4 World Trade Center, 150 Greenwich Street,21st Floor,New York, NY 10007
PORT AUTHORITY TRANS-HUDSON CORPORATION

Date 11/18/2015

REQUEST FOR QUOTATION

	Collective# / **/ Bid Due Date** 0000044493 / / 12/09/2015 Bids must be received no later than 11:00 AM on the above Bid Due Date.
Contact person/Telephone Nancy Ubilla/212-435-4605	**Deliver Goods/Services To:** Path Foot of Cape May Road Harrison NJ 07029

Quantity	Description	Unit Price	Total
	Supply and deliver PATH SmartLink Cards as specified in the "Port Authority Trans-Hudonson SmartLink Card Technical Specifications, Revision A, October 26, 2006". Three (3) Year Requirements Contract to commence on or about 1/1/16 - 12/31/18. The minimum order per delivery will be 40,000 cards. Delivery to: PATH Corporation Attn: Robert Brink 122 Academy Street Jersey Coty, NJ 07302 A price preference of 10 % is available for NY/NJ Minority and Women Business Enterprises (M/WBE) or 5% for NY/NJ Small Business Enterprises (SBE) certified by the Port Authority (PA) by the day before bid opening for awards not exceeding $1,000,000. My firm was certified as a _____on_____. EXTENSION PERIOD: The Port Authority shall have the absolute right to extend the Base Term for an additional period of up to one hundred and twenty (120) days subsequent to the Expiration Date of the Base Term. The prices quoted by the Contractor for base		
	PLEASE QUOTE FULLY DELIVERED PRICES	PAYMENT TERMS Total Delivered Price	

This Quotation is subject to the terms and conditions set forth on the back page hereof. Bidder is advised to read these before signing.

We have read the instructions and, if favored with an order, we agree to furnish the items enumerated herein at the prices and under the conditions indicated.

Signed _____
Firm Name _____
Telephone number_____Date_____
Fax Number_____
Federal Taxpayer ID _____

Bidder Must Sign In Two Places

NOTICE TO BIDDERS: Unless the following term of assurance that the above offer is irrevocable is signed, the offer submitted herein shall not be deemed to be complete.

The foregoing offer shall be irrevocable for 90 days after the date on which The PORT AUTHORITY TRANS-HUDSON CORPORATION opens this proposal.

Signed_____Date_____
Firm Name_____

REQUEST FOR QUOTATION

Bid Due Date
12/09/2015

Quantity	Description	Unit Price	Total
	period shall remain in effect during this Extension Period without any adjustment. The Port Authority will advise the Contractor in writing, if the term is so extended, at least thirty (30) days prior to the expiration date. TERMINATION: The Port Authority may terminate this Contract with or without cause at any time upon five (5) days written notice to the Vendor and in such an event this Contract shall cease and expire on the date set forth in the notice of termination as fully and completely as though such date was the original expiration date. Such cancellation shall be without prejudice to the rights and obligations of the parties arising out of portions of this agreement already performed but no allowance shall be made for anticipated profits. The Vendor shall complete delivery of all items ordered before receipt of the notice of termination. This is not to be considered an order for delivery, but merely, upon issuance, vendor shall be bound to honor requests from the facilities for the materials shown for the period, commencing on January 1, 2016 - December 31, 2018. Quantities shown are estimates only and constitute no guarantee what quantity, if any may actually be called for.		
	PLEASE QUOTE FULLY DELIVERED PRICES	PAYMENT TERMS Total Delivered Price	

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Signed_____Date_____
Firm Name_____

REQUEST FOR QUOTATION

Bid Due Date
12/09/2015

Quantity	Description	Unit Price	Total
	This is a Formal Bid Invitation Mail Sealed Bids to: The Port Authority of NY & NJ Attn: Bid Custodian Procurement Department 4 World Trade Center 150 Greenwich Street, 21st Floor New York, NY 10007 by the date and time listed above, where it will be publicly opened and read. If you do not use or have an envelope provided, you must clearly mark the outside envelope/package with 'BID ENCLOSED' and show the company name, address, as well as Bid number and Due date as stated on this bid document. Bids are only accepted Monday through Friday, excluding Port Authority holidays, between the hours of 8 A.M. & 5 P.M., via regular mail, express delivery service or hand delivery. Express carrier deliveries by commercial vehicles can be made via vendors approved by Silverstein Properties, the 4 World Trade Center (4WTC) Property Manager, through the Vehicle Security Center (VSC). Presently, UPS is the only delivery vendor with approved recurring delivery times. There is extensive security at the World Trade Center Site. Individuals must present a valid government-issued photo ID		
	PLEASE QUOTE FULLY DELIVERED PRICES	PAYMENT TERMS Total Delivered Price	

This Quotation is subject to the terms and conditions set forth on the back page hereof. Bidder is advised to read these before signing.

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Signed _____
Firm Name _____
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Signed_____Date_____
Firm Name_____

4 World Trade Center, 150 Greenwich Street,21st Floor,New York, NY 10007
PORT AUTHORITY TRANS-HUDSON CORPORATION

REQUEST FOR QUOTATION

Bid Due Date
12/09/2015

Quantity	Description	Unit Price	Total
	to enter 4 WTC. Individuals without packages or carrying small packages or boxes that can be conveyed by hand or on a hand truck may enter through the lobby. All envelopes, packages and boxes may be subject to additional security screening. There is no parking available at 4 WTC/150 Greenwich Street, and parking in the surrounding area is extremely limited. A valid government-issued photo ID is required to gain access into the building to attend the bid opening or hand deliver a bid. Bids that are not received by the bid custodian by the scheduled bid opening date will be considered late.		
	PATH - Smart Link Cards Estimated Qty Unit Price Total Est. 3 Year Contract Price 270,000 (cards) x $_____ = $_____ (The minimum order per delivery will be 40,000 cards)		
	PLEASE QUOTE FULLY DELIVERED PRICES	PAYMENT TERMS	Total Delivered Price

This Quotation is subject to the terms and conditions set forth on the back page hereof. Bidder is advised to read these before signing.

We have read the instructions and, if favored with an order, we agree to furnish the items enumerated herein at the prices and under the conditions indicated.

Signed _____
Firm Name _____
Telephone number_____Date_____
Fax Number_____
Federal Taxpayer ID _____

Bidder Must Sign in Two Places

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The foregoing offer shall be irrevocable for 90 days after the date on which The PORT AUTHORITY TRANS-HUDSON CORPORATION opens this proposal.

Signed_____Date_____
Firm Name_____

4 World Trade Center, 150 Greenwich Street,21st Floor,New York, NY 10007
PORT AUTHORITY TRANS-HUDSON CORPORATION

REQUEST FOR QUOTATION

Bid Due Date
12/09/2015

Quantity	Description	Unit Price	Total
1.00	**The item covers the following services:** Smart Link Cards, 3Yr Requirements Contr		
	PLEASE QUOTE FULLY DELIVERED PRICES	**PAYMENT TERMS**	**Total Delivered Price**

This Quotation is subject to the terms and conditions set forth on the back page hereof. Bidder is advised to read these before signing.

We have read the instructions and, if favored with an order, we agree to furnish the items enumerated herein at the prices and under the conditions indicated.

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The foregoing offer shall be irrevocable for 90 days after the date on which The PORT AUTHORITY TRANS-HUDSON CORPORATION opens this proposal.

Signed_____Date_____
Firm Name_____

PA280/9-03

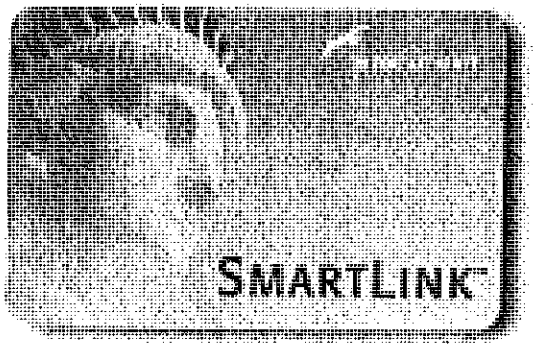
TERMS AND CONDITIONS

1. The Port Authority (PA) reserves the right to request information relating to seller's responsiblity, experience and capability to perform the work.
2. Unless otherwise provided, complete shipment of all items must be in one delivery FOB delivery point. Payment will not be made on partial deliveries unless authorized in advance by the party to be charged and the discount, if any, will be taken on the total order.
3. PA payment terms are net 30 days. Cash discounts for prompt payment of invoices may be taken but will not be considered in determining award, except in the case of tie bids.
4. Separate unit and total FOB delivered prices must be shown.
5. Sales to the PA and to PATH are currently exempt from New York and New Jersey State and local taxes and generally from federal taxation. The seller certifies that there are no federal, state, municipal or any other taxes included in the prices shown hereon.
6. The PA shall have the absolute right to reject any or all proposals or to accept any proposal in whole or part and to waive defects in proposals.
7. Unless the phrase "no substitute" is indicated, bidder may offer alternate manufacturer / brands, which shall be subject to Port Authority approval. Please indicate details of product being offered with bid.
8. Acceptance of seller's offer will be only by Purchase Order Form signed by the PA. No change shall be made in the agreement except in writing.
9. If the seller fails to perform in accordance with the terms of this purchase order, the PA may obtain the goods or services from another contractor and charge the seller the difference in price, if any, a reletting cost of $100, plus any other damages to the PA.
10. Upon request, sellers are encouraged to extend the terms and conditions of any terms agreement with the PA to other government and quasi-government entities by separate agreement.
11. By signing this quotation or bid, the seller certifies to all statements on Form PA 3764A regarding non-collusive bidding; compliance with the PA Code of Ethics; and the existence of investigations, indictments, convictions, suspensions, terminations, debarments and other stated occurrences to assist the PA in determining whether there are integrity issues which would prevent award of the contract to the seller. The PA has adopted a policy set forth in full on PA 3764A, that it will honor a determination by an agency of the State of New York or New Jersey that a bidder is not eligible to bid on or be awarded public contracts because the bidder has been determined to have engaged in illegal or dishonest conduct or to have violated prevailing wage legislation. The Terms and Conditions of PA 3764A apply to this order. A copy can be obtained by calling (212) 435-4600 or at http://www.panynj.gov/business-opportunities/become-vendor.html
12. The vendor may subcontract the services or use a supplier for the furnishing of materials required hereunder to such persons or entities as the Manager, Purchasing Services may from time to time expressly approve in writing. All further subcontracting shall also be subject to such approval.
13. The successful bidder (vendor) shall not issue nor permit to be issued any press release, advertisement, or literature of any kind, which refers to the Port Authority or that goods will be, are being or have been provided to it and/or that services will be, are being or have been performed for it in connection with this Agreement, unless the vendor first obtains the written approval of the Port Authority. Such approval may be withheld if for any reason the Port Authority believes that the publication of such information would be harmful to the public interest or is in any way undesirable.
14.Neither the Commissioners of the Port Authority, nor Directors of PATH, nor any of them, nor any officer, agent or employee thereof, shall be charged personally by the Contractor with any liability, or held personally liable to the Contractor under any term or provision of this Agreement, or because of its execution or attempted execution, or because of any breach, or attempted or alleged breach, thereof.

PATH

PORT AUTHORITY TRANS-HUDSON

SMARTLINK CARD



TECHNICAL SPECIFICATIONS

Revision A

(October 26, 2006)

PATH Regional Fare Collection System

TABLE OF CONTENTS

REVISION CONTROL

Revision	Detail of Revision	Originator	Date
	Initial Release	N. Hamidi	06/19/06
A	Philips DESFire chip requirement added	N. Hamidi	10/26/06
B			
C			

LIST OF CONTROLLED COPY HOLDERS

1. N. Hamidi – TSD, Port Authority
2. J. Pecora – PATH

1.0 INTRODUCTION

This specification defines the requirements for the Port Authority Trans-Hudson (PATH) smart card fare media called the SmartLink℠ (SL) card. The SL card is a contactless proximity card used in the PATH Regional Fare Collection System (PRFCS). The PRFCS system supplier is Cubic Transportation Systems (CTS). The integrated circuit chip for SL fare media shall be the Philips DESFire chip and SL card shall conform to the relevant sections of the attached Regional Interoperability Standard for Electronic Transit Fare Payments (RIS) and relevant CTS documents referenced in this specification. The version of DESFire chip selected shall be compatible with the existing PRFCS SmartLink card readers.

2.0 TECHNICAL REQUIREMENTS

The technical requirements of the SL card are based upon the relevant sections of the following RIS specification and the CTS documents (Optional items stated in each document are clarified accordingly):

- Regional Interoperability Standard for Electronic Transit Fare Payments (RIS) 3.6, Part-2 Version 2.01
  - Item 7.2 – Lot ID Number – not required
  - Item 7.5 – Manufacturer Information Lot Code – not required
  - Item 7.6 – Generation of Cross Reference Look-up Table – not required
  - Item 7.7 – Manufacturers' Early Access Scheme – required. This number identifies the chip manufacturer and the type of card. The four digit prefix in the serial number printed on the card is "0161" – Which is the code for Philips-DESFire chip for the SmartLink card.
- CTS Drawing 4300-01002 Rev. F, Tabulated Specification Control Drawing, CSC Philips DESFire, 4Kb
- CTS Document 8500-62003 Rev. F.00, Design Information Bulletin for the Nextfare ™ Smart Card Serialization and Printing
  - Item 2.1 – Electronic Serial Number – required.
  - Item 3.2.2 – Printing of Batch ID & Soft Serial Number. Batch ID – required to be printed on the lower left hand corner of the card ("MMYYWW", where MM = card manufacturer, YY = year of manufacture, WW = week of card manufacture). Soft Serial Number – not required to be printed.
- CTS Document 9387-31001 Rev. B, Art, Front, SmartLink
- CTS Document 9387-31002-2 Rev. C, Art, Back, Full

The above documents specify the card and the printing on the card. These documents are attached in the Appendix.

3.0 MANUFACTURING REQUIREMENTS

3.1 SECURITY CONTROL

The SL card supplier shall keep track of all materials utilized in the production of the SL cards. The SL cards shall be manufactured in a secure area, accessible only to personnel who are involved in the manufacture and handling of the SL cards. An account shall be kept of all SL cards at all times during production, packaging, and delivery. The SL supplier shall furnish a certified record of the SL cards produced in a form registered by the production equipment. The SL cards shall be packed under the supervision of responsible personnel and be kept in a secure location before shipment. A manufacturer's batch identification number shall be printed at the back of SL cards as defined in the CTS document – Design Information Bulletin for the Nextfare Smart Card Serialization and Printing.

3.2 DISPOSAL OF SURPLUS MATERIALS, SCRAP AND REJECTED FARE MEDIA

All surplus SL cards generated during production, scrap and rejected SL cards shall be disposed of in a manner that renders the SL cards unusable and that is acceptable to PATH, and with a certified record of disposal. All artwork and related material used in the manufacture of PATH SL cards shall be delivered with the final shipment of fare media. All special tools, dies or like items manufactured for the production of PATH SL cards shall be surrendered to PATH on demand.

3.3 CERTIFICATION

The SL supplier shall test and certify that the material used in the fabrication of the SL card meets all the requirements of this specification.

PATH reserves the right to review the supplier's test data and supporting documentation and to conduct independent tests on delivered fare media prior to acceptance. The same shall apply to the security control requirements described in sections 3.1 and 3.2.

3.4 QUALITY ASSURANCE

A detailed Quality Assurance Plan specific to this product, detailing inspections, tests, procedures, sampling frequencies and required results must be submitted to and approved by PATH within 30 calendar days after contract award. The Quality Assurance Plan cannot be revised without PATH approval.

3.4.1 Proofs

Following an award PATH will require three sets of Proofs of the completed SL card for inspection and approval prior to final printing. Proofs should be sent directly to:

Nuri Hamidi
Port Authority – TSD
1 Madison Avenue
7th Floor
New York, NY 10010
Tel. (212) 435-3231

4.0 PHYSICAL CHARACTERISTICS

4.1 DEFECTS

The SL card shall be free of all defects which impair their in-service performance; e.g., surface blemishes, loose dirt, fuzz, residual chemicals, abrasive material, holes, cracks, breaks, dents, edge and corner irregularities as defined, burrs or sharp corners on any edge, loss of or blurred graphics or texts, etc.

4.2 FINISH

SL card shall be free of burrs, splinters, and sharp edges. Samples shall be submitted to PATH for approval before production run.

