![EMVCo logo]

EMV®
Contactless Specifications for Payment Systems

Book A

Architecture and General Requirements

Version 2.11
June 2023

Legal Notice

The EMV® Specifications are provided "AS IS" without warranties of any kind, and EMVCo neither assumes nor accepts any liability for any errors or omissions contained in these Specifications. EMVCO DISCLAIMS ALL REPRESENTATIONS AND WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT, AS TO THESE SPECIFICATIONS.

EMVCo makes no representations or warranties with respect to intellectual property rights of any third parties in or in relation to the Specifications. EMVCo undertakes no responsibility to determine whether any implementation of the EMV Specifications may violate, infringe, or otherwise exercise the patent, copyright, trademark, trade secret, know-how, or other intellectual property rights of third parties, and thus any person who implements any part of the EMV Specifications should consult an intellectual property attorney before any such implementation.

Without limiting the foregoing, the Specifications may provide for the use of public key encryption and other technology, which may be the subject matter of patents in several countries. Any party seeking to implement these Specifications is solely responsible for determining whether its activities require a license to any such technology, including for patents on public key encryption technology. EMVCo shall not be liable under any theory for any party's infringement of any intellectual property rights in connection with the EMV Specifications.

Revision Log – Version 2.11

This section outlines notable updates that have been made to this specification since the publication of the *EMV Contactless Specifications for Payment Systems, Book A Architecture and General Requirements, Version 2.10*.

Incorporated changes described in the following Specification Bulletin:

Specification Bulletin no. 277: Try Another Interface - Terminal Behavior

Specification Bulletin no. 278: Update of Book A and B Due to Introduction of Book C-8

Minor editorial changes

Contents

Figures

Tables

Requirements

1   Scope

With the goal of realising universal acceptance of contactless cards in an international interchange environment, EMVCo has developed a design for contactless payments that is compatible with existing payment system solutions, whilst offering the opportunity for the eventual development of a common EMV contactless acceptance solution.

The design defines a generalised POS System environment that includes:

- reader functionality,

- terminal functionality,

- Entry Point software that performs the initial analysis of a contactless transaction and invokes appropriate kernel software, and

- several kernels, each of which provides processing appropriate to certain contactless transactions.

This specification (Book A) describes the overall architecture, plus requirements for general features not specific to Entry Point or individual kernels. The other specifications in the suite, listed in section 2.1, describe Entry Point, the kernels, and the communication protocol.

1.1   Audience

This specification is intended for use by manufacturers of readers and terminals. It may also be of interest to manufacturers of contactless cards and to financial institution staff responsible for implementing financial applications in contactless cards.

1.2 Overview

This volume includes the following chapters and annexes.

Chapter 1 contains general information that helps the reader understand and use this specification.

Chapter 2 lists related specifications and standards.

Chapter 3 describes conventions used in this specification.

Chapter 4 defines key terms used throughout the specifications, including card, transaction, POS System, Entry Point, kernel, and Outcome.

Chapter 5 describes the architecture of the POS System discussed throughout the specifications.

Chapter 6 describes all Outcomes and associated parameters.

Chapter 7 provides on overview of user interaction.

Chapter 8 defines POS System requirements.

Chapter 9 provides recommendations for the user interface, including the use of visual and audio indications of the transaction status.

Chapter 10 outlines performance requirements.

Annex A provides an overview of the data elements used in the *EMV Contactless Specifications for Payment Systems*.

Annex B provides guidance on Outcome and parameter setting.

Annex C is a glossary of terms and abbreviations used in this specification.

2 References

The following specifications and standards contain provisions that are referenced in this specification. The latest version shall apply unless a publication date is explicitly stated.

If any provision or definition in this specification differs from those in the standards listed in section 2.3, the provision or definition herein shall take precedence.

2.1 Volumes of the Contactless Specifications

This specification is part of an eleven-volume set:

Book A: Architecture and General Requirements

Book B: Entry Point Specification

Book C-2: Kernel 2 Specification

Book C-3: Kernel 3 Specification

Book C-4: Kernel 4 Specification

Book C-5: Kernel 5 Specification

Book C-6: Kernel 6 Specification

Book C-7: Kernel 7 Specification

Book C-8: Kernel 8 Specification

Book E: Security and Key Management

Level 1 Specifications for Payment Systems, EMV Contactless Interface Specification

2.2 EMV Documents

EMV documents are available on the EMVCo website: http://www.emvco.com/

	EMV Integrated Circuit Card Specifications for Payment Systems, including the following and all applicable Specification Bulletins:
[EMV Book 1]	*EMV Integrated Circuit Card Specifications for Payment Systems*, Book 1, Application Independent ICC to Terminal Interface Requirements
[EMV Book 2]	*EMV Integrated Circuit Card Specifications for Payment Systems*, Book 2, Security and Key Management
[EMV Book 3]	*EMV Integrated Circuit Card Specifications for Payment Systems*, Book 3, Application Specification
[EMV Book 4]	*EMV Integrated Circuit Card Specifications for Payment Systems*, Book 4, Cardholder, Attendant, and Acquirer Interface Requirements

2.3 ISO Standards

ISO 639-1	Codes for the representation of names of languages – Part 1: Alpha-2 Code.
	Note: This standard is updated continuously by ISO. Additions/changes to ISO 639-1:1988: Codes for the Representation of Names of Languages are available on:
	http://www.loc.gov/standards/iso639-2/php/code_changes.php
ISO 4217	Codes for the representation of currencies and funds.
ISO 14443-3	Identification cards – Contactless integrated circuit(s) cards – Proximity cards – Part 3: Initialization and anticollision
ISO/IEC 8859	Information Processing – 8-bit Single-Byte Coded Graphic Character Sets.

3   Conventions

This specification uses the following conventions.

'0' to '9' and 'A' to 'F'	16 hexadecimal characters
*n*b, *nn*b, *nnn*b, ...	Binary values
xx	Any value
proprietary	Not defined in this specification and/or outside the scope of this specification
may	Denotes an optional feature
shall	Denotes a mandatory requirement
should	Denotes a recommendation

3.1   Requirement Numbering

Requirements in this specification are uniquely numbered with a four-part numeric identifier appearing next to each requirement.

A requirement may have different numbers in different versions of the specification. Hence, all references to a requirement must include the version of the specification as well as the requirement's number.

3.2   Data Element Formats

The *EMV Contactless Specifications for Payment Systems* use the following data element formats.

A	Alphabetic data elements contain a single character per byte. The permitted characters are alphabetic only (a to z and A to Z, upper and lower case).
an	Alphanumeric data elements contain a single character per byte. The permitted characters are alphabetic (a to z and A to Z, upper and lower case) and numeric (0 to 9).

ans   Alphanumeric Special data elements contain a single character per byte. The permitted characters and their coding are shown in the Common Character Set table in *[EMV Book 4]* Annex B.

      There is one exception: The permitted characters for Application Preferred Name are the non-control characters defined in the ISO/IEC 8859 part designated in the Issuer Code Table Index associated with the Application Preferred Name.

b   These data elements consist of either unsigned binary numbers or bit combinations that are defined elsewhere.

      Binary example: The Application Transaction Counter (ATC) is defined as "b" with a length of two bytes. An ATC value of 19 is stored as Hex '00 13'.

      Bit combination example: Processing Options Data Object List (PDOL) is defined as "b" with the format shown in *[EMV Book 3]* section 5.4.

cn   Compressed numeric data elements consist of two numeric digits (having values in the range Hex '0'–'9') per byte. These data elements are left-justified and padded with trailing hexadecimal 'F's.

      Example: The Application Primary Account Number (PAN) is defined as "cn" with a length of up to ten bytes. A value of 1234567890123 may be stored in the Application PAN as Hex '12 34 56 78 90 12 3F FF' with a length of 8.

n   Numeric data elements consist of two numeric digits (having values in the range Hex '0'–'9') per byte. These digits are right-justified and padded with leading hexadecimal zeroes. Other specifications sometimes refer to this data format as Binary Coded Decimal ("BCD") or unsigned packed.

      Example: Amount, Authorised (Numeric) is defined as "n 12" with a length of six bytes. A value of 12345 is stored in Amount, Authorised (Numeric) as Hex '00 00 00 01 23 45'.

var.   Variable data elements are variable length and may contain any bit combination. Additional information on the formats of specific variable data elements is available elsewhere.

4   Terminology

The *EMV Contactless Specifications for Payment Systems* define the processing of a transaction using a contactless card and processed on a POS System that includes Entry Point and one or more kernels, with information passed within the POS System by means of an Outcome. Each of the key terms in that sentence has a particular meaning in the specifications, as described in the following sections.

4.1 Card

Within these specifications, a card is considered to be any consumer token supporting contactless payment transactions, whether in the form of a payment chip card, a key fob, a mobile phone, or another form factor. From the perspective of a contactless reader, the other form factors communicate and behave the same as a contactless card that is compliant with *Level 1 Specifications for Payment Systems, EMV Contactless Interface Specification*. With respect to cardholder verification, mobile devices may take advantage of the user interface on the handset to allow cardholder verification of a contactless transaction by means of a confirmation code entered on the handset.

4.2 Transaction

Within these specifications, a transaction (unless otherwise specified) is considered to be one conducted over the contactless interface with a contactless card.

A transaction start is defined differently depending on how it is initiated. It can be initiated by the merchant, typically by entering the transaction amount. Alternatively, it can be initiated when a card enters the polling field and responds, indicating its presence. (Configuration of transaction initiation is described in more detail in section 5.6.2.)

A transaction continues until the final transaction disposition is indicated to the cardholder. This may be immediately after the kernel processing for an offline approval or decline or after reception of the authorisation response if the transaction is sent online. If further communication with the card is required, then this is a part of the transaction.

If another interface is requested, then the contactless transaction is concluded and a new (non-contactless) transaction is considered to start with whichever alternate interface is selected.

4.3 POS System

Within these specifications, a POS System is the device that communicates with contactless cards, processes contactless transactions, and may support other payment functionalities such as magnetic stripe or contact chip transactions.

The physical architecture can be any of the following:

- Fully integrated terminal: All elements included in a single device.

- Intelligent card reader: The reader handles most of the contactless transaction processing, passing the results for completion by the terminal.

- Combination of terminal and transparent card reader: The reader provides communication with the card, whilst kernels and other processes are in the terminal.

The second and third architectures are representative of adding a contactless reader to an existing contact terminal that may already be deployed.

The basic functions of the POS System include:

- communication with contactless cards

- application selection and kernel activation

- displaying messages to the cardholder

- displaying messages to the merchant

- accepting merchant data entry of the transaction amount

- cardholder verification (e.g. signature)

- provision of online connections

- provision of data capture for clearing and settlement

4.4 Entry Point

Within these specifications, Entry Point is software in the POS System that is responsible for the following:

- performing pre-processing

- discovery and selection of a contactless application that is supported by both the card and the reader

- activation of the appropriate kernel

- handling of Outcomes returned by the kernel, including passing selected Outcomes to the reader

Under exception conditions, Entry Point may return an Outcome to the reader as a result of its own processing.

Detailed information about Entry Point is provided in Book B.

4.5 Kernel

Within these specifications, a kernel is software in the POS System that processes certain contactless transactions. Entry Point selects a kernel based on the characteristics of the transaction, the applications supported by both the card and the reader, and the priority that may be assigned to each application.

Detailed information about the kernels is provided in Books C-*n*.

4.6 Outcome

An Outcome is the primary instruction from the kernel on how processing should be continued. A set of parameters with the Outcome allow the kernel to indicate choices, such as messages to be displayed and whether the kernel wishes to be restarted, for example, after an online authorisation.

When a kernel provides an Outcome, control is passed back to Entry Point which handles certain parameters immediately, then either processes the Outcome or forwards it to the reader as a Final Outcome.

Note: Under exception conditions, Entry Point may not be able to select a kernel and will directly provide a Final Outcome and pass control back to the reader.

Detailed information about Outcomes is provided in Chapter 6.

5   POS System Architecture
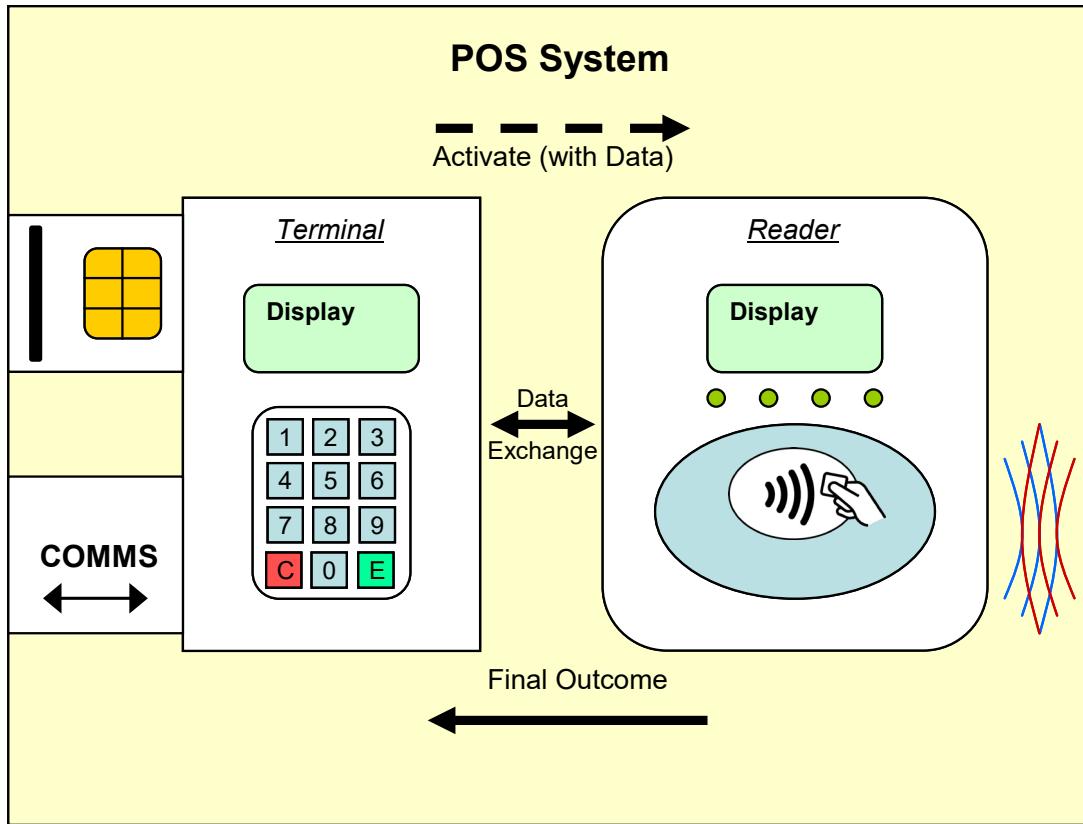
This chapter discusses the architecture of the POS System. The following topics are included:

5.1 POS System Descriptive Model

To accommodate the broad range of possible architectures discussed in section 4.3 without developing detailed requirements for all the individual elements, EMVCo has based its design on the descriptive model shown in Figure 5-1. Conceptually this is along the lines of an intelligent reader device as this is considered to be the most widespread architecture; however, it is not intended to be prescriptive.

