Guidelines for development of ISO 28560-3 conformant devices

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1. Introduction

The document gives relevant information about RFID in Libraries related to implementation of ISO 28560.

The author is one of the editors of ISO 28560-3.

2. Scope

Separate conformance rules are provided for the system support, data encoding, data decoding, and data editing processes to enable devices that do not need to support all components to be able to claim conformance.

To fully comply with ISO 28560 an RFID system must as a minimum comply with ISO 28560-2 or ISO 28560-3. A system may comply with both these parts of ISO 28560, in the sense being able to support both encoding schemas. The encoding for a tag shall comply with one encoding schema and the library shall choose between ISO 28560-2 and ISO 28560-3.

This document defines the conformance requirements for ISO 28560-3.

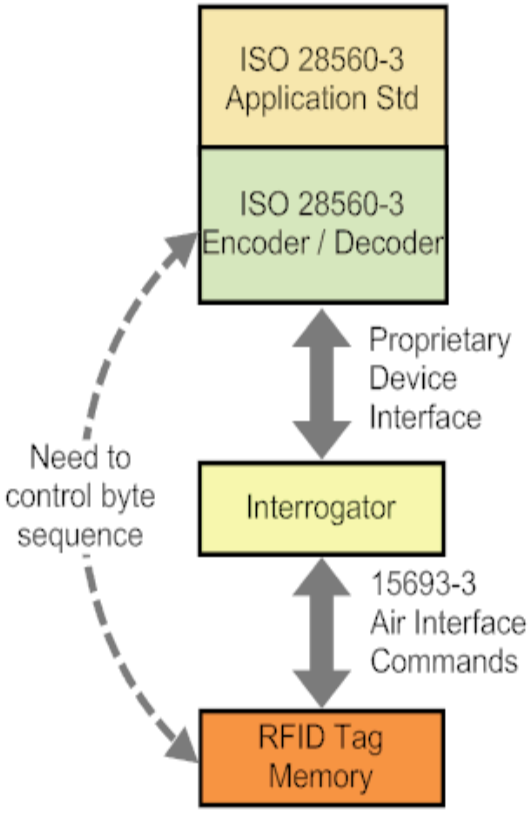
3. Conformance requirements for ISO 28560-3

To fully comply with ISO 28560-3, in the context of the feature set provided by an RFID system, the system must adhere to ISO 28560-1 and ISO 28560-3 for the data elements utilized as it provides those features, and must not disturb any additional data elements which are properly encoded on the tag, according to ISO 28560-3.

The compliance specification, and the standards, should not be used to limit differentiation in feature offerings. Rather, it should become an opportunity to identify areas of differentiation in system features, while enhancing interoperability through the implementation of the standard.

Throughout this document the term “report or record a message” is used to indicate that all forms of error checking/validation require some kind of feedback mechanism, whether that be direct to a user or to a processing log. The mechanism adopted is at the discretion of the vendor.

It is important to understand that bit and byte ordering rules vary based on the standards being referred to, the development of proprietary interfaces to the interrogator, the interrogator's processing of data, even the brand and model of computer and operating system used. The figure (to the right) illustrates some of the issues and constraints.



ISO/IEC 18000-3 Mode 1 refers to the air interface protocol defined in ISO/IEC 15693-3. This makes clear that the AFI and DSFID (as single byte values are transmitted in commands and responses least significant bit first. The unique chip id, or UID, is a multiple-byte field that is transmitted least significant byte first, each byte is transmitted least significant bit first.

Unlike some of the more recent RFID technologies, ISO/IEC 18000-3 Mode 1 has no standardised device interface. This means that the bit and byte ordering might be addressed in the interrogator, or input API to the interrogator. It is therefore important for systems designers to address these issues for the particular software, hardware and operating system being used.

ISO 28560-3 has encoding examples in Annex B. The following passages will clarify the transmission sequence for the data in the first blocks of memory in the example shown in ISO 28560-3, Table B.2.

In a memory with a 4-byte block structure, tThe first block contains the Content Parameter, the Type of Usage, the Set Information, and the first character of the primary item identifier. The byte containing the combination of the Type of Usage and the Content Parameter is encoded in the lowest addressable block of user memory and in the lowest addressable byte. In this example, in a memory with a 4-byte block the encoding is:

Increasing block addresses ▼	Increasing byte addresses ►►►►			
▼	11	01	01	31
▼	30	30	30	30

The air interface *Write Single Block* command (or request) to write to the lowest block is shown below, with each byte sent to the tag least significant bit first.

