

A^{RF44} UART TTL modules



User Guide

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About this Document

This guide describes the A^{RF44} devices, their options and accessories

Declaration of Conformity



Manufacturer's name: **ADEUNIS R.F.**
 Manufacturer's address: Parc Technologique PRE ROUX IV
 283 rue Louis NEEL
 38920 CROLLES - FRANCE

declares that the product if used and installed according to the user guide available on our web site www.adeunis-rf.com

Product Name: **ARF44**
 Product Number(s): **ARF7419A**
 is designed to comply with the RTTE Directive 99/5/EC:

EMC: according to the harmonized standard EN 301 489.
 Safety: according to the standard EN 60950-1/2001
 Radio: according to harmonized standard EN 300-220 covering essential radio requirements of the RTTE directive.
 Notes: - Conformity has been evaluated according to the procedure described in Annex III of the RTTE directive.
 - Receiver class (if applicable): 3.

According to the 1999/519/EC recommendation, minimum distance between the product and the body could be required depending on the module integration.

Warnings: - CE marking applies only to End Products: Because this equipment is only a subassembly, conformity testing has been reduced (equipment has been design in accordance to standards but full testing is impossible). Manufacturer of End Products, based on such a solution, has to insure full conformity to be able to CE label marking.
 - As the integration of a radio module requires wireless technological knowledge, ADEUNIS RF proposes its technical proficiency to its customers for a pre-compliance qualification of end products. In case of no-conformity, ADEUNIS RF will not be held back responsible if this stage has not been realised.

Crolles, November 6th, 2007
 VINCENT Hervé / Quality manager

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Overview

The A^{RF44} 4 radio transceiver converts data from a serial link into a radio frame to be sent to a similar piece of equipment. The communication is half-duplex.

The operating parameters of these radio transceivers can be fully updated through AT commands via the serial link.

Interface

Mechanical specification

The transceiver is available under SMD format without printed antenna.

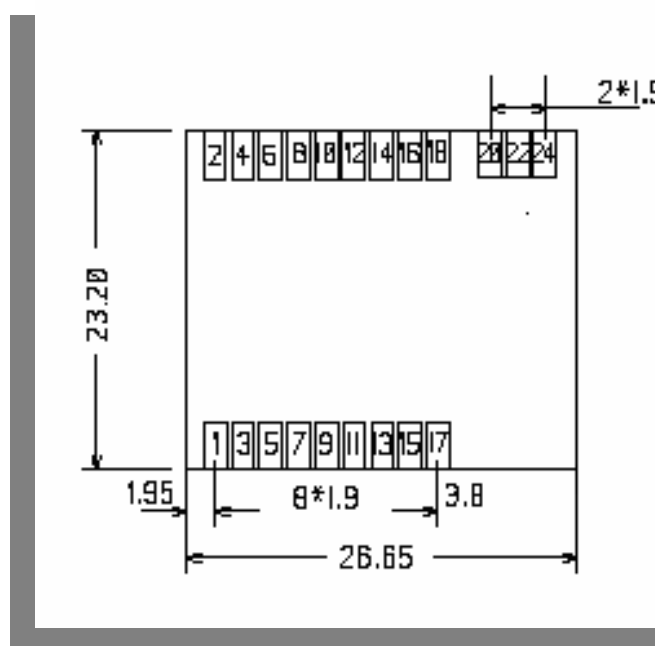


Figure 1: mécanique version SMD sans antenne imprimée

Signal description

<u>Pin number</u>	<u>Pin name</u>	<u>I/O direction</u>	<u>Description</u>
Power and reset			
1, 17, 18	GND		Digital GND (connected with radio GND)
2	VCC		Power supply
3	/Reset		Reset
RF interface			
20	GND RF		Radio GND (connected with digital GND)
22	RF in/out		RF Antenna IN/OUT
24	GND RF		Masse radio (connected with digital GND)
Serial interface			
14	RxD	I	Serial input.
16	TxD	O	Serial output
Powerdown			
4	Power-down	I	Powerdown mode management (leave unconnected if not used)
Not used			
5, 6, 7, 8, 9, 10, 11, 12, 13, 15	Reserved	O	

Directions are noted from module point of view.

Radio Communication

Available Channels

This module modem has 14 channels over the 863-870 MHz Band that can be selected using AT commands.

