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## User Guide for the Evaluation Kit ATA8520-EK1-E and the ATA8520-EK2-E and ATA8520-EK3-E Extension Boards

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ATAN0104

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### Features

- User guide for the evaluation kit ATA8520-EK1-E and extension boards ATA8520-EK2-E and ATA8520-EK3-E
- This kit demonstrates a Flash application with the
  - ATA8520-EK1-E evaluation kit:  
with the Atmel® SIGFOX™ ATA8520D V1.3 transceiver device and an Atmel ATmega328P AVR® microcontroller with AT30TS75A temperature sensor as a battery-powered kit for standalone operation
  - ATA8520-EK2-E and ATA8520-EK3-E extension boards:  
Includes Atmel SIGFOX ATA8520D V1.3 transceiver device with an AT30TS75A temperature monitoring device. An additional MCU application development kit, i.e. Xplained mini or Arduino UNO is required.

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### Description

This user guide describes an evaluation kit and the extension boards for a SIGFOX application. This application uses an Atmel ATmega328P AVR microcontroller to read out an AT30TS75A temperature sensor using the built-in TWI connection and controls the RF telegram transmission using the SIGFOX ATA8520D V1.3 transceiver device. This application requires a SIGFOX base station infrastructure to capture the RF telegram and supply payload data at the SIGFOX back end of the SIGFOX Cloud. For more information on operating the SIGFOX network and SIGFOX Cloud, see <http://www.sigfox.com> information.

The evaluation and development kit tool packs are available for download from the Atmel website: <http://www.atmel.com/devices/ATA8520.aspx>. These tool packs include

- The ATAN0054 quick start guide for the kit and the Atmel ATAN0104 user guide
- The schematic, layout and Gerber data for the ATAB0101A PCB
- The source code for the Atmel ATmega328P as an Atmel Studio 6 project

The Atmel ATA8520D SIGFOX transceiver is a SIGFOX-certified device which includes the complete SIGFOX protocol stack to operate in the SIGFOX network within the 868MHz ISM band. The device is controlled from any host MCU using the SPI commands as described in the datasheet [1]. Included in the tool pack is a ATA8520D library as C source code for the SPI commands.

## References

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- [1] Atmel® ATA8520D datasheet and user guide
- [2] Atmel AT30TS75A datasheet
- [3] <http://www.sigfox.com>
- [4] <http://backend.sigfox.com>
- [5] <http://www.atmel.com/devices/ATA8520.aspx>
- [6] Atmel ATAN0054 – ATA8520-EK1-E/EK2-E/EK3-E quick start guide
- [7] ATA8520-EK123-E\_Tool\_pack\_V1.0.zip

## 1. Getting Started with the ATA8520-EK1-E Kit

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

- A single PCB ATAB0101A with
  - An Atmel® ATA8520D SIGFOX™ transceiver device
  - An Atmel ATmega328P AVR® microcontroller at 8MHz
  - An AT30TS75A temperature sensor with TWI
- An 868MHz monopole antenna for connection to the SMA connector

The kit requires an external power supply or battery for 3.0V to 3.3V at 50mA which is not included in the kit.

**Figure 1-1. ATA8520-EK1-E Kit Components**



The 868MHz monopole antenna is connected to the SMA connector of the PCB and the external power supply or battery has to be connected to connector X1.

**Caution:** Ensure correct polarity at the connection to avoid damage to the equipment. The PCB has no reverse polarity protection for the power supply connection.

The kit comes with preconfigured devices for starting the Flash application of the Atmel ATmega328P once the power is applied. This application controls the RF telegram transmission and reads out the temperature sensor at one-hour intervals or when pressing the SW1 button. The red LED1 starts blinking for about 7-8s, i.e. during telegram transmission. The device then enters power-down mode until a wake-up from the internal timer or a button press occurs.

Every fifth transmission is executed as an uplink/downlink request, i.e. it will first transmit the RF telegram with sensor data and requests a payload data packet from the SIGFOX cloud via a base station. The execution of these request will take about 40-50s.

The Atmel ATA8520D device includes the SIGFOX ID and PAC registration code (see label attached to PCB) to register the kit with the user's account for the SIGFOX back end. The user has to open a SIGFOX cloud account to access the back end. From this account the data payload transmitted from the devices can be retrieved in various ways as described in the SIGFOX online help.

An Atmel debugger (Atmel JTAGICE3 or Atmel ICE), which can be connected to connector XISP1, is required for application development. Please see the marker for pin1 to connect with the correct orientation. The debugger can only be used if Atmel Studio 6 is installed in the front end. Atmel Studio 6 can be downloaded from <http://www.atmel.com> with additional user instructions and tools. The documentation for the kit components and for the software is included in the tool pack zip folder [7] which can be downloaded from the Atmel website [5].

The kit and the boards are preprogrammed and temperature calibrated to operate at room temperature (24°C). For operation with a wider temperature range a temperature calibration as described in "ATAN0142 - ATA8520D Crystal Calibration" has to be applied. This is mandatory to comply with the CE certification for the kit and boards and is valid for a temperature range of -20°C to +55°C.

