# Reliability Test Report

## Part Type:
Diplexer Filter

## Platform:
FR4 PCB, Electroless Nickel, Immersion Gold Finish

## Test Laboratory
SGS-CSTC Standards Technical Services Co. LTD, Shenzhen China.

## M/A-Com P/N Used:
MAFL-009272-CD0AC0

## M/A-Com Part Numbers Qualified by Similarity:
All Filters on Gold Plated FR4 PCB

## Test Results Table

<table>
<thead>
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<th>Test Group</th>
<th>Description</th>
<th>Test Method</th>
<th>Test Parameters / Comments</th>
<th>Edocs-3P1692 Reference</th>
<th>Sample Size</th>
<th>Result</th>
<th>Report Section</th>
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<tbody>
<tr>
<td><strong>Group 1</strong></td>
<td>Visual &amp; Dimensions</td>
<td>MIL-STD-883 Method 2009.9</td>
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<td>Glass Transition Temp (TG)</td>
<td>ASTM D7028</td>
<td>TG TEST</td>
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</table>
Reliability flow Chart:

SELECT AT RANDOM 100
PRODUCTION PARTS

n=124

Electrical Test

n=10

Hi Temp Life
Stabilization Bake
100°C 500hrs

n=10

Pressure Cooker
121°C 15psi 96hrs

n=5

Relief 230°C 305secs

n=5

Solvent Resistance

Mil STD-883
Method 2010.1

n=10

Visual & Dimensional Inspection
15-10 Magnification

n=10

Steam Age
35°C, 95%RH 120hrs

n=5

Bake 150°C 120hrs

n=5

Salt Atmosphere 24 hrs

n=3

Visual Inspection

Mil STD-883
Method 2010.1

n=1

Glass Transition Temp (Tg) Test

ASTM D1528

Test Group 3
TVS & Thermal Shock
Sample Size: 100pcs

Test Group 6
PCB Pressure Cooker Testing
Sample Size: 100pcs

Test Group 1
Relief: Resistance to High Temp
Sample Size: 100pcs

Test Group 1
Visual & Dimensional Inspection
Sample Size: 100pcs

Test Group 2
Solderability of Terminations
Sample Size: 20pcs

Test Group 5
Corrosion Test: Salt atmosphere
Sample Size: 4pcs

Test Group 7
Failure Material & Flaking
Sample Size: 3pcs
Test Group 1

1.1 Dimensional Analysis:

1.1.1 Test Purpose:
These measurements are to verify that the units meet the dimensional specifications outlined in the data sheet.

1.1.2 Test Method/Specification:
Refer to dimensional section of MAFL-009272-CD0AC0 data sheet

See Figure 1.1A
1.1.3 Measurement Results:
Sample(s) Description: MAFL-009272-CD0AC0

Quantity: 30 PCS
All 30 samples measured meet the data sheet dimensional specifications.

The measurement results can be seen in Figure 1.1B.

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<th>C</th>
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<th>E</th>
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<td>13.5+/−0.1mm</td>
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</table>

Average: 30.02 15.51 6.85 13.58 28.02 1.56 5.11

All the dimensions are within the spec.
1.2 Solvent Resistance Test:


1.2.1 Test Purpose:
The purpose of this test is to verify that the markings will not become illegible on the component parts when subjected to solvents.

1.2.2 Test Method/Specification:

1.2.3 Appearance Inspection:
Appearance inspection performed before and after test.

1.2.4 Sample(s) Inspection before Test:
Sample(s) Description: MAFL-009272-CD0AC0
Quantity: 2 PCS (1#, 2#)
Appearance Inspection: No visual damage was found on samples before test. See Photo 1.2A.

