

# Application Interface Document

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## Document History

Date (Rev):	By:	Description:
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## Purpose

This document describes the interface and communication protocols between the Development board and SDK Samples.

## BLE Role Definitions

The communication interface between the device (referred to in this document as 'device') and the mobile application (referred to in this document as 'app' or 'application') shall be BLE. The device shall be a connectable BLE peripheral device. The mobile application shall be a BLE central device.

## Interface Description

This section describes the interface capabilities between the device and the application. The device shall advertise a total of 3 services used to facilitate communication. All data transfer while the application is connected to the device is encrypted through the BLE protocol.

1. Device advertisement
  - a. When the device is enabled by the user the device will begin advertising as a connectable peripheral with the name "E-Ink". At this point the application can connect to the device.
2. Device Information Service

The device shall advertise an information service. This service shall contain 4 read-only characteristics containing the following information.

  - a. Battery level as a percentage
3. Device Command Service

The device shall advertise a command service. This service shall contain 2 write-only characteristics and 1 read-only characteristic containing the following.

  - a. Command value set by the application to tell the device which command to execute
  - b. A command data value set by the application to provide any supporting command data
  - c. A result value set by the device to notify the application of a success or error executing the command

The following commands shall be recognizable by the device:

- a. Display a particular card immediately
  - i. The device shall update the screen to display the front image of a specific card
- b. Remove a particular card

- i. The device shall remove the specified card and its associated back if applicable
  - c. Remove all cards
    - i. The device shall remove all cards
- 4. Device Card Transfer Service

The device shall advertise a card transfer service. This service shall contain 4 write-only characteristics and 1 read/write/notify characteristic containing the following.

  - a. A memory index (1-25) set by the application to indicate which card to update,
  - b. A flag to indicate whether an image is compressed. Only the uncompressed images are supported on this hardware.
  - c. Card image data set by the application
  - d. Write done indication set by the application and cleared by the device. Will allow for notifications.
  - e. A flag to indicate whether the image is the front or back of a card

This service shall operate as follows. The application will check the 'write done' field. If 0x00 the application may start writing a new card. The application will set the memory index of the card to write, set the card back flag to indicate whether this is the front or back image of the card, and set whether or not the image is compressed. The application will then write the card image data in chunks, waiting for a write success notification after each write command indicated by 'write done' set to 0x01 by the device. When the application is finished writing all the card data, it will set the 'write done' to 0xBB. The application will then wait for the device to clear the 'write done' value to 0x00 indicating it is ready to receive another card. It is recommended the application monitor 'write done' for notifications if planning on writing multiple cards.

Some additional considerations are as follows:

- a. The application shall use the maximum MTU size available on that phone to increase data transfer speed. The device shall support BLE 4.2 and higher.
- b. Cards can be added /edited in any order.
- c. The device can only accept image data that is not compressed.

## Protocol Description

This section describes the protocol details between the device and application.

### 1. Advertising packet

Advertising Data NORMAL OPERATION			
bytes	description	value	notes
1	Length of item in bytes	0x02	
2	Data type value	0x01	Flags
3	Flag value	0xFF	
4	Length of item in bytes	0x0B	
5	Data type value	0xFF	Manufacturer specific data
6	Company identifier LSB	0x01	
7	Company identifier MSB	0x01	
8	Contact card share method	0xFF	Not in Use
9	Index of contact card to be shared	0xFF	0x01 – 0x19 (1-25 decimal)
10-15	MAC address	0xFFFFFFFFFFFF	Mac address of the device (in reverse order)
16	Length of item in bytes	0x07	
17	Data type value	0x03	Complete list of 16-bit service class UUIDs
18	Service UUID LSB	0x00	Command service = 0x1400
19	Service UUID MSB	0x14	
20	Service UUID LSB	0x00	Card transfer service = 0x1500
21	Service UUID MSB	0x15	
22	Service UUID LSB	0x16	Information service = 0x1600
23	Service UUID MSB	0x00	
24	Length of item in bytes	0x06	
25	Data type value	0x09	Complete local name
26-30	Local name	0x4449474D45	"E-Ink"

### 2. Information Service

Service UUIDs	
Base UUID	0xFFFFFFFF-XXXX-XXXX-XXXX-FFFFFFFFFFFFFF 0xFFFFXXXX-XXXX-XXXX-XXXX-FFFFFFFFFFFFFF
Service UUID	0x1600
Characteristic UUIDs	
Battery level	0x1601 (not in use)
RFID TID	0x1602 (not in use)
RFID User Memory	0x1603 (not in use)
Device information	0x1604

Characteristic Description			
characteristic	type	length	values
Battery level	Read	1 byte	0x00 – 0x64 (0% to 100% in decimal) (not in use)
RFID TID	Read	12 bytes	Not in Use
RFID User Memory	Read	20 bytes	Not in Use
Device information	Read	2 byte	Byte 1 = hardware version (0x00 – 0xFF) Byte 2 = firmware version (0x00 – 0xFF)

### 3. Command Service

Service UUIDs	
Base UUID	0x440FAD5E-E9C6-40DB-8711-B63A046AEC67 0x440FXXXX-E9C6-40DB-8711-B63A046AEC67
Service UUID	0x1400

Characteristic UUIDs	
Command id	0x1401
Command data	0x1402
Command result	0x1403

Characteristic Description			
characteristic	type	length	values
Command id	Write	1 byte	0x00 = display card (front) 0x03 = wipe device clean 0x06 = remove card
Command data	Write	20 bytes	Associated data to complete the command
Command result	Read	1 byte	0x01 = Success Otherwise, error. Error codes are described below.

#### 4. Card Transfer Service

Service UUIDs	
Base UUID	0XXXXXXXXX-XXXX-XXXX-XXXX-XXXXXXXXXXXX 0XXXXX <del>XXXX</del> -XXXX-XXXX-XXXX-XXXXXXXXXXXX
Service UUID	0x1500

Characteristic UUIDs	
Memory index	0x1501
Compressed	0x1502
Card data	0x1503
Write done	0x1504
Card back	0x1505

Characteristic Description			
characteristic	type	length	values
Memory index	Write	1 byte	0x00 – 0x1A (0-27 decimal)
Compressed	Write	1 byte	0x00 = Data is uncompressed 0x01 = Data is compressed
Card data	Write	Max length	
Write done	Read/Write/Notify	1 byte	Set to 0xF1 by Device if the memory index provided is not valid  Set to 0x01 by Device to let the application know it can send the next chunk of data  Set to 0xBB by application to signify entire contact information has been written.
Card back	Write	1 byte	0x00 = Front of card 0x01 = Back of card

## Command Data and Results

This section defines the required data fields for each command in the command service and the possible result values.

### 1. Display Card (command 0x00)

Characteristic	Possible values
Data	Card index between 0x00-0x19 (0-25 decimal) that currently contains a card.
Result	0x01 = Success 0xF9 = Error

### 2. Remove card (command 0x06)

Characteristic	Possible values
Data	Card index between 0x00-0x19 (0-25 decimal) that currently contains a card. To delete all cards send the value 0xAA
Result	0x01 = Success 0xF9 = Error

If a bad command value is sent, result characteristic will be 0xFF.