

**WIZARPOS International Co., Ltd.**

# **EMV Kernel Interface**

version 4.23

## Revision History

version	Date	Description	who
1.00	2013-12-20	create	Michael Li
4.01	2018-10-18	Remove: emv_terminal_param_set emv_terminal_param_set2 Add: emv_terminal_param_set_tlv	Michael Li
4.02	2018-10-22	Update emv_aid_param_add	Michael Li
4.03	2018-10-31	Add Appendix	Michael Li
4.04	2018-11-02	Update error code	Michael Li
4.05	2018-11-09	Add: 4.16 emv_get_kernel_checksum 4.17 emv_get_config_checksum	Michael Li
4.06	2018-12-10	Add: 4.18 emv_set_force_aac	Michael Li
4.07	2018-12-12	1. Add special application priority for US Common Debit AID(See 5.2:EF07, 5.5:EF06) 2. Add Appendix B	Michael Li
4.08	2018-12-25	Add NSICCS (Indonesia) Support	Michael Li
4.09	2019-1-23	Add emv_get_candidate_list_tlv	Michael Li
4.10	2019-3-11	Add emv_set_kernel_attr	Michael Li
4.11	2019-3-21	Update emv_get_candidate_list_tlv	Michael Li
4.12	2019-4-4	Add new error code ERROR_APP_UNSUPPORTED 39	Michael Li
4.13	2019-4-8	Add: emv_generate_pseudo_track1; emv_generate_pseudo_track2	Michael Li
4.14	2019-4-9	Add 9F6D, 9F6E in emv_aidparam_add	Michael Li
4.15	2019-4-24	Add DF11, DF12, DF13 in emv_terminal_param_set_tlv	Michael Li
4.16	2019-4-26	Add 4.22 emv_offline_pin_verified	Michael Li
4.17	2019-4-26	Add 4.23 emv_log_file_clear	Michael Li
4.18	2019-5-5	Add 4.24 emv_get_offlinepin_times	Michael Li
4.19	2019-5-8	Update 4.15 Set acceptance for Bypass PIN	Michael Li
4.20	2019-6-11	Add 1.6 set_contactless_detach_enable	Michael Li
4.21	2019-11-21	Add 'Interac' , 'MIR' , 'WISE' Support	Michael Li
4.22	2019-12-24	Add Error Code	Michael Li

4.23	2020-3-9	Add 'C5_JCB' Support	Michael Li
------	----------	----------------------	------------

<b>1. IC READER .....</b>	<b>7</b>
1.1 OPEN READER AND WAIT CARD.....	7
1.2 CLOSE READER.....	7
1.3 GET CURRENT CARD TYPE .....	7
1.4 GET CARD ATR.....	7
1.5 APDU COMMAND.....	7
1.6 SET DETACH ATTRIBUTION OF CONTACTLESS CARD FOR READER CLOSING.....	8
<b>2. STORE AND SET EMV DATA .....</b>	<b>8</b>
2.1 CHECK THE EXISTENCE OF DATA FOR THE TAG .....	8
2.2 GET THE DATA FOR THE TAG .....	8
2.3 GET THE DATA FOR THE TAG LIST .....	8
2.4 SET THE DATA FOR THE TAG.....	9
<b>3. EMV TRANSACTION PROCESSING.....</b>	<b>9</b>
3.1 EMVKERNEL INITIALIZE .....	9
3.2 INITIALIZE EMV TRANSACTION DATA.....	11
3.3 EMV PROCESSING FUNCTION .....	11
<b>4. OTHERS FUNCTIONS.....</b>	<b>11</b>
4.1 GET EMV KERNEL VERSION .....	11
4.2 SET TRANSACTION AMOUNT .....	12
4.3 SET OTHER AMOUNT .....	12
4.4 SET TRANSACTION TYPE .....	12
4.5 SET EMV KERNEL TYPE.....	12
4.6 IS NEEDED ADVICE THE TRANSACTION .....	12
4.7 IS NEEDED SIGN THE TRANSACTION .....	13
4.8 SET THE TRANSACTION FORCE ONLINE .....	13
4.9 READ TRANSACTION RECORD FROM THE CARD .....	13
4.10 GET CANDIDATE APPLICATION LIST.....	13
4.11 GET CANDIDATE APPLICATION LIST WITH TLV FORMAT .....	13
4.12 SET THE SELECTED INDEX FOR APPLICATION SELECTION .....	14
4.13 SET THE RESULT OF CARDHOLDER ID CHECK .....	14
4.14 SET THE RESULT OF ONLINE PIN .....	14
4.15 SET ACCEPTANCE FOR BYPASS PIN.....	14
4.16 SET THE RESULT OF ONLINE AUTHENTICATION.....	14
4.17 GET KERNEL CHECKSUM .....	15

