

FA Report for ALT STB BFX-UA300 Choke Burned and FFC Cable Melted Issue

Date : 2022-March-18
Version: 02

1. Establish the Team

Team Leader

- RD: Rick Chen
- QA: CB Lin

Team Member

RD: Sean Jiang

PE: Jack Han, Michael

QA: Toney, Rachel

TE: Mark

PM: Ben

2. Description of Problems

1. Issue Description



- On 2021-Feb-04, ALT customer complained that 1pcs BFX-UA300 field defect.
Defect Symptom: FFC cable melted , and T1 component (choke) burned.
S/N: 2149695001202109001829



FFC cable melted



T1 component (choke) burned

3. SFIS data & Test log check

3.1 SFIS data check - 1

MAC	SN	Frist Assembly Date
A8934AFE7F19	2149695001202109001829	05-Nov-2021

SERIAL_NUMBER	SHIPPING_SN	GROUP_NAME	IN_STATION_TIME	ATE_STATION_NO
A8934AFE7F19	N/A	ASSY	11/5/2021 2:43:49 AM	
A8934AFE7F19	N/A	BT	11/5/2021 4:18:44 AM	L09K18BT0001
A8934AFE7F19	N/A	PT	11/5/2021 4:23:30 AM	L09K18PT0002
A8934AFE7F19	N/A	UP	11/5/2021 4:25:37 AM	L09K18UP0001
A8934AFE7F19	N/A	ASSY2	11/6/2021 7:34:07 PM	
A8934AFE7F19	N/A	ASSY3	11/6/2021 7:43:26 PM	
A8934AFE7F19	N/A	ASSY4	11/6/2021 7:50:20 PM	
A8934AFE7F19	N/A	FT1	11/6/2021 7:59:39 PM	L09K18FT1001
A8934AFE7F19	N/A	FT2	11/6/2021 8:05:35 PM	L09K18FT2001
A8934AFE7F19	N/A	FT3	11/6/2021 8:10:03 PM	L09K18FT3001
A8934AFE7F19	N/A	RC	11/6/2021 8:12:17 PM	L10K18RC0001
A8934AFE7F19	N/A	RC1	11/6/2021 8:18:58 PM	L09K18RC1001
A8934AFE7F19	N/A	VI	11/7/2021 3:56:31 AM	
A8934AFE7F19	2149695001202109001829	RC2	11/7/2021 3:58:43 AM	L09K18RC2001
A8934AFE7F19	2149695001202109001829	VI1	11/7/2021 4:06:19 AM	
A8934AFE7F19	2149695001202109001829	PACK_BOX	11/7/2021 4:20:10 AM	
A8934AFE7F19	2149695001202109001829	CHECK_WEIGHT	11/7/2021 4:28:12 AM	
A8934AFE7F19	2149695001202109001829	PACK_CTN	11/7/2021 4:28:40 AM	
A8934AFE7F19	2149695001202109001829	PACK_PALT	11/7/2021 7:41:50 AM	
A8934AFE7F19	2149695001202109001829	FQA	11/7/2021 7:56:43 AM	
A8934AFE7F19	2149695001202109001829	STOCKIN	11/7/2021 8:34:39 PM	

Result:

Check production data of this defect product, no test fail record. ➔ No abnormal found.

3. SFIS data & Test log check

3.1 SFIS data check - 2

Part	P/N	Vendor	D/C	L/C	Defect Rate
FFC cable	376.00039.005	P-TWO	202140	-	0.45% (47/10,369)
Choke (T1)	155.00089.005	CHILISIN	2135	V96-152400006HZ	0% (0/10,369)
PCB	308.03581.055	VGT	2136	202109-0001	0% (0/4,796)

Result:

No PCB defect & no choke defect at factory, and 0.45% defect rate for FFC cable at factory.

