Hardware Description RF Design Kit

1. Description

The RF Design Kit supports the development of RKE systems with Atmel's UHF FSK/ASK remote control transmitters and UHF FSK/ASK remote control receivers.

The RF Design Kit consists of a motherboard (microcontroller board), an RF receiver (receiver design board), an RF transmitter (transmitter design board), an interface board and various other components. The configuration of the RF receiver and transmitter is programmable via the PC with the RF Design Kit software. The data communication between the PC and the application boards works via the serial port (RS-232).

2. Design Kit Contents

The RF Design Kit is built up in a modular manner, that is, one motherboard can operate almost the whole RF transmitter and receiver family.

Please bear in mind that the motherboard, the desired transmitter board, and the receiver board have to be ordered separately. Hence, a complete kit set, as illustrated in Figure 2-1 on page 2, may look slightly different for the various versions.

The various kit versions and the corresponding board order numbers can be found in the selection guide at http://www.atmel.com/products/Auto/.

2.1 Motherboard ATAB-RFMB

- **1 Motherboard (Microcontroller Board)**
- **1 Interface Board**
- **1 9-pin RS-232 Cable**
- **1 DC Power Cable**
- **1 Atmel CD-ROM "Software/Documentation"**
- **1 Atmel CD-ROM "Products"**

2.2 Transmitter Board

- **1 Transmitter Design Board**
- **1 Lithium Battery CR2032**
- **1 PCB Jack for Transmitter Design Board**
  (Used to Supply the Transmitter IC from Battery)

2.3 Receiver Board

- **1 Receiver Design Board**
- **1 Whip Antenna with BNC Connector (Male)**
- **1 Adapter SMB (Female) to BNC (Female)**

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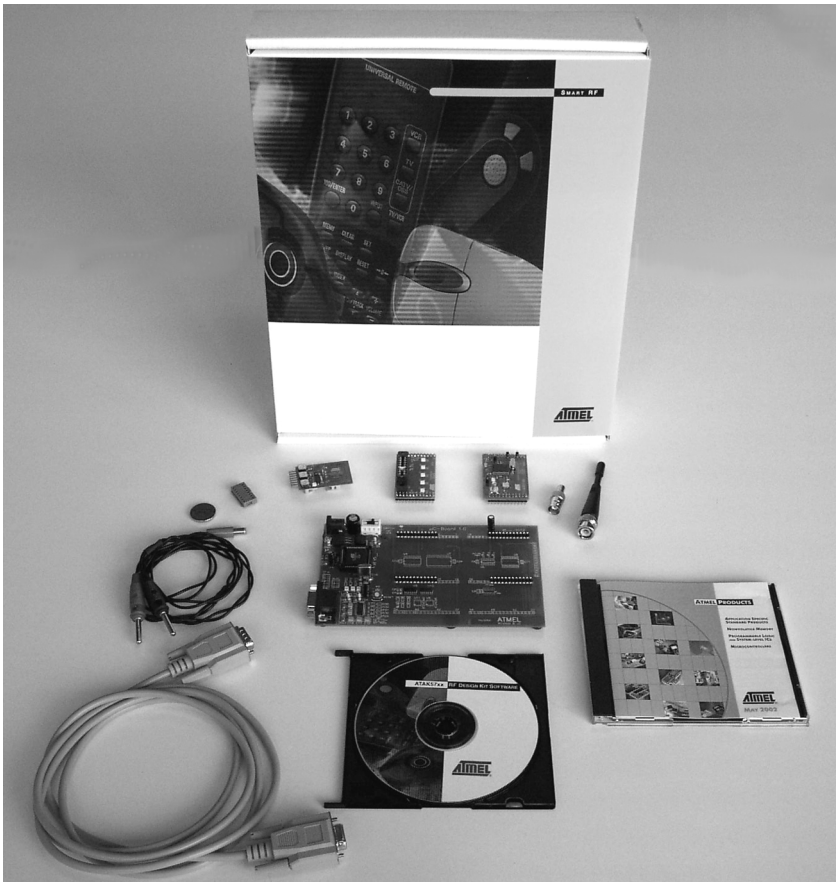
Application Note

