WARWICK WIRELESS
LIMITED

X8200 SYNTHESISED RADIO MODEM

Data Sheet DS168-2

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1.0 FEATURES

- Operates on international licensed and licence free radio bands.
  RF Bands: 310MHz to 500MHz UHF In 3.175MHz bands
  868MHz to 920MHz UHF In 3.175MHz bands
- Conforms to ETSI 300-220, ETSI 300-113, ETSI 300-683, MPT1329, MPT1411.
- Remot Modems can be monitored and re-configured over the radio link.
- 127 at 25KHz or 256 at 12.5KHz selectable radio channels.
- Range 10km to 20km line of sight and 1km to 3km in buildings for ERP of 500mW.
- RS232 & RS485 serial Interface with baud rates of 1.2KBaud to 115.2Kbaud.
- Automatic network configuration of RF frequency.
- 4K of buffer memory.
- Store and Forward Repeater Mode to extend range.
- Addressable individually and globally.
- On-line AT commands for modem dial-up operation and RF channel change.
- Packet Data Mode and Forward Error Correction for error free communication.
- Low power standby mode.

The X8200 Radio Modem transmits and receives half duplex serial data at baud rates of 1.2KBaud to 115.2KBaud by means of a FM Radio Transceiver operating on the UK and European licence exempt bands and most other world wide data frequencies.

A 4K buffer memory is provided so that data can be packetised, repeated and passed asynchronously between the host and modem . The CTS output signal can be used for flow control in duplex and packetised applications. The over air data speed can be configured at either 5K bits/sec or 10K bits/sec. This is independent of the baud rate.

The set up menu of the X8200 can be accessed either by a PC running any terminal emulation program like Hyperterminal in the accessories section or remotely over the radio link. The set up menu is selected either by connecting pin 6 (Configuration Mode) on the 9 way D Connector to pin 5 (0V) or typing $ then ESC directly after the power has been applied. The menu configuration is permanently stored on EEPROM.

On-line “AT” commands can be sent to the modem to change the address configuration, repeater path or RF frequency during normal operation so that any modem can “dial up” any other modem on the network.

Data can be formed into packets and passed from one modem to another. If the received packet has errors detected then the data will automatically be sent again. Both size of the data packet and the number of retries can be set in the menu.

The X8200 radio modem is powered from DC source of between 10 to 26VDC. In receive mode it will take 95mA and in transmit 350mA at 12V. Taking DTR low will switch the modem into a power saving stand-by mode. In this state it will consume approximately 0.1mA. It will take approximately 20mSec for the modem to become fully operational after DTR is taken high or power is applied.

The modem is housed in a robust, lightweight aluminium enclosure.
Additional options include: X7201 Power Supply and PC to Modem Cable
X7204 IP67 Enclosure.
X7205 Ethernet Interface

2.0 SPECIFICATION

2.1	RF Frequency Bands		147MHz to 174MHz VHF (X8200HP only) 300MHz to 500MHz UHF in 3.175MHz Bands 868MHz to 920MHz UHF in 3.175MHz Bands
	RF Power:	X8400	5mW
		X8200	5mw – 500mW
	Channels		127 / 255
	Channel Separation		25KHz / 12.5KHz
	Modulation		F3D. F1D
	Receiver Sensitivity		0.3µV for 10dB SINAD
	Antenna Connector		BNC/TNC

2.2 Modem

Interface Baud Rate	115.2K, 57.6K, 38.4K, 19.2K, 9.6K, 4.8K, 2.4K, 1.2K
Data Word	8 bits
Parity	Odd, Even, None
Stop Bits	1 or 2
Modulation	Gaussian Minimum Shift Keying
Interface	RS232 and RS485
Communication speed	10Kbits/sec, 5Kbits/sec

2.3 Power Supply

DC Supply Voltage	10V to 26V
DC Supply Current at 12V	
Transmitting	330mA
Receiving	95mA
Stand By	0.lmA

2.4 Mechanical and Environmental

Dimensions X8200 UHF 800mW……	Length = 140mm Width = 65mm Height = 26mm
Operating Temperature Range	-10 to +55 deg C

3.0 CONNECTIONS

3.1 9 Way D Type Connector RS232/RS485

1		POWER 10 - 26VDC	INPUT
	6	CONFIGURATION MODE	INPUT
2		RS232 RD RECEIVE DATA	INPUT
	7	-VE RS485	INPUT/OUTPUT
3		RS232 TD TRANSMIT DATA	OUTPUT
	8	CTS	OUTPUT
4		DTR (STANDBY)	INPUT
	9	+VE RS485	INPUT/OUTPUT
5		0V	INPUT

PIN 1+VE 10V to 26V regulated power supply, capable of supplying 1Amp.