4.18 GET CONFIGURATION CHECKSUM .....	15
4.19 SET THE TRANSACTION FORCE AAC FOR FIRST GENERATE AC .....	15
4.20 GET PSEUDO TRACK1 DATA FOR AMEX & DISCOVER CONTACTLESS IN MSD MODE.....	15
4.21 GET PSEUDO TRACK2 DATA FOR AMEX & DISCOVER CONTACTLESS IN MSD MODE.....	15
4.22 IS OFFLINE PIN VERIFIED.....	16
4.23 CLEAR EMV TRANSACTION LOG .....	16
4.24 GET THE TIMES OF OFFLINE-PIN ENTRY .....	16
4.25 GET CURRENT PROCESS TYPE .....	16
<b>5. EMV PARAMETERS .....</b>	<b>16</b>
5.1 CLEAR AID INFO .....	16
5.2 ADD AID INFO.....	16
5.3 CLEAR CAPK INFO.....	18
5.4 ADD CAPK INFO .....	19
5.5 SET EMV TERMINAL PARAMETERS BY TLV.....	19
5.6 CLEAR EXCEPTION FILE .....	20
5.7 ADD EXCEPTION FILE.....	20
5.8 CLEAR REVOKED CERTICATES .....	20
5.9 ADD REVOKED CERTIFICATE .....	21
5.10 SET EMV KERNEL ADDITIONAL ATTRIBUTE .....	21
<b>ANNEX A: TAG LIST DEFINED BY MASTERCARD.....</b>	<b>21</b>
A.1 CONTACTLESS KERNEL ID (DF810C).....	21
A.2 CVM CAPABILITY – CVM REQUIRED (DF8118) .....	22
A.3 CVM CAPABILITY – No CVM REQUIRED (DF8119) .....	22
A.4 KERNEL CONFIGURATION (DF811B) .....	23
A.5 MAG-STRIPE CVM CAPABILITY – CVM REQUIRED (DF811E).....	23
A.6 MAG-STRIPE CVM CAPABILITY – No CVM REQUIRED (DF812C).....	23
<b>ANNEX B: TAG LIST DEFINED BY AMERICAN EXPRESSPAY.....</b>	<b>24</b>
B.1 CONTACTLESS READER CAPABILITIES (9F6D).....	24
B.2 ENHANCED CONTACTLESS READER CAPABILITIES (9F6E) .....	24
<b>ANNEX C: TAG LIST DEFINED BY JCB .....</b>	<b>26</b>
C.1 TERMINAL INTERCHANGE PROFILE (9F53) .....	26
<b>ANNEX D: TAG LIST DEFINED BY INTERAC.....</b>	<b>27</b>
D.1 MERCHANT TYPE INDICATOR .....	27

D.2 TERMINAL TRANSACTION INFORMATION (TTI) .....	27
D.3 TERMINAL OPTION STATUS (TOS).....	28
<b>ANNEX E: TAG LIST DEFINED BY MIR.....</b>	<b>28</b>
E.1 TERMINAL TPM CAPABILITIES (DF55) .....	28
<b>ANNEX F: TAG LIST DEFINED BY WIZARPOS.....</b>	<b>30</b>
F.1 COMBINATION OPTIONS (EF10).....	31

## 1. IC Reader

### 1.1 open reader and wait card

```

/*
 * @param[in] reader : reader type      : 0  all of readers
 *                                     : 1  only contact reader
 *                                     : 2  only contactless reader
 * return value      : < 0  Fail
 *                   : >= 0 Success
 * (If select open all of readers, any open success return success)
 */
int open_reader(int reader)

```

### 1.2 close reader

```

/*
 * @param[in] reader:  reader type : 0 all of readers
 *                  : 1 only contact reader
 *                  : 2 only contactless reader
 */
void close_reader(int reader)

```

### 1.3 get current card type

```

/*
 * return value : 1  contact card
 *              : 2  contactless card
 *              : -1 no card
 */
int get_card_type(void)

```

### 1.4 get card ATR

```

/*
 * @param[out] pATR : the value of ATR
 * return value  : the length of ATR
 */
int get_card_atr(unsigned char *pATR)

```

### 1.5 APDU command

```

/*
 * @param[in] cmd      : APDU command
 * @param[in] cmdLength : the length of APDU command

```

```

* @param[out] respData : the value of card response
* @param[in]   respDataLength : accepted max length of card
response
* return value  : >= 0 :the length of card response
*               < 0 :Fail
*/
int transmit_card( unsigned char *cmd,
                  int cmdLength,
                  unsigned char *respData,
                  int respDataLength)

```

## 1.6 Set detach attribution of contactless card for reader closing

```

/**
* @param enable
* 0 - don't detach card when close contactless reader;
* 1 - waiting detach card when close contactless reader
* 2 - do not control
**/
void set_contactless_detach_enable(int enable)

```

## 2. store and set EMV data

### 2.1 check the existence of data for the tag

```

/*
* @param[in] tag : tag name
* return value : < 0 the data not exist
*              >= 0 the length of data
*/
int emv_is_tag_present(int tag)

```

### 2.2 get the data for the tag

```

/*
* @param[in] tag : tag name
* @param[out] data : the value of the data
* @param[in] dataLength : accepted max length of the data
* return value : < 0 : Fail
*              >= 0: the length of the data
*/
int emv_get_tag_data(int tag, unsigned char *data, int dataLength)

```

### 2.3 get the data for the tag list

```

/*

```



```

* @param[in] tagNames      : the list of the tags
* @param[in] tagCount      : the count of the tags
* @param[out] pTagsValue   : the values of the data (TLV format)
* @param[in] pTagsValueLength : accepted max length of the data
* return value             : < 0 : Fail
*                          : >= 0: the length of the data
*/
int emv_get_tag_list_data(int *tagNames, int tagCount,
                        unsigned char *pTagsValue,
                        int pTagsValueLength);

```

## 2.4 set the data for the tag

```

/*
* @param[in] tag      : tag name
* @param[in] data     : the value of the data
* @param[in] length  : the length of the data
* return value       : < 0 : Fail
*                   : >= 0 : the tag的长度
*/
int emv_set_tag_data(int tag, unsigned char *data, int length)

```

## 3. EMV transaction processing

### 3.1 EMVKernel initialize

```

typedef struct
{
    // callback function for card event
    CARD_EVENT_OCCURED pCafdEventOccured;
    // callback function for EVM processing
    EMV_PROCESS_CALLBACK pEVMProcessCallback;
}EMV_INIT_DATA;
void emv_kernel_initialize(unsigned char *pInitData)

