

HATS² Testing: Reflow Simulation Report



HATS Job Number: HATS Sample Report	Lab Job Number: Tracking Number
Customer Name: Your Name	Company Name: Company Name
Company Address: Your Street , Your City, Your State, Your Postal Code, Your Country	Phone Number: Your Phone Number
E-mail Address: Your E-Mail Address	Coupon Designator: Test Coupon ID

Reflow Profile: IPC-230C	Quality of Profiles: 6	Failure Percentage (%): 5
Quantity of Coupons: 12	Number of Nets: 2	Coupon Thickness: 2.5 mm
Net 1 Via Type: Buried-Offset	Net 1 Quantity of Holes: 195	Net 1 Hole Size: .300 mm
Net 2 Via Type: Buried-Offset	Net 2 Quantity of Holes: 160	Net 2 Hole Size: .300 mm

High Speed Via Reliability Testing

IPC-TM-650 Method 2.6.27B

IPC-TM-650 Method 2.6.7C

HATS² Single Via Test Coupons

IPC-2221 Type "D" Coupons

HATS-Tester.com



Convection Reflow Simulation in a HATS² Unit

TEST SPECIMEN

The Test Specimens were comprised of IPC-2221B Appendix A type D coupons.

REFERENCE

IPC-TM-650 Method 2.6.27B Thermal Stress, Convection Reflow Assembly Simulation.

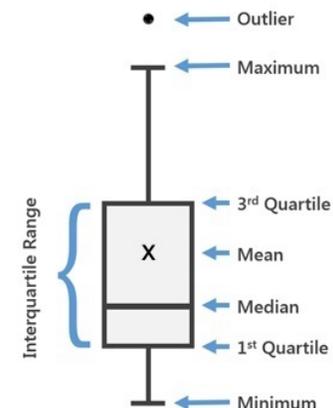
METHOD/ REQUIREMENT

- 1) Pre-condition: Bake the test samples for 6h in clean oven at 120°C.
- 2) Insert connectors into test coupon connection holes and place them into a HATS² chamber.
- 3) Expose the coupons to Reflow Simulation Profiles in accordance with IPC-TM-650 2.6.27B at the temperature and for the number of profiles described in the pages above.
- 4) Monitor Electrical Resistance of each net in accordance with IPC-TM-650 2.6.27B during the reflow profiles.

RESULTS

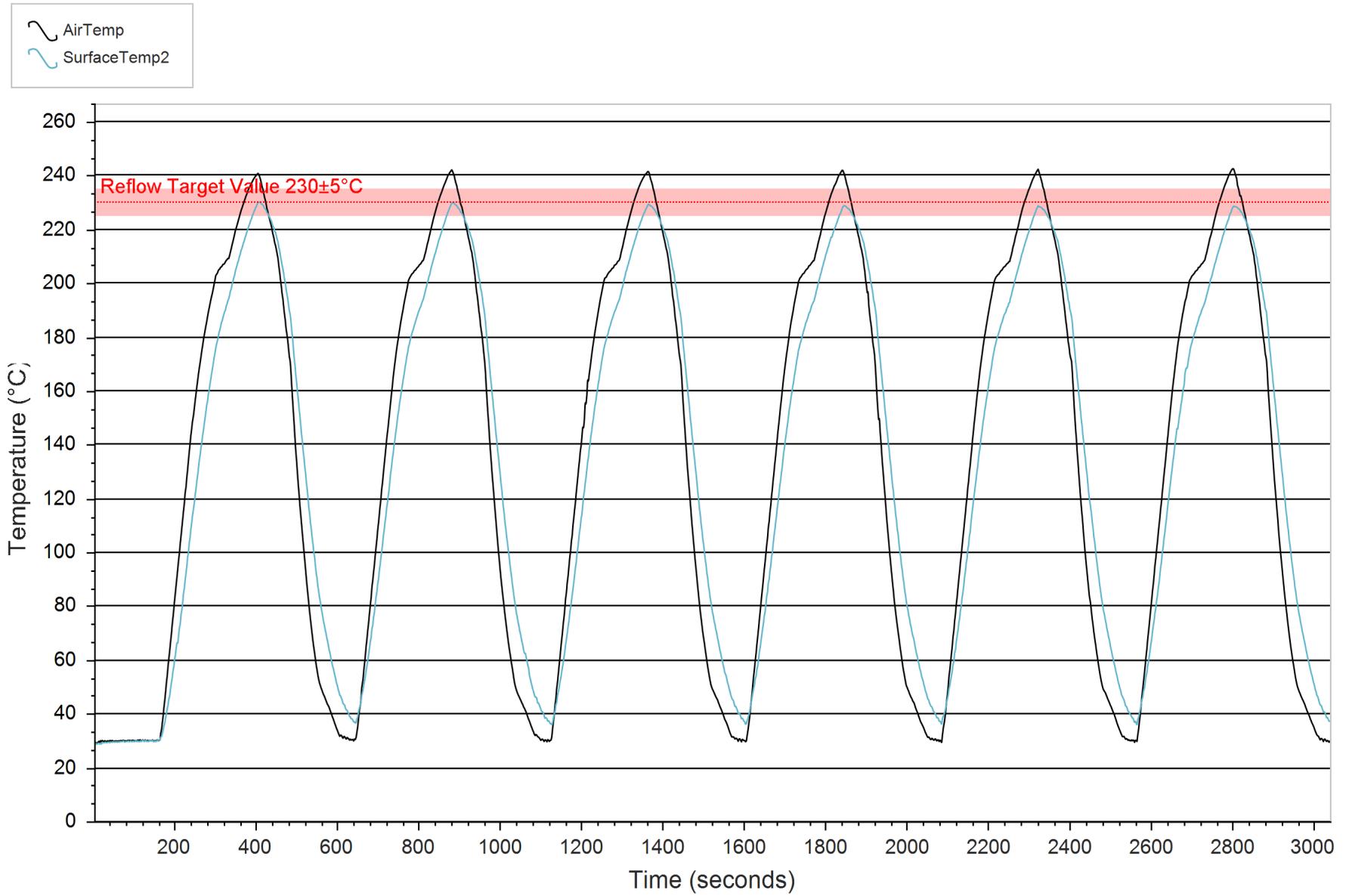
The samples were tested by the methods given above. See attached test sheets and graphs for actual test results.

