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## User Guide for the Evaluation Kit ATA8510-EK1

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### APPLICATION NOTE

### Features

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- User guide for the ATA8510-EK1 evaluation kit
- Demonstrates an application with the
  - RF transceiver Atmel® ATA8515 in a base station with an Xplained PRO SAMD20 kit
  - Atmel ATA8510 RF transceiver remote sensor with an AT30TS75A temperature sensor and an optional CMM-1923 real-time clock
  - Two-way RF communication
- New software version of the SAMD20 base station V2.0 is without FreeRTOS

### Description

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This user guide describes an evaluation kit for industrial RF applications having the following components:

- A base station using an
  - Xplained PRO SAMD20 evaluation kit
  - Xplained PRO OLED1 extension board
  - Xplained PRO ATA8510/15 extension board
- Remote temperature sensor with Atmel® ATA8510 running a Flash application

The Atmel ATA8515 is used as an RF transceiver in the base station and runs in polling mode to detect data telegrams and displays the received message on the OLED. The received message is also streamed to a PC terminal program using a virtual COM port connection.

The remote sensor includes an AT30TS75A temperature sensor device and a CMM-1923 real-time-clock device for waking up the Atmel ATA8515 RF transceiver. The Flash application reads the temperature data from the sensor device using a TWI bus protocol implemented in software and broadcasts the temperature data via the RF link.

The RF application uses a 2-way communication, i.e., the transmitted RF telegrams are acknowledged from the receiver.

The RF link operates on channel 433.92MHz at an 8kBit/s data rate using FSK modulation with Manchester encoding.

## References

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- [1] Atmel® ATA8510/ATA8515 datasheet
- [2] Atmel AT30TS75A datasheet
- [3] C-MAX CMM-1923-V1.0 datasheet
- [4] <http://www.atmel.com>
- [5] <http://www.iar.com>
- [6] Atmel ATAN0096 - ATA8510 Programmers Guide
- [7] Atmel ATAN0035 - ATA583x and ATA578x Configuration Tool Guide and software
- [8] Atmel ATAN0036 - ATA583x and ATA578x Flash Application Development
- [9] Atmel ATA8510/ATA8515 User Manual
- [10] ATA8510-EK1\_Tool\_Pack\_V2.0.zip

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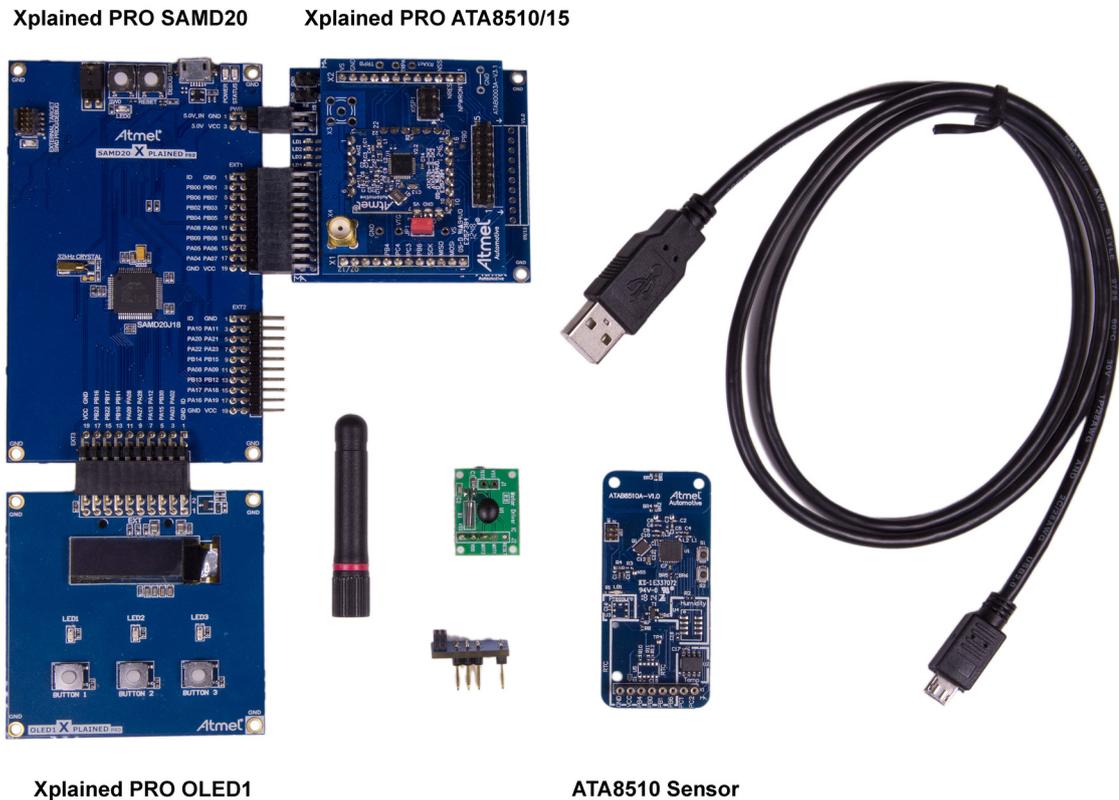
# 1. Getting Started

Figure 1-1 shows the components which are included in the evaluation kit. The kit includes

- A base station with
- Xplained PRO SAMD20 evaluation board
- Xplained PRO OLED1 extension board
- Xplained PRO ATA8510/15 extension board
- A remote temperature sensor with Atmel® ATA8510 [1], AT30TS75A [2], and an optional CMM-1923 [3] devices
- A mini USB cable
- A mini ISP adapter
- A 433MHz whip antenna

The remote sensor requires a CR2032 coin cell battery not included in the kit.

