

Temperature Mapping - 107L Glass Door

Engineering Report GDMA - ER019 - 107G

27/11/2020

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GLEN DIMPLEX MEDICAL APPLIANCES

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1: Temperature Mapping Protocol

The Protocol

The protocol will establish the pull down time and temperature distribution over a 24 hour period in a controlled ambient temperature. Multiple monitoring points will be used as laid out in the Test Procedure of this report. The effect of multiple door openings will also be observed and recorded.

Appliance Data

Appliance Data	
Appliance Name	107L Glass Door Pharmacy Refrigerator
Model Number	444410630
Serial Number	00100031

Control Data	
Ambient Operating Temperature Range	10°C - 32°C
Operating Temperature Range	2°C - 8°C (5°C \pm 3°C)
Set Point - Pre-set	3°C
Set point - Adjustable Range	2°C - 5°C
Low Temperature Alarm - Pre-set	1°C
High Temperature Range	9°C

2: Test Procedure

Temperature Measuring Equipment

Depending on the volume of the appliance undergoing temperature mapping a number of temperature data loggers are used to read and record the internal temperature of the appliance.

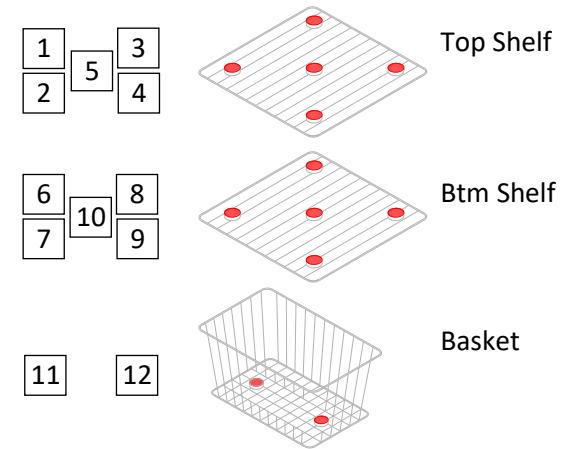
The data loggers are manufactured by Lascar Electronics – part number EL-USB-1LCD-GD.

Data Logger Positions

Data loggers were placed in 5 positions on each of the 2 full shelves, and 2 positions in the basket as shown in the table opposite.

Each logger is identified by individual QC numbers.

Position	Location	Graph	Logger
1	Top Shelf Left Back	4:1	QC-147
2	Top Shelf Left Front	4:2	QC-242
3	Top Shelf Right Back	4:3	QC-243
4	Top Shelf Right Front	4:4	QC-246
5	Top Shelf Centre	4:5	QC-244
6	Bottom Shelf Left Back	4:6	QC-241
7	Bottom Shelf Left Front	4:7	QC-201
8	Bottom Shelf Right Back	4:8	QC-245
9	Bottom Shelf Right Front	4:9	QC-105
10	Bottom Shelf Centre	4:10	QC-012
11	Basket Left	4:16	QC-173
12	Basket Right	4:17	QC-231



Data Logger Calibration

All loggers used both for this test procedure and end of line performance test are comparatively calibrated against a certified reference by GDMA.

All loggers used for this temperature mapping have a maximum deviation of $\pm 0.5^{\circ}\text{C}$.

Mapping Test Procedure

Each logger is set to record a temperature reading every minute, a minimum of 1440 readings in every 24 hrs.

The loggers are activated at the start of the test when the appliance is switched on.

The procedure is carried in controlled ambient temperature of $20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ @ at RH 50%.

Door Openings Procedure

The door openings were carried out during the last hour of the 24 hour period. A total of 4 door openings were carried out as 15 minute intervals, the door was left open for 30 seconds. The temperatures before and after closing are recorded and the time taken for the air temperature to recover back to the temperature before the door opening.

3:1 Summary Analysis

Summary of all temperature points

A summary of the average temperatures recorded by the data loggers over the 24 hour period is shown the table below. This data excludes the pull down time for the 107L Glass Door Refrigerator is approximately 30 minutes at an ambient temperature of 20°C. Detailed results of each data logger are shown in section 4: of this report.

107 Glass Door - Summary Of Average Temperatures °C / 24hrs												
Location	Top Shelf					2nd Shelf					3rd Shelf	
Data Point	1	2	3	4	5	6	7	8	9	10	11	12
Average Data Point Temperatures @ 1 Hour Intervals Over 24 Hour Period	n/a	4.4	4.9	5.3	4.6	3.3	3.3	4.4	4.3	3.6	6.3	6.7
	n/a	4.0	4.5	5.0	4.2	3.2	3.1	4.2	4.2	3.4	5.6	6.0
	n/a	4.0	4.5	5.0	4.2	3.1	3.1	4.3	4.1	3.5	5.5	6.0
	n/a	4.0	4.5	4.9	4.1	3.0	3.0	4.2	4.1	3.4	5.5	6.0
	n/a	4.0	4.5	4.8	4.1	3.0	3.0	4.2	4.1	3.4	5.5	6.0
	n/a	4.0	4.5	4.8	4.1	3.0	2.9	4.2	4.1	3.4	5.5	6.0
	n/a	4.1	4.7	4.9	4.3	3.2	3.1	4.5	4.3	3.5	5.6	6.1
	n/a	3.9	4.5	4.8	4.0	2.9	2.8	4.3	4.0	3.3	5.5	6.0
	n/a	3.9	4.5	4.7	4.0	2.9	2.8	4.2	4.1	3.3	5.5	6.0
	n/a	3.9	4.5	4.7	4.0	2.9	2.8	4.2	4.0	3.3	5.5	6.0
	n/a	3.9	4.5	4.7	4.0	2.9	2.8	4.2	4.1	3.3	5.5	6.0
	n/a	3.8	4.4	4.7	4.0	2.9	2.8	4.2	4.0	3.3	5.5	6.0
	n/a	3.9	4.5	4.7	4.0	2.9	2.8	4.2	4.0	3.4	5.5	6.0
	n/a	3.9	4.5	4.7	4.0	2.9	2.8	4.2	4.0	3.4	5.5	6.0
	n/a	3.9	4.4	4.7	4.0	2.9	2.8	4.2	4.0	3.3	5.5	6.0
	n/a	4.1	4.7	4.9	4.3	3.2	3.1	4.5	4.3	3.6	5.6	6.1
	n/a	3.9	4.5	4.7	4.1	2.9	2.9	4.2	4.1	3.4	5.5	6.0
	n/a	4.0	4.5	4.7	4.0	3.0	3.0	4.2	4.0	3.4	5.5	6.0
	n/a	3.9	4.4	4.6	4.0	3.0	2.9	4.1	4.1	3.3	5.5	6.0
	n/a	3.9	4.5	4.7	4.1	3.1	3.0	4.2	4.0	3.4	5.5	6.0
n/a	4.0	4.5	4.7	4.1	3.0	3.0	4.1	4.1	3.4	5.5	6.0	
n/a	4.0	4.5	4.8	4.2	3.2	3.1	4.3	4.1	3.5	5.5	6.0	
n/a	4.0	4.5	4.9	4.2	3.2	3.1	4.2	4.1	3.5	5.5	6.0	
n/a	4.4	4.8	5.2	4.5	3.5	3.5	4.5	4.5	3.8	5.9	6.2	
Ave Data Point	n/a	4.0	4.5	4.8	4.1	3.1	3.0	4.2	4.1	3.4	5.6	6.0
Ave Location	4.4					3.6					5.8	
107 GD Ave	4.26											

