



Application Note: AS3953-AN01 – Demoboard Description

AS3953

NFC interface IC (Tag Demokit)

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1. General Overview

This application note describes the AS3953 Tag Demo Kit and its usage. The purpose of the demonstrator is to show all the features and functionalities of the IC. The demo works with a reader (Phone or AS3911 GP demonstrator). The main features are:

- Demonstration of a file transfer with different datarates
- Demonstration of passive EEPROM programming via RF Field which then will be read out later when the board is connected and powered – demonstrating ISO14443A-4 compliance
- File and URL transfer (bidirectional) with an NFC phone – demonstrating framing mode

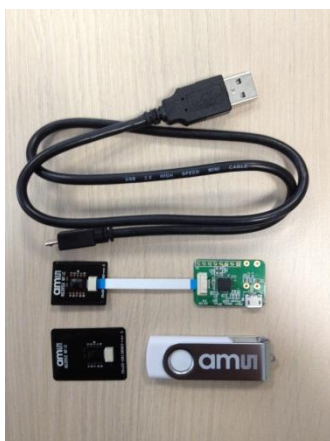
The Demo Kit allows you to supply all components by the PC USB Port. No external supply or battery is needed. Except the USB cable and the flex cable (included), no wiring is needed. This allows a fast and comfortable Demo of the AS3953.

1.1. Kit Content

The AS3953 Tag Demo Kit includes the following items:

- AS3953 Tags (two tags, 25 x 20 mm & 35 x 25 mm)
- Flex cable
- Controller Board with USB interface
- USB Cable
- USB Data Stick

Figure 1:
Package Content





1.2.Compatibility

This demo works with

- AS3953 GP GUI version 3.1.6.0 or higher and FW 3.1.6 or higher
- AS3911 GP GUI version 2.0.18.0 or higher and FW version 2.0.18 or higher
- Google Galaxy Nexus Phone (Android version 4.0 or higher)

2. Hardware Description

2.1.Demo Board Description

The AS3953 demo kit is comprised of 2 boards, the analog tag board and the controller board. The analog tags consist of the AS3953 and an coil antenna. There are the option to mount additional two matching component (one serial and one parallel) on these tags.

Attention: It is necessary to cut the line between the pads of the serial component foot print, if a component should be placed here.

The flex cable connector consists of 8 pins:

P1: VSS/GND

P2: /SS (active low)

P3: SCLK

P4: MOSI

P5: MISO

P6: IRQ

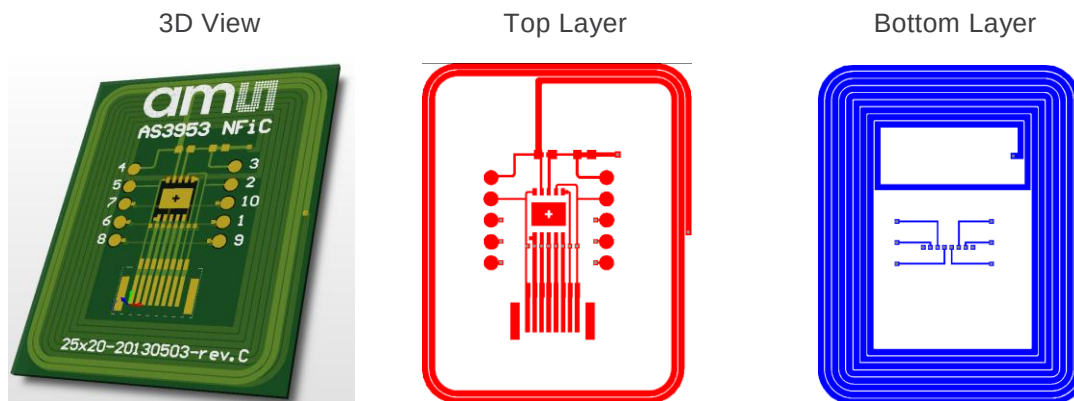
P7: VP_SPI

P8: VP_REG

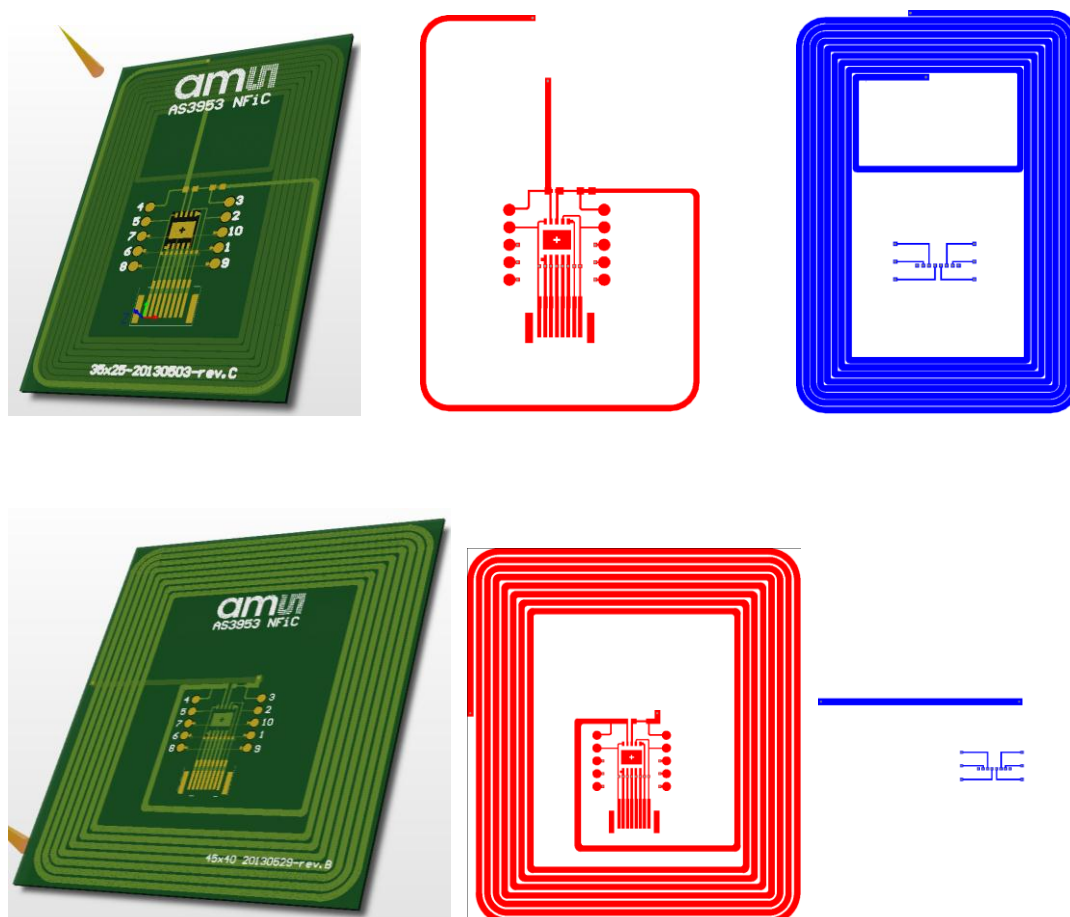
The controller board mainly consists of the USB connector, PIC27FJ64GB002 and a 8MHz crystal. The board is powered by USB. The above mentioned construct allows:

1. Optional possibility to add another antenna PCB on top
2. a provision to disconnect the on-board micro and connect another micro for the development purpose
3. harvested power measurement with the VP_REG - and GND - pins.

2.1.1. Analog Tag Board Layout (Typical)



The above pictures show the tag with the dimension 25 x 20 mm. Two bigger tags are also available (35 x 25 mm; 45 x 40 mm):

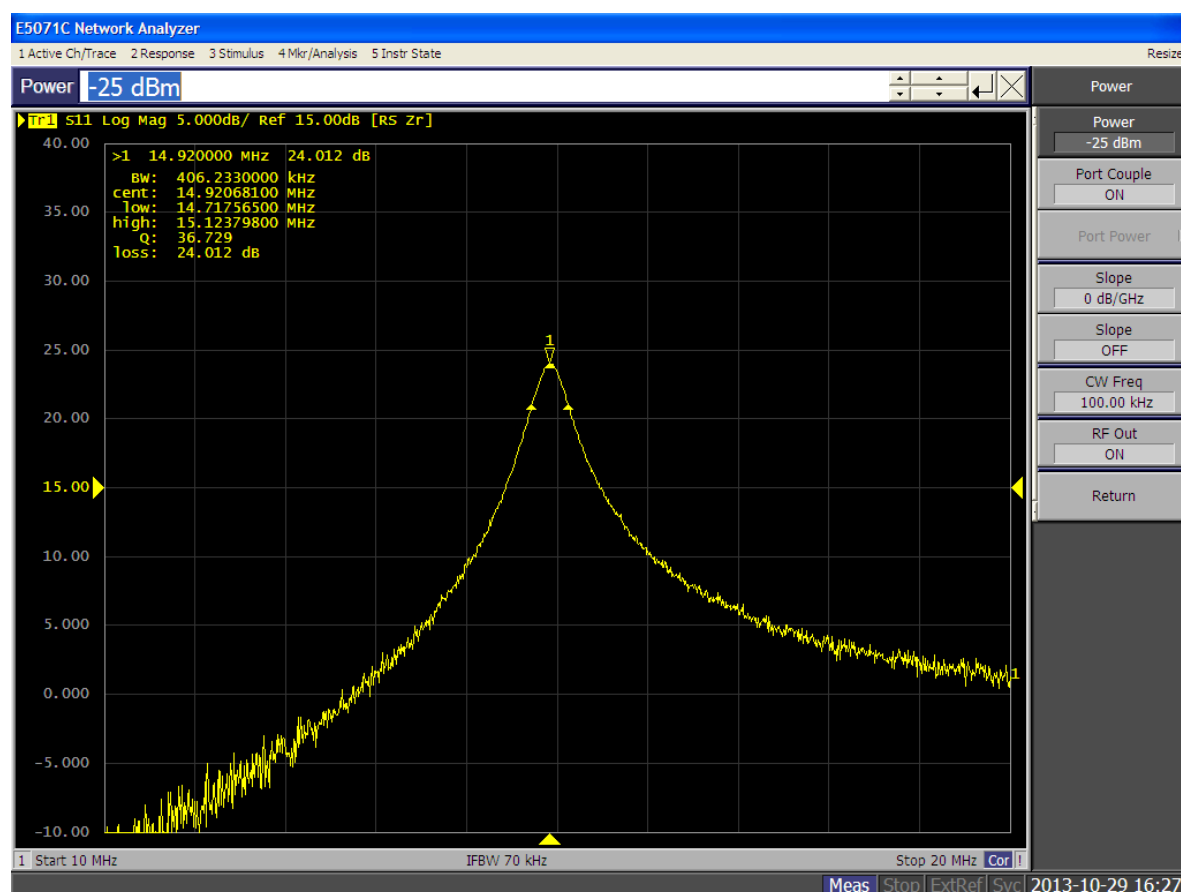


2.1.1.1. Antenna characterization

Tag form factor [mm]	Resonance frequ.@ low power [MHz]	Resonance frequ.@ high power [MHz]	Antenna Q – Factor	System Q - Factor
25 x 20	14,9	14,2	37	14
35 x 25	15	14,2	35	15
45 x 40	15,1	14,2	65	20

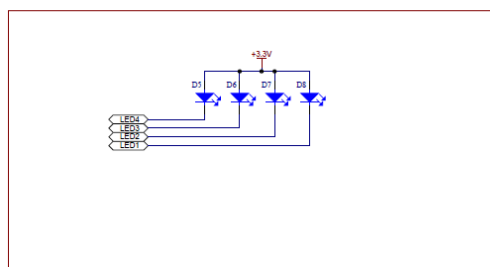
Typical measurement results:

Antenna Q – Factor of Tag 25 x 20 mm



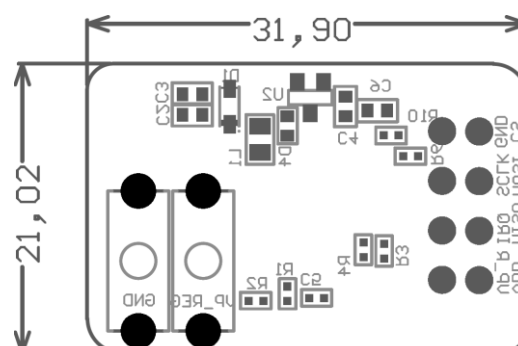
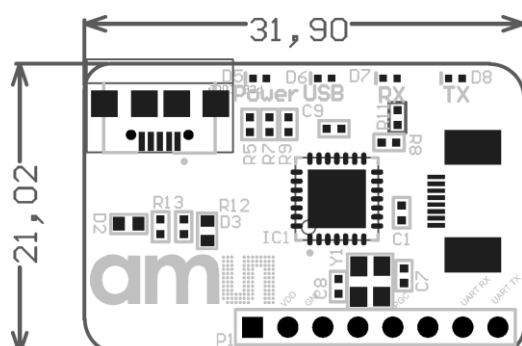
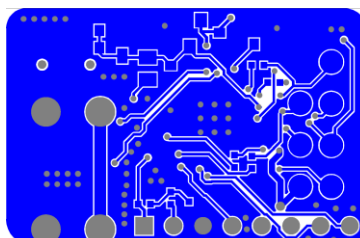
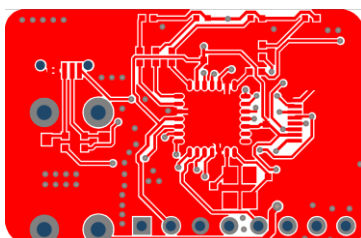
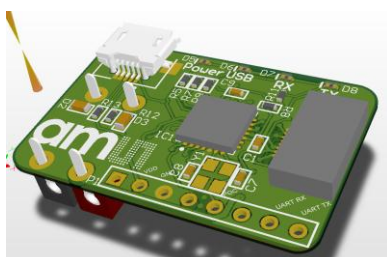
Power Supply

The diagram illustrates the power supply circuit. It features two voltage regulators: a 5V regulator (U1) and a 3.3V regulator (U2). The 5V regulator is connected to the USB_PWR pin and has an input capacitor C1 (100nF) and an output capacitor C2 (100nF). The 3.3V regulator is connected to the 5V output of the first regulator and has an input capacitor C3 (100nF) and an output capacitor C4 (100nF). The output of the 3.3V regulator is labeled +3.3V.



The diagram shows a PIC24FJ64GB002 microcontroller (IC1) interfaced with an EP1210 Connector (TP1) and a 7-segment display (T1). The microcontroller is powered by a +3.3V supply (VDD) and ground (VSS). It has a 10k pull-up resistor (R1) on the MCLR pin (pin 26) and a 10nF capacitor (C1) on the VDD pin (pin 10). The microcontroller is connected to the EP1210 Connector via a 470Ω resistor (R2) on the MCLR pin (pin 26) and a 10k pull-up resistor (R1) on the VDD pin (pin 10). The microcontroller is also connected to the 7-segment display (T1) via a 470Ω resistor (R3) on the MCLR pin (pin 26) and a 10k pull-up resistor (R1) on the VDD pin (pin 10). The 7-segment display is powered by a +3.3V supply (VDD) and ground (VSS). The display has a 10k pull-up resistor (R1) on the MCLR pin (pin 26) and a 10nF capacitor (C1) on the VDD pin (pin 10). The display is connected to the microcontroller via a 470Ω resistor (R2) on the MCLR pin (pin 26) and a 10k pull-up resistor (R1) on the VDD pin (pin 10). The display is also connected to the microcontroller via a 470Ω resistor (R3) on the MCLR pin (pin 26) and a 10k pull-up resistor (R1) on the VDD pin (pin 10).

Bottom Layer



2.2.BOM

2.2.1. Controller board

Bill of Materials			AS3953 Controller Board Small			
Company:			ams AG			
Originator:			mram			
PCB Name:			AS3953 Controller Board Small			
PCB Version:			1.0			
Report Date:			22.02.2013			
#	Designator	Comment	Component_Description	Manufacturer	Manufacturer Part Number	Quantity
1	*1	89212_Connector	TE CONNECTIVITY / AMP -	TE CONNECTIVITY / AMP	1734592-8	
2	BU1, BU2	Banana_Socket_THMD	HIRSCHMANN TEST AND	HIRSCHMANN TEST AND	PB4 BLACK, PB4 RED	
3	C1, C9	100n	MULTICOMP - MCCA000512	MULTICOMP	MCCA000512	
4	C2, C6	10u	TDK -	TDK	C1608X5R1A106K080AC	
5	C3, C4	1u	KEMET -	KEMET	C0603C105K9RACTU	
6	C5	10n	MULTICOMP - MCCA000040	MULTICOMP	MCCA000040	
7	C7, C8	18p	MULTICOMP - MCCA000097	MULTICOMP	MCCA000097	
8	D1	Zener	ON SEMICONDUCTOR -	ON SEMICONDUCTOR	MM3Z6V8T1G	
9	D2, D3, D4	24V	COOPER BUSSMANN -	COOPER BUSSMANN	0603ESDA-TR1	
10	D5, D6, D7, D8	LED_LUMEX	LED BLUE 470NM WTR	Kingbright Corp	APHHS1005QBCD	
11	IC1	PIC24FJ64GB002	MICROCHIP -	MICROCHIP	PIC24FJ64GB002-VMIL	
12	L1	Ferritbeat	FAIR-RITE - 2508051107Y0	FAIR-RITE	2508051107Y0	
13	P1	dnp				
14	R1	10k	TE CONNECTIVITY -	TE CONNECTIVITY	CRG0402J10K	
15	R2, R3, R4, R5, R6, R7, R8, R9, R12, R13	470	MULTICOMP -	MULTICOMP	MCMR04X4700FTL	
16		27R	YAGEO (PHYCOMP) -	YAGEO (PHYCOMP)	RC0402FR-0727RL	
17	TP1, TP2, TP3, TP4, TP5, TP6	Testpoint				
18	U1	USB_Micro_AB	CONN RCPT MICRO USB AB	Hirose Electric Co Ltd	ZX62-AB-5PA(11)	
19	U2	AS1360-33	IC REG LDO 3.3V .15A	ams	AS1360-33-T	
20	Y1	12MHz	TXC - 7M-12.000MAAJ-T	TXC	7M-12.000MAAJ-T	
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3. Software Description