Rev. 4718C–RKE–11/05

Figure 2-1. Kit Contents



3. Motherboard

3.1 Features

- **Flexibility to Operate Various Transmitter and Receiver Design Boards**
- **12 V DC Power Supply with Short-circuit Protection**
- **RS-232 Connector**
- **Power-on Switch**
- **Plug-in Connector for DC Power Cable**
- **Four Contact Strips to Connect the Interface Board and the Receiver Design Board**
- **LED for Power Supply Indication**
- **RESET Key**
- **LED for Sensitivity Indication**
- **LED for IC_ACTIVE Indication of the Receiver**
- **LED for Indication of RESET and Communication over RS-232**

3.2 General Functionality

The motherboard is an AVR®-based microcontroller board which handles the data communication with the RF Design Kit software on a connected PC, the receiver design board and the transmitter design board. Its building blocks are shown in Figure 3-1 and the schematic is given in Figure 3-2 on page 5 (only the actually assembled components are illustrated). The function of the LEDs is described in Table 3-1 on page 4.

Figure 3-1. Building Blocks of the Motherboard

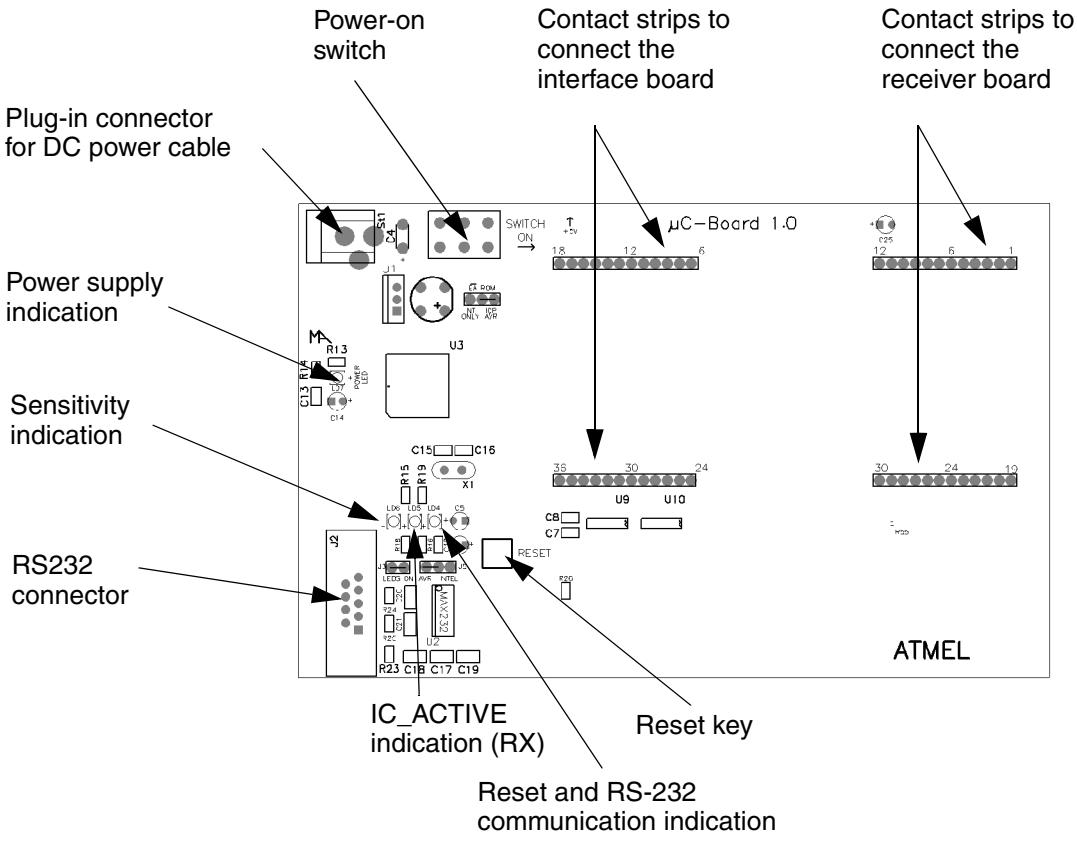
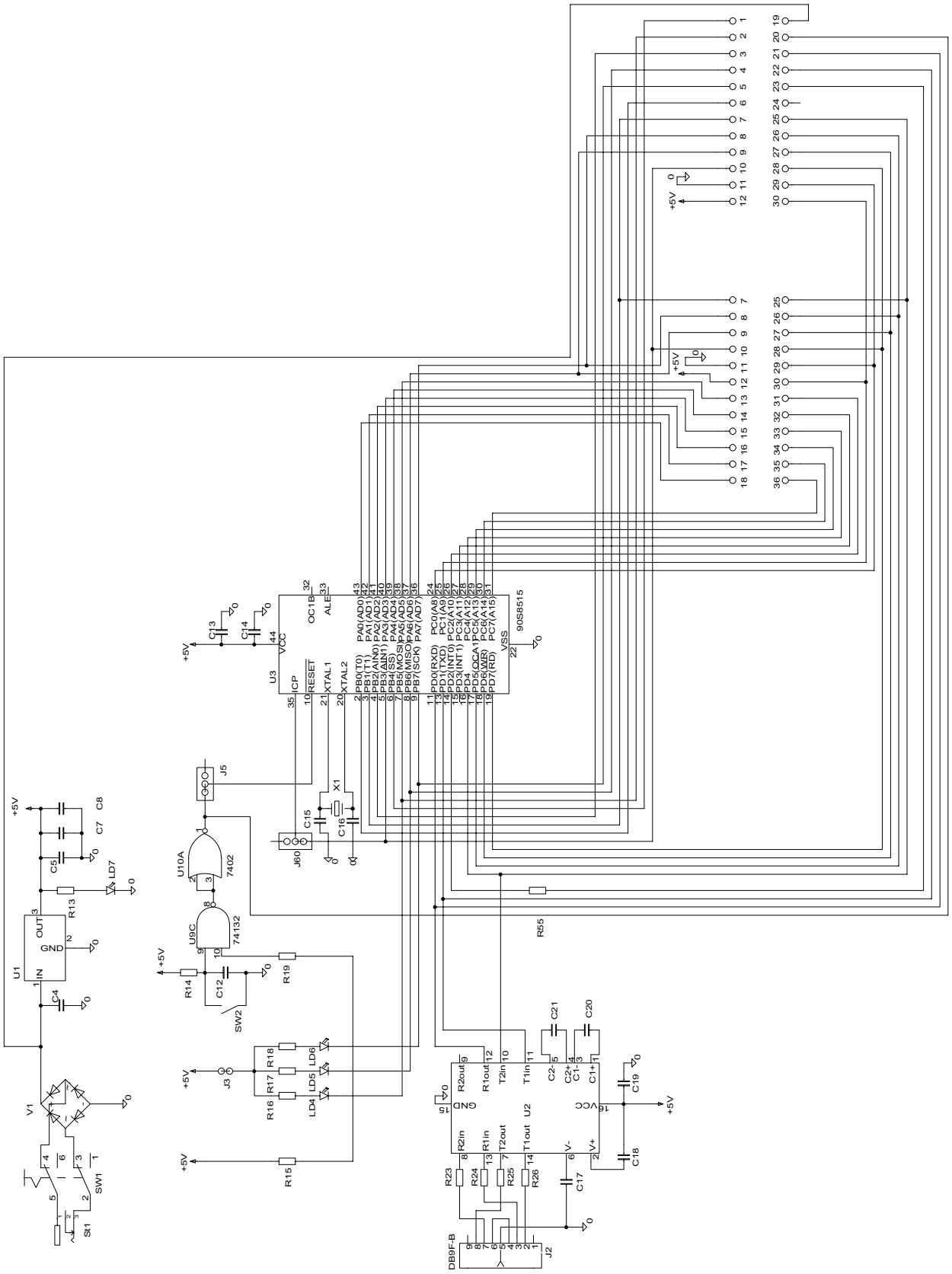


