
User Guide for Car Access Reference System Kit with 1-way RF

ATAN0002: ATAK51001-V1

Features

- Complete system solution demonstrating Remote Keyless Entry (RKE), Passive Entry/Passive Start (PEPS), and Immobilizer (IMM) functionality.
- Key fob variants include:
 - UHF Fixed-N PLL RKE TX (Atmel ATA5771/3/4)
 - 125KHz 1D IMM transponder (Atmel ATA5580)
 - Integrated UHF Frac-N PLL RKE TX + 125KHz IMM transponder (Atmel ATA5795)
 - Integrated 125KHz 3D PEPS + 1D IMM (Atmel ATA5790) and UHF Frac-N PLL RKE TX (Atmel ATA5749C)
- Car side components include:
 - 6-channel 125KHz PEPS antenna coil driver (Atmel ATA5279N)
 - Integrated 125KHz IMM basestation + Atmel ATtiny87 (Atmel ATA5272)
 - UHF receiver (Atmel ATA5723/4/8)
- Open system software provided includes:
 - RKE Rolling Code using AES
 - Immobilizer stack using AES
 - Scalable and configurable
 - PC GUI for system visualization and viewing data communication
- Body computer emulation using Atmel ATmega2560 on Atmel STK600 development platform.

Overview

This document provides set up and usage instructions for the Car Access Reference (CAR) System using one-way RF communication. It showcases a complete system in which it is possible to evaluate the comprehensive family of Car Access products offered by Atmel®. Reference designs are used which are both scalable and configurable, enabling the adaptation of the basic hardware and software building blocks into specialized system requirements that exist today.

1. Getting Started

1.1 Kit Contents

This kit contains the following items:

- Atmel® ATAB0001A CAR System Interface Board
- Atmel ATAB5279 6-Channel Coil Driver Board (including 2 coils)
- Atmel ATA5723/24/28-DK Receiver Application Board (including RF antenna)
- Atmel ATA5272-EK1 Basestation Application Board (including coil)
- Atmel ATA5580 Immobilizer Transponder
- Atmel ATA5771/73/74 Transmitter Application Board
- Atmel ATA5795-EK1 Transmitter with 1D LF Application Board
- Atmel ATA5790-EK1 PEPS Transmitter with 3D / 1D LF Application Board
- ISP Interface Adaptor
- USB To Serial Converter
- 120/240AC to 12VDC wall transformer
- (3) 10-wire cables for I/O port connections between STK600 and System Interface Board
- Quick Start Guide

- Notes:
1. An Atmel STK600 is required, but not included in this kit. Please contact www.atmel.com or your local Atmel Sales office for more info on obtaining one.
 2. CR2032 lithium coin cell batteries (3) are required for normal operation of each handheld transmitter PCB.

1.2 Connecting the Hardware

Prepare the Atmel STK600 with the Atmel ATmega2560 device board as described in the Atmel STK600 User Guide. Using a 2-wire cable supplied with the Atmel STK600 kit, connect RS232 SPARE pins RXD and TXD to PORTH pins PH0 and PH1 making sure RXD connects to PH0 and TXD connects to PH1. Using the two 10-wire cables supplied with the STK600 kit, connect PORTK to SWITCHES and PORTC to LEDS. Using the three 10-wire ribbon cables supplied with this kit, make connections from the Atmel STK600 to the System Interface Boards; PORTB to PB, PORTD to PD, and PORTE to PE.

Note: Be sure to properly match header alignment to pin 1 on both ends of the cable when making these connections.

Mount the Atmel ATAB5279 6-Channel Coil Driver Board, Atmel ATA5272-EK1 Basestation Application Board, and the Atmel ATAB5723/24/28 Receiver Application Board to the System Interface Board taking care to align the X1 and X2 pin headers on them with the X1 and X2 pin sockets on the System Interface Board. Connect RF antenna to Receiver Application Board. Locate the coils terminated with pigtail wires and connect one to TPA1N and TPA1P and the other to TPA2N and TPA2P on the 6-Channel Coil Driver Board. Attach the round immobilizer coil to the Basestation Application board connector XANT1.

Complete the set-up by connecting supplemental 12VDC power from wall transformer to mating receptacles on Atmel STK600 and System Interface Board.

1.3 Programming the Atmel ATmega2560 on the Atmel STK600

To program the Atmel ATmega2560 on the device card installed in the Atmel STK600, connect a 6-wire cable between the two 6-pins ISP headers on the Atmel STK600. See [Figure 1-1 on page 3](#) and [Figure 1-2 on page 3](#). Ensure that the VTARGET jumper is mounted, and that the voltage is within the operating range for the target device.

Be sure to set the target voltage for 5.0V when programming the Atmel ATmega2560. Refer to [Figure 1-3 on page 4](#) to [Figure 1-7 on page 6](#) for a screen shot of the properly completed ISP programming menu along with a view of proper fuse settings.

Figure 1-1. Atmel STK600 ISP Headers

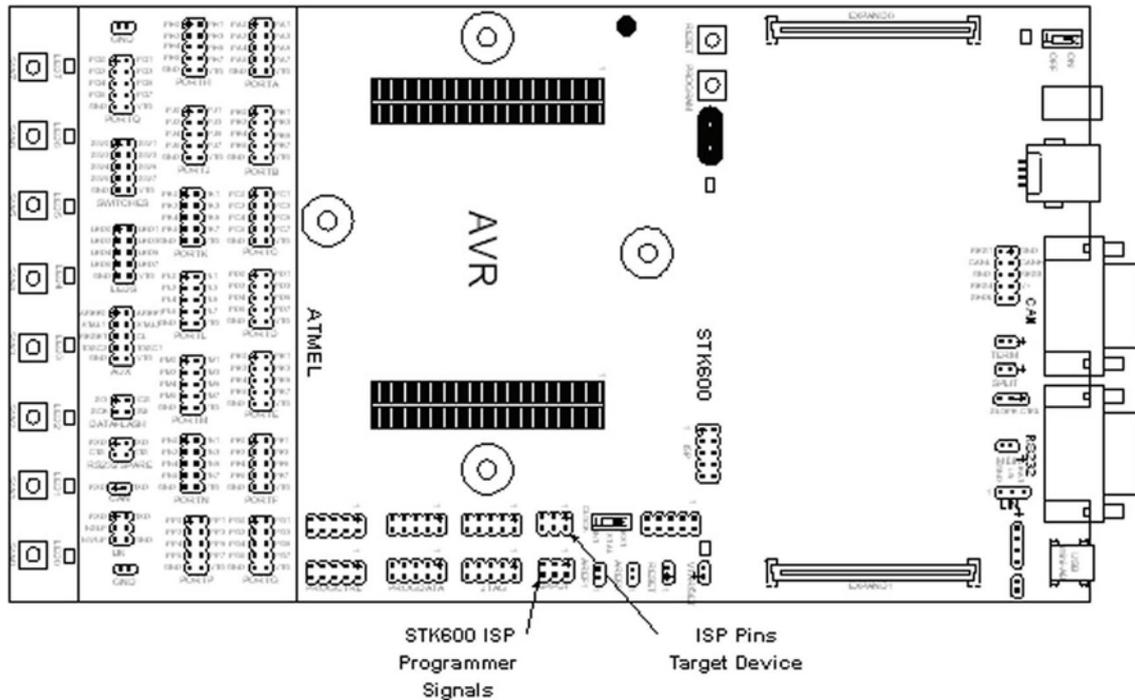
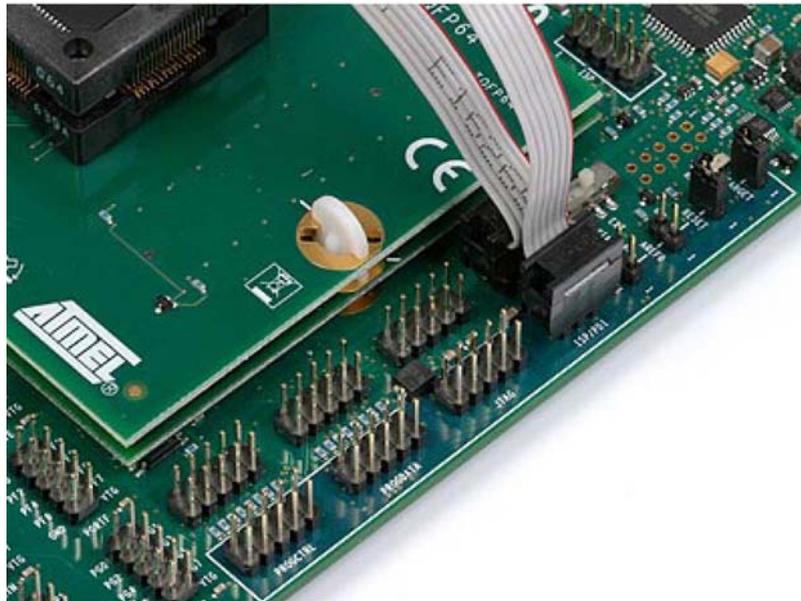


Figure 1-2. ISP 6-Wire Ribbon Cable Connection



Please refer to [Figure 1-3 on page 4](#) to [Figure 1-7 on page 6](#) for a series of screen shots depicting the programming steps described below. Using Atmel® AVR Studio®4, program the Atmel ATmega2560 on the Atmel STK600 by selecting the “Display the ‘Connect’ Dialog” icon ([Figure 1-3 on page 4](#)). Select “STK600” and “USB” followed by clicking on “Connect” button to enable display of the Programming window ([Figure 1-4 on page 4](#)). Select the “Main” tab and pick the Atmel ATmega2560 device. Be sure to set ISP frequency to 100kHz. Click the “Read Signature” button to be sure signature matches the selected device. Select the “Fuses” tab and verify proper fuse settings exist ([Figure 1-5 on page 5](#)).

Select the “HW Settings” tab and set the VTarget to 5.0V (Figure 1-6 on page 5). Next select the “Program” tab and browse to locate files titled “ATAK51001-V1_STK600.hex” for the Flash memory image and “ATAK51001-V1_AOIP_BS.eep” (Figure 1-7 on page 6). The files can be found in the distribution files supplied with this kit.

