



Technical Evaluation of Sensor Technology (TEST) Program

*PurpleAir PA-II Sensor
2018 – 2nd Quarter*



Introduction and Sensor Profile

This analysis report is focused on assessing the performance of the PurpleAir PA-II sensor as a part of the District's Technical Evaluation of Sensor Technology (TEST) Program. The PurpleAir PA-II sensor uses an optical laser-based particle counting methodology to estimate the mass of varying diameters of particulate matter, including PM1, PM2.5, and PM10. The PA-II sensor also measures temperature, pressure, and relative humidity.

Background and Approach of Evaluation Test

In November of 2017, the National Aeronautics and Space Administration (NASA) began an air quality study to compare the performance of PurpleAir sensors to regulatory PM2.5 analyzers. The study is focused on the conditions in the San Joaquin Valley and is based at the California Air Resources Board (CARB) air monitoring sites of Modesto, Fresno-Garland, Visalia-Church, and Bakersfield-California. The data sets compare PurpleAir sensor PM2.5 data to that of the regulatory PM2.5 data that is collocated at the four CARB sites. The scatter plots and time series graphs below show how the datasets compare for both hourly values and the 24-hour average.

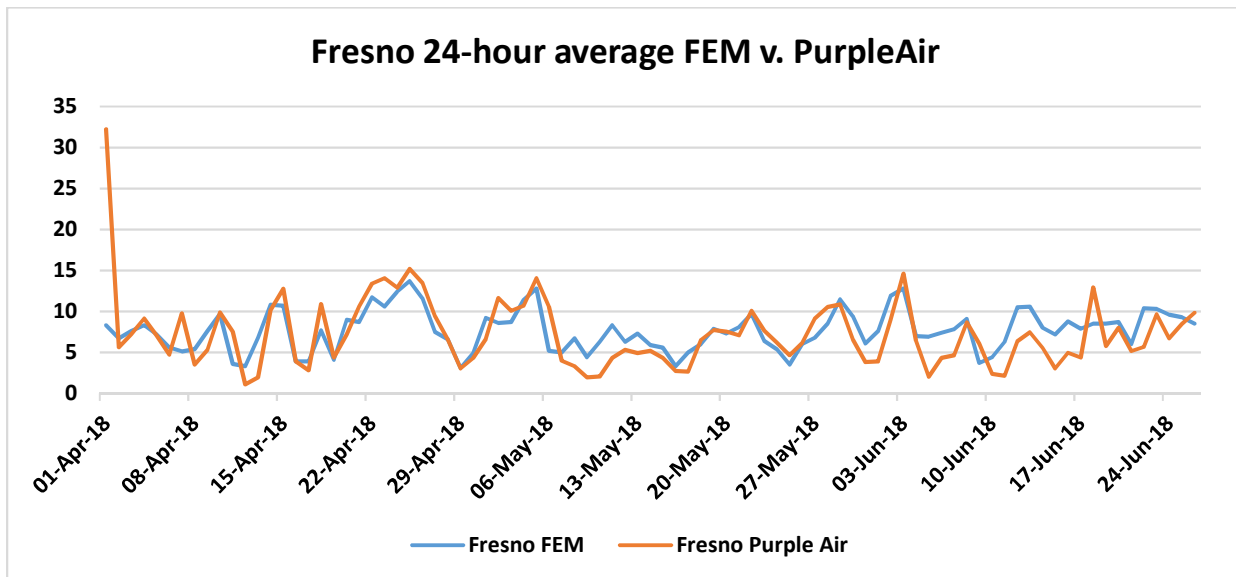
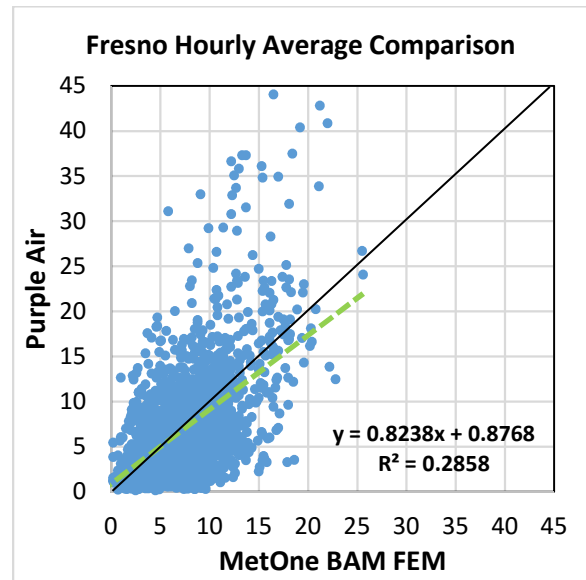
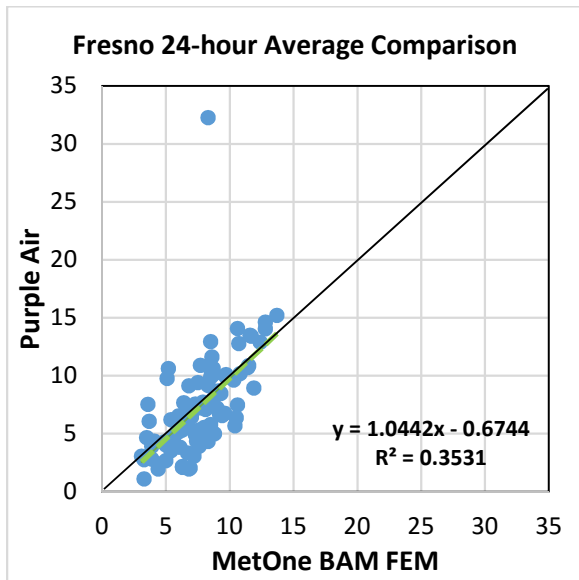
Overview of Analysis Findings from Current Period