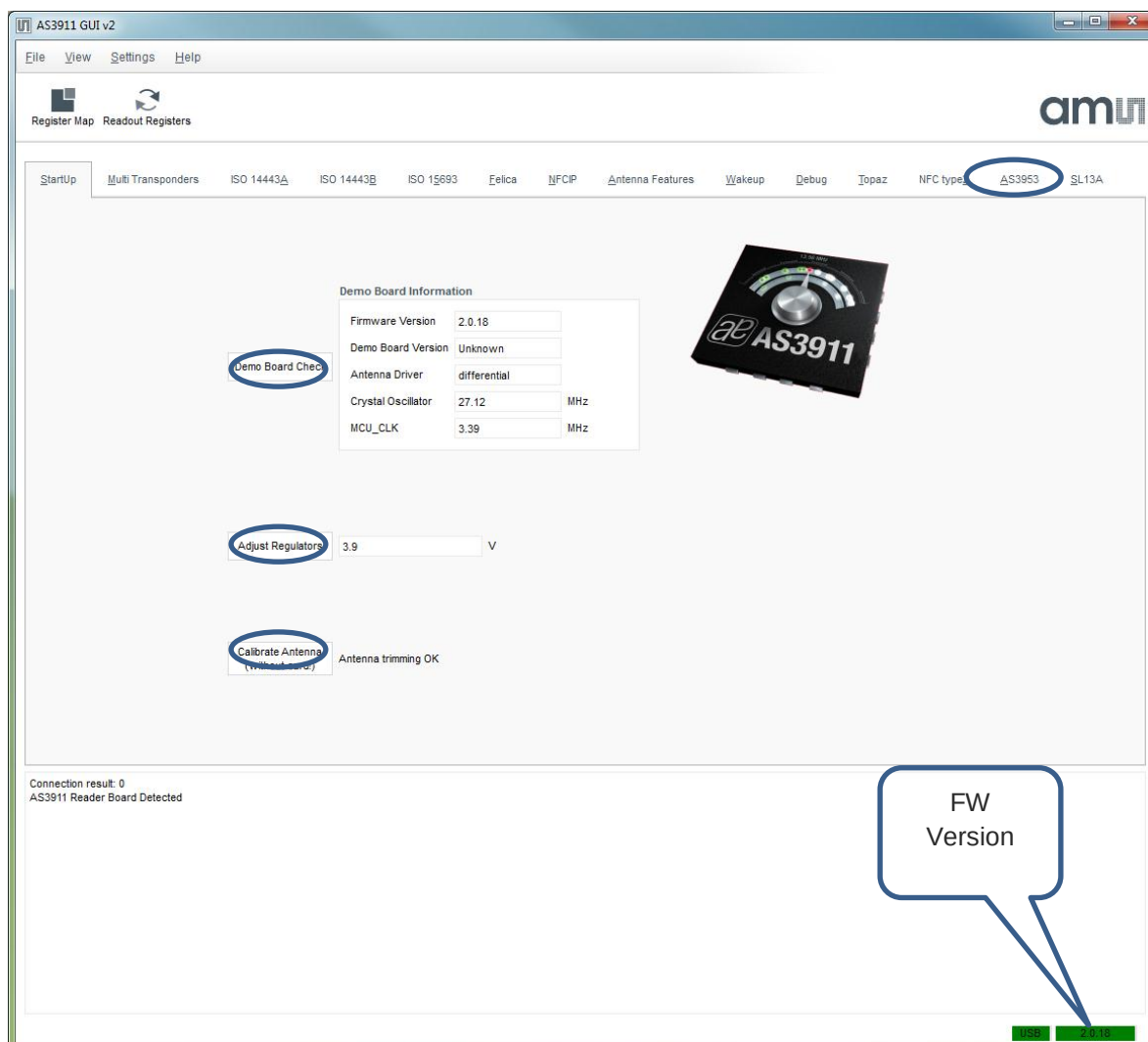
AS3953 demo kit behaves like a 14443A-4 Tag. It can be used with AS3911 GP board (Reader) or a standard NFC phone. We have defined Google Galaxy Nexus as our reference mobile phone (Android version 4.0 or higher).

The SW can be downloaded from the following destinations:

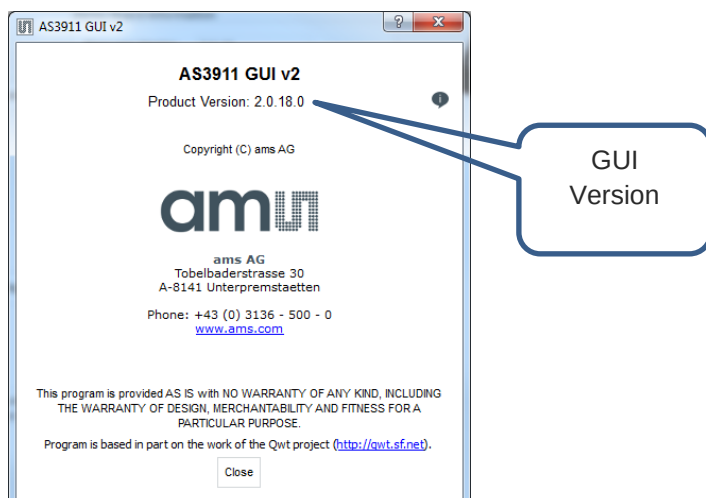
	Software download to:	FTP side	User	password
AS3911G P_GUI	General Purpose Demo GUI	http://www.space4ams.at/user/AS3911GP_GUI/default.php	GPgui	hgewdt3
AS3953 GUI	General purpose	http://www.space4ams.at/user/AS3953_GUI/default.php	as3953_gui	rtvzi3

