Overview of Real Time X-ray for ERAI/IHS Conference 2012

Clifton Aldridge (Laboratory Manager)

Dynamic Research and Testing Laboratories, LLC

Dynamic Research and Testing Laboratories, LLC is located in Albuquerque New Mexico. The Laboratory is within the Electronic Contract Manufacturer “IEC Electronics, Inc”

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Dynamic Research and Testing Laboratories, LLC

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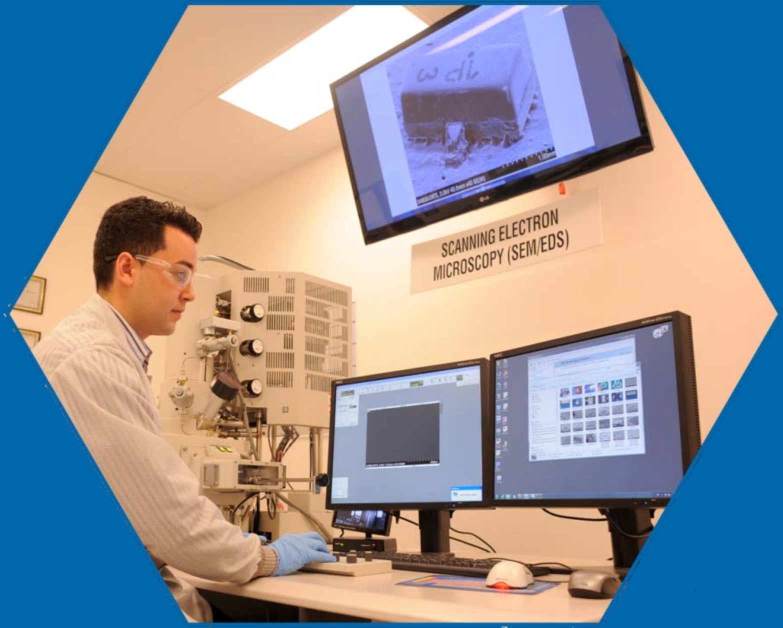
DRTL Capabilities

Dynamic Research and Testing Laboratories (DRTL)

- Component Risk Mitigation
- Destructive Physical Analysis
- Failure Analysis
- Parts Screening
- Product Qualifications
- Material Qualifications
- Consulting Services



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Real Time X-ray Fluorescence (XRF)

Overview

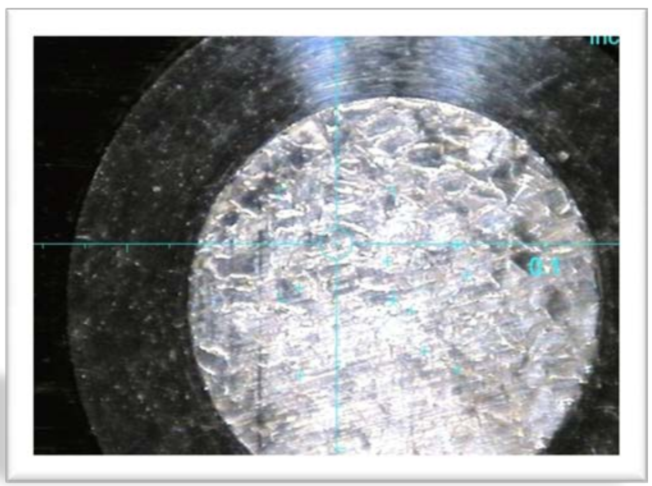
1) Explain why X-ray Fluorescence (XRF) has become an integral part of a counterfeit avoidance inspection process
2) Provide evidence of XRF being used to identify suspect counterfeit parts
3) Discuss challenges associated with device verification in XRF.
4) Offer guidance relative to what to do when XRF cannot be compared to the manufacturer's datasheet.
5) Outline the significance or insignificance of having a "golden sample " for comparative purposes
6) Explain when and if XRF can or cannot accurately conclude if a part is or is not counterfeit
7) Explain when OCM verification is required
8) Offer guidance relative to determining the minimum lot size to be tested
9) Offer guidance relative to selecting samples for test from a large lot
10) Provide guidance that will assist attendees in the avoidance of "false positive " or "false negative" XRF interpretations

Scope

XRF technique is applicable to electronic and other parts as listed in the accompanying list in the main document. In general, the detection technique is meant for use on piece parts that are not yet assembled on to a circuit board or are disassembled from a circuit board. Consult documents that provide guidance on assessing assembled circuit cards for evaluation of suspect parts that are already on a circuit card. Parts disassembled from a circuit board may have material contamination from the assembly, use and disassembly process making XRF detection results not suitable for comparison purpose.

Purpose

The purpose of this document is to provide information and instructions on how to use XRF as a technique to detect risk of counterfeit electronic parts including active, discrete, passive, electro-mechanical and connectors parts. The process of detection is based on identification of elements (or absence thereof) in a component. The counterfeit detection process using XRF can be on as received components or on de-lidded, de-capsulated, or otherwise prepared parts. The detection of counterfeit risk can also be based on the concentration levels of materials under consideration. For reliable decision making, findings from XRF analysis needs to compared with known good parts like any other analysis methods.



Definition

- The process of emissions of characteristic x-rays. Analysis using x-ray fluorescence is called "X-ray Fluorescence Spectroscopy(XRF)."

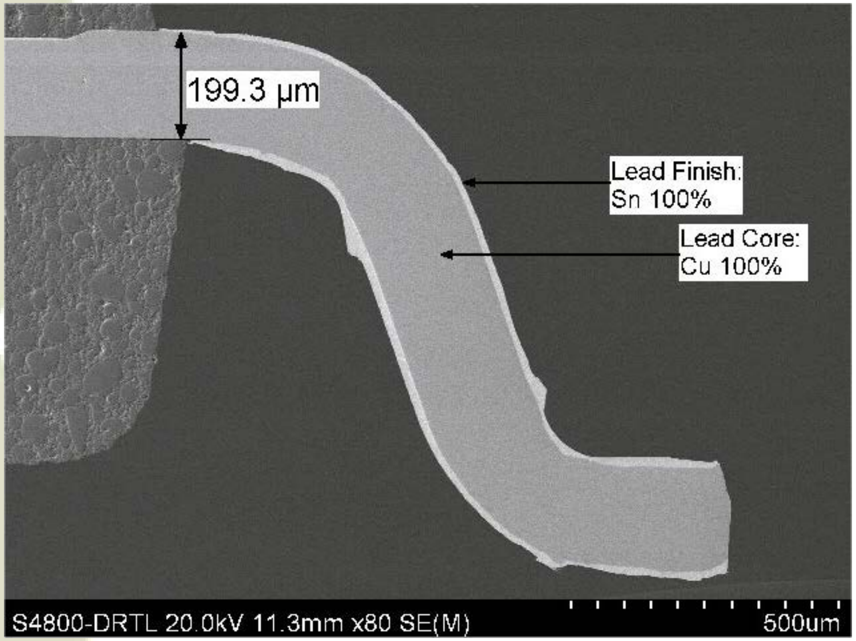
- The XRF instrument shall be capable of qualitatively identifying the metals present in a complex sample and providing quantitative accuracy sufficient to insure at least 3 wt% Lead (Pb)

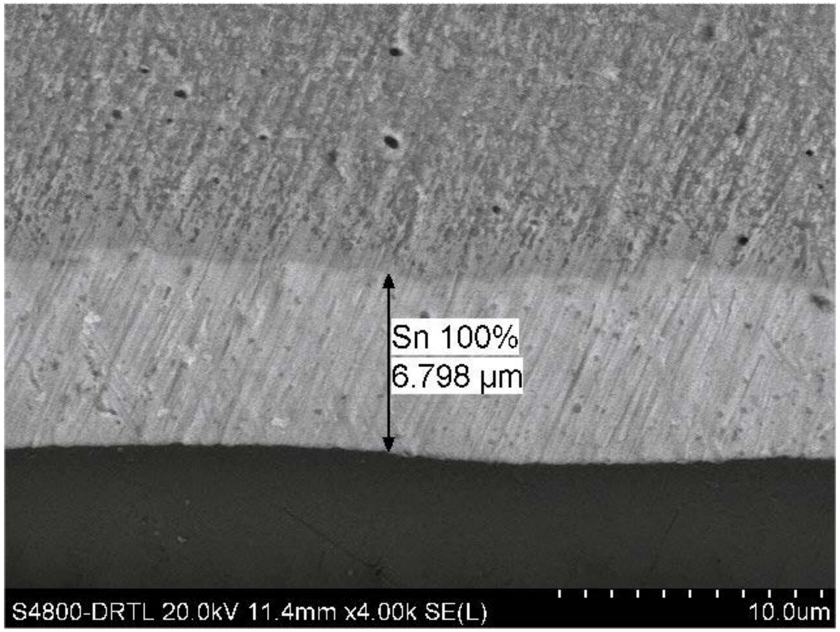
- The detector resolution shall be sufficient to quantify lead (Pb) with +/- 2 wt% accuracy, in the range from 0 to 10 wt%, in combination with interfering energy lines from elements such as bismuth (Bi). Note, proportional counter detectors may not be able to meet this requirement, a peltier cooled pin diode detector or detector providing increased resolution may be required to achieve this. The excitation voltage for the X-rays shall be a minimum of 40 KeV to support detection of higher energy lines

XRF Section (SAE G-19 Counterfeit Detection Committee)

XRF Uses

- Bulk material identification (Elemental Only)
- Lead finish verification (Gold, Nickel, Tin-Lead, 100% Tin…)
- Identification of prohibited materials (Cadmium and Zinc Finishes)
- Non-destructive lead finish thickness measurements





