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NTAG I²C Explorer Kit Peek and Poke

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User manual
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Document information

Info	Content
Keywords	NTAG I2C, Explorer kit, PC, NFC Tag, Peek and Poke
Abstract	This User Manual aims at describing the functionalities and how to use the Peek and Poke GUI of the NTAG I2C Explorer kit.

Revision history

Rev	Date	Description
1.0	20160418	First version

Contact information

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1. Object

NTAG I²C Explorer kit is an all-in-one demonstration and development resource to demonstrate the unique properties of the NTAG I²C tag chip. By including a full complement of hardware and software tools, users can not only investigate the capabilities of the chip through the various demonstrations, but also develop and test their own applications (additional LPC-Link2 debug probe[1]).

This User Manual explains how to use the Peek and Poke application.

Technical aspects related to the IC functioning (i.e. the configuration registers) are beyond the scope of this document. In order to get further technical details please consult the dedicated Datasheet “NTAG I²C, NFC Forum type 2 Tag compliant IC with I²C interface”.

2. NTAG I²C introduction

The NTAG I²C is the first product of NXP’s NTAG family offering both contactless and contact interfaces. In addition to the passive NFC Forum compliant RF interface, the NTAG I²C product provides an I²C interface that allows the IC to communicate with the microcontroller when the chip is powered by an external device, i.e. a mobile phone.

The NTAG I²C operating in energy harvesting mode provides the possibility to supply external low power devices (e.g. microcontrollers) with the energy generated from the RF field of the external NFC device.

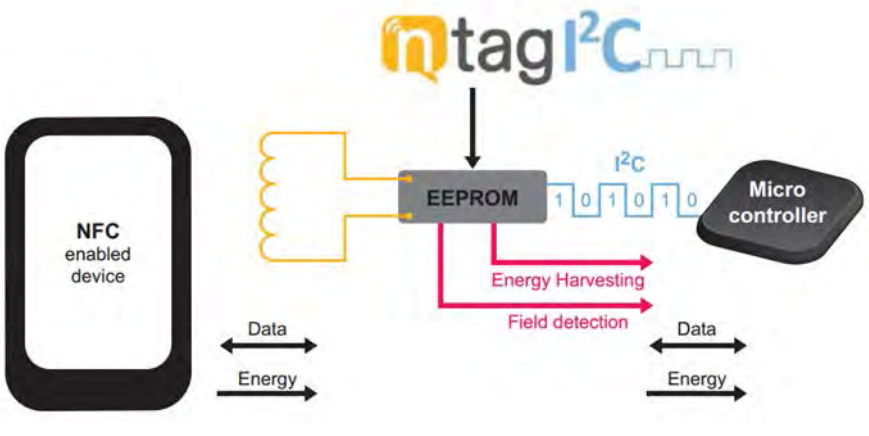

Fig 1. NTAG I²C

The NTAG I²C product has two types of memories:

1. EEPROM memory compliant with the NFC Forum Type 2 Tag implementation.
2. 64-byte SRAM memory, which is mapped with the EEPROM memory and is externally powered.

[1] http://nxp.com/LPC-LINK2

The NTAG I²C features a Pass-Through mode that allows fast download and upload of data from the RF interface to the I²C interface and vice versa. This functionality makes use of the SRAM memory that allows fast data transfer between interfaces without the EEPROM performance limitations.

In addition to the I²C interface functionality, the NTAG I²C product features a Field Detection Pin for waking up the host-connected devices or synchronizing the data transfer between the two interfaces.

3. NTAG I²C Explorer kit contents

The NTAG I²C Explorer kit (NEK) consists of hardware and software tools that developers can use to understand the NXP NTAG I²C tag chip functionality and demonstrate its potential for other application. The kit includes:

3.1 Hardware components

3.1.1 NTAG I²C Explorer board

A hardware board based on the NXP LPC 11U24 32-bit ARM Cortex-M0 microcontroller, with on-board LCD display, NXP LM75B temperature sensor, voltage monitors, I²C serial bus connector, JTAG/SWD debug connector, RGD LED micro USB connector and five push button controls.

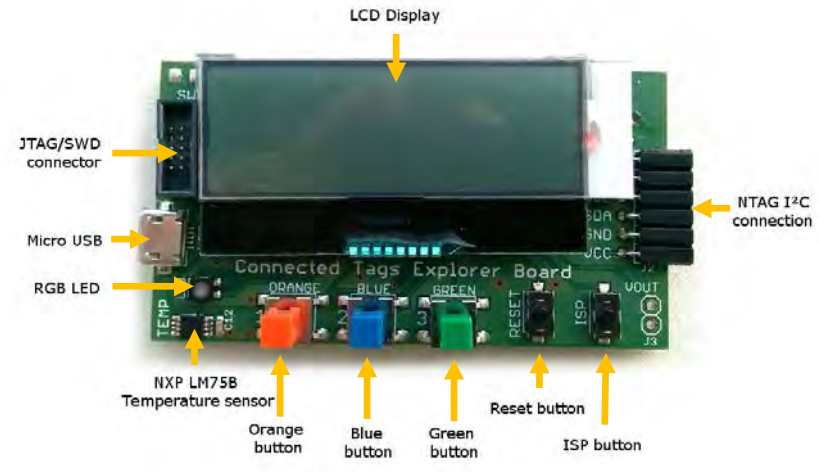

Fig 2. NTAG I²C Explorer board

3.1.2 Antenna board

The antenna board carries the NTAG I²C 1k version itself and provides two interfaces:

I. The RF interface to an NFC reader

II. The I²C interface to the NTAG I²C Explorer board

Fig 3. Antenna board

3.1.3 USB reader

The USB reader is a NFC reader device (Identiv uTrust CLOUD 3700F reader). Together with the Windows app, the USB reader can be used as a substitute in case an NFC mobile phone is missing.

