

RFID Application Kit ATAK2270

User Manual





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1.1 RFID Products Promoted by ATAK2270 Kit

The RFID application kit (ordering code ATAK2270) promotes the key features of various RFID products from Atmel®.

The following products are supported by the kit:

- U2270B Read/write base station IC
- TK5530/e5530 Read-only transponder
- TK5551 Standard read/write transponder
- TK5552/T5552 Read/write transponder micromodule with 1-Kbit memory
- T5557/ATA5567 Multifunctional read/write transponder
- ATA5570 Multifunctional read/write transponder with sensor input
- ATA5577 Enhanced read/write transponder

1.2 Included Hardware Components

- Microcontroller board with piggybacked antenna board
- Reader antenna coil 100 mm \varnothing , L = 700 μ H, Q = 36
- Serial communication cable RS232
- Jack connector cable for power supply
- Power supply 120V to 240V
- Installation software and documentation on CD-ROM
- *Atmel Standard Products* CD-ROM
- IC samples (3 pieces of each): U2270B-MFP; TK5530-HM232-PP; TK5551M-PP; TK5552A-PP; T555711-TAS; T555715-PAE; ATA556711-TAS; ATA556715-PAE; ATA5570-TAS; ATA5577Mxxx-xx; ISO Card ATA556715-PAE; Coin Tag ATA556715-PAE
- Transponder SMD antenna coil SDTR 1103, 4.77 mH, Q = 25 (Manufacturer: Predan)
- Transponder test board ATAB5570 with sensor input

1.3 Equipment Needed

- Host PC with Windows® 95 or higher



Section 2

Getting Started

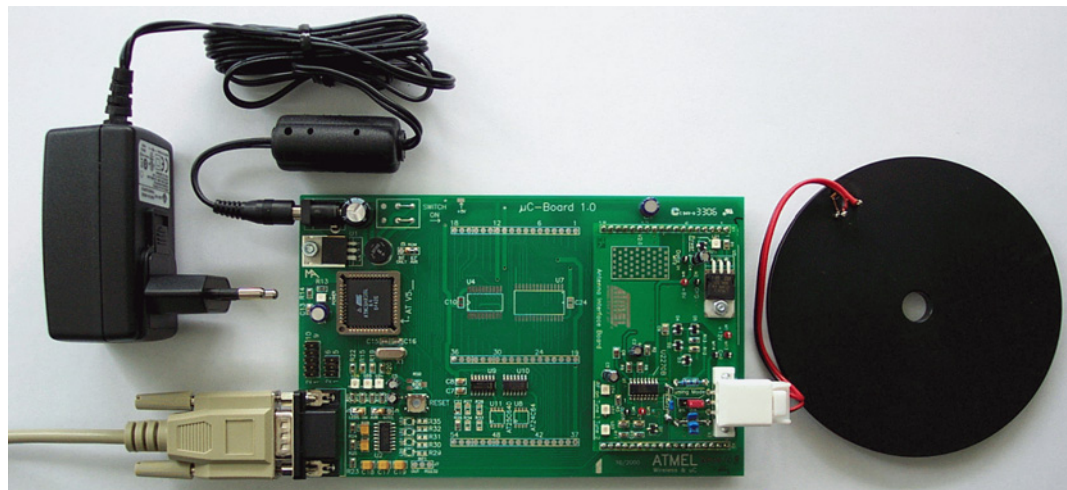
Build up the RFID reader application system according to the configuration shown on the cover and in [Figure 2-1](#):

1. Plug the antenna into the socket of the interface board.
2. Connect a serial RS232 cable between the RS232 connector and either COM1 or COM2 of the PC.
3. Connect the supply line from the 12V power source to the jack connector. Alternatively use the mains SMPS.

2.1 Hardware Settings and Connector Positions

The main board with the AVR[®] ATmega8515L controls piggybacked reader interface and maintains the communication with the host. On delivery the AVR is flashed with the current firmware and does not need any special programming or settings. Check that jumper J3 on the antenna interface is in the default position *en*.

Figure 2-1. Application Board Unit



Getting Started

Figure 2-2. Antenna Interface Board

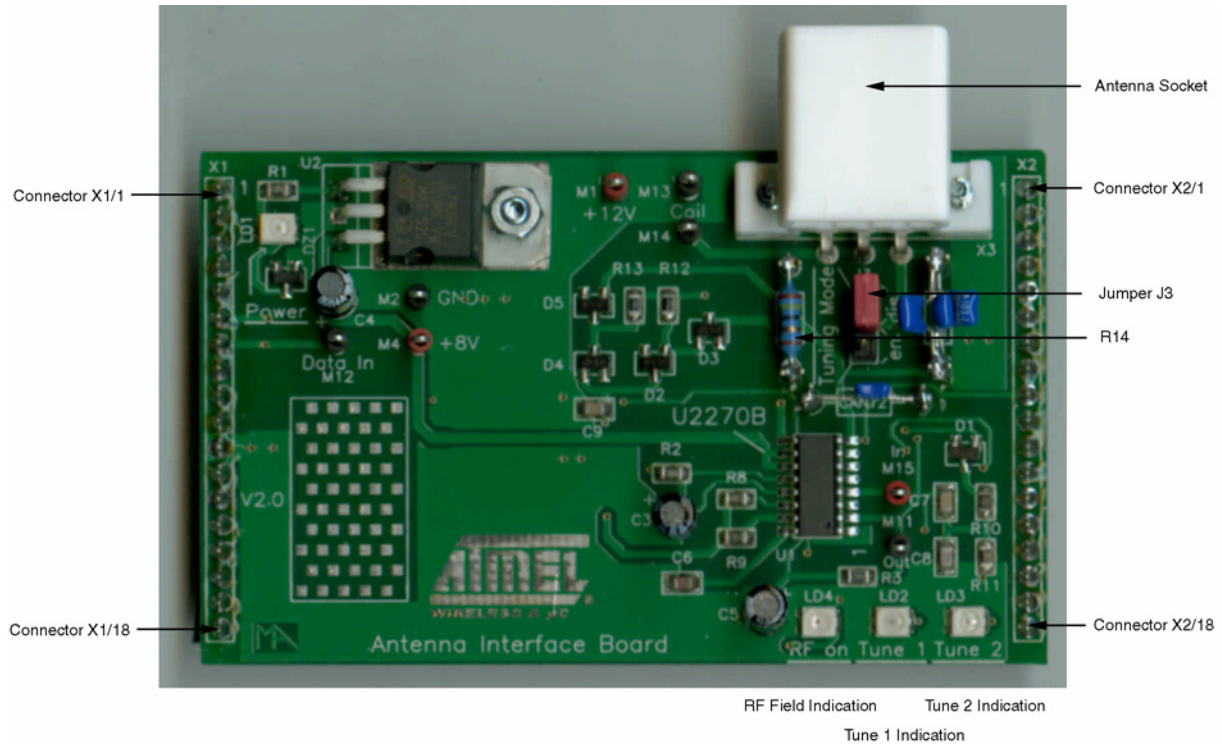
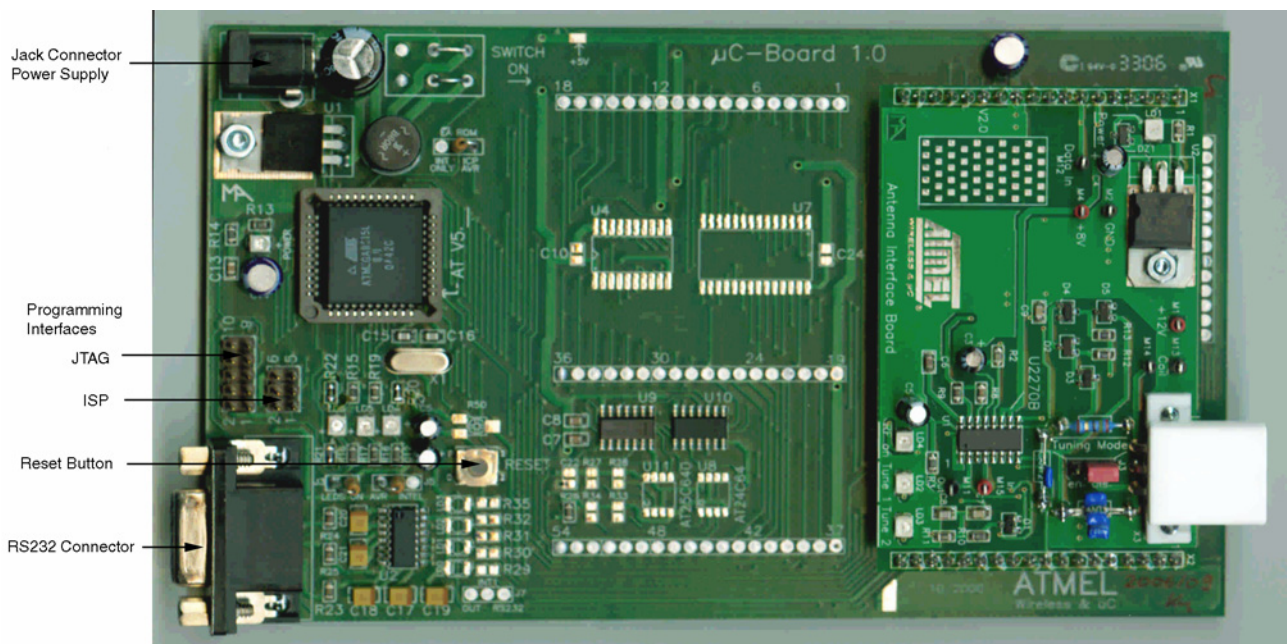


Figure 2-3. Application Board Top View



2.2 Software Installation

The ATAK2270 host installation software as well as the related datasheets and documentation are provided by the CD-ROM included in the kit. Furthermore, the up-to-date software and documentation are available via the web.

Execute the setup.exe file found on the CD-ROM to launch the installation and generate the ATAK2270.exe program file. If the default settings are accepted during installation, the program file will be installed to path: X:\Programme\ATAK2270\ATAK2270.exe.

Note: Administrator rights are required to install this software.

2.2.1 AVR Programming Guide

The AVR base board (Figure 2-3) is equipped with two programming interfaces, ISP and JTAG allowing reprogramming or updating the firmware of AVR flash memory.

ISP is a downloading method. Only six I/O lines are needed. The provided header works with the ATSTK500 as well as the AVR ISP In-System Programmer. Both of these are available from Atmel or distributors for very low cost program development. To program the flash memory and the EEPROM, first connect the programming tool to the MB using a six-pin ribbon connector. Make sure that proper orientation is maintained by aligning pin1. The files types accepted use Intel Hex format.

To program a hex file into the target AVR device, select “Program AVR” and then “Connect...” from the “Tools” menu in AVR Studio. Once AVR Studio has been opened, connect to the STK500 or AVRISP by selecting “STK500 or AVRISP” in the Platform List. Then select “Connect...”. The driver for the STK500 and AVRISP is then started, and the STK500 dialog should appear. Note that the system supports other programming platforms as well, like the JTAGICE or the JTAGICE mkII.

