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14443/NFC Harmonization
Study on use-cases in overlapping application areas

Japan Committee SC6 and SC17

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14443/NFC Harmonization

1   Introduction

This document provides the study on use-cases in overlapping application areas and the list of requirements for the 14443/NFC Harmonization. The word NFC (e.g. ISO/IEC 18092, ISO/IEC 21481) includes their test standards.

The ISO/IEC 21481 specifies "External RF field threshold value", "RF Field detection", and "Mode selection for NFCIP-1 device, PCD, and VCD". And the "Mode selection for NFCIP-1 device, PCD, and VCD" means that doing "RF Field detection" by the "External RF field threshold value" before becoming PCD or VCD. And no condition for the mode selection is specified by the ISO/IEC 21481. For this reason, we think that our study about ISO/IEC 18092 and ISO/IEC 14443 covers ISO/IEC 21481, except ISO/IEC 15693. We think that the detection protocol and communication protocol of ISO/IEC 15693 are different from 14443/NFC, but it should be further studied about RF field characteristics, for example Hmin and Hmax.

2   Use-cases

2.1   ISO/IEC 18092 applications

Read and write built-in NFCIP-1 device of electronic appliances by built-in NFCIP-1 device of electronic appliances. The main use-cases are as follows.

i)   Initial device set-up faster and easier
     e.g. Easy Bluetooth Pairing, Wi-Fi Protected Setup - NFC

ii) Business card information transfer between NFC phones
     e.g. NOKIA 6131NFC and 6212classic

iii) Use for a personal computer peripheral interface
     e.g. Windows and LLCP

iv) Read and write the NFC Forum Tags Type 1, 2, 3 (see annex.)
     e.g. NOKIA 6131NFC and 6212classic

v)   Read and write the NFC Forum Tags Type 4
     e.g. NOKIA 6212classic

2.2   ISO/IEC 14443 applications

Communication between PICC and PCD. Security architecture is available as ISO/IEC 7816 IC Card Standard specification.

i)   Personal Identification Contact-less Card systems
     e.g. Employee ID Card, Drivers Licence, Passport

ii) Micro-payment Contact-less Card systems
     e.g. eMoney, Debit card

iii) Transport ticket Contact-less Card systems
     e.g. CEPAS Card

iv) Loyalty program Contact-less Card systems
   e.g. Airline company card

2.3 Overlapping application areas

2.3.1 How application areas overlap

If ISO/IEC 14443 PCD/PICC is built into electronic appliances then following overlapping application areas with ISO/IEC 18092 applications can be observed. A user is not able to distinguish these use cases because of the similar look-and-feel. See Table 1.

Table -1   Use-cases in overlapping application areas

Overlapping application areas	ISO/IEC 14443 use case	ISO/IEC 18092 use case	Example
(i)	Communication between built-in PICC of electronic appliances and built-in PCD of electronic appliances	Communication between two NFCIP-1 electronic appliances	Photograph 1
(ii)	Communication between built-in PICC of electronic appliances and PCD	Communication between NFCIP-1 electronic appliances and PC peripherals	Photograph 2
(iii)	Communication between PICC and built-in PCD of electronic appliances	Read and write the NFC Forum Tags Type 1, 2, and 3	Photograph 3

Photograph 1 shows an example of overlapping application area (i). It shows following four cases. 1) both electronic appliances are ISO/IEC 14443 compliant (hereinafter "14443"). 2) both electronic appliances are ISO/IEC 18092 compliant (hereinafter "18092"). 3) one is 14443 PCD and the other is 18092 electronic appliance. 4) one is 14443 PICC and the other is 18092. A user is not able to distinguish these cases because of the similar look-and-feel.
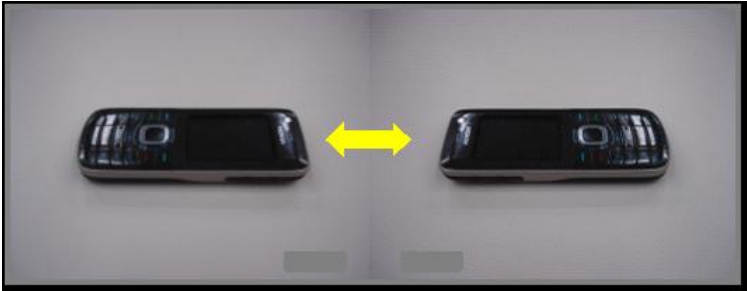
Photograph 1

Photograph 2 shows an example of overlapping application area (ii). It shows following four cases. 1) both electronic appliances are 14443. 2) both electronic appliances are 18092. 3) one is 14443 PCD and the other is 18092 electronic appliance. 4) one is 14443 PICC and the other is 18092 electronic appliance. A user is not able to distinguish these cases because of the similar look-and-feel.

