RESET Air Accredited Monitor

Sample Testing Report for
Passed Monitors
2021.11.09

Disclosure Statement

This is a report based on internal testing performed based on the RESET Air Standard for Accredited Monitors.

Data and results of this report are not permitted to be released for public viewing unless it has been granted access by RESET.

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1. Introduction and Methodology

This is a RESET Air Accredited Monitor – Grade B testing report for the indoor air quality monitoring units, sample monitors.

The monitors were placed in close vicinity and tested for $PM_{2.5}$, TVOC, CO_2, temperature, and humidity in an ambient indoor environment, and were subjected to fluctuation in readings caused by human activities indoor and air quality changes outdoor. They were placed in the room furthest away from the outdoors and left unperturbed until the end of the testing period. Data accuracy, trend consistency, and the discrepancy between units were evaluated.

The date and time used in the data below are based on China Standard Time.

All tests were performed in Shanghai in the RESET Office Laboratory.

The tests were performed by Stanton Wong.

The report was written by Rico Xi.

2. Preparation

- All test monitors and reference monitors were placed next to each other for consistent sampling.
- The door of the office laboratory remained open during testing to allow an overall ambient environment.
- The indoor testing environment is equipped with a central ventilation system. Ventilation lowers the air pollutant concentrations over time even with the door closed.
- An outdoor environment is used to measure the CO_2 baseline.

Monitors to be Tested

Brand	Product Series	Device No.	Device ID
Sample Brand	Sample Models	No. 1	tstA0000001
		No. 2	tstA0000002
		No. 3	tstA0000003
		No. 4	tstA0000004
		No. 5	tstA0000005

Note: The Sample Models monitors measure the following parameters: $PM_{2.5}$, TVOC, CO_2, temperature, and humidity.

Reference Monitors

Brand	Product Series	Testing Parameters	Monitor ID
DST	NANO	TVOC, CO_2, Temperature, Humidity	rfA0000000
TSI[2]	Q-Trak 7575-x	Temperature, Humidity	—

[1] **Grade B** Certified air quality monitors.
DST NANO, used as a backup reference for the TVOC, CO_2 and Temperature and Humidity monitoring tests.

[2] **Grade A** air quality monitors.
TSI Q-Trak 7575-x, used as a backup reference for Temperature and Humidity monitoring tests.

3. Set up, Testing Procedure, Results, and Analysis

1) $PM_{2.5}$ (unit: µg/m³)

Set Up

i. Outdoor air was the source of $PM_{2.5}$
ii. Airsns NANO and TSI DustTrak were used as reference monitors
iii. Data from Sample Monitors were recorded on Sample Data Platform, and data from Airsns NANO were recorded on QLEAR. Both were averaged over 30-minute intervals, and then extracted to .csv