Figure 1-3. Connection Dialog for Atmel ATmega2560



Figure 1-4. Main ISP Programming Window for Atmel ATmega2560

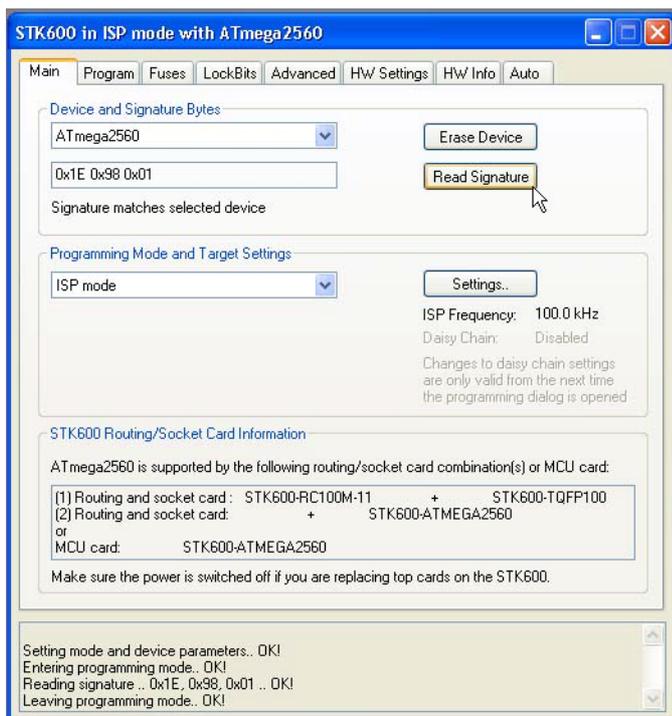


Figure 1-5. Fuse Setting Window for Atmel ATmega2560

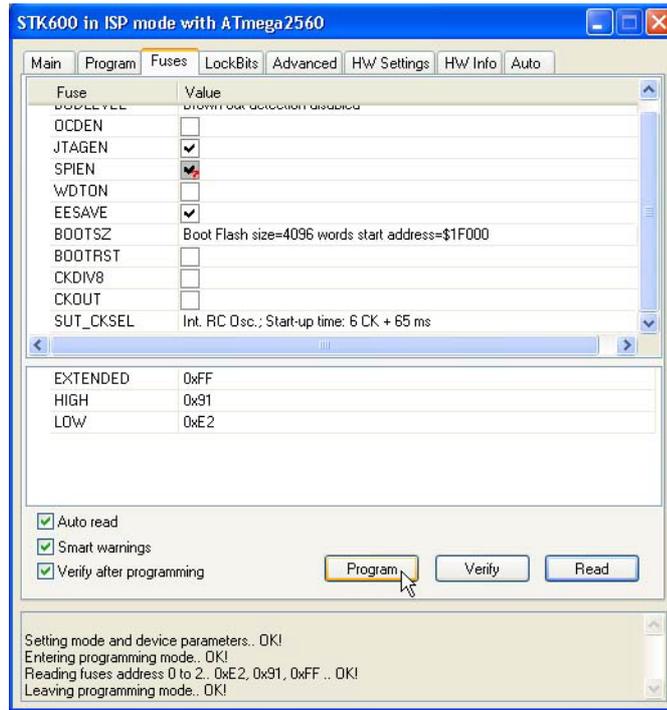


Figure 1-6. Hardware Setting Window for Atmel ATmega2560

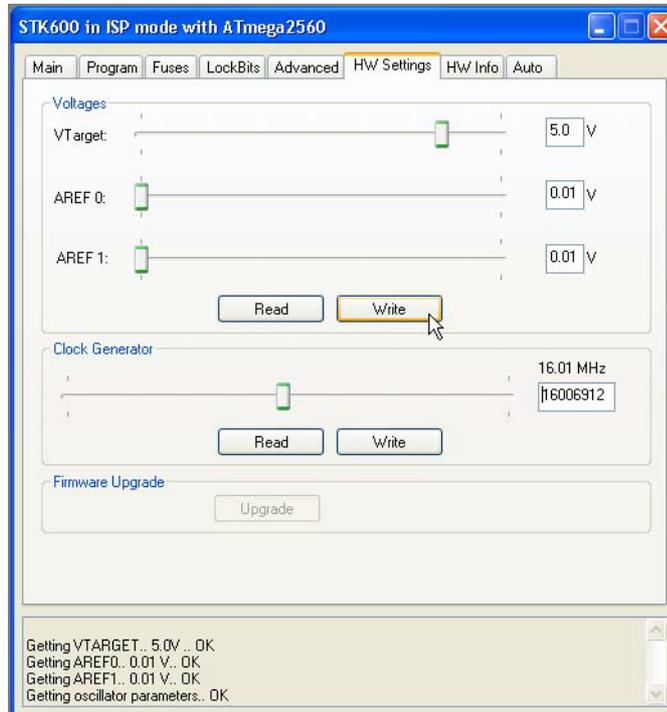
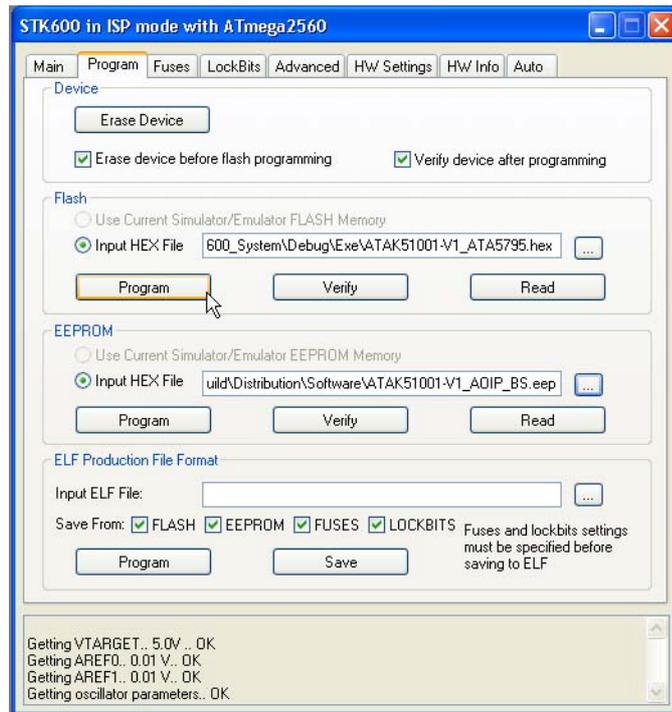


Figure 1-7. Program Window for Atmel ATmega2560



The Atmel® STK600 ISP capability may be used to program other AVR microcontrollers in this kit. Remove the end of the 6-wire ISP cable connected to “ISP Pins Target Device” pin header (see [Figure 1-1 on page 3](#)) and use this free end instead to connect to the other PCBs supplied with this kit.

When using Atmel STK600 ISP, it is OK to ignore the warning message that appears indicating that the installed top card in the Atmel STK600 contains the Atmel ATmega2560 and is not compatible with selected device.

1.4 PC Graphical User Interface

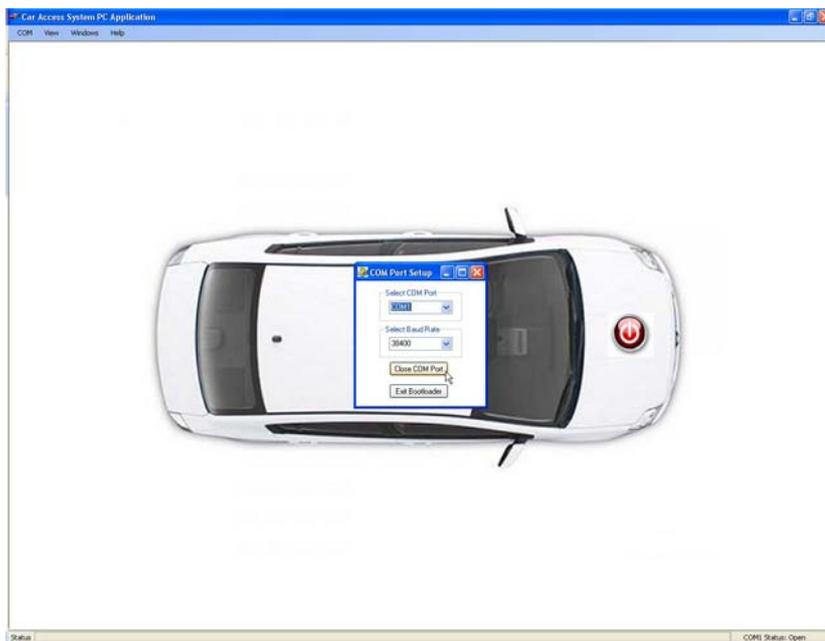
To improve the user experience, this kit includes a Graphical User Interface (GUI). It is provided to assist in the visualization of system operation and contains both visual animation and audio feedback of common Car Access System functionality. To bring up this capability, locate the STK600's RS-232 port and connect it to your PC's using supplied USB to Serial Converter. Locate the file named “ATAK51001-V1_PC_Application.exe” in your distribution files and double click on it to enable its operation. The opening screen will appear as shown in [Figure 1-8 on page 7](#).

Figure 1-8. PC GUI Opening Screen



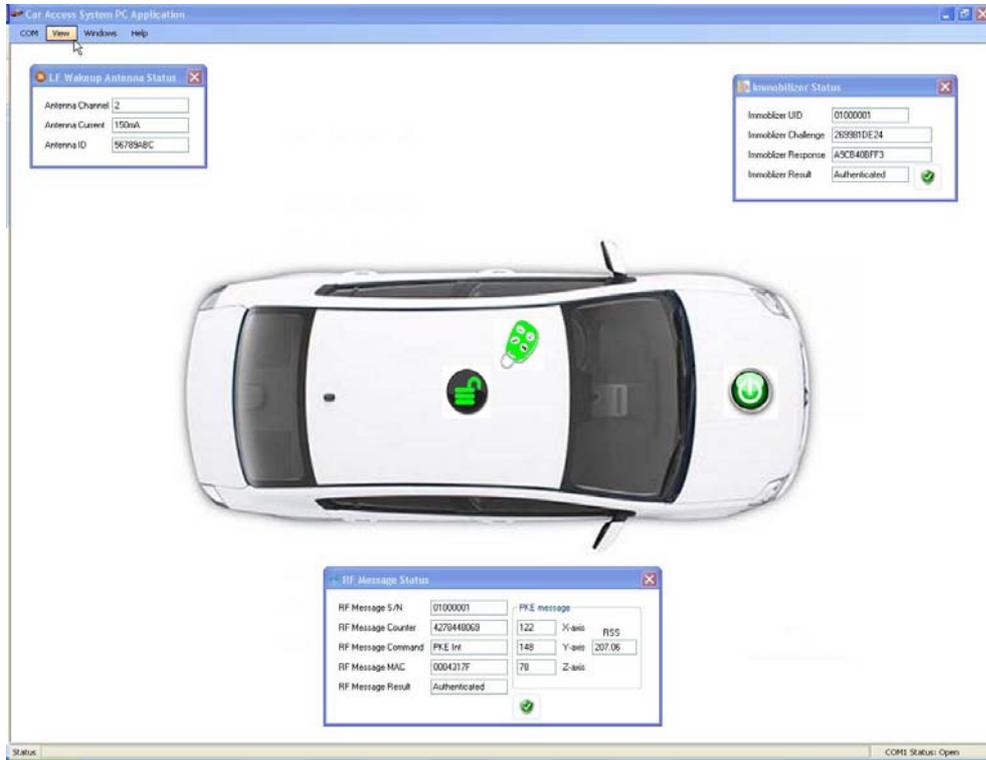
To enable communication between the Atmel® STK600 and the GUI, locate and click the “COM” command in the tool bar located in the top left corner of the screen. Select the COM port corresponding to the connection made on your PC. When using the included USB converter, check to make sure that the COM port is correct. For true serial ports, this will be the dedicated serial port of the host PC which is typically COM1. Insure that the value populated in the Baud Rate field is set to 38400. Confirmation of successful serial connectivity will be the field in the lower right portion of gray status bar at the bottom of the screen. See [Figure 1-9](#) as an example.

Figure 1-9. Serial Communication Set-up



To open windows containing function specific message content, select “View” from the blue tool bar at the top of the screen and click on “RF Messaging”, “Immobilizer”, and “LF Messaging”. After the three windows pop up, they can be re-positioned in the screen by clicking on the blue bar and dragging it to a new location as shown in [Figure 1-10](#).

Figure 1-10. Message Status Windows



Finally, be sure to enable your PC's sound output so that audio feedback for CARS functionality can be heard! Now, you are ready to explore the CARS functionality.

2. Car Access Reference System Functionality

This section explains each of the sub-systems comprised in a typical Car Access System; Remote Keyless Entry (RKE), Immobilizer (IMM), Passive Entry (PE), and Passive Start (PS).