4.3 COLORS AND GRAPHICS

The base color material shall be white. The colors of the pre-printed graphics and text shall be as per the CTS documentation. The graphics shall be legible and shall not smear, transfer, or wear during normal handling.

4.3.1 GRAPHICS DESCRIPTION

The SL card graphics shall conform to the artwork provided at the time of bid.

5.0 DELIVERY

5.1 DELIVERY ADDRESS

All production fare media shall be delivered as specified in the purchase order.

5.2 DELIVERY SCHEDULE

The delivery schedules shall be specified in the purchase order.

5.3 SECURITY MEASURE ON DELIVERY

The production SL cards shall be packed as per the RIS specification and must be labeled with name of manufacturer, production run number, type of fare media, total quantity shipped, quantity for each box, and each box should be numbered in relation to total number of boxes (i.e. 1 of 40). If specified in the purchase order the production SL cards shall be jointly inspected by the representatives of the fare media supplier and PATH at the time of packing into the boxes.

APPENDIX

APPENDIX

The Greater New York & New Jersey Metropolitan Region
New York ✦ New Jersey ✦ Connecticut ✦ Pennsylvania

REGIONAL INTEROPERABILITY STANDARD
FOR
ELECTRONIC TRANSIT FARE PAYMENTS (RIS)©

PART 2 PICC, PCD AND CID PHYSICAL AND ELECTRICAL SPECIFICATION

RIS 3.6
Part-2 Version 2.01

July 1, 2005

THE PORT AUTHORITY OF NY & NJ

Proprietary and Confidential

PREFACE

CONFIDENTIALITY OF DOCUMENT:

The objective of this document is to further the standardization of the interface between proximity integrated circuit cards (PICC's) and proximity coupling devices (PCD's). The information within this document is offered free of charge and may be incorporated, with written permission from the Port Authority, within a business system solution in order to further this objective. The Port Authority prohibits the licensing or charging of fees for use of any portion of this Regional Interoperability Standard for Electronic Transit Fare Payments (RIS). Any licensing or charging for use and/or development of any and all derivatives of this specification is similarly prohibited.

Document Control

Document file name:	RIS-3.6-Part-2-v2.01 01Jul2005.doc
Property of:	The Port Authority of New York and New Jersey
Issue Date:	July 1, 2005
Status:	Part-2 Version 3 Revision 2.01

Revision History

Revision	Date	Description of change
1.00	06/30/2003	Release of Regional Interoperability Standard Version 3 Initial release of Part 2 PICC, PCD and CID Physical and Electrical Specification
1.10	09/10/2003	Updated to incorporate selected comments provided voluntarily from third parties invited to review Version 1.00.
1.11	12/01/2003	Updated with revised format
2.00	06/30/2004	Updated with Limited Use per pending ISO/IEC 14443 requirements and proposed early manufacturers' ID; updated to comply with RIS formatting standard
2.01	07/01/2005	Updated copyright range, header format, file name

Commitment to an Open Standard

All agencies, vendors and individuals providing comments, corrections or additions to the RIS documentation are required to sign a binding letter of agreement that confirms their willingness to abide by the terms of use defined within the RIS Intellectual Property Rights (IPR) Policy. A copy of the Binding Letter of Agreement for Intellectual Property (IP) Usage Intent is included in Appendix B of this doument.

DISCLAIMER:

While PANYNJ reasonably believes that the RIS contains no proprietary/confidential information, trade secrets or intellectual or other property of third persons, it does not represent or warrant this. Therefore, PANYNJ assumes no risk or responsibility of third party claims arising out of the use of the RIS. Any party making use of the RIS agrees to release PANYNJ from all liability in connection therewith, and they further agree to defend, indemnify and hold harmless PANYNJ against any claims by third persons based upon their use of the RIS.

Further, any party that makes use of the RIS does so at its own risk. PANYNJ assumes no responsibility for any element of any implementation of the RIS, whether in whole or in part, including – but not limited to – system design, performance, integrity, operability, cost or maintainability.

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INDEX OF FIGURES

Table of Acronyms

ADA:	American Disabilities Act.
AES:	Advanced Encryption Standard
AFC:	Automatic Fare Collection
AFI:	Application Family Identifier
AID:	Application Identifier
ALPO:	Account Linked Product Object
ALPOX:	Account Linked Product Object Extension
ANSI:	American National Standards Institute
APDU:	Application Protocol Data Unit
API:	Application Program Interface
APTA:	American Public Transportation Association
ASK:	Amplitude Shift Keying
ATQA:	Answer To Request type A
ATQB:	Answer To Request type B
ATRA:	Advanced Transit Association
AVM:	Automatic Vending Machine
AVPO:	Auto Value Product Object
AVPOX:	Auto Value Product Object Extension
bps:	bits per second
Bps:	Bytes per second
BPSK:	Binary Phase Shift Keying
CID:	Card (PICC) Interface Device
COS:	Card Operating System
CSC:	Contactless Smart Card
CSR:	Customer Service Representative
DAC:	Data Authentication Code
DEA	Digital Encryption Algorithm
DES:	Data Encryption Standard
DIO:	Directory Index Object
DIOX:	Directory Index Object Extension
3DES	Triple DES
DPA:	Differential Power Analysis
EEPROM:	Electrically Erasable Programmable Read Only Memory
EM	Embedded Microprocessor (PICC)
EMV:	Europay MasterCard Visa
ESD:	Electro Static Discharge
IC:	Integrated Circuit
ISO:	International Standards Organization
K (k):	Kilo (as in Kilo bytes)
kGy:	Kilo grays
LAN	Local Area Network
LU:	Limited Use Smart Card
MAG:	Magnetic
MRAM:	Magnetoresistive Random Access Memory
MB:	Million Bytes or Mega Bytes
MFM:	Modified Frequency Modulation
Mhz:	Million Hertz or Mega Hertz
ML:	Memory Logic (Such as Limited Use CSC)
mseo:	Millisecond
NRZ-L:	Non-Return to Zero Level

nseo:	nanosecond
NYCT:	New York City Transit
OOK:	On/Off Keying
OS:	Operating System
OTP:	One Time Programmable
PANYNJ:	Port Authority of New York & New Jersey
PCD:	Proximity Coupling Device
PET/PETG	Polyethylene Terephithalate/Glycol
PHPO:	PICC Holder Profile Object
PHPOX:	PICC Holder Profile Object Extension
PICC:	Proximity Integrated Circuit Card
PIO:	Product Index Object
PIOX:	Product Index Extension
PO:	Product Object
POS:	Point of Sale
P&TPO:	Pass and Transfer Product Object
PVC:	Polyvinyle Chloride
RAM:	Random Access Memory
RIS:	Regional Interoperability Standard
RF:	Radio Frequency
RFID:	Radio Frequency Identifiable Device
ROM:	Read Only Memory
SAM:	Security Access Module
SBC:	Single Board Computer
SI:	Silicon
SJT:	Single Journey Ticket
SV:	Stored Value
SV&TPPO	Stored Value and T-Purse Product Object
SVT:	Stored Value Ticket
TAPO:	Transit Application Product Object
TCIP:	Transit Communications Interface Profiles
THO:	Transaction History Object
T-Purse:	Transit Purse
TVM:	Ticket Vending Machine
UID:	Unique Identifier
US:	United States

1.0 INTRODUCTION

This Part of the RIS defines the physical, electrical, dimensional, environmental and delivery requirements for the PICC, PCD and card interface device (CID) to support interoperability of these devices in a multi-agency, fare collection system. It is necessary to define these requirements to maintain an open architecture (a design which facilitates and encourages competitive supply of products and services to the transit industry) within the confines of transit industry-supported standards. This specification is written in a fashion that should accommodate technical improvements in proximity products in the future. The two PICC product categories specifically defined are Full-Featured and Limited Use. These two PICC categories provide complete coverage for electronic fare media needs of a multi-agency or regional smart card program and facilitates migration toward a PICC-only system.

Features or sections that are highlighted in [redacted] are considered optional.

2.0 SMART CARD PROXIMITY SYSTEM

A proximity card system consists of three functional elements defined as the PICC, PCD and CID (which contains a PCD). It is essential that these three elements work together in an efficient manner to ensure system performance and inter-system interoperability. Although other standards for PICC and PCD elements exist, those standards leave open the opportunity for individual manufacturers and integrators to incorporate various proprietary features that inhibit the establishment of an open architecture. It is the primary objective of the RIS to work in conjunction with those other standards in order to provide a comprehensive rule set for the development and implementation of PICC-based fare collection systems within a multi-agency program. In order to achieve this objective, the RIS also defines requirements for the CID, a system element that has not, to date, been addressed by any of the existing standards.

When a PICC enters into the active radio frequency (RF) field of a PCD, it initiates interactive communications with the PCD. The PCD sends and receives digital information originated from or destined to be received by a single board computer (SBC) which hosts the transit fare payment (or other) application The combined hardware and software application of a PCD and SBC is known as a CID (See Figure 2-01). The CID is capable of supporting fare payment transaction processing, data storage, interface communications and security hosting.

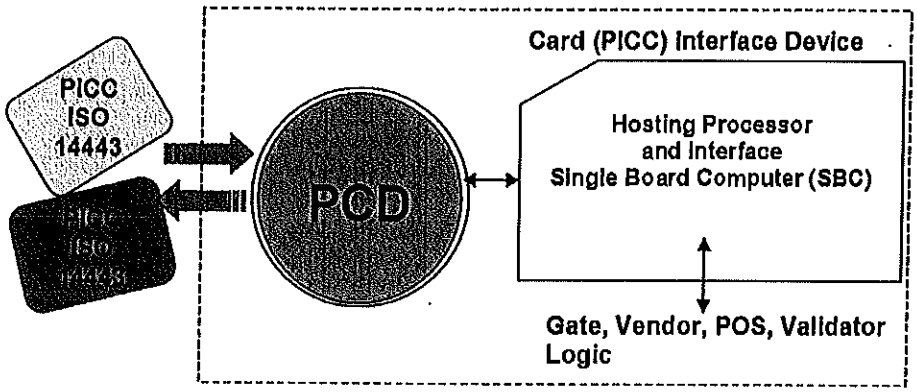


Figure 2-01 Proximity Card System

2.1 PICC Types

There are two distinct types of PICC's available to accommodate the requirements of an interagency fare collection program. These includes smart cards with an embedded microprocessor (referenced as Full-Featured (FF) cards) and those utilizing memory logic (referenced as Limited Use (LU) cards). FF and LU PICC's are explained in greater detail below. These two PICC product types can be used interchangeably or in combination as the core electronic fare media for any fare collection system. Cards intended for use in any interagency fare collection system must be fully compliant with requirements defined herein

and must also be compliant with ISO/IEC 14443, the International standard for PICCs.

2.1.1 Full Featured (FF) PICCs

Modern FF PICC's are designed to accommodate the specific needs of public transportation with features such as: Improved transaction processing speeds, integrated triple data encryption standard (3DES) security modules, single instruction processor access cycles (fast and efficient processor execution), standard size or flexible Block/Record structures, Full ISO 14443 part 1-4 compliance, hardware and software anti-tear logic, single silicon (Si)-mask modifiable embedded card operating system (COS), and expandable and re-usable data-memory sizes. Table 2-01 below provides a summary of the PICC specifications that are more fully defined elsewhere within this document.

TABLE 2-01 FULL-FEATURED PICC SPECIFICATION BRIEF

PICC Feature	Specification / Standard	Comments
Chip Architecture	Based on a RISC or minimal clock/instruction cycle microprocessor	
Physical Characteristics	ISO/IEC 14443, Part 1	
Radio Frequency and Signal Interface	ISO/IEC 14443, Part 2	
Initialization and Anti-Collision	ISO/IEC 14443, Part 3	Selectable to allow for a detect only mode
Transmission Protocol	ISO/IEC 14443, Part 4	
Application Protocol Data Unit (APDU) Commands	ISO 7816-4	▪ Select File ▪ Read Binary ▪ Update Binary ▪ External Authenticate (Optional) ▪ Internal Authenticate (Optional) ▪ Get Challenge (Optional)
Data-Memory Structure	Flexibility to emulate 16 Byte-Blocks or Records	
Standard User Memory Size	4KB	Optional 2KB, 8KB
Applications/Products	Minimum of three (3) @ 16 Files each	
Life Cycle	3 years minimum with 10,000 write cycles	Refer to Part 05 for a complete definition of a write cycle
Anti-Tear	Supports an Anti-Tear scheme with option to select or deselect	
Operating System and File System	Capable of supporting 3 or more keys/file	
Security	▪ 3DES (112-bit double length keys per ANSI X3.92 Rev. 1981)	

PICC Feature	Specification / Standard	Comments
	▪ Hardware DES Crypto Accelerators preferred	
DPA Resistance Protection Circuitry	DPA Resistance Protection Circuitry per Common Criteria Level EAL3 +, EAL4+, EAL6	
PCD to PICC Baud Rate	Minimum of 106kbps and 212kbps with support for increased baud rates of (424kbps and 848kbps, as optional)	
Card Operating System (COS)	Embedded with support for listed APDU commands	
Transaction Performance	Typical transaction completed in 250 milliseconds (ms) or less	▪ Defined in greater detail in RIS Part-05 Performance however, A typical transaction will consist of no less than a two read commands each accessing 64 bytes of data in length followed by two write commands accessing no less than 16 bytes, and having no less than three mutual authentifications processes completed within 250 milliseconds (ms) or less
Device Die Size	Under 10 mmsq using processing geometry technology no larger than 0.35um	
Communications with PCD	Must perform in a stable and active etate from a read distance of no less than 6.0cm measured from the top surface of the PCD antenna using the PCD's maximum allowable power output measured in Amps/Meter and as defined within ISO/IEC 14443 Part-2.	

2.1.2 Limited Use (LU) PICCs

LU-type memory logic based PICC is defined as a proximity smart card with limited functionality and a limited life cycle. An LU PICC provides a cost effective transit smart card solution for application as a single journey ticket, short-term pass or as a stored value instrument. LU PICCs are designed to offer the issuer an alternative to magnetic media. Efforts by various members of the standards bodies such as ANSI/INCITS continue to work toward the standardization of LU PICC's particularly in the area of packaging, memory size and anti-collision requirements.

Note: Some PICC products available today are designed to meet a portion of the ISO/IEC 14443 specifications but do not adhere to all aspects of Part 1, 3 or 4 of that standard. Due to fact that LU PICC's have physical and other aspects that are not addressed by the ISO/IEC standard, it is expected that a separate national or international LU standard will be established in the future.

The LU specification in Appendix-A is provided in the absence of an applicable International standard and is summarized in Table 2-02 below.

TABLE/LIST 2-02 LIMITED USE SPECIFICATION SUMMARY

Feature	Specification / Standard	Comments
Chip Architecture	Based on existing memory logic product architecture	In time, more cost effective solutions may become available.
General	ISO 14443, Parts 2-3 Optional: Anti-collision, Detect Only Method	
Data-Memory Structure	16 Bytes/ Block	
Data Memory Size	1KB or less of usable space	
Fare Products Storage	Maximum of four distinct products	Agency/regional policy may allow changes to this standard.
Packaging	ID-1 at 12 millimeters thick, paper, polyvinyl, or combination	
Life Cycle	6 months and or a minimum of 1000 transaction cycles	
Fare Product Transaction Time	Per RIS Part-05: Certification and Testing Criteria (<250ms)	
Technology Base	Silicon, Organics and/or Nanotechnology based products acceptable with qualifications	
Security	Digital Signature per RIS Part-3 and Part-1 section 5.0, Security Requirements	
Read/Write Distance	Minimum 2.54cm @ maximum power output for PCD	

2.2 ISO/IEC 14443 Compliance

The RIS is structured to take advantage of the existing body of international and national standards including ISO/IEC 14443. Specific RIS requirements necessary to ensure interoperability within the transit environment will be addressed as exceptions or additions to the ISO 14443 specification throughout this document.

ISO/IEC 14443 contains four-parts as described below.

2.2.1 ISO/IEC 14443, Part 1 (2000-15-04)

Part 1: Physical characteristics for identification cards, contactless integrated circuit(s) cards, and proximity cards.

Part 1 provides the basic set of standards for physical and electrical specification for PICC's in a standard ID-1 (credit card) format.

Note: Limited Use PICC products constructed with thin paper, polyvinyl and or plastic are not covered presently by this standard.