```

- 1) typedef void (\*CARD\_EVENT\_OCCURED)(int eventType)
  - // any card event occurred, this function will be revoked
  - // @param[in] eventType : SMART\_CARD\_EVENT\_INSERT\_CARD = 0;
  - // : SMART\_CARD\_EVENT\_REMOVE\_CARD = 1;
  - // : SMART\_CARD\_EVENT\_POWERON\_ERROR = 9;
  - // : SMART\_CARD\_EVENT\_CONTALESS\_HAVE\_MORE\_CARD = 10;
- 2) typedef void (\*EMV\_PROCESS\_CALLBACK)(unsigned char \*pData);
  - // callback function for EVM processing, pData have 2 bytes
  - // unsigned char status = pData[0];

```

// unsigned char desc = pData[1];
* status:
* STATUS_ERROR = 0; //ERROR
* STATUS_CONTINUE = 1; // not completed, need to continue
* STATUS_COMPLETION = 2; // completed
* desc
* when status = STATUS_COMPLETION, desc means:
* APPROVE_OFFLINE = 1; //Transaction approved Offline
* APPROVE_ONLINE = 2; //Transaction approved Online
* DECLINE_OFFLINE = 3; //Transaction declined Offline
* DECLINE_ONLINE = 4; //Transaction declined Online
*
* when status = STATUS_ERROR, desc means:
* SUCCESS = 0; //SUCCESS
* ERROR_NO_APP = 1; //No Supported Application Selected
* ERROR_CARD_BLOCKED = 2; //card return 6A81 when Application Select
* ERROR_APP_SELECT = 3; //Error when Application Select
* ERROR_INIT_APP = 4; //Error when Initialize Application Data
* ERROR_EXPIRED_CARD = 5; // Card Expired
* ERROR_APP_DATA = 6; //Error when Read Application Data
* ERROR_DATA_INVALID = 7; // have invalid data
* ERROR_DATA_AUTH = 8; // Fail in offline authentication
* ERROR_GEN_AC = 9; //Generate AC error when Transaction Process
* ERROR_PROCESS_CMD = 10; //Process Command ERROR
* ERROR_SERVICE_NOT_ALLOWED = 11; //Service not Allowed
* ERROR_PINENTRY_TIMEOUT = 12; //PIN Entry timeout
* ERROR_OFFLINE_VERIFY = 13; //Check Offline PIN Error when Cardholder Verify
* ERROR_NEED_ADVICE = 14; //Communication Error with Host, but the card need
advice, halted the transaction
* ERROR_USER_CANCELLED = 15;
* ERROR_AMOUNT_OVER_LIMIT = 16; // amount over limit
* ERROR_AMOUNT_ZERO = 17; // amount can not be zero
* ERROR_OTHER_CARD = 18; // Please try other card
* ERROR_MISSING_DATA = 19; //missing mandatory data
* ERROR_APP_BLOCKED = 20; // application is blocked
* ERROR_POWER_ON_AGAIN = 21; // Please power on card again
* ERROR_CONTACTLESS_INTERRUPT = 22; // contact card inserted when reading
contactless card record
* ERROR_MSD_NOT_SUPPORTED = 30; // Magstripe Mode not supported
* ERROR_AMOUNT_NOT_PRESENT = 31; // amount not present
* ERROR_CCC = 32; // CCC Error for mastercard contactless
* ERROR_EXCHANGE_RR_DATA = 33; // Exchange relay resistance data error for
mastercard contactless
* ERROR_GET_PDOL_DATA = 34; // Get PDOL data error

```

```

*      ERROR_RESTART = 35; // Please restart the transaction
*      ERROR_SEE_PHONE = 36; // Please see phone
*      ERROR_NEXT_AID = 37; // Please select next aid
*      ERROR_ANOTHER_INTERFACE = 38; // Please try another interface
*      ERROR_APP_UNSUPPORTED = 39; // The app in card is unsupported
*      ERROR_PERFORM_TRANSACTION = 40; // Perform transaction bad sw
*      ERROR_RECOVERY_NOT_SUPPORT = 41; // Tearing recovery not supported
*      ERROR_RECOVERY_LIMIT_EXCEEDED = 42; // Recovery limit exceeded
*      ERROR_SEE_ATTENDANT = 43
*      ERROR_CANNOT_PROCESSED = 44
*      ERROR_PAYMENT_NOT_ACCEPTED = 45
*      ERROR_TOO_MANY_TAPS = 46
*      ERROR_CONDITIONS_NOT_SATISFIED = 47
*
* when status = STATUS_CONTINUE, desc means:
*      EMV_CANDIDATE_LIST = 1; //notify Application show Application Candidate List
*      EMV_APP_SELECTED = 2; //Application Select Completed
*      EMV_READ_APP_DATA = 3; //Read Application Data Completed
*      EMV_DATA_AUTH = 4; //Data Authentication Completed
*      EMV_OFFLINE_PIN = 5; // notify Application prompt Caldholder enter offline PIN,
*      EMV_ONLINE_ENC_PIN = 6; //notify Application prompt Caldholder enter Online PIN
*      EMV_PIN_BYPASS_CONFIRM = 7; //notify Application confirm to Accepted PIN
Bypass or not
*      EMV_PROCESS_ONLINE = 8; //notify Application to Process Online
*      EMV_ID_CHECK = 9; //notify Application Check Cardholder's Identification
*/