## 2. Getting Started with the ATA8520-EK2-E and -EK3-E Extension Boards

Figure 2-1 and Figure 2-4 show the components which are required for the evaluation kit. The kit includes

- A single PCB ATAB0101A with
  - An Atmel® ATA8520D SIGFOX™ transceiver device
  - An AT30TS75A temperature sensor with TWI
- An 868MHz monopole antenna for connection to the SMA connector

The kit is available in two versions depending on the connector type of the additionally required development kit:

- An ATA8520-EK2-E Xplained mini (Figure 2-1): to be used with an additional Xplained mini (Figure 2-2) or Arduino UNO kit
- An ATA8520-EK3-E Xplained Pro (Figure 2-3): to be used with an additional Xplained Pro kit (Figure 2-4)

Figure 2-1. ATA8520-EK2-E Xplained Mini Extension Board with Attached External Antenna



Figure 2-2. ATA8520-EK2-E Xplained Mini Extension Board Mounted on Xplained Mini

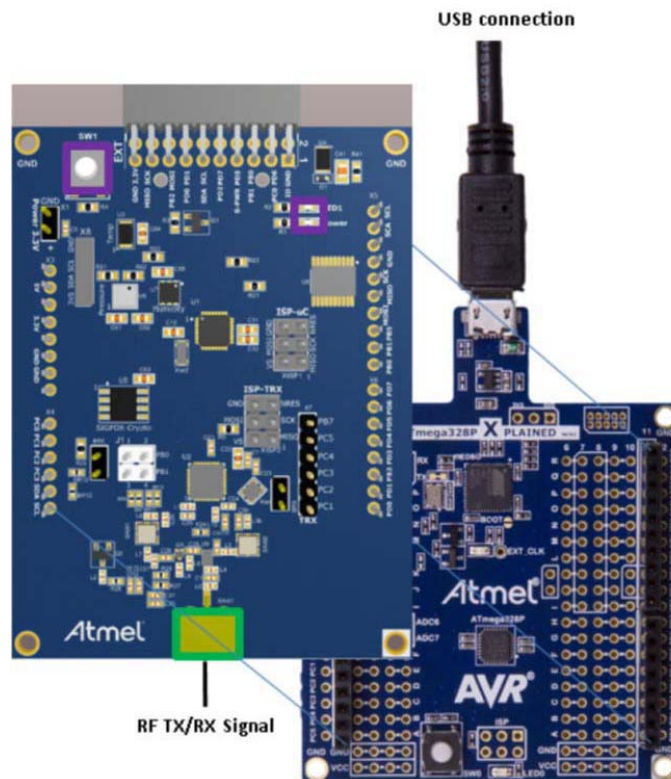
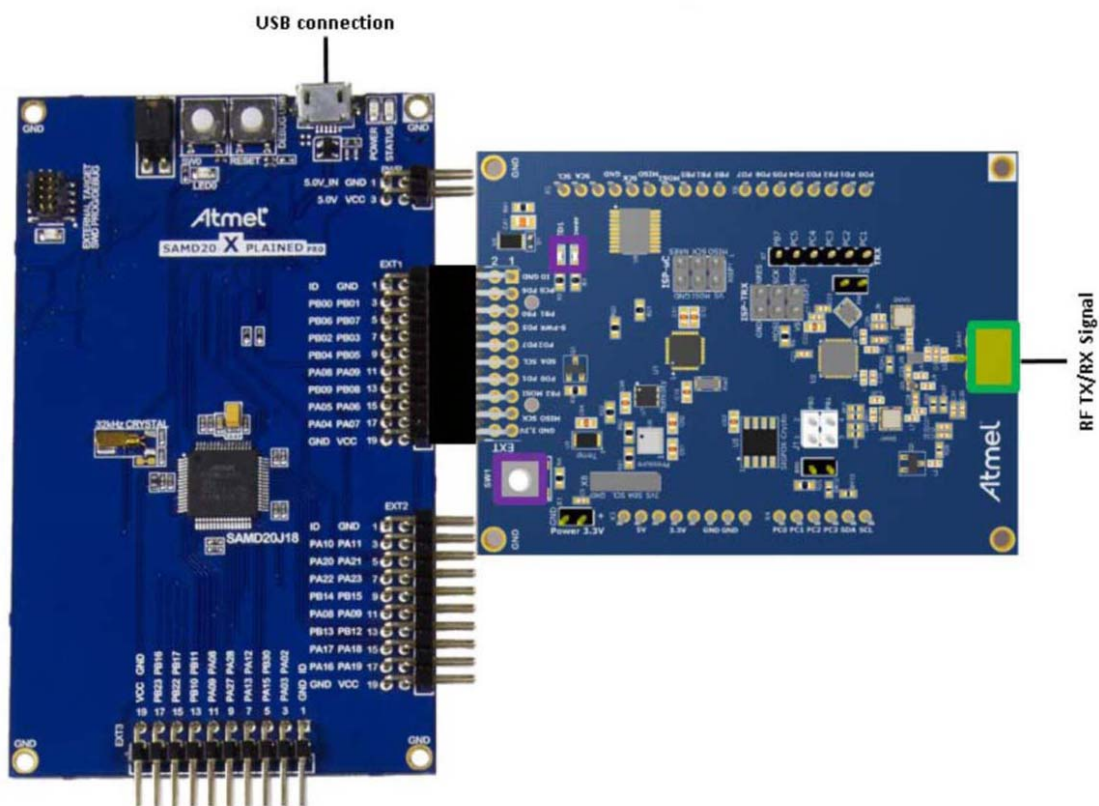