Box Plots are used to graphically display the distribution of a data set. The Box (Interquartile Range or IQR) extends from the first quartile (25th percentile of the data set) to the third quartile (75th percentile of the data set) and represents 50% of the population of the data set. The Median value of the data set is represented by a line and the Mean value by an "X" within the box. A line and whisker extend from the bottom of the box (1st Quartile) to the Minimum value, representing the lower 25% of the population of the data set. A line and whisker extend from the top of the box (3rd Quartile) to the Maximum value, representing the upper 25% of the population of the data set. Statistical Outliers in the data set are represented by a "●" above or below the whiskers and are defined as any data value that is more than 1.5 times the IQR Distance away from the IQR.



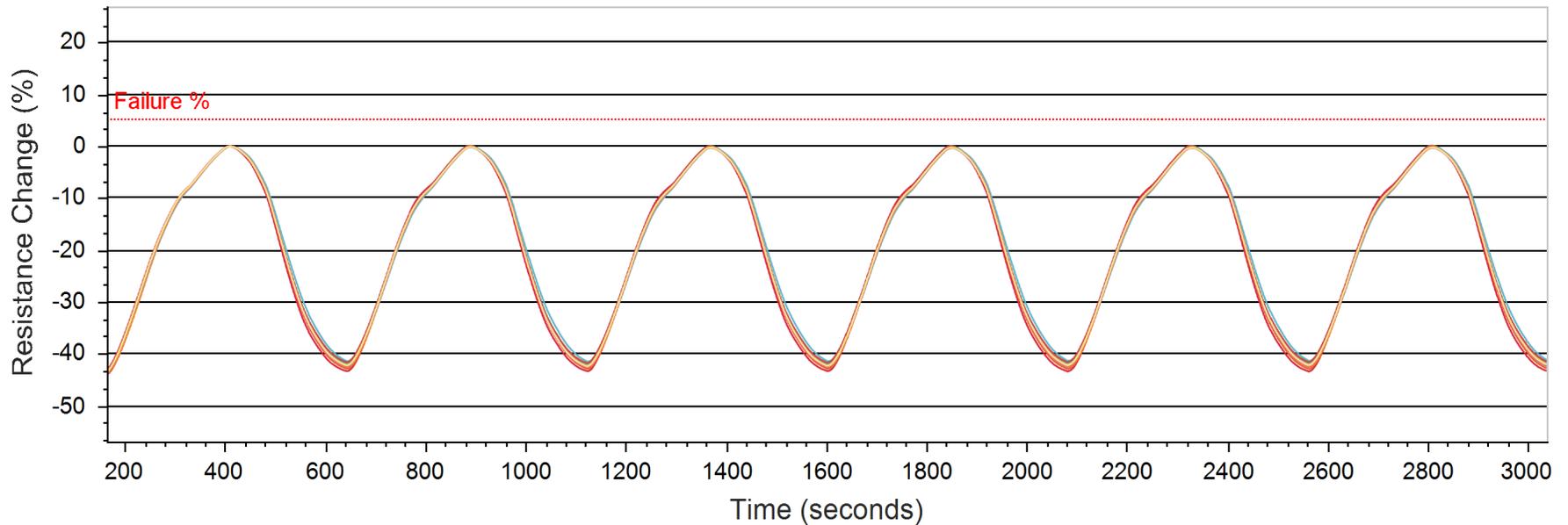


Reflow Simulation Temperature Profile





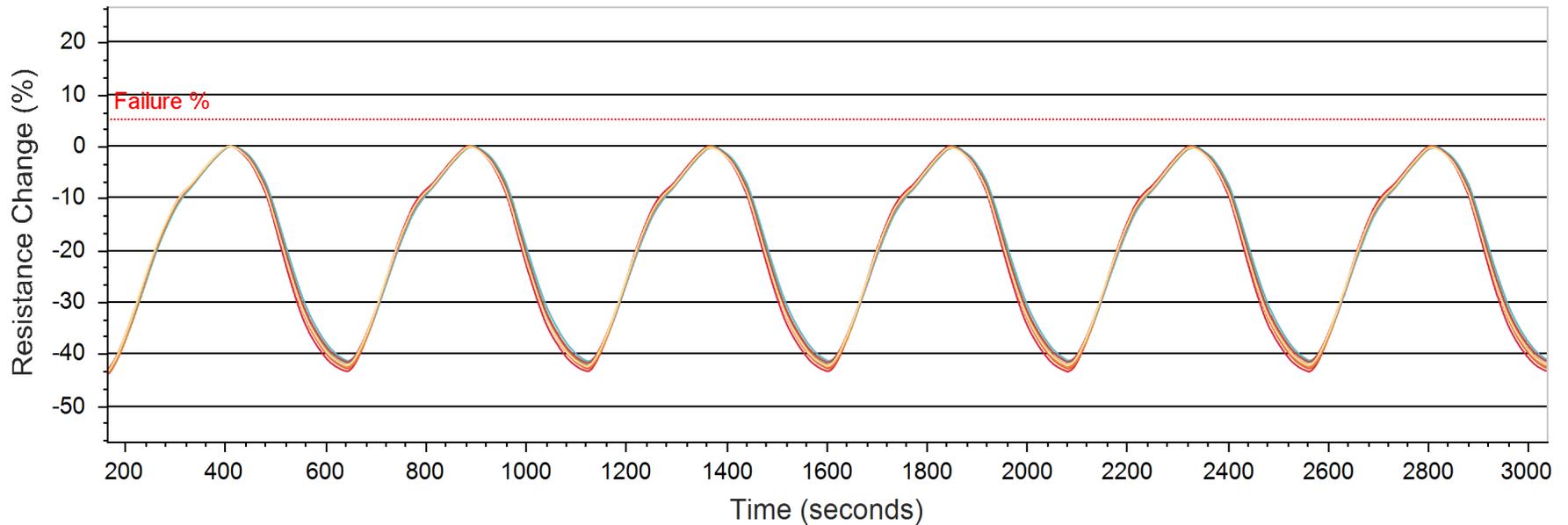
Reflow Simulation - Net 1 Resistance Change



Coupon Number	1	2	3	4	5	6