Fig 4. Identiv uTrust CLOUD 3700F reader

In Windows 7 operative systems, when a smartcard is placed over the reader there is frequently an issue regarding the smartcard mini-drivers. Although a solution to this problem is given in this section, more information can be found on the Windows Support Webpage[2]. To solve this issue it has to be disabled the Smart Card Plug and Play in local Group Policy and changed primary group policy settings for smart cards. The procedure is as follows:

1. Click **Start**, type gpedit.msc in the **Search programs and files** box, and then press ENTER.
2. In the console tree under **Computer Configuration**, click **Administrative Templates**.
3. In the details pane, double-click **Windows Components**, and then double-click **Smart Card**.
4. Right-click **Turn on Smart Card Plug and Play service**, and then click **Edit**.
5. Click **Disabled**, and then click **OK**.

[2] http://nxp.com/SMART-CARD-SUPPORT

6. Click **Start**, type regedit in the **Search programs and files** box, and then press ENTER.
7. Go through the tree key, on the left, up to the key **HKEY_LOCAL_MACHINE \ Software \ Microsoft \ Cryptography \ Calais.**
8. Add a new DWORD value named CardDisconnectPowerDownDelay and set its value to 0.
9. Click **Start**, type services.msc in the **Search programs and files** box, and then press ENTER.
10. Find the smart card service in the list, right-click and click Restart.

3.2 Software components

3.2.1 NTAG I²C Explorer board firmware

The firmware runs on the NTAG I²C Explorer board and is flashed during production at the MCU which supports the demonstration functionality of the hardware. The delivered NTAG I²C Explorer board firmware consists of three applications:

- **NTAG_I²C_Explorer_Bootloader**: This project implements the secondary bootloader application. It is flashed at on-chip memory address starting at 0x0000 0000 and it is the first application to be executed after the MCU boots. This application has three functions:
  - Jump to the start memory of the user application.
  - Enter into Flashing mode functionality.
  - Enter into USB mode (Peek and Poke).
- **NTAG_I²C_Explorer_Demo**: This project implements the logic supporting the Android / Windows demonstration applications. It is flashed at on-chip flash memory starting at 0x0000 4000 address and it is executed after the bootloader jumps to the application start address.
- **NTAG_I²C_Explorer_Blink**: This is a sample project that sets into blinking mode the NTAG_I²C Explorer board as soon as the RF field is detected. This application is provided to illustrate the NFC flashing functionality and its binary image is provided embedded by default into the Android app.

3.2.2 Android app

The demo application on an Android NFC phone (“NFC mobile”) showcasing the various features of the NTAG I²C. This software component is available for download from the public NXP website as well as at Google Play.

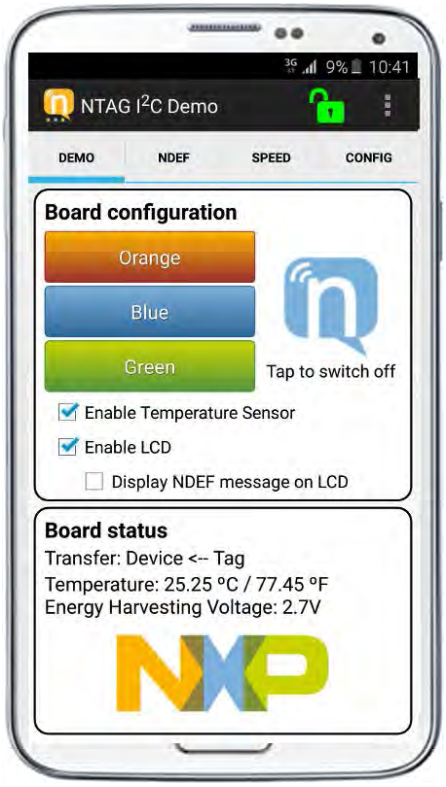

Fig 5. Android app GUI

Note: The UM10989 describes in detail how to get started with the Android app tool and the different functionalities it offers.

3.2.3 Windows app

Together with the USB reader, the Windows app can be utilized to substitute a missing NFC mobile phone. The Windows app has identical functionalities as the Android app. This software component is available as a download from the public NXP website.

