

Cleaning test - report

FLUX RESIDUES removal



&



Solder paste:

M731-GWS-T8J
M705 GLV-HF type 4
M705-GRN360-K1VM

PCB type: assembled DCT testing boards

*Cooperation of **DCT** as specialist for cleaning applications and producers of variable materials for electrotechnical industry helps to make our joint customer completely satisfied with his process. Thanks to this testing we are able to improve our current processes or develop new.*

Thank you **Senju Metal Industry**

About DCT objective testing

DCT is Czech company that develops and produces cleaning processes including cleaning machines and cleaning fluid for electrotechnical industry. This enables us to be able to suit the whole process to customer's specific needs. To be able to provide the best solution for our customer, we cooperate with producers of materials used in electrotechnical industry. We do this testing to be compatible and to be able to remove excess or residues of material on the surface which are undesirable.

What is our standard test procedure for removing flux residues?

Based on our long experiences we use the most popular, the most successful and broad cleaning process for flux removal from assembled PCB. This process is

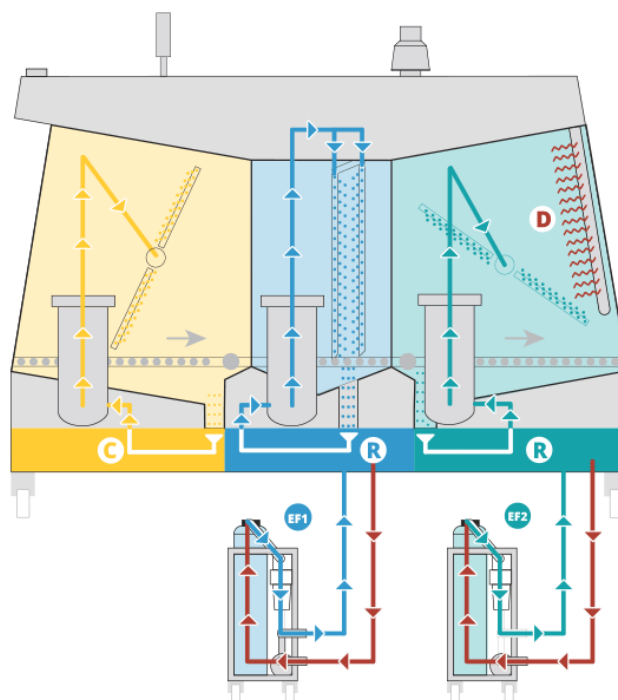
vertical high pressure spray in air cleaning technology in cleaning machine Injet TWIN 388 CRRD and broad types of water based Decotron® cleaning fluid.

Cleaning is followed by two rinsing using DI water at conductivity 1-2uS with continual deionization and hot air drying.

(More types of cleaning fluid and different types of cleaning machines are tested on request.)

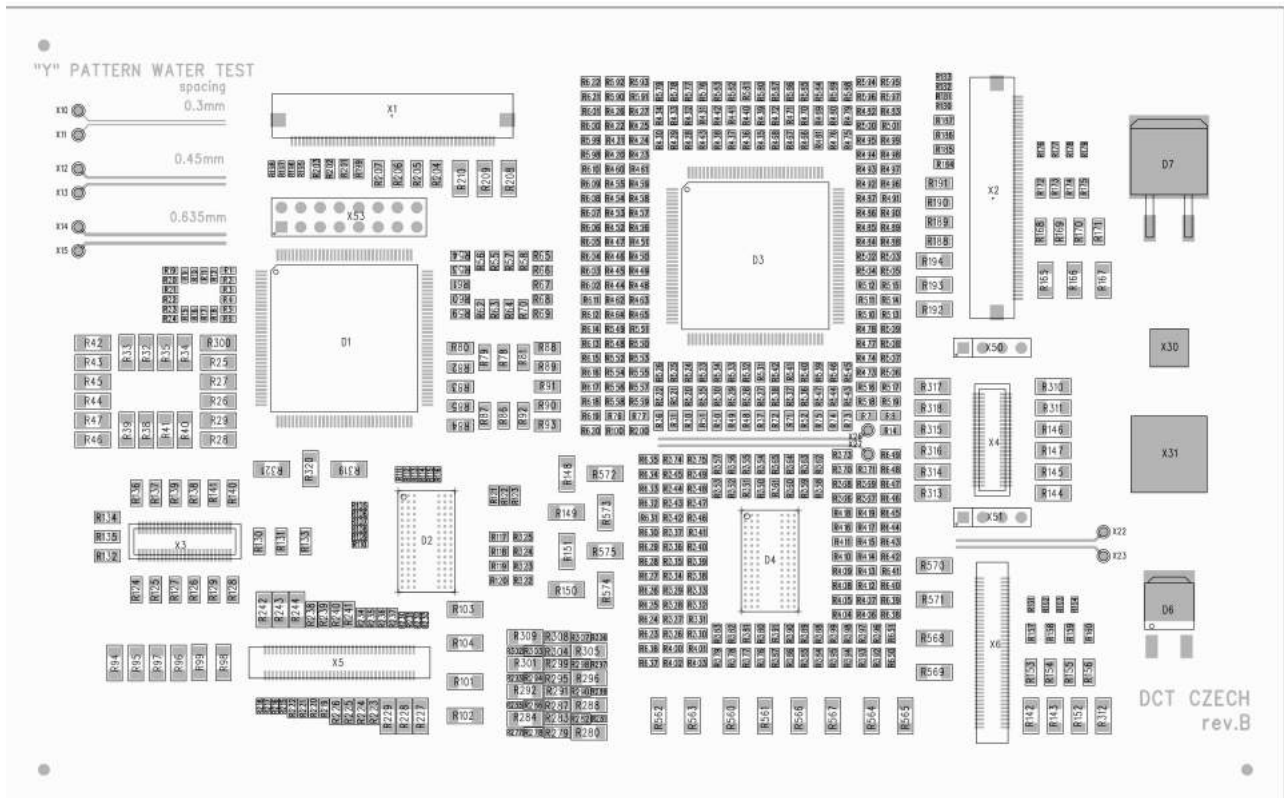
4 INDIVIDUAL PROCESS + 2 EXTERNAL ACTIVE FILTRATION

