Getting started with AS3910 Demonstration Board

Demo board revision: A-V1.0

Revision of this document: 7
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1 Disclaimer

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2 Package content

- AS3910 Demo board A-V1.0
- Plastic cover for Demo board
- USB cable
- CD-ROM with demo application and documentation
- ISO14443A Mifare Ultralight tag
- ISO14443A Mifare Classic 1k tag
- ISO15693 I-CODE tag

3 Content of CD ROM

CD_ROM contains three directories:

- **GUI:** contains installer file.
- **FTDI USB driver:** contains USB driver needed for USB communication between the PC and the Demo board
- **Documentation:** Contains AS3910 datasheet and description of AS3910 demo board design including demo board schematics and BOM

4 Installing USB driver

Before connecting the Demo board to the PC, the FTDI USB driver has to be loaded. Insert the *AS3910 Demo CD*, open the directory *FTDI USB driver* and execute *CDM_2.04.06.exe*

5 Connecting the Demo board and starting the GUI

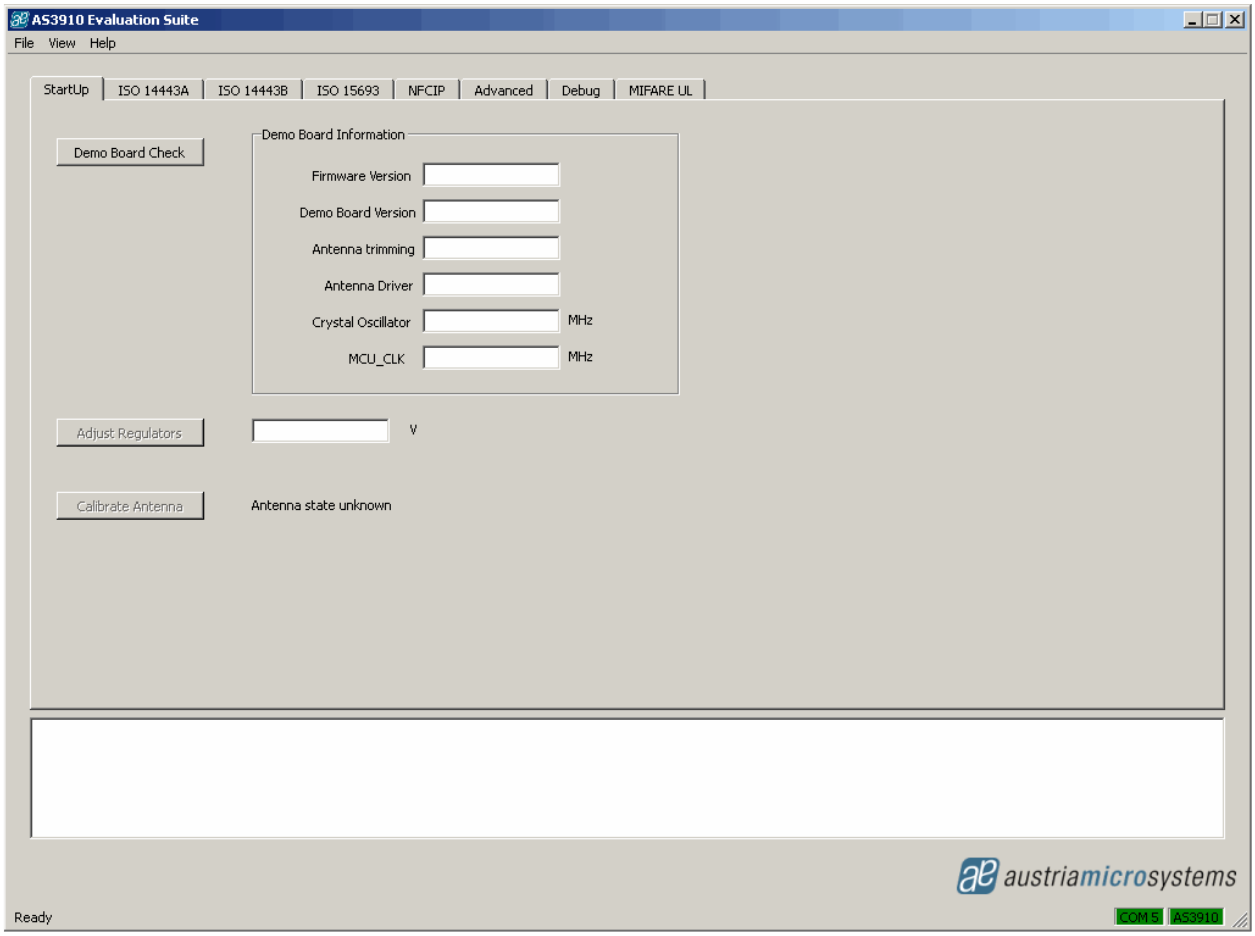
Slide the AS3910 Demo board in the plastic cover and connect the power supply, then connect the Demo board to a PC with the provided USB cable (FTDI USB driver has to be loaded before).

Follow the GUI install procedure by running *AS3910_EvalSW_Setup.msi*, located on the GUI directory of the CD.

6 Operating GUI

6.1 StartUp tab

When the GUI is started, the window depicted below is shown. In the lower right corner the used port is displayed (COM4 in this case). The *StartUp* tab is activated.
First the button *Demo Board Check* has to be clicked. This action checks the USB connection to Demo board and reads some Demo board information which is required for the GUI operation. The configuration of the AS3910 is done based on this information.



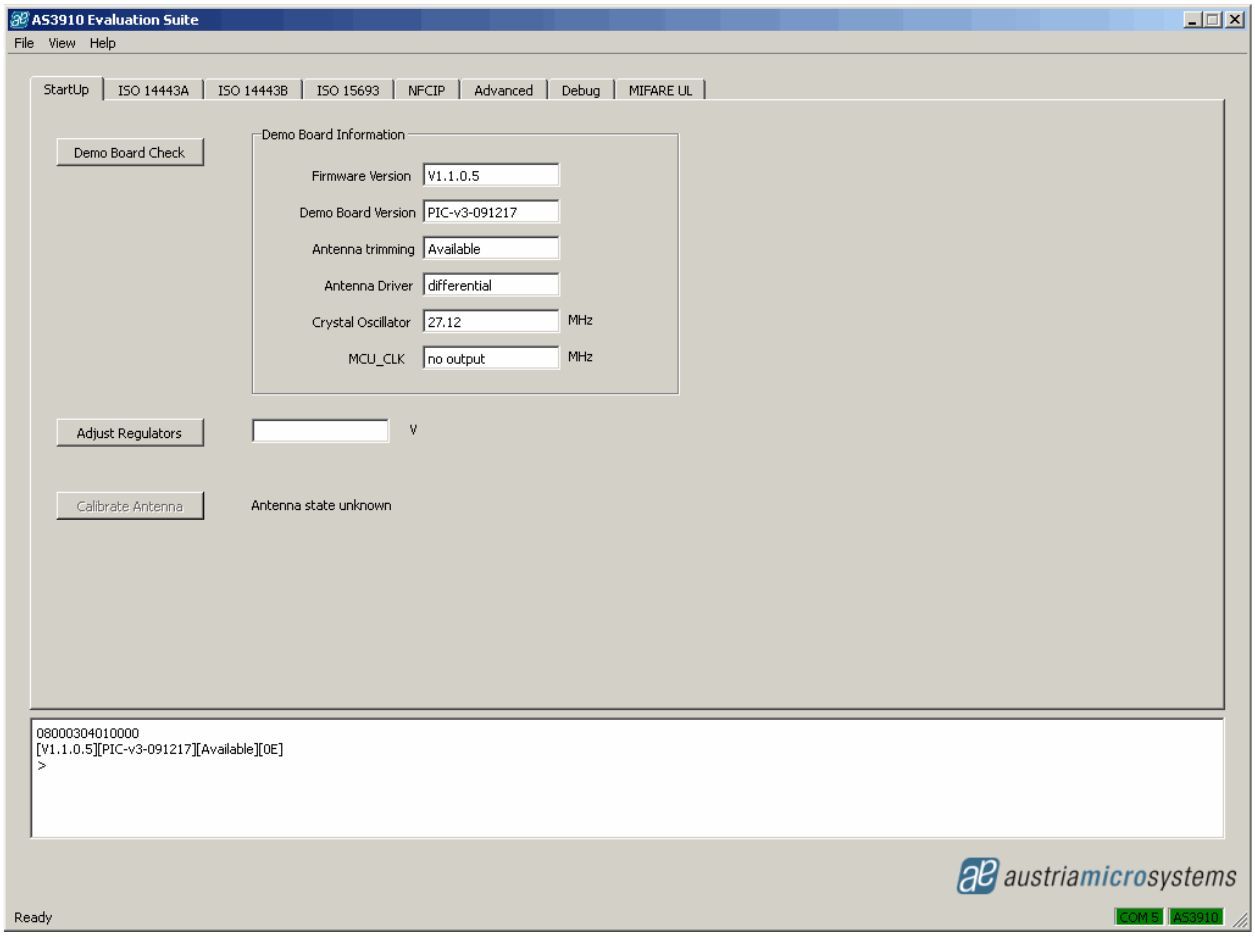


Figure above depicts the GUI window after clicking the button *Demo Board Check*. The button *Adjust Regulators* has to be clicked to run the AS3910 direct command *Adjust Regulators*. This command automatically sets the regulators to improve system Power Supply Rejection Ratio (PSRR).

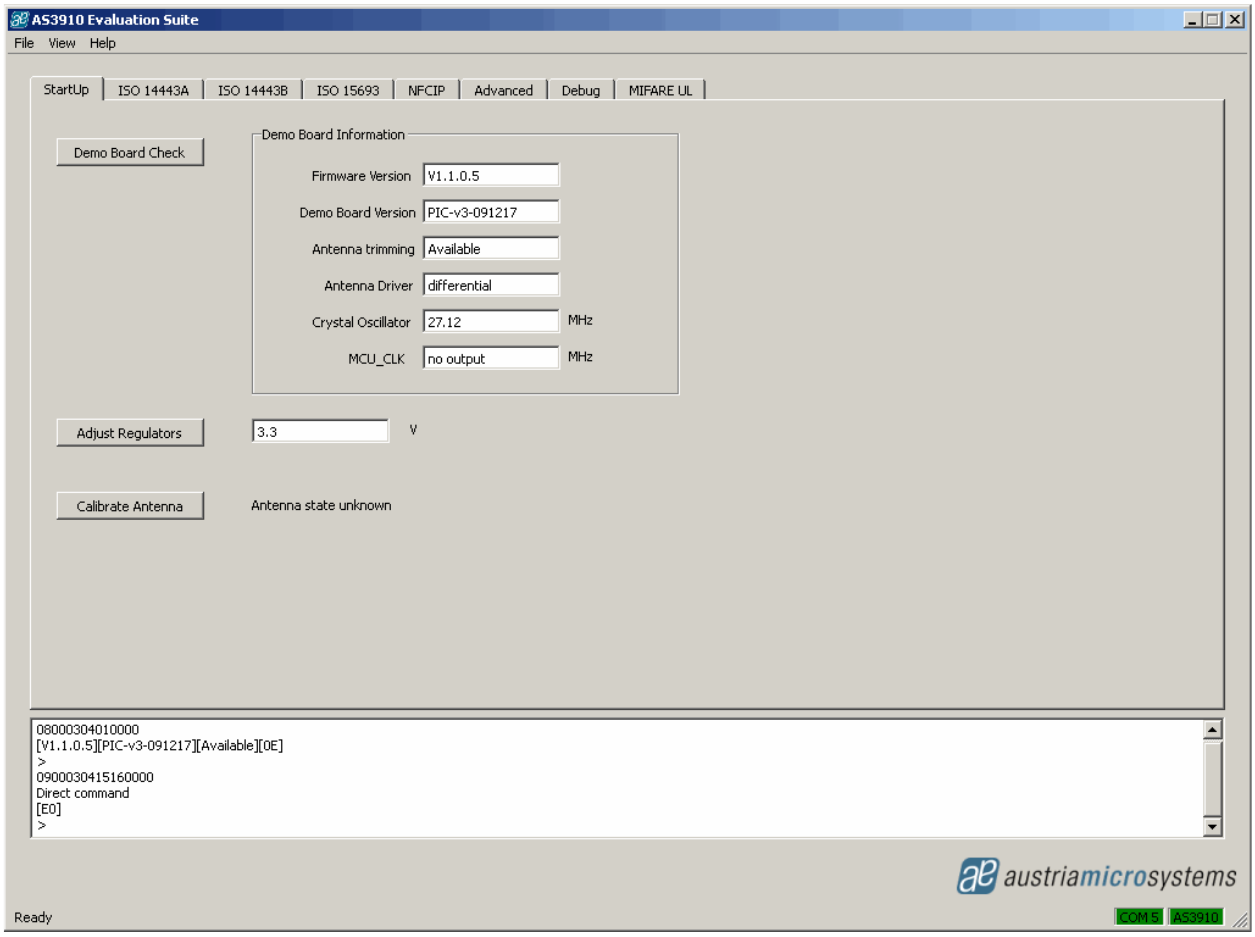


Figure above depicts GUI window after clicking the button *Adjust Regulators*. Regulated voltage is displayed next to the button.
Button *Calibrate Antenna* has to be clicked to run the AS3910 direct command *Calibrate Antenna*. This command automatically adjusts the resonance frequency of the antenna LC tank. Note that this command has to be run again in case environment of antenna coil changed (for example, in case that some metal objects have been placed next to the antenna).