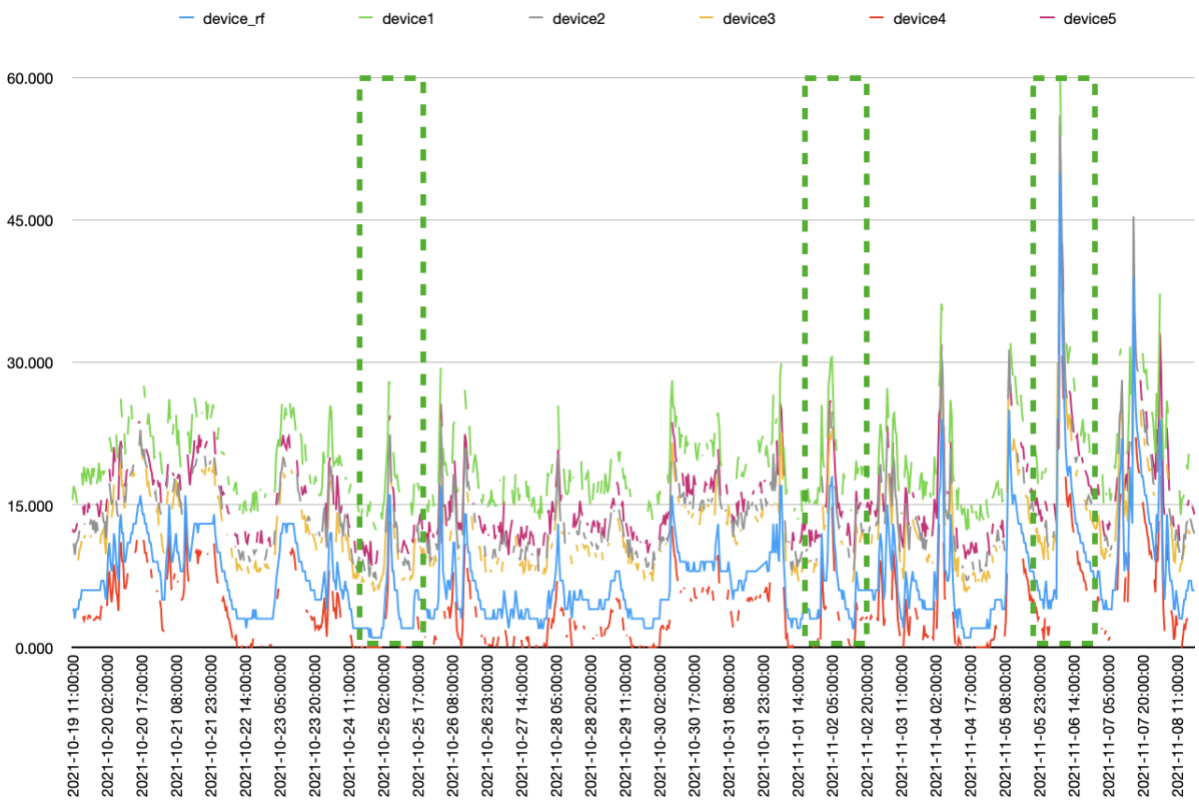
Target Accuracy

Below is a table highlighting expected $PM_{2.5}$ accuracy for Grade B monitors.

Accuracy	Grade B
0-150	±5 && 15%
150-500	±5 && 20%

Results - $PM_{2.5}$ Overall

October 19, 2021 – November 8, 2021



Overview of sample monitors and reference Airsns NANO PM2.5(blue) readings. Peaks from the following tables are taken from the maxima in the green boxes.

Peak 1 - ug/m3							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-01 10:30	16	21.75	27.671	22.4	21.022	13.267	24.404
Percent Difference to Avg			23.95%	2.93%	-3.42%	-48.46%	11.49%
Avg Pass/Fail			PASS	PASS	PASS	FAIL	PASS
Percent Difference to Reference			53.45%	33.33%	27.13%	-18.68%	41.60%
Reference Pass/Fail			FAIL	PASS	PASS	PASS	FAIL

Peak 2 - ug/m3							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-08 07:30	18	18.606	30.545	24.842	22.834	14.81	
Percent Difference to Avg			48.58%	28.70%	20.40%	-22.72%	-200.00%
Avg Pass/Fail			FAIL	PASS	PASS	PASS	FAIL
Percent Difference to Reference			51.68%	31.94%	23.68%	-19.45%	-200.00%
Reference Pass/Fail			FAIL	PASS	PASS	PASS	FAIL

Peak 3 - ug/m3							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-15 08:00	50	55.526	61.496	55.992	55.168	47.105	57.87
Percent Difference to Avg			10.20%	0.84%	-0.65%	-16.41%	4.13%
Avg Pass/Fail			PASS	PASS	PASS	PASS	PASS
Percent Difference to Reference			20.62%	11.31%	9.83%	-5.96%	14.59%
Reference Pass/Fail			PASS	PASS	PASS	PASS	PASS

Description
The peaks occur naturally in the office environment. Higher peaks were caused by outdoor pollution before filtration systems get turned on.

[Avg] Intra-model Variability
Some of the test monitors recorded data within range of each other. The rest appeared to have fluctuations in readings and sometimes missed recording data at all. Smaller values recorded seem to be out of range of each other more than the larger values.

[Reference] Reference Comparison
The test monitors recorded data that were sometimes in range of the reference monitor. In general, test monitors deviated from the reference values more at smaller values than did at larger values. Some test monitors failed to record data at the peaks.

Analysis - $PM_{2.5}$

	No. 1	No. 2	No. 3	No. 4	No. 5
Avg - Trend	PASS	PASS	PASS	PASS	PASS
Avg – Within Range	FAIL	PASS	PASS	FAIL	FAIL
Reference - Trend	FAIL	FAIL	FAIL	FAIL	FAIL
Reference – Within Range	FAIL	PASS	PASS	PASS	FAIL

[Avg] Intra-model Variability

The Sample Monitors performed poorly in regards to intra-model variability. Although there appeared to be a general trend from the data recorded, he monitors intermittently missed readings, making effective interpretation of the data problematic. The values recorded deviated significantly from each monitor, especially for monitor No.1 and No.5.

[Reference] Reference Comparison

The Sample Monitors performed poorly in regards to reference comparison. Although the monitors tested appeared to peak around the same time where the reference monitor peaked, the missed readings make it hard to determine whether the test monitors were truly following the trend of the reference. Deviations from the reference values were also not consistent among the monitors tested.

