ATAN0115

Smart RF Device Family - Getting Started Guide

APPLICATION NOTE

Features

- Introduction to the Smart RF device family, including ATA82xx receivers, the ATA8520 transmitter and ATA85xx transceivers
- Available documentation, i.e., datasheets, user guides and application notes
- Available tools for configuration
- Available evaluation kits and software
- Development tools required for application development

Description

This document provides an overview of the Smart RF ATA82xx receiver, ATA8520 transmitter and ATA85xx transceiver device families. All devices have the same architecture with the transceiver family featuring both send and receive, receivers only receive, and transmitters only transmit. The available documentation, tools and software and their purpose are described together with the evaluation kits currently available. The tools and environments required for development are described. The following reference section lists documentation all currently available for the devices.

References

[1] ATA8210/5 UHF Receiver Datasheet

[2] ATA8510/5 UHF Transceiver Datasheet

[3] ATA8210/8510 UHF Receiver/Transceiver User Manual

[4] ATA8520 SIGFOX EU Transmitter Datasheet

[5] ATA8520D SIGFOX EU Transceiver Datasheet

[6] ATA8520E SIGFOX EU and US Transceiver Datasheet

[7] ATAN0034 – ATA583x and ATA578x Power-On and Reset Behavior

[8] ATAN0035 – ATA583x and ATA578x Configuration Tool Guide and Software

[9] ATAN0036 – ATA5831 Flash Application Development Guide and Software

[10] ATAN0038 – ATA583x and ATA578x Secure SPI Link

[11] ATAN0095 – Polling Current Calculation

[12] ATAN0096 – ATA8510 Programmer's Guide

[13] ATAN0129 - ATA8520 FAQ

[14] ATAN0136 – ATA8520D Production and EOL Testing

[15] ATAN0140 – ATA8520D CE Conformance Testing and SIGFOX Certification

[16] ATAN0141 – ATA8520D Sensitivity Measurement

[17] ATAN0142 - ATA8520D Crystal Calibration

[18] ATAN0144 – ATA8520D Reference Design

[19] ATAN0158 - ATA8520E Reference Design

[20] ATAN0160 – ATA8520E Production and EOL Testing

[21] IAR Embedded Workbench for Atmel AVR – see http://www.iar.com

[22] Atmel Studio 6 and 7 and AVR Debugger – see http://www.atmel.com/products/microcontrollers/avr/default.aspx?tab=tools

[23] Atmel SIGFOX webpage: http://www.atmel.com/products/wireless/sigfox/default.aspx

[24] Atmel Smart RF webpage: http://www.atmel.com/products/wireless/smartrf/default.aspx

Table of Contents

Features..... 1

Description.....1

References..... 1

1. Overview.....4
2. Documentation.....5
3. Demo and Evaluation Kits..... 6
4. Tools and Development Environments..... 11
5. Ordering Information.....14

1. Overview

Table 1-1 provides an overview of the main features and differences between the ATA8520 SIGFOX transmitter, the ATA85xx transceiver and the ATA82xx receiver devices. While the ATA85xx family has receive and transmit functionality, the ATA82xx family only has receive functionality. The ATA8520 and ATA8520D devices are capable of operating within a SIGFOX network and as a transmitter or modem device, including SIGFOX protocol handling. The main difference between the devices within a family is availability of additional user Flash. This additional memory allows a user application to be implemented for extending the built-in ROM firmware.

Table 1-1. Smart RF Device Family Overview

Function	Transmitter 868MHz	Transceiver 315/433/868-956MHz				Receiver 315/433/868-956MHz	
Device	**ATA8520 SIGFOX 868MHz (EU)**	**ATA8510**	**ATA8515**	**ATA8520D SIGFOX 868MHz (EU)**	**ATA8520E SIGFOX 868MHz (EU) 902MHz (US)**	**ATA8210**	**ATA8215**
RX Function	-	x	x	x	x	x	x
TX Function	x	x	x	x	x	-	-
Firmware ROM	SIGFOX protocol	24Kbyte	24Kbyte	SIGFOX protocol	SIGFOX protocol	24Kbyte	24Kbyte
SRAM	-	1Kbyte	1Kbyte	-	-	1Kbyte	1Kbyte
EEPROM	-	1Kbyte	1Kbyte	-	-	1Kbyte	1Kbyte
User Flash	-	20Kbyte	-	-	-	20Kbyte	-