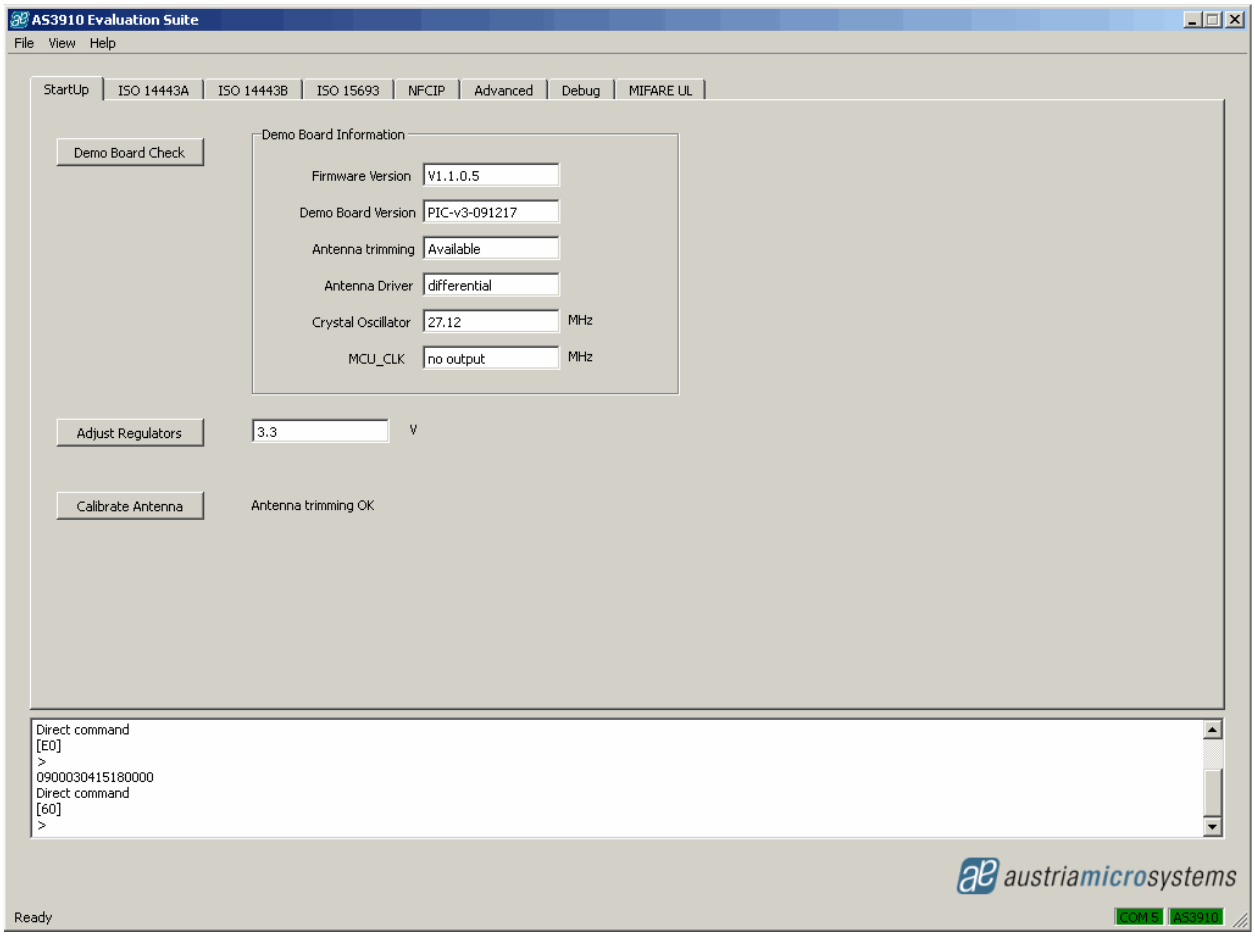
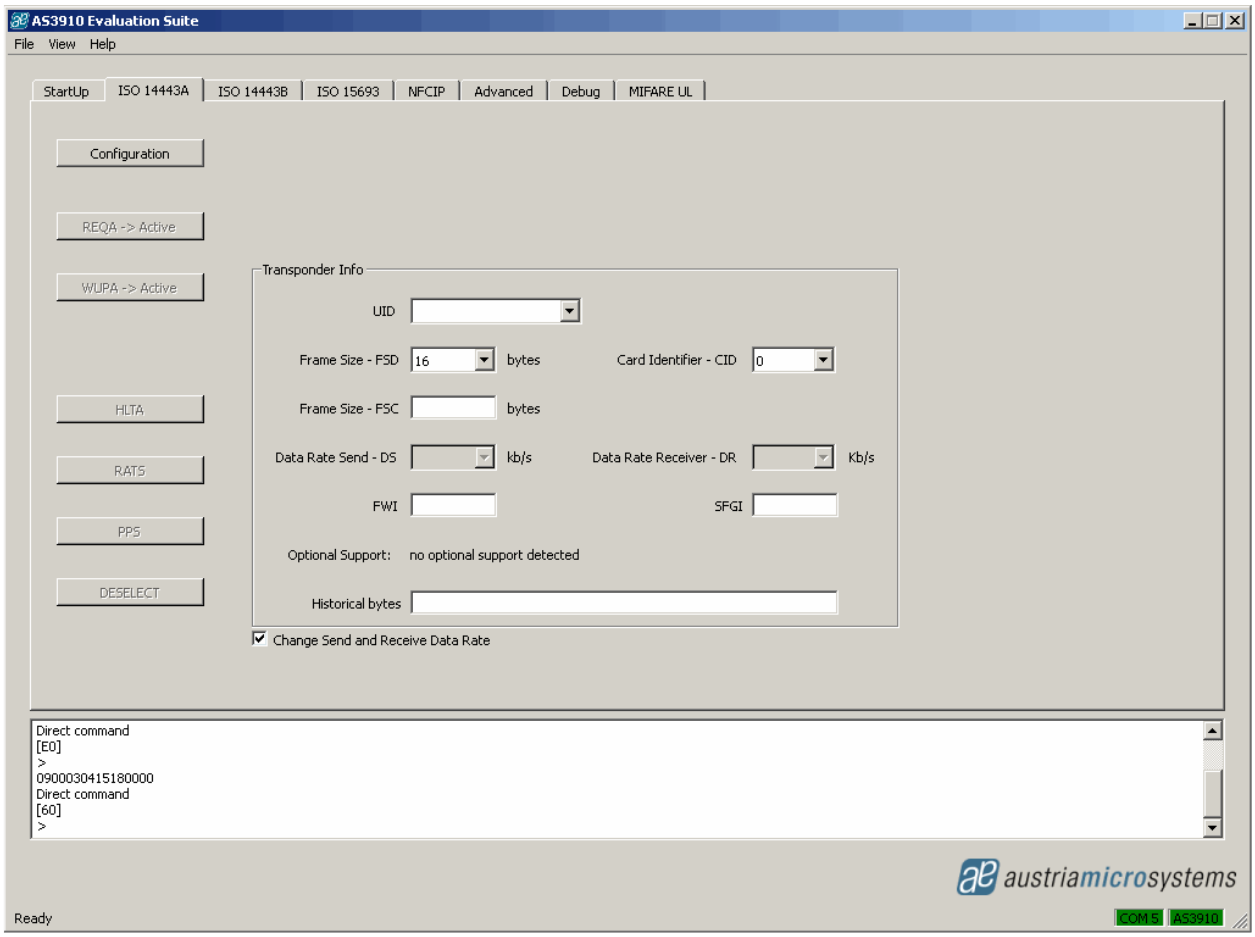


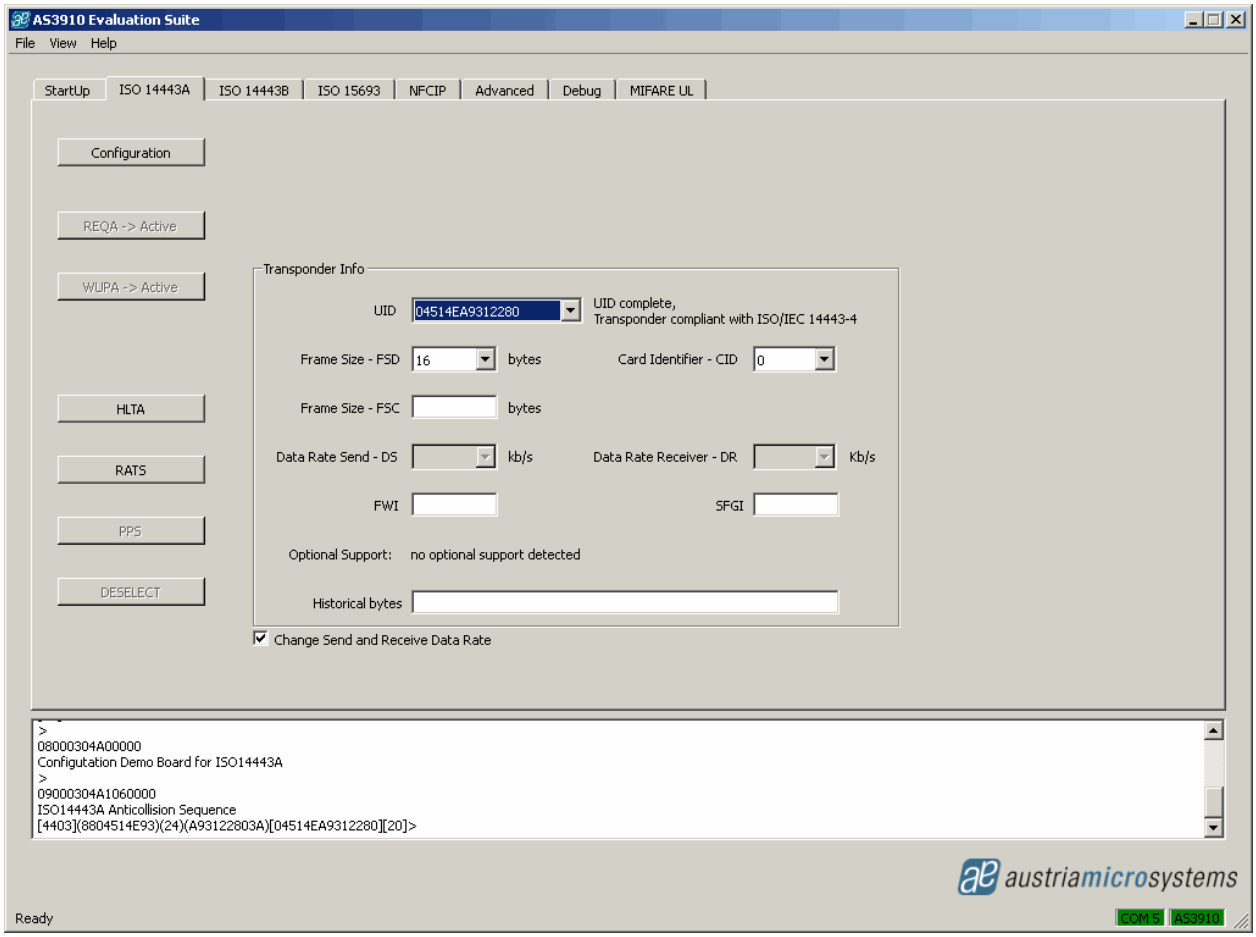
Figure above depicts the GUI window after clicking the button *Calibrate Antenna*. *Antenna trimming OK* is displayed next to the button.
After the start-up procedure is terminated, the user can proceed with the activation of other tabs.