3.1.Demonstration with AS3953 & AS3911

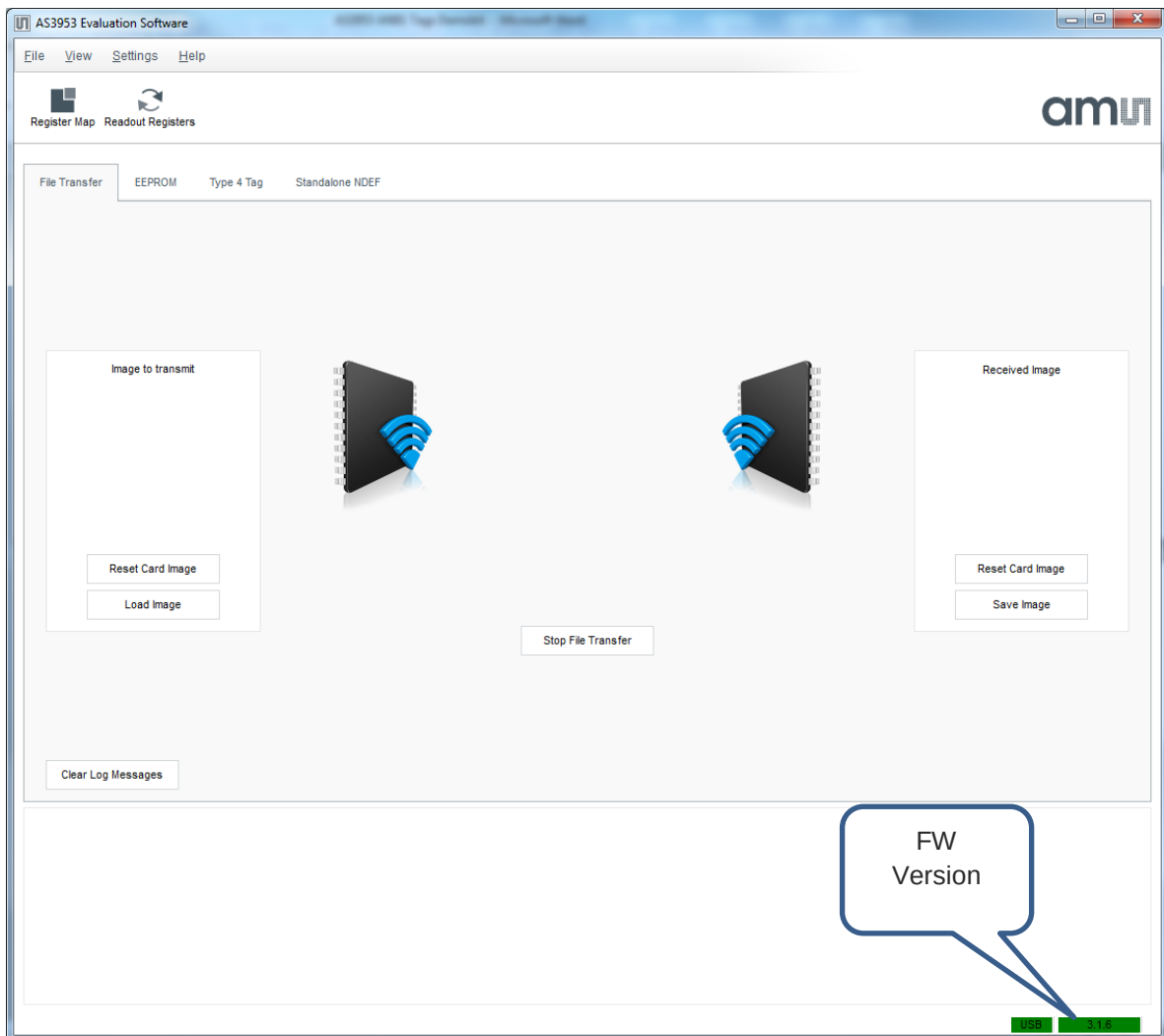
- Connect AS3911 GP demo and AS3953 GP demo with the USB to the computer and start the respective GUIs
- AS3911 FW version must be 2.0.18 or higher
- Click on “Demo Board Check”, “Adjust Regulator” and “Calibrate Antenna” to configure the board.



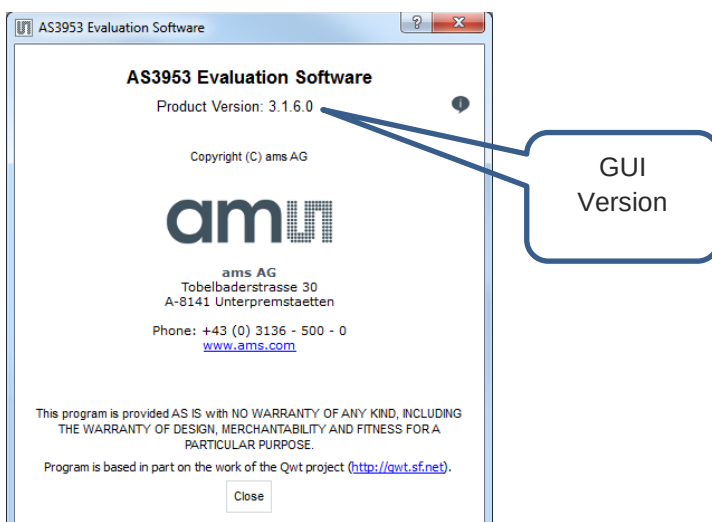
- AS3911 GUI version must be 2.0.18.0 or higher