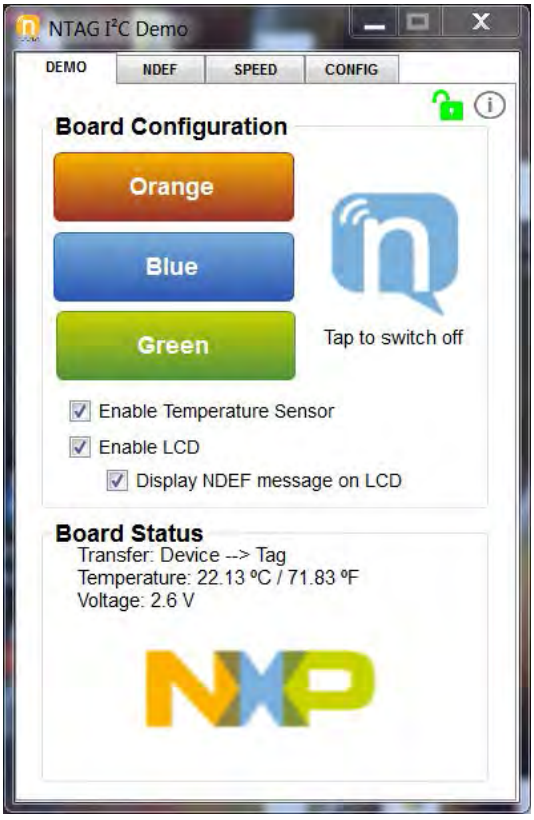

Fig 6. Windows application GUI

Note: ***The Windows application functionalities, GUI and look and feel are intentionally made exactly the same as the Android application. The Windows application is intended to run in a Windows laptop together with the Identiv uTrust CLOUD 3700F reader as a substitute in case an NFC phone is not available. Therefore, this User Manual is valid for both the Android app and Windows application. However, for convenience, only Android app screenshots are shown in this document.***

3.2.4 Peek and Poke GUI

The Peek and Poke GUI is a Windows app that can be used to examine the detailed memory contents of the NTAG I²C EEPROM via I²C interface. This software component is available as a download from the public NXP website.

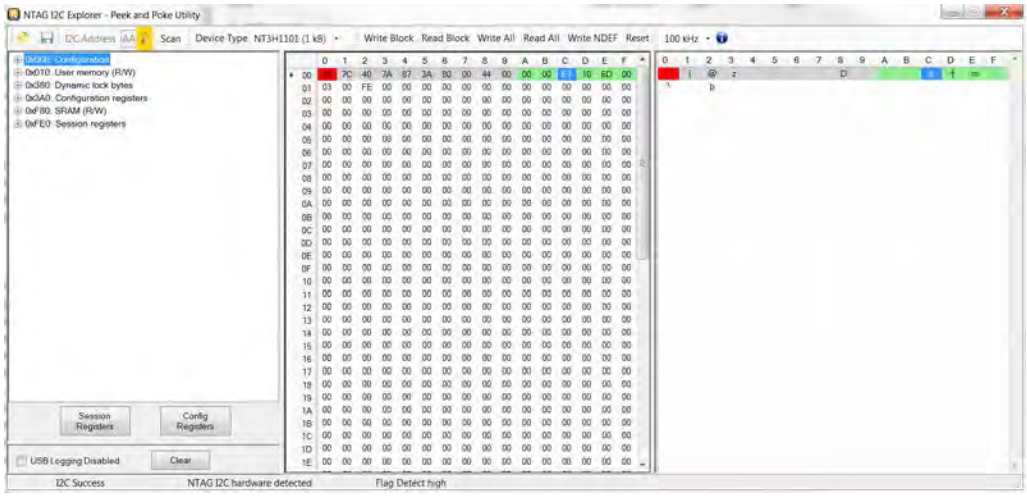

Fig 7. Peek and Poke GUI

4. NTAG I²C Explorer Peek and Poke GUI

The Peek and Poke application is a PC-based NTAG I²C exploration software tool with a graphical user interface. This software allows users to read from and write to the memory in the NTAG I²C tag chip via the I²C serial bus interface, as well as control the Session and Configuration registers.

4.1 GUI overview

Upon the start-up, the GUI overview is shown on Fig 8. Each region of the GUI is labeled for an easier reference. Each of this parts are the following:

A. The top bar contains most of the GUI controls.

B. The left column lists the NTAG memory locations for each region indicated with the hexadecimal address.

C. The center grid displays the contents of those addresses in hexadecimal format.

D. The right column displays the ASCII representation of the data listed in the center column.

E. The bar at the bottom of the GUI indicates presence or absence of any connected NTAG I2C hardware and the status of the operations.