6.2 ISO14443A tab

In this tab the ISO14443A operation of the AS3910 is demonstrated. The figure below depicts GUI window after entering the ISO14443A tab.
After entering ISO14443A tab, the button *Configuration* has to be clicked to configure the AS3910 in the ISO14443A mode.

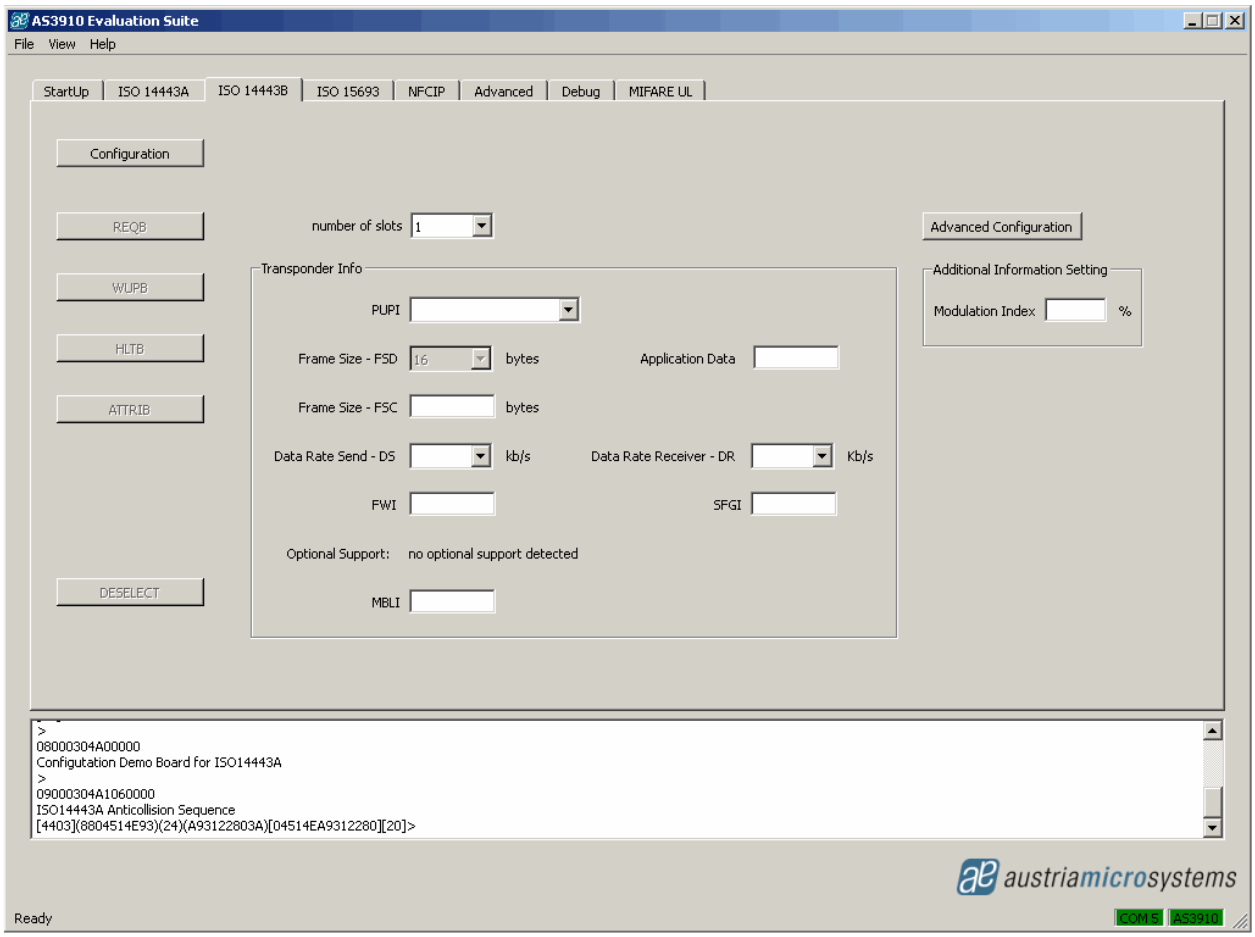


After clicking the button *Configuration,* an ISO14443A tag can be placed close to Demo board antenna. The button *REQA->Active* starts the anticollision procedure and the UID number of the founded tags is displayed.

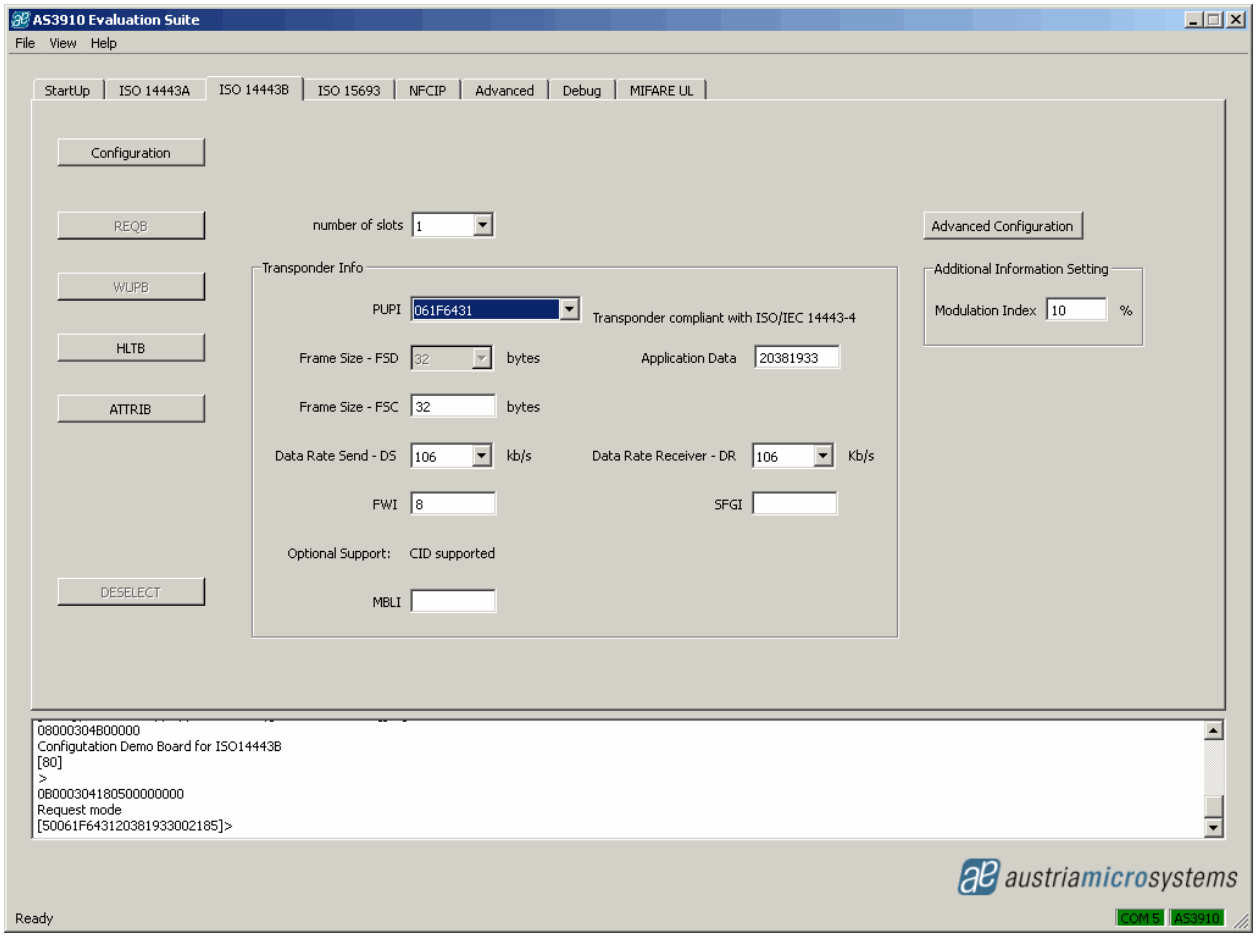


6.3 ISO14443B tab

In this tab the ISO14443B operation of the AS3910 is demonstrated. Figure below depicts GUI window after entering ISO14443B tab.
After entering ISO14443B tab, the button *Configuration* has to be clicked to configure the AS3910 in the ISO14443B mode.

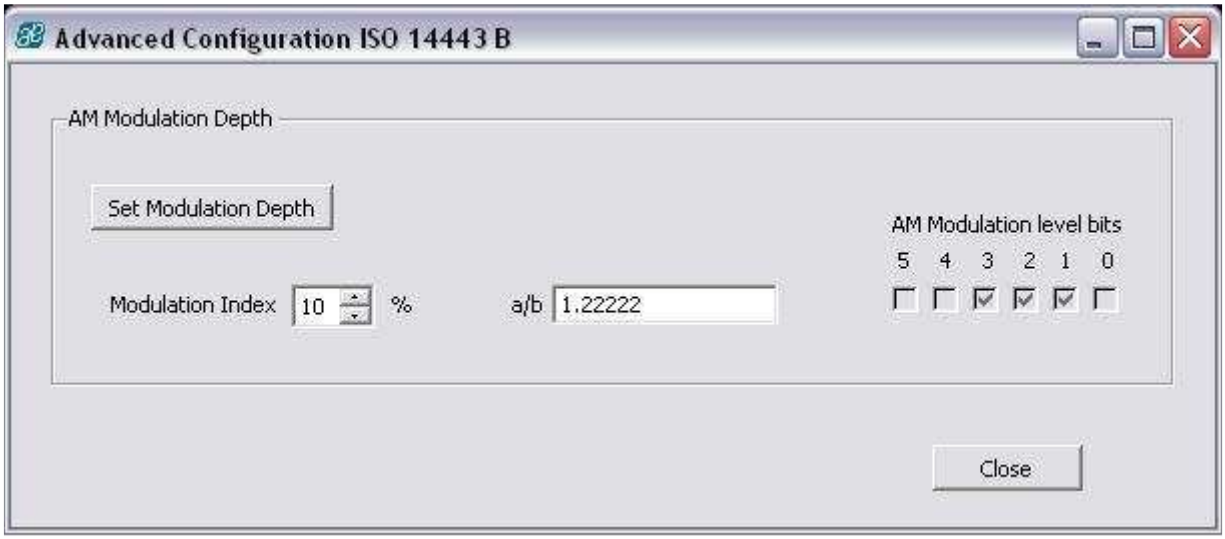


After clicking the button *Configuration,* an ISO14443B tag can be placed close to Demo board antenna. Clicking button *REQB* starts the request procedure. When REQB is terminated the PUPI number of the founded tags is displayed.