Using Atmel® AVR Studio®4, be sure to verify that VTARGET is set to 5V. This may have been modified to 3V if Transmitter boards were reprogrammed. This is necessary for proper communication between the Atmel STK600 and the CAR System Interface Board.

2.1 Remote Keyless Entry (RKE): Learn Mode and Normal Operation

RKE is a feature that allows authorized users to remotely lock or unlock their car. The RF message propagates in all directions with a range of 30m or more. This message contains information that is used to confirm the identity and verify authenticity of the user. Security is provided by the AES cryptology and by the protocol that we have implemented.

Before RKE system functionality can be observed an RF transmitter must be paired to the vehicle. This process involves placing the vehicle's receiver in a mode that allows it to learn the secret key contained in the key fob.

Press SW5 on the Atmel STK600 to enter the RF learn mode. LED5 will turn on indicating the learn mode is active. During this 10 second period, press S1 on the Atmel ATA5771/73/74 Transmitter Application Board. Successful learning is indicated by a blink on LED5 and a momentary appearance of the Learn Mode icon (a graduate's mortarboard) on the PC GUI.

As long as LED5 is on, the learn mode is active and the other transmitters supplied with this kit can be learned too; a) Atmel ATA5795-EK1 Transmitter with 1D LF Application Board using S1 and b) Atmel ATA5790-EK1 PEPS Transmitter with 3D/1D LF Application Board using S3.

To exit the learn mode, either press SW5 on the Atmel STK600 or let the 10 second period time-out. LED5 will turn off indicating normal operation.

Functionality can be observed using the PC GUI and the visual feedback from the Atmel STK600. Consecutive depressions of the transmitter LOCK button (S3 on Atmel ATA577x and Atmel ATA5795-EK1; S1 on Atmel ATA5790-EK1) will sequentially advance the illuminated LED to the left through positions LED0 - LED4. Consecutive depression of the UNLOCK button (S2) will advance the LED to the right.

The PC GUI supplies additional information such as transmitter ID, sequence counter, command, encryption, and status in the RF Message Status window. Watch the icon located in the center of the car and listen for additional feedback on RKE system status.

For additional information on the RF protocol, See Atmel AVR411, located at the following link:

http://www.atmel.com/dyn/resources/prod_documents/doc2600.pdf

This document provides detailed information on the Atmel Rolling Code Algorithm which is implemented in the RF portion of this kit.

2.2 Immobilizer (IMM): Learn Mode and Normal Operation

The immobilizer feature is typically used in vehicles as a means to restrict engine starting to authorized users only. Attempts to start the engine without an authenticated link between key and vehicle will be blocked and result in an immobilized vehicle.

Before immobilizer system functionality can be observed, the LF transponder must be paired with the vehicle. This requires the transfer of two secret keys from the vehicle's control module to the key fob / transponder. These two secret keys are Random Numbers generated on demand and must be sent to the key fob. To accomplish this, place the coil of the device being learned within 2cm of the coil attached to the Atmel ATA5272-EK1 Basestation Application Board and press SW4 on the Atmel STK600. Successful learning is indicated by a blink on LED5 and a momentary appearance of the Learn Mode icon (a graduate's mortar-board) on the PC GUI. For optimum results, align the axis of both coils in parallel. This process can be repeated for all key fobs containing devices with IMM functionality such as Atmel ATA5580 (Figure 2-1 on page 10), Atmel ATA5790 (Figure 2-2 on page 10) or Atmel ATA5795 (Figure 2-3 on page 11).

For devices with an integrated immobilizer, the RKE learn mode requirements are also satisfied during the IMM learning process. One of the two programmed secret keys is shared with RKE and also the Rolling Code Counter is read out from EEPROM during the IMM learn sequence.

Figure 2-1. Atmel ATA5580 Immobilizer Programming

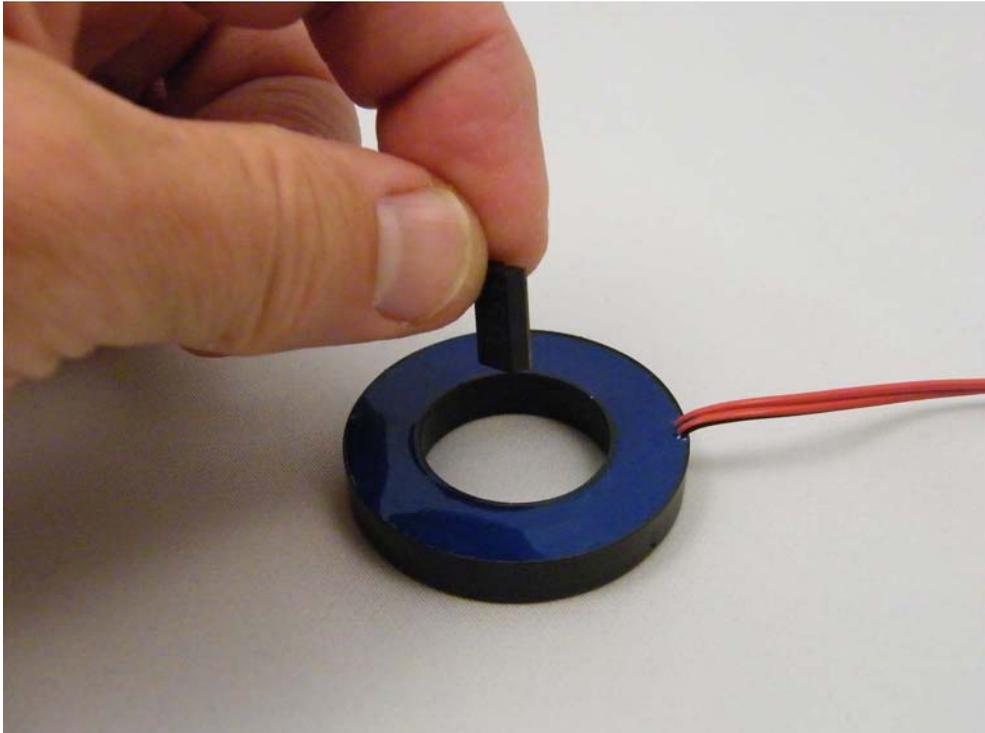
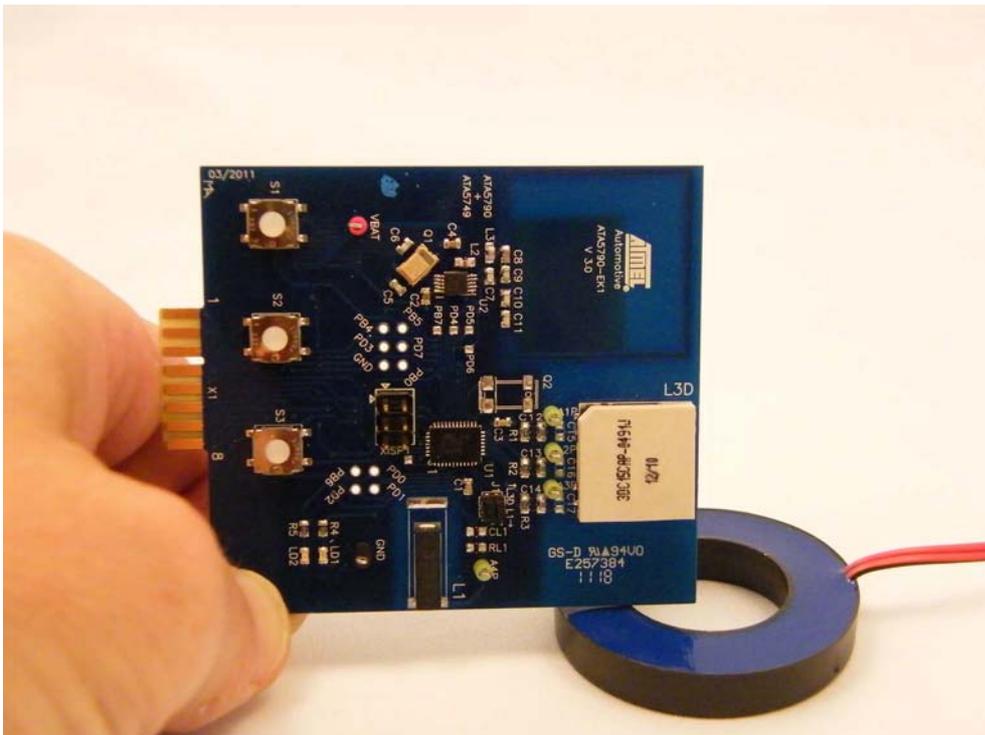
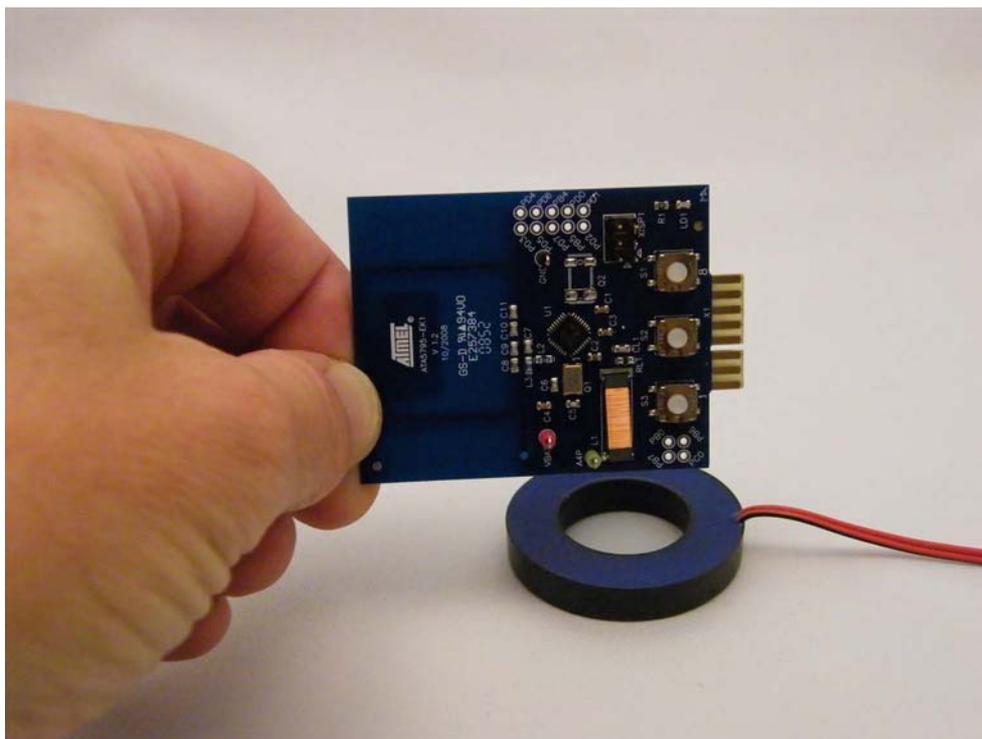


Figure 2-2. Atmel ATA5790 Immobilizer Programming



Note: The immobilizer coil is configured to be part of the integrated 3D LF coil (white square component with L3D designation on PCB). As shown in [Figure 2-2](#), this coil is oriented vertically.

