SVC-300 – corrosion issue.
Dell Materials Science Laboratory — Report 7568
Global Supply Chain Quality Engineering — Materials Analysis

Executive Summary

Dell IPS requested analysis of the SVC-300 midplane assembly with suspected residue on the PCBA surface. Sample was sent to the Material Science Lab (MSL) for an analysis.

Inspection of the SVC-300 midplane assembly revealed extensive corrosion of the midplanes PCBA components, multiple exposed vias, SAS connector terminations and SAS connector pins. Inspection revealed high accumulation of particulate matter residue accumulated in multiple areas of the PCBA assembly. Highly corrosive Sodium Chloride (NaCl) crystals embedded into the assembly PCBA components as well as corrosion byproducts in presents of green residue observed in multiple areas of the midplane PCBA assembly. Corrosion co-product observed on PCBA surfaces were 'metal salts' (mostly hydrates of Copper (II) Chloride) which does have very good solubility in water, what may have led to situation that in environment with elevated humidity those 'metal salts' creates highly conductive debris, which may have led to electrical short conditions and by that could have contributed to the failure observed at customer site. Combined hygroscopic properties of 'salts' identified on the assemblies PCBA surface creates severe risk to existing DELL equipment (on site) of failures if exposed to such a harsh environment.

Hardware Description

WWFA	Description	Part Number	Serial Number	Supplier
N/A	SVC-300 midplane assembly	0G6JCT	MTC007AD-GHRX-A00	GX N-H
N/A	SVC-300 midplane assembly	09798G	MTC007AA-GJ34-A00	GX N-H

Results

Photo 1. Representative overview and manufacturing details of the SVC-300 midplane assembly.

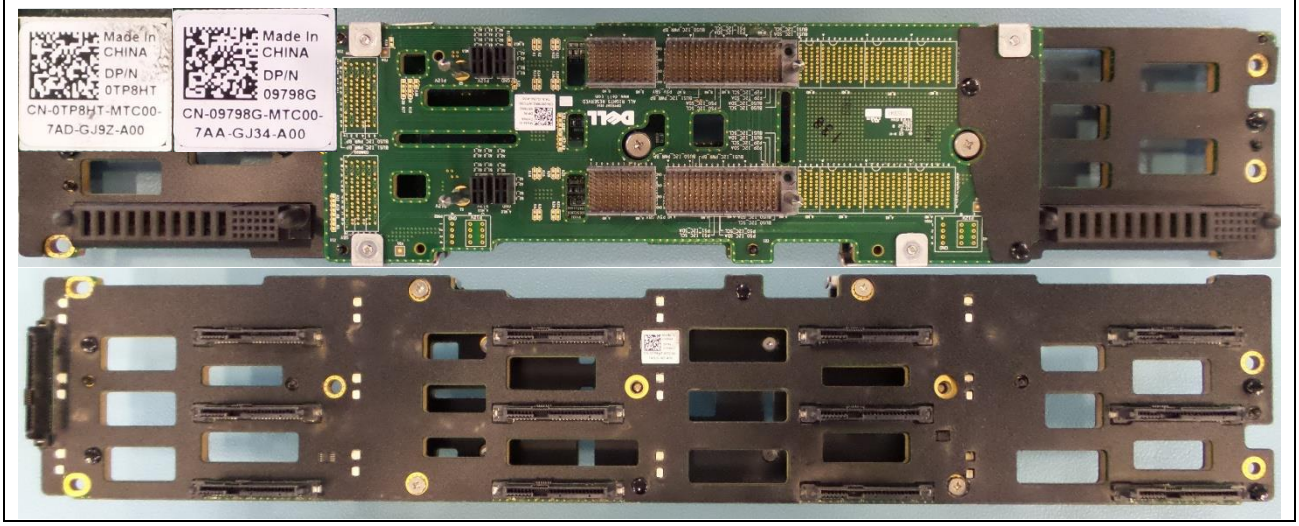


Photo 2. Representative image of the SVC-300 midplane assembly with evidence of corrosion visible without disassembling the device.