The analysis for this report covers the time period of April 1st, 2018 through June 30th, 2018 (2018 – 2nd quarter). The second quarter did not have any major events that caused PM2.5 to increase to high levels. Typical weather patterns of alternating high and low pressure occurred during the period. While certain wildfires did occur later in the quarter (Lions began June 26), they did not cause a direct Valley floor impact before the end of the period. As overall PM2.5 concentrations were lower during this quarter, the PurpleAir sensors performed better in terms of bias, compared to quarters when peak concentrations occurred and the PurpleAir sensors were clearly biased high.

Site Specific Analysis of PurpleAir PA-II Sensor Performance

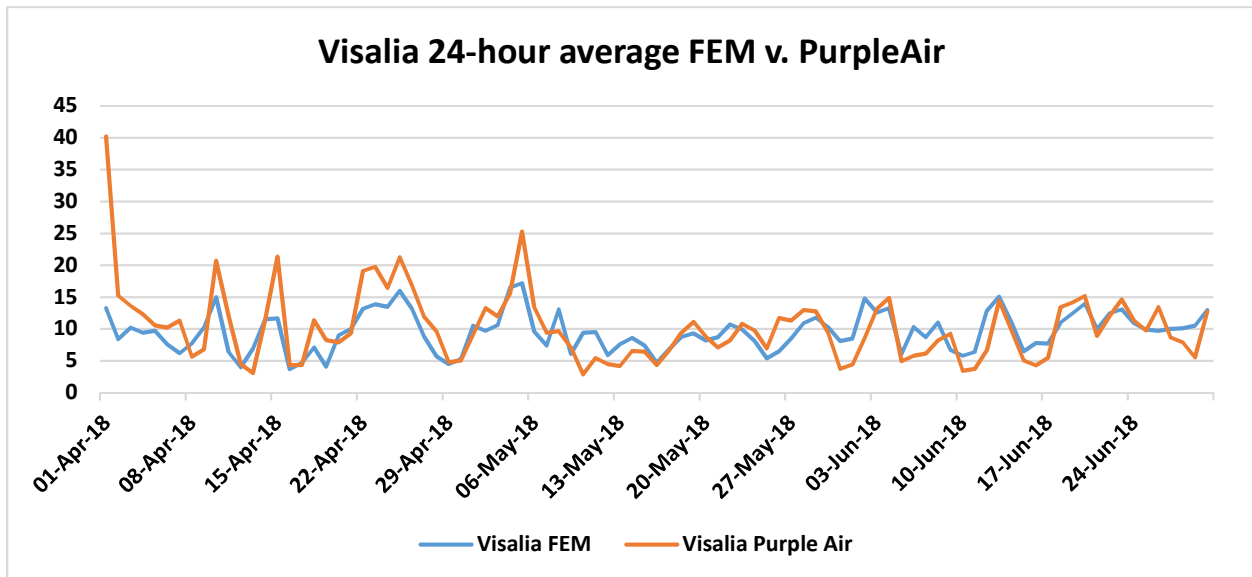
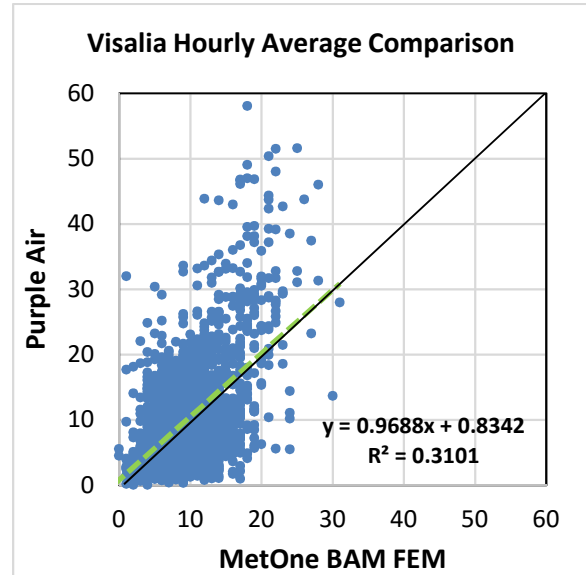
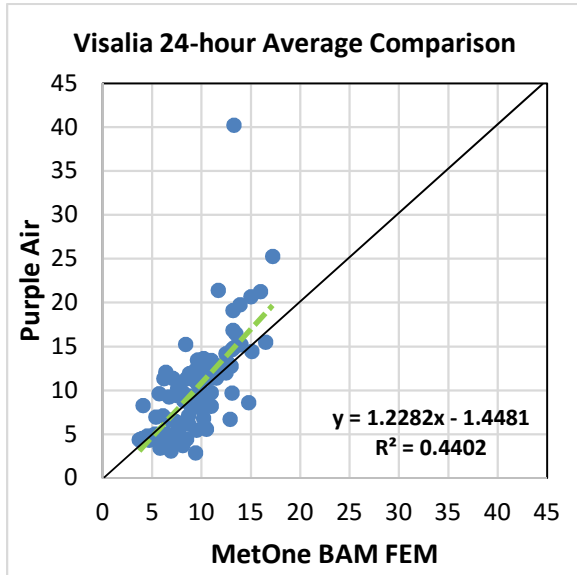
Fresno-Garland