```

## 3.2 Initialize EMV transaction data

```
void emv_trans_initialize(void)
```

## 3.3 EMV processing function

```

/*
* return value: >=0 SUCCESS, <0 Fail
*/
int emv_process_next(void)

```

## 4. Others functions

### 4.1 Get EMV Kernel version

```

/**
* @param[out] buffer: the value of emv kernel version
* @param[in] bufferSize: accepted max length of emv kernel version

```

```

* return value: the length of emv kernel version
*/
int emv_get_version_string(unsigned char *buffer, int bufferLength)

```

#### 4.2 Set transaction amount

```

/**
* @param[in] amount: '\0' as ending mark
* return value: >=0 Success; < 0 Fail
* If strlen(amount) > 12, return -1
*/
int emv_set_trans_amount(unsigned char *amount)

```

#### 4.3 Set other amount

```

/**
* @param[in] amount: '\0' as ending mark
* return value: >=0 Success; < 0 Fail
* If strlen(amount) > 12, return -1
*/
int emv_set_other_amount(unsigned char *amount)

```

#### 4.4 Set transaction type

```
int emv_set_trans_type(unsigned char transType)
```

```

#define TRANS_GOODS_SERVICE    0x00
#define TRANS_CASH              0x01
#define TRANS_INQUIRY          0x04
#define TRANS_TRANSFER          0x05
#define TRANS_PAYMENT           0x06
#define TRANS_ADMIN             0x07
#define TRANS_CASHBACK          0x09
#define TRANS_CARD_RECORD       0x0A

```

#### 4.5 set emv kernel type

```

/**
* @param[in] kernelType: 1 EMV Contact Kernel
* 2 EMV Contactless Kernel
* 3 UPCASH Kernel for China Union Pay
*/
int emv_set_kernel_type(unsigned char kernelType)

```

#### 4.6 Is needed advice the transaction

```
/**
```

```

* return value:  1 need advice
*                0 not need advice
*/
int emv_is_need_advice(void)

```

#### 4.7 Is needed sign the transaction

```

/**
* return value:  1 need sign
*                0 not need sign
*/
int emv_is_need_signature(void)

```

#### 4.8 Set the transaction force online

```

/**
* @param[in] flag:  flag=1 Yes,  flag = 0 No
*/
int emv_set_force_online(int flag)

```

#### 4.9 Read transaction record from the card

```

/**
* @param[out] data      : transaction record
* @param[in]  dataLength : accepted max length for the transaction
record
* return value          : < 0 : Fail
*                       : >= 0: record count
*/
int emv_get_card_record(uint8_t *data, int dataLength)

```

#### 4.10 Get candidate application list

```

/*
* @param[out] data : application list as "LV" format
* @param[in]  dataLength : accepted max length for application list
* return value          : < 0 : Fail
*                       : >= 0: application count
*/
int emv_get_candidate_list(uint8_t *data, int dataLength)

```

#### 4.11 Get candidate application list with TLV Format

```

/*
* @param[out] data : application list with "TLV" format
*                Tag 4F: AID, It is the start of candidate record
*                Tag 9F11: Issuer Code Table Index
*                Tag 50: Application Label

```

```

*          Tag 9F12: Application Preferred Name
* @param[in] dataLength : accepted max length for application list
* return value      : < 0 : Fail
*                  : >= 0: the length of data
*/
int emv_get_candidate_list_tlv(uint8_t *data, int dataLength)

```

#### 4.12 Set the selected index for application selection

```

/**
* @param[in] index : the selected index (started by 0)
* return value  : < 0 : Fail
*              : >= 0: Success
*/
int emv_set_candidate_list_result(int index)

```

#### 4.13 Set the result of cardholder ID check

```

/* ID Type (9F62) 、ID Number(9F61)
* @param[in] result : 0: check Fail, 1:check success
* return value  : < 0 : Fail
*              : >= 0: Success
*/
int emv_set_id_check_result(int result)

```

#### 4.14 Set the result of Online PIN

```

/**
* @param[in] result : 0: Online PIN not input, 1:Online PIN inputted
* return value  : < 0 : Fail
*              : >= 0: Success
*/
int emv_set_online_pin_entered(int result)

```

#### 4.15 Set acceptance for Bypass PIN

```

/**
* @param[in] flag: 0: Disable bypass pin
                  1: Enable bypass pin
* return value  : < 0 : Fail
*              : >= 0: Success
*/
int emv_set_bypass_pin(int flag)

```

#### 4.16 Set the result of online authentication

```

/**
* @param[in] result : -1:communication failed; 0: host refused; 1: host accepted

```

```

* @param[in] respCode : 2 bytes response code from the host
* @param[in] issuerRespData : the emv data from the host
* @param[in] issuerRespDataLength : the length of the emv data from the host
* return value      : < 0 : Fail
*                   : >= 0: Success
*/
int emv_set_online_result(int result,
                          unsigned char *respCode,
                          unsigned char *issuerRespData,
                          int issuerRespDataLength)

```

#### 4.17 Get Kernel checksum

```

/**
* @param[out] buffer:   the value of emv kernel checksum
* @param[in]  bufferLength: accepted max length
* return value: the length of kernel checksum
*/
int emv_get_kernel_checksum(unsigned char *buffer, int bufferLength)

```

#### 4.18 Get Configuration checksum

```

/**
* @param[out] buffer:   the value of configuration checksum
* @param[in]  bufferLength: accepted max length
* return value: the length of configuration checksum
*/
int emv_get_config_checksum(unsigned char *buffer, int bufferLength)

```

#### 4.19 Set the transaction Force AAC for first generate AC

```

/**
* @param[in] flag: flag=1 Yes, flag = 0 No
*/
int emv_set_force_aac(int flag)