Figure 2-3. Atmel ATA5795 Immobilizer Programming



Immobilizer functionality can be observed using the PC GUI as well as visual feedback from the Atmel® STK600. Place the key fob with its immobilizer coil aligned and near to the Atmel ATA5272-EK1 Basestation coil and press SW1 on the Atmel STK600. Successful authentication (vehicle is NOT immobilized) is indicated on the Atmel STK600 by the right to left advancement of an illuminated LED in the range of LED0 to LED4 and the illumination of LED6. It is also shown on the PC GUI with the appearance of an Immobilizer icon. Since the immobilizer is a passive function, it can be demonstrated either with or without the key fob battery in place.

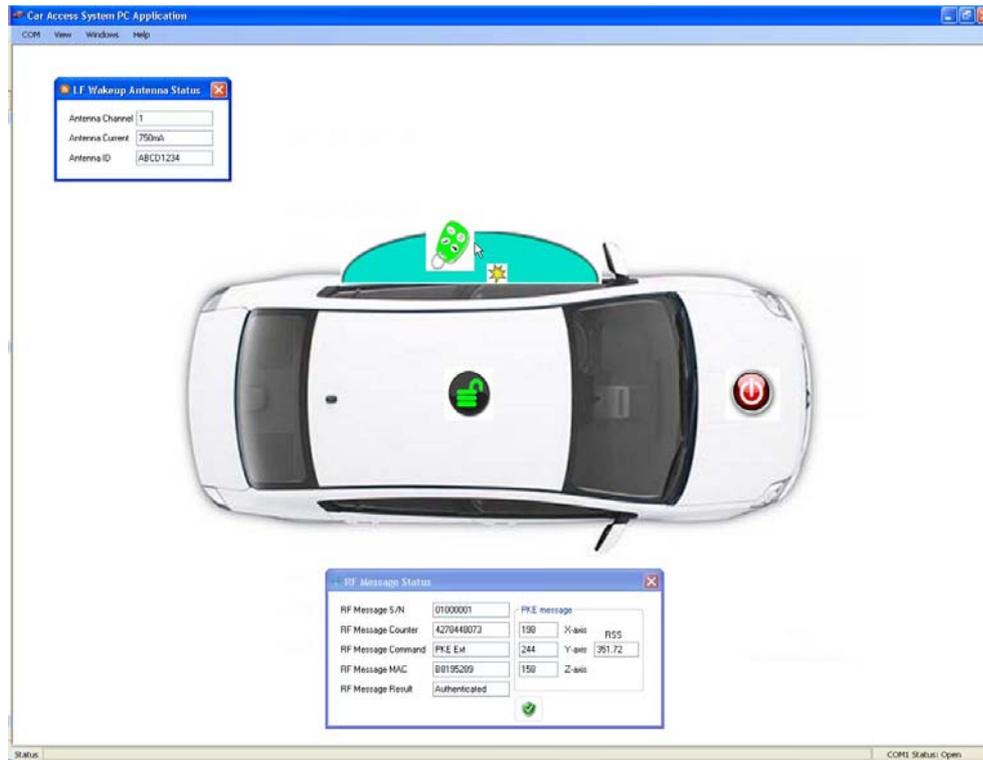
Additional details of the authentication process and protocol can be obtained in the document titled “Open Immobilizer Protocol Stack”. A registered copied can be obtained by following the link:
http://www.atmel.com/forms/registration_immobilizer_stack.asp?category_id=154&family_id=692&subfamily_id=1949&fn=d_l_doc9195.pdf

2.3 Passive Entry (PE): Learn Mode and Normal Operation

Passive Entry (PE) is a vehicle access feature that eliminates the need to manually press the LOCK/UNLOCK buttons on the key fob. Instead, the vehicle generates a magnetic field around certain regions of its periphery that is used to wake up the key fob from a low power state which then sends a response over RF back to the vehicle. The learn process for this feature is the same as for RKE or IMM.

To observe PE unlock functionality on the PC GUI, position the antennas connected to the Atmel ATAB5279 6-Channel Coil Driver Board at rights angles to each other and place the Atmel ATA5790-EK1 PEPS Transmitter with 3D/1D LF Application Board about 1m away (user standing beside vehicle). The key fob orientation doesn't matter because its three antennas are orthogonally mounted in order to enable magnetic field detection regardless of its position in space. Press SW7 on the Atmel STK600 to initiate the magnetic field generation associated with the driver side door trigger event. This typically occurs when the door handle is touched. LED7 turns on to indicate that the lock command originated from a passive trigger (not RKE) and sequentially advances the illuminated LED to the left through positions LED0 - LED4 on the STK600. The PC GUI animates the magnetic field generation in blue, the keyfob's detection, RF transmission, and the successful vehicle's authorization as a green key fob icon. This is shown in [Figure 2-4 on page 12](#).

Figure 2-4. Passive Entry - UNLOCK

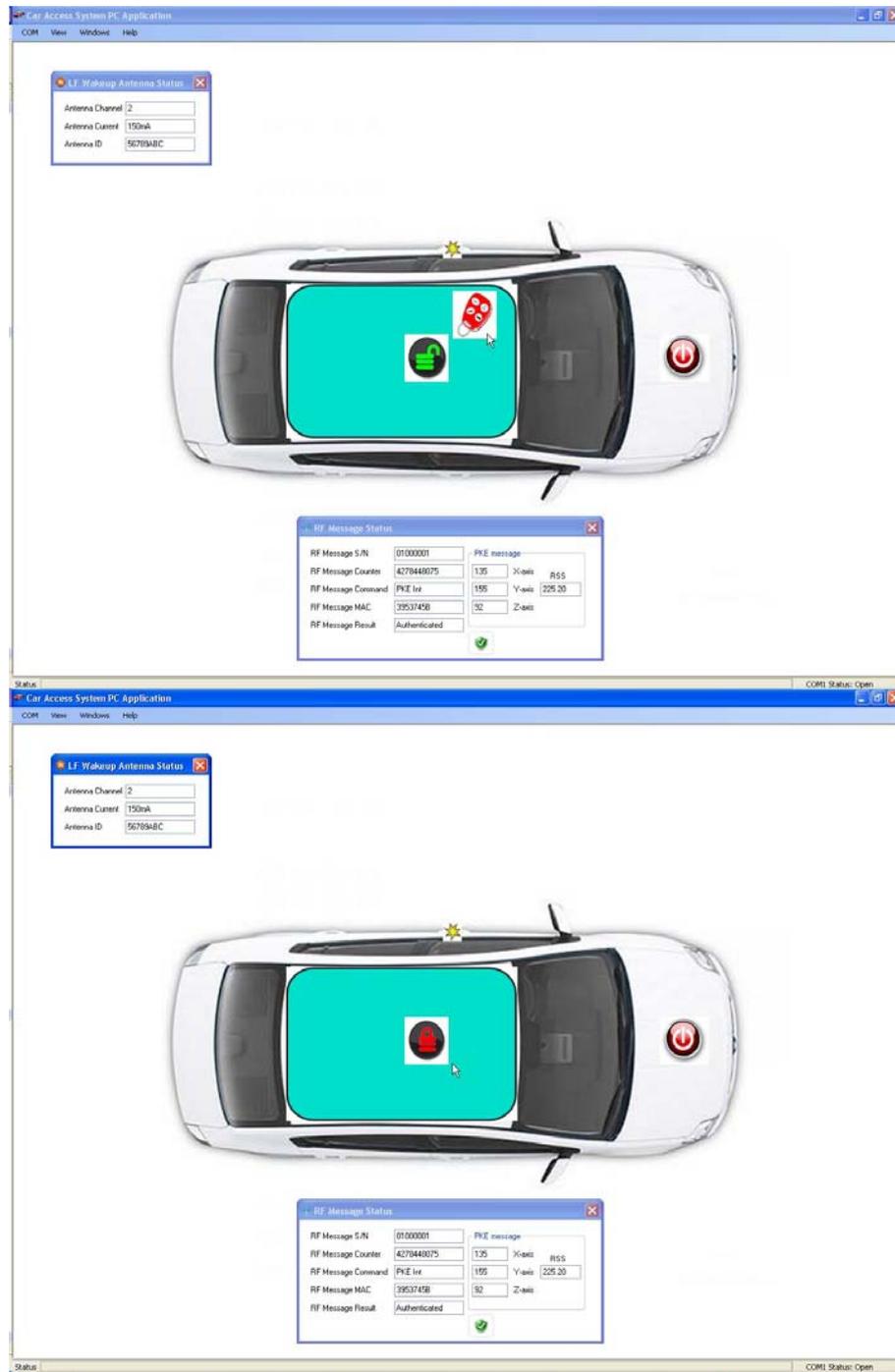


The PE Lock function shows two different use case possibilities. The first demonstrates what would happen if the key fob is forgotten inside the vehicle when the lock button on the door handle is pressed. To observe this, place the Atmel® ATA5790-EK1 PEPS Transmitter with 3D/1D LF Application Board about 0.5m away (fob inside vehicle) and press SW6 on the Atmel STK600 to trigger the magnetic field generation associated PE lock function. This typically occurs after the vehicle is switched off and the driver's door ajar switch cycles state indicating the driver is exiting the vehicle. The system will "search" the inside of the vehicle, and upon receiving a valid message indicating that the key fob is present and left in the vehicle, LED7 turns on to indicate a passive trigger (not RKE) and sequentially advances the illuminated LED to the right through positions LED4 - LED0 on the Atmel STK600. The PC GUI will show a key fob in red inside the vehicle as a warning and the doors will unlock as shown by the icon and sound. This show that keys left in the vehicle by accident can not be locked unintentionally.

Note: It is possible to intentionally lock a PEPS key in the vehicle by pressing the LOCK button on a second key fob. The second case show what happens if the key fob is removed from the vehicle. Position the Atmel ATA5790-EK1 PEPS Transmitter with 3D/1D LF Application Board >3m away (to simulate user has walked away from vehicle) and press SW6 on the Atmel STK600 to trigger the magnetic field generation. Because the key fob is out of range, an RF message will not be sent. The vehicle will wait for a time-out period and then lock the vehicle.

Both cases are shown in [Figure 2-5](#).

Figure 2-5. Passive Keyless Entry - LOCK



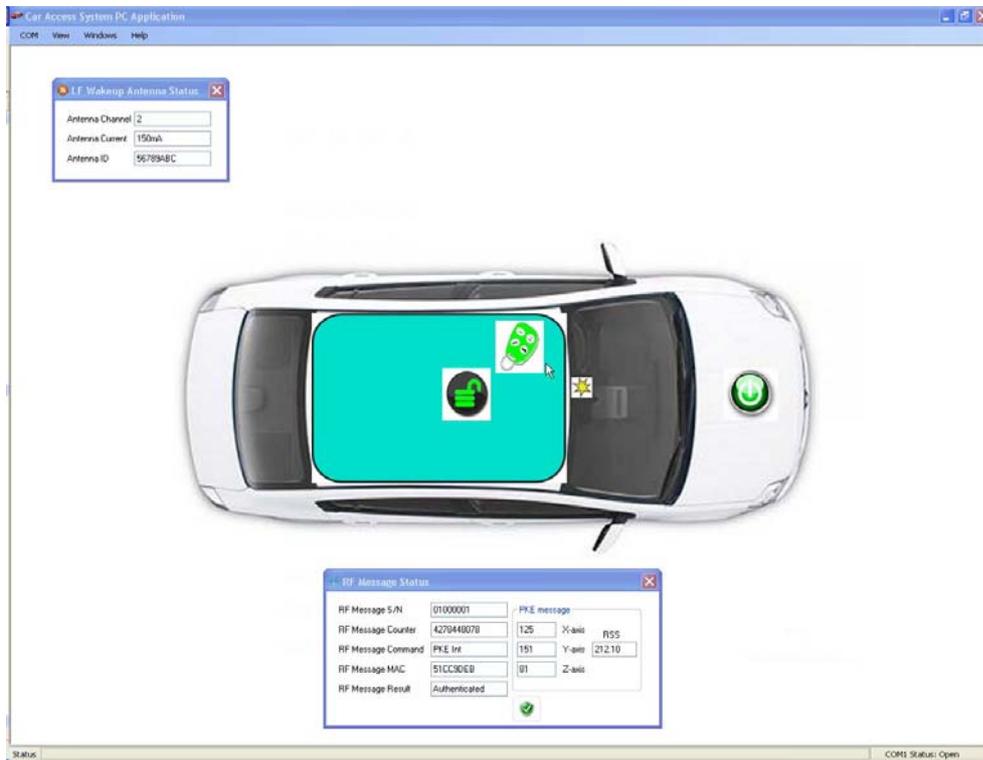
Note: In a true PEPS implementation, the system uses the received signal strength (RSSI) of the LF field at the key fob to determine if the key is inside or outside the vehicle. Because of this, an RF message may be sent if the key fob is outside the vehicle but still in LF wake-up range. Currently this ability is not shown with this kit due to the difficulty to keep physical locations constant with a demo kit that will be set up differently each time. We model this functionality by the reception (or lack thereof) of an RF message.