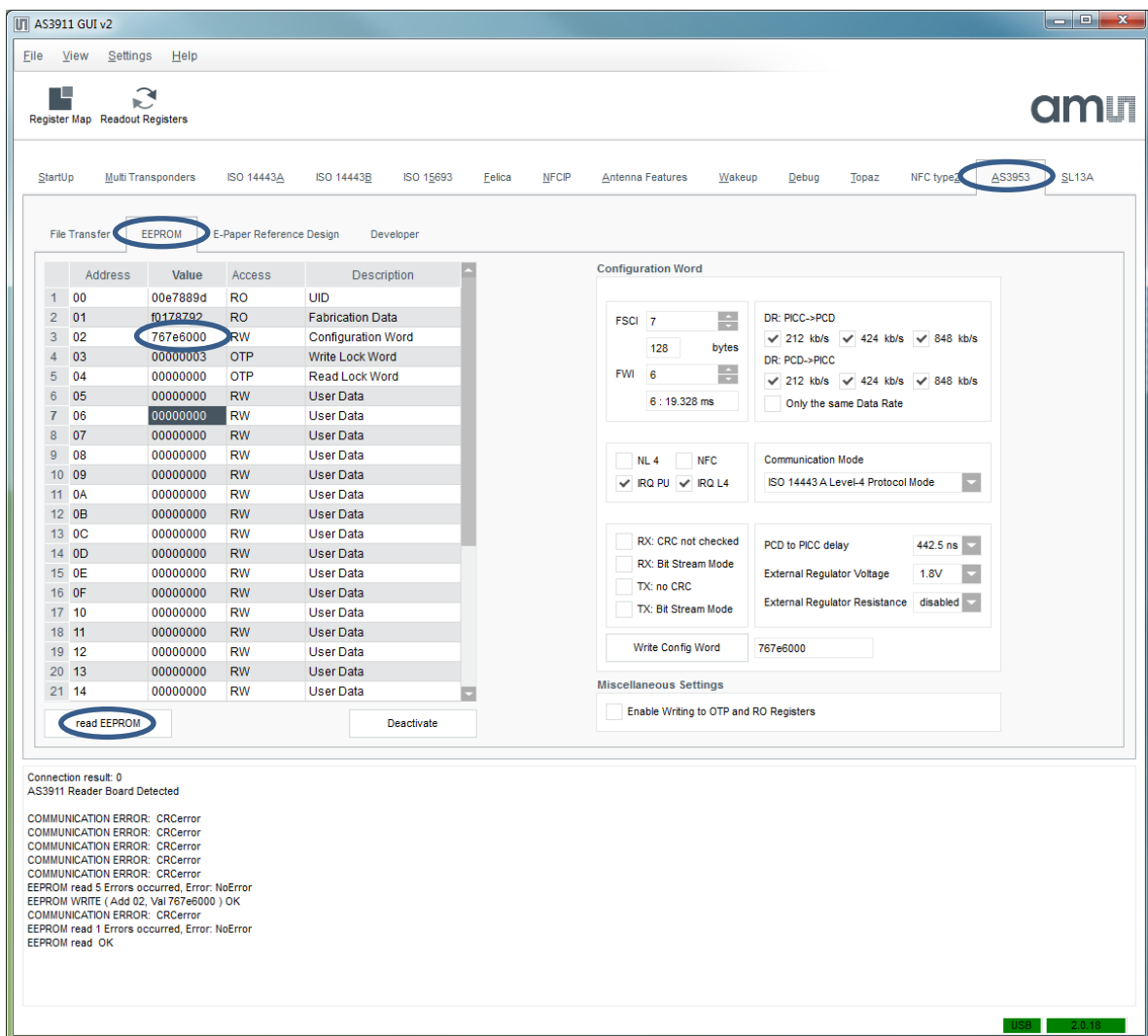
- AS3953 FW version must be 3.1.6 or higher



