

AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Evaluation Summary

Sensor Description

Manufacturer/Model:
Aeroqual/AQY-R

Pollutants:
PM_{2.5}

Time Resolution:
1-min

Type: Optical



- The accuracy of the Aeroqual AQY-R sensors for PM_{2.5} was 75.2% to 96.8% in the lab. Overall, the Aeroqual AQY-R sensors overestimated PM_{2.5} measurements < 50µg/m³ and underestimated high PM_{2.5} measurements when compared to FEM T640x in the lab.
- The Aeroqual AQY-R sensors exhibited high precision for all conc., T/RH combinations for PM_{2.5}.
- The Aeroqual AQY-R sensors showed low intra-model variability in the field evaluation and moderate intra-model variability in the lab evaluation.
- Data recovery was 100% from all units tested in the field and laboratory evaluations.
- The Aeroqual AQY-R sensors showed moderate to strong correlations with the corresponding FEM GRIMM and FEM T640 PM_{2.5} measurements from the field; and very strong correlations with the FEM T640x in the laboratory studies ($R^2 > 0.99$ for PM_{2.5}).
- The same Aeroqual AQY-R 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 04/14/2022 - 06/12/2022: the Aeroqual AQY-R sensors showed moderate to strong correlations with the PM_{2.5} mass concentration as recorded by FEM GRIMM and FEM T640, respectively.
- Data recovery from all units was ~100%.

Additional Information

Field evaluation report:

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

Lab evaluation report:

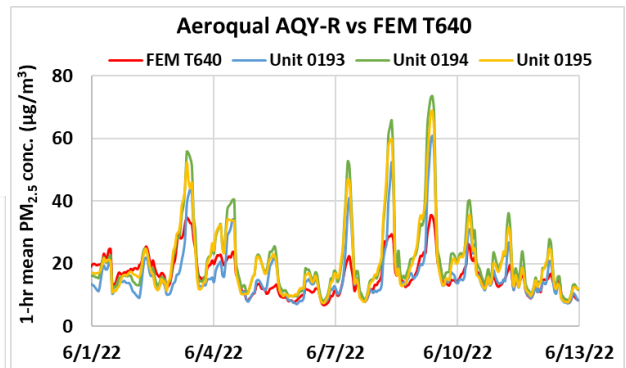
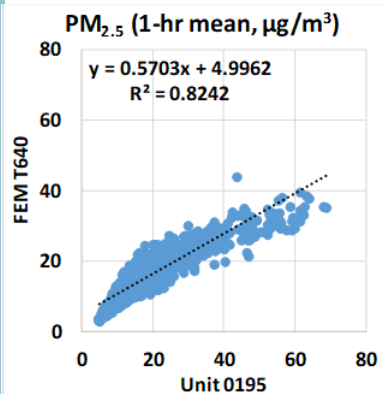
<http://www.aqmd.gov/aq-spec/evaluations/laboratory>

AQ-SPEC website:

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

1-hr mean, all ref. inst.

PM_{2.5}: $0.66 < R^2 < 0.83$



Coefficient of Determination (R^2) quantifies how the two sensors followed the PM_{1.0}, PM_{2.5}, or PM₁₀ 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.

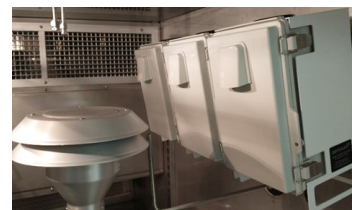
Laboratory Evaluation Highlights

Accuracy (PM_{2.5})

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

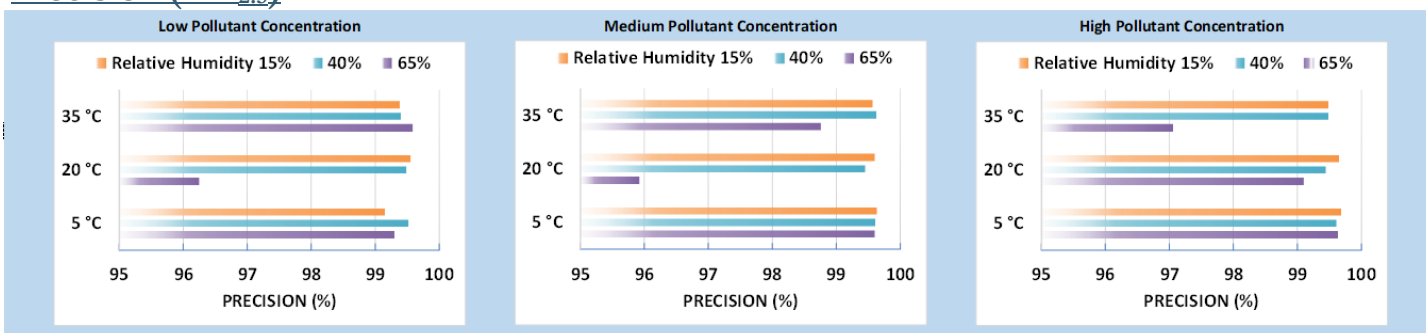
Steady State #	Sensor Mean (µg/m ³)	FEM T640x (µg/m ³)	Accuracy (%)
1	11.6	9.3	75.2
2	16.4	14.3	85.6
3	54.8	52.6	95.7
4	149.2	154.1	96.8
5	314.3	327.1	96.1

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



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

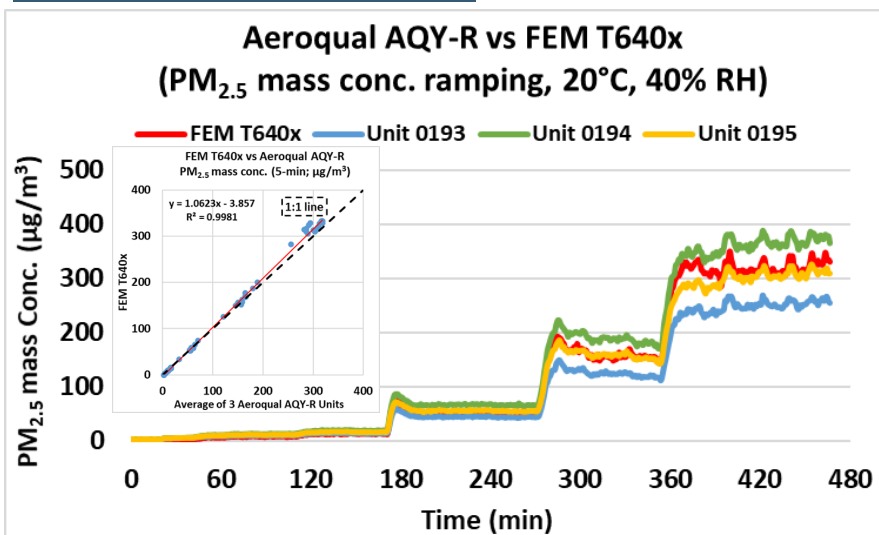
Precision (PM_{2.5})



100% represents high precision.

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% RH) cold and humid (5 °C and 65% RH), hot and humid (35 °C and 65% RH), or hot and dry (35 °C and 15% RH).

Coefficient of Determination



The Aeroqual AQY-R sensors showed very strong correlations with the corresponding FEM PM_{2.5} data ($R^2 > 0.99$) at 20°C and 40% RH.

Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the precision of the Aeroqual AQY-R sensors' PM_{2.5} measurements. Spiked concentrations were observed at the 65% RH change points at 20°C and 35°C.

Observed Interferents

N/A



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