2.2.2 ISO/IEC 14443, Part 2 (2001)

Part 2: Radio frequency power and signal interface for identification cards, contactless integrated circuit(s) cards, and proximity cards.

Part 2 of the ISO/IEC 14443 standard defines two types of RF modulation schemes. These are referenced as type A and type B. Table 2-03 describes in brief the differencea of these two schemes.

TABLE 2-03 ISO RF TYPES

	Type A	Type B
Frequency:	13.56 MHz	13.56 MHz
Modulation:	100% ASK	10% ASK
Bit Coding:	Miller Pulse Position	NRZ
Data rate:	106 kb/s*	106 kb/s*

Modulation:	Load	Load
Data Coding:	OOK	BPSK
Subcarrier:	847kHz	847kHZ
Bit Coding:	Manchester	NRZ
Data Rate:	106 kb/s*	106kb/s*

* Provisions for higher baud rates are in draft at ISO committee level (e.g., 212kb/sec, 424kb/sec & 848kb/sec.)

2.2.3 ISO/IEC 14443, Part 3 (2001)

Part 3: Initialization and anti-collision for identification cards, contactless integrated circuit(s) cards and proximity cards.

Part 3 of the standard defines how the PCD and PICC establish initial communications when the PICC is brought into the magnetic field of the PCD. This part also defines specifications for the anti-collision method used by this standard. An anti-collision scheme allows multiple PICCs to enter the field at the same time with the system determining which PICC to select for the transaction or to present an error message. Type A uses bit-wise anti-collision while type B uses slotted anti-collision. The option to select anti-collision is not supported

presently in 14443-3. The option of selecting anti-collision is a requirement of this specification.

The initialization process is a series of commands between the PCD and the PICC that determines that the correct PICC is being used for the transaction.

2.2.4 ISO/IEC 14443, Part 4 (2001)

Part 4: Transmission protocol for identification cards, contactless integrated circuit(s) cards and proximity cards.

Part 4 of the standard defines transmission protocol. This part defines the communications for the execution of a transaction by the PICC as well as data elements and data format. The protocol defined is fully transparent and therefore able to handle any application command described in ISO/IEC 7816 part 4 and above. This specification accomodates dual interface smart card platforms as well as typical commands normally supported by contact-type smart cards. Several of the existing standards that apply specifically to contact-type smart cards are listed below in Section 2.4 Complementary ISO Standards.

Note: ISO 14443, Part 4 is not required for Limited Use PICCs.

2.2.5 Complementary ISO/IEC Standards

- ISO/IEC 10373-6, Identification cards—Test methods—Part 6: Proximity cards
- ISO/IEC 7810, cards—physical dimensions
- ISO/IEC 7816-1 Integrated circuit(s) card with contacts—Part 1 which defines the physical characteristics of the card. (Optional for Dual Interface Cards)
- ISO/IEC 7816-2 Integrated circuit(s) card with contacts—Part 2 which defines the dimension and contact position of the card. (Optional for Dual Interface Cards)
- ISO/IEC 7816-3 Integrated circuit(s) card with contacts—Part 3 which defines the electrical signals and transmission protocols. (Optional for Dual Interface Cards)
- ISO/IEC 7816-4, Identification cards—Integrated circuit(s) card with contacts—Part 4: Inter-industry commands for Interchange
- ISO/IEC 7816-5, Identification cards—Integrated circuit(s) card with contacts—Part 5: Numbering system and registration procedure for application identifiers
- ISO/IEC 7816-6, Identification cards—Integrated circuit(s) card with contacts—Part 6: Inter-industry Data elements
- ISO/IEC 7816-8, Identification cards - Integrated circuit(s) cards with contacts - Part 8: Interindustry commands for a cryptographic toolbox
- ISO/IEC 15457-1-3 , Then Flexible cards

2.3 PCD and CID Specifications

2.3.1 PCD

The PCD is an integral part of a RIS-compliant proximity system and must support long-term system application flexibility and reliability. The following Table 2-04 lists the requirements for a PCD:

TABLE/LIST 2-04 PCD REQUIREMENTS

Feature	Specification / Standard
General	ISO 14443 Part 2, 3, and 4
APDU Command Set	Must support mandatory commands defined in Table 2-01
Software Download	Via a USB, Ethernet and/or Serial port.
Auto-RF Field Tuning	Optional but preferred
Baud Rate (from PICC to PCD)	212Kbps *(Preferred support up to 847kbps*
Baud Rate from Host Port to SBC	1Mbit/second bidirectional PCD to SBC with standard USB, Ethernet or Serial port with software driver support.
Life Cycle	10 years or 10 million transaction cycles
Operational Enviroment	-10° to 60° Celsius, Humidity of 95% non-condensing
Physical Dimensions	Not to exceed: 12.0cm x 12.0cm x 6.0cm for standard end equipment (e.g.: Gates, Vendors, Validators)
Communications with PICC	Minimum distance at full power: 6.0cm with "Golden PICC" *(See RIS Part-05)*
Power Consumption	Power consumption maximum @ 5volts DC; 1.5amps or 7.5 watts
PICC Interoperability	Must not be designed to favor (initialize, recognize or initiate handshake) any particular PICC solution

Note: Golden PICCs are PICCs that are guaranteed to be fully within the specification and 100% functional. It is common to select such a PICC that meets all of the specifications but is on the worst case side of the specification. The Golden PICC ensures that a system is capable of operating according to specification.

2.3.2 CID

A CID consists of a PCD coupled with a hosting processor. The CID must comply with the requirements defined in Table 2-05.

TABLE 2-05 CID REQUIREMENTS

Feature	Specification / Standard
Power Consumption	Maximum of 5 volts DC; 4 amps or 20 watts (Excluding PCD consumption)
Security	▪ 2-4 Hardware SAM Modules ▪ Support for protected (tamper resistant) Software SAM's
Processor Architecture	X86 or RISC(+300MHz) with either Microsoft CE-04, or similar operating system support.
Host Port (to PCD)	1Mbit/second bidirectional PCD to SBC with standard USB,

	Ethernet or Serial port with software driver support.
I/O for External Communications	Minimum of one USB port plus either one Ethernet port or one high speed serial port
System Memory	Minimum 8MB of Flash and/or SRAM
PCD/SBC Configuration	Integrated as one device or configured as two distinct devices linked with an appropriate form of communications

Note: Includes all applicable requirements for the PCD (see Table 2-04) above for exception or additions.

2.3.3 PICC Physical Package Specification

PICC suppliers must adhere to physical packaging specifications to simplify the process of PICC product procurement. Section 8.0 of this document addresses any additional or exception requirements of PICC construction and layout to accomplish quality printing.

2.3.4 PICC and CID Development Kit Software Requirements

Stand-alone CID Development kit includes:

- Developers document
- Hardware interface
- Software protocol
- Electrical specification
- Functionality specification
- Environmental specification
- Hardware developers' units

3.0 RIS SPECIFIC REQUIREMENTS

In order to proceed with the development of any transit fare collection system that is required by the transit service operator to be in compliance with this Regional Interoperability Standard, there might be the need for participating suppliers to make available certain aspects of proprietary information held by the PCD, PICC and card operating system (COS) suppliers. This is especially true to achieve full testing and certification. Examples of this information will include the following:

a. PICC Operating Systems and Specifications
b. PCD Operating Systems and Specifications
c. Software development kits (SDKs) for card and reader platforms and specifications
d. Security capabilities and specifications
e. PCD and PICC application programming interfaces and specifications
f. Interface documents and API Libraries

3.1 ISO 14443 Implementation Requirements

The ISO 14443 standard provided a level of flexibility to accommodate vendor-specific implementations. In order to ensure a greater level of interoperability for any PICC / PCD configuration within a promity smart card system, more specific implementation methods must be defined. Specific instances include:

3.1.1 ISO 14443-3 AFI Coding

In the case of type A PICCs the standard does not specify the coding of an AFI table. However, RIS Part-03 of the protocol designates use of the available Proprietary Coding bits to specify AFI "like" categories.

In the case of type B PICCs the standard specifies the coding of AFI bites. Type B product suppliers must comply with RIS Part-03.

3.1.2 ISO 14443-4 (7816-4) APDU Commands

RIS Part 3 requires vendors to adhere to a specified set of APDU commands. This is necessary to restrict the implementation of unique interpretations of the APDU commands. Even though ISO 7816-4 has a complete specified command set, it has proven to be non-acceptable when applied to card technologies outside of contact type. Therefore, PICC vendors have applied in many cases the use of one actual command (allowed by ISO 14443-4) that allows them claimed compatibility. The prime reason for vendors taking the liberties of creating subset 7816-4 commands is over the concern of transaction throughput. The full implementation of the standard simply burdens the PICC to the point that transactions operate far below their demanded cycle time for public transportation. (Also see Table 2-01)

3.1.3 ISO 14443-3 Anti-Collision

The RIS standard reserves the right as an option to select Anti-Collision as a "Detect Only" feature for either type A or type B PICCs. It has been proven in various parts of the world that Anti-Collision can interfere with the fare policies or fare processing of some agencies and financial issuing banks. An example of this is where two cards are presented in the PCD active field and fare or value is added or deducted to/from the wrong card (where the patron is holding two or more valid PICCs in the field). This may cause the patron to contact the issuer, requiring labor-intensive customer service actions to be taken.

In the event that Anti-Collision is selected to behave as a "Detect Only" the PICC and CID must inform the patron through the gate, farebox or validator display with a logical mechanism that would enable such messages as: "Present only one card" or "Two cards present". In turn, the PICC and CID will act through software in an appropriate manner as not to cause any system lock-up or any damage to the PICCs or CID normal operation.

Limited Use PICCs as mentioned in Section 2.2 can be designated by the agency, region or issuer to support a Anti-Collision "Detect Only" mode feature. However, if a Anti-collision "Detect Only" mode is specified, use of the LU-PICC must not cause a malfunction in systems that adhere to ISO 14443 Parts 2 through 4.

3.1.4 PICC Durability Testing

High durability of smart cards is critical to the level of patron acceptance long term. Even though there are ISO standards such as ISO/IEC 14443-1, it hes been proven that these physcial characteristics are simply not sufficient to ensure that these PICCs will survive usage in a public transportation environment. The participating agencies will require that all PICCs procured for the region will follow the enhanced ISO/IEC14443-1 phyical characteristics as stated below:

- Irradiation Testing (As per Table 3-01). Also see section 9.0
- Enhanced Dynamic Bending Stress *(Also see LU Appendix A)*

3.1.4.1. PICC Stress Testing

Stress Testing:	To achieve compliance to ISO 14443 Part –1 including the call out for ISO 10373. In addition, the card body with fully functional integrated module/IC and antenna must not fail when subjected to ISO 14443-1, Section 4.3.3 of the Dynamic Bend test with an increased h, A= 26mm and h, B=12mm.
Torsion Stress:	To achieve full compliance to ISO-14443 Part-1 including the call out for ISO 10373. In addition, the card body with fully functional integrated module/integrated circuit (IC) and antenna must not fail when subjected to ISO 14443-1, Section 4.3.4 of the Dynamic "Torsional" test with angle of rotation α of 20 degrees.

3.1.5 PICC General Specifications

TABLE 3-01 PICC GENERAL SPECIFICATIONS

Parameter	Specification
Physical FF PICCs	ISO 7810, ISO 7811-1 through -6, ISO 7816-1, ISO 10536-1, ISO 14443-1 compatible.
Operating Frequency / Power:	13.66 MHz Inductive Coupling, (No Battery).
EMC Susceptibility:	ISO 10536-1 EN 50082-2
Safety:	ISO 7810 (Physical) ISO 7813 (Flammability) ENV 50166-2 (RF Human Exposure)
Memory Technology	FRAM, EEPROM, MRAM *(Once qualified)*
Start up time (anti-collision Protocol)	Per ISO/IEC 14443-3
Memory Organization:	16 Bytes per Block or Record or flexible Block/Record Structures
Operating Temperature:	-20 °C to +60 °C
Storage Temperature (and maximum post-processing temperature):	-20 °C to +70 °C
Operating Humidity:	10%-90% RH (internally-mounted components), 6% to 100% RH external.
ESD	PICC shall not be damaged when subjected to a 10 kV discharge through 150 Ω from 150 pF. Test per ISO/IEC 10373-6.
Read/Write Cycle Test:	10^6 Read and Write cycles dependent on technology choice.
PICC Life	In use, transit environment—3 years.
Irradiation Tolerance	56 kGy with no package, printing or device deterioration *(Or Incompliance with the US Postal Service Irradiation Specification)*

4.0 ADDITIONAL CLASSES OF SMART CARDS

As stated in earlier sections of this document, the RIS primarily addresses requirements for contactless-only solutions, however, provisions within this standard allow for other types of smart card product formats including Dual Interface (a.k.a. "Combi-Card") products.

4.1 Dual Interface Cards

Dual interface cards consist of contact and contactless capability integrated onto one monolithic silicon substrate. This type of card is appropriate for use in programs where certain transactions require physical contact between the smart card and reader and other transactions (such as transit fare payments) require use of a faster, contactless interface. Contact-based features of the card are defined within the ISO 7816 standard.

The term "Dual Interface Cards" may also refer to products which have two separate RF modulation and communications schemes (such as a ISO 14443 and ISO15693) on one monolithic silicon substrate. ISO15693 applies to RF identification (RFID) products which are not supported by the RIS.

Since dual interface cards are more costly to produce and, accordingly, carry a higher price, it is not recommended that this type of card be implemented unless there are critical business requirements mandating such an implementation.

4.2 Contact Cards

Contact-only type smart cards contain a single silicon substrate with an attached metallic plate that facilitates communication between card and reader when the plate is touching a corresponding electrical contact points within the reader. The RIS does not include requirements or standards for this type of card.

4.3 Hybrid Cards

Hybrid cards can consist of multiple IC devices or a combination of an IC and a magnetic strip. As an example, a hybrid card may have one contact-type IC module, a contactless IC module and a magnetic strip. Similar to Dual Interface cards, hybrid cards are used in programs that require the support of various types of card reading technologies. Because of the requirement to embed one or more IC modules and potentially a magnetic strip and other technologies, these cards may carry a significant cost premium but may serve as a transitional product for a program converting from one type of technology (i.e.: Magnetic tickets, etc.) to another (i.e.: PICCs, etc.) or to facilitate the linking of two or more programs using different card interface technologies. This type of card class is defined within the RIS only to the extent that such cards include a contactless IC module.

5.0 FARE PAYMENT ELEMENTS

Typical automatic fare collection (AFC) system elements include the following hardware:

- Fare Gates
- Bus Farebox
- Handheld fare devices
- Validators
- On-Board (Bus) Computer
- Ticket Vending Machines (TVM) / Load Terminal
- Station/Garage/Depot Server / Computer
- Passenger Information Units
- Central Processing System Computer(s)
- PICC initialization terminal
- Regional Clearinghouse Computer

Each component will typically be linked to a network that allows PICC-related transactions to be transferred from the fare payment device (fare gate / farebox) or load terminal to the Station Server or Bus Depot computer. This information is then passed on to the Central Processing System (CPS). The supporting networks could be wireless or wired but must provide bandwidth in excess of 1 mbit/sec from each end device.

Note: Bandwidth for wireless wide area networks are likely to remain under 100Kbits per second for the near future.

For bus solutions, it is advisable for the collection of smart card generated transactions to be separate from the collection of other farebox data. For existing bus AFC systems, this approach allows operators to upgrade to smart card technology and the collection of its data without affecting the current fare collection process that is tailored to the collection of cash or proprietary magnetic transactions.