- | | |
|---------------------|--|
| C CLEANING | D DRYING |
| R 1. RINSING | EF1 EXTERNAL ACTIVE FILTRATION - 1. RINSING |
| R 2. DRYING | EF2 EXTERNAL ACTIVE FILTRATION - 2. RINSING |



How do we test cleaning flux residues from PCB?

1. First we **let to assemble several DCT testing boards** using desired solder paste. DCT testing board contains more than 600 commonly used components and is designed to be the most complicate for cleaning as is possible. **We test shadowing effect and effectivity of cleaning components which are difficult to clean.**

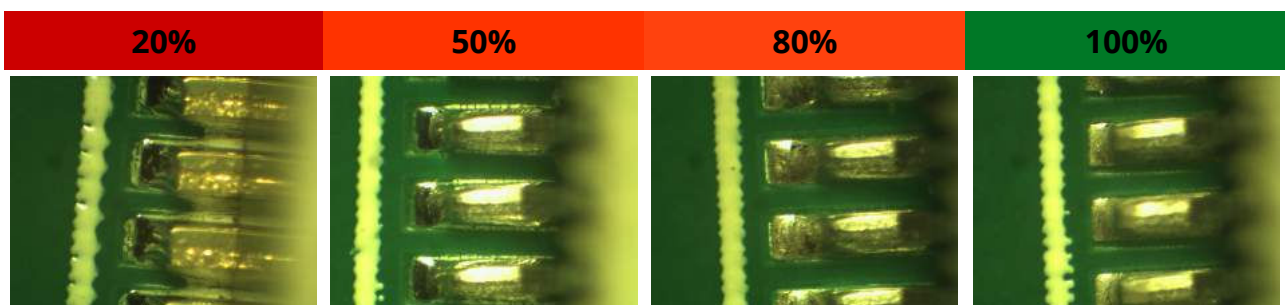


Design of DCT assembled board

We can also make conclusions of cleaning possibilities of desired solder paste based on **our customer's PCB** which allow us to use their own real PCB for testing.

2. Before test we make detailed magnified **photos of flux residues** on the surface after soldering. In next step we start testing cleaning in machine using **our standard cleaning process setting with different types of our commonly used Decotron® cleaning fluid on different chemical base to chose the best one.**

3. If we are able to remove all flux residues, we continue with **reducement of cleaning time**. It is also possible to play with temperature, different cleaning fluid and more types of cleaning technologies if requested. In case of insufficient cleanig efficiency we are able to develop new type of cleaning fluid.



—————→
increasing time and temperature, testing different cleaning fluid for succesful result

All conclusions are based on **visual inspection** under microscope and **ionic contamination testing** before and after cleaning.

We require ionic contamination $<0,500 \text{ ug Eq. NaCl/cm}^2$ after cleaning and no visible flux residues for designation as an high suitable cleaning process.

Testing cleaning flux residues of different types of Senju soldering paste:

PCBs were cleaned for 20 minutes at 60°C using different cleaning fluid and cleaning machine Injet TWIN 388 CRRD with three arm rotation vertical high pressure (2,4 bar) spray in air cleaning technology.

| Tested cleaning fluid | Properties of cleaning fluid |
|-------------------------|---|
| Decotron® 331S | Concentration: 20% Alkali one phase water based |
| Decotron® CP 381 | Concentration: 20% Alkali two phase water based, anticorrosive additives (clean and protect technology). |
| Decotron® CP 359 | Concentration: 20% Alkali two phase water based, anticorrosive additives (clean and protect technology). |
| Decotron® C55S | Concentration:100 % Alkali two phase 50% Water based & 50% Alcohol based |
| Proton® 49 | 100% alcohol based |