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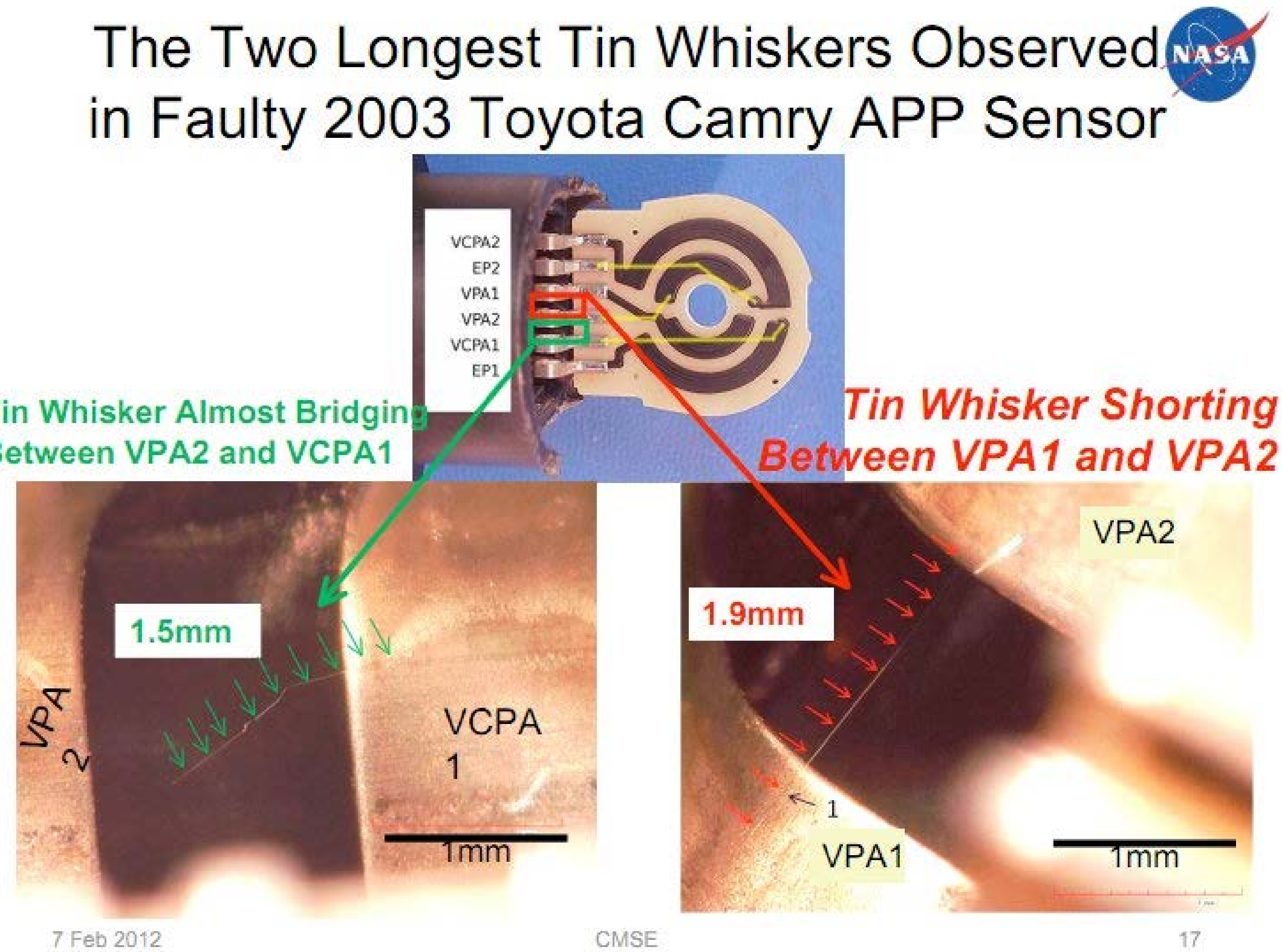
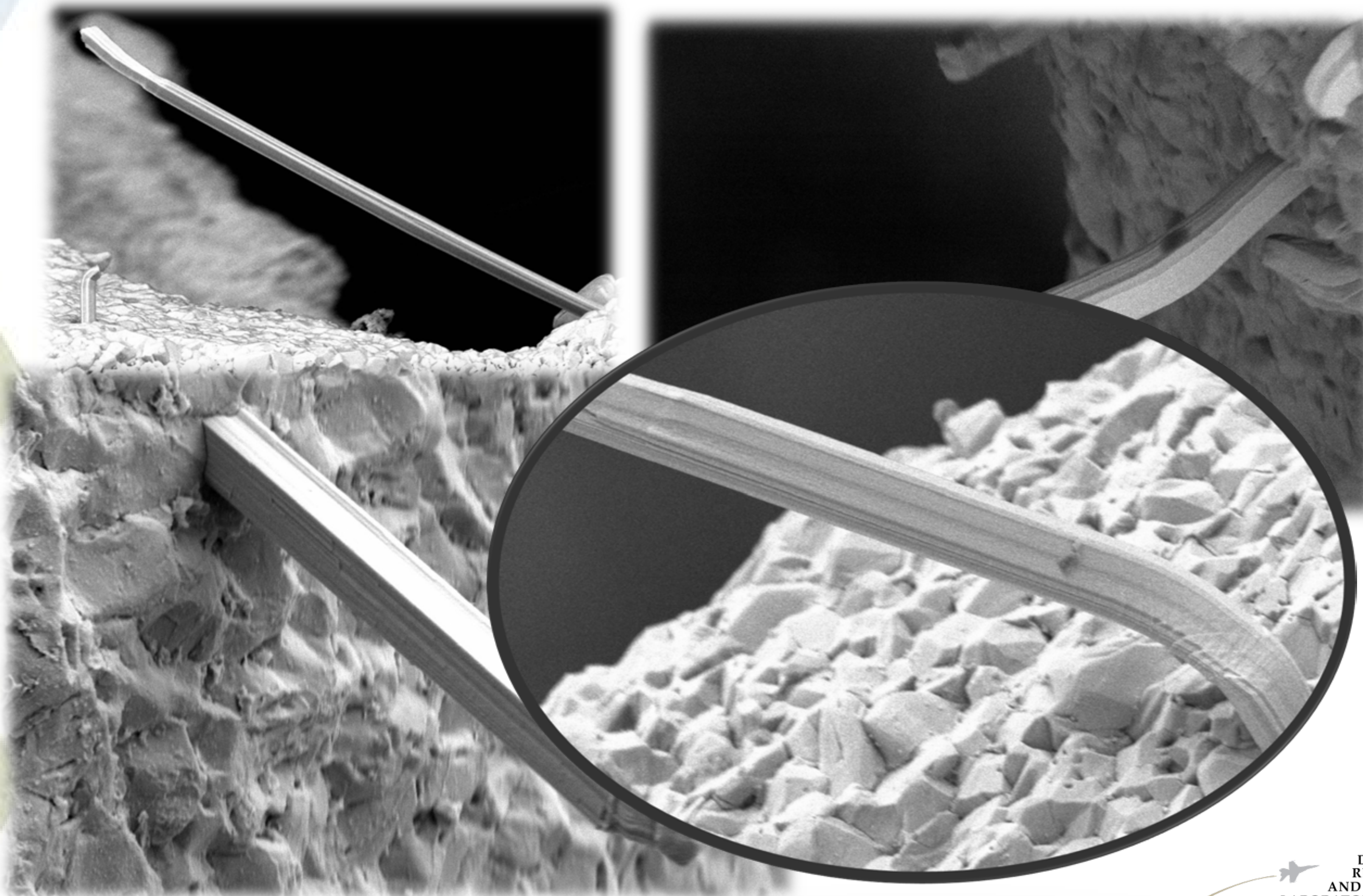
XRF Risk Detection



Presented By Henning Leidecker at CMSE 2012

XRF Risk Detection



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Reference Documents

JEDEC, JESD 213 - Standard Test Method Utilizing X-Ray Fluorescence (XRF) for Analyzing Component Finishes and Solder Alloys to Determine Tin (Sn) – Lead (Pb) Content, March 2010.

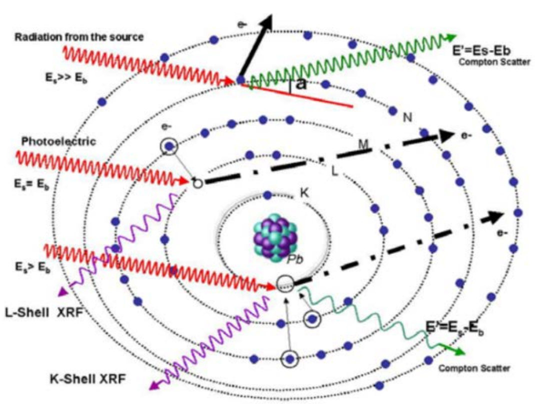
Naval Air Systems Command, "Solder Alloy Analysis: X-Ray Fluorescence Test Equipment Evaluation Report," NAVAIR, July 2009.

Mil-Std 883, Test Method 2037 (proposed), "X-RAY FLUORESCENCE (XRF) SCAN FOR TIN (Sn)-LEAD (Pb) CONTENT ANALYSIS," US DoD, 2012.

MIL-STD-1580 Requirement 9 DETAILED REQUIREMENTS FOR PROHIBITED MATERIALS ANALYSIS AND INCOMING INSPECTION OF EXTERNAL PACKAGE PLATING MATERIALS USING X-RAY FLUORESCENCE SPECTROMETRY OR SCANNING ELECTRON MICROSCOPY WITH ENERGY DISPERSIVE SPECTROSCOPY

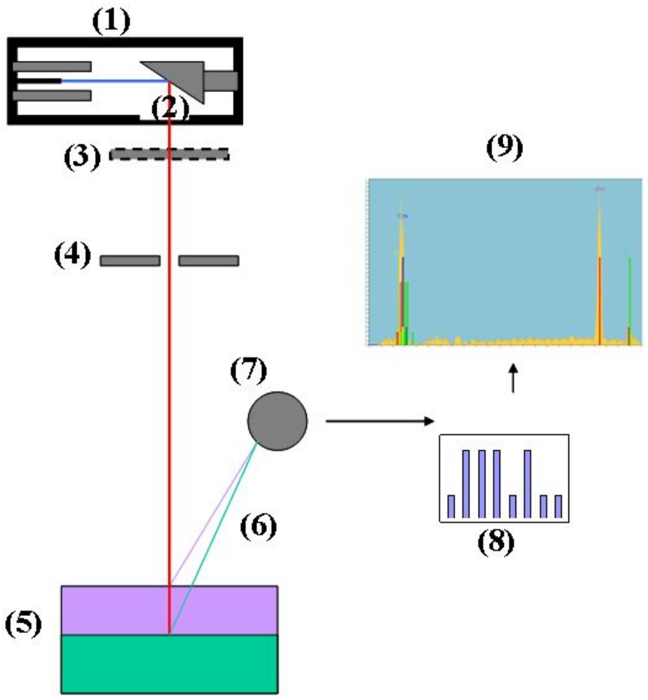
Description of Methodology & Procedure

X-ray Fluorescence (XRF) is a fast and simple way of material composition detection. Its most notable qualities include no, or minimal, sample preparation, non-destructive analysis, and compatibility with solid, liquid, and powdered samples. XRF spectrometers range from light hand-held devices to table-top machines. The principle of operation is detection of energy level of ejected electron under incident X-ray. Figure below shows the basic principle and Figure 2 shows a schematic of an XRF system. In this schematic diagram, the following items are labeled.



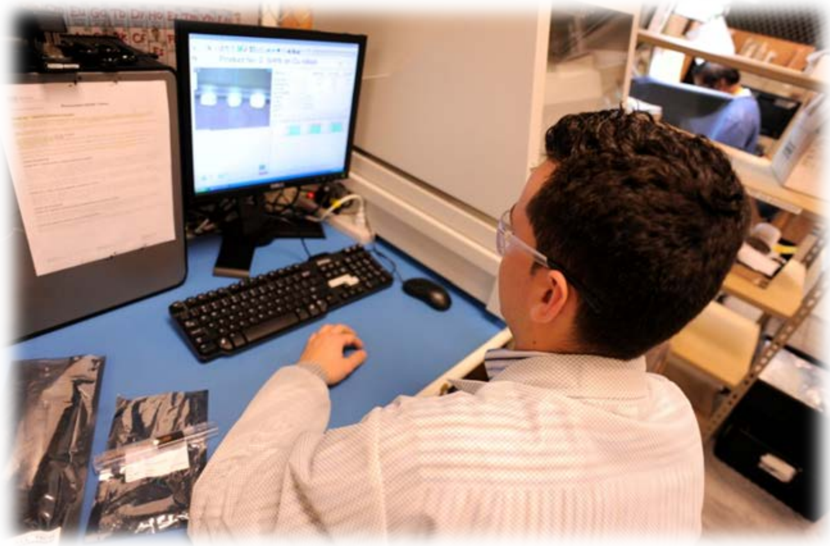
Description of Methodology & Procedure

- X-ray tube **(1)** (cathode, anode) which provides the primary beam **(2)**
- Primary beam filter (optional) **(3)**
- Collimator **(4)** Video Camera
- Sample **(5)**
- Characteristic fluorescence radiation **(6)**
- Detector **(7)**
- Count rate **(8)**
- Spectrum/Measurement Results **(9)**



Principle of XRF Spectroscopy

- Incident X-ray beam strikes sample
- Excitation of characteristic lines (x-ray fluorescence)
- Element specific characteristic radiation is detected and a spectrum is created
- Software evaluates spectrum for presence/absence of elements
- Useful for bulk material analysis and layer thickness measurements



Description of Methodology & Procedure

Energy Dispersive X-ray (EDX) analysis is sometimes referred to also EDS or EDAX analysis. It is a technique used for identifying the elemental composition of a area of interest on a sample. The EDX analysis system works as an integrated feature of a Scanning Electron Microscope (SEM).