```

#### 4.20 Get Pseudo Track1 Data for Amex & Discover Contactless in MSD Mode

```

/**
* @param[out] data:   the value of track1 data
* @param[in]  dataLength: accepted max length
* return value: the length of track1 data
*/
int emv_generate_pseudo_track1(byte[] data, int dataLength)

```

#### 4.21 Get Pseudo Track2 Data for Amex & Discover Contactless in MSD Mode

```

/**

```

```

* @param[out] data:    the value of track2 data
* @param[in]  dataLength: accepted max length
* return value: the length of track2 data
*/
int emv_generate_pseudo_track2(byte[] data, int dataLength)

```

#### 4.22 Is Offline PIN Verified

```

/**
* is offline verified
* @return  -1 - Failed(Wrong PIN)
*          0 - Not Request
*          1 - YES
*/
int emv_offlinepin_verified()

```

#### 4.23 Clear EMV transaction log

```
int emv_log_file_clear()
```

#### 4.24 Get the times of offline-pin entry

```
int emv_get_offlinepin_times()
```

#### 4.25 Get current process type

```

/*
* return value : 1   EMV (Contact) Mode
*               : 2   EMV (contactless) Mode
*               : 3   Mag-stripe Mode
*/
int emv_get_process_type()

```

## 5. EMV parameters

### 5.1 Clear AID info

```

/**
* return value: >=0: Success; < 0: Fail
*/
int emv_aidparam_clear(void)

```

### 5.2 Add AID info

```

/*
* @param[in] data : see form below, format is TLV
* @param[in] dataLength : the length of the data

```



```

* return value      : < 0 : Fail
*                  : >= 0: Success
*/

```

```
int emv_aidparam_add( uint8_t *data, int dataLength)
```

name	Format	Length(byte)	tag
AID	b	5–16	9F06
Application selection Indicator (ASI)	b	1	DF01
Application version number	b	2	9F08
TAC—Default	b	5	DF11
TAC—Online	b	5	DF12
TAC—Denial	b	5	DF13
Terminal floor limit	b	4	9F1B
Threshold value for Biased Random Selection	b	4	DF15
Maximum Target Percentage to be used for Biased Random Selection	cn	1	DF16
Target Percentage to be used for Random Selection	cn	1	DF17
Default DDOL	b	Var.	DF14
Ability for Online PIN	b	1	DF18
Application Label	an	1-16	50
Application Preferred Name	an	1-16	9F12
Application Priority Indicator	b	1	87
Merchant Identifier	an	15	9F16
Acquirer Identifier	n	6-11	9F01
MCC	n	4	9F15
Transaction Reference Currency Code	n	3	9F3C
Transaction Reference Currency Exponent	n	1	9F3D
Default TDOL	b	Var.	DF22
Contactless Floor Limit	n	6	DF19
Contactless Limit	n	6	DF20
CVM Limit	n	6	DF21
Contactless Kernel ID (See A.1)	n	1	DF810C
C2: CVM Capability – CVM Required (See A.2)	b	1	DF8118

name	Format	Length(byte)	tag
C2: CVM Capability – No CVM Required (See A.3)	b	1	DF8119
C2: kernel configuration (See A.4)	b	1	DF811B
C2: Mag-stripe CVM Capability – CVM Required (See A.5)	b	1	DF811E
C2: Reader Contactless transaction limit (No On-device CVM)	n	6	DF8124
C2: Reader Contactless transaction limit (On-device CVM)	n	6	DF8125
C2: Mag-stripe CVM Capability – No CVM Required (See A.6)	b	1	DF812C
C2: Mag-stripe Application Version Number (Reader)	b	2	9F6D
C4: Contactless Reader Capabilities	b	1	9F6D
C4: Enhanced Contactless Reader Capabilities	b	4	9F6E
C5: Terminal Interchange Profile	b	3	9F53
Is US Common Debit AID 0 – No; 1 - Yes	n	1	EF07
MIR: Terminal TPM Capabilities	b	2	DF55
MIR: Transaction Recovery Limit	b	1	DF56
Is apply to NSICCS (Indonesia) 0 - No; 1 - Yes	n	1	EF08
Interac: Merchant Type Indicator(MTI)	n	1	9F58
Interac: Terminal transaction Information(TTI)	b	3	9F59
Interac: Contactless Receipt Required Limit	n	6	9F5D
Interac: Terminal Option Status(TOS)	b	2	9F5E
Interac: Interac Retry Limit	n	1	EF09

\* C2 - Only for Mastercard MCL

\* C4 - Only for American Expresspay

\* MIR - Only for MIR

\* Interac - Only for Interac

### 5.3 Clear CAPK info

```
/**
 * return value: >=0 Success; < 0 Fail
 */
int emv_capkparam_clear(void)
```

## 5.4 Add CAPK info

```

/*
 * @param[in] data : see form below, format is TLV
 * @param[in] dataLength : the length of the data
 * return value      : < 0 : Fail
 *                   : >= 0: Success
 */
int emv_capkparam_add( uint8_t *data, int dataLength)

```

Name	Format	length (byte)	tag
RID	b	5	9F06
Certification Authority Public Key Index	b	1	9F22
Certification Authority Public Key Expiration Date	n8	8	DF05
Certification Authority Public Key hash Algorithm Indicator	b	1	DF06
Certification Authority Public Key Algorithm Indicator	b	1	DF07
Certification Authority Public Key Modulus	b	Var.	DF02
Certification Authority Public Key Exponent	b	1 or 3	DF04
Certification Authority Public Key Checksum	b	Var.	DF03

