

NANO-INDI RFID

(Radio Frequency Identification Device)

**A REMOTELY READABLE INDICATOR
TECHNOLOGY FOR BOTH
INVENTORY & QUALITY CONTROLS**

**NANO-RFID
DESTRUCTION OF
ELECTRONIC CIRCUITS**

BARCODE



One- Dimensional Bar Code:

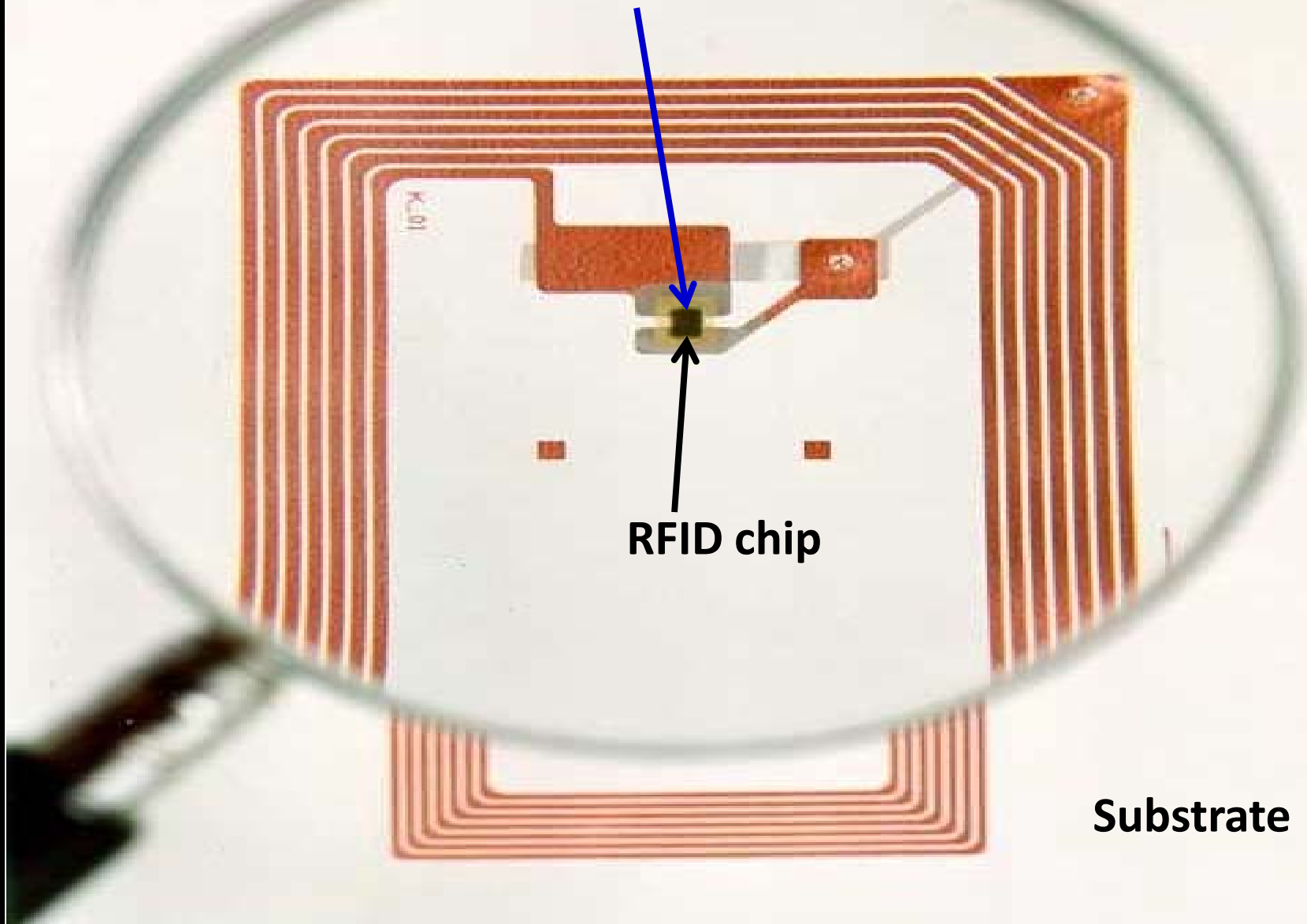
This 1-D bar code is widely used as the universal product code (UPC) on millions of consumer items

Prices of perishables are scanned at the check-out. However, the current barcodes do not monitor the quality of the perishables



