Testing Report - $PM_{2.5}$ Base Testing

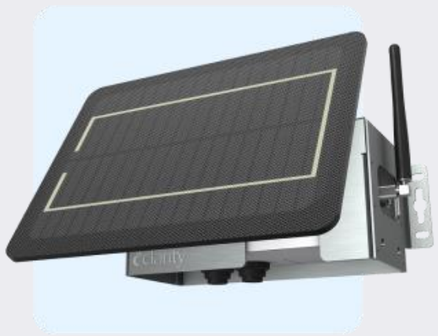
Clarity Node-S

This report reflects the v2.1 Global $PM_{2.5}$ Calibration performance

Roosevelt, UT

Utah Department of Environmental Quality

August 2024—October 2024



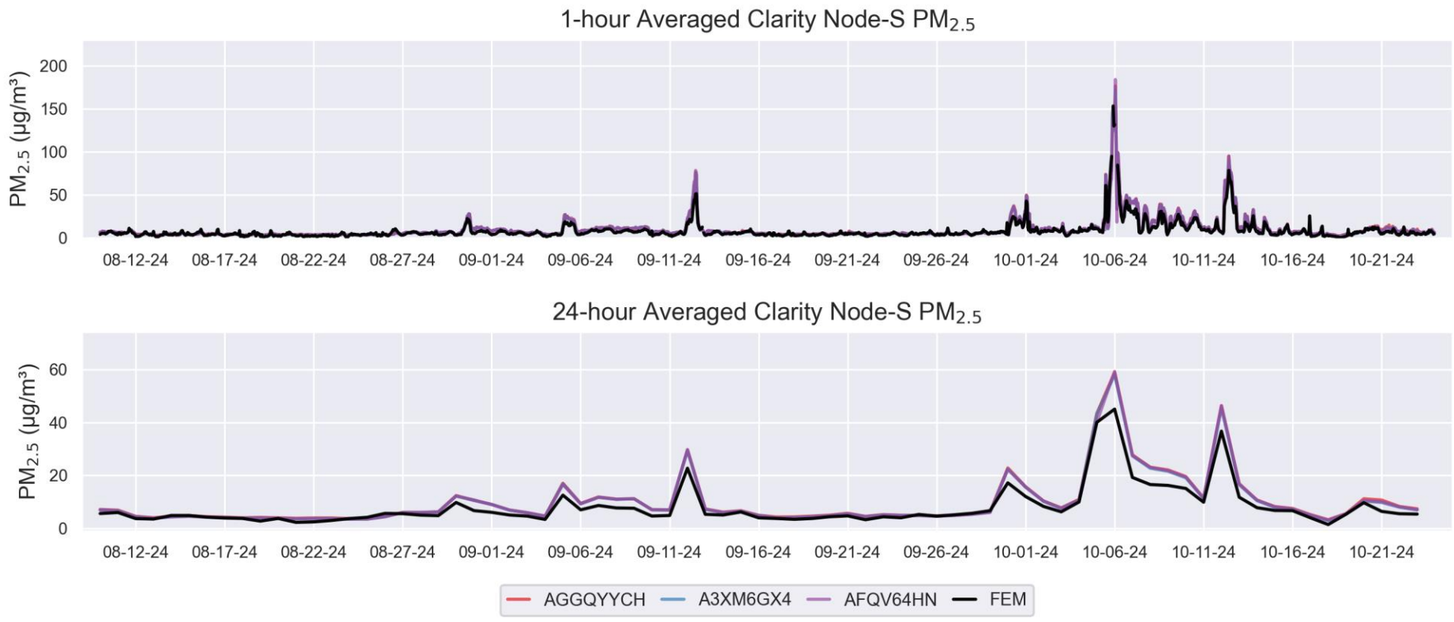
Deployment Details

Testing Organization and Site Information	
Testing organization (Name, Organization type, Contact website)	Utah Department of Environmental Quality
Testing location (City, State, Latitude and Longitude)	Roosevelt Roosevelt, UT 40.29, -110.01
AQS site ID	49-013-0002
Sampling timeframe (MM-DD-YY)	08-10-24 to 10-23-24
Sensor data source	Clarity Cloud
Reference data source	$PM_{2.5}$: AirNow API Meteorological: AirNow-Tech

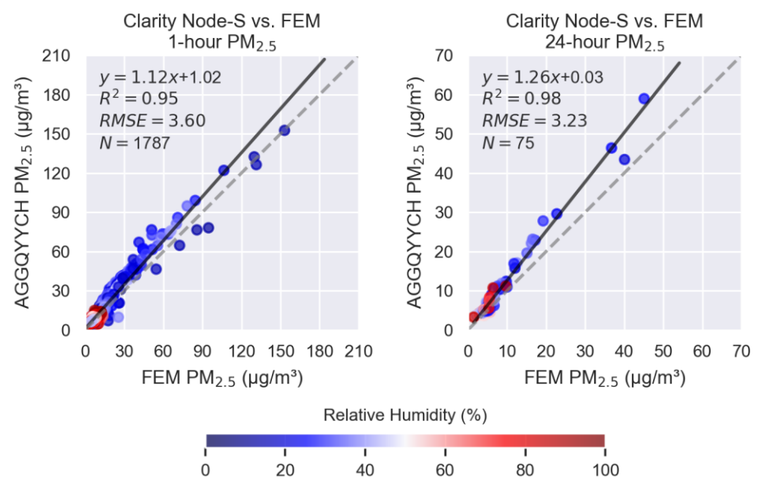
Sensor Information			
Manufacturer, model	Clarity Node-S		
Device firmware version	2.4.1.01		
Sampling time interval	1-hour		
Sensor serial numbers	AGGQYYCH	A3XM6GX4	AFQV64HN
	☐	No Issues	
	Clarity Node-S		
Issues encountered during deployment?	2.4.1.01		

