A vertical strip on the left side of the page shows three ATMEGA microcontrollers mounted on a blue printed circuit board (PCB). The chips are black with gold pins and the ATMEL logo is visible on each. The background of the strip is a blurred, colorful image of the PCB.

# STK511

## AVR<sup>®</sup>-Based Uni-Directional Radio Starter Kit

## Outline

- **Introduction**
- **Kit Contents**
- **Receiver Application Board**
- **Receiver Interface Board**
  - **Stand-alone Operation**
  - **Operation with STK500**
- **Transmitter Application Board**
- **System Setup**
  - **General Setup**
  - **Demo Setup – Hardware**
  - **Demo Setup – Software**
  - **Demo Receiver Configuration**
  - **Demo Transmitter Configuration**
- **Running the Demo**
- **Conclusion**

## Introduction

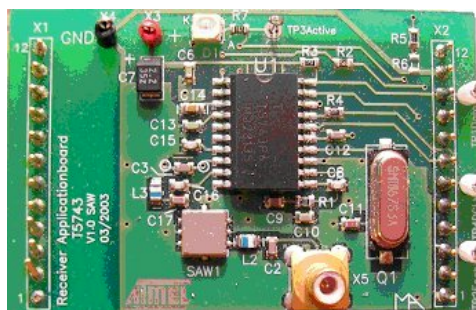
- **UHF radio covers 315, 434, 868 and 915 MHz**
- **Supports “intelligent” receiver ICs**
- **Atmel reference design receiver uses AVR® in STK500**
- **Atmel reference design transmitter uses ATtiny13**
  - **Supports 8-pin TSSOP PLL transmitters ICs**
  - **ASK or FSK transmission is pushbutton selectable**
- **Receiver Interface Board**
  - **Supports stand-alone receiver operation**
  - **Quickly programs configuration registers**
    - **OPMODE**
    - **LIMIT**
  - **Doubles as an expansion card for STK500**
    - **Enables quick prototype development**
    - **Sample software for STK500 included**

## Kit Contents

- **STK511 Receiver Interface Board (IFB)**
- **RF Receiver Application Board (RAB) – one of the following:**
  - T5743 (315/433.92 MHz)
  - T5760 (868 MHz)
  - T5761 (915 MHz)
- **RF Transmitter Application Board (TAB) – one of the following:**
  - Tiny13 + T5750 (868/915MHz)
  - Tiny13 + T5753 (315MHz)
  - Tiny13 + T5754 (433.92MHz)
- **CD containing sample software and related documents**
- **Antenna**
  - Transmitter uses integrated PCB trace
  - Receiver uses external monopole whip

## Receiver Application Board

- Registers part of Atmel receivers (T5743/60/61)
  - OPMODE & LIMIT set performance of receiver
  - Must be reprogrammed upon power-up
  - Programmed using one-wire protocol over DATA line
- LED to indicate IC activity
- Test points for viewing signal activity
- Matching network for receive antenna



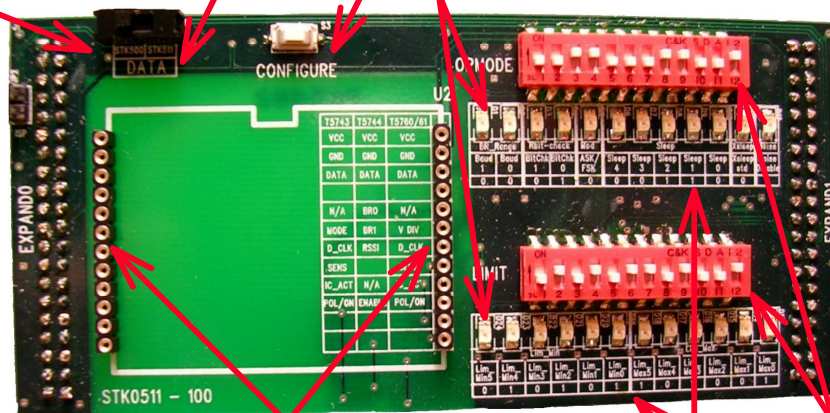
## Receiver Interface Board

**Data Selector Switch**  
 --Sends the received DATA to the STK500 for decoding  
 --Sends the DATA line to the STK511 for programming