PIN 2 RD RS232 Receive serial data from host

PIN 3 TD RS232 Transmit serial data to host.

PIN 4 DTR A signal of between 0v to –7V will switch the modem into standby power mode. Leave open circuit for normal use.

PIN 5 0V Power supply and common for host.

PIN 6 CON Configuration input. Connecting 0V to this input will send the configuration menu to the host when the power is applied. It is left open circuit for normal operation

PIN 7 –VE RS485 Bi-directional data.

PIN 8 CTS Brought low by the modem when a RF carrier is detected or the receiver buffer memory is full. This can be connected to RTS on the host to inhibit data from the host in duplex operations.

PIN 9 +VE RS485 Bi-directional data.

3.2 LED Indicators

Three LEDS on the front of the modem indicate the following states:

TX	Green	On when modem is transmitting data.
RX	Green	On when a RF carrier of greater than 0.9uV is detected by the modem.
POWER	Red	On when power is applied to the modem

4.0 OPERATION

A transmission is started by sending data to RD (pin 2) or the RS485 terminals (pin7 & 9).The radio modem places this data in the transmitter buffer memory while it checks to see if the RF channel is free. If it is not then the data is stored in the buffer until the channel becomes free. If it is free then a preamble message will be transmitted so that the receiving modems can align to the incoming data. When Tx Priority is set, data will be transmitted regardless of the condition of the RF Channel.

The modem will then transmit a command byte which will instruct the distant modems to perform the functions set in the menu followed by the addressing and repeater functions. The data that has been placed in the buffer memory will then be transmitted. The transmission is terminated when a gap of two data bytes is detected in the incoming data stream.

If more data is sent after a gap of two data bytes then the above sequence will be repeated.

When the receiving modem detects the presence of incoming data it takes CTS (pin 8) low. The repeater command byte is decoded and the transmitter address compared to the receiver address. If they are the same or if the global address of 00 is decoded or if the address mode is switched off then the data will be presented at the serial output port TD (pin 3). At the end of the message CTS is taken high.

If the packetisation option is selected the receiving modem will check the CRC byte. If it is correct an ACK sent to the transmitting modem. If the CRC is incorrect a NACK is sent to the transmitting modem and the data is sent again. The number of re-trys are set in the Menu.

If the repeater command is decoded or the repeater mode set in the configuration menu then the data will be stored and then re-transmitted.

5.0 GETTING STARTED

5.1 Basic Connection

TRANSMIT	(TD)	ON HOST TO RECEIVE (RD) ON MODEM PIN 2
RECEIVE	(RD)	ON HOST TO TRANSMIT (TD) ON MODEM PIN 3
GROUND	(0V)	ON HOST TO 0V ON MODEM PIN 5

5.2 Power Connection

PIN 1 = POSITIVE 12V / 24V
PIN 5 = NEGATIVE 0V

5.3 Factory Setting

The radio modem is supplied with the following settings:

Warwick Wireless Ltd
X8200 Radio Modem V#.#

Advanced Menu	**Y**
Modem ID	**01**
Baud	**9600**
Parity	**N**
Odd/Even	**E**
RF Power	**5**
Key Transmitter	**N**
RF Channel	**17**
RSSI	**N**
Sensitivity	**00**
Comms eed	**S**
Address Mode	**N**
Enable AT Instr	**N**
Restore Defaults	**N**
Exit without Save	**N**
Save & Exit	**N**

Warwick Wireless Ltd
Advanced Menu

Return to Main Menu	**Y**
Message Tag	**0000**
TX Priority	**N**
FEC	**N**
Packetise Data	**N**
Number of Retries	**05**
Packet Size	**20**
Logger Mode	**N**
Enable Remote Access	**Y**
Access Remote Modem	**N**
Engage Repeater Path	**N**
Set Repeater Path	**00**

M01 M02 M03 M04 M05 M06 ---- M16

5.4 Plug and Play

Connect three wires to the RS232 serial port of the host terminal (0V, TD and RD) as described above. Connect a regulated 12V/24V, 1Amp power supply to the radio modem. X7202 PC to Modem cables can be used along with a X7201 power supply.

Configure a PC to Hyperterminal in the Accessories section to the following:

Go to **File** and then t **Properties**.
Set the Configuration to :
9600 Baud
No Parity
1 Stop Bit
XON/XOFF to OFF
RTS/CTS to OFF (no handshaking)
Settings should be: Terminal Keys set
Emulation set to ANSI

ASCII Set Up : Deselect all.

Connect up a second modem in the same way.

Pressing a key on one PC will transmit the character to the other. Refer to the Section 8.0 Trouble Shooting if this does not happen.