Reference Resistance (Ohms)	1.78497	1.87741	1.99319	1.76907	1.78800	2.09981
Maximum Resistance % Change	0.12	0.12	0.05	0.05	0.00	0.00
Cycle Failed 5% Limit	>6	>6	>6	>6	>6	>6
Coupon Number	7	8	9	10	11	12
Reference Resistance (Ohms)	1.83203	1.80280	1.65762	1.83384	1.91245	1.79566
Maximum Resistance % Change	0.00	0.00	0.00	0.00	0.00	0.00
Cycle Failed 5% Limit	>6	>6	>6	>6	>6	>6
Coupon Number	13	14	15	16	17	18
Reference Resistance (Ohms)	-	-	-	-	-	-
Maximum Resistance % Change	-	-	-	-	-	-
Cycle Failed 5% Limit	-	-	-	-	-	-



Reflow Simulation - Net 2 Resistance Change



Coupon Number	1	2	3	4	5	6
Reference Resistance (Ohms)	1.40075	1.45572	1.42876	1.43150	1.34757	1.43823
Maximum Resistance % Change	0.09	0.10	0.05	0.04	0.00	0.00
Cycle Failed 5% Limit	>6	>6	>6	>6	>6	>6
Coupon Number	7	8	9	10	11	12
Reference Resistance (Ohms)	1.46291	1.37998	1.33383	1.41559	1.38943	1.41805
Maximum Resistance % Change	0.00	0.00	0.00	0.00	0.00	0.00
Cycle Failed 5% Limit	>6	>6	>6	>6	>6	>6
Coupon Number	13	14	15	16	17	18
Reference Resistance (Ohms)	-	-	-	-	-	-
Maximum Resistance % Change	-	-	-	-	-	-
Cycle Failed 5% Limit	-	-	-	-	-	-