2) **TVOC** (unit: ppb)

Set Up

i. Office air was the source of TVOC
ii. Airsns NANO and TSI DustTrak were used as reference monitors
iii. Data from Sample Monitors were recorded on Sample Data Platform, and data from Airsns NANO were recorded on QLEAR. Both were averaged over 30-minute intervals, and then extracted to .csv

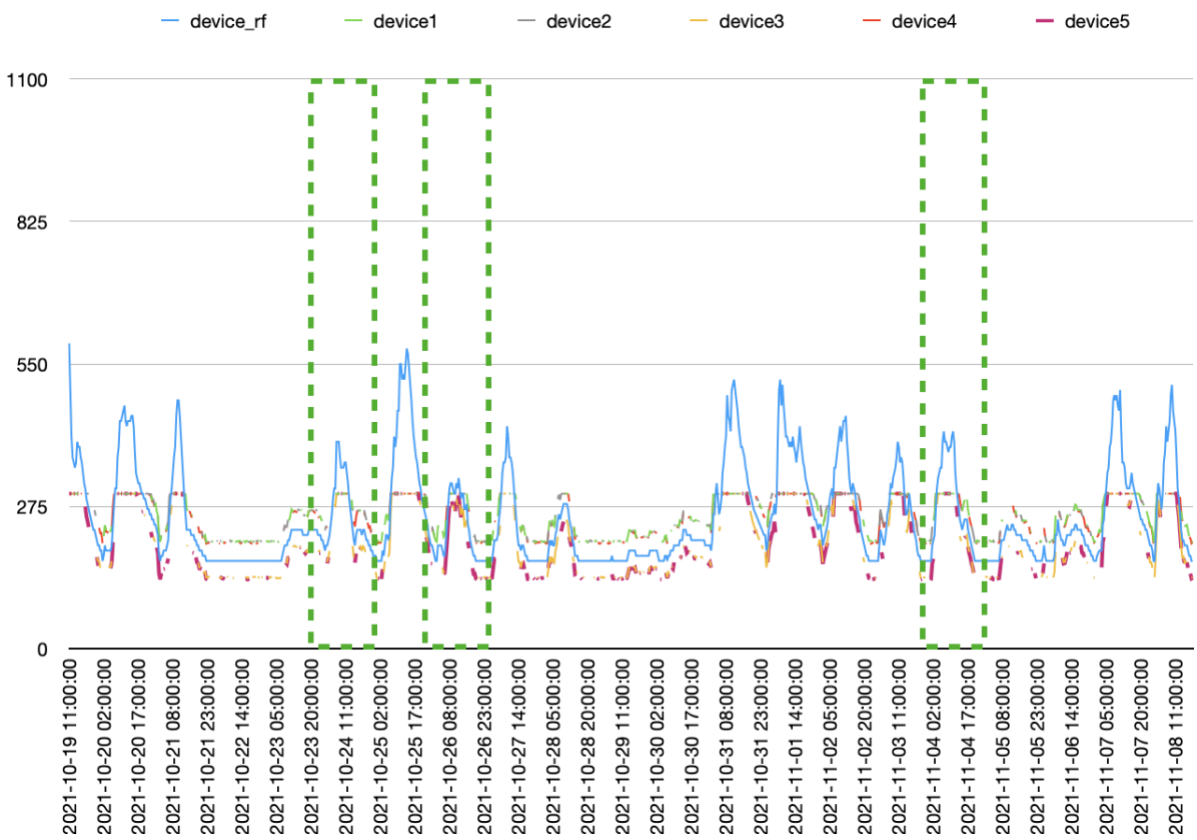
Target

Below is a table highlighting expected TVOC accuracy for Grade B monitors.

Accuracy (ppb)	Grade B
65-260	±8.7 && 15%
440 - 2180	±8.7 && 20%

Results - TVOC Overall

October 19, 2021 – November 8, 2021



Overview of sample monitors and reference Airsns NANO TVOC(blue) readings. Peaks from the following tables are taken from the maxima in the green boxes.

Peak 1 - ppb							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-02 11:00	400	180	300	300			300
Percent Difference to Avg			50.00%	50.00%	-200.00%	-200.00%	50.00%
Avg Pass/Fail			FAIL	FAIL	FAIL	FAIL	FAIL
Percent Difference to Reference			-28.57%	-28.57%	-200.00%	-200.00%	-28.57%
Reference Pass/Fail			FAIL	FAIL	FAIL	FAIL	FAIL

Peak 2 - ppb							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-09 04:00	280	218.51	300	300	247.667		244.866
Percent Difference to Avg			31.43%	31.43%	12.51%	-200.00%	11.38%
Avg Pass/Fail			FAIL	FAIL	PASS	FAIL	PASS
Percent Difference to Reference			6.90%	6.90%	-12.26%	-200.00%	-13.39%
Reference Pass/Fail			PASS	PASS	PASS	FAIL	PASS

Peak 3 - ppb							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-11 14:30	400	240	300	300	300		300
Percent Difference to Avg			22.22%	22.22%	22.22%	-200.00%	22.22%
Avg Pass/Fail			FAIL	FAIL	FAIL	FAIL	FAIL
Percent Difference to Reference			-28.57%	-28.57%	-28.57%	-200.00%	-28.57%
Reference Pass/Fail			FAIL	FAIL	FAIL	FAIL	FAIL

Description
Spikes occur after the coffee machine is cleaned in the connected space next door.