AN EXAMPLE OF A RFID

A RFID has an electronic chip

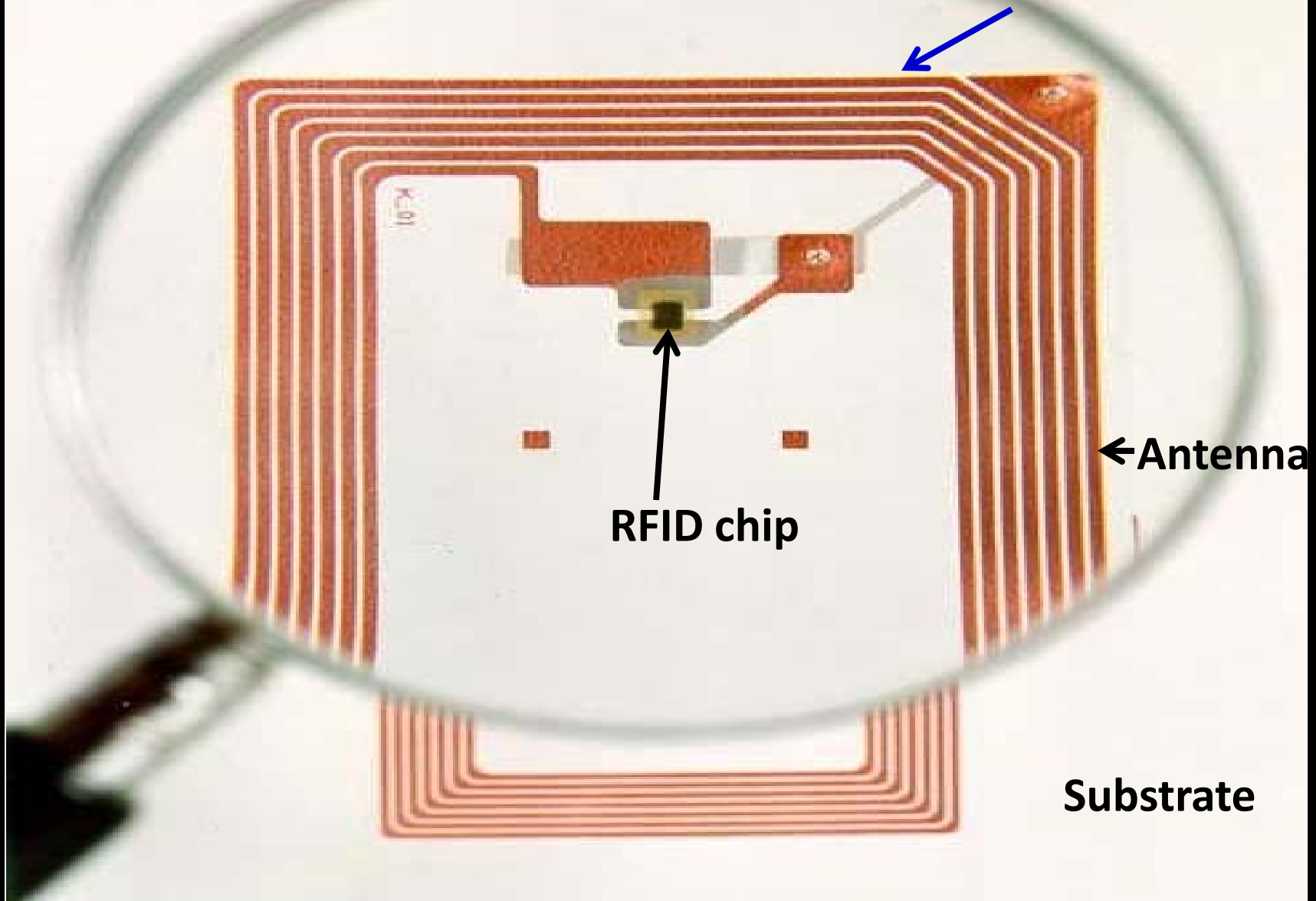


RFID chip

Substrate

AN EXAMPLE OF A RFID

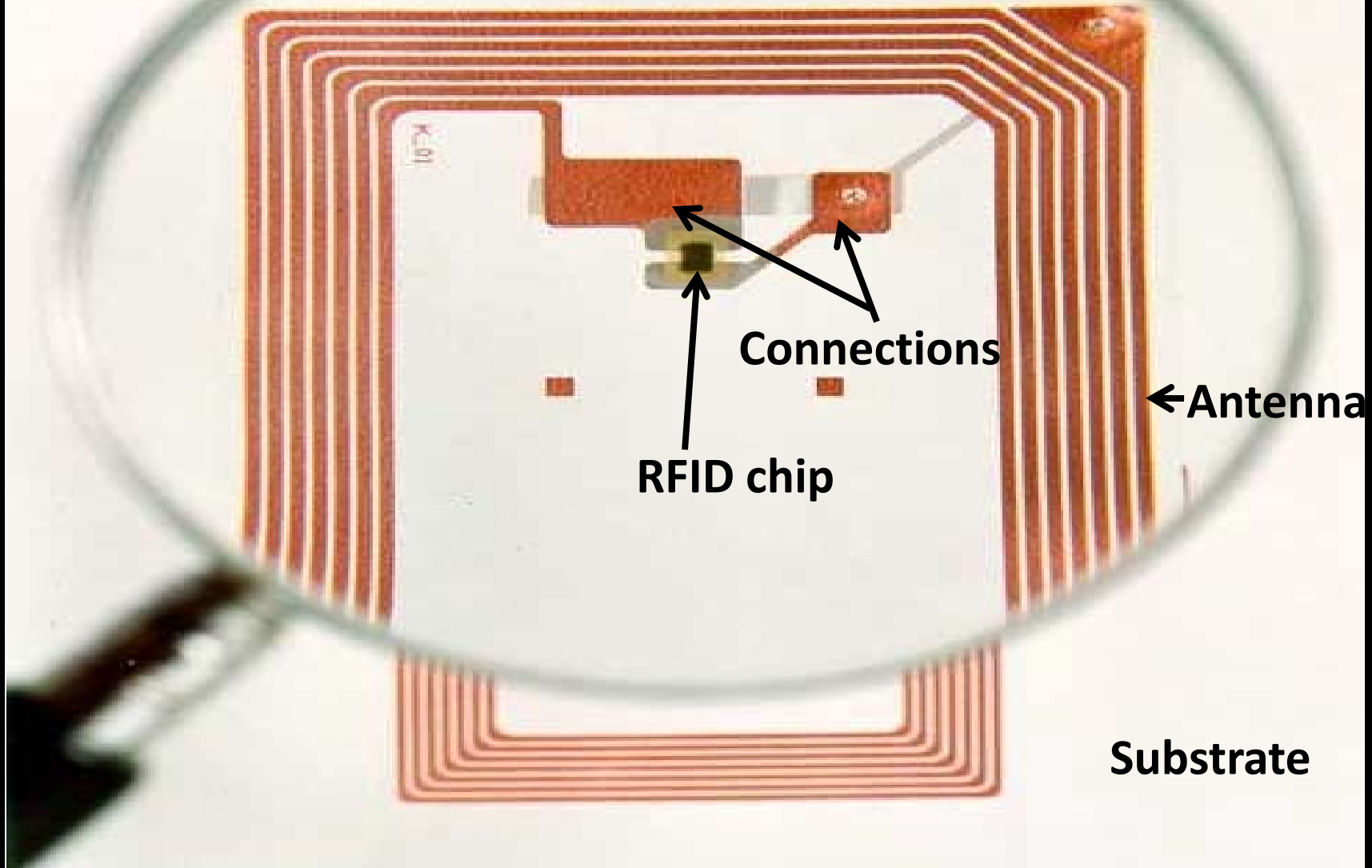
A RFID has an electronic chip and an antenna