3. SFIS data & Test log check

3.2 Test log check



Log Function test online result					
MAC ID	Shipping SN	Log Data			
A8934AFE7F19	2149695001202109001829	 FT1_PASS_A8934 AFE7F19_.doc	 FT2_PASS_A8934 AFE7F19.doc	 FT3_PASS_A8934 AFE7F19.doc	 RC_PASS_A8934 AFE7F19.doc
			 RC1_PASS_A8934 AFE7F19.doc		 RC2_PASS_A8934 AFE7F19.doc

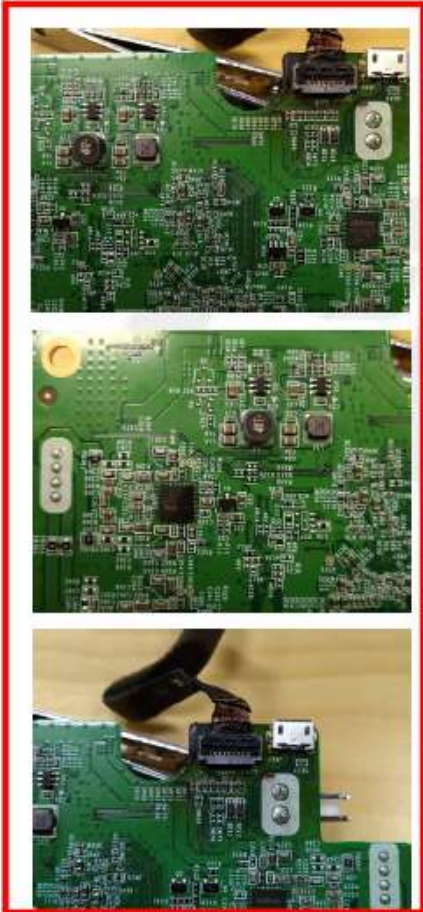
Result : Check test log is normal. And All function PASS.
 Shipping on 08-Nov-2021 – the first lot 300 units only. (DN:5142005136_300pcs_1108)



4. Analysis Root Cause

4.1 VI inspection: Take apart of AMP board.

Top side



Bottom side



- At top side:
 1. 24V trace had charred and FFC connector was burned out.
 2. The other circuits look ok and are not affected.
- At bottom side:
 1. SOC, eMMC, and other circuit are ok.
 2. 24V power choke and capacitors were burned out at 24V frond end.
- Simulated FFC cable folding on the top of power choke, the burned out area are as well as position of choke. See next page detail pictures.

4. Analysis Root Cause

4.2 FII FA step by step

4.2.1 Measure the impedance of power trace.

- Only 24V circuit is short to GND.

Unit: Ohm			VDD_EE	1.35V	VDDCPU	3.3V
	24V	5V	L52	L53	L51	L2
Defect AMP board	3.3	43.3K	454	1.72K	573	14.66K
OK AMP board	35.05K	43.3K	454	1.79K	659	15.39K

4.2.2 Cut off 24V trace to isolate power choke circuit.

- After cutting off 24V power trace, the short is in choke circuit.