For the 24-hour average, PurpleAir data had a 0.40 µg/m³ low bias during the April 1st, 2018 through June 30th, 2018 period. For the hourly average, PurpleAir data had the same 0.40 µg/m³ low bias over the same period.



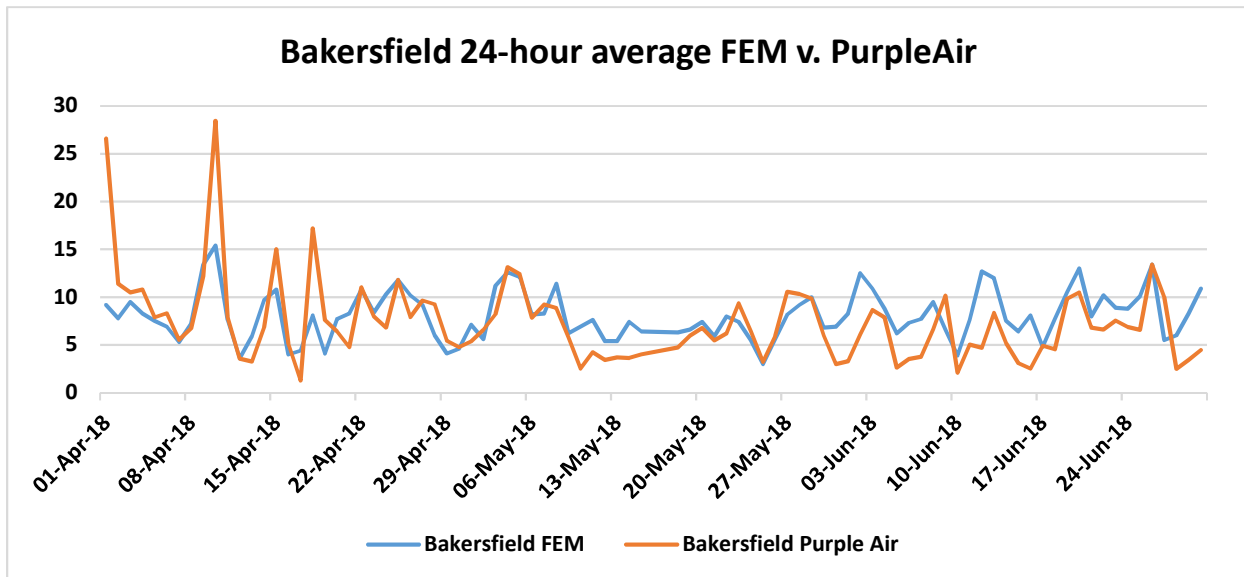
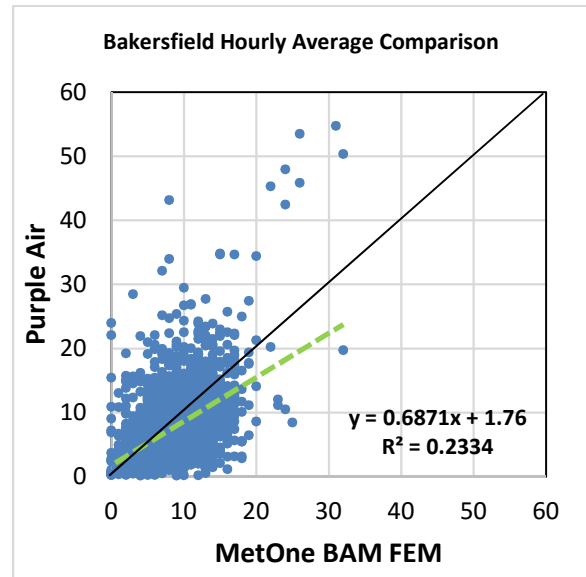
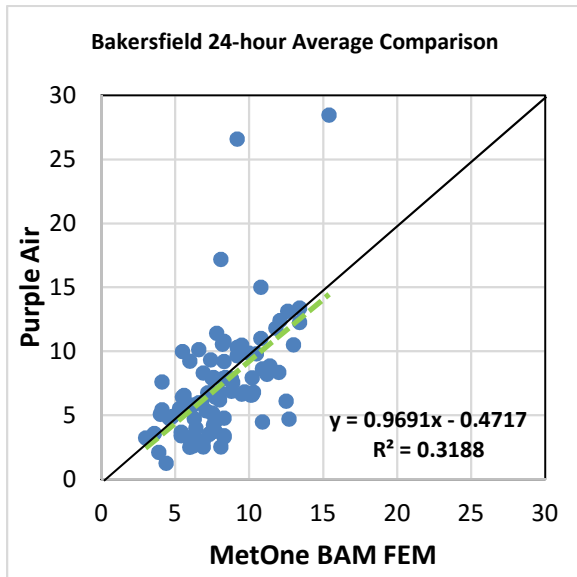
Visalia-Church

For the 24-hour average, PurpleAir data had a $0.70 \mu\text{g}/\text{m}^3$ high bias during the April 1st, 2018 through June 30th, 2018 period. For the hourly average, PurpleAir data had a $0.53 \mu\text{g}/\text{m}^3$ high bias over the same period.