Diagram 5-01 provides an illustration of a typical system interconnect network and fare payments transaction flow for a PICC-based fare payment system. Such systems include one or more of the following interfaces between components:

- PICC and CID
- Fare Gate and a Station Computer (server, data concentrator, controller)
- Bus Farebox and an On-Board computer (and potentially a mobile router)
- TVM and a station computer (server, data concentrator, controller)
- Station Computer and a Central Processing System Computer
- Regional Clearinghouse and Central Processing System Computers

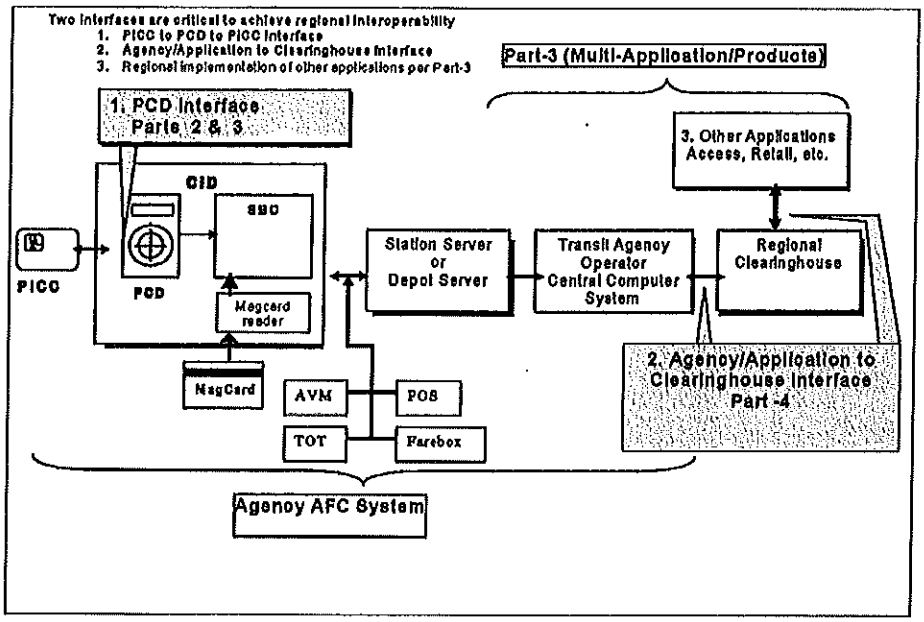


Figure 5-01 PICC, CID Interconnect

6.0 FILE, DATA AND MEMORY REQUIREMENTS

This section defines the file and data record requirements for the interaction between the PICC and the CID. This section also organizes memory utilization for both the Full Featured (FF) and Limited Use (LU) PICC products. Multi-application smart card requirements are provided in Part-3 of the Standard.

6.1 Application Transit Objects & Memory Requirements

The efficient management and allocation of available PICC data memory is critical to overall system performance. Table 6-01 lists the mimium required memory size for each transit object as defined in RIS Part-3. The total figure at the bottom of the table indicates data memory utilization for a Full-Featured PICC if two transit fare products are loaded (stored) on the PICC.

TABLE 6-01 MINIMUM MEMORY REQUIREMENT FOR A PICC WITH 2 TRANSIT APPLICATIONS (Full-Featured)

Transit Application Profile	128
PICC Card Holder Profile	128
Product Object	128
Product Extension	0
Product Index Object	128
T-Purse, E-Purse	128
Add Value History	640
Transaction History Object	1408
Security Key Sets (2-16 Byte keys/set/product)	512
Directory Index Object	128
Total Minimum memory bits	3,328 (416 bytes)

Table 6-02 lists the nominal number of RIS data objects that can be supported by PICCs with various data memory sizes. The standard Full Featured PICC data memory size is 4KB although 2KB* and 8KB* memory sizes are also supported by the RIS.

Note: The 4KB PICC was selected to adequately support a robust fare payments application for a regional program while minimizing the need for premature PICC upgrades. Regional/agency policy may determine that a PICC with less or greater memory is required for a particular program or for a subset of patrons within that program.

TABLE 6-02 SAMPLE STORAGE CAPACITY FOR DATA OBJECTS (BY PICC MEMORY SIZE)

Sample Objects Stored	2KB Card	4KB Card	8KB Card
Transit Application Profile	1	1	1
PICC Card Holder Profile	1	1	1
Product Objects	30	73	159
Product Extensions	1	2	3
Product Index Object	1	1	1

Sample Objects Stored	2KB Card	4KB Card	8KB Card
T-Purse, E-Purse,	2	2	2
Add Value History Object (4 entries plus one copy)	5	5	5
Transaction History Object (10 entries plus one copy)	11	11	11
RIS Directory Index Object	1	1	1
Security Key Sets (2-16 Byte keys/set/product)	33	77	164

Table 6-03 depicts the memory utilization requirements for each of the the PICC data object configurations shown in Table 6-02.

TABLE 6-03 SAMPLE OF ~MAXIMUM FARE PRODUCT MEMORY REQUIREMENTS FOR VARIOUS PICC PLATFORMS (FULL-FEATURED)

Sample Object	2KB Card**	4KB Card**	8KB Card**
Transit Application Profile	128	128	128
PICC Card Holder Profile	128	128	128
Products Objects*	4,096	9216	20,352
Product Extensions*	128	256	384
Product Index Object	128	128	128
T-Purse	256	256	256
Add Value History Object	640	640	640
Transaction History Object	1,408	1,408	1,408
RIS Directory Index Object	128	128	128
Security Key Sets (2-16 Byte keys/set/product)	8,448	19,712	41,984
**Total Bits	15,488 (1,936 bytes)	32,000 (4,000 bytes)	65,536 (8,192 bytes)

* Each Product Object or its Extension consumes 128 bits of memory. Allocation of products can be divided among Passes, Purses, Stored Value, Account Linked and AutoValue up to the maximum value assigned to each column. *(Also see Table 6-02)*

** PICCs being supplied by various vendors often will specify data memory sizes that have less usable space than the total advertised. In this case, reduction of one or two fare products from the configuration will usually reduce memory utilization to accommodate this decreased memory availability.

Table 6-04 defines the minimum core memory size requirement or the memory overhead associated with the implementation of the required data architecture for a Full-Featured PICC. All categories in the Table that have zero entries are not considered core elements.

TABLE 6-04 CORE MEMORY OVERHEAD REQUIREMENTS FOR A (FULL-FEATURED) PICC

Data Objects Stored	2KB Card	4KB Card	8KB Card

Data Objects Stored		2KB Card	4KB Card	8KB Card
Transit Application Profile		128	128	128
PICC Card Holder Profile		128	128	128
Products Objects		0	0	0
Product Extensions		0	0	0
Product Index Object		128	128	128
T-Purse		0	0	0
Add Value History Object		640	640	640
Transaction History Object		1,408	1,408	1,408
RIS Directory Index Object		128	128	128
Security Key Sets (2-16 Byte keys/set/product)		0	0	0
**Total Bits		2,560 (320 bytes)	2,560 (320 bytes)	2,560 (320 bytes)

Note: Limited Use PICCs will generally support up to four transit fare products/objects. With mutual regional agreement more fare products / objects can be supported on an LU PICC).

TABLE 6-05 MINIMUM MEMORY REQUIREMENTS FOR AN LU-TYPE PICC PLATFORM
(With various fare products quantities)

Sample Objects Stored	384 bit Card	384KB Card*	1KB Card*	2KB Card
Transit Application Profile	Special Case	128	128	NA
PICC Card Holder Profile	Special Case	128	128	NA
Products Objects	Special Case	2 @ 256	12 @ 1,536	NA
Product Index Object	Special Case	128	128	NA
Add & Deduct Value History Object (4 entries plus copy)	Special Case	640	640	NA
Transaction History Object (10 entries plus copy)	Special Case	1,408	1,408	NA
Digital Signature per Product	Special Case	256	1,536	NA
				NA
Total Bits/Bytes	384 (48 bytes)	2,944 (368 bytes)	4,096 (512 bytes)	NA

Note: PICCs being supplied by various vendors will often specify data memory sizes that have less usable space than the total advertised. In this case, reduction of one or two fare products from the configuration shown will usually reduce memory utilization to accommodate this decreased memory availability.

7.0 PICC ADMINISTRATIVE NUMBER

This section describes the serialization, printing, and specification for the administration number for the PICC.

The Administration Number consists of a unique PICC Serial Number plus a manufacturer ID taken from Table 7-01 in RIS 3.0, Part-2, with a leading zero and a check digit added to the end. The administrative number is assigned to uniquely identify the PICC, to track its usage in the system, and for customer service including but not limited to: Customer service, Autoload, and fraud analysis. The Administration number is the only number that will define a PICC within the AFC system.

7.1 Electronic Serial Number

Currently most PICC integrated circuit (IC) or die manufacturers encode smart cards with a 4-byte electronic serial number that is unique per IC Manufacturer/Licensee and unalterable. For some PICC types, this will increase to a six or seven-byte number and may contain manufacturer ID information as described in section 3.5 herein. Electronic Serial Numbers (ESN) is NOT guaranteed to be sequential or unique across manufacturers. The PATH and Smart Link projects will utilize a standard seven-byte representation of the unique PICC electronic serial number and zeroes will be used to pad electronic serial numbers if less than seven byte electronic serial numbers are provided by particular card types.

To create the unique Administrative number a one-byte unique PICC manufacturer code (as defined by the RIS 3.0 Part-02, Table 7-01) will be combined with the above-described manufacturer's ESN (seven bytes) with a leading zero and a check digit appended to the end. This combination of 20 digits is used to make up the Administrative number that is used by the fare collection system as the only number to track the PICC. The 20-digit Administrative number will also be printed on the card.

The 20 digit Administrative number is defined below:

0mmm ssss ssss ssss sssc

Where: Range 0mmm: Leading 0 and 3 digit Manufacturer/Type Code
0 to 255 (see mmm per table 7-01)

ssss: 7-byte, 15 digit giving a serial number count of: 0 to 281,474,976,710,655

(ssss is read from the PICC as part of PICC/PCD communications initialization as defined in ISO/IEC 14443-Part 2 & 3 and section 7.9 of this document. Zero's are used for padding when an electronic chip serial number read from the PICC is less than 7 bytes)

C: Check digit 0 to 9

(Check digit calculated as described in Section 7.3)

7.2 Lot ID Number (Optional)

The lot identification number is assigned and controlled by the PICC manufacturer based on the production and customer data. It is assigned when the production lot is produced and is used for tracking the PICC inventory back to the specific manufacturing batch or lot as well as the customer it was manufactured for. Printing of the lot ID on, or encoding it within the PICC is optional, but if used will be as defined in section 7.5 below.

7.3 Administrative Number Check Digit Calculation Method

To verify the correctness of the Administration number on data entry or for customer service, a Check Digit is appended to the printed or displayed Administration number, and carried through the database. This section describes the process in which the Check digit is calculated.

The leading zero, Manufacturer/Type [mmm] Code, Electronic ID (s...s) and any padding zeroes that create 19 digits are multiplied by a series of weights (...2, 1, 2, 1, 2, 1) starting with the rightmost digit. The units and tens digits of each resultant product are added together as single digits. The resultant must be divisible by 10 or the Card Administration printed number is invalid.

The calculation involves adding the units and tens digits of each resulting product without the check digit's product value (while keeping its position for multiplier placement) and choosing a value that will take the result to the next multiple of ten. This is the same algorithm used for Credit and Debit Card check digit calculation.

Example:

	0 m m m	s s s s	s s s s	s s s s	s s s c
Sample Digits	0 1 2 3	0 1 2 3	4 5 6 7	8 9 0 1	2 3 4 9
Multiplier	2 1 2 1	2 1 2 1	2 1 2 1	2 1 2 1	2 1 2 1
Result	0 1 4 3	0 1 4 3	8 5 12 7	16 9 0 1	4 3 8 9

Addition= 0+1 +4+3 +0+1+4+3 +8+5+1+2+7+1+6+9+0+1+ 4+3+8+9 = 80 = Valid

Calculation: 71 + C = 80 (the next multiple of ten after 71), therefore c = 9

7.4 Assignment of Administrative Numbers

Administrative numbers should be assigned by a single PICC manufacturer in sequential order whenever possible. Since PICCs will typically be procured in multiple orders, coordination is required between the scheme operator and the PICC manufacturer to ensure that assignment of Administrative numbers for each new order continues in sequence with the previous order.

A process must be established within each scheme to confirm that a duplicate Administrative number has not been assigned to two or more PICCs. In the event a duplicate Administrative number is found, the related PICC must be reported to the scheme owner and the manufacturer and must be destroyed or returned according to a defined procedure.

Note: Unbroken sequencing of Administrative numbers cannot be guaranteed since serial numbers are assigned before final quality checks are performed and actual yield is likely to be less than 100 percent. Accordingly, some PICC serial numbers may be missing once PICCs are packaged for shipping to the scheme owner/operator. The PICC manufacturer and or PICC encoder/initializer must report serialization breaks to the scheme owner/operator at time of shipment.

7.5 Manufacture Information Lot Code

(Optional, but recommended)
The PICC Manufacture Information Lot Code is a string of six characters consisting of a two digit Manufacturer's Print Code, a two-digit year of manufacture and a two-digit week of manufacture as defined below. The Manufacture Information Code is printed on the card and is not electronically encoded. The printed value is taken from Table 7–01 and has a relationship to the Manufacturer's Identification number in that table. The year YY and week WW are printed only to provide the date of manufacturing. Implementation of this option allows for a quick confirmation of the origin of the PICC to facilitate research, in particular when electronic access to PICC memory is not possible.

Manufacturer Information Code: AAYYWW

AA = Manufacturer's Print Code (from Table 7-01, Print Code)

YY = Year of manufacture. Two-digit numeric value. Example: Year 2003 = 03.

WW = Week of manufacture. Two-digit numeric value. Example: Week of March 09 (2003) = 11.

Example: AK0311 would represent an ASK card manufactured in week 11 of the year 2003.

Notes: If printed with the PICC Administrative Number, the Manufacture Information Lot Code would appear as follows (Also see Figure 8-02 & 8-03). Two spaces should appear between the last digit of the Administrative number and the Manufacture Information Code.

0mmm ssss ssss sssc AAYYWW

The Manufacturer ID Byte included in some chip manufacturer's seven Byte Serial numbers is to be used only as part of the chip serial number. If included on some card types, it will be ignored but will continue to be used as part of the

chip electronic serial number. This manufacturer ID Byte will have no relationship to the Manufacture/Type Code mmm described in Table 7-01.

TABLE 7-01 RIS MANUFACTURER IDENTIFICATION

MMM-Code	Manufacturer	AA-Print Code	Notes
001-009	ASK	AK	
010-019	Spare		
020-029	Cubic/CTS	CT	
030-039	ERG	ER	
040-049	G&D	GD	
050-059	Spare		
060-069	Fujitsu	FJ	
070-079	Spare		
080-089	Gemplus	GP	
090-099	Spare		
100-109	Innovision	IV	
110-119	Spare		
120-129	Kovio	KV	
130-139	Spare		
140-149	OTI	OT	
150-159	Spare		
160-169	Philips	PL	
170-179	Spare		
180-189	Schlumberger	SB	
190-199	Spare		
200-209	Texas Instruments	TI	
210-219	Spare		
220-229	Sony	SY	
230-239	Spare		
240-255	Port Authority RIS	PA	
000	Reserved		Not to be used!

7.6 Generation of Cross Reference Look-up Table (Optional)

In the event that a reference number (rather than the actual Administrative number) is printed on the PICC the following procedure must be implemented.

During the final PICC encoding and testing stage at the manufacturer or encoder's facility, a table must be generated to create a cross-reference between the value printed on the surface of the PICC and the encoded PICC Administrative number. This approach eliminates visible exposure of the true Administrative number and may also be utilized to facilitate unbroken sequencing of the values printed on the PICC.

The Cross Reference table must be delivered to the scheme owner/operator in a mutually acceptable format via a secure method. The Table will be similar to the example shown in Table 7-02.

TABLE 7-02 CROSS-REFERENCE LOOKUP TABLE EXAMPLE

Electronic IC Serial Number	Printed Number
0001 0000 0000 5555 0001	0001 0000 0000 0000 5555
0001 0000 0000 5556 0001	0001 0000 0000 0000 5556
0001 0000 0000 5590 0001	0001 0000 0000 0000 5557
0001 0000 0000 5592 0001	0001 0000 0000 0000 5558

The Cross-Reference table should utilize an ASCII text file or Excel® spreadsheet format.

The ASCII text file will contain one-line per issued card.

The Cross-Reference table line format is defined as follows:

Electronic Serial number Four bytes<four spaces> Printed Serial Number Four Bytes<space> <carriage-return>

Carriage return: <standard ASCII carriage return character>.

7.7 Manufacturers' Early Access Code Scheme (Optional)

The ISO/IEC 14443 Part-3 (2001) specification does not provide for early detection of a manufacturers product code. There is a scheme that does permit the early detection of the PICC manufacturer however but, with no specific product identification. This early manufacturers code can be located in the Table-11 of 14443 Part-3. Table-11 represents the use of ISO/IEC 7816-6/AM1 that calls out a limited set of PICC integrated circuit manufactures by use of a two-digit code. The ISO/IEC 14443 standard enables Table-11 but selecting a

"Cascade" level of two or three. This is achieved through the use of Table 7-03 below that was extracted from ISO/IEC 14443 Part-3 standard. This table supports either the use of a double or triple size UID (Unique Identifier).