Figure 1-1. ATA8510-EK1 Kit Components

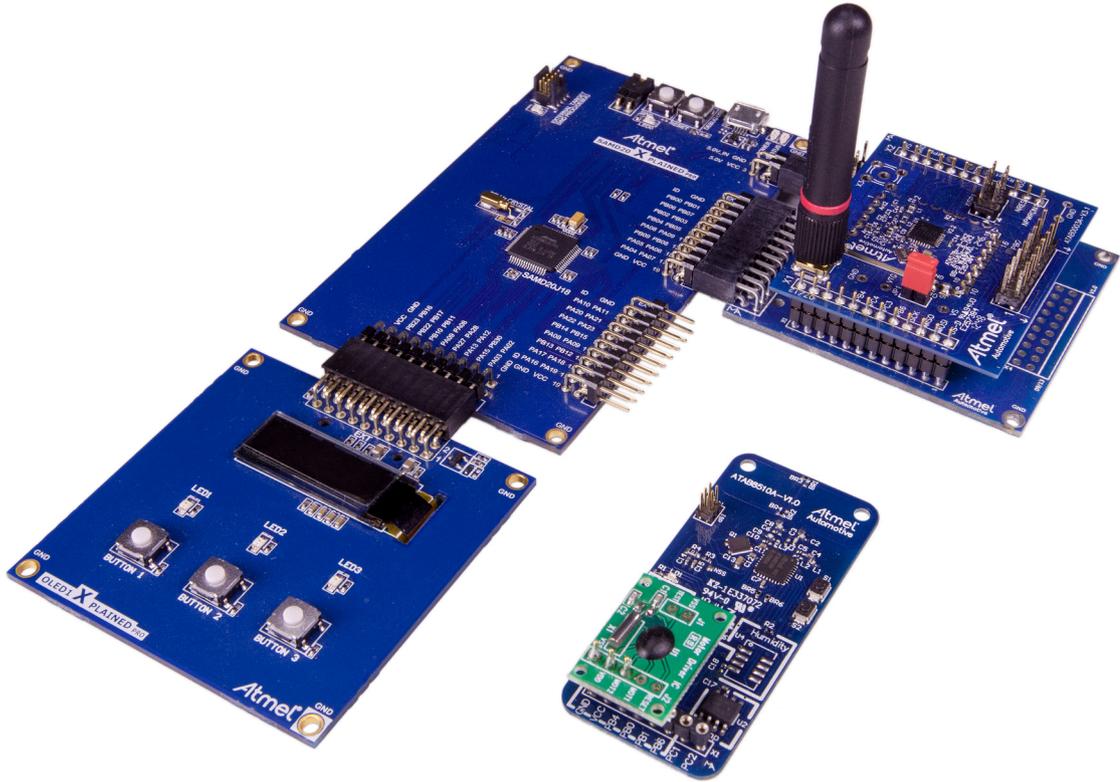


## 1.1. Kit Setup

The Xplained PRO OLED1 board is connected to the EXT3 extension header and the Xplained PRO ATA8510/15 board is connected to the EXT1 extension header of the Xplained PRO SAMD20 board as shown in Figure 1-2. The 433MHz whip antenna is mounted on the X4 connector of the Xplained PRO ATA8510/15 board. These boards are powered using the USB cable connected to the debug USB connector of the Xplained PRO SAMD20 board. The USB cable can be connected to a 5V/500mA USB power supply for stand-alone operation. When using the virtual COM port, the USB cable is connected to

a PC's USB port, which requires previous installation of Atmel Studio 6 or 7 IDE [4]. This installation includes all required USB drivers for operation of the Xplained PRO SAMD20 board.

Figure 1-2. ATA8510-EK1 Kit



Atmel Studio 6 or 7 can be downloaded from [4] with additional user instructions and tools. Documentation for the Xplained PRO SAMD20 and Xplained PRO OLED1 are also available from [4]. Documentation for other components in the kit and the software is included in the tool pack zip folder [10] available on the Atmel web site [4].

The OLED displays a welcome screen after power-up

```
ATA8510-EK1 Demo Kit
(c)2016 Atmel V2.0
ATA8515 V1.2
wait for RF signal ...
```

and waits for an RF telegram from the remote sensor. After installing the CR2032 coin cell into the remote sensor (be sure to observe correct polarity), the sensor immediately starts sending RF telegrams at 2s intervals when the optional RTC module is installed. The OLED shows the temperature value from the sensor with a resolution of 1°C. The time interval between the RF signal reception in seconds and the signal strength rssi on the base station and RSSI on the sensor is also shown:

```
dt=2s    rssi=221
T=22°C
RSSI=128
```

When removing the CMM-1923 real-time clock, the transmission of an RF telegram can be initiated by pressing the S2 button (for more information, see [Figure 3-2](#)). The display can be switched to different modes via the buttons 1-3 on the Xplained PRO OLED1 extension board (for more information, see section [Base Station Application for SAMD20 MCU](#)).

The tool pack zip folder [10] contains the documentation and software for the kit. Extract the folder into a directory on the PC to get the following structure:

..\Application_Notes	Documentation for the kit and the application notes for the devices
..\Documentation	Device datasheets
..\Hardware	Hardware documentation of the boards
..\Software	Kit software and tool support extensions
..\Software\Programming_Files	Device programming files in *.hex format
..\Software\IDE_Support_Files	Tool support files for IAR Workbench and Atmel Studio 6
..\Software\base	Software project and sources for the Xplained PRO kit
..\Software\base\EEPROM	Configuration file for the Atmel ATA8515 device of the base station
..\Software\base\SAMD20_XplainedPRO_SW	Atmel Studio 6 or 7 project directory
..\Software\sensor	Software project and sources for the remote sensor
..\Software\sensor\EEPROM	Configuration file for the Atmel ATA8510 device of the remote sensor
..\Software\sensor\ATA5831_FLASH_IAR_2.32.0	IAR Embedded Workbench project directory

## 1.2. Upgrade Kit V1.x to V2.0

Any Atmel® ATA8510-EK1 kit can operate with V2.0 tool pack by programming the SAMD20 base station with the application software from tool pack V2.0 [10]. The remote sensor need no update and will operate with V1.x and V2.0 base station applications (see section [Xplained PRO SAMD20 Base Station](#) for more details).

## 2. Data Protocol and Signal Timing

The remote sensor is sending a RF data telegram every 2s or when the button S2 is pressed with the temperature data. The base station receiver is polling for this data telegram on RF channel 433.92MHz in regular intervals of 5ms. The RF transmission and data protocol of the remote sensor and the base station is using the following settings:

- Transmission order is MSB first for preamble and data section
- RF channel: 433.92MHz
- Data rate: 8kBit/s with FSK modulation and Manchester encoding
- Deviation:  $\pm 8$ kHz

Each data packet uses 2 bits before and after the data telegram to force a Manchester code violation, which is detected by the receiver to separate the data packets and to restart the synchronization procedure of the receiver.

### 2.1. Data Protocol for Remote Sensor Telegram

The remote sensor data protocol parameters are shown in [Table 2-1](#). The Manchester encoding is using a low-to-high transition for a '0' bit and a high-to-low transition for a '1' bit.