Then select the AVR target device from the pull-down menu on the “Program” tab and locate the Intel-hex file to download. Select the “program” button. Repeat for the EEPROM section.

The same steps apply when using the JTAGICE MKII.

The JTAG Platform allows more control during software development by allowing real-time debugging of the source code. The JTAGICE MKII supports setting breakpoints and stepping through the code being executed on the target micro. This is very useful for a more complex software project such as this one.

Fuse Settings:

Fuse bits must be set properly for the kit to function. The only fuse bits that should be set are listed below.

- JTAG Interface Enabled; (JTAGEN = 0)
- Serial program downloading (SPI) enabled; (SPIEN = 0)
- Boot Flash section size = 512 words Boot start address = \$FE00; (BOOTSZ = 11)
- Brown-out detection level at VCC = 2.7V; (BODLEVEL = 1)
- Int. RC OSC. 8MHz; Start-up time; 6CK + 64 ms; (CKSEL = 0100 SUT = 10)

All others should be unchecked.



Description of the Application Board System

3.1 System Overview

The ATAK2270 application board unit ([Figure 2-3](#)) consists of a ready-to-run standard microcontroller main board equipped with the Atmel AVR[®] microcontroller ATmega8515L, combined with a piggybacked antenna interface board containing the U2270B reader IC.

The following functionality is controlled by the AVR microcontroller:

- Handling of the bi-directional data communication between the RS232 interface and the host PC
- Execution of the read and write commands to be sent to the antenna interface
- Decoding of the specific read data delivered by the antenna interface

The source program is written in C, and the compiled hex code is loaded in the 8-kByte Flash of the microcontroller.

3.2 Power Supply

To operate the reader board, an external power supply in the range of DC 10V to 15V/200 mA has to be connected to the jack, alternatively use the mains SMPS. A bridge rectifier placed at the connector input is used for polarity independence.

3.3 Antenna Interface

The antenna interface ([Figure 2-2](#)) is supplied and controlled by the main board via header pin X2/1. The current power supply voltage is indicated by LED1, *Power*. To adapt a specific antenna coil to the resonant frequency and the Q factor, the components CANT1/CANT2 and R14 ([Figure 2-2](#)) can be changed. For the antenna included in the kit, the parameters are matched as follows:

Resonant frequency: $f_{\text{res}} = 125 \text{ kHz} \pm 1\%$, adjusted by CANT1/CANT2 with jumper 3 in position *dis*

Whole antenna quality factor: $Q = 20$, adjusted by R14

3.3.1 Frequency Tuning Mode Selection

The reader interface has a built-in frequency tuning feature. By the host software, the resonant frequency of the LC antenna circuit can be switched in four steps. Therefore the board is equipped with two stages of high-voltage transistor switches to tune the resonator via switched capacitors.

Table 3-1. The Frequency Tuning Can Be Selected Using Jumper J3

Tuning Mode	Jumper J3 Position
Disabled	1-2
Enabled	2-3

In default setting *Tuning Mode* is activated, allowing the adjusting of antenna frequency by host menu. The binary control of the two tuning stages enables the selection of one out of four frequency states. According to the menu definition the frequency steps are designated as follows:

<i>High Frequency</i>	134.2 kHz (acc. ISO11784/85)
<i>Semi High Frequency</i>	130 kHz
<i>Semi Low Frequency</i>	125 kHz
<i>Low Frequency</i>	121 kHz

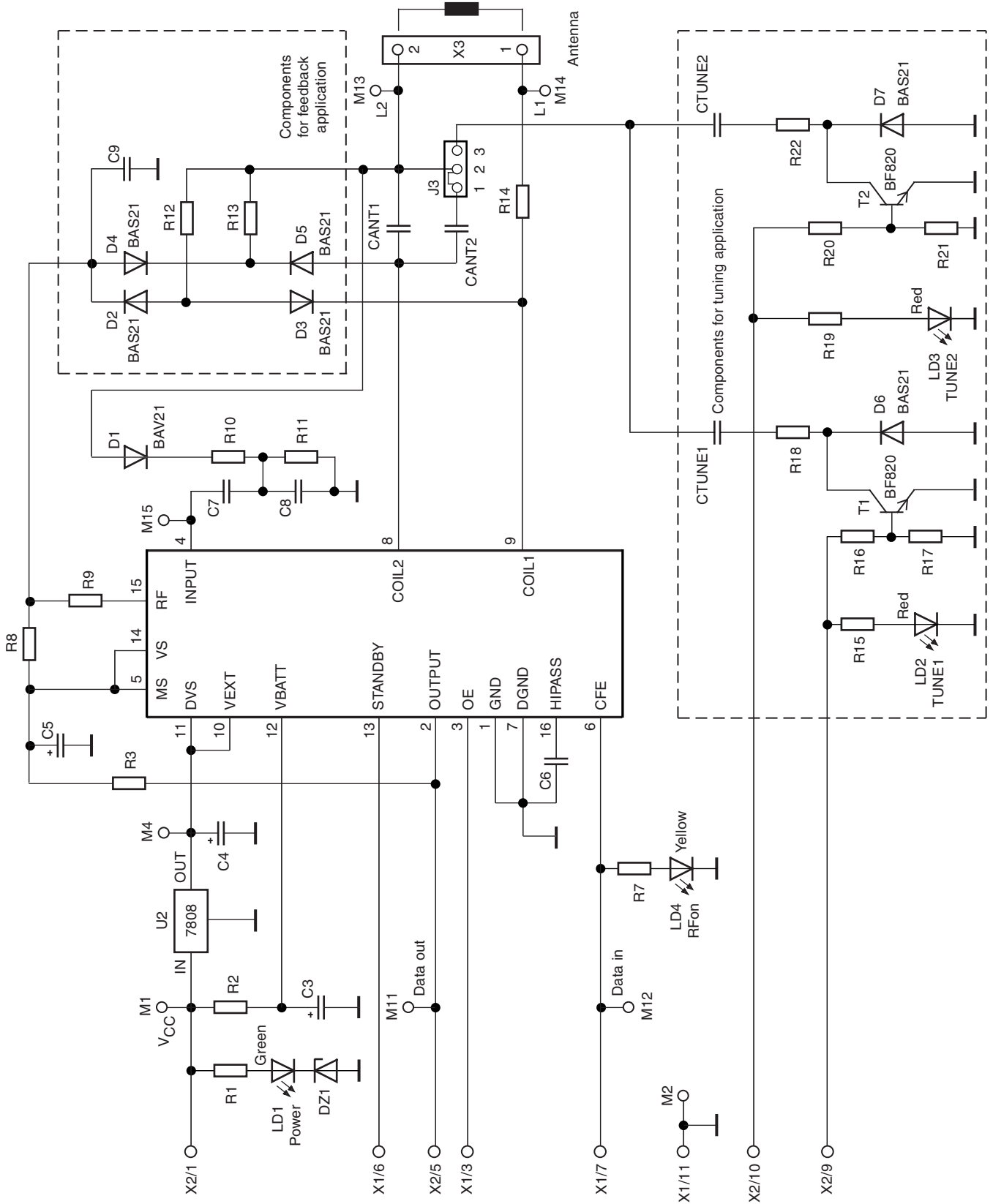
In disabled mode, the interface operates with the fixed frequency adjusted typically to 125 kHz.

The currently selected frequency stage is displayed on the application board by the red LEDs *Tune 1* and *Tune 2* (shown in [Figure 2-2](#), see [Table 5-1](#) for interpretation).

3.3.2 RF Field Control

The status of the RF field controlled by the microcontroller is indicated by the yellow LED *RF on*.

Figure 3-1. Circuit Diagram of the Antenna Interface



Description of the Application Board System

3.3.3 Antenna Interface Parts List

U1	U2270 B	SO16
U2	LM7808	TO220

3.3.3.1 Diodes

D1	BAS21	SOT23	
D2	BAS21	SOT23	
D3	BAS21	SOT23	
D4	BAS21	SOT23	
D5	BAS21	SOT23	
D6	BAS21	SOT23	
D7	BAS21	SOT23	
DZ1	BZX84C	5.6V	SOT23

3.3.3.2 LEDs

LD1	TLMC3100 (green)	PLCC2
LD2	TLMT3100 (red)	PLCC2
LD3	TLMT3100 (red)	PLCC2
LD4	TLMA3100 (yellow)	PLCC2

3.3.3.3 Transistors

T1	BF820	SOT23
T2	BF820	SOT23

3.3.3.4 Resistors

R1	3.6 k Ω	0805
R2	360 Ω	0805
R3	10 k Ω	0805
R7	1 k Ω	0805
R8	68 k Ω	0805
R9	43 k Ω	0805
R10	1 k Ω	0805
R11	390 k Ω	0805
R12	75 k Ω	0805
R13	100 k Ω	0805
R14	24 Ω	0805
R15	1 k Ω	0805
R16	3.6 k Ω	0805
R17	1.5 k Ω	0805
R18	100 Ω	0805
R19	1 k Ω	0805
R20	3.6 k Ω	0805
R21	1.5 k Ω	0805
R22	100 Ω	0805



3.3.3.5 Capacitors

CANT1	1.8 nF 120 to 180 pF/100V	COG
CANT2	330 (270) pF/100V	COG radial
CTUNE1	150 pF/100V	COG 0805
CTUNE2	330 pF/100V	COG 0805
C3	10 μ F/16V	radial
C4	22 μ F/16V	radial
C5	22 μ F/16V	radial
C6	220 nF	0805
C7	6.8 nF/100V	0805
C8	2.2 nF/100V	0805
C9	4.7 nF	0805

3.3.3.6 Miscellaneous

- SUB-D 9-pole socket
- 3-pole connector for coil
- Gold-pin block for jumper (1 \times 3-pole)
- 2 gold-pin block 1 \times 18-pole (used for pin connector to the main board)

The antenna coil included in the kit measures the following parameters related to 125 kHz:

Inductance	$L = 700 \mu\text{H}$
Coil diameter	$d = 100 \text{ mm}$
Winding number	$n = 60$
Wire diameter	$d_w = 0.25 \text{ mm}$



Basic Transponder Functionality Getting Started

4.1 System Installation

1. Install the host software according to the instructions in [Section 2.2](#).
2. Connect the application board unit with the host PC using the RS232 serial cable included in the kit.
3. Connect a 12V (AC or DC) power supply to the board using the jack connector cable. The power-on status is indicated by green LEDs labelled *Power* located, one each, on the interface and main board.
4. Start the host software on the host PC. If the program was installed to the default location, it is located at: X:\Programme\ATAK2270\ATAK2270.exe.
5. After the start window has appeared, select the COM port and the transponder version to be used.

4.2 Checking Simple Transponder Function

1. Select the transponder type to be used.
2. Place transponder close to the base-station antenna.
3. Enter the transponder's configuration details such as bit rate, coding, ID-code length, and signature. (For non-specialized applications, use the default settings).
4. Click on *Configure Transponder* (this function programs selected settings into configuration block).
5. Choose the *Write* tab to program the indicated data blocks of the transponder.
6. Select *Program Transponder*.
7. To read out the transponder, click on the *Read* button in the *Read* tab to show the transponder code.