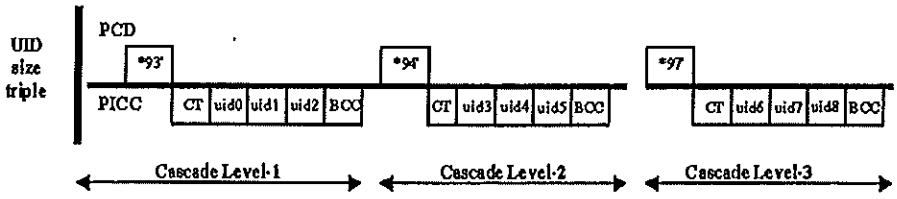
TABLE 7-03 ISO/IEC 14443 UID SIZE

Cascade Level	UID Size	Number of UID bytes
1	Single	4
2	Double	7
3	Triple	10

The following implementation in conjunction with the use of ISO/IEC 14443 Part-3 (2001) specification provides for an early detection of the manufacturers unique ID as well as that of the manufactures specific product identifier. This method is applicable for Type –A PICCs only.

Note: Caution is advised in adopting this early product identifier since this implementation is not approved by the ISO/IEC committees as of the release of this document.

Most PICC integrated circuit manufacturers either support a Single or Double UID Size. In the case of the Double UID Size there are 7 bytes represented in which 6 bytes are used for the actual serial number and a 7th byte used to represent the manufactures two-digit code (uid0). Implementing a Cascade level-3 permits the use of 10 bytes. This early detection of the manufacturers product unique ID can be accommodated in the empty bytes 8-10 if Cascade level-3 is implemented. This is the method that is recommended to provide this feature. Figure 7-01 below represents the "Usage of Cascade Levels".



* These values are taken from the ISO 14443 Part-3 (2001) Table-6 "Coding of SEL" that select the Cascade levels from 1-3

Figure 7-01 Usage of Cascade Levels

Once Cascade level 3 is selected, there are three additional bytes made available for product identification or added serialization. Since a six-byte serial number is already significant in size, there is no further need to allocate morel bytes to increase the size of serialization. Further, providing both the integrated circuit manufacturers ID and a specific product ID grants an even larger unique serial number count. Two of the three bytes in this implementation; uid7 and uid8

are now allocated for the manufacturers product ID's. Implementing Table-7-01 (RIS Manufacturers ID) from this document by allocating these two UID bytes allows for the use of the three-digit code scheme. The three digits are assigned per Table 7-04. The lower nibble of the byte designated by uid8 may be used to increase the product codes by greater than ten per manufacturer by changing the least significant bit to a one (1) or 00000001. If more than 20 product ids are needed than uid8 would be coded as 00000010 and so on.

Uid9 will be reserved for future use and all bits in this byte and well as the most significant bits (high nibble) of uid8 must be set to zero (0) as a default value.

TABLE 7-04 RIS MANUFACTURER IDENTIFICATION WITH ISO/IEC 14443 PART-3

mmm-Code	Manufacturer	AA-Print Code	Uid7	Uid8
001-009	ASK	AK	00000001 - 00001001	00000000 Or 00000001 * * For 10 or more additional values
010-019	Spare		00001010 - 00010011	00000000 Or *00000001
020-029	Cubic/CTS	CT	00010100 - 00011101	00000000 Or *00000001
030-039	ERG	ER	00011110 - 00100111	00000000 Or *00000001
040-049	G&D	GD	00101000 - 00110001	00000000 Or *00000001
050-059	Spare		00110010 - 00111011	00000000 Or *00000001
060-069	Fujitsu	FJ	00111100 - 01000101	00000000 Or *00000001
070-079	Spare		01000110 - 01001111	00000000 Or *00000001
080-089	Gemplus	GP	01010000 - 01011001	00000000 Or *00000001

nnnn-Code	Manufacturer	AA-Print Code	Uid7	Uid8
090-099	Spare		01011010 - 01100011	00000000 Or *00000001
100-109	Innovision	IV	01100100 - 01101101	00000000 Or *00000001
110-119	Spare		01101110 - 01110111	00000000 Or *00000001
120-129	Kovio	KV	01111000 - 10000001	00000000 Or *00000001
130-139	Spare		10000010 - 10001011	00000000 Or *00000001
140-149	OTI	OT	10001100 - 10010101	00000000 Or *00000001
150-159	Spare		10010110 - 10011111	00000000 Or *00000001
160-169	Philips	PL	10100000 - 10101001	00000000 Or *00000001
170-179	Spare		10101010 - 10110011	00000000 Or *00000001
180-189	Schlumberger	SB	1011010 - 10111101	00000000 Or *00000001
190-199	Spare		10111110 - 11000111	00000000 Or *00000001
200-209	Texas Instruments	TI	11001000 - 11010001	00000000 Or *00000001
210-219	Spare		11010010 - 11011011	00000000 Or *00000001
220-229	Sony	SY	11011100 -	00000000

mmm-Code	Manufacturer	AA-Print Code	Uid7	Uid8
			11100101	Or *00000000
230-239	Spare		11100110 - 11101111	00000000 Or *00000001
240-255	Port Authority RIS	PA	11110000 - 11111111	00000000 Or *00000001
000	Reserved		Not to be used!	00000000

8.0 PICC LAYOUT AND PRINTING SPECIFICATION

Layout and printing specifications must be consistent with the physical construction of the PICC so that appealing printing and embossing aesthetics are achieved.

8.1 PICC Construction

PICC dimensional construction layout requirements are provided to ensure that the PICC printing and optional embossing specifications can be implemented. Figure 8.01 established these areas in which the module, antenna and embossing can be properly positioned.

Note: Embossing of PICCs is not recommended to the potential for damage to the silicon and/or antenna modules.

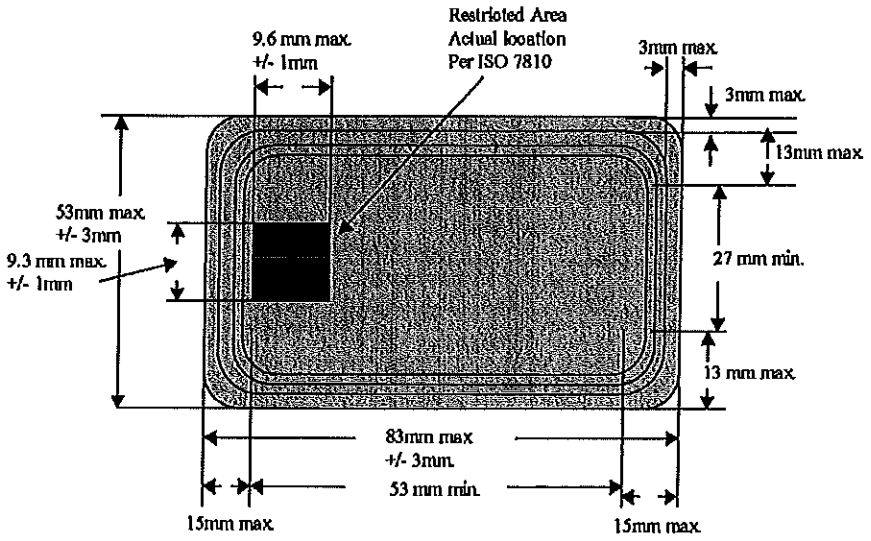


Figure 8-01 Smart card dimensions

Note: The die area specified is per standard contact module specifications defined in ISO/IEC 7810.

8.1.1 Physical Packaging

The PICC body must be fully compliant with ISO/IEC 14443 Part-1. PICCs bodies may be made from Polyethylene Terephthalate (PET) plastic or a composite of PET and Polyvinyl Chloride (PVC). The scheme owner/operator

should reserve the right to require PVC where appropriate. Small quantity orders and first production cards will most likely use PVC materials.

Note: PVC materials emit toxic gases if burned and, therefore, must be properly fire-protected if held in storage in large quantities.

8.1.2 Printed Layout and Finish

The PICC should have a Fine Matte finish on the back (where the PICC Administrative number is typically printed) and Fine Matte or glossy finish on the front (where full color graphics and cardholder personalization elements are normally applied).

Note: The scheme owner/operator may elect to finish both sides of the PICC in Fine Matte or glossy.

Color selection for virgin stock: Pantone High White plastic material.

See example PICC Layout Figures 8-02A&B and 8-03A&B below:

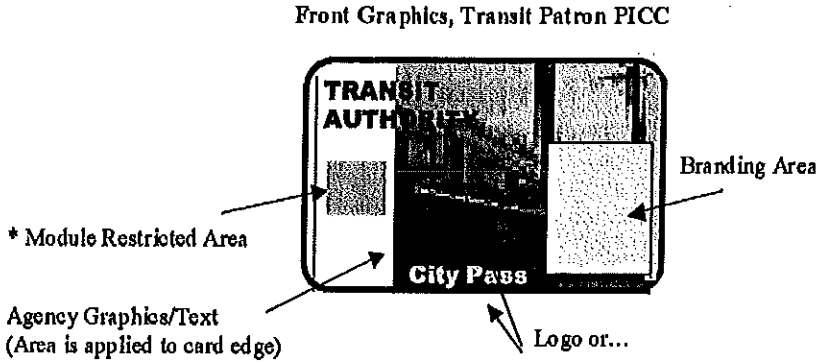


Figure 8-02A Front Graphics, Transit Patron PICC

Note: PICCs that are pre-printed may use the "restricted die area" since the printing is accomplished prior to the die lamination process thereby eliminating the potential for damage to the module.

The printing of the Administration Number and Lot ID should be durable such that they will be readable after 3 years of normal use.

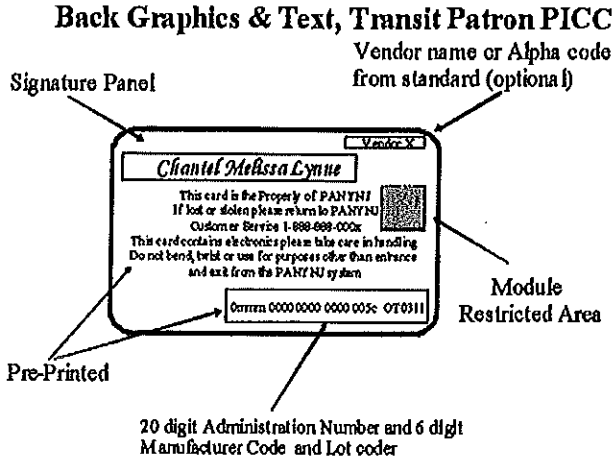


Figure 8-02B Front Graphics, Transit Patron PICC

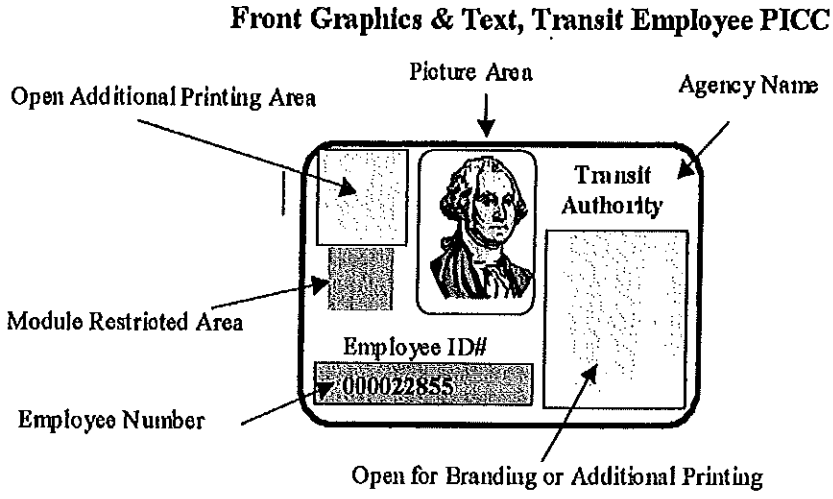
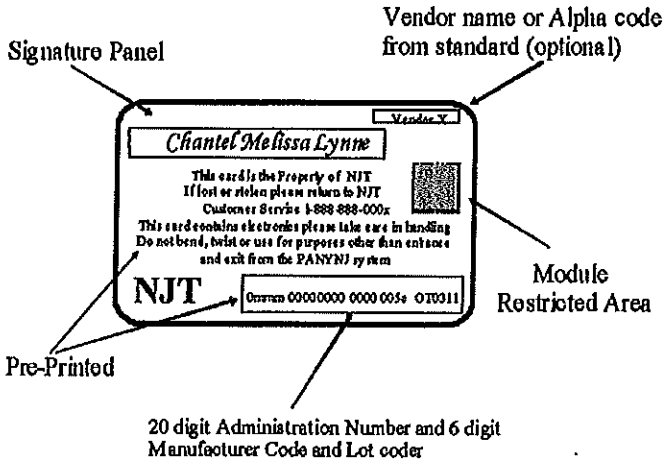


Figure 8-03A Front Graphics, Transit Employee PICC

Back Graphics & Text, Transit Employee PICC



8.1.3 Varnishing/Hard Coating

If the manufacturer applies varnish/hard coat to the PICC, it must be applied after all printing. PICCs that are shipped without a printed PICC Administrative number must be free of varnish/hard coating in this space to allow for subsequent printing of the PICC Administrative number.

8.1.4 Embossing (Not Recommended)

Embossing will be a desired option by some of the issuers of PICCs. Typical bankcard embossing requires support for up to four lines of embossing. Since a PICC contains a contactless circuit and an antenna that covers a broader area of the PICC body, the overall area available for embossing is limited. Accordingly, embossing of PICCs is not recommended. If embossing is required, the fourth line must be omitted since it would damage the antenna that typically occupies the periphery of the PICC.

9.0 PICC SHIPPING AND HANDLING (ISSUERS AND MANUFACTURERS)

PICCs contain a fragile electronic integrated circuit device that is placed within a paper or plastic laminated packaging material. Although these packaging materials provide a degree of protection for the circuit, they are still very susceptible to damage caused by excessive bending and or applied pressure. This is particularly true for paper-based PICC products. In addition, PICCs shipped in boxes of hundreds of units can exhibit deteriorating of the printed graphics if incorrectly packaged. This section addresses the required handling and shipping of PICCs.

9.1 PICC Supplier/Manufacturer Packaging for shipment

Manufacturers are required to ship PICCs in individual cartons of 500 units. Each carton is to be packed in such a manner that each PICC is tightly pressed against each other to prevent one PICC from having space to rub against the next units in the package. Loosely packed cartons allowing the movement of the PICCs during shipment or transport usually causes varying degrees of damage to the PICC surface.

Shipments of PICCs are required to be in double wall cardboard boxes with no more than six cartons per shipping box. The shipping box must meet or exceed the corrugated "Mullen Testing" standard per Table 9-01.

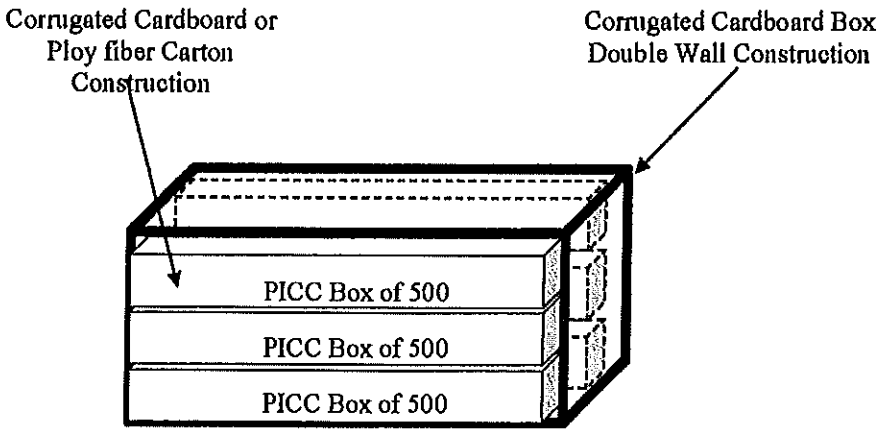


Figure 9-01 PICC Six cartons per box recommended shipping

TABLE 9-01 CARDBOARD BOX CONSTRUCTION SPECIFICATION

Double Wall Corrugated Board		
Bursting Test (MULLEN)	**Maximum Weight Limit**	**Edge Crush Test (ECT)**
200#	80 lbs.	42 ECT
275#	100 lbs.	48 ECT

9.2 Mailing PICCs

9.2.1 US Postal System

To mail a PICC, it is necessary to understand how the standard US Postal System handles mail. The US Postal System typically uses standardized letter handling equipment throughout the nation for feeding, reading, sorting and postage cancellation. This equipment is designed to handle standardized letter formats with dimensions of less than 6.125 inches in height and 11.5 inches in length with an aspect ratio not to exceed 1.3:2.5. This equipment processes thousands of letters each hour by a combination of optical character reading (OCR) and or barcode scanning. In order to achieve this throughput, fully automated optical sorters require the letter packaging material and its contents to be reasonably flexible in nature. Since standard plastic 30 mil +/- 3 mils smart cards are not classified as reasonably flexible in nature they are encouraged by the US Postal System to be handled in a different manner. This non-standard mailing method is referred to as the "Flat System" and recommends that the mailing package be made of a thin cardboard such as those used in a CD-ROM mailer. See Diagram 9-02 for the dimensions of this-type of package.