The channels are selected according to the following table:

<i>Channel S200</i>	<i>Frequency (MHz)</i>
13	863,25
12	863,75
11	864,25
10	864,75
9	865,25
8	865,75
7	866,25
6	866,75
5	867,25
4	867,75
3	868,25
2	868,75
1	869,525
0	869,75

Channel selection

The S200 register allows choosing the desired channel.

Antenna requirements

This module is not available with printed antenna. An external one has to be added to achieve correct communication between the products. Several possibilities:

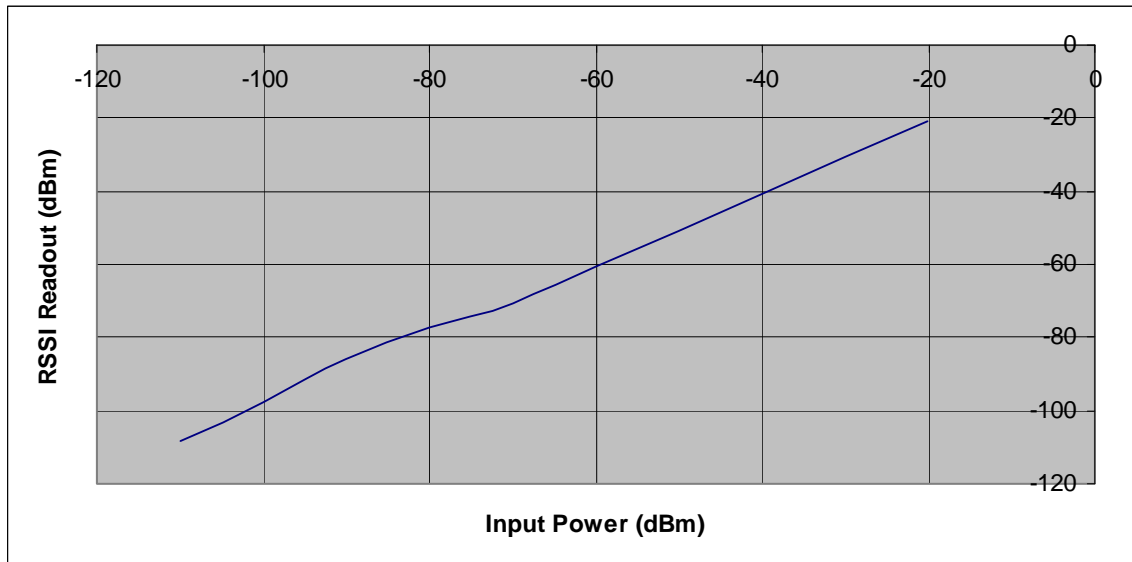
The best technical/economical compromise is a $\frac{1}{4}$ wave (8.6 cm length) antenna soldered on the "mother board". The link between the RFin_out pin of the module and the antenna should be a 50 Ω line. The larger the ground plane around the antenna, the more efficient and "isotropic" it will be.

If necessary, this antenna can be distant thanks to a coaxial cable connected to the "mother board"; the line must be a 50 Ω line.

RSSI Reading

The RSSI (Received Strength Signal Indicator) gives an indication for the received power level.

It could be accessed with AT commands.



The RSSI level is only an indication. Use this level with care due to the dispersion between components.

The schema above could be modified from one to another product. The operating temperature could also have an impact on these dispersions.

The RSSI level could also indicate the potential presence of jammer in the used channel.

The RSSI is a necessary but not sufficient condition to obtain a correct reception.

Transceiver operating mode

Two operating modes are available :

Command mode (usage of AT commands)

Transceiver or normal mode (serial data are transmitted on radio link)

At power up the transceiver is in transceiver mode: it is able to send / receive data to / from the radio link according to its current parameter configuration.

Serial data rate

This module is only available with one data rate: 19200bps, 8 data bits, 1 stop bit, no parity, no flow control.

Command mode

The command mode is used to read and update the modem configuration registers using AT command.