1.2.5 Test Procedure:
Lab Environmental Conditions: Ambient temperature: 25±3ºC, Relative humidity: 55±20%RH.

1.2.6 Test Result(s):
Standard’s failure criteria:
After subjection to the test, evidence of damage to the device and any specified markings which are missing in whole or in part, faded, smeared, blurred, or shifted (dislodged) to the extent that they cannot be readily identified from a distance of at least 15.0 cm (6 inches) with normal room lighting and without the aid of magnification or with a viewer having a magnification no greater than 3X shall constitute a failure.

Appearance Inspection: No visual damage was found on samples after test. See Photo 1.2B.

<table>
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<tr>
<th>Sample Item</th>
<th>Sample No.</th>
<th>Appearance after test</th>
<th>Conclusion</th>
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<td>022011</td>
<td>No visible damage</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>022012</td>
<td>No visible damage</td>
<td>Pass</td>
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</table>

Photo 1.2A Samples Before Test  Photo 1.2B Samples After Test
1.3 Terminal Fatigue Testing:


1.3.1 Test Purpose:
This test is designed to check the capabilities of the device solder pads to withstand a delamination (peel) stress of specified tension and time.

1.3.2 Test Method/Specification:
Refer to Mil-STD-883G Method 2004.5 condition D.
Test Condition:

- A minimum tension of 8 ounces (2.22 N) shall be applied, without shock, to each solder pad to be tested in a direction perpendicular to the solder pad surface and maintained for 30 seconds minimum.

Test Profile:

![Solder pad adhesion](image)

1.3.3 Appearance Inspection:
Appearance inspection performed before and after test.

1.3.4 Sample(s) Inspection before Test:
Sample(s) Description: MAFL-009272-CD0AC0

Quantity: 5 PCS (3#~7#)
Appearance Inspection: No visual damage was found on samples before test. See Photo 1.3C.

1.3.5 Test Procedure:

Test Equipment:

Name: Testometric
Model: CMT6503
Equipment No.: 10611042

Lab Environmental Conditions: Ambient temperature: 25±3°C, Relative humidity: 55±20%RH.
1.3.6 Test Result(s):
Standard’s failure criteria:
When examined, using 10X magnification, after removal of the tension stress, the appearance of any delamination involving constituent solder pad interfaces shall be considered an adhesion failure of the solder pad. Separation of the solder pad from the device is an obvious (without visual magnification) adhesion failure. Separation of the wire from the solder fillet (leaving the solder pad intact) or wire breakage is considered a test procedure failure.

<table>
<thead>
<tr>
<th>Sample Item</th>
<th>Sample No.</th>
<th>Appearance after test</th>
<th>Conclusion</th>
</tr>
</thead>
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<td>MAFL-009272-CD0AC0</td>
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<td>No visible damage</td>
<td>Pass</td>
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<td>No visible damage</td>
<td>Pass</td>
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<td>022162</td>
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<td>022164</td>
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</table>

Photo 1.3C Sample Before Test 

Photo 1.3D Sample After Test
**Test Group 2**

**2.1 Steam Age Test:**


2.1.1 Test Purpose:
The test aim is to verify the samples’ ability to resist the environment conditions.

2.1.2 Test Method/Specification:
Refer to client’s requirements.
- Test Temperature: 35ºC
- Test Humidity: 95%RH
- Test Duration: 168 hours

2.1.3 Appearance Inspection:
Appearance inspection performed before and after test.

2.1.4 Sample(s) Inspection before Test:
Sample(s) Description: MAFL-009272-CD0AC0

Quantity: 10 PCS
Appearance Inspection: No visual damage was found on samples before test. See Photo 2.1B.

2.1.5 Test Procedure:

Test Equipment:

**Name:** Temp & Humidity Chamber

**Model:** ETH-B0-100

**Equipment No.:** POLY-I-242

Photo 2.1 A - Samples Under Test

Lab Environmental Conditions: Ambient temperature: 25±3ºc, Relative humidity: 55±20%RH

2.1.6 Test Result(s):
Appearance Check: No visual damage was found on samples after test. See Photo 2.1C.
2.2 Bake Test:


2.2.1 Test Purpose:
The test aim is to verify the samples’ ability to resist the environment conditions.

2.2.2 Test Method/Specification:
Refer to client’s requirements.
- Test Temperature: 150ºC
- Test Duration: 100 hours

2.2.3 Appearance Inspection:
Appearance inspection performed before and after test.

2.2.4 Sample(s) Inspection before Test:
Sample(s) Description: MAFL-009272-CD0AC0

Quantity: 10 PCS
Appearance Inspection: No visual damage was found on samples before test. See Photo 2.2B.