Example of a *Write Single Block* ISO/IEC 15693-3 air interface command

SOF	***Flags***	***Command***	***UID[1]***	***Block***	***Data***	***CRC16***	***EOF***

		Code		***Number*[2]**			
	8 bits	**21**	**D5 9B 7A 13 00 01 04 E0**	**8 bits**	**11 01 01 31**	**16 bits**	

NOTES:
1. The UID is only required under specific flag settings. The UID of the tag in this example is E0040100137A9BD5
2. The value of the lowest block number varies depending on the memory architecture defined by different IC manufacturers and models

3.1 System Support Using ISO/IEC 18000-3 Mode 1 RFID Tags

This is included as a separate component because explicit air interface protocol processes are required to support these features. This requirement applies as an additional layer to the data encoding, decoding, and editing requirements. Some of the requirements enable a conformance statement to be declared based on a subset of options possible in ISO/IEC 18000-3 Mode 1.

- Support one or more block sizes (within the specified range of 1 to 32 bytes per block), by declaring specific block sizes that are supported.

- Support one or more memory sizes by declaring specific memory encoding capacity or the minimum and maximum capacity supported.

- Support the writing of the AFI using specified air interface commands. Declare whether AFI locking is supported.

- Support the writing of the hard-coded DSFID using specified air interface commands. Declare whether DSFID locking is supported.

- Support the encoding and decoding of the AFI compliant with ISO 28560-1:
  - Using $C2_{HEX}$ for all loan items that leave the library;
  - Optionally, using 07_{HEX} for in stock items if this is used for the security system.
  - Declare whether an AFI other than those specified by ISO 28560-1 will be processed as non-compliant and belonging to a different application. Optionally, provide or report a message for tags with such an AFI.

- Support the encoding and decoding of the DSFID compliant with ISO 28560-3,
  - Resulting in a DSFID value of $3E_{HEX}$.
  - During the decoding procedure, a DSFID other than that declared by ISO 28560-3 shall be processed as non-compliant and belonging to a different application or encoding. Optionally, provide or report a message for tags with such a DSFID.

3.2 The Data Encoding Process

This deals explicitly with encoding data into user memory using an encoding engine, or similar device.

- Fully comply with ISO 28560-1 data elements.

- Support the selection of a sub-set of data elements to comply with a national data model, with further selection (or de-selection) of optional data elements.

- Support variable length data input where this is permitted by ISO 28560-1 and 28560-3.

- Validate input data objects to comply with ISO 28560-1.

- Encode data to the specifications in ISO 28560-3.

- Encode the CRC according to the specification in ISO 28560-3

- Correctly format the encoding when a data set is specified by the user to be locked, including the implications for adjacent data sets.

- Provide or record a message when the intended encoding exceeds the memory capacity of the RFID tag.

- Encode data such that a potential data overflow issue is resolved without permitting the partial programming of any data element on the tag.

- Optionally, provide or report messages for any input errors.

3.3 The Data Decoding Process

This deals explicitly with decoding data from user memory using a decoding engine, or similar device.

- Declare whether the decoding process supports the selective reading of a sequence of blocks across the air interface (typically for fast reading operations) where all the data sets might not be included in the air interface transmission. In this case ensure that any truncated and incomplete data set, either at the beginning and / or end of the transmission, is ignored and not treated as errors.

- Decode data to the specifications in ISO 28560-3.

- Decode the CRC according to the specification in ISO 28560-3

- Correctly decode a data set specified by the user to be locked.

3.4 The Editing Process

The editing process needs to be built on a fully functional encoding and decoding engine as defined above to enable users to decode existing tag data and edit the results by deleting, modifying (including locking) or adding data objects. Specifically:

- System features that support editing shall identify all existing locked memory blocks, and interpret this into information of locked data elements.

- System features that support editing shall provide a mechanism for identifying which memory blocks have been changed by the editing operation.

- System features that modify existing data elements on a tag shall perform that modification, taking into account that the new data might require more or less encoding space and encode to the rules of ISO 28560-3.

- System features that delete existing data elements on a tag shall perform that deletion, providing a resultant encoding compliant with the rules of ISO 28560-3.

- System features that append any additional ISO 28560 data elements not encoded on the RFID tag shall perform that modification, encoding to the rules of ISO 28560-3.

- System features that support editing shall selectively lock any modified or appended data element, as defined by the user, ensuring that the locking process results in a compliant encoding.

- System features that support editing shall automatically update the CRC.

- Provide or report relevant messages where the intended modified or appended data will not fit in the specified memory size.

- Append data to a tag such that a potential data overflow issue is resolved without permitting the partial programming of any data element on the tag

- Optionally, provide or record messages for any input errors.