6.3.1 Modulation Index adjustment

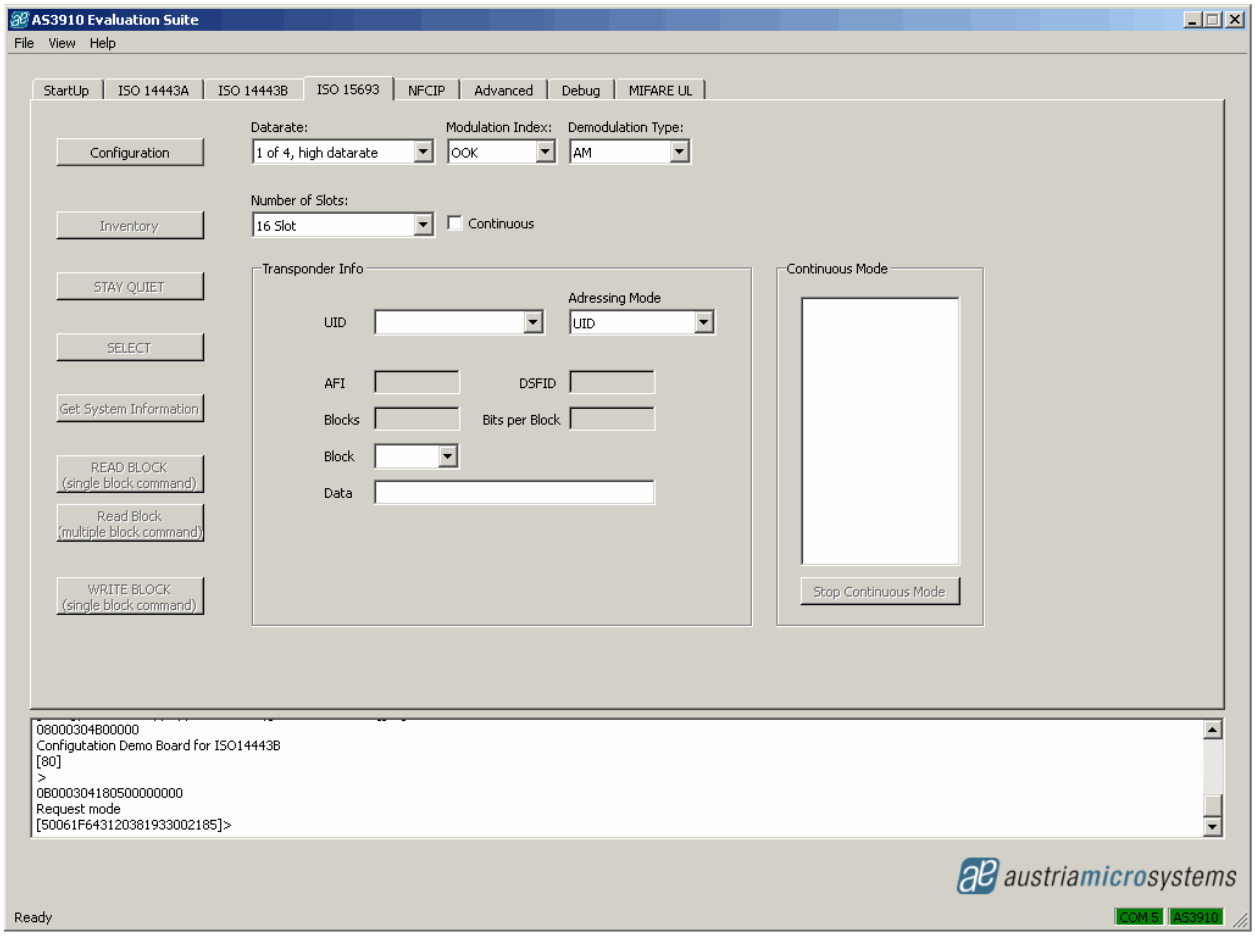
This option activates the transmission, measures the modulation depth and adapts it to comply with the modulation depth specified in the Modulation Depth Definition Register (#10). When calibration procedure is finished result is displayed in Modulation Depth Display Register. See “Device Specification, section 5.15 AM modulation depth definition using direct command Calibrate Modulation Depth” for details about setting the AM modulation depth and running this command.



Advanced Configuration button is used to change the modulation depth. Once it is selected, an *Advanced Configuration ISO14443B* window pops up. After selecting the wanted modulation depth, it is set by the *Set Modulation Depth* button.

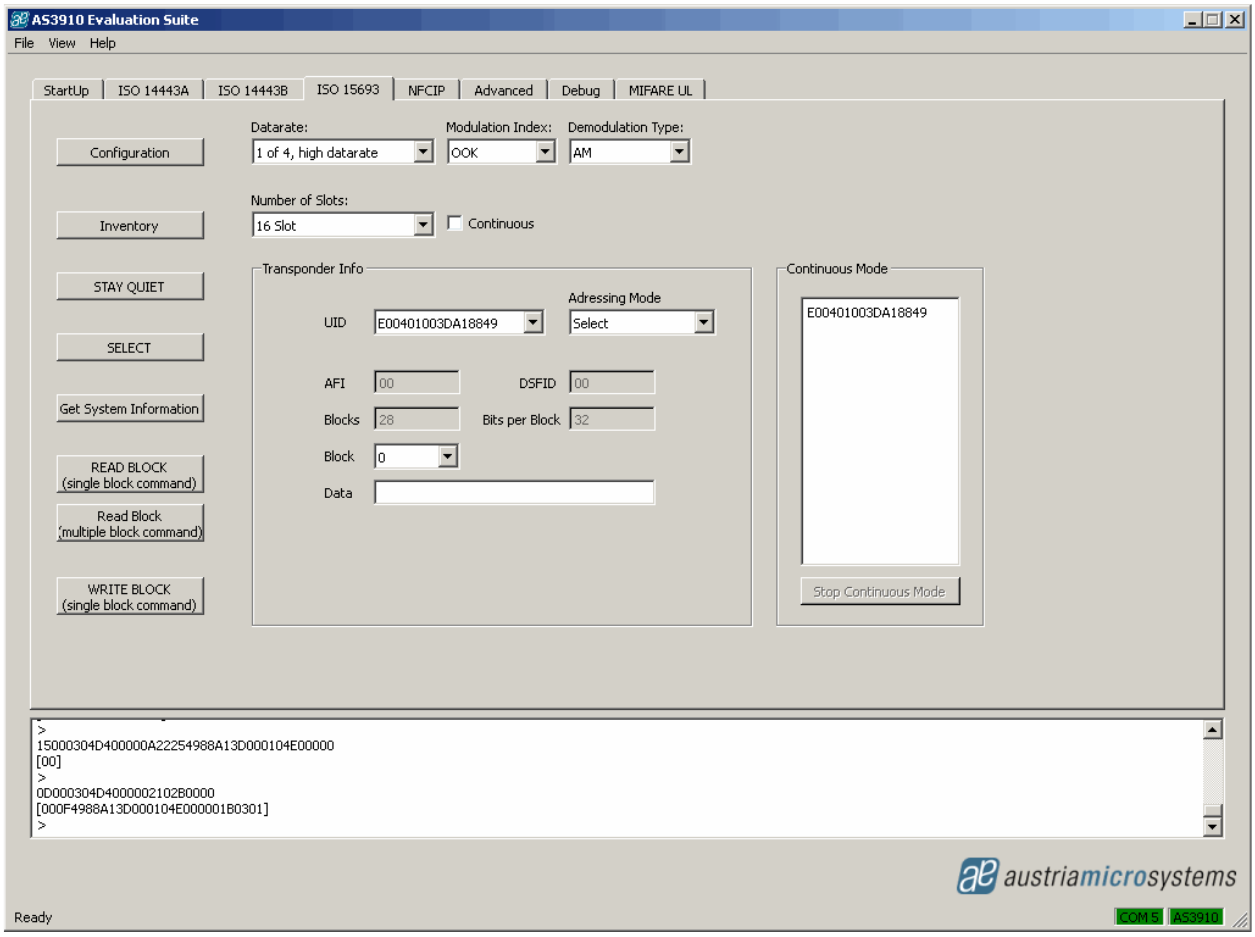
6.4 ISO15693 tab

In this tab the ISO15693 operation of the AS3910 is demonstrated. The figure below depicts the GUI window after entering the ISO15693 tab.
After entering ISO15693 tab, data-rate and modulation index have to be set and the button *Configuration* has to be clicked to configure the AS3910 in the ISO15693 mode.



Once the board is configured to operate in the ISO15693 mode, the number of slots is set and *Inventory* button has to be clicked. The result of Inventory command is shown in the picture below (UID is presented).

The selected tag can be put into Quiet mode by the *STAY QUIET* button
In case more than one tag is detected during the *Inventory* command, any of them can be selected using the *SELECT* button, then the following commands are not preceded with the UID. In case the *SELECT* command is not used, the UID must be included in all following commands. This can be selected in the Addressing Mode field (See Picture below)

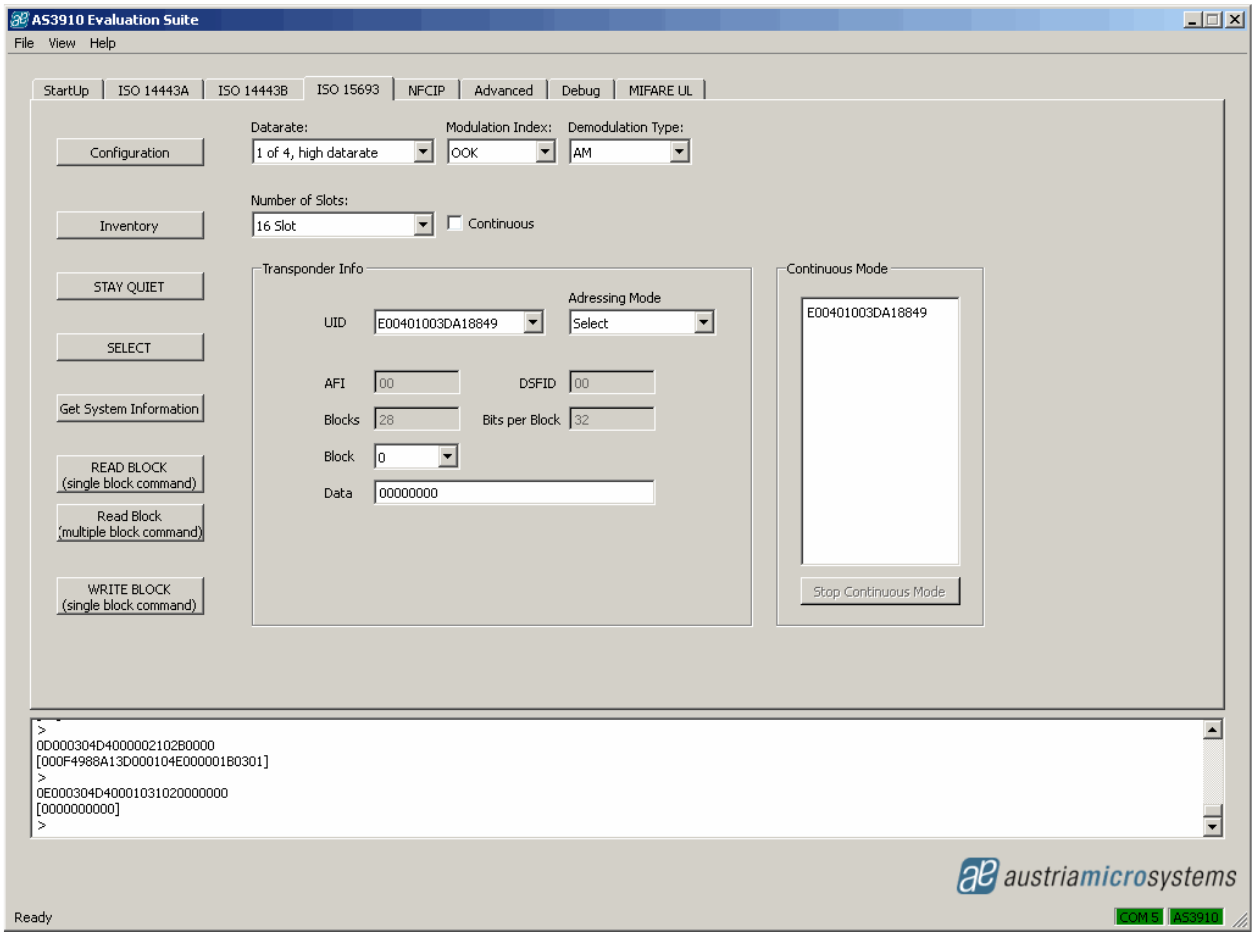


After getting the system information (by using the *Get System Information* button), it is possible to read/write data.

The transponder memory is organised in blocks, the number and size of these blocks is displayed in the *Transponder Info* field.