Unit: Ohm	Bottom	Top	Choke circuit
Defect AMP board	5.27M	6.5M	0.3

4.2.3 Remove components

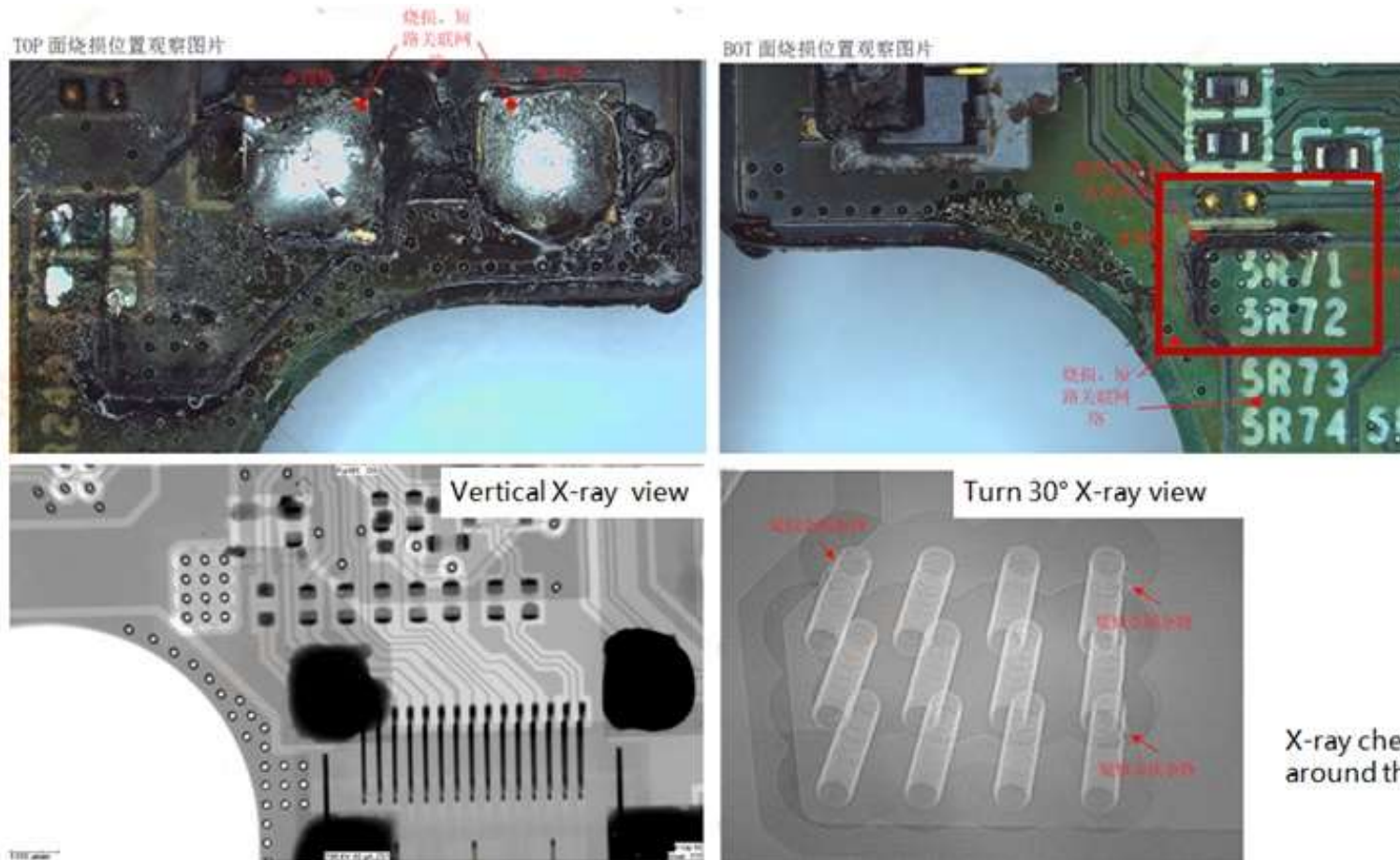
- Remove components as choke and C1/C2 capacitor, PCB is still short to GND.
- Suspect PCB power trace on 24V at choke circuit is short to GND.

PCB vendor: VGT

4. Analysis Root Cause

4.3 VGT FA step by step.

4.3.1 X-Ray inspection – see some material around the through holes.

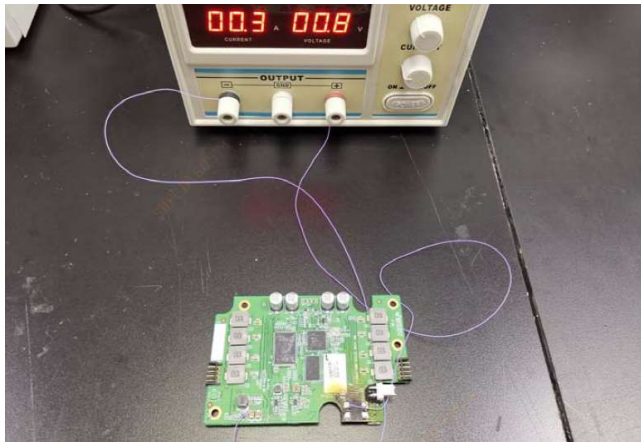


4. Analysis Root Cause

4.3 VGT FA step by step.

4.3.2 Thermal imaging check – the short location should be in the through hole.

1) energized 0.3A current to A/B circuit , to make the short point hot.



2) Thermal imaging device to view the top side : the hot location is in the through hole area.



3) Thermal imaging device to view the bottom side : the hot location is still in the through hole area.