The ATA8520 is a SIGFOX transmitter device which supports the SIGFOX uplink mode at 868MHz and the ATA8520D is a SIGFOX transceiver device which supports uplink and downlink mode at 868/869MHz. The ATA8520E is a SIGFOX transceiver device which supports uplink and downlink mode at 868/869MHz and 902/905MHz. These devices are certified “SIGFOX compliant™” and facilitate the certification process for a “SIGFOX Ready™” system, including the RF antenna. These devices also include the SIGFOX device ID and PAC registration code for SIGFOX back-end registration.

2. Documentation

The documentation for these devices is available as

1. The datasheet provides a general product description, a brief functional and hardware description, the electrical characteristics as well as ordering and package information (see [1], [2], [4], [5] and [6]).
2. The user manual includes a detailed description of the product, its functionality and hardware, electrical and timing characteristics, an appendix with a table of the AVR instructions, the register and memory map, the SPI command reference, the error codes and instructions on using the timer. The ordering and package information is also included (see [3]).

In addition to basic documentation of the devices, several application notes are available describing how the device is used:

1. A programmer's guide provides detailed information on using the internal ROM firmware and the extension, with a user Flash application for the ATA8210 and ATA8510 device (see [12]).
2. A Flash application guide provides information on using the development tools together with how to use the Flash application template for setting up a user Flash application (see [9]). The Flash application guide also includes a software package with the Flash application template for the ATA8210 and ATA8510 devices.
3. A configuration tool guide provides an introduction on using the EEPROM configuration tool. This tool is helpful when setting up the memory content of the EEPROM configuration memory (see [8]). The configuration tool guide also includes the Java-based configuration tool software. The ATA821x and ATA851x devices have integrated EEPROM memory for storing configuration data generated by the configuration tool.
4. Additional application notes provide information about the power-on and reset behavior (see [7]) and implementation of an optional secure SPI communication link (see [10]). An application note and an Excel spreadsheet are available for performing current consumption calculations for the RF receive modes for the ATA821x and ATA851x devices [11].
5. Application notes are available for the ATA8520, ATA8520D and ATA8520E SIGFOX devices with information on the development process. These includes hardware guides [18] and [19] for the PCB design and guides with software for production testing [14] and [20] and CE(ETSI) certification testing [15]. An application note describes how to perform sensitivity measurement on the ATA8520D transceiver device [16]. The crystal calibration during production testing and for the CE/ETSI testing is described in an application note with software example [17]. A FAQ list addresses typical application questions for the SIGFOX devices and kits [13].

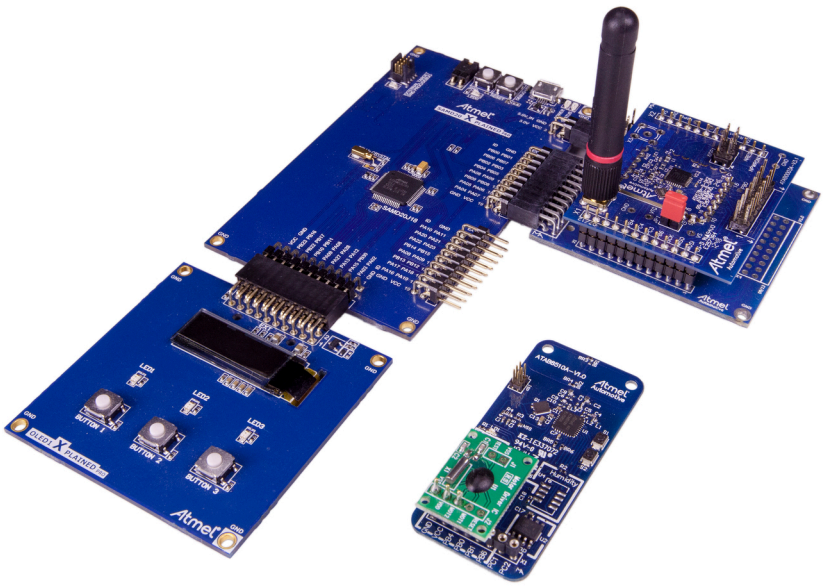
3. Demo and Evaluation Kits

A set of demo and evaluation kits is available with software applications, also in full source code, which helps users quickly start on their development projects. The following kits are currently available:

- ATA8510-EK1 (EU version)
  This kit demonstrates a bidirectional RF link between an ATA8510 and ATA8515 device. A base station with ATA8515 device is controlled by a SAMD20 ARM-CortexM0 device using the SPI command interface. An embedded remote sensor application using the ATA8510 device is controlled by the internal AVR MCU with a user-defined Flash application for reading a temperature sensor and performing bidirectional communication with the base station.

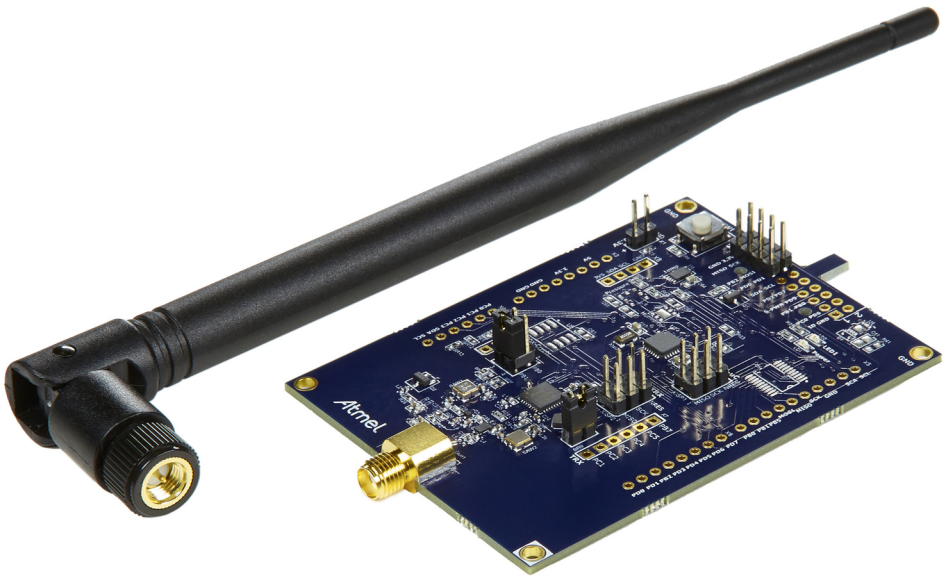
  This kit covers the functionality of the ATA8510 and ATA8515 transceiver devices and the ATA8210 and ATA8215 receiver devices for the receive functions in the application.

  Figure 3-1. ATA8510-EK1



- ATA8520-EK1-E (EU version)
  This kit explains how to operate an ATA8520D SIGFOX device with a battery-powered stand-alone application using an ATmega328P MCU as host controller and an AT30TS75A temperature sensor. The MCU controls all kit operations as well as the ATA8520D device using the SPI command interface. The kit comes with a preprogrammed ATA8520D device including the ID and PAC codes for the registration in the SIGFOX back end. The kit requires a SIGFOX account and area coverage with a SIGFOX network. Included in the kit is a one-year free subscription for operating within the SIGFOX network. The kit is preprogrammed and ready for use with an external 3V power supply, i.e., battery. The toolpack with software, hardware documentation and user guides is available on the product page of the Atmel website [23]. An additional Atmel debugger device is required for application development.

