TECHNICAL DATA SHEET
NBL-2

DRAFT

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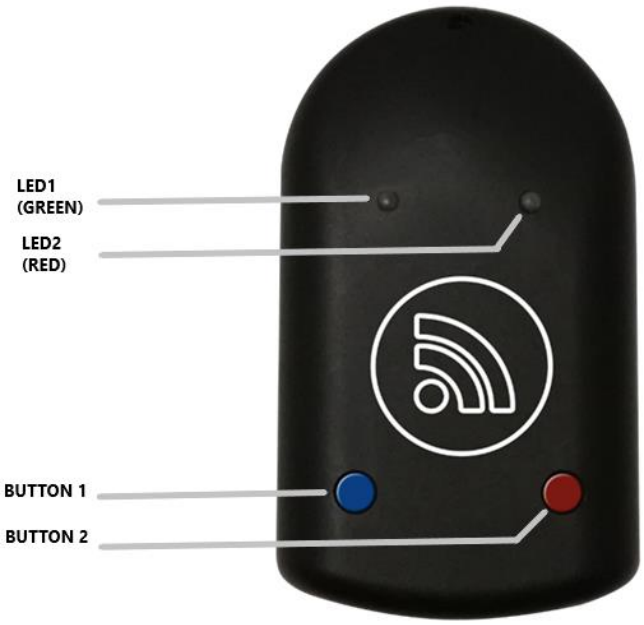
1 FEATURES

- Mifare® Classic, Desfire card supports
- Bluetooth low energy module
- Two AAA battery supply
- Up to 2 years battery operation
- Built-in two LED indicators
- Built-in two buttons
- UID and card DATA available
- Configure via BL link
- Firmware update via Bluetooth
- Operating temperature -40ºC to +85ºC
- Enclosure size: 100x58x18
- Additional sensors in NBL-2:
    - Accelerometer



2 FUNCTIONALITY

- Unpaired reader (state after default reset) is waiting for button only
- Reader scans for transponder detect or button press all time when is paired
- In case above event occurs, reader sends advertising packet for Ta time in period Tb. Defaults: Ta=50sec, Tb=100ms
- During advertising green led is flashing slowly. Reader stops blinking and advertising after disconnection.
- Depending on configuration, read card ID can be present on advertising packet or/and on characteristic
- Reader close connection and goes into low power 50 seconds after last data exchange.
- Each LED can be controlled on GATT services
- Reader can be on/off by long button press
- Reader perform sensor measurement in period which is configurable
- Button reacts immediately
- Sensors configuration is set by GATT services.
- Detecting the start and stopping the vehicle. This mode is active immediately after turn on the device.

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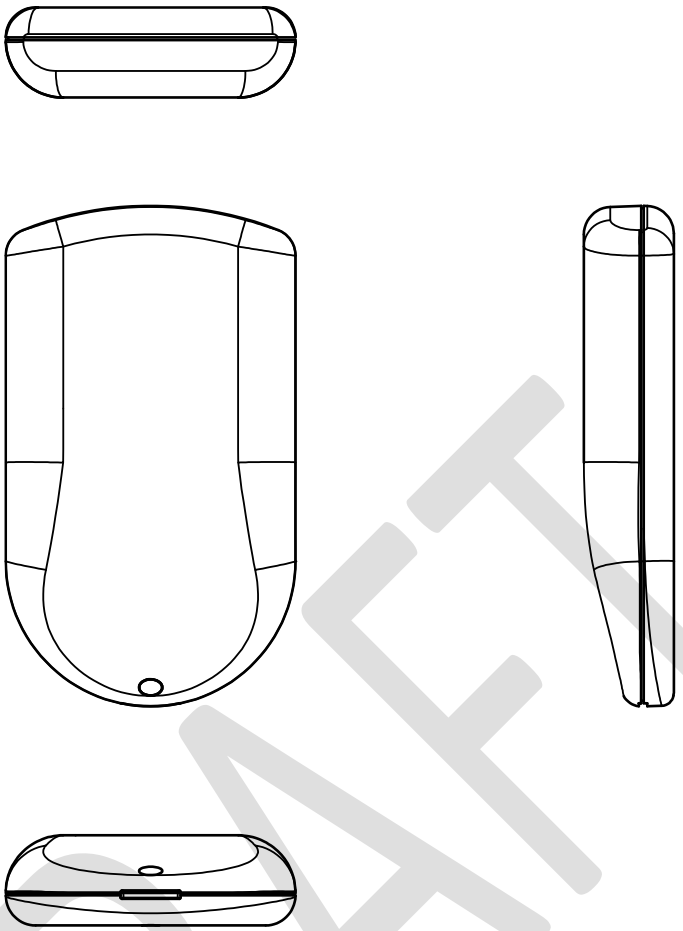
3 DIMENSIONS