Photograph 2

Photograph 3 shows an example of overlapping application area (iii). It shows following four cases. 1) Cards and electronic appliances are 14443. 2) Cards are NFC Forum Tag Type 1, 2, or 3 and electronic appliances are 18092. 3) Cards are 14443 and electronic appliances are 18092. 4) NFC Forum Tag Type 1, 2, or 3 and electronic appliances are 14443. A user is not able to distinguish these use cases because of the similar look-and-feel.

Photograph 3

2.3.2 What kind of issues exist under the overlapping application areas

2.3.2.1 Overlapping application area (i)

If the built-in PCD of electronic appliances are the cell phones, the built-in PCD of electronic appliances will interfere each other when people in the same place try to communicate between the built-in PICC of electronic appliances and their cell phone. It may happen because ISO/IEC 14443 does not specify the "Initial RF Collision Avoidance".

In case of the battery operated built-in PCD and 18092 electronic appliances, battery life is the important feature for electronic appliances.

There are four combinations under the overlapping application area (i), as shown below. In case of the combination 3 and 4, these use-cases are not specified by neither 14443 nor 18092. They do not have a common standard protocol, therefore they cannot exchange any message even refuse.

4

Table -2   Overlapping application area (i)

(1)	OK	PCD ↔ PICC	Communication between built-in PICC of electronic appliances and built-in PCD of electronic appliances
(2)	OK	NFCIP-1 device ↔ NFCIP-1 device	Communication between two NFCIP-1 devices
(3)	*1	NFCIP-1 device ↔ PCD	Read and write NFCIP-1 device by built-in PCD of electronic appliances
(4)	*2	NFCIP-1 device ↔ PICC	Read and write built-in PICC of electronic appliances by NFCIP-1 device

*1
14443 PCD can detect Target mode of NFCIP-1 device as a Type A PICC, but 14443 PCD cannot communicate with the NFCIP-1 device because lack of common data transfer protocol.
14443 PCD cannot detect Target mode of NFCIP-1 device working on 212 kb/s or 424 kb/s, because 14443 does not specify the detection mechanism for the NFCIP-1's 212 kb/s and 424 kb/s.

*2
Passive Initiator mode of NFCIP-1 device cannot detect 14443 PICC Type B. And Passive Initiator mode of NFCIP-1 device can detect 14443 PICC Type A, but it cannot communicate with the NFCIP-1 device because lack of common data transfer protocol. Target mode of NFCIP-1 device cannot detect any PICC.
NFCIP-2 device can detect 14443 PICC Type A and B by using PCD mode.

2.3.2.2   Overlapping application area (ii)

If the built-in PCD of electronic appliances are the cell phones, the built-in PCD of electronic appliances will interfere each other when people in the same place try to communicate between the built-in PICC of electronic appliances and their cell phone. It may happen because ISO/IEC 14443 does not specify the "Initial RF Collision Avoidance".

In case of the battery operated built-in PCD and 18092 electronic appliances, battery life is the important feature for electronic appliances.

There are four combinations under the overlapping application area (ii), as shown below. In case of the combination 3 and 4, these use-cases are not specified by ISO/IEC 14443 or ISO/IEC 18092. They do not have a common standard protocol, therefore they cannot exchange any message even refuse.

Table -3   Overlapping application area (ii)

(1)	OK	PICC ↔ PCD	Communication between built-in PICC of electronic appliances and PCD of electronic appliances
(2)	OK	NFCIP-1 device ↔ NFCIP-1 device	Communication between two NFCIP-1 devices
(3)	*3	PICC ↔ NFCIP-1 device	Communication between built-in PICC of electronic appliances and NFCIP-1 device
(4)	*4	NFCIP-1 device ↔ PCD	Read and write NFCIP-1 device by PCD of electronic appliances

*3
Passive Initiator mode of NFCIP-1 device cannot detect 14443 PICC Type B. And Passive Initiator mode of

NFCIP-1 device can detect 14443 PICC Type A, but it cannot communicate with the NFCIP-1 device because lack of common data transfer protocol. Target mode of NFCIP-1 device cannot detect any PICC.
NFCIP-2 device can detect 14443 PICC Type A and B by using PCD mode.

*4
14443 PCD can detect Target mode of NFCIP-1 device as a Type A PICC, but 14443 PCD cannot communicate with the NFCIP-1 device because lack of common data transfer protocol.
14443 PCD cannot detect Target mode of NFCIP-1 device working on 212 kb/s or 424 kb/s, because ISO/IEC 14443 does not specify the detection mechanism for the NFCIP-1's 212 kb/s and 424 kb/s.

2.3.2.3   Overlapping application area (iii)

If the built-in PCD of electronic appliances are the cell phones, the built-in PCD of electronic appliances will interfere each other when people in the same place try to communicate between the built-in PICC of electronic appliances and their cell phone. It may happen because ISO/IEC 14443 does not specify the "Initial RF Collision Avoidance".

In case of the battery operated built-in PCD and 18092 electronic appliances, battery life is the important feature for electronic appliances.