Table 3-1. Function of the LEDs on the Motherboard

Designator	Colour	Function	Comment
LD4	Green	Flashes after a RESET and during communication via RS-232	–
LD5	Yellow	IC_ACTIVE of the receiver, operated inversely as LED IC_ACTIVE on the receiver design board On -> Receiver inactive (sleep mode) Off -> Receiver active (bit-check and receiving mode)	Depending on the programmed sleep times of the receiver this LED switches off rather quickly. Due to inertia of the human eye, this LED seems to be on though it is flashing. When increasing the sleep time, the LED emits brighter light and vice versa.
LD6	Red	Sensitivity indicator On -> Full sensitivity Off -> Reduced sensitivity	–
LD7	Green	5 V power supply indicator for the motherboard and for the contact strips On -> Voltage on Off -> Voltage off	Contact strips are used as power supply for the interface board and the receiver design board.

Figure 3-2. Schematic of the Motherboard



4. Interface Board

The interface board (see Figure 4-1) consists of a socket for programming of the transmitter design board and five LEDs for different functions as illustrated in Table 4-1. For protection against short circuits, the programming socket is equipped with a polarizing key between pin 3 and pin 4.

Figure 4-1. Interface Board

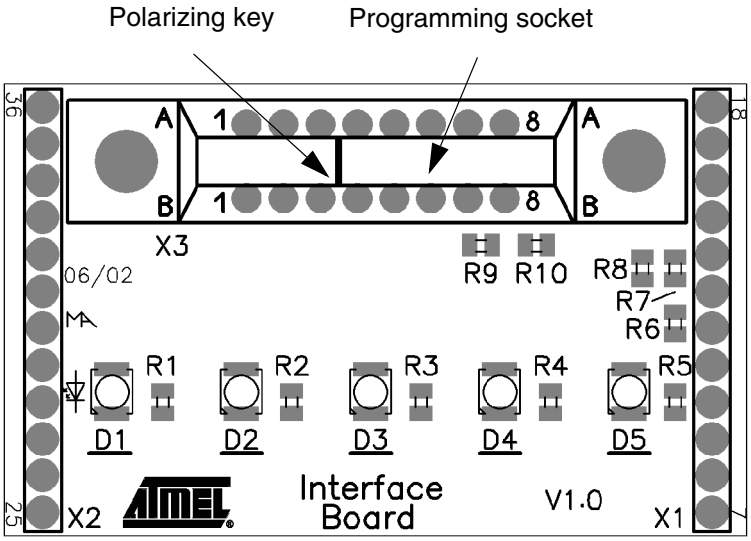


Table 4-1. Function of the LEDs on Interface Board

Designator	Color	Function
D1	Blue	On -> AVR is ready to receive data from the connected receiver Flashing -> data is being received
D2	Orange	Testword incorrect and microcontroller limits ok, see page 8
D3	Yellow	Microcontroller limits out of selected borders
D4	Green	Testword ok and microcontroller limits ok, see page 8
D5	Red	Communication via RS-232 is active

