

Field Evaluation Edimax EdiGreen Home



Background

- From 05/04/2018 to 07/03/2018, three **Edimax EdiGreen Home (Model AI-2002 W)** sensors were deployed at our (SCAQMD) Rubidoux station and ran side-by-side with Federal Equivalent Method (FEM) instruments measuring the same pollutants
- Edimax EdiGreen Home [3 units tested]:
 - Particle sensor (**optical; non-FEM**) (Model PMS5003)
 - Each sensor reports: PM_{2.5} mass concentration ($\mu\text{g}/\text{m}^3$)
 - Time resolution: 10 seconds
 - Sensor also records: PM₁₀ ($\mu\text{g}/\text{m}^3$), CO₂ (ppm), TVOC (ppb) and formaldehyde (mg/m^3)
 - **Unit cost: ~\$ 299**
 - IDs: 3664, 365A, B8B6
- MetOne BAM (reference method):
 - Beta-attenuation monitors (**FEM PM_{2.5}, FEM PM₁₀**)
 - Measures PM_{2.5} & PM₁₀ mass ($\mu\text{g}/\text{m}^3$)
 - **Unit cost: ~\$20,000**
 - Time resolution: 1-hr
- GRIMM (reference method):
 - Optical Particle Counter (**FEM PM_{2.5}**)
 - Uses proprietary algorithms to calculate total PM_{1.0}, PM_{2.5}, PM₁₀ mass from particle number measurements
 - **Unit cost: ~\$25,000 and up**
 - Time resolution: 1-min

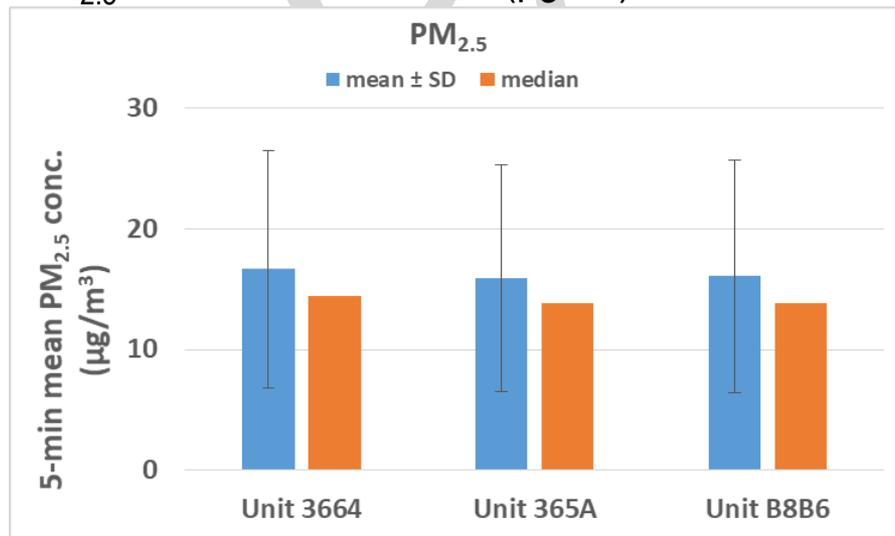


Data validation & recovery

- Basic QA/QC procedures were used to validate the collected data (i.e. obvious outliers, negative values and invalid data-points were eliminated from the data-set)
- Data recovery for PM_{2.5} mass concentrations from all Edimax EdiGreen Home was > 99.6%

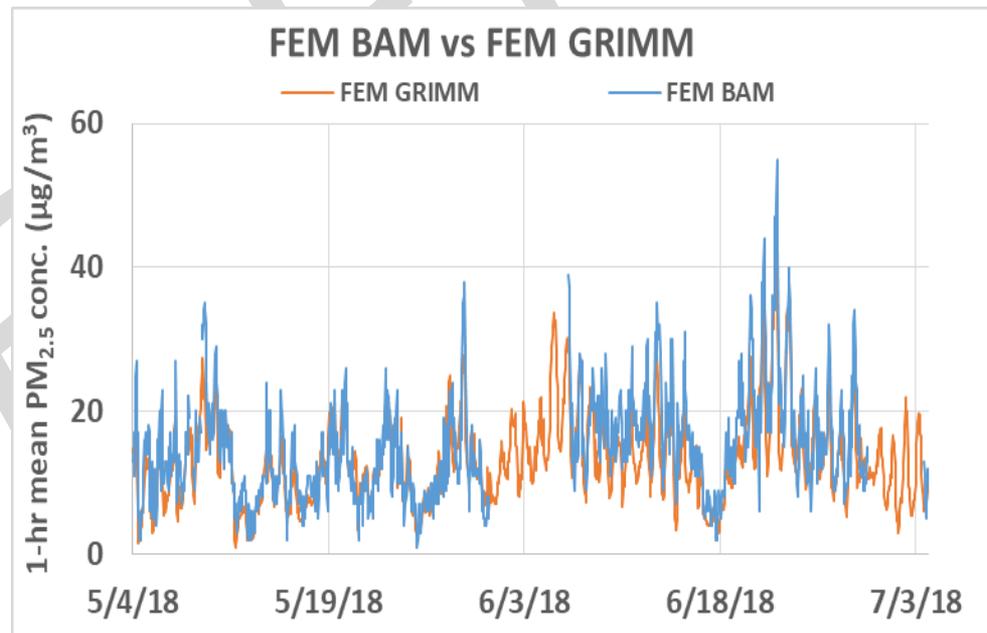
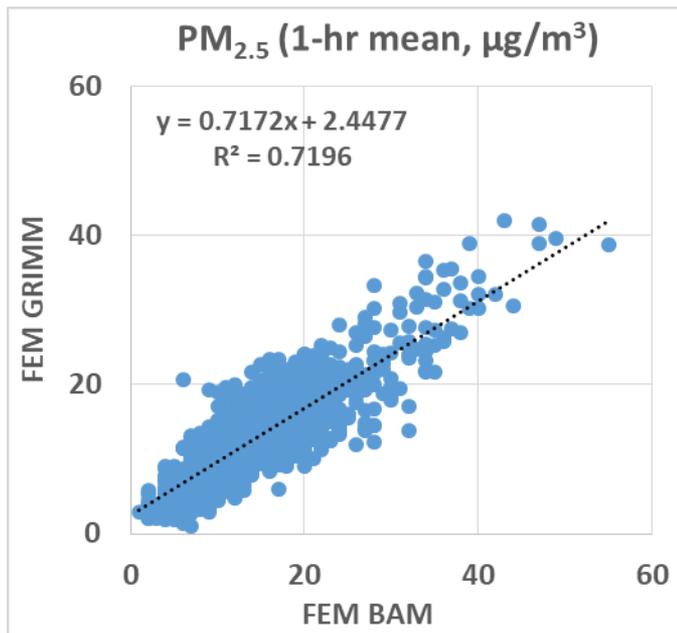
Edimax EdiGreen Home; intra-model variability