9.2.2 Metered Mail

In addition to the above requirements to mail a PICC, it is necessary to apply postage to each package via a postage meter rather than using stamps or other "live postage". Since metered mail is not cancelled, it avoids the cancellation press equipment that could damage the fragile electronic integrated circuit within the card if the cancellation press-head were to come in contact with the circuit. It is recommended that PICC mailers be shipped in batches using postal trays.

9.2.3 Mail Irradiation

The process of mail irradiation can be applied at the option of the US Postal Service to all mail sent through the US Postal System. This is the process of exposing mail with a focused radioactive beam to remove the possible treat of Anthrax. Although most mail will not be exposed to this radioactive process, mail addressed to any member of the US Government, especially Congressmen, Cabinet members and the President and most US Government-specific ZIP codes in the Washington DC area are most likely to undergo this process.

Irradiation being applied to some PICCs in preliminary tests has proven to cause PICC package discoloration and circuit failure especially if the strength of the beam exceeds 56 kGy. The government applies 56 kGy on a single pass of the mail. A second pass (although unlikely to occur) will greatly increase the chance of PICC circuit failure and discoloration since this will be the equivalent of 112 kGy exposures. It is the responsibility of the PICC issuer to notify the PICC supplier if such type of mailing irradiation will occur.

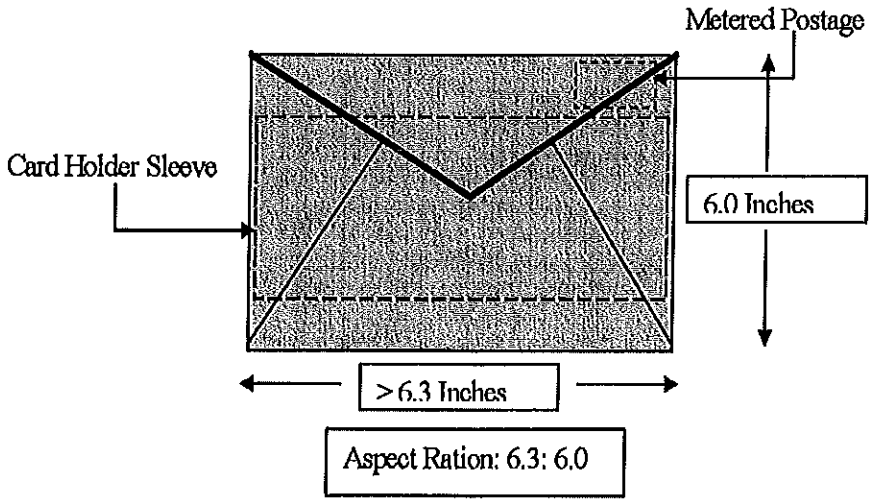


Figure 9-02 PICC/CD Mailer

9.2.4 Shipping and Handling Guideline Summary

Items 1 through 7 below identify potential problems that should be avoided and provide guidelines to prevent damage to PICCs during shipping and handling.

Refer to Section 7.0 of this document for other PICC guidelines and specifications.

1. PICCs should never be processed by mail equipment or other automated optical handling equipment that applies to the PICC package any twist or bending of less than 2.0 inches in diameter in either the transverse or longitudinal direction. Additionally, PICCs housed within mailers should not be processed in equipment with media transport speeds at or above 100 inches per second (such as the Optical DBCS-III Sorter Model 995 used by the United States Postal Service). Use of this type of machine may cause excessive stress to the integrated silicon device (die) and

mounting module/antenna within the card. External damage may not be noticeable in most cases but may substantially impact PICC performance.

2. All PICCs should be placed within an approved credit card-type card insert handler. If the PICCs are individually mailed, the card insert handler should be placed in a padded envelope with dimensions of at least 6.0 inches long by 6.3 inches wide. No more than two cards may be placed in an envelope of this type and the handler should be located in the center of the envelope.

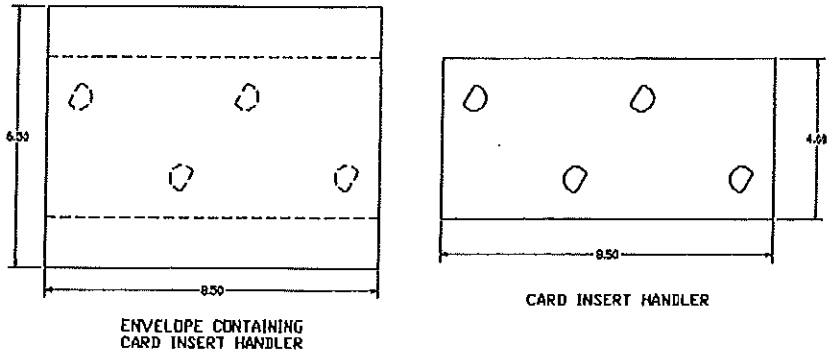


Figure 9-03 Envelope dimensions

3. All envelope mailings should be registered and pre-metered to avoid the use of any type of postage cancellation equipment.

4. Bulk shipments should be sent in tightly packed boxes of approximately the same height and width of a standard card as described in ISO 7810. The PICCs must not be allowed to shift or rub against each other during shipping or handling as the printed surface of the PICCs may deteriorate.

   Note: PICCs having a glossy finish will exhibit a higher degree of surface damage over that of matte or fine matte finish.

5. Boxes holding large quantities of PICCs should be made of corrugated cardboard that provides reasonable shock or damage protection to the physical properties of the PICCs (a box surrounded by Styrofoam "peanuts" is highly recommended. The number of PICCs in a single box should not exceed 500.

6. Not more than 1000 PICCs should be stacked vertically—face to back.

7. PICCs should not be subjected to long periods of stress bending especially in temperatures less than 10 °C or greater than 30 °C. This could result in permanent deformation of the PICCs.

9.3 Patron Return Procedure for PICCs

Damage to the PICC (due to improper handling) is inevitable; accordingly a PICC return/replacement process must be established by the scheme owner/operator. This process should include a method to evaluate the damage that has occurred.

10.0 APPENDIX-A

10.1 Limited Use PICC Specification

10.2 INTRODUCTION

Limited Use PICCs are designed to satisfy the need for a low cost fare media with limited features and expected lifecycle.

10.3 PHYSICAL SPECIFICATION

The Limited Use PICC will adhere to ISO/IEC 14443 Part-1 (2000-04-15 version) with the exception the following exceptions. (Note: the following specifications are part to ISO 14443 Working Group – 8 as a new work order as of the publishing of this document).

The Limited Use PICC shall have physical characteristics according to the requirements of the card type ID-1 with modifications to the thickness and construction materials specification. This specification in all cases uses the ID-1 "X" and "Y" dimensions of approximately 84mm x 53mm with ISO 7810 specified tolerances of +/- 0.02mm. In addition, the thickness shall adopt the ISO/IEC 15457-1 & 3 Thin Flexible Card specifications were applicable. The modified thickness specification recognizes and classifies two distinct types (See Figures A-1, A-2, A-3 and A-4 also see Table 5):

Type: LU_ID-1M (Identification Card Modified) with a thickness (z) of):
400um (0.40mm) +/- 20um (0.02mm)

Type: LU_TFC.1 (Thin Flexible Card) with a thickness of:
270um (0.27 mm) +/- 20um (0.02mm)

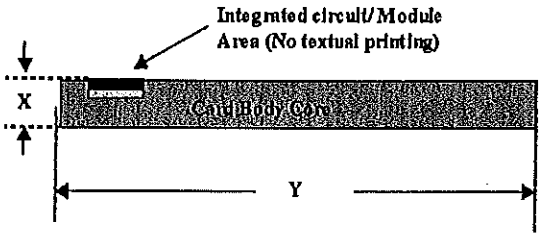


Figure A-1 (LU_ID-1M card format)

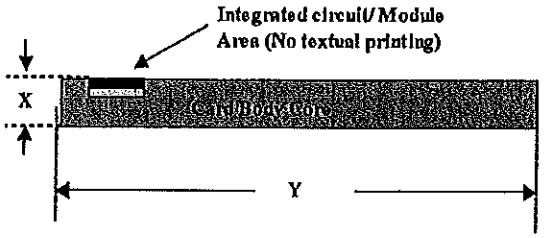


Figure A-2 (LU_TFC.1 card format)

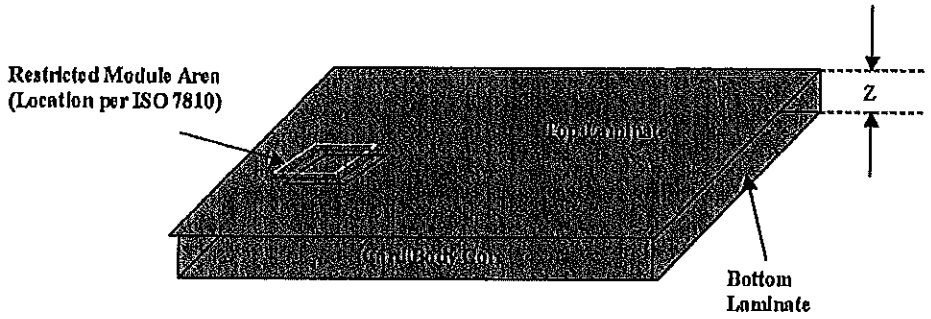


Figure A-3 (LU_ID-1M card format)

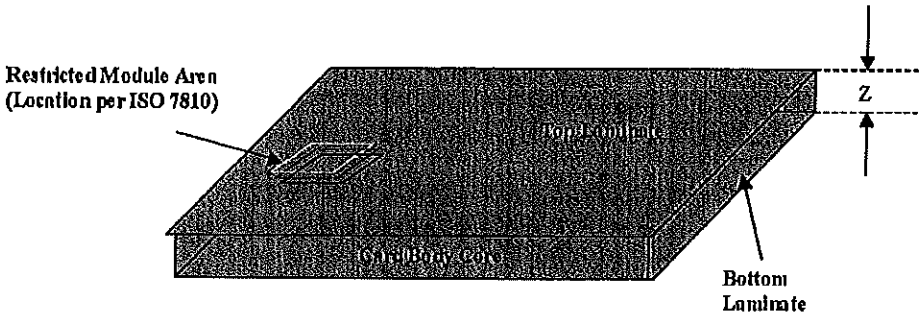


Figure A-4 (LU_TFC.1 card format)

10.3.1 PICC Materials

Limited Use card materials shall be extended to include other than generically referred to plastic. The expected lifecycle of the PICC will need to be taken into account in the selection of these card materials. Post printing of the PICC shall be accommodated if required by the application usage excluding the PICCs Restricted Module Area as defined by the card manufacturer. (See Table 1A).

TABLE 1A PERMITTED MATERIALS AND PACKAGE THICKNESS

Type	Paper	Composite	Plastic
*LU_TFC.1 (Size)	270um +/- 20um	270um +/- 20um	270um +/- 20um
LU_ID-1M (Size)	400 um +/- 25um	400 um +/- 25um	400um +/- 25um
Note: Table entries refer to the nominal thickness of the material plus tolerance.			

Note: The die thickness with laminated printed package material must not exceed the maximum PICC package thickness specification for either the 270um or 400um packaging.

10.3.2 Surface Material

PICC surface materials must be capable of meeting post-printing requirements as defined within the individual card printing specification of the scheme owner/operator. *(See Materials Reference in this section)*

10.3.3 Antenna Material

Materials used for the construction of the antenna must be consistent with the required electrical and physical stress specifications required by ISO/IEC 14443 as well as the extended specification in this document. Suggested materials that can be applied are listed in the Materials Reference at the end of this section.

10.4 LU PICC LIFECYCLE

LU PICCs must be designed and packaged in a manner that permits a minimum lifecycle of:

Packaging Material	Lifecycle	Environment
Paper	5 days	Less than 90% humidity
Paper with Poly or other coating	35 days	Less than 95% humidity
Poly (PET or PVC)	100 days	Less than 95% humidity

The lifecycle values in the table assume 4 uses per day. These uses are defined as a completed transaction containing either reads or writes of the PICC data plus security. A completed transaction is defined as an event where a patron presents a PICC within the PCD/CID's active field and allows it to remain in the field until the transaction is completed. Such transactions may include: Entry via a transit Faregate, Farebox, Validator, AVM or a retail application utilizing a POS terminal configured with a PCD/CID.

10.5 DYNAMIC BENDING AND STRESS

10.5.1 Stress Testing

Stress Testing	Full compliance to ISO 14443 Part –1 including the call out for ISO 10373. In addition, the PICC body with fully functional integrated module/IC and antenna must not fail when subjected to ISO 14443-1, Section 4.3.3 of the Dynamic Bend test with an increased h, A= 26mm and h, B=12mm.

10.5.2 Torsion Testing

Torsion Stress	Full compliance to ISO-14443 Part-1 including the call out for ISO 10373. In addition, the PICC body with fully functional integrated module/ IC and antenna must not fail when subjected to ISO 14443-1, Section 4.3.4 of the Dynamic Torsional test with angle of rotation of 20 degrees.

10.6 EMBOSSING

No provision for embossing.

10.7 MATERIALS REFERENCE

Suggested Antenna materials:

- Silver,
- Aluminum
- Copper-alloy

Suggested Card Surface Materials:

- Triplex: Poly/Paper/Poly
- Paper with Poly Protective coating
- Poly on Poly
- Paper

Note: Poly can be made up of either PET or PVC materials

10.8 Electrical & Distance Activation Specification

Limited Use PICCs will adhere to all of ISO/IEC14443-2 with the additional of the following specifications:

10.8.1 Activation

A PICC placed in the active field of the PCD will become fully activated if within 3.0 cm of the PCD antenna surface at minimum. The PCD emitted field strength will adhere to ISO/IEC 14443 Part-2 (Amp/Meter) specification to achieve this LU minimum fully active distance.

10.8.2 Bit Rate

ISO/IEC 14443-2 section 8.1.1 and 8.2.1 addressing a standard bit rate of 106kbits/sec will be extended to optionally support a higher bit rates up to 212kbits/sec. All Bit rates within the ISO/IEC 14443 amended and approved standard that are beyond the required 212kbits/sec. are acceptable.

10.9 Data Block/Records Length

Data Blocks/Records will be 16 bytes in length.

10.9.1 Data Memory

Data memory will be no greater than 1K Byte of usable space.

Note: This memory limitation is necessary to adhere to the intended purpose and application of the product to remain as a low cost, limited application and limited lifecycle product.

10.10 Initialization and Anti-collision

Limited Use will adhere to ISO/IEC14443-3 but will require that the Anti-collision scheme for both type "A" and "B" be placed in a "Detect Only" mode of operation. This mode will detect that more than one valid PICC is in the field but, will not perform any read or write functions. Instead, the PCD/CID issues a logical signal that can be interrupted by the hosting equipment to present a warning message to the patron.