2.2.5 Test Procedure:
Test Equipment:

**Name:** Thermal Shock Chamber

**Model:** TS300

**Equipment No.:** SZREL-010

Lab Environmental Conditions: Ambient temperature: 25±3ºc, Relative humidity: 55±20%RH

2.2.6 Test Result(s):
Appearance Check: No visual damage was found on samples after test. See Photo 2.2C

![Photo 2.2A - Samples Under Test](image)

![Photo 2.2B Samples Before Test](image)

![Photo 2.2C Samples After Test](image)
2.3 Solderability Test:

2.3.1 Test Purpose:
The purpose of this test is to verify the solderability of the samples subjected to the steam age and bake testing outlined in sections 2.1 & 2.2.

2.3.2 Test Method/Specification:
- Dip and Look solderability Test.
- Solder Temperature 245°C ± 5 °C
- Solder: SN60
- Immersion rate: 1” per second ± 0.25” per second
- Dwell Time: 5 seconds ± 0.5 second.

2.3.3 Appearance Inspection:
Appearance inspection performed before and after test.

2.3.4 Sample(s) Inspection before Test:
Sample(s) Description: MAFL-009272-CD0AC0

Quantity:
10 PCS after Steam age test.
10PCS after Bake test.

Appearance Inspection: No visual damage was found on samples before test.

2.3.5 Test Result(s):
Appearance Check: Samples checked using magnification of 10-15x.
All samples meet the criteria for acceptable solderability.
The solder coverage is >95%
See Photo 2.3A

Photo 2.3A Sample After Solderability Test
Test Group 3:

3.1: High Temperature Life Stabilization Bake Test:


3.1.1 Test Purpose:
The purpose of this test is to determine the effect on microelectronic devices of storage at elevated temperatures without electrical stress applied.

3.1.2 Test Method/Specification:
Refer to Mil-STD-883G Method 1008.2 condition A.
- Test Temperature: 100ºC
- Test Duration: 500hours

3.1.3 Appearance Inspection:
Appearance inspection performed before and after test.

3.1.4 Sample(s) Inspection before Test:
Sample(s) Description: MAFL-009272-CD0AC0

Quantity: 76 PCS
Appearance Inspection: No visual damage was found on samples before test. See Photo 3.1B.

3.1.5 Test Procedure:
Test Equipment:

Name: Ramp Temperature Cycling Chamber
Model: WK-800/70/25
Equipment No.: SZREL-009

Lab Environmental Conditions: Ambient temperature: 25±3ºC, Relative humidity: 55±20%RH

3.1.6 Test Result(s):
Appearance Check: No visual damage was found on samples after test. See Photo 3.1C.

Photo 3.1B Sample Before Test

Photo 3.1C Sample After Test
### 3.2: Thermal Shock Test:


#### 3.2.1 Test Purpose:
The purpose of this test is to determine the resistance of the part to sudden exposure to extreme changes in temperature and the effect of alternate exposures to these extremes.

#### 3.2.2 Test Method/Specification:
Refer to Mil-STD-883G Method 1011.9 condition A.

- Low Temperature: 0°C.
- High Temperature: 100 °C.
- Dwell Time: 10 minutes.
- Test Cycles: 100.
- Total duration: about 34 hours.

#### 3.2.3 Appearance Inspection:
Appearance inspection performed before and after test.

#### 3.2.4 Sample(s) Inspection before Test:
**Sample(s) Description:** MAFL-009272-CD0AC0

**Quantity:** 76 PCS (after Hi temp Life Stabilization Bake Test).

Appearance Inspection: No visual damage was found on samples before test. See Photo 3.2C.