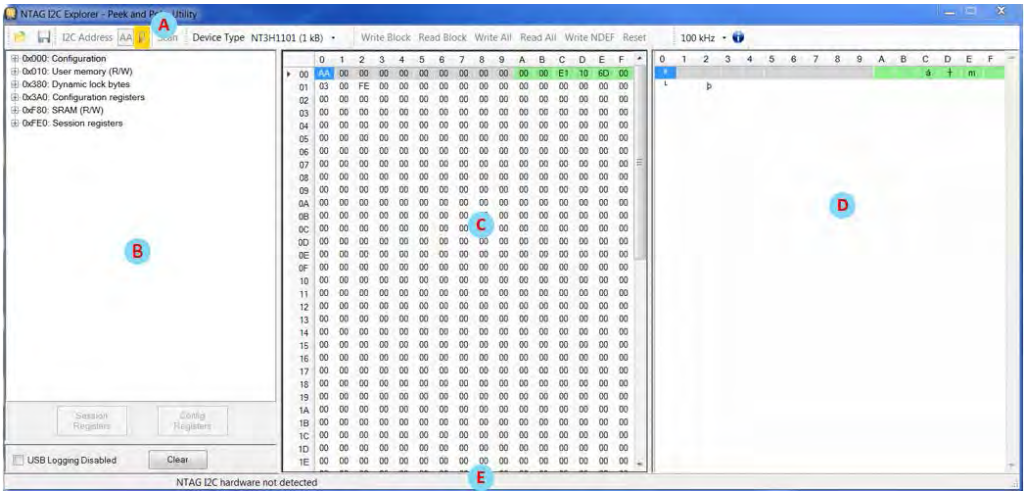

Fig 8. Peek and Poke GUI overview

4.2 GUI top control bar details

This section details each of the controls of the navigation bar on the top. See it depicted on Fig 9. The actions offered on this bar are: exporting and importing memory contents from or to a file, read and write to the memory, reset the memory to a default value, select the type of the device connected, scan for connected devices, setting of the device address and the selection of the speed of the bus for the communication. Besides, there is an information button about the application.

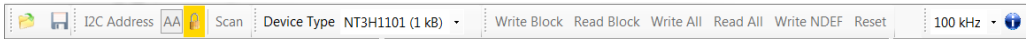

Fig 9. Peek and Poke navigation Bar

4.2.1 Export / import memory contents

At the beginning of the navigation bar there are two icons to export and import the memory contents. They are shown in Fig 10, highlighted in red. The first folder icon is to open an HEX file containing a memory data and import it. The second icon, a disk, allows the user to export the data of the tables it into an HEX file.

Fig 10. Peek and Poke import and export memory contents controls

4.2.2 Read and write controls

Read and write control buttons can be found at the top of the initial screen. Fig 11 shows the controls.

- *Write Block* button: Writes 16 bytes of data from the selected grid block into the tag.
- *Read Block* button: Reads a 16 bytes data block and displays the contents on the grid.
- *Write All* button: Writes the entire EEPROM memory with the data on the grid into the tag.
- *Read All* button: Reads the entire EEPROM memory and displays it on the grid.

Fig 11. Peek and Poke Read and Write controls

4.2.3 Write NDEF message

The control *Write NDEF* opens a form with the option to enter a text and write it as an NDEF message or to write a default NDEF message. Fig 12 shows the control.

The default NDEF message is a NDEF SmartPoster composed by a Text message and a URI record (Text record: NTAG I2C Explorer, an AAR: android.com:pkgcom.nxp.ntagi2cdemo_dev, and URI record: www.nxp.com/demoboard/OM5569).

Fig 12. Peek and Poke Write NDEF message control

Fig 13 shows the form with the two options to write a message and the tables with the message written and highlighted.

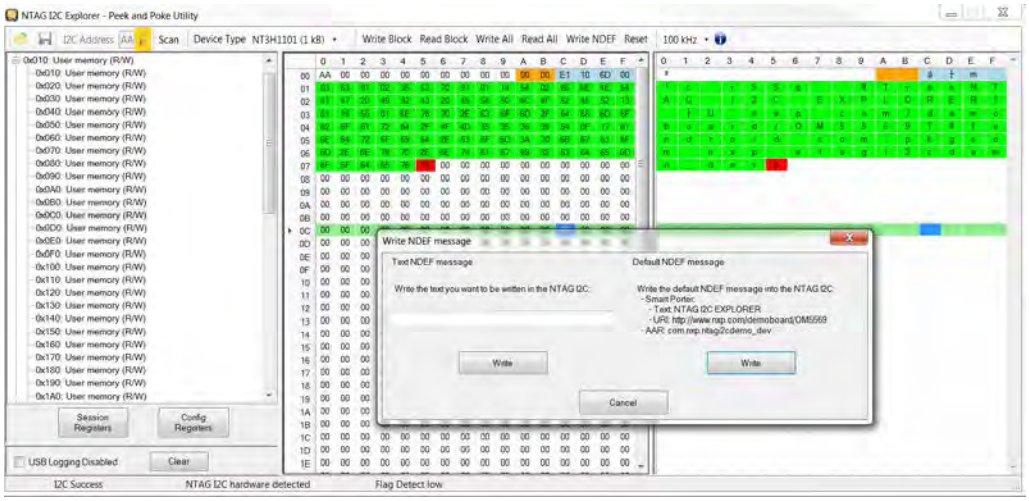

Fig 13. Peek and Poke Write NDEF form and tables showing the message

4.2.4 Reset tag memory

The reset button sets the NTAG I²C tag memory to the default value and displays it in the grid. The default tag memory value corresponds to a default NDEF message on the user memory, see structure on 4.2.3, and the default session and configuration register settings as defined in the NTAG I²C product datasheet. Fig 14 shows the control.

Fig 14. Peek and Poke Reset tag control

4.2.5 Device selection

The device selection allows to change the device type. There are two possibilities here: the NT3H1101 or the NT3H1201. The first option refers to the devices that have up to 1 kB of memory size and the second one refers to the 2 kB memory size. This is an important feature because it will show a different grid depending on the memory size. Fig 15 shows the control.

