Application note

13.56 MHz RFID Reader IC

Getting started with AS3910 Demonstration Board

Demo board revision: A-V1.0

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1 Disclaimer

Please note that the provided reference design board, evaluation board, verification board or demonstration board (hereafter named "demonstration circuit board") are experimental printed circuit boards and are therefore intended for device demonstration and evaluation purposes only for semiconductor integrated circuits supplied by austriamicrosystems. The demonstration circuit boards are not production qualified. Device parameters measured with these demonstration circuit boards may not represent typical production test data.

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The demonstration circuit boards may be operated for demonstration or evaluation purposes in non-residential areas only. austriamicrosystems' understanding is that the customer's products using the semiconductor integrated circuits shall be designed in compliance with all applicable requirements of the appropriate regulatory agency (e.g. FCC, ETSI, CE, JQA, etc.) and will, upon testing and release, be in compliance with these regulatory requirements. Operation of the customer's products must not cause harmful interference and must accept any interference.

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.

28 A53910 Evaluation Suite	×
File View Help StartUp ISO 14443A ISO 14443B ISO 15693 NFCIP Advanced Debug MIFARE UL Demo Board Check	
austriamicrosystem	ns
Ready COM5 AS391	

Image: Signature State Image: Signature State File View Help	×
StartUp ISO 14443A ISO 14443B ISO 15693 NECP Advanced Debug MIFARE LU Demo Board Check	
08000304010000 [V1.1.0.5][PIC-v3-091217][Available][0E] >	
austriamicrosystem	ıs
Ready COM5 AS3910	

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).

AS3910 Evaluation Suite	
StartUp ISO 14443A ISO 14443B ISO 15693 NFCIP Advanced Debug MIFARE UL	
Demo Board Check Firmware Version V1.1.0.5	
Demo Board Version PIC-v3-091217 Antenna trimming Available	
Antenna Driver differential	
MCU_CLK no output MHz	
Adjust Regulators 3.3 V	
Calibrate Antenna Antenna state unknown	
08000304010000 [V1.1.0.5][PIC-v3-091217][Available][0E] > 0900030415160000 Direct command [E0] >	•
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ady Konta Ass	910 //

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).

AS3910 Evaluation Suite	×
StartUp ISO 144438 ISO 15693 NFCIP Advanced Debug MIFARE UL Demo Board Check Demo Board Information Firmware Version VI.1.0.5 Demo Board Version PIC-v9.3091217 Antenna Driver differential Antenna Driver differential Grystal Oscillator Z7.12 MHz Adjust Regulators 3.3 V Calbrate Antenna trimming OK Antenna trimming OK	
Direct command	
austriamicrosystem	าร
Ready COM5 AS391	1/1

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.

# A53910 Evaluation Suite File Now	
StartUp ISO 14443A ISO 14443B ISO 15693 NFCIP Advanced Debug MIFARE UL	1
Configuration	
REQA -> Active	
Transponder Info	
Frame Size - FSD 16 💌 bytes Card Identifier - CID 0	
HUTA Frame Size - FSC bytes	
RATS Data Rate Send - DS v kb/s Data Rate Receiver - DR v Kb/s	
FWI SFGI	
PP5	
Optional Support: no optional support detected	
DESELECT Historical bytes	
Change Send and Receive Data Rate	
Direct command [E0]	
> 0900030415180000	
Direct command [60]	
>	×
	austriamicrosystems
Ready	COM5 053910
nool	M33210

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.

😹 AS3910 Evaluation Suite File View Help						×
StartUp ISO 14443A ISC) 14443B ISO 15693 M	IFCIP Advanced	Debug MIFARE UL			1
Configuration						
REQA -> Active						
WUPA -> Active	Transponder Info					
	UID	04514EA9312280	UID complete, Transponder compliant wit	h ISO/IEC 14443-4		
	Frame Size - FSD	16 💌 bytes	Card Identifier - CID	0 💌		
HLTA	Frame Size - FSC	bytes				
RATS	Data Rate Send - DS	kb/s	Data Rate Receiver - DR	Kb/s		
	FWI		SFGI			
PPS	Optional Support: r	10 optional support detect	ted			
DESELECT	Historical bytes					
	Change Send and Receiv	ve Data Rate				
> 08000304A00000						
Configutation Demo Board for ISO > 09000304A1060000 ISO14443A Anticollision Sequence [4403](8804514E93)(24)(A931228	14443A 303A)[04514EA9312280][20]>					_
					all austr	iamicrosystems
Ready						COM 5 A53910

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.

避 AS3910 Evaluation Suite		X
File View Help		
StartUp ISO 14443A	ISO 144438 ISO 15693 NFCIP Advanced Debug MIFARE UL	
Configuration]	
REQB	number of slots 1	Advanced Configuration
WUPB		Additional Information Setting
HLTB	Frame Size - FSD 16 bytes Application Data	
ATTRIB	Frame Size - FSC bytes	
	Data Rate Send - DS 💌 kb/s Data Rate Receiver - DR 💌 Kb/s	
	FWI SFGI	
	Optional Support: no optional support detected	
DESELECT	MBLI	
>		
Configutation Demo Board I	or ISO14443A	
> 09000304A1060000 ISO14443A Anticollision Sec [4403](8804514E93)(24)(A	juence 93122803A)[04514EA9312280][20]>	-
		austriamicrosystems
Ready		COM 5 A53910 //

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.