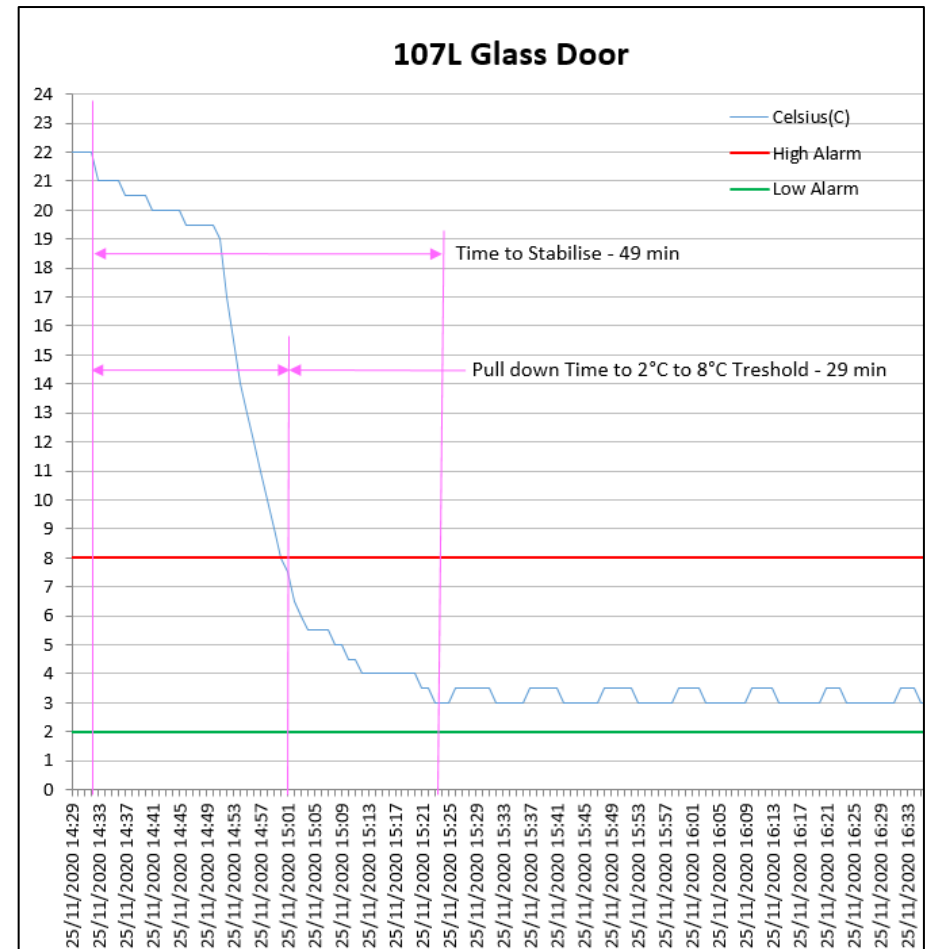
3:2 Summary Analysis

Summary of Operating Data

107L Glass Door - Running Data Over 24 Hour Period	
Pull down time to 2°C - 8°C operating threshold (Minutes)	29
Time to stabilised temperature (Minutes)	49
Maximum temperature after stabilised temperature 2°C - 8°C threshold achieved	3.5°C
Minimum temperature	2.5°C
Average cabinet Temperature	4.26°C

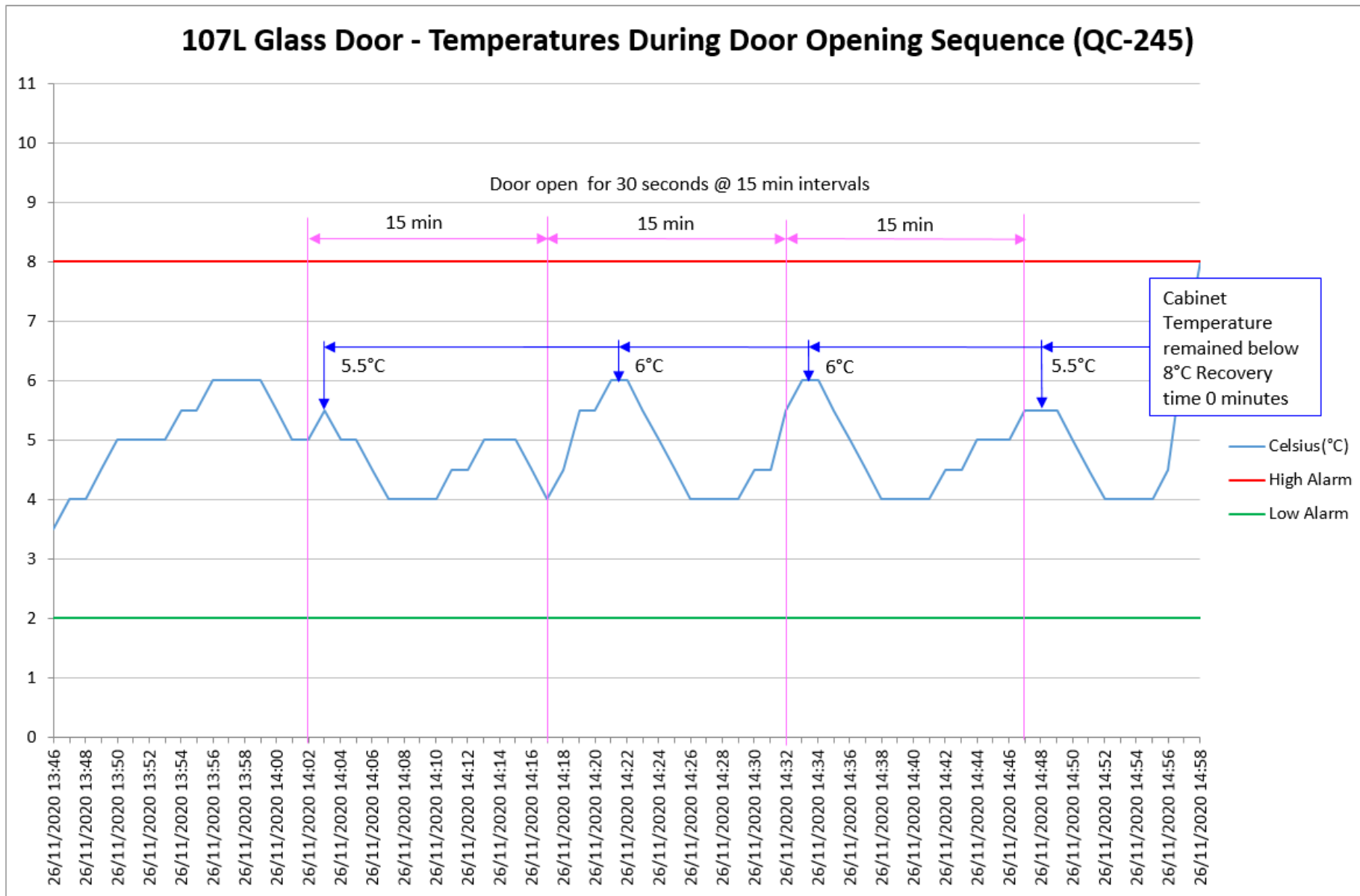
Summary of Door Opening Data

158L Glass Door – Door Opening Data	
Number of door openings carried out	3-4
Time interval between each door opening (Minutes)	15
Door open time (Seconds)	30
Door Opening No1	
Cabinet air temperature before door open	5.0°C
Cabinet air temperature during door open	4.5°C
Highest air temperature recorded during door opening sequence	4.5°C
Recovery time back to 2°C - 8°C threshold (Minutes)	0
Door Opening No2	
Cabinet air temperature before door open	4.0°C
Cabinet air temperature during door open	6.0°C
Highest air temperature recorded during door opening sequence	6.0°C
Recovery time back to 2°C - 8°C threshold (Minutes)	0
Door Opening No3	
Cabinet air temperature before door open	5.5°C
Cabinet air temperature during door open	6.0°C
Highest air temperature recorded during door opening sequence	6.0°C
Recovery time back to 2°C - 8°C threshold (Minutes)	0