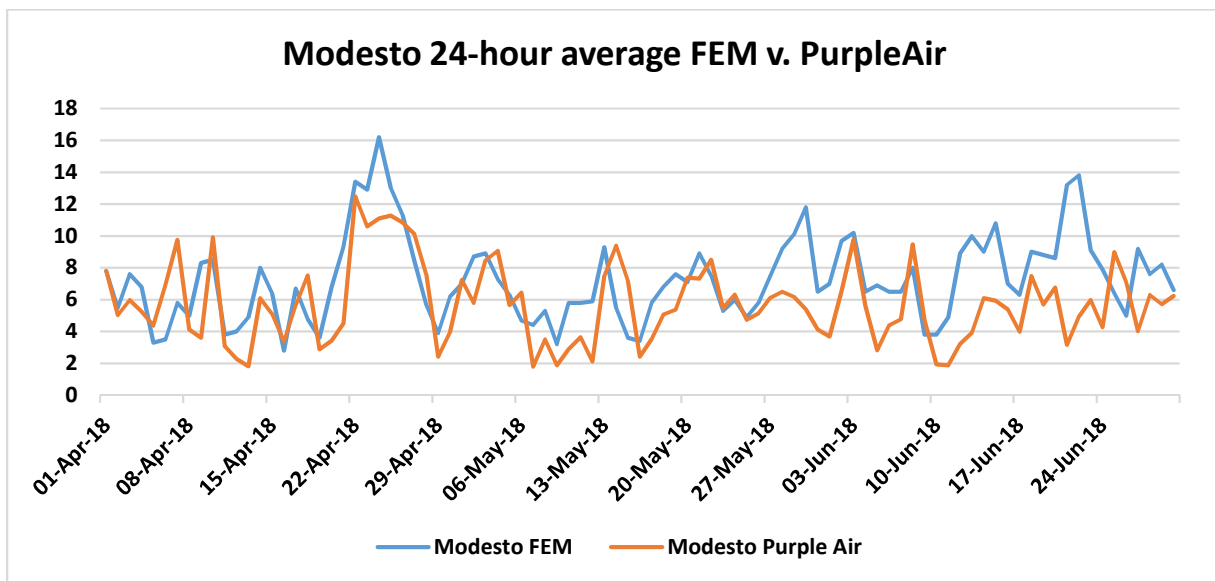
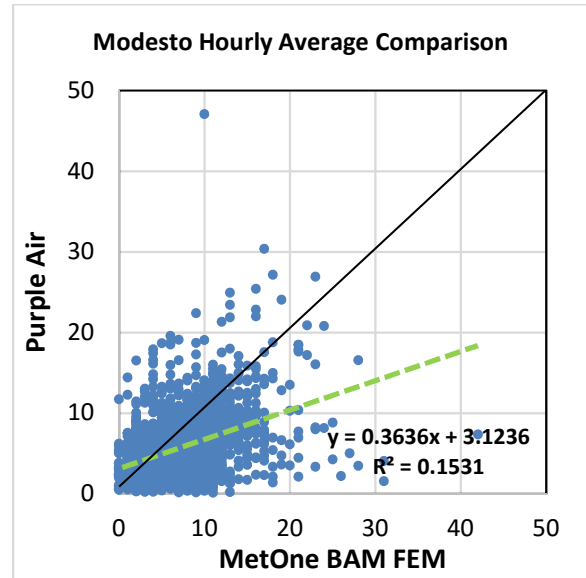
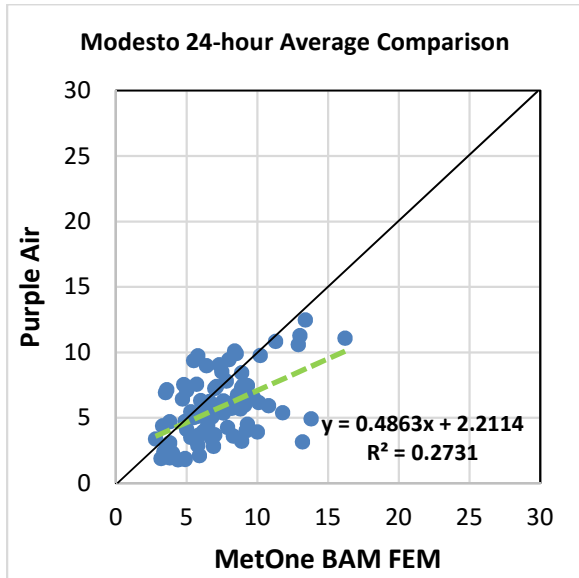
Bakersfield-California

For the 24-hour average, PurpleAir data had a $0.70 \mu\text{g}/\text{m}^3$ low bias during the April 1st, 2018 through June 30th, 2018 period. For the hourly average, PurpleAir data had a $0.75 \mu\text{g}/\text{m}^3$ low bias over the same period.



Modesto-14th St.

For the 24-hour average, PurpleAir data had a 1.60 µg/m³ low bias during the April 1st, 2018 through June 30th, 2018 period. For the hourly average, PurpleAir data had a 1.43 µg/m³ low bias over the same period.



Statistical Summary

The following table provides a statistical summary of the data collected during the analysis period of this report.

Statistic	Fresno-Garland	Visalia-Church	Bakersfield-Cal	Modesto
FEM Avg	7.7	9.6	8.1	7.3
Sensor Avg	7.3	10.3	7.4	5.7
FEM 1-hr Max	25.6	31	32	42
Sensor 1-hr Max	44	58	55	47
FEM 24-hr Max	13.7	17.2	15.4	16.2
Sensor 24-hr Max	32.2	40.2	28.5	12.5
1-hr R ²	0.2858	0.3101	0.2334	0.1531
1-hr Slope	0.8238	0.9688	0.6871	0.3636
1-hr Intercept	0.8768	0.8342	1.76	3.1236
24-hr R ²	0.3531	0.4402	0.3188	0.2731
24-hr Slope	1.0442	1.2282	0.9691	0.4863
24-hr Intercept	-0.6744	-1.4481	-0.4717	2.2114