



3rd Party Qualified Manufacturing Plan

Company

Address

City, ST, Zip

IPC J-STD-001H

Section 8: Cleanliness

SIR Test Report

Date, 2025

SIR Testing Executive Summary

EXECUTIVE SUMMARY

- This study will evaluate the performance of batch and inline rinsing with XYZ cleaning chemistry

PROBLEM STATEMENT

- Flux and process residues collect on active circuit traces
- Electrochemical failures (parasitic leakage and/or dendrite formation) are point-specific
- This failure is often found under component terminations

PROCESSES TESTED

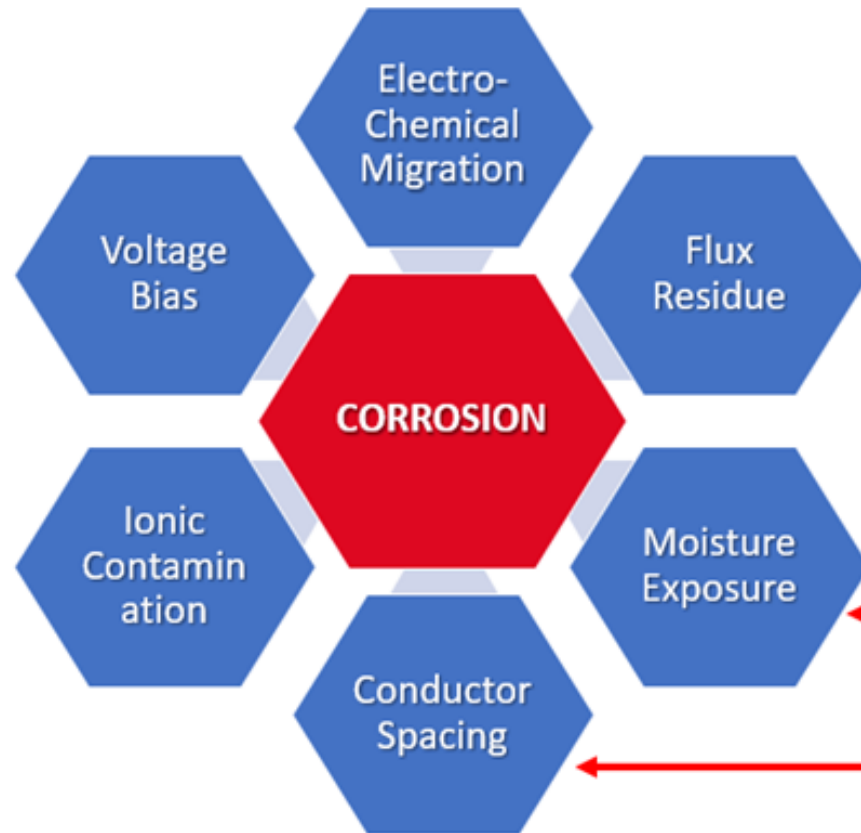
- Surface Mount

MATERIALS AND CLEANING EQUIPMENT TESTED

- MGX B52 Legacy 2 test board reflowed with ABC solder paste and cleaned with XYZ cleaning chemistry
 - Batch Washer – Aqueous Technologies Trident
 - Inline Washer – Aquastorm AS200
-

SIR TEST METHOD

SIR is effective at Testing for Each Risk Factor

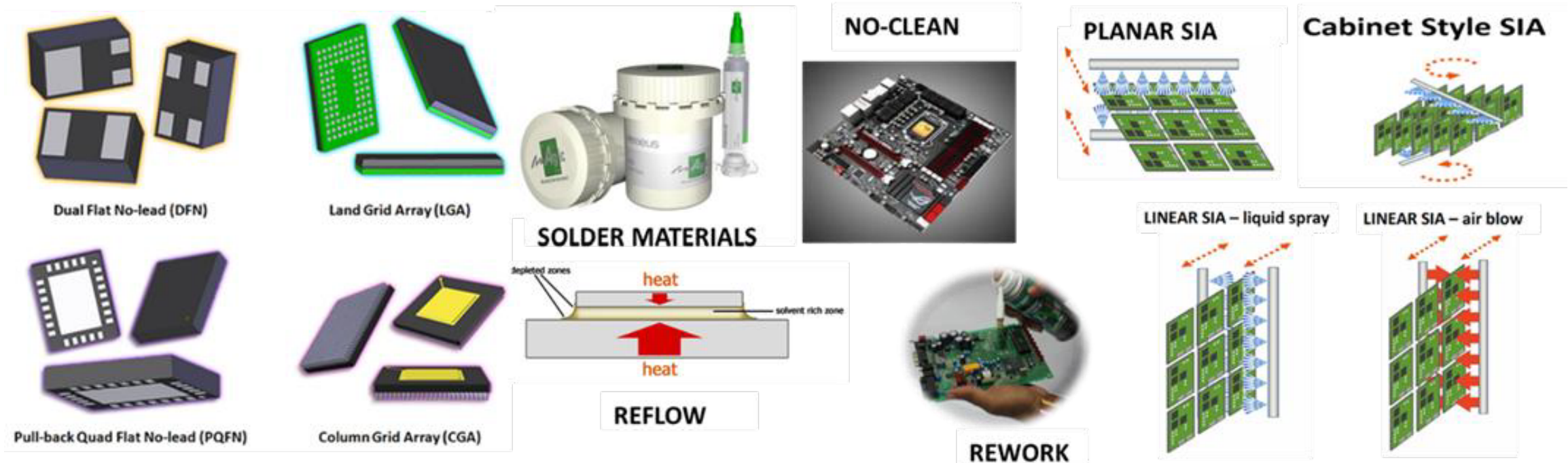


Risk Factor	LOWEST	MID	HIGHEST
Flux	No-Clean	Rosin Activated	Water Soluble
Cleanliness	Flux Residues Cleaned	No-Clean Benign Glassy Shell	Active Flux Residue
Moisture Exposure	Controlled	Moderate	Harsh
SMT	J-Leaded	BGAs	Leadless/BTC
Liquid Flux	Selective Soldering	Wave Soldering	Topical
Manual /Repair	Wire Core Only	Flux Bottle	Topical Cleaning



Electrical and Chemical Test Methods

- SIR determines the effects of process contamination on specific components, soldering materials, reflow, and cleaning conditions.
- Ion Chromatography identifies the ions and their concentration levels.

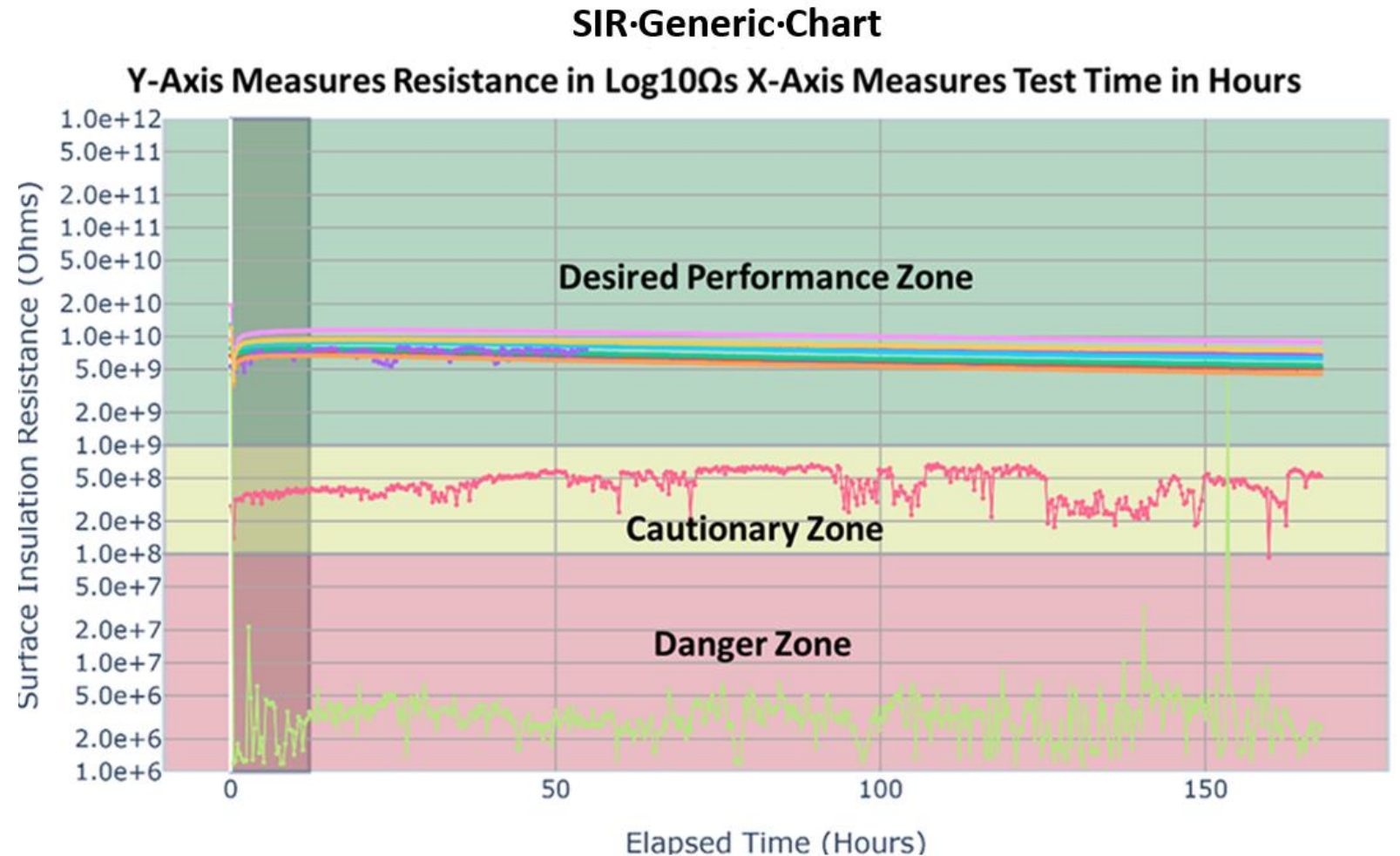


SIR Test Method

- SIR detects the effects of ionic and polar residues
- Test Parameters
 - 40°C
 - 90% RH
 - 5 Volts Bias
 - 168 Hours

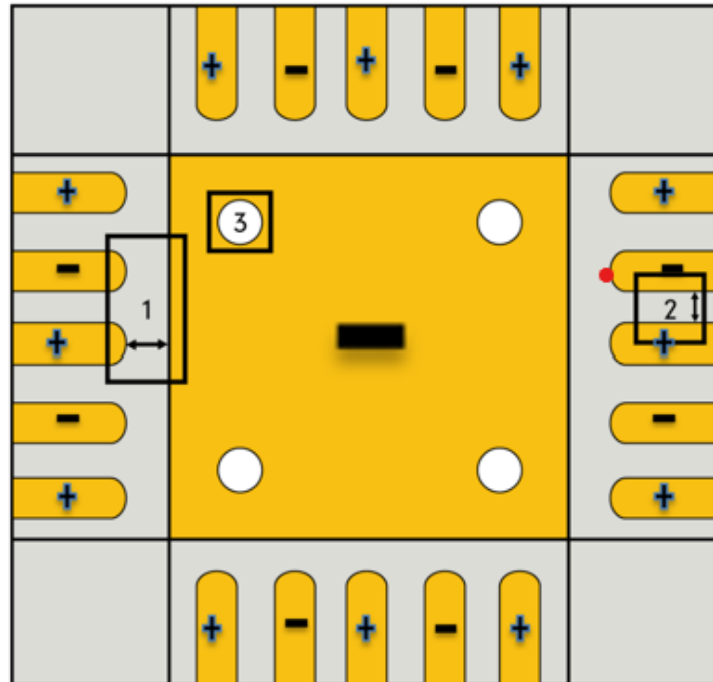
→ Pass/Fail

- **Green** – Pass – Desired Performance
- **Yellow** – Pass – Cautionary
- **Red** – Fail – Danger



Components

- SIR is an electrical test method
- Comb structure of opposite polarity between signal pins
- Detects leakage currents and dendritic growth



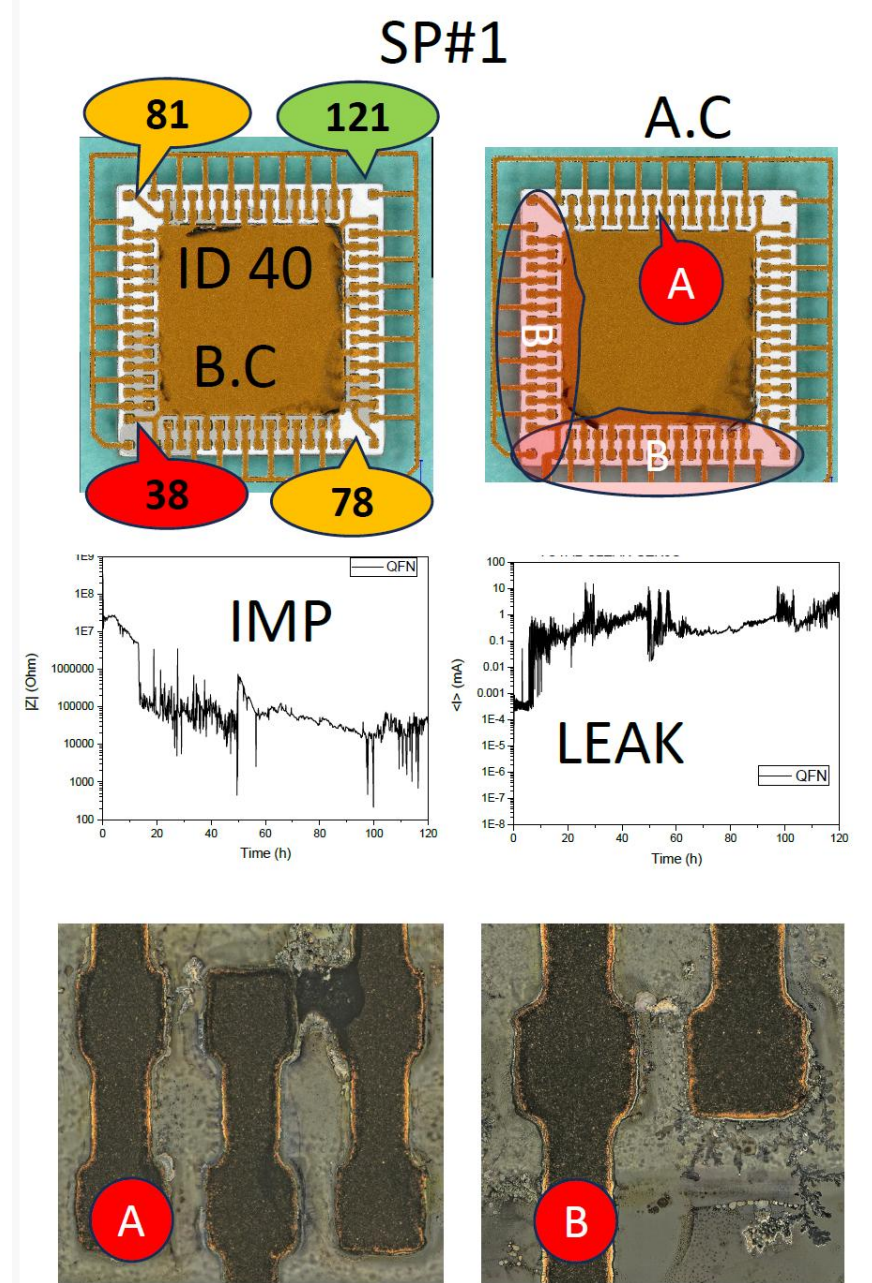
Dendritic Growth Risk Areas
Partially activated flux risk sites

1. b/t grounded thermal pad perimeter and power in I/O
2. b/t power-ground I/O pins
3. Blackside through hole thermal vias where flux has traveled/outgassed

Electrochemical Reliability

– SIR tests for the reliability effects from:

- Components and Boards
- Solder Materials
- Flux Residues
- No Clean vs. Cleaning
- Cleaning agents
- Cleaning machines
- Rinsing
- Wash Bath Control
- Bath Life



TEST PLAN

Batch Cleaning Machines

- Aqueous Tech Trident LDO
 - Rotating Spray Arm Tank to Tank
 - Boards are sprayed perpendicular to the plane



Batch Cleaning Machine Parameters

Batch Cleaning Machine	
Wash	
Chemistry	XYZ Cleaning Agent
Concentration	15%
Wash Temperature	150°F
Wash Time	15 minutes
Rinse	
Rinse Time	20 seconds
Total # of Rinses	10
Cleanliness Set Point	700 k Ω
Rinse Temperature	Ambient
Dryer	
Dryer Time	30 minutes
Dryer Temperature	160°F



Inline Cleaning Machines

- ITW AS 200 Inline
- High-powered direct spray impingement
 - Boards are sprayed perpendicular to the plane
 - Process
 - Pre-Wash/Wash/Chem Iso/Rinse/Final Rinse/Dry
 - Boards are tracked through the wash on a conveyor belt



Cleaning Machines

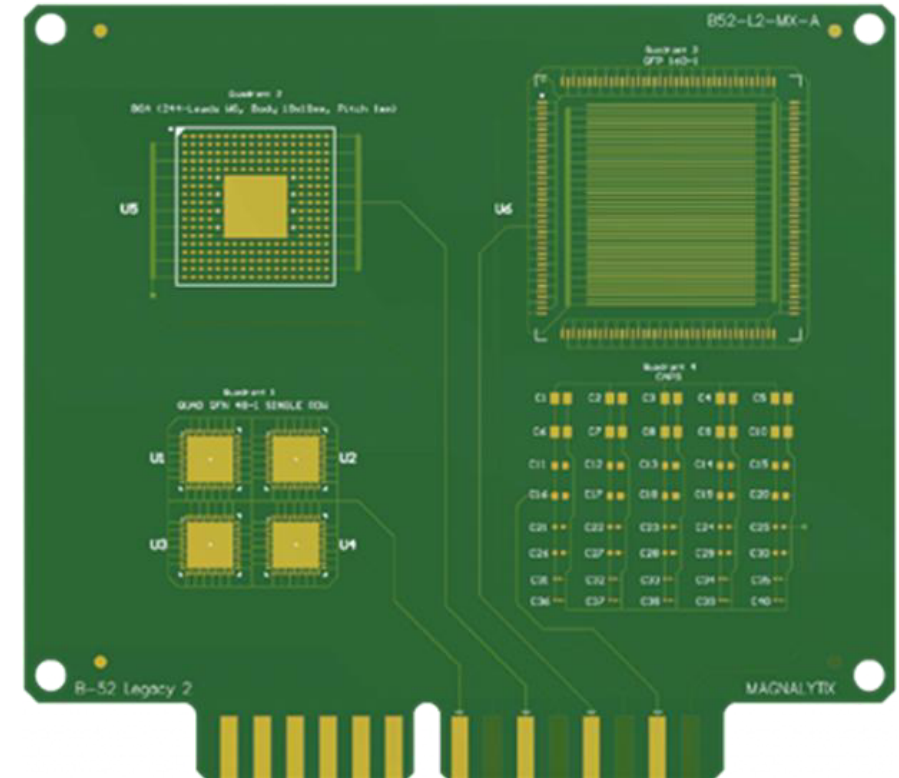
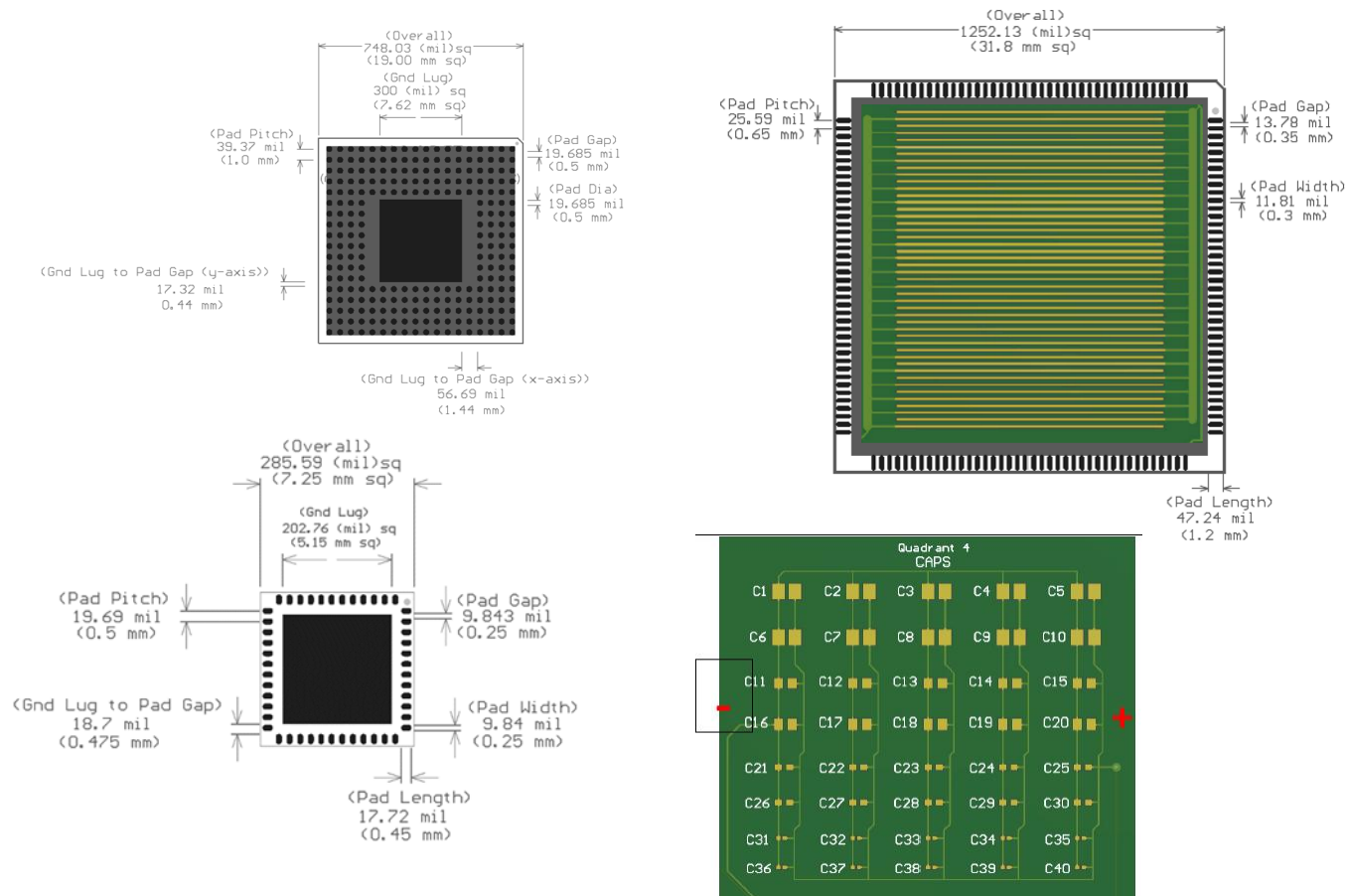
Inline Cleaning Machine	
Wash	
Chemistry	XYZ Cleaning Agent
Concentration	15%
Conveyor Speed	1.0 fpm
Wash Temperature	150°F
Wash Upper Manifold	8 Spray Bar Intermix
Wash Lower Manifold	4 Spray Bar Intermix
Wash Manifold Height	4"
Pre-Wash Upper Pressure	55 PSI
Pre-Wash Lower Pressure	50 PSI
Pre-Wash Flow	1.6 gal/min.
Wash Upper Pressure	60 PSI
Wash Lower Pressure	50 PSI
Wash Upper Hurricane Pressure	40 PSI
Wash Lower Hurricane Pressure	30 PSI



Inline Cleaning Machine	
Chemical Isolation - Rinse	
Chemical Isolation Upper Pressure	20 PSI
Chemical Isolation Lower Pressure	15 PSI
Chemical Isolatin Flow	1.4 gal/min
Rinse Temperature	140°F
Rinse Upper Manifold Configuration	8 Spray Bar Intermix
Rinse Lower Manifold Configuration	4 Spray Bar Intermix
Rinse Manifold Height	4"
Rinse Upper Pressure	80 PSI
Rinse Lower Pressure	70 PSI
Rinse Hurrican Upper Pressure	40 PSI
Rinse Hurricane Lower Pressure	30 PSI
Final Rinse Upper Pressure	60 PSI
Final Rinse Lower Pressure	50 PSI
Final Rinse Flow	1.5 gal/min
Dryer 1 Temperature	180°F
Dryer 2 Temperature	250°F
Dryer 3 Temperature	260°F

MGX B-52 Legacy 2 Test Board

- ABC Solder Paste



MGX B-52 Test Board

- The MGX B-52 test board is a challenging test board due to the use of bottom terminated components.
 - QFNs are challenging to clean due to the large thermal lug, tight pitch, and low standoff gap.
 - The center lug on the BGA 244 adds additional flux residue under the component termination.
 - The QFP-160 SIR comb is highly challenging to clean due to the rectangular pad structure. The SIR comb is useful in detecting rinsing issues.
 - The cap network populated with 40 caps of various sizes and tight density is also a difficult challenge.
- Because of these features, the MGX-B-52 Legacy 2 is more representative of production hardware.

SIR TEST PARAMETERS

SIR Test Parameter Overview

Duration & Interval

Duration:	168 hours
Interval:	10 minutes

Voltage

Bias Voltage:	5v
Measurement Voltage:	5v

Channel Overview

Passing:	14
Warning:	4
Failing:	6

Environmentals

Target Temperature:	40.00 C
Target Humidity:	90 %RH

Measurement Parameters

Pass Limit:	8.000000 Log ₁₀ Ω
Warning Band:	9.000000 Log ₁₀ Ω

Elapsed Time

Started on:	Wed, Feb 5 1:18 PM CST
Completed on:	Wed, Feb 12 1:10 PM CST

SIR Test Validation Overview

Hardware Validation

High Resistance Meter	Status: Online 
Card Controller	Status: Online 
Bias Power Supply	Status: Online 

Validation Results

Slot 1 : Board 53 - Batch	Type : B 52 Legacy 2	Open Pass 	Resistor Pass 
Slot 2 : Board 54 - Batch	Type : B 52 Legacy 2	Open Pass 	Resistor Pass 
Slot 3 : Board 55 - Batch	Type : B 52 Legacy 2	Open Pass 	Resistor Pass 
Slot 4 : Board 57 - Inline	Type : B 52 Legacy 2	Open Pass 	Resistor Pass 
Slot 5 : Board 58 - Inline	Type : B 52 Legacy 2	Open Pass 	Resistor Pass 
Slot 6 : Board 59 - Inline	Type : B 52 Legacy 2	Open Pass 	Resistor Pass 

SIR Test Channel Overview

Chamber Location	Board Type	Identifier	Paste	Cleaning Machine	Wash Conc.	QFN48 - Minimum Reading.	FBGA244 - Minimum Reading	QFP160 - Minimum Reading	SMT Caps - Minimum Reading
Slot 1	B52 Legacy 2	Board 53 - Batch	ABC Solder Paste	Batch Cleaning Machine	15%	Pass	Pass	Pass	Fail
Slot 2	B52 Legacy 2	Board 54 - Batch	ABC Solder Paste	Batch Cleaning Machine	15%	Pass	Pass	Pass	Fail
Slot 3	B52 Legacy 2	Board 55 - Batch	ABC Solder Paste	Batch Cleaning Machine	15%	Pass	Pass	Pass	Fail
Slot 4	B52 Legacy 2	Board 57 - Inline	ABC Solder Paste	Inline Cleaning Machine	15%	Pass	Pass	Pass	Fail
Slot 5	B52 Legacy 2	Board 58 - Inline	ABC Solder Paste	Inline Cleaning Machine	15%	Pass	Pass	Pass	Fail
Slot 6	B52 Legacy 2	Board 59 - Inline	ABC Solder Paste	Inline Cleaning Machine	15%	Pass	Pass	Pass	Fail

BATCH CLEANING MACHINE

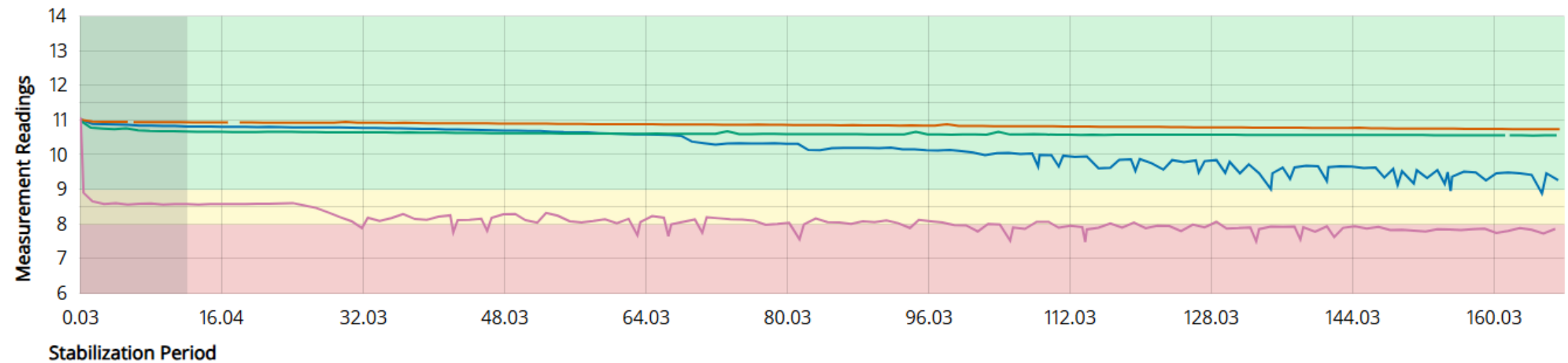
B-52 Legacy 2: Slot #1

Batch Cleaning Machine

Slot
1

Board 53 - Batch

Board Type: B 52 Legacy 2

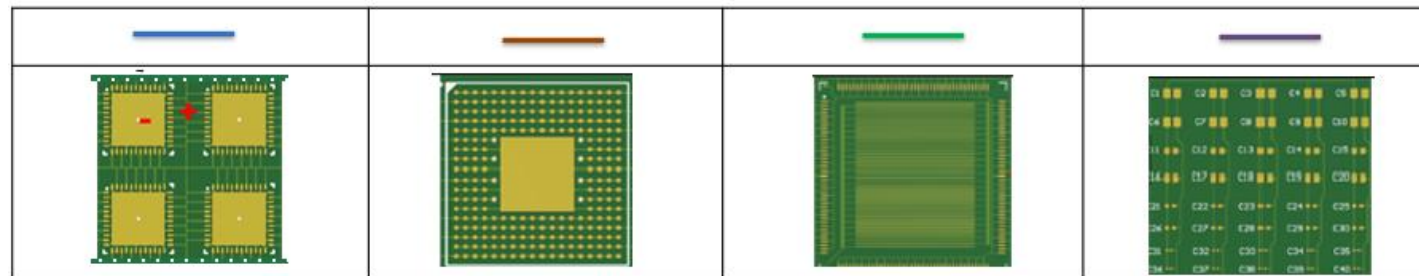


1: Board 53 - Batch A) 4 QFN 48

1: Board 53 - Batch B) 1 FBGA 244

1: Board 53 - Batch C) 1 QFP 160

1: Board 53 - Batch D) 10 0805, 0603, 0402, and 0201 10pF caps



B-52 Legacy 2: Slot #1

Batch Cleaning Machine

Channel A

Component: 4 QFN 48

Measurement Stats

Last Reading: 9.359304 $\text{Log}_{10}\Omega$
Maximum: 10.841702 $\text{Log}_{10}\Omega$
Minimum*: 8.899116 $\text{Log}_{10}\Omega$
Median: 10.189421 $\text{Log}_{10}\Omega$
Mean: 10.184733 $\text{Log}_{10}\Omega$
StdDev: 0.492326 $\text{Log}_{10}\Omega$
Variance: 0.242385 $\text{Log}_{10}\Omega^2$

* Value determines channel color

Measurement Info

Measurement Count: 936

Channel B

Component: 1 FBGA 244

Measurement Stats

Last Reading: 10.744083 $\text{Log}_{10}\Omega$
Maximum: 10.963347 $\text{Log}_{10}\Omega$
Minimum*: 10.744083 $\text{Log}_{10}\Omega$
Median: 10.860566 $\text{Log}_{10}\Omega$
Mean: 10.855444 $\text{Log}_{10}\Omega$
StdDev: 0.060531 $\text{Log}_{10}\Omega$
Variance: 0.003663 $\text{Log}_{10}\Omega^2$

* Value determines channel color

Measurement Info

Measurement Count: 936
Errors: 1 (0.1%)

Channel C

Component: 1 QFP 160

Measurement Stats

Last Reading: 10.571918 $\text{Log}_{10}\Omega$
Maximum: 10.757174 $\text{Log}_{10}\Omega$
Minimum*: 10.568979 $\text{Log}_{10}\Omega$
Median: 10.605372 $\text{Log}_{10}\Omega$
Mean: 10.612745 $\text{Log}_{10}\Omega$
StdDev: 0.032266 $\text{Log}_{10}\Omega$
Variance: 0.001041 $\text{Log}_{10}\Omega^2$

* Value determines channel color

Measurement Info

Measurement Count: 936
Errors: 1 (0.1%)