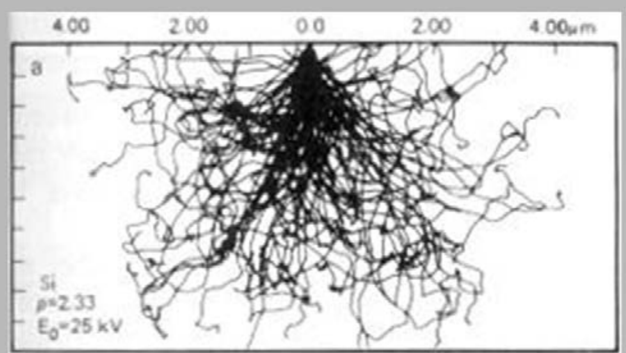
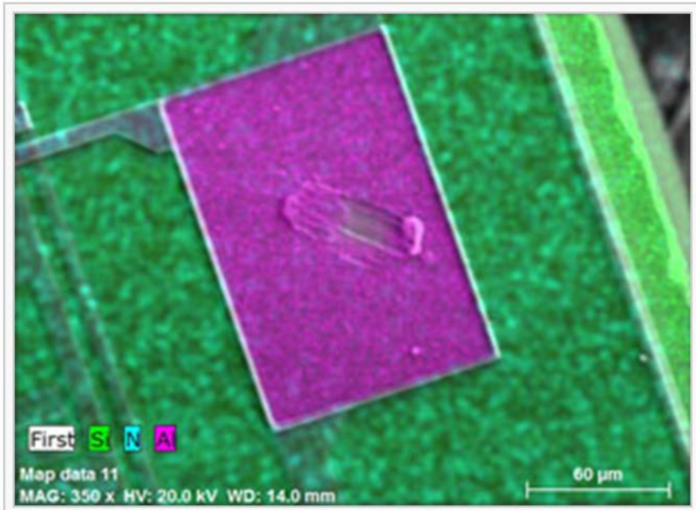
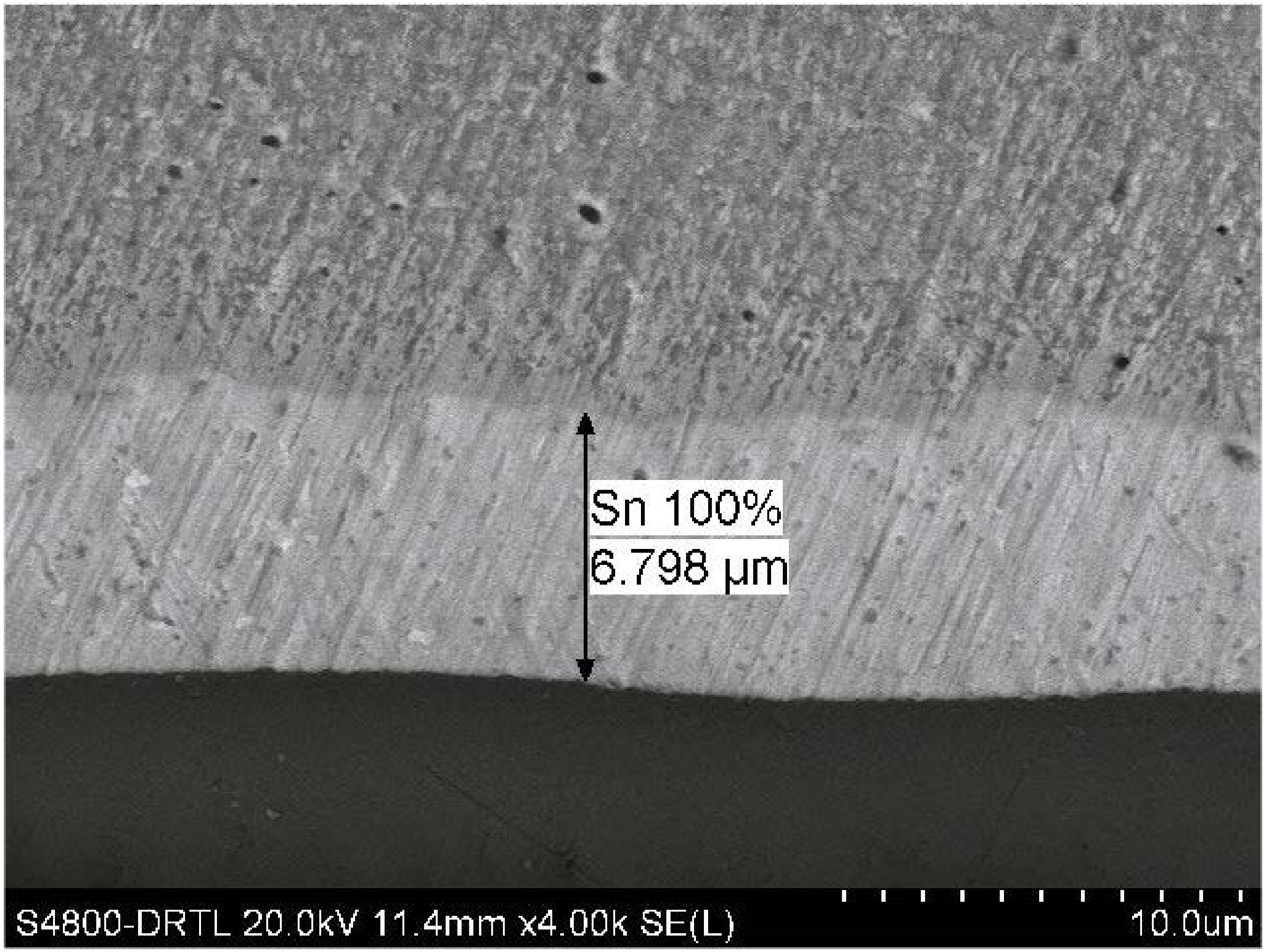


Fig. 1. A diagram of atoms traveling in a lattice, entering at the top. This illustrates Monte Carlo Dynamics. (Reimer, Ludwig, Scanning Electron Microscopy Springer-Verlag, 1985, p. 99)



Energy Dispersive X-Ray Spectroscopy (EDX/EDS/EDAX)



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Standards Required for Detection of 3% Pb

From JESD 213

4.7 Verification Standards

For tin – lead (Sn / Pb) alloys, a tin-lead composition standard with a lead content of 3.0 wt% is required. This Sn / Pb standard shall be a cast alloy sample made from high purity tin and lead. The values for the standards shall be traceable to values provided by the National Institute of Standards and Technology (NIST). If surface finish thickness is a concern, a foil standard of ≥ 99.9 wt% tin of a specified thickness consistent with component design is required.

NOTE For guidance on traceability to values for NIST Standard Reference Materials or other certified reference materials, refer to the NIST Policy on Traceability at http://ts.nist.gov/traceability/.

From MIL-STD-1580 Req 9

9.1.2.7 Verification Standards: For tin – lead (Sn / Pb) alloys, a minimum of two verification standards are required: (1) a ≥ 99.9 % tin foil of a specified thickness and (2) a tin-lead composition foil standard with a lead content of 3.0 wt% and a thickness of no more than 0.6 mil (15 µm). This Sn / Pb foil standard shall be a cast alloy sample made from reagent grade tin and lead. The values for the foil standards shall be traceable to values provided by the National Institute of Standards and Technology (NIST).

XRF Section (SAE G-19 Counterfeit Detection Committee)

Dynamic Research and Testing Laboratories (DRTL) Proficiency Test Report for XRF testing

2011080084 Date 08/27/11

SnPb Standard 3.03%Pb S/N ACYFS

Source of Uncertainty	Value +/-	Probability Distribution	K	Standard Uncertainty	% confidence
Fischer reference standards and reference materials used	0.42	Normal	2	0.21	95
Methods and equipment used	0.0340	Normal	2	0.02	95
Environmental conditions	0.0100	Normal	2	0.01	95
Properties and condition of the item being tested	0.0100	Normal	2	0.01	95
The Operator(Automated Meaurements by Machine)	na	na	na	na	na
				0.2108	
DRTL's XRF Estimated Measurement Uncertainty			2	0.4216	95

DRTL's XRF Estimated Measurement Percent Uncertainty **15.2%**

Note: Units of Measuremnt % WT Lead(Pb)

	IEC Albuquerque, NM 87107	Eastern Applied Research, Lockport NY 14094	IEC Newark, NY 14513	
	2.71	2.80	2.68	
	2.66	2.75	2.71	
	2.74	2.71	2.60	
	2.80	2.87	2.80	
	2.80	2.79	2.71	
	2.80	2.88	2.74	
	3.00	2.78	2.69	
	2.72	2.78	2.67	
	2.87	2.88	2.73	
	2.63	2.76	2.63	
	2.77	2.80	2.70	2.7563
Std Dev:	0.1076	0.0585	0.0566	0.0742
Std Uncert:	0.0340	0.0185	0.0179	0.0235

The DRTL process of estimating Measurement Uncertainty begins with the identification of sources contributing to the uncertainty including, but are not limited to:

a) reference standards and reference materials used,
b) methods and equipment used,
c) environmental conditions,
d) properties and condition of the item being tested, and
e) the Operator(Automated Meaurements by Machine)

XRF (SnPb3.03%) | ABQ Serial Numbers | ISO CERT 17025 EAR | ISO Cert ABQ XRF | ISO CERT Newark XRF

XRF Section (SAE G-19 Counterfeit Detection Committee)

Measurement Uncertainty (GUM)

The requirement is for a minimum of 3% of Lead (Pb)

The uncertainty in the measurement is +/-15.2%

A true 3% Lead content could measure between 2.54% and 3.46%

Or a minimum measurement of 3.46% is required to ensure a 3.0% Lead Sample

XRF Section (SAE G-19 Counterfeit Detection Committee)

Table 1 — Matching XRF Instrument Beam Size to Sample Size

Beam Collimation	X-ray Beam Size	Sample Area	Typical Samples	Exclusions
Capillary Optic (SEM Mounted X-ray detector)	2 mil (50 µm) (see note **)	6 sq. mil (0.004 sq. mm) to 50 sq. mil (0.032 sq. mm)	Chip components, fine wire, round leaded devices	Rounded or irregular surfaces that change height more than 10 mils (250 µm) relative to a line tangent to the highest point
Capillary Optic (Benchtop XRF)	3 mil (80 µm)	15 sq. mil (0.009 sq. mm) to 200 sq. mil (0.13 sq. mm)	Chip components, fine wire, round leaded devices	Rounded or irregular surfaces that change height more than 10 mils (250 µm) relative to a line tangent to the highest point
Mechanical Slot (Benchtop XRF)	8 mil (203 µm)	128 sq. mil (0.083 sq. mm) to 0.25 sq. inch (1.6 sq. cm)	SMT diodes, Ribbon leaded components, wire and cable, hardware	Size limited
Mechanical Slot (Handheld XRF)	About 400 mil (1 mm to 10 mm)	As small as 0.25 sq. inch (1.6 sq. cm.)	Fasteners and hardware	Size limited
**In this case, the primary beam is an electron beam, not an X-ray beam.				

In summary, a bench top XRF, equipped with a PIN Diode or Silicon Drift detector, and utilizing a plating thickness plus composition software application file is the preferred instrument. A lower cost handheld system or proportional counter detector could be used as long as the beam size and bulk material analysis or lower resolution are fully understood and not an issue for the users application.