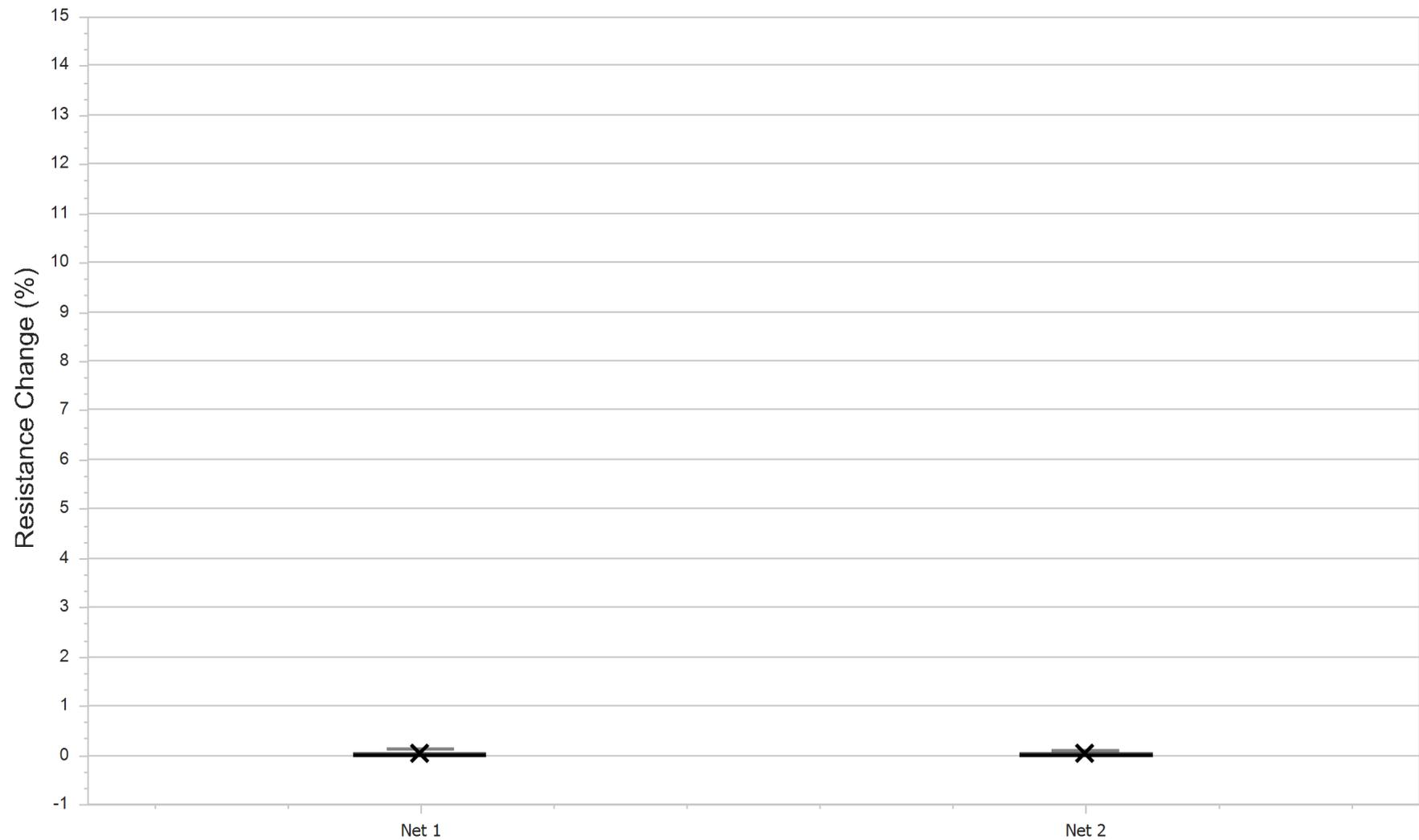
Box Plot of Cycles to Failure



X-Axis: Net Designation (Quantity Passed of Total)



Box Plot of Max Resistance Change (%)



HATS² Testing: Temperature Cycling Report



HATS Job Number: HATS Job Number	Lab Job Number: Tracking Number
Customer Name: Your Name	Company Name: Your Company
Company Address: Your Street, Your City, Your State, Your Postal Code, Your Country	Phone Number: Your Phone
E-mail Address: Your Email	Coupon Designator: Test Coupon ID

Cycle Range (°C): -55 to 145

Quality of Cycles: 750

Failure Percentage (%): 5

Quantity of Coupons: 12

Number of Nets: 2

Coupon Thickness: 2.7 mm

Net 1 Via Type: Blind

Net 1 Quantity of Holes: 230

Net 1 Hole Size: .175 mm

Net 2 Via Type: Buried

Net 2 Quantity of Holes: 124

Net 2 Hole Size: .300 mm

High Speed Via Reliability Testing

IPC-TM-650 Method 2.6.27B

IPC-TM-650 Method 2.6.7C

HATS² Single Via Test Coupons

IPC-2221 Type "D" Coupons

HATS-Tester.com



Thermal Cycling/Shock in a HATS² Unit

TEST SPECIMEN

The Test Specimens were comprised of IPC-2221B Appendix A type D coupons.

REFERENCE

IPC-TM-650 Method 2.6.7.2C for Air-to-Air Thermal Shock.

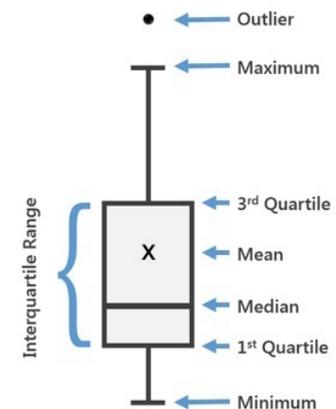
METHOD/ REQUIREMENT

- 5) Pre-condition: Bake the test coupons for 6h in clean oven at 120°C.
- 6) Insert connectors into test coupon connection holes and place them into a HATS² chamber.
- 7) Expose samples to the thermal shock extremes and cycles quantities described in the pages above.
- 8) Measure the resistance of each net at the end of every high temperature cycle section using a four-wire Kelvin Bridge.
- 9) Coupons are considered to be acceptable until they reach the percentage change in resistance described in the pages above when compared to the measurement taken at the first cyce.