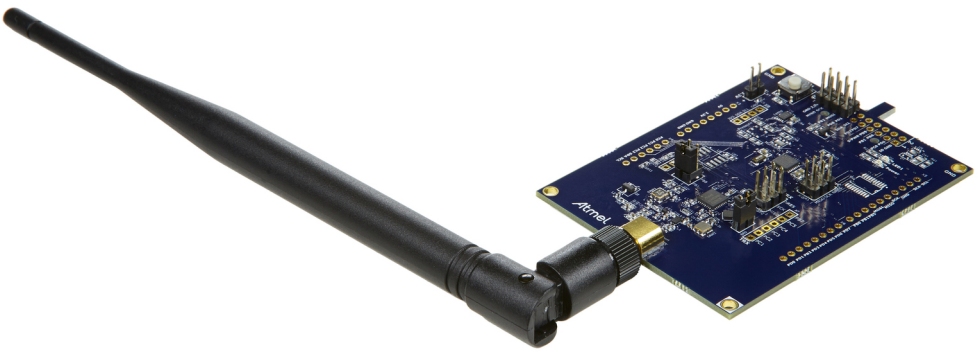
Figure 3-2. ATA8520-EK1-E



- ATA8520-EK2-E (EU version)
  This extension board can be used together with an Xplained Mini or Arduino UNO development board and includes an ATA8520D SIGFOX device and an AT30TS75A temperature sensor, together with the four connectors required for the Xplained Mini connection. To operate the kit, go to the Atmel website product page and download the toolpack with software, hardware documentation and user guides for the Xplained Mini and Arduino UNO target platforms [23].

  The Xplained Mini and Arduino UNO development board are not included in the kit.

Figure 3-3. ATA8520-EK2-E



- ATA8520-EK3-E (EU version)
  This extension board can be used together with an Xplained PRO development board and includes an ATA8520D SIGFOX device and an AT30TS75A temperature sensor. To operate the kit, go to the Atmel website product page and download the toolpack with software, hardware documentation and user guides for the following Xplained PRO target platforms [23]: SAMD11, SAMD20, SAMD21, SAML21.

  The XplainedPRO development board is not included in the kit.

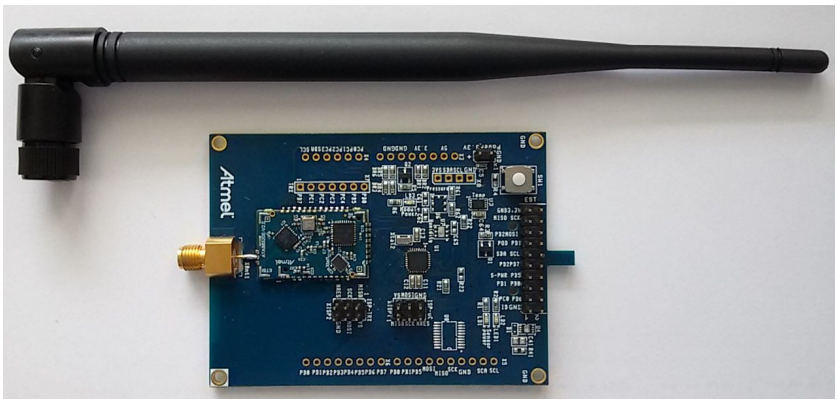
Figure 3-4. ATA8520-EK3-E



The ATA8520-EK1-E kit and the extension boards ATA8520-EK2-E and ATA8520-EK3-E are CE(ETSI) and "SIGFOX compliant™" certified. All hardware documentation is included in the toolpack, which can be used as reference. See also the application notes [15], [16], [17] and [18].