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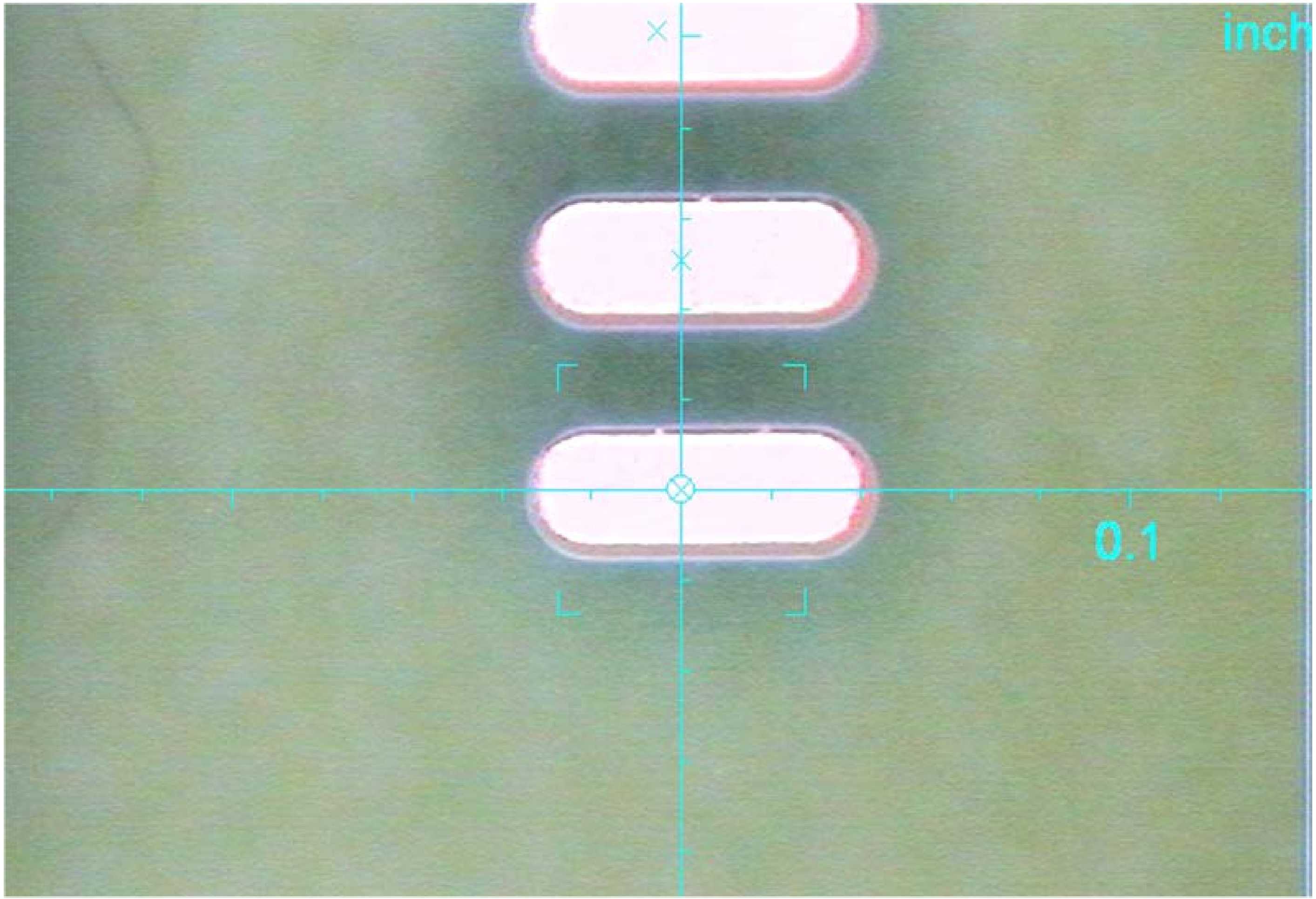

XRF Section (SAE G-19 Counterfeit Detection Committee)

X-Ray Fluorescence (XRF) CP Inspection/Screening Requirements

➢ X-ray Fluorescence (XRF) Spectroscopy is a tool for material composition detection. Its most notable benefits include no, or minimal, sample preparation, non-destructive analysis, and potential to use with a large variety of electronic components. In addition, under certain conditions, XRF can be used to determine layer thicknesses in multilayer structures. Although primarily a non-destructive analysis technique, the tool can be used for investigating internal material composition (e.g., wire bond, passivation, and metallization) of suitably prepared samples. In general, the detection technique is meant for use on piece parts that are not yet assembled on to a circuit board or are disassembled from a circuit board. If necessary, components assembled on a board can also be evaluated.XRF spectrometers range from light hand-held devices to table-top machines.

➢ The purpose of this procedure is to use XRF as a technique to detect risk of electronic parts being counterfeit. The coverage can include active, discrete, passive, electro-mechanical and connectors parts. The process of risk level determination is based on identification of elements (or absence thereof) in specific locations on or within a component. The counterfeit detection process using XRF can be on external surfaces of as received components or on de-lidded, de-capsulated, or otherwise prepared parts. The detection of counterfeit risk can also be based on the concentration levels of materials under consideration and thicknesses of the material layers. For reliable decision making, XRF analysis can be compared to the findings from known good parts. However, in the absence of ability to make such comparisons, XRF analysis can be used to determine the component to component consistency within a purchased lot. XRF can also help identify the manufacturing technique used to place a component within a particular timeframe.

➢ The component process flow for XRF based detection will of course depend on the purpose of the evaluation. For example, a lead finish examination shall be performed on the 3 sample devices that were examined for Remarking and Resurfacing, to verify that the Lead Finish / Solder Ball & Column composition matches the device specifications or datasheet. Along with the plating material(s)

XRF Section (SAE G-19 Counterfeit Detection Committee)

X-Ray Fluorescence (XRF) Counterfeit Flow Detection Test

Best results are typically obtained when individual design, construction and material requirements are known; meaning the screener or the evaluator must have access to the engineering data for the item under test. Prior physical analysis may be required to gather such data. Some of these items need to be ascertained before beginning XRF analysis. Examples are given below.

- Spatial resolution: required for electronic components.
- Alignment, Focusing System, and Scanning Capability
- Measurements Location and Frequency: must be performed on single items; multiple samples under the beam are unacceptable. Devices with varied geometry shall be measured at each different plane.

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XRF Sampling

Proposed Sampling Plan

Per JESD-213 5.3

Sampling Plans size shall be a minimum of five (5) components per plating lot, or as specified in a statistically based sampling plan derived from MIL-STD-1916. If visual inspection of the analysis surface at 30X can provide evidence of material homogeneity, one spot per sample may be analyzed. If the sample surface is visually heterogeneous at 30X magnification or less, each visually distinct surface requires a separate scan on each sample. The testing facility shall determine the number of spot location measurements required per sample to ensure a high level of confidence is obtained. This determination shall be based upon the equipment used for testing, manufacturing processes, materials used and geometry of the component being tested

Per MIL-STD-1580 9.1.3.14

Sampling Plan: A minimum of 1 sample per homogeneous lot shall be subjected to Prohibited Materials analysis as long as the samples appear consistent in optical appearance from sample to sample. If any variations are noted in optical appearance among samples, a minimum of 2 samples shall be evaluated and shall consist of the devices that vary in appearance.

XRF Section (SAE G-19 Counterfeit Detection Committee)

X-Ray Fluorescence (XRF) Counterfeit Flow Detection Test

Steps in performing analysis with a bench top system:

1. Place the sample in the spectrometer
2. Position and focus of the sample:
3. Choose the analysis mode you need to use
   - Spectrum
   - Material
   - Thickness
4. Choose the parameters of operation
   - Voltage
   - Primary beam filter
   - Collimator size
   - Anode current
   - Acquisition time
5. Perform analysis
6. Create report

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X-Ray Fluorescence (XRF) Counterfeit Flow Detection Test

XRF can detect counterfeit (or poor quality) parts by measuring the elemental composition of materials present in the parts and comparing them with an authentic part. It facilitates simultaneous analysis for 20-25 elements. It is non-destructive, does not require sample preparation and it provides relatively quick analysis results.

- However, there is potential for false positive and false negative detection for elements. Users should be aware of the issues related to the automated analysis software.
- Heterogeneity vs homogeneity of the target area of inspection.
- Atomic range of detection in between the elements Aluminum and Uranuim (Z=13 to 92).
- Sample size (i.e., the size of the part) v/s Spot size limitations.

XRF Section (SAE G-19 Counterfeit Detection Committee)

X-Ray Fluorescence (XRF) Test Report

A report on XRF inspection of part authentication should include the following details.

- Part number of item under test (to include lot/serial number if applicable)
- Number of parts inspected
- Settings used for each part
- Type of equipment used to include make and model
- Identification of material requirements verification (engineering data, additional testing of known good part)
- Key differences observed between DUT and known good part (if available)
- Results of testing to includes measurements/readings to include identification of test spot location
- Summary and conclusions

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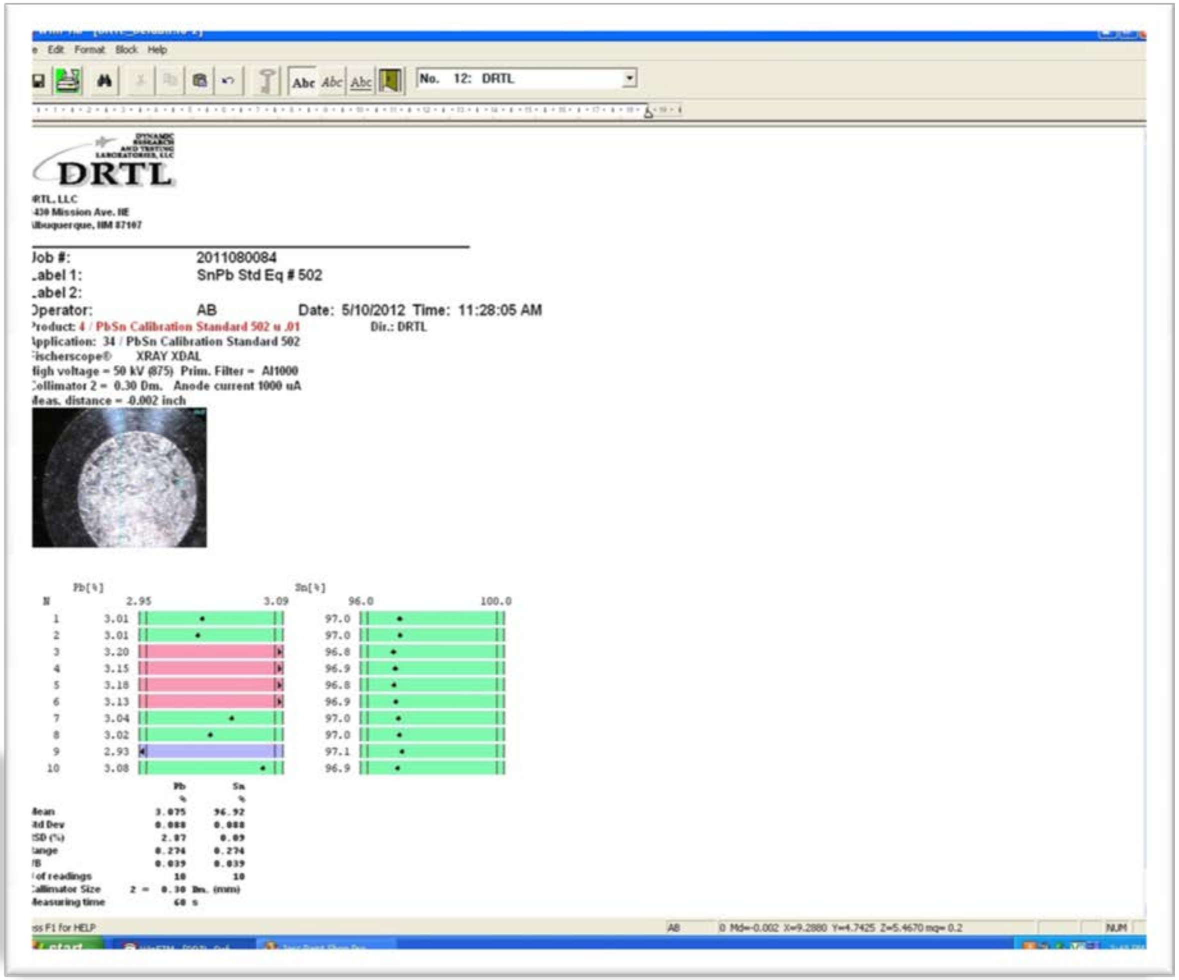
X-Ray Fluorescence (XRF) Test Report



