

DNA Marking & Authentication: A Secure Anti-Counterfeiting Program for the Electronics Industry



October 19, 2011

ERAI Data

(Presented by Missile Defense Agency at DMSMS 2011)

186 reported suspect parts purchased over 2 months = 1,116 parts/year:

- 906 Integrated Circuits at an average price of \$7.08 each
- 138 Discrete Active Components at an average price of \$2.03
- 72 Discrete Passive Components at an average price of \$0.05

The total estimated annual sales price of ERAI, member reported, suspect counterfeit parts, is \$14.7m.

*This does **NOT** include the cost of repair, rework, failed testing, failed systems, and potentially lost lives.*

Jack Stradley (former SIA Chairman)

(Presented at DMSMS 2011)

The number of people specifically involved in anti-counterfeiting measures varies by size and nature of the manufacturer. It can be more than 10 or as low as 1. Taking an average of:

- 3 people per manufacturer
- > 300 manufacturers worldwide
- An annual person cost of \$150k

The total cost is > \$135m per year.

We are all paying the price.

DNA to Assure Safety & Recapture Market

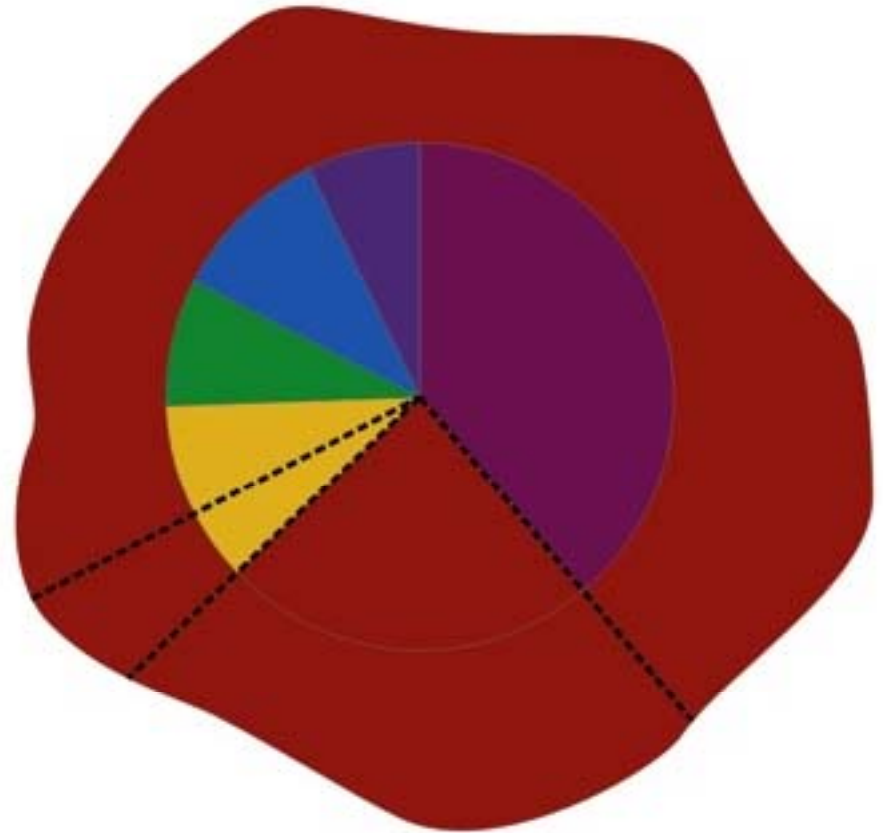
U.S. Department of Commerce conducted a four-year study between 2005 and 2008 which revealed that 39% of 387 companies encountered counterfeit electronic components, microcircuits, or circuit boards

DNA can be used to regain a Company's proportionate Market Share.

According to the National Electronics Distributors Association, counterfeiting has become a **\$100-billion** problem.

....or grow their Market Share.

....or dominate a Market.



Can You Tell the Difference?



Real



Fake

We Can!

DNA offers absolute authentication. Parts can be “**branded**” at the **molecular level** using the gold standard for forensic evidence most preferred by global courts.

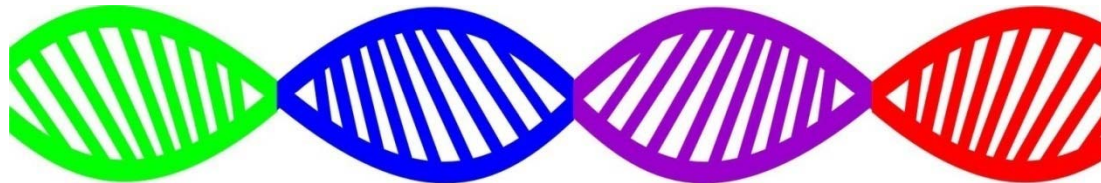
Creating a SigNature DNA Marker



Large Botanical DNA is acquired.



DNA is segmented.



Segments are shuffled, reassembled and encrypted to form a unique, secure DNA marker.