Figure 5-1: POS System Descriptive Model

The right hand element represents a reader which communicates with the contactless card and processes the contactless application. It therefore includes the functionality of Entry Point and the contactless kernels. It would also normally contain the user interface of cardholder-facing display, visual status indicators (such as lights or LEDs), and beeper.

The left hand element maps more closely to an EMV contact terminal and includes the merchant input and display, the online communications interface, plus any contact or mag-stripe interfaces. Functions such as signature CVM or online PIN CVM are expected to be acquired the same way as for an EMV contact terminal.

Most of the *EMV Contactless Specifications for Payment Systems* address the reader element; this includes the Communication Protocol to a contactless card (*Level 1 Specifications for Payment Systems, EMV Contactless Interface Specification*), Entry Point (Book B), and the contactless kernels (Books C-*n*).

5.2 Terminal and Reader Responsibilities

Within the descriptive model the reader is responsible for:

- communication with contactless cards

- application selection and kernel activation

- running the contactless kernel applications

- CVM selection

- creation of a Final Outcome and parameter set

- management of a "no card response" timeout

- management of the contactless field

Whilst the terminal is responsible for:

- provision of data entry (amount) by the merchant

- processing of Final Outcomes, including the handling of authorisation requests and responses

- cardholder verification (unless delegated to a cardholder device, such as a mobile phone)

- communication for authorisation messages and clearing records, using mag-stripe or chip-based data

- transactions on other interfaces (contact and mag-stripe)

- other aspects of transaction processing, including timeouts and cancellations
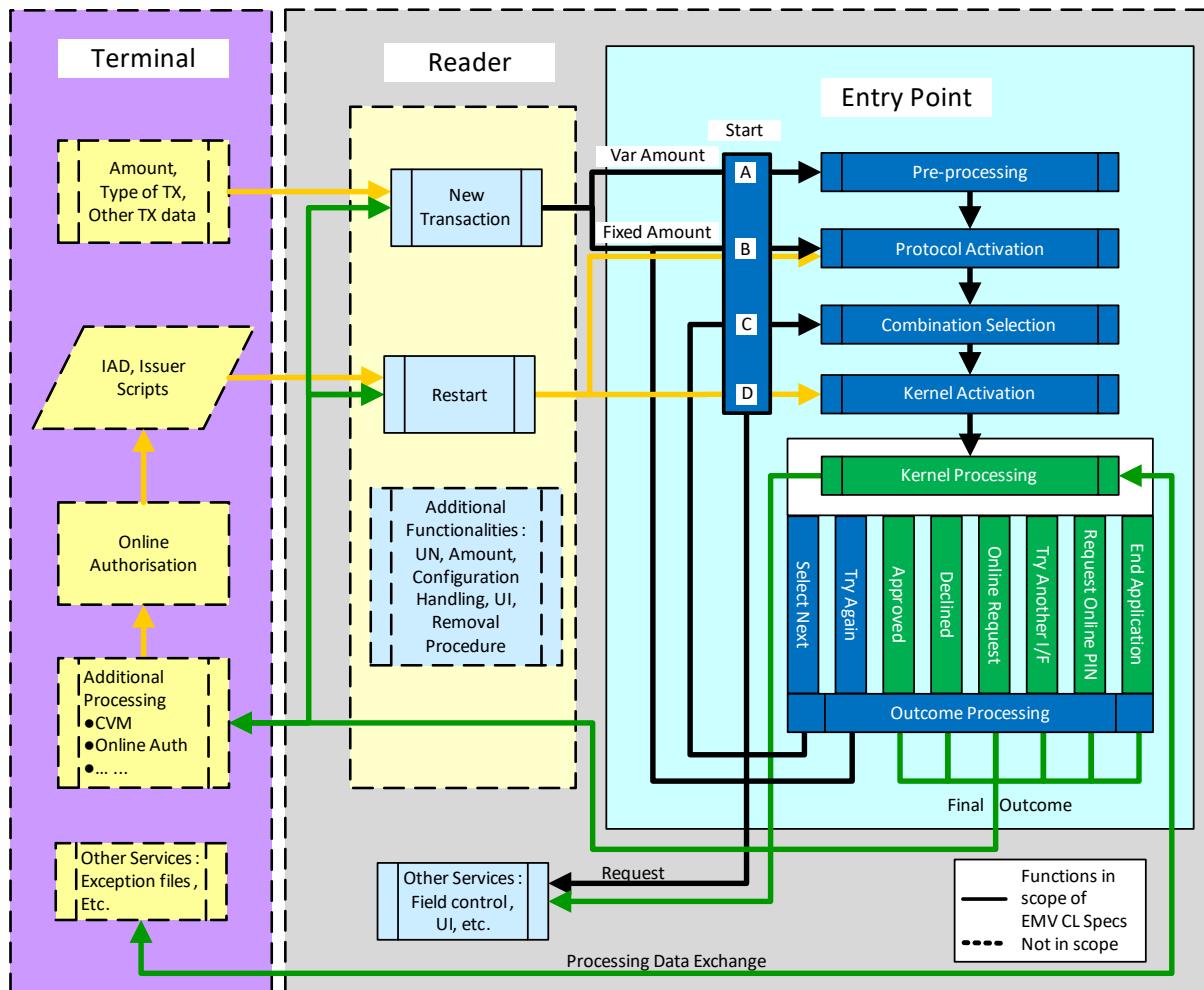
Depending on the design, the terminal and reader are between them also responsible for:

- initiation of new transactions, including card removal and the contactless field state between transactions

- displaying messages to the merchant

- displaying messages and status to the cardholder

- provision of Unpredictable Numbers

- provision of data included in online responses, including Authorisation Response Code, Issuer Authentication Data, and Issuer Scripts

- indication of "unable to go online"

With respect to performance, the reader will be mostly responsible for the "card in field" timing and the terminal for the transaction disposition timing. For details see Chapter 10.

5.3 Logical Architecture

Figure 5-2: Logical Architecture

The reader contains Entry Point and a set of kernels, as illustrated in Figure 5-2.

Terminal and reader requirements in Chapter 8 are based on this model but can be distributed differently between the elements denoted as the terminal and the reader. Nevertheless, for the overall architecture described here to work successfully with all merchant/acquirer acceptance environments, the functional requirements of Chapter 8 must be met.

5.4 Operating Modes

A terminal is installed in an acceptance environment that can handle mag-stripe data, chip data, or both. This information is provided in the Kernel Configuration Data and in conjunction with the card presented will determine the operating mode of an individual transaction: mag-stripe mode or EMV mode. Mag-stripe mode transactions are usually sent online for authorisation, whereas EMV mode transactions may complete offline in the interest of speed, and can be sent online when the situation requires it.

5.5 POS System Functions

This section discusses the following POS System functions:

5.5.1   Non-interference with Contact Chip Interface

For a POS System capable of accepting transactions over multiple interfaces, all permitted interfaces should be made available to the merchant/cardholder to perform a transaction. If the cardholder chooses the contact interface, to prevent interference between the contact chip and contactless interfaces, the POS System must power down the contactless interface prior to initiating a contact chip transaction and keep it powered down for the duration of the transaction.

5.5.2   No Overlapping Transactions

The POS System is responsible for ensuring that a new transaction is not started until the completion of the previous transaction. The completion of a transaction is a combination of the terminal having a transaction disposition and the physical removal of the card from the field. In some environments it may be necessary to employ a removal procedure to ensure that the card has left the field, whereas in others the physical configuration and the way the transaction completes may be sufficient.

Examples:

In some environments, such as a vending machine where the user has to physically collect goods from the bottom of the machine, it is unlikely that the card will be left on the reader or that the next customer will try to make a purchase before the first customer has moved away. Such a POS System could have simple logic to manage card removal and initiation of the next transaction.

In other environments, such as access through a gate or turnstile, it may be important that the POS System checks that a card has been physically removed and that the next transaction is not initiated until the first customer has made sufficient progress through the gate. Note that a removal procedure for the card as defined in *Level 1 Specifications for Payment Systems, EMV Contactless Interface Specification*, section 9.5, could be started when the kernel indicates the Card Read Successfully status,[1] as this is the earliest point in a transaction after which cards can be removed.

Kernels may require a mobile device to be re-presented after entry of a confirmation code and this may be addressed by means of a restart. Some kernels may require the POS System to check that the mobile device was actually removed from the field after the first presentment, possibly by use of the removal procedure between the Final Outcome and the restart.

5.5.3   Cancellation

Once a transaction has been started, there must be a means to cancel the transaction in case the user is unable to present a contactless card within a reasonable amount of time. This may be by means of a timeout or merchants may have a cancel option. To handle these scenarios, depending on the implementation, the POS System may attempt to complete the transaction using another interface, or may terminate the transaction.

---

[1] Status values are discussed in section 9.2.

5.5.4 Field Management

Whether the field is on or off between transactions will depend on the acceptance environment, and the POS System is responsible for ensuring the field condition. For environments with Autorun "No", the field is off between transactions; with Autorun "Yes", the field is on between transactions. This does not preclude the POS System from manipulating the field whilst ensuring the transaction is complete. (Autorun is described in more detail in section 5.6.2.)

Additionally, it is generally recommended for Kernels to always request a field reset or power-off (depending on factors such as cardholder device formfactor) at the end of transaction, for example, by setting an appropriate value for the Outcome Parameter, Field Off Request.

5.5.5 Displaying Amount

In acceptance environments where the Transaction Type and the exact amount are known before the start, the amount must be indicated to the cardholder, preferably by means of a terminal/reader display. In some circumstances the amount may be displayed by labels, such as posted prices on a vending machine. This is typical for EMV mode environments (with Autorun "No") where the Transaction Type and amounts are made known to the reader as the transaction is started.

Other environments may not know the Transaction Type or amount until the interaction with the card is complete. This is typical for mag-stripe mode environments (with Autorun "Yes").

5.5.6 Transaction Disposition

The POS System is responsible for indicating the transaction disposition to the cardholder. The transaction disposition may be obtained directly from the Outcome (if **Approved** or **Declined**), or it may be necessary that an online authorisation be completed first. The manner of indication may be via a message, vending of goods, granting or denying access, or other functions.

An online authorisation will either result in a response with a Response Code and possible EMV TLV data, or will timeout and be considered as unable to go online.

In EMV mode environments, typical EMV TLV data elements that may be present are Authorisation Response Code (Tag '8A'), Issuer Authentication Data (Tag '91'), and Issuer Script Template (Tag '71', '72').

5.5.7   Receipts

The POS System may have acceptance rules relating to receipts, specific to location, environment, and possibly payment system. In such cases, an 'N/A' in the Outcome parameter Receipt indicates that the kernel has no preference and that these rules should be applied as applicable.

5.5.8   Cardholder Verification

Under certain circumstances when performing a contactless transaction, the POS System may be required to request Cardholder Verification to ensure that the person presenting the card is the person to whom the application in the card was issued.

The kernel should be aware of the CVM capabilities of the POS System (e.g. the capability to print a Signature, or for Online PIN CVM the presence of a PIN entry device and acquirer online message capabilities).

As described in section 5.9, once the kernel has finished processing the contactless transaction, an Outcome is indicated by the kernel. For some Outcomes the Outcome parameters set by the kernel may indicate a request for Cardholder Verification or indicate that Cardholder Verification has already taken place.

The identified CVMs and corresponding requirements are described below:

Online PIN

> The kernel requests that an online transaction includes a PIN.
>
> - The cardholder is prompted for PIN entry.
>
> - The PIN is encrypted and included in the online authorisation request.
>
> - If the timeout function supporting the Removal Timeout has been requested in the Outcome parameters, then it should be deferred until the completion of PIN entry.

Confirmation Code Verified

> The kernel indicates that the consumer has positively completed a CVM on their consumer device (e.g. mobile phone). This may be as a result of a single presentment with the Confirmation Code pre-entered by the cardholder, or it may be the result of two presentments with a restart and the Confirmation Code being entered by the cardholder when prompted by the kernel.

Obtain Signature

The kernel requests that a signature be obtained from the cardholder.

- If the terminal supports signature capture on a transaction receipt, then the terminal prints a receipt with a signature entry line.

- If the terminal supports signature capture via screen entry, then the terminal displays the signature screen panel.

- The cardholder is prompted for a signature.

No CVM

The kernel indicates that no cardholder verification is required for this transaction and no CVM should be requested.

N/A

The kernel indicates no CVM preference.

The POS System may have acceptance rules relating to CVM, specific to location, environment, and possibly payment system. In such cases, an 'N/A' indicates that the kernel has no preference and that these rules should be applied as applicable.

5.6 POS System Configuration

The POS System must have configuration data that defines:

- country and currency codes

- how a transaction is initiated (by terminal action or automatically after a previous transaction is completed)

- the supported operating modes

- the types of transaction supported

- for each combination of transaction type, application, and kernel, both Kernel Configuration Data and Entry Point Configuration Data

Details about the various types of configuration data are provided in the following sections.

5.6.1   POS System Country and Currency Codes

The POS System must be configured with a Terminal Country Code (Tag '9F1A') and with one or more Transaction Currency Codes (Tag '5F2A'), depending on whether multiple currencies are supported.

5.6.2   POS System Configuration for Starting a Transaction

The POS System must be configured such that a contactless transaction is either initiated by terminal action or starts automatically after the previous transaction has completed.

The configuration parameter is Autorun [No, Yes].

Support for the Autorun parameter is optional. If the Autorun parameter is not supported, then the POS System must function as if the value of Autorun is "No".

If the value of Autorun is "No", then the transaction start is initiated by the merchant, typically by entering the amount. If the value of Autorun is "Yes", then the transaction start is when a card enters the polling field and responds, indicating its presence.

In general "No" is for environments supporting EMV mode transactions, where the terminal needs to know the amount before starting a transaction, the field is off between transactions, and the reader is dependent on and under control of the terminal. "Yes" is generally for environments supporting mag-stripe mode transactions, where the field is on between transactions, and the reader does not depend on the terminal and initiates contactless transactions independently.

Depending on the acceptance environment, the Autorun parameter is not constrained as above. For example, environments supporting EMV mode transactions with a fixed amount and field on between transactions could use Autorun "Yes" and environments supporting mag-stripe mode transactions with manual start and field off between transactions could use Autorun "No".