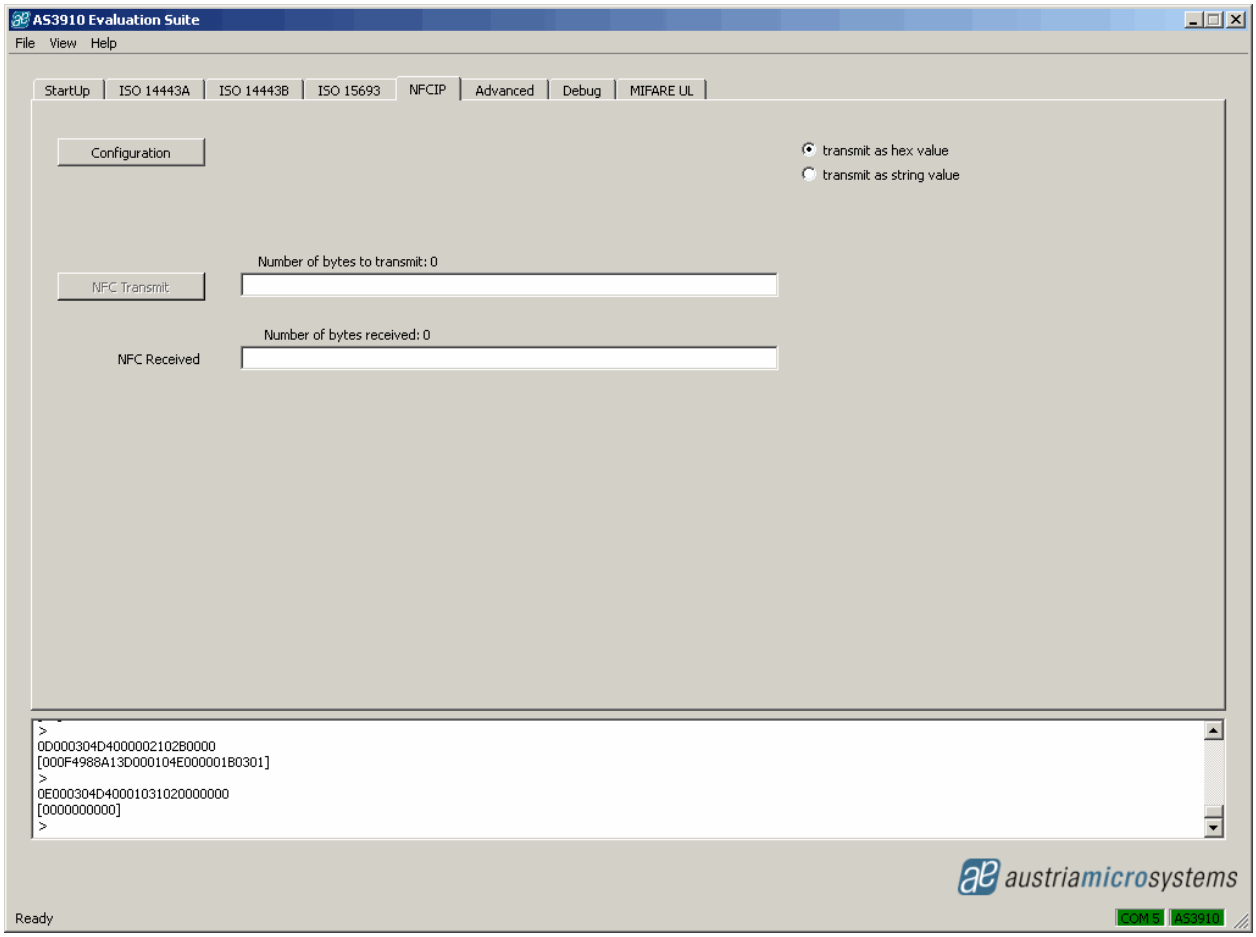
ISO15693 mandatory commands are *Inventory* and *STAY QUIET*. All others are optional and not every tag may support them. I.e. Some tags do not support single block READ. To overcome this, multiple blocks READ command for reading only one selected block is implemented on this GUI.

To read data, the wanted block has to be selected in advanced. The result is displayed on the *Data* field as presented in the picture below.
To write data, the block has to be selected and the data placed in the *Data* field.


AS3910 Evaluation Suite
File View Help
StartUp ISO 14443A ISO 14443B ISO 15693 NFCIP Advanced Debug MIFARE UL
Configuration
Inventory
STAY QUIET
SELECT
Get System Information
READ BLOCK (single block command)
Read Block (multiple block command)
WRITE BLOCK (single block command)
Datarate:
1 of 4, high datarate
Modulation Index:
OOK
Demodulation Type:
AM
Number of Slots:
16 Slot
Continuous
Transponder Info
UID
E00401003DA18849
Adressing Mode
Select
AFI
00
DSFID
00
Blocks
28
Bits per Block
32
Block
0
Data
00000000
Continuous Mode
E00401003DA18849
Stop Continuous Mode
>
0D000304D4000002102B0000
[000F4988A13D000104E000001B0301]
>
0E000304D40001031020000000
[0000000000]
>
austriamicrosystems
Ready
COM 5
AS3910

6.5 NFCIP tab

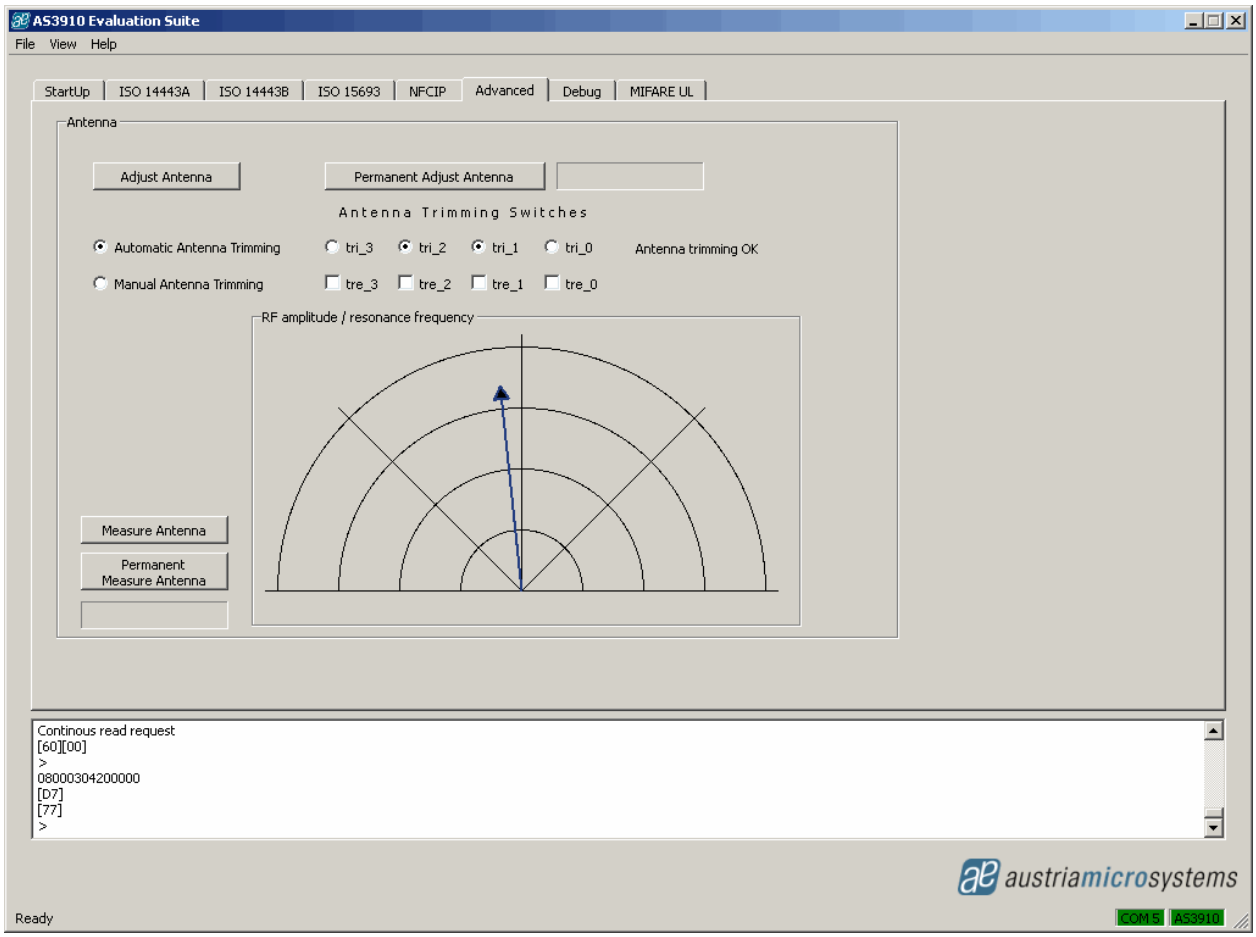
In this tab the NFCIP is demonstrated. Figure below depicts GUI window after entering the *NFCIP* tab.



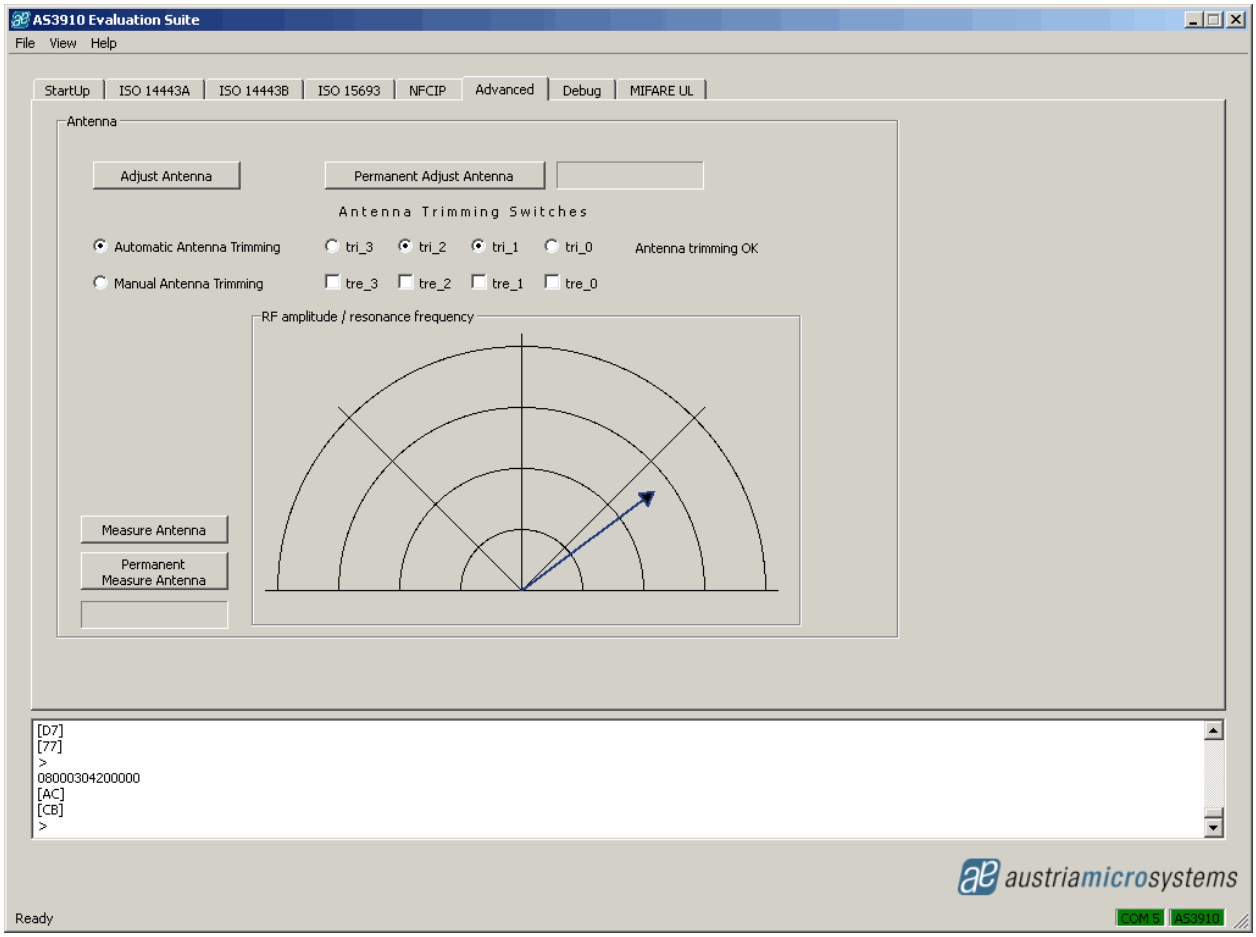
After entering *NFCIP* tab, the button *Configuration* has to be clicked. This configures the AS3910 in the NFCIP mode.
Immediately after entering in this mode, AS3910 is set to receive mode.
The GUI allows to transmit a hexadecimal (only complete bytes can be sent) or string values. To transmit some data, it has to be written in the *NFC Transmit field* ("AS3940 NFCIP communication test" in this case). The transmission is initiated by the button *NFC Transmit*.
The message is received by the receiving device and appears in the *NFC Received* field