Fig 15. Peek and Poke Device selection

4.2.6 I²C device address and scanning

It is possible to change the I²C address of the NTAG I²C IC. Fig 16 shows the control. First it is needed to unlock the I²C address controls with the locker icon. Then change the I²C address value in the text box. After click on I²C Address button and it will change the

I²C value in the device. The default I²C serial bus address of the NTAG I²C tag chips is 0xAA.

The Scan button will scan the entire range of possible addresses until it finds the device I²C address.

Fig 16. Peek and Poke Address and scanning

4.2.7 I²C clock frequency

The I²C serial bus clock frequency can be changed by selecting a data rate from the drop-down. The maximum data rate supported by the tag is 400 KHz. Fig 17 shows the control.

Fig 17. Peek and Poke I²C Clock frequency control

4.3 Memory block selection

Another useful functionality of the Peek and Poke utility is given by its fluent and intuitive graphical exploration of the tag memory. As it was introduced in section 4.1, the application consists in three main panels. The left panel helps the user by selecting the memory sectors by the type of information they contain. This is done through a scroll tree menu allowing the user to explore a specific block or register. The center panel shows a grid structure that represents the hexadecimal content of the memory divided in blocks of 16 bytes. For the sake of a better understanding, the right panel displays the ASCII representation of the memory with the same structure.

When the user selects an item on the left menu, the specific sector is highlighted on the center and right panels to clearly identify the bytes devoted for that purpose. The content of a certain byte can be changed by modifying its value in the center panel and pressing either *Write Block* or *Write All*.

In the following subsections, the description of each node in the left panel are addressed.

4.3.1 Configuration

The *Configuration* node in the left panel will highlight the first block of the memory. This block is read-only and therefore editing its content is not allowed in the center panel. The only information that can be modified is the *I²C address* byte and it must be done through the button included exclusively to this end (Section 4.2.6).

Expanding the *Configuration* node will show the five sectors included in this block, allowing the user to identify the specific location for each of them.

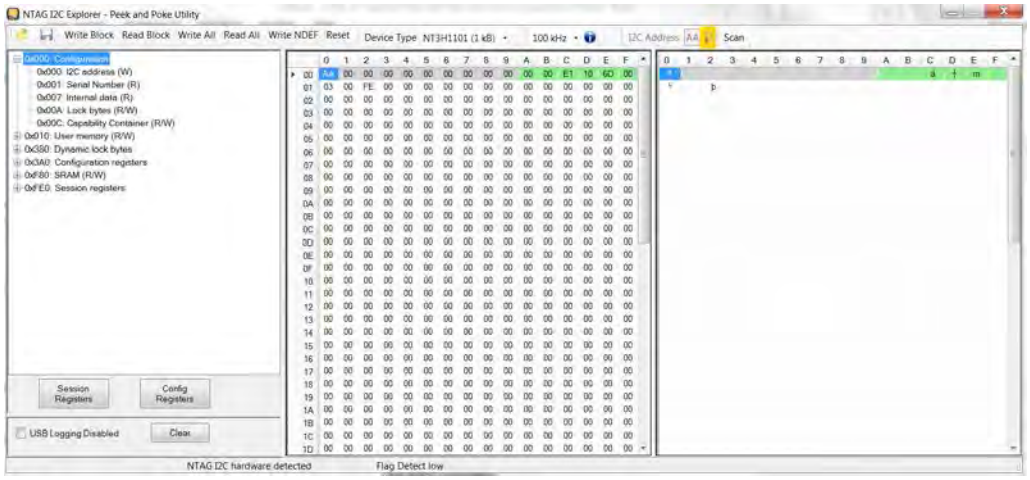

Fig 18. Memory block selection - Configuration

4.3.2 User memory

The *User Memory* node will show the content of the tag user memory in the central and right panels. The tree structure in this case allows the user to locate a specific block of the user memory. All this content is completely editable through the center panel interface.