5.6.3   POS System Configuration for Acceptance Environment

The operating modes supported by a POS System will depend on the acceptance environment and acceptance rules. Kernels need to know this in order to request the necessary data elements and execute the applicable processing flow. Therefore configuration data is provided to the kernel by the POS System indicating the operating modes that it supports:

- EMV mode

- Mag-stripe mode

- Both EMV mode and mag-stripe mode

This terminology is generic for the purposes of this specification. The actual configuration parameters will vary per Combination {AID – Kernel ID} and details of the parameters for each kernel can be found in the corresponding Book C.

5.6.4   POS System Configuration for Type of Transaction

The POS System needs to know the types of transaction it supports, from the following list:

- Purchase
- Purchase with cashback
- Cash Advance (cash withdrawal)
- Refund

In order for a kernel to function correctly, it needs to know about the environment in which it is installed and what can be expected of Entry Point and the terminal. The functionality can differ for the type of transaction and between AIDs supported by a given kernel. In order for Entry Point processing to match kernel expectations, the reader must be configurable with respect to the kernels and AIDs it supports. For each type of transaction supported, this list of Combinations {AID – Kernel ID} can be represented by a table, as indicated by the example in Table 5-1.

Table 5-1: Example Combination Table per Transaction Type

	AID_1	AID_2	…	AID_{n-1}	AID_n
Kernel 2		√			
Kernel 3				√	√
Kernel 4		√			
Kernel 5	√				√
Kernel 6				√	
Kernel 7				√	√
Kernel 8		√		√	√

5.6.5 Kernel and Entry Point Configuration Data

For each supported combination {AID – Kernel ID }, the reader has:

1. Kernel Configuration Data – For each supported type of transaction, A set of static data for kernel configuration.

   The value of this data is persistent from one transaction to the next and represents configuration information such as the mode (EMV / mag-stripe), CVM support, online/offline capabilities, and the RID-specific CA public key dataset. Updates of the values are exceptional and always occur outside of transaction processing. Details of the data that must be configured for each kernel can be found in the corresponding Book C.

   Note: Tag values can have different meanings for different kernels.

   The appropriate data set will be available to the kernel selected by Entry Point.

2. Entry Point Configuration Data – For each supported type of transaction, A set of static data for Entry Point processing.

   Again, the value of this data is persistent and represents transactional configuration information, such as contactless limits and CVM limits. Exceptional updates happen outside of transaction processing.

   Table 5-2 defines the available data set for each Combination. All configured data sets will be available for Entry Point processing. All elements defined in Table 5-2 are optional and may be omitted from a specific instance of a combination.

Table 5-2: Entry Point Configuration Data per Combination

Status Check Support flag, if present
Zero Amount Allowed flag, if present
Zero Amount for Offline Allowed flag, if present
Reader Contactless Transaction Limit, if present
Reader Contactless Floor Limit, if present
Terminal Floor Limit (Tag '9F1B'), if present
Reader CVM Required Limit, if present
Terminal Transaction Qualifiers, if present
Extended Selection Support flag, if present

5.7   Transaction Data

Entry Point uses the data sets described in section 5.6.5 during Pre-Processing to compute the Entry Point Pre-Processing Indicators for each combination, as defined in Table 5-3.

The indicators are made available to the kernel selected by Entry Point.

Entry Point temporarily stores the computed indicators to support selection of another combination for the same transaction or reactivation of a kernel after an *Online Request* Outcome or a *Request online PIN* Outcome.

In addition to the configuration data discussed above, each kernel will need data that is specific to the transaction. Typical transaction-specific data elements are listed in Table 5-5.

Table 5-3: Entry Point Pre-Processing Indicators

Status Check Requested
Contactless Application Not Allowed
Zero Amount
Reader CVM Required Limit Exceeded
Reader Contactless Floor Limit Exceeded
Copy of TTQ (if present as part of configuration data); for definition, see Table 5-4

Table 5-4: Terminal Transaction Qualifiers

Byte	Bit	Definition
1	8	1b – Mag-stripe mode supported 0b – Mag-stripe mode not supported
	7	RFU (0b)
	6	1b – EMV mode supported 0b – EMV mode not supported
	5	1b – EMV contact chip supported 0b – EMV contact chip not supported
	4	1b – Offline-only reader 0b – Online capable reader
	3	1b – Online PIN supported 0b – Online PIN not supported
	2	1b – Signature supported 0b – Signature not supported
	1	1b – Offline Data Authentication for Online Authorizations supported 0b – Offline Data Authentication for Online Authorizations not supported
2	8	1b – Online cryptogram required 0b – Online cryptogram not required
	7	1b – CVM required 0b – CVM not required
	6	1b – (Contact Chip) Offline PIN supported 0b – (Contact Chip) Offline PIN not supported
	5-1	Each bit RFU
3	8	1b – Issuer Update Processing supported 0b – Issuer Update Processing not supported
	7	1b – Consumer Device CVM supported 0b – Consumer Device CVM not supported
	6-1	Each bit RFU
4	8-1	Each bit RFU

Table 5-5: Example Transaction-specific Data Elements

Data Element	Tag	Notes
Transaction Type	'9C'	See Table 5-6 regarding the values of these data elements.
Amount, Authorised (Numeric)	'9F02'	
Amount, Other (Numeric)	'9F03'	
Unpredictable Number	'9F37'	
Transaction Currency Code	'5F2A'	Transaction-specific only if multiple currencies are supported.

The type of transaction, amount, and cashback amount are known to the terminal and are mapped as described in Table 5-6.

Table 5-6: Type of Transaction

Type of Transaction	Transaction Type (Tag '9C')	Amount, Authorised (Numeric) (Tag '9F02')	Amount, Other (Numeric) (Tag '9F03')
Purchase	'00'	Purchase amount	Zero
Purchase with cashback	'00' or '09'	Sum of purchase and cashback amount	Cashback amount
Cash Advance	'01'	Withdrawal amount	Zero
Refund	'20'	Amount to be refunded	Zero

Details of the data that must be available for each kernel can be found in the corresponding Book C. For example, a kernel that supports Online Response may also require online response data such as Issuer Authentication Data and Issuer Scripts.

Note: Tag values can have different meanings for different kernels.

5.8   Entry Point Processing

Entry Point is responsible for processing the configuration data, the discovery and selection of a mutually supported contactless application, activation of the appropriate kernel, and handling of the Outcome when the kernel finishes (including processing selected Outcome parameters and passing the Outcome to the reader).

Under exception conditions, Entry Point may return an Outcome to the reader as a result of its own processing.

The mechanism to select an application is designed around the presence of a Proximity Payment System Environment (PPSE) in the card. This allows Entry Point to obtain all the available brands and applications with a single command and to make an immediate choice based on priority and kernel availability.

The use of additional proprietary selection methods is not precluded but is outside of the scope of this specification. Users of such methods should be aware of the potential negative impact on performance introduced by any increase in the number of commands. The method also must deal with the complexity of managing priorities amongst all available brands and applications.

5.8.1   Starting Conditions

For environments in which the field is normally off, Entry Point will not be started for a new transaction before the POS system knows that the card has been removed from the field (e.g. by using a removal procedure) and the normal start conditions (such as amount entry) have been fulfilled. This is typically the situation for EMV mode environments.

For environments in which the field is normally on, Entry Point will be started for a new transaction before the POS system knows that the card has been removed from the field (e.g. by using a removal procedure). This is typically the situation for mag-stripe mode environments. It does not however preclude that merchant interaction might be required to turn on the field, perhaps for power saving in battery powered devices.

Entry Point may start at any of several start locations, depending on the environment and, if it is being restarted within a transaction, depending on the characteristics of the first Final Outcome.

Start A

> **Start A** is normally used for a new transaction in an EMV mode acceptance environment where the field is off between transactions and the amount is variable and determined (e.g. by merchant entry) before the transaction can start. When starting at **Start A**, configuration data supplied by the POS System is processed for each supported Combination to produce the Entry Point Pre-Processing Indicators.

Start B

Start B is normally used for a new transaction in a mag-stripe mode acceptance environment where the field is on between transactions and the amount is fixed or not needed for the contactless processing. When starting at **Start B**, there is no Pre-Processing and the Entry Point Pre-Processing Indicators have fixed values.

Environments with a fixed amount (e.g. a vending machine with identically priced goods) that may normally have the field off between transactions do not need Pre-Processing and can use **Start B**.

Start B can be also used when Entry Point is restarted within a transaction, either after an online request or if a card is to be re-presented (e.g. mobile device with confirmation code).

Start C and Start D

Start C is used when Entry Point is restarted within a transaction in order to attempt a different Combination {AID – Kernel ID}.

Start D is used when Entry Point is restarted within a transaction in order to process data provided in response to an online request, for risk management purposes.

When starting at **Start C** or **Start D**, Entry Point provides the kernel with the original Entry Point Pre-Processing Indicators.

5.8.2 Application Selection and Kernel Activation

The selection mechanism is designed around the use of a PPSE. For multi-brand acceptance, this allows Entry Point to obtain all the available brands and applications with a single command and to make an immediate choice based on priority and kernel availability.

A PPSE response returned by a card contains one or more File Control Information (FCI) data elements forming a list of products supported by the card, the kernel they will run with, and their priority relative to one another.

Note: Cards may indicate in the PPSE response via inclusion of the Terminal Categories Supported List (tag '9F3E') and/or Selection Data Object List (tag '9F3F') that additional terminal information be provided by Entry Point. This terminal information may be used by the card to adjust the list of applications used for application selection. Entry Point implementations that support the SEND POI INFORMATION (SPI) command issue the command to send the requested terminal information to the card, and the card response is the list of applications to use for application selection.

Entry Point compares the ADF Names and Kernel Identifiers with the transaction type specific set of Combinations of AIDs and kernels that it supports for the given transaction type. The result is a list of Combinations, prioritised according to priority value or (for equal priority matches) by their order in the FCI list. AIDs and ADF Names can be obtained from the relevant payment system.

Existing cards that are already deployed do not have a Kernel Identifier in the FCI data; Entry Point reads absence of a Kernel Identifier as 'existing application'. The type of existing application is determined from the AID. The current mapping is as follows:

Kernel 2 for MasterCard AIDs

Kernel 3 for Visa AIDs

Kernel 4 for American Express AIDs

Kernel 5 for JCB AIDs

Kernel 6 for Discover AIDs

Kernel 7 for UnionPay AIDs

Exceptions to the above may occur if Entry Point has a specific setting for the linkage between a product and a kernel.

In the final selection, Entry Point picks the Combination with the highest priority, sends the SELECT AID command with the AID of this Combination, and hands over processing to the selected kernel. The Entry Point Pre-Processing Indicators for the relevant Combination are made available to the selected kernel.

Note that this flexible approach allows for a specific card to include multiple Directory Entries pointing to the same kernel for different ADF Names, or conversely pointing to different kernels for the same ADF Name.

5.8.3   User Interface Request

During Entry Point processing, if Entry Point wishes to inform the cardholder about the progress of the transaction, Entry Point may send a User Interface Request and expects the reader to process this request.

The request will contain a combination of the data listed in Table 7-1 on page 62.

5.9   Kernel Processing

Once activated, a kernel continues the dialogue with the card using the necessary command/response exchanges and might call for a User Interface Request (e.g. "Remove Card") from the reader. On completion the kernel provides an Outcome to Entry Point and the Outcome is processed according to the guidelines in Chapter 8.

5.9.1   User Interface Request

During kernel processing, if a kernel wishes to inform the cardholder about the progress of the transaction, the kernel may send a User Interface Request and expects the reader to process this request.

The request will contain a combination of the data listed in Table 7-1 on page 62.

5.9.2   Processing Data Exchange

Data Exchange provides a flexible communication mechanism between terminal and kernel. It allows the kernel to send data to and request data from the terminal. Using the Data Exchange mechanism, the kernel can take the initiative to request a service from the terminal (e.g. for hot file/exception list checking) and will do so by requesting a Data Exchange.

If the terminal is able to service the request, it will return a Data Exchange with the requested data. This mechanism allows the terminal to exercise a level of control on the kernel – and may influence the kernel's interaction with the card – by virtue of its ability to update the current transaction data.

The data or service that is requested is context specific and may vary with the kernel and the AID currently in use. Implementations must take care that data is exchanged with the correct kernel while it is active.

5.9.3   CVM Selection and Cardholder Verification

During kernel processing, the kernel will determine from the acceptance environment and issuer settings in the card whether a cardholder verification is needed for the transaction. Methods that may be supported are online PIN and signature – offline PIN is not suitable due to the "card in field" timing issues.

In some markets it may be that contactless transactions are designated as without cardholder verification, but only for transaction amounts below a certain limit, whereas other markets, perhaps with an online PIN infrastructure in place, may allow any amount for contactless transactions, with online PIN above a certain threshold.

The use of mobile devices allows for the entry of Consumer Device CVM on the handset as a CVM.

More information on cardholder verification processing can be found in section 5.5.8.

6   Outcomes and Parameters

An Outcome is the primary instruction from the kernel or Entry Point on how processing should be continued. The parameters allow the kernel to indicate choices, such as messages to be displayed and whether the kernel wishes to be restarted after an online authorisation.

When a kernel provides an Outcome, control is passed back to Entry Point which handles certain parameters immediately, then either processes the Outcome or forwards it to the reader as a Final Outcome.

6.1   Outcomes

The following Outcomes are defined:

- *Select Next*
- *Try Again*
- *Approved*
- *Declined*
- *Online Request*
- *Request Online PIN*
- *Try Another Interface*
- *End Application*

Table 6-1 describes the Outcomes and indicates the responsibilities of the kernel, Entry Point, and the reader or terminal for each.

Table 6-1: Outcomes

Outcome	Description	Kernel	Entry Point	Reader/ Terminal
Select Next	The kernel has determined that the selected Combination is unsuitable and the next Combination (if any) should be tried.	Creates Outcome, passes to Entry Point	Processes Outcome	No processing
Try Again	The kernel wishes that a card be presented again; this may be a result of an error, such as tearing, that could resolve if the transaction is attempted again. It is one way a kernel may handle a mobile device that requires a confirmation code to be entered.			

Outcome	Description	Kernel	Entry Point	Reader/ Terminal
Approved	The kernel is satisfied that the transaction is acceptable with the selected contactless card application and wants the transaction to be approved. This is the expected Outcome for a successful offline transaction. This might also occur following reactivation of a kernel after an online response.	Creates Outcome, passes to Entry Point	• Processes selected Outcome parameters • Passes Outcome to reader as a Final Outcome	Processes the Final Outcome
Declined	The kernel has found that the transaction is not acceptable with the selected contactless card application and wants the transaction to be declined. This might also occur following reactivation of a kernel after an online response.			
Online Request	The transaction requires an online authorisation to determine the approved or declined status. If the kernel wishes to be restarted when the response has been received (e.g. to receive issuer update data), then this is indicated in the parameters.			
Request Online PIN	The issuer has requested Online PIN in the Authorisation Response Code after the transaction has gone online i.e. after the Online Request outcome.			