If a second PC is not available simply power up the second modem. Configure the ID numbers and the Enable Remote Access option on both. Then use the Access Remote Modem option to display the menu of the remote modem.

Fig 1 shows how an open network using the above configuration would work. All the data transmitted from one modem will be received by all of the others. This is similar to an RS485 network but instead of connecting the equipment by wire a radio modem is used.

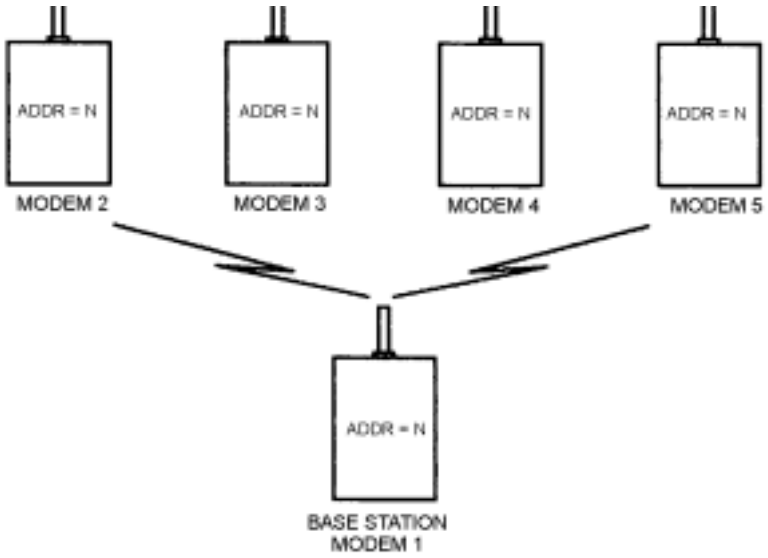


FIGURE 1 OPEN NETWORK

6.0 CONFIGURATION

6.1 Access Configuration Menu

There are three ways the menu can be accessed:

Typing $ then pressing the Esc Key as the first two characters after the Radio Modems has been switched on.

Connecting Pin 6 on the D-connector to 0V on Pin 5. Then switching the Radio Modem on.

Using the Remote Access feature to display the menu of a distant Radio Modem.

A PC configured as a dumb terminal with the following settings should be used:

9600 Baud
No Parity
1 Stop Bit
Echo off
XON/XOFF to OFF
RTS/CTS to OFF (no handshaking)

6.2 Configuration Menu

There are 31 parameters in the configuration menu which are displayed on 3 pages.

The vertical and horizontal arrow keys are used to move around the menu. Alternatively the numbers keys 2, 4, 6 and 8 can also be used as follows:

Down arrow key or 2 key will move the cursor down the menu
Left arrow key or 4 key will reduce the value
Right arrow key or 6 key will increase the value
Up arrow key or 8 key will move the cursor up the menu

The Enter Key is used in the following function:

Restore Defaults
Exit without Save
Save & Exit
Access Remote Modem
Set Repeater Path

The Space Bar Key is used to delete modem ID numbers in the Repeater Path

To save any changes made in the menu :

Move the cursor to **Save & Exit,**
Use the horizontal arrow key to select **Y**.
Press the **Enter** Key

The configuration menu shown below will be displayed when a radio modem with Modem ID set to 01 remotely accessed a radio modem with Modem ID set to 02.

Warwick Wireless Ltd
X8200 Radio Modem V#.#

	Local	Remote
Menu	**N**	**N**
Modem ID	**01**	**02**
Baud	**9600**	**9600**
Parity	**N**	**N**
Odd/Even	**E**	**E**
RF Power	**5**	**5**
Key Transmitter	**N**	**N**
RF Channel	**17**	**17**
RSSI	**N**	**N**
Sensitivity	**00**	**00**
Comms Speed	**S**	**S**
Address Mode	**N**	**N**
Enable AT Instr	**N**	**N**
Restore Defaults	**N**	**N**
Exit not Saved	**N**	**N**
Exit & Save	**N**	**N**

Menu	Move to next Menu
Modem ID	User defined ID number.
Baud	Baud Rate 1.2K to 115.2K
Parity	Enable Parity.
Odd/Even	Select Parity.
RF Power	Set level of RF Power.
Key Transmitter	Switch on Transmitter
RF Channel	Set RF Frequency.
RSSI	Bar Graph of Rx Signal
Sensitivity	Set the Receiver Sensitivity
Comms Speed	Slow/Fast
Address Mode	Enables Modem Address.
AT Enable AT Instr	AT instruction are enabled.
Restore Defaults	Set Factory Defaults.
Exit without Save	Return without saving operation without saving settings.
Save & Exit	Return to Modem and save Settings.