[Avg] Intra-model Variability
The test monitors frequently missed readings. There appeared to be somewhat of a trend, and the values appeared to be somewhat in range with each other. Average value of the five monitors is not a good indicator due to missed readings.

[Reference] Reference Comparison
The test monitors recorded data that are difficult to align with the trend from the reference. The values recorded were mostly out of range with the reference values.

Analysis - TVOC

	No. 1	No. 2	No. 3	No. 4	No. 5
Avg - Trend	PASS	FAIL	PASS	PASS	PASS
Avg – Within Range	PASS	PASS	FAIL	FAIL	PASS
Reference - Trend	FAIL	FAIL	FAIL	FAIL	FAIL
Reference – Within Range	FAIL	FAIL	FAIL	FAIL	FAIL

[Avg] Intra-model Variability

The Sample Monitors frequently missed recording data. When recording, they appeared to provide data relatively in range with each other and had somewhat of a trend. The monitors appeared to have sensitivity issues that prevented them from recording values large than 300ppm. The Sample Monitors performed poorly for TVOC in regard to intra-model variability since due to data recording inconsistency.

[Reference] Reference Comparison

The Sample Monitors performed poorly for TVOC in regard to reference comparison. They appeared to have some agreement with the reference when the values were low. However, they failed to record effective data when the TVOC values were above 300ppm, making the data not viable to compare to the reference. The trends only followed reference up until 300 ppm.

3) CO_2 (unit: ppm)

Set Up

i. CO_2 was naturally generated in the office
ii. Airsns NANO was used as a reference monitor
iii. Data from Sample Monitors were recorded on Sample Data Platform, and data from Airsns NANO were recorded on QLEAR. Both were averaged over 30-minute intervals, and then extracted to .csv