Outcome	Description	Kernel	Entry Point	Reader/ Terminal
Try Another Interface	Any of the following: • The kernel is unable to complete the transaction with the selected contactless card application, but knows from the configuration data that another interface (e.g. contact or magnetic-stripe) is available. The kernel could indicate a preference for the alternate interface. • Entry Point was unable to identify a contactless card application that could complete the transaction and returns control to the POS System, which might attempt a different interface. • The issuer has requested to 'Try Another Interface' in the Authorisation Response Code after the transaction has gone online i.e. after the Online Request Outcome	May create Outcome and pass it to Entry Point	Either of the following: • Receives Outcome from kernel, processes selected Outcome parameters, and passes Outcome to reader as a Final Outcome • Under exception conditions, creates Outcome and passes it to reader	Processes the Final Outcome

Outcome	Description	Kernel	Entry Point	Reader/ Terminal
End Application	Any of the following: • The kernel has completed processing and requires no further action. • The kernel wished to restart after the card has been removed. It is one way a kernel may handle a mobile device that requires a confirmation code to be entered. • The kernel experienced an application error, such as missing data, that will not resolve if the transaction is attempted again with the same selected contactless card application. • Entry Point was unable to identify a contactless card application that could complete the transaction with the current card and wants the POS System to direct the cardholder to present another card.	May create Outcome and pass it to Entry Point	Either of the following: • Receives Outcome from kernel, processes selected Outcome parameters, and passes Outcome to reader as a Final Outcome • Under exception conditions, creates Outcome and passes it to reader	

6.2 Outcome Parameters

Each Outcome has a list of mandatory parameters:

- Start

- Online Response Data

- CVM

- UI Request on Outcome Present

- UI Request on Restart Present

- Data Record Present

- Discretionary Data Present

- Alternate Interface Preference

- Receipt

- Field Off Request

- Removal Timeout

The parameters indicate the kernel's expectations of Entry Point, the reader, and the terminal (or Entry Point's expectations of the reader and the terminal). These include user interface needs, and if and where Entry Point processing should be restarted, for example, after an online authorisation. It is expected that kernels will be configured such that they will only make requests that are supported by the environment.

Note: The precise format for the Outcome Parameters may differ on a kernel to kernel basis. It is also advised that future kernel developers should follow the same format from one of the existing kernels.

The Outcome Parameters are defined in Table 6-2.

Table 6-2: Outcome Parameters

Outcome Parameter	Description	Values	Meaning of Value
Start	Indicates whether Entry Point should be restarted after the Outcome has been processed, and which Entry Point start location should be used. Typically used in conjunction with an online request and allows for issuer risk management via a variety of approaches, such as a "second presentment" or "present and hold". It may also be used to allow card removal to be confirmed, before a kernel is restarted.	B	Restart Entry Point from Protocol Activation. If the same card is present, the same kernel will be selected. • Used by *Online Request* for "two presentments". • Used by *End Application* to confirm card removal before restart. • Used by *Try Again*, which is processed by Entry Point.
		C	Restart Entry Point from Combination Selection. Currently only used by *Select Next* processed internally by Entry Point.
		D	Restart Entry Point from Kernel Activation. The same kernel will be selected. There will be no removal procedure and the field will stay on. Used by *Online Request* for "present and hold" and *Request Online PIN* for the second submission of online data after entry of online PIN.
		N/A	Do not restart Entry Point.

Outcome Parameter	Description	Values	Meaning of Value
Online Response Data	Conditions whether the kernel should be restarted based on the presence of data in the online response.	EMV Data	The kernel restart should occur only if the EMV TLV data Tag '91', '71', and/or '72' is present in the online response. (If the kernel wishes to be restarted only for issuer risk management, but no issuer update data is returned, then there is no point in restarting the kernel.)
		Any	The kernel restart should occur regardless of the presence of any online response data. Used, for example, for "present and hold".
		N/A	Not applicable.

Outcome Parameter	Description	Values	Meaning of Value
CVM	The kernel may request cardholder verification or may indicate that CVM has already occurred.	Online PIN	The kernel requests that an online transaction includes a PIN (having determined that online PIN is supported).
		Confirmation Code Verified	The kernel indicates that the consumer has successfully completed a CVM on their consumer device (e.g. confirmation code entry on a mobile phone).
		Obtain Signature	The kernel requests that a signature be obtained from the cardholder. The terminal may print a receipt with a signature entry line, or the terminal may have other means, such as electronic signature capture.
		No CVM	The kernel indicates that no cardholder verification is required for this transaction.
		N/A	The kernel indicates no CVM preference. A CVM may or may not be required as a result of acceptance rules applied by the POS System.
UI Request on Outcome Present	Either the kernel or Entry Point may include a User Interface Request to be acted upon as the outcome is processed.	Yes No	The User Interface Request defined in section 7.1 may be used to indicate a message/status to be presented to the cardholder.

Outcome Parameter	Description	Values	Meaning of Value
UI Request on Restart Present	The kernel may include a User Interface Request to be processed if Entry Point is restarted.	Yes No	The kernel can use a User Interface Request as defined in section 7.1 to indicate a message/status to be presented to the cardholder as Entry Point is restarted. The two UI Requests can be used as a pair, for example to provide advice before and instruction after online processing.
Data Record Present	Depending on the transaction outcome, the kernel will make available data records appropriate to the implementation for clearing and/or authorisation.	Yes No	The data provided may be full chip data, or reduced data appropriate to a specific kernel. An overview is found in Annex A and details are specified in Books C-*n*.
Discretionary Data Present	The kernel indicates whether it has made available discretionary data (e.g. balance, cardholder name).	Yes No	The use of kernel discretionary data provided in association with an Outcome is not addressed in this specification.
Alternate Interface Preference	The kernel indicates a preference for an alternate interface if the contactless interface cannot be used.	Contact Chip Mag-stripe N/A	Indicates the kernel's preference, if any.

Outcome Parameter	Description	Values	Meaning of Value
Receipt	The kernel indicates whether a receipt is to be provided.	Yes	Provide a receipt.
		N/A	The kernel has no preference. A receipt may or may not be required as a result of acceptance rules applied by the POS System. Note: If the value of the CVM parameter is 'Obtain Signature', then the terminal may choose to obtain it by means of a receipt with signature entry line, regardless of the value of this parameter.
Field Off Request	The kernel indicates whether to turn off the field (without card removal procedure). The hold time will delay the processing of the next change to the field until it has elapsed.	*hold time value*	Any value (including zero) indicates that the field is to be turned off. The hold time is in units of 100ms.
		N/A	No change to the field is requested.
Removal Timeout	The kernel indicates whether a timeout function should be started with the time specified.	*time value*	For an **Online Request** Outcome, the kernel may instruct the terminal to start a timeout function and, if the timeout occurs, to prompt the user to remove the card. When the online response is received (or if the terminal was unable to go online), the result of the timeout will be available to the kernel when it is restarted. The parameter value indicates the time setting for the timeout function, in units of 100ms. The default is zero (no timer).

6.3   Outcome Processing

In order to complete the transaction and arrive at the correct start for the following new transaction, the POS System must process each kind of Outcome as described below. The requirements listed are allocated to the reader and terminal according to the architectural overview described in Chapter 5, but the separation between the two may differ between implementations and it is not important which entity performs the actions, provided that the overall POS System fulfils all the requirements.

Table 6-3 describes POS System processing for a first Final Outcome. Table 6-4 describes POS System processing for a second Final Outcome; that is, one that follows an *Online Request* Outcome. Table 6-5 describes POS System processing for a third Final Outcome following a *Request Online PIN* Outcome.

Table 6-3: First Final Outcome

First Final Outcome	POS System Processing
Approved	• The terminal considers the transaction disposition as "approved". • The terminal advises the cardholder of the transaction outcome. • If a cardholder receipt is required, the terminal prints it or provides it electronically (e.g. email). • The terminal captures CVM signature or online PIN if requested. • The terminal prepares a clearing record using the data record provided with the Outcome. • Once the above steps are complete, the POS System continues processing at 'Requirements – New Transaction Preparation and Start' on page 67.
Declined	• The terminal considers the transaction disposition as "declined". • The terminal advises the cardholder of the transaction outcome. • Once complete, continue with 'Requirements – New Transaction Preparation and Start' on page 67.

First Final Outcome	POS System Processing

Online Request	• The POS System advises the cardholder that an online transaction is in progress. An initial message to the cardholder might have been displayed as a result of the kernel including a User Interface Request with the Outcome. If a PIN CVM is required, then the message directs the cardholder to enter the PIN.
	
	 • The terminal initiates an online authorisation request, using the data record provided with the Outcome. If the CVM is online PIN, then the terminal processes and submits the encrypted online PIN.
	
	 • The terminal receives the online response or might determine that the request was unable to go online.
	
	 • If the Start parameter was any value other than 'N/A', then:
	
	    o The terminal makes available the transaction disposition in the online response together with all of the EMV TLV data elements present.
	
	    o The reader reactivates Entry Point by continuing with 'Requirements – Online Response – Restart' on page 72.
	
	 • The terminal determines the transaction disposition, based on the online response indication (with Unable To Go Online a decline).
	
	 • If the outcome is Approve or Decline, then:
	
	    o The terminal advises the cardholder of the transaction outcome.
	
	    o If a cardholder receipt is required, the terminal prints it or provides it electronically (e.g. email).
	
	    o The terminal captures CVM signature if requested.
	
	    o The terminal prepares a clearing record if transaction disposition is "approved".
	
	    o Once complete, continue with 'Requirements – New Transaction Preparation and Start' on page 67.

First Final Outcome	POS System Processing
Try Another Interface	• The terminal allows the transaction to be attempted on another interface – contact chip or mag-stripe according to its capabilities. If a preference is indicated in the Outcome, then (depending on payment system rules) this might need to be taken into account. • The POS System advises the cardholder that another interface might be used. An initial message to the cardholder might have been displayed as a result of including a User Interface Request with the Outcome. • The transaction details (e.g., transaction amount) are known to the terminal and the transaction is completed on the same device. In this case the merchant must not be required to re-enter the transaction details to perform the transaction over the other interface. • The terminal processes the transaction using the other interface and might use the ADF Name provided with the Outcome to seek to select the same application if the chip interface is used. Cardholder communication will be as per the normal processing for a chip or mag-stripe interface. • Once complete, continue with 'Requirements – New Transaction Preparation and Start' on page 67.
End Application	**If** the Start parameter is 'N/A', **then**: • The terminal determines the transaction disposition as "terminated". • The POS System advises the cardholder of the situation. • The terminal continues according to its environment and acceptance rules. This might allow further transaction attempts by the cardholder, or might require a complete restart. • Once complete, continue with 'Requirements – New Transaction Preparation and Start' on page 67. **Else** the POS System confirms card removal before restarting Entry Point as indicated by the Start parameter.

Table 6-4: Second Final Outcome (Following an Online Request)

Second Final Outcome	POS System Processing
Approved	• The terminal determines the transaction disposition as "approved". • The POS System advises the cardholder of the transaction outcome. • If a cardholder receipt is required, the terminal prints it or provides it electronically (e.g. email). • The terminal captures CVM signature if requested. • The terminal prepares a clearing record. • Once complete, continue with 'Requirements – New Transaction Preparation and Start' on page 67.
Declined	• The terminal determines the transaction disposition as "declined". (This overrules an "approved" in the online response). • The POS System advises the cardholder of the transaction outcome. • Once complete, continue with 'Requirements – New Transaction Preparation and Start' on page 67.
Online Request	Not applicable.

Second Final Outcome	POS System Processing
Try Another Interface	• The terminal allows the transaction to be attempted on another interface – contact chip or mag-stripe according to its capabilities. If a preference is indicated in the Outcome, then (depending on payment system rules) this might need to be taken into account.
	• The POS System advises the cardholder that another interface might be used. An initial message to the cardholder might have been displayed as a result of including a User Interface Request with the Outcome.
	• The transaction details (e.g., transaction amount) are known to the terminal and the transaction is completed on the same device. In this case the merchant must not be required to re-enter the transaction details to perform the transaction over the other interface.
	• The terminal processes the transaction using the other interface and might use the ADF Name provided with the Outcome to seek to select the same application if the chip interface is used. Cardholder communication will be as per the normal processing for a chip or mag-stripe interface.
	• Once complete, continue with 'Requirements – New Transaction Preparation and Start' on page 67.

Second Final Outcome	POS System Processing

Request Online PIN	• The POS System advises the cardholder that an online transaction is in progress. An initial message to the cardholder might have been displayed as a result of the kernel including a User Interface Request with the Outcome. The issuer has determined in the Online Request that Online PIN CVM is required, therefore the message directs the cardholder to enter their PIN.
	
	• The terminal processes and submits the encrypted online PIN CVM. With the additional online PIN data result, the terminal initiates an online authorisation request, using the data record provided with the Outcome, which is the same data as the previous Online Request. The terminal receives the online response or might determine that the request was unable to go online.
	
	• If the Start parameter was any value other than "N/A", then:
	
	   o The terminal makes available the transaction disposition in the online response together with all of the EMV TLV data elements present.
	
	   o The reader reactivates Entry Point by continuing with 'Requirements - Online Response - Restart' on page 64.
	
	• The terminal determines the transaction disposition, based on the online response indication (with Unable To Go Online a decline).
	
	• The terminal advises the cardholder of the transaction outcome.
	
	• If a cardholder receipt is required, the terminal prints it or provides it electronically (e.g. email).
	
	• The terminal prepares a clearing record if transaction disposition is "approved".
	
	• Once complete, continue with 'Requirements - New Transaction Preparation and Start' on page 59.

End Application	• The terminal determines the transaction disposition according to the online response indication. • The POS System advises the cardholder of the situation. • The terminal continues according to its environment and acceptance rules. • Once complete, continue with 'Requirements – New Transaction Preparation and Start' on page 67.

Table 6-5: Third Final Outcome (Following a Request Online PIN)

Third Final Outcome	POS System Processing
Approved	• The terminal determines the transaction disposition as "approved". • The POS System advises the cardholder of the transaction outcome. • If a cardholder receipt is required, the terminal prints it or provides it electronically (e.g. email). • The terminal captures CVM signature if requested. • The terminal prepares a clearing record. • Once complete, continue with 'Requirements – New Transaction Preparation and Start' on page 56.
Declined	• The terminal determines the transaction disposition as "declined". (This overrules an "approved" in the online response). • The POS System advises the cardholder of the transaction outcome. • Once complete, continue with 'Requirements – New Transaction Preparation and Start' on page 56.
Online Request	Not applicable.
Try Another Interface	Not applicable.
Request Online PIN	Not applicable.
End Application	• The terminal determines the transaction disposition according to the online response indication. • The POS System advises the cardholder of the situation. • The terminal continues according to its environment and acceptance rules. • Once complete, continue with 'Requirements – New Transaction Preparation and Start' on page 56.