Warwick Wireless Ltd
Advanced Menu

	Local	Remote
Menu	**N**	**N**
Message Tag	**0000**	**0000**
TX Priority	**N**	**N**
FEC	**N**	**N**
Packetise Data	**N**	**N**
Number of Retries	**05**	**05**
Packet Size	**20**	**20**
Logger Mode	**N**	**N**
Enable Remote Access	**Y**	**Y**
Access Remote Modem	**Y**	**N**
Engage Repeater Path	**N**	**N**
Set Repeater Path	**02**	**00**

Local M01 M02 M03 M04 M05 M06 ---- M16
02

Remote M01 M02 M03 M04 M05 M06 ----- M16

Use space bar to delete repeater path

Menu	.	Move to next Menu
Message Tag		Adds Ident. No. to Data
TX Priority		Data transmitted priority
FEC		Forward Error Correction
Packetise Data		Data is formed into packets with error detections and Acknowledgments. CTS to RTS must be connected on Host.
Number of Retries		Sets number of retries.
Packet Size		Sets packet size. 64-1024
Logger Mode		Data is stored until polled.
Enable Remote Access		Allows distant Modem to change settings.
Access Remote Modem		Displays settings of remote operation without saving Modem with ID on AT Path.
Engage Repeater Path		Enable repeater path.
Set Repeater Path		Sets AT Path M01 to M16.

Warwick Wireless Ltd
Network Settings

	Local	Remote
Menu	**N**	**N**
DT Address	**0000**	**0000**
Auto Configuration	**N**	**N**
Seek Time (sec)	**0**	**0**
Network Timer (sec)	**20**	**20**
Tx Delay (mSec)	**0000**	**0000**

Menu .	Move to next Menu
DT Address	DT Address for Hayes AT Instruction. 0 to 64,000
Auto Configuration	Enables the RF Channel Auto Configuration Mode
Seek Time (Sec)	The timer is used in two ways in the Auto Configuration Mode 1) To test for a free RF Channel as a Base Station. 2) To set the detection time at an Outstation.
Network Timer (Sec)	Used by the Basestation in Auto Configuration Mode to maintain contact with all Outstation on the Network.
Tx Delay (mSec)	The start of the transmission will be delayed from 0 to 9999mSec

6.3 Menu

The horizontal arrows are used to select the other two pages of the menu.

6.4 Modem ID Number

Each modem in a network can be given an individual ID number between 0 and 99

This is used for:
- Remote Access Menu
- Modem Addressing
- Repeater Function
- Packet Data Function

6.5 Baud Rate Settings

A baud rate is entered by moving the cursor under the current setting with the vertical arrow keys. Then by pressing the horizontal keys the value will change:

BAUD RATE
115.2K
57.6K
38.4K
19.2K
9.6K
4.8K
2.4K
1.2K

6.6 Parity On/Off

If a parity bit is required use the horizontal arrow key to select Y
The parity bit is only used between the host and the radio modem

6.7 Odd or Even Parity O/E

If parity is required either O for Odd or E for Even parity can be set by pressing the horizontal arrow keys.

6.8 RF Power

The RF output power can set using a number between 1 minimum and 5 maximum. The horizontal arrow keys are used to change the value.

6.9 RF Channel

The Radio Frequency can be set by using a number between 1 and 127. If channel 0 is selected the radio will use the DIL switch settings to select the RF frequency

RF Frequency Table

1	458.525000	33	459.325000	65	460.125000	97	460.925000
2	458.550000	34	459.350000	66	460.150000	98	460.950000
3	458.575000	35	459.375000	67	460.175000	99	460.975000
4	458.600000	36	459.400000	68	460.200000	100	461.000000
5	458.625000	37	459.425000	69	460.225000	101	461.025000
6	458.650000	38	459.450000	70	460.250000	102	461.050000
7	458.675000	39	459.475000	71	460.275000	103	461.075000
8	458.700000	40	459.500000	72	460.300000	104	461.100000
9	458.725000	41	459.525000	73	460.325000	105	461.125000
10	458.750000	42	459.550000	74	460.350000	106	461.150000
11	458.775000	43	459.575000	75	460.375000	107	461.175000
12	458.800000	44	459.600000	76	460.400000	108	461.200000
13	458.825000	45	459.625000	77	460.425000	109	461.225000
14	458.850000	46	459.650000	78	460.450000	110	461.250000
15	458.875000	47	459.675000	79	460.475000	111	461.275000
16	458.900000	48	459.700000	80	460.500000	112	461.300000
17	458.925000	49	459.725000	81	460.525000	113	461.325000
18	458.950000	50	459.750000	82	460.550000	114	461.350000
19	458.975000	51	459.775000	83	460.575000	115	461.375000
20	459.000000	52	459.800000	84	460.600000	116	461.400000
21	459.025000	53	459.825000	85	460.625000	117	461.425000
22	459.050000	54	459.850000	86	460.650000	118	461.450000
23	459.075000	55	459.875000	87	460.675000	119	461.475000
24	459.100000	56	459.900000	88	460.700000	120	461.500000
25	459.125000	57	459.925000	89	460.725000	121	461.525000
26	459.150000	58	459.950000	90	460.750000	122	461.550000
27	459.175000	59	459.975000	91	460.775000	123	461.575000
28	459.200000	60	460.000000	92	460.800000	124	461.600000
29	459.225000	61	460.025000	93	460.825000	125	461.625000
30	459.250000	62	460.050000	94	460.850000	126	461.650000
31	459.275000	63	460.075000	95	460.875000	127	461.675000
32	459.300000	64	460.100000	96	460.900000		