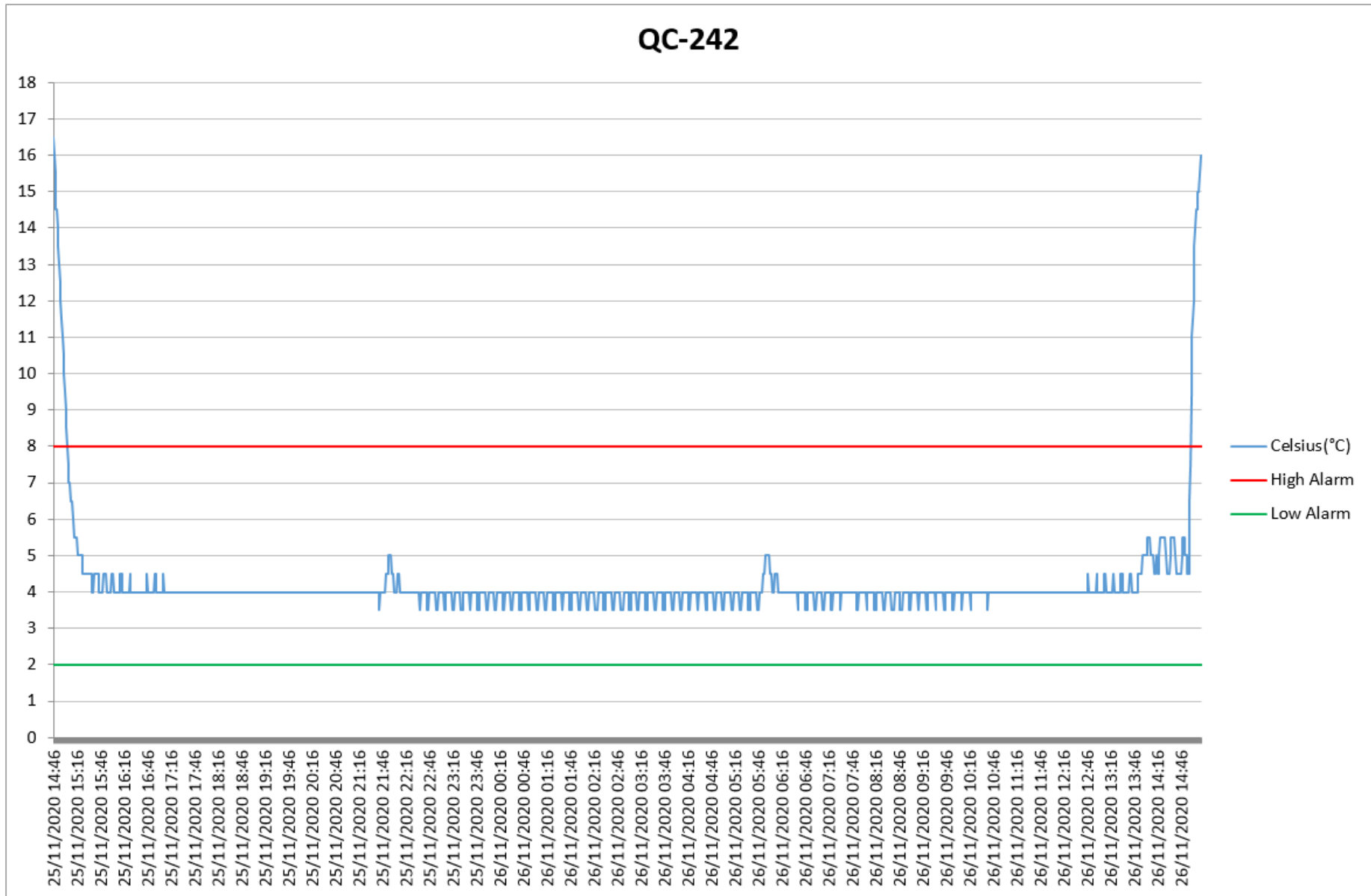
Pull Down time from ambient Temperature
Stabilisation time from ambient Temperature