FRM/FEM Information	
Manufacturer, model, designation	Thermo Scientific Model 5030i SHARP VSCC FEM
Sampling time interval	1-hour
Date of calibration	-
Date of flowrate verification check	08-29-24 08-29-24 (bi-annual audit) 09-24-24 10-25-24
Description, date(s) of maintenance activities	-

Time Series Plots

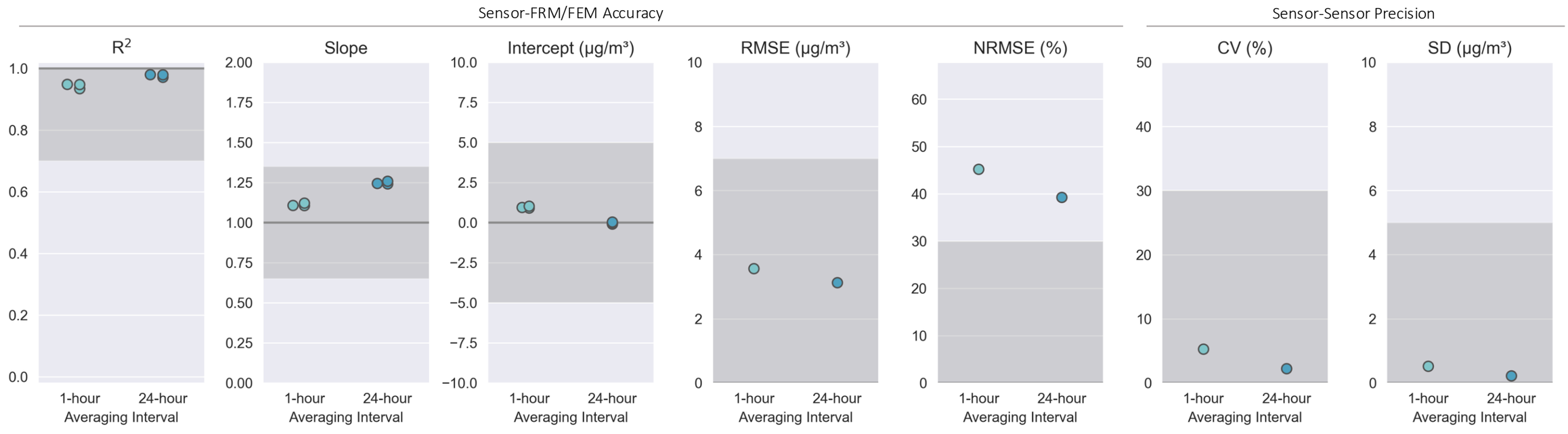


Scatter Plots: Comparison to FRM/FEM

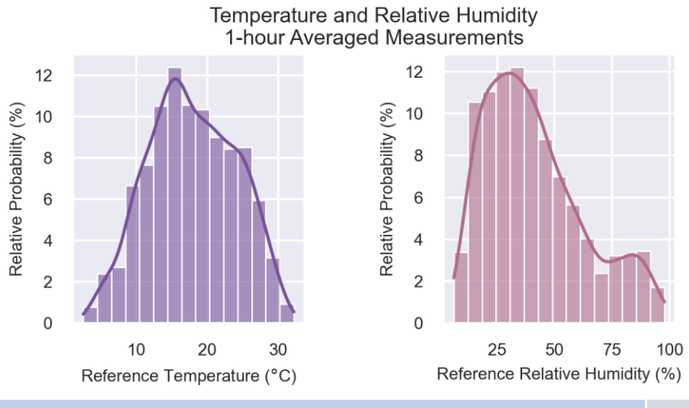


Range of FRM/FEM concentrations over duration of base test (µg/m³)	[1-hr] 0.0-153.1, avg: 7.9, [24-hr] 1.4-45.1, avg: 8.0
Number of 24-hr periods in FRM/FEM monitor measurements with a goal concentration ≥ 25 µg/m³	3