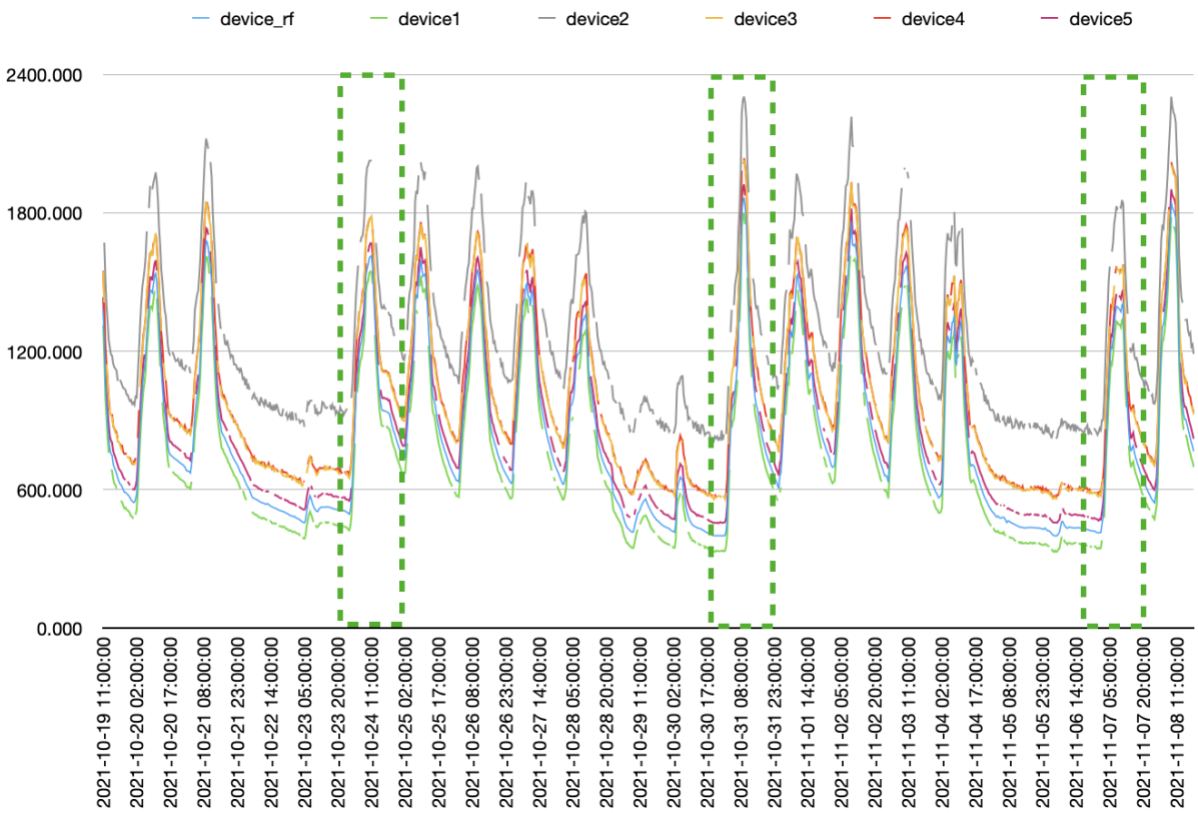
Target

Below is a table highlighting expected CO_2 accuracy for Grade B monitors.

Accuracy	Grade B
400-2000	±50 && 3%
2000-5000	±50 && 5%

Results - CO_2 Overall

October 19, 2021 – November 8, 2021



Overview of sample monitors and reference Airsns NANO CO_2 (blue) readings. Peaks from the following tables are taken from the maxima in the green boxes.

Peak 1 - ppm							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-02 11:00	1611	1759.2	1546.37	2025.73	1779.26	1775.9	1668.71
Percent Difference to Avg			-12.88%	14.08%	1.13%	0.95%	-5.28%
Avg Pass/Fail			FAIL	FAIL	PASS	PASS	PASS
Percent Difference to Reference			-4.09%	22.81%	9.93%	9.74%	3.52%
Reference Pass/Fail			PASS	FAIL	FAIL	FAIL	PASS

Peak 2 - ppm							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-09 09:30	1867	2018.3	1799.13	2304.05	2028.16	2037.23	1923.15
Percent Difference to Avg			-11.48%	13.22%	0.49%	0.93%	-4.83%
Avg Pass/Fail			FAIL	FAIL	PASS	PASS	PASS
Percent Difference to Reference			-3.70%	20.96%	8.27%	8.72%	2.96%
Reference Pass/Fail			PASS	FAIL	FAIL	FAIL	PASS

Peak 3 - ppm							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-15 05:00	1409	1560	1343.46	1839.84	1573.19	1576.46	1467.25
Percent Difference to Avg			-14.92%	16.46%	0.84%	1.05%	-6.13%
Avg Pass/Fail			FAIL	FAIL	PASS	PASS	PASS
Percent Difference to Reference			-4.76%	26.52%	11.01%	11.22%	4.05%
Reference Pass/Fail			PASS	FAIL	FAIL	FAIL	PASS

Description
All peaks were caused by regular use of the office space next to the testing space without the fresh air system turned on.

[Avg] Intra-model Variability
The test monitors recorded data that presented similar trends, but the values from No.1 and No.2 are out of range with the rest of the group.

[Reference] Reference Comparison
The test monitors recorded data that had similar trends with the reference, but the values deviated from the reference values significantly for most of the test monitors.

Analysis - CO_2

	No. 1	No. 2	No. 3	No. 4	No. 5
Avg - Trend	PASS	PASS	PASS	PASS	PASS
Avg – Within Range	FAIL	FAIL	PASS	PASS	PASS
Reference - Trend	PASS	PASS	PASS	PASS	PASS
Reference – Within Range	PASS	FAIL	FAIL	FAIL	PASS

[Avg] Intra-model Variability
The Sample Monitors performed poorly for CO_2 in regard to intra-model variability. Although the trends recorded were consistent among the group, values frequently deviated from each other.

[Reference] Reference Comparison
The test monitors performed poorly for CO_2 in regard to reference comparison, Although the trends recorded were similar to that of the reference, values frequently deviated from those recorded by the reference.

4) **Temperature** (unit: °C)

Set Up

i. The testing chamber was subject to ambient temperature fluctuation
ii. Airsns NANO was used as a reference monitor
iii. Data from Sample Monitors were recorded on Sample Data Platform, and data from Airsns NANO were recorded on QLEAR. Both were averaged over 30-minute intervals, and then extracted to .csv

