

2 PRODUCT OVERVIEW

2.1 GENERAL

The ZRT Series has been designed as a range of high specification, low cost radio modems for stand alone applications or for integration into OEM products.

Through the use of advanced DSP technology, the design has been optimised for reliability and low current consumption, making the ZRT suitable for operation on remote sites without mains power.

Applications include security, command & control, data logging, SCADA, telemetry, remote switching or any similar applications where serial data needs to be transmitted.

The ZRT is available with three different serial interfaces:-

- An RS232 interface with all signalling lines to allow full handshaking if required.
- A TTL version of the unit which uses 5V TTL voltage levels on the serial interface connector rather than RS232 signalling levels, but is otherwise the same.
- A version with an RS232/RS422/RS485 interface. Required interface mode is selected using the configuration software. In RS232 mode, the RTS line is looped back to CTS and the DSR line is looped back to DSR. RS422/RS485 half-duplex (2-wire) or full duplex (4-wire) modes are both supported.

The data rate on the serial interface can set to a range of values from 150 baud to 38,400 baud, while the over-air data rate can be independently set to a range of values between 150 baud and 9,600 baud. If high throughput speeds are not required, the modem can be set to a slower over-air rate to take advantage of the associated improvement in receiver threshold.

The ZRT is available with two different transmit powers. The low power version meets the licence-exempt ETS300-220 specification while the higher power 5W version meets the tougher ETS300-113 and the USA and Canadian specifications.

2.2 TRANSMITTER

The transmitter frequency can be user programmed anywhere within its pre-aligned bandwidth. There are two power versions available, 10mW to 750mW and 100mW to 5W. The transmit power of any particular hardware version can be set accurately within the relevant range under software control.

2.3 RECEIVER

The receiver is a very low current double conversion superheterodyne with an active balanced mixer for very good intermodulation performance. Careful attention to spurious response, adjacent channel and blocking performance, makes the product ideal for crowded telemetry channels.

To achieve high performance the programmable bandwidth of the receiver has been limited (for UHF it is 10MHz, ± 5 MHz from centre frequency), full details are in the technical specification section.

Should re-alignment be required, the unit can be returned to our service centre.

2.4 MPU CONTROL

The Microprocessor (MPU) is the heart of the product and at the centre is a 128k flash microprocessor that controls all the interface circuits to the radio module and external input/outputs. As well as the control functions, the processor provides DSP functionality that enables modem operation between 150 and 9,600bps. The processor has 128k of flash memory from which the code is executed and internal EEPROM for storing programmed parameters.

2.5 PROGRAMMING & CONFIGURATION

The parameters of the ZRT are PC programmable via the serial port. Full details of all the programmable parameters are covered in the separate programming manual. Details of cables and adaptors needed for the various interface versions are given in Section 5.6.

2.6 SOFT MODEM:

The ZRT has a "soft modem" which allows over-air transmission at rates between 150bps and 9,600bps using a range of different modulation schemes. The over-air rate can be selected by the operator to optimise link performance.

2.7 MODES OF OPERATION

2.7.1 Transparent Operation

The ZRT can operate transparently without packetising the data and without adding any other overheads, thereby maximising data throughput rates. It requires no knowledge of the data it is transmitting. Data is simply transmitted and received with minimal delay.

2.7.2 Protocol specific modem

The radio recognises a complete frame and only transmits and receives data conforming to that format. No addressing of radios or routing of data is performed. Protocols such as MODBUS & DNP3 can be supported in this way.

2.7.3 Routing modem

The radios recognise a protocol specific frame and the address to which the frame is to be sent. Routing information must be stored in each radio for each destination address that requires the use of repeaters. Any radio in the system can operate as a repeater. The radio does not perform any acknowledgement or retries. Any protocol using a fixed address field such as MODBUS can be supported.

2.8 HANDSHAKING

On the RS232 Full Handshaking and TTL versions, transmission control can either use RTS control signals or be configured for automatic initiation of transmission on receipt of serial data at the traffic interface. In either case, the radio provides a CTS output which can optionally be used for flow control.

On the RS232/RS422/RS485 version, transmission is automatic when transmit data is applied. The DSR line is internally looped back to DSR and, when configured for RS232 mode, the RTS line is also looped back to CTS.

In all versions, the radio incorporates a 1,024 byte internal buffer to cope with situations where the interface data rate is higher than the over-air rate.

2.9 ADDITIONAL FEATURES

The ZRT incorporates the following additional features which enhance the usability of the product and assist with the operation and maintenance of systems using the product:-

2.9.1 Status LEDs:

The ZRT Radio Modems have a number of front panel LED's to enable the operator to see at a glance the status of the product and the serial data port.

2.9.2 Time-out Timer

The transmitter within the ZRT has a user programmable time-out timer which allows the maximum continuous transmission time to be set in order to prevent channel blocking due to a fault.

2.9.3 Power-Save Modes

The ZRT has both internally controlled and externally controlled power-save modes to reduce overall power consumption to extremely low levels for operation on sites without mains power.