Door opening graph analysis on page 6 of this report

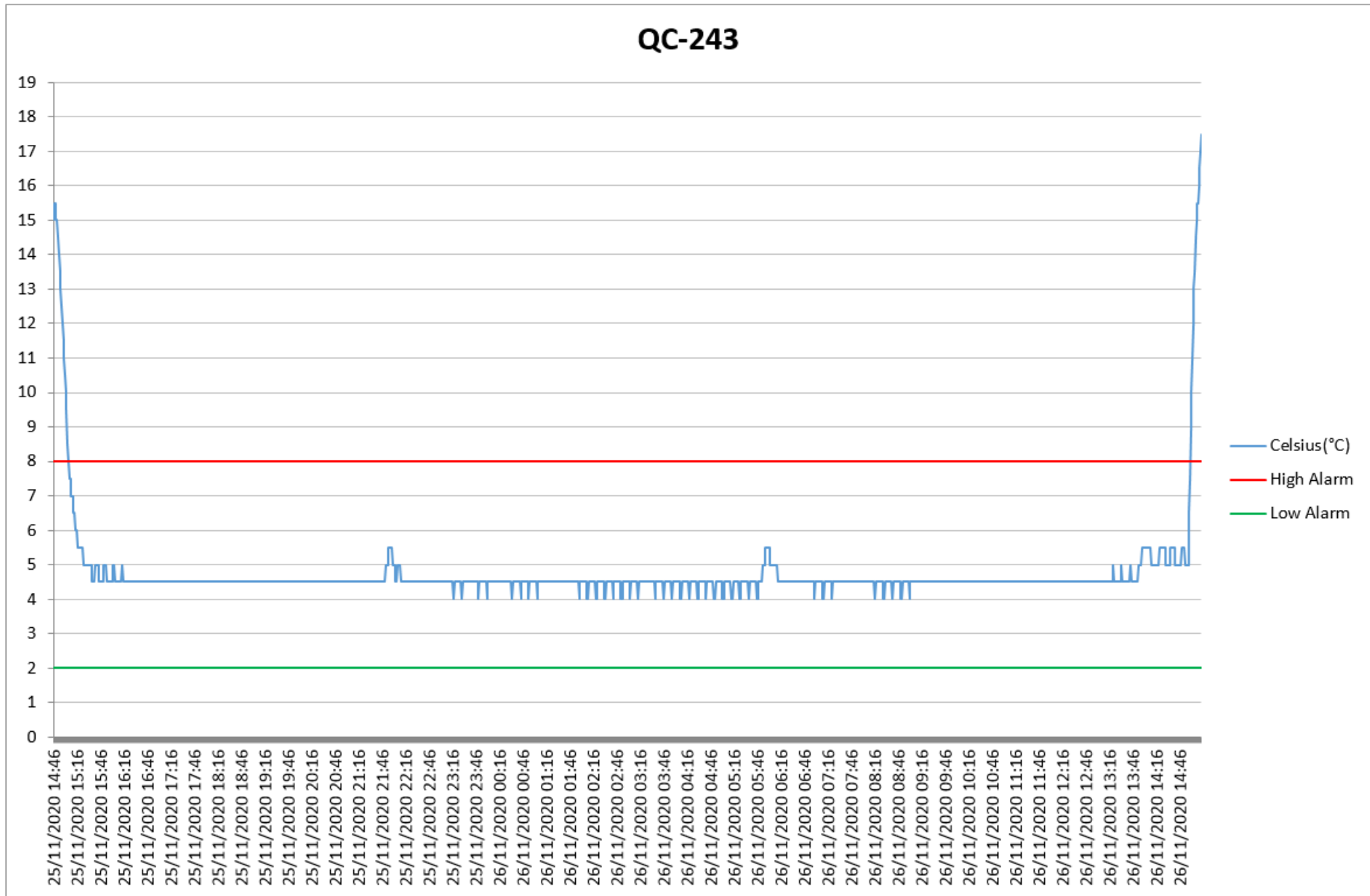


Data Logger Failed

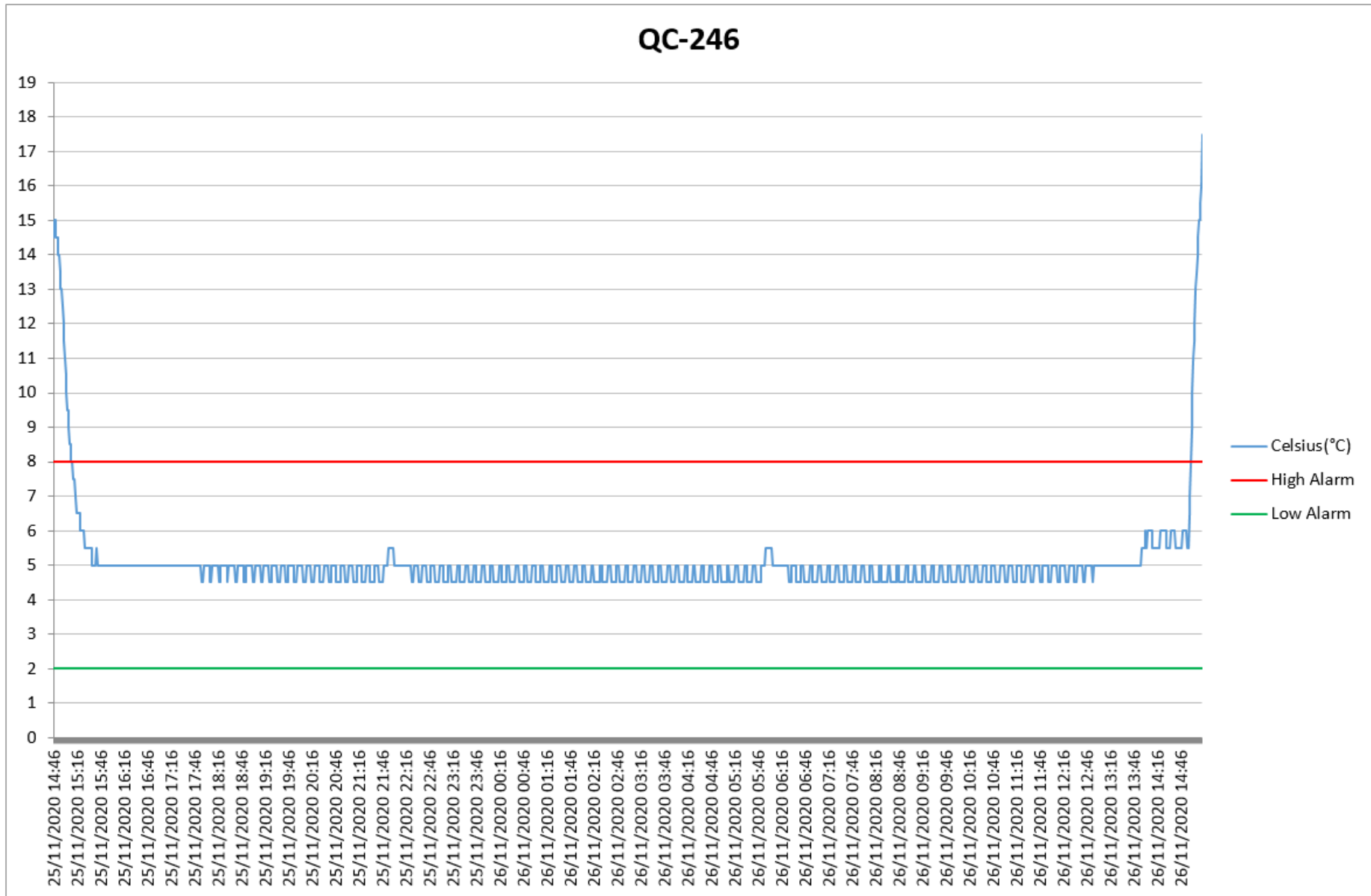
4:2 Temperature Mapping Results – Top Shelf Left Front



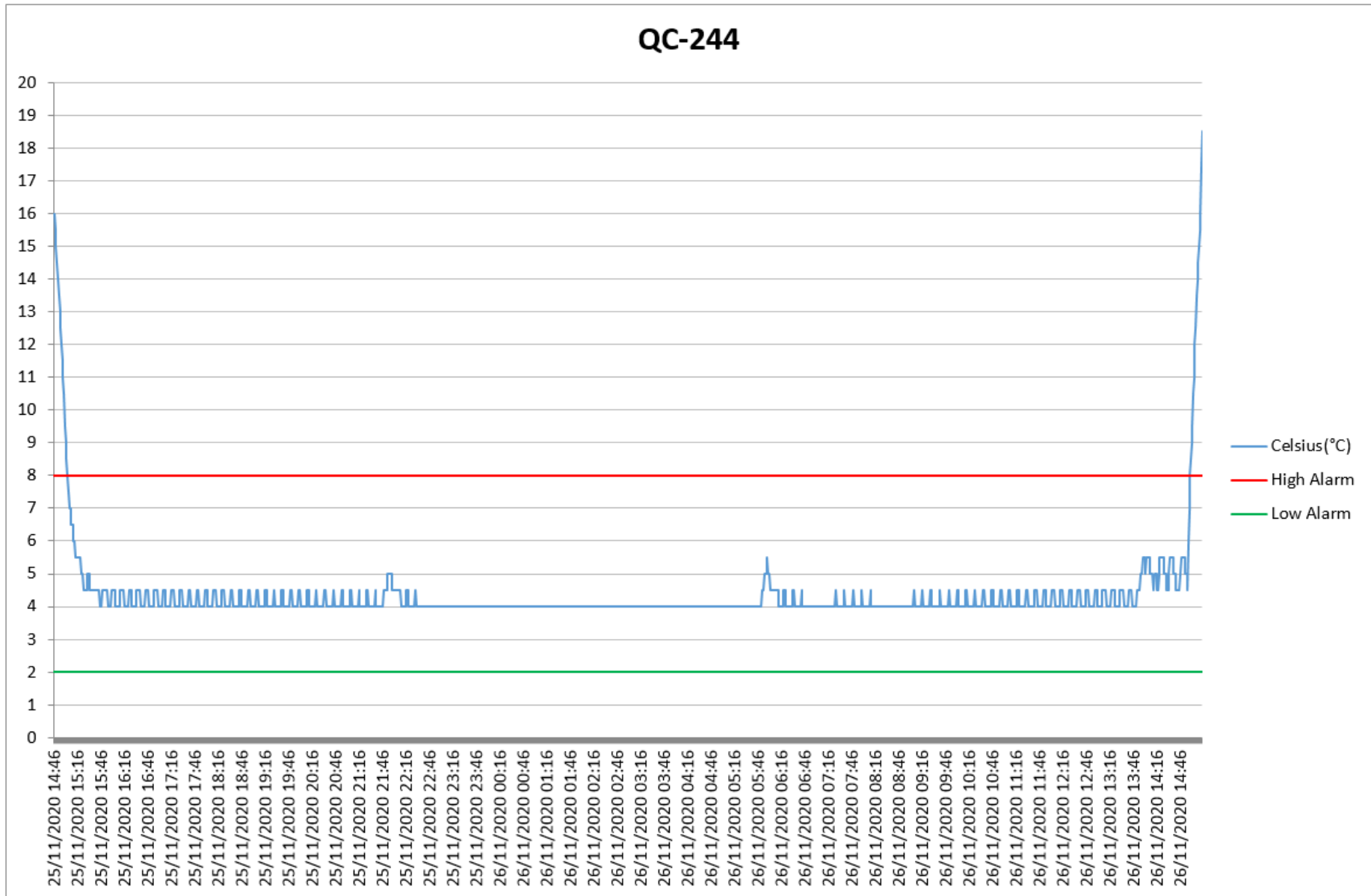
4:3 Temperature Mapping Results – Top Shelf Right Back