7   User Interaction Overview

For contact and mag-stripe cards, it has been fairly intuitive how and when the card is presented to the terminal; however, this is less evident for contactless cards due to the nature of the technology and the limited transaction time. To provide a uniform contactless user experience and reduce consumer confusion, it is important to have a consistent way to indicate when and where to present the card and when the card can be removed. The question of where to present the card has been addressed by the use of the EMVCo Contactless Symbol identifying the contactless "landing plane" (described in *Level 1 Specifications for Payment Systems, EMV Contactless Interface Specification*), whilst this specification offers best practice guidelines on how to relate with the cardholder and provide a uniform experience as a transaction proceeds.

Although complete consistency would be highly advantageous, EMVCo recognises that many differences exist in the global acceptance infrastructure, depending on location, specific market requirements, integration into merchant systems and other hardware, in addition to whether the terminal is attended or unattended. Local rules and governance for disability and terminal-layout will also differ. Therefore whilst the majority of the visual and audible signals described are common to many markets, it should be expected that there will be some local and regional differences and the payment systems should be contacted to confirm their specific requirements. The important outcome is that in a given market there is a consistent consumer experience for particular types of acceptance device, for all product brands.

This specification concentrates on the interaction between the cardholder and the reader whilst reading the card data, but there is also some information on the cardholder experience before and after the card is read and how the final transaction outcome is indicated to both cardholder and merchant.

The guidelines are intended to be used to achieve a uniform cardholder experience during a contactless payment transaction. These are not specific requirements for which test and approval will be offered by EMVCo.

7.1 User Interface Request

Any element of the overall POS System may have need of user messaging, and in particular kernels and Entry Point will request messages and status to be presented and POS Systems must be able to service these requests. The exact configuration of message display or status indication will vary according to design and implementation.

A User Interface Request as indicated in Table 7-1 has a hold time function, in that when a message is requested an associated time may be sent with it, the function of which is to introduce a delay before the next message can be displayed. In this way messages will be displayed long enough for the cardholder to read them, when the processing sequence may otherwise overwrite one message with another before the first would have been read.

Table 7-1: User Interface Request Data

Data Element	Description
Message Identifier	Indicates the text string to be displayed, with the different standard messages defined in section 9.4. If the Message Identifier is not recognised, the reader should ignore it and the message currently displayed should not be changed as a result of the User Interface Request.
Status	Identifies the status of the transaction (for example when the card can be removed) to be indicated through the setting of lights or LEDs and/or the production of an audio signal. More information on Status is provided in section 9.2. If the Status value is not recognised, the reader should ignore it and the current status of lights or LEDS should not be changed and no audio signal should be produced as a result of the User Interface Request.
Hold Time	If provided, indicates that the reader is to delay the processing of the Message Identifier in the next User Interface Request until the Hold Time has elapsed. The Hold Time is an integer in units of 100ms; the default value is zero. Only messages that must be displayed for a minimum period of time should be given a Hold Time. Note: An alert status with a timed operation (e.g. LED sequence or audio tone) will not be truncated by a subsequent User Interface Request.

Data Element	Description
Language Preference	If Language Preference (as per EMV Tag '5F2D' according to ISO 639-1) is present and if the language is supported by the reader or terminal, then the message identified and all subsequent messages to the cardholder are displayed in this language until the transaction concludes. For content and use of the Language Preference, please refer to *[EMV Book 3]* Annex A, and *[EMV Book 4]* section 11.1.
Value Qualifier	For the purpose of this specification, Value Qualifier is defined as either "Amount" or "Balance".
Value	If Value Qualifier is present and equals "Amount" or "Balance", the Value will be displayed as an amount or balance in conjunction with the message. The representation will be according to the Currency Code with leading zeros suppressed whilst leaving at least one significant digit (so that an amount of 0.09 would be shown as 0.09 and not as .09, 09, or 9). Note: Value may be zero (e.g. 0.00).
Currency Code	Numeric value as per ISO 4217.

7.2 Messaging and Status Display

The exact arrangement of displays for the user and the merchant will vary across implementations and acceptance environments. For the contactless user interface, in addition to readable messages, the POS System may provide lights or LEDs to indicate reader status (for example when the card can be removed) and/or audio feedback such as a beep. Some attended contact terminal systems already include displays for the user and the merchant and many contactless readers include a user-facing display and status LEDs.

In many environments messages on the terminal will be driven by the acceptance environment and the results of online processing, whilst messages on the reader display will follow the contactless transaction flow. However, there is no clear dividing line and messages may well be displayed in more than one place. Interaction is required such that the consumer is adequately and correctly informed as a transaction progresses, including possible online processing, CVM, and second presentment of a card. In some architectures the terminal may have access to and use the display on the reader in order to provide information to the cardholder, for example that the transaction was successful or that it is being sent online. If used for this purpose then the terminal should not interrupt the basic contactless transaction messaging and the user experience must be consistent between payment brands and transaction results.

More information on the user interface—including a suggested message set, visual and audible status indicators, and guidelines on pairing a given message to an associated status—can be found in Chapter 9.

Although the communication is expressed in terms of the illumination of a number of LEDs and/or the sounding of a beep, this is not mandatory and there is nothing to prevent other implementations as long as a consistent consumer experience is implemented. The suggested messages guiding cardholder action are given in English, but it is only the meaning that is relevant and it is expected that local languages appropriate to the market will be used to provide equivalence. The choice of language may be changed during a transaction to reflect the Language Preference that may be returned by the card during application selection, as defined in *[EMV Book 4]* section 11.1.

7.3   Amount Display and Entry

The amount of a transaction is important information and should be clearly indicated to the cardholder. The amount may be indicated on the reader in conjunction with the "Present card" message (see Book B, section 3.2.1), in which case the act of presenting the contactless card represents user confirmation. Other environments may use other techniques, such as values clearly posted or different values associated with individual selection buttons, or may deal with the amount retrospectively.

When the amount is entered through the use of a keypad, the terminal should allow the amount to be displayed during entry. If the amount was entered incorrectly, the attendant or cardholder should be able either to correct the amount entered prior to authorisation and proceed with the transaction or to cancel the transaction.

8 POS System Requirements

Support for the architecture described in this specification implies certain functions and requirements for the terminal and reader which collectively form the POS System. In order for a kernel to function correctly, it needs to know about the environment in which it is installed and what can be expected from the POS System. Kernels are expected to take configuration information into account when giving Outcomes that specify functions, such as online authorisation or signature CVM, that are generally supported by the terminal element of a POS System.

Requirements – Configurations

8.1.1.1   For each supported type of transaction, the reader shall be configurable with a list of supported Combinations {AID – Kernel ID}.

8.1.1.2   For each supported Combination, the reader shall be configurable with:

- a set of Kernel Configuration Data

- **and** a set of Entry Point Configuration Data for readers using **Start A** for new transactions
  or a fixed TTQ value for readers using **Start B** for new transactions

---

Requirements – Entry of Amount

8.1.1.3   **If** the value of the POS System configuration parameter Autorun is 'No',
then the terminal shall handle the entry of the amount and shall make the following data available to the reader:

- amount

- type of transaction

- cashback amount if the type of transaction is 'Purchase with cashback'

For further information on amount entry and management, please refer to *[EMV Book 4]* section 6.5.1.

Requirements – New Transaction Preparation and Start

After any type of transaction is completed, the POS System must prepare for a new contactless transaction as described in the following requirements:

8.1.1.4   The reader shall clear the Restart flag.

8.1.1.5   **If** the value of the POS System configuration parameter Autorun is 'No',
then the reader shall do all of the following:

- Ensure the field is off.

- Request message '14' (Welcome), status Idle.

- Wait for instruction from the terminal and then activate Entry Point at **Start A** and make the following available to Entry Point:

  o Transaction Type

  o the corresponding set of supported Combinations and Entry Point Configuration Data

  o Amount, Authorised

  o Amount, Other[2]

8.1.1.6   **If** the value of the POS System configuration parameter Autorun is 'Yes',
then the reader shall do all of the following:

- Ensure the field is on.

- Request message '15' (Present Card), status Ready to Read.

- Activate Entry Point at **Start B** and make the following available to Entry Point:

  o for the selected type of transaction (as configured), the corresponding set of supported Combinations and Entry Point Configuration Data/fixed TTQ value

---

[2] For definition of amount for cashback, please refer to *[EMV Book 4]* section 6.5.1.

Requirements – New Transaction Preparation and Start

8.1.1.7   The reader shall make the following available to the selected kernel:

- for the selected type of transaction, the corresponding set of Kernel Configuration Data for the selected Combination

- Amount, Authorised

- Amount, Other (if cashback)

- Unpredictable Number (kernels may also require a source of random data that may be used for the Unpredictable Number and other purposes)

- Issuer Authentication Data (if present)

- Issuer Script Templates (if present)

- other data elements detailed in the relevant Book C

Requirements – Unpredictable Number

The POS System must make available an Unpredictable Number (Tag '9F37') for when Entry Point activates a kernel.

8.1.1.8   Each time a kernel is activated (including the result of *Select Next* and *Try Again* Outcomes), the Unpredictable Number (Tag '9F37') provided to the kernel shall have a new value.

Requirements – RFU Bits and Bytes

8.1.1.9   The reader shall ignore the value of a bit specified as RFU and shall not change its behaviour, unless explicitly stated otherwise.

Note: A bit specified as Reserved for Future Use (RFU) is set as specified, or to 0b if no indication is given. A data field having a value coded on multiple bits or bytes cannot be set to a value specified as RFU. If the reader receives a data field having a value specified as RFU, the reader behaves as defined by the requirement that specifically addresses the situation.

Requirements – Multiple Interfaces

For a POS System that makes multiple interfaces available when starting a new transaction:

8.1.1.10   **If** the presence of a card with a contact interface is detected, **then** the POS System shall power down the contactless interface prior to initiating a contact chip transaction and shall keep it powered down for the duration of the transaction.

If either of the following is true:

- the presence of a contactless card is detected,

- **or** a contactless card interaction is not complete,

and subsequently a card with a contact interface is detected, **then** the contactless transaction shall be terminated and the contactless interface shall be powered down for the duration of the transaction.

Design consideration should be given to placement of the contactless reader relative to other card interfaces. The contactless reader should not be placed such that it is frequently activated when cardholders attempt to use other interfaces.

8.1.1.11   For POS devices capable of accepting transactions over multiple interfaces, the transaction data shall be from a single interface and data shall not be mixed across interfaces.

- For contact chip transactions (POS Entry Mode indicates a contact chip read), the value of all card-originated data used for the transaction shall be as read from the contact chip interface.

- For contactless chip transactions (POS Entry Mode indicates a contactless chip read), the value of all card-originated data used for the transaction shall be as read from the contactless chip interface.

- For physical magnetic stripe transactions (POS Entry Mode indicates a physical magnetic stripe read), the value of all card-originated data used for the transaction shall be as read from the magnetic stripe interface.

Requirements – Processing Data Exchange Request

8.1.1.12	Within a transaction, the terminal shall send Data Exchange information **only if** a Data Exchange has been initiated by the kernel.
8.1.1.13	**If** a Data Exchange initiated by the kernel expects response information, **then** the terminal shall send the information or a null response.
8.1.1.14	When sending Data Exchange information, the terminal shall ensure that it is sent to the correct kernel.

Requirements – User Interface Request

When the reader receives a User Interface Request from any source, then the following requirements apply:

8.1.1.15	The reader shall present the meaning of the message and status to the cardholder.
8.1.1.16	**If** the request includes a hold time, **then** any subsequent User Interface Requests received during this period shall not be processed until the hold time has elapsed.
8.1.1.17	**If** all of the following are true: • Language Preference is supported, • **and** the request includes Language Preference, • **and** the reader and/or terminal support the language, **then** this message and all subsequent messages to the user shall be displayed in this language until the transaction concludes.

Requirements – User Interface Request

8.1.1.18   **If** all of the following are true:

- Value Qualifier is supported,

- **and** the Value Qualifier is present,

- **and** the Currency Code is recognised,

then the value shall be displayed in conjunction with the message as follows:

- o **If** Value Qualifier is "Amount",
  then the Value shall be displayed as the transaction amount.

- o **If** Value Qualifier is "Balance",
  then the Value shall be displayed as a balance.

- o **In both cases**, the Value shall be represented according to the Currency Code as described in ISO 4217 with leading zeros suppressed whilst leaving at least one significant digit.

Requirements – Final Outcome Processing

8.1.1.19   The reader shall retain the following Final Outcome parameters for the duration of a transaction (in case required for a restart):

- Start

- Online Response Data

- UI Request on Restart Present

- if the value of UI Request on Restart Present is 'Yes', the associated User Interface Request

8.1.1.20   **If** the Outcome parameter Start has a value other than 'N/A',
then the reader shall set the Restart flag.

Requirements – Final Outcome Processing

8.1.1.21   **If** the Outcome parameter Removal Timeout has a value other than zero,
then the reader shall start a timeout function using the value of the parameter and reset the timeout indicator to 0.

When the reader is informed by the terminal of the results of an online authorisation request, it shall stop the timeout function.

If the timeout occurs, the reader shall:

- Send a User Interface Request with the following parameters:

    o Message Identifier: '17' ("Card Read OK. Please Remove Card")

    o Status: Card Read Successfully

- Set the timeout indicator to 1.

Requirements – Online Response – Restart

The following requirement applies if the Outcome is Online Request and the retained Start parameter is any value other than 'N/A'.

8.1.1.22   **If** either of the following is true:

- the value of the Online Response Data parameter is 'Any',

- **or** the value of the Outcome parameter Online Response Data is 'EMV Data' and at least one of the following data elements is present:

    o Issuer Authentication Data (Tag '91')

    o Issuer Script Template (Tag '71', '72')

then the reader shall activate Entry Point at the Start indicated by the retained Start parameter.

Requirements – End Application – Restart

The following requirement applies if the Outcome is End Application and the retained Start parameter is any value other than 'N/A'.

8.1.1.23   After confirming that the card has been removed, the reader shall activate Entry Point at the Start indicated by the retained Start parameter.

Requirements – Request Online PIN – Restart

The following requirement applies if the Outcome is Request Online PIN and the retained Start parameter is any value other than 'N/A'.

