UHF Professional Data modem

User Guide

09-07-V1-smn / 206883A

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About this document

This guide describes the A^RF73 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: **ARF73**
Product Number(s): ARF7499BD
Product options:

complies with the RTTE Directive 99/5/EC:

EMC: conformity is proven by compliance to the harmonized standard EN 301-489
Safety: conformity to the standard EN 60950-1/2001
Radio: conformity is proven by compliance to harmonized standard EN 300-113 covering essential radio requirements of the RTTE directive.

Exposure to radio frequency signals: Regarding the 1999/519/EC recommendation, when using the device, keep the product's antenna at least 1 m from your body at maximum power level. This distance could be reduced for lower power levels. For more information, please contact Adeunis RF technical offices.

This product works in licensed frequency bands. Please don't hesitate to contact us if you need support on this item and want to know how to address the market in such bands.

Crolles, May 12th, 2009
VINCENT Hervé / Quality manager

Download of the user guide

Thank you for having chosen the ADEUNIS RF products. The user guide is downloadable on our web site www.adeunis-rf.com

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Paragraph **Modems > Data modem**
Print version available upon request
- ✓ Tel : +33 4 76 92 07 77
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Overview

The ARF73 modem range provides data transmission solution for applications requiring very long distances or working in very severe environment.

This product is available in a robust IP65 housing and is provided with an antenna, a cable including RS232 data transmission wires and power supply.

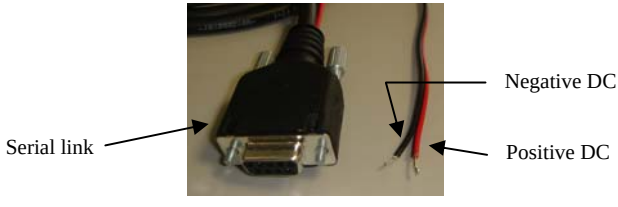
The modem offers a transceiver mode and a command mode which allow various configuration of the product (serial data rate, frequency and channel selection, mode of transmission…).

This product has to be used in licensed frequency band and may be available for 400 to 470MHz frequency range. The product is calibrated during factory process on a dedicated sub-band and can be adjusted in +/-3.5MHz range by using the command mode of the product.

Product Power supply

The ARF73 product is supplied from a DC voltage source. Required voltage is 10V minimum and must not exceed 28V.

The positive '+' polarity must be applied on the red cable. The input voltage is protected against reverse polarity and short transient voltage.



The total power consumption is less than 1.5A under 12V at full RF power, so it is recommended to use a DC power 0-30V which can source at least 2A.

The green “ON” led is continuously lighted when the ARF73 is powered on.

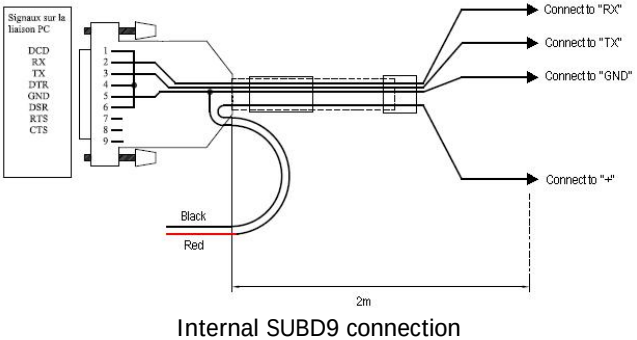
Serial link wiring

The ARF73 is delivered with an RS232 cable interface with a female SUBD-9. The modem is wired as a DCE equipment.

The outgoing data from the modem are wired on pin 2. The incoming data from the external equipment comes on pin 3. Pin 5 is used to connect GNG between the external equipment and the modem.

Pin 1, pin 4 and pin 6 are internally wired together.

There is no hardware flow control lines wired to the modem.



Internal SUBD9 connection

Radio communication

Radio communication

Radio communication is performed when the modem is set in transceiver mode (this is the default at power-up).

The radio data rate is fixed to 9600bps.

The output power may be programmed to 0.5W, 2W or 4W to either optimize covered range or power consumption.

Radio channels

The S250 registers determined the center frequency of the bandwidth of the modem. The modem is calibrated during factory process on this central frequency which can not be changed by using command mode. For this reason, S250 is a read only register.

By default, the modem is delivered with a predefined frequency table recorded in S200 register. The central frequency corresponding to the S250 register can be found in this table at position 8. First frequency of the table is referred has position 0.
The frequency table can freely (with respect of 12.5kHz of spacing) be changed using command mode of the product in a range of +/-3.5MHz around the central frequency displayed in S250. Note that the frequency must be written with 4 digits after the point even if they are zeros. Each new frequency must be separated by entering a <CR> char.

The channel selected from the frequency table for radio transmission and reception is set in S201 register. S201=0 corresponds to the first channel of the frequency table, S201=15 is the last one.