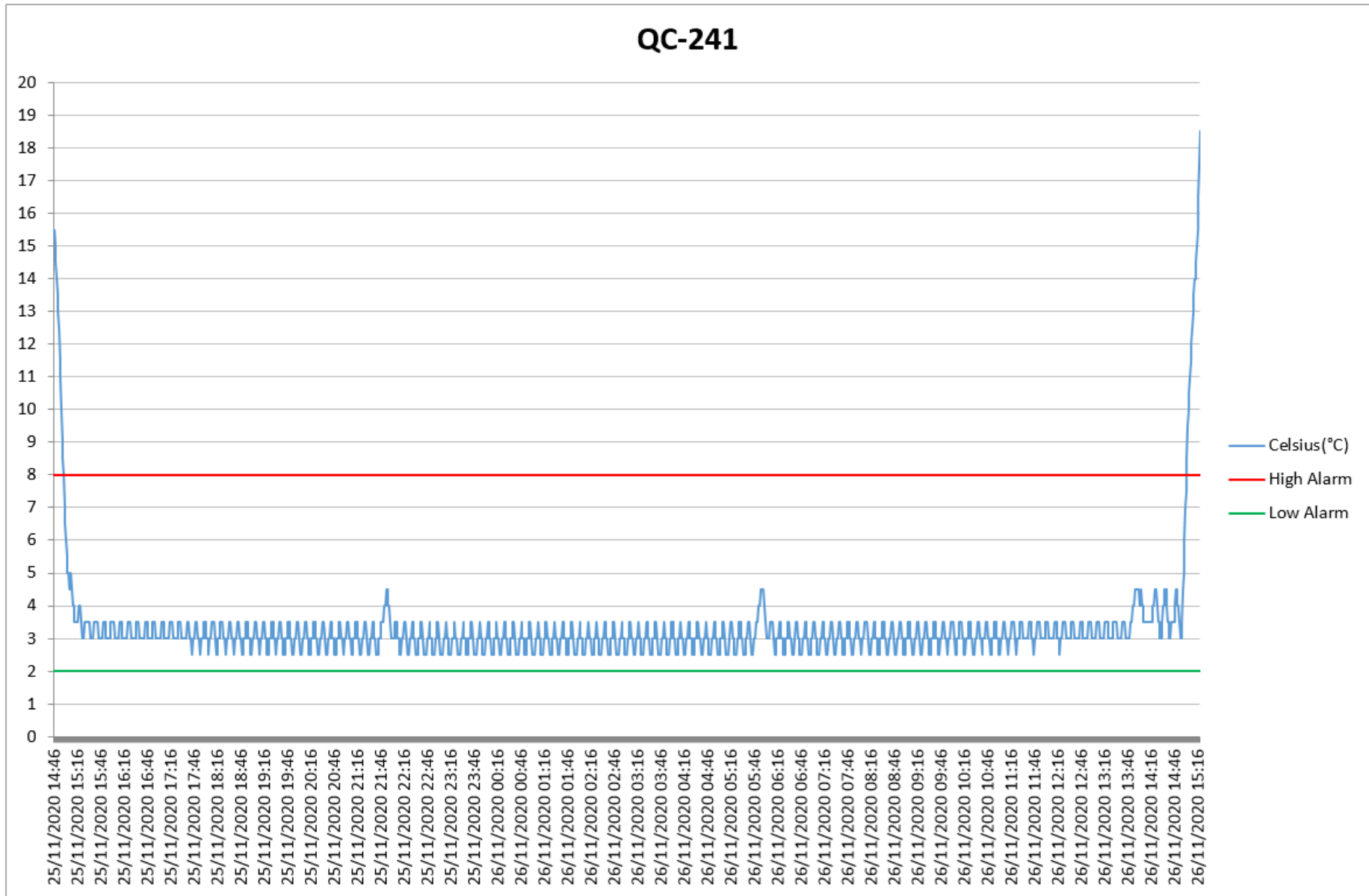
4:4 Temperature Mapping Results – Top Shelf Right Front



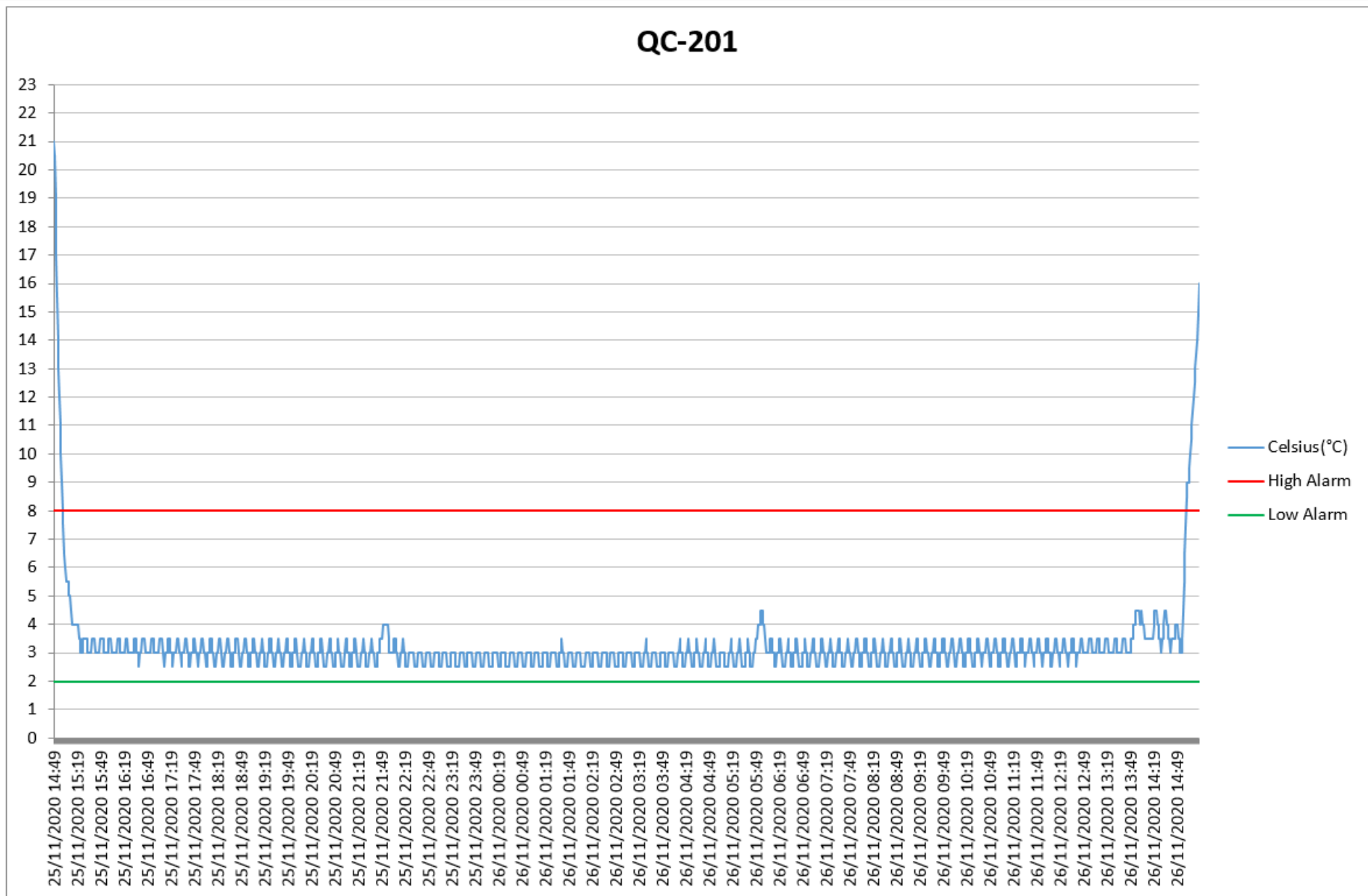
4:5 Temperature Mapping Results – Top Shelf Centre