**Table 2-1. Data Protocol**

Protocol Item	# of Data Bits	Value	Description
Preamble	55	'1'	Pre-burst for wake-up and synchronization
Start bit	1	'0'	Start bit to indicate data payload
Data payload	8	0x14	ID for no valid sensor data
		0x19	ID for low battery voltage ( $V_{CC} < 2.2V$ )
		0x64	ID for temperature data ( $-55$ to $+125^{\circ}C$ )
	16	Signed integer	Temperature value ( $0.1^{\circ}C$ resolution)
8	Checksum	Checksum of ID and data payload as 2th complement	
Total	88		Data telegram with Ttx = 11ms at 8kBit/s

The acknowledge protocol send by the remote sensor has the following data:

**Table 2-2. Acknowledge Protocol**

Protocol Item	# of Data Bits	Value	Description
Preamble	55	'1'	Pre-burst for wake-up and synchronization
Start bit	1	'0'	Start bit to indicate data payload
Data payload	8	0x60	ID for RSSI data
	16	Integer	RSSI value [0-255]
	8	Checksum	Checksum of ID and data payload as 2th complement
Total	88		Data telegram with Ttx = 11ms at 8kBit/s

## 2.2. Data Protocol for Base Station Acknowledge

The base station acknowledge protocol parameters are shown in [Table 2-3](#). The Manchester encoding is using a low-to-high transition for a '0' bit and a high-to-low transition for a '1' bit.

**Table 2-3. Acknowledge Protocol**

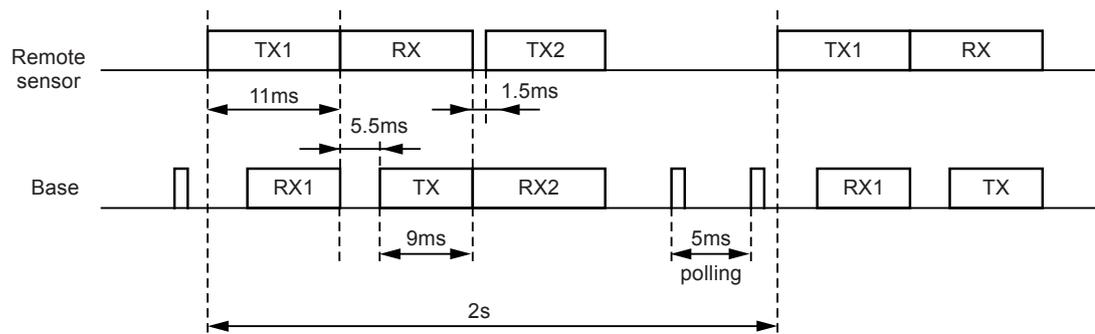
Protocol Item	# of Data Bits	Value	Description
Preamble	55	'1'	Pre-burst for wake-up and synchronization
Start bit	1	'0'	Start bit to indicate data payload
Data payload	8	0x60	ID for RSSI data
	8	0x60	Repeated
Total	72		Data telegram with Ttx = 9ms at 8kBit/s

## 2.3. Signal Timing

The signal timing of the data transfer is shown in [Figure 2-1](#).

1. The remote sensor transmits a data telegram with duration of 11ms every 2s or when button S2 is pressed (TX1). The pre-amble duration is 7ms while the data payload duration is 4ms. The remote sensor switches then into receive mode with a timeout period of 20ms (RX).
2. The base station is polling for a valid RF signal which matches the RF channel, the data rate, the modulation scheme and the correct data encoding every 5ms. This polling interval is chosen to match with the length of the pre-amble. When a valid telegram is received (RX1) the base station acknowledges this telegram (TX) and waits for an acknowledgement frame from the remote sensor with the remote sensor signal strength data and a timeout of 90ms (RX2).
3. The remote sensor transmits the acknowledgement frame with the RSSI signal strength (TX2) and switches then into OFF mode.
4. The base station reads the acknowledgement frame with the RSSI data (RX2), displays the result and switches into polling mode again.

**Figure 2-1. Signal Timing**



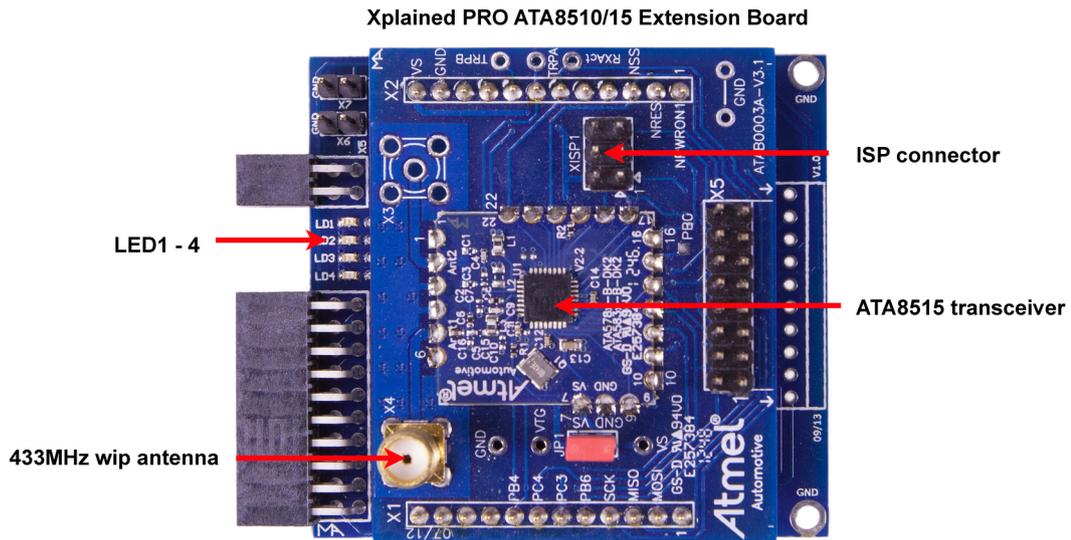
### 3. Hardware Description

The description and documentation of the Xplained PRO SAMD20 board and the Xplained PRO OLED1 board are available within Atmel® Studio 6 or 7 on the Atmel website [4]. The hardware description of the Xplained PRO ATA8510/15 extension board and the remote sensor are included in the tool pack zip folder [10]. The base station is powered by the USB cable whereas the remote sensor uses a CR2032 coin cell battery.

#### 3.1. Base Station Transceiver

The Atmel® ATA8515 base station transceiver is mounted on an adapter board as shown in Figure 3-1. This adapter board is plugged onto the Xplained PRO ATA8510/15 extension board which includes the LEDs 1-4. The adapter board has a programming adapter XISP1 which is used for programming the EEPROM configuration data into the device. This extension board is connected to the EXT1 and PWR header of the Xplained PRO SAMD20 board. The extension board has two additional connectors, X6 for supplying the kit with 5V and X7 to access the kit's internal 3V supply voltage.

