AT86RF211 Daughter Boards

User Guide

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Section 1

Introduction

1.1 Description

This kit has been designed as a quick-start guide to working with the AT86RF211 (TRX01) transceiver.

The kit includes:

- Ready-to-use RF Daughter Boards.
- A PC software that enables you to easily find the value of the transceiver's registers that correspond to the set-up you want.
- A documented AVR® Software Tool Kit containing all the interesting procedures to start your software design quickly.
- Atmel is also able to provide the Gerber files of these boards. In this way, it is possible to directly "photocopy" the RF core onto your product. Please ask your Atmel FAE for more details.

1.2 Disclaimer

- The boards have been tested according to the main RF and EMC standards in Europe (ETS) and the USA (FCC). However they cannot be integrated into a finished product and put on the market without re-testing their compliance as a whole.
- Since these boards are intended to be used on an industrial workbench and modified by the user to build prototypes, NO WARRANTY OF ANY KIND can apply. The user MUST read the user guide BEFORE using this kit, to become familiarized with its features and use it accordingly. NO LIABILITY will be accepted by Atmel, whatever may arise as a result of the use of these boards.

Section 2

Hardware Description

2.1 RF Modules

5 RF modules are available:

- **AT86RF211DB-BIBAND**: optimized for operations in the 868 MHz and 915 MHz frequency band, it features printed inductors and a low-cost printed antenna (tunable for use in either band). Exactly the same hardware is used for both bands.
- **AT86RF211DB-433TRI:** also a very low-cost implementation. Delivered only at 433 MHz, it can later be easily changed to operate at 868 or 915 MHz with the same hardware.
- **AT86RF211DB-868LNA/AT86RF211DB-915LNA**: the former is intended for the 868 MHz band, the latter for the 915 MHz band. They include a SAW filter, and a low-cost external LNA for improved performance. Outside these two options, the same hardware applies for both.
- **AT86RF211-DBxxx107**: they are delivered with the AT86RF211 development kits (AT86RF211-DKxxx107). The options are an RF SAW filter and a ±17.5 kHz BW secondary IF filter that provides high selectivity (narrow band). They are designed for 433 MHz, 868 MHz or 915 MHz operations.
- **AT86RF211-DBxxxLT:** these boards have the same performance as the previous ones with through-hole components for cost reduction purposes.

The performances and bills of materials of these boards are summarized in the BOM application note, to which you should refer to find the right BOM for your application.