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RTL, LLC
430 Mission Ave. NE
lbuquerque, NM 87107

Job #: 2011080084
Label 1: SnPb Std Eq # 502
Label 2:
Operator: AB Date: 5/10/2012 Time: 11:28:05 AM
Product: 4 / PbSn Calibration Standard 502 u .01 Dir.: DRTL
Application: 34 / PbSn Calibration Standard 502
Fischerscope® XRAY XDAL
High voltage = 50 kV (875) Prim. Filter = Al1000
Collimator 2 = 0.30 Dm. Anode current 1000 uA
Meas. distance = -0.002 inch

N	Pb[%] (2.95 – 3.09)	Sn[%] (96.0 – 100.0)
1	3.01	97.0
2	3.01	97.0
3	3.20	96.8
4	3.15	96.9
5	3.18	96.8
6	3.13	96.9
7	3.04	97.0
8	3.02	97.0
9	2.93	97.1
10	3.08	96.9

	Pb %	Sn %
Mean	3.075	96.92
Std Dev	0.088	0.088
RSD (%)	2.87	0.09
Range	0.274	0.274
VB	0.039	0.039
# of readings	10	10
Collimator Size	2 = 0.30 Dm. (mm)	
Measuring time	60 s	

ss F1 for HELP

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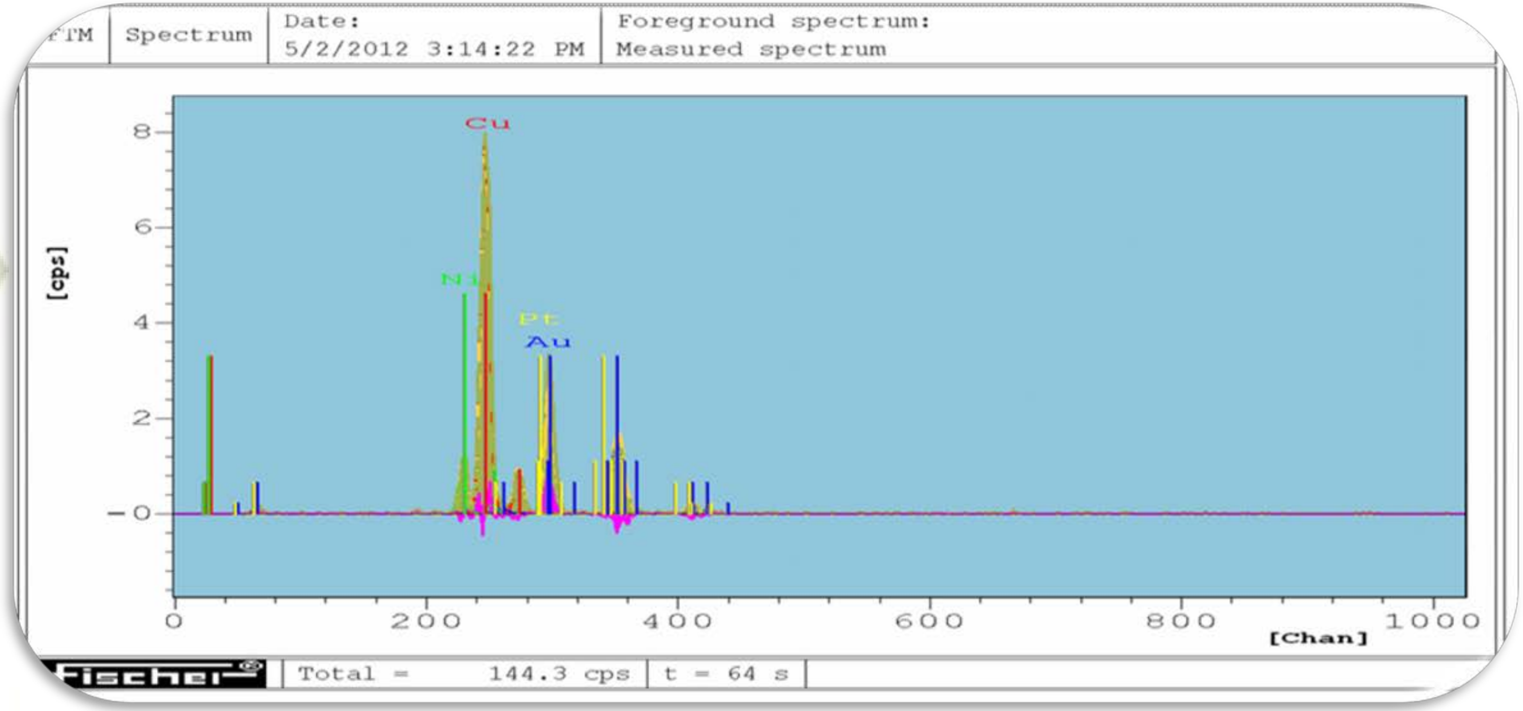
X-Ray Fluorescence (XRF) Spectra



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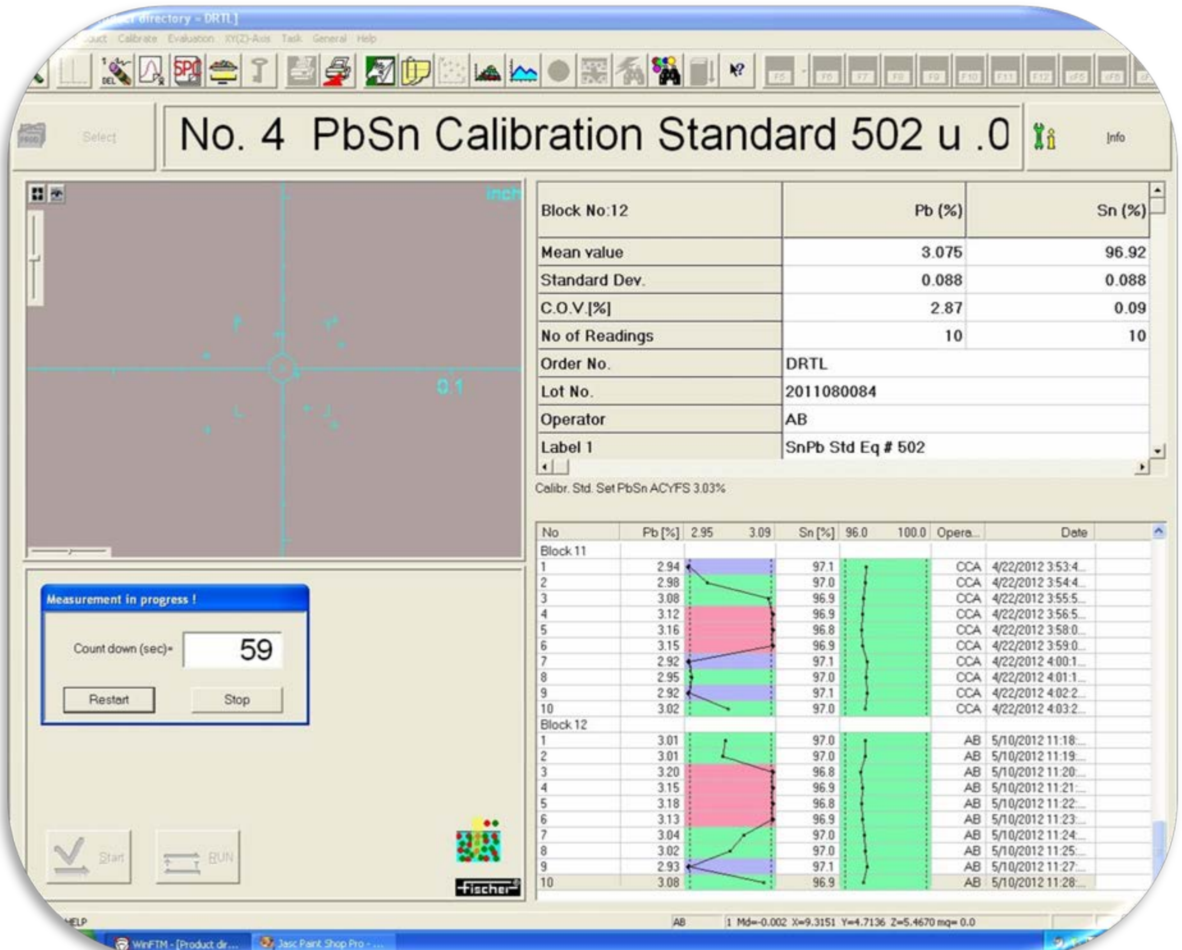
X-Ray Fluorescence (XRF) Test Report



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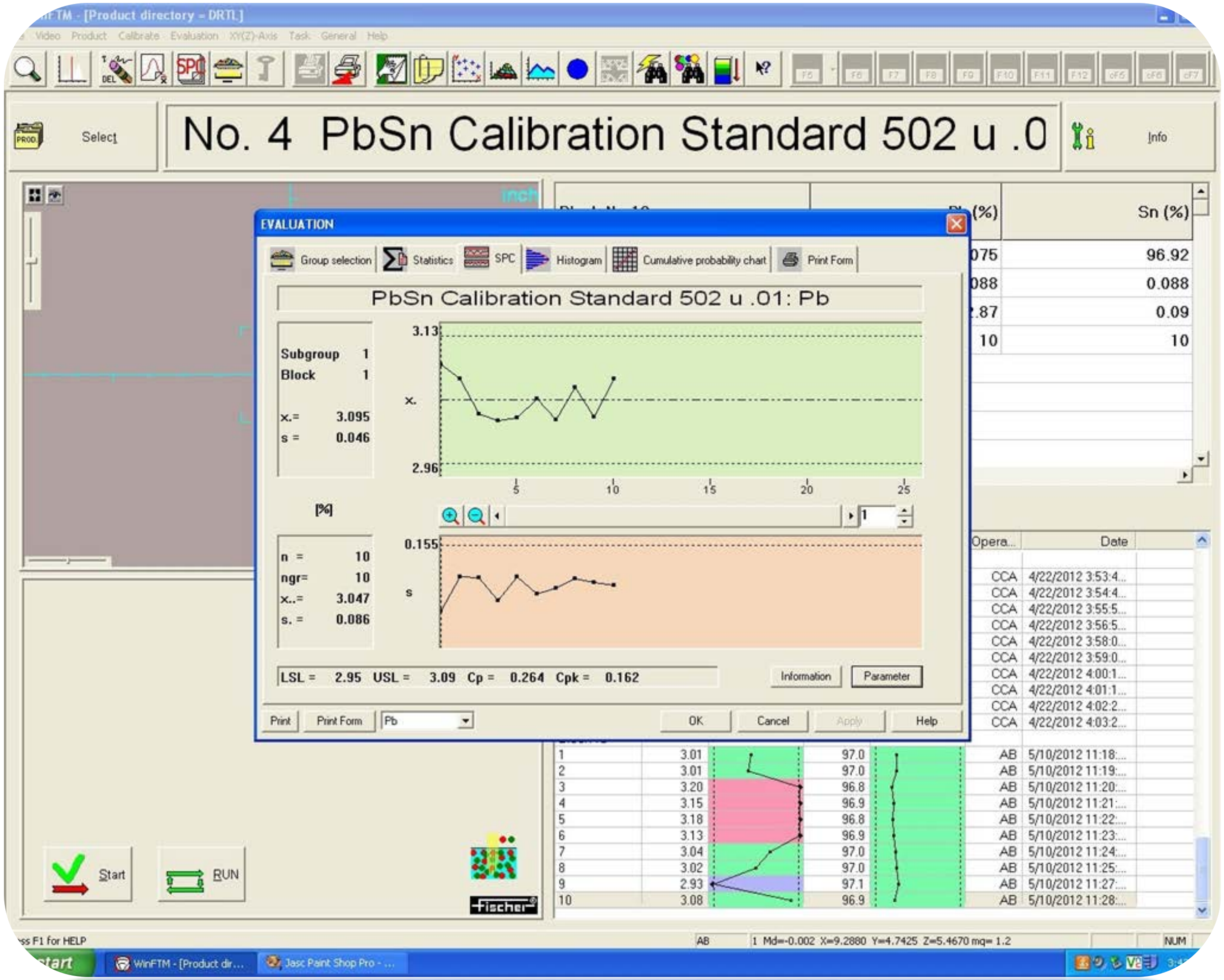