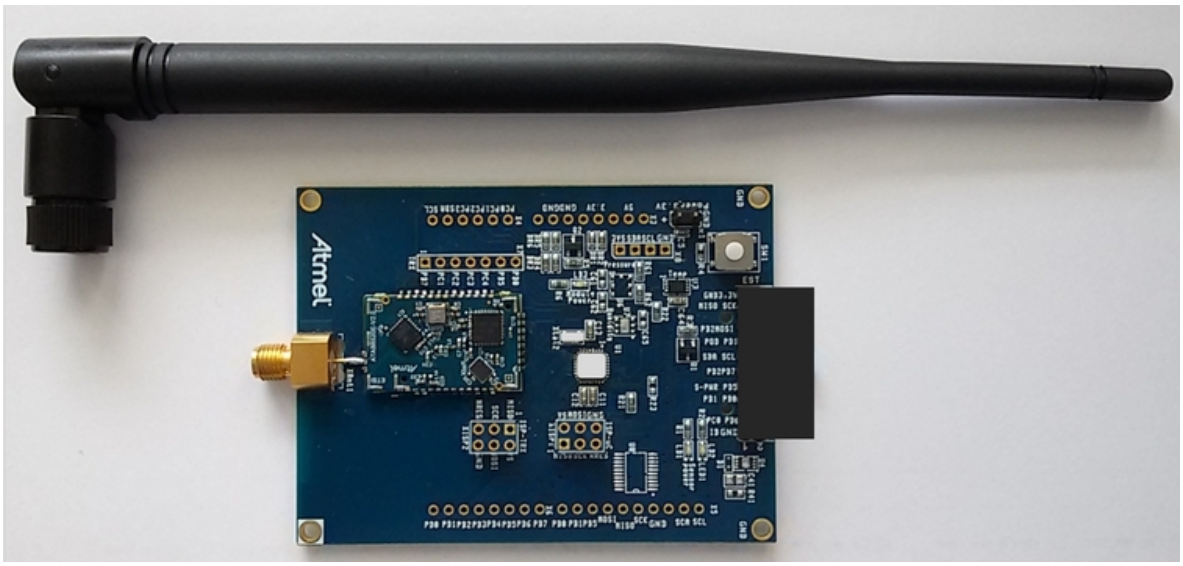
- ATA8520-EK4-E (EU version)
  This is similar to the ATA8520-EK1-E kit but uses the ATA8520E SIGFOX device with a battery-powered stand-alone application using an ATmega328P MCU as host controller and an AT30TS75A temperature sensor. All RF components are placed on a module PCB on-top of a base board. This module PCB is intended as reference design for the RF circuitry. The MCU controls all kit operations similar to ATA8520-EK1-E and comes with a preprogrammed ATA8520E device including the ID and PAC codes for the registration in the SIGFOX back end. The kit requires a SIGFOX account and area coverage with a SIGFOX network. Included in the kit is a one-year free subscription for operating within the SIGFOX network. The kit is preprogrammed and ready for use with an external 3V power supply, i.e., battery. The toolpack with software, hardware documentation and user guides is available on the product page of the Atmel website [23]. An additional Atmel debugger device is required for application development.

Figure 3-5. ATA8520-EK4-E



- ATA8520-EK6-E (EU Version)
  This extension board can be used together with an Xplained PRO development board and includes an ATA8520E SIGFOX device and an AT30TS75A temperature sensor. To operate the kit, go to the Atmel website product page and download the toolpack with software, hardware documentation and user guides for the following Xplained PRO target platforms [23]: SAMD11, SAMD20, SAMD21, SAML21. The XplainedPRO development board is not included in the kit.

Figure 3-6. ATA8520-EK6-E



- ATA8520-EK1-F (US Version)
  This kit is similar to the ATA8520-EK4-E kit but is intended for the US to operate at 902MHz. It uses the ATA8520E SIGFOX device with a battery-powered stand-alone application using an ATmega328P MCU as host controller and an AT30TS75A temperature sensor. All RF components are placed on a module PCB on-top of a base board. This module PCB is intended as reference design for the RF circuitry. The MCU controls all kit operations similar to ATA8520-EK4-E and comes with a preprogrammed ATA8520E device including the ID and PAC codes for the registration in the SIGFOX back end. The kit requires a SIGFOX account and area coverage with a SIGFOX network. Included in the kit is a one-year free subscription for operating within the SIGFOX network. The kit is preprogrammed and ready for use with an external 3V power supply, i.e., battery. The toolpack with software, hardware documentation and user guides is available on the product page of the Atmel website [23]. An additional Atmel debugger device is required for application development.