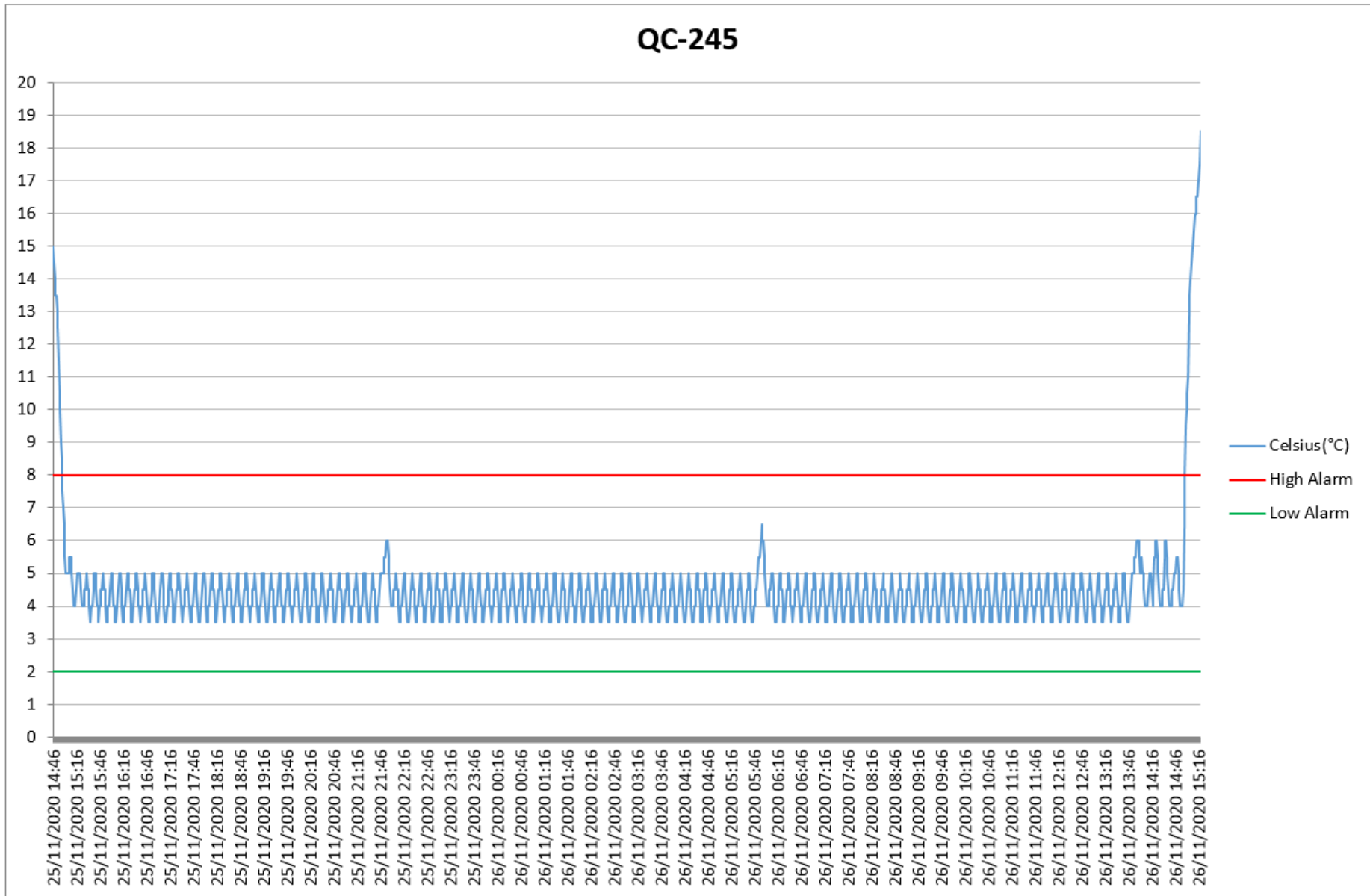
4:6 Temperature Mapping Results – Bottom Shelf Left Back



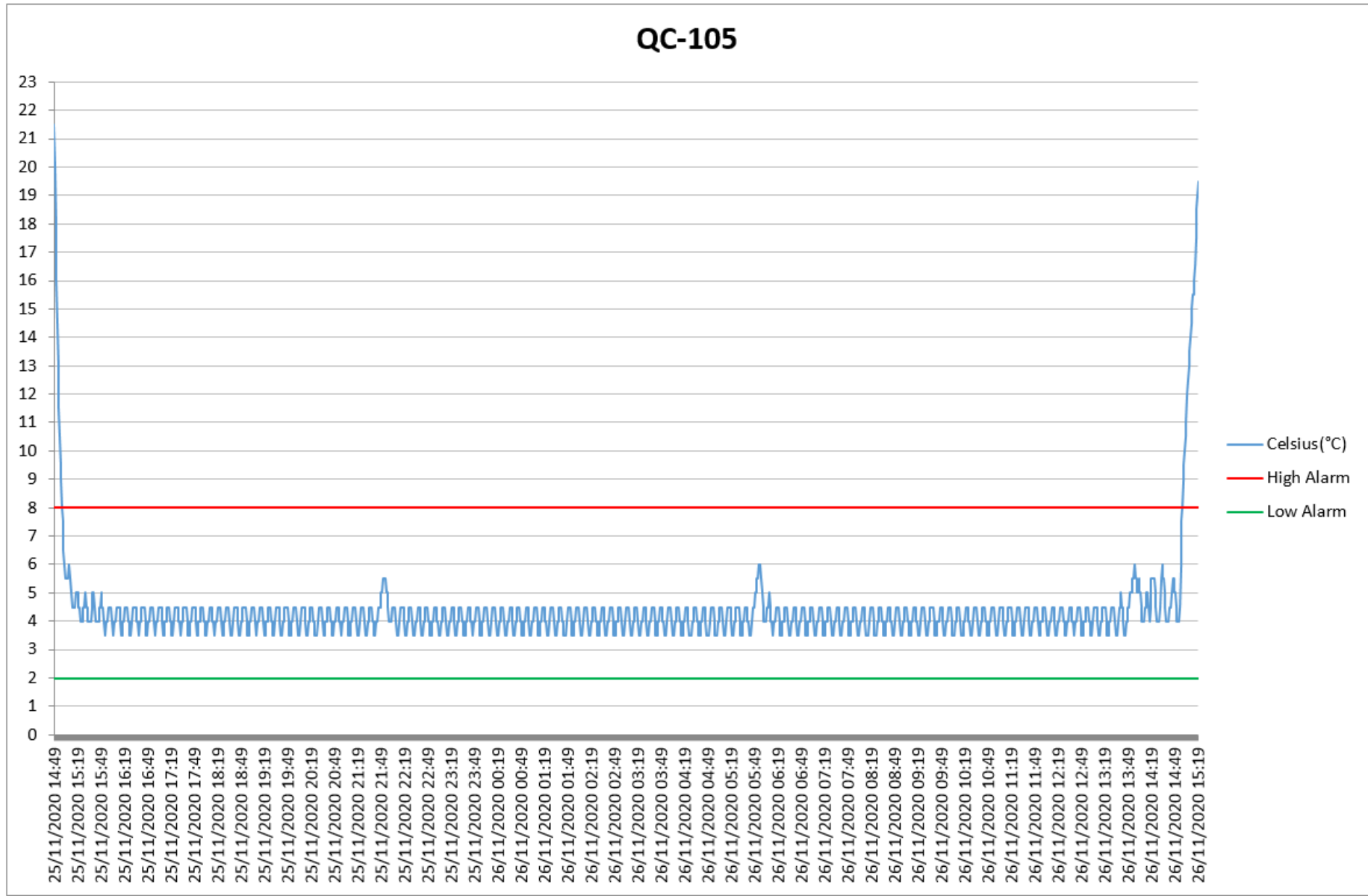
4:7 Temperature Mapping Results – Bottom Shelf Left Front



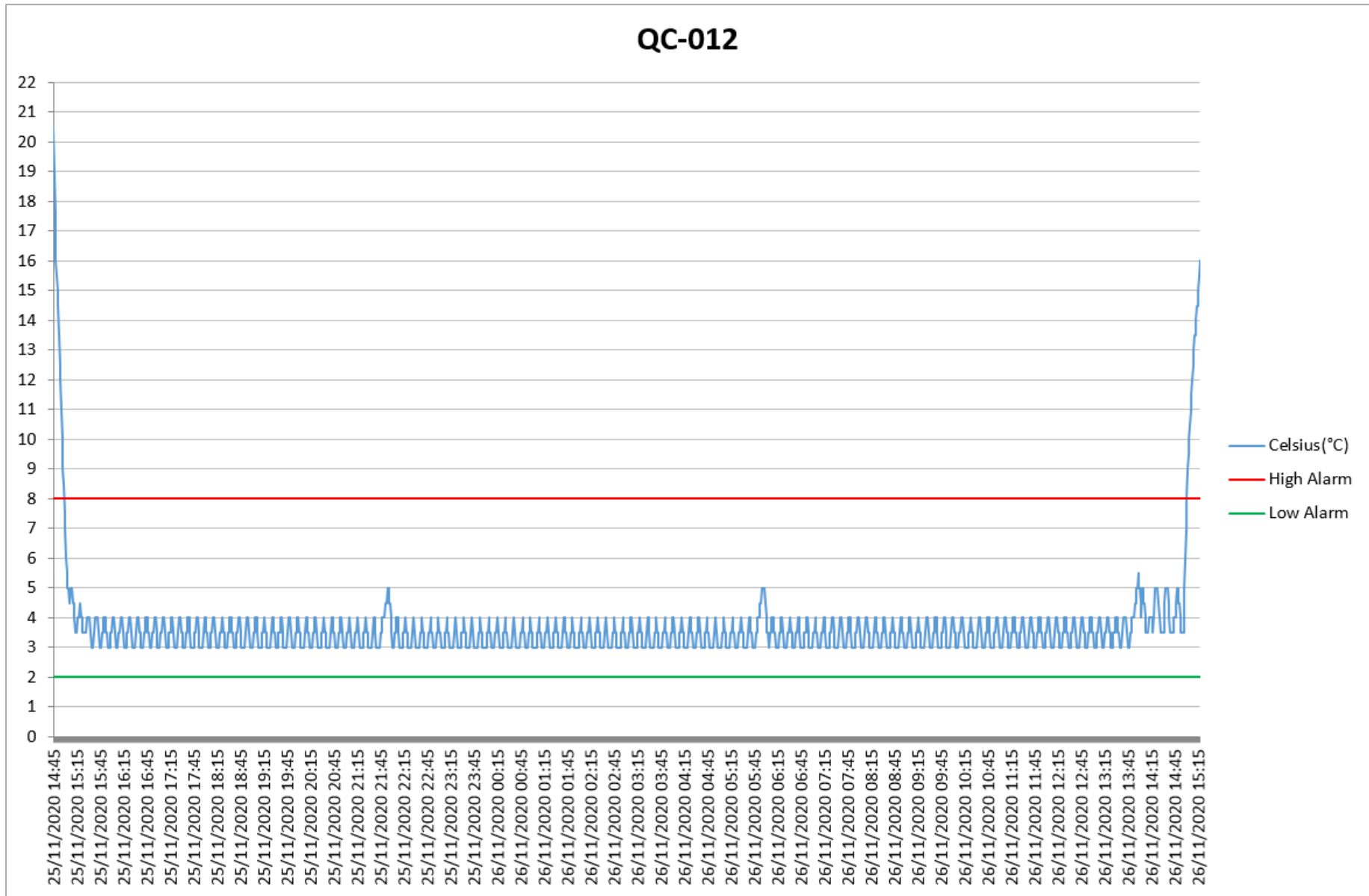
4:8 Temperature Mapping Results – Bottom Shelf Right Back