Figure 5-1. Start Window of the ATAK2270 Host Software



5.1 Software Structure

The software included supports the following Atmel transponder types:

- TK5530/e5530 read-only
- TK5551 read/write
- TK5552/T5552 read/write (1 kBit)
- T5557/ATA5567 multifunctional read/write
- ATA5570 multifunctional read/write with sensor input
- ATA5577 Advanced multifunctional read/write

All transponder types and their particular features and functions can be controlled by the same host software. The features specific to the different transponder types are set individually using the appropriate configuration window for that transponder.

Note: This software does not evaluate all settings offered by the various transponder types. If an unsupported feature is selected in the software, a message will be displayed.

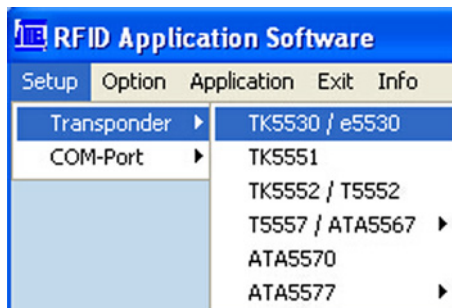
5.2 Start Window

The host software menu bar has five menus: *Setup*, *Option*, *Application*, *Exit*, and *Info*.

5.2.1 Setup

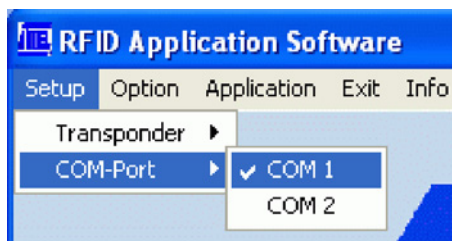
Select the appropriate transponder in the *Setup* -> *Transponder* menu (Figure 5-2). The user interface displayed depends on the transponder chosen.

Figure 5-2. Transponder Menu



In the submenu *COM-Port*, select the RS232 serial port used to communicate with the RFID application kit (*COM-Port*). (To check that communication is established between the PC and the application board, press F12 on the PC keyboard. If the correct COM port is selected, all the LEDs will light up; if the LEDs do not light, change the COM port.)

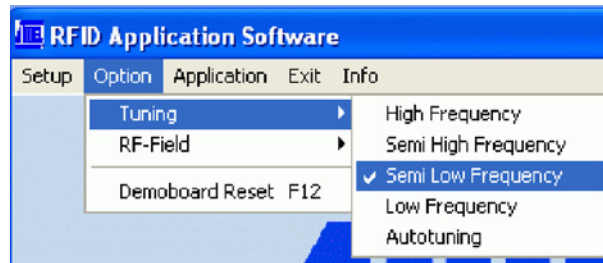
Figure 5-3. COM-Port Menu



5.2.2 Options

The submenu *Tuning* offers two different tuning modes: manual tuning (*High to Low Frequency*) or *Auto-tuning* (Figure 5-4). To enable the autotuning feature, set jumper J3 on the antenna interface to *en* (see Table 3-1).

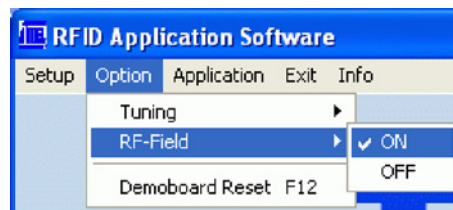
In manual tuning mode, the user can choose from four frequency stages – *Low*, *Semi Low*, *Semi High*, and *High* – typically between 121 kHz to 134.2 kHz. In autotuning mode, the software scans through the four frequency steps until a transponder is read out; if no response is received, a failure message is displayed. The currently selected frequency stage is indicated on the application board, binary encoded by the *Tune1* and *Tune2* LEDs (for interpretation, see Table 5-1).

Figure 5-4. Tuning Menu**Table 5-1.** Tuning Stage LED Indication

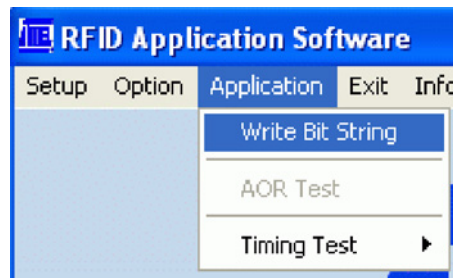
Tune2	Tune1	Frequency
0	0	High
0	1	Semi High
1	0	Semi Low (default)
1	1	Low

Select the submenu *RF-Field* to switch the antenna's RF field *ON* or *OFF*. The current status is indicated by the yellow LED, *RF On*, on the interface board. *ON* is the default value.

Clicking *Demoboard Reset* resets the application board and returns all changes in the option menu to the default values. The reset can also be triggered by pressing *F12*.

Figure 5-5. RF-Field Menu

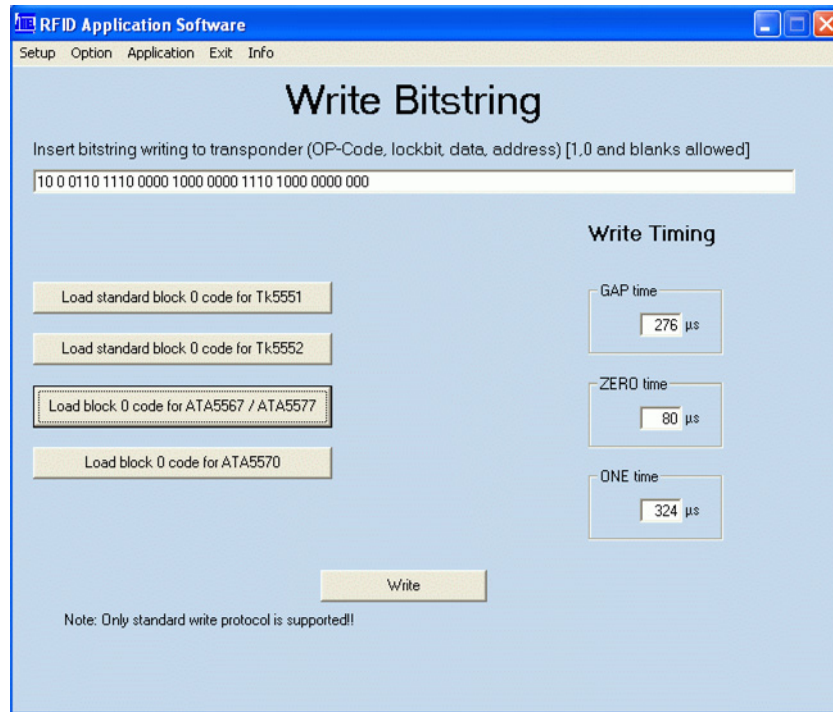
5.2.3 Application

Figure 5-6. Application Menu

5.2.3.1 Write Bit String

The input text box in the *Write Bit String* window can be used to enter programming data, which can be sent to any block. The bit string entered can be freely composed; therefore, it is important to consider the bit sequence, specified above the text box. For the supported transponder types, typical default configurations can be displayed in the text box by clicking a corresponding *Load standard block...* buttons. Clicking the Write button, sends the bit string to the transponder using the write times specified in the Writing Timing area.

Figure 5-7. Write Bitstring Window



5.2.3.2 Timing Test

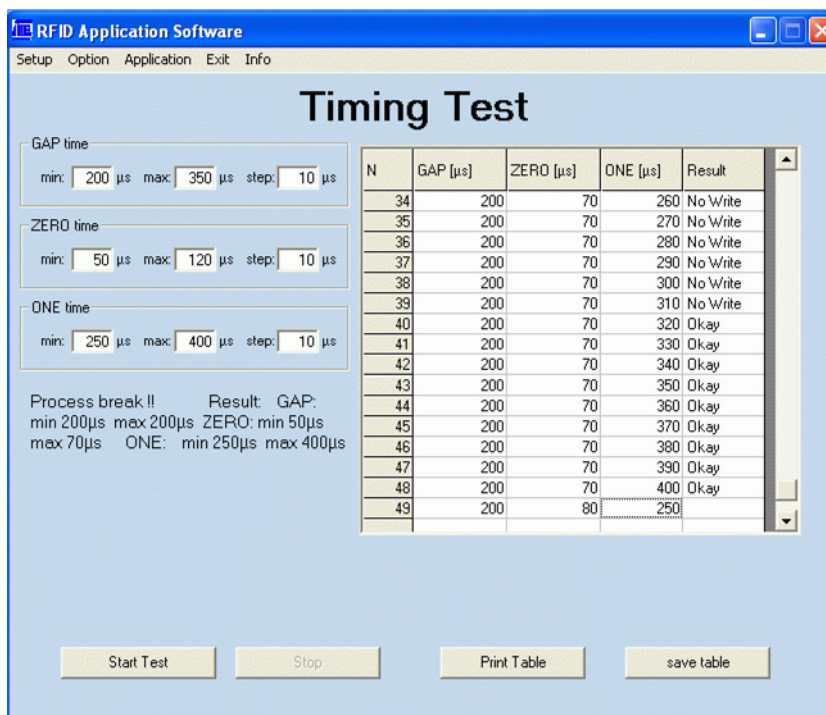
If specific antennas have to be matched to a transponder IC, the *Timing Test* feature can be used to determine the appropriate write timing needed for OOK data downlink. The write time ranges for logical one, logical zero, and gap can be defined. When the *Start Test* button is clicked, data is written to the tag starting with the minimal time values. Following this, the programmed data content will be read back and verified, and the results displayed in the window.

The write-read-compare procedure continues through all the time ranges with the specified time step width. The current time settings of the write execution with related results are displayed in a table. When the timing test is finished, the resulting table can be printed or saved to the directory where the program was started.

The test is restricted to a defined transponder configuration as follows:

Bitrate Rf/32
Coding Manchester
Code Length Block 1 to 2
Signature Header

Figure 5-8. *Timing Test* window



5.2.4 Exit

To exit the program, click *Exit*.

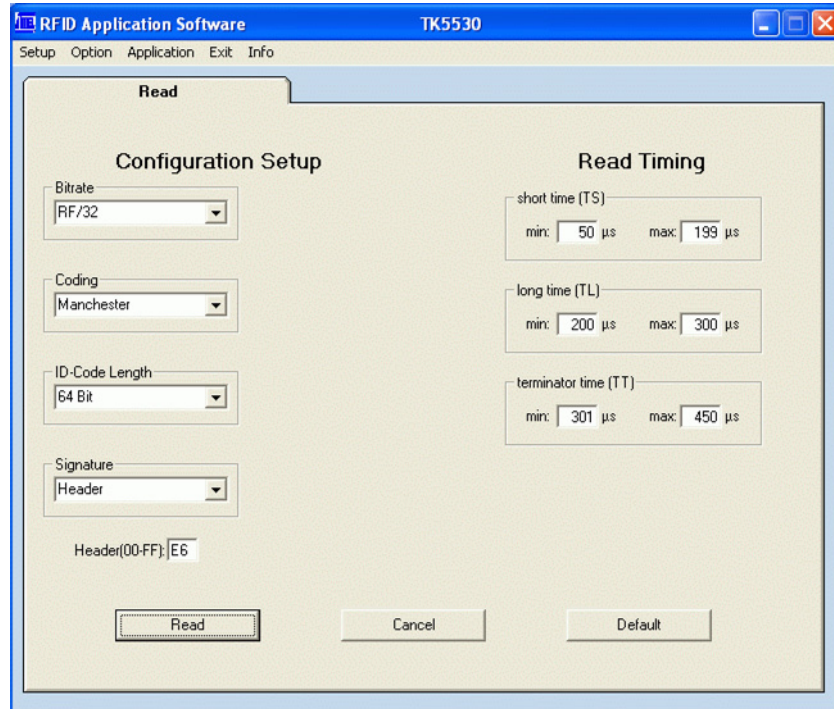
5.2.5 Info

To see information about the software version and release date, Clicking *About* in the *Info* menu.