2 AS3910 Evaluation Suite File View Help						_ 🗆 X
StartUp ISO 14443A	ISO 14443B ISO 15693	NFCIP Advanced	Debug MIFARE UL			
Configuration						
REQB	number of slots	1			Advanced Configuration	
WUPB	Transponder Info	061F6431	Transponder compliant wil	th ISO/IEC 14443-4	Additional Information Setting Modulation Index 10 %	
HLTB	Frame Size - FSD	32 v bytes	Application Data	20381933		
ATTRIB	Frame Size - FSC	32 bytes				
	Data Rate Send - DS	106 💌 kb/s	Data Rate Receiver - DR	106 💌 Kb/s		
	FWI	8	SFGI			
	Optional Support:	CID supported				
DESELECT	MBLI					
08000304B00000 Configutation Demo Board fo [80]	or I5O14443B					
> 08000304180500000000 Request mode [50061F6431203819330021	85]>					_
					austriamicros	vstems
Deadu					COME	052010

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.

M Modulation Depth	
Set Modulation Depth	AM Modulation level bits
Modulation Index 10 📩 % a/b 1.22222	

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.

File View Help	_ <u> </u>
StartUp ISO 14443A ISO 14443B ISO 15693 NFCIP Advanced Debug MIFARE UL	
Datarate: Modulation Index: Demodulation Type: Configuration 1 of 4, high datarate OOK AM	
Number of Slots: Inventory 16 Slot	
STAY QUIET Continuous Mode	
Get System Information Blocks Bits per Block	
READ BLOCK (single block command) Data	
Read Block (multiple block.command)	
WRITE BLOCK (single block command) Stop Continuous Mode	
08000304800000	
Configutation Demo Board for ISO144438 [80] > 0800030418050000000 Request mode Requ	
	•
	crosystems

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)

38 A53910 Evaluation Suite
StartUp ISO 144438 ISO 15693 NFCIP Advanced Debug MIFARE UL Datarate: Modulation Index: Demodulation Type: Configuration 1 of 4, high datarate OOK Aff Number of Slots: Inventory IS Stat Continuous STAY QUIET Transponder Info Adressing Mode E00401003DA18849 E00401003DA18849 SELECT AFI O DSFID O E00401003DA18849 E00401003DA18849 READ BLOCK (eingle block command) Blocks Bit Bit Bit Bit Bit WRITE BLOCK (eingle block command) WRITE BLOCK (eingle block command) Expected block command) Expected block command) Expected block command) Expected block command)
> >

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.

A53910 Evaluation Suite	
StartUp ISO 14443A ISO 15693 NFCIP Advanced Debug MIFARE UL Datarate: Modulation Index: Demodulation Type: Configuration 1 of 4, high datarate OOK AM	
Inventory 16 Slot Continuous STAY QUIET Transponder Info Adressing Mode	
UID E00401003DA18849 Select E00401003DA18849 SELECT AFI 00 DSFID 00	
Get System Information Blocks 28 Bits per Block 32 READ BLOCK (single block command) Block Image: Command c	
WRITE BLOCK (single block command) Stop Continuous Mode	
> 0D000304D4000002102B0000	
[000F4988A13D000104E000001B0301] > 0E000304D40001031020000000 [000000000] >	¥
ady adv	910 //

6.5 NFCIP tab

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

S A53910 Evaluation Suite			X
StartUp ISO 14443A ISO 14443B	ISO 15693 NFCIP Advanced Debug MIFARE UL		1
Configuration		 transmit as hex value transmit as string value 	
NIMbe NFC Transmit	r of bytes to transmit: 0		
Numb	er of bytes received: 0		
0D000304D4000002102B0000 [000F4988A13D000104E000001B0301] > psp00304D40001031020000000			
[000000000]			•
		aus aus	tria micro systems
Ready			COM 5 AS3910 //

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.

Image: Signal State Image: Signal State File View Help	
StartUp ISO 14443A ISO 14443B ISO 15693 NFCIP Advanced Debug MIFARE UL	1
Adjust Antenna Permanent Adjust Antenna Antenna Antenna Switches	
Automatic Antenna Trimming tri_3 C tri_2 C tri_1 tri_0 Antenna trimming OK Manual Antenna Trimming [tre_3 [tre_2 [tre_0	
Measure Antenna Permanent Measure Antenna	
Continous read request [90][00] > 08000304200000 [C9] [75] >	
austriamicrosyste	ms

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.

artUp ISO 14443A ISO 144	443B ISO 15693 NFCIP Advanced	d Debug MIFARE UL	
Configuration	Transponder Info		
	UID		
	Memory Content	Lock Description	
REQA -> Active	Page 0	Serial Number	
	Page 1	Serial Number	
	Page 2	Internal / Lock	
	Page 3		
	Page 5		
	Page 6		
-Memory Operation	Page 7		
C READ Data from Page	Page 8		
C WRITE Data to Page	Page 9		
C LOCK Page	Page 10		
Page 🚽	Page 11		
	Page 12	_	
Data	Page 13		
Everyte	Page 15		
Execute	1030 10		

