Qualification Summary for RoHS-Compliance Coaxial Resonators

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In order to comply with EU Directive 2002/95/EC – Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) Trans Tech, Inc. (TTI) is replacing the current Sn/Pb plated tab with Au plated tab for Coaxial Resonators. All other materials and processes, including solder reflow profiles, will remain the same for the Coaxial Resonator product line.

Qualification Resonators, using tabs with Sn/Pb and Au plating, were manufactured during Nov 2005. Testing and evaluation was performed on these parts to approve the Au plated tab for use in manufacturing of TTI Coax resonator products.

The Qualification Resonators were subjected to:

- Multiple reflows at 260 C, with frequency measurement after each reflow.
- Thermal Shock Testing followed by frequency measurement
- Salt Fog Tests
- Solder Wetting - Tab
- Pull Test – Tab
- Mechanical Shock & Vibration followed by frequency measurement
- Solder Joint Analysis for Gold Embrittlement.

(Results Table Page #2)

Summary

After environmental testing, the performance of the Coaxial Resonator showed minimal shift in frequency, acceptable solder wetting, no evidence of Au embrittlement, and micro structural integrity of the tab solder joint.

Based on these tests and results, the Au plated tab has passed qualification testing and is acceptable for use in RoHS compliant Coaxial Resonators. The Au tabbed resonators are compatible with RoHS processes, and backward compatible with non-RoHS soldering processes.

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Condition	Performed By	Au Tab"
		% ▲ Freq
Salt Fog Testing[1]	METLABS	0.017%
		Cumulative ▲ Freq
Reflow 1 @ 260[5]	TTI	Initial Freq
Reflow 2 @ 260[5]	TTI	0.04%
Reflow 3 @ 260[5]	TTI	0.08%
Thermal Shock[2]	TTI	0.10%
Mechanical Shock[3] & Vibration[4]	METLABS	0.15%

Test	Performed By	Results
Pull Test	TTI	Pass
Solder Wetting Test	TTI	Pass
Gold Embrittlement Evaluation[7]	WMI	No Au Embrittlement

1. Salt Fog test in accordance with MIL-STD-810E Method 509.3
2. Thermal shock of -40C to +90 C with dwell times at each temperature of a minimum of 30 minutes and maximum of 10 second transition times between temperatures. JEDEC JESD22-A106 Condition A
3. Mechanical shock MIL-STD-202F method 213B Condition E (1000g's for 0.5 mS)
4. Vibration testing in accordance with MIL-STD-202 Method 204D Condition D (Vibration 20G up to 2000 Hz)
5. BTU Reflow Oven (TRS–18-212) 260 C Profile
6. METLABS TEST REPORT; ESL18475-GEN, Nov 3, 2005
7. WALDVOGEL METALURGICAL, INC - MATERIALS ANALYSIS REPORT #20051128 – RESONATOR SOLDER JOINT ANALYSIS Nov 28, 2005. "Gold embrittlement is not an issue and is not expected to be a failure mechanism for these parts"