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**Specification of implementation for
integrated circuit cards—
Part 4: High speed proximity cards**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan IC Card System Application Council (JICSAP)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS X 6319-4:2010** is replaced with this Standard.

This **JIS** document is protected by the Copyright Law.

Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

JIS X 6319 series consists of the following four parts under the general title “*Specification of implementation for integrated circuit cards*”:

Part 1: Integrated circuit cards with contacts

Part 2: Proximity cards

Part 3: Common commands for interchange

Part 4: High speed proximity cards

Specification of implementation for integrated circuit cards— Part 4: High speed proximity cards

Editor's note : This English-translated edition includes some discrepancies from the original Japanese edition, which resulted from correction of errors or modifications made in the process of editing.

Introduction

This Japanese Industrial Standard has been prepared to specify the high speed contactless proximity integrated circuit cards (hereafter referred to as cards or PICCs) and the proximity coupling devices.

In order to provide the further details for interoperability of contactless interfaces (i.e. interfaces which do not use the conductive contact for signal communication or for power supply to the PICC), this Standard provides implementation specifications. Use of new standards in building and operating integrated circuit card systems is in no way constricted because contactless proximity integrated circuit cards have the potential to be used for a variety of applications and systems, while the performance of IC chips, such as power consumption, is constantly being improved by technological advances. Consideration is also given to the possibility that integrated circuit cards with or without contacts may be integrated into the same system.

The PICCs offer the functionality for:

- processing multiple files at one time;
- ensuring a transaction integrity with internal add-subtract calculation;
- bit coding for stable communication;
- response time parameters which enable timeout management for each command;
- and command recognition assuming power disruption during processing.

The PICCs are used in systems such as electronic ticketing at railway stations and event sites, which require high-speed processing of accesses during user's moving.

No International Standard corresponding to this Standard has been established at this point. Instead, **JIS X 5211** specifies the compatible proximity interface (only for contactless part).

1 Scope

This Standard specifies the physical characteristics, air interface, transmission protocols, file structure, commands and the like, which are used by high-speed proximity integrated circuit cards.

The accessing method for files that require authentication in the PICC defined by this Standard is described in Annex A (informative).

Examples of access to the PICC defined by this Standard are described in Annex B (informative) so that a reader of this Standard understands the usage of this Standard.

Test methods for the PICC and the PCD are defined by this Standard in Annex D (normative) and Annex E (normative) respectively.

Guidance for implementing the functionality specified in this Standard on **JIS X 5211** conformant devices is described in Annex F (informative).

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) listed below shall be applied.

JIS X 5211 *Information technology—Telecommunications and information exchange between systems—Near Field Communication—Interface and Protocol (NFCIP-1)*

NOTE : Corresponding International Standard: ISO/IEC 18092 *Information technology—Telecommunications and information exchange between systems—Near Field Communication—Interface and Protocol (NFCIP-1)* (IDT)

JIS X 5213 *Information technology—Telecommunications and information exchange between systems—Near Field Communication Interface and Protocol (NFCIP-1)—RF interface test methods*

NOTE : Corresponding International Standard: ISO/IEC 22536 *Information technology—Telecommunications and information exchange between systems—Near Field Communication Interface and Protocol (NFCIP-1)—RF interface test methods* (IDT)

JIS X 5214 *Information technology—Telecommunications and information exchange between systems—NFCIP-1—Protocol Test Methods*

NOTE : Corresponding International Standard: ISO/IEC 23917 *Information technology—Telecommunications and information exchange between systems—NFCIP-1—Protocol Test Methods* (IDT)

JIS X 6301 *Identification cards—Physical characteristics*

NOTE : Corresponding International Standard: ISO/IEC 7810 *Identification cards—Physical characteristics* (IDT)

JIS X 6305-1 *Identification cards—Test methods—Part 1: General characteristics*

NOTE : Corresponding International Standard: ISO/IEC 10373-1 *Identification cards—Test methods—Part 1: General characteristics* (IDT)

JIS X 6305-6 *Identification cards—Test methods—Part 6: Proximity cards*

NOTE : Corresponding International Standard: ISO/IEC 10373-6 *Identification cards—Test methods—Part 6: Proximity cards* (IDT)

JIS X 6320-4 *Identification cards—Integrated circuit cards—Part 4: Organization, security and commands for interchange*

NOTE : Corresponding International Standard: ISO/IEC 7816-4 *Identification cards—Integrated circuit cards—Part 4: Organization, security and commands for interchange* (IDT)

JIS X 6322-1 *Identification cards—Contactless integrated circuit cards—Proximity cards—Part 1: Physical characteristics*

NOTE : Corresponding International Standard: ISO/IEC 14443-1 *Identification cards—Contactless integrated circuit cards—Proximity cards—Part 1: Physical characteristics* (IDT)

JIS X 6322-2 *Identification cards—Contactless integrated circuit cards—Proximity cards—Part 2: Radio frequency power and signal interface*

NOTE : Corresponding International Standard: ISO/IEC 14443-2 *Identification cards—Contactless integrated circuit cards—Proximity cards—Part 2: Radio frequency power and signal interface* (IDT)

JIS X 6322-3 *Identification cards—Contactless integrated circuit cards—Proximity cards—Part 3: Initialization and anticollision*

NOTE : Corresponding International Standard: ISO/IEC 14443-3 *Identification cards—Contactless integrated circuit cards—Proximity cards—Part 3: Initialization and anticollision* (IDT)

JIS X 6322-4 *Identification cards—Contactless integrated circuit cards—Proximity cards—Part 4: Transmission protocol*

NOTE : Corresponding International Standard: ISO/IEC 14443-4 *Identification cards—Contactless integrated circuit cards—Proximity cards—Part 4: Transmission protocol* (IDT)

ISO/IEC 18033-3 *Information technology—Security techniques—Encryption algorithms—Part 3: Block ciphers*

3 Terms and definitions, abbreviations and symbols

For the purpose of this Standard, the terms and definitions, abbreviations and symbols given in JIS X 5211, JIS X 5213, JIS X 5214, JIS X 6305-6, JIS X 6320-4, JIS X 6322-1 to JIS X 6322-4, and the following apply.

3.1 Terms and definitions

3.1.1 access type

classified group of accessing methods possible to a service file that has the same block format

3.1.2 access control process category

information on whether pre-authentication is required or not at the time of accessing, and the accessing method for blocks in service files

3.1.3 area key

key to authenticate the right of access to area files

3.1.4 area file

file to manage the file hierarchy in the PICC

3.1.5 area file structure

block to define the range of the file identifiers of available files, the number of available blocks, and the right of access for the PICC service operator

3.1.6 area file identifier

identifier consisting of the area number and the access control process category

3.1.7 area number

unique number to identify the area file in the PICC

3.1.8 response time descriptor

information to determine the response time for each command

NOTE : In JIS X 6319-4:2005, the “response time descriptor” was referred to as the “Pad”.

3.1.9 add-subtract calculation access

access type that enables addition and subtraction of one block by treating it as one value

3.1.10 decrement access

one of the add-subtract calculation accesses in the access control process category indicating that reading and decrement-writing of the data in the PICC are possible

3.1.11 service key

key to authenticate the right of access to service files

3.1.12 service file

accessing unit when the PCD accesses the PICC, which is the area defined so as to have the same access control process category in the PICC's memory area

3.1.13 service file structure

block to define the access control process category of the relevant service, and the position, range, etc. of the accessible block

3.1.14 service file identifier

identifier consisting of the service number and the access control process category

3.1.15 service number

number to identify the unique service file in the PICC

3.1.16 system code

parameter used for narrowing down the possible PICCs during the communication initialization

3.1.17 higher layer protocol

protocol layer (not specified in this Standard) to transmit the information which belongs to the protocol (the application or the higher layer of protocol) not defined in this Standard by using the protocol layer specified in this Standard

3.1.18 status flag

flag to indicate the result of processing, which consists of the status flag 1 indicating the result of processing or the position where an error has occurred, and the status flag 2 indicating detailed information thereof

3.1.19 mutual authentication

mutual confirmation of the PCD and the PICC as a legitimate entity by using the commands and responses between the PCD and the PICC, as defined in **10.7** and **10.12**

3.1.20 time slot

time frame defined for the anticollision among multiple response messages from PICCs in the communication initialization

3.1.21 direct access

one of the add-subtract calculation accesses in the access control process category indicating that reading and over-writing of the data in the PICC are possible

3.1.22 issue ID (IDi)

information written when the PICC is issued

3.1.23 issue parameter (PMi)

additional information written when the PICC is issued

3.1.24 PICC identifier

unique number for the PICC designated by the manufacturer

NOTE : In **JIS X 6319-4:2005**, it was referred to as “NFCID2”.