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

2 A53910 Evaluation Suite File View Help		<u> </u>
File View Help StartUp ISO 14443A Configuration REQA -> Active Memory Operation © READ Data from Pa © WRITE Data to Pag © LOCK Page Page ALL Data	ISO 144438 ISO 15693 NFCIP Advanced Debug MIFARE UL Transponder Info UID 1933523A081660 Mifare UL transponder Memory Content Lock Description Page 0 Serial Number Page 1 Graduation Page 3 Graduation Page 4 Graduation Page 5 Graduation Page 6 Graduation Page 7 Graduation Page 8 Graduation Page 9 Graduation Page 10 Graduation Page 11 Graduation Page 12 Graduation Page 13 Graduation	
Execute 08000304A00000 Configutation Demo Board fo > 09000304A1070000 ISO14443A Anticollision Seq [4400](880483525D)(04)(3A	or ISO14443A AUBIC60AD)[0483523A0B1C80][00]>	tems

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.

SS A53910 Evaluation Suite				
StartUp ISO 14443A	ISO 14443B ISO 15693	NFCIP Advanced	Debug MIFARE UL	
Configuration REQA -> Active	Transponder Info	0483523A0B1C80 Memory Content 0483525D 3A0B1C80 AD487000 11223347 00000000 00000000	Mifare UL transponder Lock Description Serial Number Serial Number Internal / Lock OTP IV	
READ Data from Pag WRITE Data to Page LOCK Page Page ALL Data Execute	Page 7 Page 8 Page 9 Page 1 Page 1 Page 1 Page 1 Page 1 Page 1	00000000 12345678 00000000 100000000 100000000 200000000 300000000 400000000 512345678	User area	
[0000000000000000000000000000000000000	000000000]> 000000000]> 012345678]>			▲ ↓ ↓ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■

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).

88 A53910 Evaluation Suite File View Help			
StartUp ISO 14443A ISO 14443B Configuration Transport REQA -> Active Transport Memory Operation REQA -> Active READ Data from Page WRITE Data to Page LOCK Page LOCK Page Page 10 Data 12345678 Execute Execute	ISO 15693 NFCIP Advanced nder Info UID 0483523A081C80 Memory Content Page 0 0483525D Page 1 3A081C80 Page 2 AD487000 Page 3 11223347 Page 4 0000000 Page 5 0000000 Page 5 0000000 Page 5 0000000 Page 9 0000000 Page 9 0000000 Page 10 0000000 Page 11 0000000 Page 12 0000000 Page 13 0000000 Page 14 0000000 Page 14 0000000 Page 15 00000000 Page 15 0000000 Page 15 000000 Page 15 000000 Page 15 000000	Debug MIFARE UL Mifare UL transponder Lock Description Serial Number Serial Number Internal / Lock OTP V U User area User area U	
0A00030418300C0000 Request mode [000000000000000000000000000000]> 0E00030419A20A123456780000 Mifare LU. Request mode [A0]> Writing successful			■ ■ ■ ■ ■ ■ ■ ■

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.

避 AS3910 Evaluation Suite File View Help		
File View Help StartUp ISO 14443A ISO 14443B Configuration Transp REQA -> Active	ISO 15693 NFCIP Advanced Debug MIFARE UL onder Info UID 0483523A081C80 Mifare UL transponder Memory Content Lock Description Page 0 0483525D Serial Number Page 1 3A081C80 Serial Number Page 2 AD487000 I Internal / Lock Page 3 11223347 OTP	ier
Memory Operation C READ Data from Page C WRITE Data to Page C LOCK Page Page Data 12345678 Execute	Page 4 00000000 M Page 5 00000000 M Page 6 00000000 M Page 7 3801P - One Time Programmable Page 7 Carefully! After execution is page locked at Page 7 Carefully! After execution is page locked at Page 7 OK Cancel Page 7 OX Cancel Page 13 00000000 I Page 14 00000000 I Page 15 12345678 I	and becomes read-only
[0000000000000000000000000000000000000		austriamicrosystems

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

Imple	mented 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 ad- dress 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, pre- pare 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

Big A53910 Evaluation Suite File View Help	×
Settlp S0 14433 S0 15693 NFCP Advanced Debug MFARE LL Demo Board Check Image: Constraint of the state of the	
Direct command [E0] > 0900030415180000 Direct command [60] >	A
	austriamicrosystems

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

Big AS3910 Evaluation Suite File View Help	
StartUp ISO 144438 ISO 15693 NFCIP Advanced Debug MIFARE UL Demo Board Check Pero Board Information Firmware Version V1.1.0.5 Demo Board Version PIC-v3-091217 Antenna trimming Available Antenna Driver Additable Antenna Driver MHz Antenna Driver MHz MHz MHz	
> 0900030415180000 Direct command [60] > AMSFirmwareUpdater.exe Exit Code: 0	
	austriamicrosystems