AN EXAMPLE OF A RFID

A RFID has an electronic chip and an antenna

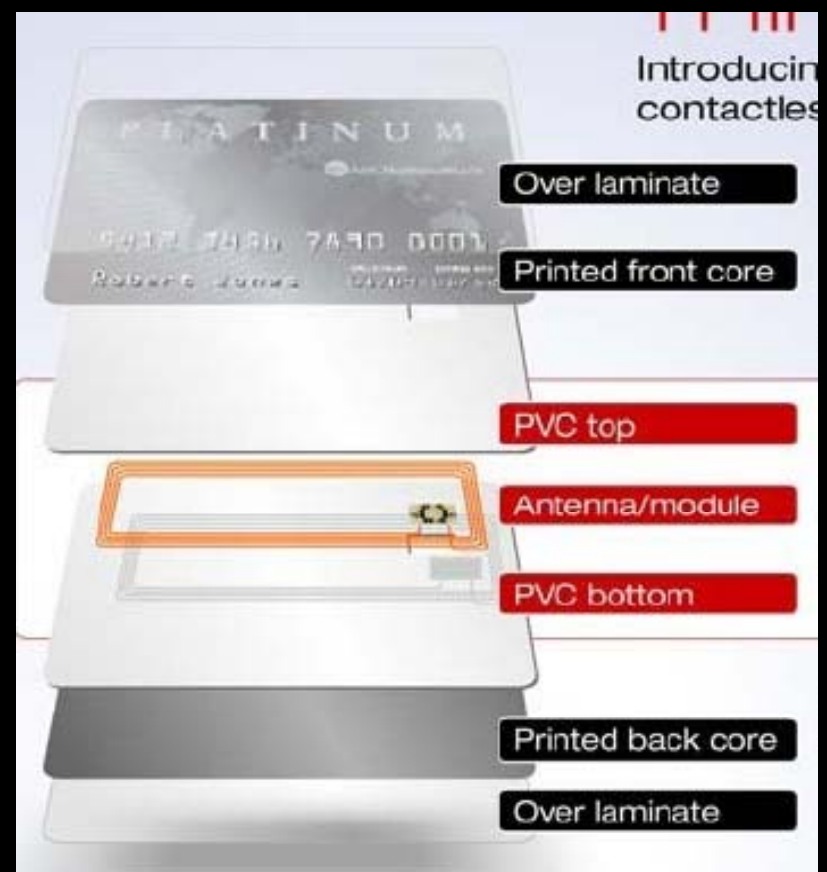
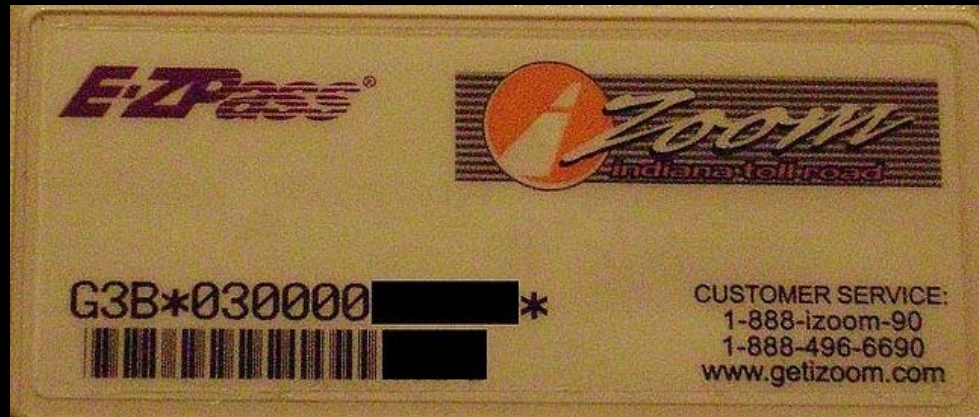
Thickness of Al/Cu antenna is usually less than 100 nm



HOW A RFID WORKS?