- AS3953 GUI version must be 3.1.6.0 or higher

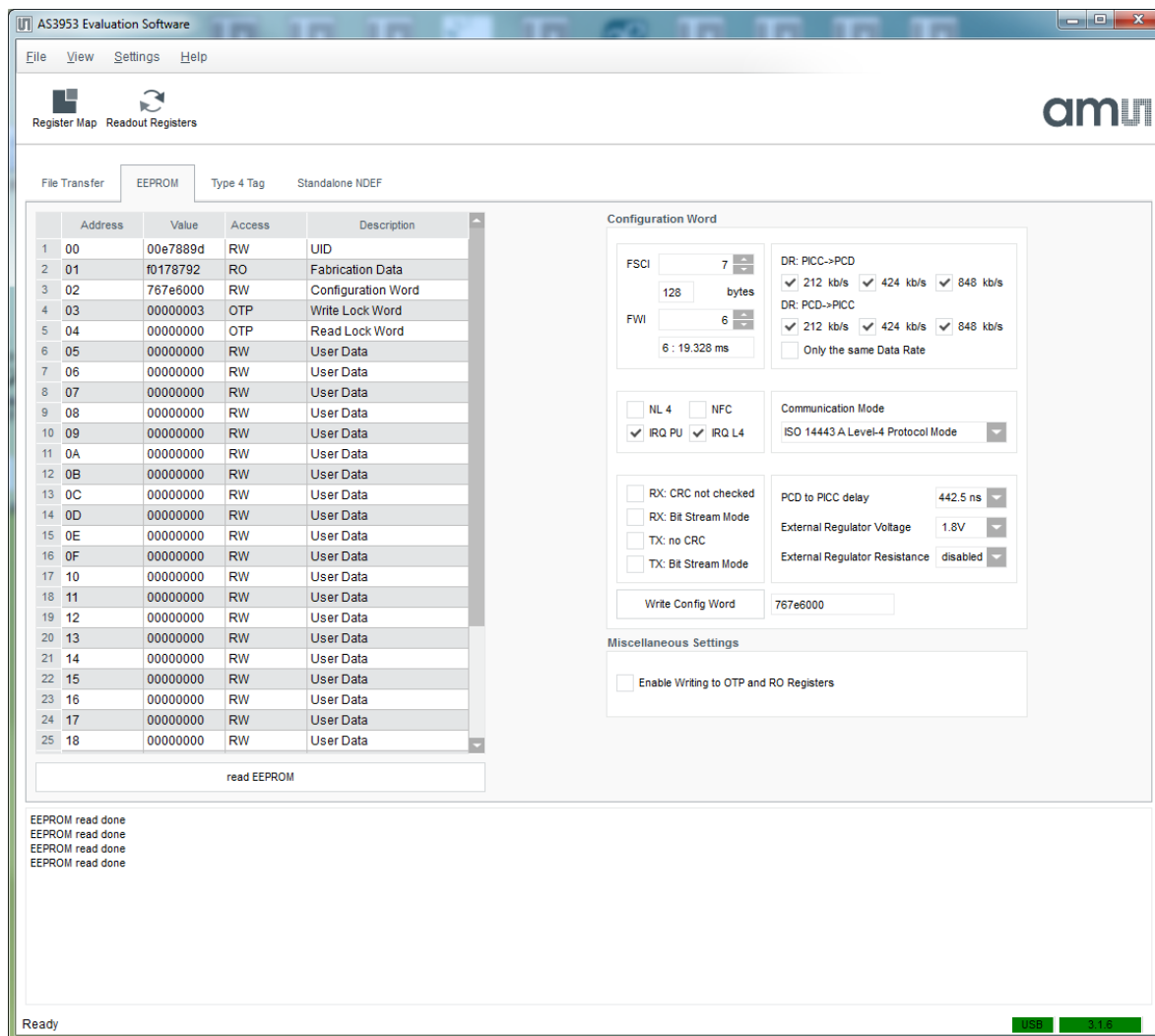


- To transmit from AS3911 (Reader) to AS3953(NFiC):
On AS3911 GUI select “load image”, select “speed settings” and click on “Write to Card” to execute the file transfer. NOTE: do not forget to keep the AS3953 antenna on AS3911 antenna.
- To transmit from AS3953(NFiC) to AS3911 (Reader):
On AS3953 GUI select “load Image”. On AS3911 GUI, select “speed settings” and click on “Read from Card” to execute the file transfer.
- EEPROM Read/write (from RF Field):
This can be done passively. Disconnect the analog tag board from the controller board so that it is not powered. Place it on the top of the AS3911. Use the GUI sub-tab in the AS3953 tab of AS3911 GUI. Click on “Read EEPROM” and see the config bit changing. The EEPROM can be written by just changing the values here. NOTE: be aware of the effects while writing address 3 and 4.



- EEPROM Read/write (from MCU):

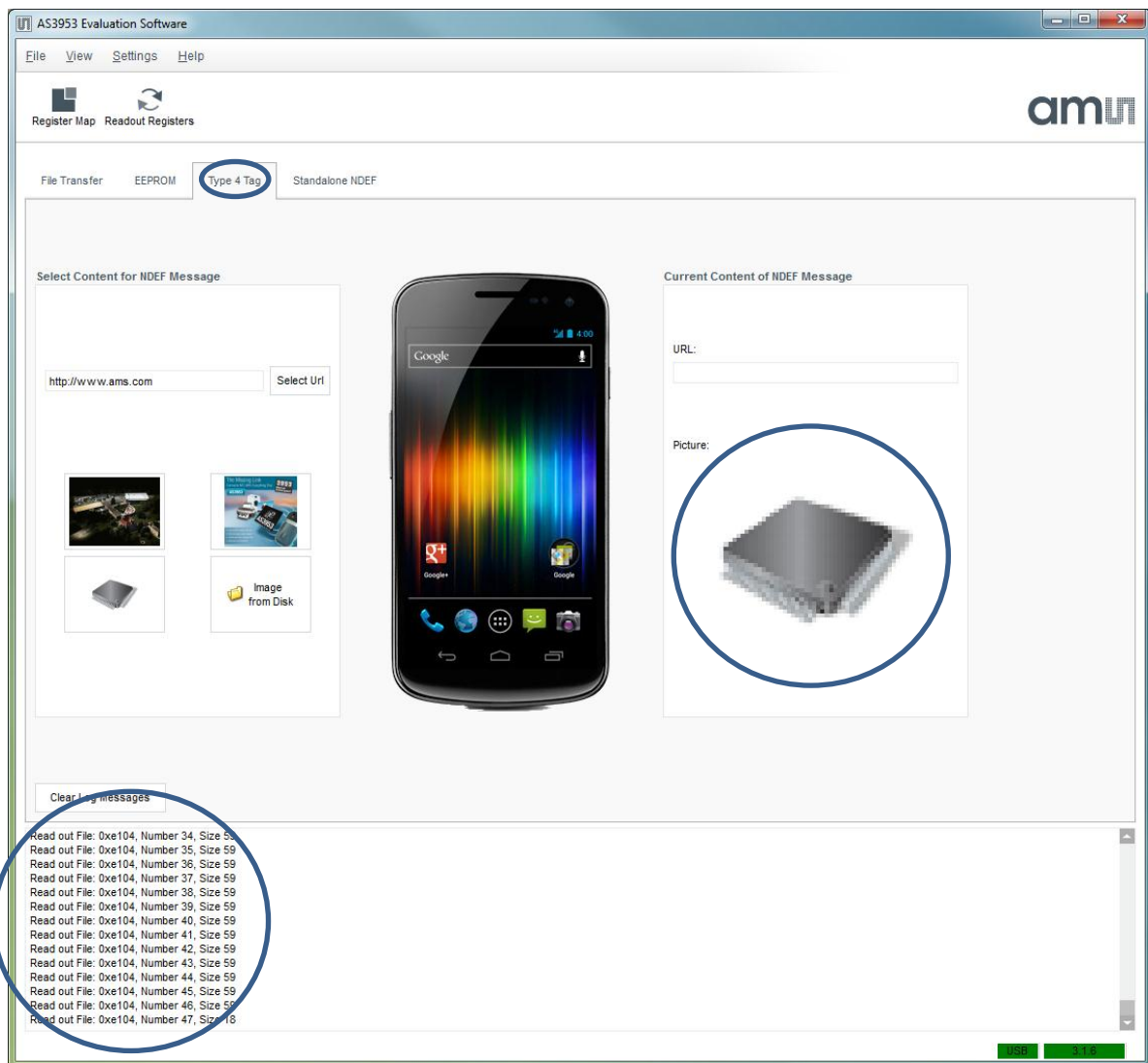
Now connect this Analog tab board to the controller board and connect it to the GUI via USB. The EEPROM tab in the AS3953 GUI can be used to read/write out the EEPROM content when the AS3953 is not in the field.