- Very low intra-model variability (4.7%) was observed between the different Edimax EdiGreen Home sensors for PM_{2.5} mass concentrations ($\mu\text{g}/\text{m}^3$).

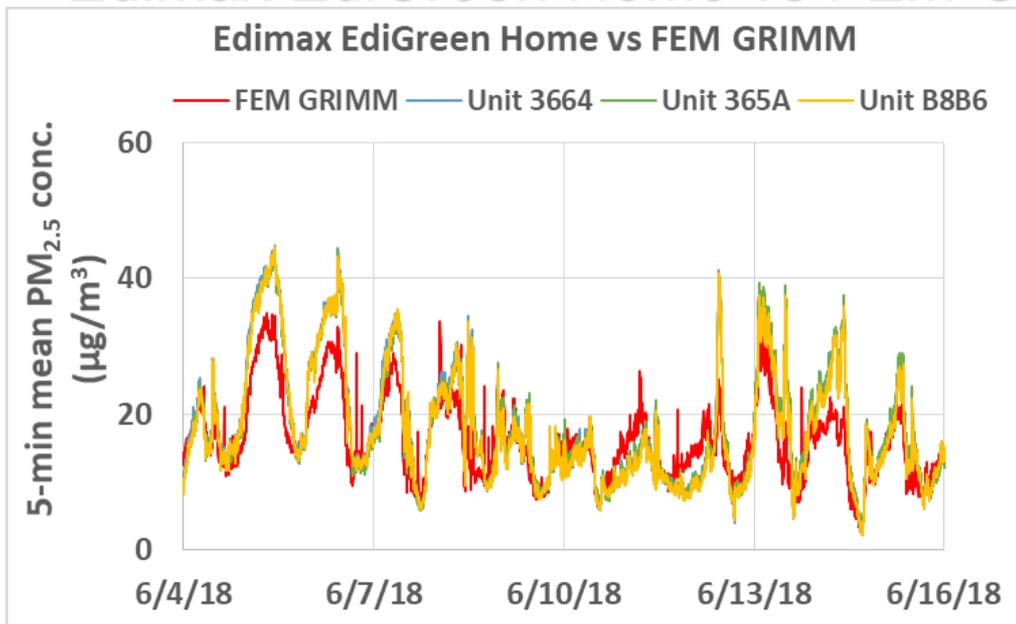


Equivalent Methods: GRIMM vs BAM

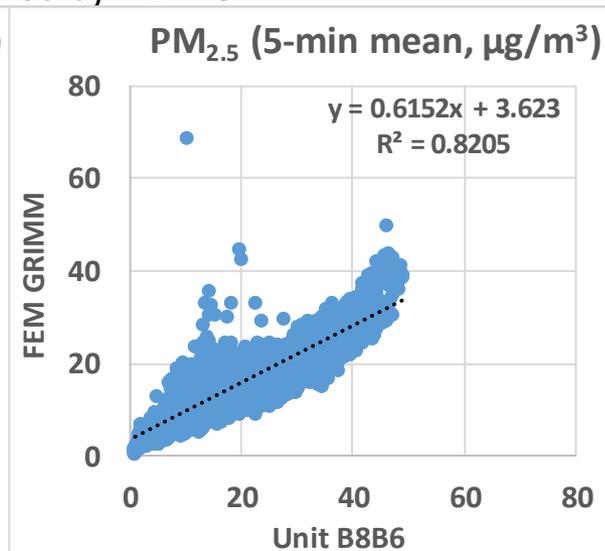
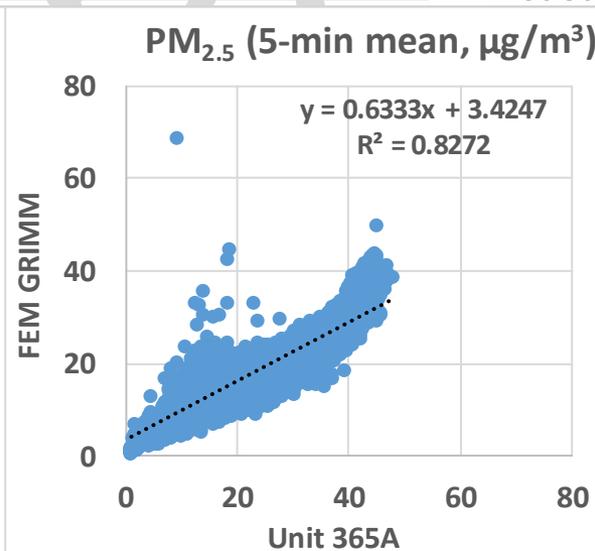
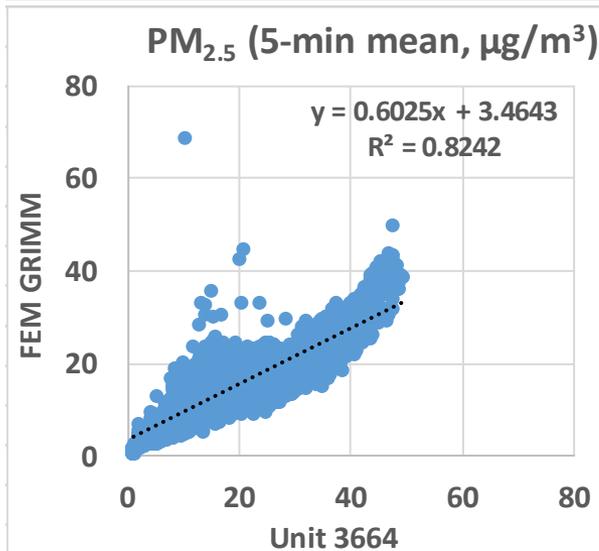
- Data recovery for PM_{2.5} was 100% and 82% for GRIMM and BAM, respectively
- PM_{2.5} mass concentrations measured by the equivalent methods (GRIMM and BAM) show good correlations (1-hr mean, $R^2 > 0.71$)