- A RFID is composed of an antenna (usually made from >100 nm copper or aluminum) connected to an electronic chip on a plastic substrate
- When exposed to certain radio frequency, the antenna produces a tiny current which is sufficient to power the chip and the chip is read. The chip is programmed to send a message back. The message is emitted by the same antenna. A detector monitors the message
- **An example of RFID is an EZ pass (electronic toll collection system)**

RFID & APPLICATIONS





Keeping Pallets Intact:

The unique serial number in the electronic product code (EPC) lets RFID readers scan all the cases in a pallet without having to break it down.

This provides a huge cost savings in warehouse management and is the reason why Wal-Mart required its suppliers to begin using RFID in 2005.

**TTI, TI, HUMIDITY,
STERILIZATION
CHEMICALS AND
OTHER DETECTION
DEVICES BY
DESTRUCTION AND
CREATION OF RFID**

NANO-RFID INDICATING DEVICES

- RFID indicating devices are not known/reported
- We have developed several types of RFID indicating devices, e.g., RFID TI, TTI, Visitors passes, sterilization
- These devices/processes use an activator tape having an etchant
- One etching process creates an antenna by selective etching for monitoring e.g., time or time-temperature, thereby making the RFID readable
- **The other etching process destroys the antenna of a RFID inlay with time or time-temperature, thereby making the RFID non-readable**