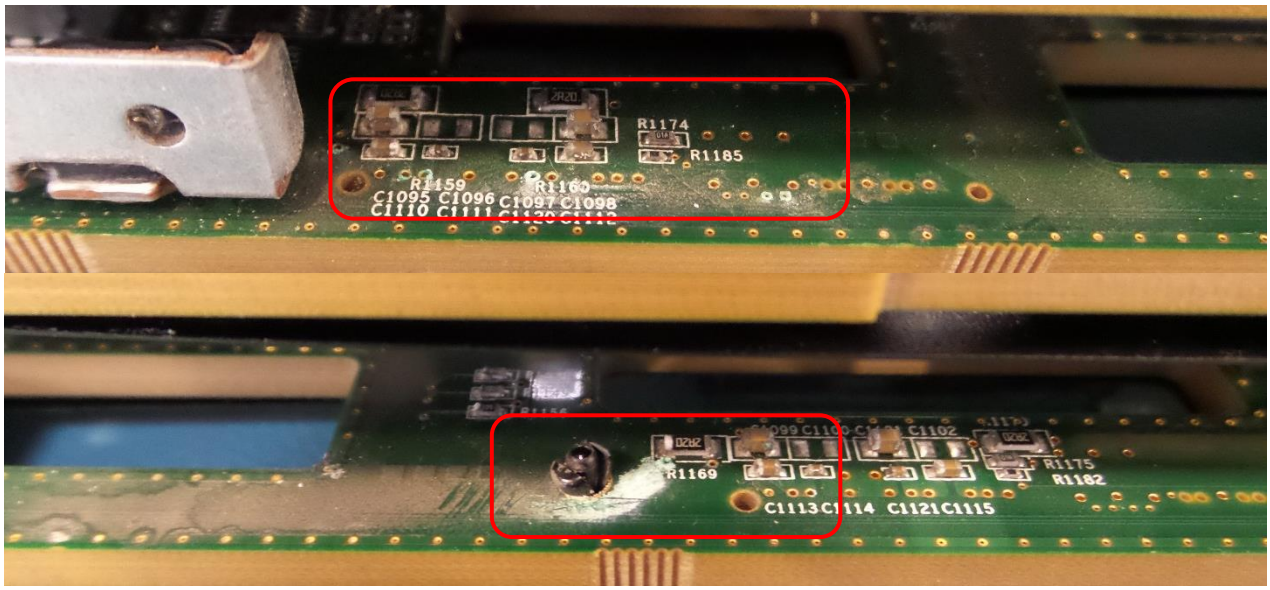


Photo 3. Representative images of the SVC midplane board assembly areas impacted by corrosion.