10.10.1 Anti-Collision Type

Anti-collision is addressed in ISO/IEC14443-3 for both type A and type B PICCs to PCD sequencing. Limited Use PICC's will have the type of anti-collision made optional as per the following sections:

10.10.1.1. Bit Collision Detection – Type A PICCs

In ISO/IEC14443-3 section 6.1.5.3, type A PICCs use bit collision detection protocol in the event that more than one PICC is present in the volume of the PCD active field creating a potential collision. The PCD must arbitrate in a manner that only one PICC is read or written to at a time. Limited Use will require that an option be made available to select an Anti-collision mode for "Detect Only". If this mode is enabled, the PCD sequence will detect that two or more PICCs are in the active field and will create an output status bit to report such an event to the hosting processor for the patron display. If this event occurs while this type of anti-collision is operative, the PCD will not allow any further PICC to PCD activity to take place until one of the PICCs in the active PCD field is

removed. In Table A.1, bit b12 may be used to signify that a LU type of PICC is using an anti-collision scheme other than that specified in ISO/IEC 14443 Part-3.

Note: This section of the ISO/IEC 14443 Part-3 is under review by the standards committee for change. Bit B12, will most likely be re-assigned to a reserved bit.

10.10.1.2. Bit Collision Detection – Type B PICCs

In ISO/IEC 14443-3 section 7.3 through 7.8.2 type B PICCs collisions are time slot marked for Anti-collision processing in the event that more than one PICC is present in the volume of the PCD active field. The PCD must arbitrate in a manner that only one PICC is read or written to during a given period of time. Limited Use will require that an option be made available to select an Anti-collision mode for "Detect Only". If this mode is enabled, the PCD sequence will detect that two or more PICCs are in the active field and will create an output status bit to report such an event. If this event occurs while Anti-collision is in this mode, the PCD will not allow any PICC to PCD activity to take place until only one PICC is in the active PCD field.

10.11 Product Identification

LU PICC product identification is not defined in ISO/IEC14443-3 with respect to type A or type B. The following two sections create the necessary modifications to ISO/IEC 14443-3 to allow for early PICC product-type detection.

10.11.1 Type A Platforms

In section 6.4.2.1 of Part 3 of ISO/IEC 14443, the standard states the availability of 4 "Proprietary coding" bits for the Answer to Request (ATQA). As stated by the standard, these are bits 9 to 12. The following table depicts the utilization of these proprietary bits to identify a LU or FF-type A platform baud rate. The use of bits b9-b11 will track the latest ISO/IEC in draft standard for support of higher baud rates.

TABLE A.1 BAUD RATE OF TYPE A PICC

Baud Rate and LU Indicator	b12	b11	b10	b9
106 k bits sec	0	0	0	0
212k bits sec	0	0	0	1
424 k bits sec	0	0	1	0
848 k bits sec	0	1	0	0
Proprietary bit for LU anti-collision use or Reserved bit	1	0	0	0

10.11.2 Type B Platforms

In section 7.7.3 of Part 3 of ISO/IEC 14443, the standard states the availability of an AFI coding byte in the Application Data portion of the Answer to Request (ATQB) format to represent Transport related applications. As stated by the

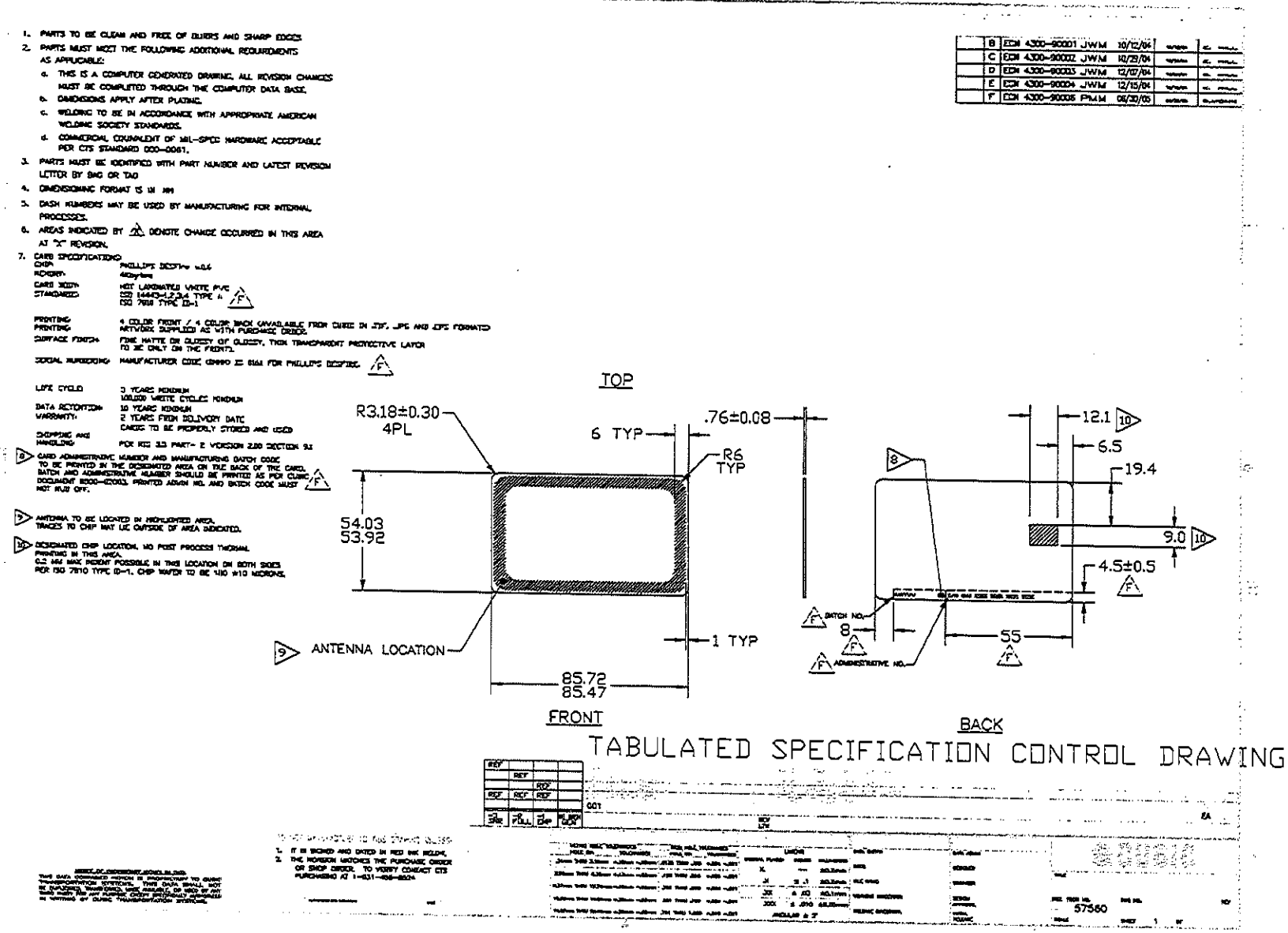
standard, the coding of the Application Family Identifier (AFI) allows for the coding of the Least Significant half byte of the AFI with hexadecimal values ranging from '1' to 'F'. The RIS shall require the value of the "Least Significant half byte" of the AFI to be set to '1' resulting with a coding of '1,1' for the AFI to represent LU platforms of 512 bits and a coding of '1, 2' for LU platforms of 1,024 bits.

TABLE 4A.2 LU IDENTIFICATION OF TYPE B

AFI Most Significant half byte	AFI Least Significant half byte	Use
'1'	'0'	Default
'1'	'1'	Future LU
'1'	'2'	Future LU
'1'	'3'	Future LU
'1'	'4'	Transit 384 bite single product LU platform
'1'	'5'	Transit 512 bite single product LU platform
'1'	'6'	Transit 1 Kbytes duo product LU platform
'1'	'7'	Transit FF platform

10.12 Transmission Protocol

Limited Use PICCs will not support or utilize ISO/IEC 14443-4.


1. PARTS TO BE CLEAN AND FREE OF BURRS AND SHARP EDGES
2. PARTS MUST MEET THE FOLLOWING ADDITIONAL REQUIREMENTS AS APPLICABLE:
a. THIS IS A COMPUTER GENERATED DRAWING. ALL REVISION CHANGES MUST BE COMPLETED THROUGH THE COMPUTER DATA BASE.
b. DIMENSIONS APPLY AFTER PLATING.
c. WELDING TO BE IN ACCORDANCE WITH APPROPRIATE AMERICAN WELDING SOCIETY STANDARDS.
d. COMMERCIAL COUNTERPART OF MIL-SPEC HARDWARE ACCEPTABLE PER CTS STANDARD 000-0001.
3. PARTS MUST BE IDENTIFIED WITH PART NUMBER AND LATEST REVISION LETTER BY BAG OR TAG
4. DIMENSIONING FORMAT IS IN MM
5. DASH NUMBERS MAY BE USED BY MANUFACTURING FOR INTERNAL PROCESSES.
6. AREAS INDICATED BY ⚠ DENOTE CHANGE OCCURRED IN THIS AREA AT "X" REVISION.
7. CARD SPECIFICATIONS:
CHIP: PHILLIPS SCRYPTO v3.4
MEMORY: 4Kbytes
CARD BODY: HOT LAMINATED VINYL PVC
STANDARDS: ISO 14443-1,2,3,4 TYPE A ⚠F
ISO 7810 TYPE ID-1
PRINTING: 4 COLOR FRONT / 4 COLOR BACK (AVAILABLE FROM CUBIC IN .TIF, .JPG AND .EPS FORMATS
PRINTING: ARTWORK SUPPLIED AS WITH PURCHASE ORDER
SURFACE FINISH: FINE MATTE OR GLOSSY OF GLOSSY, THIN TRANSPARENT PROTECTIVE LAYER TO BE ONLY ON THE FRONT).
SERIAL NUMBERING: MANUFACTURER CODE (0990) IS 0161 FOR PHILLIPS SCRYPTO. ⚠F
LIFE CYCLE: 5 YEARS MINIMUM
100,000 WRITE CYCLES MINIMUM
DATA RETENTION: 10 YEARS MINIMUM
WARRANTY: 2 YEARS FROM DELIVERY DATE
CARDS TO BE PROPERLY STORED AND USED
SHIPPING AND HANDLING: PER MIL 33 PART- 2 VERSION 2.00 SECTION 9.2
8 CARD ADMINISTRATIVE NUMBER AND MANUFACTURING BATCH CODE TO BE PRINTED IN THE DESIGNATED AREA ON THE BACK OF THE CARD. BATCH AND ADMINISTRATIVE NUMBER SHOULD BE PRINTED AS PER CUBIC DOCUMENT 8000-E2003. PRINTED ASIAN MIL AND BATCH CODE MUST NOT RUB OFF. ⚠F
9 ANTENNA TO BE LOCATED IN HIGHLIGHTED AREA. TRACES TO CHIP MAY LIE OUTSIDE OF AREA INDICATED.
10 DESIGNATED CHIP LOCATION. NO POST PROCESS THERMAL PRINTING IN THIS AREA. 0.2 MM MAX INCENT POSSIBLE IN THIS LOCATION ON BOTH SIDES PER ISO 7810 TYPE ID-1. CHIP WAFER TO BE 130 ±10 MICRONS.
TOP
R3.18±0.30
4PL
6 TYP
.76±0.08
R6
TYP
54.03
53.92
1 TYP
ANTENNA LOCATION
85.72
85.47
FRONT
12.1
10
6.5
19.4
9.0
10
4.5±0.5
F
BATCH NO.
8
55
ADMINISTRATIVE NO.
BACK
TABULATED SPECIFICATION CONTROL DRAWING
B ECN 4300-90001 JWM 10/12/04
C ECN 4300-90002 JWM 10/29/04
D ECN 4300-90003 JWM 12/07/04
E ECN 4300-90004 JWM 12/15/04
F ECN 4300-90005 PMM 06/30/05
1. IT IS ENCHED AND DATED IN RED INK BELOW.
2. THE REVISION MATCHES THE PURCHASE ORDER OR SHOP ORDER. TO VERIFY CONTACT CTS PURCHASING AT 1-631-406-6824
57560

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DESIGN INFORMATION BULLETIN

FOR THE

NEXTFARE™

SMART CARD SERIALIZATION AND PRINTING

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Proprietary Notice

Cubic Transportation Systems, Inc.
5650 Kearny Mesa Road
San Diego, CA 92111 USA

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REVISION STATUS

(Template Revision Date: 11 Nov 04)

Revision	Date	Description
A.00	24 Apr 03	Initial release
B.00	10 Mar 04	Minor revisions to document.
C.00	20 Oct 04	Clarification for printing of administration and soft numbers.
D.00	21 Jan 05	Included Limited Use Cards.
E.00	17 May 05	Added Magnadata to manufacturer list
F.00	10 Aug 05	More details of Administration Number and addition of Appendix A

Author/Project Engineer Brian Monk	Date	Director, System Architecture–Devices Pradip Mistry	Date
Received by Configuration Management	Date	Technical Editor Cynthia Jones	Date

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1. INTRODUCTION

This document describes the serialization, printing, and user display specification for transit smart cards. It specifically describes Nextfare™ Central System (NCS) specifications for card serialization with respect to the:

- Administration Number—A unique serial number assigned to identify the smart card and track its usage in the system and for customer service, autoload, fraud analysis, etc.
- Batch ID—An identification number assigned to the production batch that can, if required, be used to track the distribution of smart cards
- A sequentially generated soft serial number that may be used as supplemental to the batch ID number.

1.1 ACRONYMS AND ABBREVIATIONS

CSC	Contactless Smart Card
CSV	Comma-separated variable
Cubic	Cubic Transportation Systems, Inc.
HPEM	High-Production Encoding Machine
ID	Identification
ISO	International Organization for Standardization
NCS	Nextfare Central System
UID	Unique Identity
0x	Hexadecimal notation

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2. SMART CARD SERIALIZATION

This section provides the specification for the administration number that will be used by the Nextfare Central System or the card issuer for smart card tracking.

2.1 ELECTRONIC SERIAL NUMBER (RECOMMENDED)

Currently, most smart card chip manufacturers encode smart cards with a 4-byte electronic serial number that is unique per chip manufacturer/licensee and is unalterable. For some card types, this will increase to a 6- or 7-byte number. Electronic serial numbers are NOT guaranteed to be sequential or unique across manufacturers. A 1-byte unique smart card chip code and the manufacturers electronic serial number are used to make up a unique number that is used by the NCS or the card issuer to track the smart card. This number is used for autoloading, hot listing, and customer service activities and is 8 bytes long.

Because of its unique and unchangeable properties, it is recommended that the chip's electronic serial number Unique Identity (UID) be used wherever possible.

2.1.1 Soft Serial Number

Customers that desire smart card serial numbers to be sequential have the option to use a "soft" serial number. However, soft serial numbers are not applicable to limited-use cards. Where applicable, a soft serial number can be assigned and managed by the NCS. Soft serial numbers can be printed and electronically coded by the card manufacturer on request. The card manufacturer will electronically encode a 4-byte sequential soft serial number in an unused area of card memory per the following:

- Phillips MIFARE® memory cards—A 4-byte serial number in File 0 Record 1
- Cubic *GO CARD®* —A 4-byte serial number in File 15 Record 7

The NCS or card issuer will provide the beginning soft serial number. The manufacturer will also supply a comma-separated variable (CSV) electronic file that lists the soft serial and electronic serial number for the delivered smart cards.

Up to 4 bytes of space (0 to 4, 294, 967, 295) are potentially available in the regional transit application Contactless Smart Card (CSC) Issue Record and the Regional Interface Specification Transit Application Profile Object to record the soft serial number. If a soft serial number is used, it should be copied to the serial number location specified in the released version of the data format specification on card initialization. Limited-use cards such as MIFARE UltraLight and Innovision Jewel™ do not support a soft serial number.

2.1.2 Batch ID Number

The batch identification number is assigned and controlled by the card manufacturer. It is assigned when the batch is produced and is used for tracking the card inventory by batches and card distribution from issuer to point-of-sale and other distribution outlets.

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3. SMART CARD PRINT LAYOUT

This section provides a typical graphical layout and the printed numbering specifications for transit smart cards. It is recommended that the card issuer produce a detailed dimensioned drawing and artwork for the front and rear of the card to explicitly specify all of the card's details, graphics printing, and any other postproduction printing that may be required. It is also recommended that sample cards are produced and approved prior to commencement of full card production.

3.1 PRINTING ON SIDE 1

Figure 1 is a typical example of the print layout that may be required for a transit smart card on side 1, normally referred to as the front side. It indicates areas that may be restricted for printing due to the contactless and contact chip modules. The restricted areas are generally in accordance to ISO 14443, ISO 7810, and ISO 7816 standards where applicable, but may vary slightly depending on the card type and manufacturer. The exact details and graphics are subject to agreement between the card issuer and the card supplier. Contact module, signature panel, cardholder name, and user photograph are not normally applicable to limited-use cards.

