

# AQ-SPEC

## Air Quality Sensor Performance Evaluation Center

### Sensor Description

Manufacturer/Model:  
Aeroqual  
Model AQY v0.5

Pollutants:  
PM<sub>2.5</sub>

Measurement Range:  
0 - 1000 µg/m<sup>3</sup>

Type: Optical



### 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>

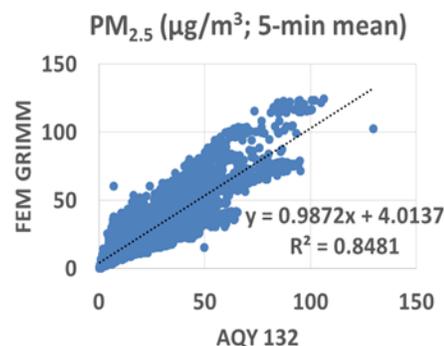
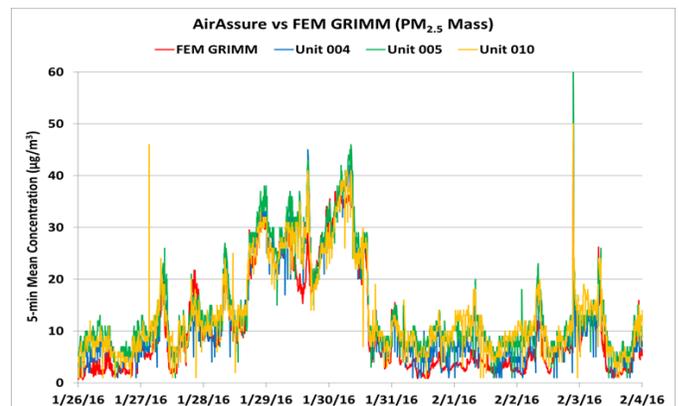
### Evaluation Summary

- Overall, the three Aeroqual AQY sensors (Units 130, 131 and 132) showed low to moderate accuracy in the laboratory studies. They overestimated the FEM GRIMM PM<sub>2.5</sub> measurements for a concentration range between 0 to 400 µg/m<sup>3</sup>
- The three Aeroqual AQY sensors exhibited high precision for all T/RH combinations tested in the environmental chamber.
- The Aeroqual AQY sensors (units IDs: 130 and 132) showed low intra-model variability in the field deployment as well as in the laboratory testing (Units 130, 131 and 132).
- The Aeroqual AQY sensors had good data recovery (>99% for 5-min average in the field, and 100% for 1-min average in the laboratory).
- For PM<sub>2.5</sub>, the Aeroqual AQY sensors (Units 130 and 132) showed strong correlations with the reference instrument from the field ( $R^2 > 0.84$ ) and very strong correlations with the reference instrument in the laboratory studies ( $R^2 > 0.99$ ; Units 130, 131 and 132).

### Field Evaluation Highlights

- Deployment period 12/22/2017- 03/27/2018: the Aeroqual AQY sensors (units IDs: 130 and 132) showed good correlations with PM<sub>2.5</sub> concentration change as monitored by FEM GRIMM and FEM BAM.
- The units showed > 99% data recovery as well as low intra-model variability.

$R^2 \sim 0.86$



Coefficient of Determination ( $R^2$ ) quantifies how the two sensors (Units 130 and 132) followed the PM<sub>2.5</sub> concentration change by FEM GRIMM.

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

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

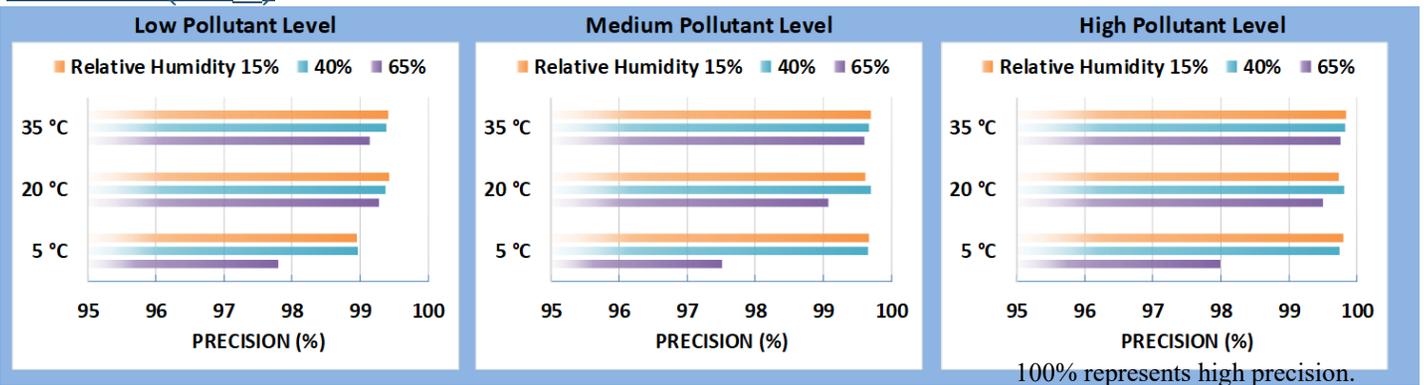
Steady State (#)	Sensor Mean ( $\mu\text{g}/\text{m}^3$ )	FEM GRIMM ( $\mu\text{g}/\text{m}^3$ )	Accuracy (%)
1	28.2	17.0	34.6
2	50.1	34.7	55.6
3	109.6	69.8	42.9
4	188.0	117.0	39.4
5	407.0	244.0	33.2
6	581.4	366.5	41.4

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

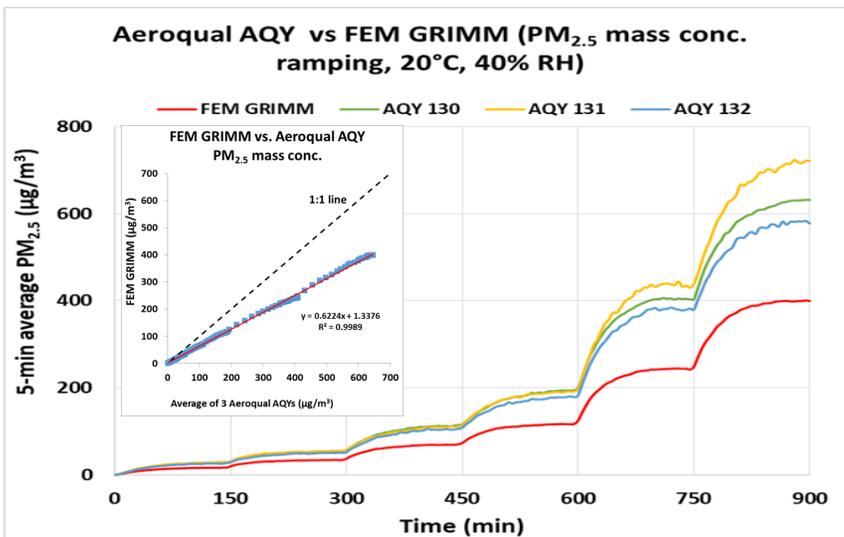


## Precision (PM<sub>2.5</sub>)



Sensor's ability of generating precise measurements of PM 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 three Aeroqual AQY sensors showed excellent correlation with the corresponding FEM  $\text{PM}_{2.5}$  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 Aeroqual AQY sensors' precision. At the set-points of RH changes, Aeroqual AQY sensors reported spiked changes in concentrations.

## Observed Interferents

N/A



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