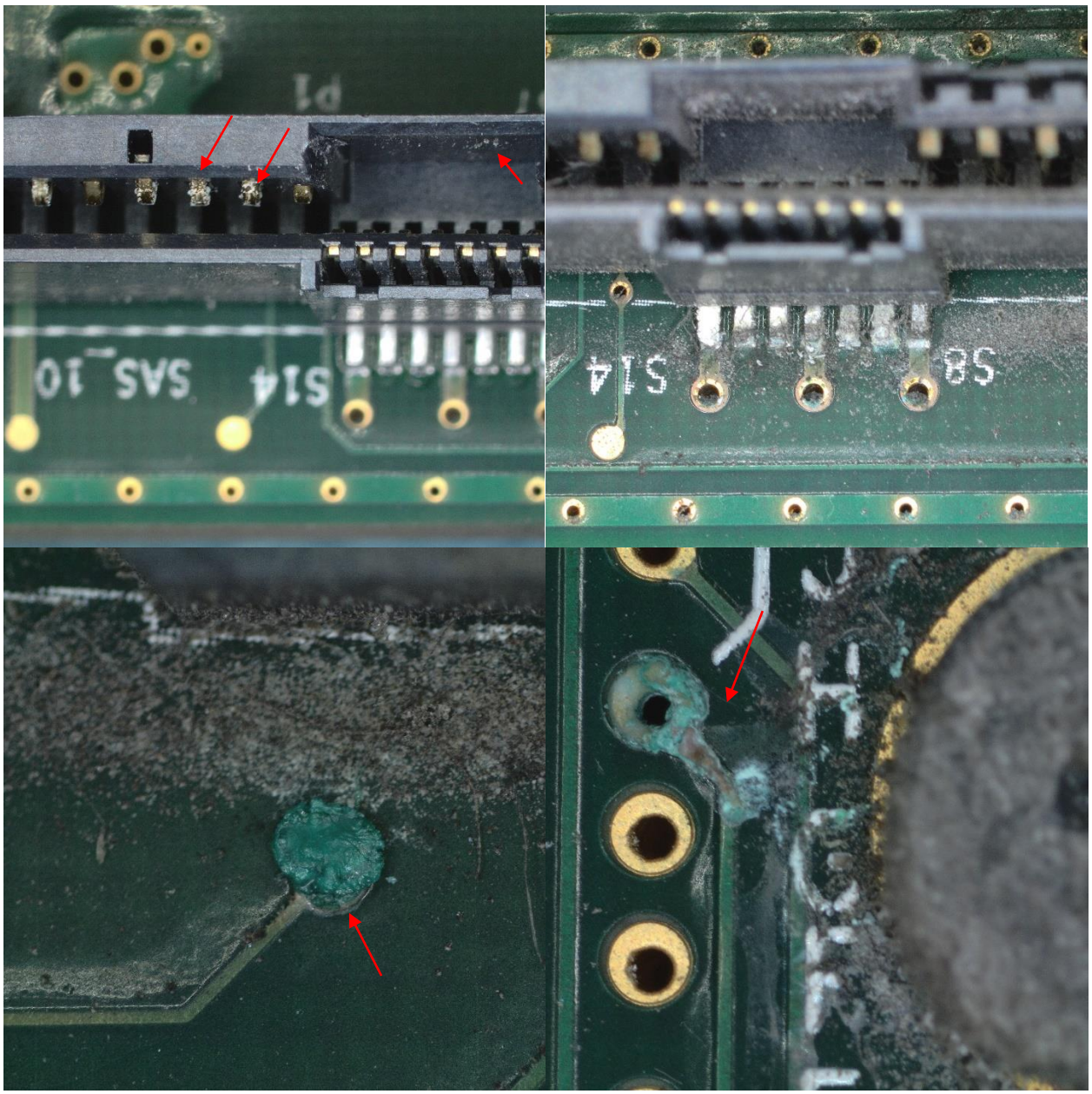


Photo 4. High magnification images of the components impacted by corrosion.