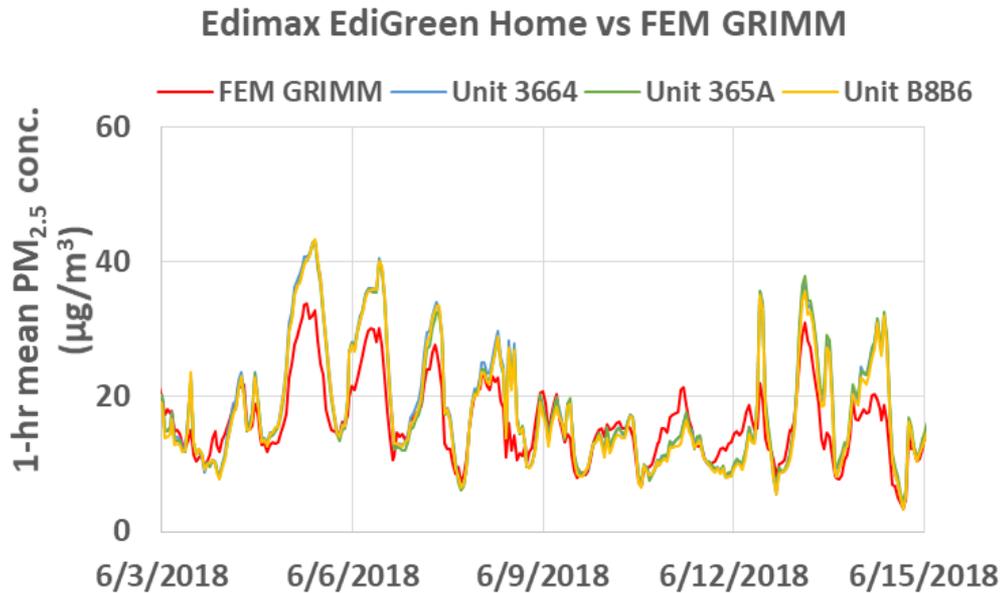
Edimax EdiGreen Home vs FEM GRIMM (PM_{2.5}; 5-min mean)



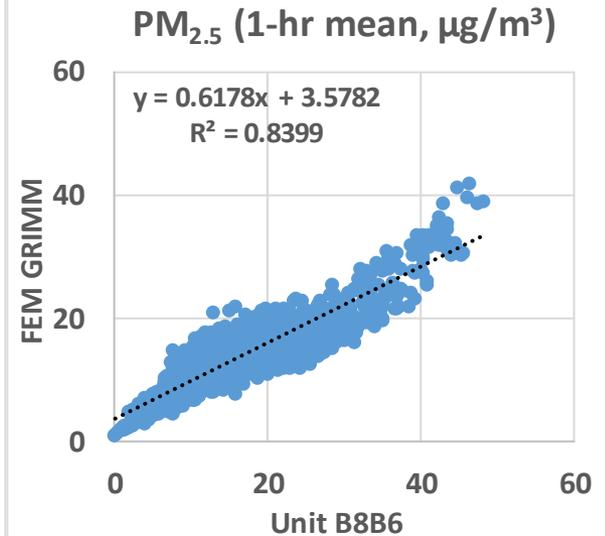
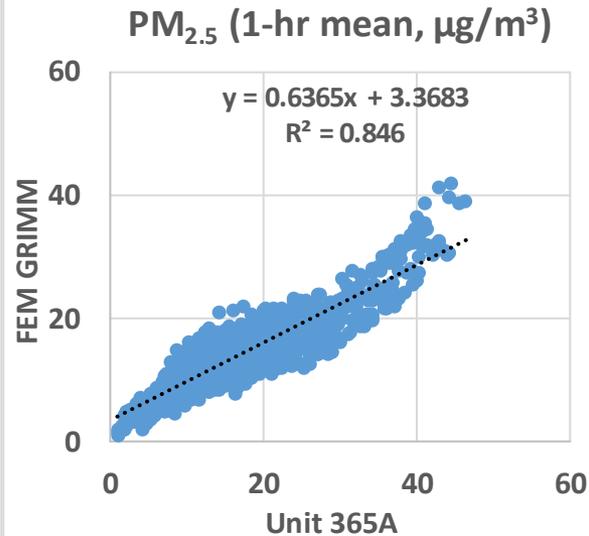
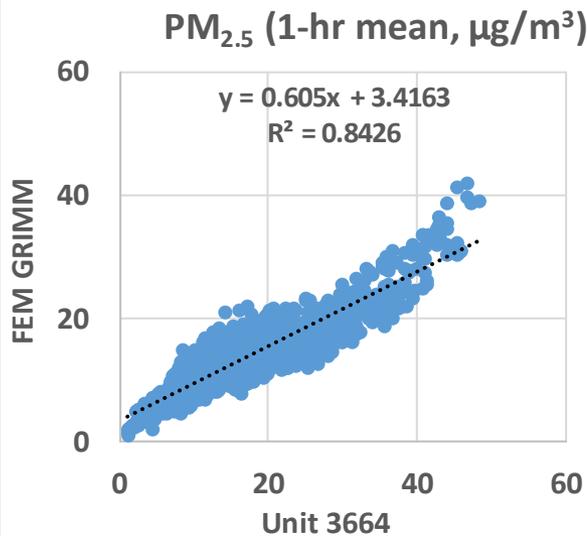
- Edimax EdiGreen Home PM_{2.5} mass measurements show good correlations with the corresponding FEM GRIMM data ($R^2 > 0.82$)
- Overall, the Edimax EdiGreen Home sensors overestimate PM_{2.5} mass concentrations measured by FEM GRIMM
- The Edimax EdiGreen Home sensors track well the PM_{2.5} diurnal variation measured by FEM GRIMM