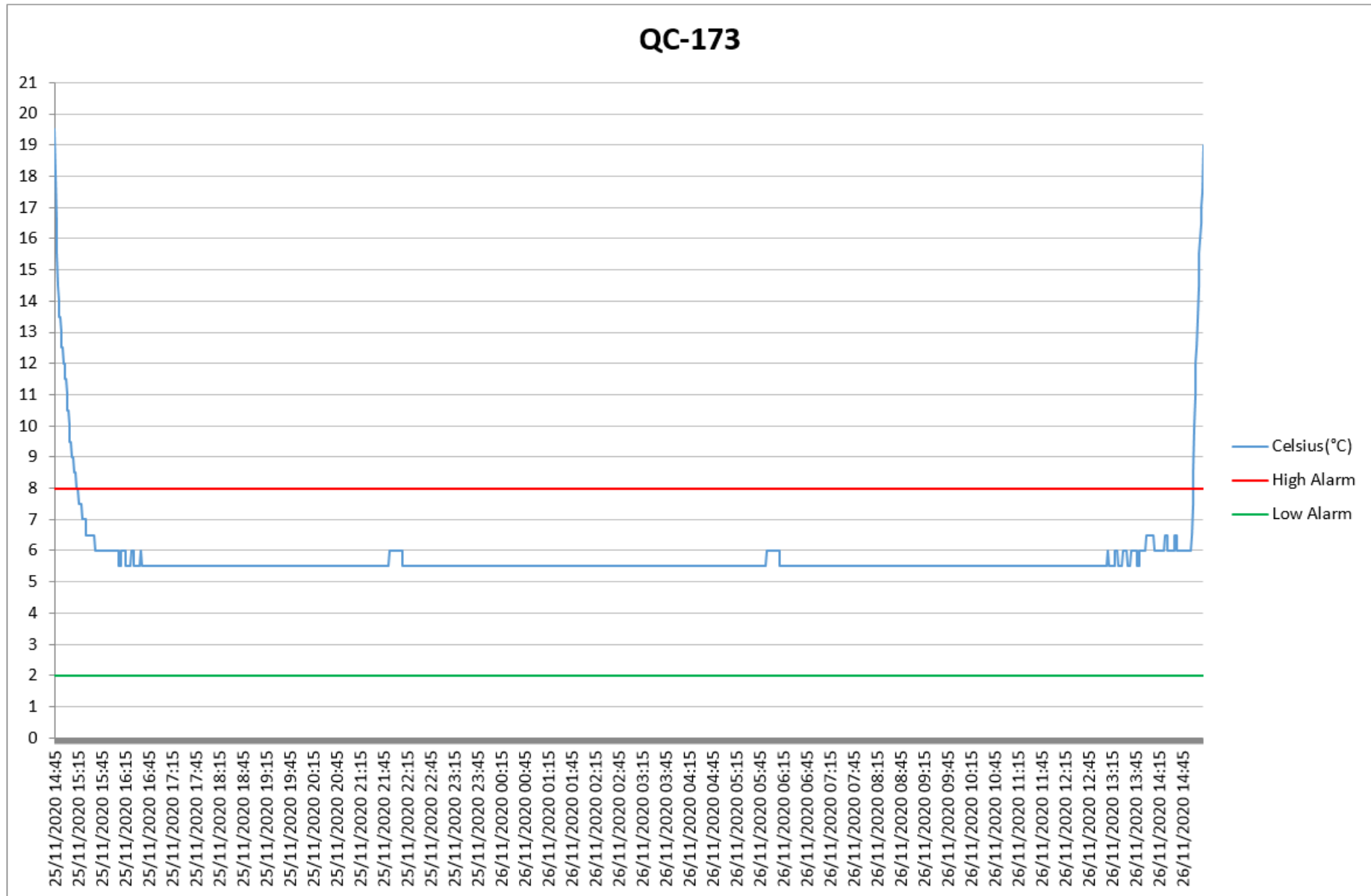
4:9 Temperature Mapping Results – Bottom Shelf Right Front



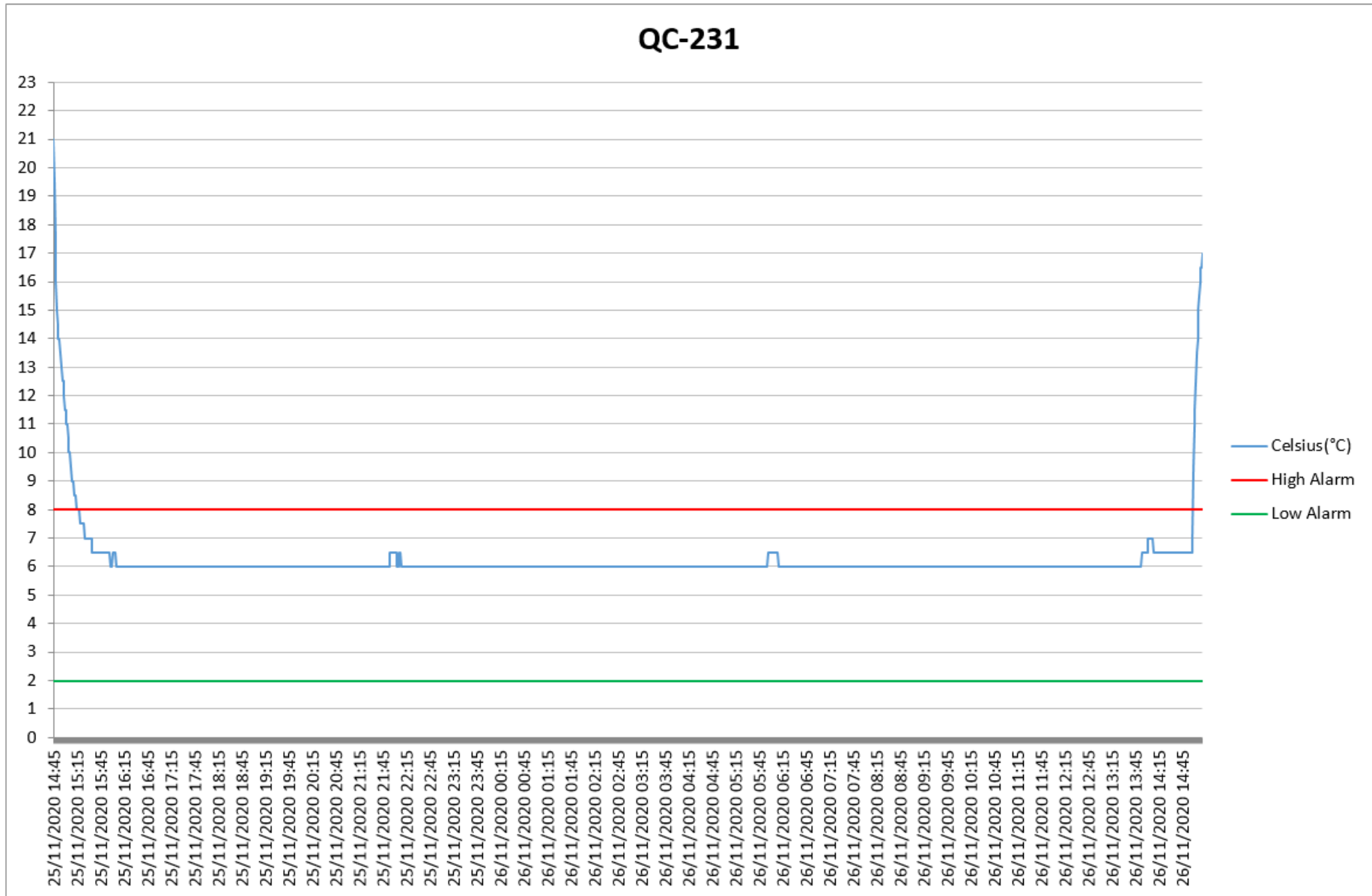
4:10 Temperature Mapping Results – Bottom Shelf Centre