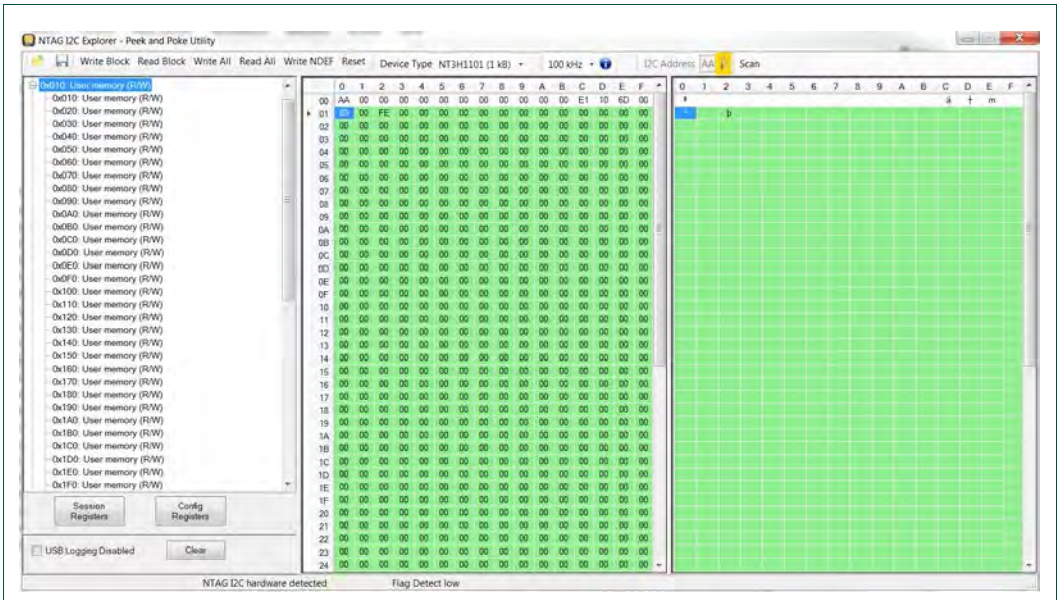

Fig 19. Memory block selection – User memory

4.3.3 Dynamic lock bytes

In order to observe the dynamic lock bytes you have to click on *Dynamic lock bytes* in the left panel. Now in the middle and right panel should appear one block highlighted in green which will show the memory position of the dynamic lock bytes.

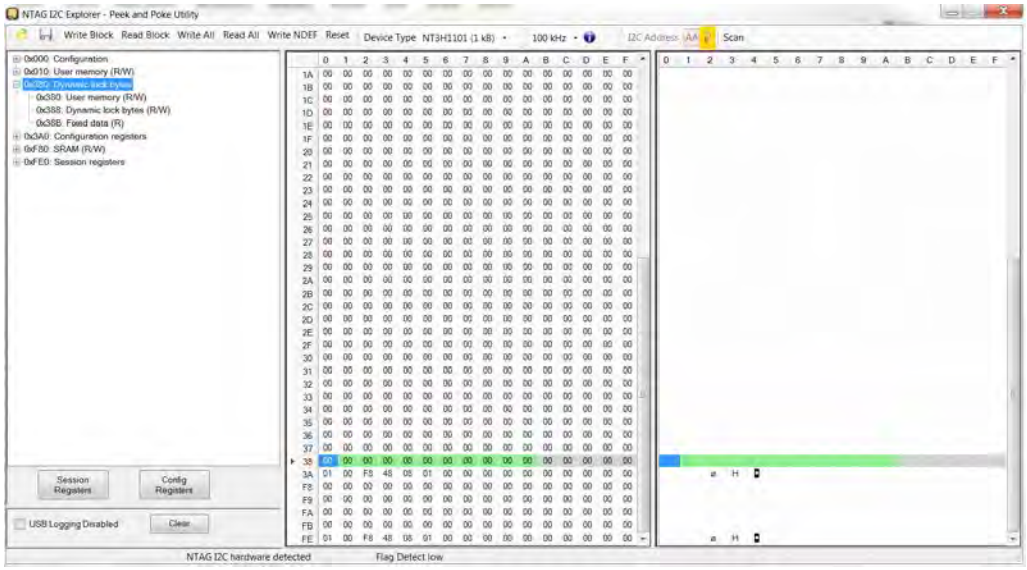

Fig 20. Memory block selection – Dynamic lock bytes

4.3.4 Configuration registers

Also you can observe the configuration registers by clicking on *Configuration registers* in the left panel. Now in the middle and right panel should appear one block highlighted in green which will show the memory position of the configuration registers.

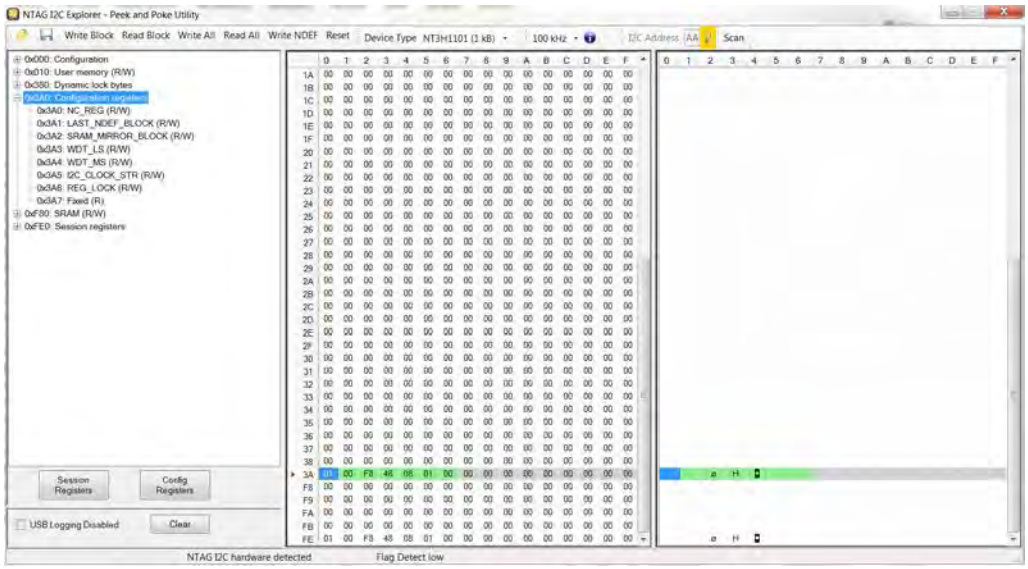

Fig 21. Memory block selection – Configuration registers

4.3.5 SRAM

To see the SRAM bytes you have to click on *SRAM* in the left panel. Now in the middle and right panel should show several block highlighted in green which will show the memory positions of the SRAM.