Figure 2-1. AT86RF211DB-BIBAND

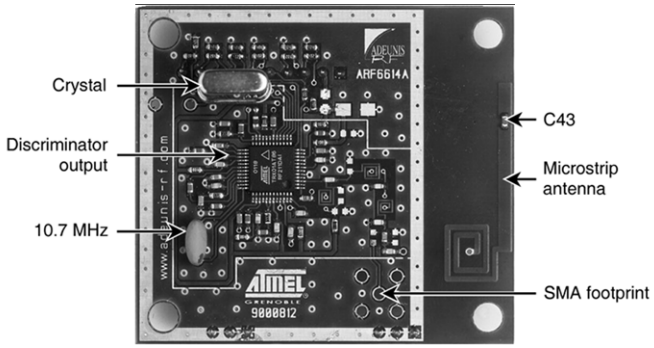


Figure 2-2. AT86RF211DB-433TRI

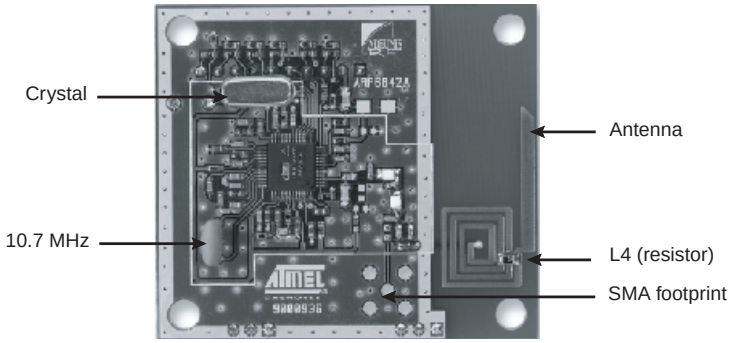


Figure 2-3. AT86RF211DB-xxxLNA

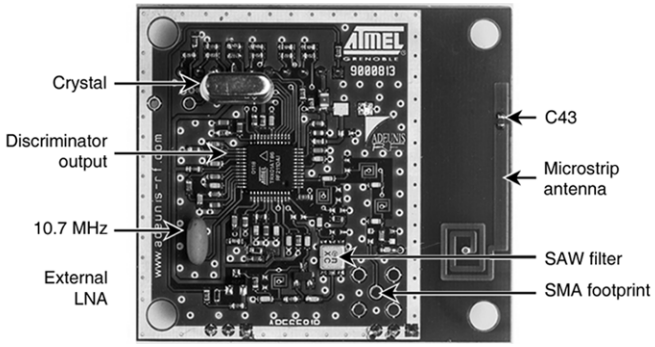


Figure 2-4. AT86RF211-DBxxx107

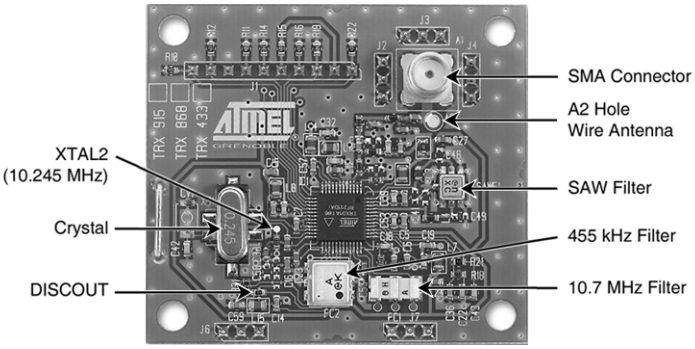
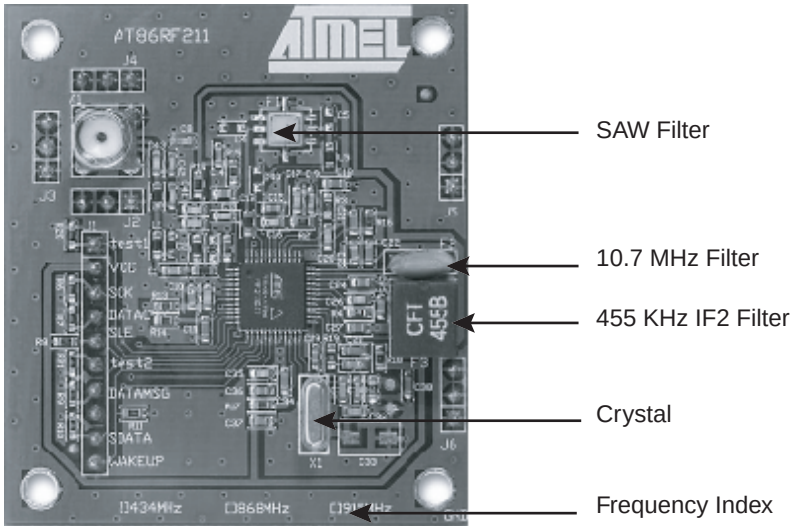
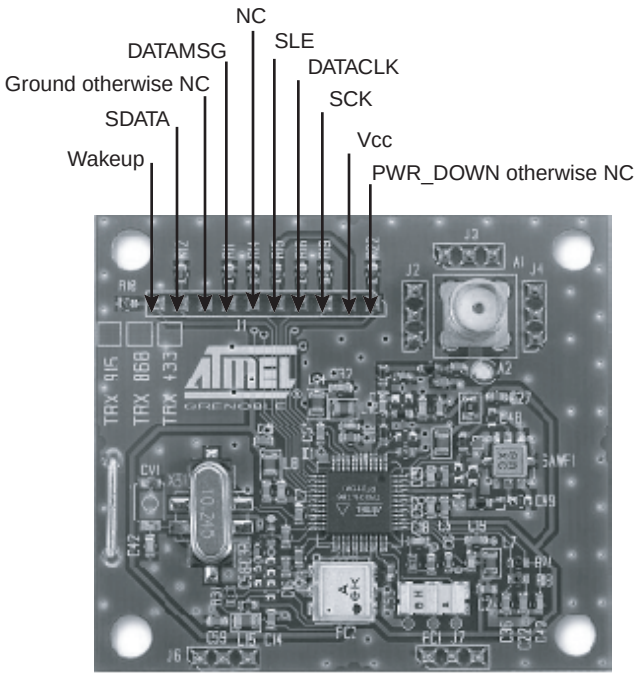


Figure 2-5. AT86RF211-DBxxxLT



2.2 Pin Arrangement

Figure 2-6. Example of Pin Arrangement



2.3 Schematics and Layout

The details of schematics are delivered in the BOM application note. All parts are standard catalog components (there are several sources for all of them).

Some characteristics and remarks:

- The **IF1 filter** (10.7 MHz center frequency) has a 3 dB bandwidth > 150 kHz.
- The **IF2** filter (if any, 455 kHz center frequency) has a 3 dB bandwidth equal to 35 kHz (for applications below 19200 bps).

- The **SAW filter** (if any) has a 3 dB bandwidth of :
  - ~ 8 MHz at 433 MHz
  - ~ 10 MHz at 868 MHz
  - ~ 40 MHz at 915 MHz
- The **SKFILT capacitor** is 10 nF. This capacitor, only used if the external comparison mode is chosen for the Data Slicer, has a correct value for data rates ≥ 4800 bits/s, but must be increased accordingly for smaller data rates.
- The **antenna** is printed, simply wired, or connected with an SMA connector depending on the version. Note that for the best radiated performance on SMA-equiped boards, the SMA connector should be removed and replaced by a single wire (and plugged in the A2 hole).
- Antenna **matching and filtering**: from the antenna to the RF pin, elements are implemented for both impedance matching and filtering. The boards are FCC and ETS compliant; however the SMA connector should be removed to ensure high frequency harmonics are correctly filtered.

Section 3

PC Demo Software

3.1 PC Software

The demo software runs under Windows® 98/2000/Me/XP.

For the installation procedure and tutorial, please refer to the Development Kit User Guide.

The software was initially developed for the AT86RF211-DKxxx107 AVR development kit. Thanks to a special dongle, it can establish a direct link between the PC and the AT86RF211 for RF evaluation purposes or software debugging.

The owner of a stand-alone daughter board cannot establish this link. However, this demo software remains very useful in setting up the device as wanted (by clicking at the relevant locations) and computing the value of the different AT86RF211 registers corresponding to this set-up (VIEW CTRL & STAT REG and VIEW FREQ & DTR REG). These values are then sent to the AT86RF211 via the serial line thanks to the user's microcontroller.

Section 4

AVR® Software Tool Kit

- A software toolkit is delivered with the boards. It contains all the relevant procedures to drive the AT86RF211. Amongst them:
  - Writing registers
  - Reading registers
  - Setting an asynchronous UART, NRZ, or Manchester communication
  - Examples of bi-directional information transfer
- All this source code was developed in C code in an IAR environment. As these libraries are fully documented, it is easy to adapt them to your needs and develop the protocol, or migrate it to a new microcontroller.
- Also contained in this kit is the tutorial for use of this demo software. It is helpful in understanding the software's structure.

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