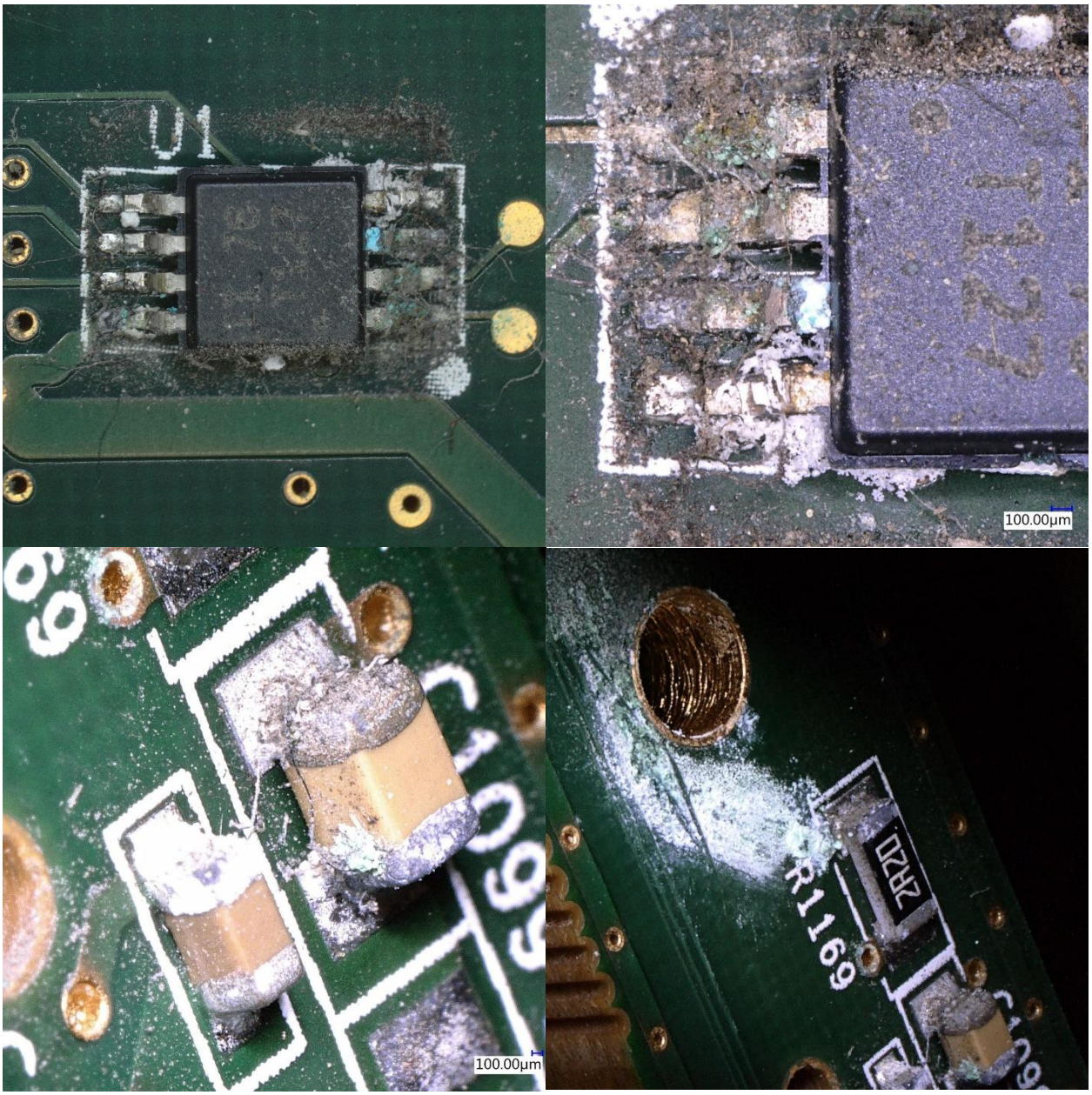


Photo 5. Representative X-ray images of the components impacted by corrosion.