## 5.5 Set EMV terminal parameters by TLV

Supported Tag	Description
5F2A	Transaction Currency Code
5F36	Transaction Currency Exponent
9F16	Merchant Identification
9F1A	Terminal Country Code
9F1C	Terminal Identification
9F1E	IFD Serial Number
9F33	Terminal Capabilities
9F35	Terminal Type
9F40	Additional Terminal Capabilities
9F4E	Merchant Name and Location
9F66	TTQ first byte
DF11	TAC—Default
DF12	TAC—Online
DF13	TAC—Denial
DF19	Contactless floor limit
DF20	Contactless transaction limit

DF21	CVM limit
DF8104	Balance Read Before Gen AC (C2)
DF8105	Balance Read After Gen AC (C2)
DF811C	Max Lifetime of Torn Transaction Log Record (C2)
DF811D	Max Number of Torn Transaction Log Records (C2)
DF812D	Message Hold Time (C2)
DF8132	Minimum Relay Resistance Grace Period (C2)
DF8133	Maximum Relay Resistance Grace Period (C2)
DF8134	Terminal Expected Transmission Time For Relay Resistance C-APDU (C2)
DF8135	Terminal Expected Transmission Time For Relay Resistance R-APDU (C2)
DF8136	Relay Resistance Accuracy Threshold (C2)
DF8137	Relay Resistance Transmission Time Mismatch Threshold (C2)
EF01	Status check support: 0 – No; 1 – Support
EF02	Zero check support: 0 – No; 1 – Support
EF03	Authorization Type For American Expresspay(C4): 0-Immediate; 1-Delayed
EF04	CDCVM support: 0 – No; 1 – Support
EF05	Extended Selection: 0 – No; 1 – Support
EF06	Priority of US Common Debit AID: 0 – The priority of US Common Debit AID is lower than Global AID; 1 – The priority of US Common Debit AID is higher than Global AID
EF10	Combination Options(C5)

```
int emv_terminal_param_set_tlv( uint8_t *data, int dataLength)
```

## 5.6 Clear Exception File

```
/**
 * return value: >=0 Success; < 0 Fail
 */
int emv_exception_file_clear(void)
```

## 5.7 Add Exception File

```
typedef struct{
    unsigned char cardNo[19];        // PAN
    unsigned char panSequence;      // PAN Sequence Number
}ExceptionFile
int emv_exception_file_add( unsigned char *exceptFile)
```

## 5.8 Clear Revoked Certificates

```
/**
 * return value: >=0 Success; < 0 Fail
 */
int emv_revoked_cert_clear(void)
```

## 5.9 Add revoked Certificate

```

Typedef struct{
    unsigned char rid[5];
    unsigned char capki;
}RevokedCert
int emv_revoked_cert_add( uint8_t *revokedCert)

```

## 5.10 Set EMV Kernel additional attribute

```

/* param data is less or equal 2 bytes,
 *
 * Byte 1:
 * bit 8 Enable auto perform UPCASH for contact card.
 * bit 7 Force select CUP application.
 * bit 6 Force check app version in FDDA for CUP contactless.
 * bit 5 Force online with Cash & CashBack for Visa contactless.
 * bit 4 Subsequent Bypass PIN entry
 * bit 3 Disable PayWave AUC check.
 * bit 2 RFU
 * bit 1 RFU
 *
 * Byte 2:
 * bit 8 Enable contactless AID select.
 * bit 7 RFU
 * bit 6 RFU
 * bit 5 RFU
 * bit 4 RFU
 * bit 3 RFU
 * bit 2 RFU
 * bit 1 RFU
 */
int emv_set_kernel_attr(byte[] data, int dataLength)

```

## Annex A: Tag List defined by MasterCard

### A.1 Contactless Kernel ID (DF810C)

Tag: 'DF810C'

Length: 1

Format: b

Description: Indicates the kernel type of contactless application

2 = Kernel 2 for MasterCard AIDs

3 = Kernel 3 for Visa AIDs

- 4 = Kernel 4 for American Express AIDs
- 5 = Kernel 5 for JCB AIDs
- 6 = Kernel 6 for Discover AIDs
- 7 = Kernel 7 for UnionPay AIDs
- 8 = PURE contactless Reader/Kernel
- 9 = RUPAY
- 10 = Interac
- 11 = MIR
- 12 = IDEMIA WISE Contactless Reader/Kernel

## A.2 CVM Capability – CVM Required (DF8118)

Tag: 'DF8118'

Length: 1

Format: b

Description: Indicates the CVM capability of the Terminal and Reader when the transaction amount is greater than the *Reader CVM Required Limit*.

CVM Capability – CVM Required		
Byte 1	b8	Plaintext PIN for ICC verification
	b7	Enciphered PIN for online verification
	b6	Signature (paper)
	b5	Enciphered PIN for offline verification
	b4	No CVM required
	b3-1	Each bit RFU

## A.3 CVM Capability – No CVM Required (DF8119)

Tag: 'DF8119'

Length: 1

Format: b

Description: Indicates the CVM capability of the Terminal and Reader when the transaction amount is less than or equal to the *Reader CVM Required Limit*.

CVM Capability – No CVM Required		
Byte 1	b8	Plaintext PIN for ICC verification
	b7	Enciphered PIN for online verification
	b6	Signature (paper)
	b5	Enciphered PIN for offline verification
	b4	No CVM required
	b3-1	Each bit RFU

#### A.4 Kernel Configuration (DF811B)

Tag: 'DF811B'

Length: 1

Format: b

Description: Indicates the Kernel configuration options.