4. Analysis Root Cause

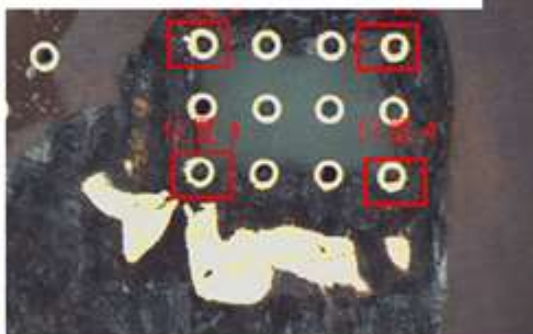
4.3 VGT FA step by step.

4.3.3 Make horizontal micro-section observe – the short location in the PCB layer 2.

1) Grind off the Top side(L1), the short still exists.



2.1) Observe L2 layer, some melted copper is found around the through hole.



2.2) L2 layer design:



3) Grind off the bottom side(L4 layer), test the A,B network, the short still exists:



4.1) Observe the L3 layer, no residual copper is found.



4.2) L3 layer design:



5) Grind off the L3 layer, but leave the L2 layer, test the through holes, which connects A and B network, there still has value of resistance.



位置1	位置2	位置3	位置4
8.426KΩ	411.05Ω	187.19Ω	1.0945KΩ
位置5	位置6	位置7	位置8
61.49KΩ	29.441MΩ	67.4MΩ	0.932KΩ
位置9	位置10	位置11	位置12
4.1661KΩ	17.892KΩ	0.504KΩ	1.8188KΩ

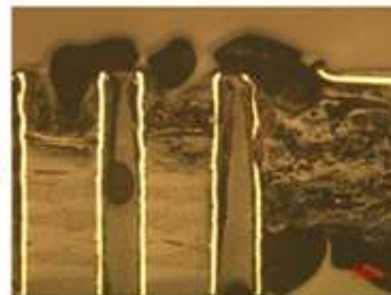
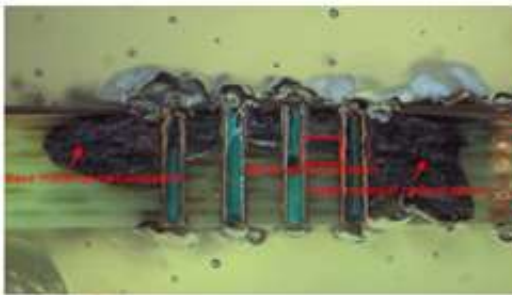
Summary : confirmed that the short point exists in the layer 2

4. Analysis Root Cause

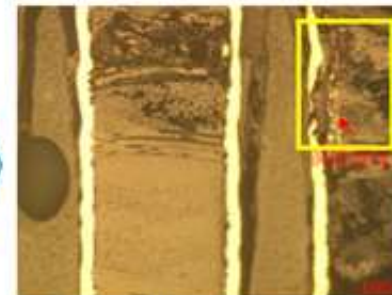
4.3 VGT FA step by step.

4.3.4 SEM observation – the lamination is cracked and melted copper could be found in the crack of the lamination.

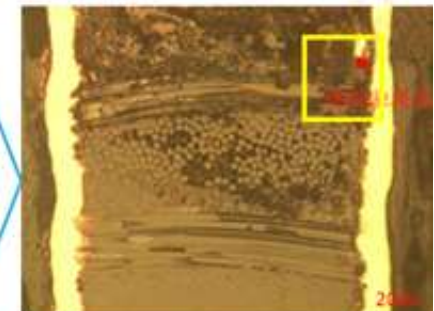
SEM observation:



50X



100X, melted copper could be found c.



200X, melted copper could be found in the lamination

SEM observation summary:
500X, the lamination is cracked and melted copper could be found in the crack of the lamination