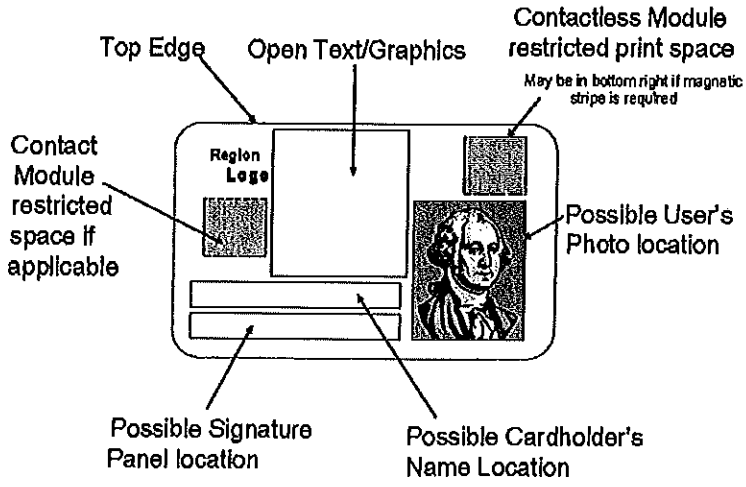

Figure 1. Smart Card Side 1 (Front) Printing Example

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3.2 PRINTING ON SIDE 2

Figure 2 is a typical example of the print layout for a transit smart card on side 2, normally referred to as the back of the card. It indicates the area that may be restricted for printing due to the contactless chip module, which will vary depending on the card type and manufacturer. Exact details and graphics are subject to agreement between the card issuer and the card supplier. Soft serial number printing is not recommended and not normally applicable to limited-use cards.

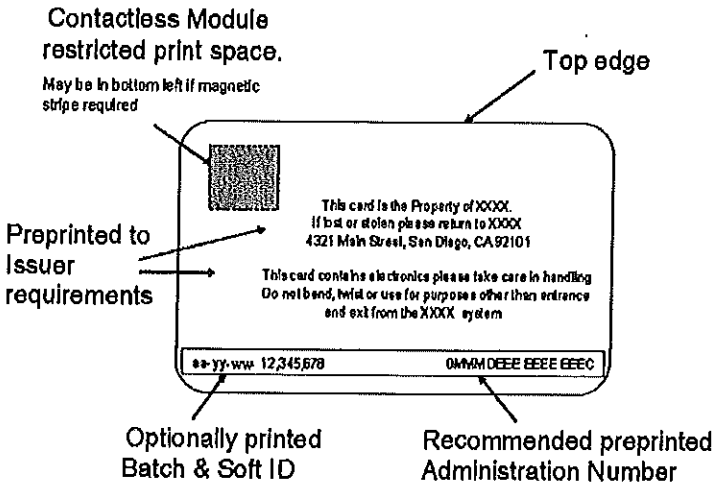

Figure 2. Smart Card Side 2 (Rear) Printing Example

The printing of the administration number and batch ID should be durable such that they will be readable after 3 years of normal use.

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3.2.1 Printed Administration Number

The administration number is printed by the card manufacturer in the bottom right-hand corner as shown in Figure 2. The format of the printed administration number follows:

- For 4 bytes, the serial number is: 0MMM 0EEE EEEE EEEC
- For 6 or 7 bytes, the serial number is: 0MMM EEEE EEEE EEEE EEEC

Where:

		Range
• MMM:	Card Chip Type Code	0 to 255
• EEEE:	For a 4-byte serial number	0 to 4, 294, 967, 295
• EEEE:	For a 6- or 7-byte serial number	0 to 281, 474, 976, 710, 655 (6 Bytes)
• C:	Check digit	0 to 9, see Figure 3

- Zeros are used for padding to emulate the standard credit card printing format.

3.2.1.1 Printed and Displayed Administration Number Check Digit

To verify the correctness of the administration number on data entry or for customer service, a check digit is appended to the printed or displayed administration number. This section describes the process in which the check digit is calculated.

The card chip type (MMM) code, electronic ID (E...E) and any padding zeroes are multiplied by a series of weights (...2, 1, 2, 1, 2, 1) starting with the right-most digit as shown in Figure 3. The units and tens digits of each product are added together as single digits. The result must be divisible by 10 or the card administration printed number is invalid.

The calculation involves adding the units and tens digits of each resulting product without the check digits product value (while keeping its position for multiplier placement) and choosing a value that will take the result to the next multiple of ten. This is the same algorithm used for credit and debit card check digit calculation.

Printed Administration Number	0	M	M	M	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	C
Example	0	1	2	3	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	9
Multiplier	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1
Result	0	1	4	3	0	1	4	3	8	5	12	7	16	9	0	1	4	3	8	9

Addition for Verification: 0+1+4+3 +0+1+4+3 +8+5+1+2+7+1+6+9+0+1+4+3+8+9 = 80 = Valid

Calculation: 71 + C = 80 (the next multiple of ten after 71), therefore C = 9

Figure 3. Check Digit Calculation and Verification

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NOTE

The Printed Administration Number contains additional padding zeroe/s (0) and a check digit (C). The Printed Administration Number is only used for print and display purposes. The 4-byte or 7-byte chip IDs, together with the manufacturer ID number as encoded on the smart card, forms an 8-byte System Administration Number that is used for autoload, hot lists and in transactions generated by the fare collection equipment. See Appendix A for examples of specific card chip types.

3.2.1.2 Manufacturer Type Code

The manufacturer ID byte included in some manufacturer's 7-byte serial numbers (e.g. 04 in Philips DES*Fire*® and UltraLight Unique IDs) is not required to be included in the Printed Administration Number because it does not necessarily uniquely describe the card type, and it can be replaced by the unique CSC card chip code (MMM) that is shown in Table 1.

Table 1. Smart Card Printing Codes

MMM Card Chip Code	Manufacturer and Type	aa Card Manufacturer Code
0	Reserved	
001	MIFARE UltraLight limited use card (48 bytes)	Card manufacturer's aa code
002	MIFARE UltraLight 2 limited use card	Card manufacturer's aa code
003	Innovision Jewel limited use card	Card manufacturer's aa code
004-007	Reserved for other limited use cards	
008-009	Spare	
010-019	ASK	AK
020-029	Cubic/CTS	CT
020	Cubic/CTS GO CARD 02	Card manufacturer's aa code
030-039	Spare	
040-049	G&D	GD
050-059	Spare	
060-069	Fujitsu	FJ
070-079	Spare	
080-089	Gemplus	GP
090-099	Spare	
100-109	Innovision	IV

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MMM Card Chip Code	Manufacturer and Type	aa Card Manufacturer Code
110-119	Spare	
120-129	Kovio	KV
130-139	Magnadata	MD
140-149	OTI	OT
150-159	Spare	
160-169	Philips	PL
160	Philips MIFARE Classic	Card manufacturer's aa code
161	Philips DES*Fire*	Card manufacturer's aa code
170-179	Spare	
180-189	Axalto	AX
190-199	Spare	
200-209	Texas Instruments	TI
210-219	Spare	
220-229	Sony	SY
230-255	Spare	

3.2.2 Batch ID and Soft Serial Number Printing

If the card issuer also requires a printed batch and/or soft serial number, either or both could also be printed on applicable card types to the issuer's specification. The issuer should take precautions in specifying the CSC artwork and printing position and dimensions to make sure that two sets of printed numbers will not confuse the cardholder. The soft serial number can only be printed without the card administration number if this is supported by the specific version of Nextfare.

The issuer should be made aware that if they want the printed soft serial number linked to the administration number and also require it to be tracked by the NCS that these numbers will need to be:

- Generated and printed by a High-Production Encoding Machine (HPEM) (if the issuer has an HPEM)
- Entered manually and printed by a point-of-issue with risk of human error (not recommended)
- Entered manually at the NCS console with risk of human error (not recommended)
- Encoded and printed by the card manufacturer as specified in Section 2.1.2.

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NOTE

Print smart card soft serial numbers after all quality control procedures have been completed to avoid missing soft sequence numbers.

Where applicable, the batch ID and the soft serial number may be printed by the card manufacturer in the bottom left-hand corner of the card as shown in Figure 2. The batch ID and the soft serial number will be formatted:

aa-yy-ww-12,345,678

Where:

- aa — Is the card manufacturer code as described in Table 1
- yy — Is year of the batch
- ww — Is week of the batch
- 12,345,678 — Is the soft serial number with leading zeroes suppressed (where applicable)

As an example, for a Cubic manufactured *GO CARD* produced in the third week of January 2002, the formatted print data would be:

02 03 CT 45,678

Alternatively, if the administration number is not printed on the smart card and only the soft serial number is printed, then it is recommended that it be printed at the bottom left-hand corner including a check digit and the year code as follows:

Soft Serial Number:	C	0	Y	Y		0	0	E	E		E	E	E	E		E	E	E	E
Example:	4	0	0	4		0	0	4	2		9	4	9	6		7	2	9	5
Multiplier:	1	2	1	2		1	2	1	2		1	2	1	2		1	2	1	2
Result:	4	0	0	8		0	0	4	4		9	8	9	12		7	4	9	10

Addition for Verification: 4+0+0+8+0+0+4+4+9+8+9+1+2+7+4+9+1+0 = 70 = Valid

Calculation: C + 66 = 70 (the next multiple of ten after 66), therefore C = 4

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4. USER DISPLAYS AND RECEIPTS

This section provides the specification for:

- Displaying the administration number at information and customer service consoles
- Printing the administration number on receipts

4.1 USER DISPLAYS

The administration number will be formatted and displayed as in Section 3.2.1. The format of the displayed administration number will be consistent with the number printed on the smart card.

When the administration number is retrieved from the NCS or device generated transactions, it will be an 8-byte number without the check digit. The retrieved serial number is formatted prior to display as follows:

- Strip out manufacturer IDs (most significant 2 bytes), leaving a 6-byte serial number.
- Format the serial number.
- Append 0MMM.
- Calculate check digit.
- Display in credit card format with spaces between each set of 4 digits, i.e. (0MMM 1234 1234 1234 123C).

4.2 RECEIPTS

For printing on receipts, the process described in Section 4.1 to format the administration will be followed. However, security considerations exist with a full print of the administration number such as:

- Registering anonymous CSCs using a printed number
- Hot listing CSCs via pranks or malicious intent

Therefore, following the determination of a formatted number, the print format for the administration number of receipts will be:

```
**** **** **** **** 123C
```

The last 4 digits (three plus the check digit) are the only digits printed. This is consistent with the printing of credit card number receipts.

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APPENDIX A

EXAMPLES OF SPECIFIC CARD UIDs AND ADMINISTRATION NUMBERS

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REVISION	DATE	DOCUMENT NAME	DOCUMENT NUMBER	PAGE
F.00	10 Aug 05	DIB for the Nextfare Smart Card Serialization and Printing	8500-62003	A-3

Table A-1. MIFARE Classic 1k

MIFARE Classic 1k Chip ID = 0xA0 = Decimal 160

Card UID Bytes[1] (Hex) 3 2 1 0	System Administration No. (Hex)	Printed/Displayed Administration No. (Dec) Omnm eeee eeee eeec
00 35 11 49	A0 00 00 00 00 35 11 49	0160 0000 3477 8331
08 4B 12 4A	A0 00 00 00 08 4B 12 4A	0160 0013 9137 6104

Note:
1 As per MIFARE Data Sheet

Table A-2. MIFARE DES*Fire*

MIFARE DES*Fire* Chip ID = 0xA1 = Decimal 161

Card UID Bytes[1] (Hex) 0 1 2 3 4 5 6	System Administration No. (Hex)	Printed/Displayed Administration No. (Dec) Omnm eeee eeee eeee eeec
04 35 11 49 72 1B 80[2]	A1 04 35 11 49 72 1B 80	0161 0583 4836 2931 0721
04 4B 12 49 72 1B 80[2]	A1 04 4B 12 49 72 1B 80	0161 0825 4191 3709 4405

Notes:
1 As per DES*Fire* Data Sheet
2 *04* is not included in Printed/Displayed Number calculation

Table A-3. MIFARE UltraLight

MIFARE UltraLight Chip ID = 0x01 = Decimal 001

Card UID Bytes[1] (Hex) 0 1 2 3 4 5 6	System Administration No. (Hex)	Printed/Displayed Administration No. (Dec) Omnm eeee eeee eeee eeec
04 35 11 49 72 1B 80[2]	01 04 35 11 49 72 1B 80	0001 0583 4836 2931 0725
04 4B 12 49 72 1B 80[2]	01 04 4B 12 49 72 1B 80	0001 0825 4191 3709 4409

Notes:
1 As per UltraLight Data Sheet
2 *04* is not included in Printed/Displayed Number calculation

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REVISION	DATE	DOCUMENT NAME	DOCUMENT NUMBER	PAGE
B	02/01/2005	ART, FRONT, SMARTLINK	9387-31001	1 of 1

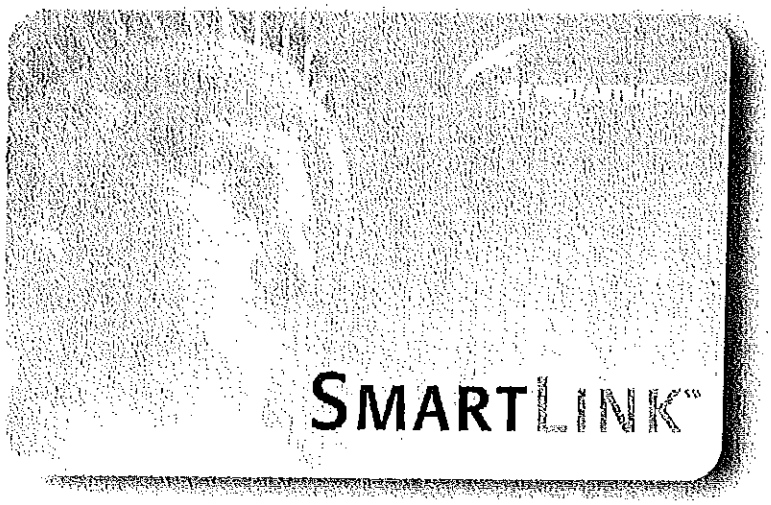
REVISION STATUS

Revision	Date	Description
A	11/05/2004	Initial Release
B	02/01/2005	ECN 4300-90005 PG

Project Engineer **Date**
Will Barley

Program Manager **Date**
Eric Hill

Received by CM **Date**



PANG1012_06.28.04
The Port Authority of NY & NJ_SmartLink Card
Option C1 – Revised 2

Note:

1. Use customer provided EPS graphics enclosed within accompanied ZIP file 9397-31001.B.Smartlink.zip.
2. See PDF file of proof document enclosed within accompanied ZIP file above for color details.

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REVISION	DATE	DOCUMENT NAME	DOCUMENT NUMBER	PAGE
C	02/16/05	ART, BACK, SMARTLINK, FULL	9387-31002-2	1 of 1

REVISION STATUS

Revision	Date	Description
A	11/30/04	Initial Release
B	02/07/05	ECN 4200-90013
C	02/16/05	ECN 4200-90014

Project Engineer *Will Barley* Date

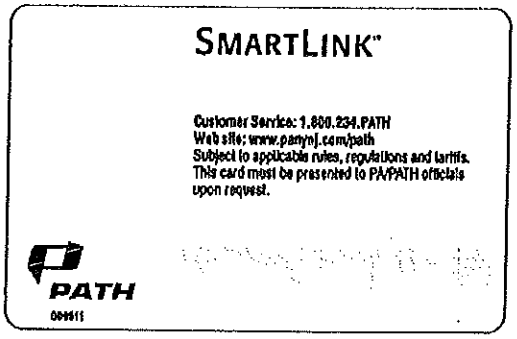
Program Manager *Eric Hill* Date

Received by CM Date

See proof provided with 9387-30001 for other specific instructions.

Use file 9387-31002-2.C.AI

Back Full Fare



Dynamic Type Specifications

Serial Number
Character: Helvetica Condensed Bold - Uppercase
Font Size: 7pts

Manufacturer Information Lot Code
Character: Helvetica Condensed Bold - Uppercase
Font Size: 5pts