Kernel Configuration		
Byte 1	b8	Mag-stripe mode contactless transactions not supported
	b7	EMV mode contactless transactions not supported
	b6	On device cardholder verification supported
	b5	Relay resistance protocol supported
	b4-1	Each bit RFU

#### A.5 Mag-stripe CVM Capability – CVM Required (DF811E)

Tag: 'DF811E'

Length: 1

Format: b

Description: Indicates the CVM capability of the Terminal/Reader in the case of a mag-stripe mode transaction when the *Amount, Authorized (Numeric)* is greater than the *Reader CVM Required Limit*.

Mag-stripe CVM Capability – CVM Required		
Byte 1	b8-5	CVM
		0000: NO CVM
		0001: OBTAIN SIGNATURE
		0010: ONLINE PIN
		1111: N/A
	Other values: RFU	
	b4-1	Each bit RFU

#### A.6 Mag-stripe CVM Capability – No CVM Required (DF812C)

Tag: 'DF812C'

Length: 1

Format: b

Description: Indicates the CVM capability of the Terminal/Reader in the case of a mag-stripe mode transaction when the *Amount, Authorized (Numeric)* is less than or equal to the *Reader CVM Required Limit*.

Mag-stripe CVM Capability – No CVM Required		
Byte 1	b8-5	CVM
		0000: NO CVM
		0001: OBTAIN SIGNATURE
		0010: ONLINE PIN
		1111: N/A
	Other values: RFU	
	b4-1	Each bit RFU

## Annex B: Tag List defined by American Expresspay

### B.1 Contactless Reader Capabilities (9F6D)

Name	Description	Source	Format	Tag	Length	Values	Location/Usage
Contactless Reader Capabilities	A proprietary data element with bits 8, 7, and 4 only used to indicate a terminal's capability to support Kernel 4 mag-stripe or EMV contactless. This data element is OR'd with <i>Terminal Type</i> , Tag '9F35', resulting in a modified Tag '9F35', which is passed to the card when requested.	Terminal	n 2	'9F6D'	1	00 = Kernel 4 Contactless (Version 1.0 mag-stripe only) 40 = Kernel 4 (Contactless Version ≥ 2.0 mag-stripe only) 80 = Kernel 4 (Contactless Version ≥ 2.0 EMV mode and mag-stripe mode)	Configured in a reader compliant with Kernel 4 and passed to the card via a modified <i>Terminal Type</i> , Tag '9F35' when Tag '9F35' is present in the PDOL of the card

### B.2 Enhanced Contactless Reader Capabilities (9F6E)

Name	Description	Source	Format	Tag	Length	Values	Location/Usage
Enhanced Contactless Reader Capabilities	Proprietary Data Element for managing Contactless transactions and includes Contactless terminal capabilities (static) and contactless Mobile transaction (dynamic data) around CVM	Terminal	b 32	'9F6E'	4		Returned to the Card in the GET PROCESSING OPTIONS in response to PDOL.



**Table 4-4: Enhanced Contactless Reader Capabilities – EMV Tag '9F6E'**

Terminal Capabilities Byte 1								
b8	b7	b6	b5	b4	b3	b2	b1	Meaning
x								1 = Contact mode supported
	1							1 = Contactless Mag-Stripe Mode supported
		0						0 = Contactless EMV full online mode not supported (full online mode is a legacy feature and is no longer supported)
			x					1 = Contactless EMV partial online mode supported
				1				1 = Contactless Mobile Supported
					0			RFU
						0		RFU
							0	RFU
Terminal CVM Capabilities Byte 2								
b8	b7	b6	b5	b4	b3	b2	b1	Meaning
1								1 = Mobile CVM supported
	x							1 = Online PIN supported
		x						1 = Signature
			x					1 = Plaintext Offline PIN
				0				RFU
					0			RFU
						0		RFU
							0	RFU
Transaction Capabilities Byte 3								
b8	b7	b6	b5	b4	b3	b2	b1	Meaning
x								1 = Reader is offline only
	x							1 = CVM Required
		0						RFU
			0					RFU
				0				RFU
					0			RFU
						0		RFU
							0	RFU

Transaction Capabilities Byte 4								
b8	b7	b6	b5	b4	b3	b2	b1	Meaning
0								RFU
	0							RFU
		0						RFU
			0					RFU
				0				RFU
					0			RFU
						0		RFU
							0	RFU

## Annex C: Tag List defined by JCB

### C.1 Terminal Interchange Profile (9F53)

#### TIP Byte 1 (Leftmost)

b8	b7	b6	b5	b4	b3	b2	b1	Meaning
1								CVM required by reader / N/A <sup>23</sup>
	1							Signature supported
		1						Online PIN supported
			1					On-Device CVM supported
				0				RFU
					1			Reader is a Transit Reader
						1		EMV contact chip supported
							1	(Contact Chip) Offline PIN supported

#### TIP Byte 2

b8	b7	b6	b5	b4	b3	b2	b1	Meaning
1								Issuer Update supported <sup>24</sup>
	x	x	x	x	x	x	x	Each bit RFU

#### TIP Byte 3 (Rightmost)

b8	b7	b6	b5	b4	b3	b2	b1	Meaning
x	x	x	x	x	x	x	x	Each bit RFU

## Annex D: Tag List defined by Interac

### D.1 Merchant Type Indicator

**Tag:** '9F58'

**Format:** 1 byte numeric

**Interface:** Contactless

**Description:** Readers shall support the definition of a Merchant Type Indicator. There shall be 5 distinct MTIs defined for contactless payment processing. The MTI is intended for use by the Card's card risk management processing

Value	Meaning
01	Default
02	Petroleum
03	Grocery
04	*Transit Open Payments
05	Undefined

