

## Detection of Counterfeit Components by K-Shell XRF Technique

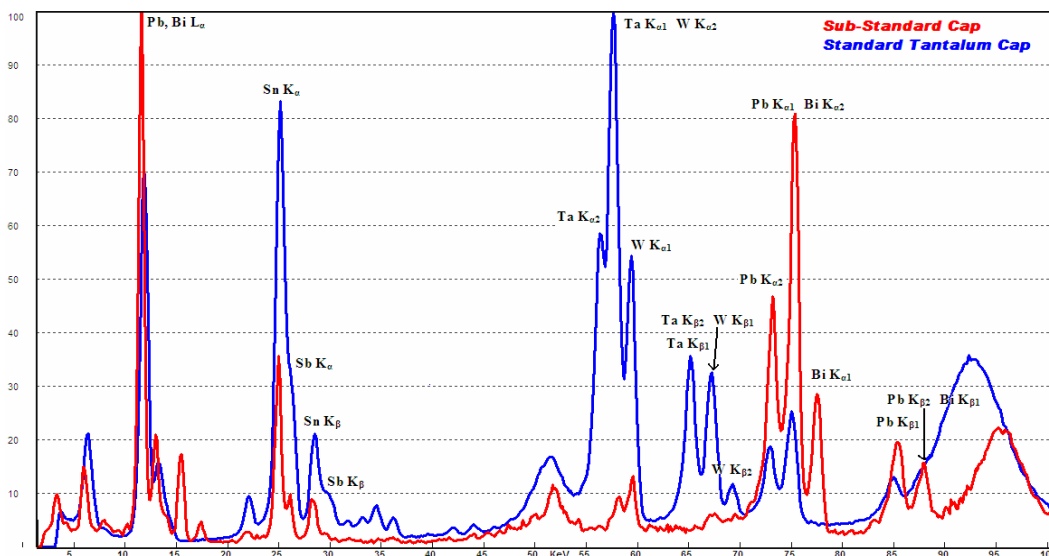
Counterfeit and substandard components are becoming major issues in the supply chain facing the electronic industry. Counterfeit suppliers are more sophisticated and are employing techniques such as laser etching in production of these components, making them virtually undetectable from real parts.

The substandard components, being manufactured under false trade names, are creating another type of challenge for the EMS industry. These components often are made from the same external materials as real parts and pass electronic functionality tests. However, material compositions of this group may be substandard, thus compromising capabilities in extreme temperature and pressures.

In the majority of cases, the substandard components do not contain expensive elements such as gold (Au), bismuth (Bi), tantalum (Ta), silver (Ag), etc. Instead, the more expensive constituents are often substituted by less costly materials such as lead (Pb), palladium (Pd), or other low cost elements.

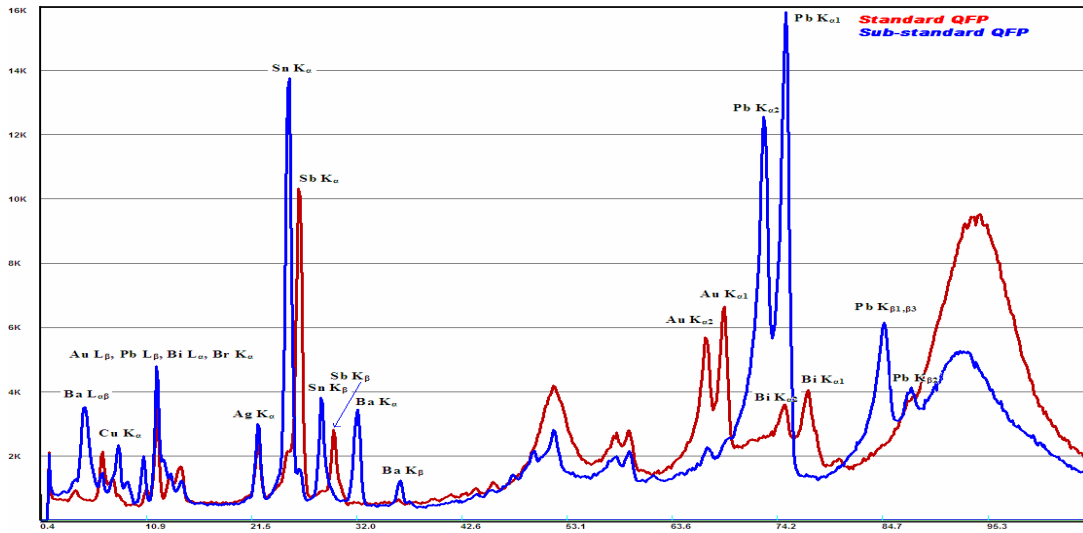
XRF systems capable of inducing K-Shell characteristic x-rays of elements with higher atomic numbers such as Pb and Bi are capable of providing qualitative spectrometric data reflecting the presence or absence of these vital materials through components and packaging without needing to disturb the actual component or the packaging materials.

The graph below show how a capacitor batch is easily identified when its x-ray fluorescence spectrometric data is compared to the standard Tantalum (Ta) capacitor's spectrum. The elemental composition differences between these two parts signify the presence of substandard component.



**Standard Capacitor containing Ta spectrum is compared with a counterfeit a Bi substitute.**

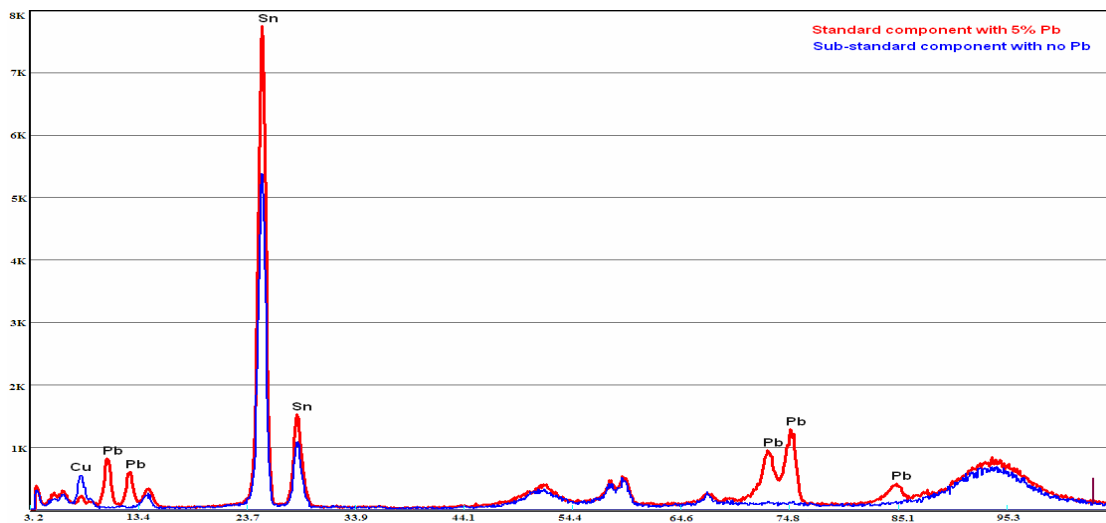
Similarly, a QFP with Pb is easily detectable from the genuine part containing Au and Bi by viewing the spectra for the two components.



**Comparison of two QFP's with different elemental composition.**

Another application is detecting components without Pb in military supply chain. The supply of Pb containing parts is shrinking and military is facing a major challenge in procurement and quality control in this area.

The spectra for two diodes with identical part numbers are shown below. The specification required 5% Pb content for each part. One batch did not contain any Pb as specified even though it was marked as SO.



**Comparison of two diodes with 5% Pb solder specification**

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