In addition an ATX instruction can be used to change the RF frequency form the serial port. For example to change the RF frequency to channel 09 the instruction would be:

A	T	X	0	9
41	54	58	30	39

Were the channel number is sent as two ASCII number characters 30-39 for 0-9

6.10 Key Transmitter

The Key Transmitter setting switches on the transmitter so that a radio site survey can be conducted. . A second Radio Modem can be used to move around the site observing either the Rx LED or the RSSI Bar Graph. If the Rx LED is on then there will be good communications.

6.11 RSSI Relative Signal Strength Indicator

The RSSI function is used to detect radio activity on the RF Channel. It can also be used to measure the signal strength of a transmission from a distant radio modem. The bar graph is not calibrated.

As a guide a maximum of nine bars will appear relating to a signal strength of -112dBm to -92dBm.

In the Remote Access Mode the distant modem will measure its own RSSI and radio the value back to the local radio modem were it will be displayed on a bar graph in the menu.

6.12 Comms Speed

Two over air transmissions speeds can be selected. These are:

F = 10Kbits/sec
S = 5Kbits/sec

The slow speed will give the most robust data link

6.13 Address Mode

The address mode uses ID numbers to “dial up” distant modems. When the data is transmitted from a distant modem the first ID number set in the repeater path is added to the data string and used as a transmitter address. The receiving modem compares the transmitter ID in the data string with its own ID number. If they are the same the data string is passed to the serial port. In addition individual modems can be dialled up by using serial ATT and ATA Instructions to change the transmitting ID number.

The ATT instruction can be used to “dial up” distant modems as shown in fig 4. The base station modern has its ID number (receiver address RXA) set to 01. The four distant stations have ID numbers 2, 3, 4 and 5. All of the distant modems have the first value in their Repeater Path (transmitter address TXA) set to 01. Therefore any distant modem can transmit data to the base station but not to each other.

The serial ATT instruction is made up of the ASCII characters for A (41), T(54), T(54). This is then followed by the ID number of the addressed station as two ASCII numbers 30 to 39

The instruction sent by the base station to address modem with ID set to 2 will be:

A	T	T	0	2	
41	54	41	30	32	DATA

Modem 3 can be dialled up in the same way with the instruction:

A	T	T	0	3	
41	54	41	30	33	DATA

The instruction string will not be transmitted over the air as long as it is sent to the modem without any breaks.

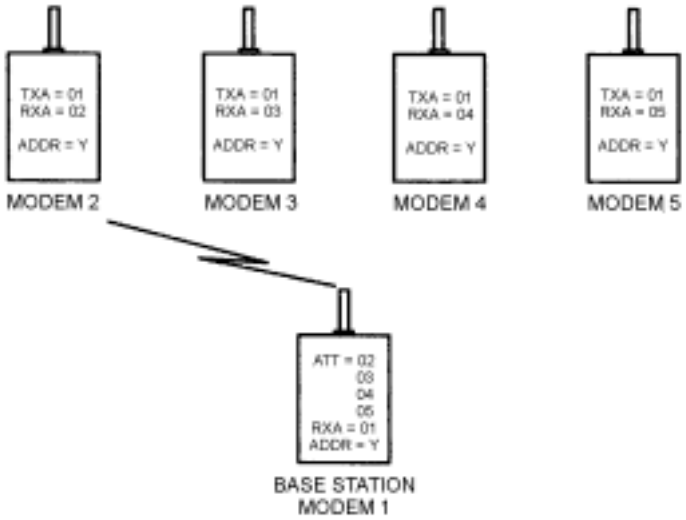
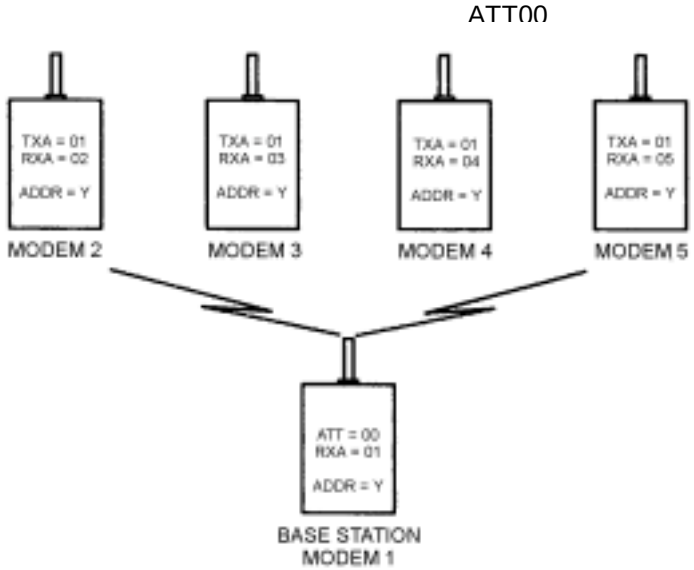