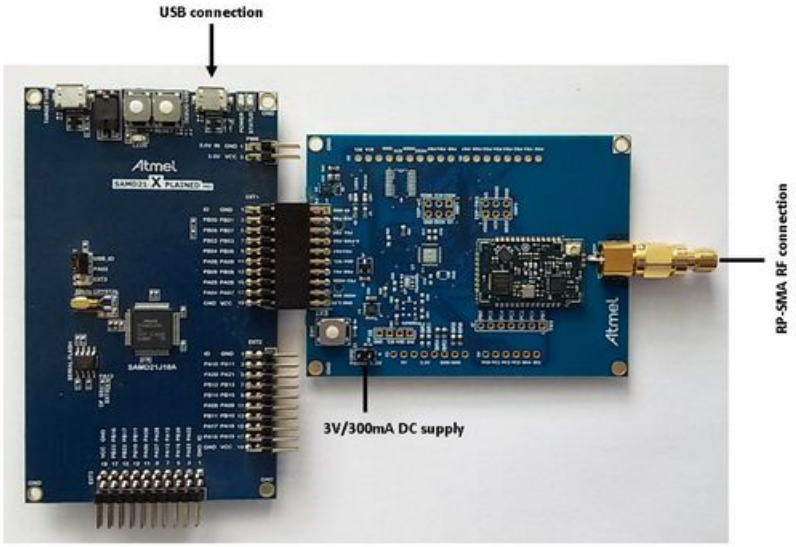
Figure 3-7. ATA8520-EK1-F



- ATA8520-EK3-F (US Version)

This extension board is intended for the US to operate at 902MHz and can be used together with an Xplained PRO development board and includes an Atmel ATA8520E SIGFOX device and an AT30TS75A temperature sensor. To operate the kit, go to the Atmel website product page and download the toolpack with software, hardware documentation and user guides for the following Xplained PRO target platforms [23]: SAMD11, SAMD20, SAMD21, SAML21. The XplainedPRO development board is not included in the kit.

Figure 3-8. ATA8520-EK3-F



The ATA8520-EK1-F kit is FCC and "SIGFOX compliant" certified. All hardware documentation is included in the toolpack, which can be used as reference. See also the application notes [16], [17] and [19].

4. Tools and Development Environments

Atmel Studio 6 or 7 [22] and the toolpacks for the kits [23] and [24] are required for application development. The IAR environment [21] together with the Flash application template [9] is mandatory for Flash application development for the ATA8210 and ATA8510 internal Flash memory and AVR controller. The ATA821x and ATA851x devices need EEPROM configuration with the EEPROM configuration tool [8] for generating the EEPROM data.

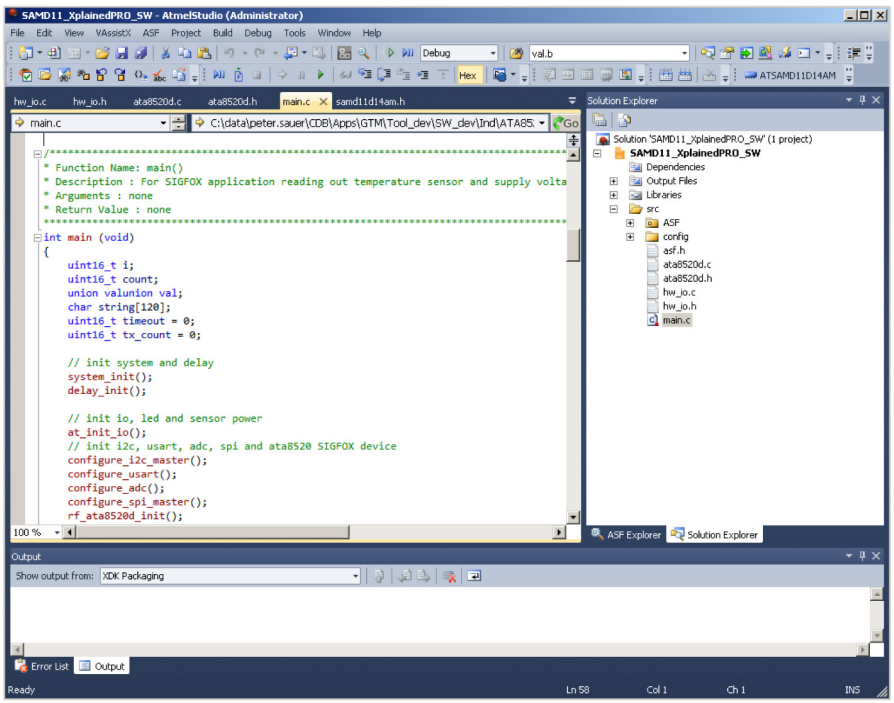
In addition to these software environments and tools, an Atmel debugger device is required for application development and debugging of the internal Flash application of the ATA8210 and ATA8510 devices. An Atmel debugger or programmer is required for programming the EEPROM data onto the ATA821x and ATA851x devices.