Figure 2-3. ATA8520-EK3-E Xplained Pro Extension Board



Figure 2-4. ATA8520-EK3-E Xplained Pro Extension Board with SAMD21 Xplained Pro Kit



The 868MHz monopole antenna is connected to the SMA connector of the PCB and the board is powered from the attached evaluation kit using 3V/5V for the ATA8520-EK2-E Xplained Mini and 3V for the ATA8520-EK3-E Xplained Pro.

The following Flash applications are available as part of tool pack distribution:

- Xplained mini – Atmega328P application at 5V/16MHz
- Arduino UNO sketch and library at 5V/16MHz
- SAMD21 application for Xplained Pro at 3V/48MHz

This application controls the RF telegram transmission and reads out the temperature sensor at 15-minute intervals or when pressing the SW1 button. The red LED1 starts blinking for about 7-8s, i.e. during telegram transmission. The device then runs in a main loop until an event from the internal timer or a button press occurs.

Every fifth transmission is executed as an uplink/downlink request, i.e. it will first transmit the RF telegram with sensor data and requests a payload data packet from the SIGFOX cloud via a base station. The execution of these request will take about 40-50s.

The ATA8520D device includes the SIGFOX ID and PAC registration code (see label attached on the PCB) to register the kit with the user's SIGFOX back-end account. The user has to open a SIGFOX cloud account to access the back end. From this account the data payload transmitted from the devices can be retrieved in various ways as described in the SIGFOX online help.

The Atmel debugger included in the development kits can be used for application development. Application development and use of the debugger is only possible if Atmel Studio 6 is installed in the front end. Atmel Studio 6 can be downloaded from <http://www.atmel.com> with additional user instructions and tools. The documentation for the kit components and for the software is included in the tool pack zip folder [7] which can be downloaded from <http://www.atmel.com/devices/ATA8520.aspx>.

### 3. Tool Pack for the Kits

The tool pack zip folder [7] 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          | data sheets of the devices                                               |
| ..\Hardware               | hardware documentation of the boards                                     |
| ..\Software               | software for the kit                                                     |
| ..\Software\ATA8520-EK1-E | Atmel® Studio 6 project directory for ATA8520-EK1-E kit with ATmega328P  |
| ..\Software\ATA8520-EK2-E | Atmel Studio 6 project directory for ATA8520-EK2-E board with Atmega328P |
| ..\Software\ATA8520-EK3-E | Atmel Studio 6 project directory for ATA8520-EK3-E board with SAMD21     |

### 4. ATA8520D SIGFOX Certified Transceiver

The Atmel ATA8520D SIGFOX™ transceiver includes the SIGFOX protocol library and a SPI communication interface for controlling device operation. The transceiver buffer of the device is loaded with a max. of 12 bytes of payload data for transmission in the 868MHz ISM band. The ATA8520D device can also receive payload data with 8 Bytes from the SIGFOX cloud when transmitting an uplink/downlink request. The Atmel ATA8520D device is certified by SIGFOX to participate in their network. A second certification step for the module or system including antenna is also required with a classification of the module or system RF performance, i.e. radiated RF output power. As a result, the RF path including antenna must also have SIGFOX certification.

The key parameters for the RF link are:

- RF channels: 868.0 to 868.6MHz for uplink and 869.4 to 869.65MHz for downlink
- RF output power: max. 14.5dBm
- RF sensitivity: –126dBm
- Data rate: 100bit/s with DBPSK modulation for uplink and 600bit/s with GFSK modulation for downlink
- Data payload: max. 12byte with LSB first for uplink and 8 bytes for downlink
- Duty cycle: max. 5 telegrams/hour, i.e. < 1% for uplink and max. 4 telegrams/day for downlink

The data transmission is AES encrypted.

The SIGFOX ID and PAC registration code are printed on a label attached to the PCB and can also be read out from the device using the SPI command interface. This ID and code are required for registering the device with the user's account for the SIGFOX back end.