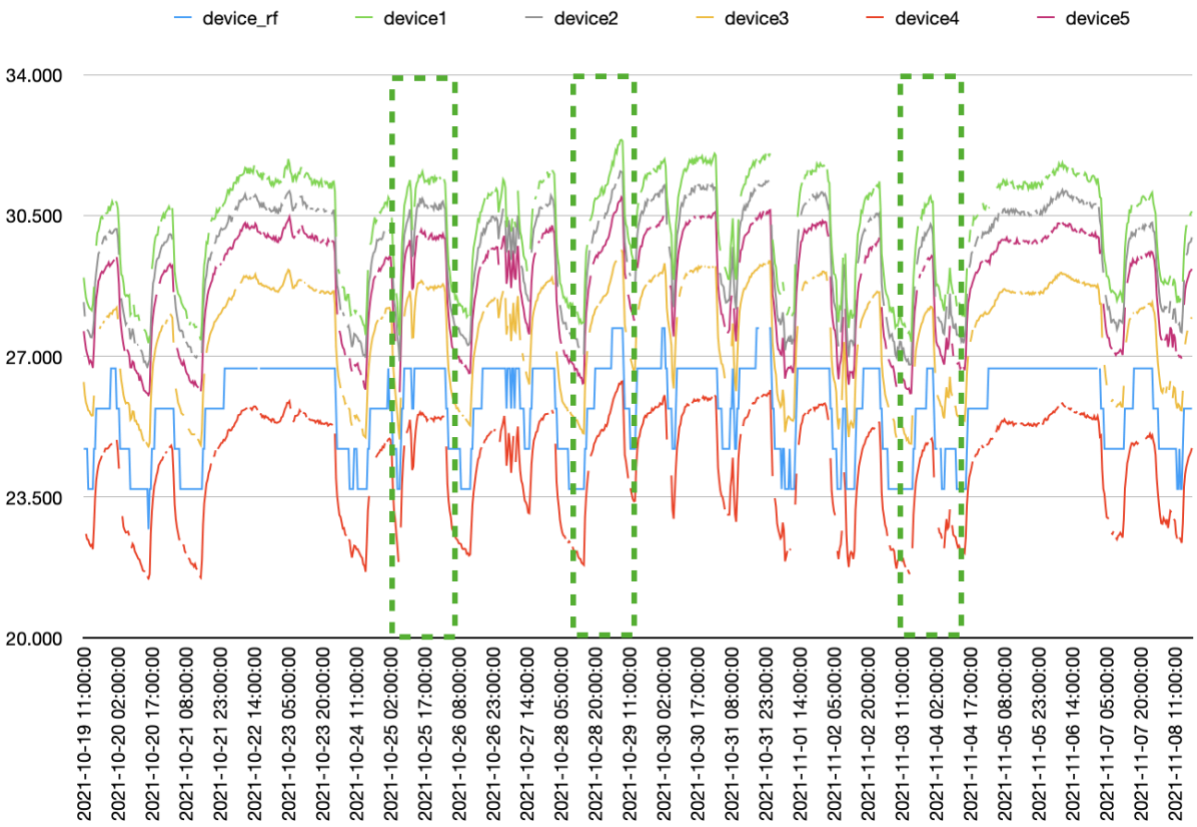
Target

Below is a table highlighting expected temperature accuracy for Grade B monitors.

	Grade B
Accuracy	±1

Results - Temperature Overall

October 19, 2021 – November 8, 2021



Overview of sample monitors and reference Airsns NANO temperature(blue) readings. Peaks from the following tables are taken from the maxima in the green boxes.

Peak 1 - °C							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-03 10:30	26.70	29.40	31.596	30.919	28.849	25.589	30.056
Difference to Avg			2.19	1.52	-0.55	-3.81	0.65
Difference to Reference			4.90	4.22	2.15	-1.11	3.36

Peak 2 -°C							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-07 07:30	27.70	30.19	32.385	31.585	29.651	26.369	30.958
Difference to Avg			2.20	1.40	-0.54	-3.82	0.77
Difference to Reference			4.69	3.89	1.95	-1.33	3.26

Peak 3 -°C							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-12 15:00	26.70	28.77	30.982	30.283	28.235	24.922	29.446
Difference to Avg			2.21	1.51	-0.54	-3.85	0.67
Difference to Reference			4.28	3.58	1.54	-1.78	2.75

Description
The peaks occurred naturally due to office temperature fluctuation with no additional disturbance.

[Avg] Intra-model Variability
The data recorded by the test monitors exhibited similar trends with each other but deviated significantly from each other in values.

[Reference] Reference Comparison
The trends recorded by the test monitors agreed with the trend of the reference. The values recorded differ from that of the reference significantly.

Analysis - Temperature

	No. 1	No. 2	No. 3	No. 4	No. 5
Avg - Trend	PASS	PASS	PASS	PASS	PASS
Avg – Within Range	FAIL	FAIL	FAIL	FAIL	FAIL
Reference - Trend	PASS	PASS	PASS	PASS	PASS
Reference – Within Range	FAIL	FAIL	FAIL	FAIL	FAIL

[Avg] Intra-model Variability
The test monitors performed well in regard with having consistent trends within the group but failed to produce consistent values.