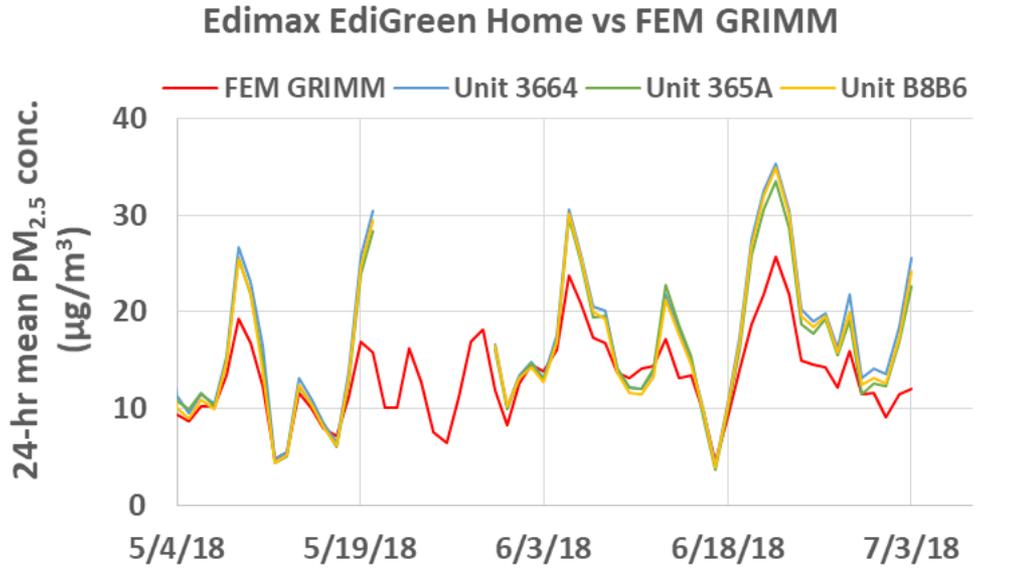
Edimax EdiGreen Home vs FEM GRIMM (PM_{2.5}; 1-hr mean)



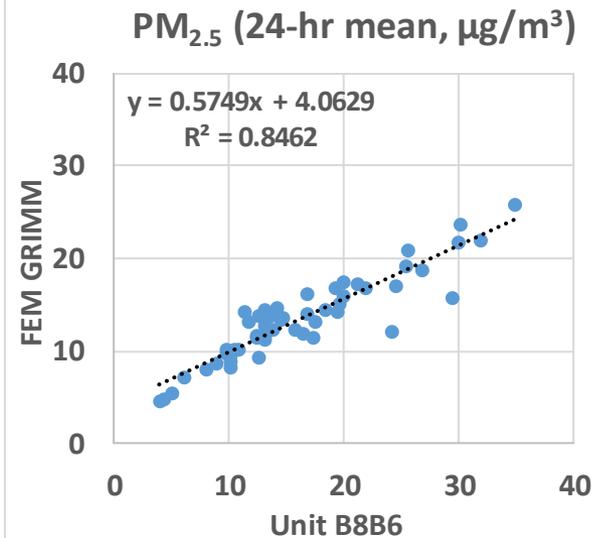
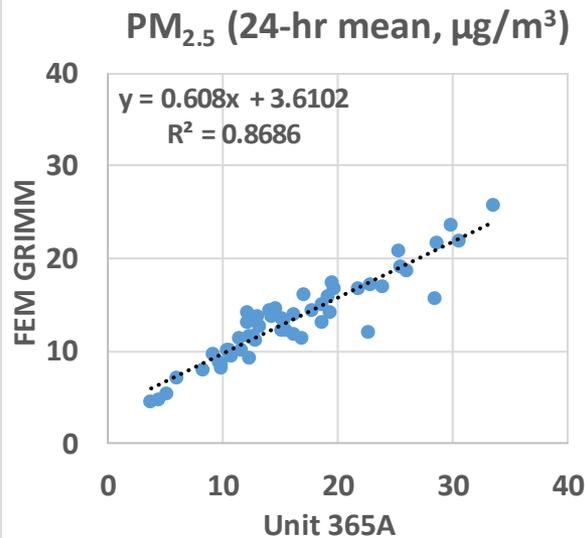
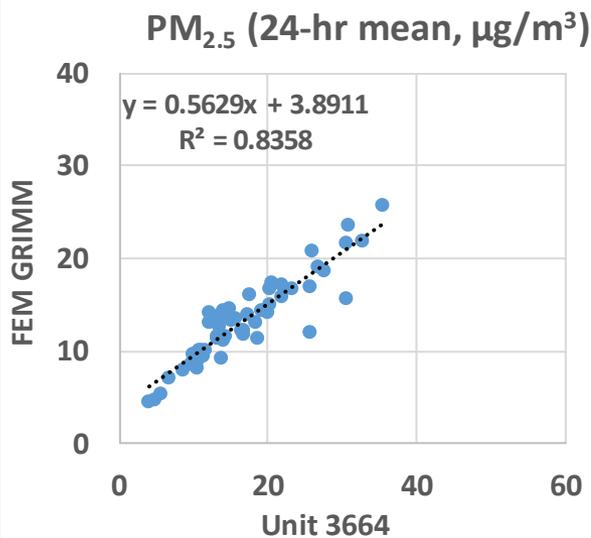
- Edimax EdiGreen Home PM_{2.5} mass measurements show good correlations with the corresponding FEM GRIMM data ($R^2 > 0.83$)
- Overall, the Edimax EdiGreen Home sensors overestimate PM_{2.5} mass concentrations measured by FEM GRIMM
- The Edimax EdiGreen Home sensors track well the PM_{2.5} diurnal variation measured by FEM GRIMM