8.1.1.24   **If** either of the following is true:

- the value of the Online Response Data parameter is 'Any',

- **or** the value of the Outcome parameter Online Response Data is 'EMV Data' and at least one of the following data elements is present:

    o Issuer Authentication Data (Tag '91')

    o Issuer Script Template (Tag '71', '72')

then the reader shall activate Entry Point at the Start indicated by the retained Start parameter.

9   User Interface Recommendations

This chapter discusses recommendations intended to accomplish the user interaction goals discussed in Chapter 7. The following topics are included:

Note that the Contactless Transaction Status values in section 9.2 and the guidelines in section 9.3 are defined with a short single presentment card interaction in mind and do not include any recommendations for a possible restart after an online authorization response.

9.1   User Interface Hardware

As all contactless transactions are expected to be conducted by the cardholder, the cardholder interface should provide a visual and audio indication of the appropriate status of a contactless transaction.

The reader or terminal should therefore contain a visual indication and an audible indication as detailed below.

9.1.1   Visual Indication

The visual indication should consist of either a set of four clearly visible visual status indicators (for example LEDs), or a display (for example LCD) that allows a graphical representation of the four visual indicators, or both. The visual indicators should represent the status of the transaction (or, between transactions, of the reader).

The four visual indicators can be of same or different colour depending on the options outlined in section 9.3.2 and section 9.3.3.

It is recommended that the cardholder interface contain both LEDs and a display but at least one should be present on the reader.

If the status indicators are being shown on a display, it is recommended that the display have a minimum of three lines, so that the status indicators can be shown in the top line followed by two lines for cardholder messages.

As a minimum any display should be capable of displaying two lines of sixteen 8x5 dot matrix characters.

The terminal or reader should be designed so that the status indicators (whether LEDs or on the display) are clearly visible to the cardholder when a card has been presented and a card read is in progress.

New or Existing Display for Messages

Any display can be used to display appropriate cardholder or merchant messages to indicate the progress of, and any required actions during the execution of, the contactless application process between the contactless card and the reader.

The display need not be incorporated into the reader itself. However, if it is not, the design should ensure that the cardholder messaging display is clearly visible to the cardholder when they are conducting a contactless transaction and looking in the direction of the reader.

Table 9-5 on page 88 indicates **suggested** messages for the display. Implementations may re-phrase the messages to make best use of the capabilities of their display.

These guidelines do not preclude a terminal or reader manufacturer from using the same hardware (e.g. the same display) to cover other interface needs.
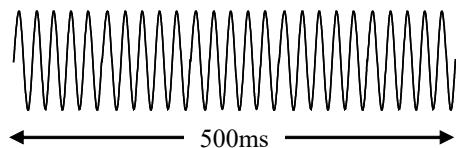
9.1.2   Audio Indication

There are only two audio indications, a success tone and an alert tone. When implemented, the reader should be capable of sounding tones at a level that will be clearly audible in the intended operational environment, i.e. the implementation should take into account typical "background" noise of the environment.

Success Tone

The success tone is a sound of approximately 1500Hz sine wave for a period of approximately 500ms.
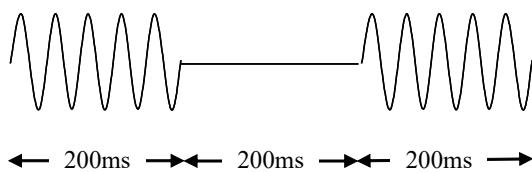
Figure 9-1: Success Tone

500ms

Alert Tone

The alert tone uses a lower frequency sine wave of approximately 750Hz to generate a double beep of approximately 200ms on, 200ms off, 200ms on.

Figure 9-2: Alert Tone

200ms   200ms   200ms

9.2 Contactless Transaction Status (User)

As a transaction starts and is processed through the reader, Entry Point, and the selected kernel, from the perspective of the user it can be considered to have a status at various points. Each status is described in Table 9-1.

Table 9-1: Contactless Transaction Status

Status	Description
Not Ready	The reader is not able to communicate with a card. This occurs towards the end of some transactions (for example whilst an online authorisation is in progress) or may occur when a reader is powered up, but is not connected to a terminal.
Idle[3]	The reader is ready for use, that is, powered on and connected (for peripheral readers with two-way communication to terminal), although the reader field is not yet active for communication with a card.
Ready to Read (Present Card)	The reader is actively attempting to initiate communication with a card.
Processing	The reader is in the process of communicating with a card that has been presented.
Card Read Successfully (Remove Card)	All application level interaction between the card and reader has completed successfully. The card may be removed and the kernel has sufficient data to continue with the transaction and arrive at an Outcome.
Processing Error	Represents a permanent error within the transaction; for example, an unrecoverable error has occurred and the reader has insufficient data to complete a transaction.

In some implementations, in particular if the Amount, Authorised always has a fixed known value, for instance in a vending machine with identical priced goods, the "Not Ready" and "Idle" status conditions are not relevant. After installation, the reader would start at the "Ready to Read" status and would be searching for a card with which to conduct a fixed amount transaction.

---

[3] Note this status is not relevant for readers in an "always-on" environment; for example, many mag-stripe mode readers.

All successful transactions will reach "Processing" status, but in most implementations it will not be necessary to communicate this to the cardholder. With the speed expected for most contactless transactions, the cardholder will not be able to distinguish between the "Processing" status and the "Card Read Successfully" status, so from a cardholder communication perspective the "Processing" status can be handled as part of the "Card Read Successfully" status.

It is important that the "Card Read Successfully" status is communicated to the cardholder as quickly as possible. Because of the cardholder experience – in particular so that the cardholder has a consistent perception of when the card can be removed – the status should be communicated immediately after the necessary card information has been received by the reader.

The "Processing Error" status indicates an erroneous event (e.g. from a kernel) and can have a number of specific definitions and situations and require different cardholder communications, which are described in more detail in section 9.3.

Transient errors, which might be recovered in a reasonable time, are not reported as processing errors and the cardholder is NOT advised about the situation. This is in order to avoid a cardholder moving the card around and potentially away from the reader whilst the reader is attempting to resolve the problem.

9.3   User Interface Guidelines

The following sections and tables describe a common set of user interface guidelines with two different options for part of the transaction flow. The different options may be required to comply with payment system or national market specific terminal user interface requirements. These requirements may vary, so it is important to contact each payment system to confirm their requirements.

In general, the differences between the two options are:

- Recommended indications that the card was read successfully

- Recommended indications that there was an error in reading the card

Note: The colours and wording of the messages are only used as examples. As stated in section 9.1.1, specific colours have not been defined. Further details on messages are described in section 9.4. In addition, the currency sign – in this case euro – is used only as an example and should be replaced by the currency sign that is appropriate to the country.
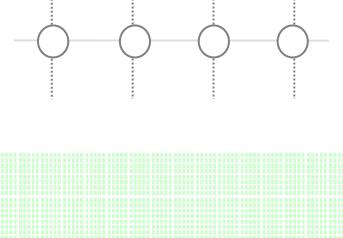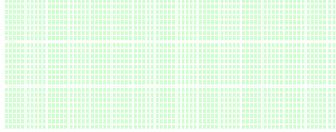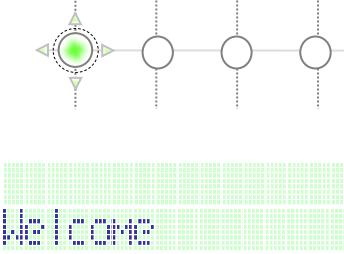
The "Card Read Successfully" options both have a defined sequence of LED behaviour that runs over a period of 875ms or 1000ms (125ms/250ms stepped turn on and 750ms all lit).
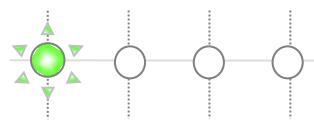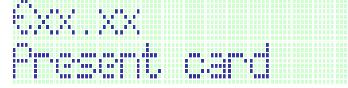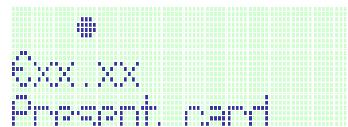
A status with a timed sequence (e.g. sequence of LEDs and an audio tone of a fixed period) will always run to completion.

9.3.1 Common User Interface Guidelines

Table 9-2 provides user interface guidelines for situations that are handled identically in the two options described in section 9.2.

Table 9-2: Common User Interface Actions

| Status / Event Name	Short Description	Cardholder Interface		Audio Indication
		Display option with LED indicator display and message display	Display only option	
Not Ready	The reader is either not powered on or, if applicable, not communicating with any attached terminal or terminal system, or no LEDs are required to be on. No indicators or message displayed.			None
Idle	The reader is powered up and connected correctly, but is not ready to read a card. The reader requires further information, such as the transaction value, before a contactless read can commence. The first indicator 'blinks on' for approximately 200ms every five seconds to indicate that the reader is powered on and communicating to any connected POS terminal.		For two line displays, display the first and second line above.	None
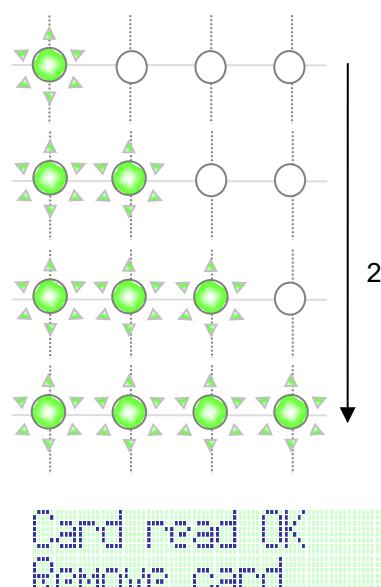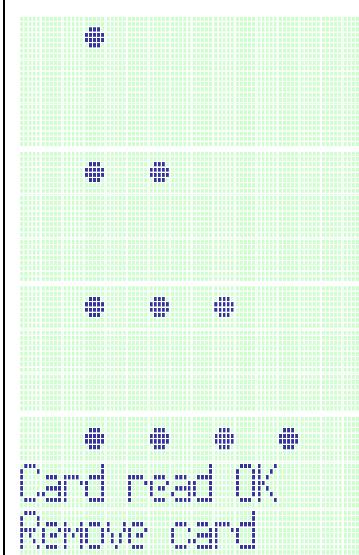
| Status / Event Name	Short Description	Cardholder Interface		Audio Indication
		Display option with LED indicator display and message display	Display only option	
Ready to Read	The reader has all the required information to initiate a contactless payment transaction. First indicator displayed solid. Transaction amount may be shown.	 Øxx.xx Present card	Øxx.xx Present card For two line displays, display the second and third line above.	None
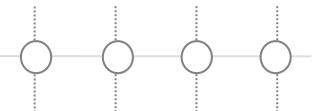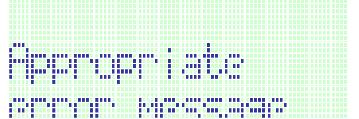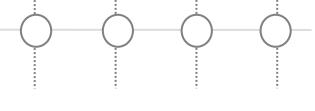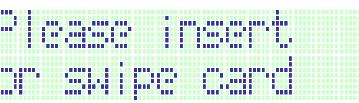
9.3.2　Option 1 for Card Read Successfully/Processing Error
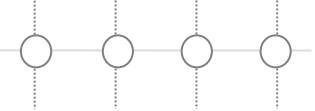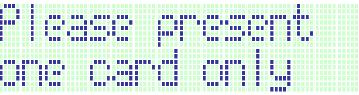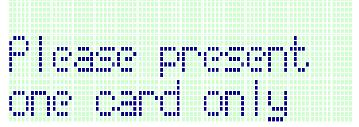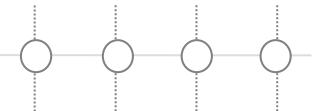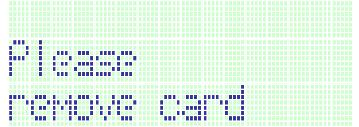
For this option the visual indicators should be of same colour and green is recommended.

Table 9-3: User Interface Actions for Option 1

Status / Event Name	Description	Cardholder Interface		Audio Indication
		Display Option with LED Indicator Display and message display	Display only option	
Processing (optional)	Not applicable for this option	Not applicable for this option	Not applicable for this option	Not applicable for this option

Status / Event Name	Description	Cardholder Interface		Audio Indication
		Display Option with LED Indicator Display and message display	Display only option	
Card Read Successfully	Contactless application process was completed successfully. This indicates that the cardholder may remove their card from the reader. This indication is not given if the result of the card read is that a contact chip transaction is required. This indication does not mean the transaction is complete. Existing authorisation processes will still take place to determine the transaction outcome. The remaining visual indicators light in order over a period of approximately 250ms indicating success. All four visual indicators then remain lit for approximately 750ms, after which they are all extinguished. The display indicates "Card read OK" and that the card should be removed.	 250ms Card read OK Remove card	 Card read OK Remove card For two line displays, display the first and second line above.	Success Tone

| Status / Event Name	Description	Cardholder Interface		Audio Indication
		Display Option with LED Indicator Display and message display	Display only option	
Processing Error: Contactless error	Any non-recoverable failure during the execution of the contactless application process between the card and reader. Display an appropriate error message. While error condition that prevents a successful card read is occurring (e.g. multiple cards are detected) turn off all visual indicators. (Some specific processing errors are described in the following rows.) When error has been resolved, return to either an "Idle" or "Ready to Read" status as appropriate.	Appropriate error Message	Appropriate error Message For two line displays, display the second and third line above.	Optional Alert Tone
Processing Error: Conditions for use of contactless not satisfied	It has been determined that the conditions for use of the contactless interface have not been satisfied. For example, card risk management indicates that a contact chip or magnetic swipe transaction is required. All indicators are turned off to indicate that the contactless interface is not acceptable for this transaction. Display prompts cardholder to insert or swipe card. Display remains until card inserted or swiped or transaction cancelled.	Please insert or swipe card	Please insert or swipe card For two line displays, display the second and third line above.	Optional Alert Tone

Status / Event Name	Description	Cardholder Interface		
		Display Option with LED Indicator Display and message display	Display only option	Audio Indication
Processing Error: Contactless collision detected	Multiple contactless cards are detected by the reader. While error condition is occurring, turn off all visual indicators. Display prompts cardholder to present a single card only. When error has been resolved return to Ready to Read to initiate contactless transaction.	Please present one card only	Please present one card only For two line displays, display the second and third line above.	Optional Alert Tone
Card not removed from reader	Following the completion of the contactless application process the reader detects that the card is still present in the field of the reader. While condition is occurring turn off all visual indicators. Display prompts cardholder to remove card.	Please remove card	Please remove card For two line displays, display the second and third line above.	None
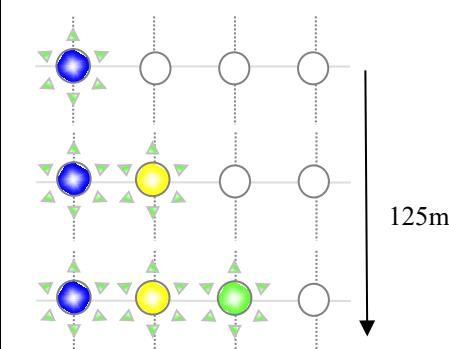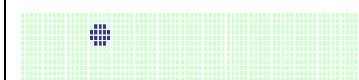
9.3.3 Option 2 for Card Read Successfully/Processing Error
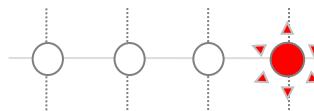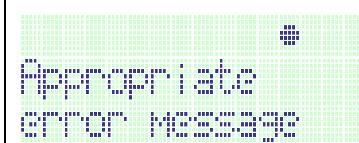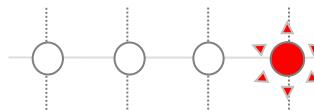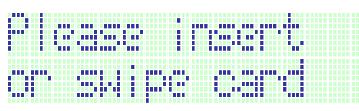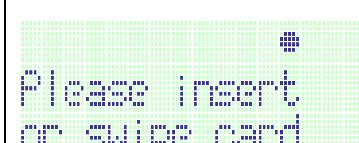
For this option the visual indicators can be of same or different colour. If different colour, the fourth indicator should be red.
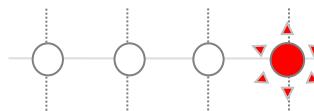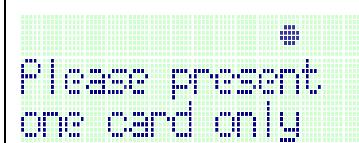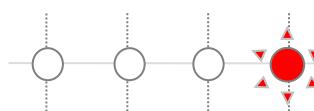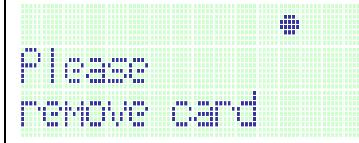
The examples shown illustrate the use of different colours.