SigNature DNA is Robust & Stable

Category	Testing Contents	Result
UV energy	Equivalent up to 350 years of UV energy accumulation in Denver	Stable
X rays	4 times X-ray exposure by X-ray scanning machine at airport	Stable
γ rays	30 kGy radiation exposure by Gamma-ray sterilization machine	Stable
pH	pH 1 to 14 overnight	Stable
Thermal	> 250°C (4 hours)	Stable
Solvents	Aggressive aprotic solvents, oxidizers, radicals	Stable

Current Hosts for DNA

- Surface treatments, plastics, laminates, varnishes, clear coats, reactive adherents
- Metal surfaces, metal coatings
- Extruded, molded plastics, IMD
- Cyanoacrylates and adhesives
- Wide range of security inks
 - Flexo, offset, gravure, thermal transfer
- Laser toner and inkjet Ink
- Cash degradation ink
- Paper, labels, packaging
- Textile treatments, yarn, fabric
 - Integrated in fibers
 - Direct application onto product
 - Woven labels, insignias



Broad IP Portfolio:

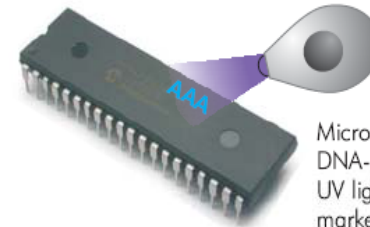
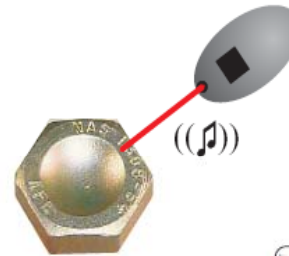
38 Patents
7 Trademarks



Screening & Authentication

SigNature® DNA Security Measures

*Rapid
Screening
in the Field*



Microchip screen with DNA-marked fluorescing ink
UV light provides instant marker detection