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4 BROADCASTING PACKET STRUCTURE

EIR Type	Description / Value	LEN
Flags – 0x01	0x06 GeneralDiscoverable, BrEdrNotSupported	3B
Complete name – 0x09	'NBL-2' (for NBL-2 device)	7B
Service data – 0x16	Data format:	21B

BYTE:	0..1	2	3	4	5	6	[7..8]	9	10..18
Field:	UUID	Status	Batt	X	Y	Z	0	CID_Len	CID

Field	Description
UUID	'NX'
Status	Data format: **MSB** **LSB** Motion | Card | Confirm | 0 | 0 | 0 | B1 | B2 • **Motion** – if 1, sensor detect movement • **Card** – if 1, the ID is read • **Btn1** – state of button 1 • **Btn2** – state of button 2
Batt	Battery level in %.
X	X Axis acceleration
Y	Y Axis acceleration
Z	Z Axis acceleration
CID_Len	ID length.
CID	ID card number.

Total packet length: 31B

5 GATT SERVER FUNCTIONALITY

GATT Structure:

- Device Information Service
  - Manufacturer Name Characteristic
  - Model Number Characteristic
  - Serial Number Characteristic
  - Hardware Revision Characteristic
  - Firmware Revision Characteristic
  - System ID Characteristic
- Device Status/Operation Service
  - Reset Characteristic
  - Device Status0 Characteristic
  - Device Status1 Characteristic
  - Device Answer Characteristic
- General Configuration Service
  - Periods Characteristic
  - Advertising time Characteristic
  - Advertising payload Characteristic
  - Active sensor Characteristic
  - Accelerometer sensor configuration Characteristic
  - Led/button configuration Characteristic

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5.1 DEVICE INFORMATION SERVICE

UUID	0x180A
DESCRIPTION	

5.2 CHARACTERISTIC

Characteristic	UUID	Type	Sample Value
Manufacturer Name	2A29	Read	Netronix
Model Number	2A24	Read	NBL-2
Serial Number	2A25	Read	0000
Hardware Revision	2A27	Read	0x00800002 (for NBL-2-v1)
Firmware Revision	2A26	Read	X.Y
System ID	2A23	Read	t.b.d.

5.3 STATUS/OPERATION SERVICE

UUID	4d696372-6f63-6869-702d-524e00000001
DESCRIPTION	

5.3.1 RESET CHARACTERISTIC

UUID	BF3FBD80063F11E59E00000000000002
TYPE	Read/Write
LENGHT	???
DESCRIPTION	???

5.3.2 DEVICE STATUS0 CHARACTERISTIC

UUID	BF3FBD80063F11E59E00000000000003
TYPE	Read
LENGHT	9
DESCRIPTION	Data format:

BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE [4..5]	BYTE 6	BYTE [7..8]
State	X Axis	Y Axis	Z Axis	Delta	Battery	0

Field	Description
State	Button and sensor status. **MSB** … **LSB** Motion | Card | Confirm | 0 | 0 | 0 | B1 | B2 • **Motion** – Motion detected • **Card** – Card detected • **Confirm –** Card ID confirmed • **Btn1** – state of button 1 • **Btn2** – state of button 2
X Axis	Measured Z axis acceleration.
Y Axis	Measured Y axis acceleration.
Z Axis	Measured Z axis acceleration.
Delta	Absolute value of all axis sum.
Battery	Battery level in %.

5.3.3 DEVICE STATUS1 CHARACTERISTIC

UUID	BF3FBD80063F11E59E00000000000004
TYPE	Read
LENGHT	17

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DESCRIPTION Data format:

BYTE 0	BYTE[1..16]
CardID_Len	CardID

Field	Description
CardID_Len	ID length.
CardID	ID card number, padded with 0

5.3.4 DEVICE ANSWER CHARACTERISTIC

UUID BF3FBD80063F11E59E00000000000005

TYPE Read/Write

LENGHT 1

DESCRIPTION Data format:

BYTE 0
Answer

Field	Description
Answer	Card ID confirm.