3.1.25 file identifier

information used for the file identification in the PICC’s memory area, including the area identifier for area files and the service identifier for service files

3.1.26 block

minimum unit for reading, writing and deleting information in the PICC’s memory area

3.1.27 block number

number for management of the logical location of a block which belongs to a specific service file and is used when accessing the memory area of the PICC from the PCD

3.1.28 block list

list indicating the access mode to the block, the block number and the order of service files designated by the list of file identifiers

3.1.29 cash back and decrement access

one of the add-subtract calculation accesses in the access control process category that indicates reading of the data in the PICC, and writing either of the addition with a value equal to or less than the value decremented in the last access or of the decrement of the data in the PICC are possible

3.1.30 request code

parameter used by the PCD to request the additional information from the PICC during the communication initialization

3.1.31 request data

additional information sent out by the PICC according to the request from the PCD during the communication initialization

3.1.32 effective exception processing for power disruption

processing that responds to a command having a matching PICC identifier even if it is not the REQ command

3.2 Abbreviations and symbols

ASK	amplitude shift keying
bdata	data included in a command message or a response message, to be read from block(s) or to be written to block(s)
CRC	cyclic redundancy check code
EDC	error detection code
<i>fc</i>	frequency of operating field (carrier frequency)
FSD	frame size for proximity coupling device
FSDI	frame size for proximity coupling device integer
<i>H_{max}</i>	maximum field strength of the PCD antenna field
<i>H_{min}</i>	minimum field strength of the PCD antenna field
IDI	issue ID
LEN	length byte
LSB	least significant byte
lsb	least significant bit
MSB	most significant byte
msb	most significant bit
N	number of anticollision slots or PICC response probability in each slot
PCD	high speed proximity coupling device
PICC	high speed proximity card
PMi	issue parameter
R	slot number chosen by the PICC during the anticollision sequence
REQ	request command
RF	radio frequency
RFU	reserved for future use
WUP	wake up command

For the purpose of this Standard, data values are expressed as follows.

b“xxxx xxxx”	bit of binary numbers
“XX”	hexadecimal numbers

4 Physical characteristics

4.1 General physical characteristics

The PICC shall have the general physical characteristics of card type ID-1 specified in **JIS X 6301**.

4.2 Dimensions

The PICC shall have the nominal dimensions of card type ID-1 specified in **JIS X 6301**.

4.3 Surface condition

The surface of the PICC shall be flat and smooth to allow the PICC to be transported, etc.

4.4 Substrate material

The substrate of the PICC shall be made of polyethylene terephthalate (PET) or other material equivalent in performance.

4.5 Additional physical characteristics

4.5.1 Static electricity

The PICC shall continue to operate normally after having been tested by the method specified in **JIS X 6305-6** where the test voltage of 6 kV is applied.

4.5.2 Static magnetic field

The PICC shall continue to operate normally after having been exposed to a static magnetic field of 640 kA/m.

NOTE : There is a possibility that data on magnetic stripes are deleted under such a magnetic field.

4.5.3 Operating temperature

The PICC shall continue to operate normally at an environmental temperature from 0 °C to +50 °C.

NOTE : The operating temperature was defined as -5 °C to +50 °C in **JIS X 6319-4:2010** as the specification of implementation. As the use case where **JIS X 6319-4** is implemented on NFC mobile devices or the like increases, such devices are becoming used with **JIS X 6322** series and **JIS X 5211** as the reference standards. In order to avoid the confusion in the case where this Standard is applied, the operating temperature has been aligned with that specified in **ISO/IEC 7810**.

4.5.4 Cold- and heat-proof properties

After having been left under the designated temperature and humidity condition according to the method specified in **JIS X 6305-1**, the PICC shall continue to operate normally and satisfy the warpage specification thereof.

4.5.5 Moisture proof

After having been left at 40 °C in temperature and at 90 % in relative humidity for 48 h, the PICC shall continue to operate normally and satisfy the warpage specification thereof.

4.5.6 Cyclic thermal proof

The PICC shall continue to operate normally after ten thermal cycles, each consisting of 30 min at $-25\text{ }^{\circ}\text{C}$, 5 min at ordinary temperature and humidity ($23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$, relative humidity of 40 % to 60 %), 30 min at $+85\text{ }^{\circ}\text{C}$ and 5 min at ordinary temperature and humidity.

4.5.7 Drop impact proof

The PICC shall continue to operate normally after having been dropped twice in respective three directions (longitudinal, lateral and surface directions) from the height of 1.5 m onto a concrete surface.

4.5.8 Bending stiffness

The PICC shall continue to operate normally after the test in which a load of 0.7 N is applied for 1 min according to the method specified in **JIS X 6305-1**.

4.5.9 Point pressure stiffness

The PICC shall continue to operate normally after a pressure, which is equal to the force generated by applying a force of 1.5 N to a steel ball of $\phi\text{ }1\text{ mm}$, is applied to the IC chip implemented position.

4.5.10 Delamination

The PICC shall have the peeling strength of 6 N/cm or more when tested according to the method specified in **JIS X 6305-1**.

4.5.11 Adhesion and blocking

The PICC shall show no adverse effects on the appearance and the separation of card after the test in which a pressure of 2.5 kPa is applied according to the method specified in **JIS X 6305-1**.

4.5.12 Chemical proof

The PICC shall show no adverse effects on the appearance and functions after having been immersed for 1 min in each designated solution according to the method specified in **JIS X 6305-1**.

4.5.13 Optical transparency

The light transmission density of the PICC shall be at least 1.5 when tested according to the method specified in **JIS X 6305-1**.

4.5.14 Storage temperature

The PICC shall continue to operate normally after having been stored at $-35\text{ }^{\circ}\text{C}$ and at $+85\text{ }^{\circ}\text{C}$ in temperature for 60 min, respectively.

4.5.15 Environmental protection

The PICC shall not cause toxic hazard in normal use. The PICC shall not generate toxic gas when it is disposed or incinerated.

4.5.16 Curl, burr and chipped particles

The PICC shall not cause any malfunction of the issuing or processing machine by curl, burr and chipped particles.

5 Air interface

5.1 Power transfer

The PCD shall transfer the power to the PICC by producing the RF operating field.

5.1.1 Frequency

The frequency f_c of the RF operating field shall be 13.56 MHz.

5.1.2 Allowable frequency deviation

The allowable frequency deviation shall be within ± 50 ppm.

5.1.3 Leakage electric field strength

The leakage electric field strength shall conform to the regulations of the Radio Act.

5.1.4 Operating field

The minimum field strength of the PCD antenna field under unmodulated state is H_{min} , and the value thereof shall be 1.5 A/m (rms).

The maximum field strength of the PCD antenna field under unmodulated state is H_{max} , and the value thereof shall be 7.5 A/m (rms) (See 6.2 of JIS X 6322-2).

5.2 Communication signal interface from PCD to PICC

5.2.1 Bit rate

The elementary time unit etu shall be according to the following formula.

$$1\ etu = 128 / (D \times f_c)$$

The divisor D depends on the bit rate as shown in Table 1.

Table 1 Value of divisor D

Bit rate	Divisor D
$f_c/64$ (approx. 212 kb/s)	2
$f_c/32$ (approx. 424 kb/s)	4

5.2.2 Occupied frequency bandwidth

The occupied frequency bandwidth shall be not more than 7R (R: the number of bits per second of the modulated signal composed of pulse streams).

5.2.3 Modulation

The communication signal interface from the PCD to the PICC shall use the modulation principle of ASK 10 % of the operating field.

The modulation index shall be between 8 % and 14 %.

The modulated waveform shall conform to the values shown in Figure 1 and Table 2. The rising and falling edges of the waveform shall be monotonic.

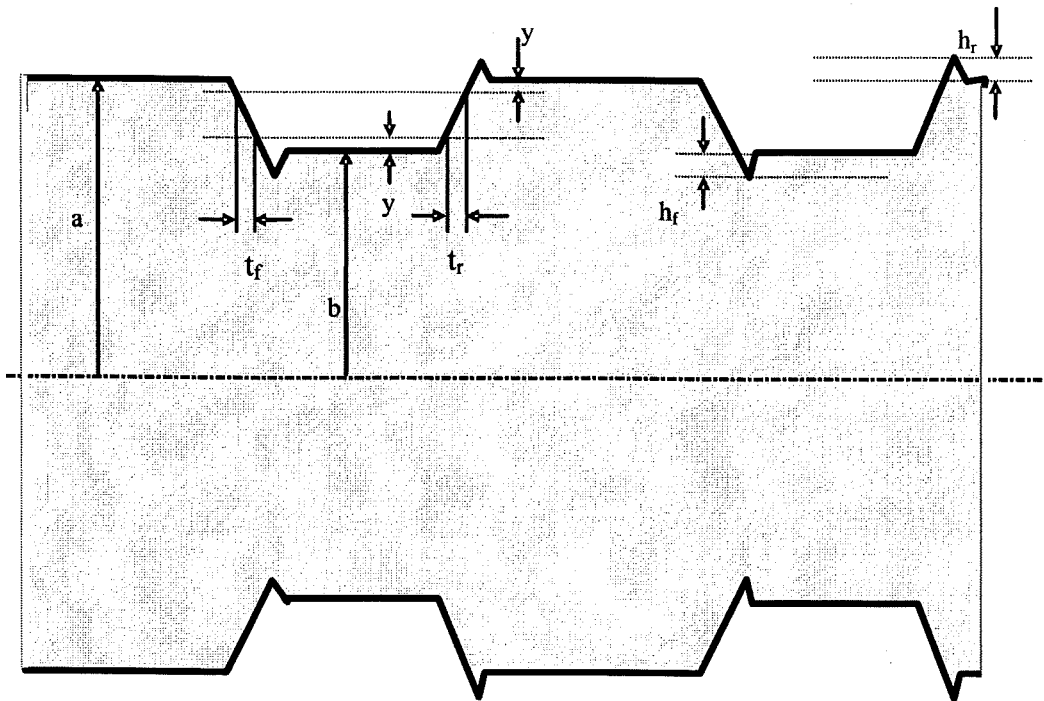


Figure 1 Modulated waveform

Table 2 Modulated waveform parameters

Item	Bit rate	
	$f_c/64$	$f_c/32$
t_f	2 μ s max	1 μ s max
t_r	2 μ s max	1 μ s max
y	$0.1 \times (a - b)$	$0.1 \times (a - b)$
h_f, h_r	$0.1 \times (a - b)$ max	$0.1 \times (a - b)$ max

5.2.4 Bit coding method

Manchester coding shall be used for the bit coding.