Cleaning recommendation:

| Tested Cleaning fluid | Suitability of cleaning fluid for Senju solder paste type* | | |
|-------------------------|--|--------------------------|------------------------|
| | Senju M731-GWS-T8J | Senju M705 GLV-HF type 4 | Senju M705-GRN360-K1VM |
| Decotron® 331S | The best | The best | Suitable |
| Decotron® CP 381 | Hihgly suitable | Hihgly suitable | Hihgly suitable |
| Decotron® CP 359 | not tested | not tested | Hihgly suitable |
| Decotron® C55S | Hihgly suitable | Hihgly suitable | The best |
| Proton® 49 | Not recommended | Not recommended | Not recommended |

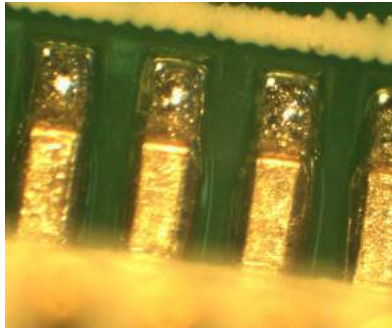
*See attached photodocumentation from cleaning test using cleaning fluid evaluated as „the best“. This result only shows ability of cleaning tested sample and comparison of cleaning effectivity of each of them. All setting must be verified and customized for individual PCB. Result from this test should be used as a guide to optimize specific cleaning process. For deeper study or trial test please contact DCT representative.

Conclusion:

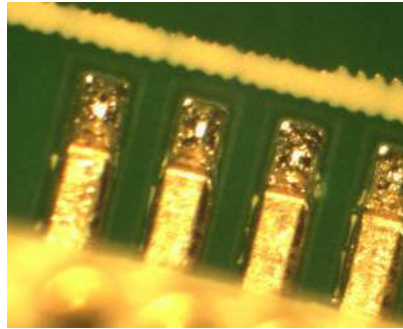
If compare severity of cleaning each solder paste, the most difficult for cleaning were flux residues from soldering paste **Senju M705 GLV-HF type 4**. The easiest to clean were flux residues from **Senju M705-GRN36-K1VM**.

Lower cleaning time (<20 min) or temperature (<60°C) of the cleaning fluid result in white residue on **conector X5** (MOLEX 537480808; PIN:80; 0,5mm; H:3mm) coming from insufficient cleaning of flux residues.

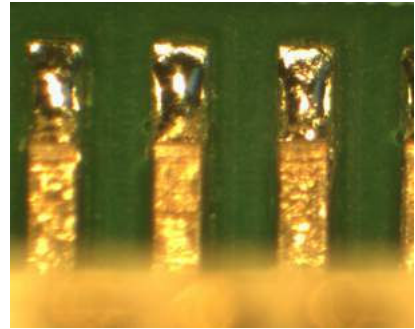
Conector X5 (MOLEX 537480808; PIN:80; 0,5mm; H:3mm)



Before celaning



After 10 min cleaning



After 20 min cleaning

Integrity testing

All tested materials, documents, DCT boards, more photos and ROSE reports from test are thoroughly concluded to make this report and saved in DCT for future potential needs and are available on request for verification to customer or producer. DCT certifies that all data within this report are true and accurate.

Test was performed by:

Ing. Lenka Musilová / **laboratory specialist** / Lm@dct.cleaning /

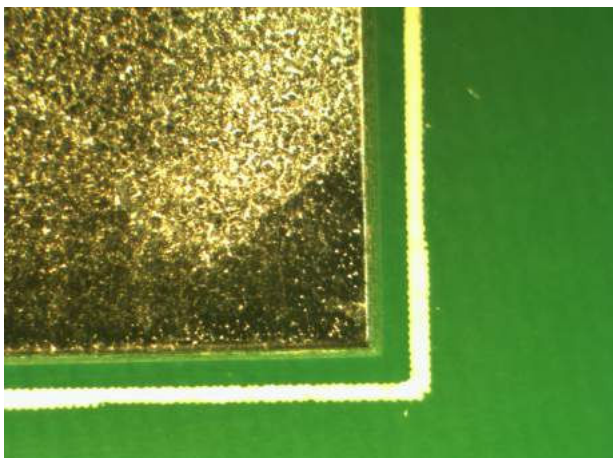
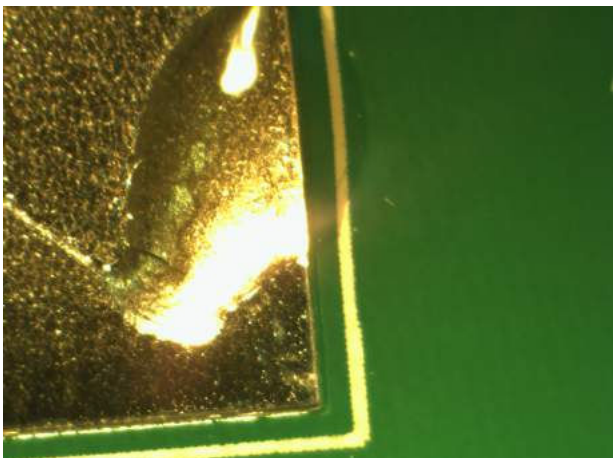
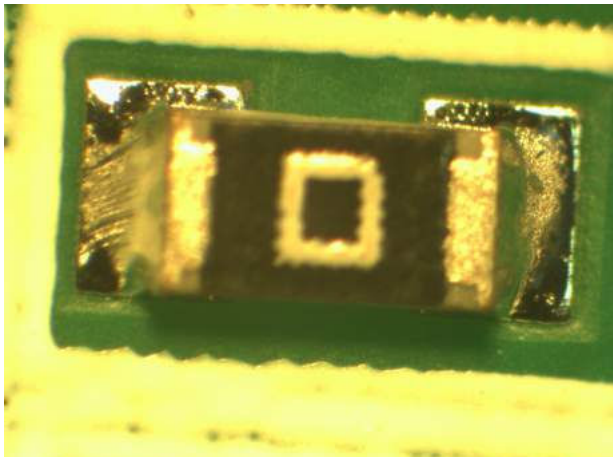
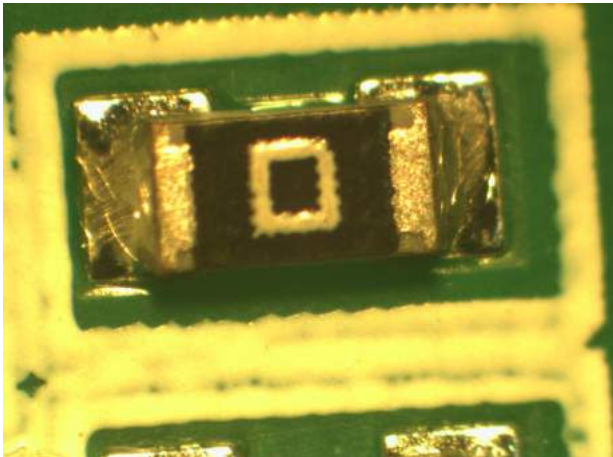
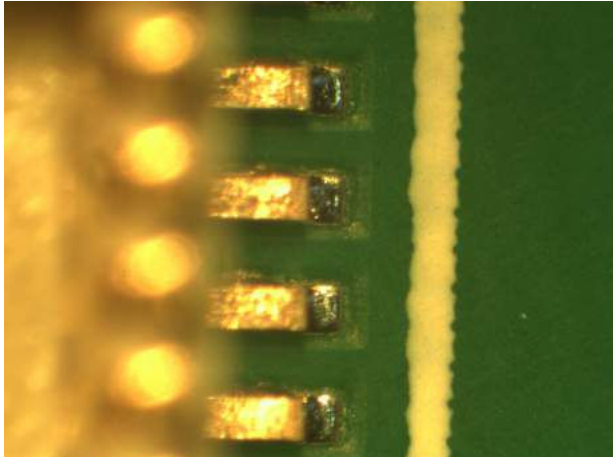
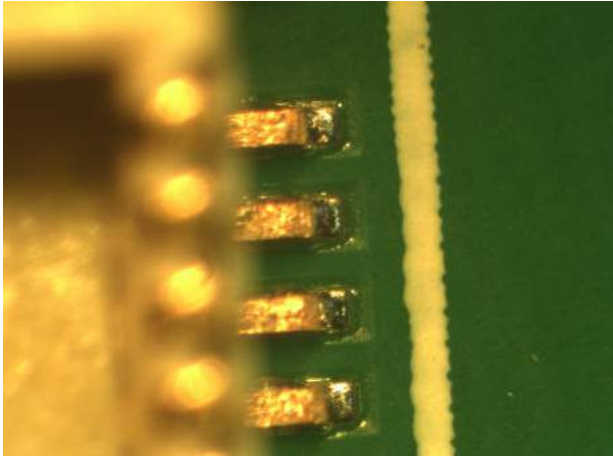
Created: **24.10.2016**

Attachement 1:

Senju M731-GWS-T8J , cleaning result for high suitable process

PCB BEFORE

PCB AFTER



ROSE test result: **0,103 ug Eq. NaCl/cm²**



ROSE tester data log

IPC-TM-650 2.3.25
Static extraction method

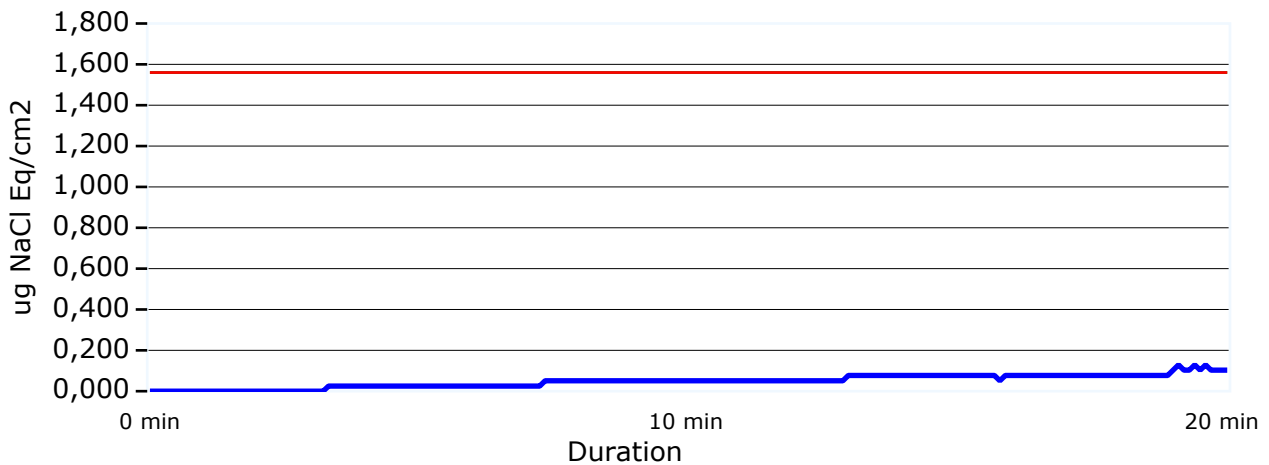
Detection and Measurement of Ionizable Surface Contaminants by Resistivity of Solvent Extract

Setup:

| | | | |
|--------------------------------------|------------|--|--------------|
| Test name: | SENJU | Duration (min): | 20 |
| PCB part name: | M731GVST8J | Fluid type (IPA/DI water): | 75/25 |
| PCB length (cm): | 17,5 | Fluid temperature (°C): | 24,7 |
| PCB width (cm): | 10,5 | Baseline conductivity (uS/cm ²): | <0.062 |
| PCB Surface area (cm ²): | 367 | Conductivity cell sensitivity (uS/cm ²): | 0.0001 |
| | | ROSE SN.: | ROSE-02_v3.1 |

Test Status: **PASS**
Limit (ugNaCl/cm²): **1,560**
Result (ug NaCl/cm²): **0,103**

Contamination vs. Time



Legend:

| | |
|--|----------------------------------|
| | IPC limit of ionic contamination |
| | Limit of ionic contamination |
| | Measured ionic contamination |