Channel D

Component: 10 0805, 0603, 0402, and 0201
10pF caps

Measurement Stats

Last Reading: 7.775519 $\text{Log}_{10}\Omega$
Maximum: 8.636373 $\text{Log}_{10}\Omega$
Minimum*: 7.495600 $\text{Log}_{10}\Omega$
Median: 8.035910 $\text{Log}_{10}\Omega$
Mean: 8.072919 $\text{Log}_{10}\Omega$
StdDev: 0.219116 $\text{Log}_{10}\Omega$
Variance: 0.048011 $\text{Log}_{10}\Omega^2$

* Value determines channel color

Measurement Info

Measurement Count: 936

First Failure Detected:

Thu, Feb 6 9:10 PM CST

Elapsed Time: 31.86 hours

Total Failed Measurements: 398 (42.52%)

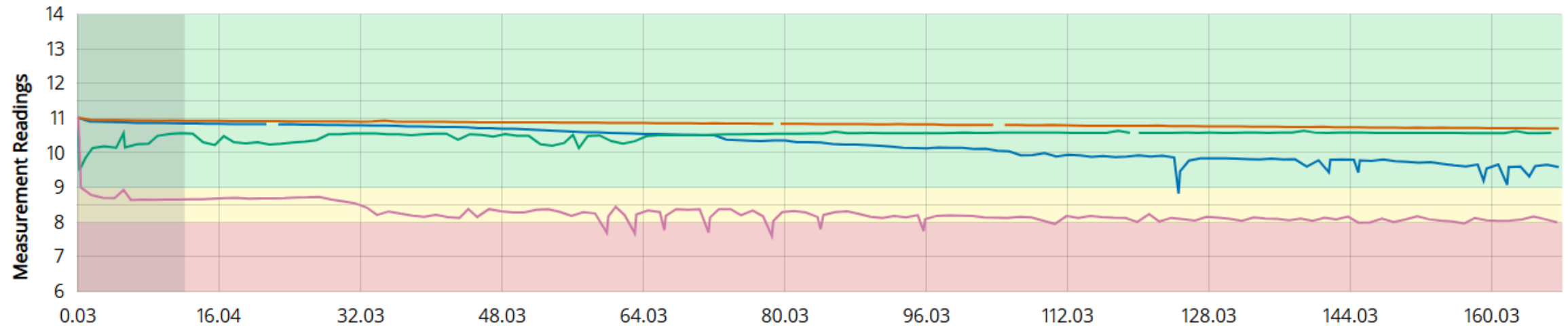
B-52 Legacy 2: Slot #2

Batch Cleaning Machine

Slot
2

Board 54 - Batch

Board Type: B 52 Legacy 2

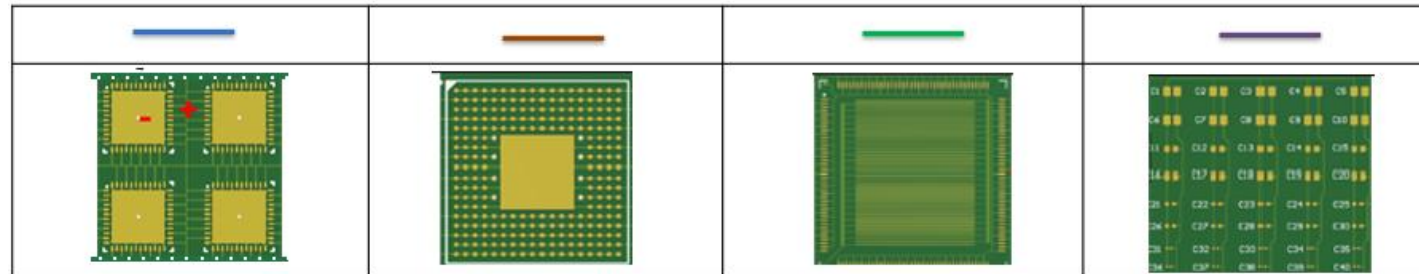


2: Board 54 - Batch A) 4 QFN 48

2: Board 54 - Batch B) 1 FBGA 244

2: Board 54 - Batch C) 1 QFP 160

2: Board 54 - Batch D) 10 0805, 0603, 0402, and 0201 10pF caps



B-52 Legacy 2: Slot #2

Batch Cleaning Machine

Channel A

Component: 4 QFN 48

Measurement Stats

Last Reading: 9.600307 $\text{Log}_{10}\Omega$
Maximum: 10.870610 $\text{Log}_{10}\Omega$
Minimum*: 8.838616 $\text{Log}_{10}\Omega$
Median: 10.225863 $\text{Log}_{10}\Omega$
Mean: 10.246645 $\text{Log}_{10}\Omega$
StdDev: 0.432456 $\text{Log}_{10}\Omega$
Variance: 0.187019 $\text{Log}_{10}\Omega^2$

* Value determines channel color

Measurement Info

Measurement Count: 936
Errors: 1 (0.1%)

Channel B

Component: 1 FBGA 244

Measurement Stats

Last Reading: 10.714406 $\text{Log}_{10}\Omega$
Maximum: 10.955970 $\text{Log}_{10}\Omega$
Minimum*: 10.714105 $\text{Log}_{10}\Omega$
Median: 10.840434 $\text{Log}_{10}\Omega$
Mean: 10.834222 $\text{Log}_{10}\Omega$
StdDev: 0.066085 $\text{Log}_{10}\Omega$
Variance: 0.004366 $\text{Log}_{10}\Omega^2$

* Value determines channel color

Measurement Info

Measurement Count: 936
Errors: 2 (0.2%)

Channel C

Component: 1 QFP 160

Measurement Stats

Last Reading: 10.584484 $\text{Log}_{10}\Omega$
Maximum: 10.654302 $\text{Log}_{10}\Omega$
Minimum*: 10.149889 $\text{Log}_{10}\Omega$
Median: 10.581553 $\text{Log}_{10}\Omega$
Mean: 10.532626 $\text{Log}_{10}\Omega$
StdDev: 0.100582 $\text{Log}_{10}\Omega$
Variance: 0.010116 $\text{Log}_{10}\Omega^2$

* Value determines channel color

Measurement Info

Measurement Count: 936
Errors: 1 (0.1%)

Channel D

Component: 10 0805, 0603, 0402, and 0201
10pF caps

Measurement Stats

Last Reading: 8.048401 $\text{Log}_{10}\Omega$
Maximum: 8.744767 $\text{Log}_{10}\Omega$
Minimum*: 7.615625 $\text{Log}_{10}\Omega$
Median: 8.198498 $\text{Log}_{10}\Omega$
Mean: 8.242861 $\text{Log}_{10}\Omega$
StdDev: 0.206686 $\text{Log}_{10}\Omega$
Variance: 0.042719 $\text{Log}_{10}\Omega^2$

* Value determines channel color

Measurement Info

Measurement Count: 936



First Failure Detected:

Sat, Feb 8 1:10 AM CST

Elapsed Time: 59.86 hours

Total Failed Measurements: 39 (4.17%)

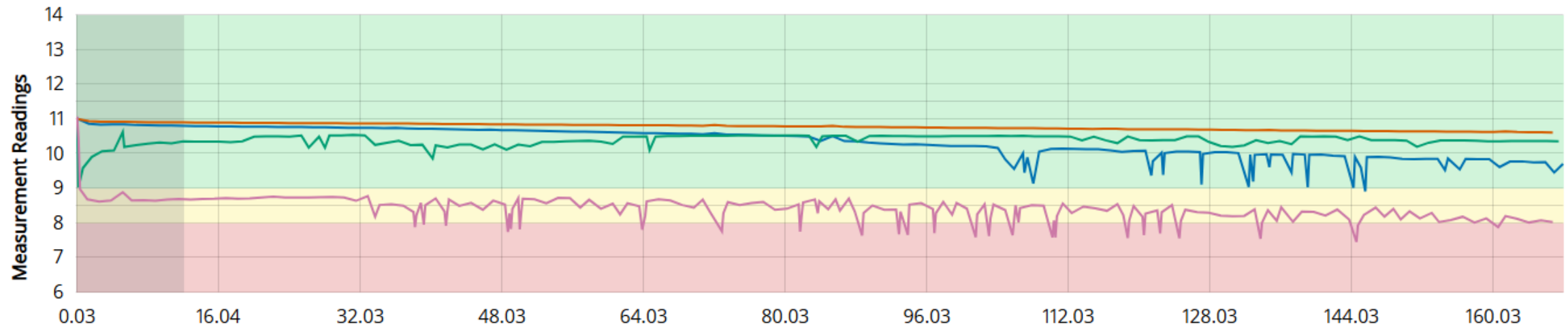
B-52 Legacy 2: Slot #3

Batch Machine Cleaning

Slot
3

Board 55 - Batch

Board Type: B 52 Legacy 2

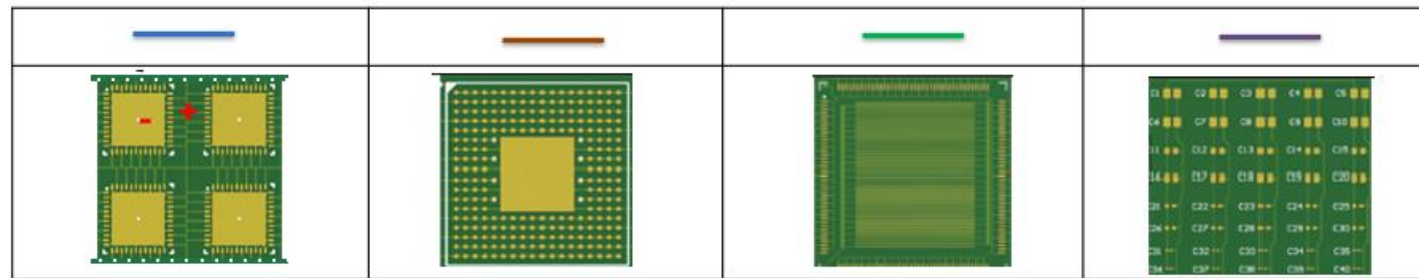


3: Board 55 - Batch A) 4 QFN 48

3: Board 55 - Batch B) 1 FBGA 244

3: Board 55 - Batch C) 1 QFP 160

3: Board 55 - Batch D) 10 0805, 0603, 0402, and 0201 10pF caps



B-52 Legacy 2: Slot #3

Batch Cleaning Machine

Channel A

Component: 4 QFN 48

Measurement Stats

Last Reading: 9.712491 $\text{Log}_{10}\Omega$

Maximum: 10.846132 $\text{Log}_{10}\Omega$

Minimum*: 8.918733 $\text{Log}_{10}\Omega$

Median: 10.318542 $\text{Log}_{10}\Omega$

Mean: 10.309351 $\text{Log}_{10}\Omega$

StdDev: 0.387658 $\text{Log}_{10}\Omega$

Variance: 0.150278 $\text{Log}_{10}\Omega^2$

** Value determines channel color*

Measurement Info

Measurement Count: 936

Channel B

Component: 1 FBGA 244

Measurement Stats

Last Reading: 10.619125 $\text{Log}_{10}\Omega$

Maximum: 10.920513 $\text{Log}_{10}\Omega$

Minimum*: 10.616337 $\text{Log}_{10}\Omega$

Median: 10.777620 $\text{Log}_{10}\Omega$

Mean: 10.771520 $\text{Log}_{10}\Omega$

StdDev: 0.086727 $\text{Log}_{10}\Omega$

Variance: 0.007521 $\text{Log}_{10}\Omega^2$

** Value determines channel color*

Measurement Info

Measurement Count: 936

Channel C

Component: 1 QFP 160

Measurement Stats

Last Reading: 10.370819 $\text{Log}_{10}\Omega$

Maximum: 10.551241 $\text{Log}_{10}\Omega$

Minimum*: 9.864639 $\text{Log}_{10}\Omega$

Median: 10.395501 $\text{Log}_{10}\Omega$

Mean: 10.413326 $\text{Log}_{10}\Omega$

StdDev: 0.109808 $\text{Log}_{10}\Omega$

Variance: 0.012057 $\text{Log}_{10}\Omega^2$

** Value determines channel color*

Measurement Info

Measurement Count: 936

Channel D

Component: 10 0805, 0603, 0402, and 0201
10pF caps

Measurement Stats

Last Reading: 8.050127 $\text{Log}_{10}\Omega$

Maximum: 8.791037 $\text{Log}_{10}\Omega$

Minimum*: 7.459031 $\text{Log}_{10}\Omega$

Median: 8.457157 $\text{Log}_{10}\Omega$

Mean: 8.429350 $\text{Log}_{10}\Omega$

StdDev: 0.238843 $\text{Log}_{10}\Omega$

Variance: 0.057046 $\text{Log}_{10}\Omega^2$

** Value determines channel color*

Measurement Info

Measurement Count: 936

First Failure Detected:

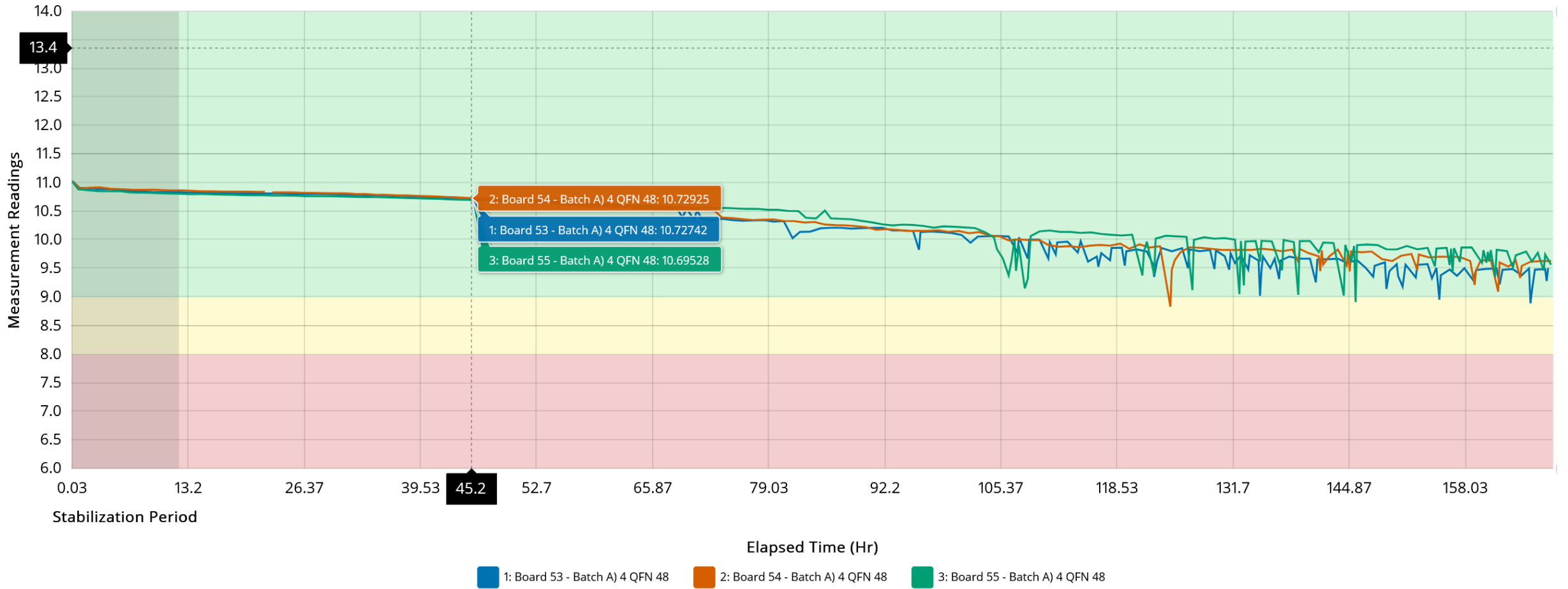
Fri, Feb 7 3:30 AM CST

Elapsed Time: 38.20 hours

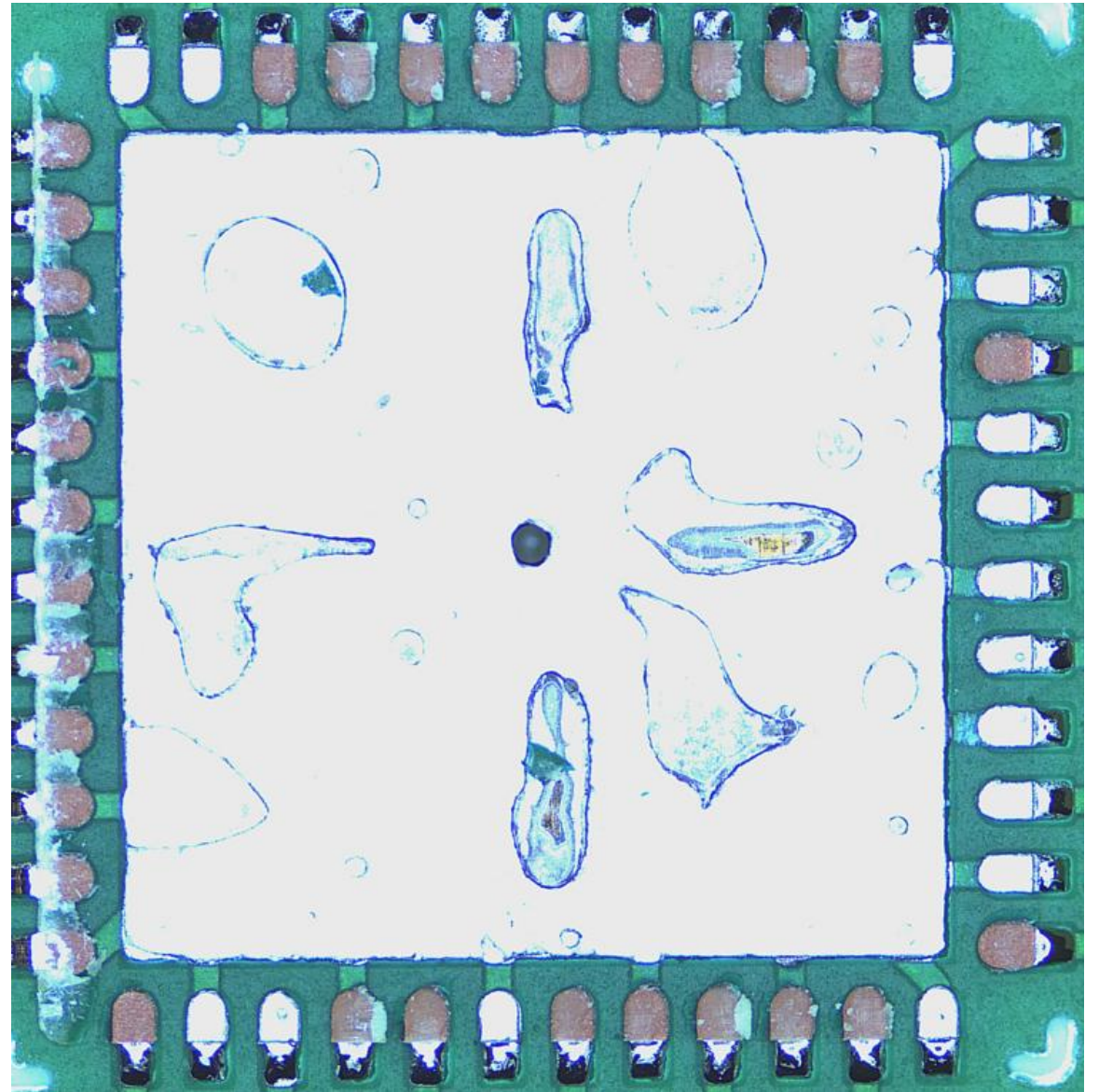
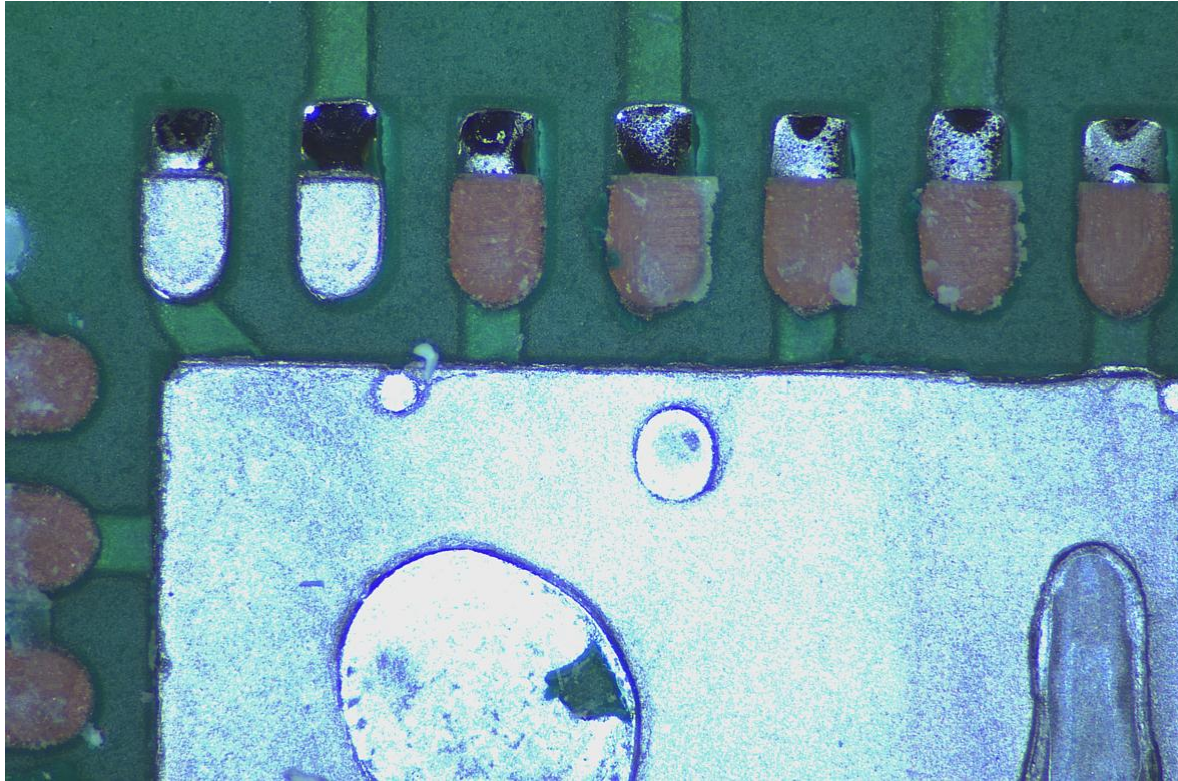
Total Failed Measurements: 36 (3.85%)

QFN-48

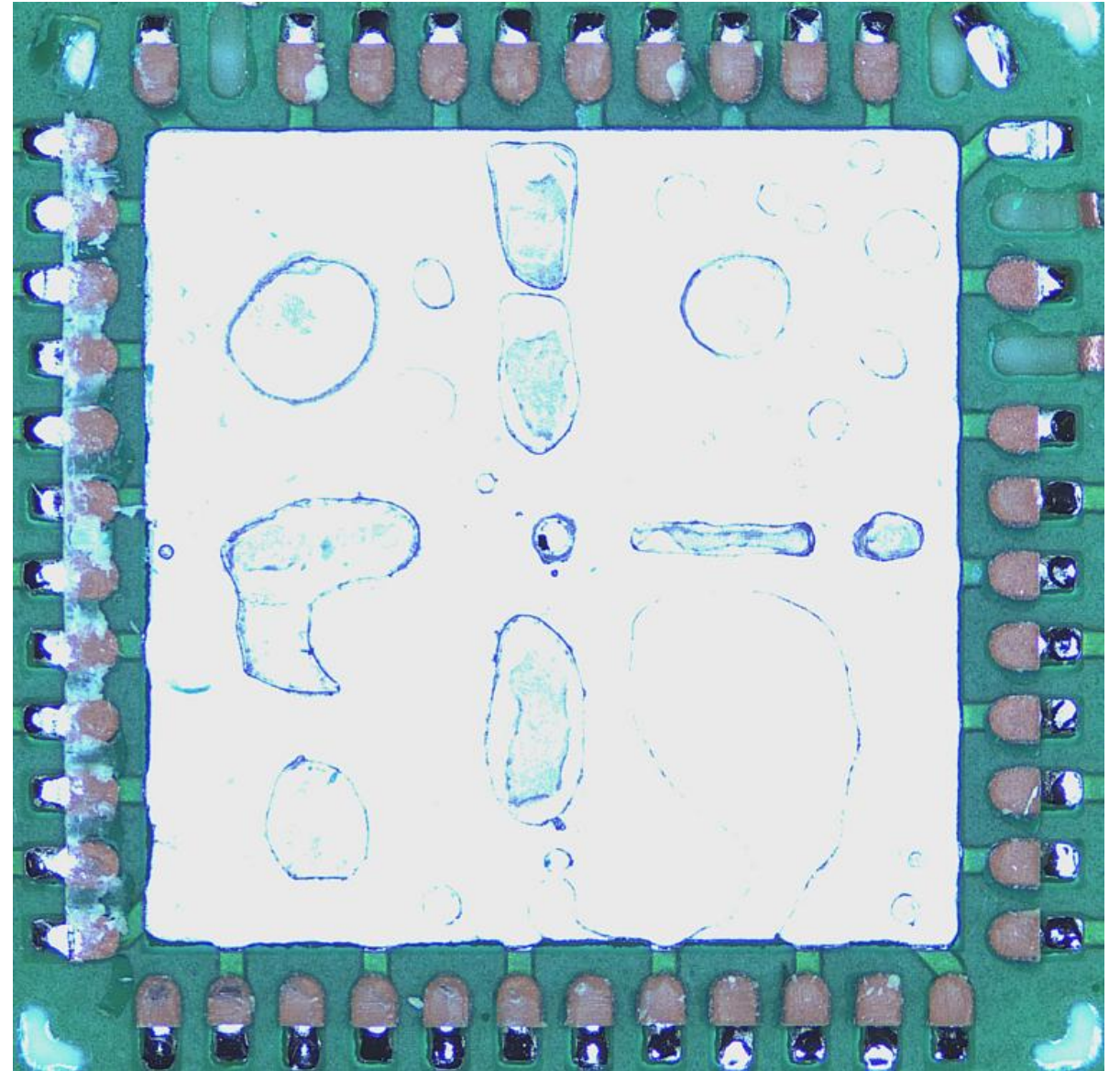
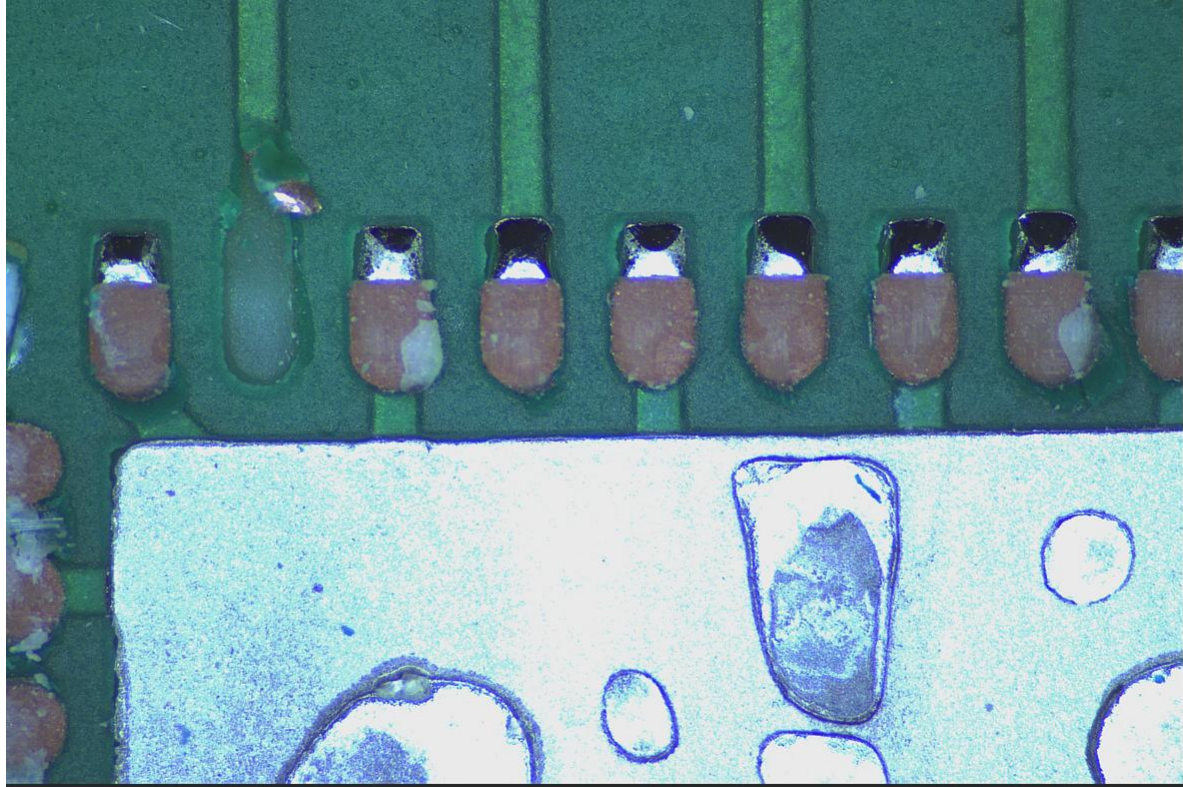
Batch Cleaning Machine



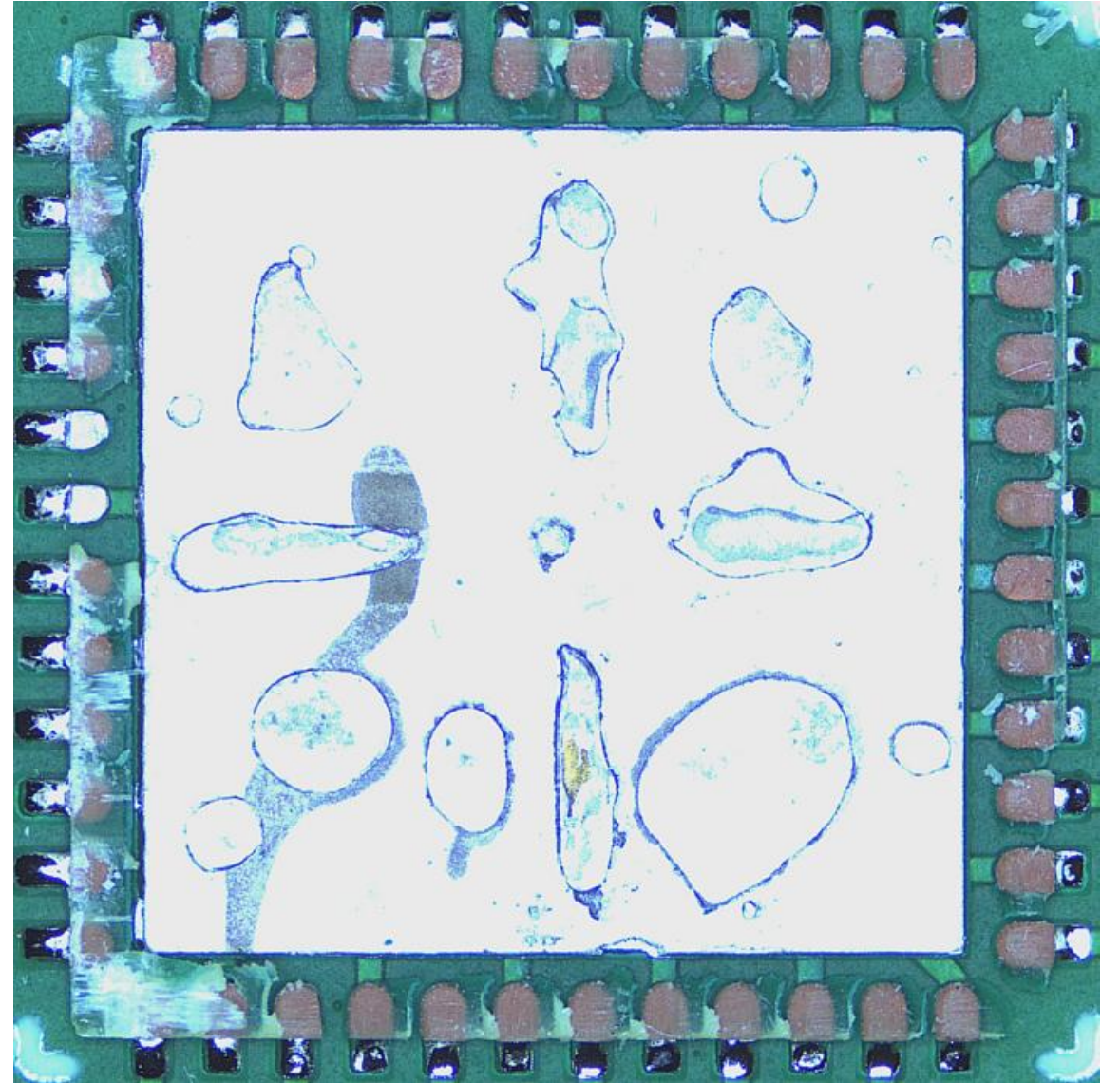
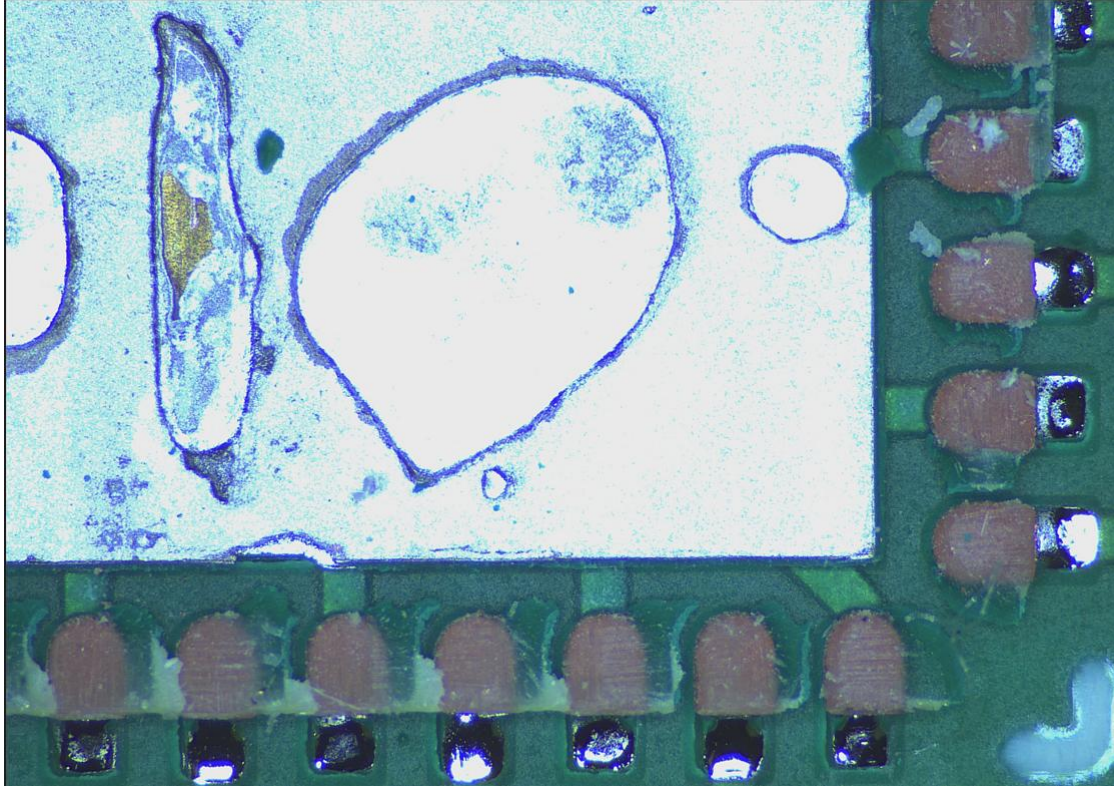
QFN-48 Board #1