2.4 Passive Start (PS): Learn Mode and Normal Operation

Passive Start is a feature that enables the user to start the engine by pressing a pushbutton mounted in the interior of the vehicle, typically on the dashboard. This eliminates the need for a mechanical key. The pushbutton triggers the generation of a magnetic field in the interior of the vehicle which is measured by the key fob. If the key fob detects magnetic field strength corresponding to a location within the vehicle and the vehicle can authenticate the key fob to the vehicle, the engine is allowed to start.

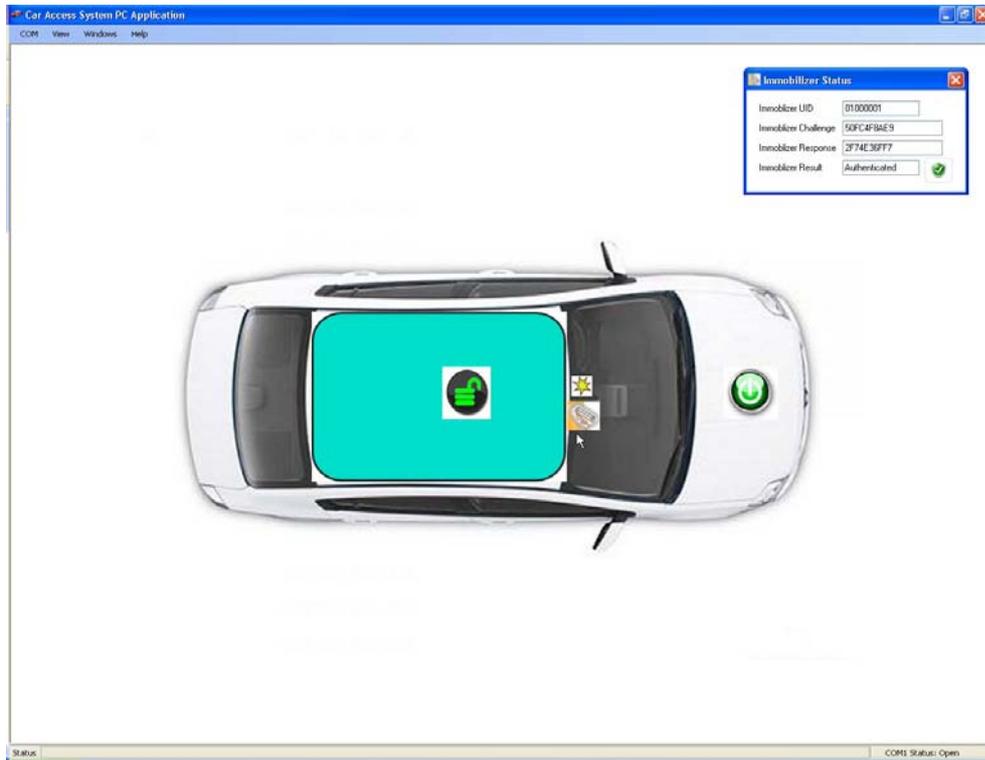
This feature can be observed with the Atmel® ATA5790-EK1 PEPS Transmitter with 3D / 1D LF Application Board. Using the same set up described in [Section 2.3 “Passive Entry \(PE\): Learn Mode and Normal Operation” on page 11](#), locate the key fob within 1m of the Atmel ATAB5279 6-Channel Coil Driver Board's antenna coils and press SW0. LED7 will illuminate and an LED will sequence from left to right in the field contained by LED4 to LED0 indicating successful engine start. The PC GUI will animate this process as shown in [Figure 2-6](#).

Figure 2-6. Passive Start



The system also includes a contingency in case the battery within the Atmel® ATA5790-EK1 PEPS Transmitter is discharged. To observe this, remove its battery and place the immobilizer coil aligned and near to the Atmel ATA5272-EK1 Basestation coil (shown in [Figure 2-5 on page 13](#)). Pressing SW0 will trigger the passive start function as before. However, because the system did not receive an RF response due to the removed battery it will time-out and try the Immobilizer function next. This time LED6 will illuminate indicating the back up immobilizer was the source of authentication to start the engine. This is also animated on the PC GUI as shown in [Figure 2-7](#).

Figure 2-7. Backup Passive Start using Immobilizer



3. Source Code Modification

FLASH and EEPROM programming is required for all boards that contain an AVR microcontroller and can be accomplished using In System Programming (ISP). The affected PCB assemblies are noted below:

- Atmel® ATA5771/73/74 Transmitter Application Board
- Atmel ATA5795-EK1 Transmitter with 1D LF Application Board
- Atmel ATA5790-EK1 PEPS Transmitter with 3D / 1D LF Application Board
- Atmel ATA5272-EK1 Basestation Application Board

The ISP frequency (SCK) must be less than 1/4 of the target clock. The ISP frequency is set by the Atmel STK600 programming dialog in AVR Studio®.

3.1 Adding New Device Support to AVR Studio4

Support for the new devices showcased in this Evaluation Kit must be added to AVR Studio. All files referenced below are included with this kit.

Note: [Studio install path] is typically C:\Program Files\Atmel\
[IAR install path] is typically C:\Program Files\IAR Systems\Embedded Workbench 5.4

For AVRStudio4 support file, the following files must be properly located as noted below:

- ata5790.xml” and “ata5795.xml” files go into [Studio install path]\AVR Tools\Partdescriptionfiles
- ata5790def.inc” and “ata5795def.inc” files go in [Studio install path]\AVR Tools\AVRAssembler\Appnotes
- ata5790def.inc” and “ata5795def.inc” files go in [Studio install path]\AVR Tools\AVRAssembler2\Appnotes

For General support, the following files must be properly located and edited as noted below:

- Atmel ATA5790.h file goes in your project root folder
- Edit the [Studio install path]\AVR Tools\Compilers\supportedparts.txt file by adding two new lines; one for ATA5790 and one for ATA5795

For IAR Compiler support, the following files must be properly located as noted below:

- ioata5790.h” and “ioata5795.h” file goes in [IAR install path]\avr\inc
- Inkata5790.xcl” and “Inkata5795.xcl” files goes in your project root folder

3.2 Programming the Atmel ATA5272-EK1 Basestation

Prepare the Atmel ATA5272-EK1 Basestation Application Board (including coil) for programming by removing the PA4/OUT jumper. The AVR® microcontroller contained within the Atmel ATA5272 is an Atmel ATtiny87. Please refer to [Figure 3-1 on page 17](#) to [Figure 3-5 on page 19](#) for a series of screen shots depicting the programming steps described below. Using AVR Studio4®, program the Atmel ATtiny87 on the Atmel STK600 using the same sequence of steps described in the previous section. Select the “Display the 'Connect' Dialog” icon and specify “STK600” and “USB” followed by clicking on “Connect” button to enable display of the Programming window. Select the “Main” tab and pick the AT tiny87 device. Be sure to set ISP frequency to 100kHz. Verify proper fuse settings and insure target voltage is set to 5.0. Return to “Main” tab and verify proper set up by clicking the “Read Signature” to be sure signature matches the selected device. Next select the “Program” tab and browse to locate files titled “ATAK51001-V1_ATA5272.a90” to program into the Flash and “ATAK51001-V1_AOIP_BS.eep” to program into the EEPROM. The files can be found in the distribution files supplied with this kit.

After programming, be sure to restore the PA4/OUT jumper to its original location for normal operation.

Figure 3-1. Connection Dialog Window for Atmel ATA5272-EK1 Basestation Application Board



Figure 3-2. Main ISP Programming Window for Atmel ATA5272-EK1 Basestation Application Board

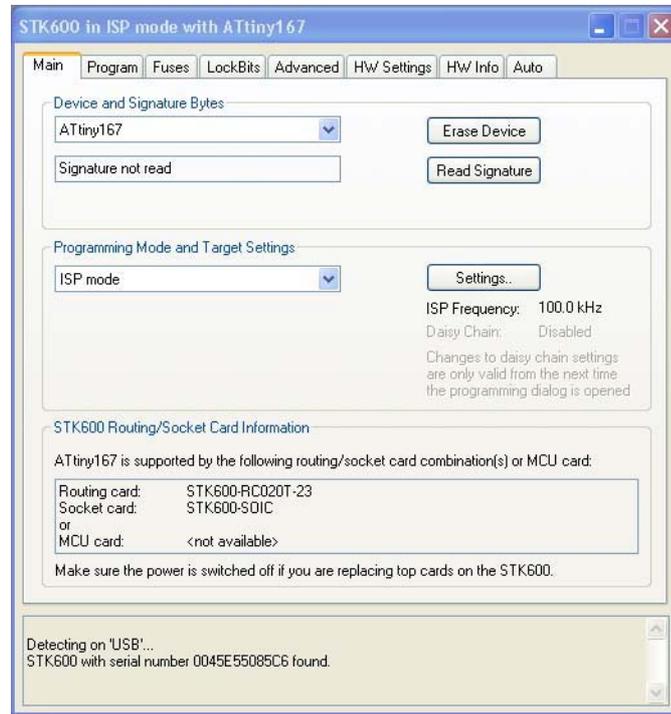


Figure 3-3. Fuse Setting Window for Atmel ATA5272-EK1 Basestation Application Board

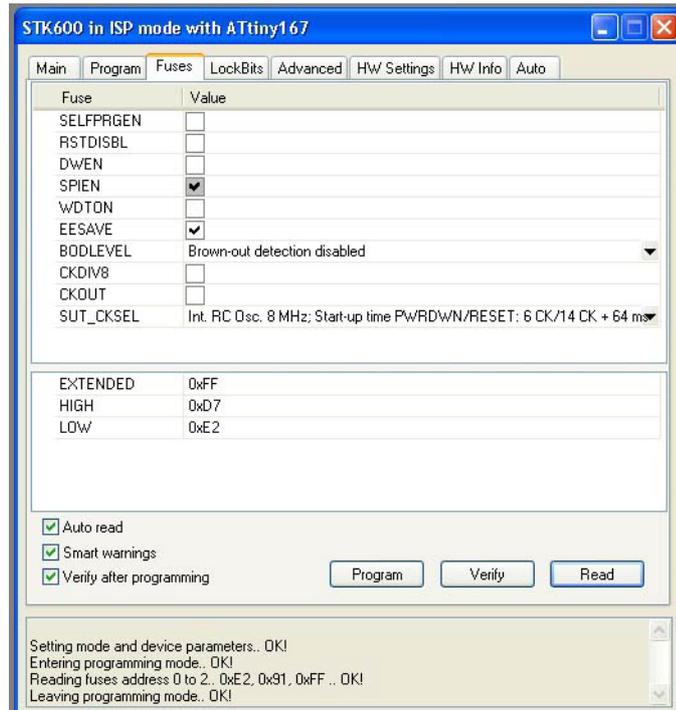


Figure 3-4. Hardware Settings Window for Atmel ATA5272-EK1 Basestation Application Board