#### 3.2.5 Test Procedure:
Test Equipment:

**Name:** Thermal Shock Chamber

**Model:** TS300

**Equipment No.:** SZREL-010

Lab Environmental Conditions: Ambient temperature: 25±3°C, Relative humidity: 55±20%RH

#### 3.2.6 Test Result(s):
Appearance Check: No visual damage was found on samples after test. See Photo 3.2D.
3.3: Functional Test:

3.3.1 Initial Functional Test Results
The 76 units were functionally tested for Insertion loss before being subjected to High Temperature Life Stabilization Bake and Thermal Shock outlined in sections 3.1 & 3.2. All 76 units passed to specification. The initial test results are plotted in Figure 3.3A below.

<table>
<thead>
<tr>
<th>Port1_reflection</th>
<th>dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freq(MHz)</td>
<td></td>
</tr>
<tr>
<td>80.722</td>
<td>-45</td>
</tr>
<tr>
<td>169.063</td>
<td>-35</td>
</tr>
<tr>
<td>257.405</td>
<td>-25</td>
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<tr>
<td>345.747</td>
<td>-15</td>
</tr>
<tr>
<td>434.089</td>
<td>-5</td>
</tr>
<tr>
<td>522.43</td>
<td>5</td>
</tr>
<tr>
<td>610.772</td>
<td>15</td>
</tr>
<tr>
<td>699.114</td>
<td>25</td>
</tr>
<tr>
<td>787.456</td>
<td>35</td>
</tr>
<tr>
<td>875.797</td>
<td>45</td>
</tr>
<tr>
<td>964.139</td>
<td>55</td>
</tr>
<tr>
<td>1020</td>
<td>65</td>
</tr>
<tr>
<td>1055</td>
<td>75</td>
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<td>1090</td>
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<tr>
<td>2375</td>
<td>195</td>
</tr>
<tr>
<td>2550</td>
<td>205</td>
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</table>

<table>
<thead>
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<th>Port2_port3_transmission</th>
<th>dB</th>
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</thead>
<tbody>
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<td>Freq(MHz)</td>
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</tr>
<tr>
<td>80.722</td>
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</tr>
<tr>
<td>169.063</td>
<td>-95</td>
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<td>-70</td>
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<tr>
<td>522.43</td>
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<td>610.772</td>
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<tr>
<td>699.114</td>
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<td>1675</td>
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<td>2200</td>
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<td>2375</td>
<td>445</td>
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<tr>
<td>2550</td>
<td>470</td>
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</tbody>
</table>
Figure 3.3A – Test Plots before Temperature Testing.
3.3.2 Functional Test Results After Temperature testing
The 76 units were functionally re-tested after High Temperature Life Stabilization Bake and Thermal Shock.
All 76 units continue to pass specification.
The test results after Temperature testing are plotted in Figure 3.3B below.
Port1_port2_transmission

Port1_port3_transmission

Figure 3.3B – Test Plots after Temperature Testing.
Test Group 4:

4.1 Convection Oven Profile:

4.1.1 Test Purpose:
The purpose of this test is to determine the resistance of the part to high temperature experienced during Convection Oven reflow.

4.1.2 Test Method/Specification:
Refer to client’s reflow requirements.
- Test Temperature: 230ºC
- Test Duration: 30 seconds.
See Figure 4.1A

4.1.3 Appearance Inspection:
Appearance inspection performed before and after test.

4.1.4 Sample(s) Inspection before Test:
Sample(s) Description: MAFL-009272-CD0AC0
Quantity: 10 PCS
Appearance Inspection:
No visual damage was found on samples before test.
See Photo 4.1B.

4.1.5 Test Procedure:
Test Equipment:
7 Zone Convection Reflow Oven.
4.1.6 Test Result(s):
Appearance Check: No visual damage was found on samples after test. See Photo 4.1C.