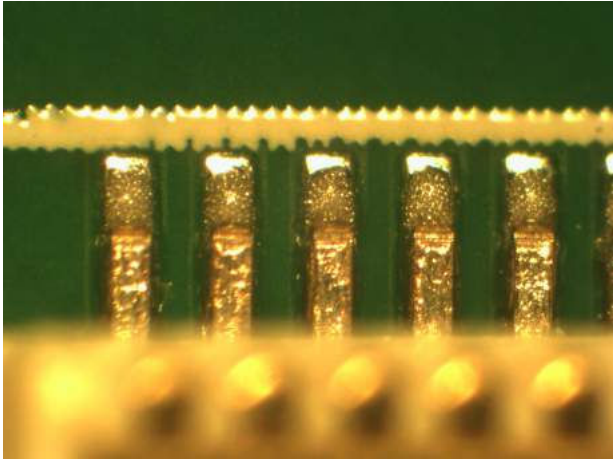
Testet by: LEN

Sampling time: 10/25/2016 13:36:19

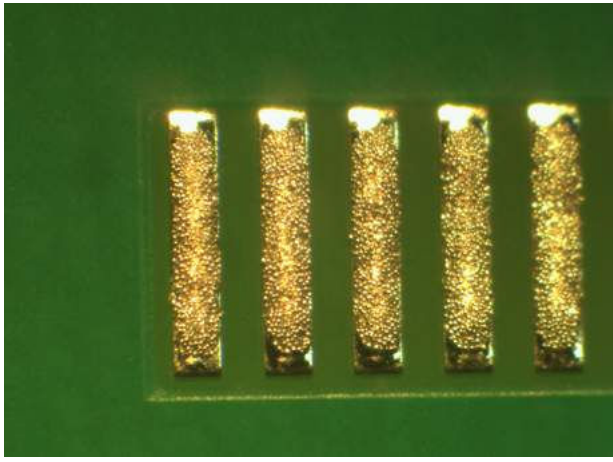
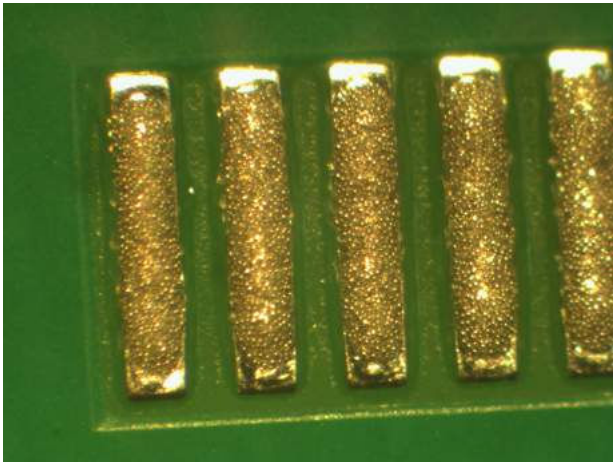
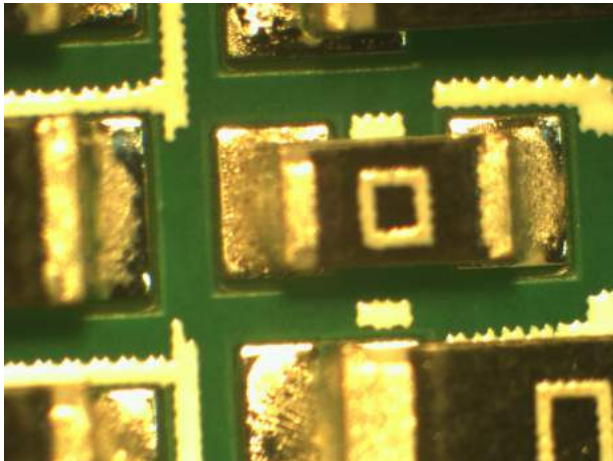
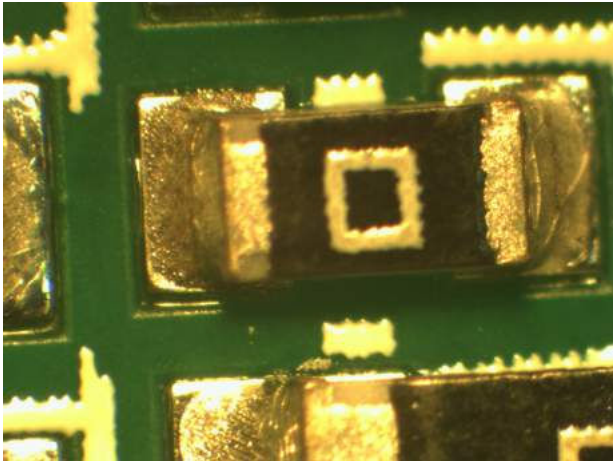
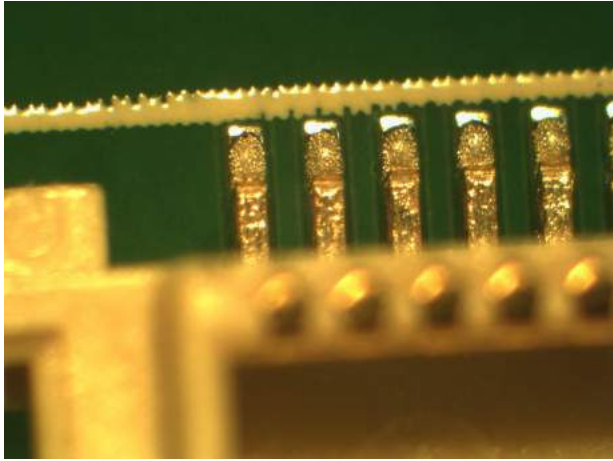
Attachement 2:

Senju M705 GLV-HF type 4, cleaning result for high suitable process

PCB BEFORE



PCB AFTER



ROSE test result: **0,155 ug Eq. NaCl/cm²**



ROSE tester data log

IPC-TM-650 2.3.25
Static extraction method

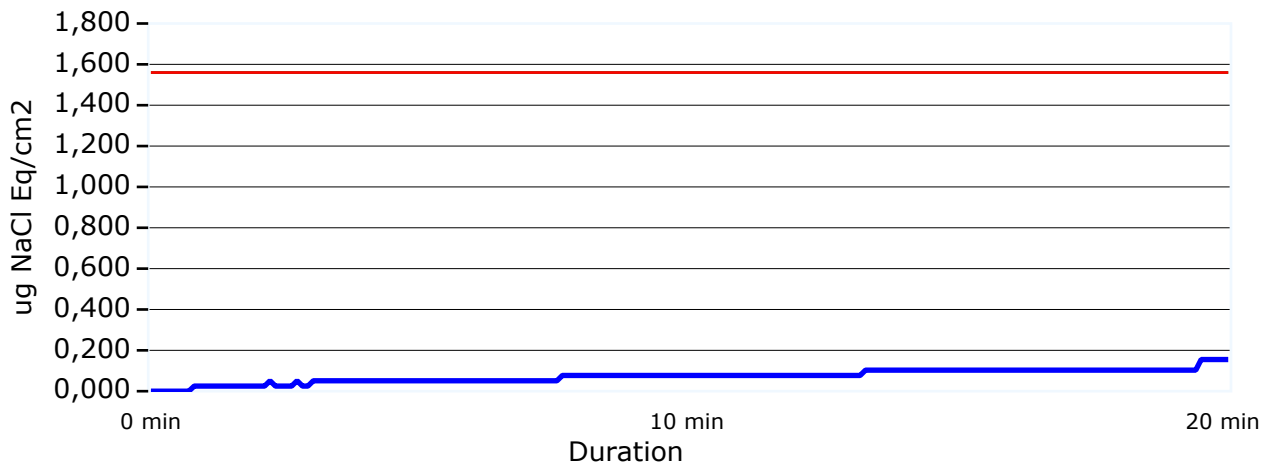
Detection and Measurement of Ionizable Surface Contaminants by Resistivity of Solvent Extract