Logic 1: the first half of the bit duration corresponds to the high field amplitude (unmodulated state) of the carrier, and the second half corresponds to the low field amplitude.

Logic 0: the first half of the bit duration corresponds to the low field amplitude of the carrier, and the second half corresponds to the high field amplitude (unmodulated state).

No signal state: the amplitude of the carrier wave remains high (unmodulated) throughout the entire bit duration.

An example of bit coding is shown in Figure 2.

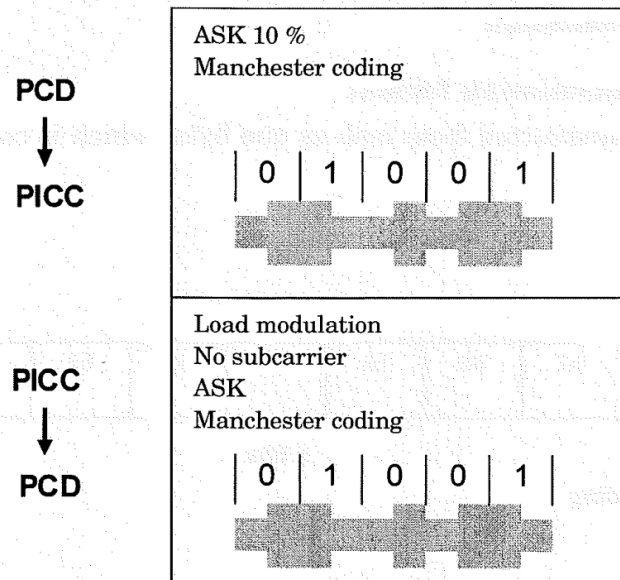


Figure 2 Example of bit coding

5.3 Communication signal interface from PICC to PCD

5.3.1 Bit rate

The bit rates shall be as shown in Table 1.

5.3.2 Modulation

The PICC shall be capable of communicating to the PCD via an inductive coupling by the load modulation of the carrier frequency.

The amplitude of load modulation shall be at least $30/H^{1.2}$ (mV peak) when measured by the test method specified in **JIS X 6305-6**. However, it shall be at least $22/H^{0.5}$ (mV peak) if the compatibility with **JIS X 6322-2** needs to be considered.

H is the value of field strength in A/m (rms).

5.3.3 Bit coding method

Manchester coding shall be used for the bit coding.

Logic 1: the first half of the bit duration corresponds to the high field amplitude (unmodulated state) of the carrier, and the second half corresponds to the low field amplitude.

Logic 0: the first half of the bit duration corresponds to the low field amplitude of the carrier, and the second half corresponds to the high field amplitude (unmodulated state).

No signal state: the amplitude of the carrier wave remains high (unmodulated) throughout the entire bit duration.

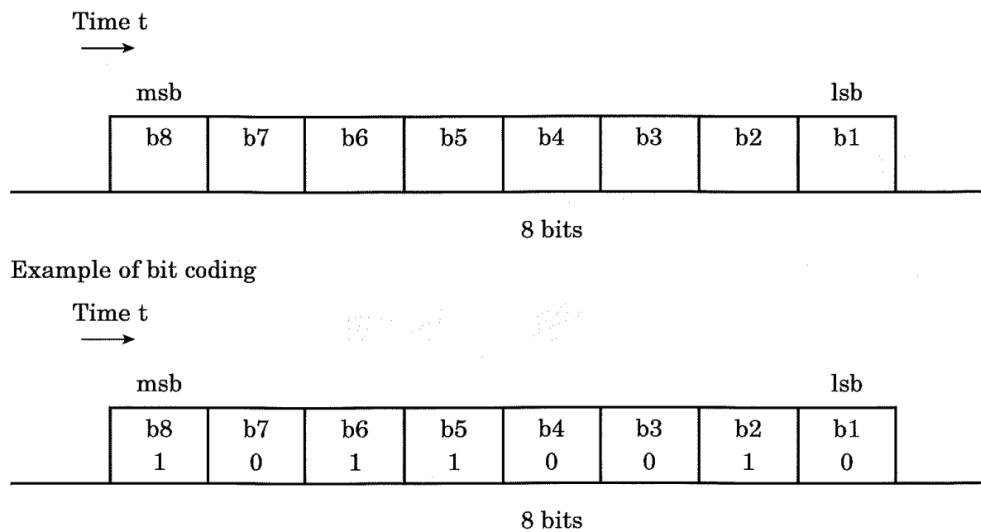
6 Character, frame format and response timing

In this clause, the character, frame format and response timing of the PICC are specified. The bit configuration and the coding shall be as specified in 5.2.4 and 5.3.3.

6.1 Character transmission

6.1.1 Character transmission format

One character is transmitted from msb as one byte, which is composed of eight bits as shown in Figure 3.



Example: b"10110010" for "B".

Figure 3 Character transmission format

6.1.2 Character interval

No interval shall exist between any consecutive characters.

The consecutive characters shall be sent out without interval in the character stream as shown in Figure 4.

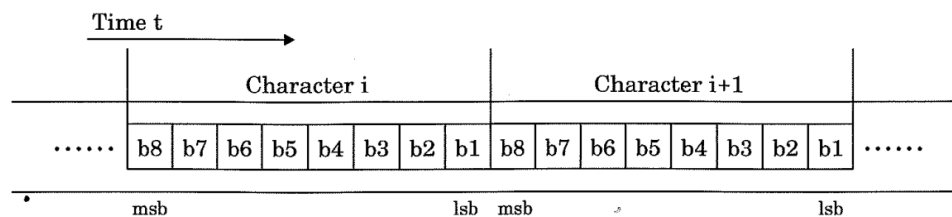


Figure 4 Character stream

6.1.3 Character transmission order

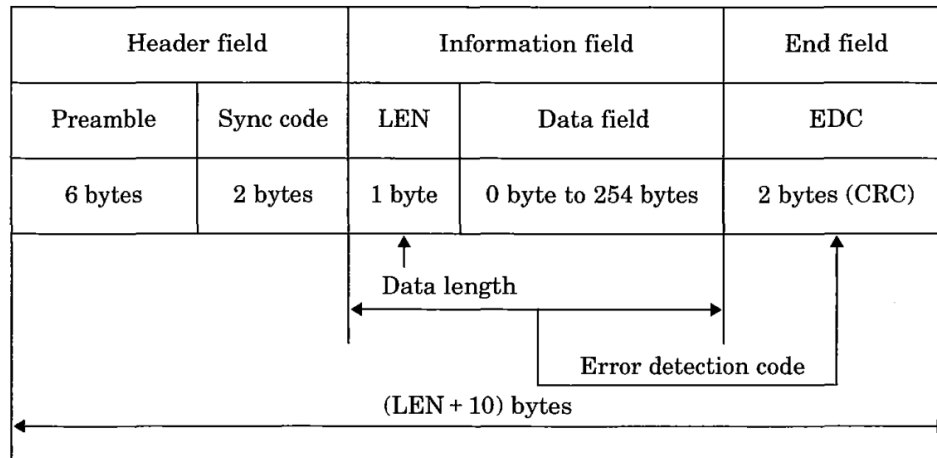
The character transmission order shall be the big endian format. When designated, the little endian format is applicable.

NOTE : See Annex C for the endian format.

6.2 Frame format

The PCD and the PICC shall communicate by the frame format.

The frame consists of the header field, the information field and the end field (see Figure 5).



Length byte (LEN): 1 byte

Data field: (LEN - 1) bytes

NOTE: The length of the data field was defined as 1 byte to 253 bytes in **JIS X 6319-4:2005**.

Figure 5 Frame format

6.2.1 Header field

The header field shall consist of 6 bytes of the preamble and 2 bytes of the sync code. The values thereof shall conform to **JIS X 5211**, and shall be as follows (see Figure 5).

Preamble (6 bytes): "000000000000"

Sync code (2 bytes): "B24D"

6.2.2 Information field

The information field shall consist of the length byte (LEN) and the data field (see Figure 6).

The first byte is the length byte (LEN), and the value thereof indicates the number of bytes in the information field including the length byte (LEN).

LEN shall be set "01" to "FF" (the number of bytes in the information field).

The data field shall consist of a single message.

Information field	
LEN	Data field
1 byte	(LEN - 1) bytes

Figure 6 Information field configuration

There are two types of message, the command message and the response message.