RESULTS

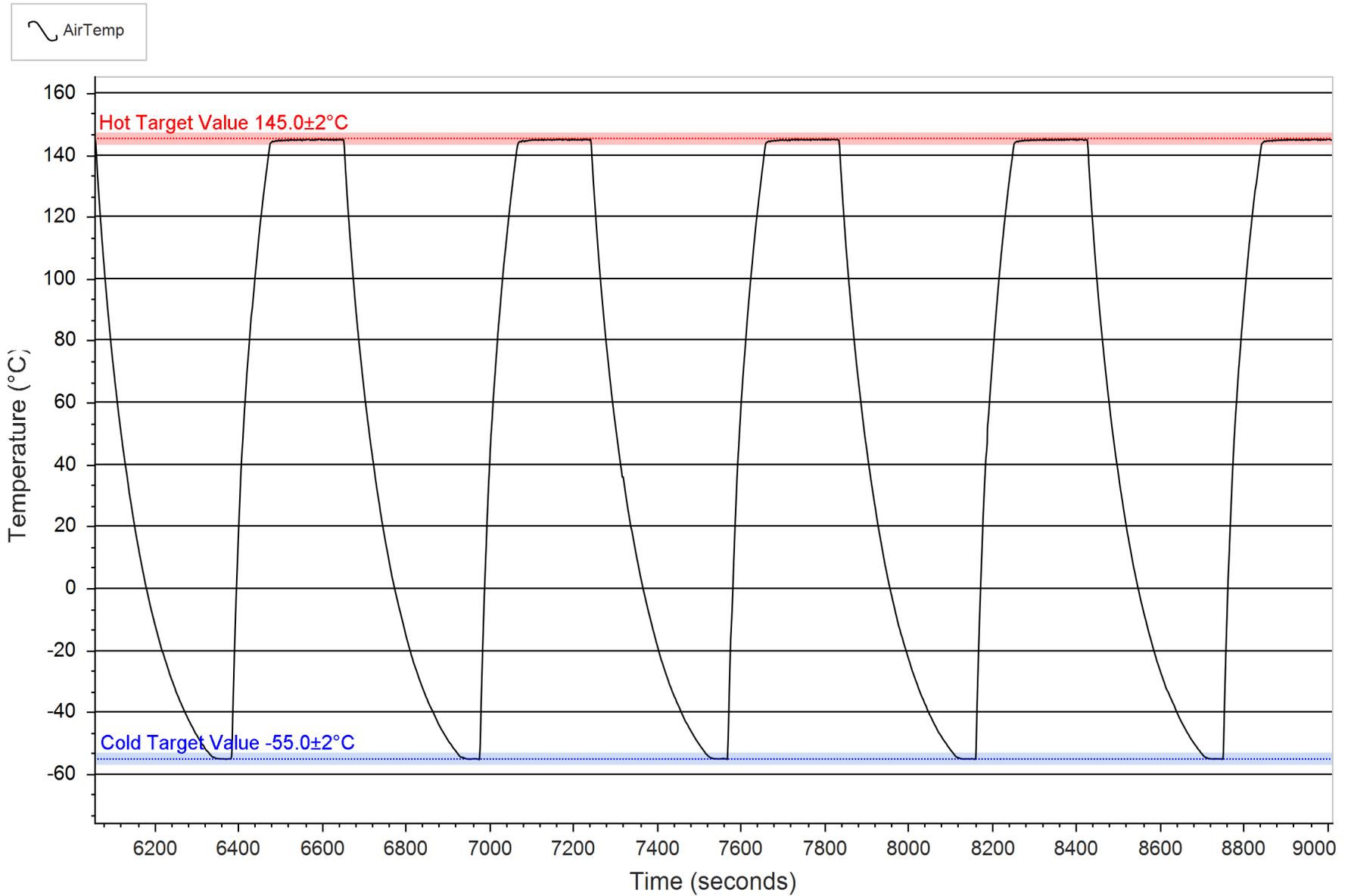
The samples were tested by the methods given above. See attached test sheets and graphs for actual test results.

Box Plots are used to graphically display the distribution of a data set. The Box (Interquartile Range or IQR) extends from the first quartile (25th percentile of the data set) to the third quartile (75th percentile of the data set) and represents 50% of the population of the data set. The Median value of the data set is represented by a line and the Mean value by an "X" within the box. A line and whisker extend from the bottom of the box (1st Quartile) to the Minimum value, representing the lower 25% of the population of the data set. A line and whisker extend from the top of the box (3rd Quartile) to the Maximum value, representing the upper 25% of the population of the data set. Statistical Outliers in the data set are represented by a "●" above or below the whiskers and are defined as any data value that is more than 1.5 times the IQR Distance away from the IQR.