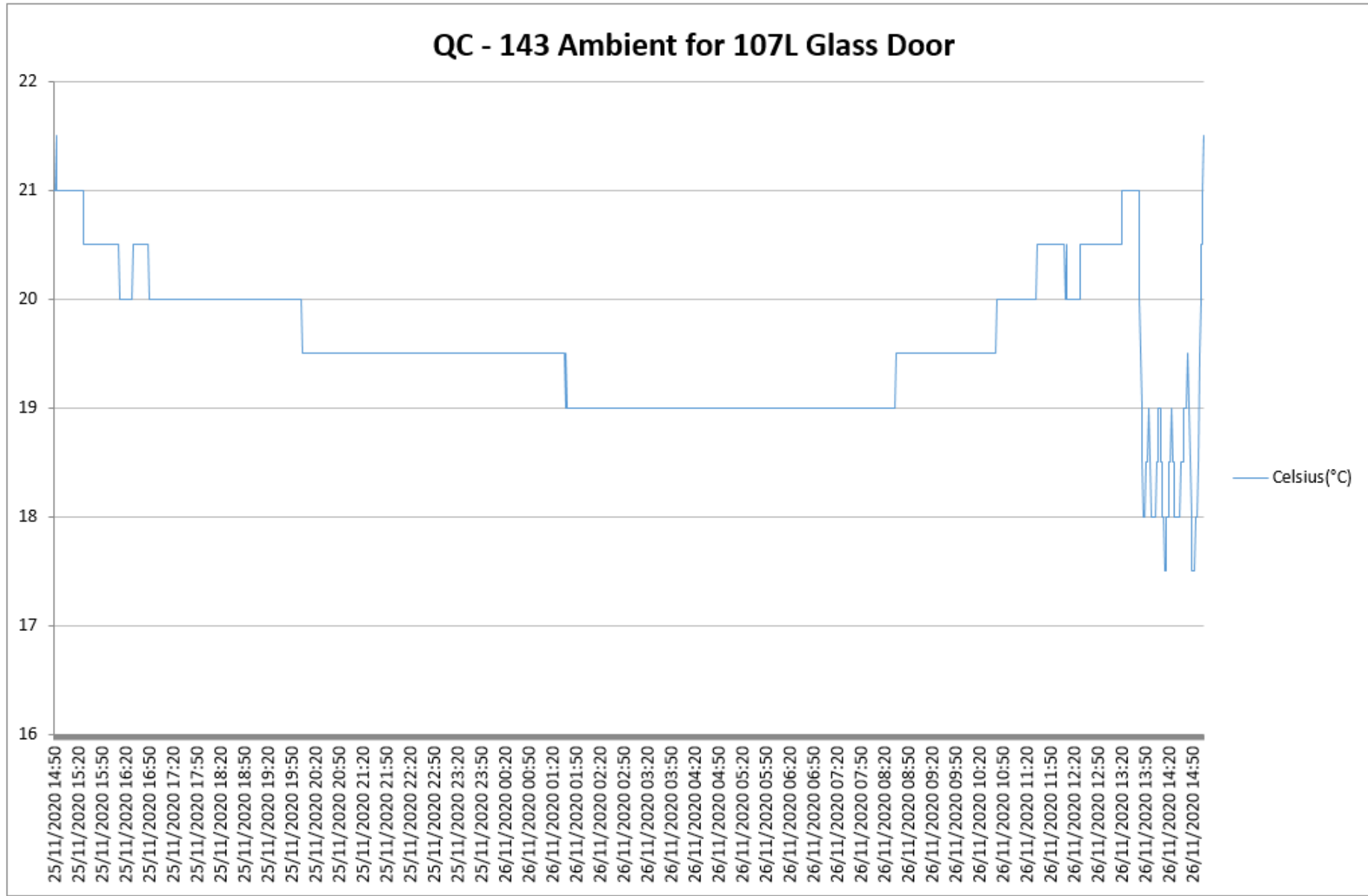


4:1:11 Temperature Mapping Results – Basket Left





4:1:12 Temperature Mapping Results – Basket Right





5: Data Logger Know Reference Certificate and Procedure

Certificate of Calibration Issued By Trescal Ltd		
Date of Issue: 09 December 2019	Certificate Number: 3181570005	
Trescal Ltd Park Gate Close, Bredbury Park Way Bredbury, Stockport, SK6 2SL, UK Tel: +44(0) 161 406 7878 Fax: +44(0) 161 406 7979 Email: calibration.manchester@trescal.com		Page 1 of 3 APPROVED SIGNATORY  Nicolau Morais
Customer: Glen Dimplex Home Appliances, Stoney Lane Whiston, Prescot, Merseyside, L35 2XW		
Equipment Details		
Description:	Thermocouple Data Logger	
Manufacturer:	Pico Technology	Customer Ref: QC9771
Type No:	TC-08	Date of Receipt: 28/11/2019
Range:		Order No: P218914
Serial No:	AO830382	Our Reference: 00555749
Calibrated By:	Sara Bruno	Date: 05/12/2019
Calibration Summary		
<p>The Quality Assurance arrangements adopted comply with Trescal Limited Calibration Division's BSI Registration to BS EN ISO 9001:2015. The calibration of all test equipment and standards referenced comply with ISO 10012:2003 and are traceable to National or International Standards or are derived by approved ratio techniques. The instrument reported on this certificate has been calibrated in accordance with the specification stipulated in the contract, order or with the following calibration values. The results were recorded on the stated date and do not reflect the stability of the instrument. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.</p>		
The item(s) covered by this calibration certificate were calibrated at the Trescal laboratory shown at the top of the page.		
Ambient Conditions	Temperature: 20°C ± 2 °C	Humidity: 45% RH ± 20% RH
Date of next calibration:	05/12/2020	
<small>The results given within this certificate only relate to the item calibrated. The uncertainty limits quoted refer to the measured values only, with no account being taken of the instruments ability to maintain its calibration. The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor k=2 providing a confidence level of approximately 95%. The uncertainty evaluation has been derived from EA-402 M:2013 'Evaluation of the Uncertainty of Measurement in Calibration'.</small>		
<small>EMS 00004-28-May2018</small>		

Data Logger Comparative Calibration Procedure

Data loggers are set to the required settings: 2°C Low Temperature and 8°C high Temperature @ 60 second recording frequency.

Data Loggers are placed into a control fridge cabinet 3 at a time. Once the fridge temperature has stabilized back to its pre-set temperature the data loggers are soaked for 1 hour. The fridge temperature is monitored and logged with an external temperature monitoring system (Pico) this system is calibrated and certified, certificate opposite.

The temperatures recorded by the data loggers are compared with the Pico system, any data logger that shows a difference of ± 0.5°C to that of the Pico monitoring system is rejected.

All data loggers are assigned a "QC" number and entered into the data logger register.