5.3 Transponder Type Software Interface Description

5.3.1 TK5530/e5530 Read-only Transponder Menu

Figure 5-9. TK5530 Read Tab



Selecting Transponder >TK5530/e5530 from the Setup menu, opens the the TK5530 user interface. A Read tab is displayed. The read tab is divided into two areas – Configuration Setup and Read Timings. The following parameters can be configured in the Configuration Setup area:

- *Bitrate:* Rf/32, Rf/40 or Rf/64
- *Coding:* Manchester or Bi-phase
- *ID-Code Length:* 32, 64, 96 or 128 bit
- *Signature:* Header

Note: For further details, refer to the e5530 datasheet.

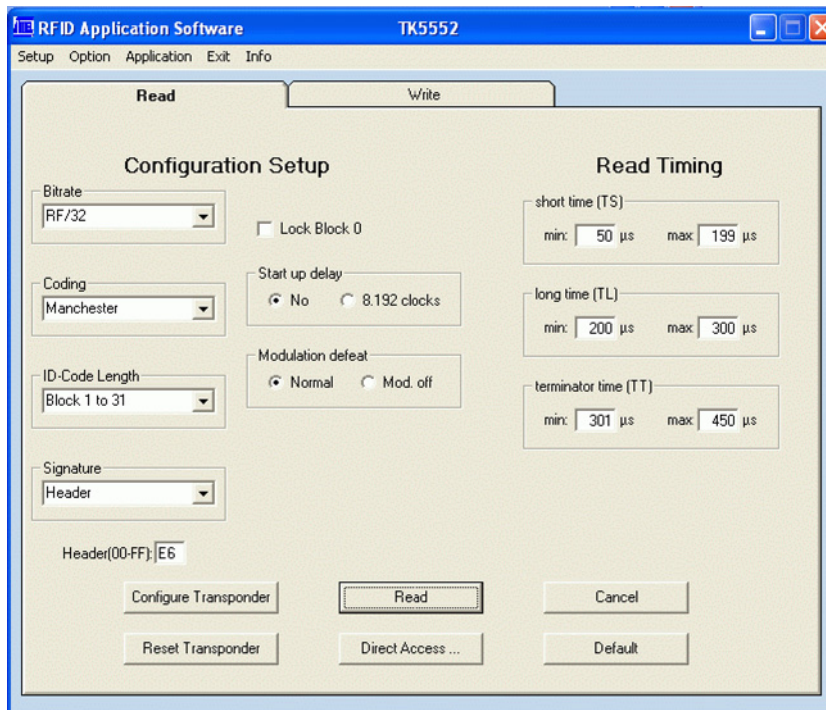
The timing parameters for decoding can be set in the Read Timing area. Under normal operating conditions, the default values can be used.

To read the transponder, click the **Read** button. A message box is displayed showing either the decoded transponder code (in hex) or an error report. Decoding is carried by transferring the Configuration Setup and Read Timing settings to the microcontroller on the RFID application kit. The incoming data stream is decoded to binary values using real-time analysis and sent to the PC.

The **Default** button restored the default settings. The **Cancel** button is used to exit the application.

5.3.2 TK5552/T5552 Read/Write Transponder

Figure 5-10. TK5552 Read Tab



Selecting Transponder >TK5552/T5552 from the Setup menu, opens the the TK5552 user interface. Two tabs are available – Read and Write. The Read tab is divided into two areas – Configuration Setup and Read Timings. The following parameters can be configured in the Configuration Setup area:

- *Bitrate:* Rf/16 and Rf/32
- *Coding:* Manchester and PSK
- *ID-Code Length:* Block0, Block1, Block1 to 2, Block 1 to 3, ..., Block 1 to 31
- *Signature:* Header
- *Lock Block 0:* Selecting this check box locks the configuration block of the transponder. This means that the bit rate, coding, etc., are locked and cannot be changed. Use this feature with care.
- *Start up delay:* Select the No radio button for no delay (only POR) or select 8.192 radio button for POR and an additional 8192 clocks of the RF field.
- *Modulation defeat:* When *Mod. off* is selected, no data will be transmitted. It appears as if no transponder is in the RF field.

Note: The base station IC U2270B does not support the reading of all bit rates and codings offered by the transponder type. If a non-supported mode is configured, a warning message will be displayed on the screen.

To change the configuration setup, click the **Configure Transponder** button to program the configuration block of the transponder. (The transponder should be placed close to the application board antenna)

The timing parameters for decoding can be set in the *Read Timing* area. For standard read mode, the default values can be used.

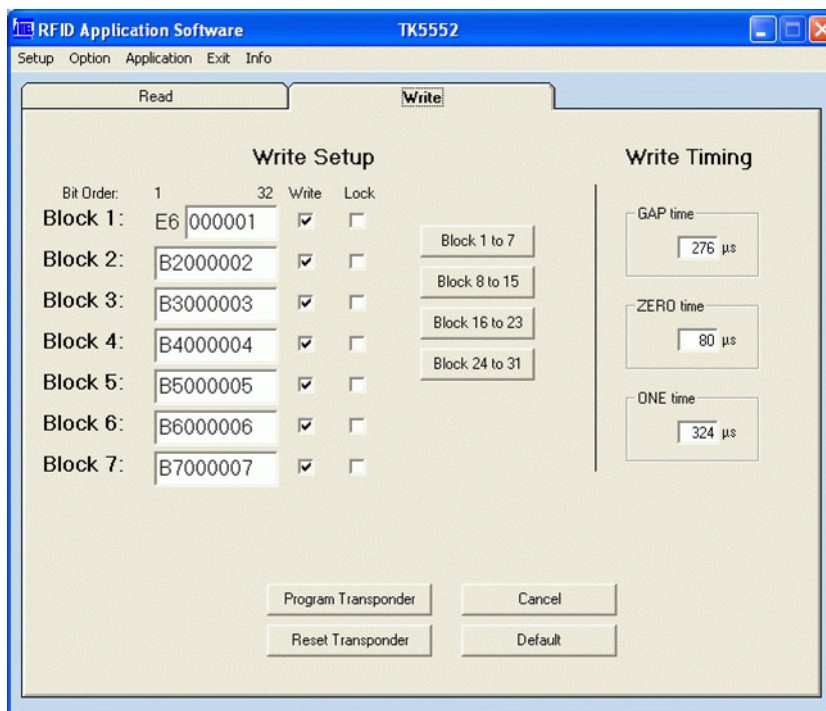


To read the transponder, click the **Read** button. If a *Header Signature* is used, ensure that the related *Header* has already been programmed into the transponder from the *Write* tab. Decoding is carried by transferring the Configuration Setup and Read Timing settings to the microcontroller on the RFID application kit via RS232 interface. The incoming data stream is decoded to binary values sent to the PC.

The **Default** button restored the default settings. The *Reset Transponder* button sends the reset command to the transponder. (There is no change in the configuration or data blocks of the transponder.)

The **Cancel** button is used to exit the application. The **Direct Access...** button enables block-wise reading of the transponder. Ensure that the correct header for the chosen block is typed into the Header text field.

Figure 5-11. TK5552 Write Tab



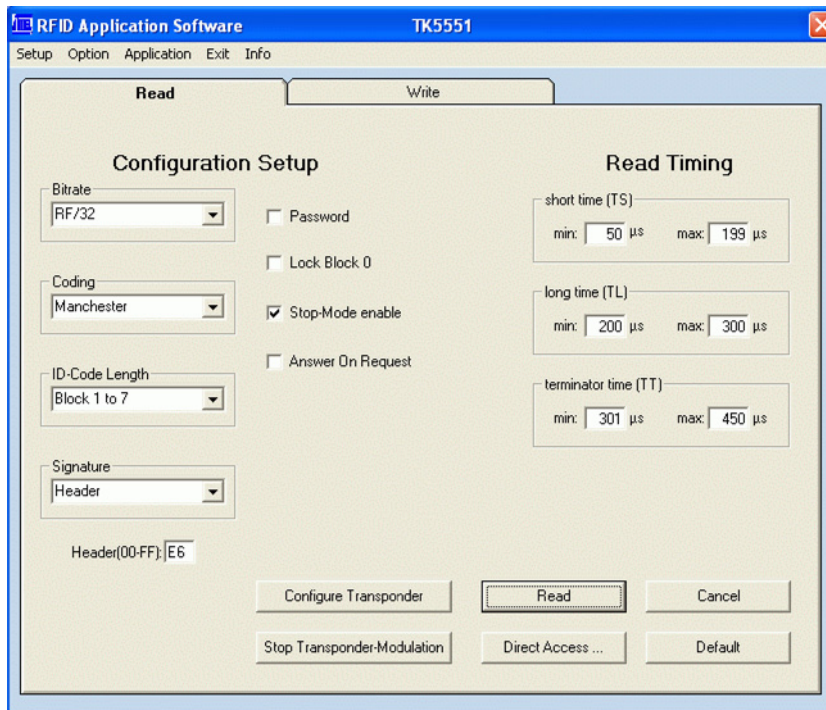
The *Write* tab has two sections: *Write Setup* and *Write Timing*. The buttons *Block 1 to 7*, *Block 8 to 15*, *Block 16 to 23*, and *Block 24 to 31* show all 31 data blocks in groups of 7 blocks. The first byte in Block 1, the header byte, can be edited in the header text field on the *Read* tab.

Clicking *Write Timing* allows the timing parameters for writing to be set. Under normal operating conditions, the default values can be used.

The transponder can be programmed using the *Program Transponder* button. The data for each block is entered in hexadecimal (characters 0 to 9 and A to F). Choose the blocks to be programmed by selecting the check box in the *Write* column. To protect the data from being overwritten, the *Lock* feature can be used. Once set, the information cannot be overwritten. Use this feature with care. Click the *Default* button to restore the default setting. The *Reset Transponder* button sends the reset command to the transponder. (There is no change in the configuration or data blocks of the transponder.) To exit the TK5552 user interface, click on the *Cancel* button.