Figure 3-1. Base Station Transceiver Board



The connector pins of the Xplained Pro ATA8510/15 extension board are summarized in the following tables Table 3-1, Table 3-2, Table 3-3 and Table 3-4.

Table 3-1. Connector X3

Function	Pin	Pin	Function
ID_data	1	2	GND
--	3	4	--
NPWRON1 (PB06)	5	6	NRESET (PB07)
LED3 (PB02)	7	8	LED4 (PB03)
EVENT (PB04)	9	10	--
--	11	12	--

Function	Pin	Pin	Function
LED1 (PB09)	13	14	LED2 (PB08)
NSS	15	16	MOSI (PA06)
MISO (PA04)	17	18	SCK (PA07)
GND	19	20	VCC

**Table 3-2. Connector X5**

Function	Pin	Pin	Function
5V in	1	2	GND
--	3	4	--

**Table 3-3. Connector X6**

Function	Pin	Pin	Function
5V in	1	2	GND

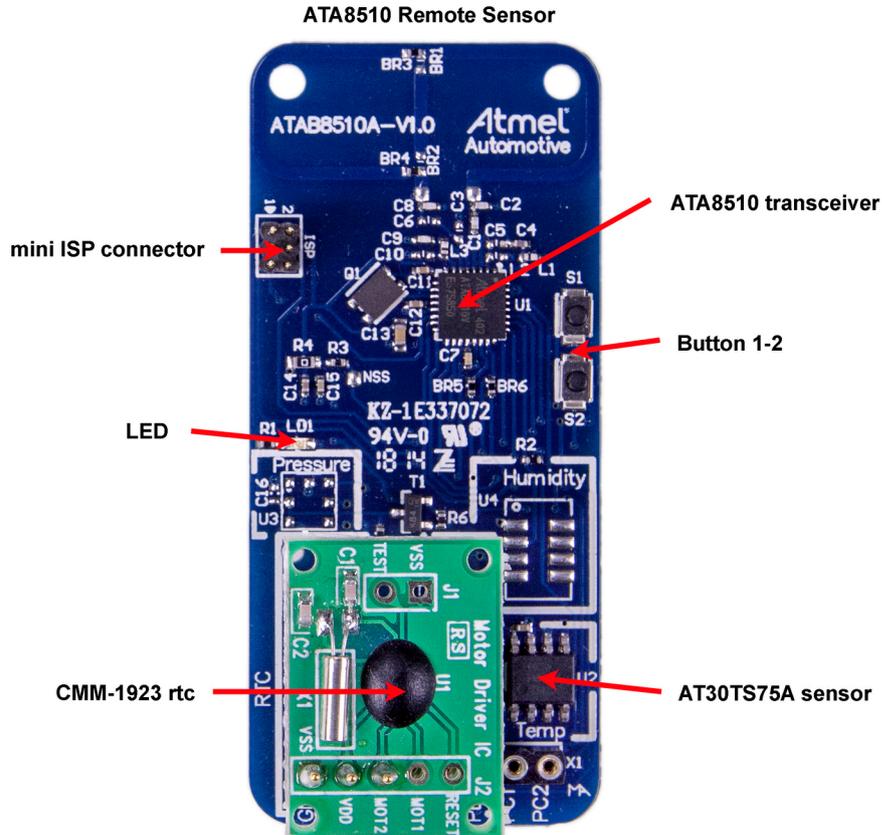
**Table 3-4. Connector X7**

Function	Pin	Pin	Function
VCC	1	2	GND

### 3.2. Remote Sensor Transceiver

The Atmel® ATA8510 remote sensor transceiver is placed on a key fob board as shown in [Figure 3-2](#). This remote sensor is powered by a CR2032 coin cell battery (not included) mounted on the bottom of the board. The board contains the real-time clock CMM-1923 [3] attached to the connector X1 and the AT30TS75A [2] temperature sensor. The S1 and S2 buttons are placed on the board with the S1 button not used in this application and the S2 button used for initiating data telegram transmission. The LED flashes during a temperature measurement before transmitting the RF data telegram. The mini ISP header is used for Flash and EEPROM programming and for Flash application debugging of the Atmel ATA8510 (see [8] for more details about Flash application development).

Figure 3-2. Remote Sensor Transceiver Board



The current consumption profile over time is shown in Figure 3-3. During the temperature measurement period of 40ms, the LED is switched on in parallel, increasing current consumption. Figure 3-3 shows current consumption for the measurement period with and without LED. The RF telegram transmission takes about 11ms at a power level of 6dBm, resulting in current consumption of about 9.4mA. In OFF mode the temperature sensor is switched off and the resulting current is indicated by the Atmel ATA8510 transceiver and the CMM-1923 RTC current consumption. This OFF mode current is highly dependent on ambient temperature shown in the datasheets [1] and [3]. Figure 3-3 indicates current consumption measured at a room temperature of 24°C.

Figure 3-3. Remote Sensor Current Consumption at 24°C

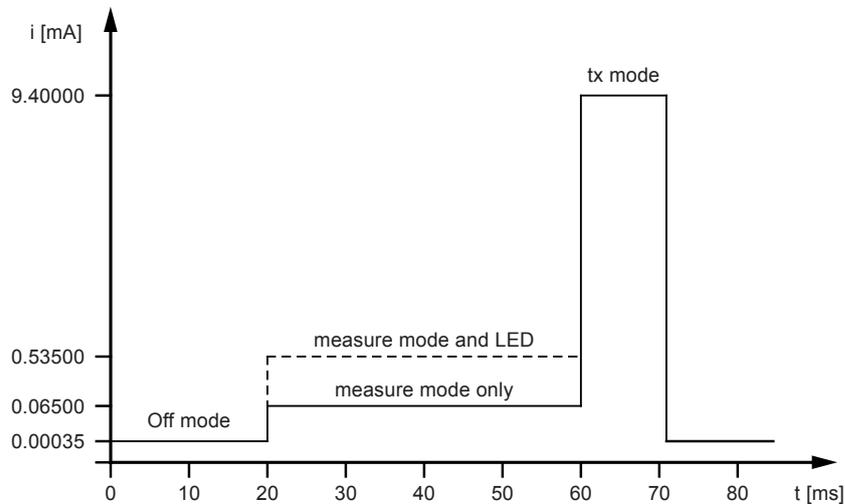


Table 3-5 summarizes battery life for a CR2032 and CR2450 coin cell without using the LED during temperature measurement at 20°C. It is assumed that the battery voltage drops from the initial value of 3V down to 2V by the end of battery service. The self discharge is defined by the manufacturer with typically 1% per year at an ambient temperature of 20°C. The battery life for this application primarily depends on the measurement interval  $T_s$ , which defines the duration of the OFF mode whereas measurement and transmit mode have fixed durations.