QFN-48 Board #2

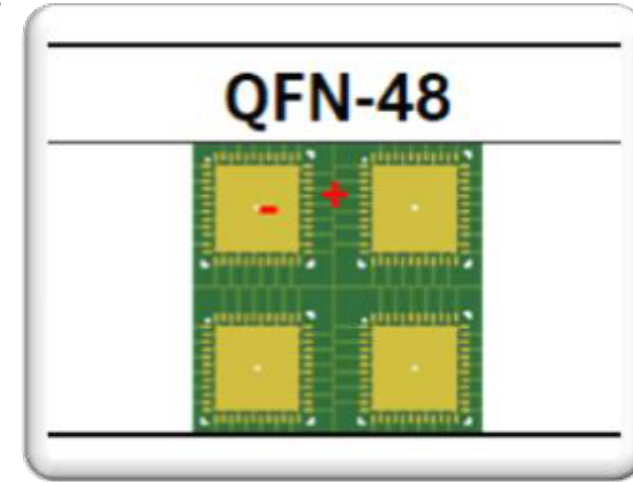


QFN-48 Board #3



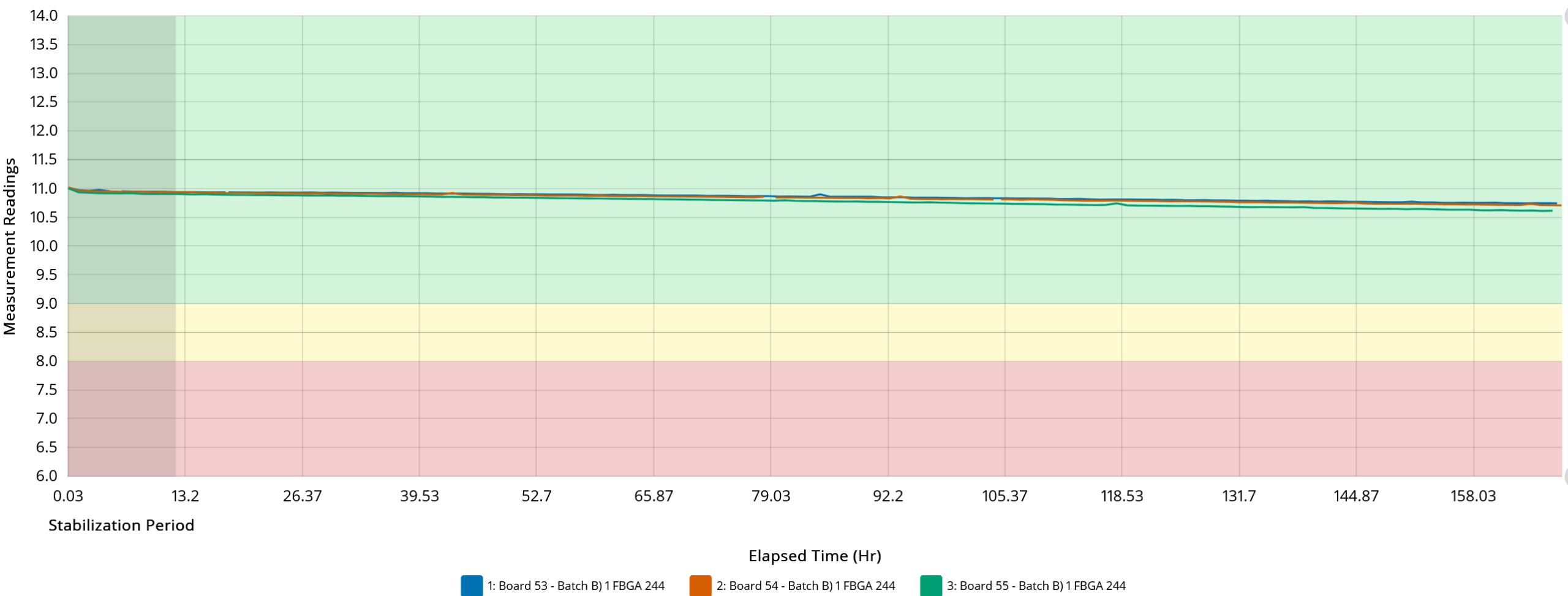
QFN-48 – Batch Cleaning Machine

- Trace levels of flux residue under the component terminations
- SIR was in the desired performance zone over the testing period
- There was a slight decline during the testing period
 - Indicative of trace flux residue
 - Could also be an indicator that the flux package is deliquescent
 - Mild leakage currents occurred at the 105-hour mark onward
- SIR passed

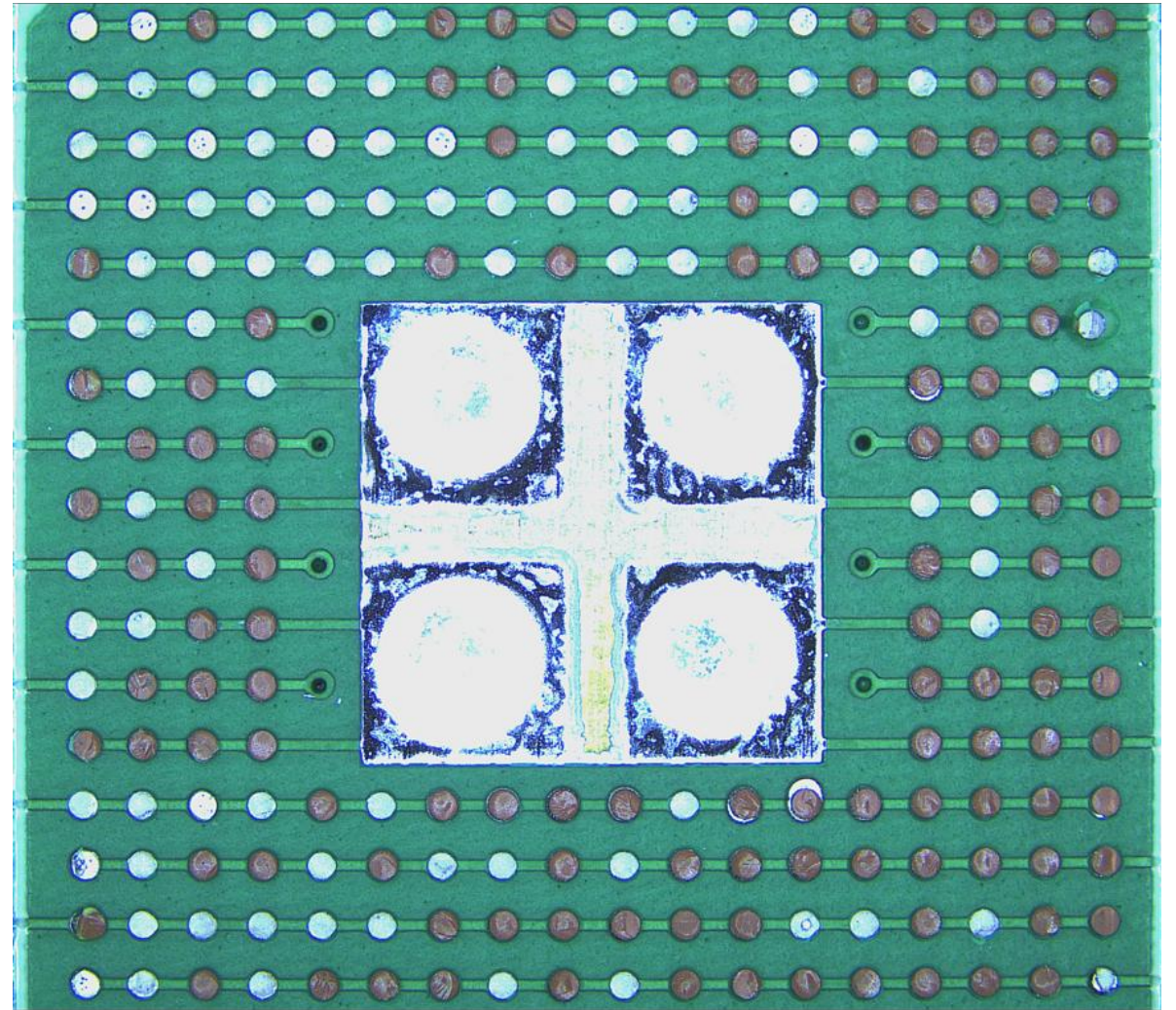
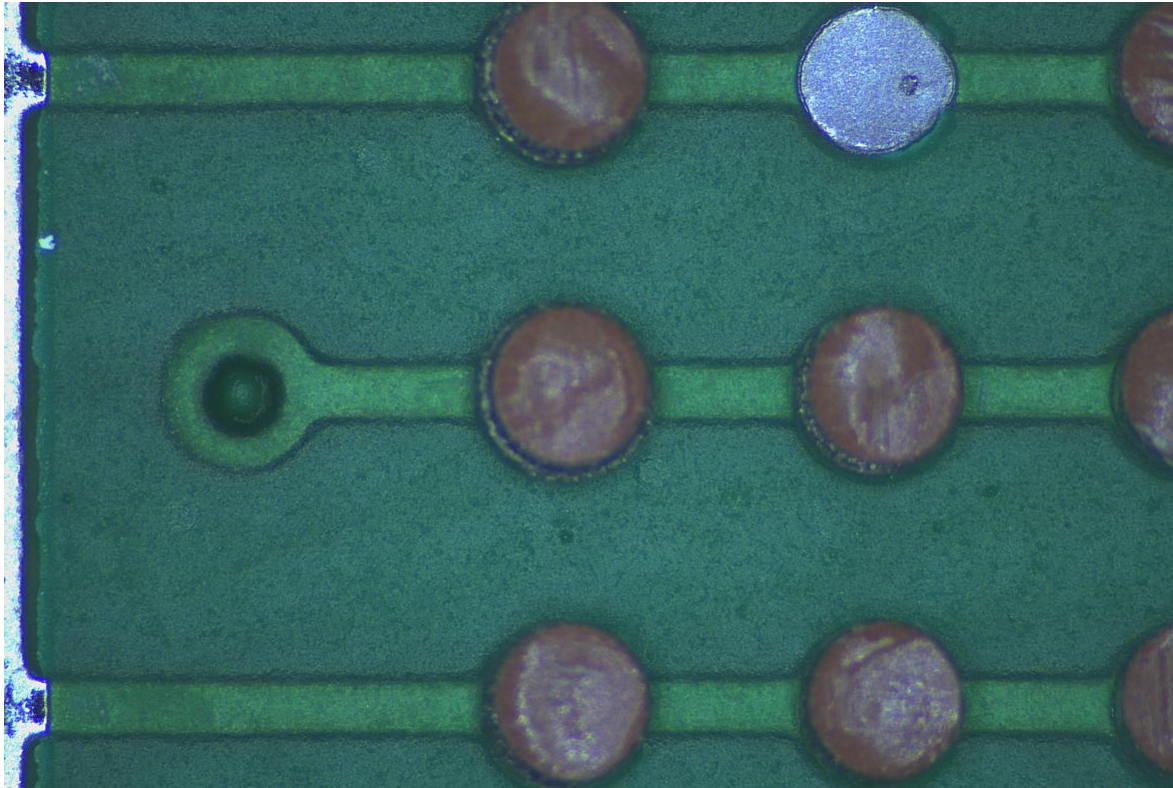


BGA 244 with a Center Lug

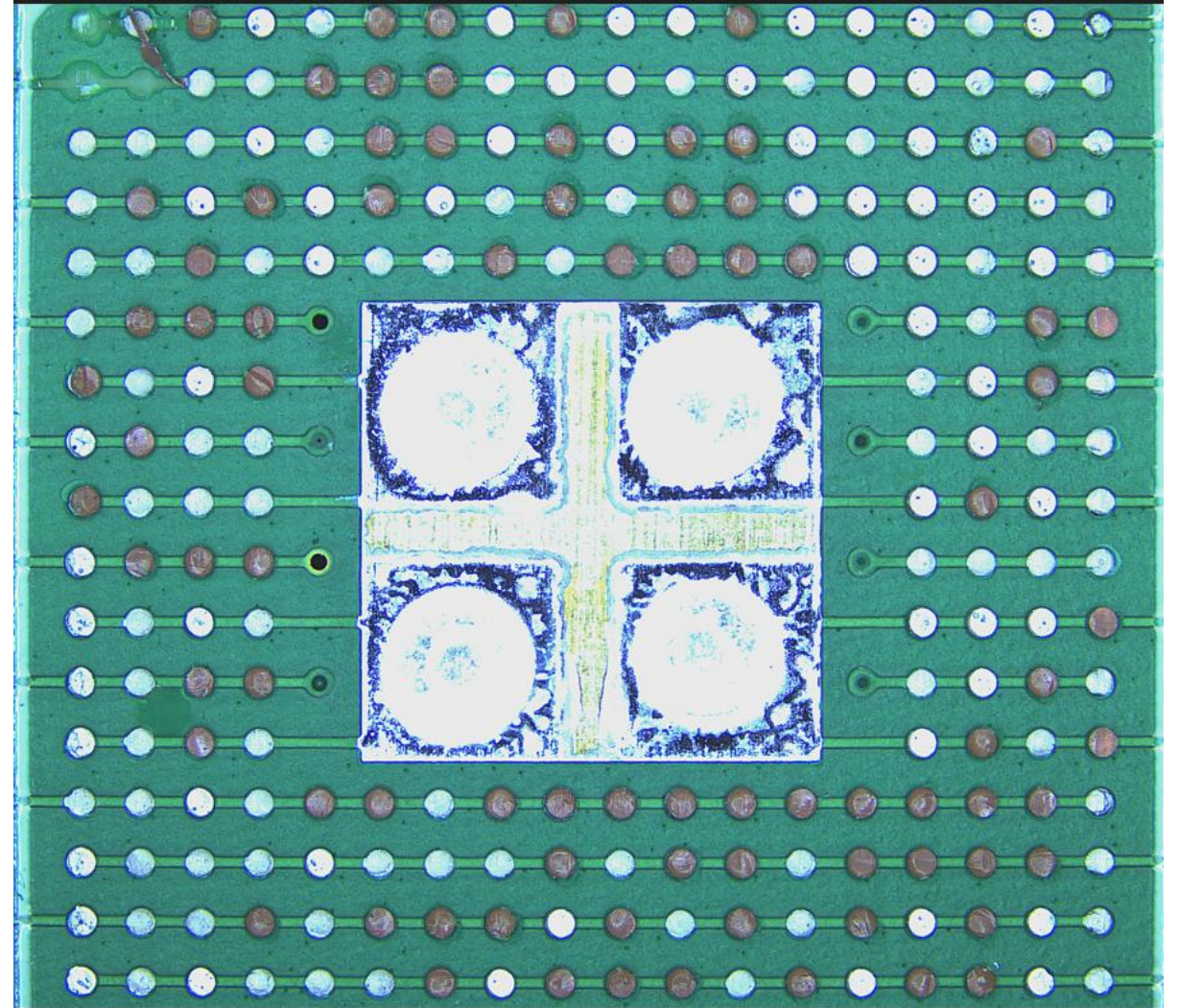
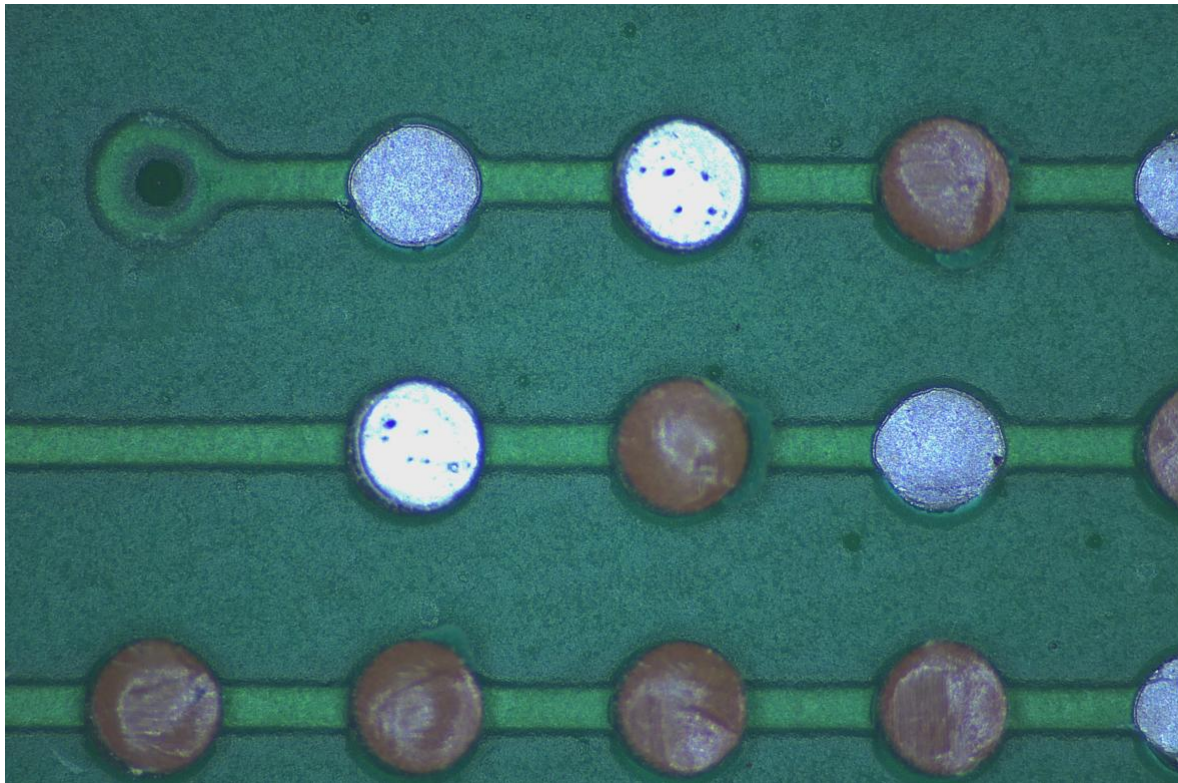
Batch Cleaning Machine



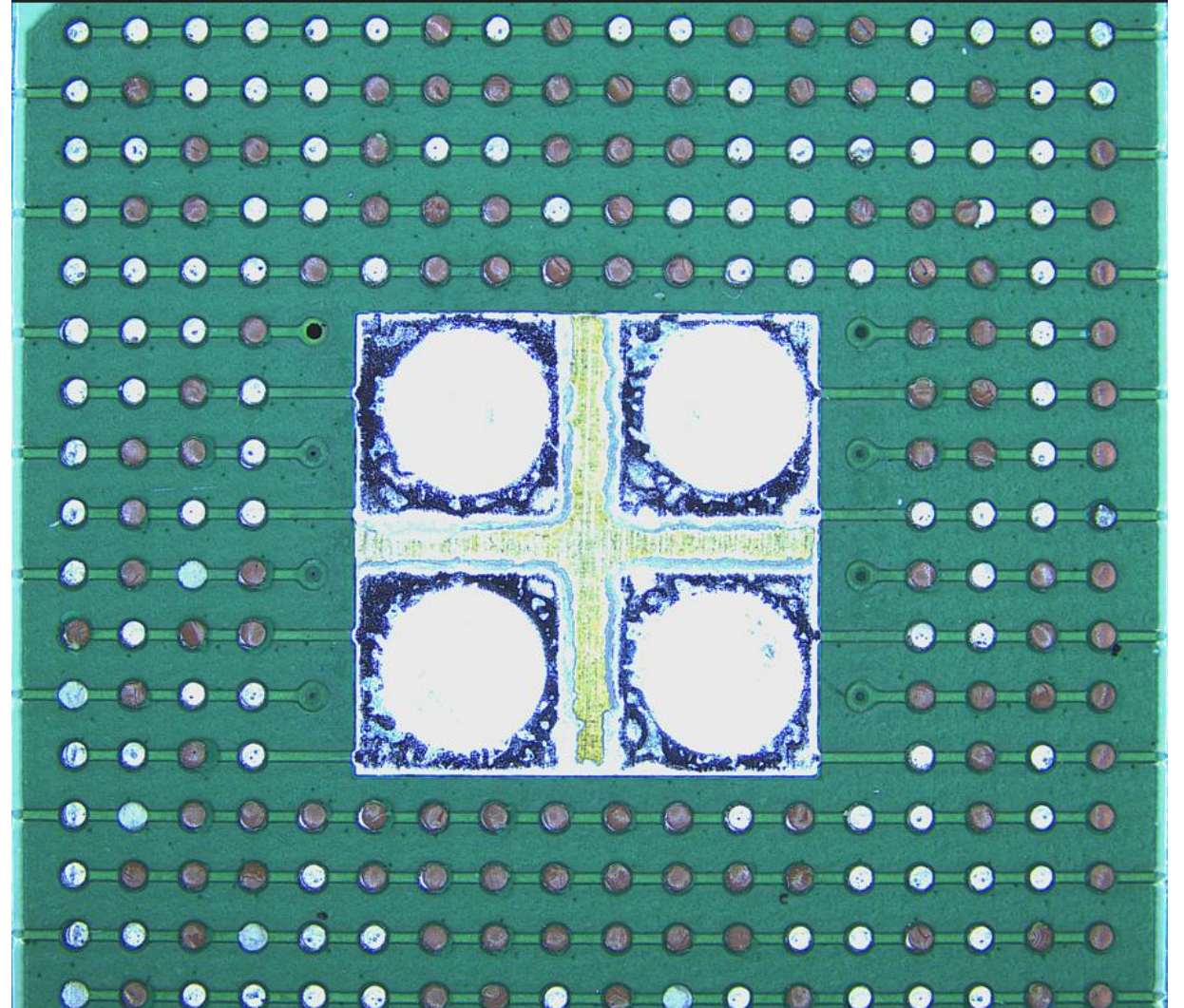
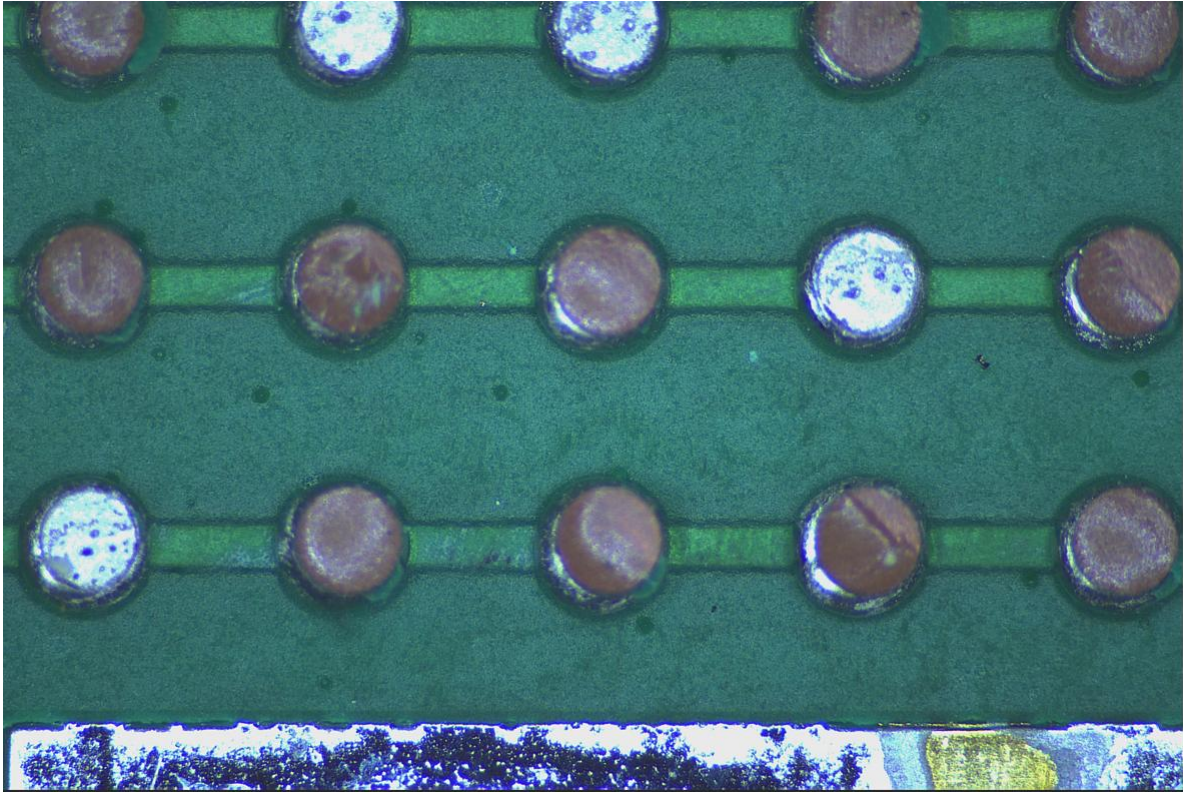
BGA 244 with a Center Board #1



BGA 244 with a Center Board #2

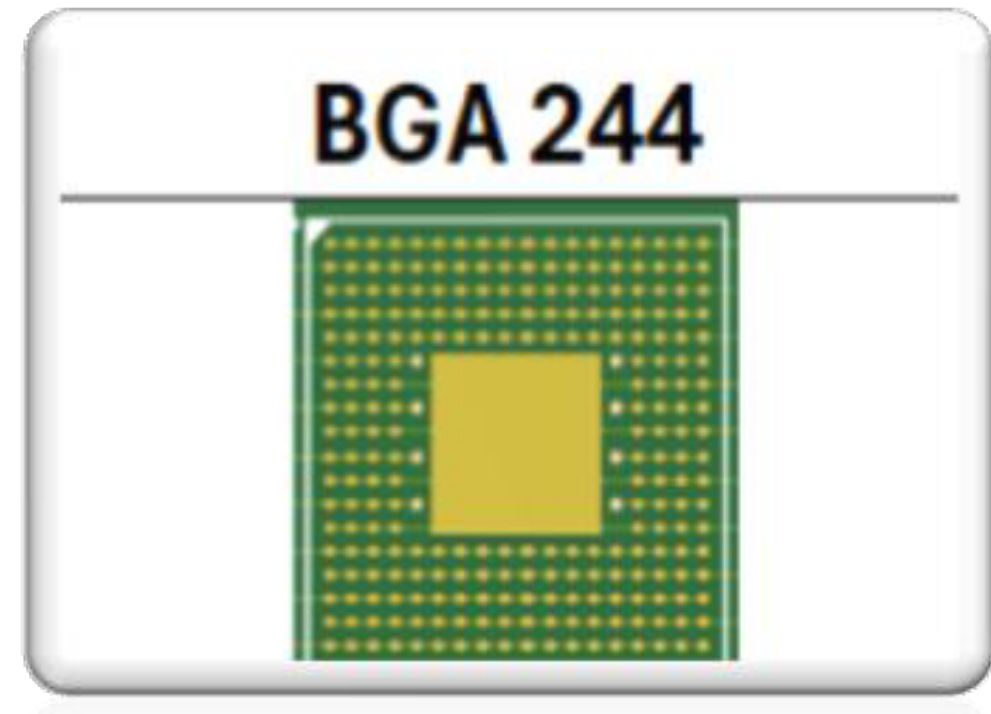


BGA 244 with a Center Board #3

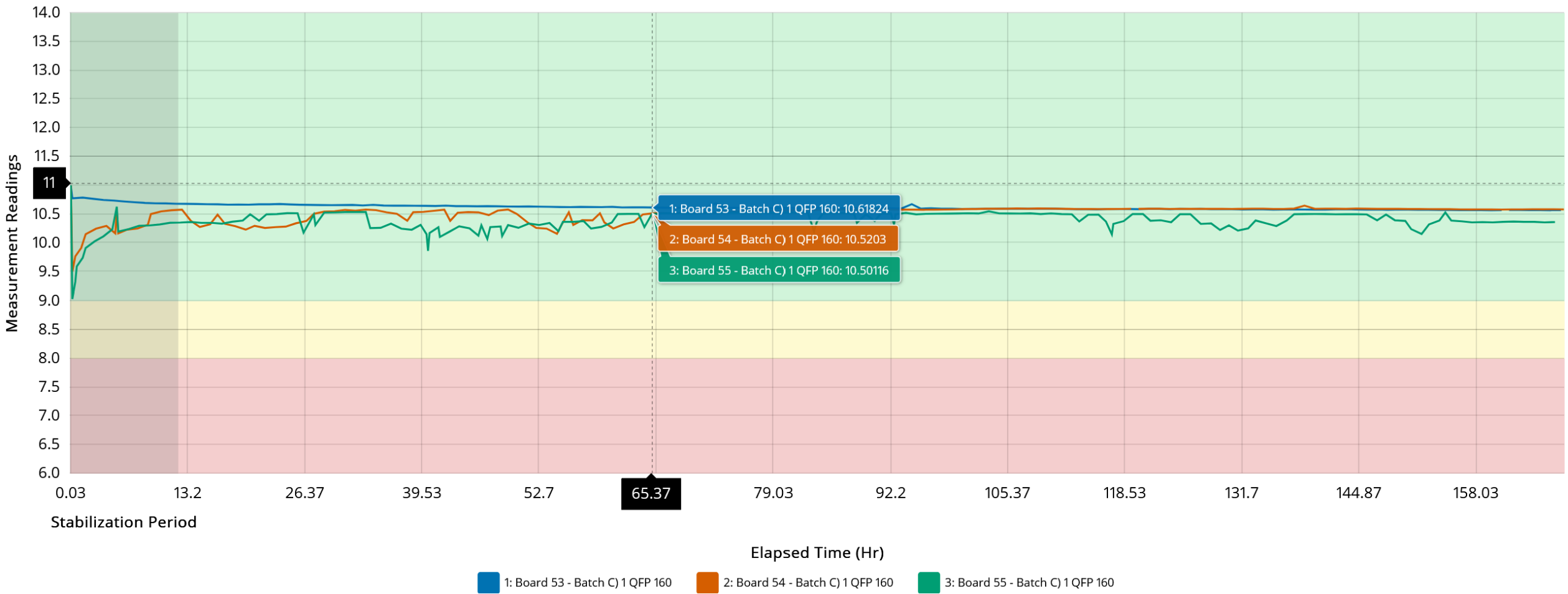


BGA 244 with a Center Lug Batch Cleaning Machine

- No flux residue under the component terminations
- SIR was in the desired performance zone over the testing period
- There was a slight (minor) decline during the testing period
- No leakage currents
- SIR passed

