Interoperability and Card Printing

A Joint Presentation from:

Oberthur Card Systems

GEMPLUS

Schlumberger
Introduction

◆ Printing during card manufacture v.s. card issuance

◆ Typical causes of print problems during issuance

◆ ISO Standards and Interoperability

◆ General recommendations
Old Fashion Manufacturing Process

- **Printing**
  - Artwork is identical on all cards and printed on large sheets

- **Lamination**
  - Card body is constructed using printed sheets on the outside layers
  - Optional inlet with antenna and contactless chip

- **Punching**
  - Individual cards are punched out of the lamination sheet

- **Milling**
  - A cavity is drilled to accommodate the chip

- **Embedding**
  - The smart card IC is plugged in

- **Personalization**
  - Card number and name are embossed on the card
Old Fashion Manufacturing Process

Pros
- Process derived from Financial Card Industry
- Sheet Printing similar to publishing
- High quality print
- Full card surface
- Print rejects scrapped before IC added value
- Low cost for large volume

Cons
- Visual personalization initially limited to embossable text
Interoperability Issues

Interoperability easily achieved on standard design
- Same artwork provided to all manufacturers
  - Standard films, disk etc...
- Color matching process at the proof approval level
  - Simple process on most artworks

Higher Skills required for visual security features:
- Rainbow Background
- Guilloche
- Microprint
- UV Printing
- Holographic Overlay

No Real Interoperability Issues Between Major Card Manufacturers
ID Cards Manufacturing Process
(as seen for US Gov Programs)

- Plain White Card Bodies Manufacturing
  - Lamination with or without contactless inlet
  - Punching

- Smart IC embedding
  - Milling & Embedding

- Card issuance
  - Chip personalization with card holder information

- Card Printing
  - Text (Name...)
  - Images (Logo, photo ID,...)
  - 2D & 3D bar codes
  - Color and B&W
US ID Cards Manufacturing Process

**Pros**
- Great Flexibility for multiple card designs

**Cons**
- Lowest yield operation done after addition of the highest added value (IC)
  - high cost print rejects
- Scratches and dust highly visible on white background
  - Higher percentage of cosmetic rejects
- Cannot print directly on the back of the chip
  - Limit the possibilities for artwork
- Print Quality generally not as good
  - High sensitivity to card body characteristics
- Printer Compatibility
  - Results are printer dependent
Typical Causes of Print Problems

- Card warpage or deformation
- Surface irregularities or dirt
- Surface plasticizer contamination
- Irregularities in thickness caused by chip or antenna embedding
- Printing too close to module
- Delamination issues
- Printer compatibility
Interoperability Issues

- Print results highly sensitive to material differences
  - Printer settings need adjustments for optimal performances
    - Print head pressure
    - Temperature
    - ...

- Different Printers may achieve different results

- Final card colors/contrast may vary per grades of «White» from different suppliers
ISO Compliance & Interoperability?

- **ISO/IEC 7810**: Identification Cards - Physical characteristics
  - Specifies card body characteristics such as Dimensions, Flatness, Opacity, Bending Stiffness, Flammability, Toxicity, Resistance to chemicals, Card dimensional stability and warpage with temperature and humidity, delamination, etc.

- **ISO/IEC 7816-1**: Physical characteristics
  - Specifies the card’s physical characteristics after the insertion of integrated circuit(s) with contacts into an ID-1 card type meeting the requirements of ISO/IEC 7810.

- **ISO/IEC 7816-2**: Dimensions and location of the contacts.
  - Specifies the dimensions, locations and assignment for each of the contacts on integrated circuit(s) cards.

- **ISO/IEC 7816-3**: Electronic signals and transmission protocols.
  - Specifies the power and signal structures, transmission mechanisms and communication with the card.

- **ISO/IEC 10373** Part 1, 2, and 3
  - Specify the test procedures used to check cards against the parameters specified in the above standards.

*ISO Standard has paved the way for interoperability, but did not addressed post embedding printing.*
Card Flatness (Warpage)

- According to ISO, the card warpage (or the height of the highest point on the card while the card lays on a flat surface) can be up to 0.060 inches or 1.5 mm (ISO/IEC 7810 - clause 8.1.11).

- Field returns show that the actual threshold of some desktop printers can be lower depending on the material used in the card structure.
Surface Profile of Contacts

- According to ISO, No point of the IC contact surface shall be higher than 0,05 mm above or lower than 0,1 mm below the adjacent surface of the card. (ISO/IEC 7816-10 - clause 4.2.3).

- In the same paragraph, ISO adds the following in bold:
  
  WARNING For cards which are printed after embedding, problems may be encountered when contacts are above the adjacent surface of the card.

Potential « tent effect » no printing zone
Contacts Plate Dimensions

- ISO defines eight contacts (C1 to C8), not the contact plate itself.
- Dimension, Shape, Geometry, Color etc are manufacturer dependant.
- Some contact plates may end closer to where you want to print text.

![Diagram of contact plate dimensions](image)
Contact Plates Samples
Contactless Cards

- **Pure Contactless**
  - single chip, contactless interface only

- **Hybrid Cards**
  - 2 separate Chips
  - No direct communication in between

- **Dual Interface Cards**
  - A single chip with both contact and contactless interfaces
  - Possibility to share memory resources between the two interfaces
Interoperability Issues

- Potential problem when printing directly above:
  - the antenna
  - The contactless chip

- Location of contactless chip not standardized
  - Varies from manufacturers to manufacturers

- Multiple type of antennas
  - Size
  - Geometry
    - Square
    - Round
    - Oval
  - Thickness
Conclusions

- Involve card manufacturers in the early stage of your artwork design
  - We’re here to help

- Get as much of your artwork printed by card manufacturers
  - Cardstock Inventory may be less costly than printing with high reject rate

- Don’t try to fill all the blank
  - A hardly required information can skyrocket your cost

- Avoid having to print variable data/picture
  - Too close to the contact plate
  - Too close to the edge of the card
  - Above the contact chip on the back of the card
  - Above the contactless chip
  - Above the antenna (contactless cards)

- Minimize risk of card contamination before printing
  - Keep the boxes sealed until the cards are needed
  - Use lint free gloves to handle the cards

- Perform some tests with printers and cards from multiple suppliers

- Don’t forget to clean your print heads!
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