Table 9-4: User Interface Actions for Option 2

Status / Event Name	Description	Cardholder Interface		
		Display Option with LED Indicator Display and message display	Display only option	Audio Indication
Processing (optional)	Indicates that reader is communicating with a payment card that has been presented. First visual indicator remains displayed. Second visual indicator displayed solid. Transaction amount displayed with a "Processing" message. Since payment transactions are so fast (less than 500ms), indication of this status will normally not be necessary.		 For two line displays, display the second and third line above.	None

Status / Event Name	Description	Cardholder Interface		
		Display Option with LED Indicator Display and message display	Display only option	Audio Indication
Card Read Successfully	Contactless application process was completed successfully. This indicates that the cardholder may remove their card from the reader. This indication is not given if the result of the card read is that a contact chip transaction is required. This indication does not mean the transaction is complete. Existing authorisation processes will still take place to determine the transaction outcome. The second and third indicators are displayed over a period of approximately 125ms indicating success. All three indicators then remain lit for a minimum of approximately 750ms, after which they are all extinguished. Note that if the "Processing" option is used the second indicator is displayed as part of the "Processing" status. The display indicates "Card read OK" and that the card should be removed.	 Card read OK Remove card	 Card read OK Remove card For two line displays, display the first and second line above.	Success Tone

Status / Event Name	Description	Cardholder Interface		
		Display Option with LED Indicator Display and message display	Display only option	Audio Indication
Processing Error: Contactless error	Any non-recoverable failure during the execution of the contactless application process between the card and reader. Display an appropriate error message. While error condition that prevents a successful card read is occurring (e.g. multiple cards are detected) display only fourth visual indicator. (Some specific processing errors are described in the following rows.) When error has been resolved, return to either an "Idle" or "Ready to Read" status as appropriate.	⭘ ⭘ ⭘ 🔴 Appropriate error message	Appropriate error message For two line displays, display the second and third line above.	Optional Alert Tone
Processing Error: Conditions for use of contactless not satisfied	It has been determined that the conditions for use of the contactless interface have not been satisfied. For example, card risk management indicates that a contact chip or magnetic swipe transaction is required. Only fourth visual indicator is displayed. Display prompts cardholder to insert or swipe card. Display remains until card inserted or swiped or transaction cancelled.	⭘ ⭘ ⭘ 🔴 Please insert or swipe card	Please insert or swipe card For two line displays, display the second and third line above.	Optional Alert Tone

Status / Event Name	Description	Cardholder Interface		
		Display Option with LED Indicator Display and message display	Display only option	Audio Indication
Processing Error: Contactless collision detected	Multiple contactless cards are detected by the reader. While error condition is occurring, display only fourth visual indicator. Display prompts cardholder to present a single card only. When error has been resolved return to Ready to Read to initiate contactless transaction.	 Please present one card only	Please present one card only For two line displays, display the second and third line above.	Optional Alert Tone
Card not removed from reader	Following the completion of the contactless application process the reader detects that the card is still present in the field of the reader. While error condition is occurring display only fourth visual indicator. Display prompts cardholder to remove card.	 Please remove card	Please remove card For two line displays, display the second and third line above.	Optional Alert Tone

9.4 User Interface Standard Messages

The reader should support language selection as defined in *[EMV Book 4]* section 11.1, except for the cardholder selection as defined in paragraph 6.

The following set of messages (or their equivalent meaning) can be used in the languages of preference for the cardholder and attendant.

Each message is uniquely identified by a two-character message identifier as shown below. The message identifier is for identification purposes only and is not to be displayed to the cardholder or attendant.

The user interface standard messages for contactless transactions are described in Table 9-5. For more information on standard messages, please see *[EMV Book 4]* section 11.2.

For Table 9-5, please note:

- The messages '0F' and '10' are applicable to both contactless and contact interface, but will have different conditions for the message depending on the interface.

- The messages from '14' thru '21' are applicable only to a contactless interface.

- The status "Not Ready" for a reader (from Table 9-2) is not reflected here, as this status is not represented with a message.

Table 9-5: User Interface Standard Messages

Message	Message Identifier	Definition
Approved	'03'	This message may be displayed to inform the cardholder that an authorisation has been obtained.
Not Authorised	'07'	This message may be displayed to inform the cardholder that an authorisation could not be obtained (i.e. a decline was the result).
Please enter your PIN	'09'	This message may be displayed to the cardholder if the reader display is used to display messages about CVM.
Processing error	'0F'	For a contactless reader, this message may be displayed to the cardholder if a generic non-recoverable error has occurred. See also message '17' and '18'.

Message	Message Identifier	Definition
Remove card or Please remove card	'10'	For a contactless reader, this message is used to represent the "Card not removed from reader" status or event. See "Card not removed from reader" in Table 9-3 or Table 9-4 for further information.
Welcome	'14'	This message is displayed prior to a cardholder presenting a card. This message is used to represent the "Idle" status for a reader. See "Idle" in Table 9-2 for further information.
Present card	'15'	This message asks the cardholder to present a card to the reader. The amount may also be shown with this message. This message is used to represent the "Ready to Read" status for a reader. See "Ready to Read" in Table 9-2 for further information.
Processing	'16'	This message may be displayed whilst the reader is dealing with the transaction. This message is used to represent the "Processing" status for a reader. See "Processing" in Table 9-4 for further information.
Card read OK Remove card or Card read OK Please remove card	'17'	This message is used to indicate that the card may be removed from the reader field. This message is used to represent the "Card Read Successfully" status or event for a reader. See "Card Read Successfully" in Table 9-3 or Table 9-4 for further information.

Message	Message Identifier	Definition
Please insert or swipe card	'18'	This message indicates that the card cannot complete the transaction using the contactless interface and that the contacts or mag-stripe should be tried instead. This message is used to represent the "Conditions for use of contactless not satisfied" status or event for a reader. See "Processing Error: Conditions for use of contactless not satisfied" in Table 9-3 or Table 9-4 for further information.
Please present one card only	'19'	This message indicates that a collision has been detected and that the cardholder should present only one card. This message is used to represent the "Contactless collision detected" status or event for a reader. See "Processing Error: Contactless collision detected" in Table 9-3 or Table 9-4 for further information.
Approved Please sign	'1A'	This message may be displayed to inform the cardholder that an authorisation (online or offline) has been obtained and a signature is required.
Authorising Please Wait	'1B'	This message may be displayed to inform the cardholder that an online authorisation is in progress.
Insert, swipe or try another card	'1C'	This message may be displayed to inform the cardholder that a new contactless card or another interface is to be used for this transaction. See also message '18', Please insert or swipe card.
Please insert card	'1D'	This message may be displayed to inform the cardholder that the chip card should be inserted into the chip slot. See also message '18', Please insert or swipe card.
[no message displayed]	'1E'	The display is cleared.

Message	Message Identifier	Definition
See Phone for Instructions	'20'	This message is displayed if in order to complete the transaction, the cardholder must interact with their mobile device (e.g. enter a confirmation code as a CVM). This message is displayed to the cardholder if a transaction has started, but in order to complete the transaction, the consumer device requires specific actions done on the consumer device itself. The message represents a variant of a "Processing Error" status or event with a specific appropriate error message. See "Processing Error" in Table 9-3 or Table 9-4 for further information.
Present card again	'21'	This message may be displayed in two situations: 1. after response to an online request where the card is requested to be presented again 2. if an error has occurred that cannot be recovered immediately but may be corrected if the card is presented again. See also message '18' and '19'. It is normally associated with the "Ready to Read" status. The amount may also be shown with this message.

10 Performance Requirements

It is an EMVCo target that contactless transactions performed in accordance with the *EMVCo Contactless Specifications for Payment Systems* will meet certain performance requirements. These are essentially a maximum time for which the card must be present in the field, sub-divided into a card tariff and a reader tariff.

In addition, for some markets there is a maximum time to completion requirement, covering the reader processing between when the card is no longer required in the field and when the POS system indicates an offline approval decision or the POS system processing time required to prepare an online request and handle the response.

10.1 Card in Field

The primary requirement is the maximum time that a card must be present in the reader field when presented for a single presentment. This is a maximum of 500ms (0.5 seconds) and is for successful transactions with no transmission errors and is between:

- Card discovery – the start of the first ISO 14443-3 command from the reader to which the card responds *and*

- Either of the following:

  o The start of the user "Card read successfully" indication to the cardholder that the card may be taken away from the reader.

    The user interface indication that the card may be taken away may be a visual indicator (e.g. LED), an audio indicator (e.g. beep), or both.

    The time measurement is to the start of the first indication given to the cardholder, for example the LED being illuminated, or the first few cycles of the audio beep.

    Other means of indication may be used, but since the EMV test procedures require either an LED or a beep (or both) then special provisions for testing would need to be arranged.
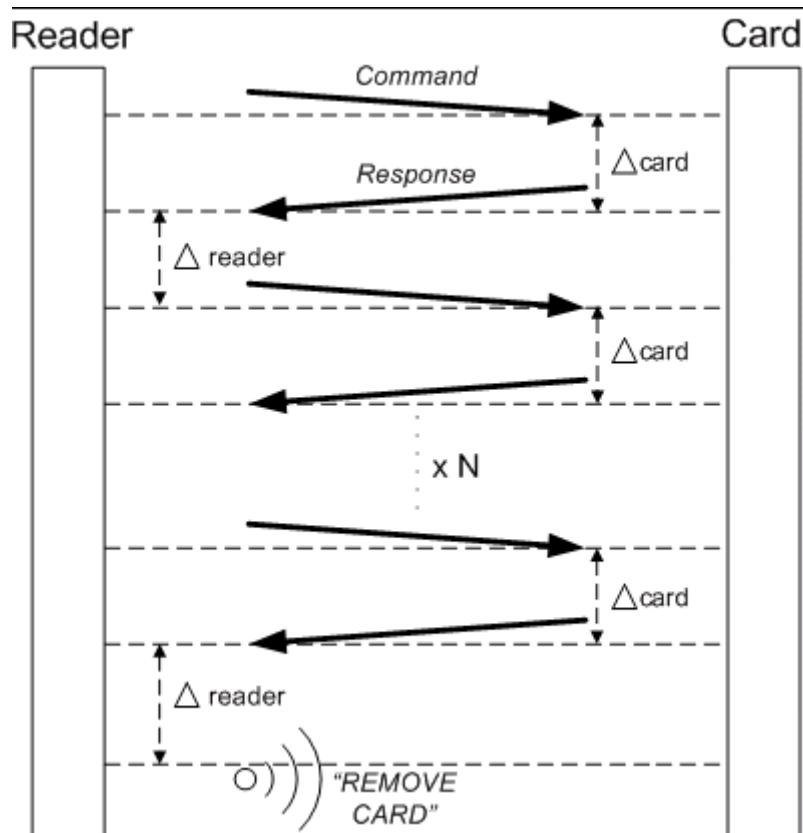
  o For cards that remain in the field during online transactions, the point at which communication is no longer required with the card prior to the Outcome making the online request.

10.2 Allocation of Tariffs

Each contactless transaction can be separated timewise into five categories:

1. Transmission of reader commands to the card

2. Card processing

3. Transmission of card responses to the reader

4. Reader processing

5. Reader processing after last command until user indication for card removal

Figure 10-1: Tariff Allocation for Transaction Timing

The time tariff allocated to readers consists of the summation of all reader transmission times and all reader processing times – categories 1, 4, and 5.

The time tariff allocated to cards consists of the summation of all card transmission times and all card processing times – categories 2 and 3.

Requirements – Reader Tariff

10.2.1.1   The time utilised by a reader shall be a maximum of 100ms.

This implies a card tariff of 400ms. This is outside the scope of EMV contactless reader requirements.

10.3 Transaction Disposition

10.3.1   Offline

For transactions that are authorised offline, declined offline, or require switching to another interface, POS systems are required to determine and display the disposition within a limited time period.

Requirements – Offline Transaction Disposition

10.3.1.1   The time that a POS system takes to indicate an offline transaction disposition shall be a maximum of 250ms. This is between:

- The end of the card response to the final application level command *and*

- The start of the transaction disposition as determined by the POS system being displayed to the cardholder.

10.3.2   Online

For transactions that are authorised or declined online, POS systems are required to prepare the authorisation request and process the response within a limited time period. This does not include the time required to enter a PIN.

Requirements – Online Transaction Disposition

10.3.2.1   The time that a POS system takes to indicate an online transaction disposition shall be a maximum of 400ms. This is the sum of the times:

- Between the end of the card response to the final application level command *and* the start of the authorisation request from the terminal

- Between the end of the authorisation response received by the terminal *and* the start of the transaction disposition being displayed to the cardholder.