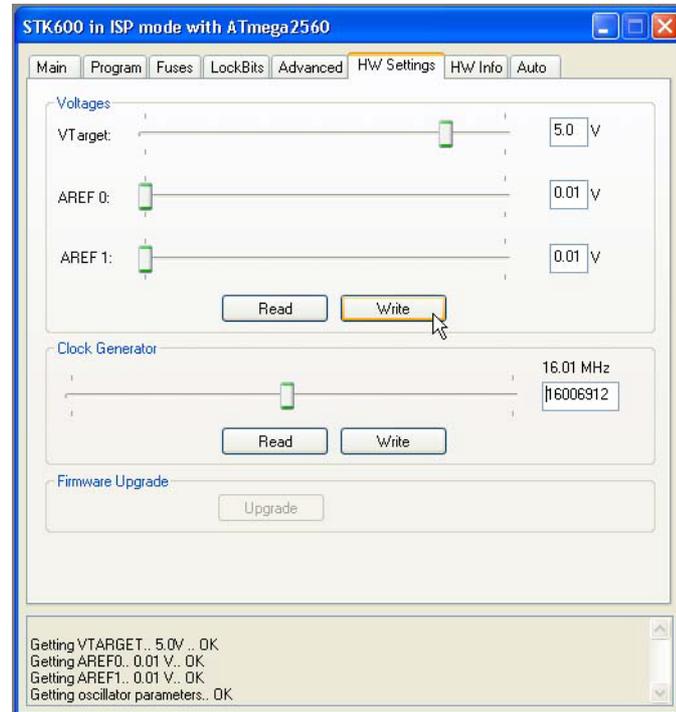
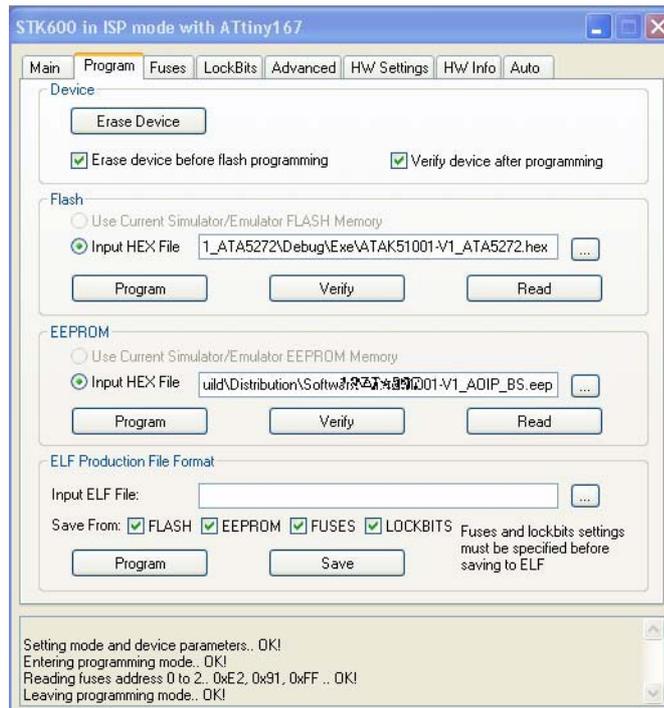


Figure 3-5. Program Window for Atmel ATA5272-EK1 Basestation Application Board



3.3 Programming the Atmel ATA5771/73/74 Transmitter

Prepare to program the Atmel® ATtiny44 contained within the Atmel ATA577x IC by connecting the ISP 6-wire cable from the Atmel STK600 to the 6-pin header on ISP Interface Adaptor. Insert the Atmel ATA5771/73/74 Transmitter Application Board into the edge card connector on the ISP Interface Adaptor.

Be sure to remove the battery in the Atmel ATA5771/73/74 Transmitter Application Board and set the target voltage for 3.0V prior to programming the Atmel ATtiny44.

Please refer to [Figure 3-6 on page 20](#) to [Figure 3-10 on page 22](#) for a series of screen shots depicting the programming steps that follow. Using AVR Studio4®, program the Atmel ATtiny44 using the Atmel STK600 in the same sequence of steps described in the previous section. Select the “Display the 'Connect' Dialog” icon. Select “STK600” and “USB” followed by clicking on “Connect” button to enable display of the Programming window. Select the “Main” tab and pick the Atmel ATtiny44 device. Be sure to set ISP frequency to 100kHz. Verify proper fuse settings and insure target voltage is set to 5.0. Return to “Main” tab and verify proper set up by clicking the “Read Signature” to be sure signature matches the selected device. Next select the “Program” tab and browse to locate files titled “ATAK51001-V1_ATA577x.a90” to program into the Flash and “ATAK51001-V1_AOIP_ATA577x_ID1.eep” to program into the EEPROM. The files can be found in the distribution files supplied with this kit.

Figure 3-6. Connection Dialog Window for Atmel ATA5771/73/74 Transmitter Application Board



Figure 3-7. Main ISP Programming Window for Atmel ATA5771/73/74 Transmitter Application Board

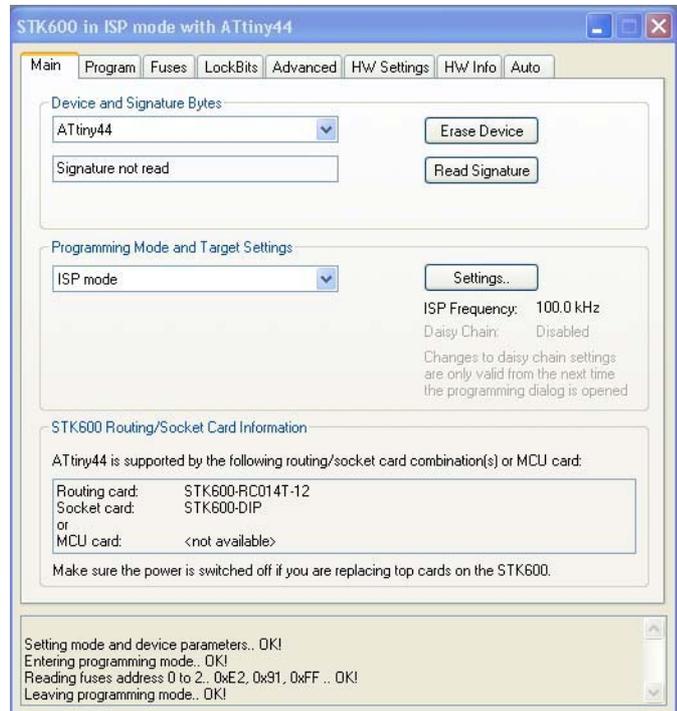


Figure 3-8. Fuse Setting Window for Atmel ATA5771/73/74 Transmitter Application Board

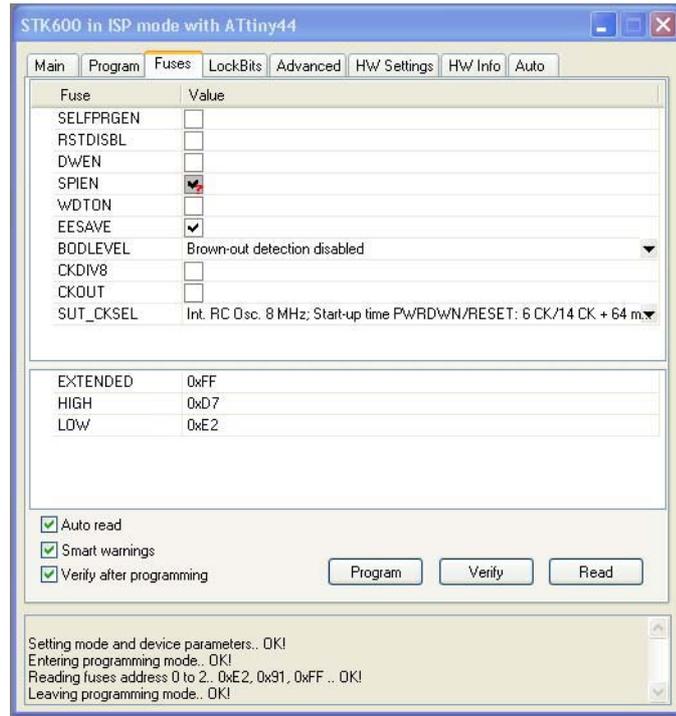


Figure 3-9. Hardware Settings Window for Atmel ATA5771/73/74 Transmitter Application Board

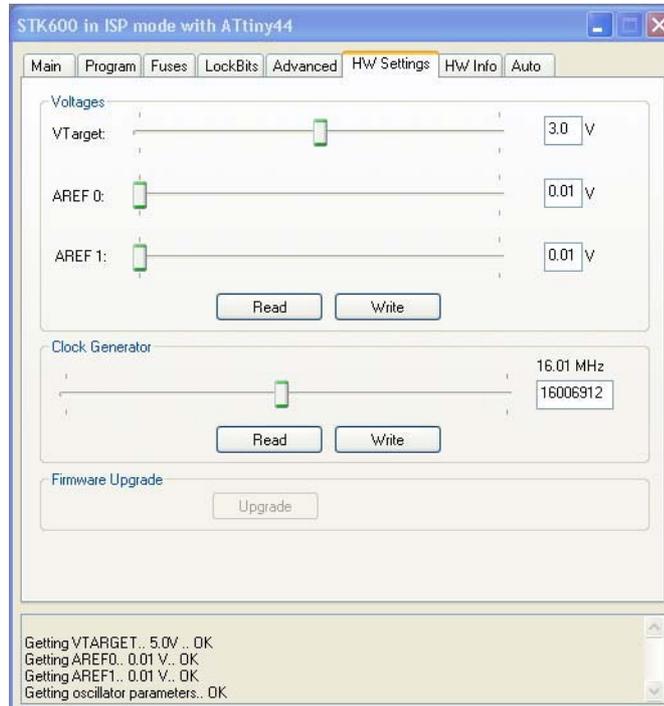
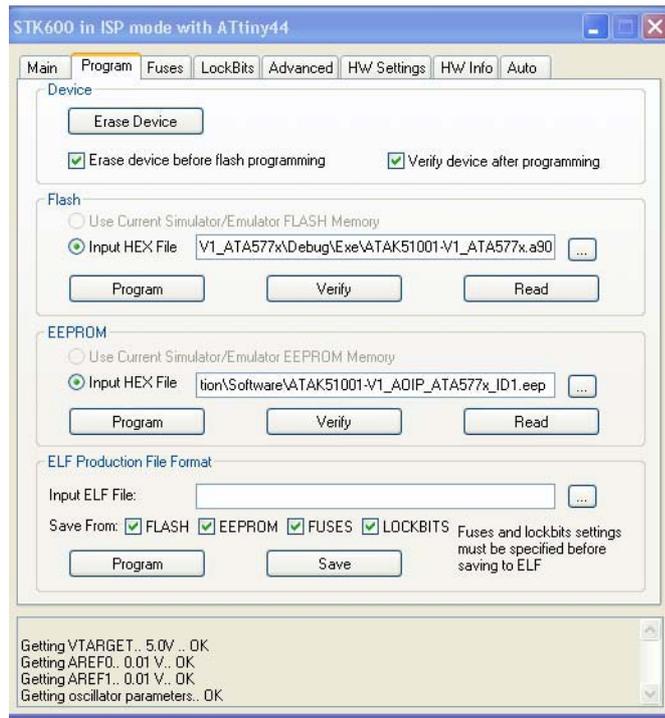


Figure 3-10. Program Window for Atmel ATA5771/73/74 Transmitter Application Board



After programming is completed and board is disconnected from ISP cable, be sure to insert battery to restore normal operation.