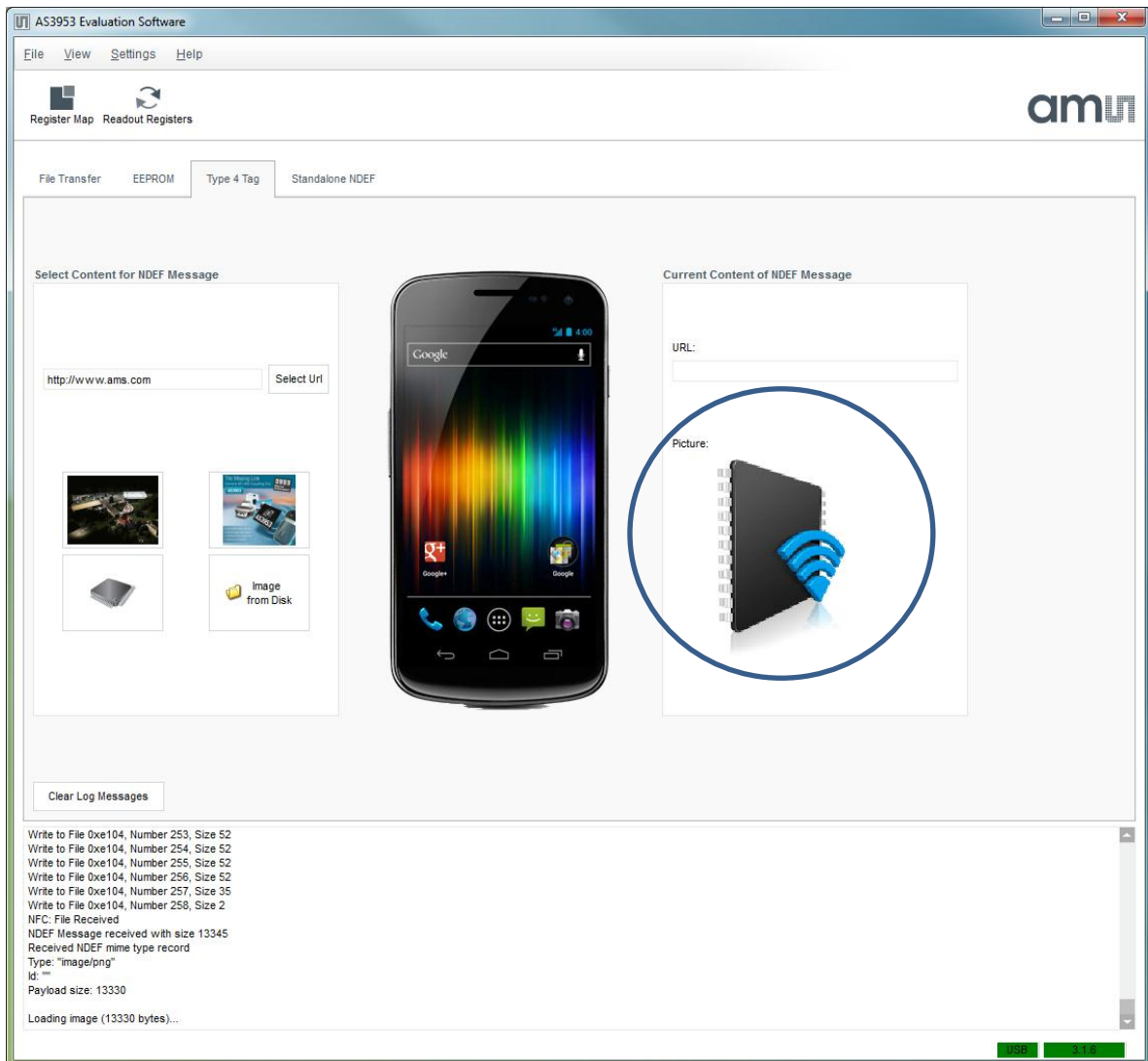
3.2.Demonstration with AS3953 & NFC phone (Android 4.0 onwards)

The NFC FW in the PIC MCU has been written such that it sends and receives the NDEF messages. Hence no special app is required to send a message to a standard NFC phone. Nevertheless, we have developed an app to send info from phone to the AS3953 GP demo.

- Move to Type 4 Tag tab in the AS3953 GUI and install the provided android app on the NFC phone.
- File/URL Transfer from GUI to Phone:
Select an image or URL which needs to be transferred to phone. Selected option should show up in the right side of the GUI. Now just unlock the phone and place it on the AS3953 GP demo antenna. Note: The filesize is limited to 64Kbit (limited by NDEF message framework)



- **File/URL Transfer from GUI to Phone:**
open the amsNFC app and click on “Transfer Image” or “Transfer URL”. Select an image or URL respectively and place the phone on the AS3953 GP demo antenna. The file transfer starts automatically.



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