5.3.3 TK5551 Read/Write Transponder

Figure 5-12. TK5551 Read Tab



Selecting Transponder >TK5551 from the Setup menu, opens the the TK5530 user interface. Two tabs are available – Read and Write. The Read tab is divided into two areas – Configuration Setup and Read Timings. The following parameters can be configured in the Configuration Setup area:

- *Bitrate:* Rf/8, Rf/16, **Rf/32**, Rf/40, Rf/50, Rf/64, Rf/100 and Rf/128
- *Coding:* **Manchester**, Biphase, direct, PSK..., FSK,...
- *ID-Code Length:* Block0, Block1, Block 1 to 2, Block 1 to 3, ..., **Block 1 to 7**
- *Signature:* **Header**, Sequence Terminator, Block Terminator, and Block and Sequence Terminator
- *Password:* Selecting this check box activates password mode (see [Section 5.4.1 "Password PWD Mode"](#))
- *Lock Block 0:* Selecting this check box locks the configuration block of the transponder. This means that the bit rate, coding, etc., are locked and cannot be changed. Use this feature with care.
- *Stop-Mode enable:* Obey stop command
- *Answer On Request:* Activates anticollision mode (selecting this shows an additional button for AOR wake-up, see [Section 5.4.2 "Answer On Request AOR Mode"](#)).

Note: The base station IC U2270B does not support the reading of all bit rates and codings offered by the transponder type. If a non-supported mode is configured, a warning message will be displayed on the screen.

To change the configuration setup, click the *Configure Transponder* button to program the configuration block of the transponder. (The transponder should be placed close to the application board antenna)

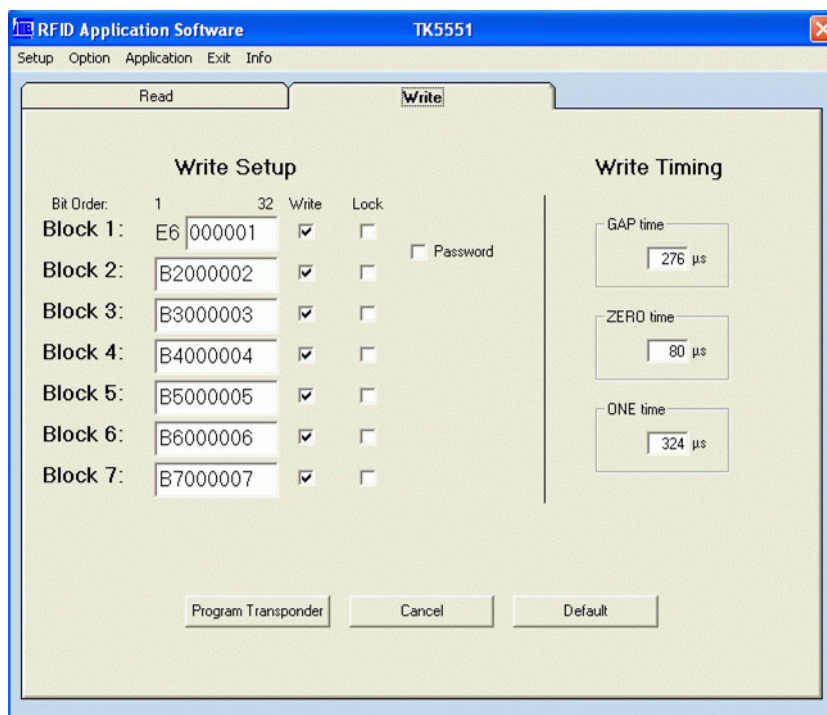
The timing parameters for decoding can be set in the *Read Timing* area. For standard read mode, the default values can be used.

To read the transponder, click the **Read** button. Decoding is carried by transferring the Configuration Setup and Read Timing settings to the microcontroller on the RFID application kit via RS232 interface. Using real-time analysis, the incoming data stream is decoded to binary values sent to the PC.

The **Default** button restored the default settings. The **Stop Transponder-Modulation** button is used to send a stop command to the transponder. (This halts modulation until POR or AOR wake-up command.)

The **Cancel** button is used to exit the application. The **Direct Access...** button enables block-wise reading of the transponder. Ensure that the correct header for the chosen block is typed into the Header text field. If *Sequence Terminator* is selected, only Block 0 and the Maxblock are readable (for example, if Block 1 to 5 is configured, then Block 5 is also readable using Direct Access).

Figure 5-13. TK5551 Write User Tab



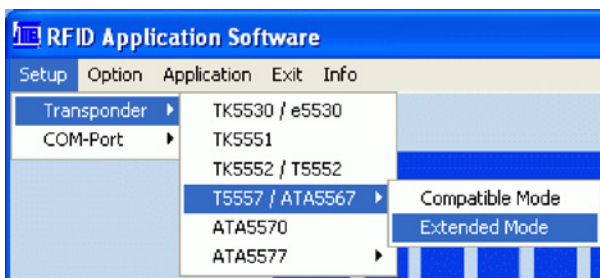
The Write tab has two sections. Write Setup and Write Timing. The first byte in Block 1, the header byte, is adjusted in the header text field of the *Read* tab. The *Password* check box is the same as the one in the *Configuration Setup*; when selected, Block 7 changes to password.

The timing parameters for writing can be set in the *Write Timing* section. Under normal operating conditions, the default values can be used. The programming of the transponder is performed by clicking the button *Program Transponder*. The data for each block is entered in hex. Choose the blocks to be programmed by selecting the check box in the *Write* column. To protect the data from being overwritten, select the *Lock* check box. Once the lock bit is set, the information cannot be overwritten. Use this feature with care. Click the *Default* button to restore the default settings. To exit the TK5551 user interface, click the *Cancel* button.

5.3.4 T5557/ATA5567 Multifunction Read/Write Transponder

The ATA5567 offers an improvement over T5557's slow power-on behavior. Apart from this difference, both transponders are functionally identical and thus can be managed by same user interface. Both transponders are backward compatible to the older T5551/TK5551 version. Therefore, they can be operated in the Compatible or Basic Mode.

Figure 5-14. T5557/ATA5567 Mode Selection



5.3.4.1 T5557/ATA5567 Compatible Mode

For Compatible Mode refer to [Section 5.3.3 "TK5551 Read/Write Transponder"](#) .

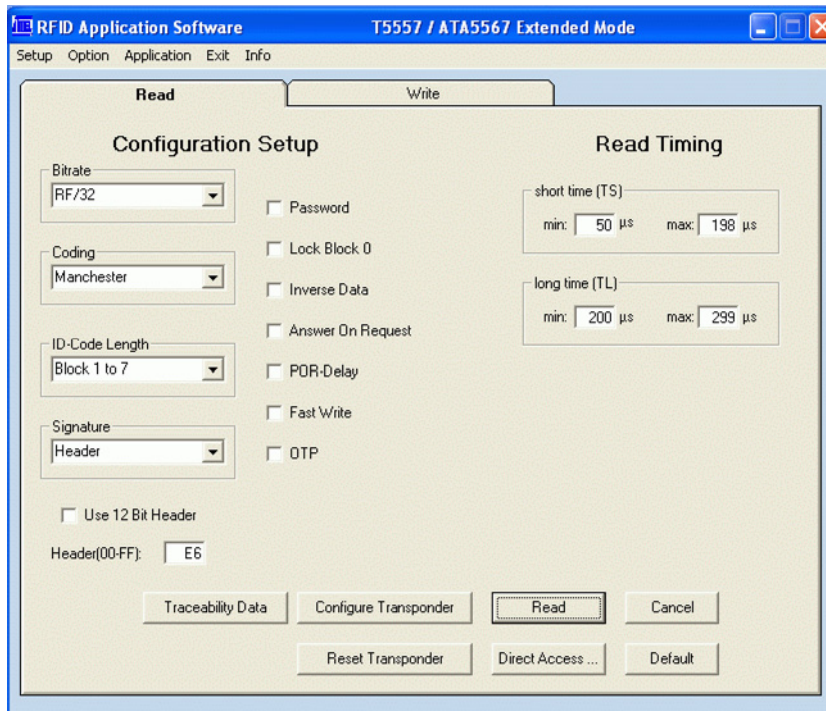
5.3.4.2 T5557/ATA5567 Extended Mode

In contrast to Compatible Mode, Extended Mode is enhanced by additional features, which can be enabled. These include:

- SST Sequence Start Marker
- Inverse Data Mode
- OTP General Data Protection
- Enlarged Data Rates
- Fast Write Mode
- Traceability Manufacturer Data

The operation in Password PWD, Answer AOR, or Direct Access Mode can be handled as described in [Section 5.4 "Operating Common Transponder Features"](#) .

Figure 5-15. Extended Mode Main Read Tab



Selecting *Extended Mode* displays the *Read* tab (Figure 5-15). The Read tab is divided into two areas – Configuration Setup and Read Timings.

5.3.4.3 Configuration Setup

- **Bitrate:** $Rf / (n + 2)$ for $n = 0$ to 126 (default setting $Rf/32$)
- **Coding:** Manchester, Biphase 1 ('50), Biphase 2 ('57), Direct, PSK..., FSK,... (refer to the T5557 datasheet), (default = Manchester)
- **ID-Code Length:** Block0, Block1, Block 1 to 2, Block 1 to 3, ..., Block 1 to 7 (default = Block 1 to 7)
- **Signature:** 8-bit Header, Sequence Start Terminator (default = Header 6Eh)
- **Use 12-bit Header:** RFID application complying to the ISO/IEC 11784/85 standard. For example, for animal IDs, the 11-bit binary header 0000 0000 001(0) is used. For this reason, a three-nibble header window is specified (default = 002h)
- **Password:** Activates password mode used for protection against overwriting and Answer On Request (AOR) Function (default = not activated)
- **Lock Block 0:** Setting this bit locks the Configuration Block 0 of the transponder. Once the lock bit is set, the bit rate, coding etc., are locked and cannot be changed. Use this feature with care.
- **Inverse Data:** Data uplink is performed inversely when activated (default = not activated)
- **Answer On Request (AOR):** Activates anticollision mode. (When this check box is selected, an additional button appears for AOR wake-up.) (Not activated is the default.)

- *POR-Delay*: In the default setting, the modulation starts after 192 clock cycles (1.5 ms at 125 kHz) are recognized. When actively selecting *POR-Delay*, the modulation delay measures 8382 clock cycles (67 ms at 125 kHz)
- *Fast Write*: When *Fast Write* is selected, the write times in the *Write* menu are reduced by half
- *OTP*: If *OTP* is set, all memory blocks are write-protected

These configuration parameters are sent to the transponder when the *Configure Transponder* button is clicked. The transponder should be placed close to the reader antenna when this is at that time.

Note: The base station IC U2270B does not support the reading of all bit rates and codings offered by the transponder type. If a non-supported mode is configured, a warning message will be displayed on the screen.

5.3.4.4 Data Read

When a read command is executed by clicking the *Read* button, the current *Read Timing* parameters, among others, are sent to the microcontroller baseboard via the RS232 interface. The data stream coming in from the antenna interface is analyzed in real time as specified by the timing definition. Afterwards, the microcontroller transfers the decoded binary values to the host. Default timing settings are suitable for the transponder samples contained in the kit. If a *Header Signature* is used, ensure that the related *Header* has already been programmed into the transponder using the *Write* menu.