![Photo 4.1B Samples Before Test](image1) ![Photo 4.1C Samples After Test](image2)

4.2: Functional Test After Reflow:

4.2.1 Functional Test Results after Convection Reflow
The 10 finished good units were functionally tested for Insertion Loss after the Convection oven reflow outlined in section 4.1.

All 10 units pass functional specification after reflow. The test results after Convection oven reflow are plotted in Figure 4.2A below.

![Port1_reflection](image3)
Figure 4.2A – Test Plots after Reflow.
Test Group 5:

5.1 Salt Atmosphere Test:

5.1.1 Test Purpose:
This test provides a controlled corrosive environment which has been utilized to produce relative corrosion resistance information for specimens of metals and coated metals exposed in a given test chamber.

5.1.2 Test Method/Specification:
Refer to Mil-STD-883G Method 1009.8 condition A.
- Concentration of salt solution: 0.5%~3.0% NaCl (m/m)
- Chamber temperature: 35ºC
- PH of salt solution at (35±2) ºC: 6.5~7.2
- Exposure period: 24h

5.1.3 Appearance Inspection:
Appearance inspection performed before and after test.

5.1.4 Sample(s) Inspection before Test:
Sample(s) Description: MAFL-009272-CD0AC0
Quantity: 5 PCS
Appearance Inspection: No visual damage was found on samples before test. See Photo 5.1A.

5.1.5 Test Procedure:
Test Equipment:
- **Name:** Salt Spray Chamber
- **Model:** CEEC-YW-150
- **Equipment No.:** 070042

Lab Environmental Conditions: Ambient temperature: 25±3ºC, Relative humidity: 55±20%RH

5.1.6 Test Result(s):
Standard’s failure criteria:
- a) Corrosion defects over more than 5 percent of the area of the finish or base metal of any package element other than leads such as lid, cap, or case.
- b) Leads missing, broken, or partially separated.
- c) Specified markings, which are missing in whole or in part, faded, smeared, blurred, shifted, or dislodged to the extent that they are not legible.

Appearance Inspection: No visual damage was found on samples before test. See 5.1B

<table>
<thead>
<tr>
<th>Sample Item</th>
<th>Sample No.</th>
<th>Appearance after test</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAFL-009272-CD0AC0</td>
<td>022114</td>
<td>No visible damage</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>022115</td>
<td>No visible damage</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>022116</td>
<td>No visible damage</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>022117</td>
<td>No visible damage</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>022118</td>
<td>No visible damage</td>
<td>Pass</td>
</tr>
</tbody>
</table>

Photo 5.1A Samples Before Test  Photo 5.1B Samples After Test
**Test Group 6:**

**6.1 Pressure Cooker Test:**


6.1.1 Test Purpose:
This test is performed to evaluate the moisture resistance integrity of non-hermetic packaged solid state devices using moisture condensing or moisture saturated steam environments.

6.1.2 Test Method/Specification:
Refer to JESD22-A-102-C and client’s requirements.
- Vapor pressure: 15 PSI
- Test Temperature: 121ºC
- Test Duration: 96 hours

6.1.3 Appearance Inspection:
Appearance inspection performed before and after test.

6.1.4 Sample(s) Inspection before Test:
Sample(s) Description: MAFL-009272-CD0AC0

Quantity: 38 PCS
Appearance Inspection: No visual damage was found on samples before test.

6.1.5 Test Procedure:

**Test Equipment:**
- **Name:** Pressure Cooker Tester
- **Brand:** KSON
- **Model:** PCT-S/S022

Lab Environmental Conditions: Ambient temperature: 25±3ºC, Relative humidity: 55±20%RH.

6.1.6 Test Result(s):
Appearance Check: No visual damage was found on samples after test.
See Photo 6.1B
6.2 Temp/Humidity Test:


6.2.1 Test Purpose:
This test is performed for the purpose of evaluating the reliability of non-hermetic packaged solid-state devices in humid environments.