The command message shall consist of the command code and the command parameters (see Figure 7).

The response message shall consist of the response code and the response parameters (see Figure 8).

Command message	
Command code	Command parameters

Figure 7 Command message

Response message	
Response code	Response parameters

Figure 8 Response message

6.2.3 End field

The end field shall consist of the error detection code (EDC) of the information field (see Figure 5).

The frame shall be deemed valid only if the EDC is correct.

The Cyclic Redundancy Check (CRC) code shall apply to the EDC.

The CRC shall be calculated by all data bits in the information field, and the value thereof shall be calculated according to the following formula. The initial value shall be "0000", where all bits are b"0".

$$\text{CRC (2 bytes)} = X^{16} + X^{12} + X^5 + 1$$

6.3 PICC response timing

The PICC shall respond as specified in **6.3.1** and **6.3.2** after the completion of the command frame from the PCD. The response timing differs in the anticollision sequence and the normal command.

6.3.1 Response timing for anticollision sequence

The PICC during the anticollision sequence shall respond with the REQ response (see **8.6**) or the WUP response (see **8.8**) at the start of one of the timeslots. The first time slot shall start after $512 \times 64/f_c$ (approximately 2.417 ms) from the completion of the command frame of the REQ command (see **8.5**) or the WUP command (see **8.7**). The time slot duration shall be $256 \times 64/f_c$ (approximately 1.208 ms). The time slot at which the PICC starts to respond shall be as specified in **8.4**.

An example of response timing for two PICCs is shown in Figure 9. In this example, PICC 1 responds with the REQ response or the WUP response in the time slot #2, and PICC 2 responds with the REQ response or the WUP response in the time slot #0.

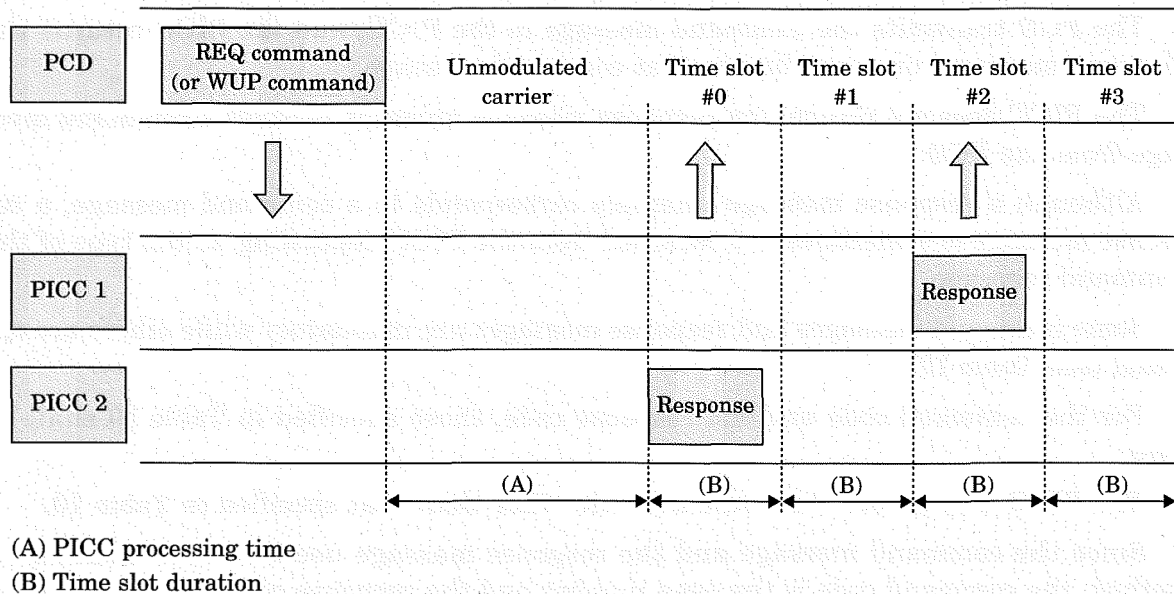


Figure 9 Example of response timing to REQ command or WUP command

6.3.2 Response timing for normal command

After the completion of the received command frame, the PICC shall start to respond with each command within the waiting time calculated from the response time calculation parameters, and complete it (see Figure 10).

The PICC shall transmit the response time calculation parameter corresponding to the command sent from the PCD to the PCD as the response of the anticollision sequence. For the calculation method of the response time, refer to the REQ response (see 8.6.3).

NOTE : The response time shall be set to optimize the communication by considering the different performance for every PICC. Also, this response time from the PICC corresponds to the maximum waiting time when it is regarded from the PCD.

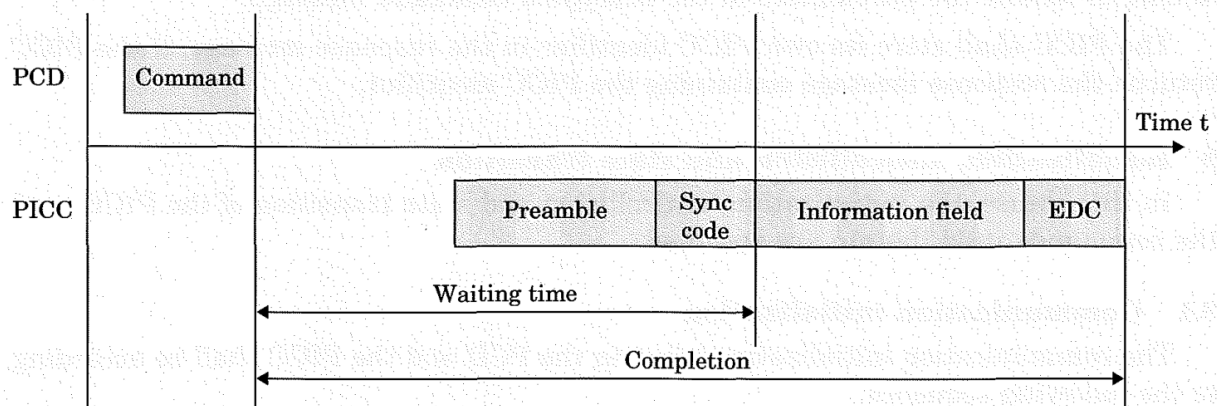


Figure 10 Waiting time

7 Overview of command message and response message

The command message and the response message are exchanged between the PCD and the PICC with the frame format.

The PCD transmits the command message to the PICC, and the PICC returns the response message corresponding to that command message.

The PICC does not return any response message unless it receives a command message from the PCD.

Although a response message uniquely corresponds to a command message, a response message is sometimes not returned from the PICC depending on the type of the command message.

Some command messages and response messages are mandatory while others are optional (see Table 10).

For the command code and the response code, those specified in Table 10 shall be used.

The PICC may ignore the command code other than that specified in Table 10.

Since the command message and the response message use the same modulation method, the command code is the even number and the response code is such the number as the command code plus 1 for separation.

The command messages and the response messages are categorized as being either encrypted or unencrypted. If the command message or the response message is encrypted, parameters are also encrypted. The encrypted messages in this Standard shall be the SecureRead command and response, the SecureWrite command and response, and the Authentication2 response. If necessary to enable the selection of type for mutual authentication and channel encryption, NewAuthentication1, NewAuthentication2, NewSecureRead and NewSecureWrite may be used instead of Authentication1, Authentication2, SecureRead and SecureWrite respectively. In this case, the encrypted messages shall be also used for the NewSecureRead command and response, the NewSecureWrite command and response, and the NewAuthentication2 response.

The PICC shall not return the response message, if the PICC receives the command message containing the PICC identifier which does not match its own PICC identifier.

The PICC shall not return the response message, if the PICC determines that it is unable to handle the parameters in the encrypted command message.

The PICC shall store its own PICC identifier in the response message, if the PICC returns the response message containing the PICC identifier.

8 Initialization, anticollision and state transition

In this clause, the initialization, anticollision and state transition of the PICC, and the commands used therein are specified.

8.1 Communication initialization

The communication initialization between the PCD and the PICC shall be according to the following sequence.

- a) The PICCs shall be powered up when placed in the RF operating field generated by the PCD.
- b) The PICCs shall wait for the reception of the REQ command (mandatory) or the WUP command (optional) from the PCD.

- c) Each PICC shall randomly select one time slot from multiple time slots, and shall respond at the timing of the selected time slot.

NOTE 1 The PCD may send out the REQ command or the WUP command repeatedly to detect the PICCs in the operating field.

NOTE 2 The PCD which supports the WUP command may send out the WUP command.

8.2 Anticollision sequence

The anticollision sequence shall be controlled by the PCD using the REQ command or the WUP command described here.

The PCD shall drive the communication with one or more PICCs. The PCD shall issue the REQ command or the WUP command to activate the PICC response.

During the anticollision sequence, the case where multiple PICCs respond simultaneously is deemed as the occurrence of collision.

As the result of the anticollision sequence, the communications from the PICCs are under the control by the PCD, and only one PICC is allowed to communicate with the PCD at a time.

The mechanism of anticollision sequence is based on the time slot principle. The number of time slots which are parameterised in the REQ command or the WUP command may be set to an integer of 1 or more.