5. Operation of the RF Design Kit

5.1 Assembly of the Kit Components

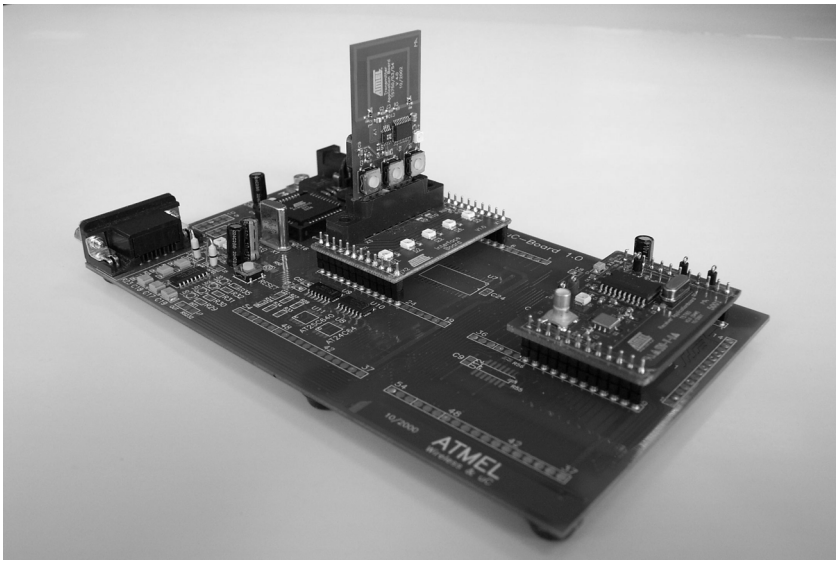
To configure the RF transmitter or receiver, the appropriate design board must be connected to the motherboard. To prevent damaging, the interface board, the design boards must be plugged-in as shown in Figure 5-1. The motherboard has to be connected to a PC via a serial port (RS-232). The configuration will be set by the RF Design Kit software.

During configuration, the AVR microcontroller on the motherboard handles the data communication with the PC, the receiver design board and the transmitter design board.

When configured, the transmitter design board operates stand-alone and can be removed.

The installation of the RF Design Kit software is explained in the separate document “Software Description RF Design Kit”.

Figure 5-1. Assembly of the Components



5.2 Starting the RF Design Kit

5.2.1 Connecting the RF Design Kit

To ensure proper operation, the following steps should be carried out before starting the RF Design Kit software:

1. Insert the lithium cell into the battery holder of the transmitter design board.
2. Check that the RF Design Kit is assembled as shown in Figure 5-1 on page 7.
3. Connect the 9-pin RS-232 cable to an unused serial port.
4. Connect the DC power cable to a 12V DC power supply unit (on-board 5 V regulator).
5. Switch on the 12V DC power supply of the motherboard.
6. Switch on the PC and start the operating system.
7. Press the reset button (Key RESET).
8. Start the RF Design Kit software with the command: *RF-Designkit.exe*

5.2.2 Progamming of the Transmitter Design Board

1. Remove the PCB jack from the transmitter design board.
2. Plug the transmitter design board into the socket on the interface board.
3. Program the desired settings via the RF Design Kit software.
4. Remove the transmitter design board from the socket of the interface board.
5. Plug-in the PCB jack to supply the transmitter IC from battery.
6. The transmitter design board can now be operated in stand-alone.