- **Answer value** :

  0x00 - Card ID reject
  0x01 – Card ID accept

5.4 GENERAL CONFIGURATION SERVICE

UUID 4d696372-6f63-6869-702d-524e00000002

DESCRIPTION to read / write configuration

5.4.1 PERIODS CHARACTERISTIC

UUID bf3fbd80-063f-11e5-9e00-000000000011

TYPE Read/Write

LENGHT 4

DESCRIPTION Data format:

BYTE 0	BYTE 1	BYTE 2	BYTE 3
Scan sensor period 1	Scan sensor period 2	Current state advertising period	
SSP_NM	SSP_MD	CSAP_H	CSAP_L

- **Scan sensor period 1**– the period of time that data is read from accelerometer if no movement is detected.

  Range: 0x00 – 0xFF
  Default: 0x04 (4s)
- **Scan sensor period 2** – the period of time that data is read from accelerometer if movement is detected.

  Range: 0x00 – 0xFF
  Default: 0x0A (10s)
- **Current state advertising period** – the time after which the device will start sending a broadcast packet, even if no data has changed.

  *Period[s] = (CSAP_H*255+CSAP_L)*

  Range: 0x0000 – 0xFFFF
  Default: 0x1770 (6000s)

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5.4.2 ADVERTISING TIME CHARACTERISTIC

UUID	bf3fbd80-063f-11e5-9e00-000000000012
TYPE	Read/Write
LENGHT	1
DESCRIPTION	Advertising time in seconds. ***Range:*** 1-255 ***Default:*** 50

5.4.3 ADVERTISING PAYLOAD CHARACTERISTIC

UUID	bf3fbd80-063f-11e5-9e00-000000000013
TYPE	Read/Write
LENGHT	1
DESCRIPTION	0 – card ID is not present on Advertising packet. 1 – card ID is present on Advertising packet ***Default:*** 1

5.4.4 ACCELEROMETER SENSOR CONFIGURATION CHARACTERISTIC

UUID	bf3fbd80-063f-11e5-9e00-000000000015
TYPE	Read/Write
LENGHT	8
DESCRIPTION	Data format:

BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE[4..5]	BYTE [6..7]
Delta Value	Sampling Period	Sampling Time	Sampling Move Time	Stop Detect Time	Card Wait Period
DV	SP	ST	SMT	SDT	CWP

Field	Description
Delta Value	Acceleration delta value. ***Range:***0x00 – 0xFF ***Default:***0x0A
Sampling Period	Movement start detect sampling period. ***Range:***0x00-0x0A ***Default:*** 0x00 (100ms)
Sampling Time	Movement start detect sampling time. ***Range:***0x00-0x20 ***Default:*** 0xA (1s)
Sampling Move Time	Defines how long motion must be detected while sampling the sensor. **(This time should be less then Sampling Time or equal)** ***Range:***0x00-0x20 ***Default:*** 0x5 (500ms)
Stop Detect Time	Determines how long motion cannot be detected while sampling the sensor to determine vehicle stoppage. ***Range:***0x0000-0xFFFF ***Default:*** 0x384 (15 min)
Card Wait Period	Period of signalling the lack of a card. ***Range:***0x0000-0xFFFF ***Default:*** 0xB4 (3 min)

5.4.5 LED/BUTTON CONFIGURATION CHARACTERISTIC

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UUID	bf3fbd80-063f-11e5-9e00-000000000018
TYPE	Read/Write
LENGHT	3
DESCRIPTION	Data format:

BYTE 0	BYTE1	BYTE2
LedMode	Btn1_WorkMode	Btn2_WorkMode

Field	Description
LedMode	0 – disable internal LED messages 1 – internal LED messages priority is higher than user LED messages 2 – internal LED messages priority is lower than user LED messages ***Default:*** 1
Btn1_WorkMode Btn2_WorkMode	Button operation mode. 0 – normal 1 – toggle ***Default:*** 0

6 MOTION DETECION MODE

If accelerometer detects movement with no tag ID in memory :

- Reader emits 3 beeps form buzzer.
- LED emits 3 red blinks.
- The reader repeats the signaling every 3 minutes until user reads tag.

If user reads tag :

- Sends a broadcast packet with card ID.
- The ID of the card is entered in the characteristics : Device Status1 Characteristic .
- The card ID is accepted or rejected by adding a value to the characteristic : Device Answer Characteristic .