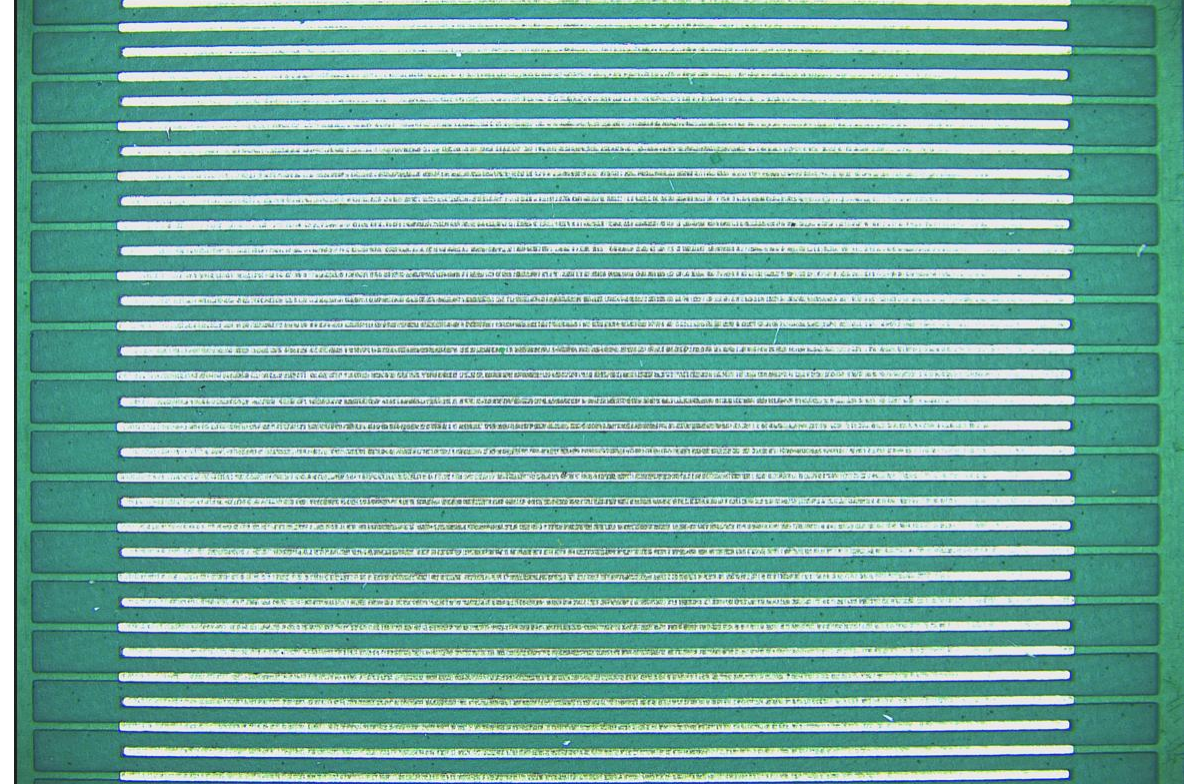
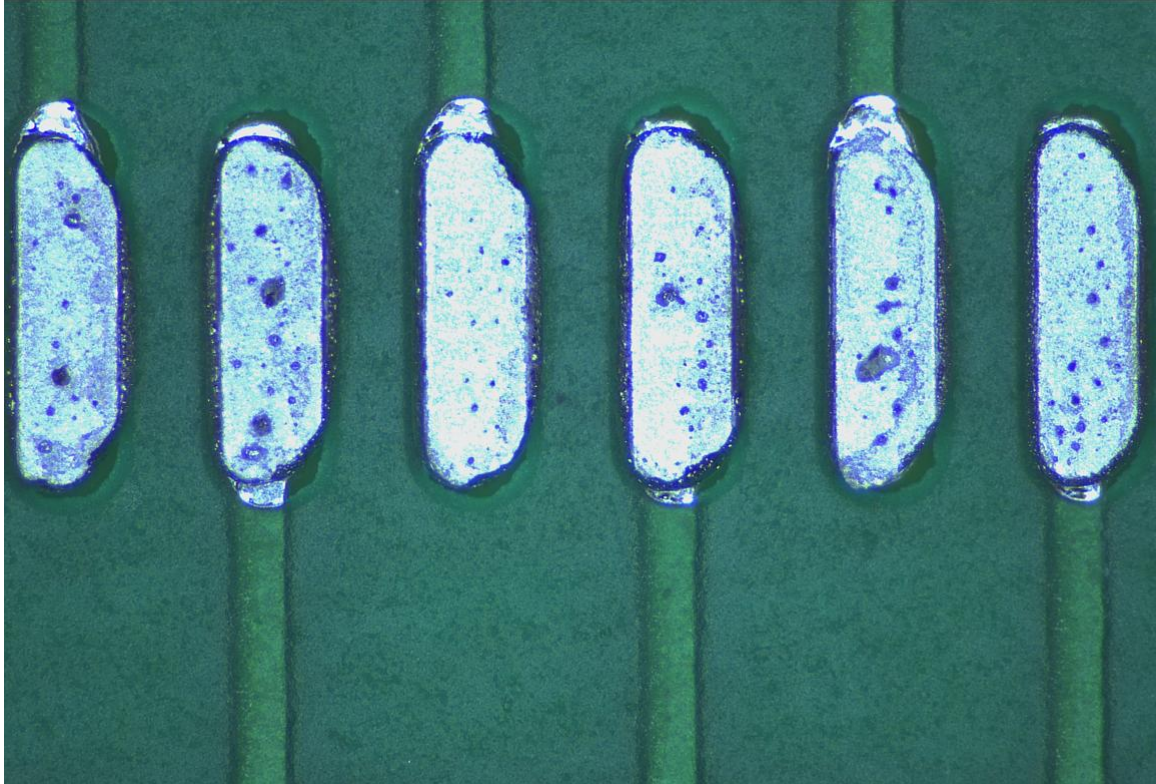


QFP-160 with an SIR Comb Batch Cleaning Machine



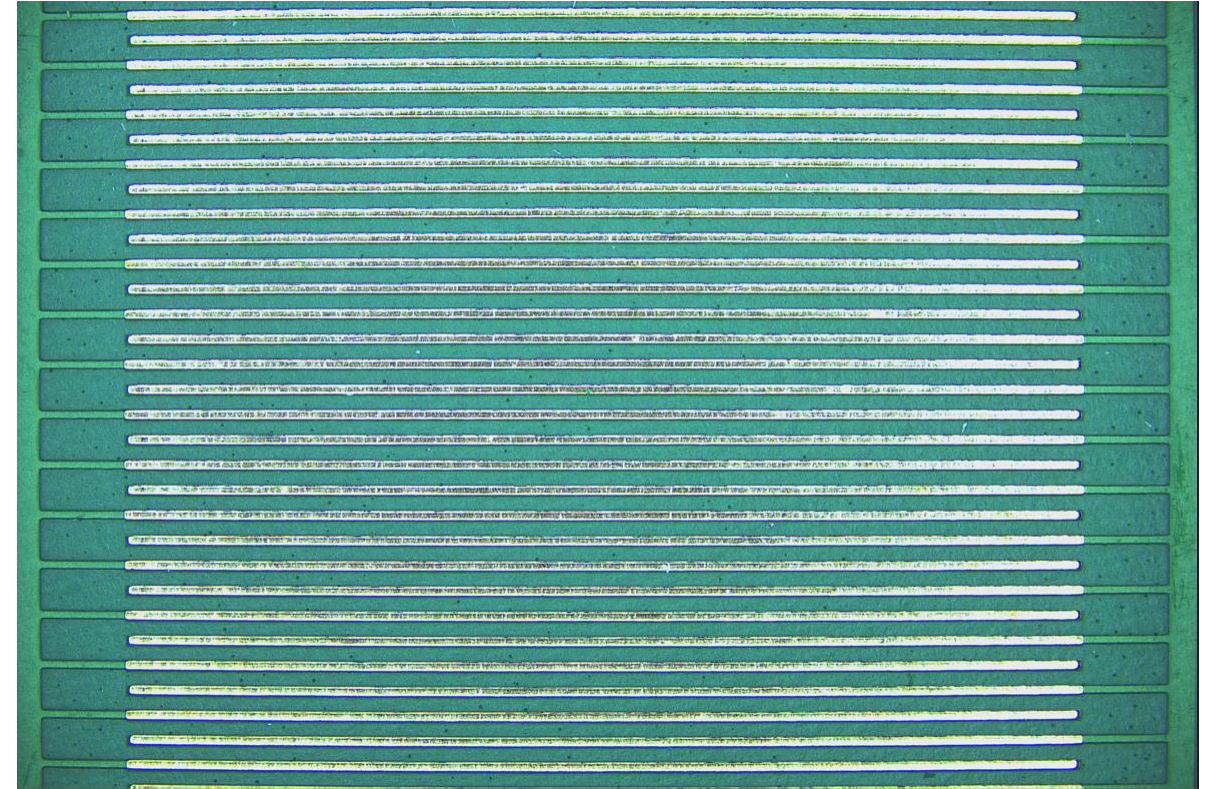
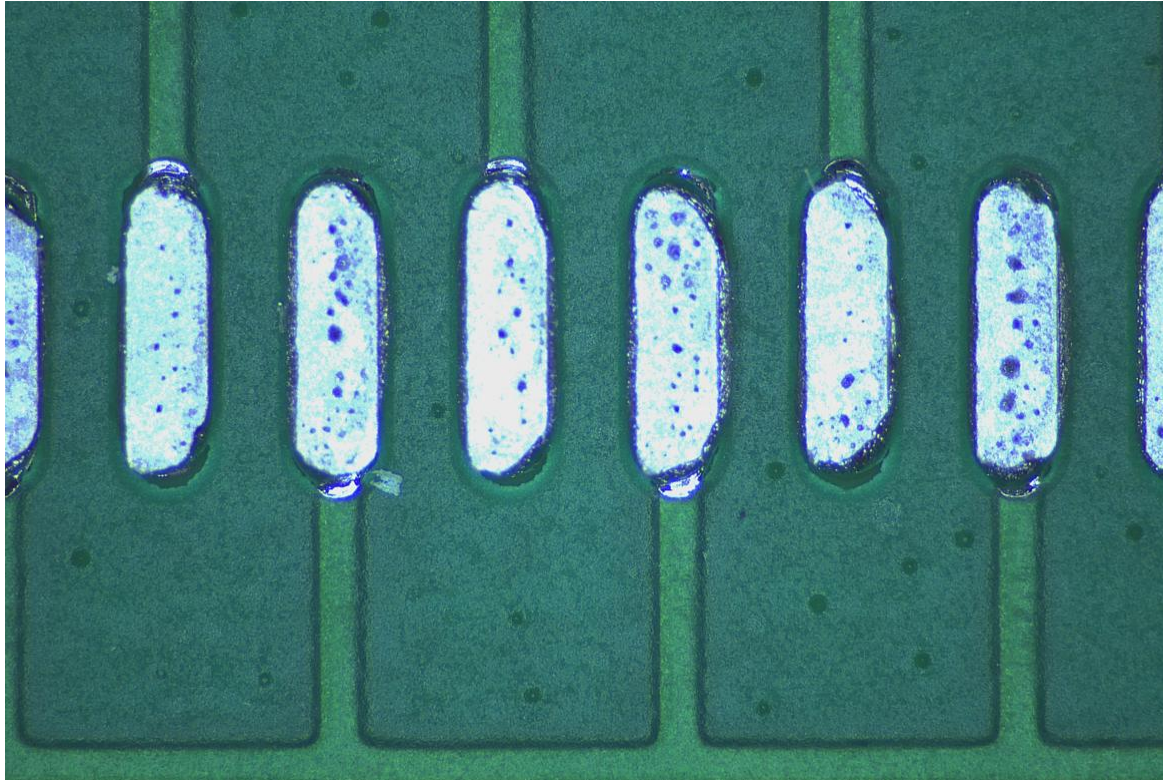
QFP-160 with an SIR Comb

Board #1



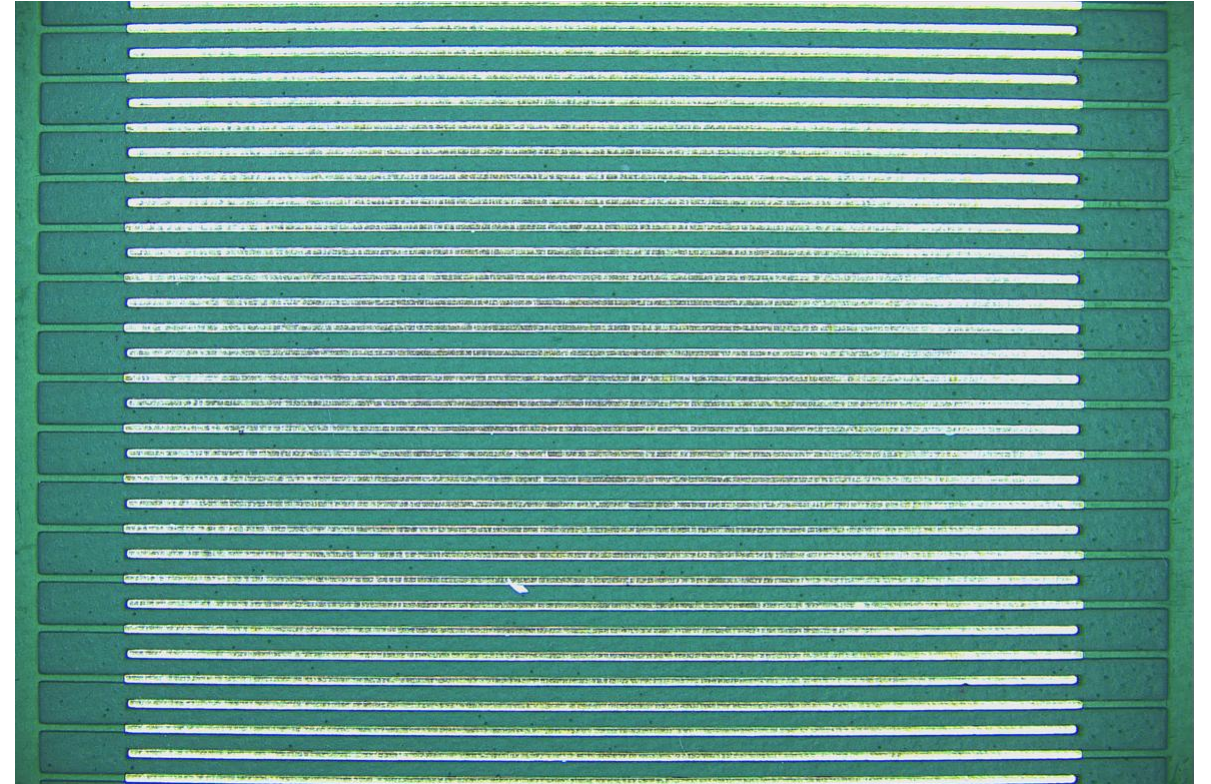
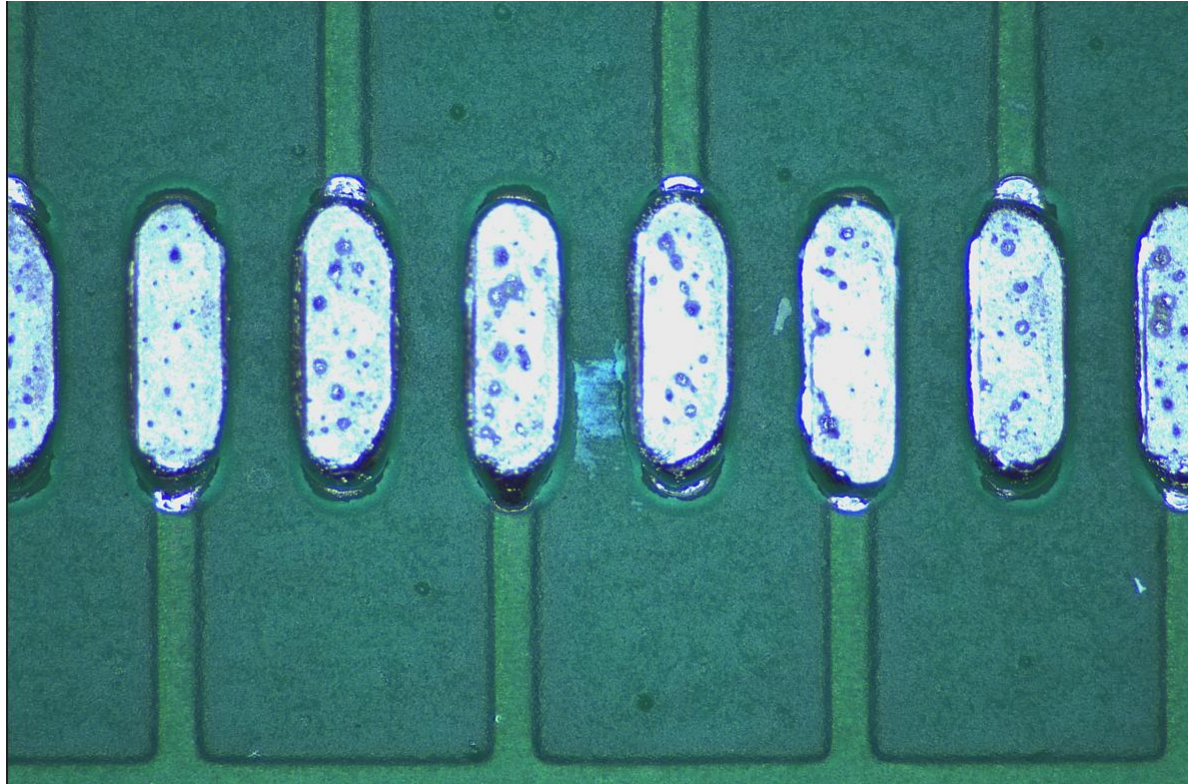
QFP-160 with an SIR Comb

Board #2



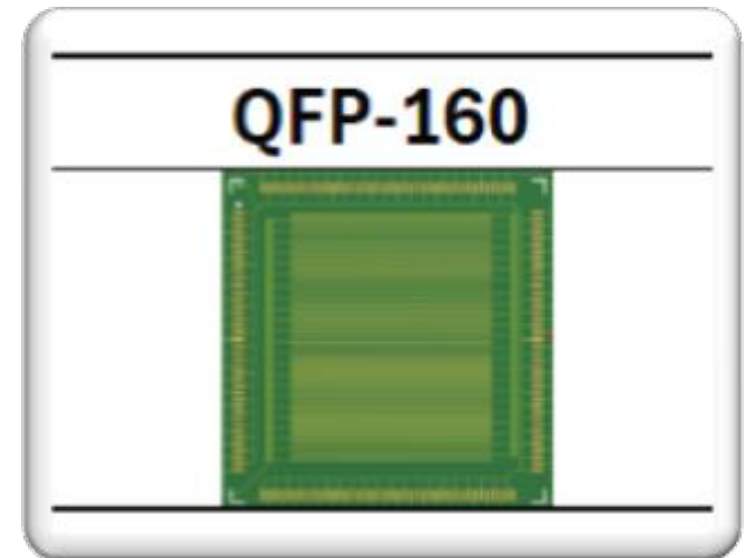
QFP-160 with an SIR Comb

Board #3

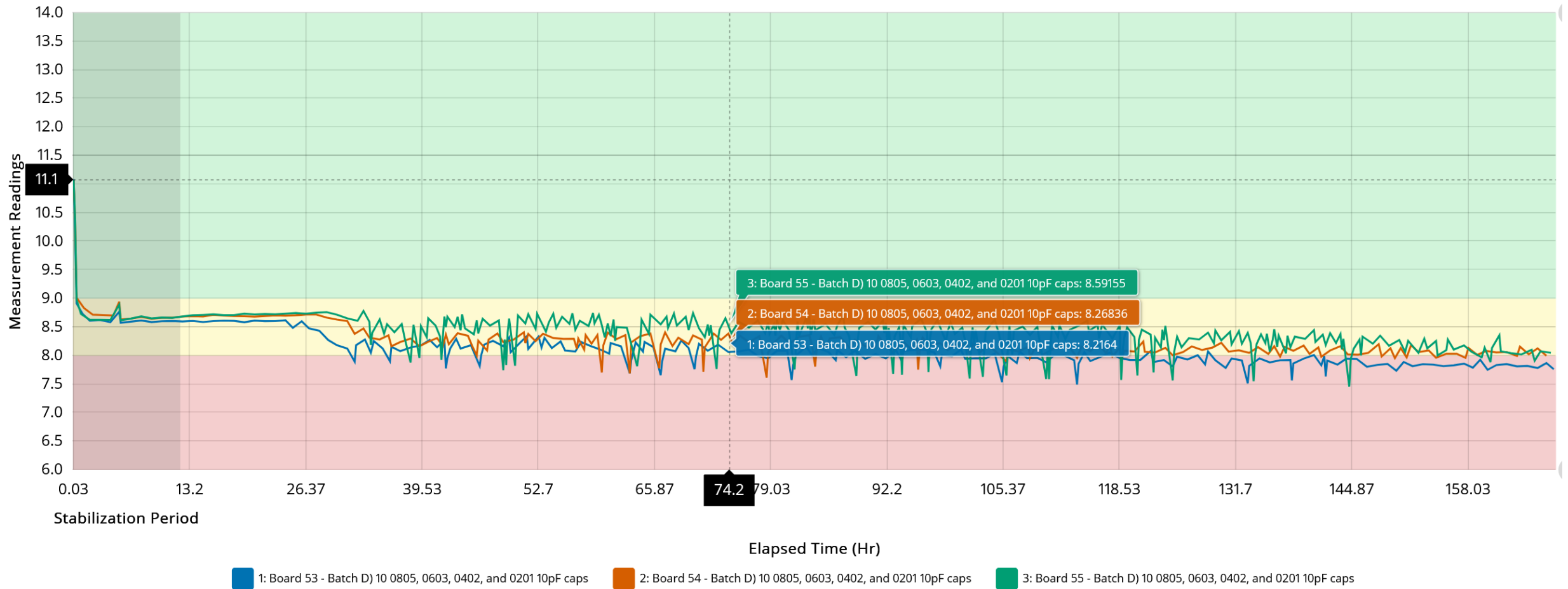


QFP-160 with an SIR Comb Batch Cleaning Machine

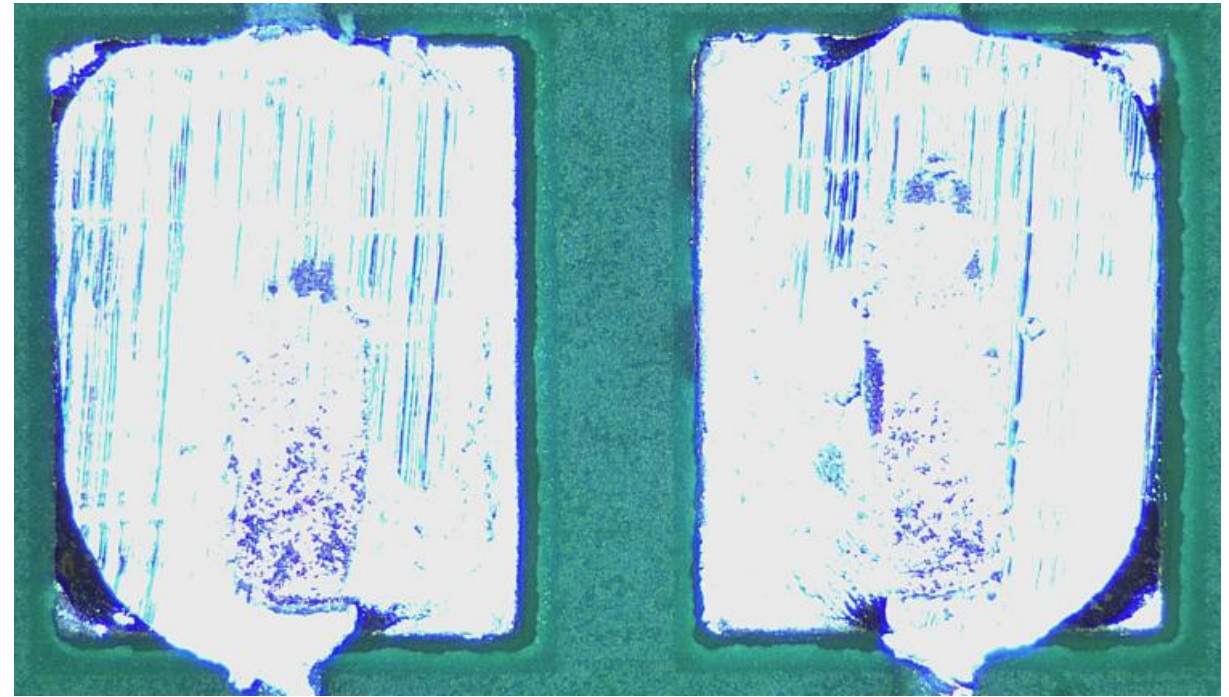
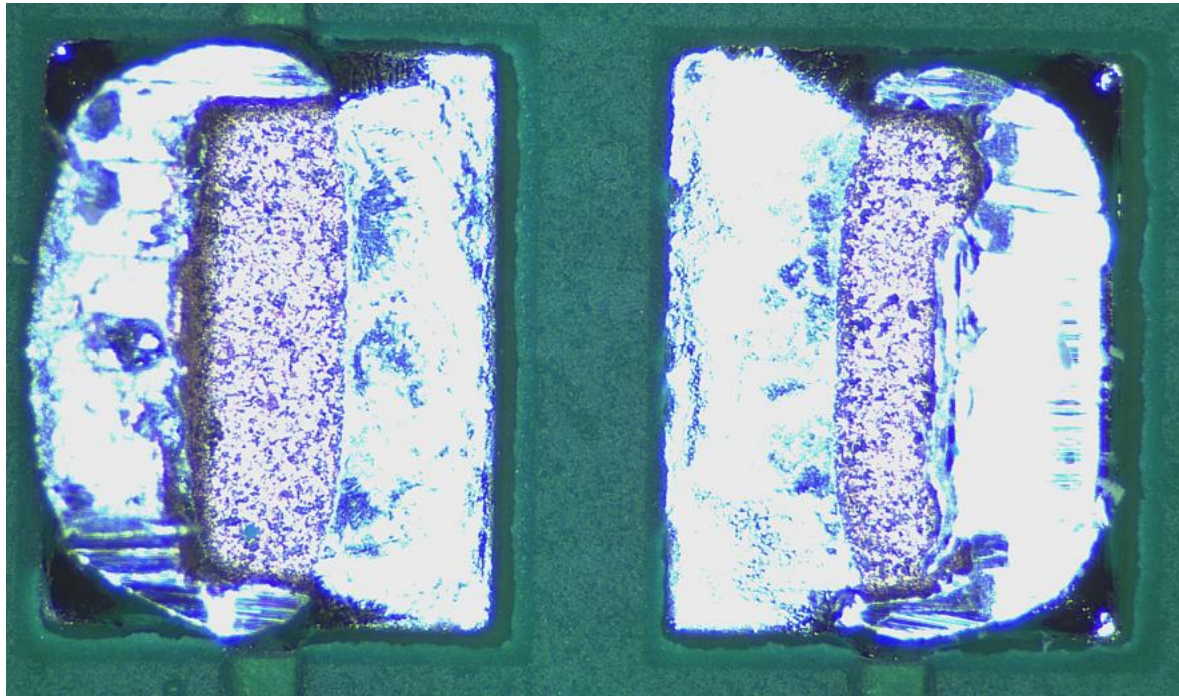
- No flux residue under the component terminations on two of the three boards
 - One board had partially cleaned flux residue between 2 pads
- SIR was in the desired performance zone over the testing period
- There were (minor) leakage currents on two of the three boards tested
- SIR passed



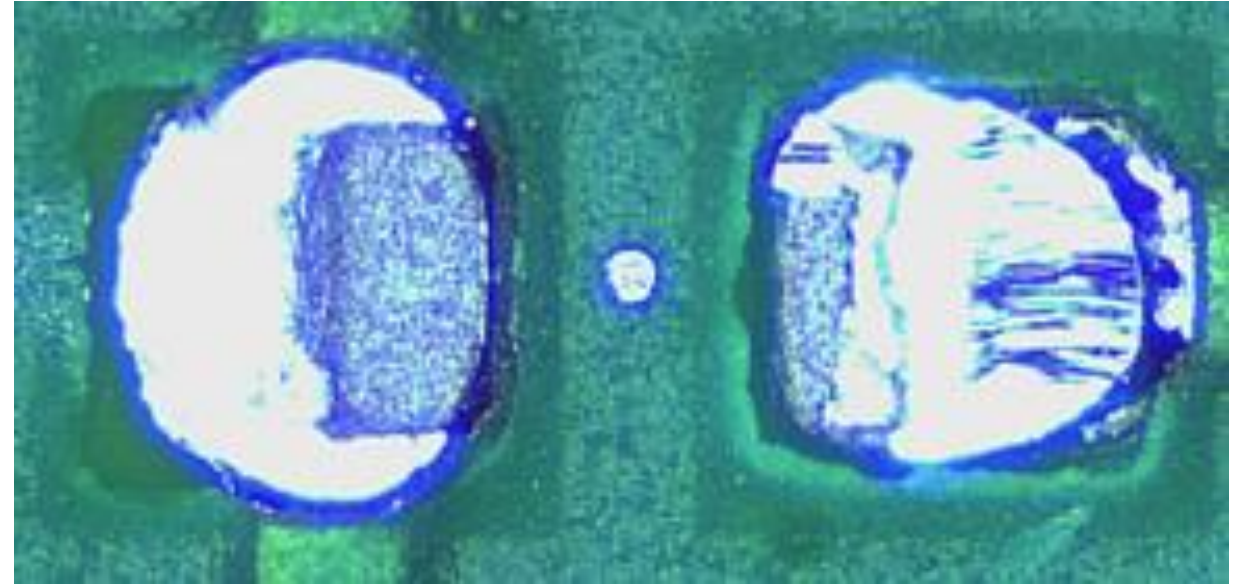
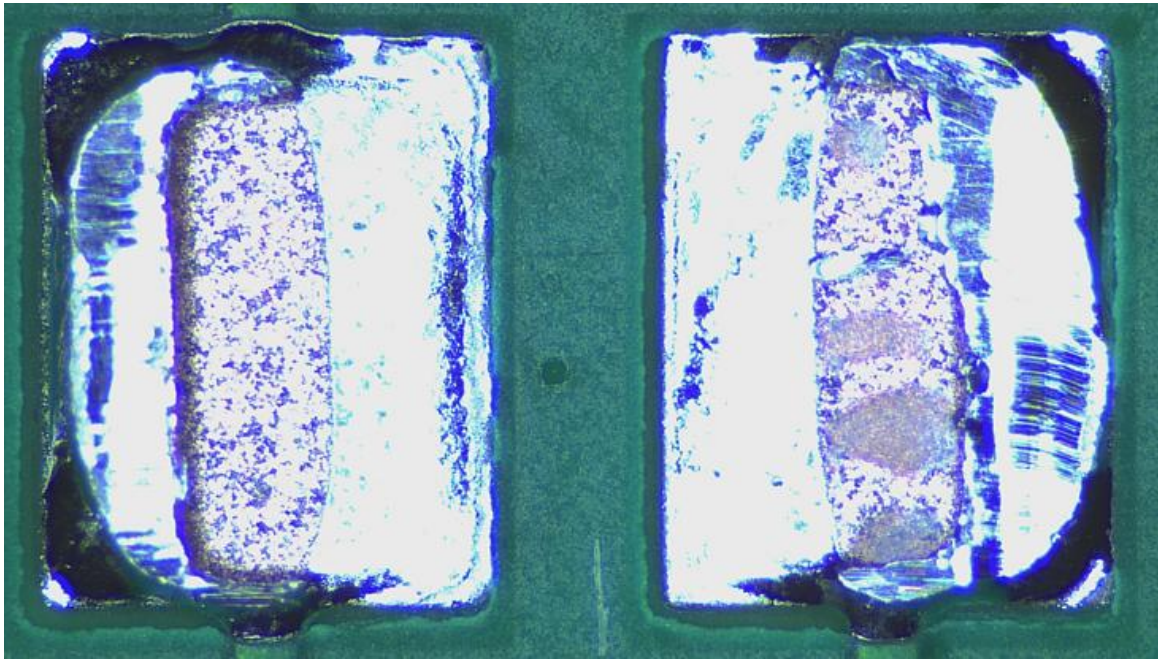
0201 / 0402 / 0603 / 0805 Caps Batch Cleaning Machine