When the PICC has received the REQ command or the WUP command and if the system code thereof corresponds to that in the parameters of the REQ command or the WUP command, the PICC shall generate a random number R and wait until the time slot matches R . Then, the PICC shall respond with the REQ response or the WUP response including the identification data (the PICC identifier and the response time descriptor).

NOTE : R is the random number in the range of 0 to N selected by the PICC (see Table 3 for the coding of N).

The PCD shall be capable of reading the identification data of the PICC in each time slot. When two or more PICCs exist in the operating field generated by the PCD and if only one PICC responds in each time slot, the PCD shall detect the identification data thereof. The PCD identifies the PICC according to the recognized identification data. Then, the PCD may select each identified PICC using the recognized identification data for the communication of the application data with that PICC.

The PCD may use the method below in order to reduce the probability of response collisions from the PICC to the REQ command.

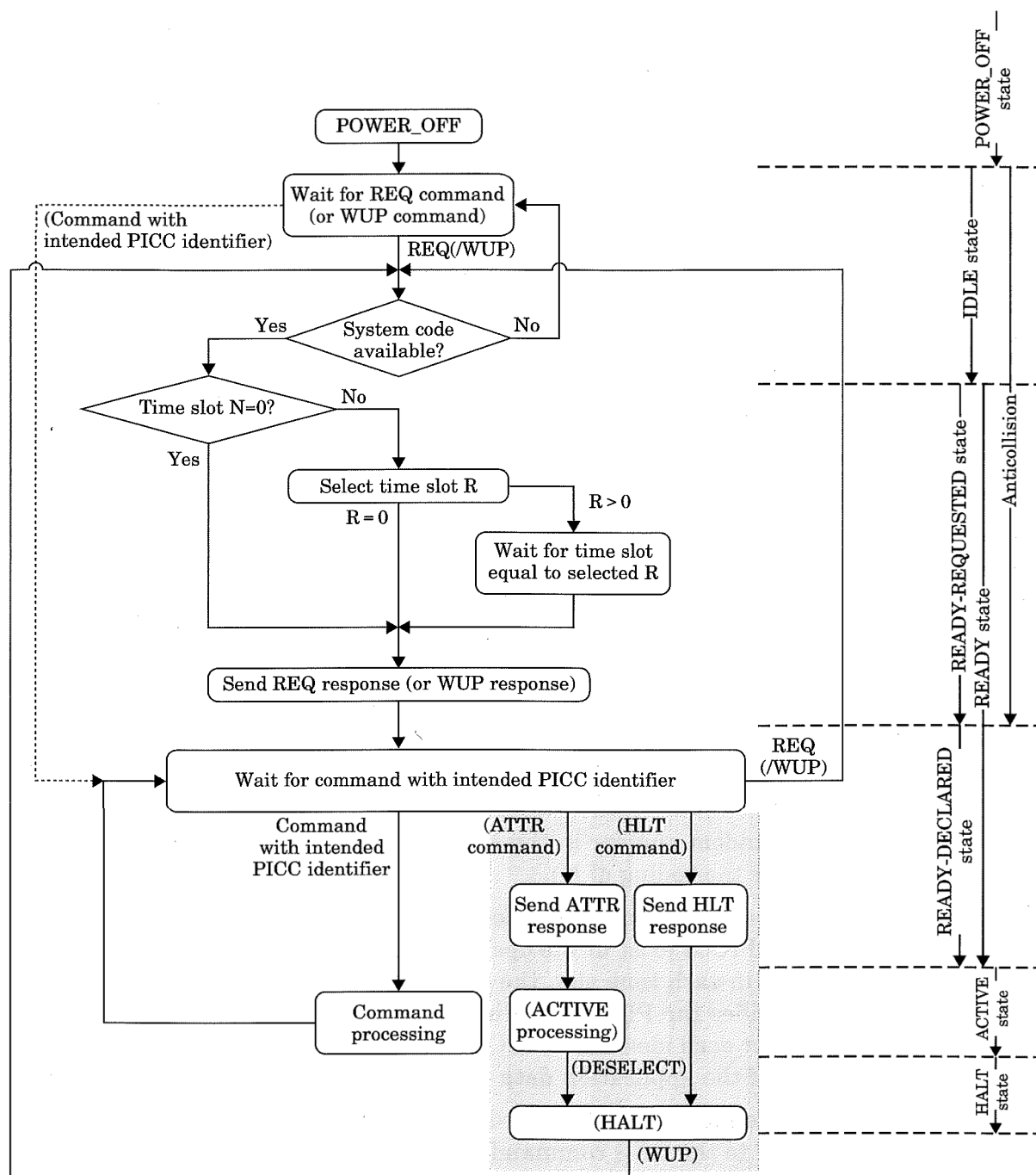
If the PCD supports the HLT command, the PCD may make the identified PICC enter the HALT state and no longer respond to the REQ command by executing the HLT command.

8.3 State of PICC

The detailed operations of the PICC during the anticollision sequence are shown by the different states or the transition conditions between the states thereof.

8.3.1 State transition

The state transition flowchart of the PICC is shown in Figure 11.



NOTE 1 See 8.7 and 8.8 for WUP command and WUP response.

NOTE 2 See 8.9 and 8.10 for HLT command and HLT response.

NOTE 3 See 8.11 and 8.12 for ATTR command and ATTR response.

NOTE 4 See JIS X 6322-4 for DESELECT.

Figure 11 State transition flowchart of PICC

8.3.2 General matters on state transition

The PICC shall enter the POWER_OFF state when the carrier power disappears.

The PICC shall operate as follows for the frame recognition.

- The PICC shall operate according to the received command if the frame from the PCD including the CRC is recognized valid.
- The PICC shall respond when it recognizes the frame as valid, and shall not respond when an error is detected.

8.3.3 POWER_OFF state

Definition: In the POWER_OFF state, the PICC is not powered due to a lack of carrier power.

State transition condition: If the PICC is placed in the operating field greater than H_{min} , the PICC shall enter the IDLE state.

8.3.4 IDLE state

Definition: The PICC is powered in the IDLE state. In this state, the PICC shall recognize the REQ command by monitoring the frame signal of the command. If the PICC supports the WUP command, the PICC may recognize the WUP command. If the PICC supports the effective exception processing for power disruption, other commands containing the PICC identifier that matches own PICC identifier shall also be recognized.

State transition condition: When the PICC recognizes the REQ command or the WUP command containing the relevant system code, the PICC shall enter the READY-REQUESTED state (see 8.5 or 8.7).

If the PICC which supports the effective exception processing for power disruption recognizes the command containing the PICC identifier that matches own PICC identifier, the PICC shall enter the ACTIVE state.

If the PICC which supports the ATTR command recognizes the ATTR command containing the PICC identifier that matches own PICC identifier, the PICC shall enter the ACTIVE state after sending out the ATTR response (see 8.3.7.2).

If the PICC which supports the HLT command recognizes the HLT command containing the PICC identifier that matches own PICC identifier, the PICC shall enter the HALT state.

If the state transition needs to be conforming to Type B in JIS X 6322-3, F.5 is applicable.

8.3.5 READY-REQUESTED state (sub-state)

Definition: In the READY-REQUESTED state, the PICC confirms the REQ command or the WUP command with a control parameter N.

State transition condition: The PICC shall enter the READY-DECLARED state after sending out the REQ response or the WUP response according to the timing specified in 8.4.

8.3.6 READY-DECLARED state (sub-state)

Definition: In the READY-DECLARED state, the PICC has sent out the REQ response or the WUP response corresponding to the last confirmed REQ command or the WUP command.

In this state, the PICC shall recognize the REQ command or other commands.

State transition condition: When the PICC recognizes the REQ command or the WUP command, the same conditions and the transition state are applied to the case where the PICC recognizes the REQ command or the WUP commands in the IDLE state.

When the PICC recognizes other command and that command contains the PICC identifier that matches own PICC identifier, the PICC shall enter the ACTIVE state (see 8.3.7.1). If the PICC identifier does not match own PICC identifier, the PICC shall remain in the READY-DECLARED state.

If the PICC which supports the ATTR command recognizes the ATTR command containing PICC identifier that matches own PICC identifier, the PICC shall enter the ACTIVE processing state after sending out the ATTR response (see 8.3.7.2).

If the PICC which supports the HLT command recognizes the HLT command containing the PICC identifier that matches own PICC identifier, the PICC shall enter the HALT state.

8.3.7 ACTIVE state

There are the command processing state and the ACTIVE processing state in the ACTIVE state (see Figure 11).

8.3.7.1 Command processing state (mandatory ACTIVE state)

Definition: The PICC shall process the received command message.

State transition condition: The PICC shall enter the READY-DECLARED state after having processed the command message.

8.3.7.2 ACTIVE processing state (optional ACTIVE state)

Definition: The higher layer protocol shall be activated.

State transition condition: When the higher layer protocol is deactivated, the PICC shall enter the HALT state.

NOTE 1 See **JIS X 6322-4**, etc. for the higher layer protocol (see **B.4**).

NOTE 2 If this Standard is implemented on a **JIS X 5211** conformant device, Annex F is applicable.

8.3.8 HALT state

Definition: The PICC shall respond only to the WUP command.