[Reference] Reference Comparison
The test monitors performed well in regard with having similar trend comparing to the reference. However, values were inconsistently higher or lower in all of the 5 monitors tested, indicating the monitors were poorly calibrated.

5) **Humidity** (unit: %RH)

Set Up

i. The testing chamber was subject to ambient humidity fluctuation
ii. Airsns NANO was used as a reference monitor
iii. Data from Sample Monitors were recorded on Sample Data Platform, and data from Airsns NANO were recorded on QLEAR. Both were averaged over 30-minute intervals, and then extracted to .csv

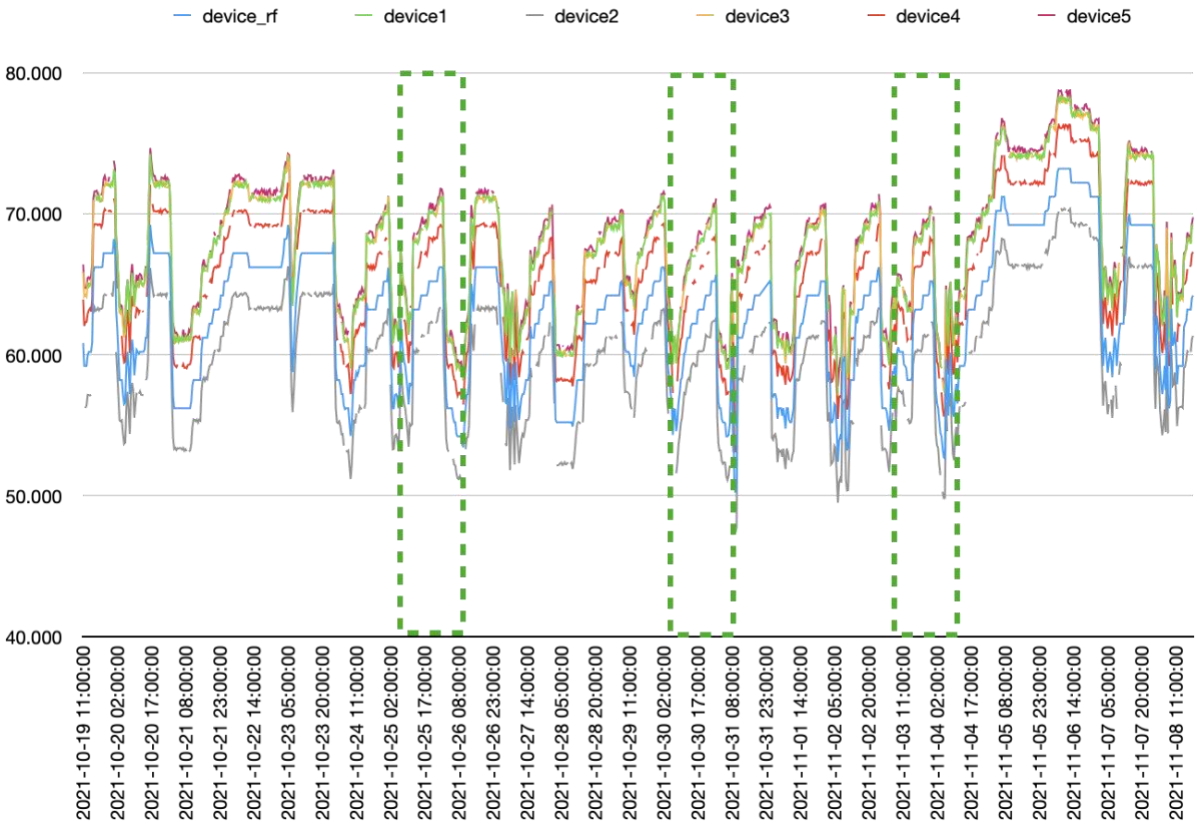
Target

Below is a table highlighting expected relative humidity accuracy for Grade B monitors.

	Grade B
Accuracy	±8%

Results - Humidity Overall

August 30, 2021 – September 14, 2021



Overview of sample monitors and reference Airsns NANO temperature(blue) readings. Peaks from the following tables are taken from the maxima in the green boxes.

Peak 1 - %RH							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-03 01:00	66.17	69.188	71.288	63.206	70.944	69.057	71.446
Percent Difference to Avg			2.99%	-9.04%	2.51%	-0.19%	3.21%
Percent Difference to Reference			7.45%	-4.58%	6.96%	4.27%	7.67%

Peak 2 - %RH							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-08 07:30	65.68	68.71	70.712	62.621	70.538	68.594	71.085
Percent Difference to Avg			2.87%	-9.27%	2.63%	-0.17%	3.40%
Percent Difference to Reference			7.38%	-4.77%	7.13%	4.34%	7.90%

Peak 3 - %RH							
Time	Reference	Avg	No.1	No.2	No.3	No.4	No.5
2021-08-15 08:30	65.2	68.231	70.307	62.346	70.125	68.103	70.275
Percent Difference to Avg			3.00%	-9.01%	2.74%	-0.19%	2.95%
Percent Difference to Reference			7.54%	-4.48%	7.28%	4.36%	7.49%

Description
Peaks occurred naturally due to ambient humidity fluctuation with no additional disturbance.