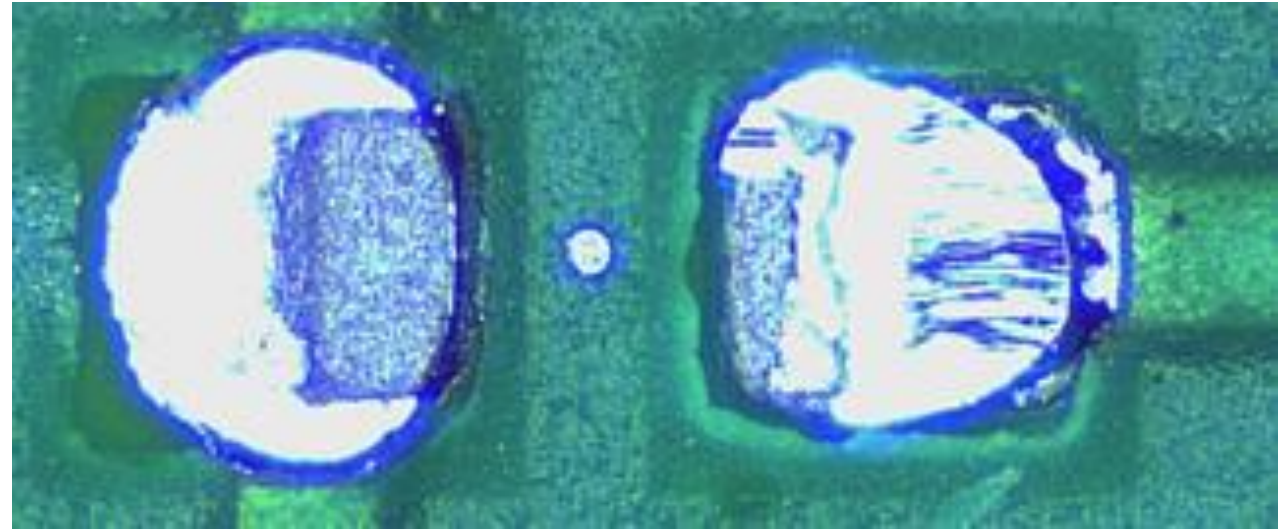
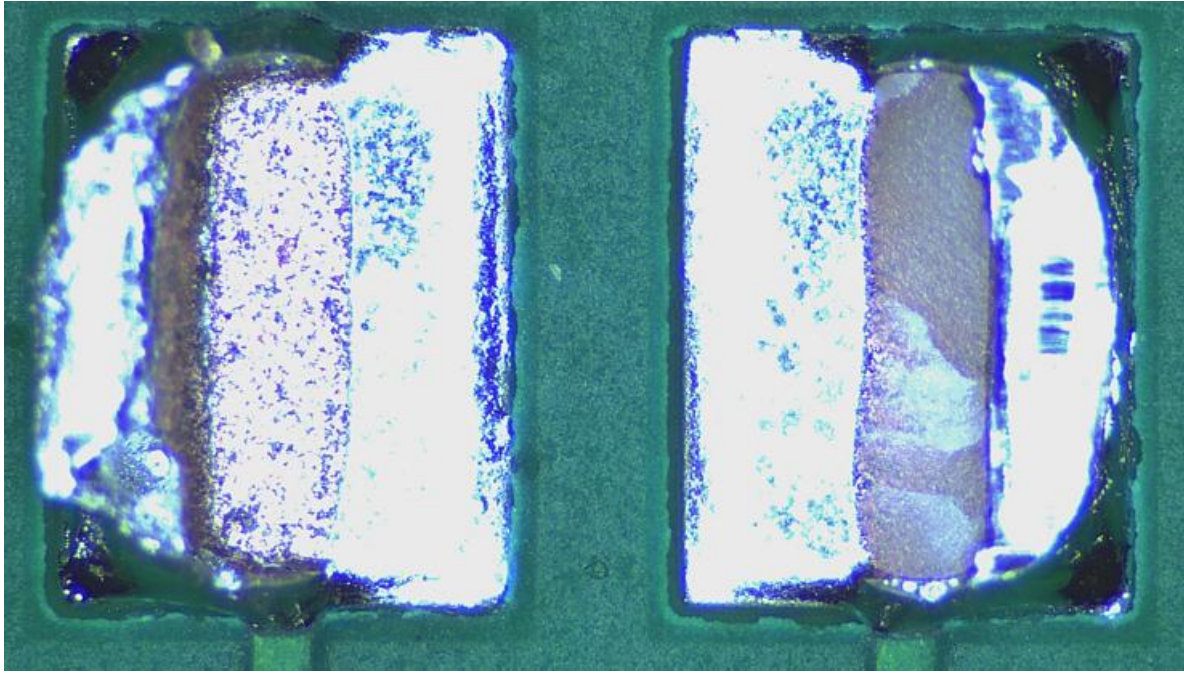
0201 / 0402 / 0603 / 0805 Caps Board #1



0201 / 0402 / 0603 / 0805 Caps Board #2

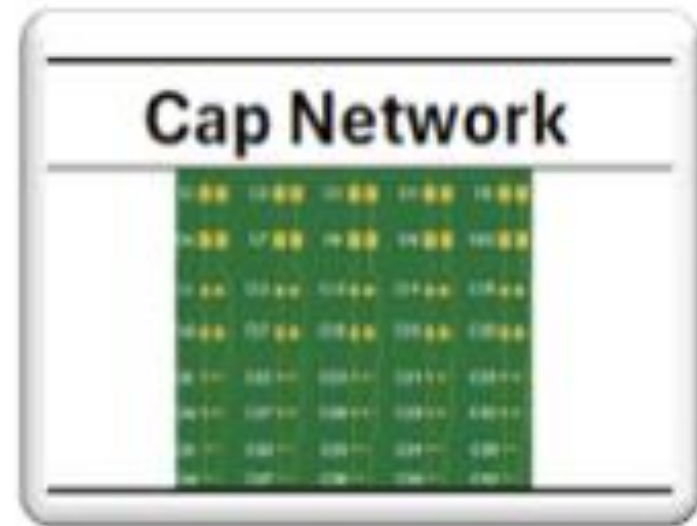


0201 / 0402 / 0603 / 0805 Caps Board #3



0201 / 0402 / 0603 / 0805 Caps Batch Cleaning Machine

- No flux residue was present under the component terminations
- SIR was in the cautionary zone with mild leakage currents into the danger zone.
 - The solder dots between the 0201 indicate a dirty stencil
 - SIR tabulates the lowest insulation resistance over the 40 components
- Under some of the 0201 caps, there was a dot of solder between the pads.
- SIR failed



INLINE CLEANING MACHINE

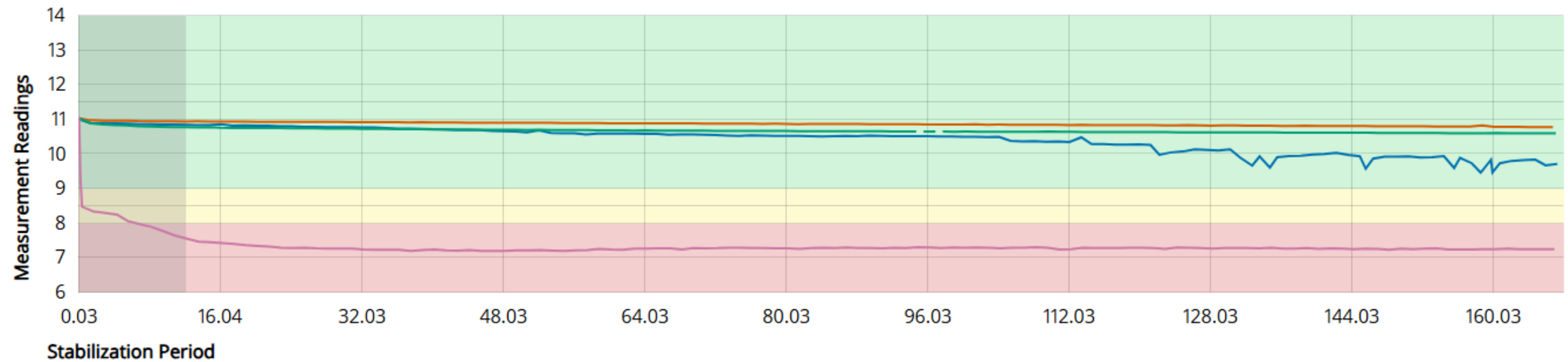
B-52 Legacy 4: Slot #4

Inline Cleaning Machine

Slot
4

Board 57 - Inline

Board Type: B 52 Legacy 2

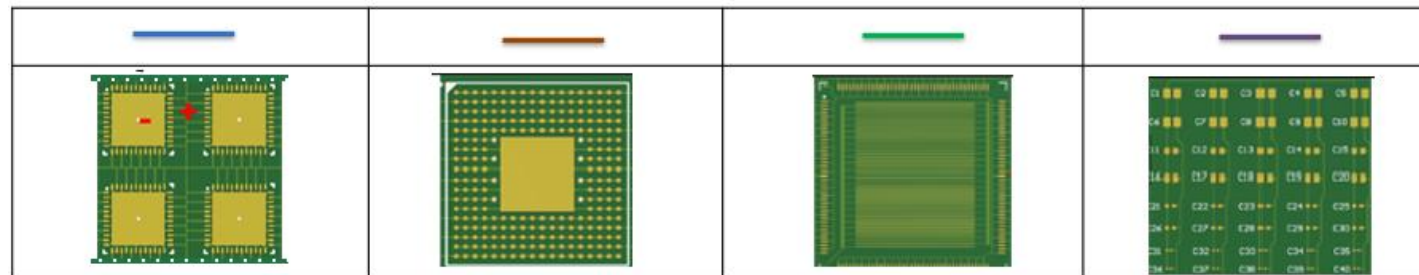


4: Board 57 - Inline A) 4 QFN 48

4: Board 57 - Inline B) 1 FBGA 244

4: Board 57 - Inline C) 1 QFP 160

4: Board 57 - Inline D) 10 0805, 0603, 0402, and 0201 10pF caps



B-52 Legacy 2: Slot #4

Inline Cleaning Machine

Channel A

Component: 4 QFN 48

Measurement Stats

Last Reading: 9.758876 $\text{Log}_{10}\Omega$
Maximum: 10.866974 $\text{Log}_{10}\Omega$
Minimum*: 9.446004 $\text{Log}_{10}\Omega$
Median: 10.523981 $\text{Log}_{10}\Omega$
Mean: 10.391280 $\text{Log}_{10}\Omega$
StdDev: 0.350629 $\text{Log}_{10}\Omega$
Variance: 0.122941 $\text{Log}_{10}\Omega^2$

* Value determines channel color

Measurement Info

Measurement Count: 936

Channel B

Component: 1 FBGA 244

Measurement Stats

Last Reading: 10.783078 $\text{Log}_{10}\Omega$
Maximum: 10.966406 $\text{Log}_{10}\Omega$
Minimum*: 10.783078 $\text{Log}_{10}\Omega$
Median: 10.872254 $\text{Log}_{10}\Omega$
Mean: 10.870662 $\text{Log}_{10}\Omega$
StdDev: 0.046061 $\text{Log}_{10}\Omega$
Variance: 0.002121 $\text{Log}_{10}\Omega^2$

* Value determines channel color

Measurement Info

Measurement Count: 936

Channel C

Component: 1 QFP 160

Measurement Stats

Last Reading: 10.605298 $\text{Log}_{10}\Omega$
Maximum: 10.825603 $\text{Log}_{10}\Omega$
Minimum*: 10.603388 $\text{Log}_{10}\Omega$
Median: 10.666165 $\text{Log}_{10}\Omega$
Mean: 10.673093 $\text{Log}_{10}\Omega$
StdDev: 0.047427 $\text{Log}_{10}\Omega$
Variance: 0.002249 $\text{Log}_{10}\Omega^2$

* Value determines channel color

Measurement Info

Measurement Count: 936
Errors: 2 (0.2%)

Channel D

Component: 10 0805, 0603, 0402, and 0201
10pF caps

Measurement Stats

Last Reading: 7.260541 $\text{Log}_{10}\Omega$
Maximum: 7.569909 $\text{Log}_{10}\Omega$
Minimum*: 7.181569 $\text{Log}_{10}\Omega$
Median: 7.279355 $\text{Log}_{10}\Omega$
Mean: 7.281497 $\text{Log}_{10}\Omega$
StdDev: 0.049241 $\text{Log}_{10}\Omega$
Variance: 0.002424 $\text{Log}_{10}\Omega^2$

* Value determines channel color

Measurement Info

Measurement Count: 936

First Failure Detected:

Thu, Feb 6 1:20 AM CST

Elapsed Time: 12.03 hours

Total Failed Measurements: 936 (100%)

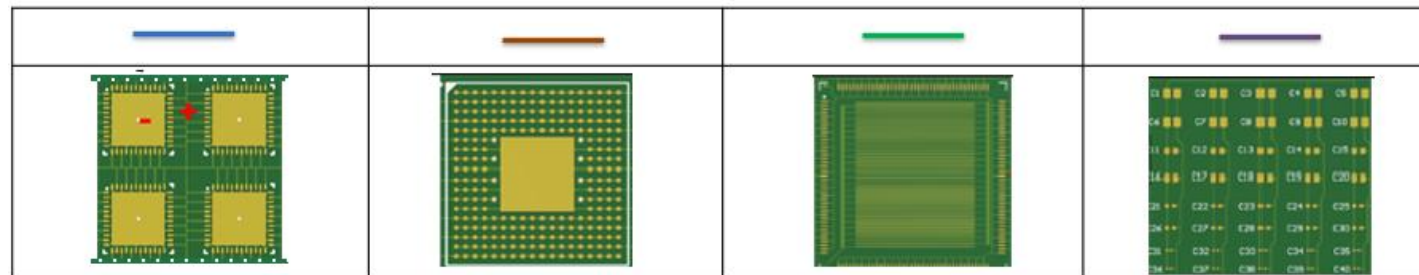
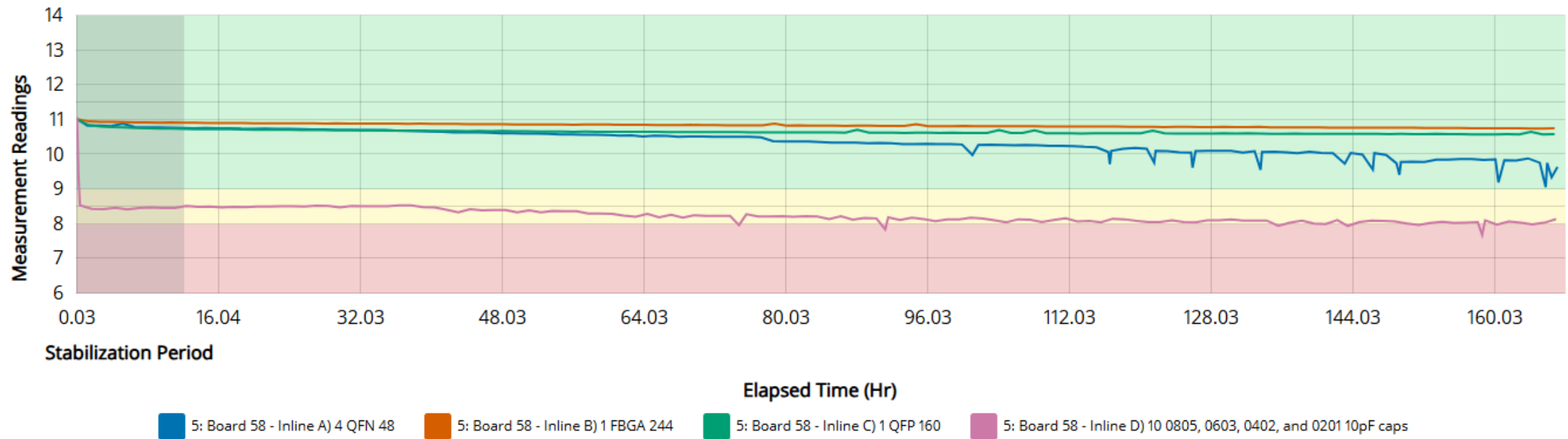
B-52 Legacy 4: Slot #5

Inline Cleaning Machine

Slot
5

Board 58 - Inline

Board Type: B 52 Legacy 2



B-52 Legacy 2: Slot #5

Inline Cleaning Machine

Channel A

Component: 4 QFN 48

Measurement Stats

Last Reading: 9.702427 $\text{Log}_{10}\Omega$
Maximum: 10.772190 $\text{Log}_{10}\Omega$
Minimum*: 8.993049 $\text{Log}_{10}\Omega$
Median: 10.327175 $\text{Log}_{10}\Omega$
Mean: 10.326132 $\text{Log}_{10}\Omega$
StdDev: 0.323343 $\text{Log}_{10}\Omega$
Variance: 0.104550 $\text{Log}_{10}\Omega^2$

** Value determines channel color*

Measurement Info

Measurement Count: 936

Channel B

Component: 1 FBGA 244

Measurement Stats

Last Reading: 10.758423 $\text{Log}_{10}\Omega$
Maximum: 10.947753 $\text{Log}_{10}\Omega$
Minimum*: 10.748926 $\text{Log}_{10}\Omega$
Median: 10.830913 $\text{Log}_{10}\Omega$
Mean: 10.833704 $\text{Log}_{10}\Omega$
StdDev: 0.047131 $\text{Log}_{10}\Omega$
Variance: 0.002221 $\text{Log}_{10}\Omega^2$

** Value determines channel color*

Measurement Info

Measurement Count: 936

Channel C

Component: 1 QFP 160

Measurement Stats

Last Reading: 10.587233 $\text{Log}_{10}\Omega$
Maximum: 10.786010 $\text{Log}_{10}\Omega$
Minimum*: 10.581831 $\text{Log}_{10}\Omega$
Median: 10.636085 $\text{Log}_{10}\Omega$
Mean: 10.644148 $\text{Log}_{10}\Omega$
StdDev: 0.042925 $\text{Log}_{10}\Omega$
Variance: 0.001842 $\text{Log}_{10}\Omega^2$

** Value determines channel color*

Measurement Info

Measurement Count: 936

Channel D

Component: 10 0805, 0603, 0402, and 0201
10pF caps

Measurement Stats

Last Reading: 8.089841 $\text{Log}_{10}\Omega$
Maximum: 8.557820 $\text{Log}_{10}\Omega$
Minimum*: 7.690366 $\text{Log}_{10}\Omega$
Median: 8.181122 $\text{Log}_{10}\Omega$
Mean: 8.228139 $\text{Log}_{10}\Omega$
StdDev: 0.172465 $\text{Log}_{10}\Omega$
Variance: 0.029744 $\text{Log}_{10}\Omega^2$

** Value determines channel color*

Measurement Info

Measurement Count: 936

First Failure Detected:

Sat, Feb 8 7:40 AM CST

Elapsed Time: 66.36 hours

Total Failed Measurements: 30 (3.21%)

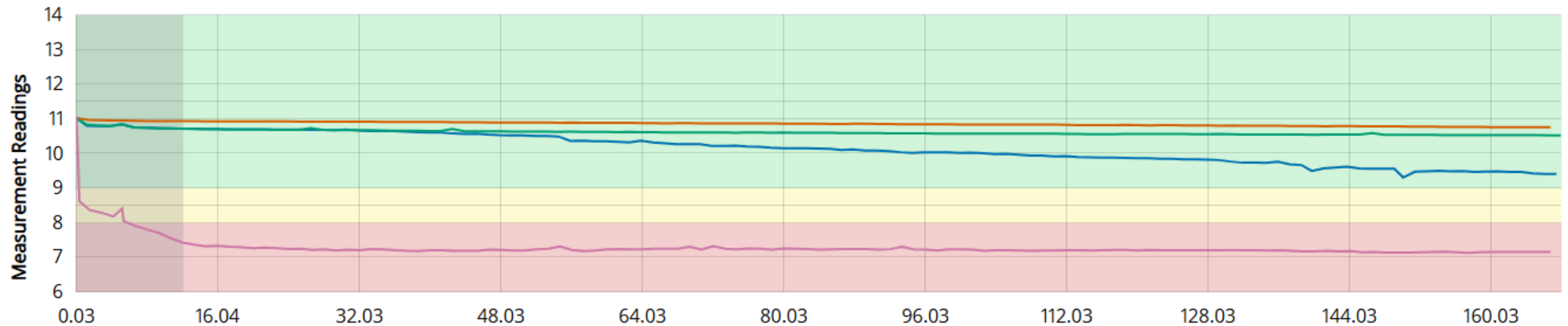
B-52 Legacy 4: Slot #6

Inline Cleaning Machine

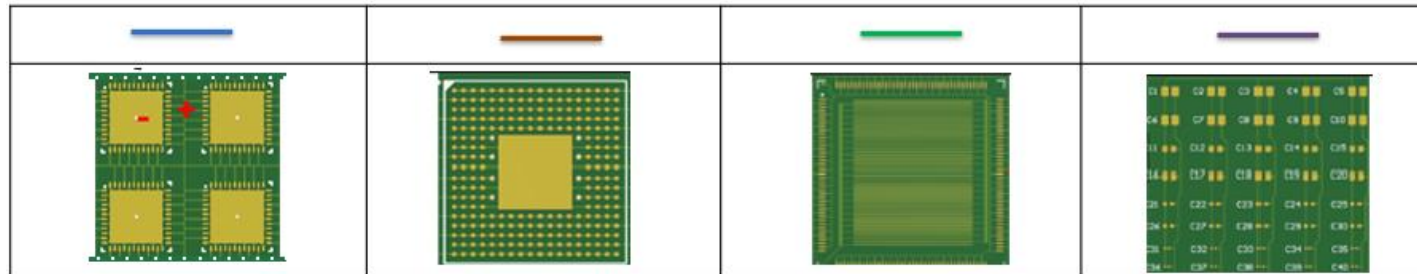
Slot
6

Board 59 - Inline

Board Type: B 52 Legacy 2



6: Board 59 - Inline A) 4 QFN 48 6: Board 59 - Inline B) 1 FBGA 244 6: Board 59 - Inline C) 1 QFP 160 6: Board 59 - Inline D) 10 0805, 0603, 0402, and 0201 10pF caps



B-52 Legacy 2: Slot #6

Inline Cleaning Machine

Channel A

Component: 4 QFN 48

Measurement Stats

Last Reading: 9.435044 $\text{Log}_{10}\Omega$

Maximum: 10.731681 $\text{Log}_{10}\Omega$

Minimum*: 9.297067 $\text{Log}_{10}\Omega$

Median: 10.091230 $\text{Log}_{10}\Omega$

Mean: 10.112207 $\text{Log}_{10}\Omega$

StdDev: 0.412182 $\text{Log}_{10}\Omega$

Variance: 0.169894 $\text{Log}_{10}\Omega^2$

** Value determines channel color*

Measurement Info

Measurement Count: 936

Channel B

Component: 1 FBGA 244

Measurement Stats

Last Reading: 10.761191 $\text{Log}_{10}\Omega$

Maximum: 10.960588 $\text{Log}_{10}\Omega$

Minimum*: 10.760861 $\text{Log}_{10}\Omega$

Median: 10.862085 $\text{Log}_{10}\Omega$

Mean: 10.858765 $\text{Log}_{10}\Omega$

StdDev: 0.051644 $\text{Log}_{10}\Omega$

Variance: 0.002667 $\text{Log}_{10}\Omega^2$

** Value determines channel color*

Measurement Info

Measurement Count: 936

Channel C

Component: 1 QFP 160

Measurement Stats

Last Reading: 10.534875 $\text{Log}_{10}\Omega$

Maximum: 10.760336 $\text{Log}_{10}\Omega$

Minimum*: 10.533407 $\text{Log}_{10}\Omega$

Median: 10.600089 $\text{Log}_{10}\Omega$

Mean: 10.607578 $\text{Log}_{10}\Omega$

StdDev: 0.050905 $\text{Log}_{10}\Omega$

Variance: 0.002591 $\text{Log}_{10}\Omega^2$

** Value determines channel color*

Measurement Info

Measurement Count: 936

Channel D

Component: 10 0805, 0603, 0402, and 0201
10pF caps

Measurement Stats

Last Reading: 7.158853 $\text{Log}_{10}\Omega$

Maximum: 7.450570 $\text{Log}_{10}\Omega$

Minimum*: 7.125479 $\text{Log}_{10}\Omega$

Median: 7.219440 $\text{Log}_{10}\Omega$

Mean: 7.222211 $\text{Log}_{10}\Omega$

StdDev: 0.042897 $\text{Log}_{10}\Omega$

Variance: 0.001840 $\text{Log}_{10}\Omega^2$

** Value determines channel color*

Measurement Info

Measurement Count: 936



First Failure Detected:

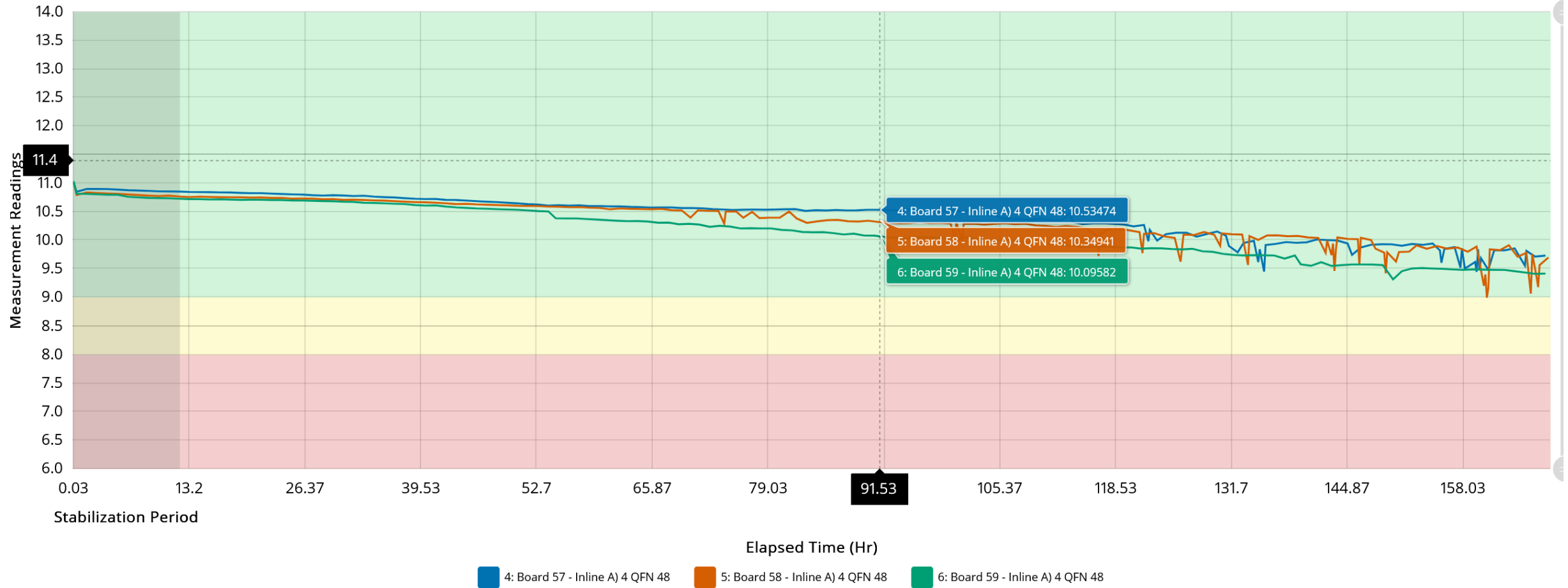
Thu, Feb 6 1:20 AM CST

Elapsed Time: 12.03 hours

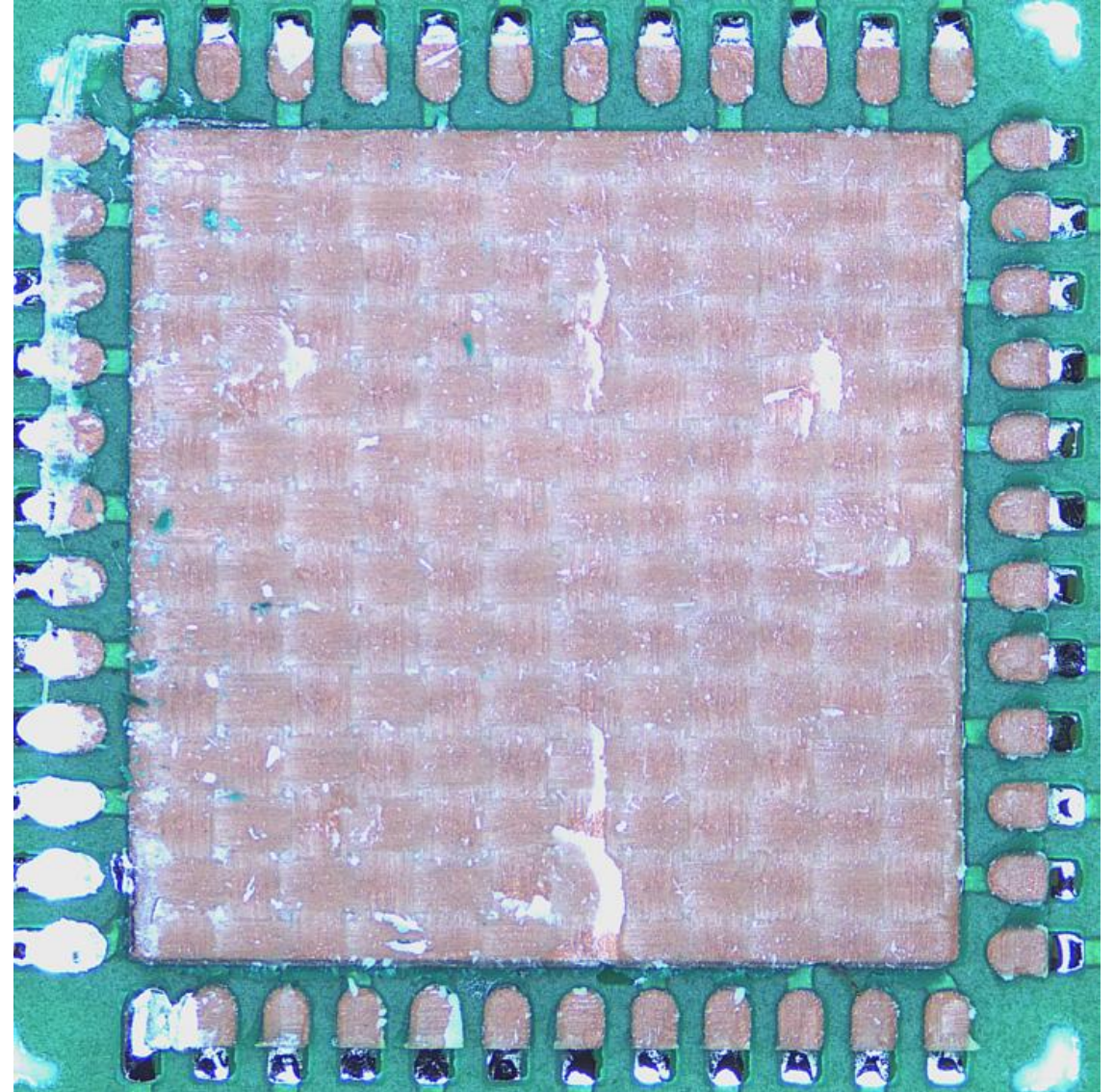
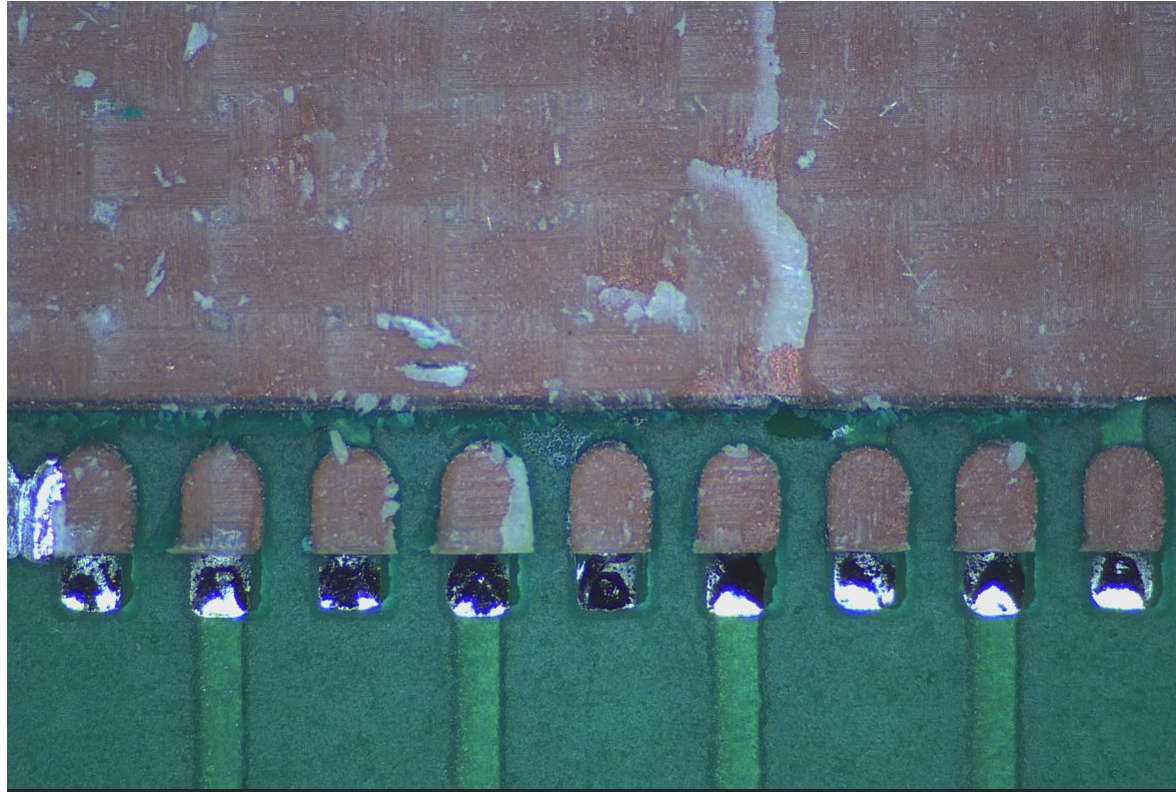
Total Failed Measurements: 936 (100%)