If accelerometer detects no movement for 15 minutes :

- Sends a broadcast packet (ID = 00000….).
- The card ID will be deleted from memory.

7 BUTTON WORK MODE

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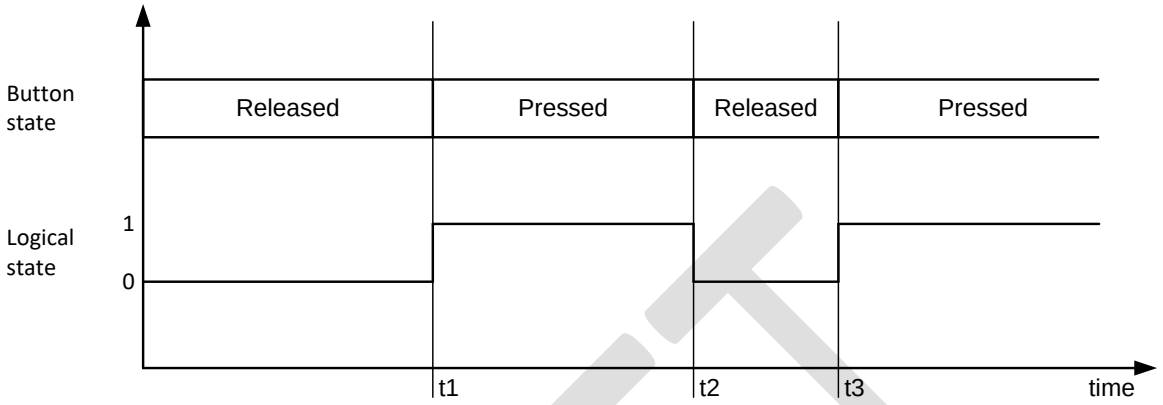
Each of the buttons can work in one of 2 modes:

- Normal
- Toggle

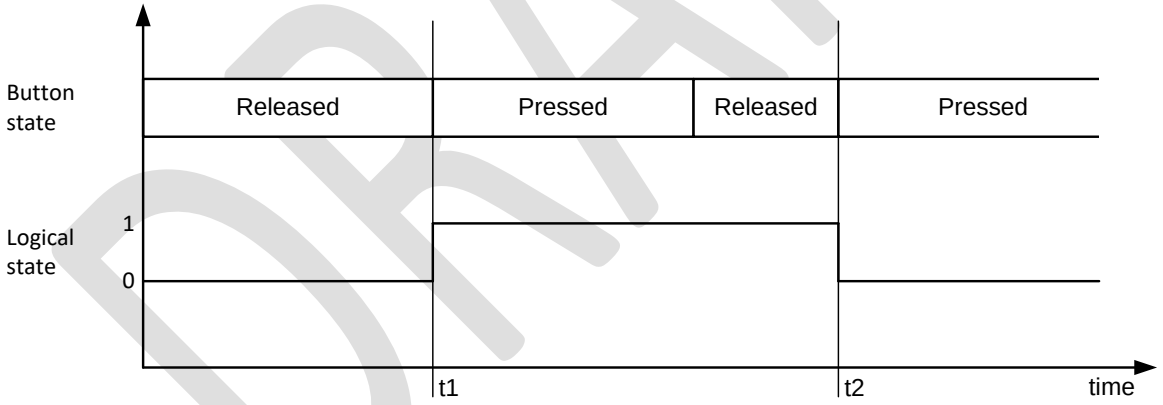
7.1 NORMAL

In Normal mode, the logical state directly reflects the physical state of the button. Each change of the button state causes the start sending of the advertising package / update of the data in the advertising package (time t1, t2 and t3 in the figure below).



7.2 TOGGLE

In toggle mode, the logic state changes to the opposite each time the button is pressed. Each change the logical state causes the start of sending the advertising package / data update in the advertising package (time t1 and t2 in the figure below).



8 POWER OFF / RESET TO DEFAULT SETTINGS

To set factory defaults and un-pairing both buttons must be pressed for 5 seconds additionally button 1 (blue) must be pressed first. It is also factory/transport configuration.

Procedure:

1. Press Button1 and hold
2. Press Button2 and hold
3. Keep the buttons pressed for 5 seconds.
4. The return to the factory settings will be signaled by flashing LED1 and LED2

9 POWER ON

Procedure:

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1. Press Button2 and hold
2. Keep the button pressed for 5 seconds.
3. The PowerOn will be signaled by flashing LED1 and LED2

10 PARING

When device have defaults settings, reader waits for button then sends advertising packet for 50 seconds and blinks LEDs. First connection in this state is pairing process. Paring mode used: No Pin.