Setup:




| | | | |
|--------------------------------------|------------|--|--------------|
| Test name: | SENJU | Duration (min): | 20 |
| PCB part name: | M705GLVHF4 | Fluid type (IPA/DI water): | 75/25 |
| PCB length (cm): | 17,5 | Fluid temperature (°C): | 25,1 |
| PCB width (cm): | 10,5 | Baseline conductivity (uS/cm ²): | <0.062 |
| PCB Surface area (cm ²): | 367 | Conductivity cell sensitivity (uS/cm ²): | 0.0001 |
| | | ROSE SN.: | ROSE-02_v3.1 |

Test Status: **PASS**
Limit (ugNaCl/cm²): **1,560**
Result (ug NaCl/cm²): **0,155**

Contamination vs. Time



Legend:

 IPC limit of ionic contamination
 Limit of ionic contamination
 Measured ionic contamination

Testet by: LEN

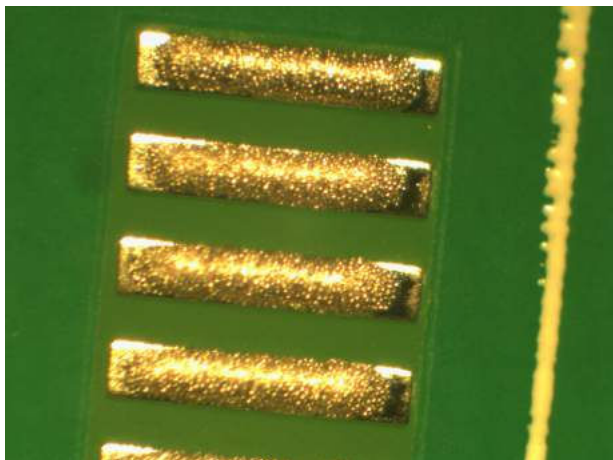
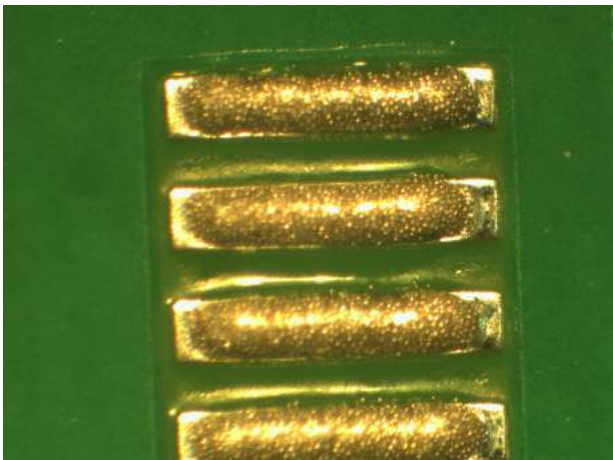
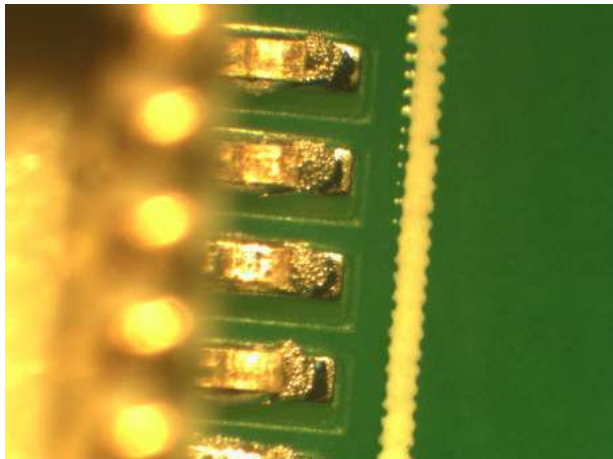
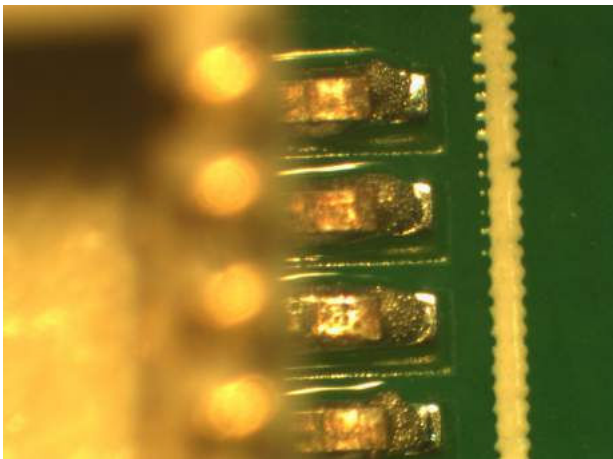
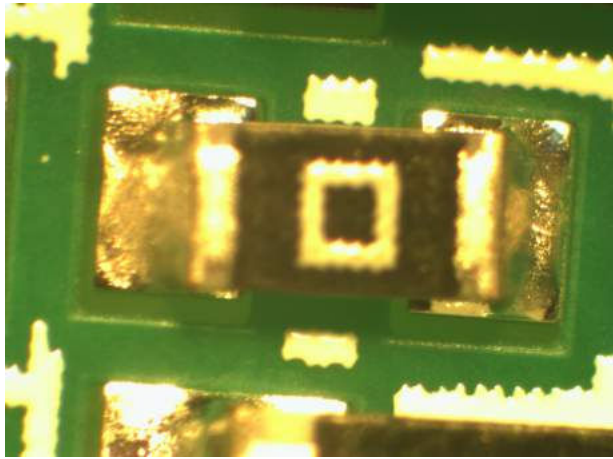
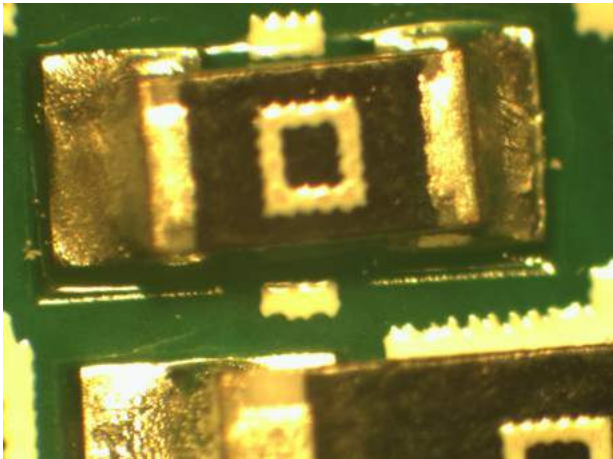
Sampling time: 10/25/2016 13:58:00