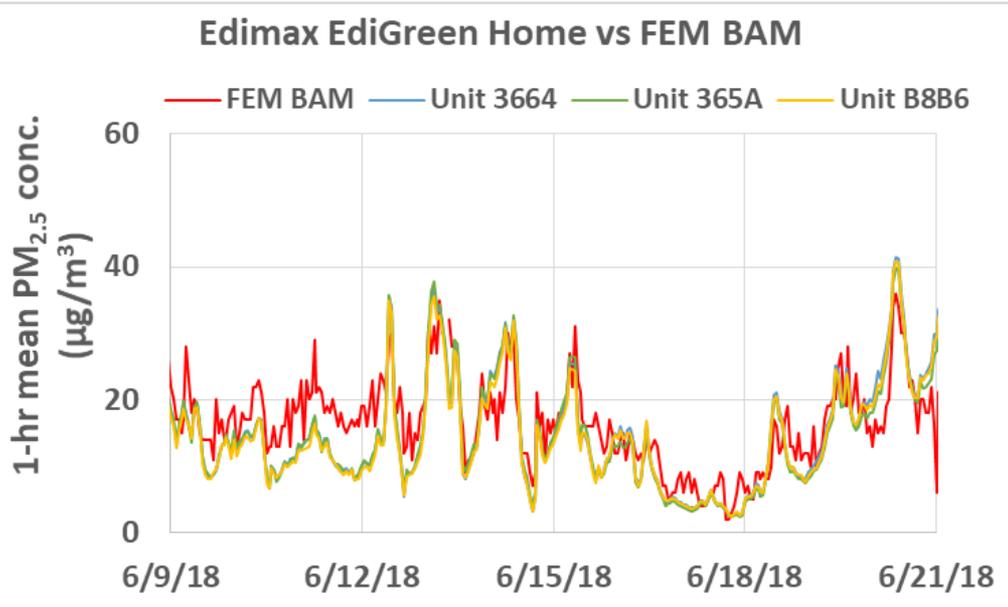
Edimax EdiGreen Home vs FEM GRIMM (PM_{2.5}; 24-hr mean)



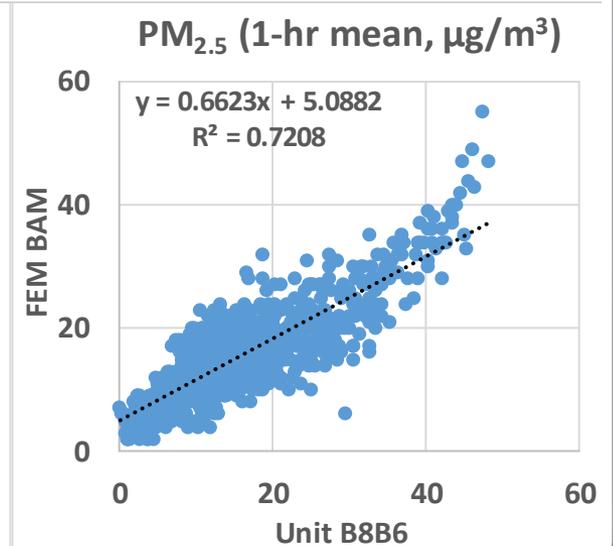
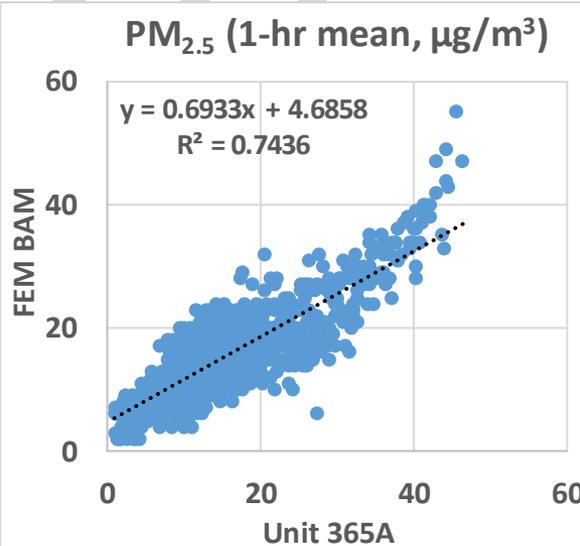
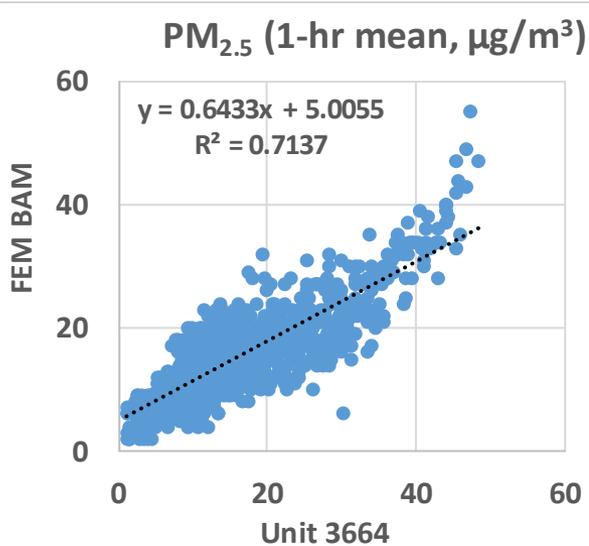
- Edimax EdiGreen Home PM_{2.5} mass measurements show good correlations with the corresponding FEM GRIMM data ($R^2 > 0.83$)
- Overall, the Edimax EdiGreen Home sensors overestimate PM_{2.5} mass concentrations measured by FEM GRIMM
- The Edimax EdiGreen Home sensors track well the PM_{2.5} diurnal variation measured by FEM GRIMM