Invisible 2-D barcode with DNA marker



DNA-marked
Critical
Documents



Label sample is received



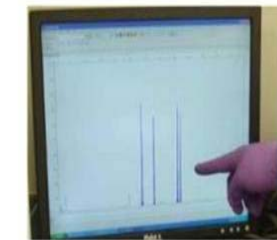
Sample Preparation



Purified DNA sample into vial



DNA authenticated using PCR machine and/ CE analysis

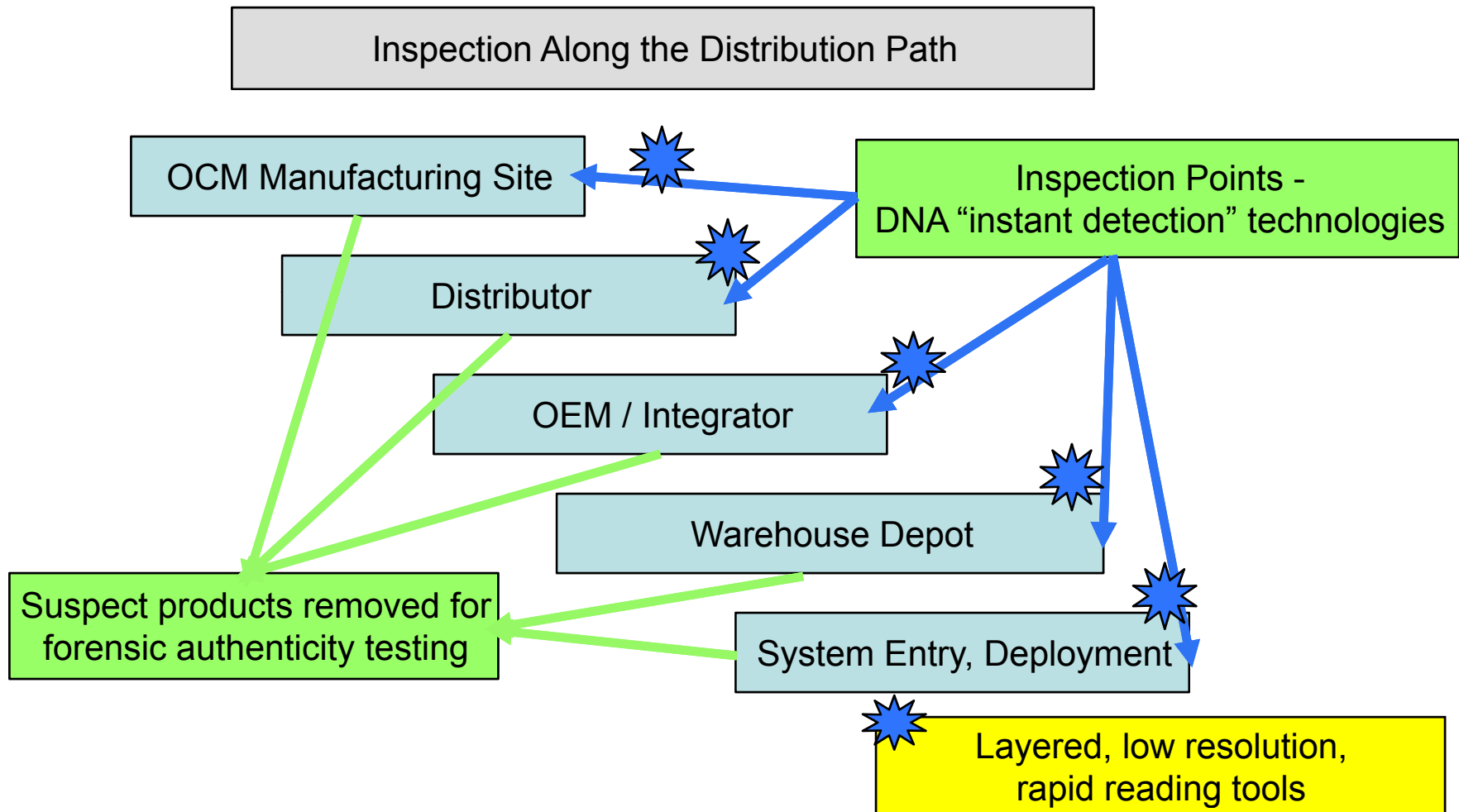


Results are absolute and definitive

*Forensic
Authentication
in the Lab*

applieddnasciences 
the ultimate reality check

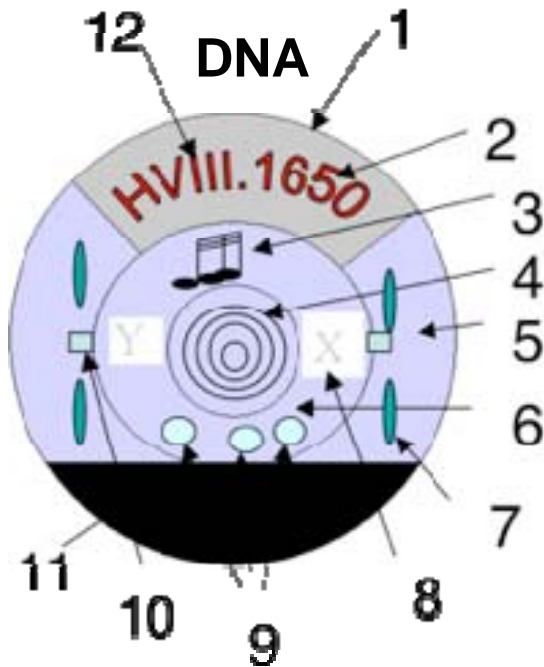
Authenticity Along the Supply Chain



EU Optical Disks tell our story...



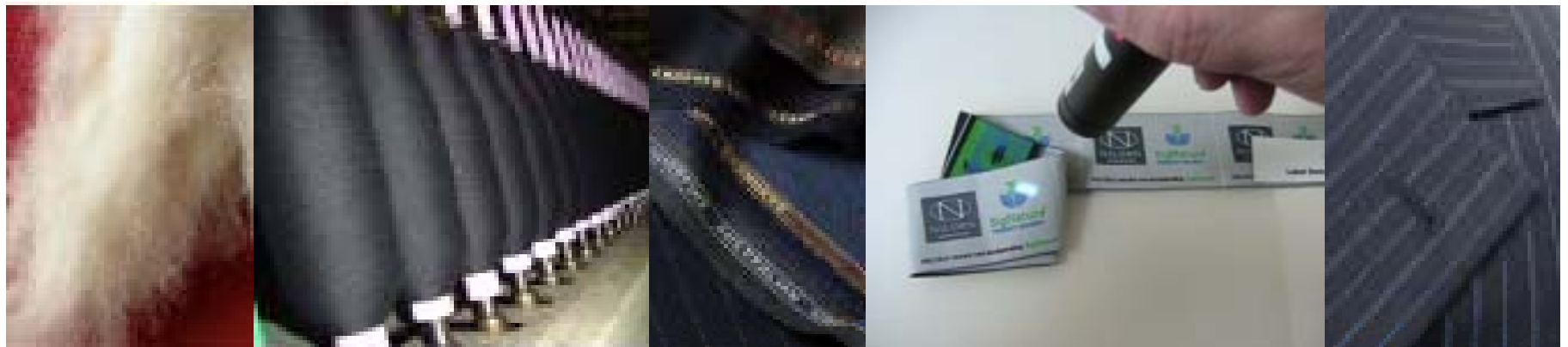
DNA



1. PET Al sputtered foil release label
2. Fluorescent red ink turns orange with red laser
3. Musical node hologram: shape shift/color change
4. 10 concentric circles. Shapes shift when tilted
5. X,Y microdots visible under 30X magnification
6. Random interference lines
7. 4 microprints of 'AUDIO VIDEO'
8. Shine red laser 30° from top of X and US 'culture' projects on paper 45° below.
9. Three circles encoded with Characters 'U' 'S' 'A'
10. Microprint 'AUDIO VIDEO'
11. Machine readable encrypted codes
12. DNA embedded in #2 fluorescent ink

Within 9 months of launch, 11 of the 12 security platforms were copied by counterfeiters. SigNature DNA was the only measure that could not be duplicated. Years later, only DNA can distinguish the genuine from the counterfeit.