**Table 3-5. Battery Life at 20°C**

Interval $T_s$ (s)	Mean Current (mA)	Battery Lifetime (Days/Years)			
		CR2032 (230mAh)		CR2450 (560mAh)	
		Days	Years	Days	Years
2	0.053	180	0.5	437	1.2
5	0.022	445	1.2	1083	3.0
10	0.011	875	2.4	2131	5.8
20	0.006	1696	4.6	4130	11.3
50	0.002	3880	10.6	9448	25.9

## 4. Software Description

The demo application uses the following programs:

1. A Flash application with EEPROM settings for the Atmel® ATA8510 remote sensor
2. A SAMD20 application with EEPROM settings for the Atmel ATA8515 receiver

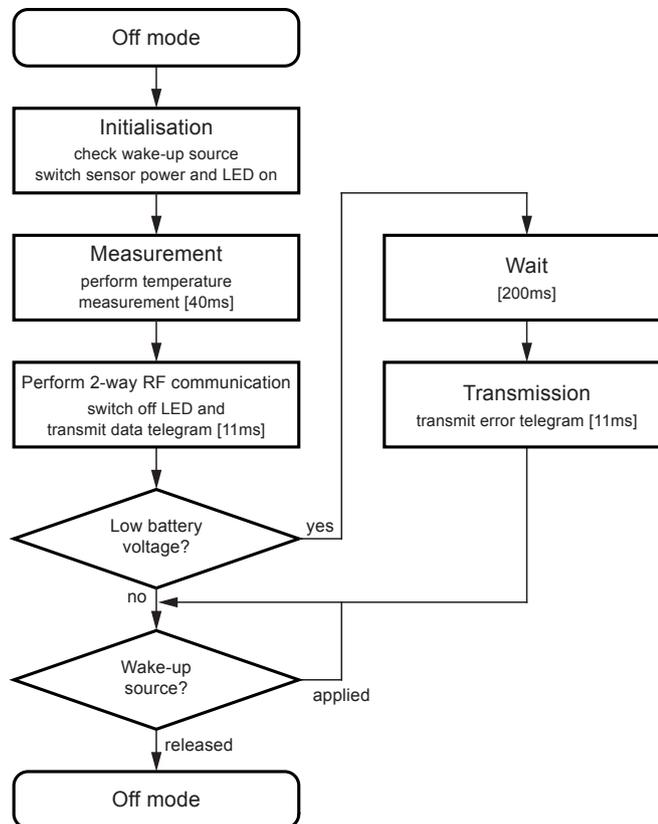
The following section describes each program flow. The IAR embedded workbench for AVR® [5] is used together with the JTAGICE3 debug tool for Flash application development of the remote sensor. Atmel Studio 6 or 7 [4] is used together with the debug tool included on the Xplained PRO SAMD20 board for SAMD20 application development.

The source code for all applications is available within the tool pack distribution [10].

### 4.1. Flash Application for the ATA8510 Remote Sensor

The program flow for the remote sensor application is illustrated in [Figure 4-1](#). The initial state of the device is the OFF mode. The real-time clock of the remote sensor wakes up the transceiver every 2s and switches the device to active mode. The temperature sensor is powered up and read out followed by the transmission of the data telegram. During transmission of this data telegram the supply voltage level is checked and if this is below 2.2V, an error message is transmitted after a delay of 200ms. The device then enters the OFF mode again until the next wake-up by the RTC (or by pressing the S2 button).

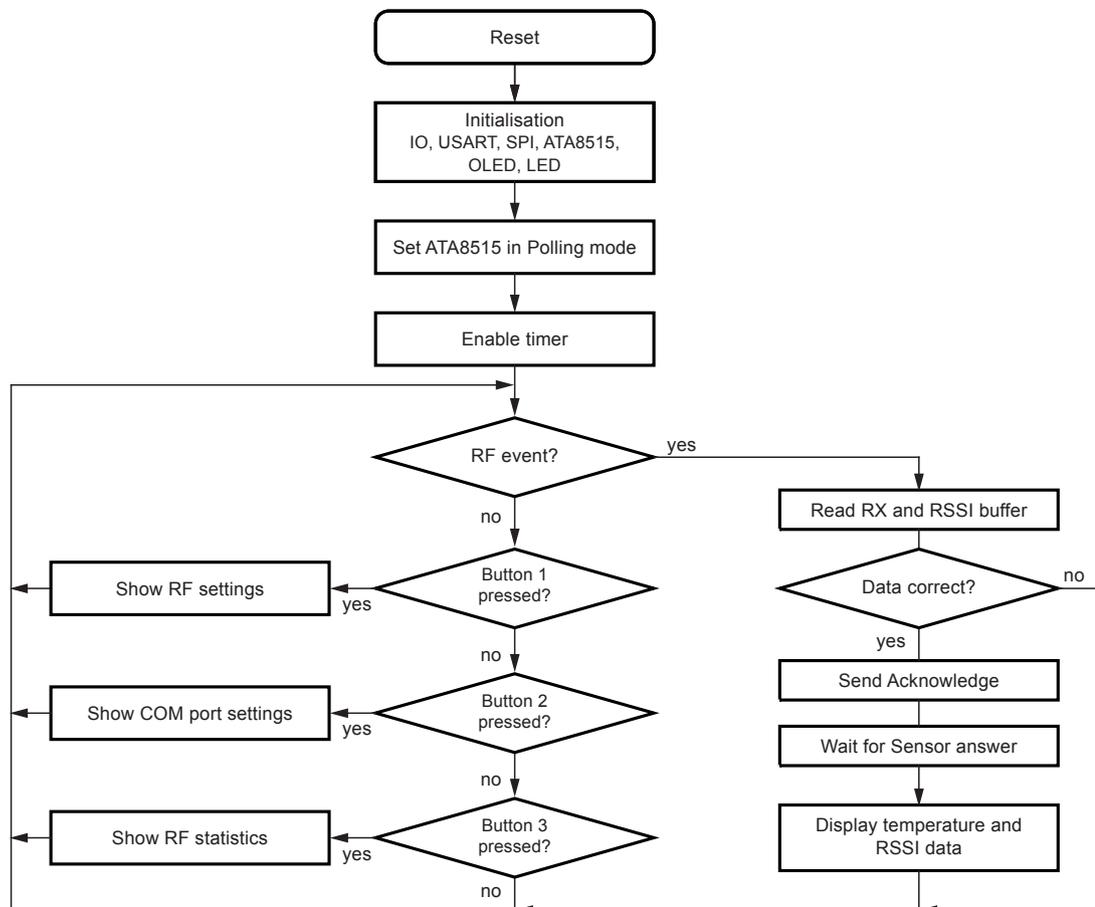
**Figure 4-1. Flash Application for the Atmel ATA8510 Remote Sensor**