Attachement 3:

Senju M705-GRN360-K1VM, cleaning result for high suitable process

PCB BEFORE

PCB AFTER



ROSE test result: **0,181 ug Eq. NaCl/cm²**



ROSE tester data log

IPC-TM-650 2.3.25
Static extraction method

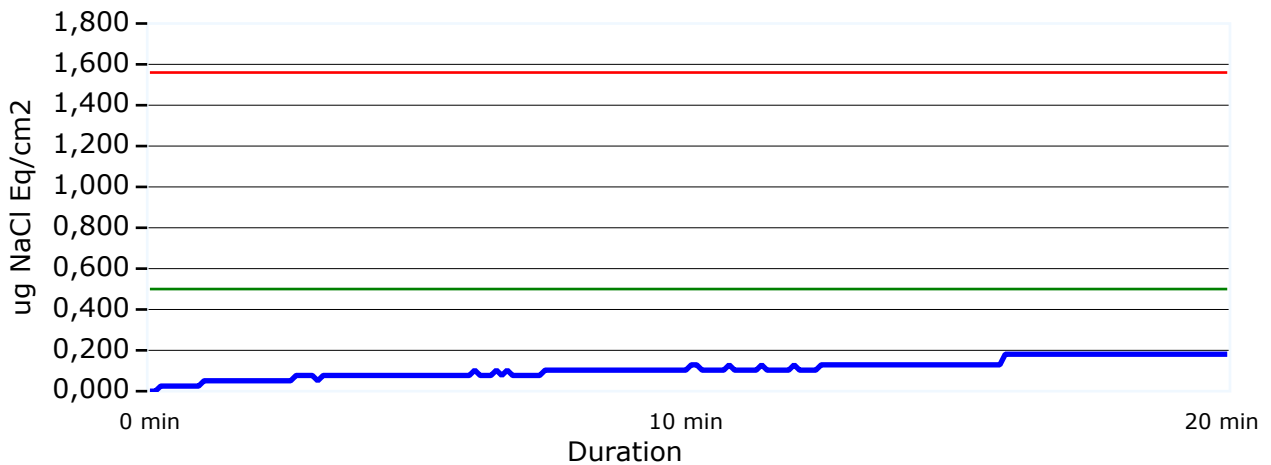
Detection and Measurement of Ionizable Surface Contaminants by Resistivity of Solvent Extract

Setup:




| | | | |
|--------------------------------------|------------|--|--------------|
| Test name: | SENJU | Duration (min): | 20 |
| PCB part name: | M705GRN360 | Fluid type (IPA/DI water): | 75/25 |
| PCB length (cm): | 17,5 | Fluid temperature (°C): | 24,9 |
| PCB width (cm): | 10,5 | Baseline conductivity (uS/cm ²): | <0.062 |
| PCB Surface area (cm ²): | 367 | Conductivity cell sensitivity (uS/cm ²): | 0.0001 |
| | | ROSE SN.: | ROSE-02_v3.1 |

Test Status: **PASS**
Limit (ugNaCl/cm²): **0,500**
Result (ug NaCl/cm²): **0,181**

Contamination vs. Time



Legend:

 IPC limit of ionic contamination
 Limit of ionic contamination
 Measured ionic contamination

Testet by: LEN

Sampling time: 10/25/2016 14:19:57