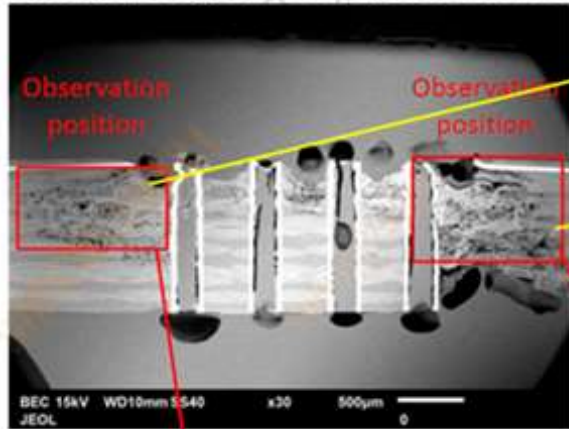
4. Analysis Root Cause

4.3 VGT FA step by step.

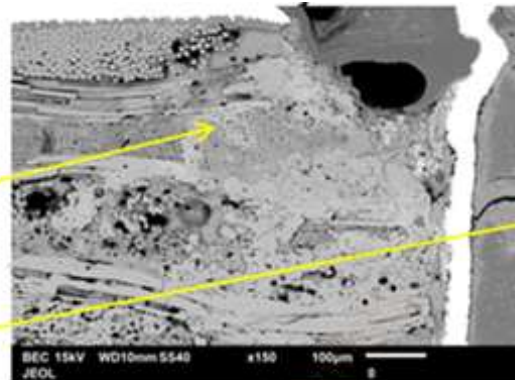
4.3.4 SEM observation – the lamination is cracked and melted copper could be found in the crack of the lamination.

SEM observation:

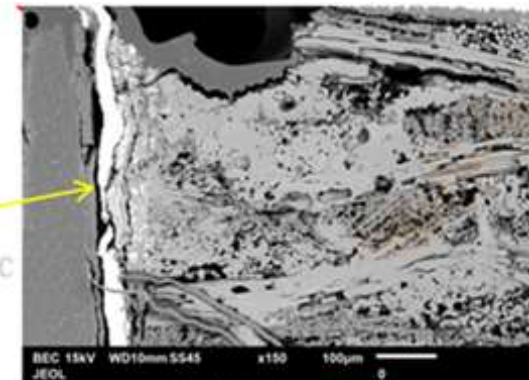
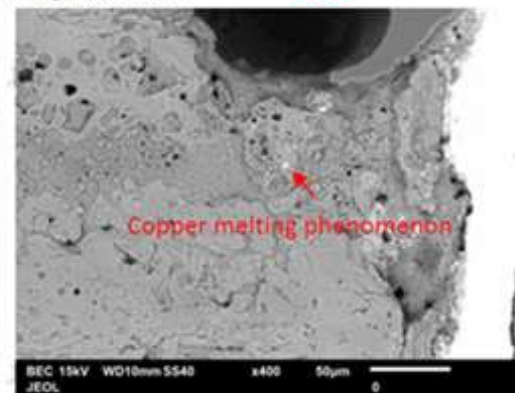
Schematic diagram of section observation



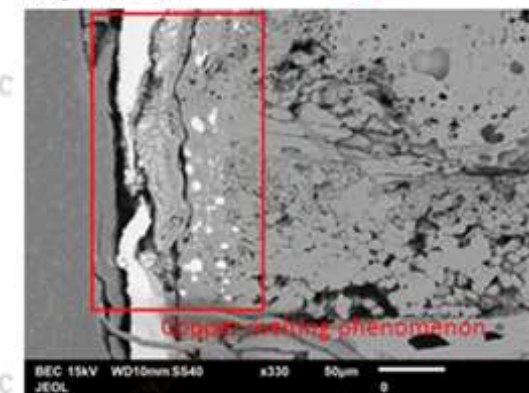
SEM observation summary:
the lamination is cracked and melted copper could be found in the crack of the lamination.