QFN-48

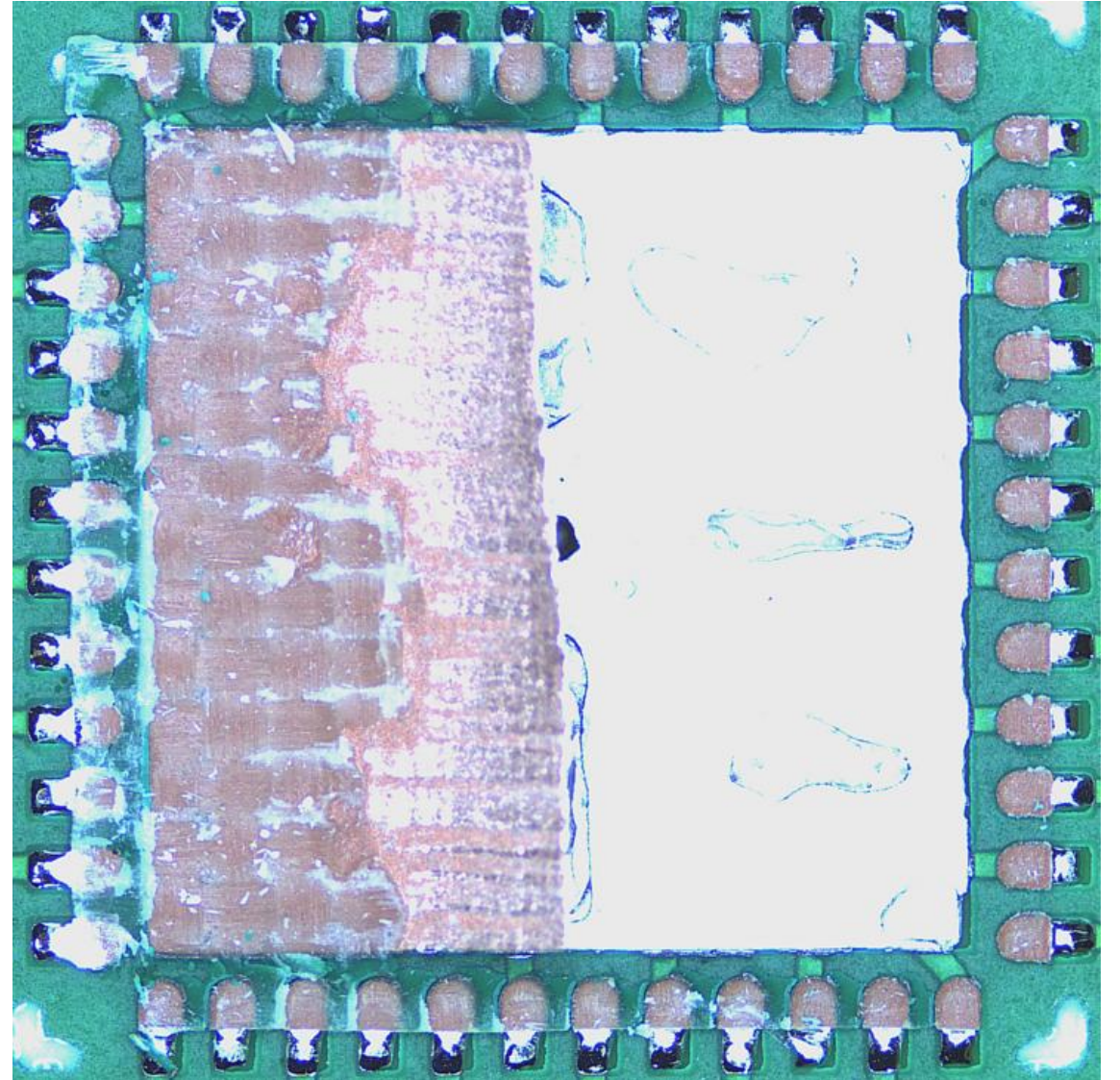
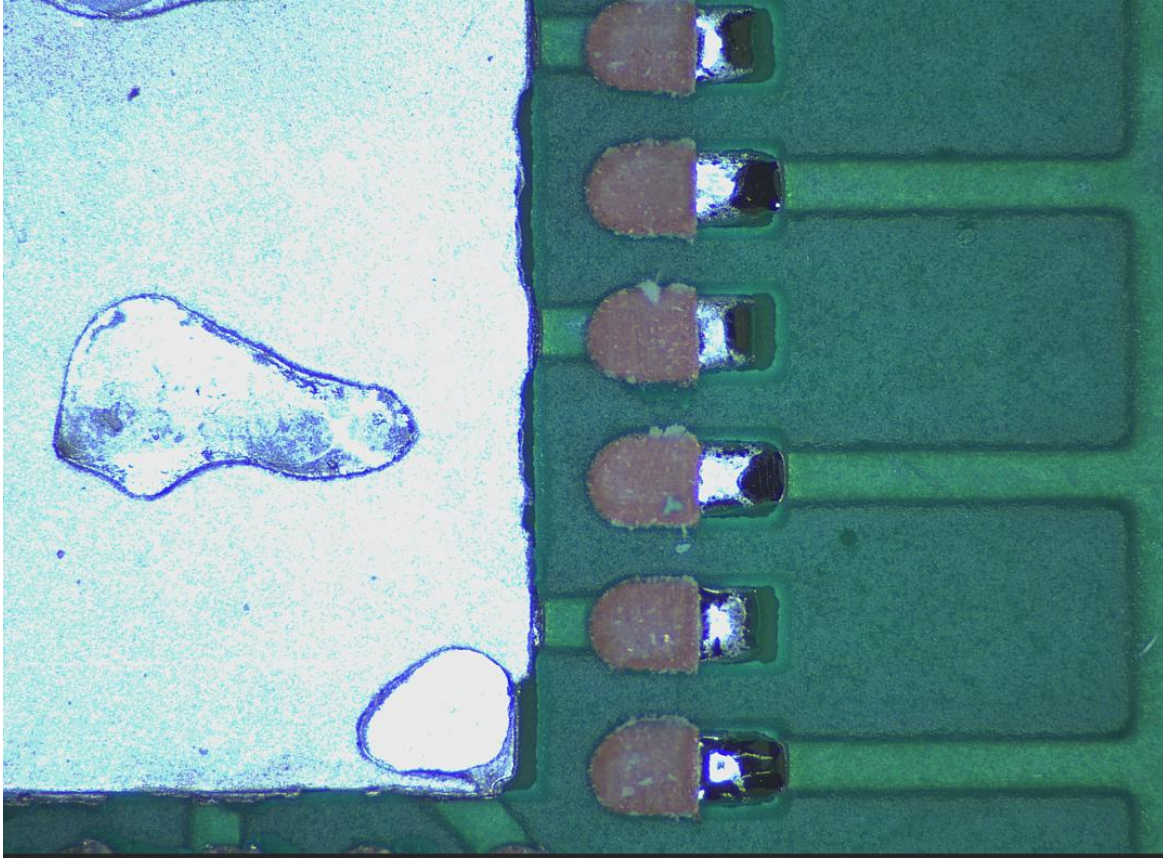
Inline Cleaning Machine



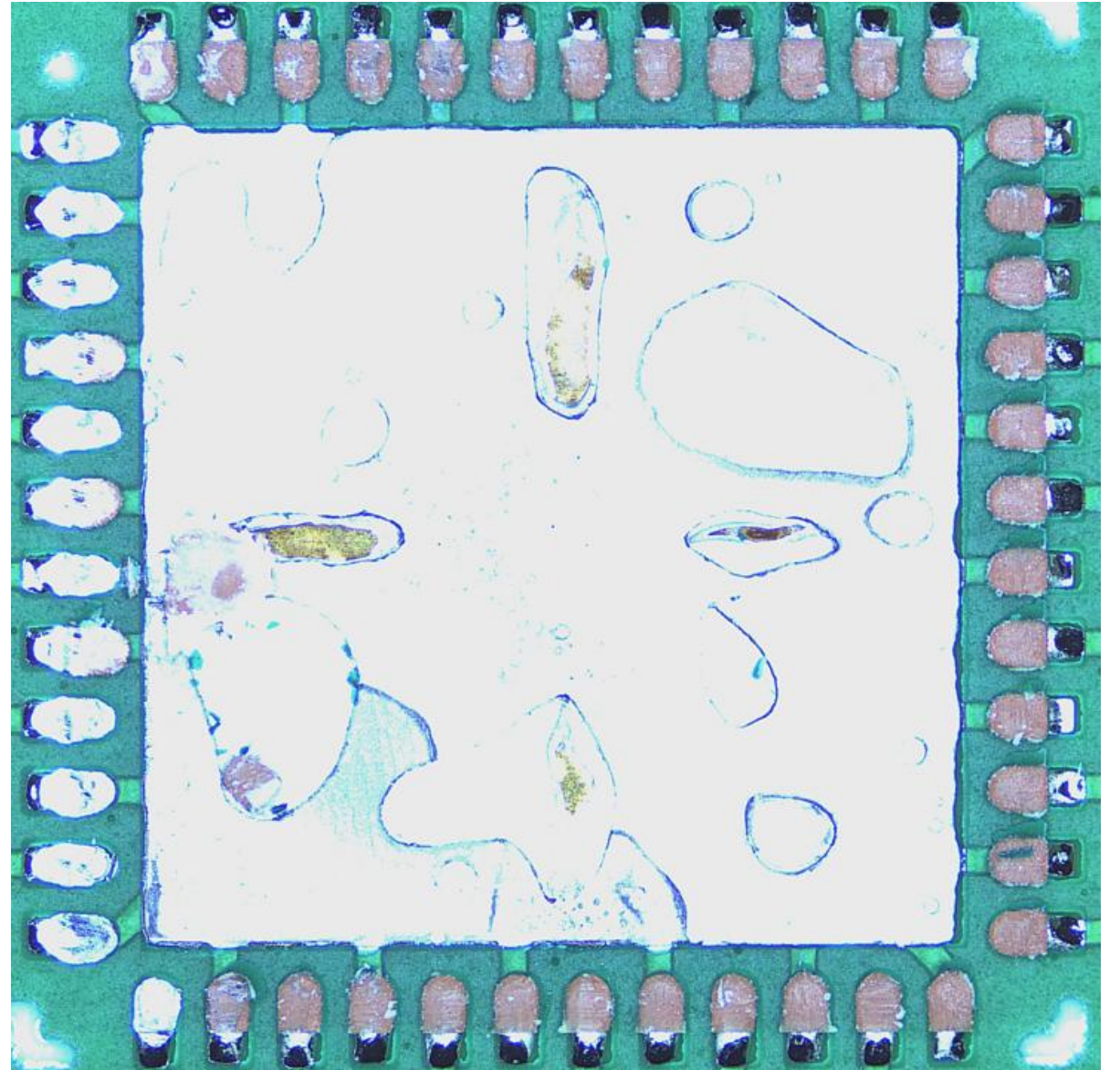
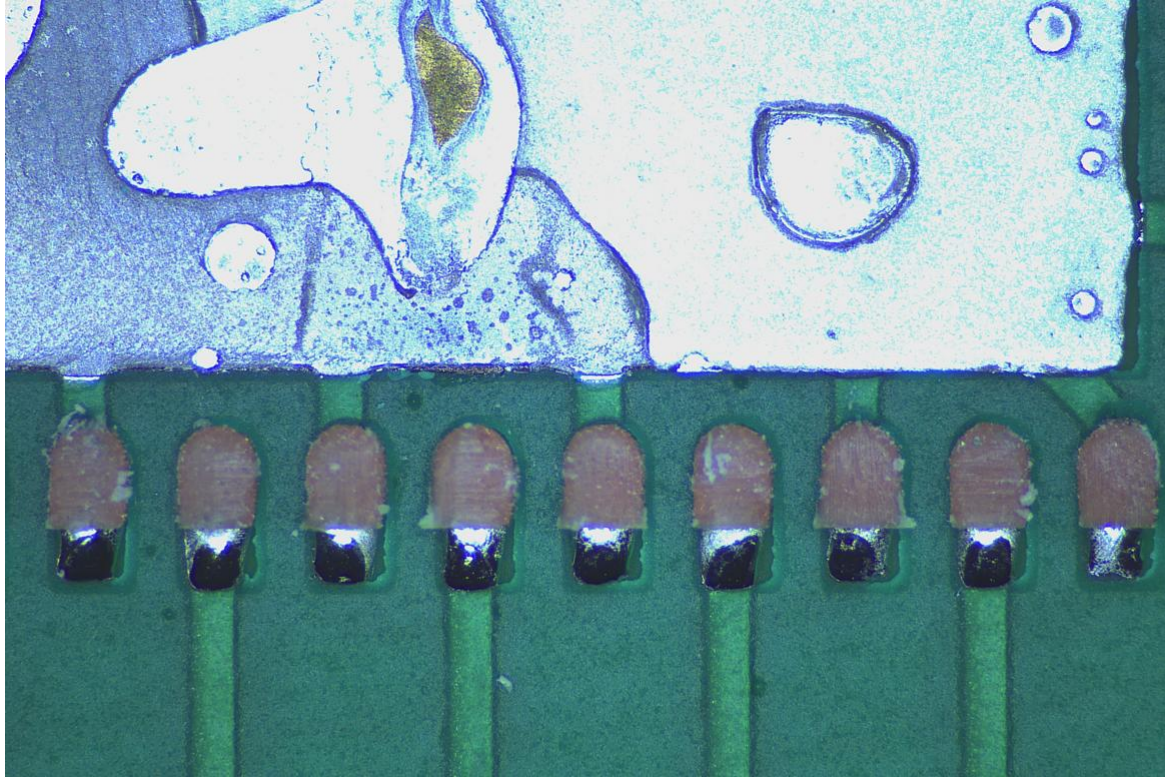
QFN-48 Board #4



QFN-48 Board #5

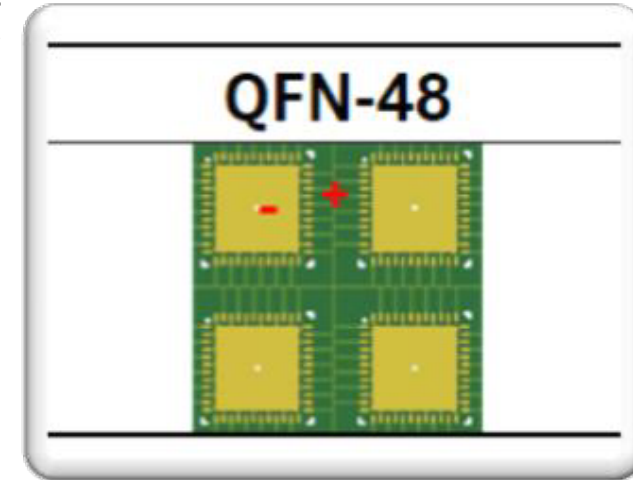


QFN-48 Board #6

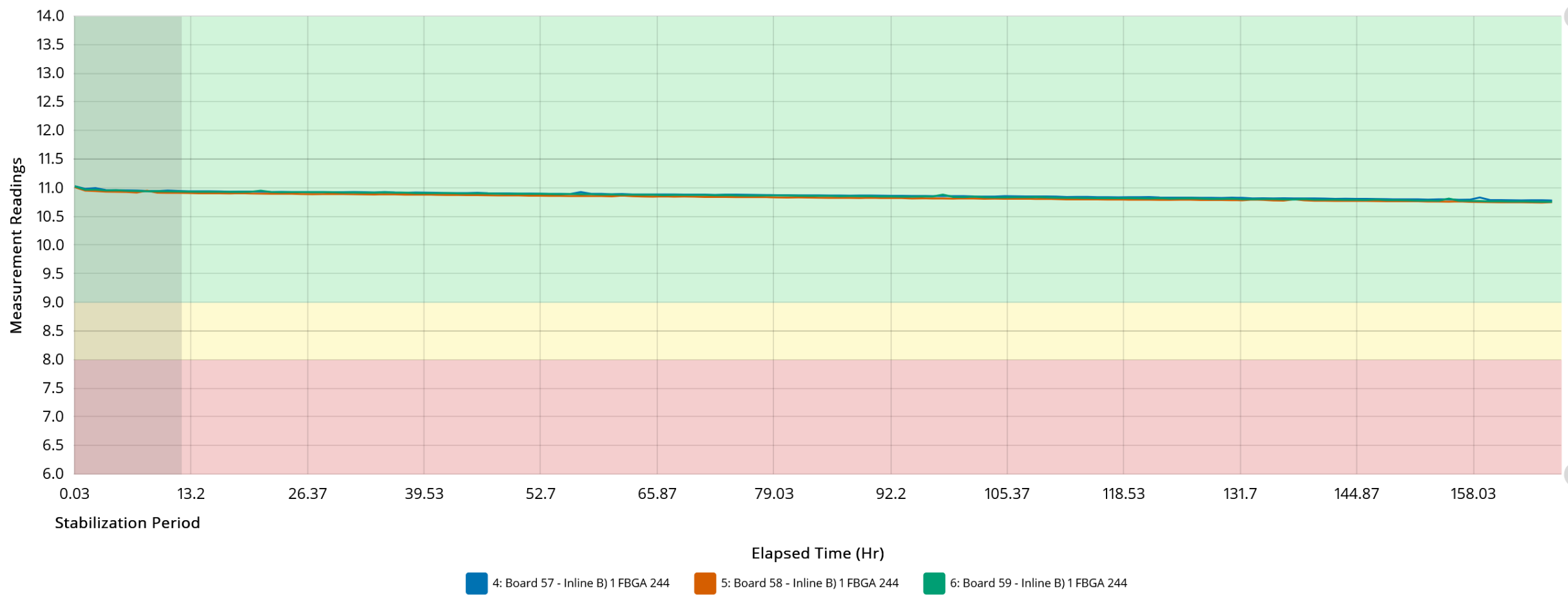


QFN-48 – Inline Cleaning Machine

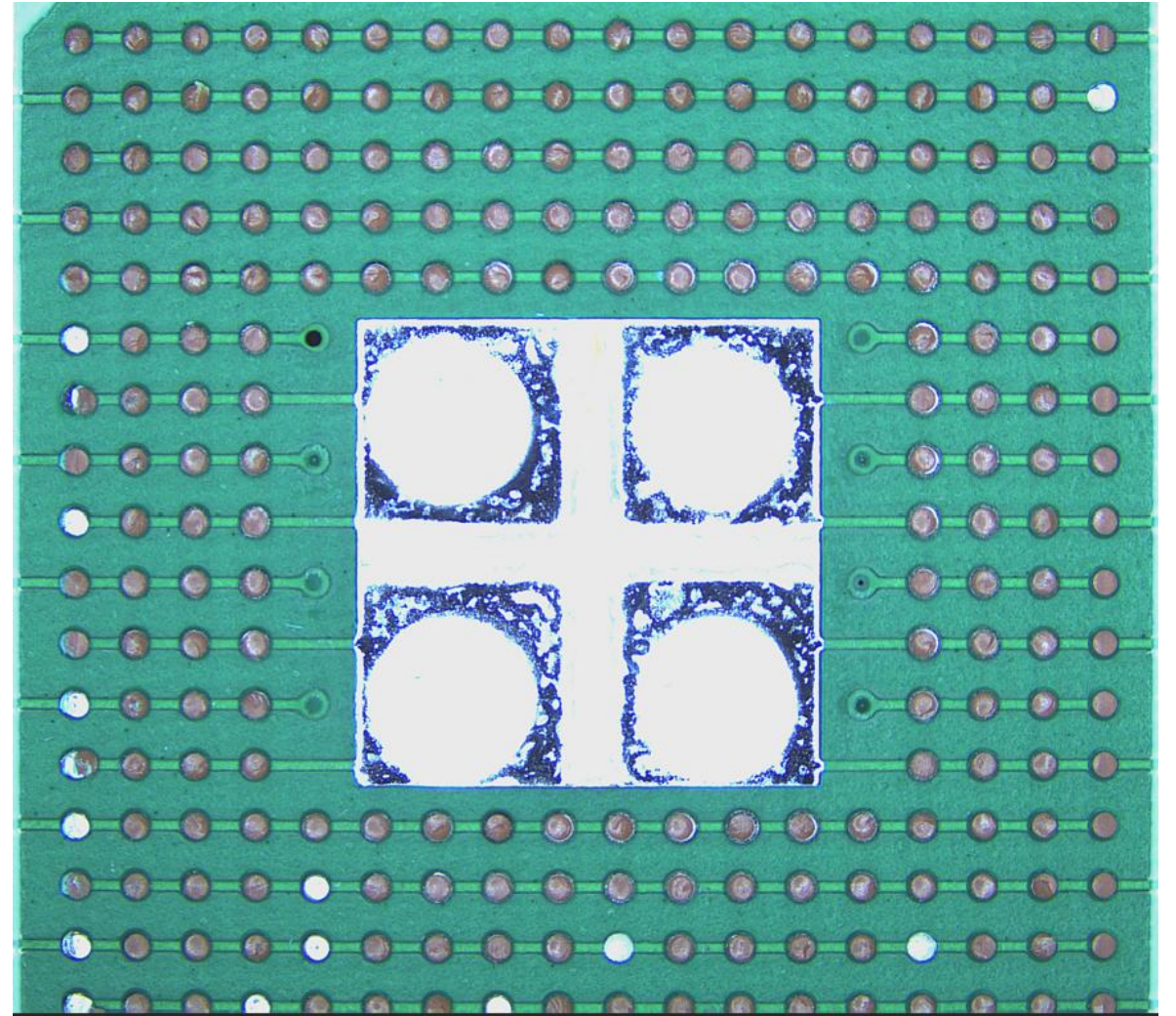
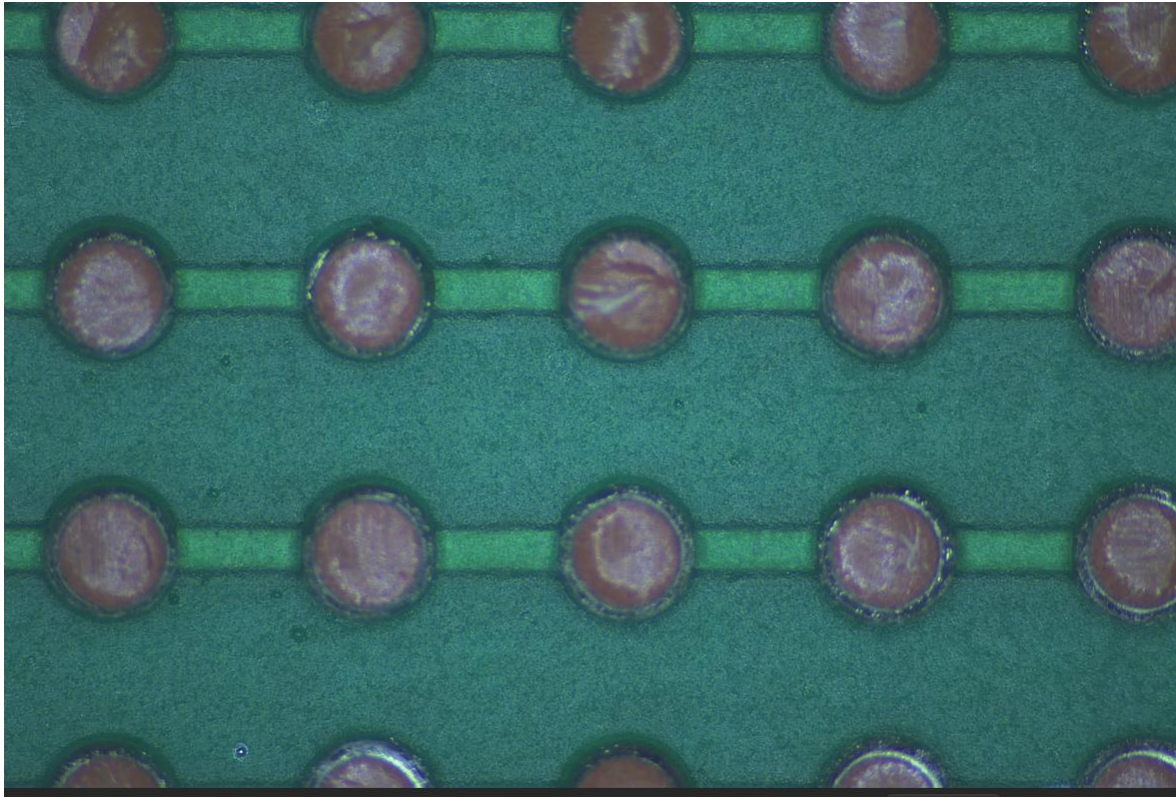
- Trace levels of flux residue under the component terminations
- SIR was in the desired performance zone over the testing period
- There was a slight decline during the testing period
 - Indicative of trace flux residue
 - Mild leakage currents occurred at the 105-hour mark onward
- SIR passed



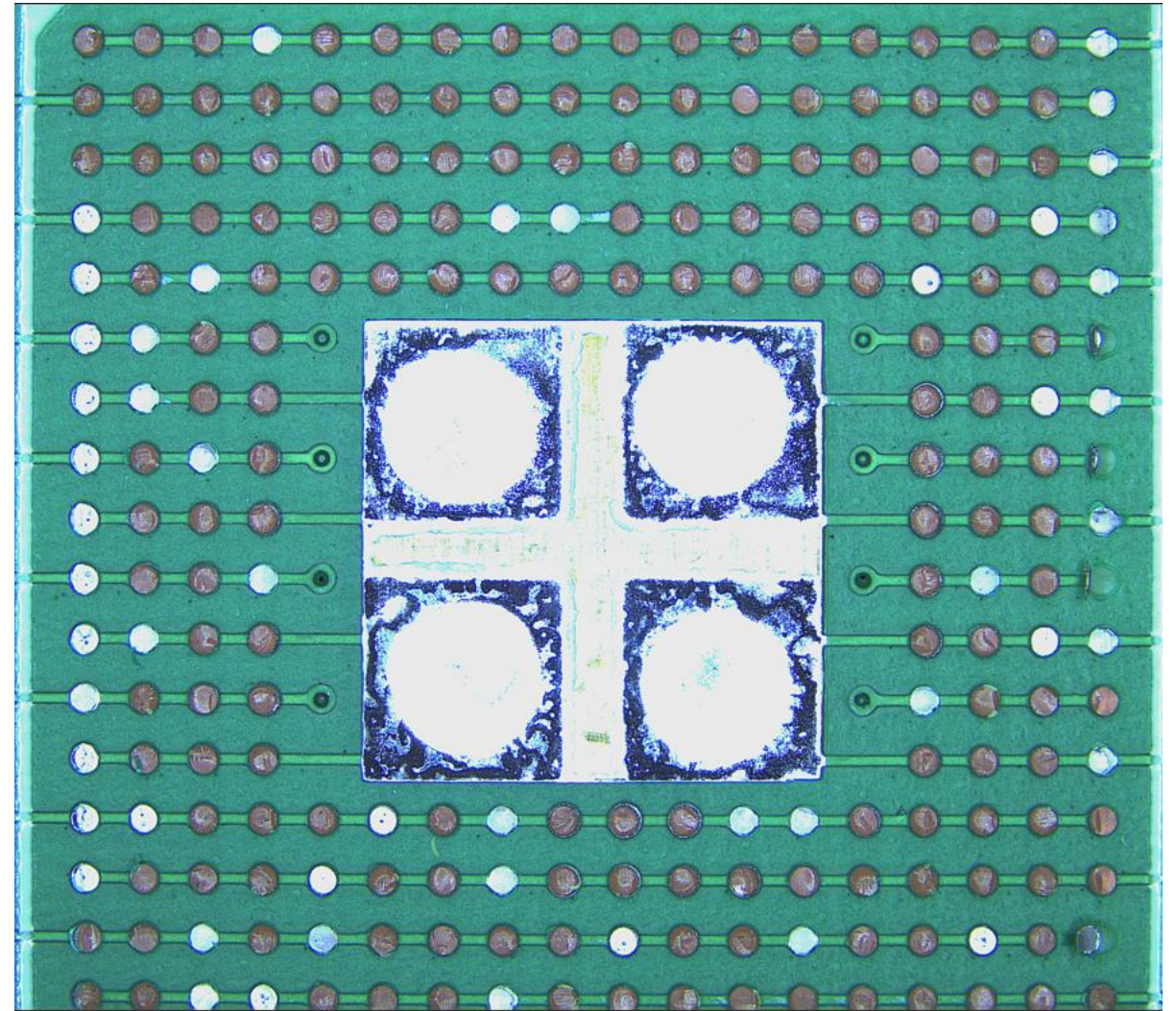
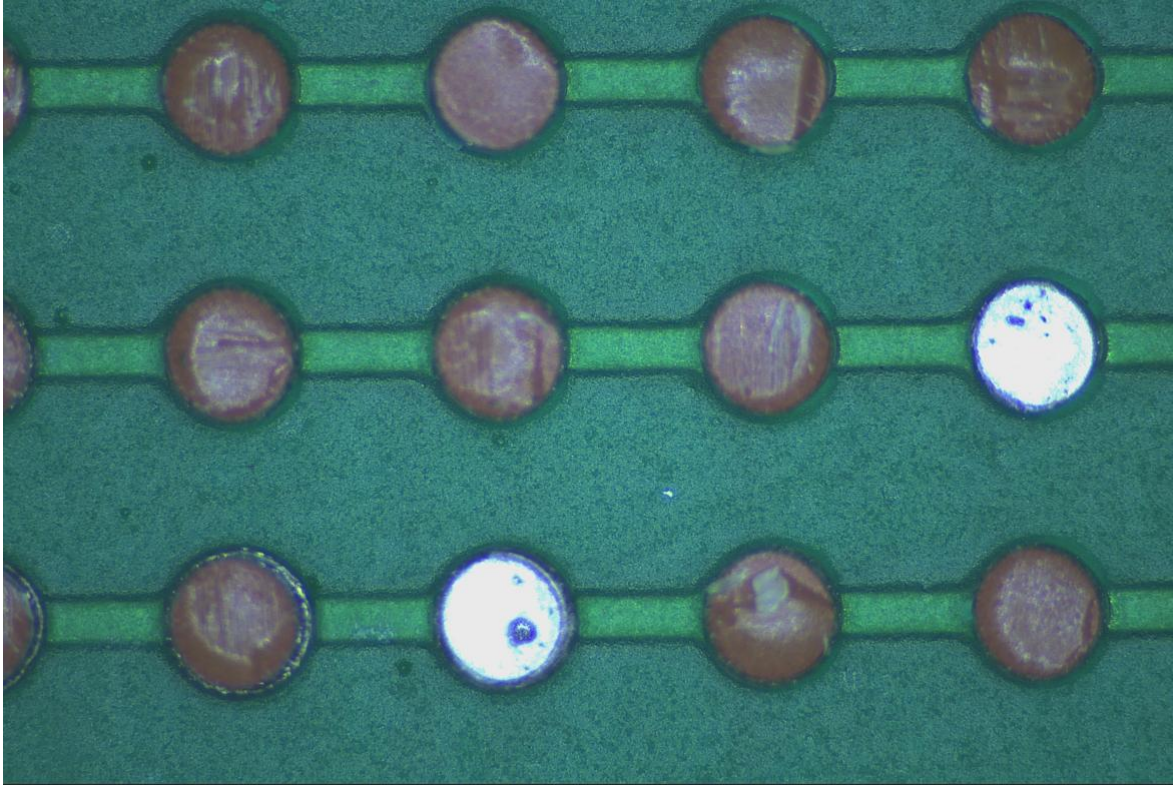
BGA 244 with a Center Lug Inline Cleaning Machine