## 5. ATAB0101A PCB Description

Figure 5-1 on page 9 shows the ATAB0101A PCB used as a platform for the SIGFOX™ kits. It works in three different modes depending on the component mounted on the PCB:

1. Battery powered standalone operating mode for the ATA8520-EK1-E kit:
  - Includes the Atmel® ATA8520D SIGFOX device
  - Includes the Atmel ATmega328P AVR® microcontroller with 8MHz internal clock and external 32.768kHz crystal
  - Includes the AT30TS75A temperature sensor with TWI
  - Includes an ATAES132 crypto device (footprint)
  - Includes an SMA antenna connector for an 868MHz external monopole antenna
  - Two LEDs:
    - i. Green LED LD1 to indicate the sensor power
    - ii. Red LED LD2 connected to port pin PD5 and connector X2/pin8 and X6/pin6 for the user application
  - User button SW1 connected to port pin PD6 and to connectors X2/pin4 and X6/pin7
  - Supply voltage divider connected to pin ADC0 to measure the battery voltage against the internal 1.1V reference
  - Includes the footprint for the following TWI sensor devices:
    - i. BMP180 air pressure sensor
    - ii. HTU20D/SHT20 humidity sensor
2. Operating mode with an additional Xplained mini or Arduino UNO kit for the ATA8520-EK2-E extension board using an ATmega328P:
  - Includes the Atmel ATA8520D SIGFOX device
  - Includes the AT30TS75A temperature sensor with TWI
  - Includes an ATAES132 crypto device (footprint)
  - Includes an SMA antenna connector for an 868MHz external monopole antenna
  - Two LEDs:
    - i. Green LED LD1 to indicate the sensor power
    - ii. Red LED LD2 connected to port pin PD5 and connector X2/pin8 and X6/pin6 for the user application
  - User button SW1 connected to port pin PD6 and to connectors X2/pin4 and X6/pin7
  - Supply voltage divider connected to pin ADC0 to measure the supply voltage against the internal 1.1V reference
  - Includes the footprint for the following TWI sensor devices:
    - i. BMP180 air pressure sensor
    - ii. HTU20D / SHT20 humidity sensor
  - Includes the connectors X3, X4, X5 and X6 for connecting the PCB on top of an Xplained mini or an Arduino UNO board
3. Operating mode with an additional Xplained Pro kit for the ATA8520-EK3-E extension board using a SAMD21:
  - Includes the Atmel ATA8520D SIGFOX device
  - Includes the AT30TS75A temperature sensor with TWI
  - Includes an ATAES132 crypto device (footprint)
  - Includes an SMA antenna connector for an 868MHz external monopole antenna
  - Two LEDs:
    - i. Green LED LD1 to indicate the sensor power
    - ii. Red LED LD2 connected to port pin PD5 and connector X2/pin8 and X6/pin6 for the user application
  - User button SW1 connected to port pin PD6 and to connectors X2/pin4 and X6/pin7



## 5.1 ATA8520-EK1-E Power Consumption and Battery Selection

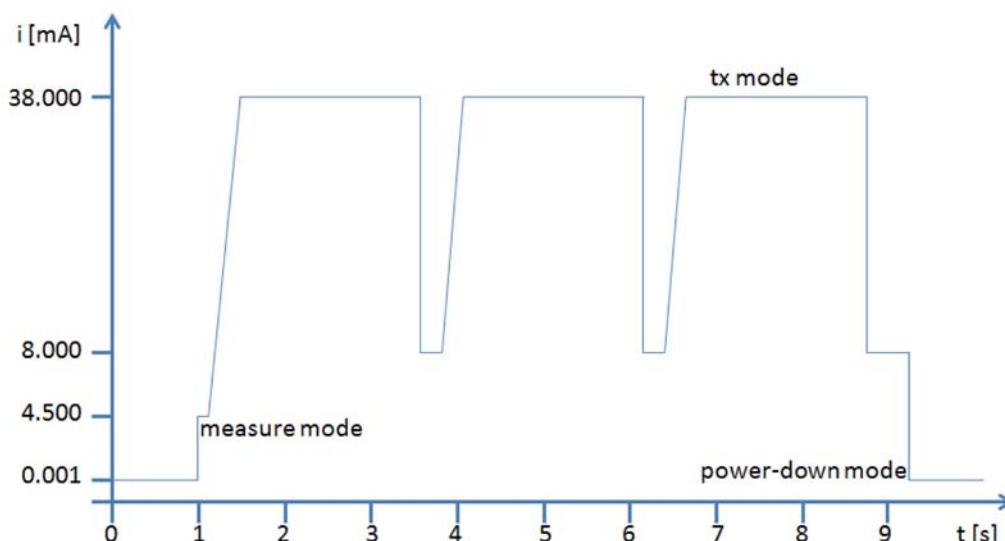
When using the PCB in standalone mode, the AVR<sup>®</sup> microcontroller can be set to a power-down mode while running the Timer2 with the external 32.768kHz crystal. This will reduce the mean current consumption to ~10 to 20µA (see [Table 5-1](#) for 5 messages per day). In this mode the sensor power is switched off and the Atmel<sup>®</sup> ATA8520D device is in OFF mode and the MCU only wakes up by pressing the button, applying an external interrupt signal or from the internal Timer2 interrupt.

[Figure 5-2](#) shows the typical current consumption profile from the different operating modes of the Flash application during a telegram transmission. This allows the calculation of a mean current consumption depending on the wake-up intervals.