## 4.2. Base Station Application for SAMD20 MCU

The program flow for the SAMD20 application is illustrated in Figure 4-2. This application performs at the start an initialization of the peripherals, the LEDs and the OLED display. The ATA8515 RF transceiver is switched into RF polling mode to check for the reception of a valid remote sensor signal. In addition a timer is initialized for time measurements between RF signal transmissions. The software is then entering an infinite loop to check for an RF event signal from the RF transceiver or for a button press of one of the buttons on the OLED1 extension board. A button press will show the corresponding information on the OLED display as shown in Figure 4-2. When a RF event is detected the RX and RSSI buffer are read and the RX data are checked with their checksum to be a valid data stream. If the data is not valid the polling mode is enabled again to check for another RF signal. If the data is valid an acknowledge signal is send followed by waiting for an RF answer telegram. Finally the received temperature and RSSI data are shown on the OLED display. All text shown on the OLED display is also streamed via the USART peripheral and can be shown on a PC Terminal program connected to the virtual COM port of the SAMD20 kit.

Figure 4-2. Flash Application for SAMD20 MCU



The OLED display will show the following text information:

**Start page:**

shows the welcome message with software and transceiver firmware version information and awaits a remote sensor signal.

```
ATA8510-EK1 Demo Kit
(c) Atmel 2016 V2.0
ATA8515 V1.2
wait for RF signal ...
```

**Button 1 menu:**

shows parameters used in the RF telegram.

```
RF-Channel 433.92MHz
Data rate 8kBit/s
FSK deviation +/-8kHz
Manchester coding
```

**Button 2 menu:**

shows parameters used for the virtual COM port. These parameters have to be set in the PC terminal application to receive the text strings.

```
COM port settings
baudrate 38.4kBaud
8 data + 1 stop bit
no parity, no handshake
```

**Button 3 menu:**

shows parameters used for the virtual COM port. These parameters have to be set in the PC terminal application. To receive the text strings.

```
Receiver statistics:
valid# 3062
error# 15
total# 3099
```

**Measurement results:**

The measurement display shows the time interval  $dt$  between two consecutive RF telegram receptions together with the RSSI value for the RF signal strength at the base station and at the Remote sensor. The temperature at the sensor is shown with a resolution of  $1^{\circ}\text{C}$ .

```
| dt=2s    rssi=221 |
|          |
|  T=22°C  |
|  RSSI=128 |
|          |
```

In case of an error the following error messages are displayed:

This message is shown when the received data telegram is corrupted or when the temperature sensor is broken or not present.

```
!!!!!!!!!!!!!!!!!!!!!!
Sensor error:
Invalid sensor data!
!!!!!!!!!!!!!!!!!!!!!!
```

This message is shown when the sensor battery has a voltage below 2.2V and needs to be replaced.

```
!!!!!!!!!!!!!!!!!!!!!!  
Sensor error:  
Low battery voltage!  
!!!!!!!!!!!!!!!!!!!!!!
```

This message is shown when a wrong acknowledge telegram was received.

```
:::::::::::::::::::::  
RF telegram error:  
Wrong ACK telegram!  
:::::::::::::::::::::
```

This message is shown when no RF acknowledge telegram was received.

```
:::::::::::::::::::::  
RF channel error:  
No RF ACK telegram!  
:::::::::::::::::::::
```

This message is shown when the RF acknowledgement from the base station could not be send.

```
:::::::::::::::::::::  
RF channel error:  
RF TX telegram err!  
:::::::::::::::::::::
```

This message is shown when the RF receiver is detecting a signal on another RF channel (this must be enabled in the EEPROM configuration of the receiver).

```
:::::::::::::::::::::  
RF channel error:  
Wrong RF telegram!  
:::::::::::::::::::::
```

### 4.3. Software Development

Atmel® Studio 6 or 7 is required for base station software development and can be downloaded from the Atmel website [4]. In addition, the tool pack [10] with software and documentation is required. IAR Embedded Workbench for AVR [5] and the JTAGICE3 AVR® debug tool [4] are required for remote sensor software development.

#### 4.3.1. Xplained PRO SAMD20 Base Station

For the software development of the base station the project file is located in the extracted folder in the subdirectory

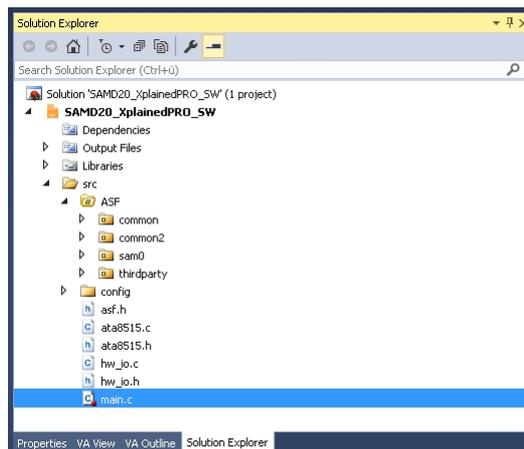
```
..\Software\base\SAMD20_XplainedPRO_SW Atmel Studio 6 or 7 project directory
```

After the installation of Atmel® Studio 6 or 7 the USB driver will be installed automatically when connecting the Xplained Pro SAMD20 board for the first time. When opening Atmel Studio you will see the landing page of this kit where you can obtain the documentation and sample projects. The OLED display will show the welcome screen and wait for a RF telegram from the remote sensor. After attaching the battery to the remote sensor the RF telegram will be immediately transmitted and is repeated every 2 seconds with an update on the temperature, RF telegram interval and RSSI signal strength parameter (if the optional real time clock is installed on the sensor otherwise the button S2 on the remote sensor can be pressed to transmit a RF telegram). You can also view the received information when opening a PC terminal application and selecting the COM port of the XplainedPRO board with a baudrate of 38.4kBaude, 8 data bit, 1 stop bit no parity and no handshake selected.