5.2.3 Programming of the Receiver Design Board

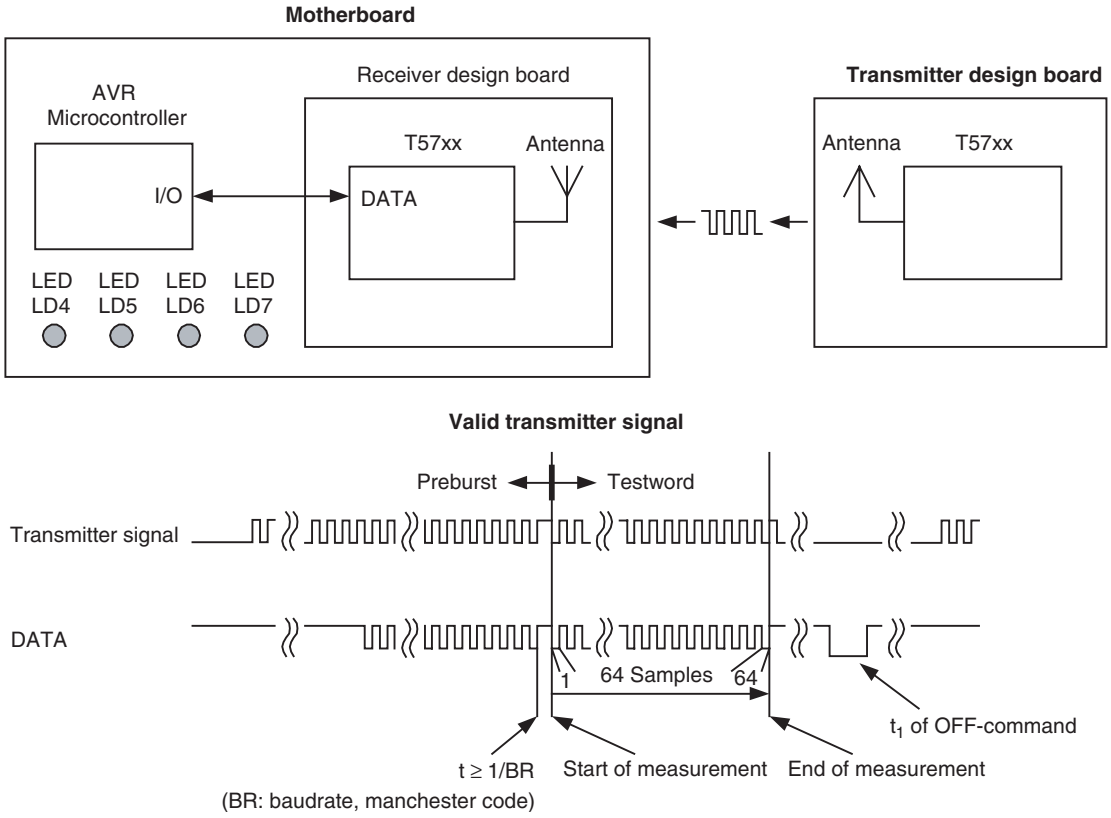
The receiver design board operates only in conjunction with the motherboard, hence proceed as follows:

1. Switch off the power supply of the motherboard.
2. Plug the receiver design board into the contact strips as shown in Figure 5-1 on page 7.
3. Switch on the power supply of the motherboard.
4. Program the desired settings via the RF Design Kit software.

5.3 Principle Function

After power on, the AVR microcontroller on the motherboard configures the RF receiver. The receiver is then in polling mode and verifies the presence of a valid transmitter signal. The parameters for the bit-check (BR_Range, $N_{bitcheck}$, T_{sleep}, Lim_min, Lim_max) are programmable with the RF Design Kit software. If a valid transmitter signal is detected, the receiver remains active and transfers the data stream to the connected AVR microcontroller on the motherboard.

Figure 5-2. Principle Function



The AVR microcontroller continuously measures the time between two signal edges (= 1 sample). If the time t ≥ 1/baud rate, the following 64 samples will be stored in the RAM of the microcontroller (start of measurement/end of measurement, see Figure 5-2 on page 9). Then, the RF receiver will be set back to polling mode by the microcontroller pulling pin DATA to '0' for a time t_1. The timing limits of 1/baud rate are programmable in the RF Design Kit software.

The 64 samples will be examined by means of the microcontroller to distinguish between a valid signal from a corresponding transmitter and signals due to noise. This is done by a time frame check where the samples are continuously compared to a programmable time window (µC_Limits).

If the samples are within the time window and the received data stream is equal to a programmable testword (Testword), this will be indicated by the LED D4 on the interface board. After the evaluation of the received data stream, the RF receiver will set back to polling mode.

The timing information (64 samples) also can be evaluated with the functions “Testword”, “Histogram” and “Timing_List” in the RF Design Kit software menu.

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