**TTI AND OTHER
DEVICES BY
DESTRUCTION OF
A RFID ANTENNA
(making it non-readable)**

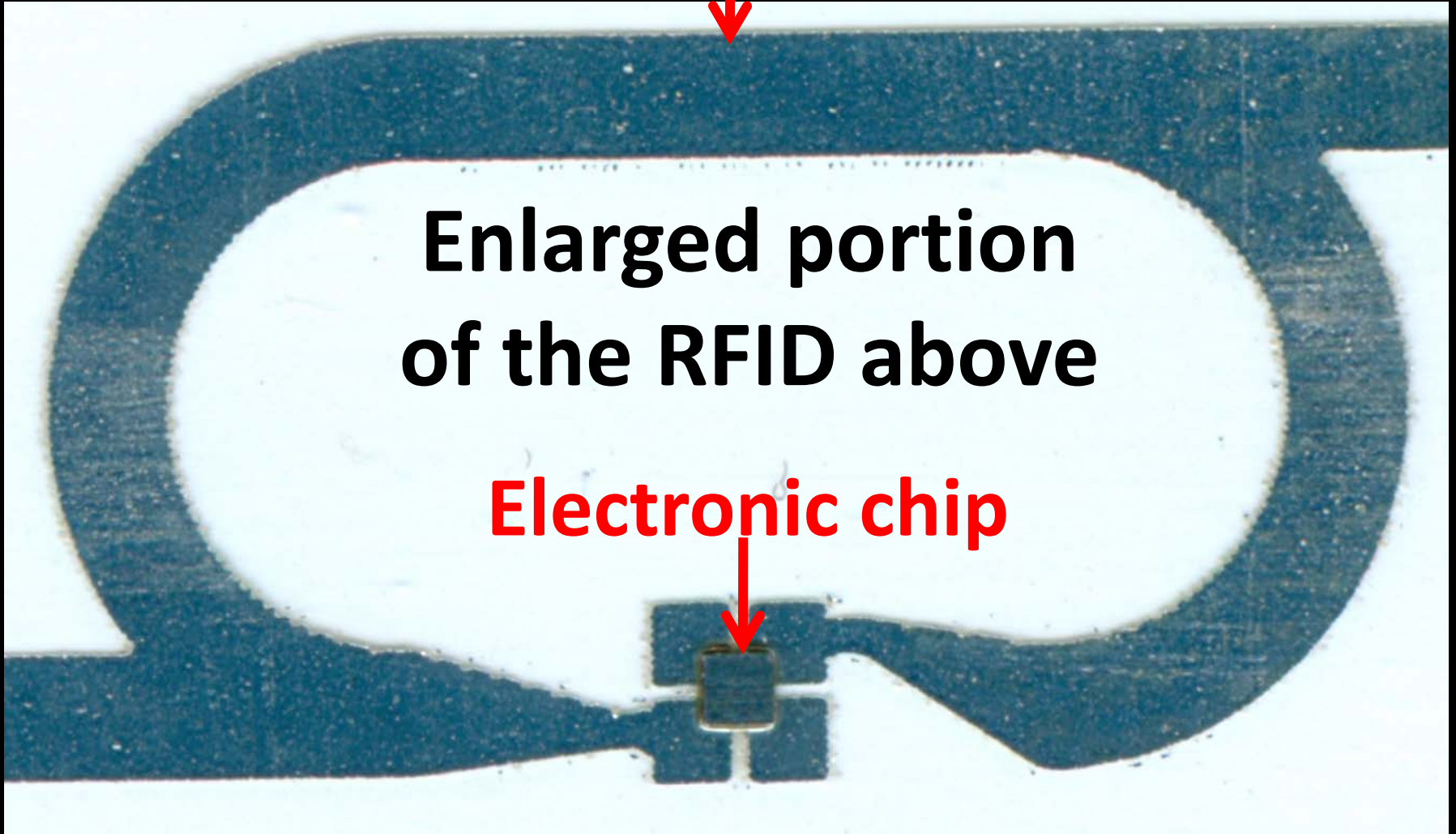
MAKING RFID NON-READABLE

- In the following series of slides, an activator tape was applied on a RFID inlay
- The RFID TTI was scanned at different periods at room temperature
- The whole TTI inlay is shown on the top and enlarged central loop and the chip are shown on the bottom of each slide
- The activator etches the metal antenna and ultimately destroys it. At one point, the chip is disconnected from the antenna and hence can't be powered, i.e., can't be read
- **This indicates that the perishables inside the box having a Nano-RFID TTI are of unacceptable quality**