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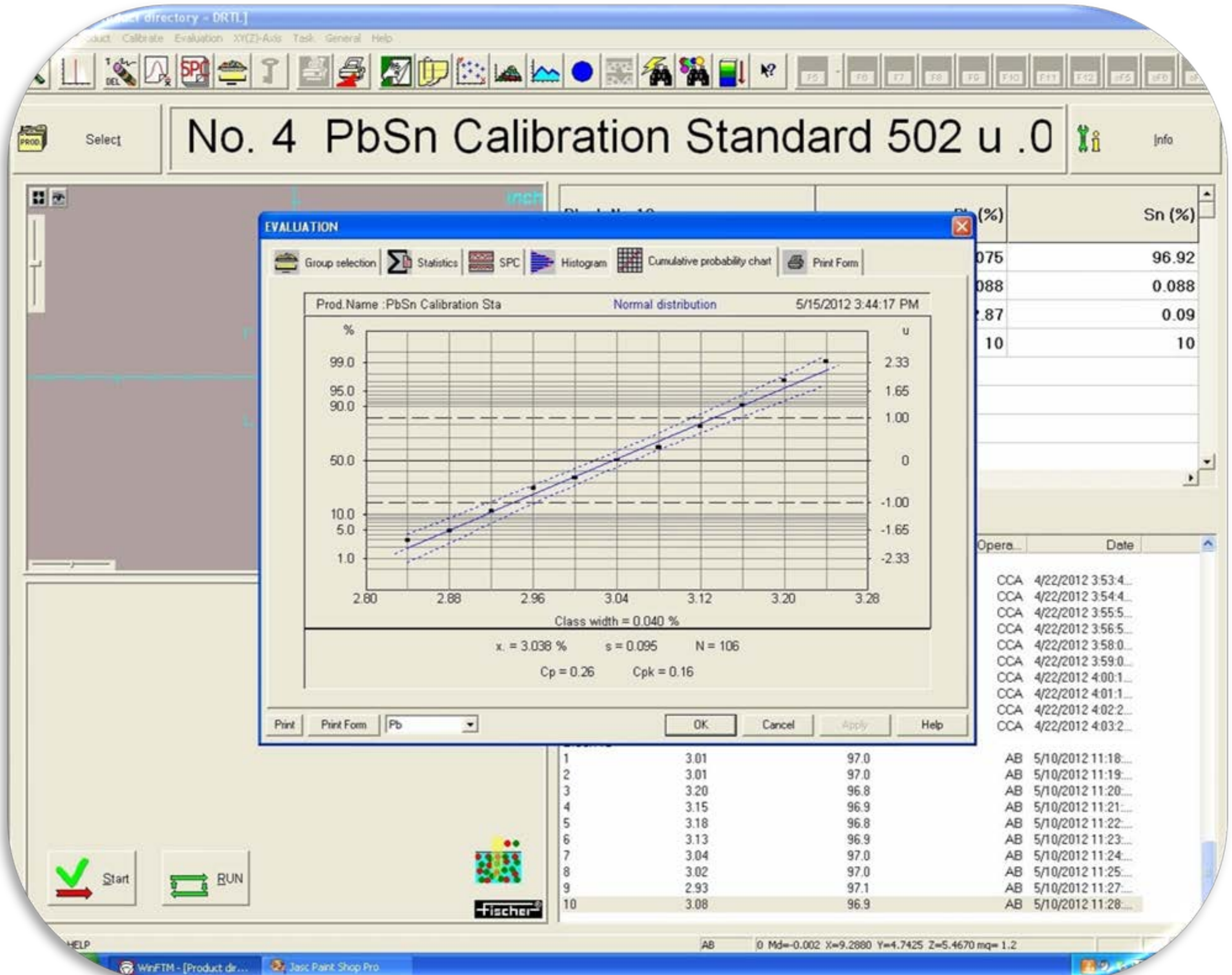

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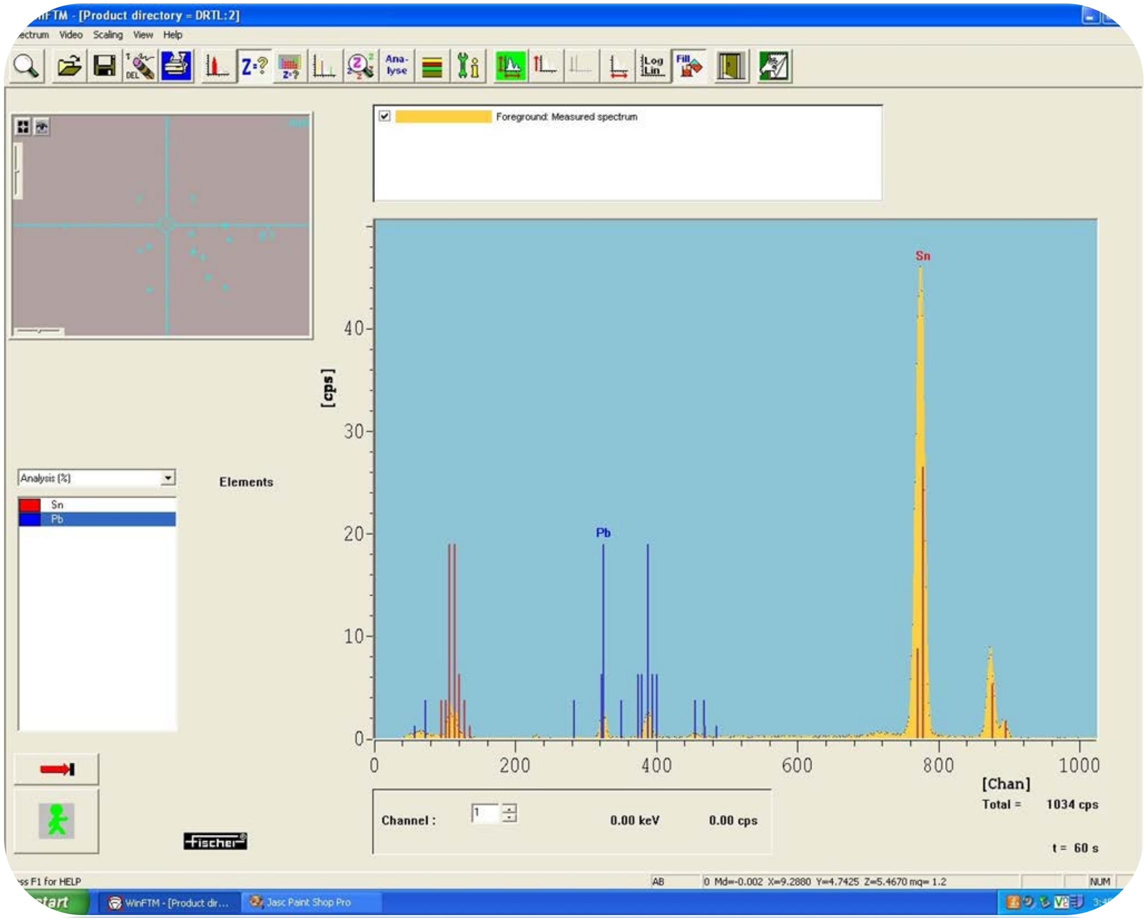
X-Ray Fluorescence (XRF) Test Report



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Frequently Asked Questions

1. Can I detect counterfeits via XRF?
2. Are XRF systems safe to use? Considering health effects, dosimetery requirements and operator safety.
3. How often should the XRF system be serviced?
4. Are there local, state or federal regulations that govern installation, use and operation of XRF systems?
5. Is handheld, Bench top, or Capillary Optic XRF necessary for counterfeit part identification?

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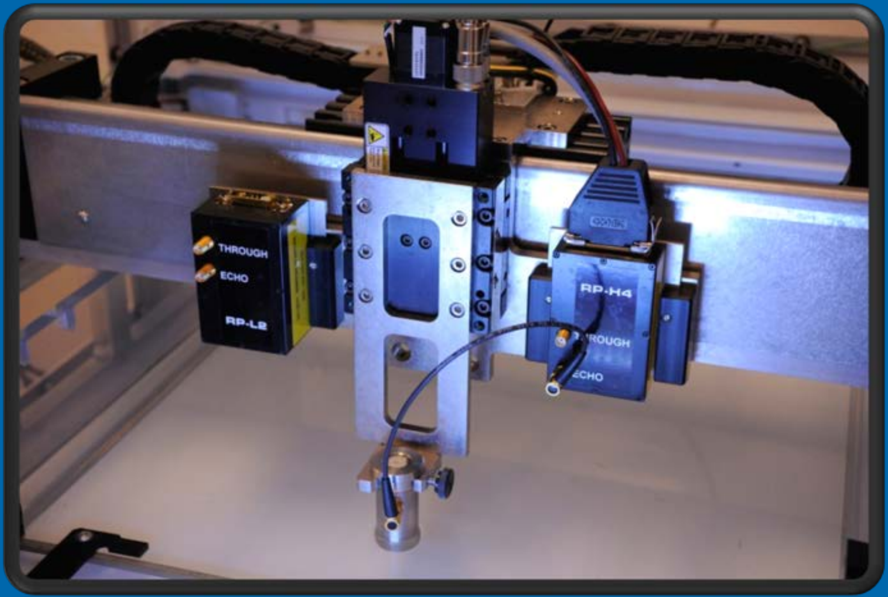
CSAM to Facilitate Lead Re-Finish Verification

- Scanning Acoustic Microscopy (CSAM)
- Transmitted or Reflected?
- Package Examples
  - Plastic Parts
  - Resistors
  - Capacitors
  - Transformers
  - Filters
  - Etc.