When the device is paired, the pairing mode is changed to pairing using the PIN. This prevents the pairing of additional devices.

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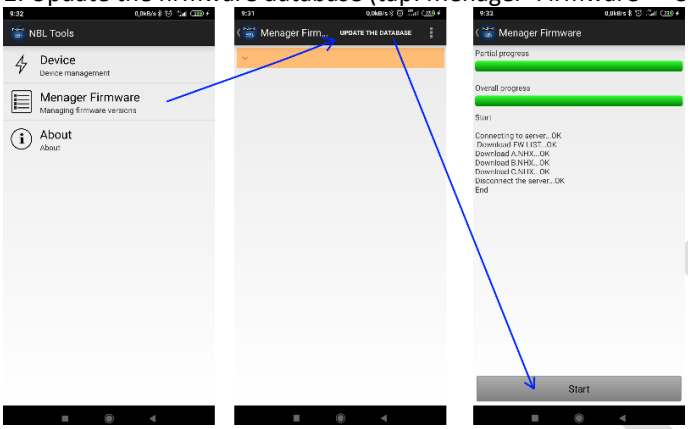
11 FIRMWAREUPDATE FUNCTIONALITY

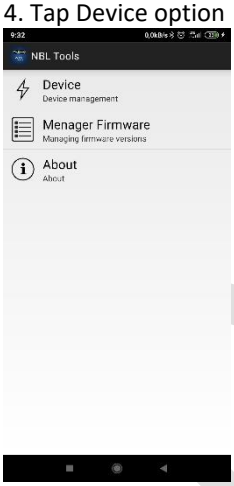
11.1 FIRMWARE UPDATE USING THE NBL TOOL APPLICATION

The firmware update is implemented using an application running on an android phone.
The bootloader mode can be started by pressing the button 1 while switching on the power. The bootloader mode is signaled by a rapid blinking of the red LED.

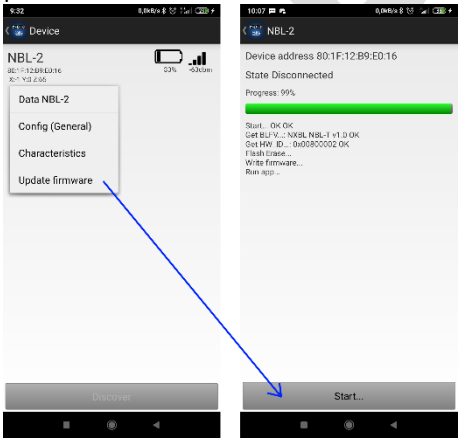
The firmware update procedure :
1. Run NBL Tools application
2. Update the firmware database (tap: Menager Firmware -> Update the database -> Start)



3. Back to main menu
4. Tap Device option



5. Wake up the device - eg entering it into the bootloader mode
6. Select the device from the list (long press), then select Update firmware from the drop-down menu and press Start button.