To start evaluating the software, you can select the main.c file from the solution window inside Atmel Studio 6 or 7 (see [Figure 4-3](#)):

The implementation can be analyzed and debugged together with the program flow shown in [Figure 4-2](#). Additional documentation regarding the other ASF functions can be obtained within Atmel Studio 6 or 7 Help.

**Figure 4-3. Base Software**



The debugging of the application is performed within Atmel Studio 6 or 7 together with the Xplained PRO SAMD20 board. This board includes an embedded debugger which is controlled by Atmel Studio.

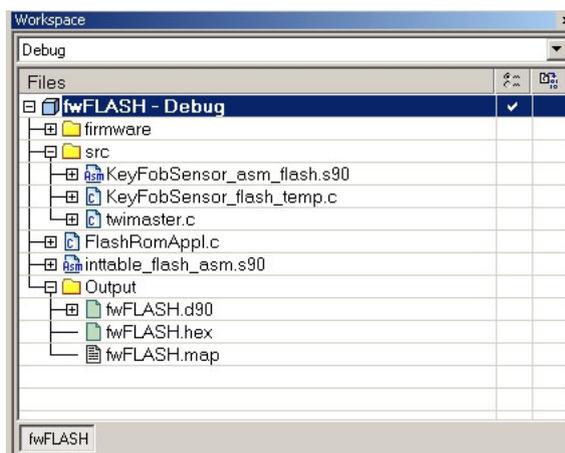
### 4.3.2. Remote Sensor

IAR Embedded Workbench for AVR<sup>®</sup> is required for remote sensor software development [5]. The project file is located in the extracted subfolder:

```
..\Software\sensor\ATA5831_FLASH_IAR_2.32.0 IAR Embedded Workbench project directory
```

After opening the IAR project Remote\_sensor.eww file, the following workspace window is available (see [Figure 4-4](#)).

**Figure 4-4. Remote Sensor Software**



Select the following files from the workspace window to start evaluating the software:

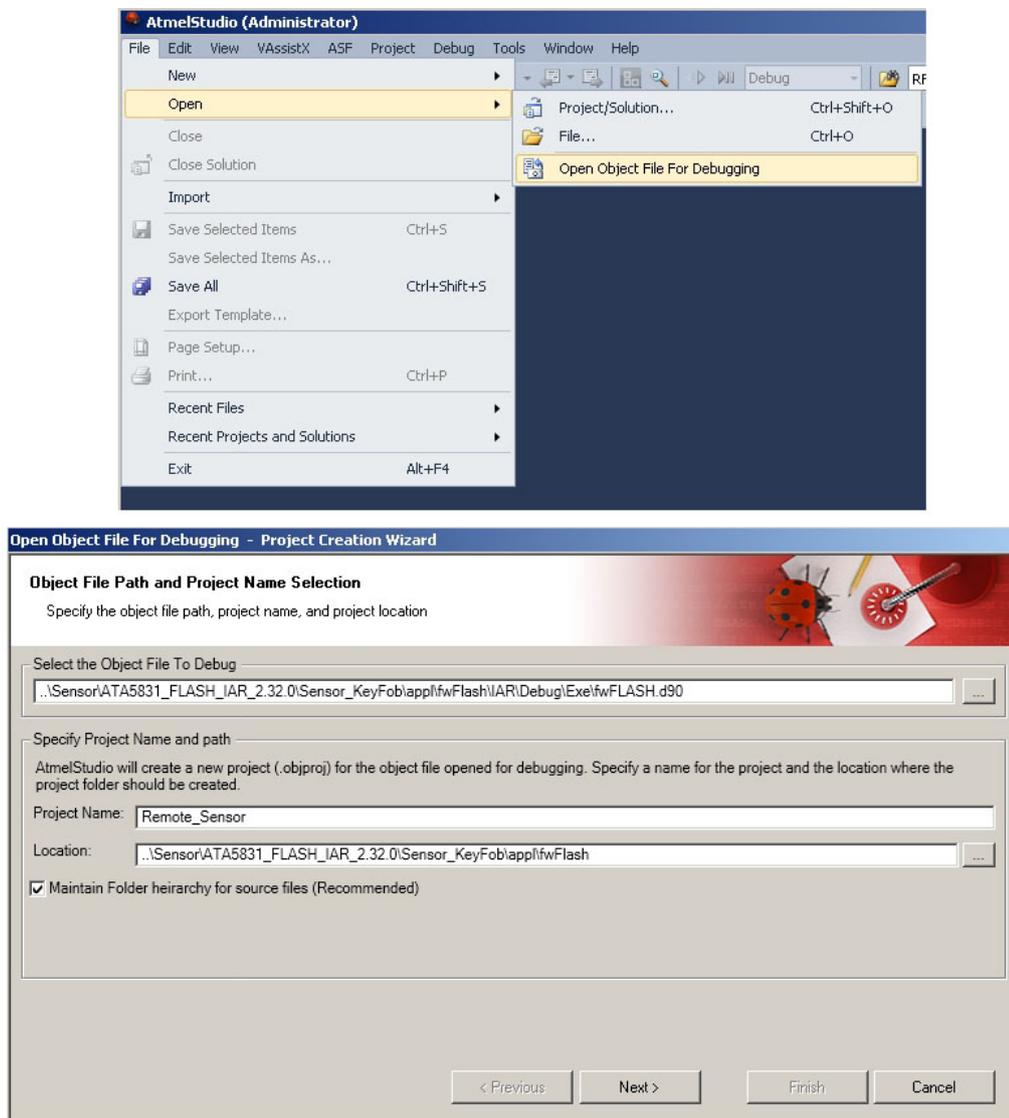
FlashRomAppl.c Main() program start with initialization and activation of the application loop

KeyFobSensor\_flash\_temp.c Application functions called within the main() function

The implementation can be analyzed, compiled, and linked together with the program flow shown in [Figure 4-1](#).