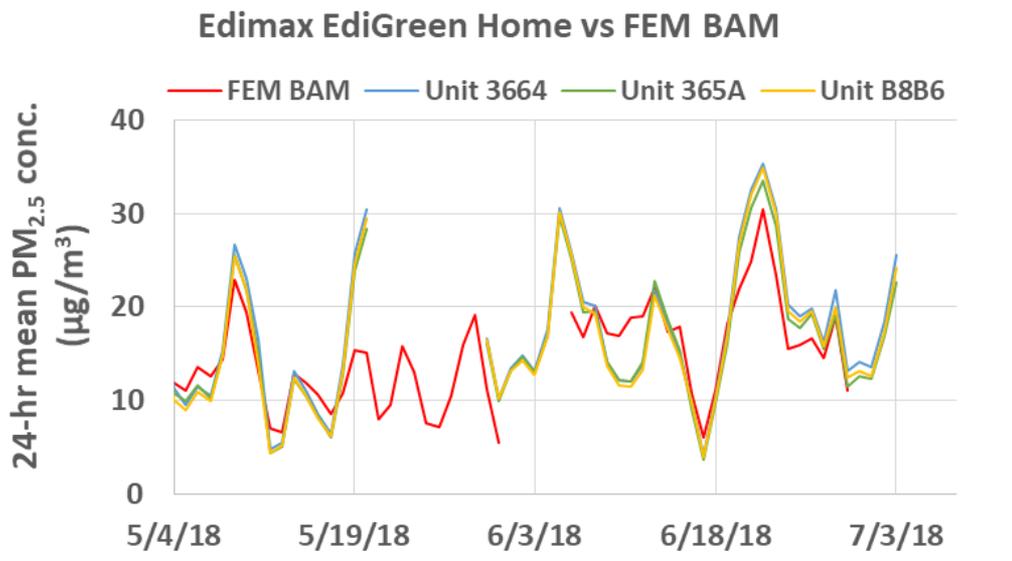
Edimax EdiGreen Home vs FEM BAM (PM_{2.5}; 1-hr mean)



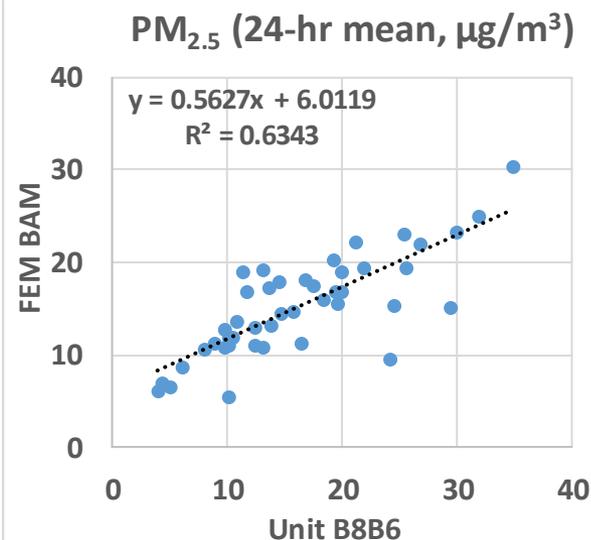
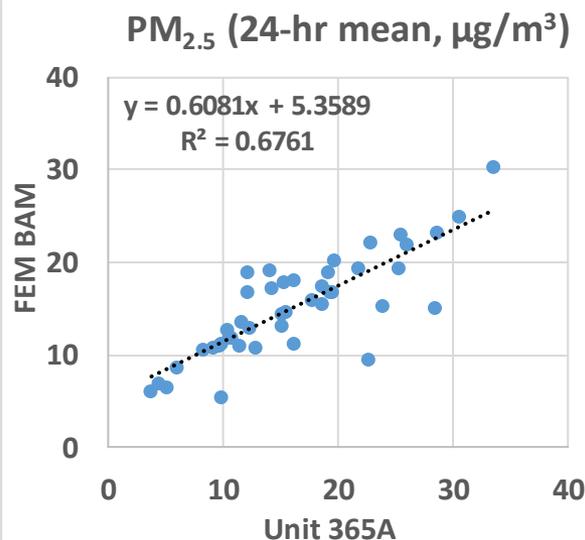
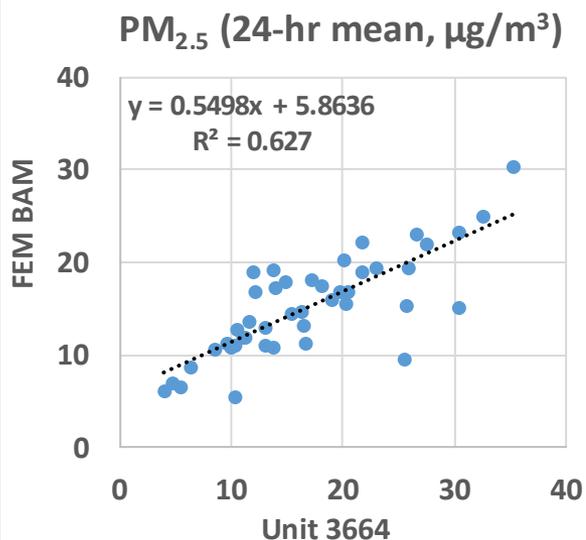
- Edimax EdiGreen Home PM_{2.5} mass measurements show moderate correlations with the corresponding FEM BAM data ($0.71 < R^2 < 0.75$)
- Overall, the Edimax EdiGreen Home sensors overestimate PM_{2.5} mass concentrations measured by FEM BAM
- The Edimax EdiGreen Home sensors track moderately well the PM_{2.5} diurnal variation measured by FEM BAM