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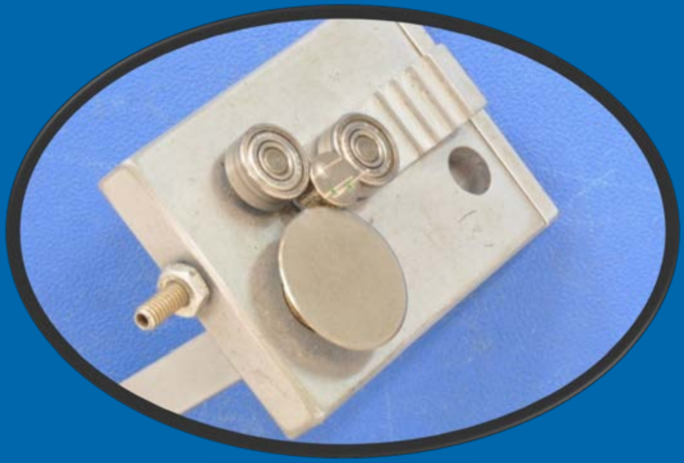
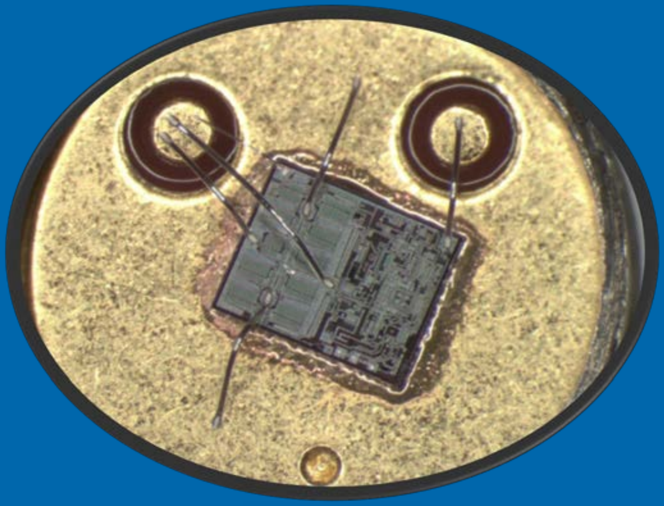
Mechanical De-Cap

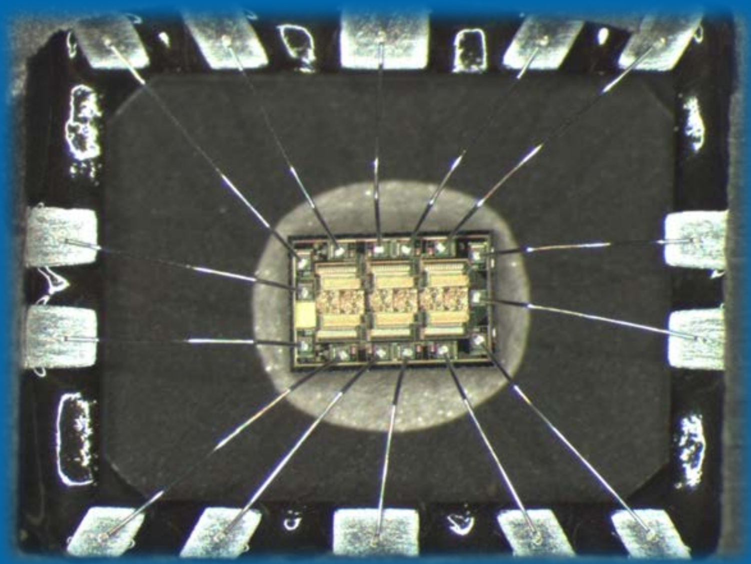
- Delidding and/or decapping are examples of mechanical de-cap
- Transistor outline (TO) package requires the lid removal via cutting of metal lid or weld





Mechanical De-Cap

- Delidding and/or decapping are examples of mechanical de-cap
- Ceramic DIP packages require to break the seal glass, or the cutting of the weld around a metal lid



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XRF Section (SAE G-19 Counterfeit Detection Committee)

8. Risk level inspection tests

	Critical Risk	High Risk	Moderate Risk	Low Risk
	4	3	2	1
Optically Inspect/Photo document	X	X	X	X
Wire Pull	X	X	X	(optional)
Die Shear (hermetic)	X	X	(optional)	(optional)
Ball Shear	X	X	(optional)	(optional)
SEM Inspection	X	(optional)	(optional)	(optional)
Perform EDX	X	(optional)	(optional)	(optional)
Unlayer/Inspect Metalization	X	(optional)	(optional)	(optional)
Glassivation Layer Integrity Testing	X	(optional)	(optional)	(optional)

XRF Section (SAE G-19 Counterfeit Detection Committee)

13. Certification Sample Questions (question answers available in Section 14)

13.1.

13.1.1. Chemical Handling

1. (True or False) Nitric acid should not be rinsed with isopropyl alcohol while decapping.
2. (True or False) Acetone and Alcohol bottles must be stored in color coded rinse bottles while under the fume hood, "red" for Acetone "yellow" for Isopropyl.
3. (True or False) Acid spills should be treated/cleaned with dry paper towels since they can absorb fluids quickly.
4. (True or False) Acid bottle storage within the fume hood is not acceptable. Small Erlenmeyer flasks (identifying the acids accordingly) with stopper are appropriate.
5. (True or False) Technicians wearing glasses are not required to wear safety goggles while under the fume hood since their glasses are considered a form of protection.

13.1.2. Safety Equipment Required

1. In the event of a chemical spill, __________ should be on hand.
   A) Bucket of water
   B) Mop
   C) Chemical spill containment material
2. Which of the following should be present in every chemical lab?
   A) Chemical grade fume hood
   B) Chemical storage cabinet
   C) Eye wash station
   D) All of the above
3. (True or False) An emergency shower station is required in every chemical lab.
4. Which of the following should be worn at all times while decapsulating?
   A) Chemical grade lab coat
   B) Chemical grade lab gloves
   C) Face shield/eye protection
   D) All of the above
5. (True or False) Tweezers should always be used to handle a component until it has been thoroughly rinsed of all chemicals.

13.1.3. Proper Techniques for Manual and Automated Decapsulation

1. When selecting a gasket size for a component, you should pick a gasket that

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Real Time X-ray Fluorescence (XRF)

Overview

1) Explain why X-ray Fluorescence (XRF) has become an integral part of a counterfeit avoidance inspection process
2) Provide evidence of XRF being used to identify suspect counterfeit parts
3) Discuss challenges associated with device verification in XRF.
4) Offer guidance relative to what to do when XRF cannot be compared to the manufacturer's datasheet.
5) Outline the significance or insignificance of having a "golden sample " for comparative purposes
6) Explain when and if XRF can or cannot accurately conclude if a part is or is not counterfeit
7) Explain when OCM verification is required
8) Offer guidance relative to determining the minimum lot size to be tested
9) Offer guidance relative to selecting samples for test from a large lot
10) Provide guidance that will assist attendees in the avoidance of "false positive " or "false negative" XRF interpretations

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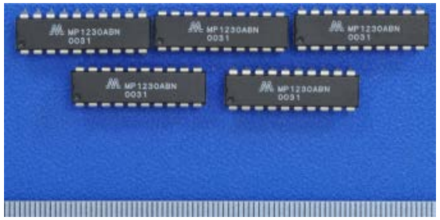
DRTL SERVICES - Comparison

DRTL Risk Mitigation Testing Strategies
(IDEA-1010, AS5553, Mil-std-1580, Modified)

Dynamic Testing and Research Laboratories (DRTL), LLC

1. **ISO 17025 Promotes Proficiency, Capability, and Accuracy.**
2. **Mil – STD Promotes "Sub-Standard" parts detection assessments.**
3. **Failure Analysis – promotes detailed analysis of " Sub-Standard" parts failure modes.**



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Quality = What is ISO 17025?

ISO/IEC 17025 is the main standard used by testing and calibration laboratories. Originally known as ISO/IEC Guide 25, ISO/IEC 17025 was initially issued by the International Organization for Standardization (ISO) in 1999. There are many commonalities with the ISO 9000 standard, but ISO/IEC 17025 adds in the concept of competence to the equation. And it applies directly to those organizations that produce testing and calibration results. Since its initial release, a second release was made in 2005 after it was agreed that it needed to have its quality system words more closely aligned with the 2000 version of ISO 9001. The contents of ISO/IEC 17025 - The ISO/IEC 17025 standard itself comprises five elements that are Scope, Normative References, Terms and Definitions, Management Requirements and Technical Requirements. The two main sections in ISO/IEC 17025 are Management Requirements and Technical Requirements. Management requirements are primarily related to the operation and effectiveness of the quality management system within the laboratory. Technical requirements includes factors which determines the correctness and reliability of the tests and calibrations performed in laboratory. Laboratories use ISO/IEC 17025 to implement a quality system aimed at improving their ability to consistently produce valid results. [2] It is also the basis for accreditation from an Accreditation Body(i.e., ILAC, A2LA, ACLASS, L-A-B, IAS, NVLAP and PJLA). Since the standard is about competence, accreditation is simply formal recognition of a demonstration of that competence. A prerequisite for a laboratory to become accredited is to have a documented quality management system. The usual contents of the quality manual follow the outline of the ISO/IEC 17025 standard.

DRTL SERVICES - Comparison

DRTL Risk Mitigation Testing Strategies
(IDEA-1010, AS5553, Mil-std-1580, Modified)

Requirements Comparison: ISO 17025 vs. AS9100 Rev C vs. ISO 9001:2008

Clause	ISO 17025	AS 9100 Rev C	ISO 9001: 2008
Legend:	***Same / Similar to*** ▯ ***Significant Disparity*** ⊘		
4	Management requirements	▯	▯
4.1	Organization	▯	▯
4.2	Management system	▯	▯
4.3	Document control	▯	▯
4.4	Review of requests, tenders and contracts	▯	▯
4.5	Subcontracting of tests and calibrations	▯	▯
4.6	Purchasing services and supplies	▯	▯
4.7	Service to the client	▯	▯
4.8	Complaints	▯	▯
4.9	Control of nonconforming testing and/or calibration work	▯	▯
4.10	Improvement	▯	▯
4.11	Corrective action	▯	▯
4.12	Preventive action	▯	▯
4.13	Control of records	▯	▯
4.14	Internal audits	▯	▯
4.15	Management reviews	▯	▯

DRTL SERVICES - Comparison

DRTL Risk Mitigation Testing Strategies
(IDEA-1010, AS5553, Mil-std-1580, Modified)

Requirements Comparison: ISO 17025 vs. AS9100 Rev C vs. ISO 9001:2008

Clause	ISO 17025	AS 9100 Rev C	ISO 9001: 2008
Legend:	***Same / Similar to*** ▯ ***Significant Disparity*** ⊘		
5	Technical requirements	▯ ⊘	▯ ⊘
5.1	General	▯	▯
5.2	Personnel	⊘	⊘
5.2.1	Personnel Certification	⊘	⊘
5.2.4	Job Description – minimum requirements	⊘	⊘
5.3	Accommodation and environmental conditions	▯	▯
5.4	Test and calibration methods and method validation	⊘	⊘
5.4.2	Standard Method	⊘	⊘
5.4.3	Lab-developed Method	⊘	⊘
5.4.5	Non-standard Method	⊘	⊘
5.4.6.2	Testing Laboratory - measurement uncertainty estimation	⊘	⊘
5.5	Equipment	▯	▯
5.6	Measurement traceability	▯	▯
5.7	Sampling	▯	▯
5.8	Handling of test and calibration items	▯	▯
5.9	Assuring the quality of test and calibration results Proficiency Testing Program - 3rd party, inter- or intra-lab	⊘	⊘
5.10	Reporting the results	⊘	⊘
5.10.5	Opinions and Interpretations	⊘	⊘