SigNature DNA Protects Supply Chain for “Made-in-England”



Fiber

Yarn & Textiles

Fabric

SigNature DNA
Woven Label

Finished
Garment

SigNature DNA-IR adducts **protect the entire supply chain**

SigNature DNA Protects 35% of the UK Cash-in-Transit Industry (>40 B\$/yr)

1. Loomis Cash Box "Attack"



Following discharge, cash is marked with SigNature® DNA.

2. Recovery of Stained Notes



Stained Evidence recovered by U.K. Police

3. Screen for SigNature® DNA



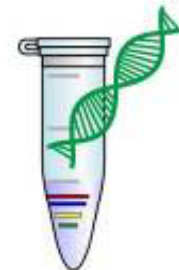
DNA marker detected with UV handheld device.

4. Sample Collection



Stained evidence sent to DNA Lab for analysis.

5. DNA Analysis



DNA is extracted and analyzed.

6. DNA Authentication



An Expert Witness Statement Report is provided to the UK Police and Loomis. Before a Case Goes to Trial, the Police submit the Report to the Crown Prosecution.

DNA-IR adducts protect the entire custody chain

- 18 months: 20+ convictions resulting in 100+ years of jail time where the **SigNature DNA taggant has been key evidence**
- 100% authentication/100% conviction rates
- Now being adopted across Sweden

Return on Investment

- For the first quarter of 2010, relative to the first quarter of 2009, our UK CViT customers indicated that **cash attacks were down 55% and cash losses down 72%**.
- The elimination of a single CViT attack would pay for the cost of our program.
- In fact, over **100 crimes were avoided**. Both customers attribute to decrease to “Deterrence by DNA”.
- **The return on their investment in SigNature DNA has been extraordinary.**



DNA Marking Microchips for U.S. Government

Protecting electronics industry,
government throughout supply chain



Fighting Counterfeit Items is a Top DLA Priority

Stewardship Excellence is one of 3 strategic focus areas for DLA with an expected action step to

Improve detection, deterrence and disposition of non-conforming, counterfeit material

Source: 2011 Director's Guidance Report

Phase 1 Successful Results

OCM & Large Authorized Distributor

- Marked 100% of production at CA facility for over 2 months
- No change to production process
- No impact on mark permanency testing
- Marks rapidly scanned without difficulty
 - Microchips at OCM
 - Labels at Distributor
- 100% Forensic authenticity
- 100% Distinction between genuine (marked) and counterfeit (unmarked) swabbed samples

Phase 2



Applied DNA Sciences Successfully Marks Mission-Critical Microchips for the Department of Defense

Stellar Results Lead to Immediate Marking Program with Defense Logistics Agency

STONY BROOK, N.Y., June 22, 2011/Marketwire - Applied DNA Sciences, Inc. (OTCBB: APDN) has successfully completed a program to DNA mark microchips for the Defense Logistics Agency of the U.S. Department of Defense. Used systematically, DNA marking could prevent counterfeit microchips, which might be defective and possibly dangerous, from entry at any point in the Department of Defense's supply chain.

The initial results were so successful that APDN has already been awarded a follow-on contract of almost \$1 million to fully engage one of the government's microchip supply chains. With interim deliverables that must be met, this final phase will include several Original Chip Manufacturers, distributors, board builders, system integrators and the Armed Forces. By including the various supply chain participants, APDN can partner with government and industry to build a forensically secure supply chain from the source to the end-user. APDN believes that the project could be a significant first step for the company toward a major role in supply chain defense with government, and in business-to-business relationships with Original Chip Manufacturers, distributors, and the manufacturers of printed circuit boards and finished electronic goods.