[Avg] Intra-model Variability
The monitors being tested all had similar trends and were well mostly within the expected range of each other except for monitor No.2.

[Reference] Reference Comparison
The trends of the five test monitors were mostly consistent with that of the reference monitor.

Analysis – Humidity

	No. 1	No. 2	No. 3	No. 4	No. 5
Avg - Trend	PASS	PASS	PASS	PASS	PASS
Avg – Within Range	PASS	FAIL	PASS	PASS	PASS
Reference - Trend	PASS	PASS	PASS	PASS	PASS
Reference – Within Range	PASS	PASS	PASS	PASS	PASS

[Avg] Intra-model Variability
The test monitors performed well for relative humidity in regard to intra-model variability, recording values and trends that are consistent to each other except for monitor No.2.

[Reference] Reference Comparison
The test monitors performed well for relative humidity in regard to reference comparison, recording values and trends that are similar to the reference.

4. Results and Conclusions

$PM_{2.5}$	No. 1	No. 2	No. 3	No. 4	No. 5
Avg - Trend	PASS	PASS	PASS	PASS	PASS
Avg – Within Range	FAIL	PASS	PASS	FAIL	FAIL
Reference - Trend	FAIL	FAIL	FAIL	FAIL	FAIL
Reference – Within Range	FAIL	PASS	PASS	PASS	FAIL

TVOC	No. 1	No. 2	No. 3	No. 4	No. 5
Avg - Trend	PASS	FAIL	PASS	PASS	PASS
Avg – Within Range	PASS	PASS	FAIL	FAIL	PASS
Reference - Trend	FAIL	FAIL	FAIL	FAIL	FAIL
Reference – Within Range	FAIL	FAIL	FAIL	FAIL	FAIL

CO_2	No. 1	No. 2	No. 3	No. 4	No. 5
Avg - Trend	PASS	PASS	PASS	PASS	PASS
Avg – Within Range	FAIL	FAIL	PASS	PASS	PASS
Reference - Trend	PASS	PASS	PASS	PASS	PASS
Reference – Within Range	PASS	FAIL	FAIL	FAIL	PASS

Temperature	No. 1	No. 2	No. 3	No. 4	No. 5
Avg - Trend	PASS	PASS	PASS	PASS	PASS
Avg – Within Range	FAIL	FAIL	FAIL	FAIL	FAIL
Reference - Trend	PASS	PASS	PASS	PASS	PASS
Reference – Within Range	FAIL	FAIL	FAIL	FAIL	FAIL

Relative Humidity	No. 1	No. 2	No. 3	No. 4	No. 5
Avg - Trend	PASS	PASS	PASS	PASS	PASS
Avg – Within Range	PASS	FAIL	PASS	PASS	PASS
Reference - Trend	PASS	PASS	PASS	PASS	PASS
Reference – Within Range	PASS	PASS	PASS	PASS	PASS

(Temperature and humidity are relatively less important than the other parameters for the purposes of RESET Air Project Certification.)

$PM_{2.5}$
The Sample Monitors were inconsistent in measuring $PM_{2.5}$ levels. Data recorded were out of range from each other and from the reference. Trends were somewhat visible, but due to the large amount of data not recorded, it is hard to determine whether the monitors truly had consistent trends when comparing to the reference.

TVOC
The Sample Monitors often missed recording data, though the data recorded appeared to be in range with each other and exhibit similar trends. However, there is apparent sensitivity issues as no values above 300 ppm is recorded by the monitors. Calibrations would be necessary for any further testing on these monitors.

CO_2
The Sample Monitors were consistent in recording similar trends comparing to each other and to the reference, but they were not consistent in values. Calibrations would be necessary for the monitors to meet RESET requirements.

Temperature
The Sample Monitors were consistent in recording similar trends comparing to each other and to the reference, but they were not consistent in values. Calibrations would be highly recommended.

Relative Humidity
The Sample Monitors were mostly consistent in recording values and trends comparing to each other and to the reference except for monitor No.2 that had lower values than the rest of the group and the reference. Though not necessary, calibrations are still recommended for optimal agreement with the reference.

Final Thoughts
The Sample Monitors do **NOT PASS** the RESET Accredited Monitor requirements for Grade B in regards to the following measured parameters: **PM2.5, TVOC, CO_2**.