3.4 Programming the Atmel ATA5790-EK1 PEPS Transmitter

Program the Atmel® ATA5790 by connecting the ISP 6-wire cable from the Atmel STK600 to the 6-pin ISP header located on the Atmel ATA5790-EK1 PEPS Transmitter board. Begin programming by selecting Tools/AVR Programming to bring up the ISP menus. Select the “Display the ‘Connect’ Dialog” icon. Select “STK600” and “USB” followed by clicking on “Connect” button to enable display of the Programming window. Select the “Main” tab and pick the Atmel ATA5795 device. Be sure to set ISP frequency to less than 100kHz! Verify proper fuse settings and insure target voltage is set to 3.0. Return to “Main” tab and verify proper set up by clicking the “Read Signature” to be sure signature matches the selected device. Next select the “Program” tab and browse to locate files titled “ATAK51001-V1_ATA5790-5749.a90” and “ATAK51001-V1_AOIP_KF1.eep” as shown in [Figure 3-11 on page 23](#) to [Figure 3-15 on page 25](#). The files can be found in the distribution files supplied with the CARS kit.

Be sure to remove the battery in the Atmel ATA5790-EK1 PEPS Transmitter and set the target voltage for 3.0V prior to programming the Atmel ATA5790.

Figure 3-11. Connection Dialog Window for Atmel ATA5790-EK1 PEPS Transmitter Application Board



Figure 3-12. Main ISP Programming Window for Atmel ATA5790-EK1 PEPS Transmitter Application Board

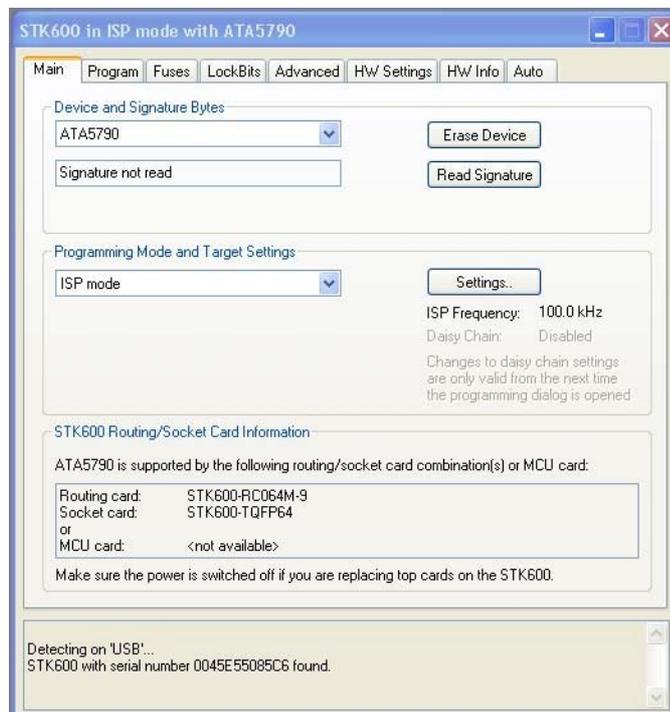


Figure 3-13. Fuse Setting Window for Atmel ATA5790-EK1 PEPS Transmitter Application Board

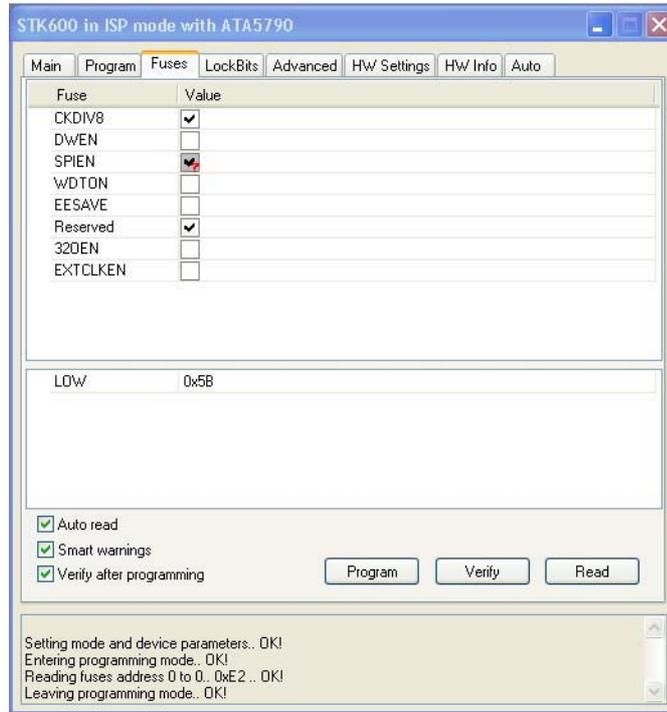


Figure 3-14. Hardware Settings Window for Atmel ATA5790-EK1 PEPS Transmitter Application Board

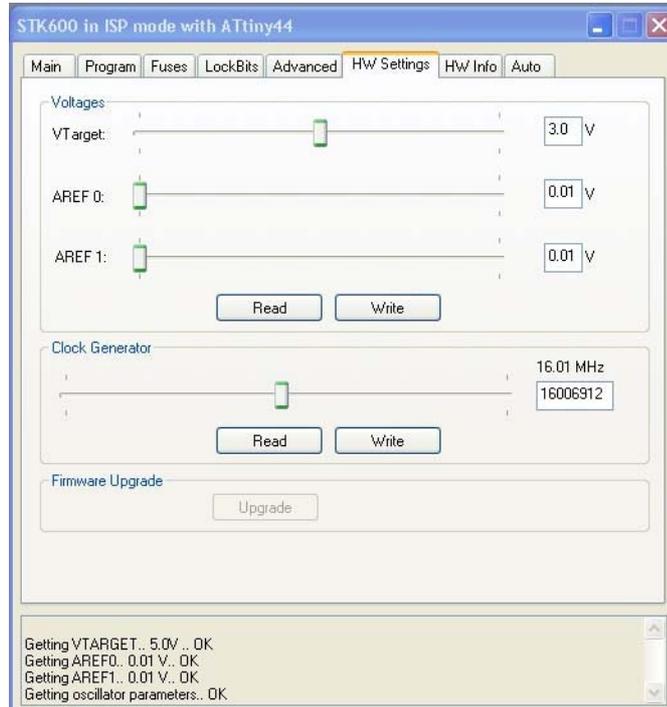
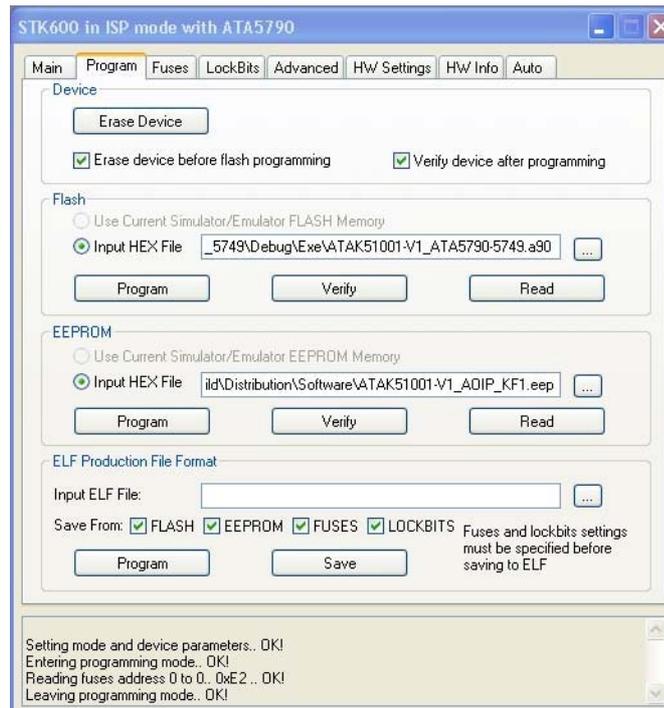


Figure 3-15. Program Window for Atmel ATA5790-EK1 PEPS Transmitter Application Board



After programming is completed and board is disconnected from ISP cable, be sure to insert battery to restore normal operation.

3.5 Program the ATA5795-EK1 Transmitter

Program the Atmel® ATA5795 by connecting the ISP 6-wire cable from the Atmel STK600 to the 6-pin ISP header on the Atmel ATA5795-EK1 Transmitter Board.

Be sure to remove the battery in key fob and set the target voltage for 3.0V prior to programming the Atmel ATA5795.

Please refer to [Figure 3-16 on page 26](#) to [Figure 3-20 on page 28](#) for a series of screen shots depicting the programming steps that follow. Using AVR Studio4®, program the Atmel ATA5795 using the Atmel STK600 in the same sequence of steps described in the previous section. Select the “Display the 'Connect' Dialog” icon. Select “STK600” and “USB” followed by clicking on “Connect” button to enable display of the Programming window. Select the “Main” tab and pick the Atmel ATA5795 device. Be sure to set ISP frequency to less than 100kHz! Verify proper fuse settings and insure target voltage is set to 3.0. Return to “Main” tab and verify proper set up by clicking the “Read Signature” to be sure signature matches the selected device. Next select the “Program” tab and browse to locate files titled “ATAK51001-V1_ATA5795.a90” to program into the Flash and “ATAK51001-V1_AOIP_KF2.eep” to program into the EEPROM. The files can be found in the distribution files supplied with this kit.