State transition condition: When the PICC recognizes the WUP command, it shall return to the IDLE state.

8.4 Anticollision response rule

If the PICC in the READY-REQUESTED state receives the REQ command or the WUP command containing the system code that matches own system code (see **8.5.2**), the PICC shall follow the following rules.

The parameter N shall be the time slot number given by the REQ command or the WUP command.

N=0: the PICC shall send the response message, and wait for the next command.

N>0: the PICC shall internally generate a random number R evenly distributed between 0 and N.

- R=0: the PICC shall send the response message, and wait for the next command.
- R>0: the PICC shall wait till the time slot matches, and send the response message, then wait for the next command.

8.5 REQ command

The REQ command shall be used by the PCD to detect whether the PICCs are in the operating field or not.

8.5.1 REQ command format

The REQ command format shall be composed of the command code of 1 byte ("00"), the system code of 2 bytes, the request code of 1 byte and the time slot number of 1 byte (see Figure 12).

Command code	System code		Request code	Time slot number
	Fixed value field	AFI field		
1 byte ("00")	1 byte ("AA")	1 byte	1 byte	1 byte

Figure 12 REQ command message format

8.5.2 System code

The system code is the parameters stored in the REQ command or the WUP command in order to select the PICCs of a specific application domain by the PCD with completion of the communication initialization.

The coding of the system code shall be such that the first byte is the fixed value field and the second byte is the AFI (Application Family Identifier) field.

The fixed value field shall be set to “AA”.

JIS X 6322-3 shall be referred to for the value of the AFI field, provided that the following rules shall apply in this Standard.

- If the fixed value field is “AA” and the application domain is not specified, the system code shall be set to “AAFF” but not “AA00”.
- The AFI field with the lower 4 bits are zero shall not be used.

For the purpose of backwards compatibility with **JIS X 6319-4:2005**, “FFFF” shall be set to the system code in addition to “AAFF” when the application domain is not specified.

NOTE 1 The system code “AA00” has been used by the existing systems conforming to **JIS X 6319-4:2005** as the specific application domain.

NOTE 2 The system code “FFFF” has been used by the existing systems conforming to **JIS X 6319-4:2005** as the non-specific application domain.

In addition to the case where the system code in the REQ command or the WUP command and that set in the PICC match, or either of the following conditions is satisfied, the PICC shall consider that the system codes are matching:

- if the system code in the command is “AAFF” and the first byte of the system code set in the PICC is “AA”;
- if the system code in the command is “FFFF”.

NOTE 3 Since the system codes with the fixed value field set to other than “AA” have been managed in the existing systems conforming to **JIS X 6319-4:2005**, this Standard uses “AA” as the fixed value. When building the system conforming to this Standard which uses the system codes with the fixed value field of other than “AA”, it is recommended to consider backward compatibility and interoperability with existing systems conforming to **JIS X 6319-4:2005**. **B.3** includes examples of the access to the PICC in the system conforming to **JIS X 6319-4:2005**.

8.5.3 Coding of request code

For the request code, the PICC shall mandatorily support “00”, and optionally support “01” and “02”.

The coding of the request code shall be as follows.

- “00”: compatible with **JIS X 6319-4:2005** and request the REQ response not containing request data (see **8.6.4**)
- “01”: request the REQ response with the system code (see **8.5.2**)
- “02”: request the REQ response with the transmission protocol capability (see **8.6.4**)
- “03” to “FF”: RFU

8.5.4 Coding of time slot number

The time slot number shall be coded as the maximum time slot value where the PICC supports for anticollision. The time slot number shall be set to “00”, “01”, “03”, “07” or “0F”, and the time slot number shall be as shown in Table 3. Other values shall be RFU.

Table 3 Coding of time slot number

b8 b1	Time slot number
00000000	1
00000001	2
00000011	4
00000111	8
00001111	16

8.6 REQ response (ATQ)

The response to the REQ command is called the REQ response or the ATQ (Answer To reQuest).

8.6.1 REQ response format

The REQ response format shall be composed of the response code of 1 byte (“01”), the PICC identifier of 8 bytes, the response time descriptor of 8 bytes and the request data of 0 byte or 2 bytes (see Figure 13).

Response code	PICC identifier	Response time descriptor	Request data
1 byte (“01”)	8 bytes	8 bytes	0 byte or 2 bytes

Figure 13 REQ response message format

8.6.2 PICC identifier

The PICC identifier corresponds to the NFCID2 defined in **JIS X 5211**, which is an 8-byte value. The first 2 bytes shall be “02FE” followed by the 6-byte PICC identification number.

The values other than “02FE” shall not be assigned in this Standard since they may be already used in the existing systems conforming to **JIS X 6319-4:2005**. The value of the PICC identifier shall be unique under the responsibility of manufacturers (see Figure 14).

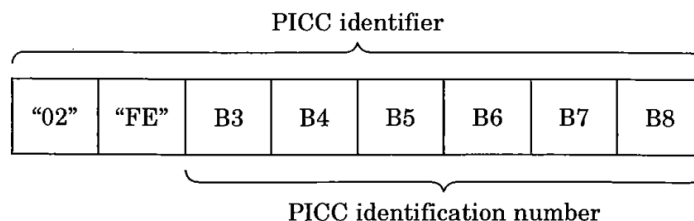


Figure 14 PICC identifier configuration

8.6.3 Response time descriptor

The response time descriptor corresponds to the Pad defined in **JIS X 5211**, which is an 8-byte value used to calculate the response time of the PICC in response to the command from the PCD.

The first 2 bytes of the response time descriptor shall be “FF”.

The LSB, B8 is RFU and shall be set to “FF” in this Standard.

The configuration of the response time descriptor is shown in Figure 15.

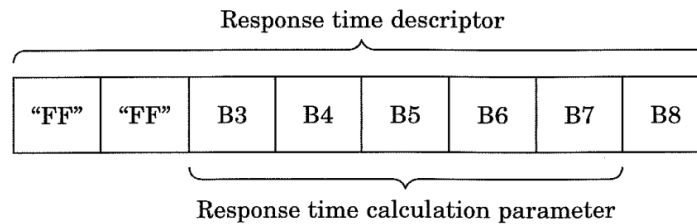


Figure 15 Configuration of response time descriptor

The correspondence between B3 and B7 of the response time descriptor and commands is shown in Table 4.

Table 4 Correspondence between B3 to B7 of response time descriptor and commands

Byte position of response time calculation parameter	Command
B3	RequestService command (see 10.3)
B4	RequestResponse command (see 10.4)
B5	Authentication1 command, Authentication2 command, NewAuthentication1 command and NewAuthentication2 command (see 10.7, 10.12 and 10.13)
B6	Read command, SecureRead command and NewSecureRead command (see 10.5, 10.8 and 10.14)
B7	Write command, SecureWrite command and NewSecureWrite command (see 10.6, 10.9 and 10.15)

The response time calculation parameter shall be composed of an exponential part (E) and two real number parts (A and B). The configuration of the response time calculation parameter is shown in Figure 16.

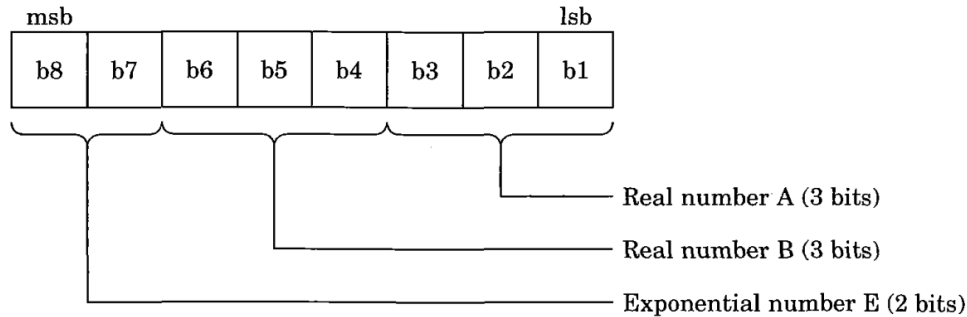


Figure 16 Configuration of response time calculation parameter

The calculation formula of the response time using the response time calculation parameter shall be as follows.

$$\text{Response time} = T \times [(B + 1) \times n + (A + 1)] \times 4^E$$

where, $T : 256 \times 16 / f_c$ (approximately 0.302 0 ms)

n : number of blocks or service files of command parameter (see Table 10)

The response time for the extended commands (see 10.11) shall be calculated by setting “FF” to the response time calculation parameter.

8.6.4 Request data

It is optional to return the request data.

The request data is the additional information to the REQ response depending on the request code (see 8.5.3) shown below for the REQ command.

The length of the request data is either 0 byte or 2 bytes.

If the request code is set to “01”, the system code set in the PICC shall be added. The coding thereof shall be as specified in 8.5.2.

If the request code is set to “02”, the transmission protocol capability of the PICC itself shall be added. The coding thereof shall be as specified in Figure 17. The first byte B1 specifies the handling of the EDC field in the block format of JIS X 6322-4 in the mapping between the frame format of this Standard and that of JIS X 6322-4. The coding of B1 shall be as specified in Figure 18. The second byte B2 shows the communication capability. The b8 shows the presence of automatic bit rate detection, the b7 to b5 are the fixed values (b“000”) in this Standard, and the b4 to b1 show the bit rate capability of $f_c/8$, $f_c/16$, $f_c/32$ and $f_c/64$, respectively (see Figure 18). The b4 and b3 are reserved as the communication capability of $f_c/8$ and $f_c/16$, and shall be set to b“0” in this Standard.