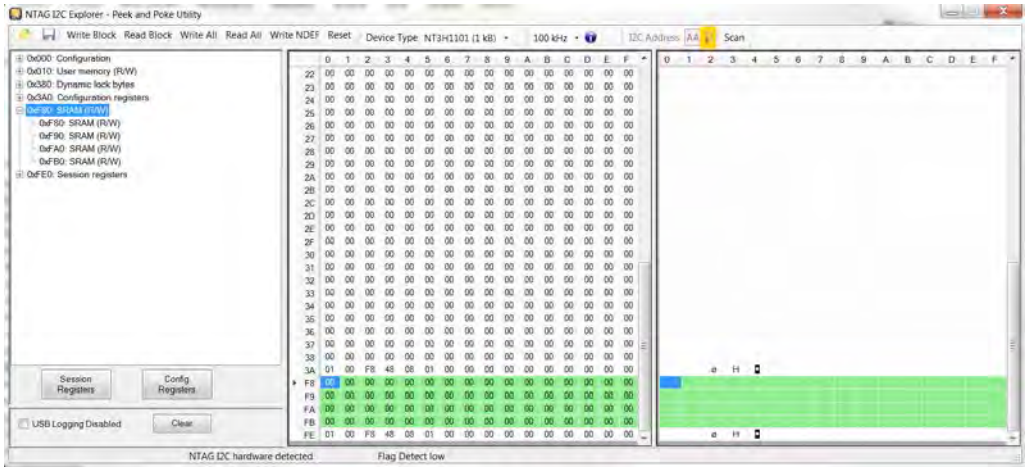

Fig 22. Memory block selection - SRAM

4.3.6 Session registers

In order to observe the session registers you can click on *Session registers* in the left panel. Now in the middle and right panel should appear the last block highlighted in green that shows the memory position of the session registers.

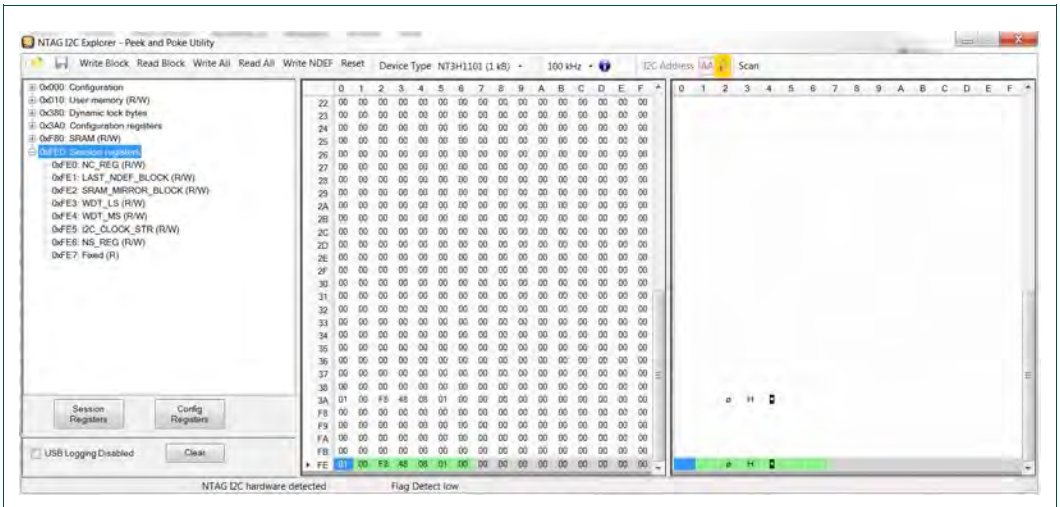

Fig 23. Memory block selection – Session registers

4.4 GUI bottom control bar details

4.4.1 USB data logging

The data that is actually transmitted over the USB connection can be displayed. This information is shown by selecting the *USB logging enabled* check box at the bottom left of the main GUI screen.

Note: USB data logging affects the amount of time required to read / write.