Performance Metrics

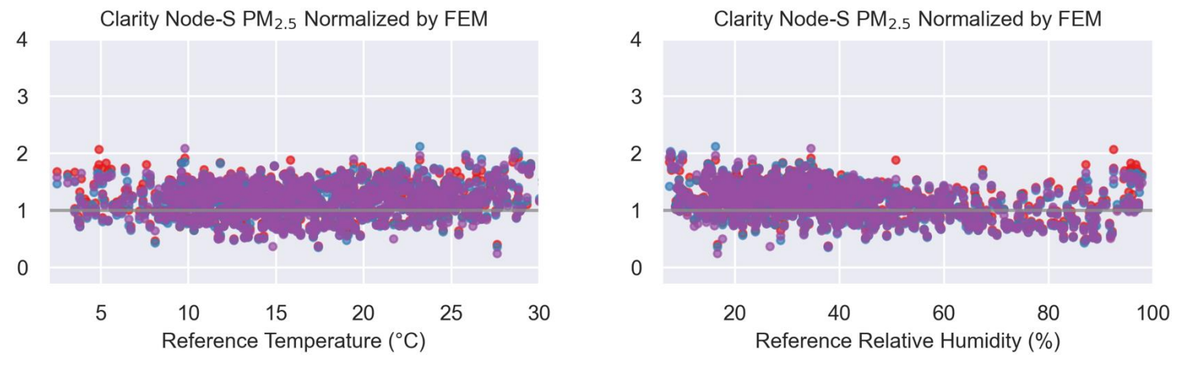


Meteorological Conditions During Deployment



Number of 24-hr periods outside sensor manufacture-listed temperature operational range (no operational range specified)	-
Number of 24-hr periods outside sensor manufacture-listed relative humidity operational range (no operational range specified)	-

Meteorological Influence



Mean number of paired, normalized concentration and temperature values (1-hr averages)	1800
Mean number of paired, normalized concentration and relative humidity values (1-hr averages)	1800

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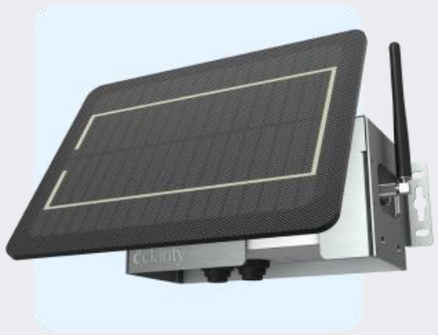

Tabular Statistics

Sensor-FRM/FEM Correlation

	Bias and Linearity						Data Quality			
	R^2		Slope		Intercept (µg/m³)		Uptime (%)		Number of paired sensor and FRM/FEM concentration values	
	1-Hour ●●●	24-Hour ●●●	1-Hour ●●●	24-Hour ●●●	1-Hour ●●●	24-Hour ●●●	1-Hour ●●●	24-Hour ●●●	1-Hour	24-Hour
Metric Target Range	≥ 0.70	≥ 0.70	1.0 ± 0.35	1.0 ± 0.35	-5 ≤ b ≤ 5	-5 ≤ b ≤ 5	75%*	75%*	-	-
Sensor AGGQYYCH	0.95	0.98	1.12	1.26	1.02	0.03	100	100	1787	75
Sensor A3XM6GX4	0.95	0.98	1.11	1.24	0.90	-0.10	100	100	1790	75
Sensor AFQV64HN	0.93	0.97	1.11	1.24	0.94	-0.04	100	100	1790	75
Mean	0.94	0.98	1.11	1.25	0.95	-0.03	100	100	1789	75

	Error			
	RMSE (µg/m³)		NRMSE (%)	
	1-Hour ★	24-Hour ★	1-Hour ☆	24-Hour ☆
Metric Target Range	≤ 7.0	≤ 7.0	≤ 30.0	≤ 30.0
Deployment Value	3.6	3.1	45.2	39.3

Device-specific metrics (computed for each sensor in evaluation)
- ○○○ Metric value for none of devices tested falls within the target range
- ●○○ Metric value for one of devices tested falls within the target range
- ●●○ Metric value for two of devices tested falls within the target range
- ●●● Metric value for three of devices tested falls within the target range

Single-valued metrics (computed via entire evaluation dataset)
- ☆ Indicates that the metric value is not within the target range
- ★ Indicates that the metric value is within the target range

Sensor-Sensor Precision

	Precision (between collocated sensors)				Data Quality	
	CV (%)		SD (µg/m³)		Number of concurrent sensor concentration pairs	
	1-Hour ★	24-Hour ★	1-Hour ★	24-Hour ★	1-Hour	24-Hour
Metric Target Range	≤ 30.0	≤ 30.0	≤ 5.0	≤ 5.0	-	-
Deployment Value	5.3	2.3	0.5	0.2	1789	75

*This value is only a recommendation for ensuring data quality and is not included in the list of target values discussed in Section 4 of the Performance Testing Protocols, Metrics, and Target Values for Fine Particulate Matter Air Sensors document.

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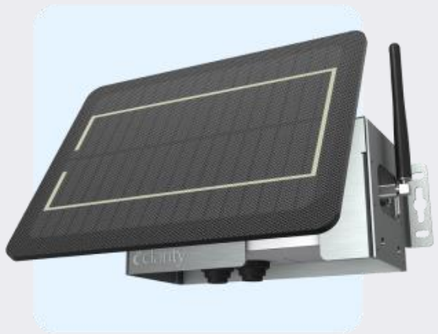

Sensor-FRM/FEM Scatter Plots