The shown current profile is a typical profile and depends on the Flash application of the Atmel ATmega328P device and the attached sensors.

During the telegram transmission the MCU is performing the LED flashing to indicate activity. This increases the current consumption and can be replaced by setting the MCU in power-down mode. When the transmission is finished an event is generated on pin PB6 of the ATA8520D which can be used to wake-up the MCU.

**Figure 5-2. Standalone Mode Current Consumption at 24°C**



[Table 5-1](#) summarizes battery service life for a typical Lithium battery which can be used with the ATAB0101A. When selecting the battery, it is important to know the peak current consumption which has to be supplied by the battery cells. It is assumed that the battery voltage drops from the initial value of 3V down to 2V at the end of its service life. The self-discharge is defined by the manufacturer as typically 1% per year at an ambient temperature of 20°C.

**Table 5-1. Battery Life at 20°C**

| Messages/Day | Mean Current [mA] <sup>(1)</sup> | Battery Lifetime (Days and Years) |       |
|--------------|----------------------------------|-----------------------------------|-------|
|              |                                  | 3V Lithium Battery (1800mAh)      |       |
|              |                                  | Days                              | Years |
| 140          | 0.421                            | 178                               | 0.5   |
| 100          | 0.301                            | 249                               | 0.7   |
| 50           | 0.151                            | 497                               | 1.4   |
| 20           | 0.061                            | 1230                              | 3.4   |
| 5            | 0.016                            | 4689                              | 12.8  |

Note: 1. The mean current values shown in the table are only for indication and cannot be taken as reference.

When operating in uplink/downlink mode the transmission and reception will take about 40 to 50 seconds. In this period the device will first send a data telegram three times as shown in [Figure 5-2](#), followed by an idle mode with about 4.5mA current consumption for about 20s and will then enter the receive mode for about 20s with 19mA current consumption. Finally a confirm telegram is sent for about 2s. This uplink/downlink mode is only possible for max. 4 transmissions/day and has to be added to the Mean Current consumptions in [Table 5-1](#).

During the uplink/downlink operation the MCU can be placed in power-down mode and can wake-up by the event of the ATA8520D.

## 5.2 Connector Description

The PCB has several connectors which are used differently depending on the PCB configuration. [Table 5-2](#) summarizes the connectors and how different PCB versions are used.

The placement of the connectors at the PCB is shown in [Figure 5-1 on page 9](#).

**Table 5-2. ATAB0101A Connectors**

| Connector        | ATA8520-EK1-E<br>Standalone Version | ATA8520-EK3-E<br>Xplained Pro Extension | ATA8520-EK2-E<br>Xplained Mini Extension |
|------------------|-------------------------------------|-----------------------------------------|------------------------------------------|
| X1 ext. power    | External 3V power supply            | --                                      | --                                       |
| X2 Xplained Pro  | --                                  | Extension connector                     | --                                       |
| X3 Xplained mini | --                                  | --                                      | Shield connector1                        |
| X4 Xplained mini | --                                  | --                                      | Shield connector2                        |
| X5 Xplained mini | --                                  | --                                      | Shield connector3                        |
| X6 Xplained mini | --                                  | --                                      | Shield connector4                        |
| X7 RF debug      | --                                  | --                                      | --                                       |
| X8 sensor        | External sensors                    | External sensors                        | External sensors                         |
| J1 RF config.    | PB0/PB1 pin usage                   | PB0/PB1 pin usage                       | PB0/PB1 pin usage                        |
| XISP1            | ISP-microcontroller connector       | --                                      | --                                       |
| XISP2            | --                                  | --                                      | --                                       |

### 5.2.1 Connector X1

Connector X1 is used for supplying an external 3V power source for standalone battery powered applications for the ATA8520-EK1-E kit.

**Caution:** These pins have no reverse polarity protection.

**Table 5-3. Connector X1**

| Function | Pin | Pin | Function |
|----------|-----|-----|----------|
| +3.3V    | 1   | 2   | GND      |

### 5.2.2 Connector X2

Connector X2 is used for connecting to an Xplained Pro MCU kit. In this connection mode the PCB is supplied with 3V of power from the Xplained Pro MCU board.

**Table 5-4. Connector X2**

| Function           | Pin | Pin | Function            |
|--------------------|-----|-----|---------------------|
| ID_data            | 1   | 2   | GND                 |
| PC0 (PB00)         | 3   | 4   | SW1 (PB01)          |
| PB1/RF_NRES (PB06) | 5   | 6   | PB0/RF_PWRON (PB07) |
| SNS_PWR (PB02)     | 7   | 8   | LED1 (PB03)         |
| RF_EVNT (PB04)     | 9   | 10  | AES_NSS (PB05)      |
| SDA (PA08)         | 11  | 12  | SCL (PA09)          |
| PD0 (PB09)         | 13  | 14  | PD1 (PB08)          |
| RF_NSS (PA05)      | 15  | 16  | MOSI (PA06)         |
| MISO (PA04)        | 17  | 18  | SCK (PA07)          |
| GND                | 19  | 20  | +3.3V               |

### 5.2.3 Connectors X3, X4, X5 and X6

Connectors X3, X4, X5 and X6 are used for connecting to an Xplained mini or Arduino UNO kit. In this connection mode the PCB is supplied with 3V and 5V of power from the Xplained mini or Arduino UNO board.