The predefined table is setup with the following values:

Channel S200	Frequency ≡ S200 (MHz)
0	S250 – 400kHz
1	S250 – 350kHz
2	S250 – 300kHz
3	S250 – 250kHz
4	S250 – 200kHz
5	S250 – 150kHz
6	S250 – 100kHz
7	S250 – 50kHz
8	S250 frequency (central frequency calibrated in factory process)
9	S250 + 50kHz
10	S250 + 100kHz
11	S250 + 150kHz
12	S250 + 200kHz
13	S250 + 250kHz
14	S250 + 300kHz
15	S250 + 350kHz

Radio rate selection

The radio rate is determined by the S254 register. For now, the only RF link speeds available is 9600bps.

Channel S254	RF link speed (bps)
0	Not available
1	Not available
2	9600

Power output

The RF output power is selected by the S231 register. There is 3 RF output power available, 500mW, 2W and 4W.

Channel S231	RF output (W)
0	0.5
1	2
2	4

After a long use at 4W, the radiator and the box can warm until 65°C without spoiling the working.

RSSI reading

The RSSI (Received Strength Signal Indicator) gives an indication for the received power level of the last demodulated frame. It is available in S230 register. This level must be used with care due to dispersion between components.

Modem operating mode

Two operating modes are available:

- Command mode for modem setup
- Transceiver mode for transmission on radio link

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

Command mode

The command mode is used to read and update the modem configuration registers using AT command. In command mode the radio reception and transmission is inhibited.

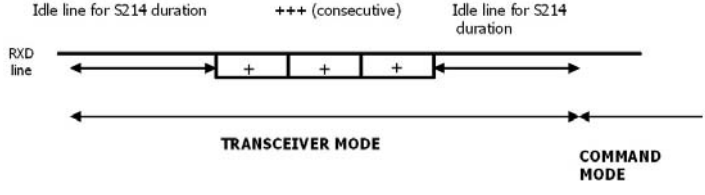
Entering command mode:
The command mode is entered by issuing a +++ sequence on the serial link. The three consecutive + characters are accepted if no character have been sent before and after the +++ sequence for a minimal duration defined by the S214 register. The S214 value is defined in ms.

Channel S214	Default value
0	240

TIPS 1

The freeware "Hercules" terminal from *http://www.hw-group.com/products/hercules/index_en.html* can help user to transmit the +++ sequence according to the timing rules of S214 by sending a text file which contain the +++ string.

TIPS 2



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

EASY CHECK

When receiving a right command, modem will answer:

- 'O'<cr><lf> (ASCII character 0x4f,0x0d,0x0a) for accepted command (meaning OK)
- 'E'<cr><lf> (ASCII character 0x45,0x0d,0x0a) for error (meaning ERROR)

Transceiver mode

In transceiver mode, two protocols are available:

- Transparent protocol
- Addressed protocol

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 data extracted from the radio frame are sent on the serial link. When the last character has been sent on the serial link, it is possible to send an answer after the end of this last character.

All the data received on the serial link are encapsulated in a radio frame.
The radio frame format depends on the used protocol.

When acting as transceiver, the radio frame transmission always starts under the following conditions:
Detection of a silence greater than S217 value (in ms) after the first char (after the last transmitted frame) transmitted on the RS232 lines,
Or when the number of received characters from the serial link is higher to the maximum radio frame size defined in S218 (in number of chars).

Transparent mode

In transparent mode, the modem acts as a wired serial link. It means that alternately, the modem sends on the radio the data received from the serial link and sends on the serial link the data received from the radio.
The radio frame format is :

- <Preamble><synchro>DATA <postambule>.
  Preamble, synchronisation and postambule are used for the radio reception.

Addressed mode

In addressed mode, data received on the serial link are sent on the radio link with the following format:

- <Preamble><synchro><Address> DATA <postambule>.
  Preamble, synchronisation and postambule are used for the radio reception.
- The Address field is set up with S256 value.
- In reception mode: The <Address> field of the radio frame is checked with the reception address contained in S252
- If the radio frame address matches the transceiver reception address (S252), DATA (and only DATA) are transmitted on the serial link

Otherwise received data are silently discarded.

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 RS232 link and for incoming radio frame on the radio link.
The RS232 link has a higher priority than the radio link (if a radio frame is demodulated meanwhile some RS232 characters are detected on the serial link, the radio frame will be discarded and the RS232 incoming data will be processed).

Processing incoming RS232 data: the incoming RS232 data are internally buffered. The buffered data are **sent in a radio frame** (the RF modulation is started) when almost one of the following conditions occurs:

when a break (silence greater than S217 timeout) is detected on the incoming serial flow (no more data to be sent).

When the radio buffer size is reached (the number of buffered characters is equal or greater than the S218 size).

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 RS232 module output.

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' followed with one or several characters or other data.
Each command is ended with <cr> (carriage return).