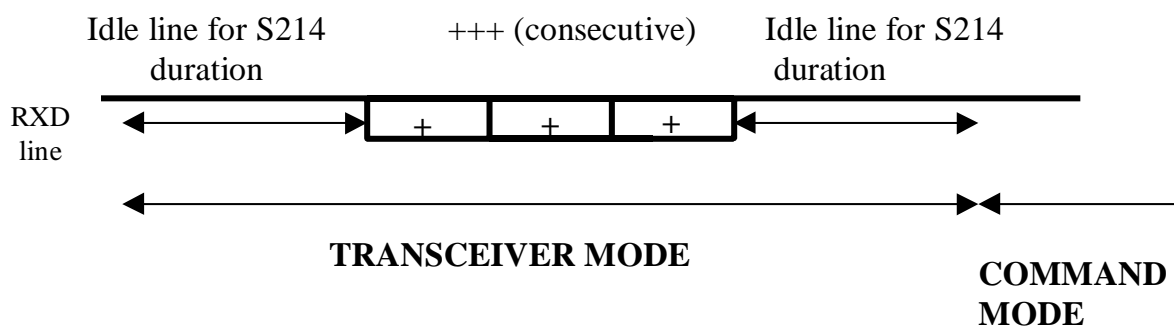
NOTE

The AT command can be locked using ATPWD command.

In command mode, the radio is inhibited (reception and transmission), excepted when using test command.

Entering command mode : issues on the serial link a +++ sequence. The sequence of 3 consecutive + characters is accepted only if no character have been seen before and after the +++ sequence. Register (S214) defines the silence duration. The 'O' char is returned if the +++ sequence has been accepted.

Tips 1 : if you are using a terminal (such as Hyperterm), you have to send the +++ sequence using a text file (first create a text file containing only the +++ characters, and then use in Hyperterm the command "Send text file" in the "Transfer menu")

Tips 2 :

Exiting command mode (return back in transceiver mode): send the serial command
ATO <cr>

Transceiver mode

In transceiver mode, the module works with a transparent protocol: When transmitting, data received from the serial link are transmitted on the radio link. When data are received on the radio link, these data are sent on the serial link. The module acts as a wire serial link.

The communication is always half-duplex. The radio transmission is processed prior to the radio reception (when the transceiver is sending a radio frame, it is not able to decode any incoming radio frame).

If no data are sent on the serial link, the modem is waiting for radio reception. Each radio frame sent by another modem is received and the validated data extracted from the radio frame are sent on the serial link.

All the data received on the serial link are encapsulated in a radio frame. When acting as transceiver, the radio frame transmission starts as soon as a char is available on the serial link.

The radio frame format is :

<Preamble><synchro>DATA <postambule>.

Preamble, synchronisation and postambule are used for the radio reception.

Powerdown Mode

In powerdown mode, the power consumption is reduced to reach less than 3 μ A. In this state, the module is not able to receive or transmit any data and is not able to enter command mode.

The powerdown mode is controlled by pin 4 of the module. This pin is tied to VCC when in transceiver or command mode. If powerdown mode is not used, the pin can be leaved unconnected.

The powerdwon mode is entered by driving the powerdown pin to 0V. The mode is activated by the detection of a high to low transition on this pin. The powerdown state is reached after a typical delay of about 2ms. The pull up on the pin is by passed during powerdown to get the better powerdown consumption.

The powerdown mode is exited by actively driving the powerdown pin to VCC. The mode is deactivated by the detection of a low to high transition on this pin. The module is ready for sending new data after a typical delay of 3ms.

AT Commands

Description

AT commands are interpreted only when the transceiver is in Command mode.

Command: are used to read and update the modem parameters

A command starts with the 2 ASCII 'AT' characters. 'AT' means 'Attention' follow with one or several characters or other data.

Each command is ended with <cr> (carriage return).

Response: is sent back for each command on the serial link.