Results tell the story

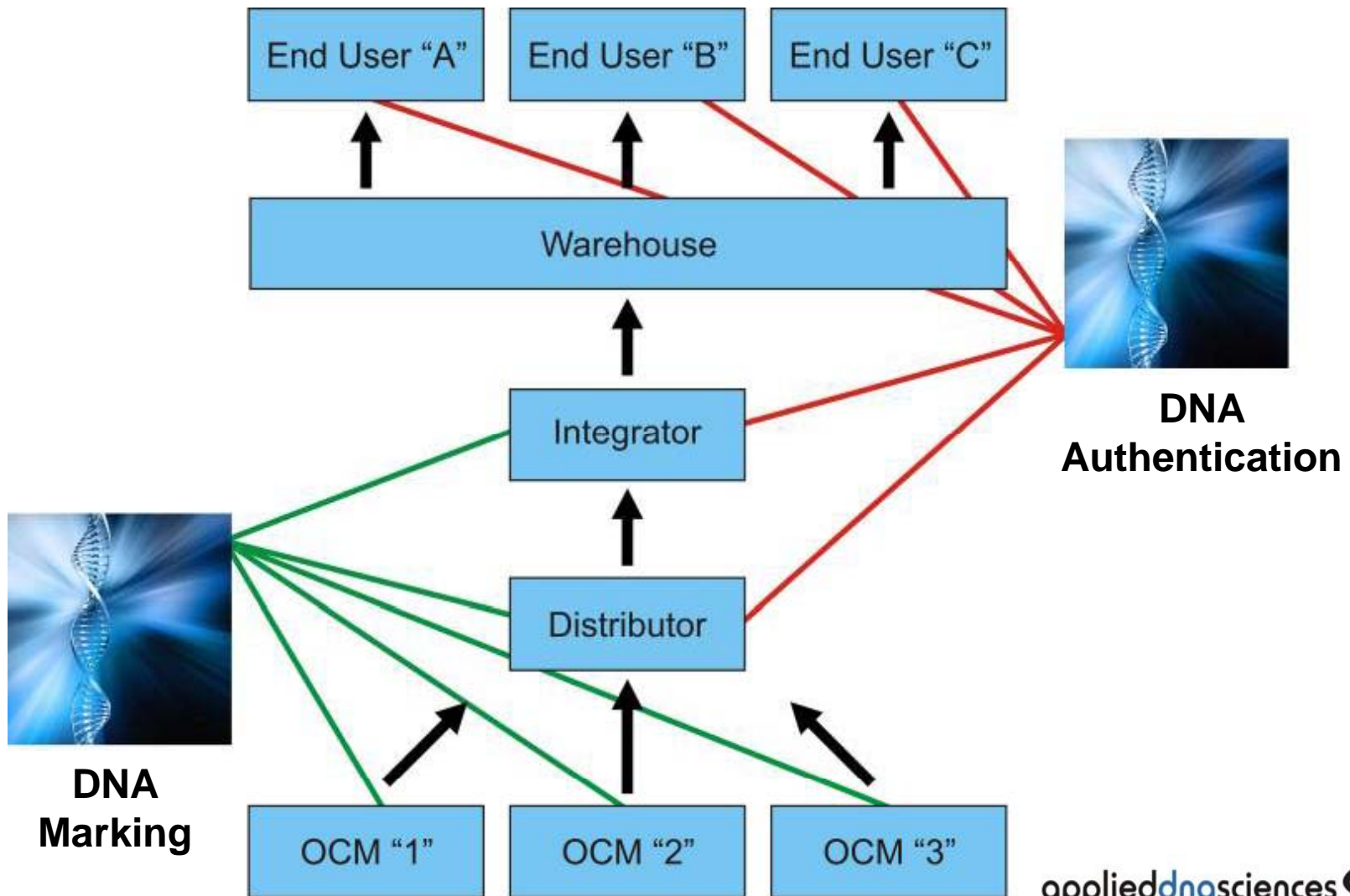
APDN announced in a previous press release that it began marking microchips for a "government agency" which we did not name at the time. Our results in that first program demonstrated the ease of applying the forensic, botanical SignaTuro® DNA taggants at an Original Chip Manufacturer. Once marked with DNA taggants, each microchip carries a "built-in" certificate of conformance to ensure authenticity and guard against counterfeiting.

Fighting Counterfeit Items Continues to be a Top DLA Priority

*“In the area of counterfeit parts,
...the potential use of DNA marking
by which manufacturers embed
information in materials to identify
them as original parts.”*

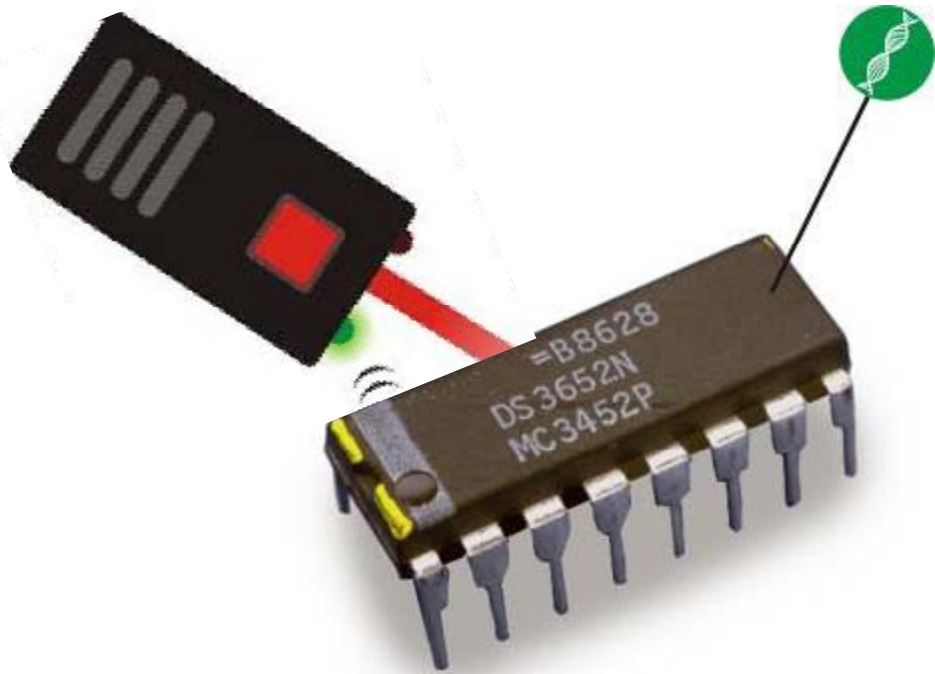
Source: 2012 Director's Guidance Report Press Release