6.2.2 Test Method/Specification:
Refer to JESD22-A-101-B and client’s requirements.
- Test Temperature: 85ºC
- Test Humidity: 85%RH
- Test Duration: 500 hours

6.2.3 Appearance Inspection:
Appearance inspection performed before and after test.

6.2.4 Sample(s) Inspection before Test:
Sample(s) Description: MAFL-009272-CD0AC0
Quantity: 38 PCS (after Pressure Cooker Test)
Appearance Inspection: No visual damage was found on samples before test.
See Photo 6.2B.

6.2.5 Test Procedure:

Test Equipment:

Name: Triple Temp & Humidity Chamber
Brand: GIANT FORCE
Model: GTH-162TR-SP/MAA0605-012

Lab Environmental Conditions: Ambient temperature: 25±3ºC, Relative humidity: 55±20%RH.

6.2.6 Test Result(s):
Appearance Check: Slight Oxidation after test – but acceptable.
See Photo 6.2C.
6.3: Functional Test:

6.3.1 Initial Functional Test Results:
The 38 units were functionally tested for Insertion loss before being subjected to Pressure Cooker and Temp/Humidity testing outlined in sections 6.1 & 6.2. All 38 units passed to specification. The initial test results are plotted in Figure 6.3A below.
Figure 6.3A – Test Plots before Pressure Cooker and Temp/Humidity testing.
6.3.2 Functional Test Results After Pressure & Humidity testing:
The 38 units were functionally re-tested after Pressure Cooker and Temp/Humidity testing. All 38 units continue to pass specification. The test results after Temperature testing are plotted in Figure 6.3B below.

Port1_reflection

Port2_port3_transmission
Figure 6.3B – Test Plots after Pressure Cooker and Temp/Humidity testing.
Test Group 7:

7.1 Lead Material & plating:

7.1.1 Test Purpose:
Measurements performed to verify that the lead plating thickness and composition meet specification.

7.1.2 Test Method/Specification:
Refer to Substrate material drawing 1000035332-CTJC000 for plating specification.
- Plating Thickness:
  - Ni: 3-5µm,
  - Au: (flash) 0.1 -.05µm

7.1.3 Sample(s) Inspection before Test:
Sample(s) Description:  MAFL-009272-CD0AC0

Quantity: 3 PCS
Appearance Inspection: No visual damage was found on samples before test.

7.1.4 Test Procedure: XRF and cross sectional analysis.

7.1.5. Test Results:
Lead plating on all samples meet the required thickness and composition specifications. See Photo 7.1A

Photo 7.1A- Cross Section of sample and thickness measurements.
7.2 Glass Transition Test:

7.2.1 Test Purpose

This test is mainly to determine the glass transition temperature of organic films using thermal mechanical analysis (TMA).

7.2.2 Test Method/Specification

Refer to IPC-TM-650 Method 2.4.24.3 and client’s requirements.

Test Method: Glass Transition Temperature and Z-Axis Thermal Expansion by TMA
Heat Flow: Heat from 22°C to 260°C at 5°C/min

7.2.3 Sample(s) Inspection before Test:

Quantity: 1 PCS (provided by client)
Appearance Inspection: No visual damage was found on samples before test.

7.2.4 Test Setup

<table>
<thead>
<tr>
<th>Name</th>
<th>Model</th>
<th>Equipment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermomechanical Analyzer</td>
<td>SEIKO TMA/SS6100</td>
<td>61-0089-00004</td>
</tr>
</tbody>
</table>

Lab Environmental Conditions:

- Ambient temperature: 25±3°C
- Relative humidity: 55±20%RH
7.1.5. Test Results:

<table>
<thead>
<tr>
<th>Test Sample</th>
<th>Tg (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000035332-CTJC000</td>
<td>137.4</td>
</tr>
</tbody>
</table>

Photo 7.2C Profile for Tg Test