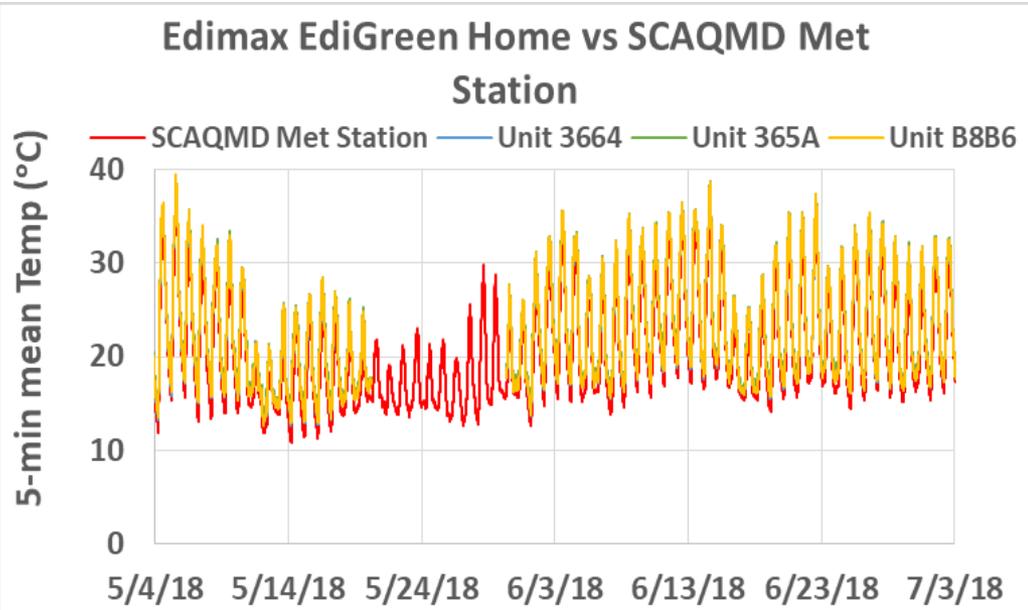
Edimax EdiGreen Home vs FEM BAM (PM_{2.5}; 24-hr mean)



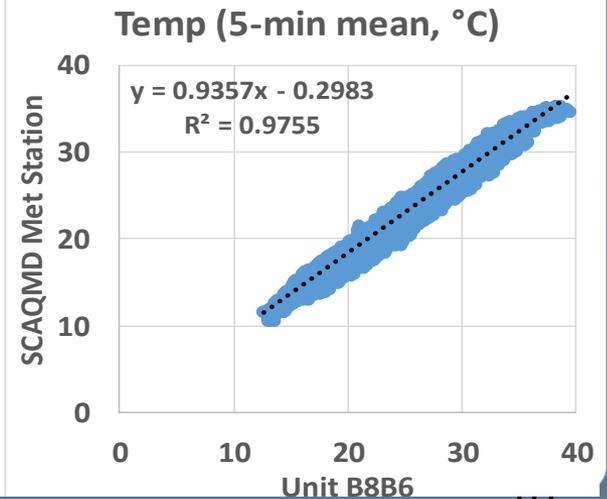
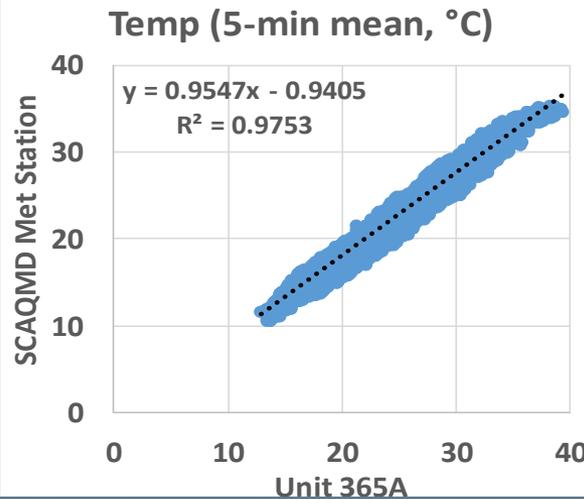
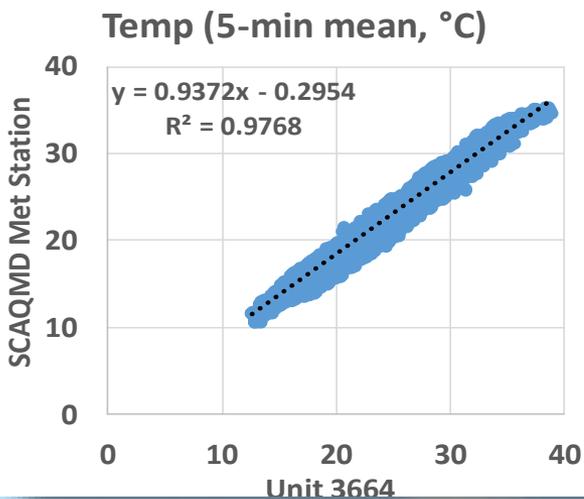
- Edimax EdiGreen Home PM_{2.5} mass measurements show good correlations with the corresponding FEM BAM data ($0.62 < R^2 < 0.68$)
- Overall, the Edimax EdiGreen Home sensors overestimate PM_{2.5} mass concentrations measured by FEM BAM
- The Edimax EdiGreen Home sensors track moderately well the PM_{2.5} diurnal variation measured by FEM BAM