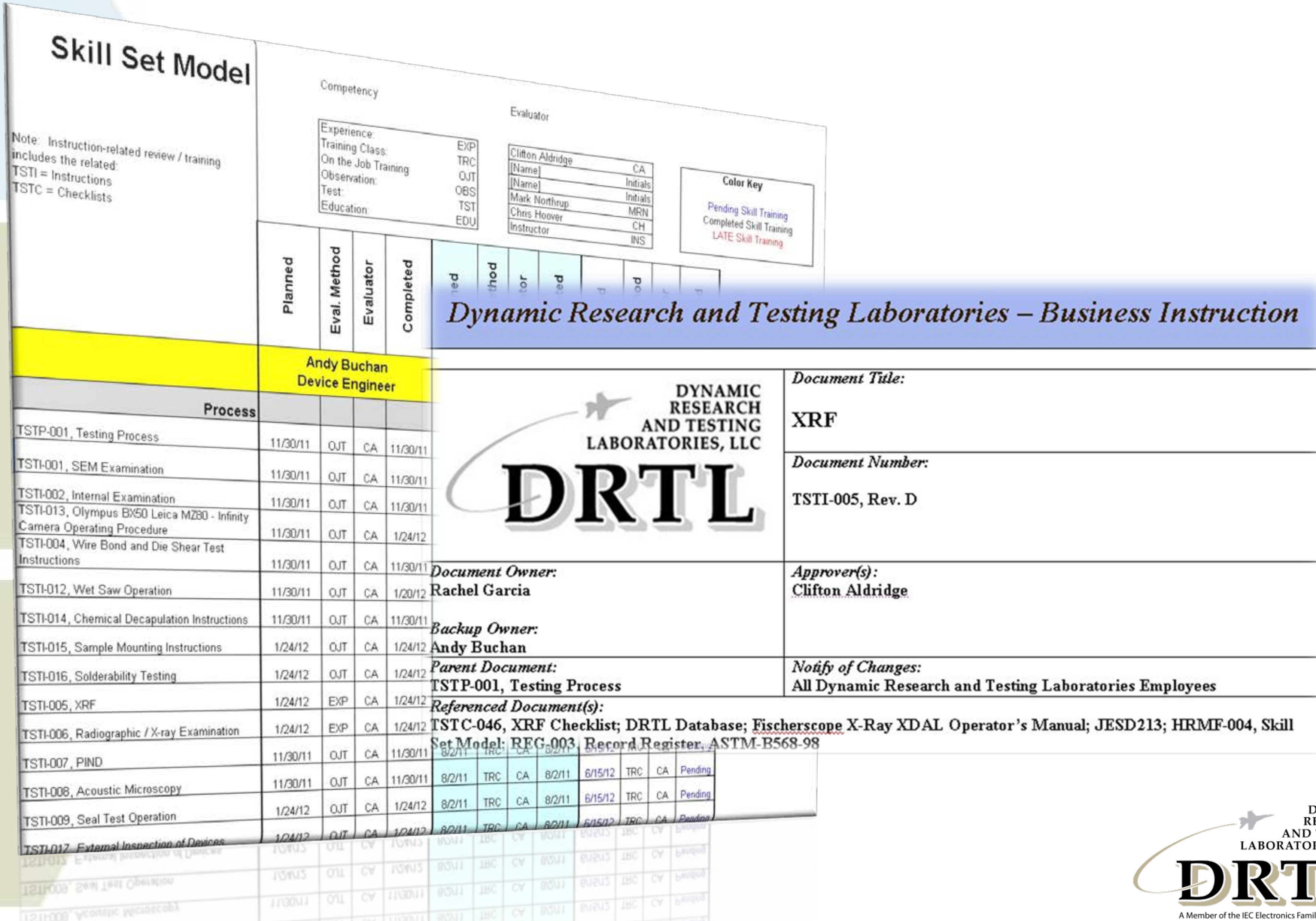
ISO 17025 Field of Tests

Scope of Accreditation to ISO/IEC 17025:2005

FIELD OF TEST	SPECIFIC TESTS OR PROPERTIES MEASURED	SPECIFICATION, STANDARD METHOD OR TECHNIQUE USED	*DETECTION LIMIT/ RANGE/ EQUIPMENT
Non-Destructive Testing (NDT)	Elemental content by XRF (Lead, tin, etc.)	JESD213	Fischerscope XDAL
Non-Destructive Testing (NDT)	Radiographic Examination / Inspection	MIL-STD-883, Method 2012 MIL-STD-750, Method 2076 MIL-STD-202, Method 209	X-TEK Model: Orbita
Non-Destructive Testing (NDT)	Acoustic Microscopy (CSAM) Examination / Inspection	IPC/JEDEC, J-STD-035	Sonix Echo
Mechanical	SEM Examination / Inspection	MIL-STD-750, Method 2077 MIL-STD-883, Method 2018	Hitachi S-4800
Mechanical	Internal Examination / Inspection	MIL-STD-883, Method 2010 and 2013 MIL-STD-750 Method 2072	Olympus BX50
Mechanical	Particle Impact Noise Detection (PIND)	MIL-STD-883, Method 2020 MIL-STD-750, Method 2052	Spectral Dynamics PTI Model: 4511 I
Mechanical	Die Shear Grams of Force	MIL-STD-883, Method 2019 MIL-STD-750, Method 2017	Dage 4000

http://www.DRTLonline.com

ISO 17025 Skill Set Model



Skill Set Model

Note: Instruction-related review / training includes the related:
TSTI = Instructions
TSTC = Checklists

Competency

Experience	EXP
Training Class	TRC
On the Job Training	OJT
Observation	OBS
Test	TST
Education	EDU

Evaluator

Clifton Aldridge	CA
[Name]	Initials
[Name]	Initials
Mark Northrup	MRN
Chris Hoover	CH
Instructor	INS

Color Key

Pending Skill Training
Completed Skill Training
LATE Skill Training

Andy Buchan
Device Engineer

Process	Planned	Eval. Method	Evaluator	Completed								
TSTP-001, Testing Process	11/30/11	OJT	CA	11/30/11								
TSTI-001, SEM Examination	11/30/11	OJT	CA	11/30/11								
TSTI-002, Internal Examination	11/30/11	OJT	CA	11/30/11								
TSTI-013, Olympus BX50 Leica MZ80 - Infinity Camera Operating Procedure	11/30/11	OJT	CA	1/24/12								
TSTI-004, Wire Bond and Die Shear Test Instructions	11/30/11	OJT	CA	11/30/11								
TSTI-012, Wet Saw Operation	11/30/11	OJT	CA	1/20/12								
TSTI-014, Chemical Decapulation Instructions	11/30/11	OJT	CA	11/30/11								
TSTI-015, Sample Mounting Instructions	1/24/12	OJT	CA	1/24/12								
TSTI-016, Solderability Testing	1/24/12	OJT	CA	1/24/12								
TSTI-005, XRF	1/24/12	EXP	CA	1/24/12								
TSTI-006, Radiographic / X-ray Examination	1/24/12	EXP	CA	1/24/12								
TSTI-007, PIND	11/30/11	OJT	CA	11/30/11	8/2/11	TRC	CA	8/2/11				
TSTI-008, Acoustic Microscopy	11/30/11	OJT	CA	11/30/11	8/2/11	TRC	CA	8/2/11	6/15/12	TRC	CA	Pending
TSTI-009, Seal Test Operation	1/24/12	OJT	CA	1/24/12	8/2/11	TRC	CA	8/2/11	6/15/12	TRC	CA	Pending
TSTI-017, External Inspection of Devices	1/24/12	OJT	CA	1/24/12	8/2/11	TRC	CA	8/2/11	6/15/12	TRC	CA	Pending

Dynamic Research and Testing Laboratories – Business Instruction

DYNAMIC RESEARCH AND TESTING LABORATORIES, LLC
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Document Title: XRF	*Document Number:* TSTI-005, Rev. D
Document Owner: Rachel Garcia *Backup Owner:* Andy Buchan	*Approver(s):* Clifton Aldridge
Parent Document: TSTP-001, Testing Process	*Notify of Changes:* All Dynamic Research and Testing Laboratories Employees

Referenced Document(s):
TSTC-046, XRF Checklist; DRTL Database; Fischerscope X-Ray XDAL Operator's Manual; JESD213; HRMF-004, Skill Set Model; REG-003, Record Register, ASTM-B568-98

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DRTL Supports SAE G19 Proposed Test Flow Summary

TABLE --- ACTIVE DEVICES RISK MITIGATION SCREENING FLOW PRELIMINARY
(microcircuits & semiconductor devices)

Steps	Mechanical/Environmental/Electrical Inspections/Tests	4 Critical Risk	3 High Risk	2 Moderate Risk	1 Low Risk	0 Very Low Risk
1	External visual Inspection, EVI_3 (General)	Y	Y	Y	Y	Y
2	Remarking & Resurfacing	Y	Y	Y	Y	Y
3	XRF	Y	Y	Y	Y	Y
4	External visual Inspection, EVI_5 (Detailed)					
5	Delid Physical Analysis					
6	SEM/OPTICAL					
7	Radiographic/X-RAY					
8	Acoustic Microscopy (AM)					
9	Miscellaneous					
10	Seal (hermetic devices)					
11	Temp cycling/ End point electrical					
12	DC Curve Trace					
13	Full DC Test, Ambient Temp					
14	DC,Key(AC,Switching, Functional),Ambier					
15	DC,Key(AC,Switching, functional), Ambie					
16	DC,Key(AC, Switching, Functional), over					
17	Burn-In & Final Electricals with Limits & Delta Limits					

Key: Y – Yes, test performed
AN-As necessary

Component Test Plan Defined

HIGH RISK

- DPA (MIL-STD-1580)
- External Visual
- Internal Visual
- X-ray
- XRF
- CSAM
- Solderability
- Environmental Stress Test
- Thermal Shock
- SEM
- EDX/S
- FTIR/TGA
- Electrical Test
- Burn-In
- Fine & Gross leak
- RGA
- PIND

MEDIUM RISK

- AS5553
- DPA
- External Visual
- Internal Visual
- Marking Permanency
- X-Ray
- XRF
- Thermal Cycle
- Electrical Test
- Burn-In
- Fine & Gross Leak

LOW RISK

- IDEA 1010
- Photograph Parts
- Co-planarity
- Damaged Leads and Terminations
- Contamination and Oxidation
- Evidence of Poor Handling, Storage or Prior Use
- Rework or Refurbishment
- Remarked and Substandard

ERAI/IHS Membership

Counterfeit Part Analysis

We would all prefer to follow the standards of the U.S. Government Industry Data Exchange Program (AS5333 – Counterfeit Electronic Parts, Avoidance, Detection, Mitigation, and Disposition) or the Independent Distributors of Electronics Association (IDEA-STD-1010-A). Unfortunately, many of us cannot use an approved vendor due to long lifecycle product demands, requiring us to perform Component Risk Mitigation Testing Methodology. Our contention is that the term "Counterfeit Parts Analysis" is better served via a Component Risk Mitigation Test Plan by using existing Destructive Physical Failure, Construction, and Electrical Analysis practices.

Legislative Advocacy

DRTL is focused on addressing the most pressing issues facing today's procurement of electronic components. We are strong advocates of the U.S. governments' push on legislative changes to detect and avoid counterfeit parts leaking into our supply chain, as referenced in the National Defense Authorization Act for Fiscal Year 2012 (Sec. 818 – Detection and Avoidance of Counterfeit Electronic Parts, and Sec. 2320 – Trafficking in Counterfeit Goods or Services) and the recent Government Accountability Office Report (DoD Supply Chain – Suspect Counterfeit Parts Can Be Found on Internet Purchasing Platforms).

DRTL and IEC Electronics

Certifications:

MIL-STD-1580
ISO/IEC 17025
AS5553
AS6171

Accredited Nadcap

IPC 600/610/620/7711

IPC J-STD-001

ITAR

Memberships:

erai MEMBER

PROUD AIA MEMBER

SMTA

SAE Aerospace G19 Counterfeit Electronic Components Committee

SAE International

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ERAI & DRTL Team

Rachel Garcia - Dynamic Research and Testing Labs, LLC.

Rachel is a Component Analyst at Dynamic Research and Testing Laboratories (DRTL). She has 8 years of experience with Destructive Physical Analysis (DPA) and holds an A.A.S in Computer Electronics Engineering Technology from ITT Technical Institute in Albuquerque, NM. Rachel is currently a member of SAE G-19 Committee.

Click here for a full bio

Andrew Buchan - Dynamic Research and Testing Labs, LLC.

Andy is a Graduate from the Rochester Institute of Technology with a Bachelors of Science in Manufacturing Engineering Technology. He began his career in the Electronics industry at IEC Electronics holding a variety of roles including Manufacturing Engineering Technician, Materials Lab Technician, Materials Lab Engineer. Andy joined Dynamic Research and Testing Laboratories (DRTL) as an Electronics Engineer. With his experience in failure analysis of printed circuit board assemblies Andy brings a unique perspective to DRTL.

Click here for a full bio

Clifton Aldridge - Dynamic Research and Testing Labs, LLC.

Mr. Aldridge has over 20 years experience with significant aerospace companies. He also gained extensive senior management experience as vice president of Analytical Solutions, Inc. His background includes performing remote component test verification of devices in various radiation environments, construction and failure analysis of microelectronic devices and component engineering activities encompassing automated test development and part obsolescence management. Mr. Aldridge holds a Bachelors of Science degree in Electrical Engineering Technology from DeVry Institute of Technology in Kansas City, Missouri.

Click here for a full bio

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Can You Afford Not To have A Risk Mitigation Strategy ?

Thank you !

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