2.9.4 Squelch Tail Elimination

As a user programmable option, the ZRT can also operate in a packetisation mode where framing characters are added at the start and end of the user's message prior to transmission and stripped off again at the receive end prior to passing the user data to the interface connector. This can be useful in getting rid of any spurious characters which may otherwise be generated at the end of messages by squelch noise as the receiver mutes and which can affect old or non-tolerant protocols.

In a high interference environment, enabling packetisation will often help to block reception of the interfering signals.

2.9.5 Forward Error Correction

The ZRT allows an optional forward error correction to be switched in when the over-air data rate is 9,600bps. This will improve error performance, but there is an associated data throughput overhead of around 30% which therefore reduces the effective transmission rate for the user data. The forward error corrector is not available at lower data rates as it offers no significant performance enhancement at these lower rates.

3 SPECIFICATIONS

3.1 TECHNICAL SPECIFICATIONS

3.1.1 General

Frequency Range:	ZRT169/170	138 - 175MHz
	ZRT225	175 - 225MHz
	ZRT450/470	406 - 512MHz
	ZRT869	863 - 870MHz
	(50MHz - 950MHz to special order)	
Power Requirements:	12VDC (10V - 15.5DC)	
	Standby:	<75uA
	Receiver on & decoding:	<70mA
	Transmitting:	300mA to 2.1A dependent on Tx power
Number of Channels:	80 sequential or 32 discrete user programmable channels.	
Min. Programmable Channel Step:	6.25kHz or 5kHz	
Channel Spacing:	12.5kHz, 20kHz or 25kHz	
Operating Temp. Stability:	2ppm	-30 to +60°C
Construction:	Aluminium enclosure.	
Size:	75mm W x 130mm L x 30mm H (excluding brackets and connectors)	
Mounting:	Screws to a flat surface.	
Weight:	250g	
Connectors:	DC Power	2-way Klippon Type
	Serial Data	9-way D-Type Female
	RF	BNC (50 ohm)
LED Indicators:	TX, Busy, System, RXD, TXD	

3.1.2 Transmitter:

RF Output Power:	ZRT 169/450/869	10mW - 750mW
	ZRT 170/225/470	50mW - 5Watts
Bandwidth:	VHF	10MHz without re-alignment
	UHF	12MHz without re-alignment
	869	30MHz without re-alignment
Internal Modulation:	Programmable for FFSK, 2-Level FSK, GMSK or 4-Level FSK.	
Max. Deviation:	± 7.5kHz max	
Duty Cycle	up to 70%	
Adj. Channel Power:	>65dB at 12.5kHz	
Spurious Emissions:	As per ETS300-113	
Rise Time:	< 9mS	

3.1.3 Receiver

Sensitivity:	0.25uV (-119dBm) for 12dB SINAD de-emphasised 0.355uV (-117dBm) for 12dB SINAD flat	
Bandwidth:	VHF	5MHz without re-alignment
	UHF	10MHz without re-alignment
	869	20MHz without re-alignment
Spurious Response:	ZRT 169/450/869	>65dB
	ZRT 170/225/470	>80dB
Blocking:	ZRT 169/450/869	>85dBuV
	ZRT 170/225/470	>90dBuV
Intermodulation:	ZRT 169/450/869	>60dB
	ZRT 170/225/470	>70dB
Adjacent Channel:	>65dB at 12.5kHz	
IF Frequencies:	45MHz and 455kHz	
Spurious Emissions:	ZRT 169/450/869	<ETS 300-220
	ZRT 170/225/470	<ETS 300-113
Mute Response Time:	<2msec	

3.1.4 Internal Modem

Serial Comms:	Asynchronous (or Synchronous with custom software). Baud rate programmable between 150bps and 38,400bps	
Interface:	/232Full version :-	RS.232 complete with signalling lines
	/TTL version:-	5V TTL levels rather than RS.232
	/232+485 version:-	RS.422/RS.485 (2 or 4 wire) or RS232 with looped back signalling lines.
Parity:	Programmable as Odd, Even or None	
NRZI:	On or Off	
Stop bits:	Programmable 1 or 2	
Data Bits:	Programmable 7 or 8	
Signalling Formats:	Programmable as V23, Bell202 or MPT1327, up to 1200 baud, coherent FFSK at 2400 baud, GMSK at 4800 baud, 4 Level FSK at 9600 baud.	
Synchronous/ Async.	Programmable as either up to 1200bps, synchronous above 1200bps	
Over-air Baud Rate:	150 - 9600bps within 12.5kHz	
Bit Error Rate:	150 - 2400 baud	less than 1×10^{-3} at -120dBm
	4800 baud	less than 1×10^{-3} at -117dBm
	9600 baud	less than 1×10^{-3} at -115dBm (FEC on)
	9600 baud	less than 1×10^{-3} at -112dBm (FEC off)
	Forward Error Corrector (FEC) is a programmable option at 9600bps.	

In the interest of improvement the above specifications are subject to change without notice.