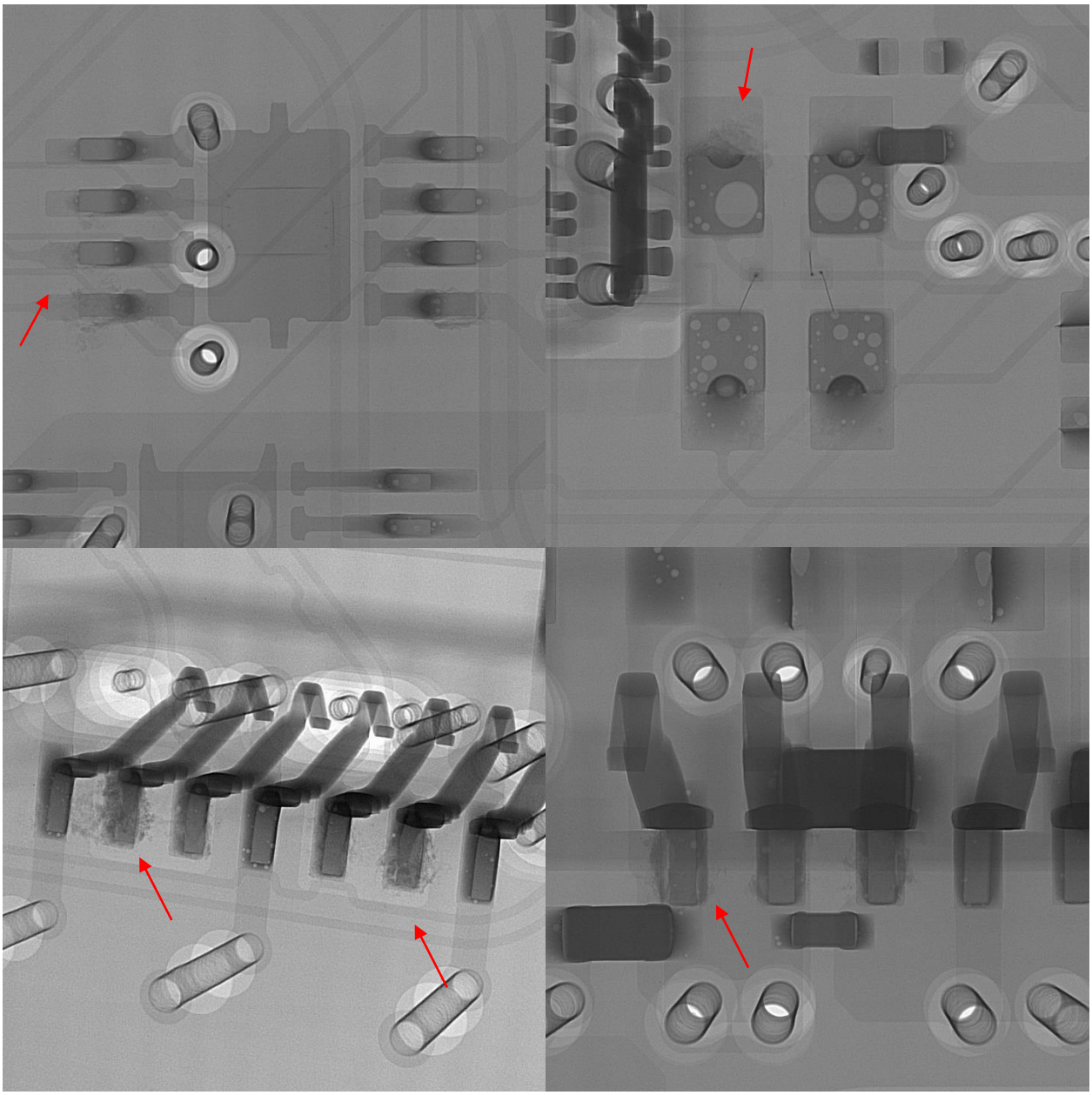
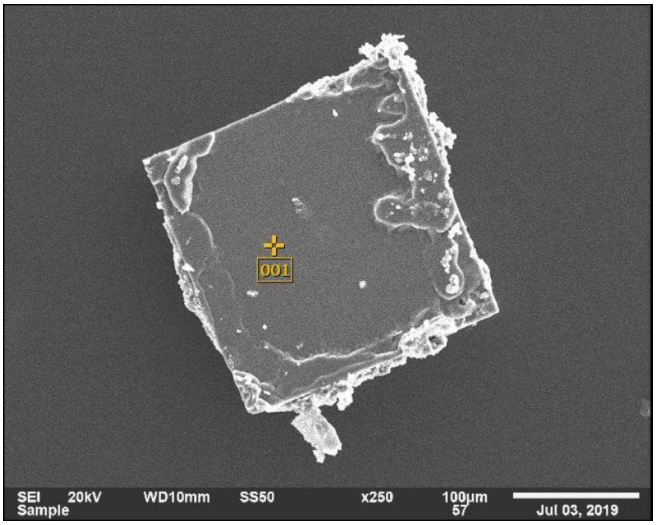


Photo 6. Scanning Electron Microscopy (SEM) & Energy Dispersive X-ray (EDX) analysis of a crystallic debris sample extracted from the midplane surface. The main elements detected were: Sodium (Na) and Chloride (Cl).