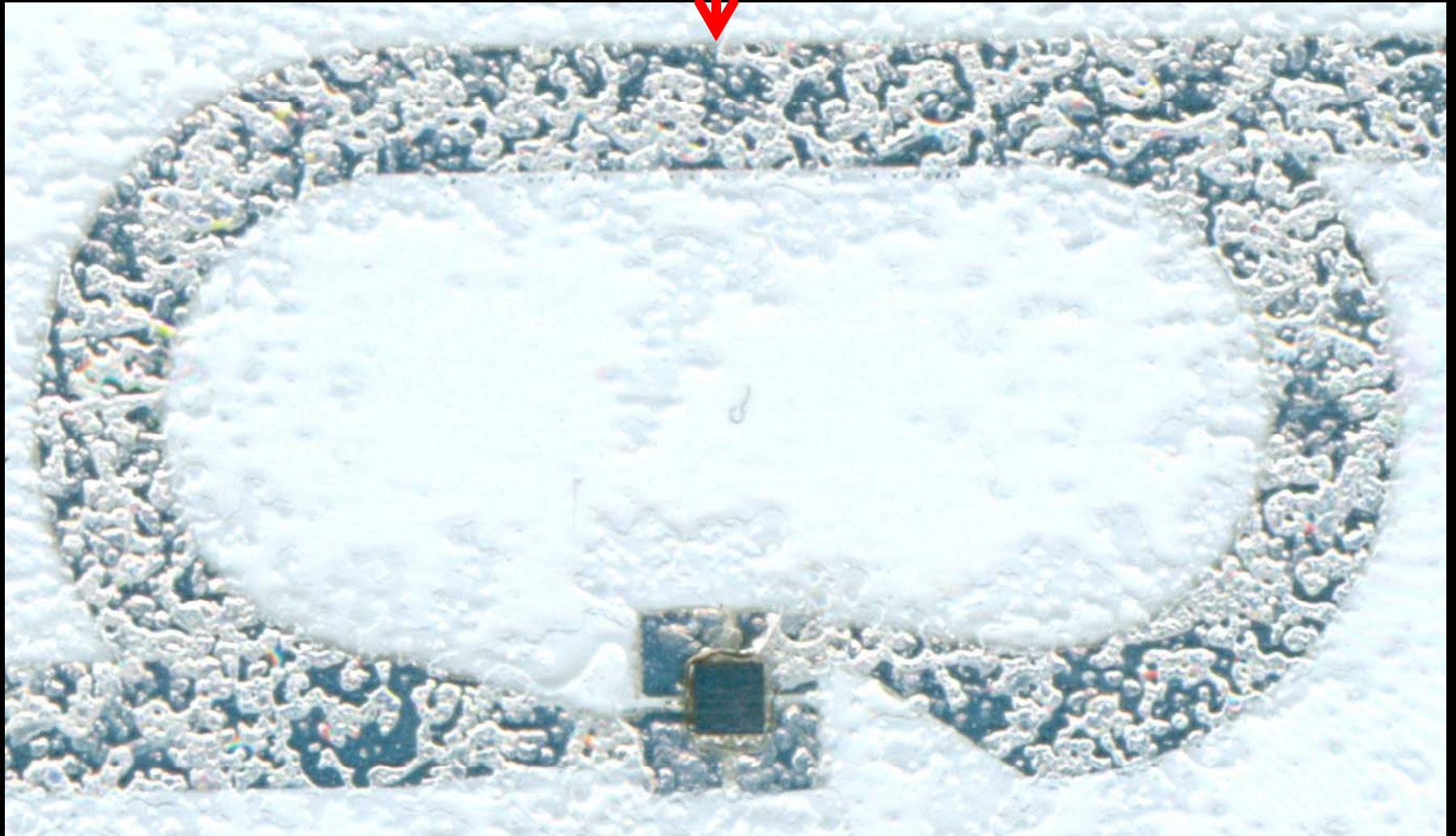


**Enlarged portion
of the RFID above**

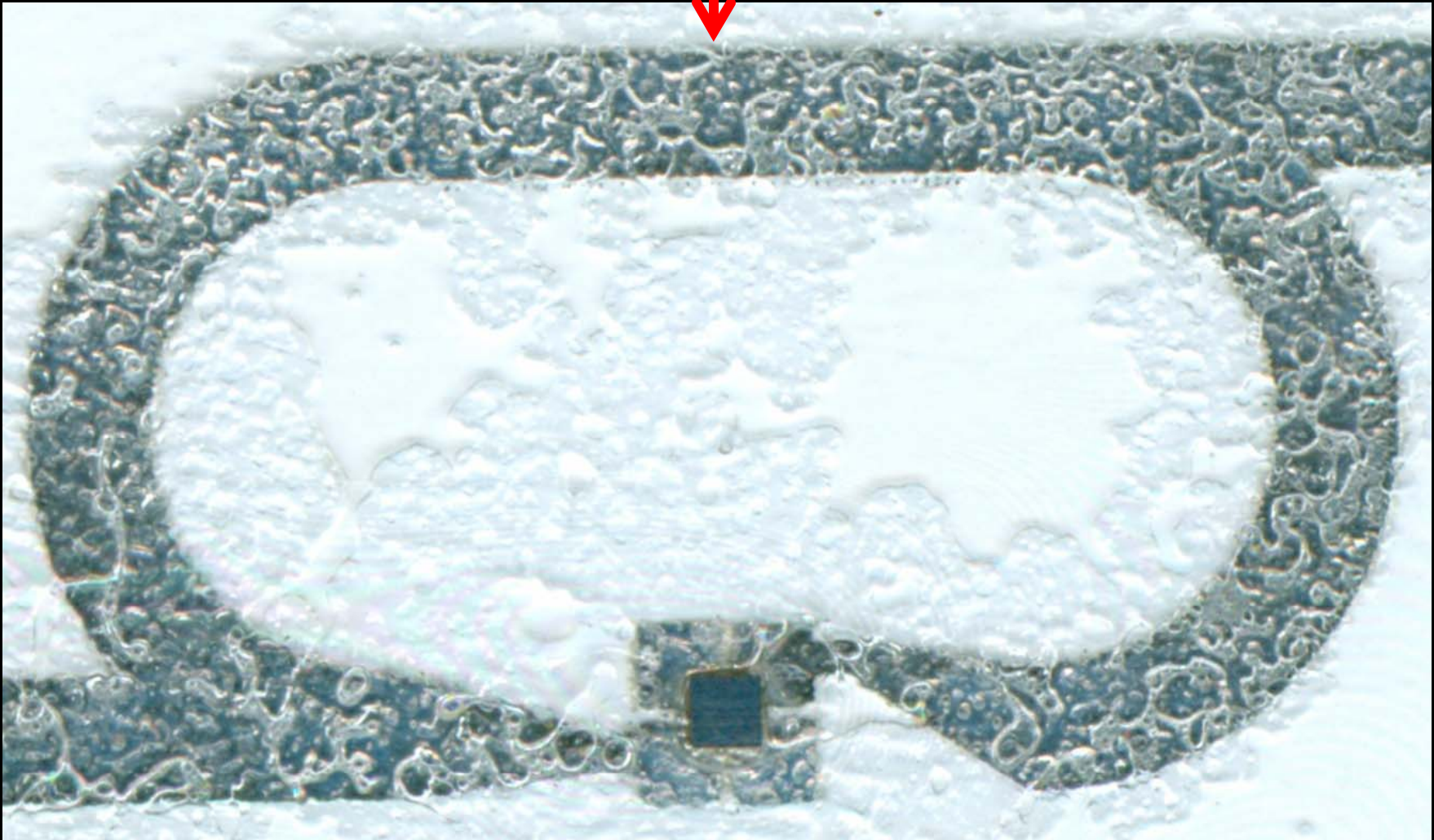
Electronic chip



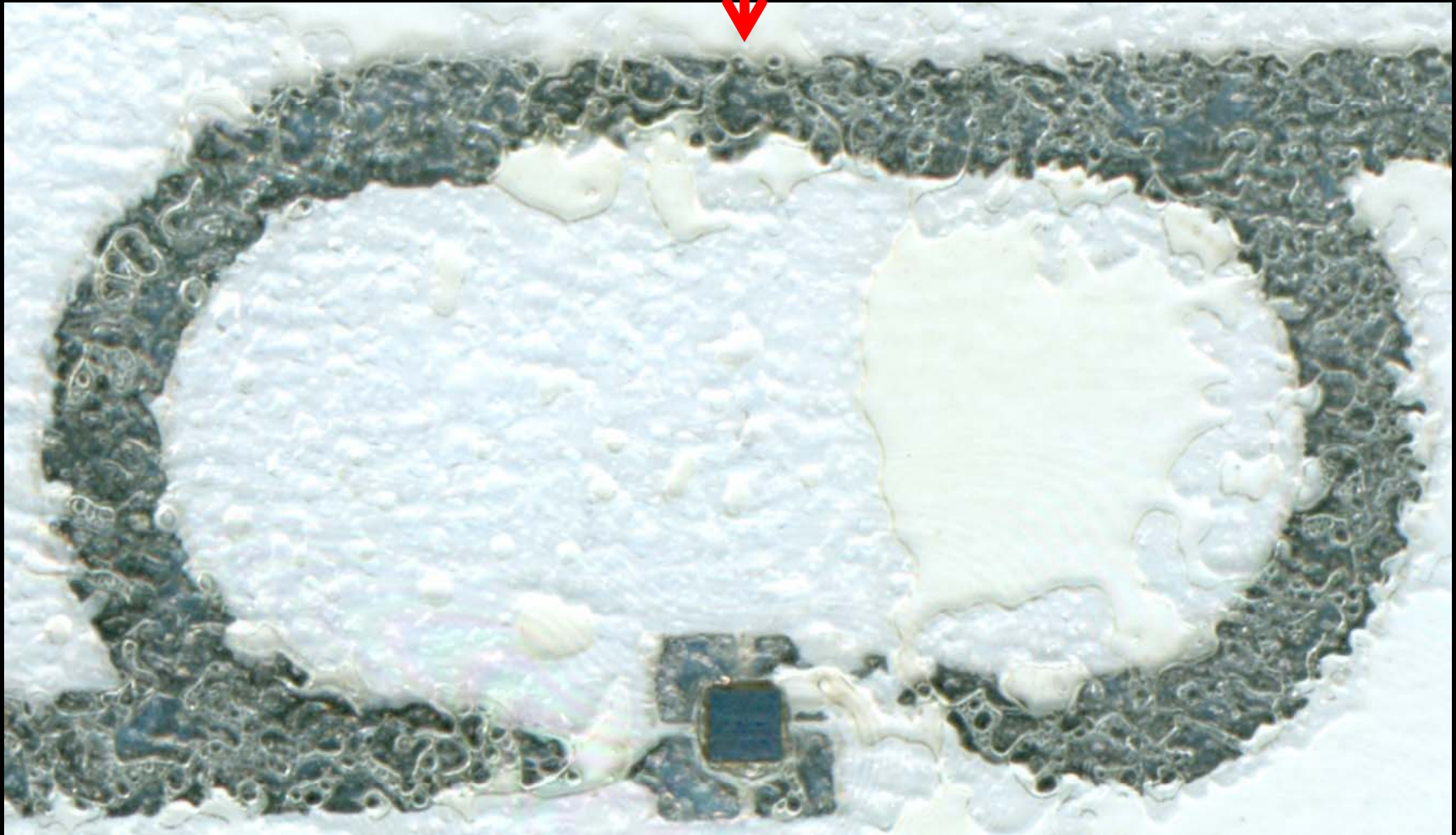