7. Correct firmware update will be signaled by device start-up led message [12.1] an buzzer start-up message.

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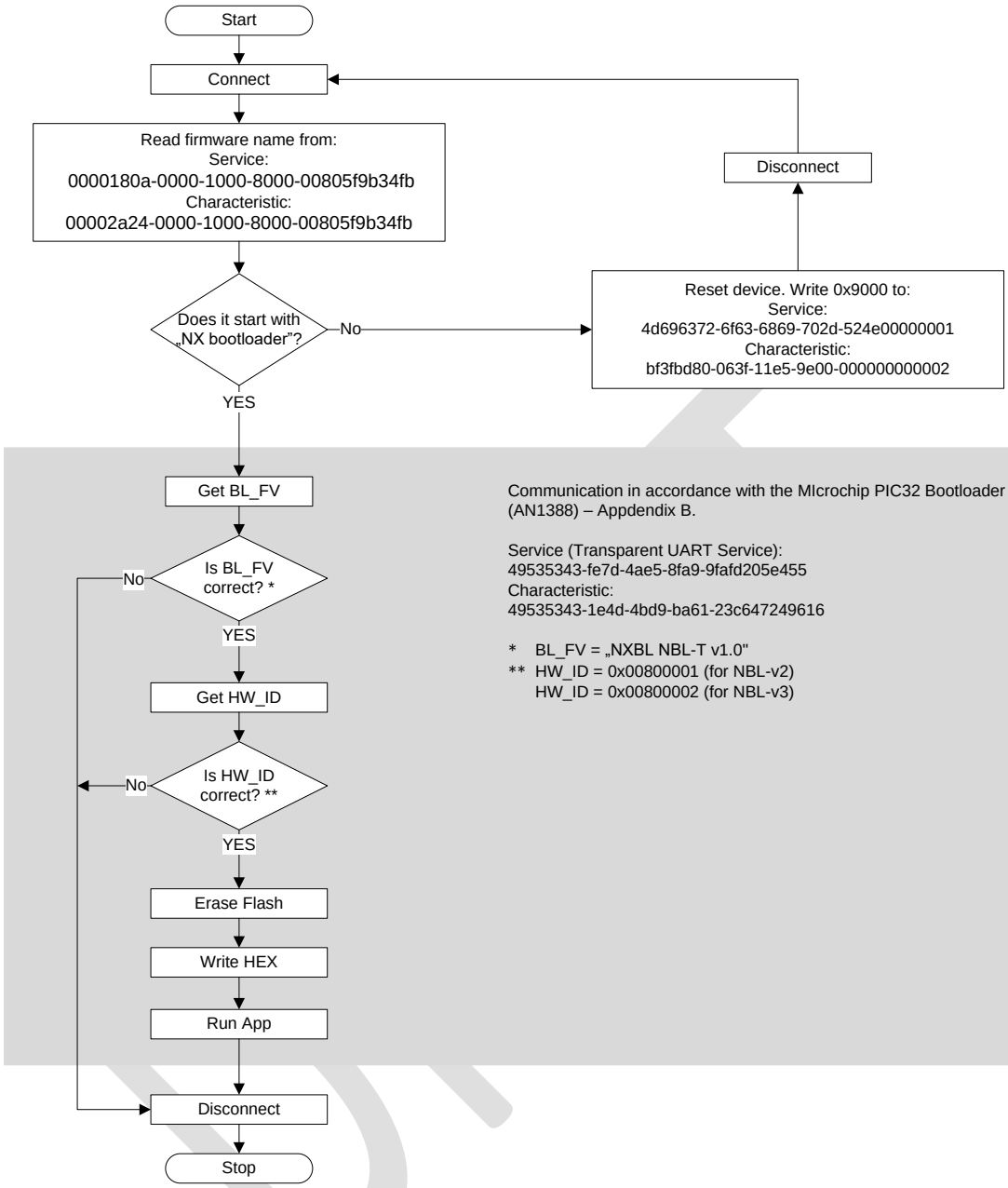
11.2 FIRMWARE UPGRADE ALGORITHM



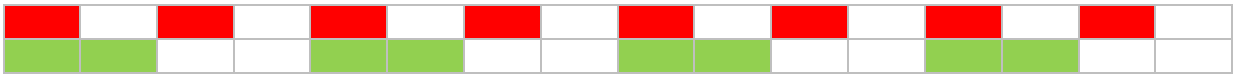
Communication in accordance with the MIcrochip PIC32 Bootloader protocol (AN1388) – Appdendix B.

Service (Transparent UART Service):
49535343-fe7d-4ae5-8fa9-9fafd205e455
Characteristic:
49535343-1e4d-4bd9-ba61-23c647249616

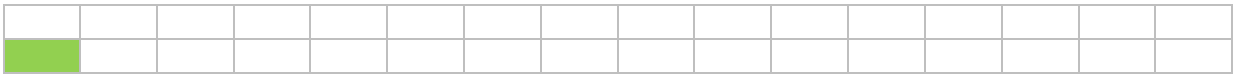
* BL_FV = „NXBL NBL-T v1.0"
** HW_ID = 0x00800001 (for NBL-v2)
HW_ID = 0x00800002 (for NBL-v3)