Connector X3 is used for supplying power to the add-on boards.

**Table 5-5. Connector X3**

| Function | Pin |
|----------|-----|
| -        | 1   |
| -        | 2   |
| -        | 3   |
| +3.3V    | 4   |
| +5V      | 5   |
| GND      | 6   |
| GND      | 7   |
| -        | 8   |

Connector X4 is used for the port C pins of the MCU.

**Table 5-6. Connector X4**

| Function | Pin |
|----------|-----|
| PC0      | 1   |
| PC1      | 2   |
| PC2      | 3   |
| PC3      | 4   |
| PC4/SDA  | 5   |
| PC5/SCL  | 6   |

Connector X5 is used for the port B pins of the MCU. Pins 1 to 6 are connected to a 3V/5V level shifter to convert the signals to 3V at PCB level.

**Table 5-7. Connector X5**

| Function     | Pin |
|--------------|-----|
| PB0/RF_PWRON | 1   |
| PB1/RF_NRES  | 2   |
| PB2/RF_NSS   | 3   |
| PB3/MOSI     | 4   |
| PB4/MISO     | 5   |
| PB5/SCK/LED  | 6   |
| GND          | 7   |
| -            | 8   |
| -            | 9   |
| -            | 10  |

Connector X6 is used for the port D pins of the MCU. Pins 3 and 8 are connected to a 3V/5V level shifter to convert the signals to 3V at PCB level.

**Table 5-8. Connector X6**

| Function    | Pin |
|-------------|-----|
| PD0         | 1   |
| PD1         | 2   |
| PD2/RF_EVNT | 3   |
| PD3/SNS_PWR | 4   |
| PD4         | 5   |
| PD5/LED1    | 6   |
| PD6/SW1     | 7   |
| PD7/AES_NSS | 8   |

#### 5.2.4 Connector X7

Connector X7 is not typically mounted. These Atmel® ATA8520D pins can also be used as supplementary I/O pins.

**Table 5-9. Connector X7**

| Function          | Pin |
|-------------------|-----|
| RPC1/RF_NPRON1    | 1   |
| RPC2/RF_TRPA      | 2   |
| RPC3/RF_TMDO      | 3   |
| RPC4/RF_TMDI      | 4   |
| RPC5/RF_TRPB      | 5   |
| RPB7/RF_RX_ACTIVE | 6   |

### 5.2.5 Connector X8

Connector X8 is not typically mounted and is used for the TWI bus connection with the switched power supply. This connector can be used to attach additional sensors and devices with the TWI connection. The power consumption is limited to ~50mA.

**Table 5-10. Connector X8**

| Function  | Pin |
|-----------|-----|
| +3.3Vsens | 1   |
| SDA       | 2   |
| SCL       | 3   |
| GND       | 4   |

### 5.2.6 Connector J1 and BR8

The connector J1 is used for connecting the NPWRON1 and NRES pins of the ATA8520D to the PB0 and PB1 port pins of the MCU. If the PB0 and PB1 pins are used for other purposes, these connections are removed. In this case the PWRON pin can be connected to pin NSS of the ATA8520D using the jumper BR8. A device reset can also be forced using the “system reset” SPI command.

Per default the following connections are set: jumper on J1 between pin3 and 4 for the NRES signal and a connection between J1/pin2 to BR8/pin2 for the PWRON signal (the NPWRON1 signal is not used for wake-up of the device).

**Table 5-11. Connector J1**

| Function  | Pin | Pin | Function |
|-----------|-----|-----|----------|
| RF_PWRON1 | 1   | 2   | PB0      |
| RF_NRES   | 3   | 4   | PB1      |

**Table 5-12. Connector BR8**

| Function | Pin | Pin | Function |
|----------|-----|-----|----------|
| RF_NSS   | 1   | 2   | RF_PWRON |

### 5.2.7 Connector ISP-TRX

Connector ISP-TRX is not mounted and is not required for applications.

**Table 5-13. Connector ISP-TRX**

| Function | Pin | Pin | Function        |
|----------|-----|-----|-----------------|
| MISO     | 1   | 2   | V <sub>CC</sub> |
| SCK      | 3   | 4   | MOSI            |
| nRES     | 5   | 6   | GND             |

### 5.2.8 Connector ISP-microcontroller

Connector ISP-microcontroller is used for ATmega328P programming and debugging for the kit ATA8520-EK1-E. This connector is not mounted in the ATA8520-EK2-E kit.

**Table 5-14. Connector ISP-microcontroller**

| Function | Pin | Pin | Function        |
|----------|-----|-----|-----------------|
| MISO     | 1   | 2   | V <sub>CC</sub> |
| SCK      | 3   | 4   | MOSI            |
| nRES     | 5   | 6   | GND             |

## 5.3 LED, Button and Sensors

The green LED LD1 is connected to the sensor power and indicates if the sensor power is switched on.