FIGURE 4 STATION ADDRESSING

6.13.1 Global Addressing

The base station can send the same data to all the modems by using the Global Address 00 (Fig 5). The following instruction would be inserted before the data by the base station host:



6.14 Receiver Sensitivity

The receiver sensitivity can be adjusted so that the modem is less likely to be affected by the presence of RF interference. This will cause a reduction in overall range.

6.15 Restore Defaults

The Factory Settings will be automatically be restored by pressing the horizontal arrow key followed by the Enter Key

They will not be stored in the EEPROM until Save and Exit has be selected and the Enter Key pressed again

6.16 Exit not Saved

The modem will return to normal operation without storing the menu settings in the EEPROM. Press the horizontal arrow key followed by the Enter Key.

6.17 Exit & Save

The modem will store the menu in the EEPROM and return to normal operation
Press the horizontal arrow key followed by the Enter Key.

6.18 Menu

Pressing the horizontal Arrow key will go to the nexted Menu.

6.19 Enable AT Instructions

Pressing the horizontal Arrow key will allow the modem to act on both Warwick AT Instructions and Hayes AT Instructions.

6.20 Message Tag

The number will be inserted at the start of each data string and will be passed to the host at the receiving station to indicate the source of the data.

The function is disabled by setting the Message Tag to 0000

6.21 TX Priority

With TX Priority set to N, the modem will monitor the RF Carrier frequency before transmitting. This is to prevent data collisions. If the RF channel is in use, then a random number delay timer is started and the transmission is attempted again when the timer times out.

If the TX Priority is set to Y then data will be immediately transmitted regardless of whether there is an RF Carrier detected or not. This is used in environments with large amounts of RF emissions.

6.22 FEC

The Forward Error Correction algorithm puts redundant bytes into the data string so that it can correct the data at the receiving modem.

6.23 Packetise Data

The Packetised Data option is set to Y and the ID number of the destination modem is set in the Set Repeater Path. This could be a single ID number for a back to back system or multiple ID numbers if a repeater path is to be used.

Data from the Host is stored in the modem memory. When the number of data bytes equals the number set in Packet Size or if there is a gap detected in the incoming data the CTS line is brought low. This line is connected to RTS on the Host and stops the data. A check sum is added to the data string and it is then transmitted over air.

The data string is checked at the receiving modem and if no corruptions have taken place an Acknowledge is sent to the transmitting modem. This then takes the CTS line high and the sequence is repeated.

If the receiving modem detects a data corruption a Not Acknowledge is sent to the transmitting modem and the data is sent again. The number of retries at set in the menu.

6.24 Number of Retries

The number of retries before the data is abandon can be set between 0 and 99 using the horizontal arrow key.

6.25 Packet Size

The number of data bytes in the data packet can be set by the following number:

2 = 64 Bytes
4 = 128 Bytes
8 = 256 Bytes
10 = 512 Bytes
20 = 1024 Bytes

6.26 Logger Mode

The modem will place all data from the host into its 4K buffer memory. When it receives an addressed message from a distant modem all the contents of the memory will be transmitted.

6.27 Enable Remote Access

Enable Remote Access is set so that a local modem can access, monitor or change the settings of a distant modem over the radio link.

6.28 Access Remote Modem.

The radio link can be used to display the menu of a remote modem. All the parameters can be changed including the RF Frequency and the RF Power. In addition the value of the receiver signal strength will be radio back.