The ATA8520, ATA8520D and ATA8520E devices do not require any debugger or programmer tool, but for application development of the host MCU development tools and the tool pack [23] is required, i.e. for PCB development.

The following tools are available for development:

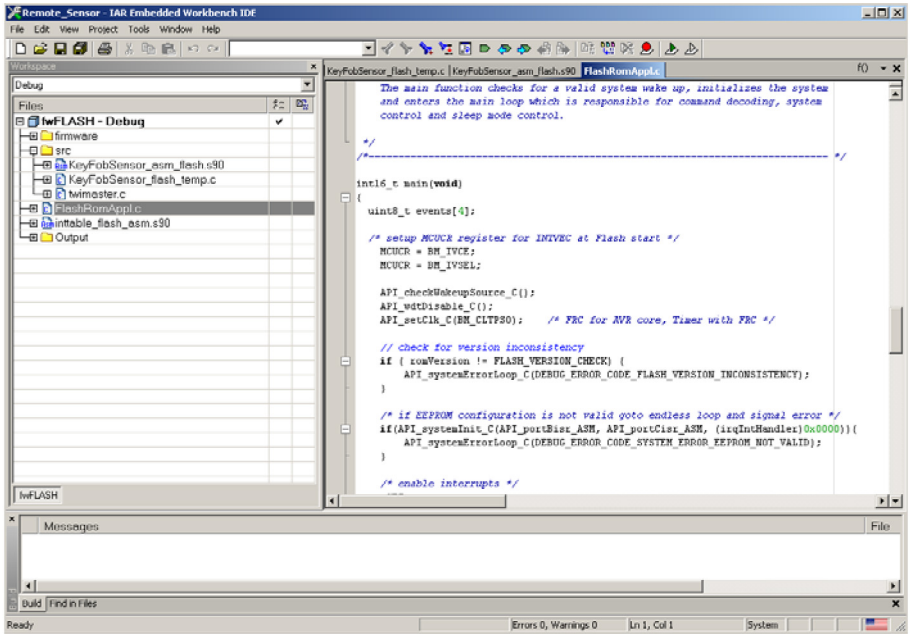
1. The Atmel Studio 6 and Atmel Studio 7 development environment [22] is required for programming the EEPROM and Flash application content. It also allows the device fuses and lock bits to be set.