The red LED LD2 is connected to port PD5 on Atmel® ATmega328P and to the connectors X2/pin8 and X6/pin6 and can be controlled by the MCU application.

The button SW1 is connected to port PD6 on Atmel ATmega328P and to the connectors X2/pin4 and X6/pin7 and can be read by the MCU application.

The PCB contains a temperature sensor connected to the TWI bus of the MCU and in addition two footprints for additional sensors, i.e. an air pressure sensor and a humidity sensor device. With the TWI connector X8 additional sensors can be connected as long as the current on the 3.3V supply will not exceed 50mA.

The PCB contains also a AES crypto device connected to the SPI bus which can be controlled from the MCU or from the RF device. Currently only the MCU will control this device using the AES\_NSS signal for the chip select. This chip select is connected to port pin PD7 and to the connectors X2/pin10 and X6/pin8.

## 6. Application Description

The Flash application for both kits is set up in the same way with the exceptions described in [Table 6-1](#). The main differences are found in the CPU and system and Timer2 clock and sleep modes.

**Table 6-1. Flash Application Differences**

| Feature                  | ATA8520-EK1-E               | ATA8520-EK2-E<br>Xplained Mini | ATA8520-EK3-E<br>Xplained Pro |
|--------------------------|-----------------------------|--------------------------------|-------------------------------|
| Oscillator and CPU clock | Internal 8MHz RC oscillator | External 16MHz clock           | External 32.768kHz crystal    |
| Timer2                   | External 32.768kHz crystal  | Internal system clock 16MHz    | Internal system clock 48MHz   |
| Sleep mode               | Power down mode             | Idle in main loop              | Idle in main loop             |
| System clock             | 8MHz                        | 16MHz                          | 48MHz                         |

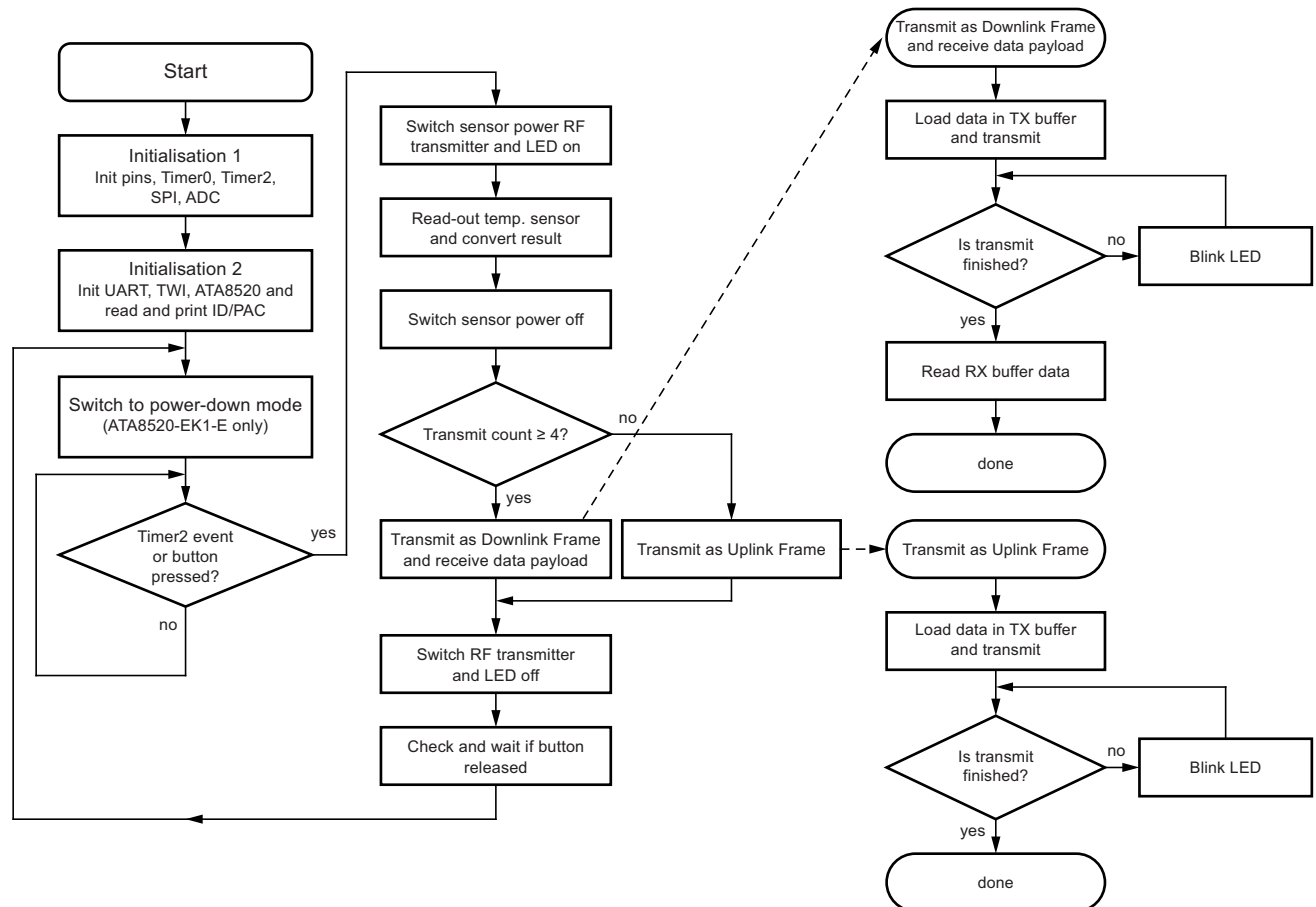
The source code for all applications is available within the tool pack distribution [7].