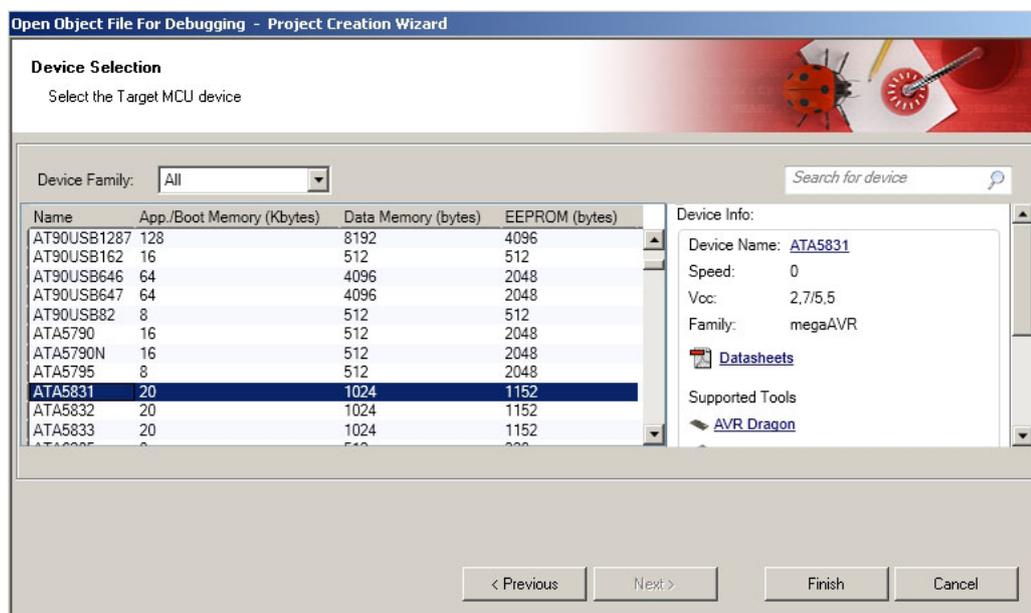
Debugging of the application is currently not supported within IAR Embedded Workbench using the AVR debug tool JTAGICE3. Atmel Studio 6 or 7 has to be used instead. Once the program is compiled and linked within IAR Workbench, the file fwFLASH.d90 has to be opened within Atmel Studio 6 or 7 as shown in [Figure 4-5](#). To select the right directory paths use the <...> buttons to locate the \*.d90 file and for the 'Location'.

**Figure 4-5. Debugging the Remote Sensor Software**



After selecting `Next>`, the device has to be selected. The Atmel ATA8510 device is not currently listed and the ATA5831 device (the similar automotive device) has to be selected instead as shown in [Figure 4-6](#). Selecting "Finish" shows the project window and after selecting the debug tool, the debugging can be performed much the way you would when using the base software.

Figure 4-6. Device Selection for Debugging



The Atmel ATA8510 device uses the debugWire interface for the debug connection (described in the user manual [9]). This connection uses the reset line on pin PC0 of the device and must be enabled within ISP programming mode. If debugWire mode is enabled, the ISP mode is not available and vice versa. Select “Disable debugWire connection” within the “Debug” menu to return to ISP mode. The 6-pin ISP connector is used as a connection to the debugger and it is recommended to connect only the V<sub>CC</sub>, GND and reset signal when debugging, leaving the SPI signals open for the application. This is important because the TWI driver software uses the PB1 pin as an SCL line shared with the ISP and SPI peripheral. Additional information on how to perform development and debugging with the Atmel ATA8510 device is provided in [6] and [8]. This application note describes development for the Atmel ATA5831 device which, in terms of Flash development, is similar to the Atmel ATA8510 device.

### 4.3.3. Re-programming of the Devices

The tool pack [10] includes the original programming files to re-program all devices in the kit.

1. For re-programming of the SAMD20 device select the device ATSAM20J18 in the device programming tool of Atmel® Studio 6 and the file SAMD20\_Flash.hex for the flash memory.
2. For re-programming of the Atmel ATA8515 device on the XplainedPRO ATA8510/15 extension board disconnect the board and apply an external 3V power supply to the connector X7. Connect pin 5 of connector X3 to GND (to prevent the device from entering the OFF mode) and select the device ATA5833 in the device programming tool and ensure that the ISP clock is set < 64kHz. Select the file Base\_Station\_EEPROM.hex for the EEPROM memory. For the fuse settings the fuses SPIEN and EESAVE should be set.
3. For re-programming of the Atmel ATA8510 device of the remote sensor attach the mini-ISP connector to the connector ISP and the debug tool and insert the CR2032 battery or apply an external 3V power supply to the mini ISP connector. Remove the CMM1923 rtc module and connect pin VCC to PB4 on connector X1 (to prevent the device from entering the OFF mode). Select the device ATA5831 in the device programming tool and ensure that the ISP clock is set < 64kHz. Select the file Remote\_Sensor\_Flash.hex for the flash memory and the file Remote\_Sensor\_EEPROM.hex for the EEPROM memory. For the fuse settings the fuses SPIEN and EESAVE should be set.

#### 4.4. EEPROM Data Settings

The EEPROM of the Atmel® ATA8510 and ATA8515 device includes the configuration of the device and the settings for the RF protocol. This EEPROM must be programmed before running application software either as an embedded Flash application or as a host application using the SPI communication link. The Atmel ATA5831 device has to be selected instead of the Atmel ATA8510 or ATA8515 within the programming dialog of Atmel Studio 6. Make sure that the ISP signals are available for the programmer only and that the device is not in OFF mode by pulling an NPWRONx pin to GND level, i.e., connect the PC1 pin to GND.

A Java GUI tool is used for generating the EEPROM programming file in HEX format (see [7] for the tool software and user guide, which is not included in the tool pack [10]). This tool can save all settings in an xml file and handling is described in the user guide [7] and the settings in the user manual [9].

The tool pack includes two subdirectories which contains the xml and HEX files for the base and the remote sensor:

```
..\Software\base\EEPROM Configuration file for the Atmel ATA8515 base station device
```

```
..\Software\sensor\EEPROM Configuration file for the Atmel ATA8510 remote sensor device
```

Only service 0 with channel 0 is used for the RF telegram. All other service settings can be ignored. For the base station the polling is defined in the polling tab of the GUI.

## 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
9343D-09/16	<ul style="list-style-type: none"><li>• Features: new bullet point added</li><li>• Reference no. [10] on page 2 changed</li><li>• Chapter 1: "Getting Started" changed and new heading "Kit Setup" added after figure 1-1 and the following text</li><li>• in new Chapter 1.1 "Kit Setup" text changed</li><li>• new Chapter 1.2: "Upgrade Kit V1.x to V2.0" added</li><li>• Chapter 2.3: text in point 2 changed and figure 2-1 changed</li><li>• Chapter 3: "Hardware Description" text changed</li><li>• Chapter 3.1: new text and tables added after figure 3-1</li><li>• Chapter 4: text changed</li><li>• Chapter 4.2: completely changed</li><li>• Chapter 4.3: text changed</li><li>• Chapter 4.3.1: completely changed</li><li>• Chapter 4.3.2: text changed</li><li>• Chapter 4.3.3: text changed</li></ul>

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