

AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Sensor Description

Manufacturer/Model:
Elitech - Temtop PMD 351

Pollutants:
PM_{1.0} (field evaluation only),
PM_{2.5}, and PM₁₀ (field
evaluation only) mass
concentration

Time Resolution:
1-min



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>

Evaluation Summary

- The accuracy of the Temtop PMD 351 sensors for PM_{2.5} was 29.2% to 33.9% in the lab. The Temtop PMD 351 sensors underestimated PM_{2.5} compared to the Teledyne T640x in the lab.
- The Temtop PMD 351 sensors exhibited high precision for all conc., T/RH combinations for PM_{2.5}.
- The Temtop PMD 351 sensors showed moderate intra-model variability for PM_{2.5} in the lab.
- Data recovery in the field was ~ 100% from the three units tested.
- Temtop PMD 351 sensors showed moderate to strong correlations with GRIMM and T640 in the field for both PM_{1.0} (R²: 0.69 to 0.76) and PM_{2.5} (R²: 0.72 to 0.75), very weak to weak correlations with reference instruments in the field for PM₁₀ (R²: 0.28 to 0.48), and very strong correlations with the reference instruments in the laboratory studies (R² > 0.99 for PM_{2.5}).
- All of the same Temtop PMD 351 units were tested both in the field (1st stage of testing) and in the laboratory (2nd stage of testing) against reference PM instruments.

Field Evaluation Highlights

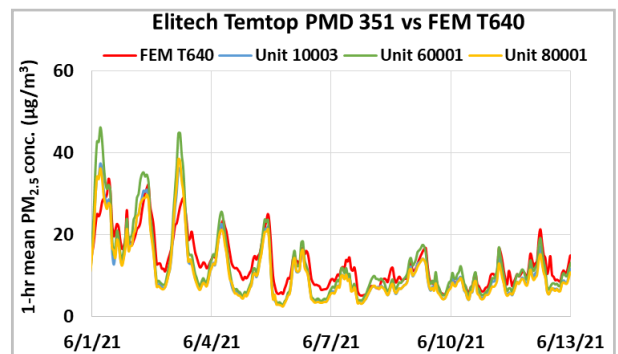
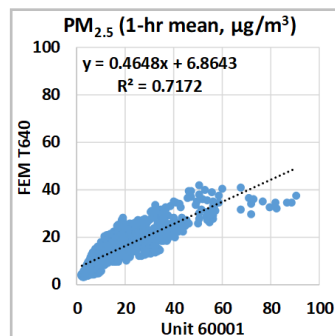
- Deployment period 04/23/2021 - 06/22/2021: the three Temtop PMD 351 sensors showed moderate to strong correlations with the PM_{1.0} and PM_{2.5} mass concentration as recorded by GRIMM and T640, and very weak to weak correlations with the corresponding GRIMM and T640 data for PM₁₀.
- The units showed data recovery was ~100%.

1-hr mean, all ref. inst.

PM_{1.0}: 0.69 < R² < 0.76

PM_{2.5}: 0.72 < R² < 0.75

PM₁₀: 0.28 < R² < 0.48



Coefficient of Determination (R²) quantifies how the three sensors followed the PM_{1.0}, PM_{2.5}, or PM₁₀ concentration change by the reference instruments.

An R² 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_{2.5})

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

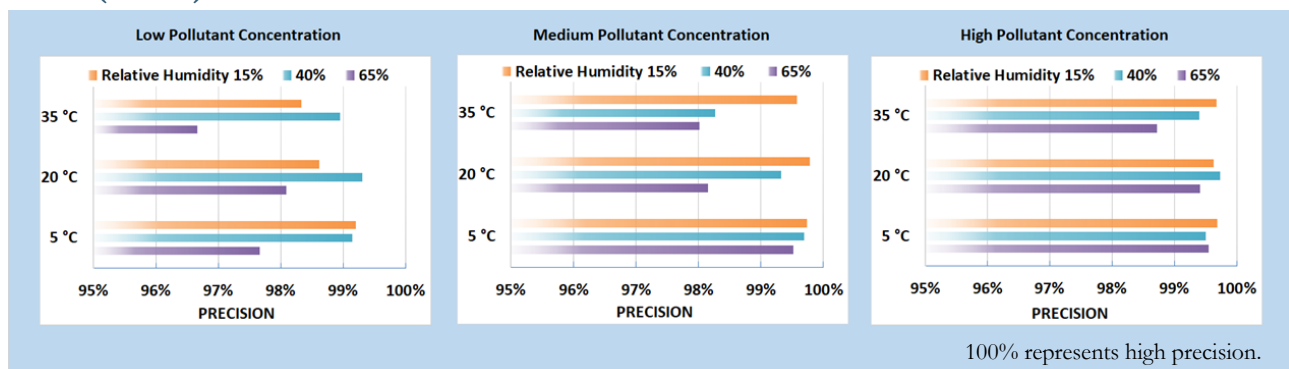
Steady State #	Sensor Mean (µg/m ³)	FEM T640x (µg/m ³)	Accuracy (%)
1	2.64	9.05	29.2%
2	14.58	47.50	30.7%
3	32.00	97.71	32.7%
4	65.89	196.31	33.6%
5	100.40	296.41	33.9%

Accuracy was evaluated by a concentration ramping experiment at 20 °C and 40% RH. The sensors' 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.

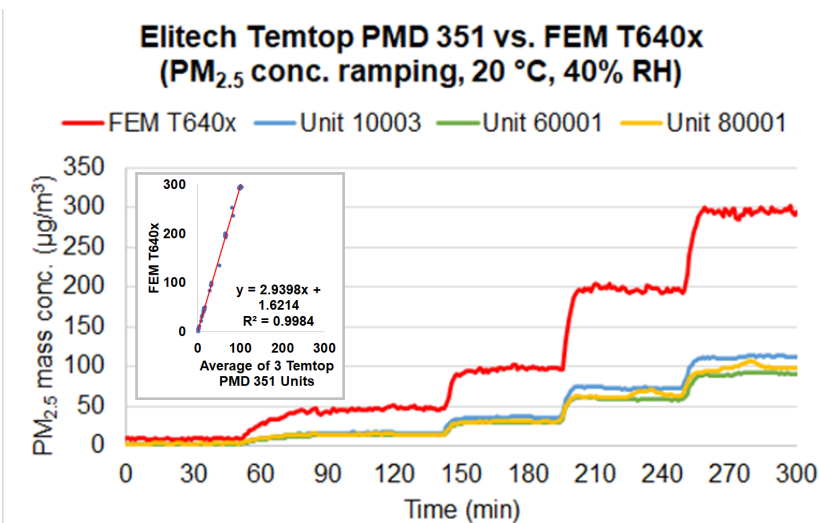


Precision (PM_{2.5})



Sensor's ability to generate precise measurements of PM_{2.5} 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 PMD 351 sensors showed very strong correlations with the corresponding FEM PM_{2.5} data ($R^2 > 0.99$) at 20 °C and 40% RH.

At the time of lab testing, the reference monitor did not report PM_{1.0}. The Temtop PMD 351 sensor's field performance did not qualify it for PM₁₀ testing in the lab.

Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the Temtop PMD 351 sensors' precision.

Observed Interferents

N/A



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