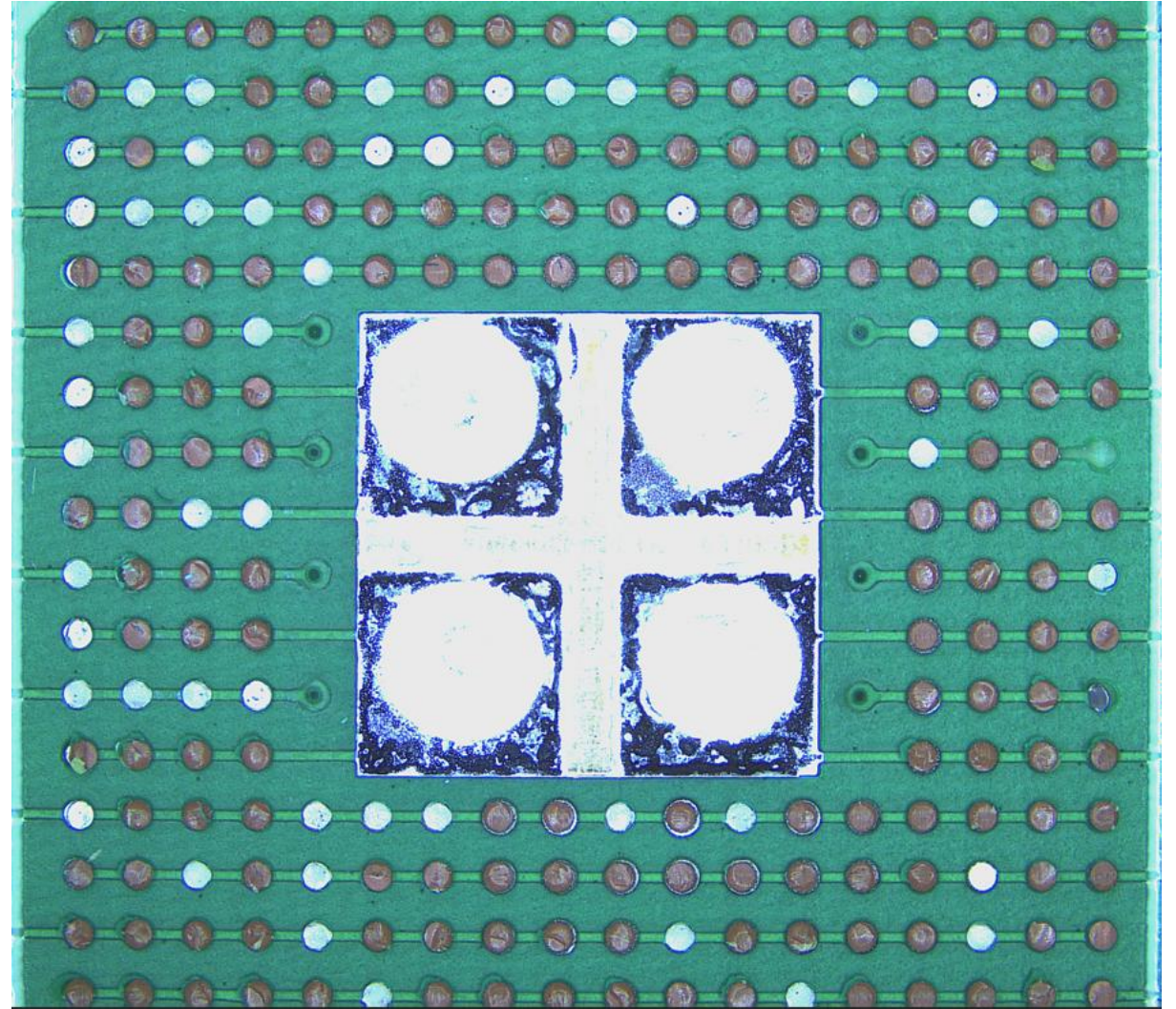
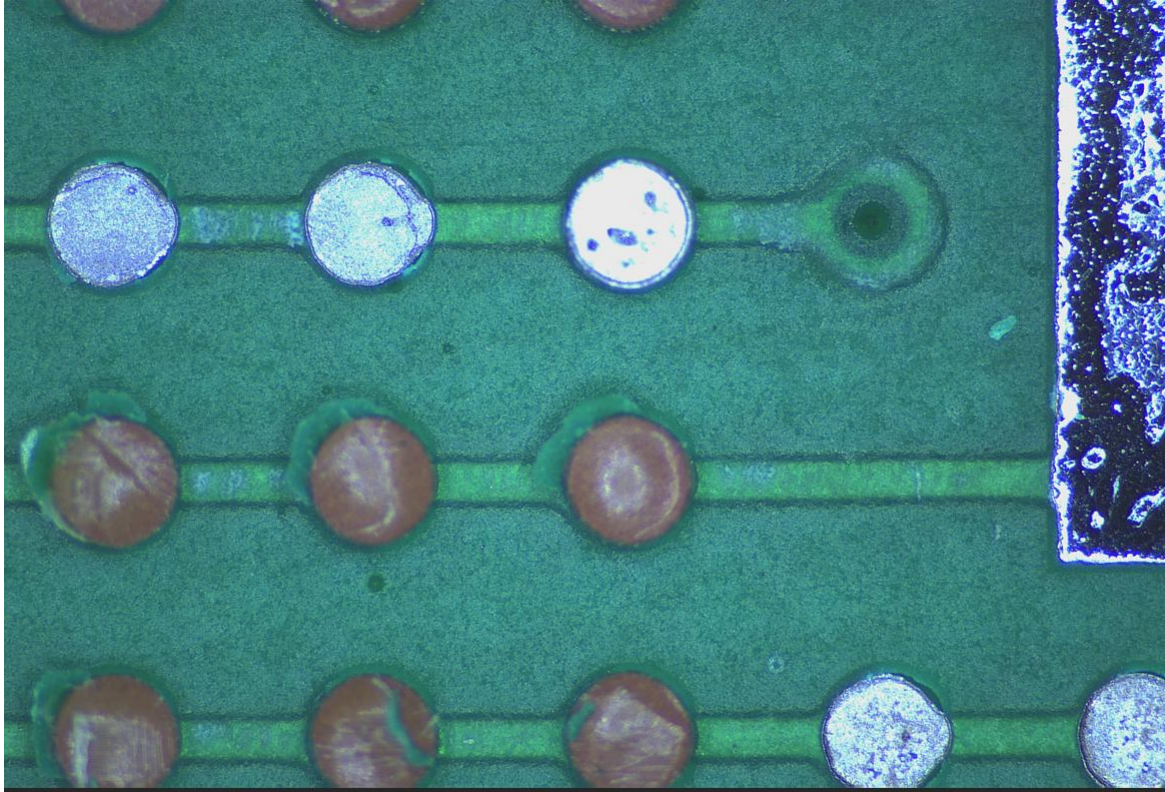
BGA 244 with a Center Board #4



BGA 244 with a Center Board #5

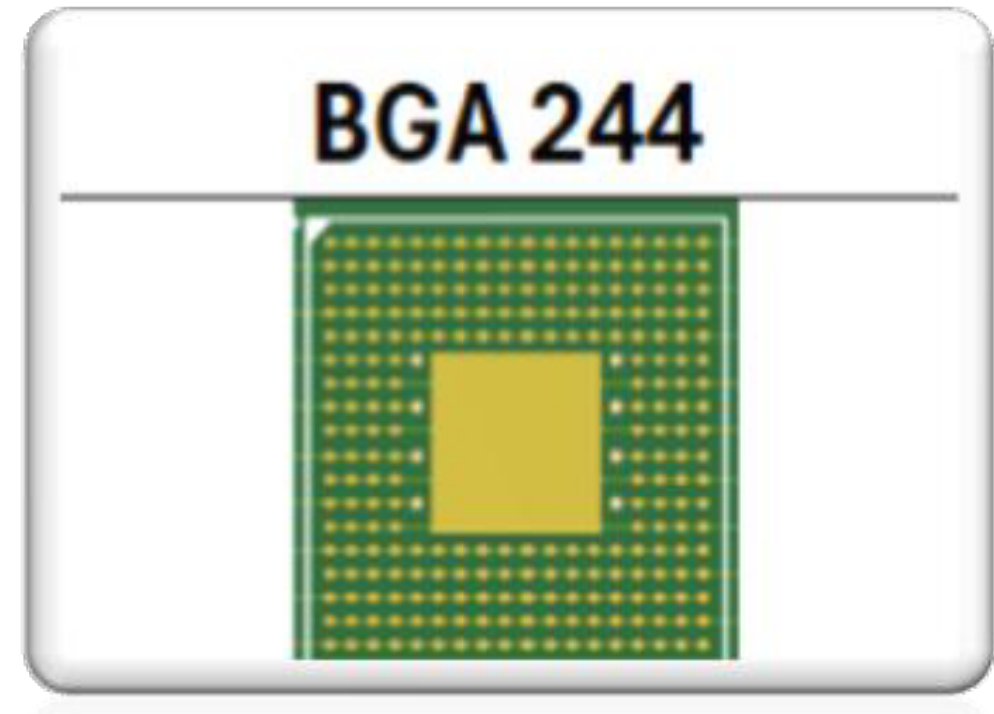


BGA 244 with a Center Board #6

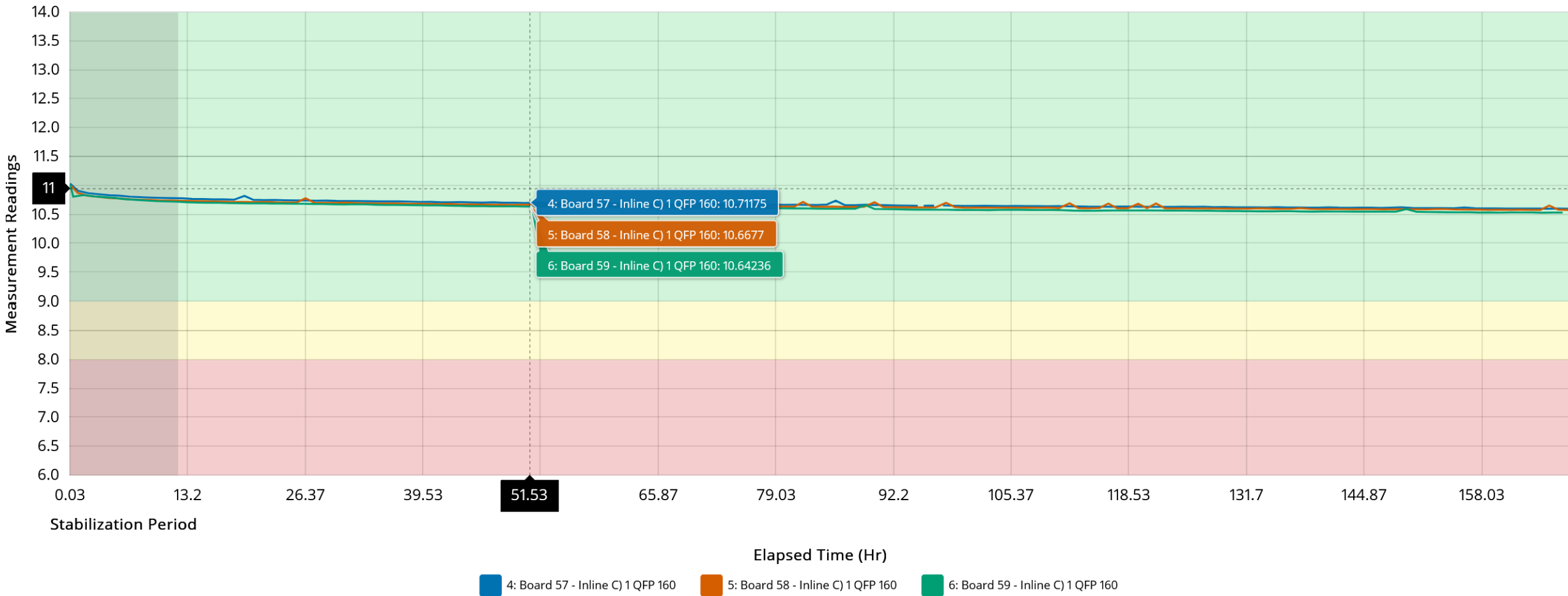


BGA 244 with a Center Lug – Inline Cleaning

- No flux residue under the component terminations
- SIR was in the desired performance zone over the testing period
- No leakage currents
- SIR passed

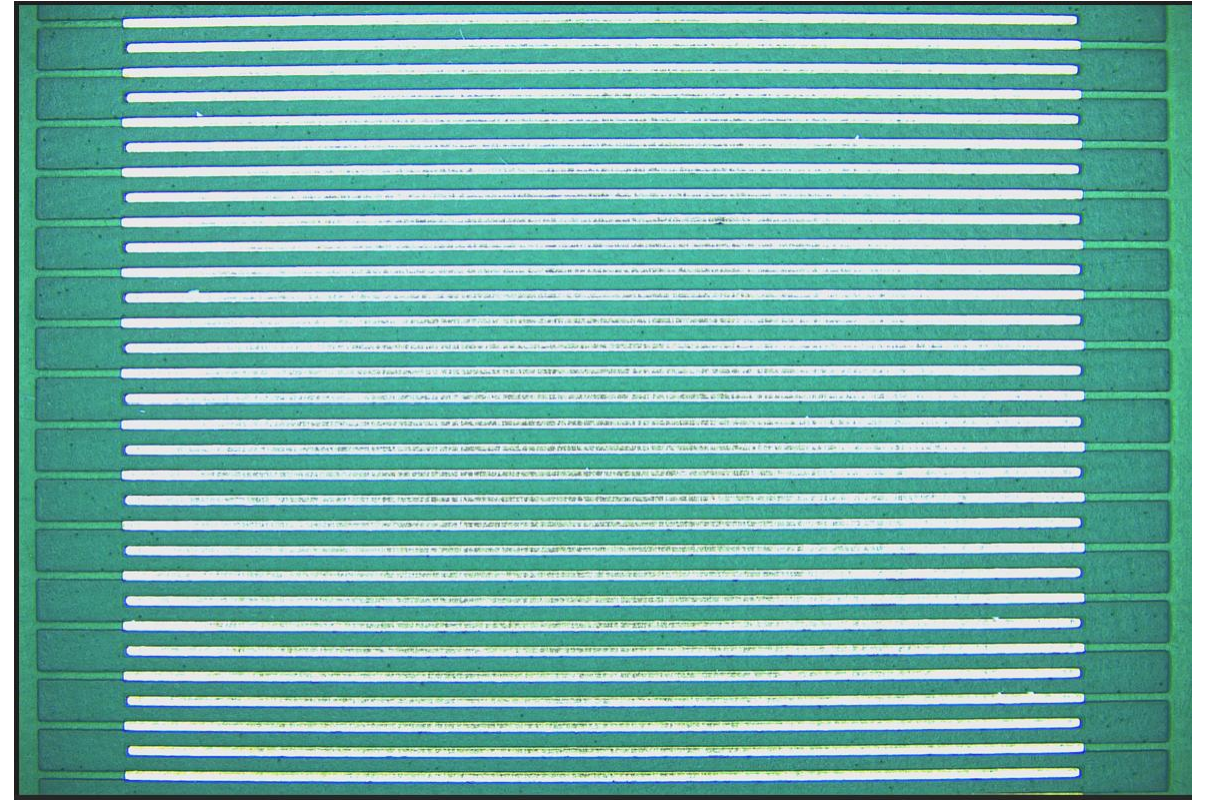
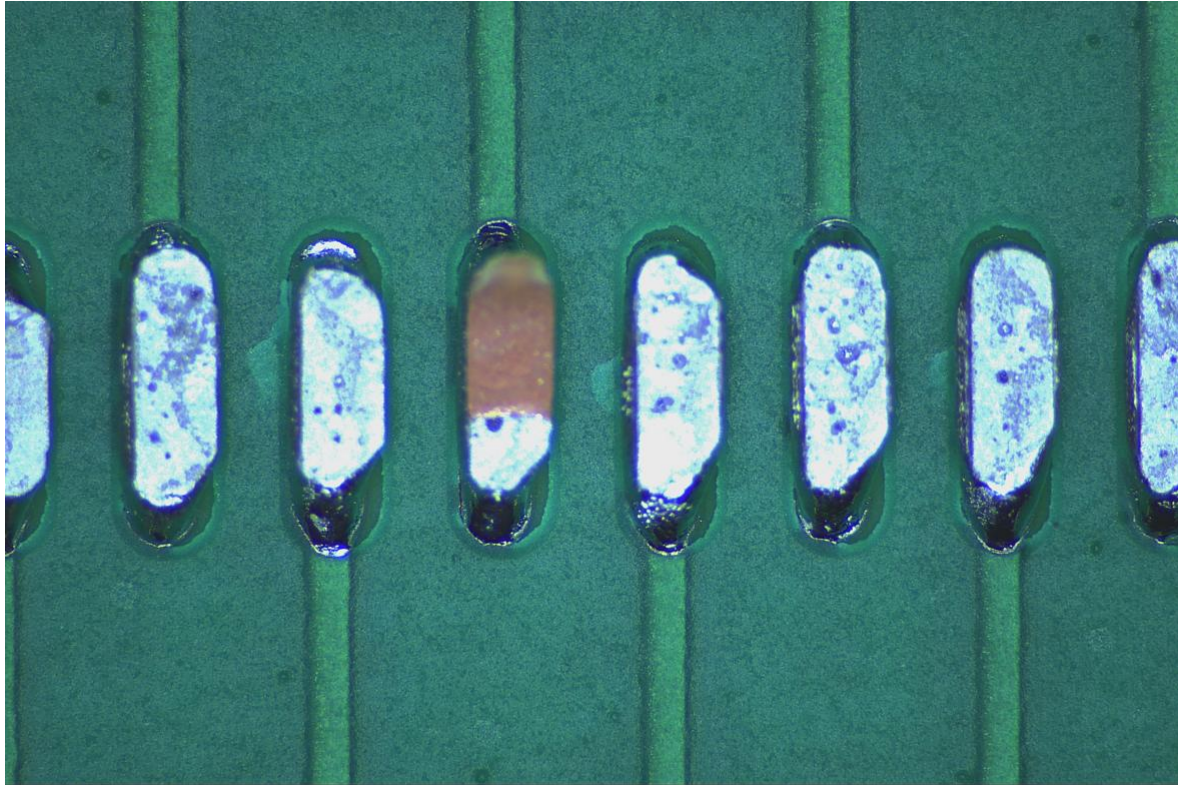


QFP-160 with an SIR Comb Inline Cleaning Machine



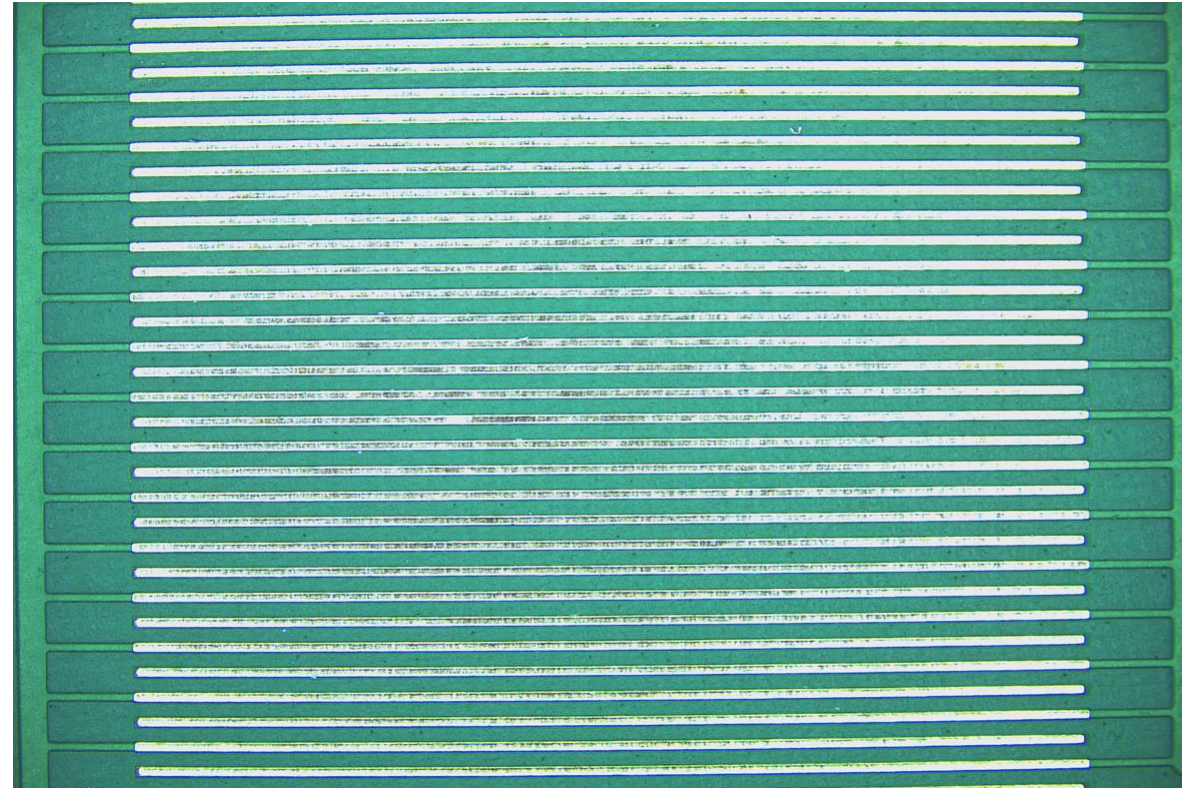
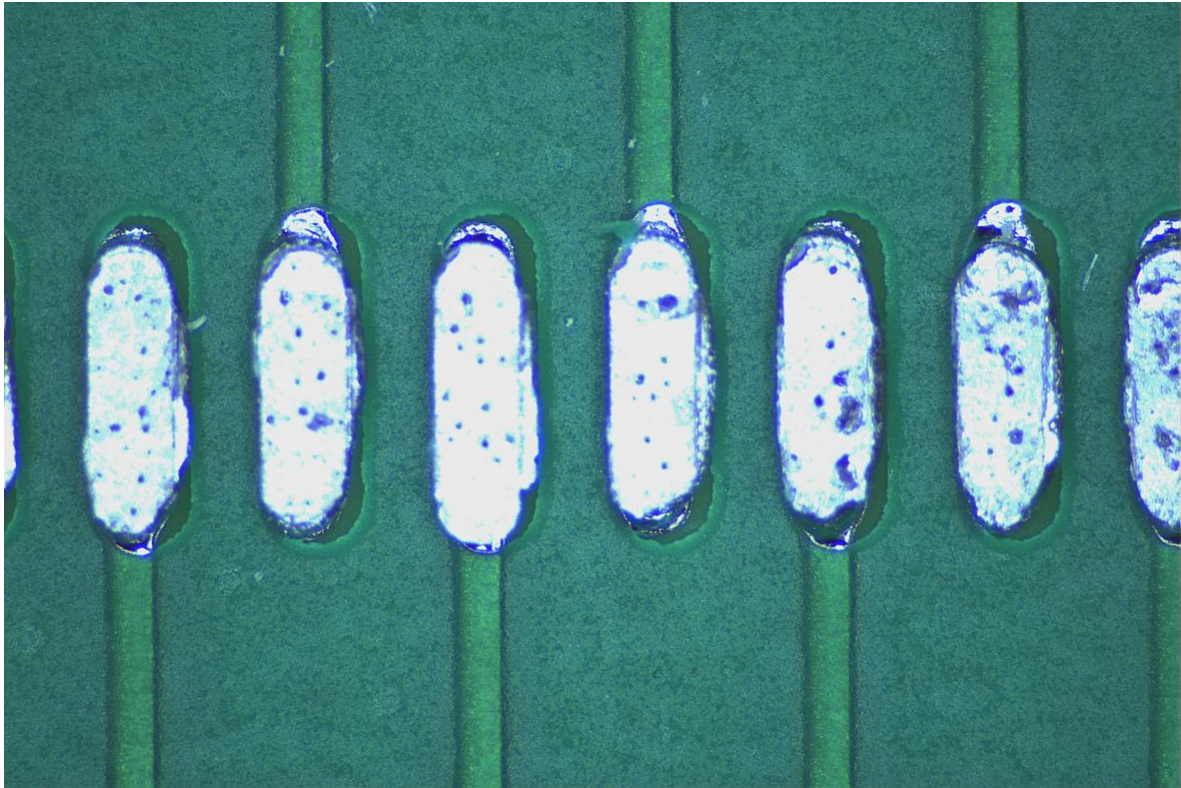
QFP-160 with an SIR Comb

Board #4



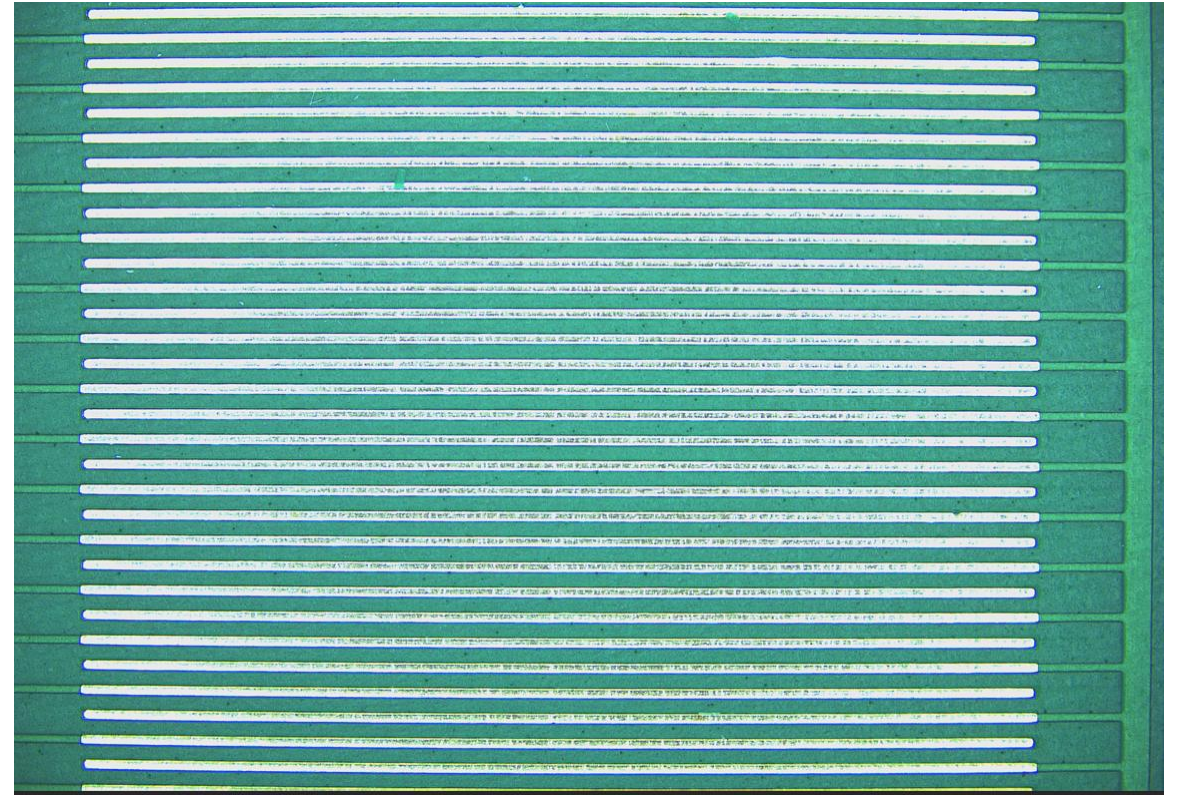
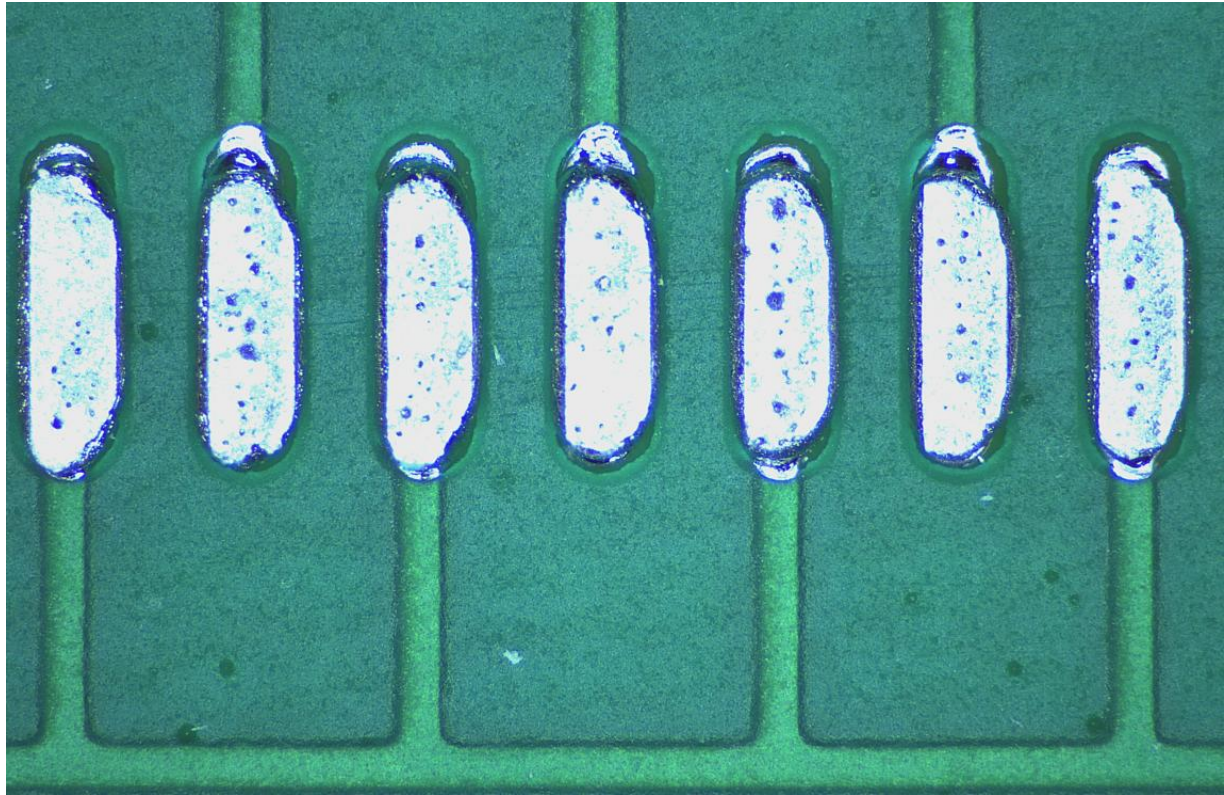
QFP-160 with an SIR Comb

Board #5



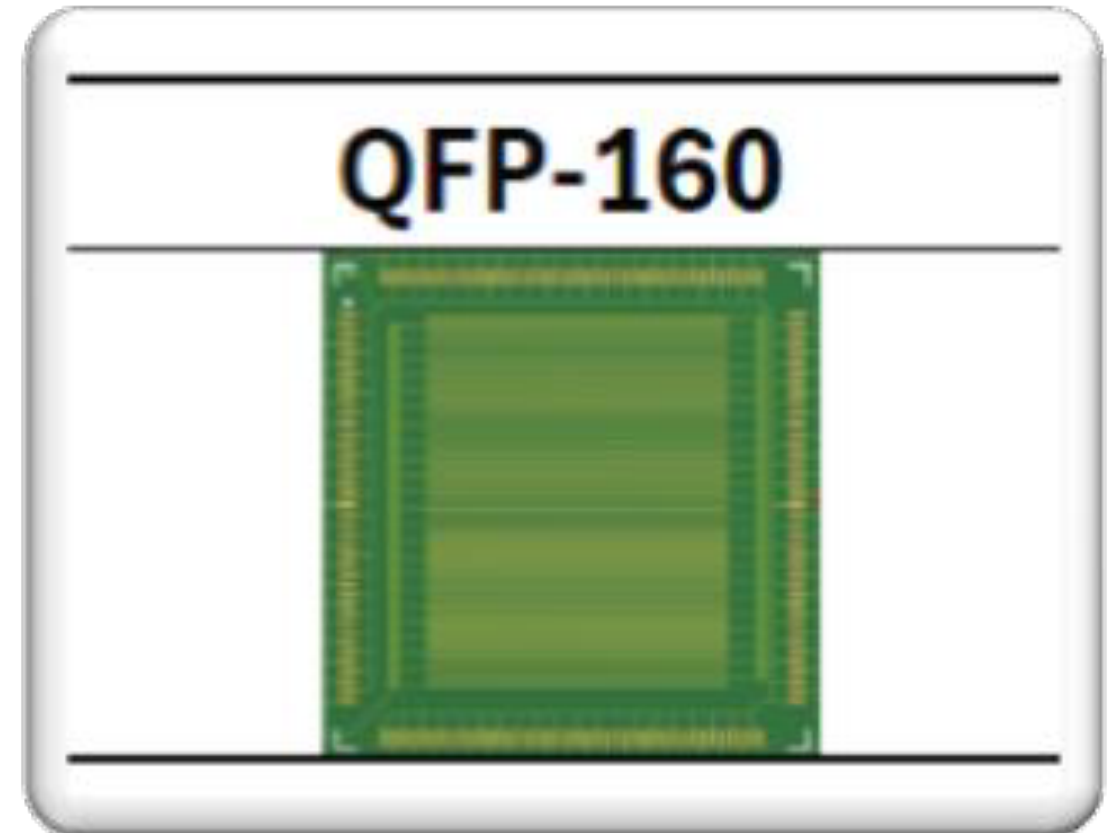
QFP-160 with an SIR Comb

Board #6

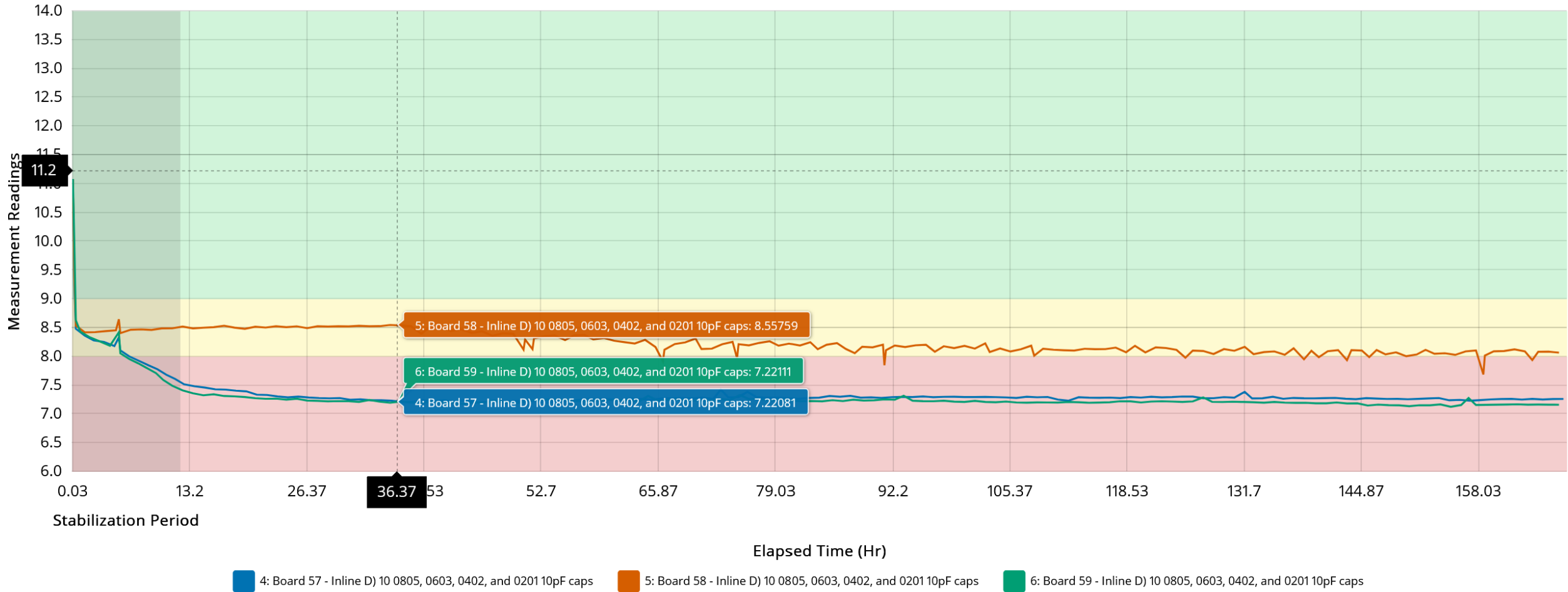


QFP-160 with an SIR Comb – Inline Cleaning

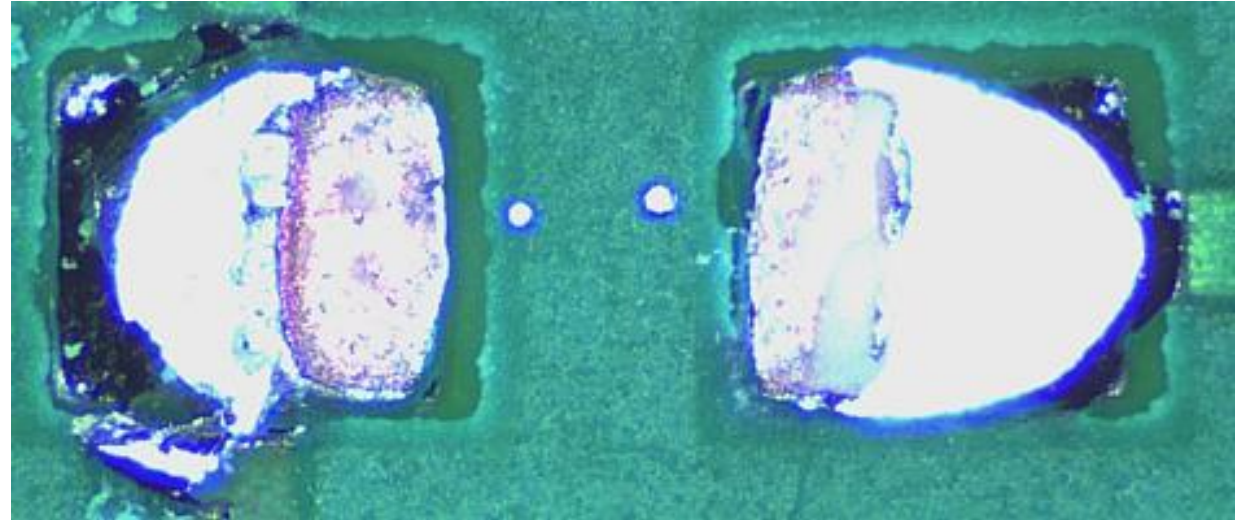
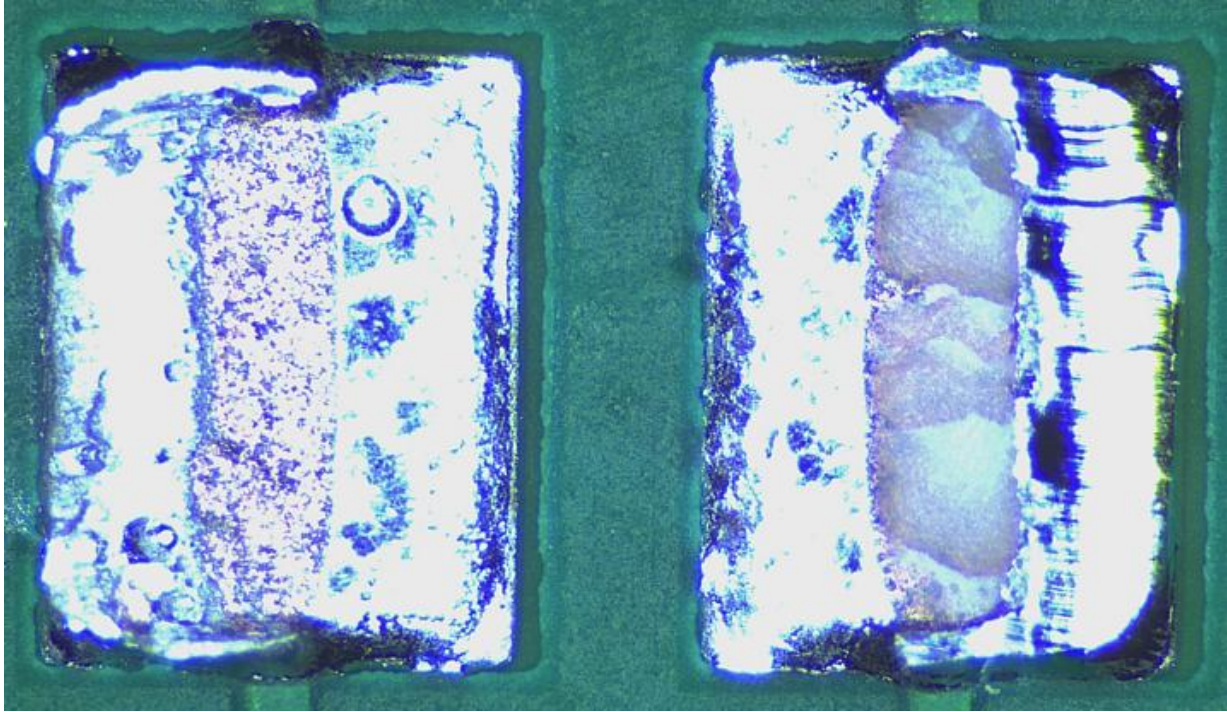
- No flux residue under the component terminations
- SIR was in the desired performance zone over the testing period
- No leakage currents
- SIR passed