12 LED

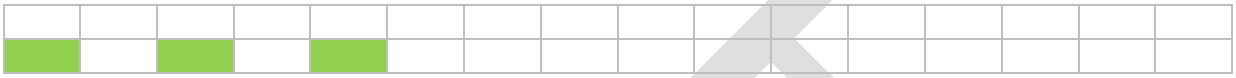
12.1 MSG_START



12.2 MSG_ADV



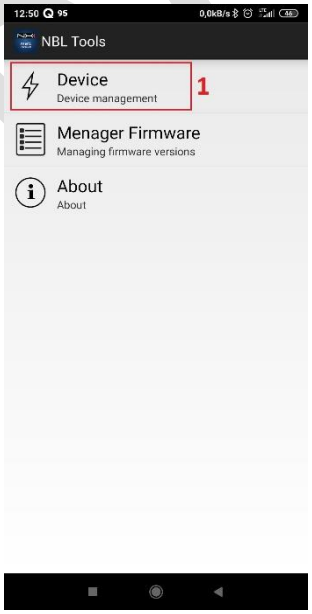
12.3 MSG_CONN



12.4 MSG_WAK_UP

13 EXAMPLE – FIRST RUN NBL-2 WITH APPLICATION NBL TOOLS

1. When NBL-2 is run for the first time, it has a default configuration and Bluetooth is in unpaired mode. In this mode, it is not possible to read the RFID card and read the Bluetooth characteristics. To initialize NBL2 it is necessary to pair with the control unit or smartphone.
2. Run application NBL Tools and tap Device option [1] .



3. Turn on NBL-2 and wake up the device with the button (short press). If your device is awake and waiting for pairing, it will appear in the app [2]. After selecting the device [2], the pairing process starts automatically. If pairing does not start automatically, press the button CONNECT [3]. The rest of the pairing is done by Android and depends on your specific phone [4]. In case of pairing problems, wake up the device again and repeat the same process.

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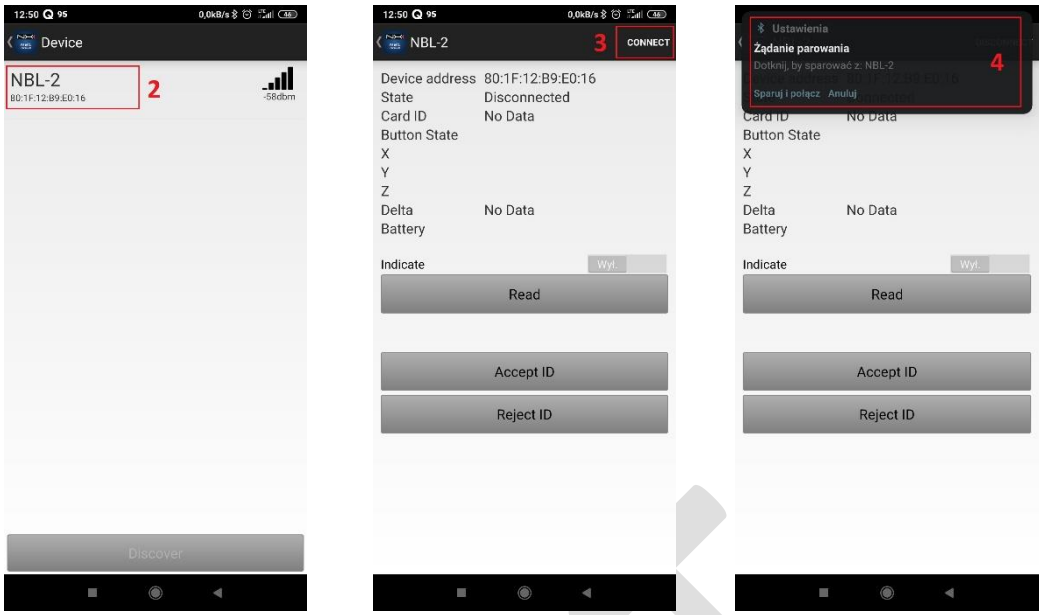
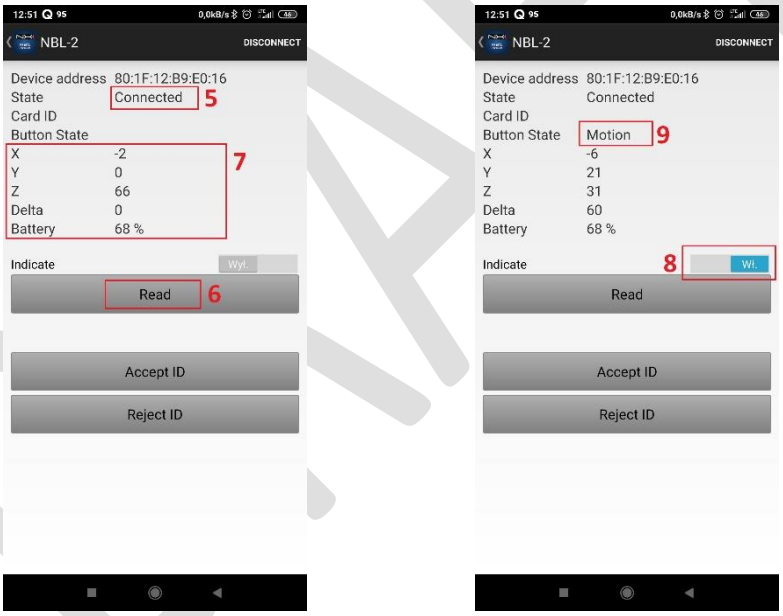
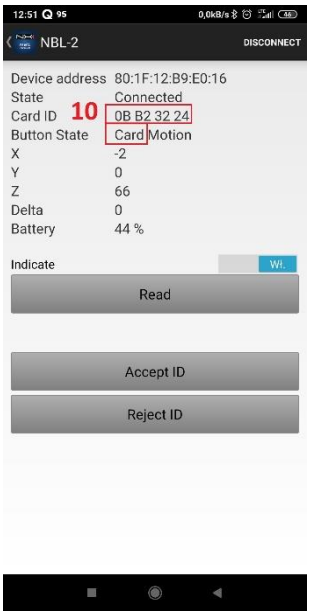
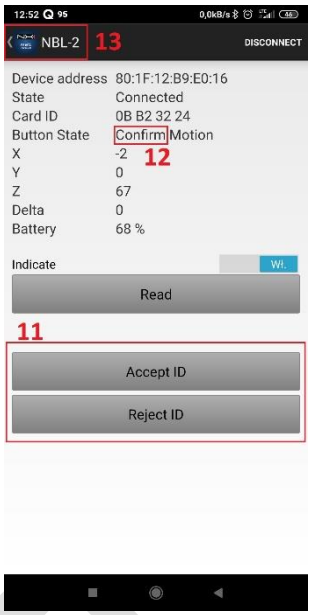