A RFID inlay before the activator tape is applied



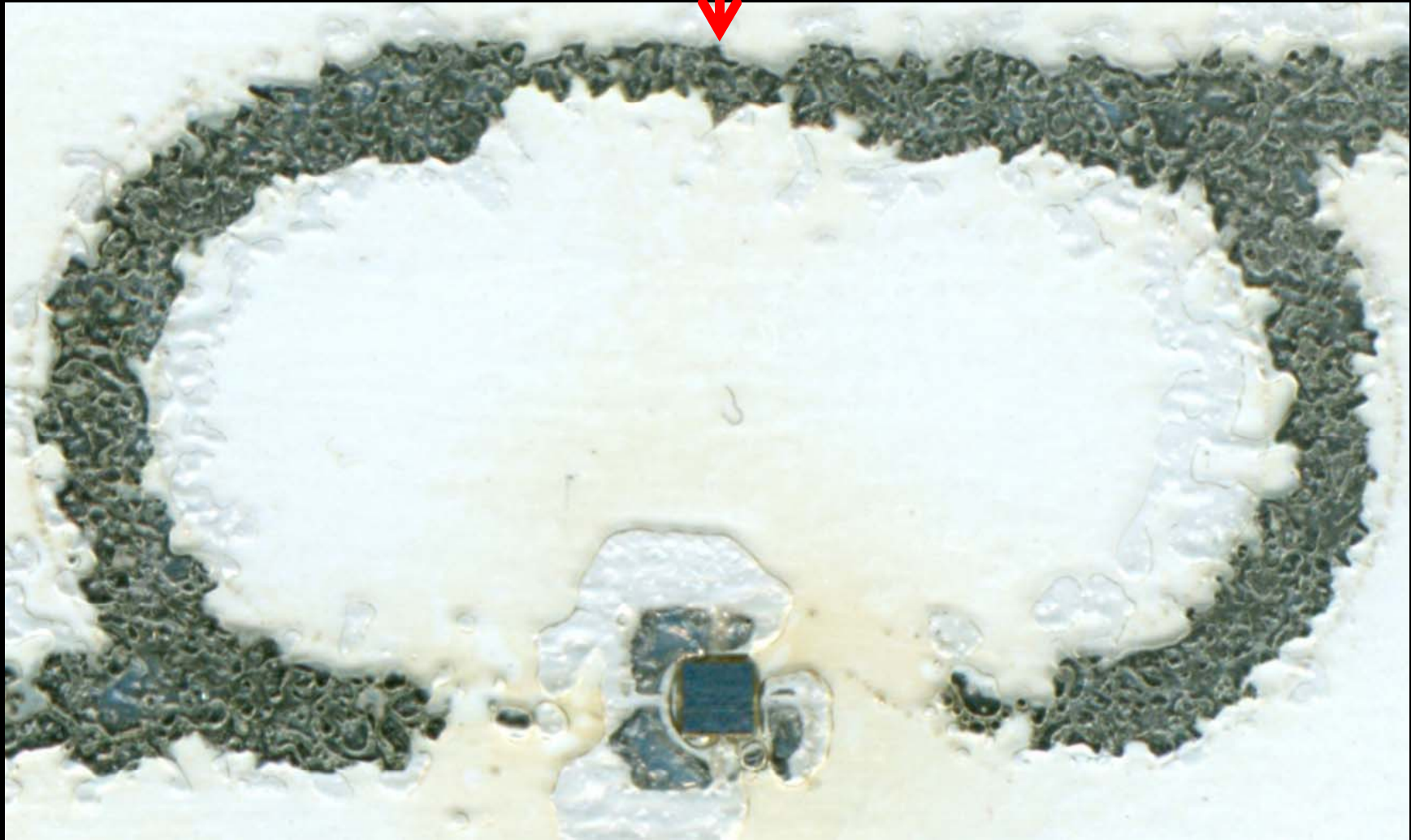
An activator tape is applied on to the RFID inlay