B1	B2
1 byte (see Figure 18)	1 byte (see Figure 18)

Figure 17 Transmission protocol capability

B1								Meaning
b8	b7	b6	b5	b4	b3	b2	b1	
0	0	0	0	0	0	0	0	PICC conforms to JIS X 6319-4:2010 only.
0	0	0	0	0	0	0	1	If PICC conforms to JIS X 6319-4:2010 , PICC transmits JIS X 6322-4 block as it is defined but without EDC field. Otherwise, PICC transmits JIS X 6322-4 block as it is defined.
0	0	0	0	0	0	1	0	PICC transmits JIS X 6322-4 block as it is defined, but its EDC is always set to "0000".
0	0	0	0	0	1	0	0	PICC transmits JIS X 6322-4 block as it is defined, but its EDC is set to CRC_A as defined in B.1 of JIS X 6322-4 .
0	0	0	0	1	0	0	0	PICC transmits JIS X 6322-4 block as it is defined, but its EDC is set to CRC_B as defined in B.2 of JIS X 6322-4 .
0	0	0	1	0	0	0	0	PICC transmits JIS X 6322-4 block as it is defined, but its EDC is set to CRC as defined in A.3 of JIS X 5211 .
Other settings are prohibited.								
B2								Meaning
b8	b7	b6	b5	b4	b3	b2	b1	
x								0: automatic bit rate detection not supported 1: automatic bit rate detection supported
	0							0: fixed value 1: RFU
		0						0: fixed value 1: RFU
			0					0: fixed value 1: RFU
				0				0: <i>fc</i> /8 not supported 1: <i>fc</i> /8 supported (reserved)
					0			0: <i>fc</i> /16 not supported 1: <i>fc</i> /16 supported (reserved)
						x		0: <i>fc</i> /32 not supported 1: <i>fc</i> /32 supported
							x	0: <i>fc</i> /64 not supported 1: <i>fc</i> /64 supported
NOTE 1 Although <i>fc</i> /8, <i>fc</i> /16, <i>fc</i> /32 and <i>fc</i> /64 are referred to in this table, only <i>fc</i> /32 and <i>fc</i> /64 covered in 5.2.3 are used in this Standard.								
NOTE 2 If automatic bit rate detection is supported, the PICC is capable of receiving and handling commands at the bit rates indicated by b1 to b4.								

Figure 18 EDC type (B1) and communication capability (B2)

8.7 WUP command

The WUP command is optional.

When the PICC in the HALT state receives the WUP command containing the system code that matches the system code set in the PICC, the PICC shall return the WUP response and enter the IDLE state.

The WUP command format shall be composed of the command code of 2 bytes ("D604"), the system code which consists of the fixed value of 1 byte ("AA") followed by the AFI of 1 byte, the request code of 1 byte ("00") and the time slot number of 1 byte (see Figure 19).

Command code	System code		Request code	Time slot number
	Fixed value field	AFI field		
2 bytes ("D604")	1 byte ("AA")	1 byte	1 byte ("00")	1 byte

Figure 19 WUP command message format

8.8 WUP response

The PICC capable of processing the WUP command shall have the function which returns the WUP response.

The WUP response format shall be composed of the response code of 2 bytes ("D705"), the PICC identifier of 8 bytes and the response time descriptor of 8 bytes (see Figure 20).

Response code	PICC identifier	Response time descriptor
2 bytes ("D705")	8 bytes	8 bytes

Figure 20 WUP response message format

8.9 HLT command

The HLT command is optional.

When the PICC in the IDLE state or the READY-DECLARED state receives the HLT command containing the PICC identifier that matches own PICC identifier, the PICC shall return the HLT response and enter the HALT state.

The HLT command format shall be composed of the command code of 2 bytes ("D602") and the PICC identifier of 8 bytes (see Figure 21).

Command code	PICC identifier
2 bytes ("D602")	8 bytes

Figure 21 HLT command message format

8.10 HLT response

The PICC capable of processing the HLT command shall have the function which returns the HLT response. The HLT response shall be composed of the response code of 2 bytes, ("D703") and the PICC identifier of 8 bytes (see Figure 22).

Response code	PICC identifier
2 bytes ("D703")	8 bytes

Figure 22 HLT response message format

8.11 ATTR command

8.11.1 ATTR command message format

The ATTR command is optional.

When the PICC in the READY-DECLARED state receives the ATTR command containing the PICC identifier that matches own PICC identifier, the PICC shall return the ATTR response and enter the ACTIVE processing state (see 8.3.7.2).

The ATTR command shall be composed of the command code of 2 bytes ("D600"), the PICC identifier of 8 bytes, the CP1, CP2 and CP3 of 1 byte for each, and the INFC field of 0 or more bytes (see Figure 23).

Command code	PICC identifier	CP1	CP2	CP3	INFC field
2 bytes ("D600")	8 bytes	1 byte	1 byte	1 byte	0 or more bytes

Figure 23 ATTR command message format

8.11.2 Coding of CP1 (Command Param 1)

The CP1 shall be coded as shown in Figure 24.

b8	b7	b6	b5	b4	b3	b2	b1	Meaning
x	x	x	x					Bit rate
				x	x	x	x	Maximum frame size of PCD

Figure 24 Coding of CP1

The upper 4 bits (b8 to b5) shall be used for the coding of the bit rate as shown in Table 5 and Table 6.

Table 5 Bit rate from PICC to PCD

b8	b7	Meaning
0	0	$fc/128$
0	1	$fc/64$
1	0	$fc/32$
1	1	$fc/16$

Table 6 Bit rate from PCD to PICC

b6	b5	Meaning
0	0	$fc/128$
0	1	$fc/64$
1	0	$fc/32$
1	1	$fc/16$

The lower 4 bits (b4 to b1) shall be used for the coding of the maximum frame size that can be received by the PCD as shown in Table 7.

Table 7 Coding of maximum frame size

Value of lower 4 bits	0	1	2	3	4	5	6	7	8	9 to F
Maximum frame size (byte)	16	24	32	40	48	64	96	128	256	RFU (>256)

8.11.3 Coding of CP2 (Command Param 2)

The CP2 represents the EDC type selected by the PCD and its coding shall be as specified by B1 in Figure 18.

8.11.4 Coding of CP3 (Command Param 3)

The CP3 shall be coded as shown in Figure 25.

b8	b7	b6	b5	b4	b3	b2	b1	Meaning
x	x	x	x					RFU
				x	x	x	x	CID

Figure 25 Coding of CP3

The upper 4 bits (b8 to b5) shall be set to b“0000” and other values shall be RFU.

The lower 4 bits (b4 to b1) shall be used for the CID (Card IDentifier) which defines the logical number of the PICC for the communication and shall be between 0 and 14. The value of 15 is RFU. The CID is specified by the PCD and shall be unique to each PICC in ACTIVE processing state. However, if not supported by the PCD, the CID shall be set to b“0000”.

8.11.5 INFC field

The INFC field may include the higher layer command which can be transmitted as the INF field of **JIS X 6322-4**.

The PICC may process this INFC field.

8.12 ATTR response

8.12.1 ATTR response message format

The PICC capable of processing the ATTR command shall have the function which returns the ATTR response.

The ATTR response format shall be composed of the response code of 2 bytes (“D701”), the MBLI/CID of 1 byte, the RP1, RP2 and RP3 each of 1 byte, and the INFR field of 0 or more bytes (see Figure 26).

The PICC shall be able to perform the process defined in **JIS X 6322-4** after returning the ATTR response. The deactivation of process shall be as specified in **JIS X 6322-4**. The PICC shall enter the HALT state after the deactivation of process of **JIS X 6322-4**.

Response code	MBLI/CID	RP1	RP2	RP3	INFR field
2 bytes ("D701")	1 byte	1 byte	1 byte	1 byte	0 or more bytes

Figure 26 ATTR response message format

8.12.2 Coding of MBLI/CID

The MBLI/CID shall be coded as shown in Figure 27.

b8	b7	b6	b5	b4	b3	b2	b1	Meaning
x	x	x	x					MBLI
				x	x	x	x	CID

Figure 27 Coding of MBLI/CID

The upper 4 bits (b8 to b5) shall be used for the MBLI (Maximum Buffer Length Index), which is the integer to define the size limit of MBL (Maximum Buffer Length) of internal buffer of the PICC for the reception of the chained frames. The MBLI shall be 0 to 15. MBL is calculated according to the following formula if the MBLI is between 1 and 15.

$$\text{MBL} = (\text{maximum frame size of PICC}) \times 2^{(\text{MBLI}-1)}$$

The PCD shall ensure that the whole length of data does not exceed the MBL when sending the chained frames to the PICC.

The MBLI shall be set to 0 in the case where the PICC provides no information about its internal buffer size limit.