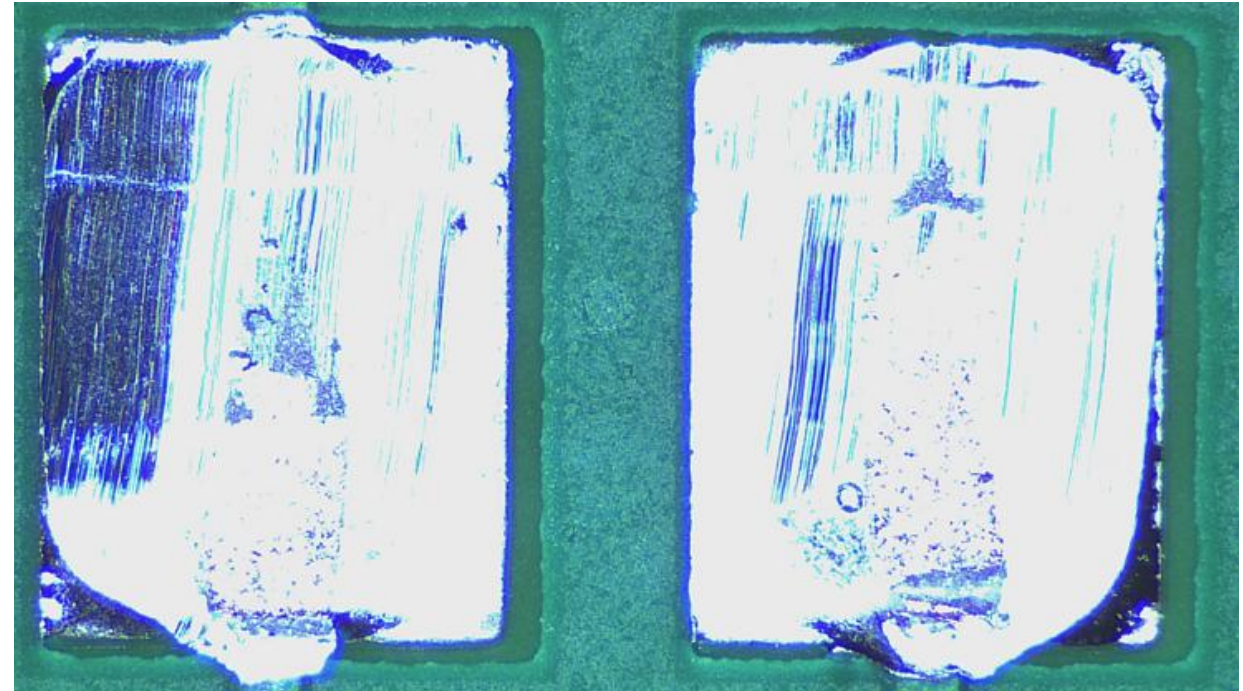
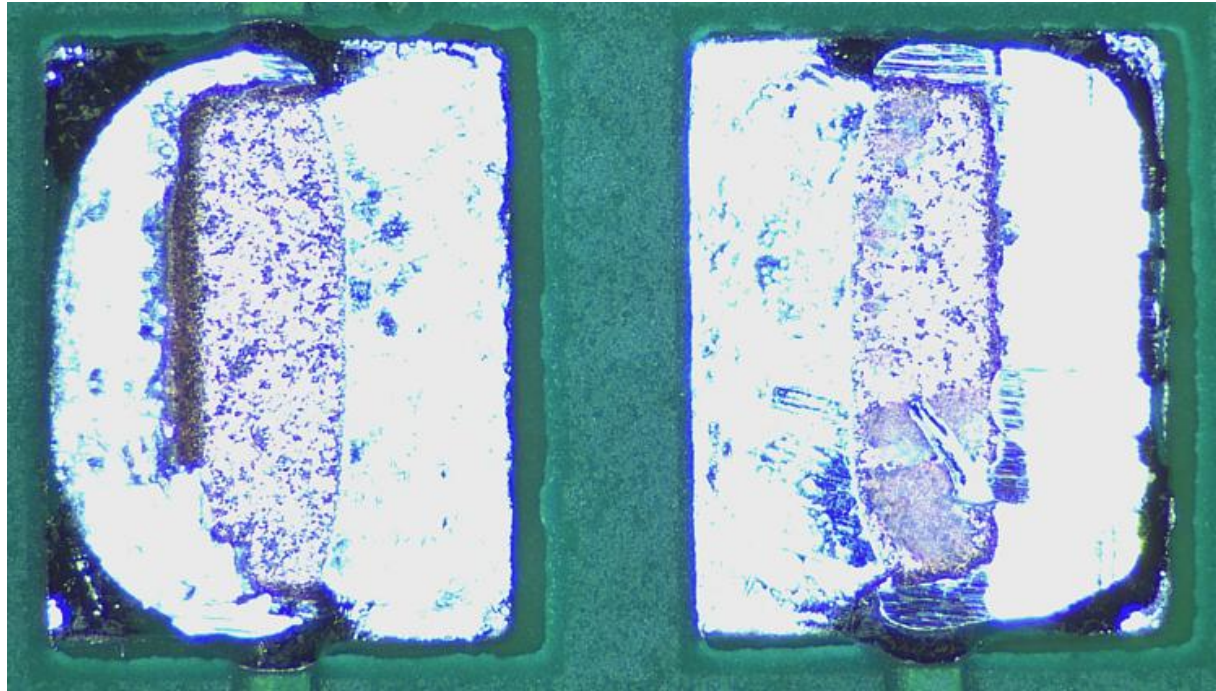
0201 / 0402 / 0603 / 0805 Caps Inline Cleaning Machine



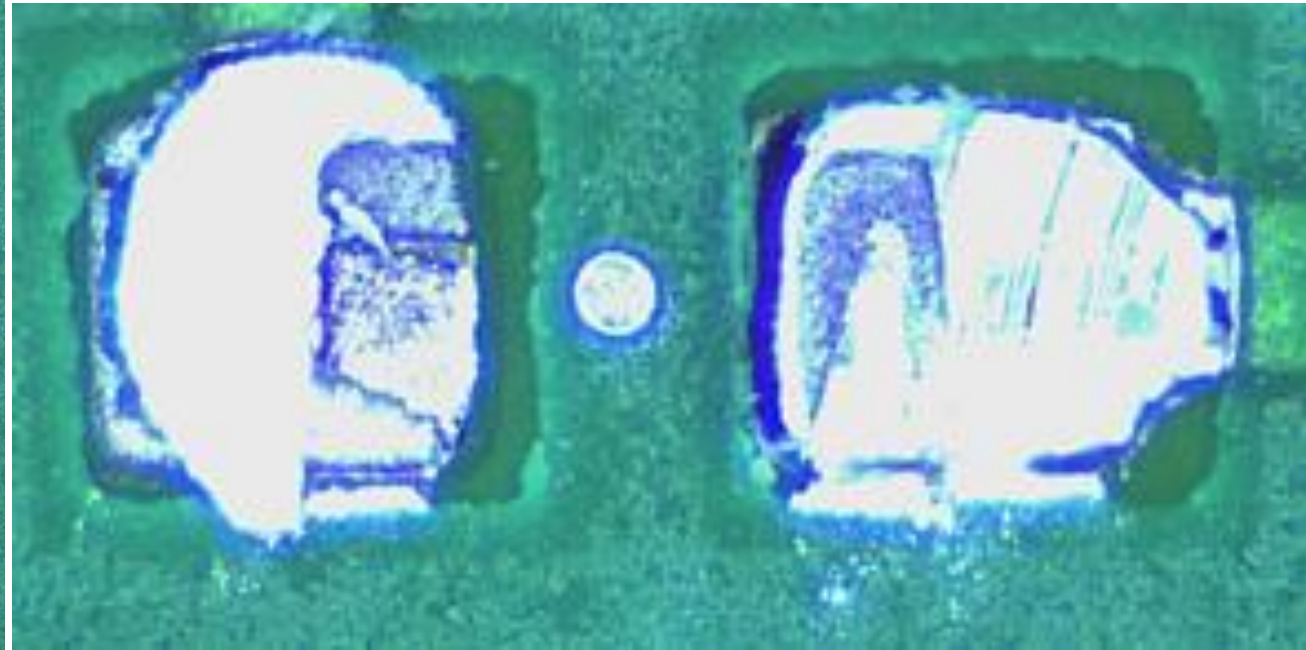
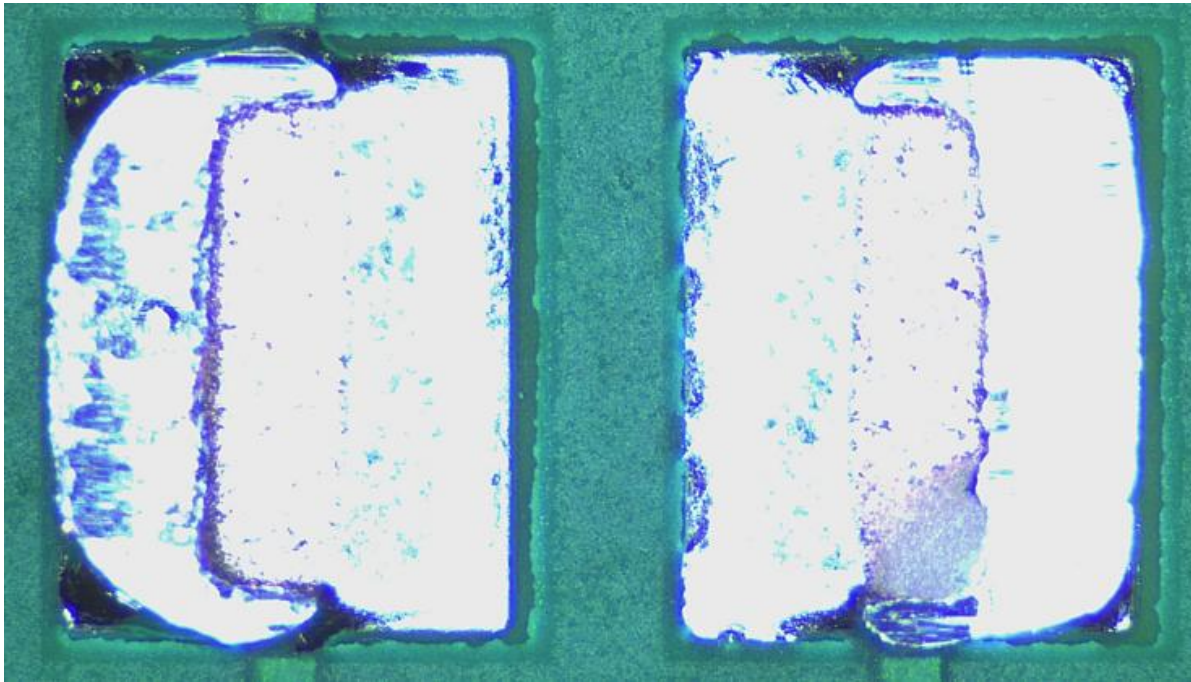
0201 / 0402 / 0603 / 0805 Caps Board #4



0201 / 0402 / 0603 / 0805 Caps Board #5

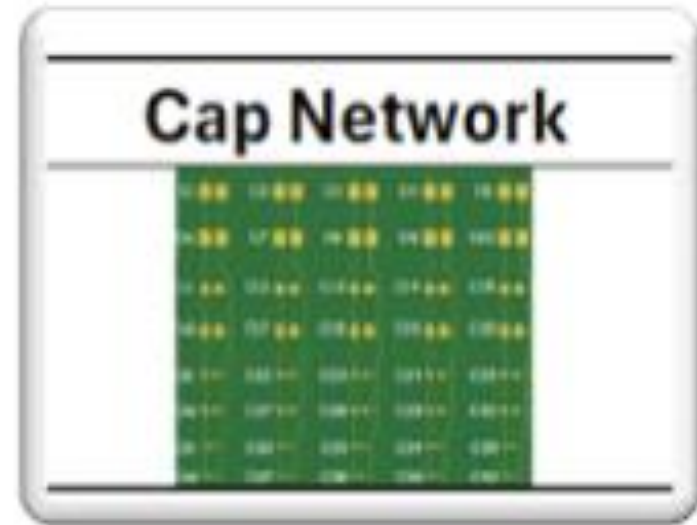


0201 / 0402 / 0603 / 0805 Caps Board #6



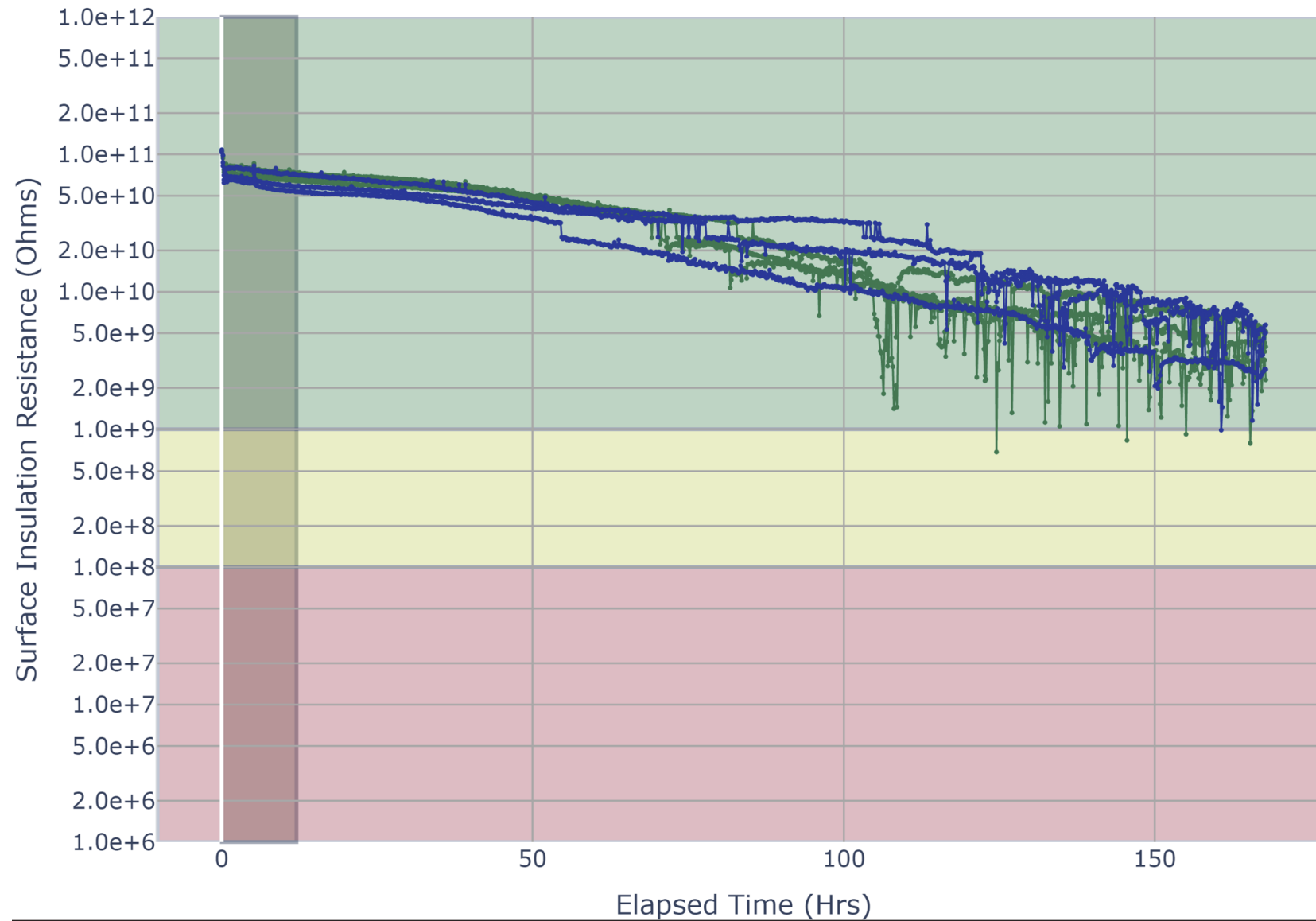
0201 / 0402 / 0603 / 0805 Caps Inline Cleaning

- No flux residue was present under the component terminations
- SIR was in the cautionary zone with mild leakage currents into the danger zone for Board 5
- SIR was in the danger zone for Boards 4 & 6 with no leakage currents
- Under some of the 0201 caps, there was a dot of solder between the pads.
 - Indicates a dirty stencil
- SIR failed

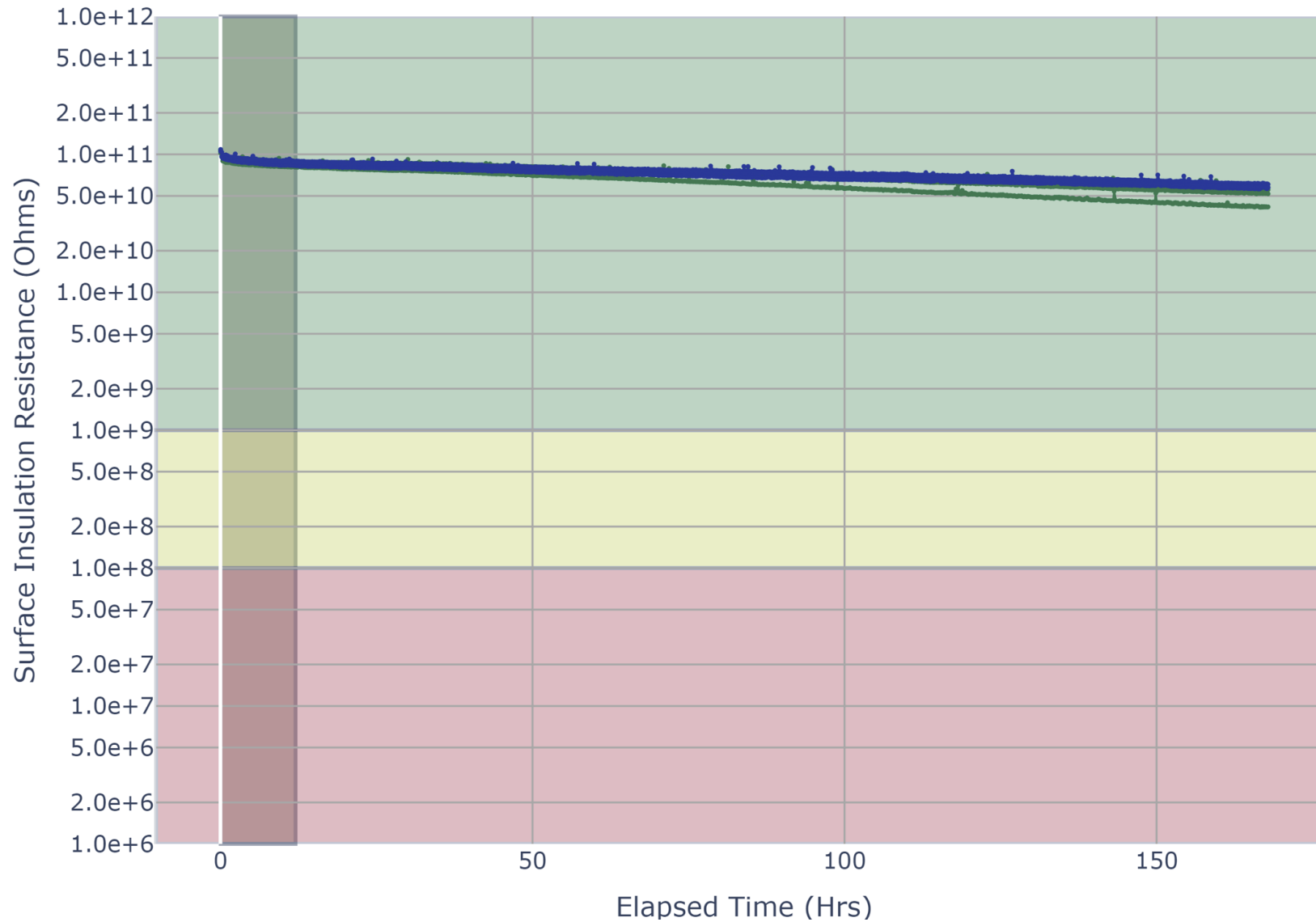


COMPARISON OF THE BATCH AND INLINE CLEANING MACHINES

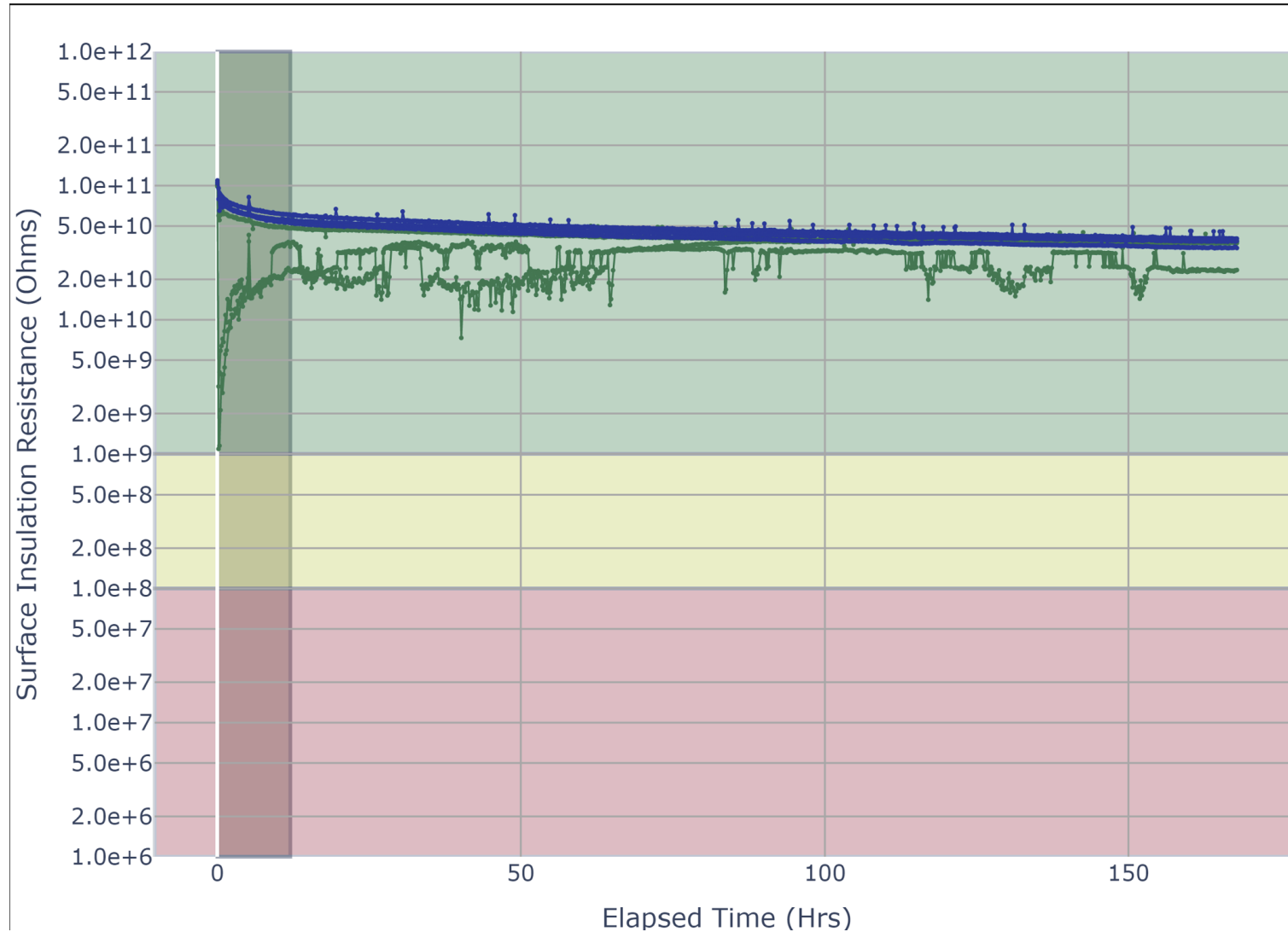
QFN-48



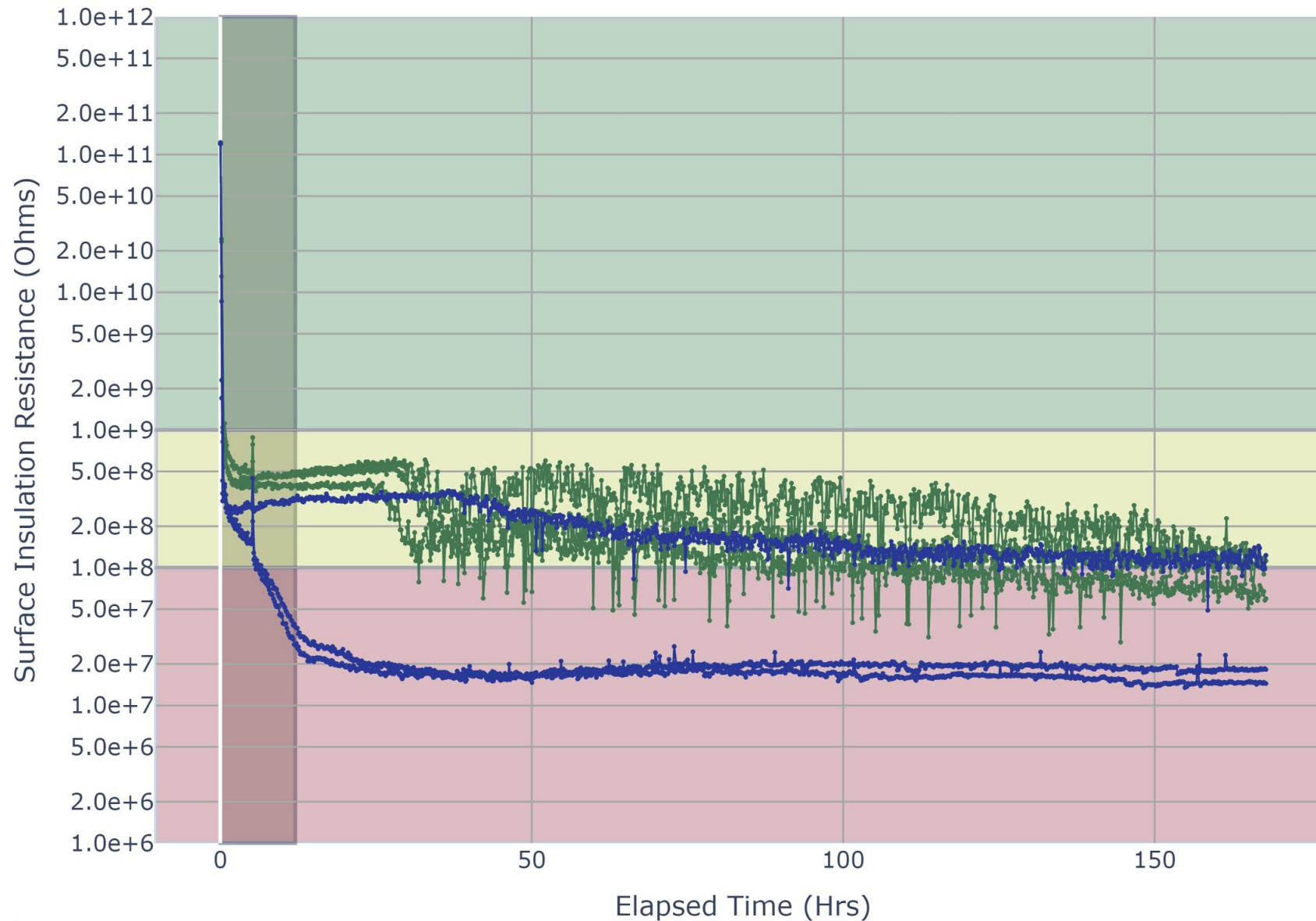
BGA 244 with a Thermal Lug



QFP-160 with an SIR Comb



0201/0402/0603/0805 Caps



INFERENCES FROM THE DATA FINDINGS

Inferences from the Data Findings

- ABC Solder Paste contained an active flux residue
 - Partially cleaned flux residue lowered insulation resistance
 - When flux was present, there were mild leakage currents
- The cap network exhibited lower insulation resistance
 - No visible flux residues were detected
 - The 0201 caps had dots of solder between the pads
 - This results from a dirty stencil
 - Most likely, the factor that drove insulation resistance lower
- No signs of rinsing issues
- The Inline and batch cleaning machines exhibited similar performance

RECOMMENDATIONS

Recommendations

- Consider a No-Clean solder paste with flux activators that are low in activity and do not absorb moisture.
- Check into the stencil underwiping process
 - Wipe frequency
 - Dry wipe or chemical wipe
 - Dial in the process to ensure solder balls are eliminated



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