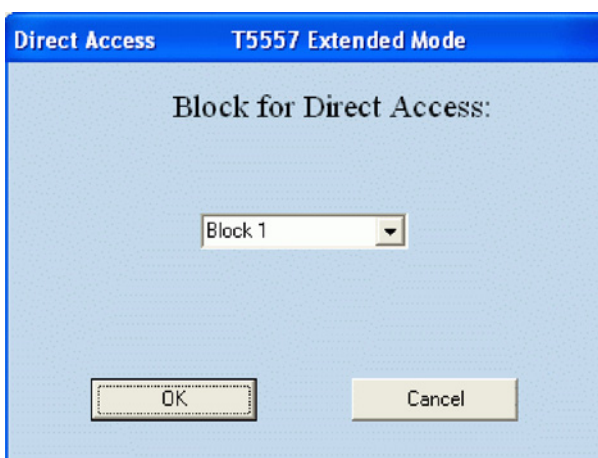
Note: When reading a transponder, the specific programmed configuration has to be matched with settings on the host menu, such as *Bitrate*, *Coding*, *ID-Code Length*, and *Signature*. If the configuration of the transponder is unknown, a reconfiguration is needed.

Click the *Default* button to resets the default settings.

Click the *Reset Command* button to send the OP code 00 to the transponder. This initializes the *Read Mode* operation.

5.3.4.4.1 Block Read Mode (Direct Access)

Figure 5-16. *Direct Access* Dialog Box



Click the *Direct Access* button to read data blockwise from page 0. Select the required block number from the drop-down list. To read data without using the block header, it is useful to configure the transponder to match the *Sequence Start Terminator* signature in advance.

5.3.4.4.2 Traceability Data

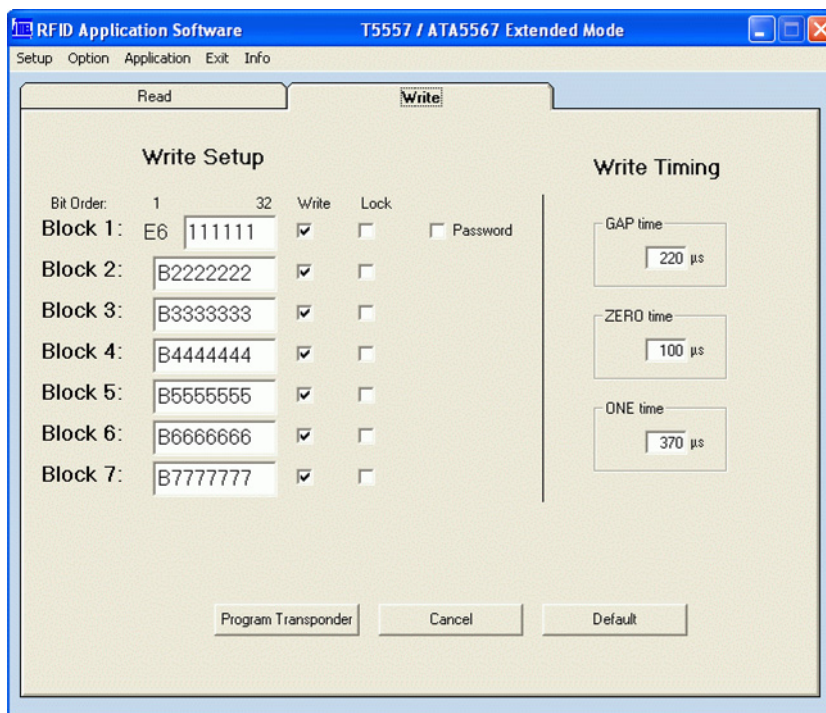
The *Traceability Data* button allows direct access to page 1, which contains the 64-bit traceability data as defined by ISO/IEC 15963-1. Refer to section [Section 5.4.3 "Readout Manufacturer \(Traceability\) Data"](#) for further details.

Exit

Use the *Cancel* button to terminate T5557 operation.

5.3.4.5 Data Write

Figure 5-17. T5557 Write Tab



The *Write* tab has two sections; *Write Setup* and *Write Timing*. The first byte in Block 1, the header byte, is adjusted in the *Header* text field on the *Read* tab. The *Password* check box is the same as in the *Configuration Setup*. If the check box is selected, Block 7 changes to password.

In *Write Timing*, on the right side, the timing parameters for writing can be set. Default values are suitable for antenna Q factors in the range of 5 to 20 and also for ATA5567 transponder samples provided with the kit.

The transponder can be programmed using the *Program Transponder* button. The data for each block is entered in hex. Choose the blocks to be programmed by selecting the check box in the *Write* column. To protect the data from being overwritten, the *Lock* feature can be used. Once set, the information cannot be overwritten. Use this feature with care. Click the *Default* button to restore the default setting. To exit the T5557 user interface, click the *Cancel* button.

5.3.5 ATA5570 Multifunction Read/Write Transponder with Sensor Input

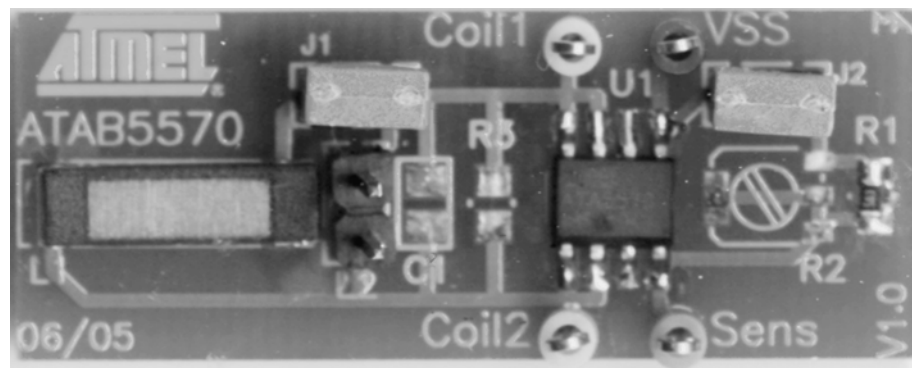
The ATA5570 is derived from the T5557; however, it is enhanced by an additional sensor input. Depending on the connected sensor resistance, the uplink data is sent either in direct or inverse mode.

Table 5-2. Data Mode Depending on Resistance

Resistance Pin 4-5	Jumper J2	Sent Data
> 140 kΩ	Open	Direct
< 70 kΩ	Closed	Inverse

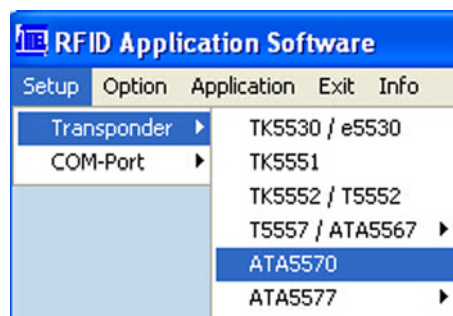
To promote the sensor functionality, a special application board is available, ATAB5570.

Figure 5-18. RFID Development Board ATAB5570



Even though the ATA5570 transponder has its own menu item (see Figure 5-19), the software routines of the T5557 are used. Hence, to operate the ATA5570 refer to the instructions for the T5557/ATA5567, see Section 5.3.4 "T5557/ATA5567 Multifunction Read/Write Transponder".

Figure 5-19. ATA5570 Mode Selection

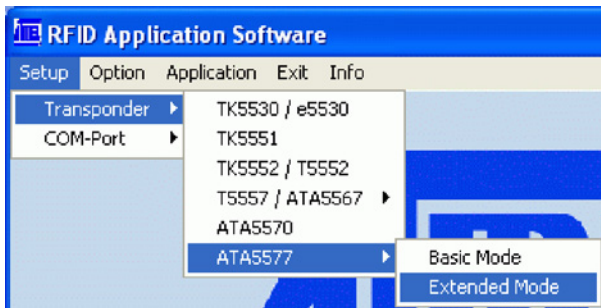


Note: To read out the traceability data, jumper J2 on the transponder board has to be replaced, and the *Inverse Data* check box in the *Configuration Setup* menu must be selected. Do not execute the *Transponder Configuration* command.

5.3.6 ATA5577 Enhanced Read/Write Transponder with AFE-Options

When the ATA5577 transponder is selected, it can be operated in either Basic Mode (compatible with the T5557/ATA5567/TK5551) or in Extended Mode for enhanced functionality.

Figure 5-20. ATA5577 Mode Selection

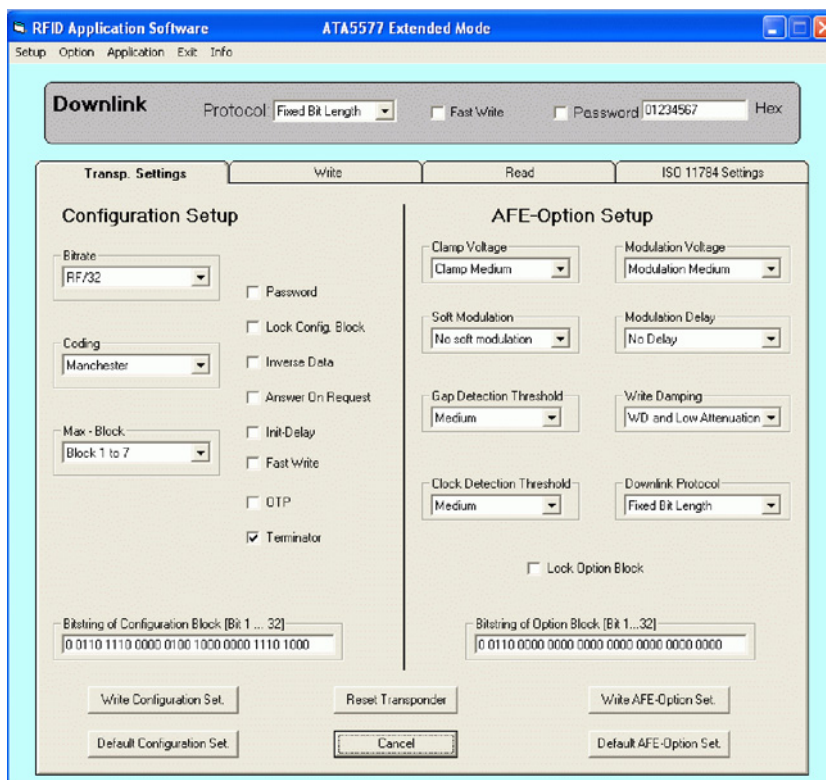


5.3.6.1 Basic Extended Mode Selection

The ATA5577 user guide describes the software functionality using the Extended Mode. Functions that are not supported by Basic Mode are indicated.

When Extended Mode is selected, the Transponder Setting tab opens. The Extended Mode has the following additional options when compared with the Basic Mode: Inverse Data, Fast Write, and OTP protection check boxes as well as a larger choice of bit rates. These settings are not available with the Basic Mode.

