

AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Sensor Description

Manufacturer/Model:
UniTec SENS-IT O₃

Pollutant: Ozone

Measurement Range:
10 ppb - 250 ppb

Type: Metal Oxide

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>

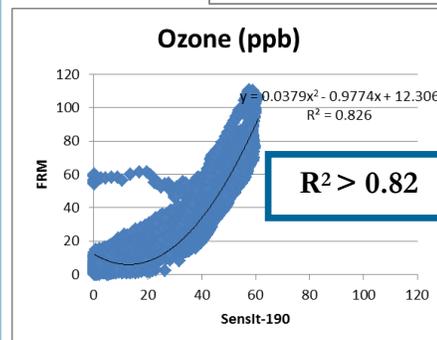
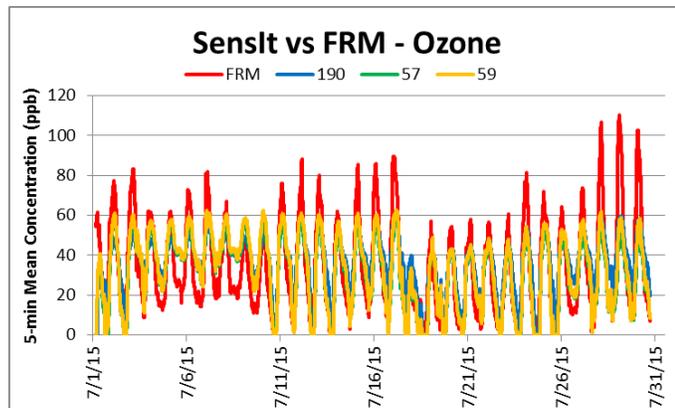
AQ-SPEC website:
<http://www.aqmd.gov/aq-spec>

Evaluation Summary

- Moderate to high intra-model variability was observed among the three Sens-IT units at different ozone concentrations. Unit U190 recorded consistently higher or lower values than the other two units (U057 and U059) and did not track well the ozone concentration ramping under different weather conditions. In the calculation of other evaluation parameters (e.g. precision, accuracy, coefficient of determination), unit U190 values were not included.
- Units U057 and U059 had relatively low accuracy compared to the FRM ozone monitor, for a concentration range between 10 to 250 ppb.
- Units U057 and U059 exhibited acceptable precision in most of the tested environmental conditions (ozone conc., T and RH). However, the Sens-IT units were susceptible to weather conditions (e.g. high temperature & RH).
- Data recovery from the three Sens-IT units was 100%.
- Sens-IT ozone units showed strong correlations with the FRM from both the field ($R^2 \sim 0.72-0.83$) and laboratory studies ($R^2 > 0.80$).

Field Evaluation Highlights

- Deployment period 07/01/2015– 07/31/2015: the three Sens-IT units followed the ozone concentration change as monitored by FRM instrument.
- Data recovery from the Sens-IT units was greater than 99%.



Coefficient of Determination (R^2) quantifies how the three sensors followed the ozone concentration change by FRM.

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

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

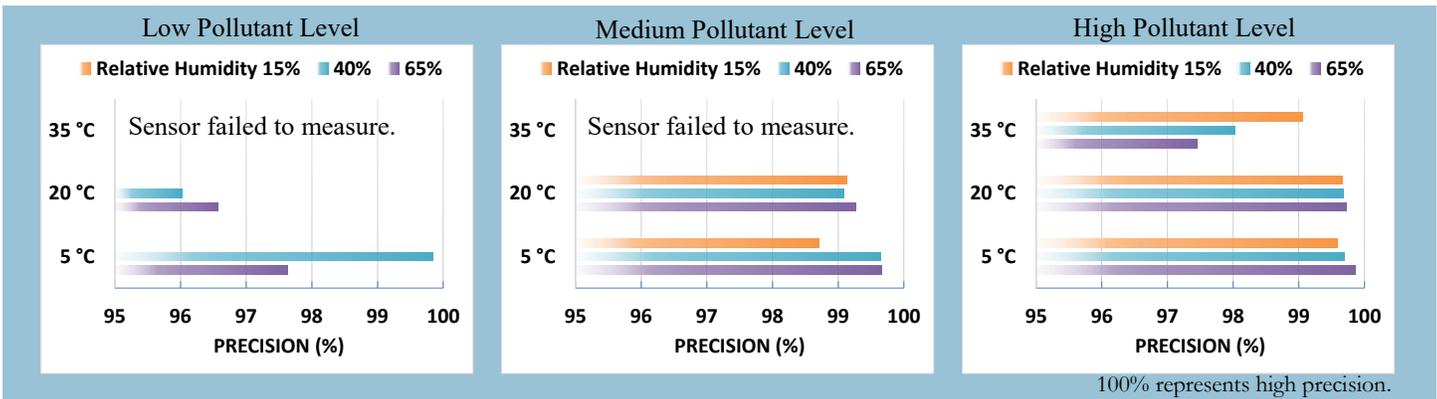
Accuracy was evaluated by a concentration ramping experiment at 20 °C and 40%. The sensor's readings at each ramping steady state are compared to the reference instrument.

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



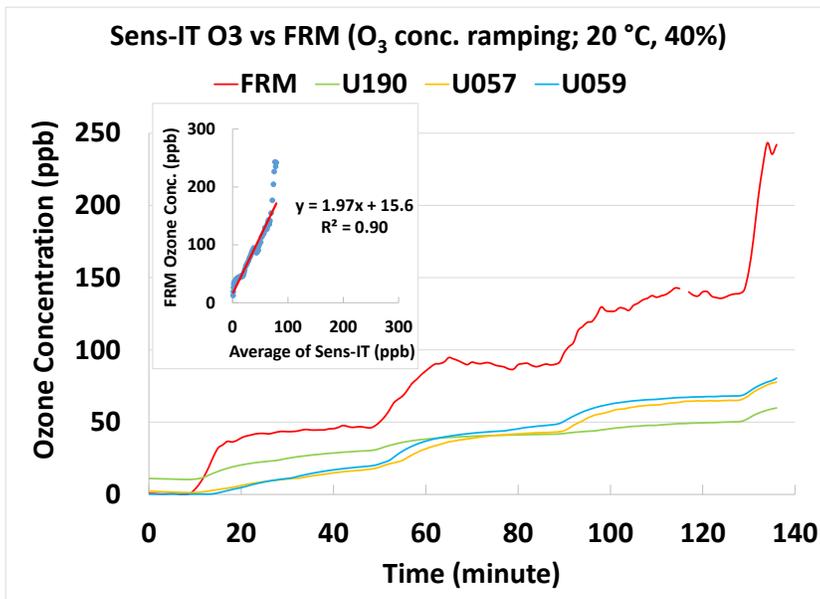
Steady State (#)	Sensor mean (ppb)	FRM (ppb)	Accuracy (%)
1	14.9	45.3	32.9
2	43.2	89.6	48.2
3	65.7	138.5	47.4

Precision



Sensor's ability to generate precise measurements of ozone 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 Sens-IT units showed strong correlations with the corresponding FRM data ($R^2 > 0.90$) at 20 °C and 40% RH.

Climate Susceptibility (R^2)

R^2	5 °C	20 °C	35 °C
15%	0.81	0.87	0.94
40%	0.95	0.90	0.80
65%	0.86	0.96	0.80

Sens-IT O₃ units' performance was affected by extreme temperature and humidity.

Observed Interferents

Low and high temperature and humidity.



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