AVR2009: AT86RF230 – Software Programming Model

Features

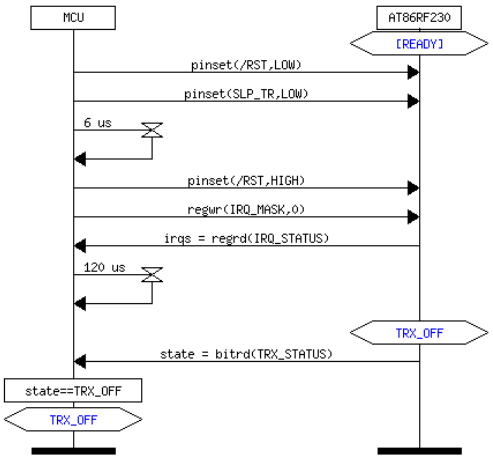
- **AT86RF230 – programming reference**
- **Message Sequence Charts with code examples**

1 Introduction

The AT86RF230 Software Programming Model (SWPM) shall provide a reference for developers utilizing the radio transceiver AT86RF230 as effective as possible. The model describes the behavior of the radio transceiver and the required programming steps to use the provided hardware features as shown in Figure 1-1.

The SWPM is targeted to software developers, who are going to develop low-level drivers for network stacks and network applications, using the AT86RF230 radio transceiver directly. The SWPM describes the hardware usage together with the related timing constraints usually handled by higher layers like IEEE802.15.4™ MAC or a ZigBee™ network layer.

Figure 1-1. MSC and example for PHY_STATE_RESET procedure



Code example

```
trx_pinset_reset(0);
trx_pinset_slptr(0);
delay_us(6);
trx_pinset_reset(1);
trx_reg_write(RG_IRQ_MASK, 0);
irqs = trx_reg_read(RG_IRQ_STATUS);
delay_us(120);
state = trx_bit_read(SR_TRX_STATUS);
ASSERT(state==TRX_OFF);
```

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Application Note

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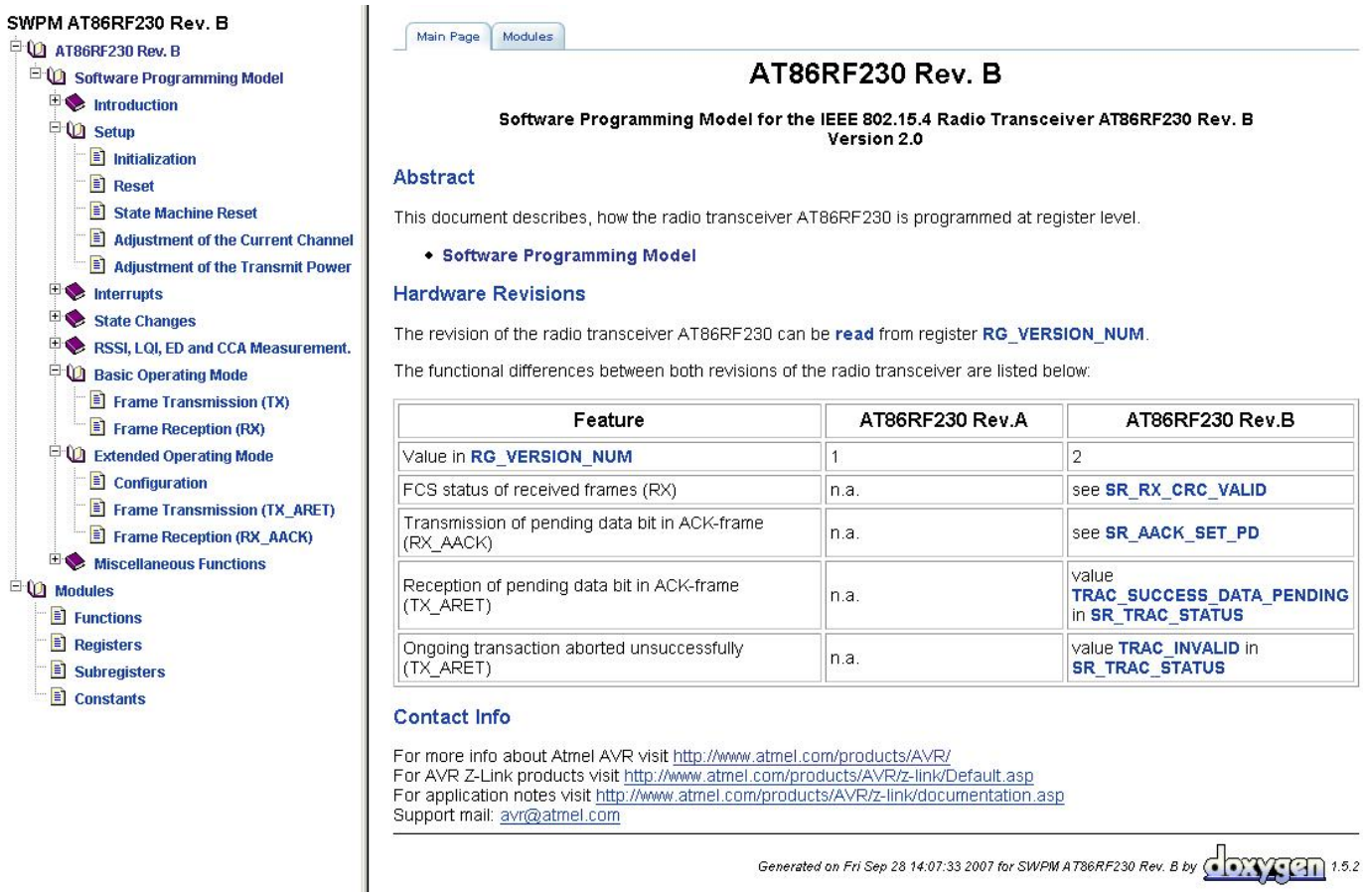
2 Functional & usage description