Figure 5-21. Transp. Settings Tab



The structure of the ATA5577 user interface differs from the other transponder types.

In the Setup window, four tabs – Transp. Settings, Write, Read and ISO 11784 – and the Downlink section allow the configuration, reading, writing and programming and reading transponder according ISO 11784/85 standard.

5.3.6.2 Downlink Settings

The Downlink section, above the tabs, indicates the current downlink mode from the reader to the transponder. Downlink modes are selectable as follows:

- Downlink Protocol Fixed Bit Length, Long Leading Reference or Leading Zero Reference (1-of-4 Coding is not supported by the software)
- Fast Write Method Not released for Basic Mode selection
- Password Mode see [Section 5.4.1 "Password PWD Mode"](#)

Note, downlink write commands must be sent with the protocol mode that is currently used by the transponder, otherwise the transponder will not understand the command.

5.3.6.3 Transponder Setting tab

The Transp. Setting tab is divided into two sections. The first, the Configuration Setup on the left side, is used to define bit set of block0. The second section AFE-Option Setup, on the right, is used to adjust the behavior of Analog Front-End AFE via bit set of block3/page1. The resulting bit strings are displayed at the bottom of each section in the Bitstring of Configuration Block text boxes.

Click the Default Configuration Set restores the default Configuration Setup settings. Click the Default AFE-Option Set, restores the AFE options. The Reset Transponder button is used to issue a reset command to transponder within the field.

5.3.6.3.1 Configuration Setup:

Selected parameters are sent to the transponder by clicking the Write Configuration Set button. Default parameters are indicated in bold.

- Bitrate:
 - Basic Mode Rf/8, Rf/16, **Rf/32**, Rf/40, Rf/50, Rf/64, Rf/100 and Rf/128
 - Extended Mode Rf / (2n + 2) for n = 0 to 63 (default **Rf/32**)
- Coding: **Manchester**, Biphase, direct, PSK..., FSK,...
- ID-Code Length: Block0, Block1, Block 1 to 2, Block 1 to 3, ..., **Block 1 to 7**
- Password: Activates password mode (**default = not activated**)
(see [Section 5.4.1 "Password PWD Mode"](#))
- Lock Config. Block: Locks the configuration block0 of the transponder (**default = not activated**)
Once locked, the configuration can never be changed. Use this feature with care
- Answer On Request: Activates anticollision mode (selecting this shows an additional button on the read tab for AOR wake-up,
see [Section 5.4.2 "Answer On Request AOR Mode"](#))



Not released in Basic Mode:

- Terminator:
 - Basic Mode **Sequence Terminator**
 - Extended Mode **Sequence Start Marker Terminator**
- Initial. Delay: Modulation switch on delay after POR (**0 = 192 Tc**; 1 = 8192 Tc)
- Inverse Data: Data uplink is performed inversely when activated (default = not activated)
- Fast Downlink: Reduces clock cycles for logical 1/0 detection (default = not activated)
- OTP: Allows a general data protection (default = not activated)

Note: If the selected settings are not supported by the reader, a warning message is displayed before the configuration is executed.

5.3.6.3.2 AFE Option Setup:

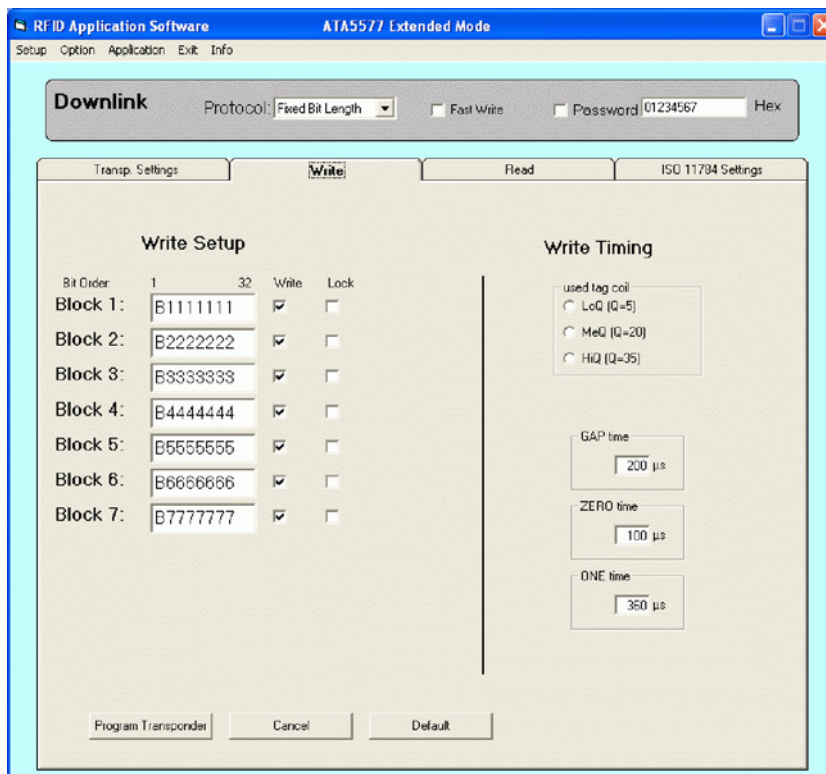
In the Analog Front-End (AFE) Option section, the behavior of the transponder can be influenced in terms of damping and modulating during downlink and uplink operation. Selected parameters are sent to the transponder by clicking the Write AFE-Option Set Button. Default parameters that are needed for Basic Mode are indicated in bold.

- Clamp Voltage: Clamp Low, **Clamp Medium**, Clamp High
- Soft Modulation **No Soft Modulation**, One Pulse Weak, One Pulse Strong, Two Pulses, Smooth
- Gap Detection Threshold Low, **Medium**, High
- Clock Detection Threshold Low, **Medium**, High
- Modulation Voltage Modulation Low, Modulation **Medium**, Modulation High
- Modulation Delay **No Delay**, One Pulse Delay, Two Pulses Delay
- Write Damping **WD and Low Attenuation**, WD and High Attenuation, Low Attenuation, High Attenuation, WD Only, OFF
- Downlink Protocol **Fixed Bit Length**, Long Leading Ref, Leading Zero Ref, 1 of 4 Coding Ref
- Lock Block 0: Setting this bit locks the whole configuration block of the transponder. Once locked, the configuration can never be changed. Use this feature with care.

Note: Changing the setup of Write Damping or Downlink Protocol has an impact on the write timing. For later reconfiguration, if the write timing is not known, configuration will not be possible.

5.3.6.4 Selecting Write tab

Figure 5-22. ATA5577 Write Tab



In the Extended Mode, the Fast Write check box in the Downlink section is released (This is the only difference to the Write tap in Basic Mode).

However the Fast Write feature makes less sense for programming via resonating antenna coupling, due to the needed time duration determined by the gap time of the ON/OFF Keying (OOK). Nevertheless, the feature is performed by the software.

It may be worth considering for production programming transponders in Fast Mode by direct coupling or by antennas with low Q factors. If the Fast Write is selected the default values of the Write Timing will be reduced accordingly.

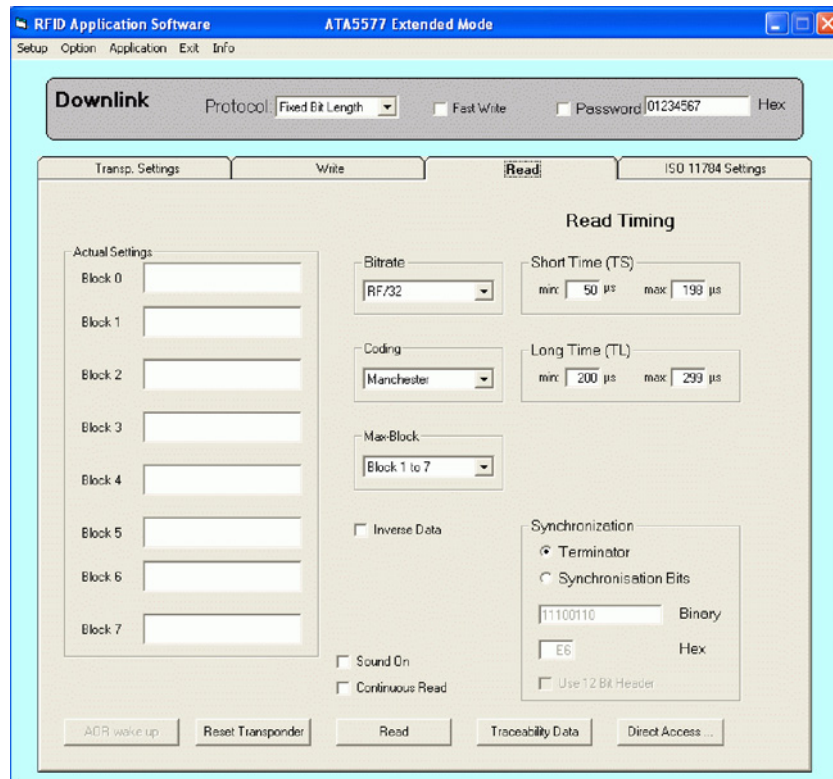
In the Write tab, the block data 1-7 and write timing text boxes are automatically populated with their default values. If the Write check boxes are not selected, the blocks will not be written. If the Lock check boxes are selected, the block will be permanently locked.

The data for each block is entered in hex. The blocks to be programmed are chosen by selecting the check box in the Write column. To protect the data from being overwritten, select the Lock check box. Once the lock bit is set, the information cannot be overwritten. Use this feature with care. Click the Default button to restore the default settings. To exit the menu, click the Cancel button.

The default write timing set should be suitable for typical antenna with Q factors in low to medium range. For special transponders, three ranges of antenna Q factors are selectable. According to Q selection, the required write timing parameters are transferred to the timing window.

5.3.6.5 Selecting Read tab

Figure 5-23. ATA5577 Read Tab



The Read menu displays the content of the data blocks 1-7. To read data from an unknown transponder, the configuration of the transponder must be first known and entered in the Bitrate, Coding, MaxBlock and Synchronization fields.

The default **Read Timing** is derived from the Bitrate setting and normally suitable for most transponder applications.

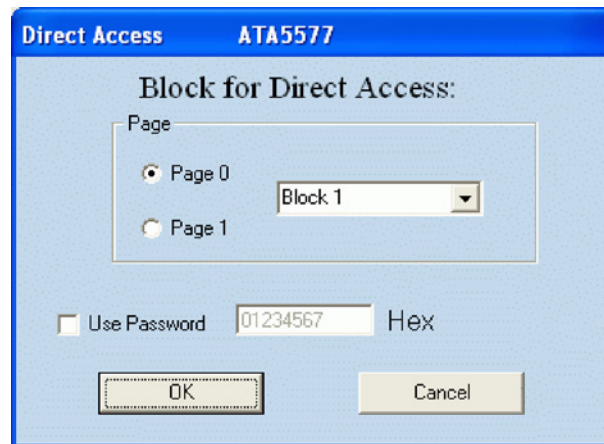
The synchronization of the transponder can be configured in the **Synchronization** area. (Terminator is selected by default.) If Synchronization Bits is chosen, an 8 bit header can be entered. E6h is entered by default in this field. An extended header can be configured by clicking the 12 Bit Header check box and entering the longer header in either the Binary or Hex text field. For an ISO11784/85 transponder, the default header 002h or 003h are needed.