First set the ID number of the target modem in the first location of the Repeater Path by pressing the horizontal arrow until the number is arrived at. Press the Enter Key. If the ID number is not known then 99 can be used as a universal entry code. Please note that using 99 will address all the Radio Modems within radio range.

Move the cursor to Access Remote Modem, press the horizontal arrow key to select Y. Then press the Enter Key. The menu from the target modem will be displayed along side the local modem.
Any and all the parameters can be altered using the arrow keys. In addition the signal strength at the distant modem will be displayed as a bar graph on the RSSI setting.

Save & Exit is used to update the menu of the distant modem. Note that the real ID of the distant modem has to be used. The 99 access code will note allow the menu in a distant modem to be changed. This is to prevent all the menus of radio modems within radio range from being modified.

Setting Exit without Save to Y and pressing the Enter Key will disconnect the link

6.29 Engage Repeater Path

Data will be first set to the modem with the ID number set in MO1 it will be then repeated to modem ID set in MO2 and so on until the last ID number set in the repeater chain.

ATA instruction can also be used from the Host to select different paths and different destinations.

6.30 Set Repeater Path

The Engage Repeater Path is set to Y.

A repeater path is set up by using the horizontal keys to increment the Set Repeater Path number. When it is the same as the ID number of the repeater modem press the Enter key. The next modem in the repeater chain is set in the same way. Finally enter the ID number of the destination Modem

The Space Bar is used to delete the entry.

The serial ATA instruction can also be used to select a data path. It is made up of the ASCII characters for A (41), T(54), A(41). This is followed by the number of stations (two ASCII numbers) to be used in the repeater path followed by the destination station ID numbers. (two ASCII numbers).

If the data string was to be transmitted to modem with ID9 and it was to be repeated at modem ID4 and then at modem ID6. The ATA Instruction would be:

A	T	A	3 Stations	ID4	ID6	ID9	
41	54	41	30 33	30 34	30 36	30 39	DATA

The maximum number of repeaters is 99

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6.31 Frequency Agility

Base Station

To enable operation as a base station the following must be set within the firmware menu:

Auto-configure set to ‘Y’.
Network code to a value other than zero
Modem ID must be set to 1.

If there is a conflict in the values set, e.g. the network code is zero, the modem will reset the auto-configure option to ‘N’ on save and exit.

Upon switch on the base station will scan through the available RF channels for a free channel, once found the unit will then operate on that channel until switch on reset.

The sequence of the scan will begin at the RF channel saved in the menu. Until a free channel is found, the modem will scan each RF channel in ascending order, looping back to the first RF channel after scanning the last. The RF module will fix the range of frequencies.

The time required to scan an individual channel is set through the menu option ‘Seek time’. This time may be set between 0 – 99 seconds. Should this time be set to zero then the scan will be bypassed, i.e. the base station will lock onto the frequency set in the menu.

Once locked onto an RF frequency, the base station will begin modem operation.

When set as a base station, each transmission will contain a flag to indicate a base station transmission. Additionally the base station will run a broadcast timer. This timer interval is set through the menu option ‘Network Timer’. Each transmission will reset this timer. If there is no transmission triggered by incoming data through the serial port, the modem will broadcast a null message.

Remote Station

To enable operation as a remote station the following must be set within the firmware menu:

Auto-configure set to ‘Y’.
Network code set to the same value as the base station
Modem ID must be set to greater than 1.

If there is a conflict in the values set, e.g. the network code is zero, the modem will reset the auto-configure option to ‘N’ on save and exit.

Upon switch on the remote station will search through the available RF channels for a base station beacon, once found the unit will then operate on that channel until either switch on reset or network time out.

The sequence of the search will begin at the RF channel saved in the menu. Until a base station beacon is found, the modem will search through each RF channel in ascending order, looping back to the first RF channel after searching the last. The RF module will fix the range of frequencies. The time required to search an individual channel is set through the menu option ‘Seek time’. This time may be set between 0 – 99 seconds. Should this time be set to

zero then the search will be bypassed, i.e. the remote station will lock onto the frequency set in the menu.

Once locked onto a base station beacon, the remote station will begin modem operation.

When set as a remote station, the modem will run a network timer. This timer interval is set through the menu option 'Network Timer'. Each base station transmission received will reset this timer. If the network timer times out, the remote station will force a switch on reset to begin seeking a base station beacon again.

7.0 RADIO TRANSMISSION

7.1 Radio Propagation

When installing a X8200 Radio Modem there are a number of factors that should be considered as they will affect the performance of the radio link. These are:

Transmitter power output.
Sensitivity of the receiver.
Height of transmitter and receiver antenna.
Length and type of the coaxial feeder cables to the antenna. These should be low loss RU67 type and kept as short as possible. As a rule of thumb the RF power is halved every 10m of antenna feeder. It is better to keep the signal wire long and the antenna feeder short.
Type of Antenna used.
Surrounding Topography.
Interference for other networks operating on the same frequency.
The Weather.