4. When the pairing process is successful, the status field will be displayed : Connected [5]. Then, to read the characteristics, press the button Read [6]. The read values will be displayed in the field [7].

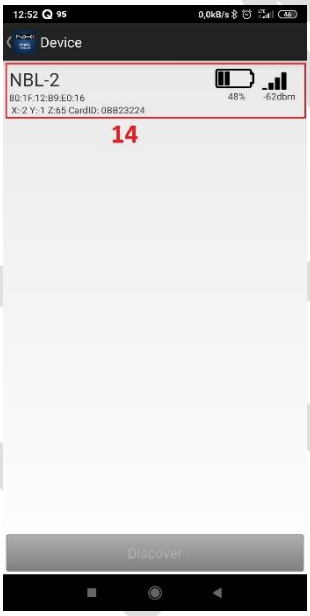


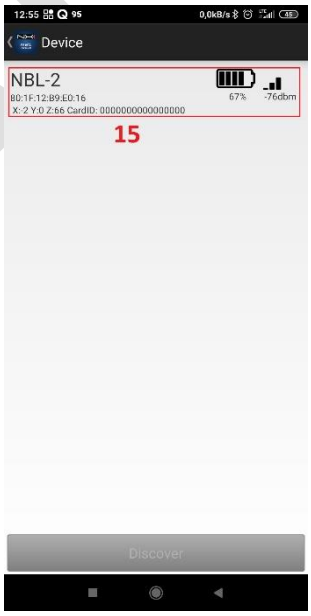
5. Then enable the option to automatically display changes in characteristics [8]. If motion is detected, a flag will appear in the field [9].
6. Then we can test the card reading and card id acceptance from the control panel. When we put a card in the field [10] , a flag and the card id will be displayed. The card id is accepted by entering the value into the characteristic : Device Answer Characteristic . In the application, we can simulate it with buttons [11]. The card ID acceptance by pressing the button is confirmed by a flag [12].





7. Click the button [13] to return to the Device menu. This button [13] also breaks the Bluetooth connection and puts the NBL-2 into sleep mode.
8. In the sleep mode, we can wake up the device by putting the card to the reader. After applying the card, the device will start sending broadcast packet with the card ID [14].





9. If the device detects no vehicle movement for a specified period of time, a broadcast packet will be sent with card ID (ID = 00000….0) [15].

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