Click the **Read** button to read the transponder block data as specified by the settings. The transponder data is read only once. To read the transponder continually, select the Continuously Read check box. To receive audible notification, select the Sound On check box. This indicates an incorrect or correct reading.

To read a specific block from page 0 or page 1, click the **Direct Access** button. The Direct Access message box is displayed, see Figure 5-24. Select the Page radio button, (Page 0 or Page 1), then select the required block from the drop-down list. If the block is password protected, select the Use Password check box and enter the correct password (in Hex).

Note, before reading, the transponder needs to be configured with terminator synchronization.

Figure 5-24. Direct ccess Dialog Box



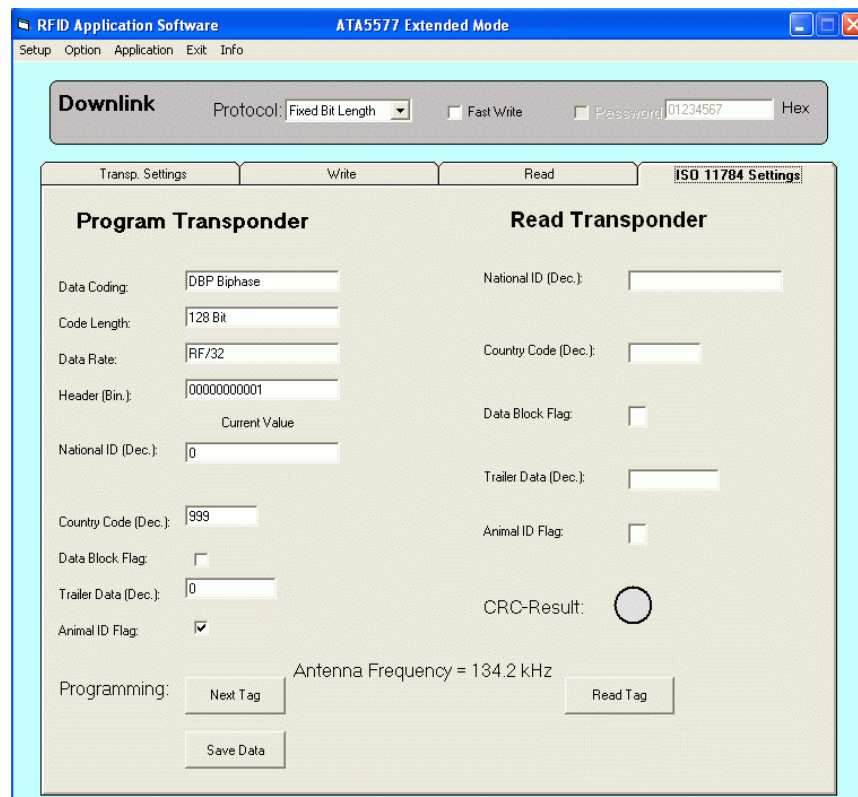
In the Read tab, an *AOR* button is displayed if AOR has been configured in the Transp. Settings tab (see Figure 5-21). The execution of the command initiates the Answer on Request procedure (Section 5.4.2 "Answer On Request AOR Mode").

Click the *Reset Transponder* button to initialize a reset. This initializes the standard Read Mode of the transponder.

Transponder manufacturer data can be read by clicking the *Traceability Data* button (Section 5.4 "Operating Common Transponder Features").

5.3.6.6 Selecting ISO 11784 Setup tab

Figure 5-25. ATA5577 ISO 11784 Setup Menu



The **ISO 11784 Setting** tab allows the programming and reading of a transponder according to the ISO standard 11784/85 used for animal ID or waste logistics. Opening the ISO 11784 Settings tab, the reader automatically changes the field frequency from 125 kHz to 134.2 kHz as specified by standard. The ISO 11784 Settings tab has two sections: Program Transponder and Read Transponder.

■ Program Transponder

The protocol data to be stored by ATA5577 is 128 bits and needs a memory space of block 1-4.

Fixed configuration:

- Data Coding DBP Biphase
- Code Length 128 Bit
- Data Rate RF/32
- Header 11 bit (0000000001)

Code numbers and flags as specified by ISO11784 code structure can be entered explicitly into the related windows.

Identification Code numbers to be enter:

- National ID free decimal number [0 to 274 877 906 943], default 1
- Country Code according to ISO 3166 default 999 for test purpose
- Data Block Flag default not activated
- Trailer Data free decimal number [0 to 16 383]
- Animal ID Flag default activated

In addition to the Identification Code, the protocol is enlarged by a 16-bit CRC error detection code and 24 bit space for data extension.

Click the **Next Tag** button to program the transponder in the field with the ISO settings above. With each subsequent click of the Next Tag button, the ID number is incremented and the current transponder is programmed with the new data. The converted binary data set can be saved to a folder by clicking Save Data button. The Save Data button remains active, afterwards saving all transponder data into the specified folder. Click again Save Data button to deactivate saving mode.

■ Read transponder

Click the Read Tag button to read the transponder. The read data stream of 128 bit length is decoded and displayed in related parameter windows. In addition, the integrity of received data is checked again by the 16 bit CRC error detection. The CRC error detection result is indicated by the color of the CRC- Result ball; green indicating that the received data is correct and grey indicating that the received data is incorrect.

5.4 Operating Common Transponder Features

5.4.1 Password PWD Mode

The transponder can be protected from unauthorized overwriting of memory data using passwords. If the transponder is configured in password mode, each block write command sent to the transponder has to be expanded by the expected password as specified by the content of block 7. To avoid data transmission of Block 7, the transponder is configured with MAXBLK = 6; thus transponder will respond without the hidden password contained in block 7.

5.4.1.1 Initializing Password Mode

Note: Commands in brackets relate to SW description for 5551, 5557, and 5567.

1. Place a transponder in close proximity to the reader antenna.
2. Select the **Write** tab and type an individual password (in hex) into the Block 7 text box.
3. Click the **Program Transponder** button.
4. Open the **Transp. Settings** (Read) tab and set the following:
 - Data rate RF/32
 - Coding Manchester
 - ID Code Length Block 1to7
 - Signature Terminator (select the Terminator check-box)
 - Password (Select the Password check box)
5. Click **Write Configuration Set.** (Configure Transponder) button. Password mode is initialized on the transponder.
6. Select the Password check box in the **Downlink** area. Enter the password for Block 7 used in step 2 above (not needed for 5551, 5557 and 5567).
From now on reconfiguration or reprogramming of block data is only possible if the password in the *Downlink* window matches the transponder password programmed in block 7.

5.4.1.2 Disabling Password Mode

1. Deselect the Password check box in the **Transp. Settings** (Read) tab and click **Write Configuration Set.** (*Configure Transponder*). Password mode is disabled.
2. Deactivate the Password check box in the Downlink area. (Not needed for 5551, 5557 and 5567)

5.4.2 Answer On Request AOR Mode

The AOR feature is used to address an individual transponder, among others in a common field. For AOR mode to function, transponders must be also be configured for password mode. Each transponder has to be programmed with a unique password. If the reader sends an AOR wake-up sequence that matches a password of one transponder present in the field, the transponder starts to transmit its ID code continuously. The transponder remains active until a POR occurs or until a new command with a different password is sent.

Note: For the AOR test procedure, it is recommended to designate all transponders with an individual password number.

5.4.2.1 Initializing AOR Mode

Note: Commands in brackets relate to SW description for 5551, 5557 and 5567

1. Place a transponder in close proximity to the reader antenna.
2. Select the **Write** tab and type an individual password (in hex) into the Block 7 text box.
3. Click the **Program Transponder** button.
4. Open the **Transp. Settings** (Read) tab and set the following:
 - Data rate RF/32
 - Coding Manchester
 - ID Code Length Block 1to7
 - Signature Terminator (select the Terminator check-box)
 - Password (Select the Password check box)
 - AOR (Select the AOR Password)
5. Click **Write Configuration Set.** (Configure Transponder) button. AOR mode is initialized on the transponder.
6. Repeat [Step 1.](#) to [Step 5.](#) to configuring each transponder for selective AOR operation.

5.4.2.2 Testing AOR Mode

1. Place all of the configured transponders in the RF field.
2. Open the **Read** tab
3. Select the Password check box in the Downlink window.
(Not needed for 5551, 5557 and 5567).
4. Enter the password of the transponder you want to read in the Password text box.
5. Click the **AOR wake-up** button.
6. Click the Read button to read out the transponder with the specified password.
7. To stop reading the transponder, click the **Reset Transponder** button.
No transponder can be read.
8. Repeat [Step 2.](#) to [Step 7.](#) to read the next transponder.

5.4.3 Readout Manufacturer (Traceability) Data

The Traceability Data button allows direct access to block 1 and 2 of page 1 which contain the 64-bit traceability data programmed and locked by Atmel during production. The data consist of both, ISO/IEC15693 and ISO/IEC7816-6 compliant identifiers:

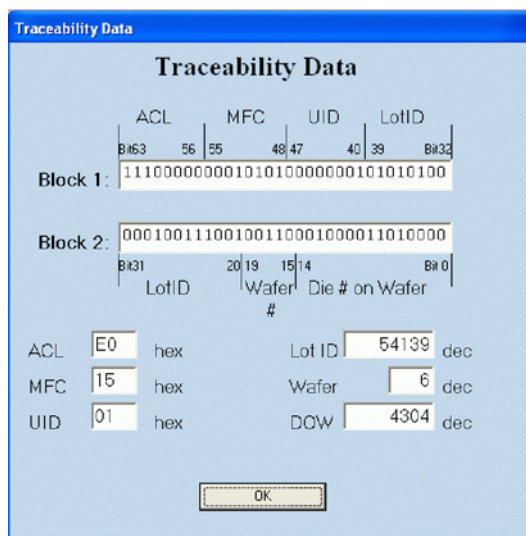
- ACL Allocation Class
- MFC Manufacturer Code
- UID Unique Identification Class

Furthermore, the trace data contain production specific information from manufacturer:

- Lot ID Lot ID Number
- Wafer Wafer Number
- DOW Die On Wafer Number

To read out the data, the Terminator synchronization has to be configured in advance, but the trace data cannot be synchronized by a header.

Figure 5-26. Traceability Data Window



- ACL Allocation Class
- MFC Manufacturer Code
- UID Unique ID Customer
- Lot ID Lot ID Production Number
- Wafer Wafer Production Number
- DOW Die On Wafer Production Number

The Traceability Data window shows the data contents in two formats:

- The text box Block 1 and Block 2 show the binary data stream stored by Block 1 and Block 2, 32 bits each. The bit position of the various ISO identifiers is shown.
- The text box ACL, MFC, UID, Lot ID, Wafer, and DOW show the trace information converted to hex format for easier interpretation of the data.





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