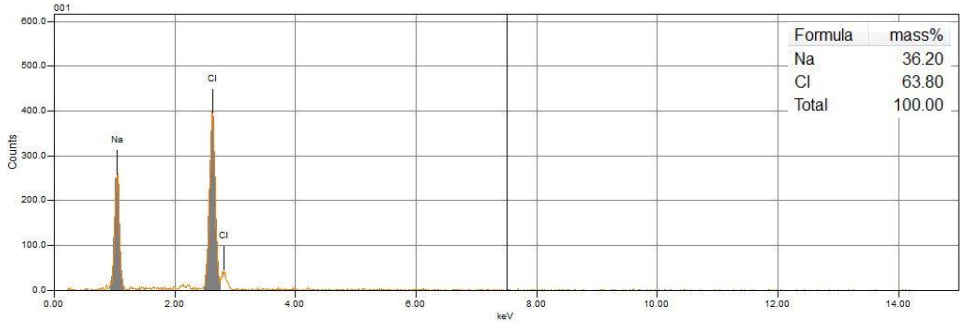
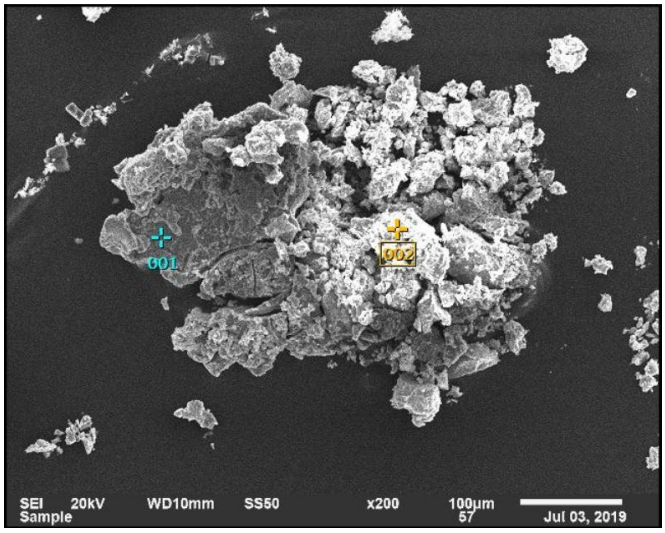
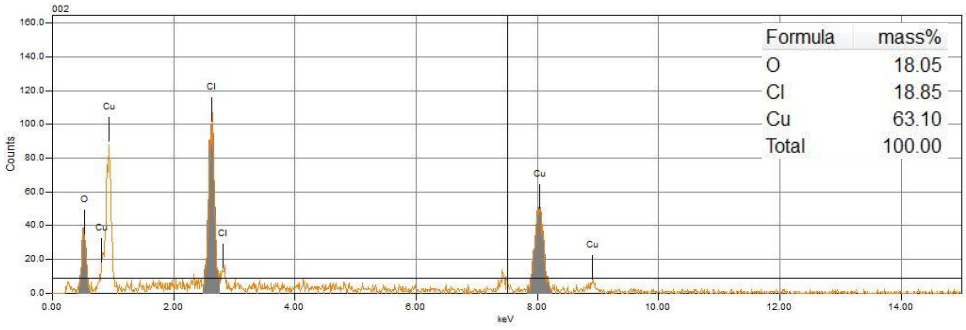


Photo 7. Scanning Electron Microscopy (SEM) & Energy Dispersive X-ray (EDX) analysis of a green debris sample extracted from the midplane surface. The main elements detected were: Copper (Cu), Chloride (Cl) and Oxygen (O).