Figure 3-16. Connection Dialog Window for Atmel ATA5795-EK1 Transmitter Application Board

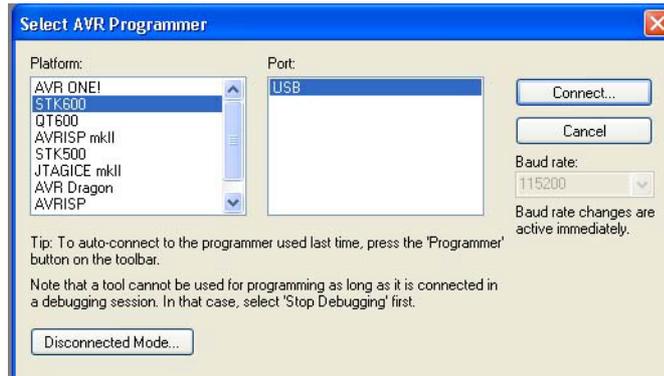


Figure 3-17. Main ISP Programming Window for Atmel ATA5795-EK1 Transmitter Application Board

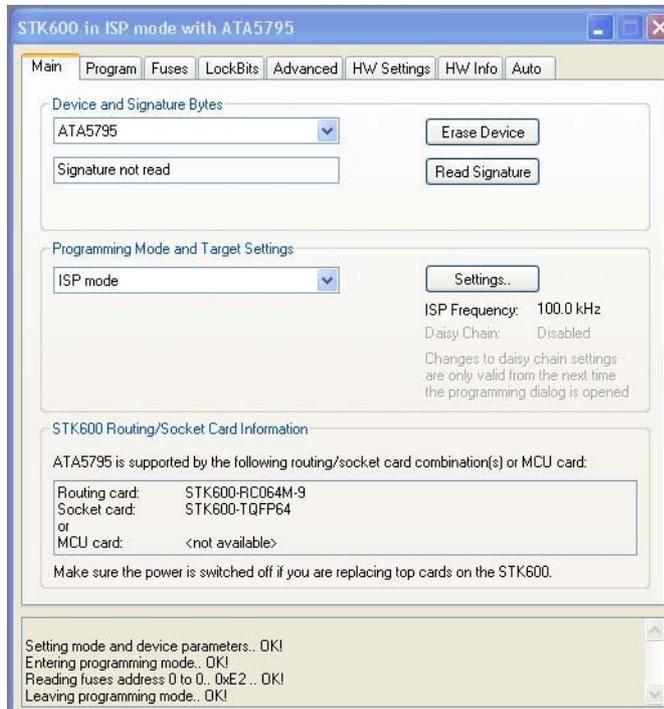


Figure 3-18. Fuse Setting Window for Atmel ATA5795-EK1 Transmitter Application Board

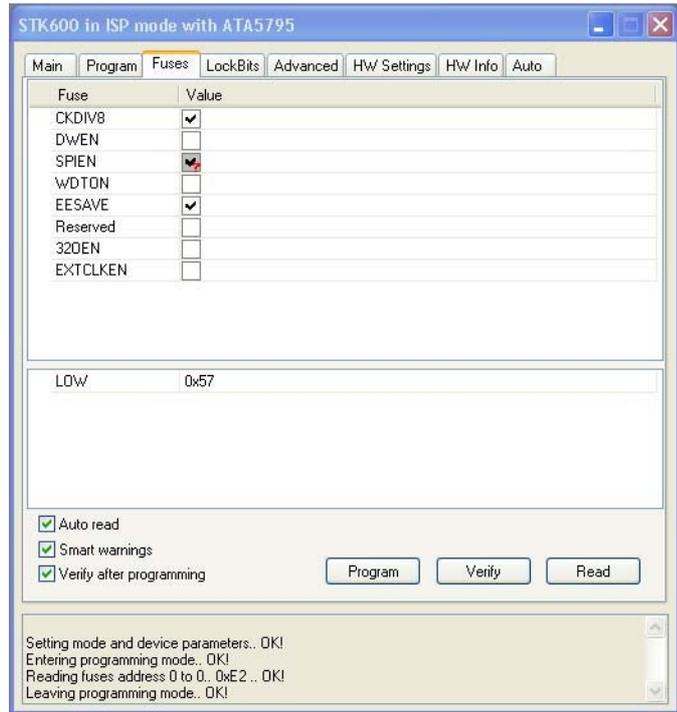


Figure 3-19. Hardware Settings Window for Atmel ATA5795-EK1 Transmitter Application Board

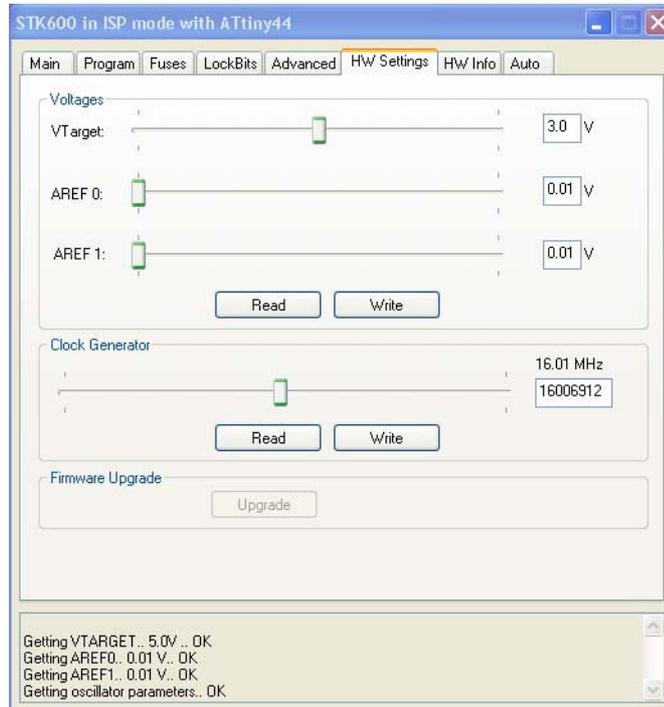
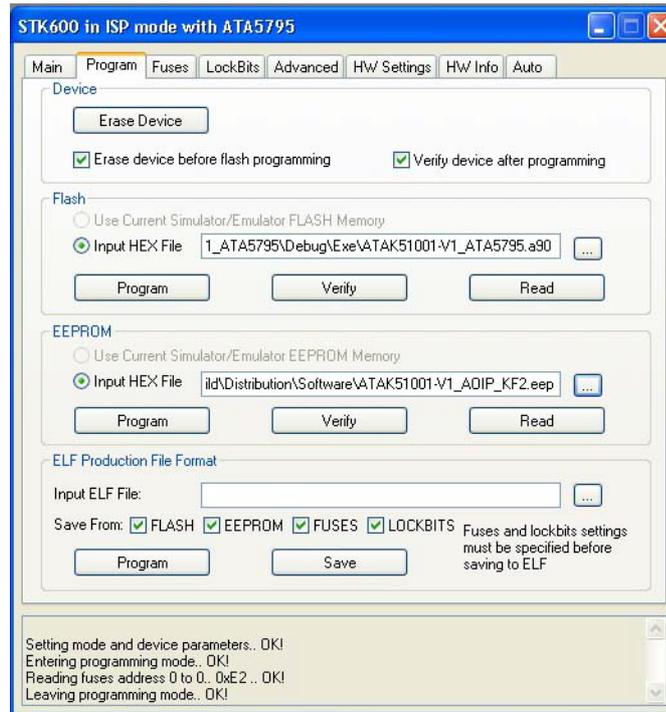


Figure 3-20. Program Window for Atmel ATA5795-EK1 Transmitter Application Board



After programming is completed and board is disconnected from ISP cable, be sure to insert battery to restore normal operation.

4. Troubleshooting

Table 4-1. Troubleshooting Guide

Problem	Cause	Solution
Get warning message saying can't program using ISP	The AVR device is in DebugWire mode.	Consult User Guide for either AVR Dragon or JTAGEICE mkII for directions on how to clear DebugWire mode. Requires opening a project and running a debug session.
	ISP clock frequency is set too high.	Using AVR Studio4®, set ISP to 100kHz or less. See Figure 1-4 on page 4 .
PKE function does not work	VTARGET on Atmel STK600 is not set to 5V	Using AVR Studio4, set VTARGET to 5V. See Figure 1-6 on page 5 .
	LF Driver antenna connection is not sufficient	Recheck the connection of the LF antennas. This may not be a solid connection.
	Key fob is not waking up	Check to see if the LED blinks on the key fob. Remove the battery and replace to reset the software.
	RF reception is corrupted	Check for other sources of RF noise or transmissions.
LED5 on Atmel STK600 periodically blinks "ON" rapidly 3 times	Atmel ATmega2560 on Atmel STK600 can establish communication with Atmel ATA5724 receiver	Check to insure receiver board is properly mounted and 12V power is applied CAR System Interface Board.
	VTARGET on STK600 is not set to 5V	Using AVR Studio4, set VTARGET to 5V. See Figure 1-6 on page 5 .
RKE or PKE function does not work	CR2032 lithium battery not inserted in socket (Atmel ATA5790, Atmel ATA5795 and Atmel ATA5774 handheld PCBs)	
	RF reception is corrupted	Check for other sources of RF noise or transmissions.
Immobilizer does not function	Key Fob transponder orientation is incorrect	Because of the properties of a magnetic field the antennas must be aligned correctly. See Figure 2-1 on page 10 to Figure 2-3 on page 11 .
	Basestation coil is placed on or near metal surfaces	Metal will detune the antenna resonant circuit. This can be fixed by moving the antenna or retuning.
	Key Fob transponder is too far away	The immobilizer draws all power to operate from the LF field. This means that the range of operation is quite small. Typically < 20cm
	PA4/OUT jumper removed	This provides the demodulated data from the LF reader to the microcontroller for processing. It is required to remove this when reprogramming the microcontroller but must be replaced.
Can't read device signature in ISP mode	12V supply not connected to Atmel STK600. Some power is supplied through USB connection, but not for ISP programming.	In addition to connecting USB between Atmel STK600 and host PC, connect 12V wall transformer output to mating plugs on Atmel STK600 and CAR System Interface Board.

5. Revision History

Please note that the following page numbers referred to in this section refer to the specific revision mentioned, not to this document.

Revision No.	History
9253B-RKE-07/15	• Put document in the latest template



Atmel Corporation 1600 Technology Drive, San Jose, CA 95110 USA T: (+1)(408) 441.0311 F: (+1)(408) 436.4200 | www.atmel.com

© 2015 Atmel Corporation. / Rev.: 9253B–RKE–07/15

Atmel®, Atmel logo and combinations thereof, Enabling Unlimited Possibilities®, AVR®, and others are registered trademarks or trademarks of Atmel Corporation in U.S. and other countries. Other terms and product names may be trademarks of others.

DISCLAIMER: The information in this document is provided in connection with Atmel products. No license, express or implied, by estoppel or otherwise, to any intellectual property right is granted by this document or in connection with the sale of Atmel products. EXCEPT AS SET FORTH IN THE ATMEL TERMS AND CONDITIONS OF SALES LOCATED ON THE ATMEL WEBSITE, ATMEL ASSUMES NO LIABILITY WHATSOEVER AND DISCLAIMS ANY EXPRESS, IMPLIED OR STATUTORY WARRANTY RELATING TO ITS PRODUCTS INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT. IN NO EVENT SHALL ATMEL BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE, SPECIAL OR INCIDENTAL DAMAGES (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS AND PROFITS, BUSINESS INTERRUPTION, OR LOSS OF INFORMATION) ARISING OUT OF THE USE OR INABILITY TO USE THIS DOCUMENT, EVEN IF ATMEL HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. Atmel makes no representations or warranties with respect to the accuracy or completeness of the contents of this document and reserves the right to make changes to specifications and products descriptions at any time without notice. Atmel does not make any commitment to update the information contained herein. Unless specifically provided otherwise, Atmel products are not suitable for, and shall not be used in, automotive applications. Atmel products are not intended, authorized, or warranted for use as components in applications intended to support or sustain life.

SAFETY-CRITICAL, MILITARY, AND AUTOMOTIVE APPLICATIONS DISCLAIMER: Atmel products are not designed for and will not be used in connection with any applications where the failure of such products would reasonably be expected to result in significant personal injury or death ("Safety-Critical Applications") without an Atmel officer's specific written consent. Safety-Critical Applications include, without limitation, life support devices and systems, equipment or systems for the operation of nuclear facilities and weapons systems. Atmel products are not designed nor intended for use in military or aerospace applications or environments unless specifically designated by Atmel as military-grade. Atmel products are not designed nor intended for use in automotive applications unless specifically designated by Atmel as automotive-grade.