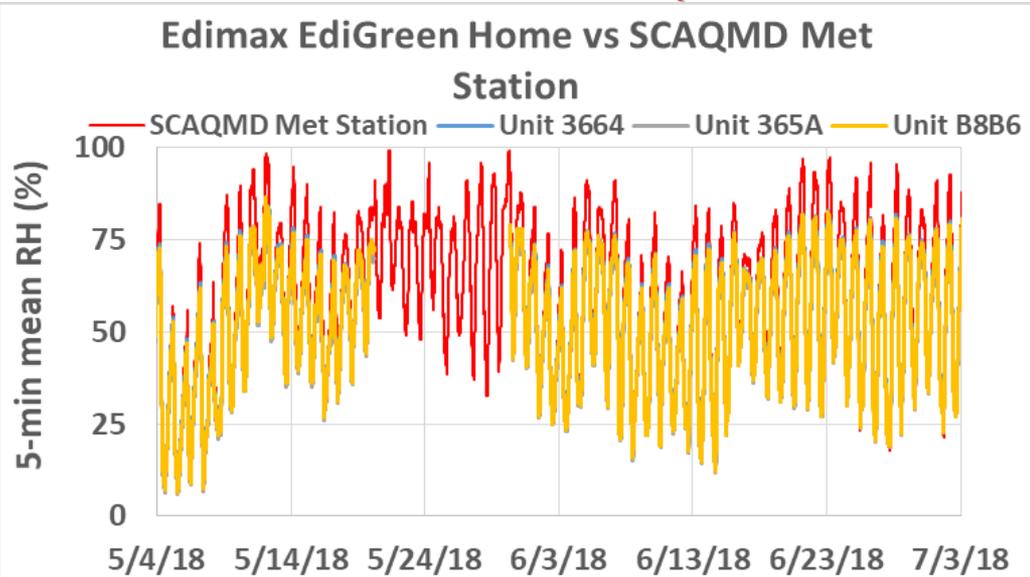
Edimax EdiGreen Home vs SCAQMD Met Station (Temp; 5-min mean)



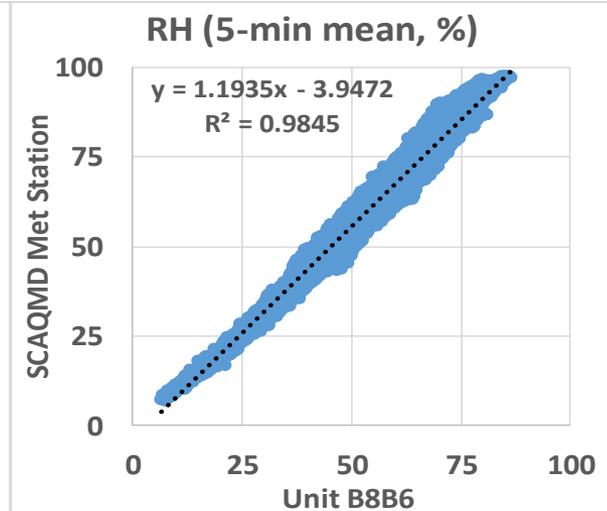
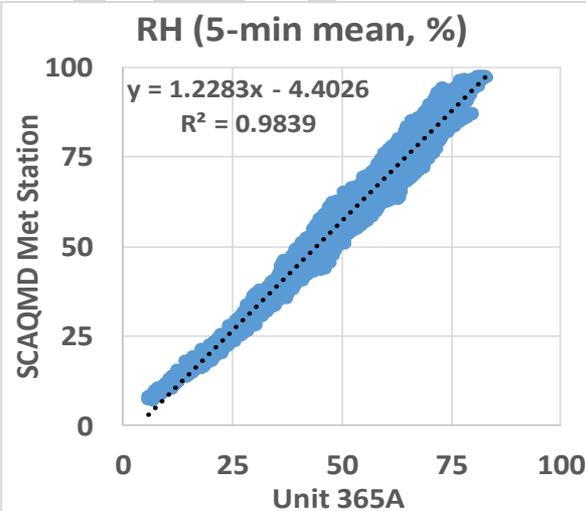
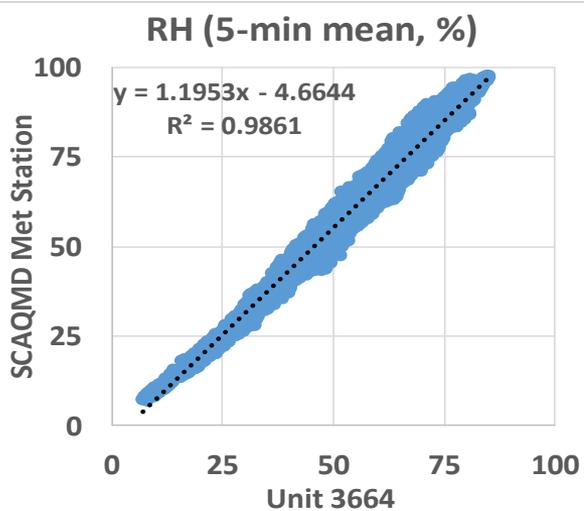
- Edimax EdiGreen Home temperature measurements show good correlations with the corresponding SCAQMD Met Station data ($R^2 > 0.97$)
- Overall, the Edimax EdiGreen Home sensors slightly overestimate temperature measured by SCAQMD Met Station
- The Edimax EdiGreen Home sensors track well the temperature diurnal variation measured by SCAQMD Met Station



Edimax EdiGreen Home vs SCAQMD Met Station (RH; 5-min mean)



- Edimax EdiGreen Home RH measurements show good correlations with the corresponding SCAQMD Met Station data ($R^2 > 0.98$)
- Overall, the Edimax EdiGreen Home sensors underestimate RH measured by SCAQMD Met Station
- The Edimax EdiGreen Home sensors track well the RH diurnal variation measured by SCAQMD Met Station



Discussion

- The three **Edimax EdiGreen Home (Model AI-2002W)** sensors had a data recovery of 99.6% with a low intra-model variability (4.7%)
- $PM_{2.5}$ mass concentration measurements measured by Edimax EdiGreen Home correlate well with the corresponding FEM GRIMM ($R^2 > 0.83$, 1-hr mean) and correlate moderately with FEM BAM ($R^2 > 0.71$, 1-hr mean) and overestimate $PM_{2.5}$ mass concentration measured by FEM GRIMM and FEM BAM
- The raw sensor used in Edimax EdiGreen Home is Plantower PMS5003
- No sensor calibration was performed by SCAQMD Staff prior to the beginning of this test
- Laboratory chamber testing is necessary to fully evaluate the performance of these sensors under known aerosol concentrations and controlled temperature and relative humidity conditions
- All results are still preliminary