The program flow for the Flash application is illustrated in [Figure 6-1](#). The application first initializes all required peripherals such as pins, timers, SPI, ADC, UART, TWI and the ATA8520D SIGFOX transceiver by reading out the ID/PAC information required for SIGFOX™ registration. This ID/PAC data is sent via the UART interface to a PC terminal application. The Timer2 is used as a real-time clock and uses either the

- External 32.768kHz crystal for the ATA8520-EK1-E kit or the
- Internal system clock for the ATA8520-EK2-E and ATA8520-EK3-E kits.

Timer2 is configured to wake up the MCU every hour or every 15 minutes. Pressing button SW1 also causes the MCU to wake up. The temperature sensor is powered up and read out and after this a data telegram is transmitted. The device then enters power-down mode again until the next wake-up by the RTC (or manually by pressing SW1).

**Figure 6-1. Flash Application Flow Chart**



During the step Initialisation1 the application will perform a check for the device version to be V1.3. This device version supports the temperature drift calibration and includes fixes for the test function. Previous device version will not support this modes

## 6.1 Software Development

Atmel® Studio 6 is required for software development and can be downloaded from the Atmel website [5]. The tool pack [7] with software and documentation is also required. When unpacking the tool pack, the folder structure as described in [Section 3. “Tool Pack for the Kits” on page 7](#) is generated.

Four different applications and folder structures are included with sample applications for the kit versions.

|                                        |                                                 |
|----------------------------------------|-------------------------------------------------|
| ..\ATA8520-EK1-E\ATAB0101A             | ATmega328P project for ATA8520-EK1-E kit        |
| ..\ATA8520-EK2-E\XplainedMini_SW       | Xplained Mini project for ATA8520-EK2-E kit     |
| ..\ATA8520-EK2-E\ArduinoUNO_SW         | Arduino IDE sketch for ATA8520-EK2-E kit        |
| ..\ATA8520-EK3-E\SAMD21_XplainedPRO_SW | SAMD21 Xplained Pro project for ATA8520-EK3 kit |

The Atmel Studio 6 installation makes all USB drivers and debugger supports available when plugging in the development kits. Not included is the ATA8520-EK1-E standalone kit which requires an AVR® debugger to be connected to the connector ISP-microcontroller for debugging and programming.

When using the Arduino UNO sketch application, the Arduino IDE has to be installed first along with the Atmel ATA8520D library.

## 7. 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9373E-AUTO-11/15 | <ul style="list-style-type: none"><li>• Section 1 “Getting Started with the ATA8520-EK1-E Kit” on page 3 updated</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 9373D-AUTO-10/15 | <ul style="list-style-type: none"><li>• ATAK55002-V1 to ATA8520-EK1-E renamed</li><li>• ATAK55002-V2 to ATA8520-EK2-E renamed</li><li>• ATAK55002-V3 to ATA8520-EK3-E renamed</li><li>• Section 4 “ATA8520D SIGFOX Certified Transceiver” on page 7 updated</li><li>• Section 5 “ATAB0101A PCB Description” on pages 8 to 14 updated</li><li>• Section 6 “Application Description” on page 16 updated</li></ul>                                                                                                                                                                                                                                                                             |
| 9373C-AUTO-07/15 | <ul style="list-style-type: none"><li>• Section 2 “Getting Started with the ATAK55002-V2 and -V3 Extension Boards” on pages 4 to 5 updated</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 9373B-AUTO-02/15 | <ul style="list-style-type: none"><li>• Title on page 1 updated</li><li>• Section “Features” on page 1 updated</li><li>• Section “Description” on page 1 updated</li><li>• Section “References” on page 2 updated</li><li>• Section 1 “Getting Started with the ATAK55002-V1 Kit” on page 3 updated</li><li>• Section 2 “Getting Started with the ATAK55002-V2 and -V3 Extension Boards” on page 4 updated</li><li>• Section 3 “Tool Pack for the Kits” on page 6 updated</li><li>• Section 5 “ATAB0101A PCB Description” on page 7 updated</li><li>• Table 5-2 “ATAB0101A Connectors” on page 10 updated</li><li>• Section 6 “Application Description” on pages 15 to 16 updated</li></ul> |



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