The antenna is getting etched



2 days/The chip is essentially disconnected from its antenna

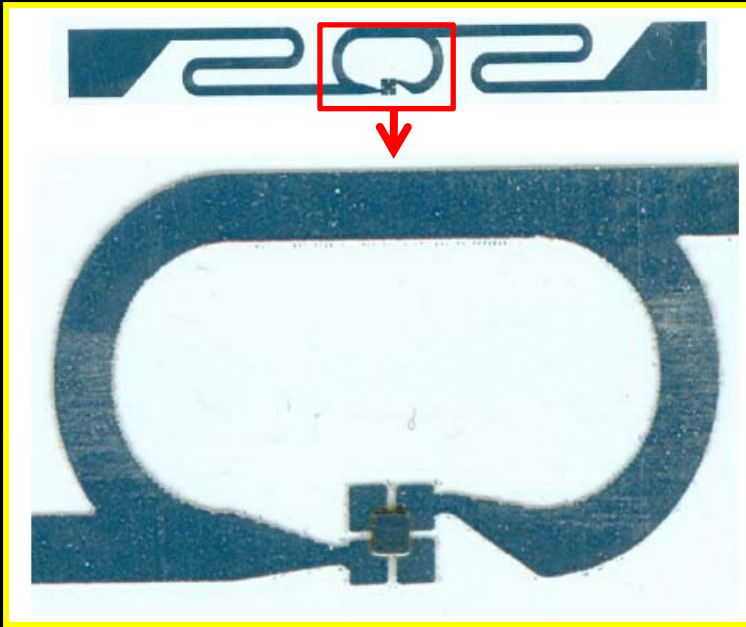


3.5 days/The chip is completely disconnected from its antenna

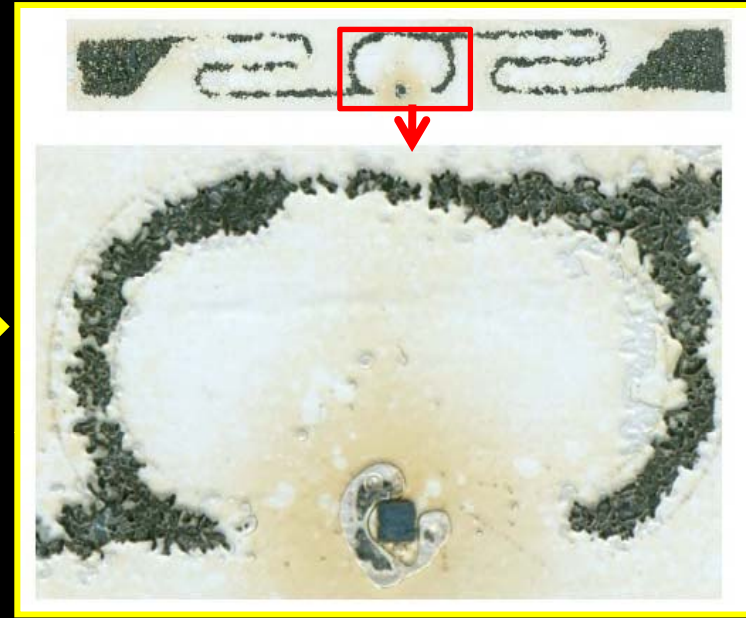


5 days/The antenna is etched/broken into pieces

The future – Nano-RFID TTIs



(a) Activated & readable



(b) 5 days and non-readable

An active and readable RFID (Radio Frequency Identification Device) inlay made inactive and non-readable by an activator for easy inventory control and simultaneously monitoring shelf life of perishables without opening the box

NANO-INDIS™

A REVOLUTION IN INDICATOR TECHNOLOGY

**AN INDICATOR TECHNOLOGY FOR
DISTRIBUTING CONDUCTIVE PATHS OF
ELECTRONIC DEVICES/RFID**

NANO-CONVERSION TECHNOLOGY

AN IGNORED BUT NOVEL AND
UNIQUE FIELD OF NANOSCIENCE

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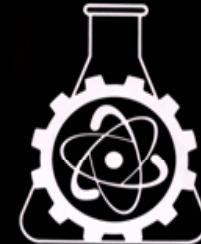
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Nano-Conversion
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