### D.2 Terminal Transaction Information (TTI)

**Tag:** '9F59'

**Format:** Binary

**Interface:** Contactless

**Description:** TTI shall contain data as defined in following table

TTI Byte 1 (leftmost)

B8	B7	B6	B5	B4	B3	B2	B1	Meaning
1								Reader with display capability
	1							Interac Contact application available
		1						Interac Contact application at other Terminal
			1					CDA supported
				1				Offline Capable terminal (value '0' means online only terminal)
					1			Online PIN supported
						0		RFU
							0	RFU

TTI Byte 2

B8	B7	B6	B5	B4	B3	B2	B1	Meaning
0	0							Contactless only Capable
0	1							Contactless & Mag stripe-read Capable
1	0							Contactless, Contact Chip & Mag stripe-read Capable
1	1							Contactless & Contact Chip Capable
		0						RFU
			0					RFU

				0				RFU
					1			Mobile NFC Device (FFI = '03') accepted
						1		Contactless Card (FFI = '00', '01' or '02') accepted
							1	Always '1'. Indicates acceptance data present in this version of TTI.

**TTI Byte 3**

B8	B7	B6	B5	B4	B3	B2	B1	Meaning
0	0	0	0	0	0	0	0	All bits are RFU

**D.3 Terminal Option Status (TOS)****Tag:** '9F5E'**Format:** Binary**Interface:** Contactless**Description:** TOS shall contain data as defined in following table.**TOS Byte 1 (leftmost)**

B8	B7	B6	B5	B4	B3	B2	B1	Meaning
1								Use other Interface if Different Currency
	1							Use other Interface if Different Country Code
		1						Use other Interface if Domestic transaction with different currency
			0					RFU
				0				RFU
					0			RFU
						0		RFU
							0	RFU

**TOS Byte 2 (Rightmost)**

B8	B7	B6	B5	B4	B3	B2	B1	Meaning
0	0	0	0	0	0	0	0	All bits are RFU

**Annex E: Tag List defined by MIR****E.1 Terminal TPM Capabilities (DF55)**

BYTE 1								
b8	b7	b6	b5	b4	b3	b2	b1	Value
x	-	-	-	-	-	-	-	Online PIN indicator (CVM)
1								Online PIN supported
0								Online PIN Not supported
-	x	-	-	-	-	-	-	Signature indicator (CVM)
	1							Signature supported
	0							Signature Not supported
-	-	x	-	-	-	-	-	CD-CVM indicator (CVM)
		1						CD-CVM allowed (for POS-terminals is always 1)
		0						CD-CVM Not supported (only for ATM)
-	-	-	x	-	-	-	-	RFU
-	-	-	-	x	-	-	-	EMV contact mode indicator
				1				EMV contact mode supported
				0				EMV contact mode Not supported
-	-	-	-	-	x	-	-	Offline-only terminal indicator
					1			Offline-only terminal
					0			Online-capable terminal
-	-	-	-	-	-	x	-	Delayed Authorization
						1		Terminal operates in Delayed Authorization mode
						0		Delayed Authorization mode disabled
-	-	-	-	-	-	-	x	ATM indicator
							1	Terminal is ATM
							0	Terminal is Not ATM

BYTE 2								
b8	b7	b6	b5	b4	b3	b2	b1	Value
x	-	-	-	-	-	-	-	Second tap indicator (to inform Reader when Terminal unable to go online)
1								Terminal unable to go online
0								Terminal able to go online
-	0	-	-	-	-	-	-	RFU
-	-	0	-	-	-	-	-	RFU
-	-	-	0	-	-	-	-	RFU
-	-	-	-	0	-	-	-	RFU
-	-	-	-	-	0	-	-	RFU
-	-	-	-	-	-	0	-	RFU
-	-	-	-	-	-	-	0	RFU

## Annex F: Tag List defined by WIZARPOS

Tag	Name	Format	Length	Description
EF01	Status check support	n	1	[Terminal Parameter] 0 – No; 1 – Support
EF02	Zero check support	n	1	[Terminal Parameter] 0 – No; 1 – Support
EF03	Authorization Type For American Expresspay(C4)	n	1	[Terminal Parameter] 0-Immediate; 1-Delayed
EF04	CDCVM support	n	1	[Terminal Parameter] 0 – No; 1 – Support
EF05	Extended Selection	n	1	[Terminal Parameter] 0 – No; 1 – Support
EF06	Priority of US Common Debit AID	n	1	[Terminal Parameter] 0 – The priority of US Common Debit AID is lower than Global AID; 1 – The priority of US Common Debit AID is higher than Global AID
EF07	Is US Common Debit AID	n	1	[AID Parameter] 0 – No; 1 – Yes
EF08	Is apply to NSICCS (Indonesia)	n	1	[AID Parameter] 0 - No; 1 - Yes, used for Bank Indonesia
EF09	Interac Retry Limit	n	1	[AID Parameter]Retry times for Interac Retry Checks
EF10	Combination options(C5)	b	2	[Terminal Parameter]Combination options

## F.1 Combination options (EF10)

### Combination Options Byte 1 (Leftmost)

b8	b7	b6	b5	b4	b3	b2	b1	Meaning
0								<i>RFU</i>
	1							Status Check supported
		1						Offline Data Authentication supported
			1					Exception File Check required <sup>19</sup>
				1				Random Transaction Selection supported
					1			<i>Magstripe Mode Supported</i> <sup>20</sup>
						1		EMV Mode Supported <sup>21</sup>
							1	Legacy Mode Supported <sup>22</sup>

### Combination Options Byte 2 (Rightmost)

b8	b7	b6	b5	b4	b3	b2	b1	Meaning
x	x	x	x	x	x	x	x	<i>Each bit RFU</i>