Field Evaluation
Elitech Temtop LKC-1000S+
• From 01/27/2020 to 03/27/2020, three Elitech Temtop LKC-1000S+ (hereinafter Temtop LKC-1000S+) sensors were deployed at the South Coast AQMD stationary ambient monitoring site in Rubidoux and were run side-by-side with a Federal Equivalent Method (FEM) instrument measuring the same pollutants.

• Temtop LKC-1000S+ (3 units tested):
  ➢ Particle sensor: optical; non-FEM (PM300, Temtop)
  ➢ Each unit reports: PM$_{2.5}$ and PM$_{10}$ ($\mu$g/m$^3$)
  ➢ Unit also measures: TVOC and formaldehyde
  ➢ Unit also displays: Temperature, Relative Humidity and AQI
  ➢ Unit cost: ~$140
  ➢ Time resolution: 1-min
  ➢ Units IDs: Unit 1, Unit 2 and Unit 3

• GRIMM (reference instrument):
  ➢ Optical particle counter (FEM PM$_{2.5}$)
  ➢ Measures PM$_{1.0}$, PM$_{2.5}$, and PM$_{10}$ ($\mu$g/m$^3$)
  ➢ 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 from Unit 1, Unit 2 and Unit 3 was ~ 78%, ~ 100% and ~ 100%, respectively, for both PM$_{2.5}$ and PM$_{10}$ measurements

Temtop LKC-1000S+; intra-model variability

- Absolute intra-model variability was ~ 0.87 and 1.17 µg/m$^3$ for PM$_{2.5}$ and PM$_{10}$, respectively (calculated as the standard deviation of the three sensor means)
- Relative intra-model variability was ~ 7.0% and 5.4 % for PM$_{2.5}$ and PM$_{10}$, respectively (calculated as the absolute intra-model variability relative to the mean of the three sensor means)
Temtop LKC-1000S+ vs FEM GRIMM (PM$_{2.5}$; 5-min mean)

- Temtop LKC-1000S+ sensors showed very strong correlations with the corresponding FEM GRIMM data ($R^2 \approx 0.91$)
- Overall, the Temtop LKC-1000S+ sensors overestimated the PM$_{2.5}$ mass concentrations as measured by FEM GRIMM
- The Temtop LKC-1000S+ sensors seemed to track the PM$_{2.5}$ diurnal variations as recorded by FEM GRIMM
Temtop LKC-1000S+ vs GRIMM (PM$_{10}$; 5-min mean)

- Temtop LKC-1000S+ sensors showed weak correlations with the corresponding GRIMM data ($R^2 \sim 0.33$)
- Overall, the Temtop LKC-1000S+ sensors underestimated the PM$_{10}$ mass concentrations measured by GRIMM
- The Temtop LKC-1000S+ sensors did not seem to track the PM$_{10}$ diurnal variations as recorded by GRIMM
Temtop LKC-1000S+ vs FEM GRIMM (PM$_{2.5}$; 1-hr mean)

- Temtop LKC-1000S+ sensors showed very strong correlations with the corresponding FEM GRIMM data ($R^2 \sim 0.92$)
- Overall, the Temtop LKC-1000S+ sensors overestimated the PM$_{2.5}$ mass concentrations as measured by FEM GRIMM
- The Temtop LKC-1000S+ sensors seemed to track the PM$_{2.5}$ diurnal variations as recorded by FEM GRIMM
Temtop LKC-1000S+ vs GRIMM (PM$_{10}$; 1-hr mean)

- Temtop LKC-1000S+ sensors showed weak with the corresponding GRIMM data ($R^2 \sim 0.36$)
- Overall, the Temtop LKC-1000S+ sensors underestimated the PM$_{10}$ mass concentrations measured by GRIMM
- The Temtop LKC-1000S+ sensors did not seem to track the PM$_{10}$ diurnal variations as recorded by GRIMM

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\begin{align*}
\text{Unit 1:} & \quad y = 0.5751x + 14.941 \\
R^2 & = 0.3744 \\
\text{Unit 2:} & \quad y = 0.525x + 15.277 \\
R^2 & = 0.3500 \\
\text{Unit 3:} & \quad y = 0.5397x + 14.945 \\
R^2 & = 0.3653
\end{align*}
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Temtop LKC-1000S+ vs FEM GRIMM (PM$_{2.5}$; 24-hr mean)

- Temtop LKC-1000S+ sensors showed very strong correlations with the corresponding FEM GRIMM data ($R^2 \sim 0.95$)
- Overall, the Temtop LKC-1000S+ sensors overestimated the PM$_{2.5}$ mass concentrations as measured by FEM GRIMM
- The Temtop LKC-1000S+ sensors seemed to track the PM$_{2.5}$ diurnal variations as recorded by FEM GRIMM
Temtop LKC-1000S+ vs GRIMM (PM$_{10}$; 24-hr mean)

- Temtop LKC-1000S+ sensors showed moderate correlations with the corresponding GRIMM data ($R^2 \sim 0.50$)
- Overall, the Temtop LKC-1000S+ sensors underestimated the PM$_{10}$ mass concentrations measured by GRIMM
- The Temtop LKC-1000S+ sensors did not seem to track the PM$_{10}$ diurnal variations as recorded by GRIMM
• The three **Temtop LKC-1000S+** sensors’ data recovery from units Unit 1, Unit 2 and Unit 3 was ~ 78%, ~ 100% and ~ 100%, respectively, for both PM$_{2.5}$ and PM$_{10}$ measurements

• The absolute intra-model variability was ~ 0.87 and 1.17 µg/m$^3$ for PM$_{2.5}$ and PM$_{10}$, respectively

• PM$_{2.5}$ mass concentrations measured by Temtop LKC-1000S+ sensors showed very strong correlations with the corresponding FEM GRIMM data ($R^2$ ~ 0.92, 1-hr mean). The sensors overestimated PM$_{2.5}$ mass concentrations as measured by FEM GRIMM.

• PM$_{10}$ mass concentrations measured by Temtop LKC-1000S+ sensors showed weak correlations with the corresponding GRIMM data ($R^2$ ~ 0.36; 1-hr mean) and underestimated PM$_{10}$ mass concentrations measured by GRIMM

• No sensor calibration was performed by South Coast AQMD 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**