ConOps: DNA Markers to Forensically ID Genuine Electronic Components



Seamless in the Supply Chain

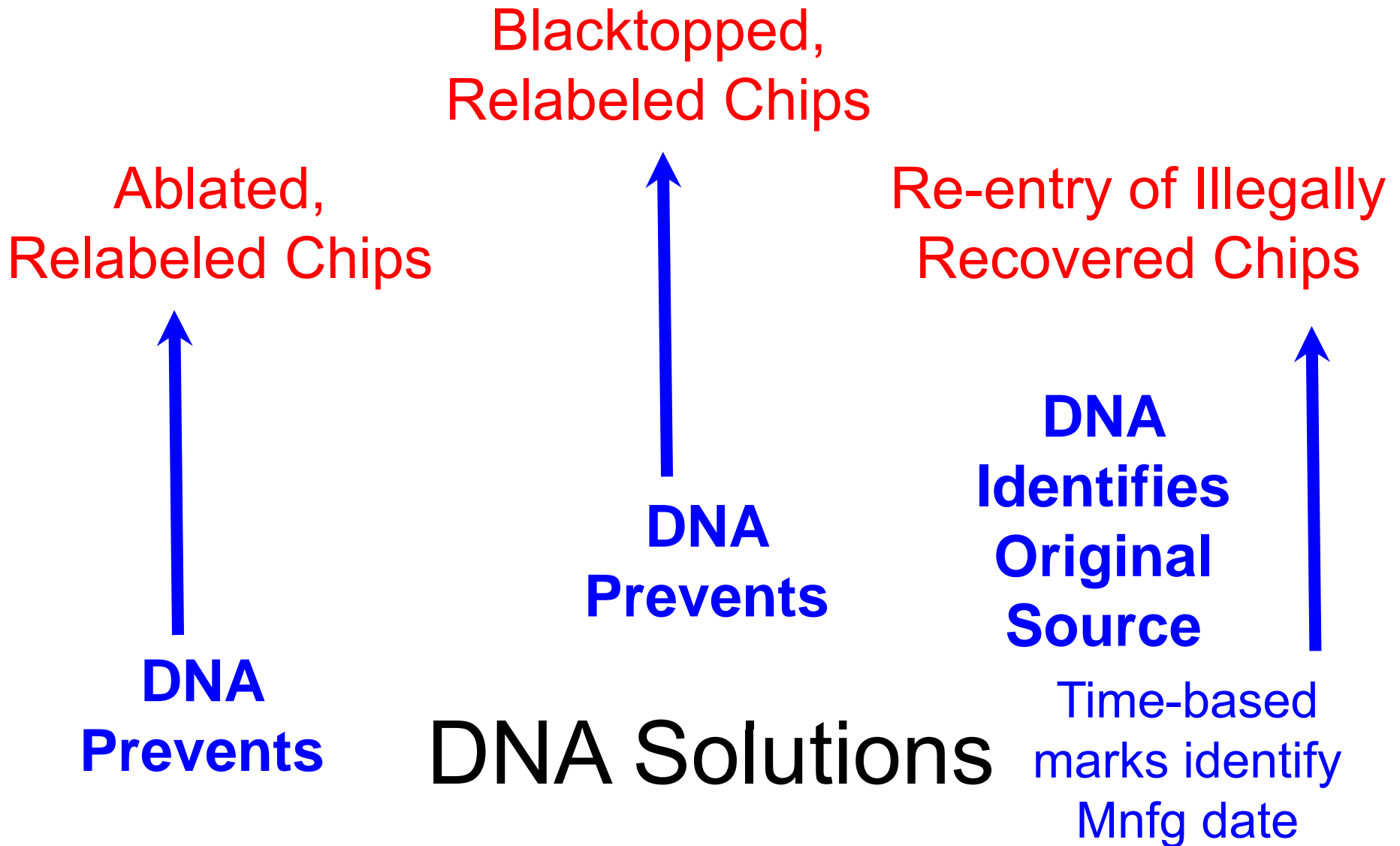
DNA adducts can protect the entire logistical chain



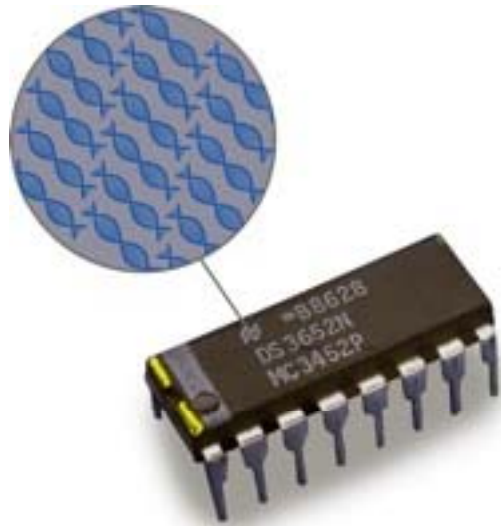
- Microchip with DNA-IR marked epoxy-acrylate ink.
- DNA in a structured, nano-particulate ensemble.

- 1) Manufacturer marks product within existing process.
- 2) Distributor scans with rapid detector.
- 3) OEM/Integrator samples randomly & sends to APDN Lab.
- 4) APDN authenticates forensically and provides audit control reports.