**Button to initiate programming of the registers**

**LEDs display the selected bit settings of the two configuration registers**

**Routing of other signals from the receiver is controlled via 0 ohm resistor setting on the back of the STK511 board**



**Onboard ATmega8515 uC with preset firmware controls the configuring of the register with the values selected by the DIP switches**

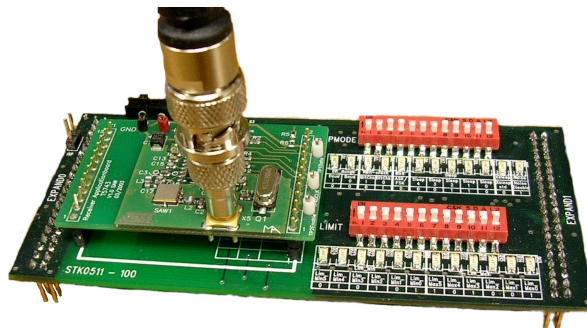
**Connectors for RF Receiver Application Boards**

**Silkscreen legend for easy identification of the settings in the registers**

**DIP switches to set bits in two configuration registers in receiver ICs**

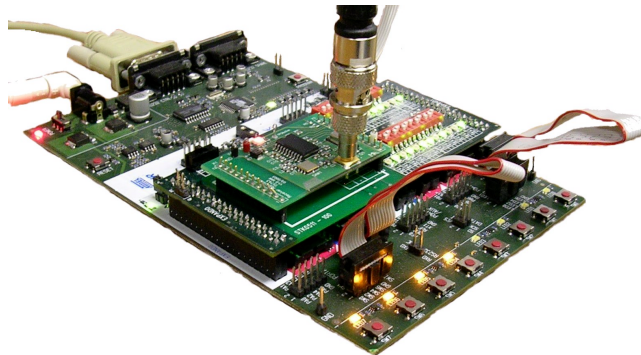
## Stand-alone Operation

- **Change receiver's settings without writing software**
  - **DIP switches set configuration register values**
  - **Embedded firmware (ATmega8515) programs registers**
- **Example: Change modulation to ASK**
  - **Set DATA selector switch on IFB to STK511**
  - **Set OPMODE register DIP switch # 5 to "ON" position**
  - **Verify "Mod" LED is illuminated (indicating ASK)**
  - **Press "CONFIGURE" button to program registers**



## Operation with STK500

- **STK511 Interface Board is an STK500 expansion card**
  - Still permits DIP switch programming of configuration registers
  - Connects receiver signals to STK500
- **STK500 Capabilities**
  - Allows user to select any AVR<sup>®</sup> for system development
  - Creates environment for easy prototyping
  - Speeds up concept verification
  - Enables functional demos using integral LEDs and switches





## Transmitter

- **Atmel ATtiny13 AVR® controls T575x transmitter**
- **Calibrated internal RC oscillator minimizes external parts**
- **Programmable using exposed 6-pin ISP header**
- **Multi function I/O (5 places)**
  - **Button input**
  - **LED driver**
  - **A/D converter**
  - **RF transmission control**
- **ASK or FSK RF modulation**
- **FSK modulation by “pulling” crystal load**
  - **Through I/O port**
  - **Through external FET**



## General Setup

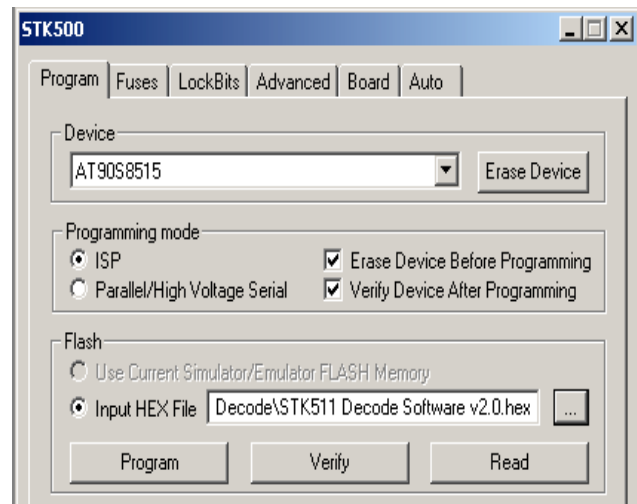
- **Stand-alone Operation (RAB to IFB Assembly)**
  - Align signal pins of RAB near DIP switches on IFB
  - Align “+” and “GND” test points of RAB near DATA switch on IFB
  - Insert RAB into 12-pin header connectors on IFB
  - Apply +5V supply to “+” and “GND” test points of RAB
  