The answer is :

'O'<cr> (ASCII character 0x4F) for accepted command (or OK command)

'E'<cr> for error

Specific string when specified

Set of commands

<u>Commands</u>	<u>Description</u>
<u>Operating mode selectin</u>	
ATO	Return back to transceiver mode.
<silence>+++<silence>	Command mode activation. The +++ sequence must be preceded and followed by a calibrated silence (no other character)
<u>Registers management</u>	
ATSn?	Displays the Sn register content where n represents the register number. The response has the following format: Sn=y<cr><lf>
ATSn=m	Sets the Sn register value with 'm'. n represents the register number..
AT&W	Saves the new register configuration in EEPROM. Each time you switch on the modem, the EEPROM configuration will be loaded in the modem registers.
AT/S	Displays all register values. The response has the following format: Sxxx=y<cr><lf> for each register.
AT/V	Software version display. The response has the following format: Adeunis RF : ARF34 Vxx.yy<cr><lf>
ATR	Restore the register default values
ATPWD=m	m = pin code (register S205) : unlock all AT commands. m = 0000 : set registers to default value and unlock all AT commands.
<u>Test modes</u>	
ATT1	Pure Carrier (data=0) transmission using current channel. The output of this mode is achieved by reception of any character on the serial link.
ATT2	Pure Carrier (data=1) transmission using current channel. The output of this mode is achieved by reception of any character on the serial link.

ATT3	2.45 kHz modulation using current channel. The output of this mode is achieved by reception of any character on the serial link.
ATT8	Reception test mode. TP1 is set when more than 80% of bits are demodulated properly.

Register description

The register value could be updated using the `ATSn=m<cr>` command and displayed using `ATSn?<cr>` command.

At power-up, the previous transceiver configuration is restored from E2PROM (non volatile) to RAM. The registers are located in RAM registers, any modification is performed on RAM registers: To save current register configurations, it is necessary to use the `AT&W<cr>` command (If not, the updated parameters are lost in case of power shortage).

The registers are shared in 2 types: read only (R) or read/write (R/W)

Type	Register	Function	Description	Default value	Note
<i>Radio management</i>					
R/W	S200	Channel number		0	1
R	S230	RSSI	Displays the reception level of the latest received message. Response: S230=-xxx dBm<cr><lf> with xxx decimal value	none	
<i>Command mode management</i>					
R/W	S205	Pin code	Pin code value Value 0000 is not allowed	1111	
R/W	S207	Pin code activation	0 pin code disabled 1 pin code enabled	0	
R/W	S214	Command timeout	Time out duration for detecting the +++ pattern, unit ms. From 3 up to 240.	6	

NOTE 1

(S200 register) see chapter [Channel selection](#)

Transceiver state machine

When operating in transceiver mode the 'RF transmission' state machine is:

Idle state of the transceiver: by default the transceiver is waiting for incoming data on the serial link and for incoming radio frame on the radio link. The serial link has a higher priority than the radio link (if a radio frame is demodulated meanwhile some characters are detected on the serial link, the radio frame will be discarded and the serial incoming data will be processed).

Processing incoming serial data: the incoming serial data are internally buffered. The buffered data are sent on a radio frame (the RF modulation is started) when at least one data is available and the preamble + synchro has been sent on the radio

Processing incoming radio frame: the valid data are extracted from the incoming radio frame and internally buffered. The buffered data are sent on the fly to the serial module output. The internal buffer is limited to 64 bytes.

Specifications

Embedded protocol	ADEUNIS RF enhanced & versatile RF comms manager
Embedded profiles	Multi-mode transceiver
Custom profiles	Designed on custom specifications
Link set-up and status	Through Hayes commands
Radio rough data rate	19500 bps
UART fixed format	19200 bps – 8 data bits - 1 stop bits – No parity – No flow control
UART TTL ports	TxD – RxD
Transceiver mono-mode	Transparent
Programmable Frequency	863 to 870 MHz / Europe
Fixed Radiated RF power	9 dBm
Sensitivity	Down to –103 dBm (for 10 ⁻³ /PN9)
Operating range (free field)	External antenna : up to 300 m
Operating voltage	Regulated 3.3V nominal (2.5 to 3.6 V)
TX / RX consumption (max)	36 mA / 23 mA (under 3.3V)
Powerdown current	< 3 µA (typical)
Operating temperature	-20°C / +70°C
Dimensions	23.2 x 26.65 mm
Standards compliance	EN 300-220 / EN 301 489

References

ARF7419A : Plugged module without antenna

ANNEX 1 : Firmware and document

Firmware	Updates
V1.00	Initial version
V1.01	RSSI and pin code added

Document	Updates
07-06-V1-smn	Initial version
08-01-V2-smn	Update the mechanical schematic
08-05-V4-lmn	RSSI added
08-07-V5-lmn	Pin code added