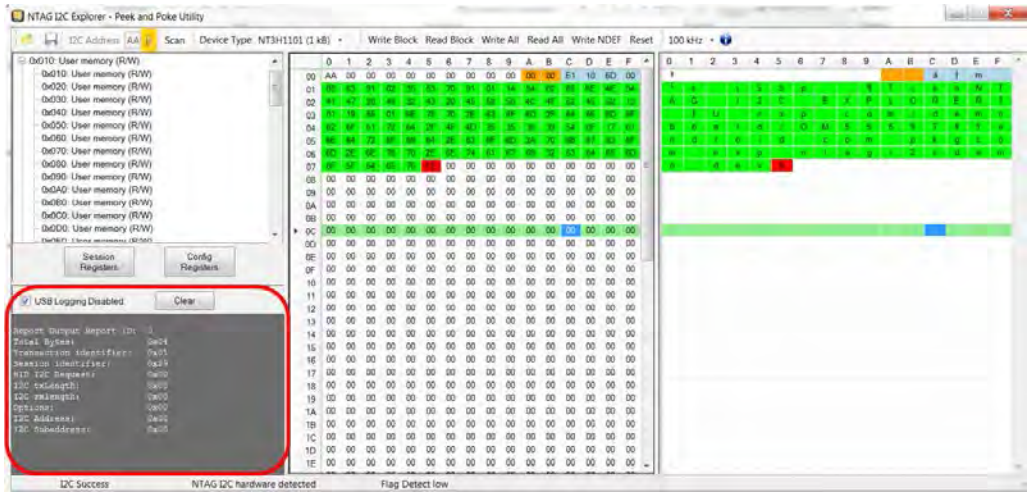

Fig 24. Peek and Poke USB data logging

4.4.2 Session registers

The user can check and edit the session registers by clicking the address 0xFE or the *Session Register* button. For a quick explanation for any of the registers listed under the session and configuration register screens, click on the small blue information (*i)* icon. This action will bring you up a help screen describing the register in a bit more detail.

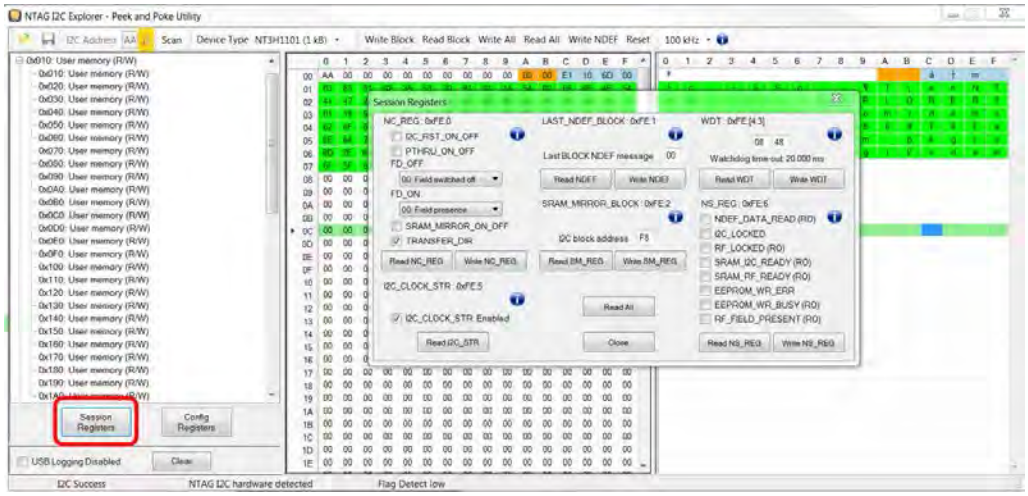

Fig 25. Peek and Poke Session Registers configuration menu

For more information on the session registers, please go to the NTAG I²C Datasheet.

4.4.3 Configuration registers

The user can check and edit the configuration registers. Press the configuration register button at the bottom left of the screen or click on the grid at memory block 0x3A for NTAG I²C 1K or 0x7A for NTAG I²C 2K. For a quick explanation of a session or configuration register, click on the small blue information (*i*) icon. This action will bring you up a help screen describing the register in a bit more detail.

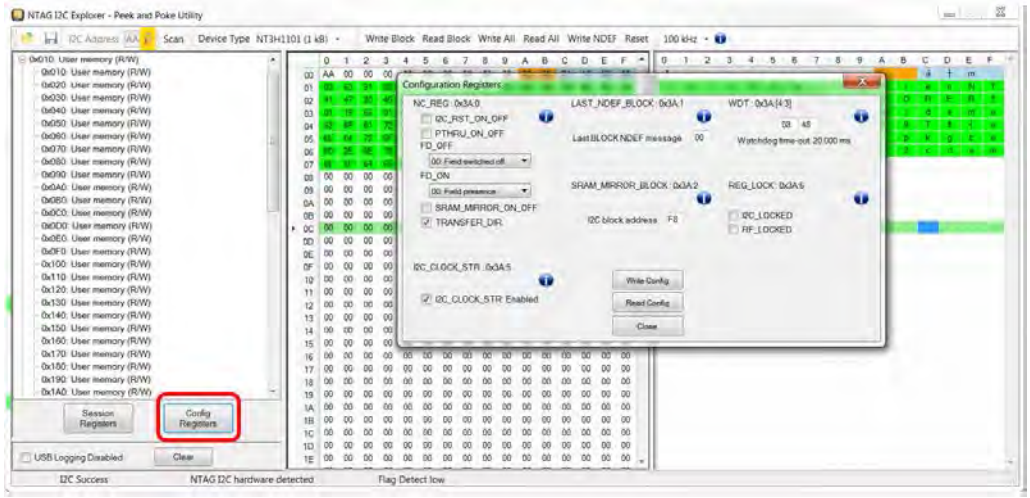

Fig 26. Peek and Poke Configuration Registers configuration menu

For more information about the configuration registers, please go to the NTAG I²C Datasheet.

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