6.6 Advanced tab

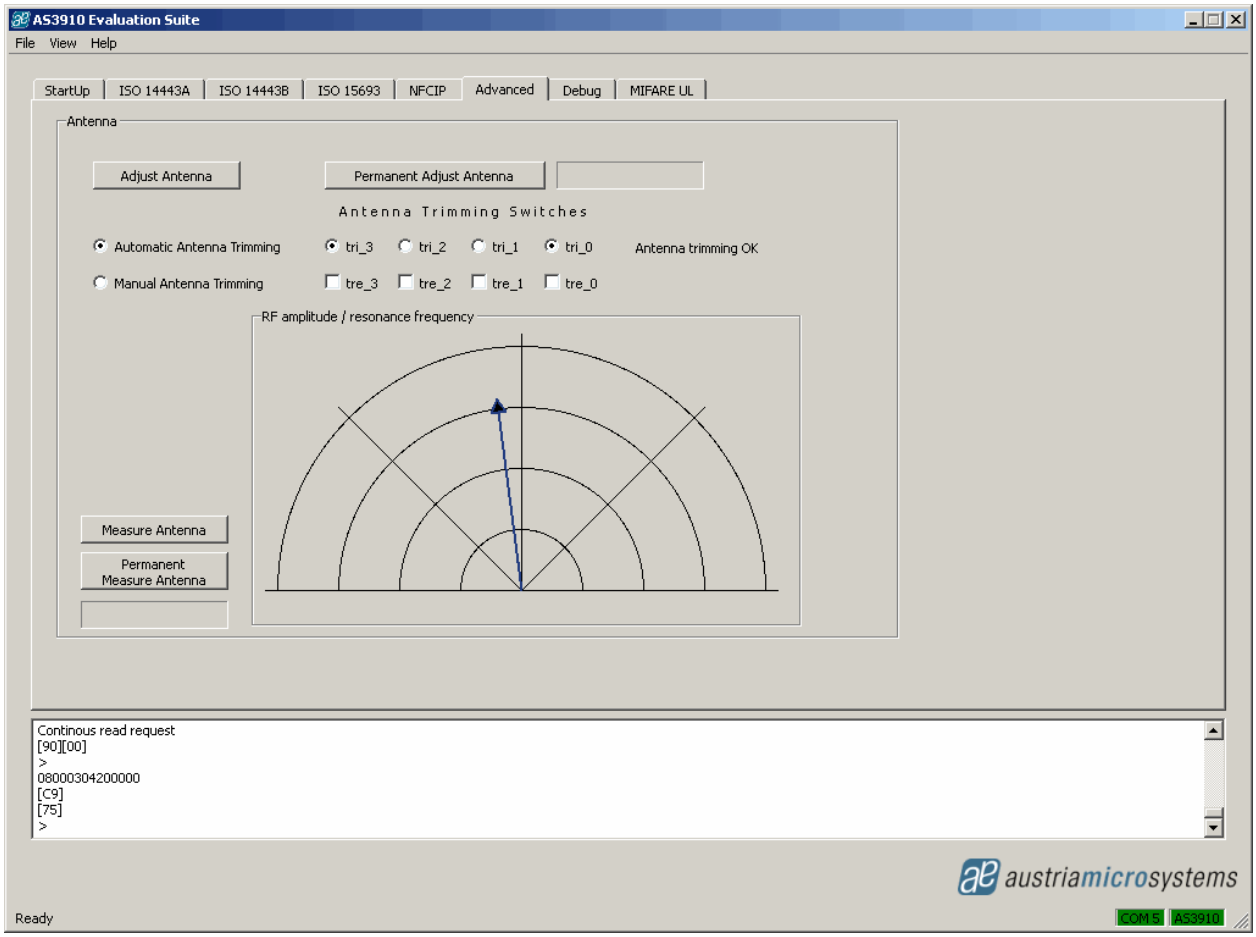
In this tab the advanced antenna trimming operation of the AS3910 is demonstrated. Figure below depicts the GUI window after entering the *Advanced* tab.
After entering the *Advanced* tab, the value of the RF amplitude and resonance frequency is measured and displayed on a graph. The value of x is derived by executing the direct command *Check Antenna Resonance*, the value of y is derived by executing the direct command *Measure RF*.
The antenna is in resonance in case the pointer is close to vertical position as depicted on figure below.



Measurement of resonance frequency can be done by the button *Measure Antenna*. Figure below depicts measurement result after placing some metal close to the antenna. In this case the antenna is not in resonance anymore (due to change of its inductance).



The antenna can be tuned by the button *Adjust Antenna* while *Automatic Antenna Tuning* is selected. Figure below depicts the result after clicking this button (metal was kept close to antenna). Note that position of trimming switches changed.



It is possible to define the position of trim switches and observe the effect on the resonance frequency. This is done by selecting *Manual Antenna Trimming* and defining the value of tre_3 to tre_0 before clicking button *Adjust Antenna* (check box marked indicates that switch is turned on).

6.6.1 Permanent measurement of the antenna

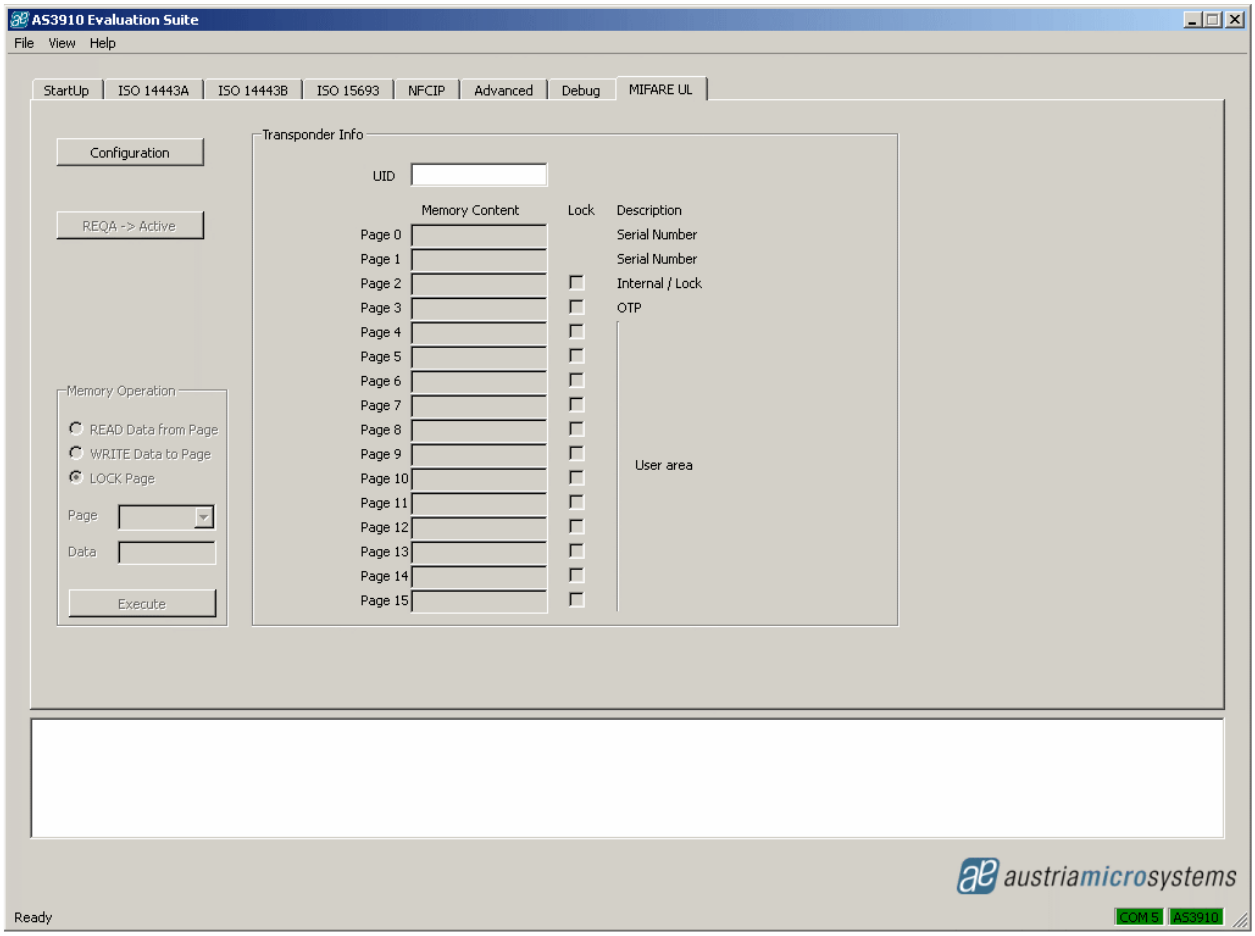
The RF amplitude and the resonance frequency of the antenna can be continuously monitored by using the button *Permanent Measure Antenna*. Once this option is activated, the effect can be seen while approaching a piece of metal to the antenna. The measured value is updated constantly.

6.6.2 Permanent trimming of the antenna

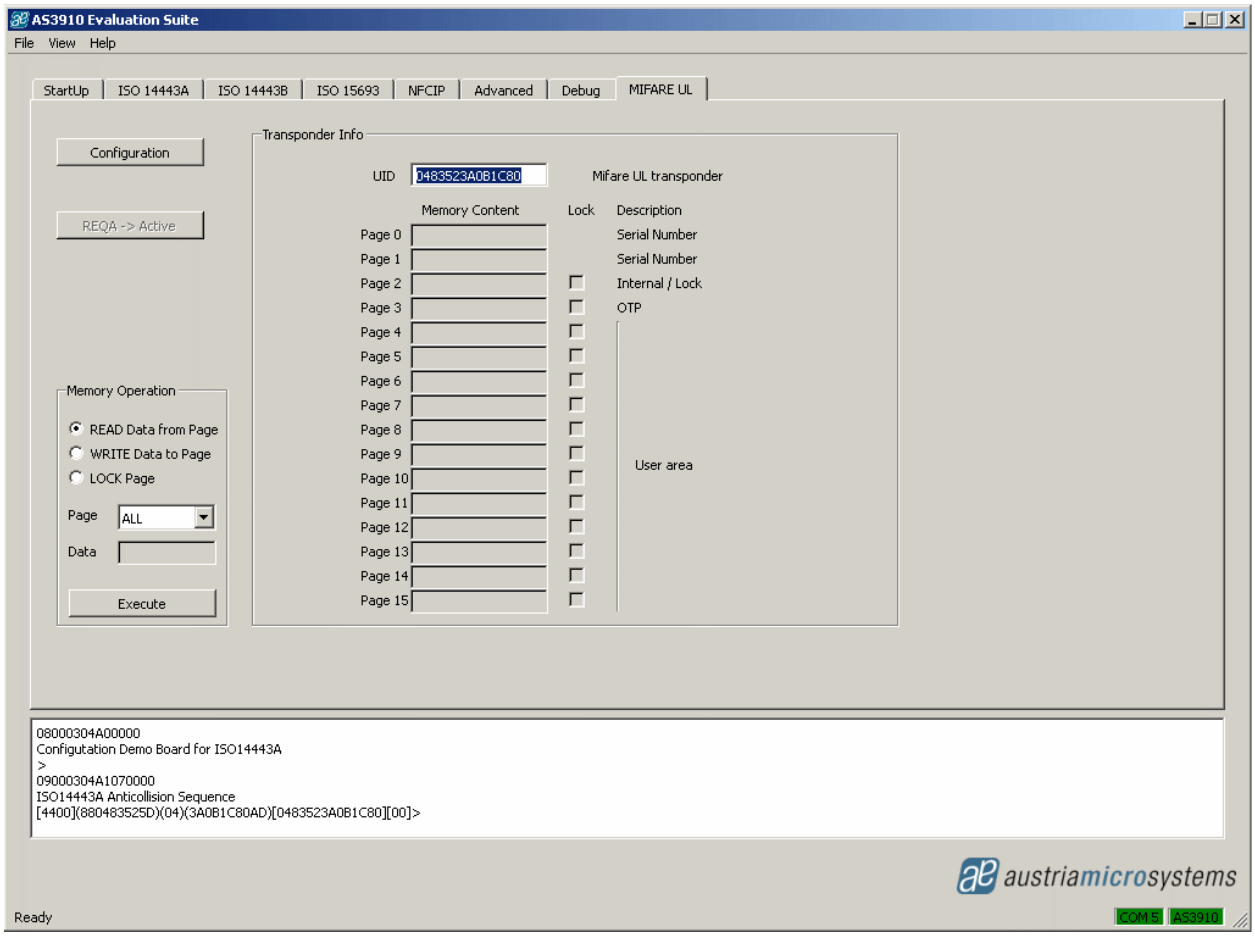
The RF amplitude and the resonance frequency of the antenna can be continuously trimmed by using the button *Permanent Adjust Antenna*. Once this option is activated, the effect can be seen while approaching a piece of metal to the antenna. The antenna trimming value is updated constantly and the resonance frequency is always centred.