10.4 Reference Cards

In order that reader performance can be fairly tested and that readers are not penalised by poorly implemented reference cards, it is necessary that cards or simulators used for reader testing meet certain configuration criteria. Significant criteria include:

- Key sizes:
  - o payment system
  - o issuer
  - o card
- Chaining – should not be needed in either direction
- Use of WTX (Wait Time Extension) – should not be necessary except for the command initiating cryptographic processing
- Number of entries in the PPSE
- Number of records to read
- Total number of commands and size of data to be sent by the reader
- Location of card – recommended that cards are static and located in a nominal good read position with the card antenna planar to the reader antenna

Readers are tested for their tariff and disposition timings using cards or a simulator relevant to the kernel under evaluation. It is also expected that implementation testing will be carried out for the overall transaction timing using representative cards from the market being considered.

Annex A Data Elements for the Data Record and Discretionary Data

The POS System may be required to handle certain data elements from the kernel to complete a transaction; these data elements are made available with data records in an Outcome. The precise data elements will depend on the implementation and environments.

Terminals and readers must be able to process various combinations of data elements, and terminals must be able to assemble them into authorisation and clearing messages appropriate to the acceptance environment. The data elements required will vary significantly between EMV mode and mag-stripe mode and depending on whether the network message is for authorisation or clearing. The following list is a comprehensive list of references to the kernel specifications where the data elements for the data records may be located.

Note: Tags values can have different meanings for different kernels.

Table A.1: Kernel Data Record and Discretionary Data Reference

Kernel 2	Section 4.5, Lists of Data Objects in OUT
Kernel 3	Annex B, Online Messages and Clearing Records
Kernel 4	Annex A, Kernel 4 Data Elements
Kernel 5	Annex C, Kernel 5 Transaction Record
Kernel 6	Annex B, Data Record Outcome Parameter
Kernel 7	Annex C, Data Elements
Kernel 8	Annex A, Data Dictionary

Annex B Guidance on Outcome and Parameter Setting

On completion, a kernel indicates its results by means of an Outcome and provides parameter values suited to the associated Outcome and to the acceptance environment (EMV mode or mag-stripe mode). This annex gives guidance on parameter settings.

The following examples are presented:

B.1   Approved

The kernel has determined that the transaction is approved, either through offline processing or after reactivation following an online response.

- **Start:** N/A

- **Online Response Data:** N/A

- **CVM:** N/A or Obtain Signature

- **UI Request on Outcome Present:** Yes

  o   Message Identifier: '03' ("Approved")

  o   Status: Card Read Successfully

- **UI Request on Restart Present:** No

- **Data Record Present:** Yes

- **Discretionary Data Present:** Yes or No

- **Alternate Interface Preference:** N/A

- **Receipt:** Yes or N/A as required

- **Field Off Request:** N/A

- **Removal Timeout:** zero

B.2   Approved (with balance)

The kernel has determined that the transaction is approved and wishes to display a balance of £1.23.

- **Start:** N/A

- **Online Response Data:** N/A

- **CVM:** N/A or Obtain Signature

- **UI Request on Outcome Present:** Yes

  o   Message Identifier: '03' ("Approved")

  o   Status: Card Read Successfully

  o   Value Qualifier: "Balance"

  o   Value: 00 00 00 00 01 23

  o   Currency Code: 0826

- **UI Request on Restart Present:** No

- **Data Record Present:** Yes

- **Discretionary Data Present:** Yes or No

- **Alternate Interface Preference:** N/A

- **Receipt:** Yes or N/A as required

- **Field Off Request:** N/A

- **Removal Timeout:** zero

B.3 Declined

The kernel has determined that the transaction is declined, either through offline processing or after reactivation following an online response.

- **Start:** N/A

- **Online Response Data:** N/A

- **CVM:** N/A

- **UI Request on Outcome Present:** Yes

  o Message Identifier: '07' ("Not Authorised")

  o Status: Card Read Successfully

- **UI Request on Restart Present:** No

- **Data Record Present:** No

- **Discretionary Data Present:** Yes or No

- **Alternate Interface Preference:** N/A

- **Receipt:** Yes or N/A as required

- **Field Off Request:** N/A

- **Removal Timeout:** zero

B.4   Try Another Interface

The kernel, Entry Point, or the Issuer has determined that the transaction cannot be completed over the contactless interface and another interface such as contact chip or mag-stripe should be attempted.

- **Start:** N/A

- **Online Response Data:** N/A

- **CVM:** N/A

- **UI Request on Outcome Present:** Yes

  - Message Identifier: '18' ("Please insert or swipe card")

  - Status: Ready to Read

- **UI Request on Restart Present:** No

- **Data Record Present:** No

- **Discretionary Data Present:** Yes or No

- **Alternate Interface Preference:** N/A, Contact Chip, or Mag-stripe

- **Receipt:** N/A

- **Field Off Request:** N/A

- **Removal Timeout:** zero

B.5   Online Request

The kernel requests online authorisation.

- **Start:** N/A

- **Online Response Data:** N/A

- **CVM:** Online PIN or Obtain Signature

- **UI Request on Outcome Present:** Yes

  o   Message Identifier: '1B' ("Authorising, Please Wait")

  o   Status: Card Read Successfully

- **UI Request on Restart Present:** No

- **Data Record Present:** Yes

- **Discretionary Data Present:** Yes or No

- **Alternate Interface Preference:** N/A

- **Receipt:** Yes or N/A

- **Field Off Request:** N/A

- **Removal Timeout:** zero

B.6   Online Request (for "Two Presentments")

The kernel has determined that the transaction must be sent online and that the card can be re-presented.

- **Start:** B

- **Online Response Data:** EMV Data

- **CVM:** N/A, Online PIN, or Obtain Signature

- **UI Request on Outcome Present:** Yes

  o Message Identifier: '1B' ("Authorising, Please Wait")

- **UI Request on Restart Present:** Yes

  o Message Identifier: '21' ("Present Card Again")

  o Status: Ready to Read

- **Data Record Present:** Yes

- **Discretionary Data Present:** Yes or No

- **Alternate Interface Preference:** N/A

- **Receipt:** Yes or N/A

- **Field Off Request:** N/A

- **Removal Timeout:** zero

B.7 Online Request (for "Present and Hold")

The kernel has determined that the transaction must be sent online while the card remains in the field.

- **Start:** D

- **Online Response Data:** Any

- **CVM:** N/A

- **UI Request on Outcome Present:** Yes

  o Message Identifier: '1B' ("Authorising, Please Wait")

  o Status: Processing

- **UI Request on Restart Present:** Yes

  o Message Identifier: '16' ("Processing")

  o Status: Processing

- **Data Record Present:** Yes

- **Discretionary Data Present:** Yes or No

- **Alternate Interface Preference:** N/A

- **Receipt:** Yes or N/A

- **Field Off Request:** N/A

- **Removal Timeout:** set by kernel

B.8   Request Online PIN

The kernel has determined that the Issuer is requesting that Online PIN entry is required.

- **Start:** D

- **Online Response Data:** Any

- **CVM:** Online PIN

- **UI Request on Outcome Present:** Yes

  o Message Identifier: '09' ("Please Enter Your PIN ")

  o Status: Processing

- **UI Request on Restart Present:** No

- **Data Record Present:** Yes

- **Discretionary Data Present:** Yes or No

- **Alternate Interface Preference:** N/A

- **Receipt:** Yes or N/A

- **Field Off Request:** N/A

- **Removal Timeout:** set by kernel

B.9   Try Again

The kernel has determined that the transaction should be attempted for a second time. In this example, the transaction is repeated to allow entry of a Confirmation Code into a mobile device, and the field is turned off for 1300ms.

- **Start:** B

- **Online Response Data:** N/A

- **CVM:** N/A

- **UI Request on Outcome Present:** Yes

  o   Message Identifier: '20' ("See Phone for Instructions")

  o   Status: Processing Error

  o   Hold Time: 13

  o   Language Preference: 'en'

- **UI Request on Restart Present:** Yes

  o   Status: Ready to Read

- **Data Record Present:** No

- **Discretionary Data Present:** Yes or No

- **Alternate Interface Preference:** N/A

- **Receipt:** N/A

- **Field Off Request:** 13

- **Removal Timeout:** zero

B.10 Select Next

The kernel has determined that the selected combination is unsuitable and the next combination (if any) should be tried. In practice, this is handled directly by Entry Point and only the UI Request parameter settings are relevant.

- **Start:** C

- **Online Response Data:** N/A

- **CVM:** N/A

- **UI Request on Outcome Present:** No

- **UI Request on Restart Present:** No

- **Data Record Present:** No

- **Discretionary Data Present:** No

- **Alternate Interface Preference:** N/A

- **Receipt:** N/A

- **Field Off Request:** N/A

- **Removal Timeout:** zero

B.11 End Application

The kernel (or Entry Point) has determined that there has been an unrecoverable error and processing should be terminated.

- **Start:** N/A

- **Online Response Data:** N/A

- **CVM:** N/A

- **UI Request on Outcome Present:** Yes

  o Message Identifier: '1C' ("Insert, Swipe or Try Another Card")

  o Status: Ready to Read

- **UI Request on Restart Present:** No

- **Data Record Present:** No

- **Discretionary Data Present:** Yes or No

- **Alternate Interface Preference:** N/A, Contact Chip, or Mag-stripe

- **Receipt:** N/A

- **Field Off Request:** N/A

- **Removal Timeout:** zero

B.12   End Application (with restart)

The kernel requires a restart after confirmation of card removal.

- **Start:** B

- **Online Response Data:** N/A

- **CVM:** N/A

- **UI Request on Outcome Present:** Yes

  o   Message Identifier: '21' ("Present Card Again")

  o   Status: Not Ready

  o   Hold time 13

- **UI Request on Restart Present:** Yes

  o   Message Identifier: '21' ("Present Card Again")

  o   Status: Ready to Read

- **Data Record Present:** No

- **Discretionary Data Present:** Yes or No

- **Alternative Interface Preference:** N/A

- **Receipt:** N/A

- **Field Off Request:** Optional

- **Removal Timeout:** zero

Annex C Glossary

This annex provides a glossary of terms and abbreviations used in this specification.

ADF	Application Definition File
AID	Application Identifier
Approved	A Final Outcome
b	Binary
C	Conditional
Candidate List	The list of Combinations constructed by Entry Point during the Combination Selection process.
C-APDU	Command APDU
Card	As used in these specifications, a consumer device supporting contactless transactions.
Cardholder Verification Method (CVM)	A method used to confirm the identity of a cardholder.
Combination	Any of the following:

For:	The combination of:
a card	• an ADF Name • a Kernel Identifier
a reader	• an AID • a Kernel ID
the Candidate List for final selection	• an ADF Name • a Kernel ID • the Application Priority Indicator (if present) • the Extended Selection (if present)

Confirmation Code	A code or password entered into a mobile device in order to confirm that a user wishes to perform a contactless mobile payment transaction.

Contactless card	See "Card".
Contactless Symbol	The symbol identifying the contactless "landing plane" near the antenna of a contactless acceptance device, where the cardholder must present the card.
CVM	Cardholder Verification Method
DDF	Directory Definition File
Declined	A Final Outcome
DF	Dedicated File
Discovery	Contactless readers poll for contactless cards. When one or more contactless cards enter the field of the contactless reader, this is called discovery.
DOL	Data Object List
EMV mode	An operating mode of the POS System that indicates that this particular acceptance environment and acceptance rules supports chip infrastructure. Typically used in conjunction with the term "transaction" (i.e., EMV mode transaction) to indicate contactless payment utilising a full chip infrastructure carrying EMV minimum data.
EMV®	A trademark owned by EMVCo, referring to the technical specifications published by EMVCo.
EMVCo	The organization that manages the EMV Specifications and their related testing processes.
End Application	A Final Outcome
Extended Selection	An option in which Entry Point appends the value indicated by the Extended Selection data element (Tag '9F29') to the ADF name in the SELECT command.
FCI	File Control Information
Final Outcome	Result provided to the reader as a result of Entry Point processing the Outcome from the kernel, or provided directly by Entry Point under exception conditions.
Hz	Hertz

Kernel   The kernel contains interface routines, security and control functions, and logic to manage a set of commands and responses to retrieve the necessary data from a card to complete a transaction. The kernel processing covers the interaction with the card between the Final Combination Selection (excluded) and the Outcome Processing (excluded).

Kernel ID   Identifier to distinguish between different kernels that may be supported by the reader.

Kernel Identifier   Identifier to distinguish between different kernels that may be indicated by the card.

LED   Light-Emitting Diode

M   Mandatory

Mag-stripe mode   An operating mode of the POS System that indicates that this particular acceptance environment and acceptance rules supports mag-stripe infrastructure. Typically used in conjunction with the term "transaction" (i.e., mag-stripe mode transaction) to indicate contactless payment based on Track 1 and/or Track 2 Data obtained from the card.

ms   Millisecond

n   Numeric

N/A   Not Applicable; a possible value for several Outcome and Final Outcome parameters

O   Optional

Online PIN   A method of PIN verification where the PIN entered by the cardholder into the terminal PIN pad is encrypted and included in the online authorisation request message sent to the issuer.

Online Request   A Final Outcome

Outcome   Result from the kernel processing, provided to Entry Point, or under exception conditions, result of Entry Point processing. In either case, a primary value with a parameter set.

PDOL   Processing Options Data Object List

PIN   Personal Identification Number

POS	Point of Sale
PPSE	Proximity Payment System Environment
Proximity Payment System Environment (PPSE)	A list of all Combinations supported by the contactless card. PPSE is used in the Entry Point Combination Selection process.
R-APDU	Response APDU
Reader	A component of the POS System; for details, please see section 4.3.
Requested Kernel ID	Internal Entry Point variable used to build the matching kernel identification during the Combination Selection process
Restart flag	Internal reader flag that indicates whether a kernel is being started for a new transaction or continuing with an ongoing transaction (e.g. in order to complete online processing, to perform on-device CVM, to recover from a communication error, etc.).
RFU	Reserved for Future Use (by EMVCo)
Select Next	An Outcome
Status Check Support	Option within the terminal related to the checking of a single unit of currency. A single unit of currency has the value of 1 of the (major) unit of currency as defined in ISO 4217. As an example a single unit of currency for Euro is 1.00.
SW1 SW2	Status Byte One, Status Byte Two
Terminal	A component of the POS System; for details, please see section 4.3.
TLV	Tag Length Value
Transaction	The reader-card interaction between the first presentment of the card and the decision on whether the transaction is approved or declined. If the transaction is authorised online, this may involve multiple presentments of the card on the reader.
Try Again	An Outcome
Try Another Interface	A Final Outcome

TTQ   Terminal Transaction Qualifiers

UI   User Interface

var   Variable length