The lower 4 bits (b4 to b1) shall contain the CID (Card Identifier) which is set to the same value as the CID of the corresponding ATTR command. If the PICC does not support the CID, the CID shall be set to b"0000".

8.12.3 Coding of RP1 (Response Param 1)

The RP1 shall be coded as shown in Figure 28.

b8	b7	b6	b5	b4	b3	b2	b1	Meaning
x	x	x	x					FWI
				x	x			RFU
						x	x	FO

Figure 28 Coding of RP1

The upper 4 bits (b8 to b5) shall be used for the FWI (Frame Waiting time Integer) which is an integer to define the FWT (Frame Waiting Time). The FWT shall be the maximum time between the end of the PCD frame and the beginning of the PICC response frame during the frame exchange specified in **JIS X 6322-4**.

The FWT shall be calculated according to the following formula. The value of FWI shall have the range from 0 to 14, and the value of 15 shall be RFU.

$$FWT = (256 \times 16/f_c) \times 2^{FWI}$$

Among the lower 4 bits (b4 to b1), b4 and b3 are RFU, and b2 and b1 shall contain FO (Frame Option), and they shall be coded as shown in Table 8.

Table 8 Coding of FO

b2	b1	Meaning
1	x	PICC supports NAD
x	1	PICC supports CID

8.12.4 Coding of RP2 (Response Param 2)

The RP2 shall be coded as shown in Figure 29.

b8	b7	b6	b5	b4	b3	b2	b1	Meaning
x	x	x	x					RFU
				x	x	x	x	Maximum frame size of PICC

Figure 29 Coding of RP2

The upper 4 bits (b8 to b5) shall be set to b“0000” and other values are RFU.

The lower 4 bits (b4 to b1) shall be used for the coding of the maximum frame size which can be received by the PICC as shown in Table 7.

8.12.5 Coding of RP3 (Response Param 3)

The RP3 shall be set to “00” and other values are RFU.

8.12.6 INFR field

The INFR field may be used for the storage of the response to the INFC field in the ATTR command.

9 File

9.1 File organization

The information in the PICC shall be managed as the files. There are two types of files, the area file and the service file. An example of the file organization in the PICC is shown in Figure 30.

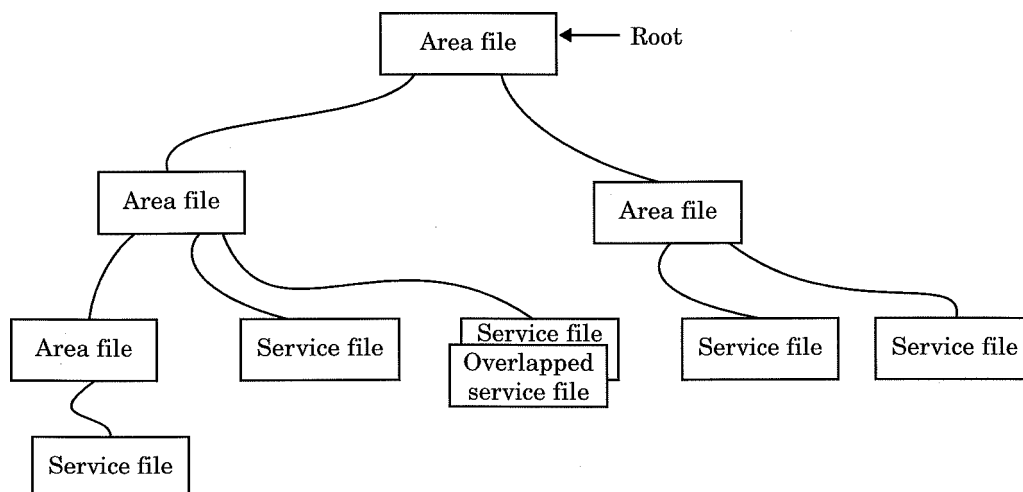


Figure 30 Example of file organization

9.2 File types

9.2.1 Overview

The area file shall be composed of the area file structure (see 9.2.2). The service file shall be composed of the service file structure (see 9.2.3) and the target actual data stored in the PICC's memory area.

The actual data stored in the PICC's memory area shall be uniquely identified by the service file identifier in the service file structure, and the processing methods to the actual data shall be determined by the access control process category in the service file identifier in the PICC.

The PICC's memory area shall be composed of the blocks in unit of 16 bytes. The logical location of each block shall be managed by the management information of two bytes. The management method of the PICC's physical memory area is not specified in this Standard.

9.2.2 Area file

The area file structure shall be composed of the area file identifier, the maximum service file identifier, the number of allocated blocks, the area key version and the variable area key as shown in Figure 31.

Information field	Number of bytes
Area file identifier	2
Maximum service file identifier	2
Number of allocated blocks	2
Area key version	2
Area key	Variable (depending on the employed cryptographic mechanism)

Figure 31 Area file structure

The area file identifier of the area file structure shall be composed of the area number of 10 bits followed by the access control process category (see 9.5) of 6 bits as shown in Figure 32. The area file identifier shall be unique in the PICC. The root area file as shown in Figure 30 shall exist with the area file identifier set to “0000”. The 6-bit access control process category shall be set to either b“000000” or b“000001”, and other values are RFU. If set to b“000000”, other area file which is managed by this area file may exist. If set to b“000001”, other area file which is managed by this area file does not exist.

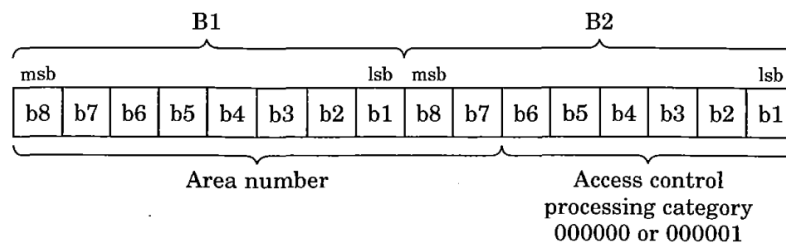


Figure 32 Area file identifier

The maximum value of the file identifier among all files managed by this area file shall be stored in the maximum service file identifier of the area file structure. The maximum file identifier shall not be set to “FFFF”.

The total sum of blocks which belong to all other area file structures and service file structures managed by this area file identifier, allocated blocks of the service file structures, and free blocks in the PICC’s memory area shall be stored in the number of allocated blocks of the area file structure.

The key version information that is applied to this area file and the service files managed by this area file shall be stored in the area key version of the area file structure. However, the content of the version information is not specified in this Standard.

The area key of the area file structure is used for mutual authentication. However, details of the key and the storage methods are not specified in this Standard.

9.2.3 Service file

The service file shall be composed of the service file identifier, the number of allocated blocks, the service key version and the service key as shown in Figure 33.

The service key version and the service key are optional.

Information field	Number of bytes
Service file identifier	2
Number of allocated blocks	2
Service key version	2
Service key	Variable (depending on the employed cryptographic mechanism)

Figure 33 Service file structure

The service file identifier of the service file structure shall be composed of the service number of 10 bits followed by the access control process category (see 9.5) of 6 bits as shown in Figure 34. The service file identifier of the service file structure shall be unique in the PICC.

Assuming there are multiple service files, if the service files have the same service number (upper 10 bits) but differ in the access control process category (lower 6 bits) of the service file identifier of the service file structure, these service files are identified as separate files. In this case, if these services files have the same access type (see 9.5.1) and the same number of allocated blocks, then these service files shall share data of those blocks and shall apply different access controls to the same blocks indicated by the number of allocated blocks field of the service file structure. This is named an overlapped service file.

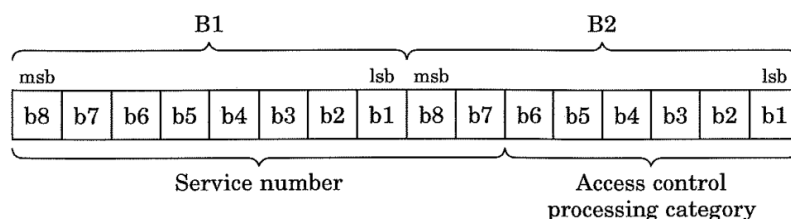


Figure 34 Service file identifier

The number of blocks in the PICC's memory area managed by this service file shall be stored in the number of allocated blocks field of the service file structure.

The key version information that is applied to this service file and the memory area managed by this service file shall be stored in the service key version of the service file structure. However, the content of the version information is not specified in this Standard.

The service key of service file structure is used for mutual authentication. However, details of the key and the storage methods are not specified in this Standard.

9.3 Organization of files

Files (multiple area files and service files) shall be organised hierarchically (e.g. Figure 30). The hierarchy of files shall be determined by the values of the file identifiers (area file identifier and service file identifier). The values in the area number of the area file identifier and the service number of the service file identifier shall be determined in accordance with the following rules.

The area files and the service files shall be identified by the lower 6 bits of the file identifier. If the lower 6 bits are b"000000" or b"000001", the file is the area file. If others, the file is the service file.

The value of the file identifiers of area files and service files immediately below the given area file shall not be less than the value of the area file identifier of the given area file, and shall be not more than the value of the maximum file identifier of the given area file.

If the file identifiers have the same upper 10 bits but differ in lower 6 bits, these file identifiers shall be treated as different file identifiers.