6.7 *Mifare UL tab*

In this tab the Mifare UL operation of the AS3910 is demonstrated. The figure below depicts the GUI window after entering the Mifare UL tab.
After entering Mifare UL tab, the button *Configuration* has to be clicked to configure the AS3910 in the Mifare UL mode.

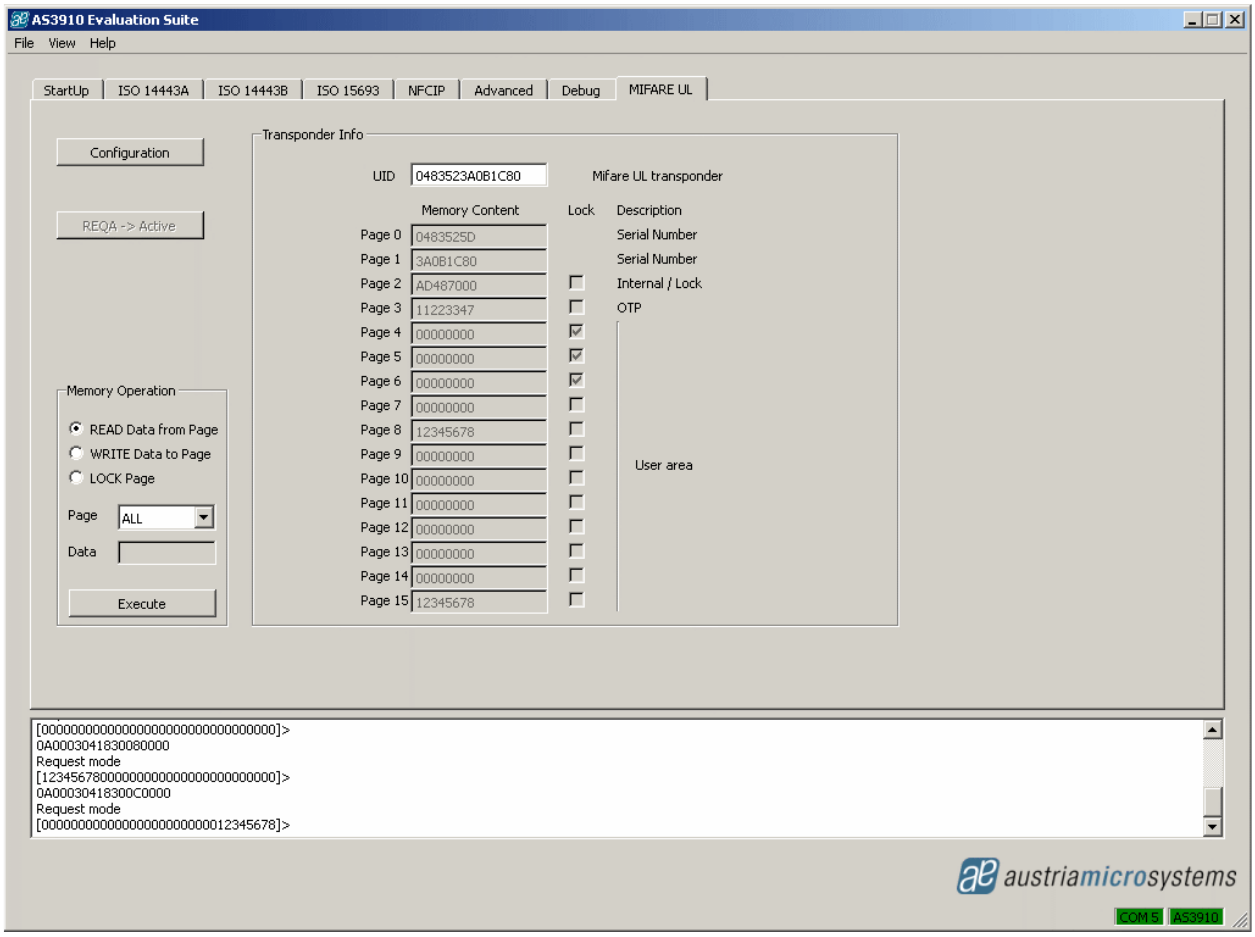


After clicking the button *Configuration,* a Mifare UL tag can be placed close to the demo board antenna. The button *WUPA->Active* starts the activation procedure and the UID number of the founded tag is displayed. In case more than one tag is detected during the *REQA->Active* command, the message “More then ONE transponder” is presented

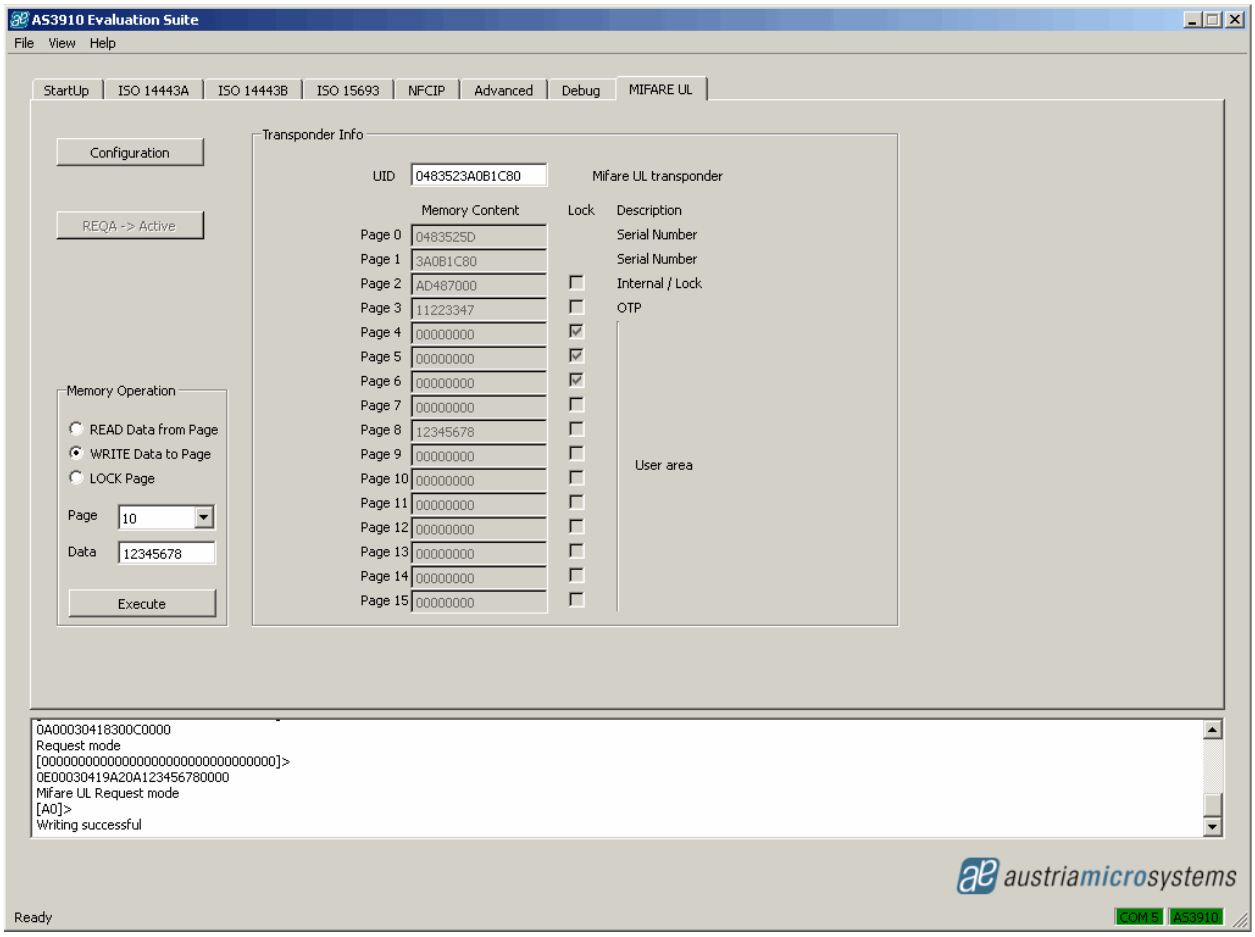


After getting the UID of Mifare UL tag, it is possible to read/write data. The transponder memory is organised in pages, the size of these pages is 4 bytes.

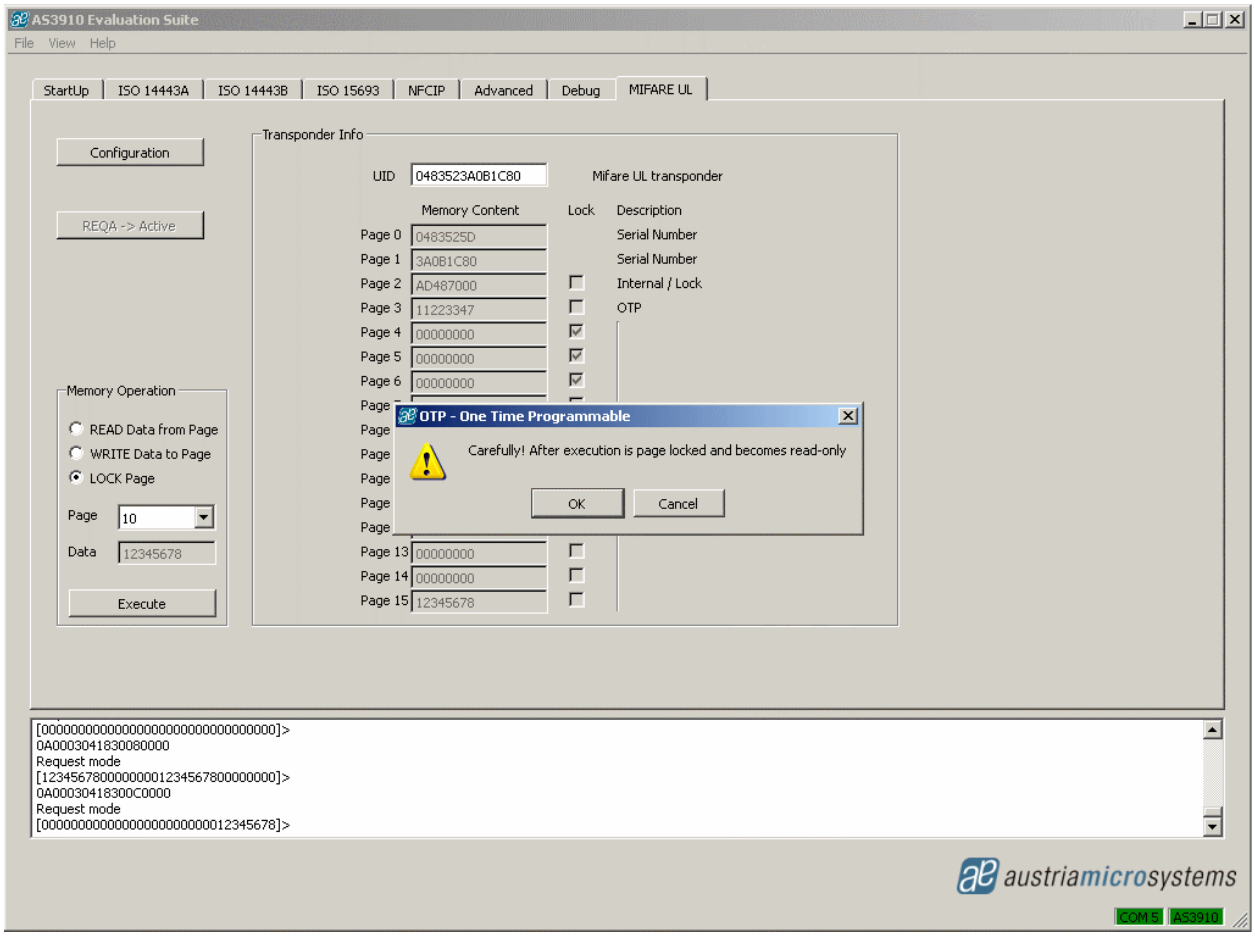
To read data, radio button "*READ Data from Page*" and the wanted Page have to be selected in pull down menu of Page. The result is displayed on the *Memory Contents* fields of Transponder Info as presented in the picture below.