- **Operation with STK500 (RAB/IFB Assembly to STK500)**
  - Align EXPAND0 and EXPAND1 pin headers of IFB & STK500
  - Insert IFB into STK500 (don't pinch ribbon cables!)
  - Use VTARGET of STK500 sourced through EXPAND0/1

## Demo Setup - Hardware

- **Verify AT90S8515 AVR® in 40-pin SCKT3000D3 (red silkscreen)**
- **Short VTARGET jumper setting on STK500**
- **Verify cable connections**
  - **DB9: From RS232 CTRL and host PC serial port**
  - **6-wire ribbon: Between SPROG3 and ISP6PIN headers**
  - **10-wire ribbon: From LEDS header to PORTC header**
- **Connect RAB/IFB Assembly to STK500**
- **Apply +12V with supplied connector**

## Demo Setup - Software

- **Open AVR Studio and select Tools ⇒ STK500/AVRISP/JTAG ICE**
- **On Board tab, verify VTARGET voltage set to 5V**
- **On Program tab**
  - **In Device, select AT90S8515 from pull-down menu**
  - **In Flash, browse Input Hex File field to STK511 Decode Software v2.0.hex located on CD**
  - **Click Program button to complete programming**



## Demo Receiver Configuration

- **Set DATA selector switch on IFB to STK511**
- **Set DIP switches as follows (SW#1 ...SW#12):**
  - **OPMODE register: 000100011001**
  - **LIMIT register: 010101101001**
  - **Default values printed on board silkscreen below DIP switch**
- **Press “CONFIGURE” button to write values into registers**
- **Set DATA selector switch on IFB to STK500**

## Demo Transmitter Configuration

- **Shipped in low current “sleep” mode**
- **Periodic RF transmission starts upon button release**
  - LED(s) blinks on RF activity
  - RF contains ambient light level data
- **Toggle ASK/FSK by pressing buttons simultaneously**
  - FSK selected if both LEDs blink
  - ASK selected if only one LED blinks
- **Reverts to “sleep” mode after 30 seconds**
- **Toggle between fast/slow update rate**
  - Press right button for ¼-second update interval
  - Press left button for 8-second update interval
- **Demo program highlights ATtiny13 A/D converter**

## Running the Demo

- **Light intensity shown as LED bar graph on STK500**
- **Varying ambient light level changes LED bar graph**
  - **As light gets brighter, more LEDs turn on**
  - **Darkness corresponds to all LEDs off**
- **1/4-second RF transmit interval yields real-time updates**
- **“DATA” test point on RAB (also PB4 on STK500)**
  - **View demodulated RF data under normal operation**
  - **View programming data when configuring the receiver registers**

## Conclusion

- **STK511 is a ...**
  - Flexible development system compatible with the STK500
  - Quality support tool that supports many Atmel devices
- **STK511 enables ...**
  - Easy chipset evaluation of Atmel's uni-directional RF radios
  - Fast design and verification of AVR®-based RF radios
- **STK511 kits are available today**
  - Get yours now!
- **Order numbers**

➤ <b>ATAKSTK511- 3</b>	<b>Operates at 315 MHz</b>
➤ <b>ATAKSTK511- 4</b>	<b>Operates at 434 MHz</b>
➤ <b>ATAKSTK511- 8</b>	<b>Operates at 868 MHz</b>
➤ <b>ATAKSTK511- 9</b>	<b>Operates at 915 MHz</b>