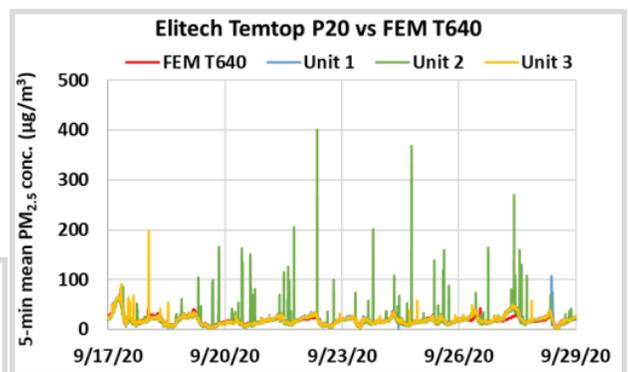
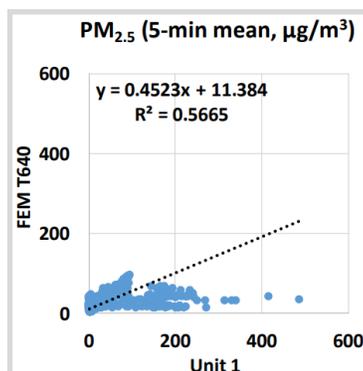
<http://www.aqmd.gov/aq-spec/evaluations/field>

Lab evaluation report:

<http://www.aqmd.gov/aq-spec/evaluations/laboratory>

AQ-SPEC website:

<http://www.aqmd.gov/aq-spec>



Coefficient of Determination ( $R^2$ ) quantifies how the three sensors followed the PM<sub>2.5</sub> concentration change by the reference instruments.

An  $R^2$  approaching the value of 1 reflects a near perfect agreement, whereas a value of 0 indicates a complete lack of correlation.

# Laboratory Evaluation Highlights

## Accuracy (PM<sub>2.5</sub>)

$$A (\%) = 100 - \frac{|\bar{X} - \bar{R}|}{\bar{R}} * 100$$

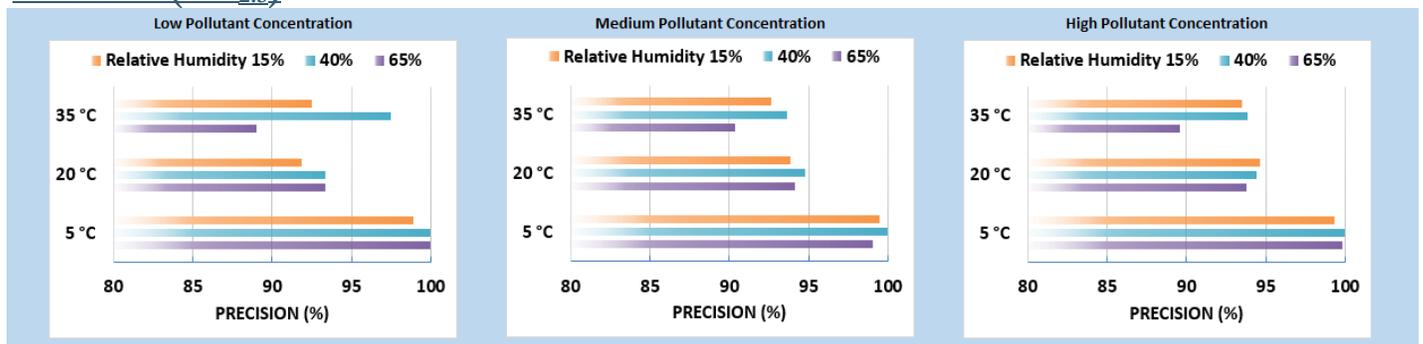
Steady State #	Sensor Mean (µg/m <sup>3</sup> )	FEM T640x (µg/m <sup>3</sup> )	Accuracy (%)
1	6.1	9.0	67.7
2	39.8	47.8	83.2
3	85.6	98.2	87.2
4	168.4	196.0	85.9
5	257.0	295.9	86.8

Accuracy was evaluated by a concentration ramping experiment at 20 °C and 40%. The sensor's readings at each ramping steady state are compared to the reference instrument.

A negative % means sensors' overestimation by more than two fold. The higher the positive value (close to 100%), the higher the sensor's accuracy.



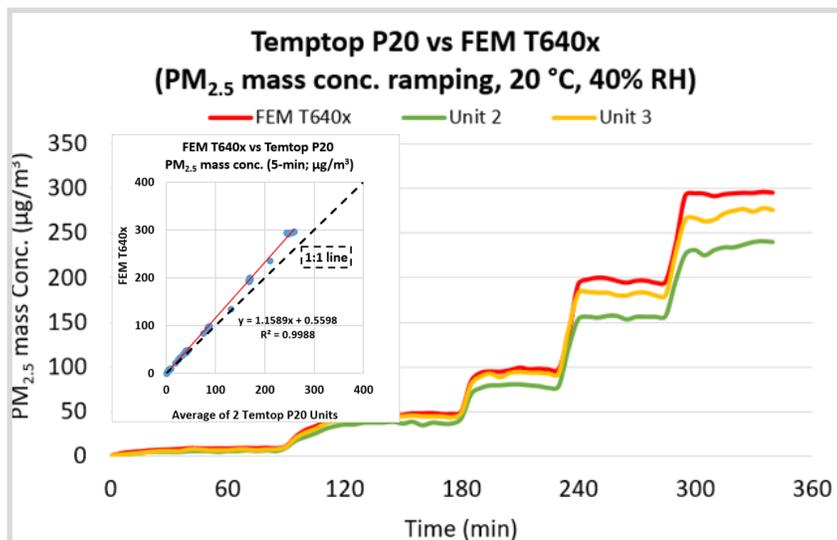
## Precision (PM<sub>2.5</sub>)



100% represents high precision.

Sensor's ability to generate precise measurements of PM<sub>2.5</sub> concentration at low, medium, and high pollutant levels were evaluated under 9 combinations of T and RH, including extreme weather conditions like cold and dry (5 °C and 15%) cold and humid (5 °C and 65%), hot and humid (35 °C and 65%), or hot and dry (35 °C and 15%).

## Coefficient of Determination



The Temtop P20 sensors showed very strong correlations with the corresponding FEM PM<sub>2.5</sub> data ( $R^2 > 0.99$ ) at 20 °C and 40% RH.

## Climate Susceptibility

From the laboratory studies, the Temtop P20 sensors' precision decreased with increasing temperature, while relative humidity had minimal effect; the sensors showed spiked conc. changes at the 65% RH change points for all temperature and PM conc. levels.

## Observed Interferents

N/A



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