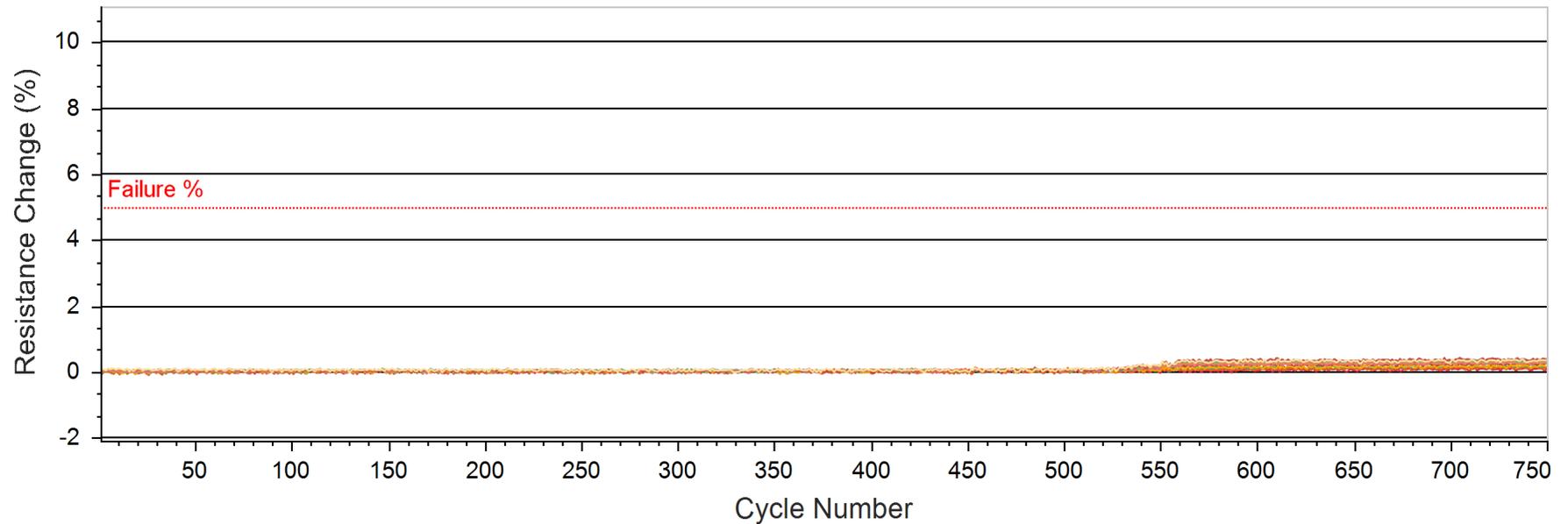


5 Cycle Sample of Profile Temperatures





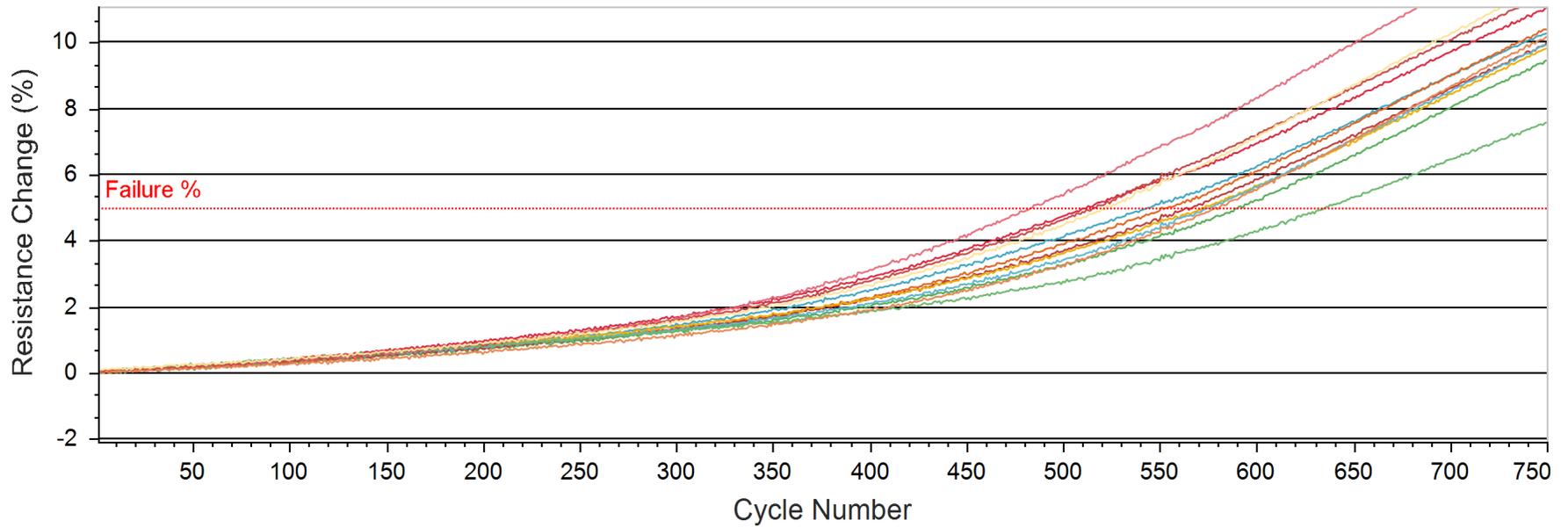
Thermal Cycling - Net 1 Resistance Change