There are four combinations under the overlapping application area (iii), as shown below. In case of the combination 3 and 4, these use-cases are not specified by ISO/IEC 14443 or ISO/IEC 18092. They do not have a common standard protocol, therefore they cannot exchange any message even refuse.

Table -4   Overlapping application area (iii)

(1)	OK	PICC ↔ PCD	Communication between PICC and built-in PCD of electronic appliances
(2)	*5	NFC Tag ↔ NFCIP-1 device	Read and write NFC Forum Tag Type 1, 2, and 3 by NFCIP-1 device
(3)	*6	NFC Tag ↔ PCD	Read and write NFC Forum Tag Type 4
(4)	*7	PICC ↔ NFCIP-1 device	Read and write PICC by NFCIP-1 device

*5
Passive Initiator mode of NFCIP-1 device can detect NFC Forum Tag Type 1, 2, and 3, but it cannot detect NFC Forum Tag Type 4. And Passive Initiator mode of NFCIP-1 device can detect NFC Forum Tag Type 1, 2, and 3, but it cannot communicate with the NFCIP-1 device because NFCIP-1 device does not support proprietary commands for them.
NFCIP-2 device can detect NFC Forum Tag Type 4 using PCD mode, but it cannot communicate with the NFCIP-1 device because lack of common data transfer protocol.

*6
ISO/IEC 14443 PCD can detect and communicate with NFC Forum Tag Type 4 as ISO/IEC 14443 PICC Type A or B.
ISO/IEC 14443 PCD can detect NFC Forum Tag Type 1 and 2 as ISO/IEC 14443 Type A PICC, but cannot communicate with them because 14443 PCD does not support proprietary commands for them.
ISO/IEC 14443 PCD cannot detect NFC Forum Tag Type 3, because ISO/IEC 14443 does not specify the detection mechanism for the NFCIP-1's 212 kb/s and 424 kb/s.

*7
Passive Initiator mode of NFCIP-1 device can detect 14443 PICC Type A, but it cannot detect 14443 PICC Type B. And Passive Initiator mode of NFCIP-1 device can detect 14443 PICC Type A, but it cannot communicate with the NFCIP-1 device because lack of common data transfer protocol. Target mode of NFCIP-1 device cannot detect any PICC.
NFCIP-2 device can detect 14443 PICC Type A and B by using PCD mode.

2.3.2.4 Example of overlapping application

18092 devices are waked up (Passive Target mode is default) by the RF field of 14443 PCD. The 14443 PCD detects an 18092 device. End-user chooses a service by the menu of the 18092 device, and then the 18092 device requests higher layer protocols to the 14443 PCD. The 14443 PCD activates the corresponding higher layer protocol for ready to service. Although this type of behaviour may possible to realize as a proprietary specifications, if this type of behaviour is specified by Standard then they are interoperable among different providers and different manufacturers.

3 Requirements

The overlapping application areas explained in clause 2.3 are existing between ISO/IEC 14443 and NFC. Neither ISO/IEC 14443 nor ISO/IEC 18092 specifies the overlapping application areas. As both industry of ISO/IEC 14443 compliant products and industry of ISO/IEC 18092 compliant products are growing, and the overlapping application areas are expected to grow. To specify the International Standard specification for the overlapping application areas is better than variety of proprietary specifications for the overlapping application areas, so that providing a reasonable cost of solutions for end-users and helping efficient industry grow. Such specification should provide standard solution including test methods for the asterisk number from 1 to 7 of the clause 2.3, however it should not have a negative impact on currently available systems compliant to ISO/IEC 14443 and NFC, and also the specification should avoid deviation so that it can be maintainable by SC 6 and SC 17.

And the specification should be considered about the restrictions caused by portable appliances' characteristics that are slightly different from plastic card as follows.

- "Initial RF Collision Avoidance" before activating 14443 RF technology so that it does not interfere the ongoing communications on 13.56 MHz.

- Assume the same hardware resources being shared by ISO/IEC 14443 and NFC, for example, antenna, battery (if it is used), and RF circuits.

- Even the antenna shape will be specified, RF characteristics of portable appliances are different due to the efficiency of other RF devices, metals, product design and so forth.

- Take into account the battery operation, because the battery life is the important feature for electronic appliances. The field strengths of PCD/NFC-initiator for the overlapping application areas as well as power-saving features should be considered.

It should be considered how to support higher layer protocols, for example, security architecture regarding ISO/IEC 7816, NFC-SEC (see annex) or other higher layers.

4 Annex

The specification of the NFC Forum Tag Types is available on the following web site.

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http://www.nfc-forum.org/specs/
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NFC-SEC represents the DIS 13157 "NFC-SEC: NFCIP-1 Security Services and Protocol" and the DIS 13158 "NFC-SEC-01: NFC-SEC Cryptography Standard using ECDH and AES". DIS was developed by Ecma International and published. You can download from the following web site.

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http://www.ecma-international.org/publications/standards/Ecma-385.htm
http://www.ecma-international.org/publications/standards/Ecma-386.htm
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