The SWPM is primarily a collection of message sequence charts (MSC) that are used to illustrate the behavior and the usage of the AT86RF230 transceiver. Message sequence charts are a method to describe and visualize message handling between different entities. They show events, transactions and the timing relations between them.

The SWPM can serve developers as a reference manual for the daily work with the AT86RF230 transceiver. The SWPM is delivered in HTML format. The HTML files contain a detailed verbal description as well as a graphical representation of the message sequence charts. In addition to the message sequence charts there are basic code examples as illustration of a possible implementation of this specific MSC in a real programming language. The language that is used for these examples is C. The main user interface to the SWPM is the file *index.html* as shown in Figure 2-1.

Figure 2-1. AT86RF230 SWPM 2.0 – introduction page



The navigation is very easy by using the navigation pane on the left side. There are eight different main categories under the Software Programming Model entry shown in Table 2-1.

Table 2-1. AT86RF230 SWPM Categories

Category name	Category description/Summary
Introduction	SPI description, registers & sub-registers, basic description of MSCs, radio states
Setup	Init, Reset, State machine reset, current channel, transmit power
Interrupts	Description of the different interrupts and their handling
State Changes	Description of the transceiver state transitions
RSSI, LQI, ED and CCA Measurement.	Measurements of different radio relevant parameters
Basic Operation Mode	Standard TX and RX modes
Extended Operation Mode	Configuration and usage of the extended TX and RX modes
Miscellaneous Functions	Calibration, CLKM, Battery Monitor, Continuous Transmission test mode

All timings given in the SWPM are based on the typical timing values from the AT86RF230 datasheet. Note that the actual timings partially depend on external circuitry and thus might be different for a particular hardware setup. For example, all power-up times depend on external capacitors connected to the voltage regulators.

The message sequence charts provide a simplified programming model, which features neither loops nor branches. Therefore, all wait times are specified as a worst-case scenario, taking into account frame transmissions of the largest possible frames, exhausting the maximal number of retries etc. Usually, an actual implementation is not going to wait for a long time in many situations, but it rather will either use interrupts to get notified about the completion status of some operation, or poll the transceiver to identify whether the operation has yielded the desired effect. Thus, the given C code examples are not meant to be an actual full implementation, they are merely provided to illustrate the case.

Further information can be found in the file *readme.html* in the top-level folder of the ZIP package.

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