Set of commands

Commands	Description
Operating mode selection	
ATO	Return into normal mode
<silence>+++<silence>	Command mode activation
Registers management	
ATSn ?	Displays the Sn register content where n represents the register number. The response has the following format: Sn=y<cr><lf>
ATSn=m	Set the 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. The command ends with a double <CR><LF> sequence.
AT/V	Software version display.
ATR	Restore the register default values. Note that S235 and S250 are not restored by ATR.

Register description

Type	Register	Function	Description	Default Value	Note
Radio management					
R/W	S200	Channel table	Set channel table	-	
R/W	S201	Channel number	Select radio channel from the table: From 0 up to 15	8	
R	S204	Preamble duration	Preamble duration unit in ms.	40	
R/W	S217	Serial Time out for radio	Serial timeout before starting radio transmission, unit ms. From 3 up to 240	3	
R/W	S218	Radio frame length	Size of the radio frame (from 1 up to 240). When this size is reached: the transceiver sends a radio frame	3	
R	S230	RSSI level	Display the reception level of the latest received message. Response S230=-xxxdBm<cr><lf> (with xxx decimal value)	none	
R/W	S231	RF out level	Adjust the RF output level 0→ 500mW (27dBm) 1→ 2W (33dBm)	2	

			2 → 4W (36dBm)		
R	S250	Receiver Frequency BW	Indicates the bandwidth adjustment of the helicoidal receiver filters. Format is 438.5000	Depending on customer demand	
R/W	S220	Over the air format	0 → addressed mode 1 → transparent mode	0	
R/W	S252	Reception address	From 0 up to 255 Used in addressed protocol only, for filtering incoming frame	0	
R/W	S256	Transmission address	From 0 up to 255 Used in addressed protocol only, added to out coming frame	0	
R	S254	RF link speed	2 → 9600 bps	2	
R/W	S255	Squelch	0 → Low (about -114dBm) 1 → Medium (about -100dBm) 2 → High (about -70dBm)	0	
R/W	S257	CSMA mode	*Under development* 0 → disable	0	
R/W	S258	CSMA RSSI threshold	*Under development* -130 → -75	-75	

Serial link management					
R/W	S210	Baudrate	Serial link rate in bits/s '4': 9 600 '5': 19 200 '6': 38 400	4	
R/W	S211	Data length	'7' : 7 bits '8' : 8 bits	8	
R/W	S212	Parity	'1' : none '2' : even '3' : odd	1	
R/W	S213	Stop bits	'1 ' : 1 stop bit '2 ' : 2 stop bit	1	
R/W	S214	Command time out	Time out duration for detecting the +++ pattern, unit in ms. From 3 up to 240ms	240	
Miscellaneous					
R/W	S233	Transmited Call Sign	FCC ID (including letters from A to Z and numbers from 0 to 9)	blank	
R/W	S234	Call sign activation	0 → disable 1 → enable	0	
R/W	S235	Serial Number	The serial number is made up of 11 digits: yyyywwnnn. Where : yyyy : year ww : week in the year nnn : number in the week	Unique for each product	
R/W	S236	Date of the last configuration	An available register to enter a date for customer information composed of 8	00000000	

			digits: yyyymmdd Where: yyyy : year mm: month dd: day		
R/W	S237	Owner	An available register with free format for customer information	blank	
R/W	S260	Firmware update	Must always be left to 0 0 → no upgrade 1 → upgrade firmware after next ATO command	0	

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

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

Specifications

General technical characteristics

Supply voltage	10 to 28 Volts
Transmission consumption	15VA (under 4W)
Reception consumption	2VA
Operating temperature	-30°C to +70 °C
Packaging	IP65 Box with TNC female antenna connector
Range	50km with included antenna
Size / Weight	169x100x55 mm + antenna / 710g
Standard compliance	EN300-113 / EN301-489 / EN60950

Radiofrequency

Programmable frequencies	400 to 470MHz (under licence)
Frequency stability	± 1kHz
Channel Spacing	12.5kHz – 25kHz on demand
Air rate	9600 bits/s

Transmitter

Modulation	GMSK BT=0.5	
Output power	0.5W (27dBm)	
	2W (30dBm)	Software selectable
	4W (36dBm)	
Output impedance	50 Ohms	

Receiver

Sensitivity	-115 dBm at 10-3 BER

Adjacent channel rejection	65dB typ.
Intermodulation	65dB

Protocol

Serial data rate	9600,19200,38400bps
Serial ports	RS232 port
Setup and configuration	through Hayes commands
Modes	Transparent/Addressed mode
Embedded protocol	ADEUNIS-RF enhanced and versatile RF communications manager
Embedded profiles	Multimode modem

References

ARF7499BD : Modem RS232 - IP65 box

Glossary

TBD	To Be Defined
NC	Not Connected
NU	Not Used
<cr>	Carrier return
<lf>	Line feed

ANNEX : Firmware updates

Firmware	Updates
V0.07	Add standard functionality of Adeunis modem
V0.06	Original version minimal for radio transmission