magnification



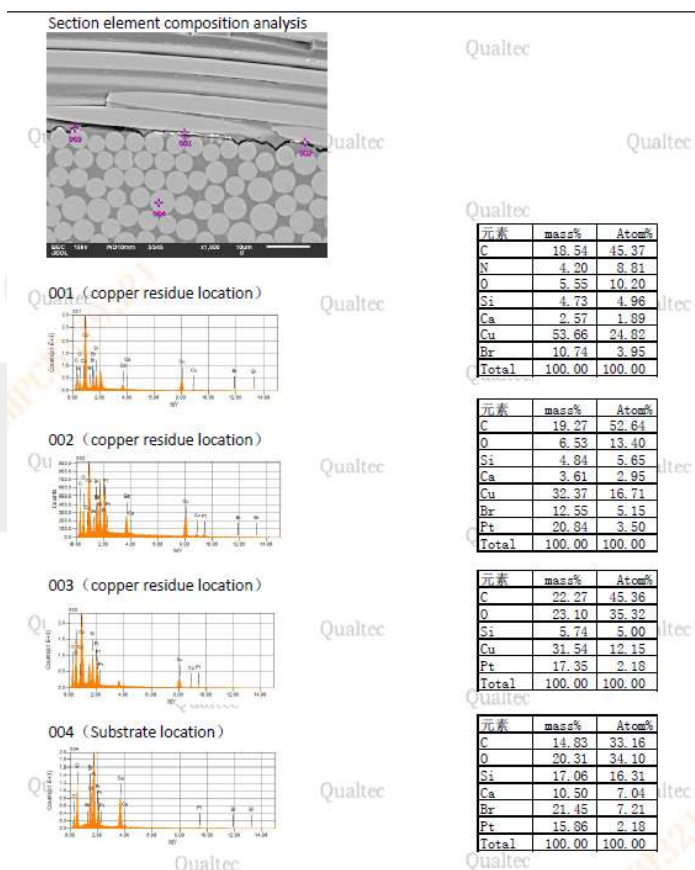
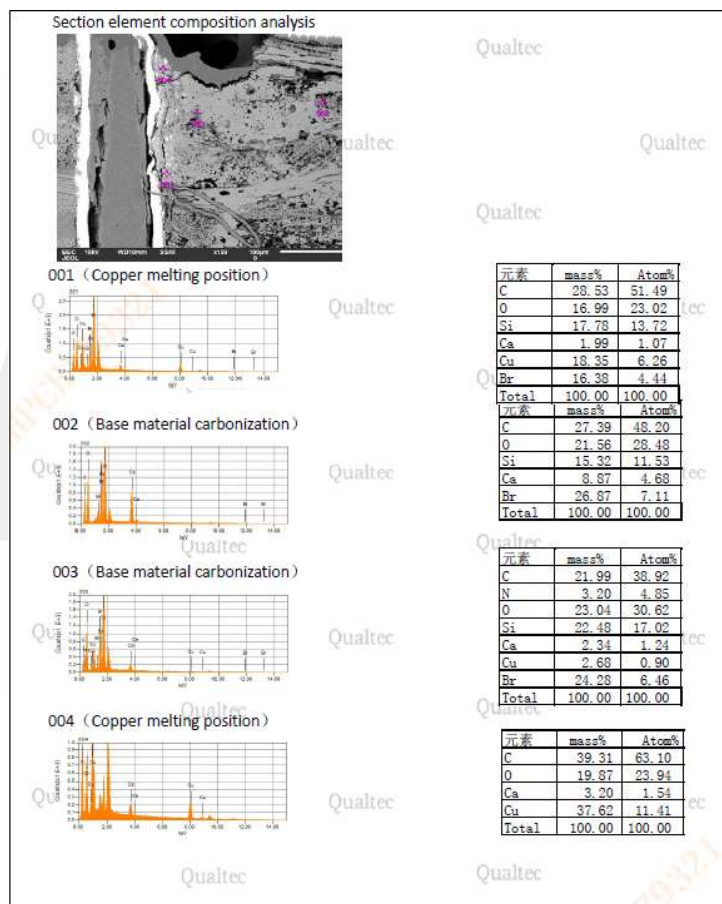
magnification



4. Analysis Root Cause

4.3 VGT FA step by step.

4.3.5 EDX analysis – Confirmed the material in the crack of lamination is melted copper.



4. Analysis Root Cause

4.3 VGT FA step by step.

4.3.6 VGT FA summary

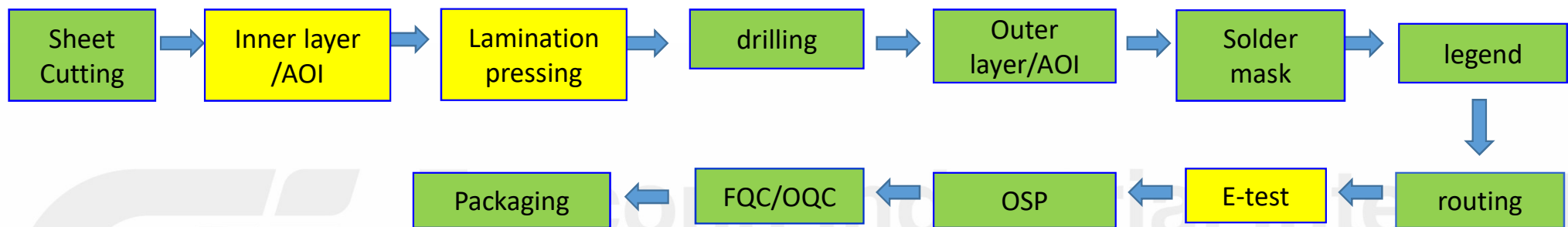
After above analysis to the returned PCBA, summarize as below:

- Made micro-section and use thermal imaging method to confirm short circuit happen in layer2 , around the through holes.
- By SEM , some melted copper could be found around the 4 through holes and in the crack of lamination. Also , the lamination grew some cracks due to the burning or some other forces such like hot air swelling.
- EDX analysis to confirm the material in the crack of lamination is copper.

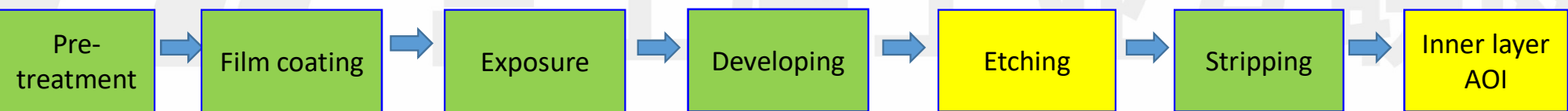
4. Analysis Root Cause

4.4 VGT PCB production process analysis.

4.4.1 PCB flow chart.



The short point is in the layer 2 , which is inner layer.
 Inner layer flow chart:



For the overall PCB flow, the possible stations for L2 layer short as below:

- [Occur station] -1: Layer 2 Etching station
- [Cover station] -1: Inner layer AOI station
- [Occur station] -2: Lamination pressing station
- [Cover station] -2: E-test station

4. Analysis Root Cause

4.4 VGT PCB production process analysis.

4.4.2 PCB production record.

❑ Inner layer AOI – Target: 97.5%

- Total produced 256 panels on 2021-Aug-26.
- L2 pass rate 99.09%, met the AOI target; Short*2pcs @defect rate 0.13%.

❑ E-Test

- E-test parameter: Insulation voltage: 250V, Conduction value: $\leq 50\Omega$, Insulation value: 10Mohm
- E-test detected 14pcs short defect, and 1pc short at L2 layer, the defect rate was 0.02%.

Part number	DC	E-test quantity	Short quantity	layer	quantity	Failure rate	Pass rate	result	Defect description	FM
308.03524.055	2136	4180 pcs	14 pcs	L1	5	0.2%	94%	pass	Metal fragment Of inner layer	
				L2	1	0.02%	94%	pass		
				L3	2	0.047%	94%	pass		
				L4	6	0.014%	94%	pass		

4. Analysis Root Cause

4.5 Summary for root cause analysis.

- FII FA result: Suspect PCB power trace on 24V at choke circuit is short to GND.
- VGT FA result:
 - Short circuit happen in layer2, around the through holes.
 - By SEM, some melted copper could be found around the 4 through holes and in the crack of lamination.
 - EDX analysis to confirm the material in the crack of lamination is copper.

The root cause that lead to the short circuit might be the below 2 ways:

Cause 1: FA analysis shows that around the holes, some melted copper lamination crack are found, maybe something suddenly happened to the components ,which was abnormal when devices or components working - Such as some kind of sudden high current or high voltage by external force, or some components were unstable.

Cause 2: Residual copper or other materials in the PCB also might lead to short .

4. Analysis Root Cause

4.6 Risk evaluation

- If it's PCB incoming issue, from the production data of VGT, it's low risk.
 - ✓ L2 AOI pass rate 99.09%, met the AOI target; Short*2pcs @defect rate 0.13%.
 - ✓ E-test detected 14pcs short defect, and 1pc short at L2 layer, the defect rate was 0.02%.



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5. Corrective Actions

5.1 VGT enhance the AOI inspector training, and as a lesson learnt for this case.

Owner: VGT/Kevin, Done on Mar-17

5.2 FII continue to monitor the defect rate of PCB. Till now, the defect rate of PCB is 0%.

Owner: FII QA/Toney, Done on Mar-17