Coupon Number	1	2	3	4	5	6
Reference Resistance (Ohms)	1.17366	1.17222	1.28474	1.10645	1.15638	1.25989
Maximum Resistance % Change	0.17	0.14	0.21	0.16	0.28	0.22
Cycle Failed 5% Limit	>750	>750	>750	>750	>750	>750
Coupon Number	7	8	9	10	11	12
Reference Resistance (Ohms)	1.29454	1.20712	1.11884	1.11736	1.17964	1.19336
Maximum Resistance % Change	0.36	0.30	0.38	0.32	0.43	0.38
Cycle Failed 5% Limit	>750	>750	>750	>750	>750	>750
Coupon Number	13	14	15	16	17	18
Reference Resistance (Ohms)	-	-	-	-	-	-
Maximum Resistance % Change	-	-	-	-	-	-
Cycle Failed 5% Limit	-	-	-	-	-	-



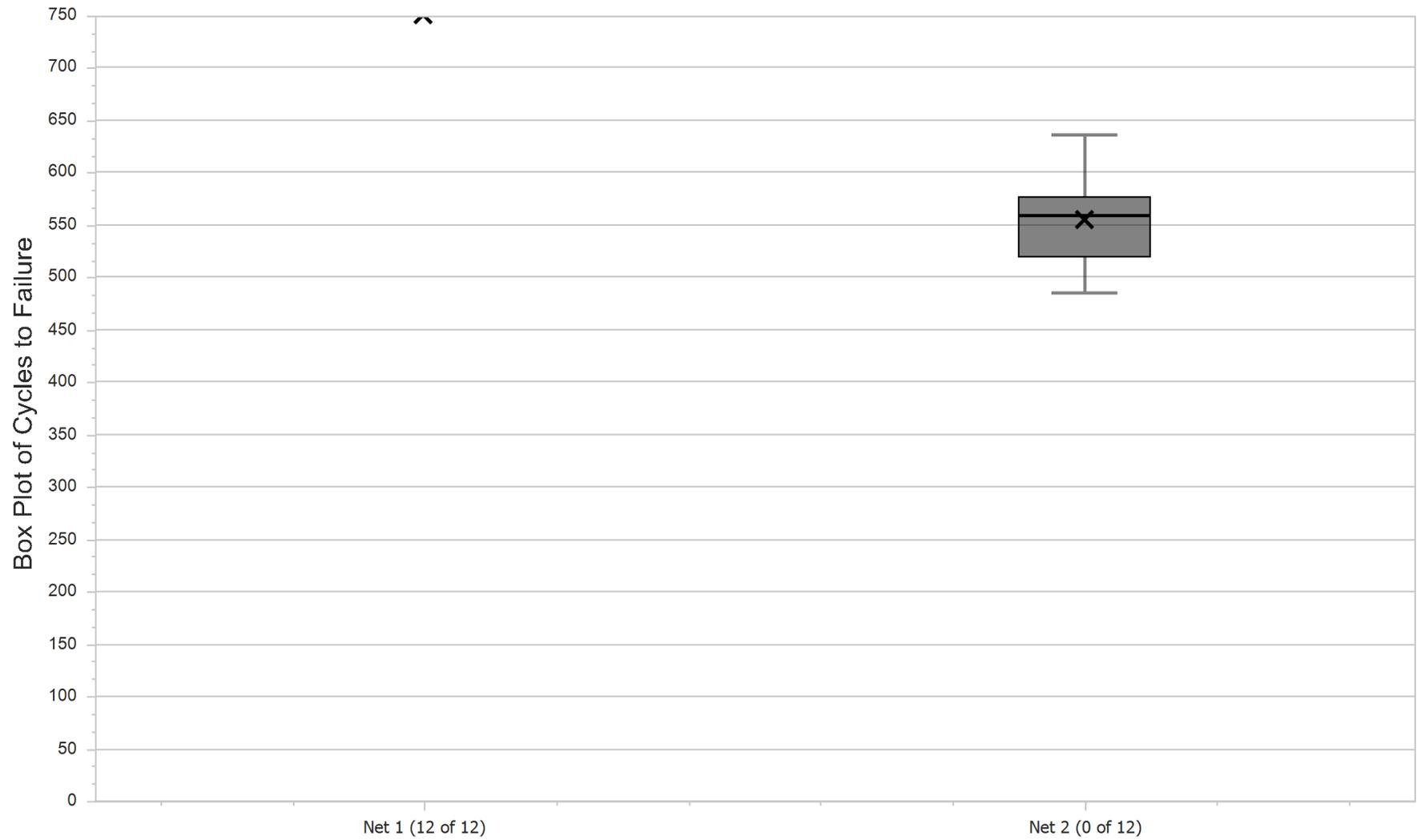
Thermal Cycling - Net 2 Resistance Change