Ion Chromatography

The overall levels of surface contamination in µg/in^2 for each anion detected are tabulated in Table 1 below.

Photo 9. Ion Chromatography spectral data.

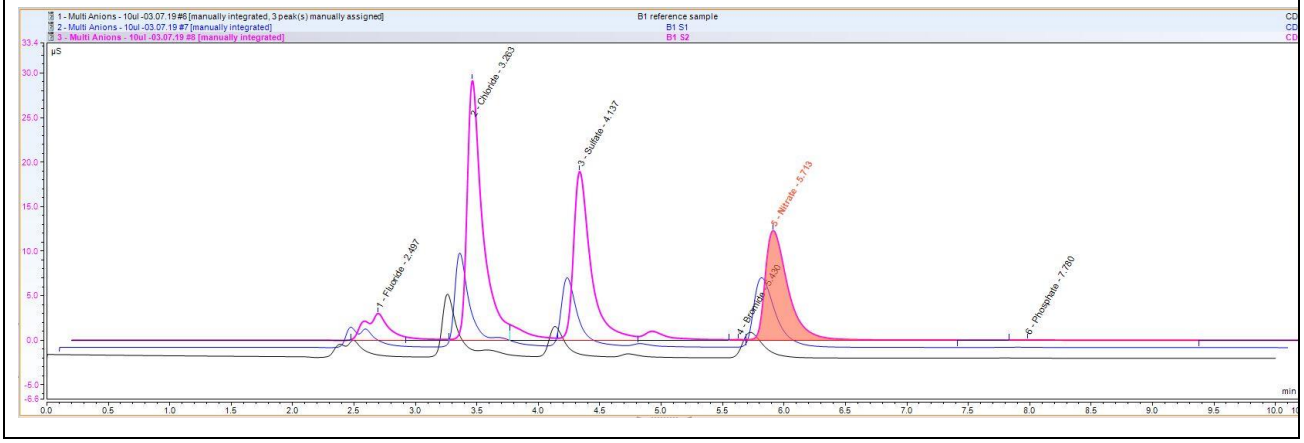


Table 1.

Description	Fluoride	Chloride	Bromide	Nitrate	Phosphate	Sulphate	WOA
Board 1 S1	22.7	130.8	ND	565.2	11.1	196.7	198.7
Board 1 S2	37.9	732.2	ND	978.2	18.1	664.3	249.5
Allowable limits	1*	3*	7*	3*	3*	3*	25*

Localized/secondary sample extraction was performed, 0.2 in^2 areas surrounding components were washed with use of 10ml of DI water at 80°C for each sample.

Samples extraction positions:
SP SN: MTC007AD-GHRX-A00:
Reference sample extracted around ref des R1152
B1 S1 – ref des R1169
B1 S2 – ref des SAS_11

* EMC-ES-1027 Rev A04. Specification Allowable Limits for Assemblies, ND – not detected

Analysis

- Inspection of the SVC-300 midplane assembly revealed extensive corrosion of the midplanes PCBA components, multiple exposed vias, SAS connector terminations and SAS connector pins.
- Inspection revealed high accumulation of particulate matter residue accumulated in multiple areas of the PCBA assembly.
- Analysis revealed highly corrosive Sodium Chloride (NaCl) crystals embedded into the assembly PCBA components as well as corrosion byproducts in presents of green residue observed in multiple areas of the midplane PCBA assembly.
- Corrosion co-product observed on PCBA surfaces were ‘metal salts’ (mostly hydrates of Copper (II) Chloride) which does have very good solubility in water, what may have led to situation that in environment with elevated humidity those ‘metal salts’ creates highly conductive debris, which may have led to electrical short conditions and by that could have contributed to the failure observed at customer site.