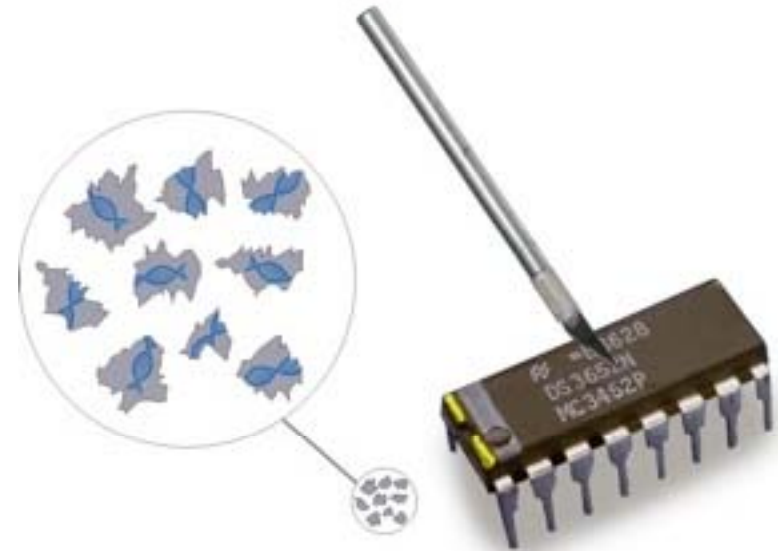
Mechanisms of Counterfeiting



Ablation Would Perturb the DNA and “Un-Mark” the Chip



The DNA is applied to a chip's surface, resulting in the formation of a structured DNA mark.



If the DNA is removed by scraping, the ordered DNA structure becomes perturbed, and the DNA unreadable.

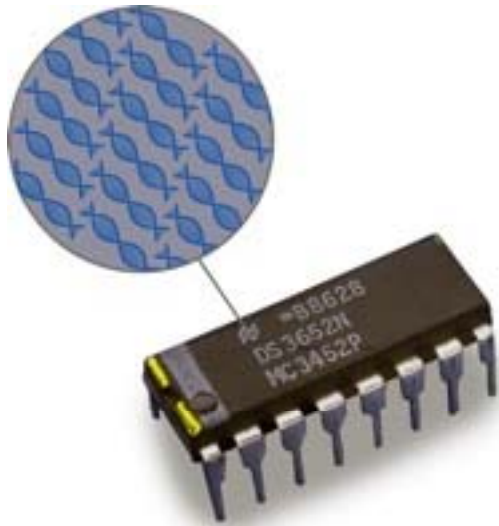
Sand-blast Erasure of Component Markings

DNA destroyed with sandblast

Photos with permission of Tom Sharpe



Refurbishing Would Cover the DNA and “Hide” the Mark



The DNA is applied to a chip's surface, allowing for forensic analysis and authentication.



If the DNA is covered by blacktopping, it becomes “unreachable” and no longer authentically marked.



Nanoensemble
destroyed in
transfer of
blacktop

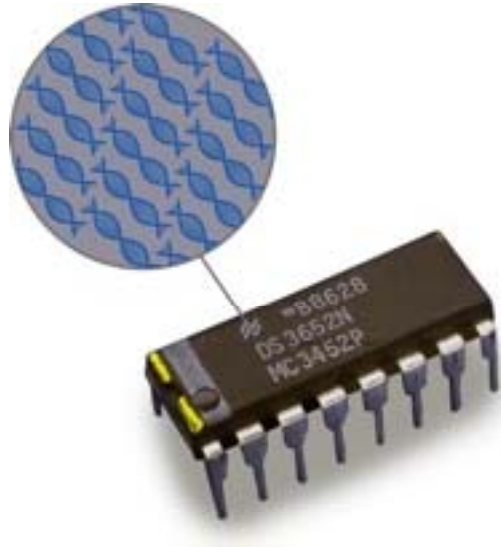
New Blacktop
Resurfacing



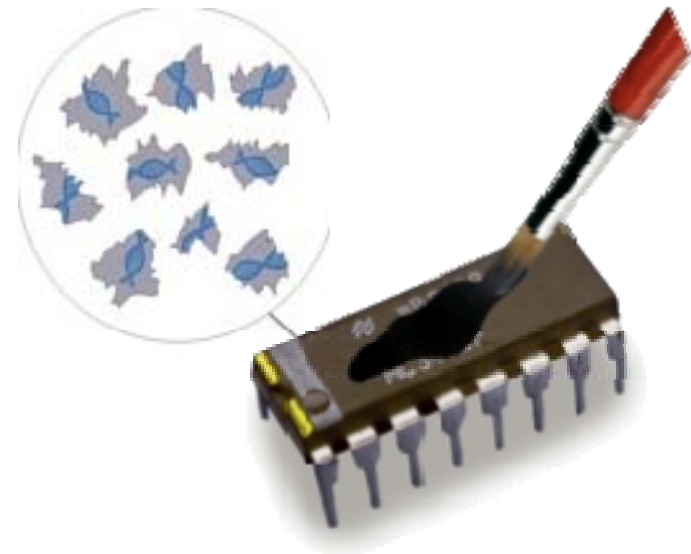
Photos with permission of Tom Sharpe



Reused DNA blacktop can not be authenticated - loss of structure during transfer eliminates detection.