To write data, radio button "*WRITE Data to Page*" and the wanted Page have to be selected and the data placed in the *Data* field (4 bytes).



To Lock Page, radio button "*LOCK Page*" and the wanted Page have to be selected in the "Page" pull down menu. Note that this command locks the page in read-only memory Page.


AS3910 Evaluation Suite
File View Help
StartUp ISO 14443A ISO 14443B ISO 15693 NFCIP Advanced Debug MIFARE UL
Configuration
REQA -> Active
Memory Operation
READ Data from Page
WRITE Data to Page
LOCK Page
Page 10
Data 12345678
Execute
Transponder Info
UID 0483523A0B1C80
Mifare UL transponder
Memory Content Lock Description
Page 0 0483525D Serial Number
Page 1 3A0B1C80 Serial Number
Page 2 AD487000 Internal / Lock
Page 3 11223347 OTP
Page 4 00000000
Page 5 00000000
Page 6 00000000
Page 13 00000000
Page 14 00000000
Page 15 12345678
OTP - One Time Programmable
Carefully! After execution is page locked and becomes read-only
OK
Cancel
[00000000000000000000000000000000]>
0A0003041830080000
Request mode
[12345678000000001234567800000000]>
0A00030418300C0000
Request mode
[00000000000000000000000012345678]>
austriamicrosystems
COM 5
AS3910

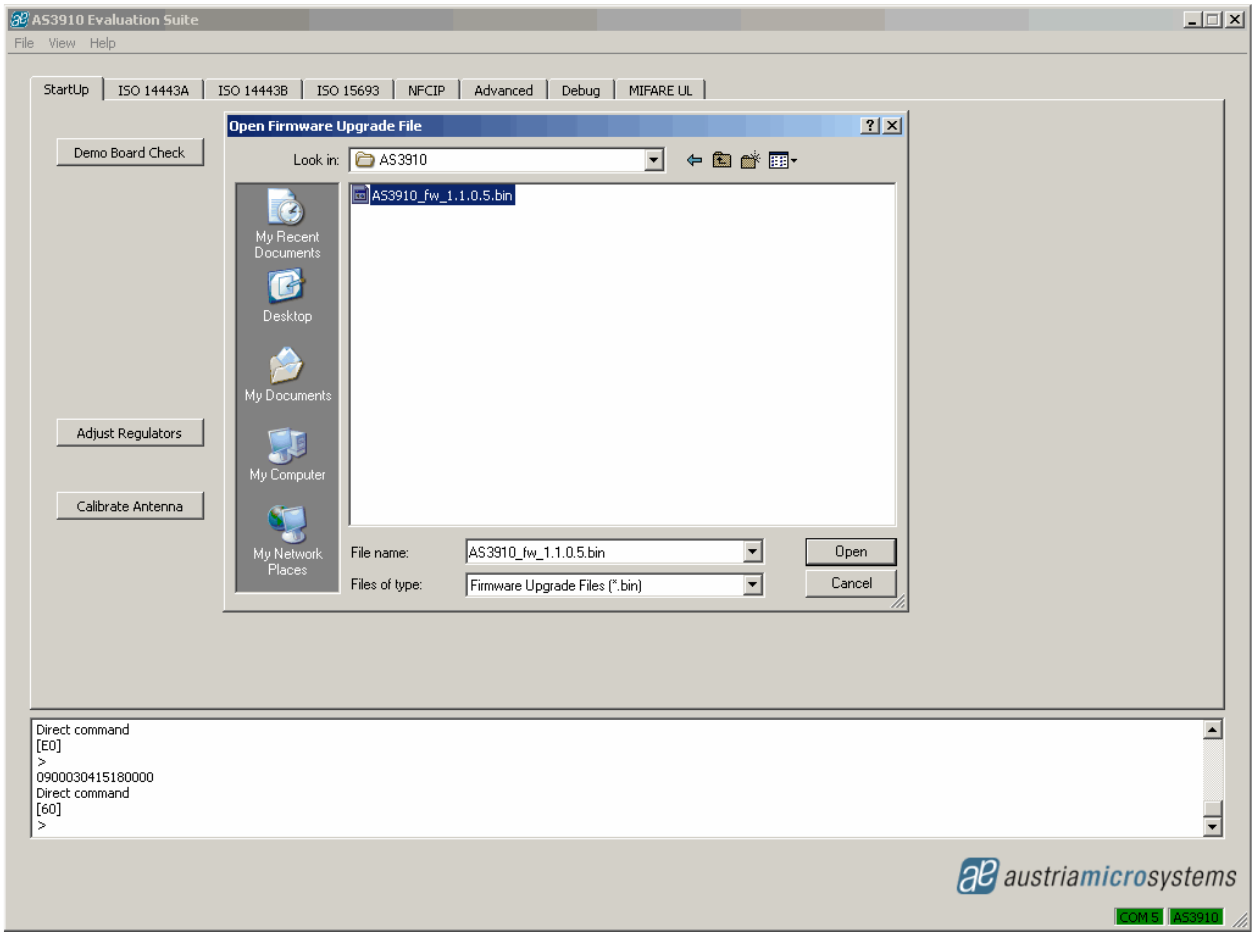
6.8 Debug tab

The *Debug* tab allows running implemented commands separately. It is also possible to prepare a file with sequence commands and then execute them

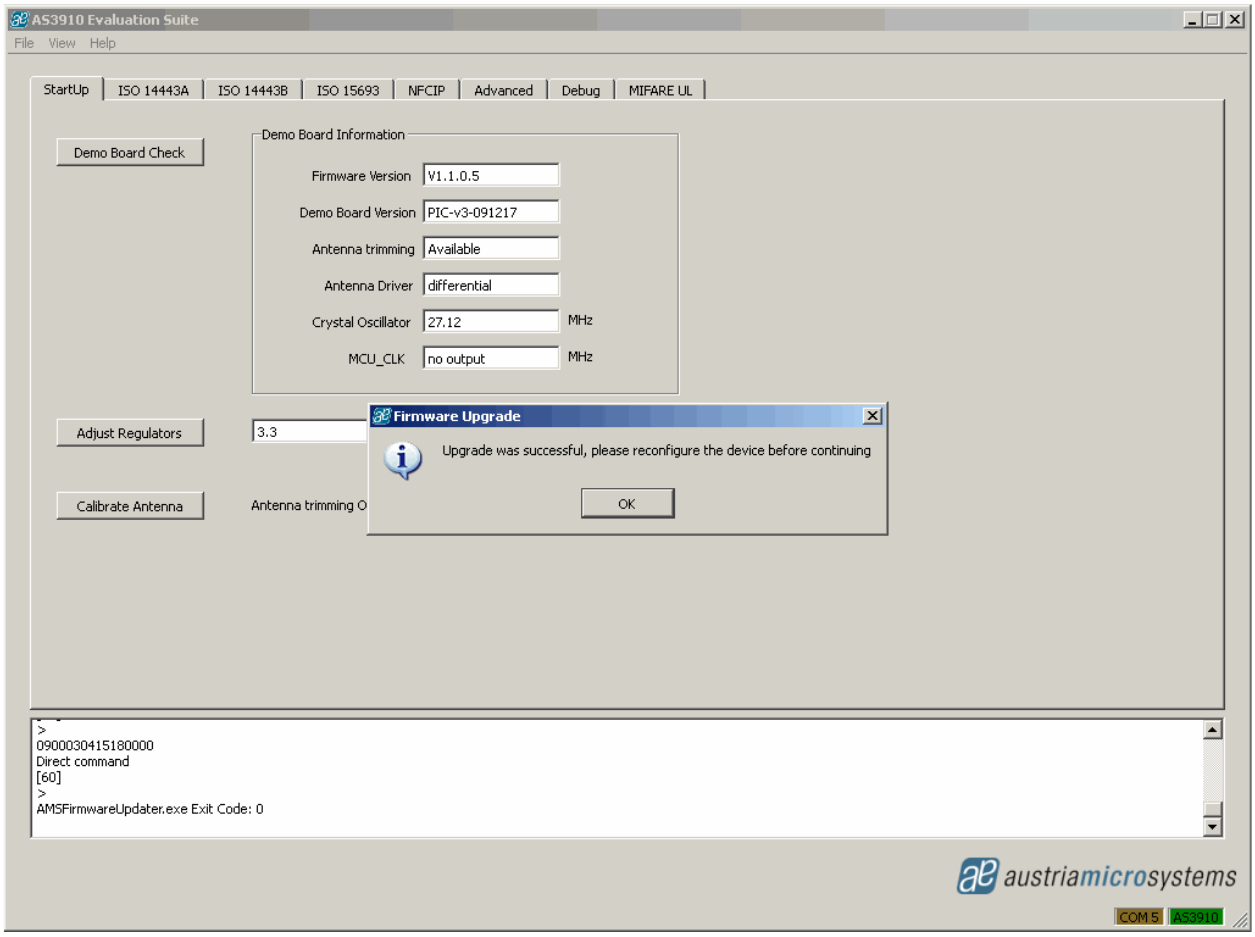
Implemented commands in uC firmware	
01	Setting Reader to corresponding Demo Board
03	RF field reset
10	Writing of a single Byte (e.g. 100190 – write to register address 0x01 data 0x90)
11	Writing of Register Data with auto-incrementing Address (e.g. 110040D006 – write data 0x40 to register address 00, D0 to register address 0x01 and 0x06 to register address 0x02)
12	Reading of a single Register Byte (e.g. 1201 – read data from register address 0x01)
13	Reading Register Data with auto-incrementing Address (exp. 130300 – read 3 consecutive registers started with register address 0x00, this mean read data from register address 0x00, read from register address 01 and read data from register address 0x02)
15	Direct Commands (e.g. 1502 – 0x02 is code from the list of direct command clear FIFO, see “Device Specification, section 5.2 Direct Commands”)
16	FIFO load (e.g. 161020304050 – load data 1020304050 in the FIFO, prepare data for transmission)
17	FIFO read (e.g. 1710 – read 10 bytes data from the FIFO, only available by receiving)
18	Request with CRC (e.g. 189370 – transmit command and data with CRC)
1A	Request without CRC (e.g. 1A9320 – transmit command and data without CRC)
20	Antenna Measure (send direct command 13 Measure RF and 19 Check Antenna Resonance)
A0	Configuration ISO14443A protocol
A106	REQA -> Active – REQA and Anti-collision sequence for ISO14443A
A107	WUPA -> Active – WUPA and Anti-collision sequence for ISO14443A
B0	Configuration ISO14443B protocol
C0	Configuration NFCIP-1 protocol
C1	NFC Transmit with CRC (e.g. C1081020304050 – send direct command 0x08 with data 1020304050 and with added CRC). See Device Specification, section 5.2 Direct Commands.

6.9 Firmware Upgrade

For upgrade with new or different firmware, chose Firmware Upgrade from Help menu. The figure below depicts the GUI window after is chosen Firmware Upgrade



The figure below depicts the GUI window after is update finished and successful.


AS3910 Evaluation Suite
File View Help
StartUp
ISO 14443A
ISO 14443B
ISO 15693
NFCIP
Advanced
Debug
MIFARE UL
Demo Board Check
Demo Board Information
Firmware Version
V1.1.0.5
Demo Board Version
PIC-v3-091217
Antenna trimming
Available
Antenna Driver
differential
Crystal Oscillator
27.12
MHz
MCU_CLK
no output
MHz
Adjust Regulators
3.3
Calibrate Antenna
Antenna trimming O
Firmware Upgrade
Upgrade was successful, please reconfigure the device before continuing
OK
>
0900030415180000
Direct command
[60]
>
AMSFirmwareUpdater.exe Exit Code: 0
austriamicrosystems
COM 5
AS3910