   Figure 4-1. Atmel Studio 6



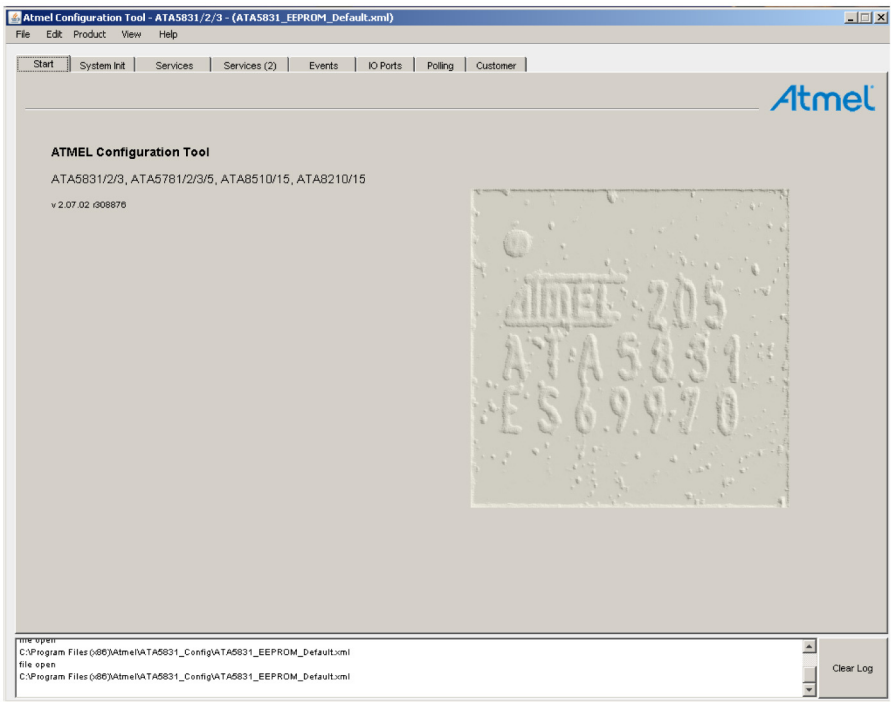
2. The IAR Embedded Workbench for Atmel AVR [21] is required for development of a user Flash application using the internal ROM firmware. The Flash application template and the ATA5831 Programmer's Guide [9] refer to this development environment.

Figure 4-2. IAR Embedded Workbench



3. No additional tools are required if the devices are operated and controlled using the SPI link. The SPI commands are described in [3], [4], [5], [6] or [12] and can be issued by any CPU host connected to the SPI lines. Even programming of the internal EEPROM can be accomplished using the SPI link. As an alternative, the AVR debugger and Atmel Studio 6 or 7 can be used for programming the EEPROM content.
4. An EEPROM Configuration Java Tool is available for generating the EEPROM programming file. The tool can generate programming files (*.hex) or include files (*.h) for the host MCU.

Figure 4-3. Atmel Configuration Tool



5. A debugger tool – such as the JTAGICE3 or Atmel ICE debugger – is required for programming the configuration content into the EEPROM of the device. This tool is also required for development and debugging of a Flash application (see [9]).

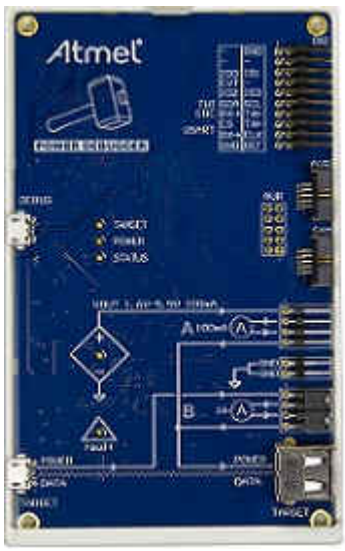
Figure 4-4. Debugger Tool



JTAGICE3 debugger

Atmel ICE debugger

Figure 4-5. Power Debugger



5. Ordering Information

The following list provides the devices and kits currently available and order numbers.

Table 5-1. Smart RF Devices

IC Part Number	Kit Part Number	Description
ATA8510-GHQW		RF transceiver with Flash memory
ATA8515-GHQW		RF transceiver
ATA8210-GHQW		RF receiver with Flash memory
ATA8215-GHQW		RF receiver
	ATA8510-EK1	Bidirectional RF link

Table 5-2. SIGFOX Devices

IC Part Number	Kit Part Number	Description
ATA8520-GHQW		EU: uplink
ATA8520D-GHQW		EU: uplink/downlink
	ATA8520-EK1-E	EU: uplink/downlink (stand-alone)
	ATA8520-EK2-E	EU: uplink/downlink (Xplained Mini/Arduino extension board)
	ATA8520-EK3-E	EU: uplink/downlink (Xplained Pro extension board)
ATA8520E-GHQW		EU and US: uplink/downlink
	ATA8520-EK4-E	EU: uplink/downlink (stand-alone)
	ATA8520-EK6-E	EU: uplink/downlink (Xplained Pro extension board)
	ATA8520-EK1-F	US: uplink/downlink (stand-alone)
	ATA8520-EK3-F	US: uplink/downlink (Xplained Pro extension board)





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