The structured DNA is rendered “chaotic” by all efforts to remove it.



The chaotic DNA can not be detected nor diluted for transfer to rogue.

The Result?

**Every effort at subterfuge
is blocked.**



DNA Tamper-Evident Labels Transform Moisture Barrier Bags into Secure Packages



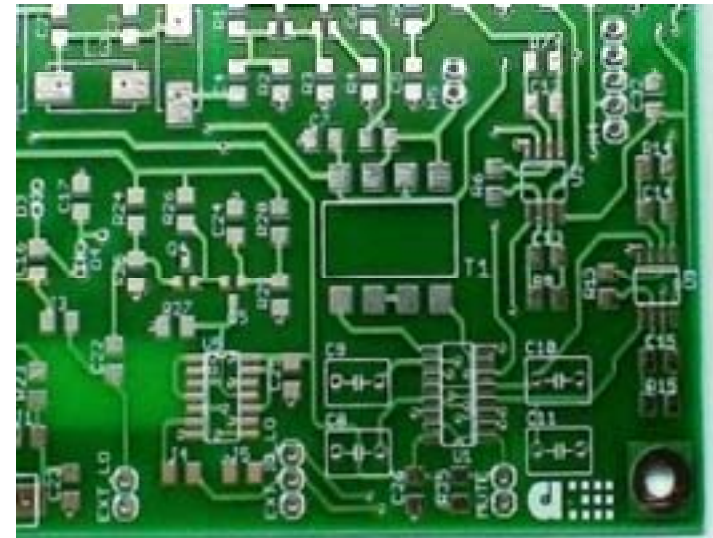
DNA Lettering Glows
Under UV Light



Tamper Evident **VOID**
Will Appear Upon Removing Label

Microchip Marking Vehicles for Printed Circuit Boards

- Conformal coatings
 - Keep dust, water and conductives out
 - Keep DNA-Rapid Reporter in
- Antistatic bags
- Tertiary Carriers, Cartons or Sealed bins



Strong Industry Reception:

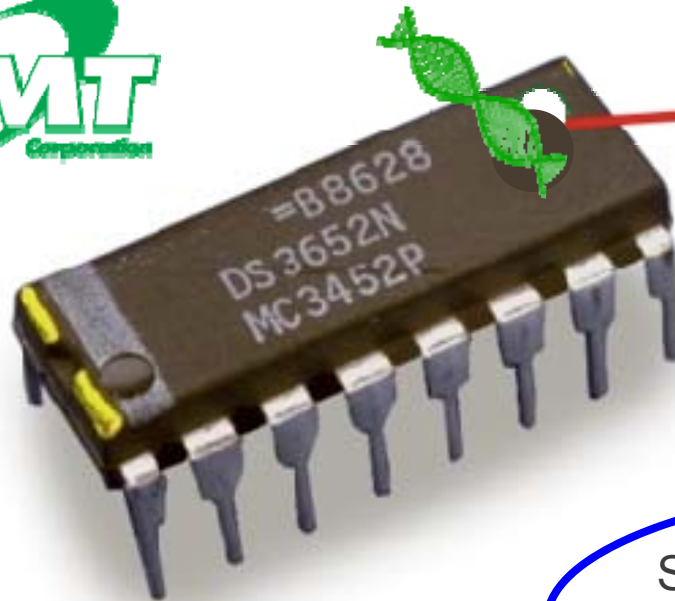
Tom Sharpe, VP, SMT Corporation:

“I fully support your ground-breaking efforts in the .. use of DNA markings with regard to counterfeit avoidance and quality assurance within DLA. We have begun in-depth conversations to partner and help advance this promising technology in our industry. I believe this technology has barely scratched the surface of all that it will ultimately become to the war on counterfeits...”

Source Verification versus Original Authenticity

Source Verification DNA for Distributors (vs Original Authenticity DNA for OCMs)

Source Verification™ DNA for Distributors

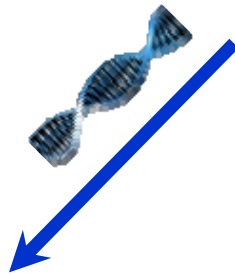


SMT Source Verification DNA Mark fluoresces when read in the field or in assembly by a hand-held device

SMT Source Verification DNA Mark fluoresces when read in the field or in assembly by a hand-held device

Source Verification Mark permits trace to a "Trusted" Independent Distributor

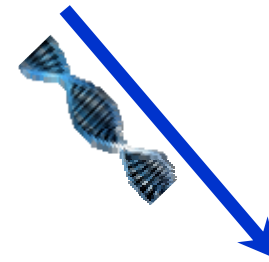
Parts “Branded” with DNA Carry their own Certificate of Conformance



Fasteners



Microchips



Spare Parts

Applied DNA Sciences

James Hayward

James.hayward@adnas.com

631-444-6370

Janice Meraglia

Janice.meraglia@adnas.com

631-444-6293

25 Health Sciences Drive
Stony Brook, NY 11790

www.adnas.com



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