Coupon Number	1	2	3	4	5	6
Reference Resistance (Ohms)	0.76842	0.79788	0.74430	0.76384	0.69275	0.75619
Maximum Resistance % Change	10.28	11.06	9.46	10.39	10.01	9.83
Cycle Failed 5% Limit	546	513	591	551	567	574
Coupon Number	7	8	9	10	11	12
Reference Resistance (Ohms)	0.75503	0.72035	0.66934	0.70893	0.76451	0.76625
Maximum Resistance % Change	9.92	13.08	7.59	10.19	11.46	11.74
Cycle Failed 5% Limit	577	485	636	579	516	523
Coupon Number	13	14	15	16	17	18
Reference Resistance (Ohms)	-	-	-	-	-	-
Maximum Resistance % Change	-	-	-	-	-	-
Cycle Failed 5% Limit	-	-	-	-	-	-



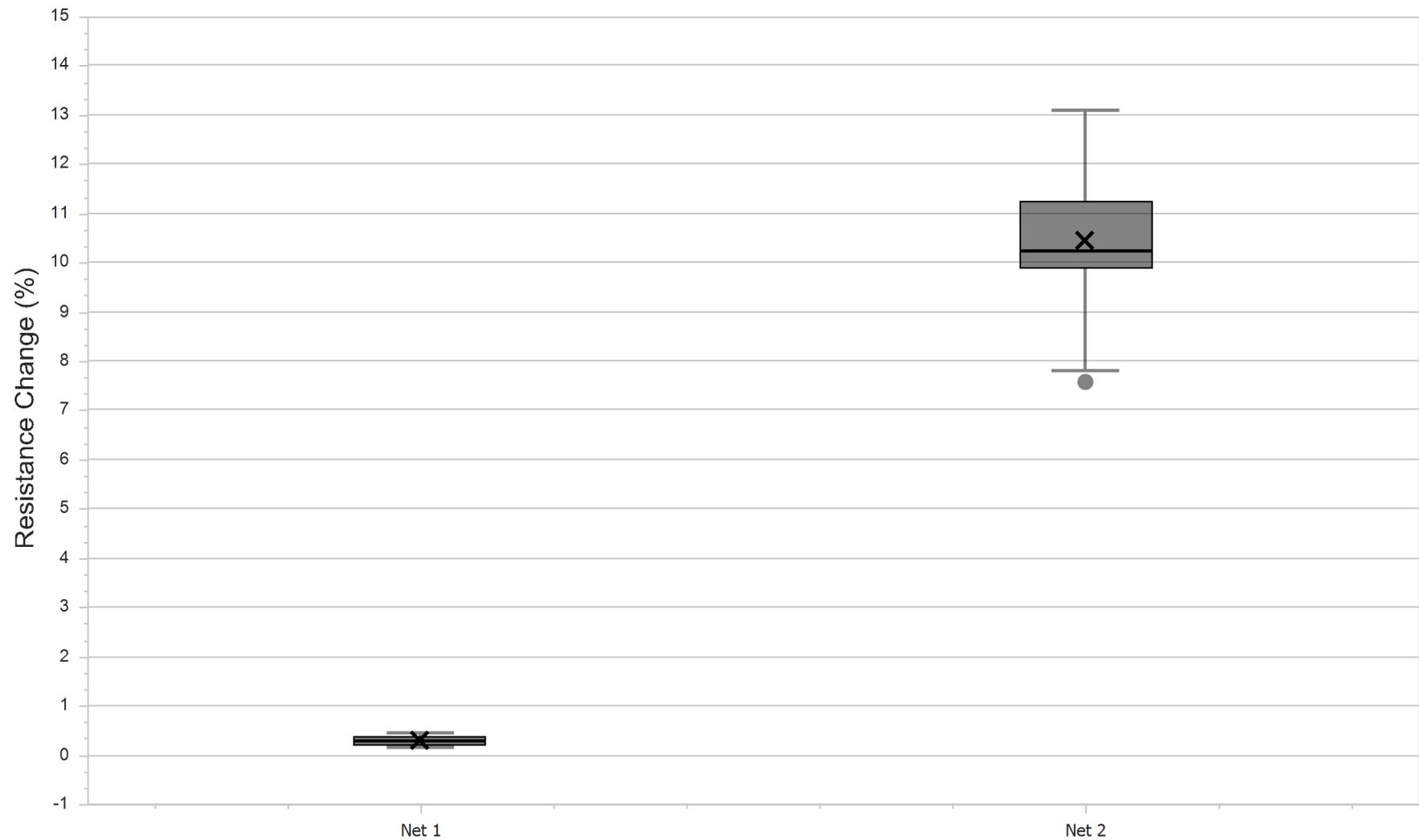
Box Plot of Cycles to Failure



X-Axis: Net Designation (Quantity Passed of Total)



Box Plot of Max Resistance Change (%)





CERTIFICATE OF CONFORMANCE

The Laboratory certifies that the test equipment used complies with the calibration requirements of correlation criterion and that the data contained in this report is accurate within the tolerance limitation of this equipment.

The report is invalid without signature of approver, and the test results of this report are only responsible for tested samples.

The report shall not be reproduced, except in full, without the written approval of the Laboratory.

Edited by:

Reviewed by:

Approved by:

Project Engineer
Date:

Project Manager
Date:

Laboratory Director
Date:

End Of Report