7.2 Antennas

The main types of antenna used in telemetry applications are as follows:

Helical
End Fed Dipole
Yagi

7.2.1 Helical Antenna

The helical stub antenna is robust, low cost and physically small. It has a gain less than unity. Range of up to 2Km.

7.2.2 End Fed Dipole

The end fed dipole antenna has a unity gain. Its main application is to provide cost effective omni-directional radiation.

Range 10 to 20 Km

7.2.3 Yagi

This antenna has a high gain typically twice (3dB) to ten times (10dB) the input power in the direction of orientation. It is the type of aerial commonly used in domestic televisions.

The output power of a transmitter connected to a Yagi antenna has to be reduced to conform

to the DTI specification. This has the advantage of reducing the overall power consumed by the transmitter without effecting the range in the direction of orientation. It also reduces interference from other users.

The receiver signal is also amplified if a Yagi antenna is used thereby extended range in the direction of orientation to around 20 Km line of sight.

7.3 Antenna Alignment

If directional yagi antenna are used it is important to aligned them correctly. This can be done using a compass and ordinance survey maps. The alignment can be checked by selecting the Key Transmitter option at the transmitting station. A radio modem is then attached to the yagi antenna feeder at the receiving station. By selecting the RSSI option in the menu the yagi antenna can be rotated to a position of peak signal strength This will be in the direction of the transmitter beacon.

7.4 Site Survey

First check the occupancy of all the radio channels at all the proposed sites. This can be achieved by using an antenna, radio modem and PC. Select the RSSI option and observe the bar graph. Note any activity. Go to the RF channel option and select the next RF Channel. Again observe the RSSI reading and make a note of any activity. Repeat this for all the RF Channels.

The radio range can be tested by erecting a radio modem, Antenna and PC at the proposed base station site. Select the Key Transmitter option.

Use a second radio modem, antenna at the distant site. If the Rx LED is lit then there is a good propagation path. In addition the RSSI option can be selected for a more accurate reading of the signal strength.

The propagation path can be tested by using the Access Remote Modem option. The RSSI value from each of the distant modems will be measured, radioed back and displayed

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Type of Antenna used.
Surrounding Topography.
Interference for other networks operating on the same frequency.
The Weather.

8.0 TROUBLE SHOOTING

8.1 No Data Transmission

Check that TD and RD are connected to the 9 way D Connector correctly. This can be checked by using a voltmeter:

a) Connect the Host to the Modem.
b) With no signal present, measure the voltage between:
   0V (Pin 5) and TD (Pin 3)
   0V (Pin 5) and RD (Pin 2)
c) Both should be between -5V to -15V.

If only one is at a negative voltage then the RD and TD connections are reversed.

8.2 No Data Reception

If the RX LED on the receiver is not lighting at the same time as the TX LED on the transmitter then check the RF frequency is the same on both modems.

If the RX LED is lit when no data is being transmitted then there might be another user on the channel. Select an RF channel were the RX LED is not lit.

If RX LED is flickering on all RF channels then look for a source of local interference such as a switch mode power supply or a computer in close proximity.

If there are other radio modems or radio telemetry systems operating on adjacent frequencies on the same site then the antenna on your system must be mounted at least 3m away from the antenna of the other systems. This will prevent the transmitter of one system interfering with the receiver of the other.

8.3 Corrupted Data

Corrupted data can be caused by poor power supplies.

Check that the power supply is regulated at 12V and has a ripple of less than 50mV on load. It must also be capable of delivering an inrush current of 0.7Amps for 20mSec. when the radio modem starts its transmit cycle.

The ripple voltage can be measured with a voltmeter set on A.C. volts.

8.4 Radio Path

The radio path can be tested by using the Access Remote Modem option. If the remote modem is in radio range and is receiving good data it will respond by displaying the signal strength of the remote modem in the RSSI option.

If the remote modem does not respond then use the Key Transmitter option to permanently transmit a carrier. Go to the distant modem and observe the RX LED. It should be on. Alternatively access the set up menu and select the RSSI option. A minimum of 3 bars should be shown.

8.5 HELP LINE NUMBER +44 (0) 1455 233616

9.0 WARNING

Information contained in this document is believed to be accurate, however no representation or warranty is given and Warwick Wireless Ltd. assumes no liability with respect to the accuracy of such information. Use of Warwick Wireless's products as critical components in life support systems is not authorised except with express written approval from Warwick Wireless Ltd. Further Warwick Wireless Limited reserve the right to change the design or specification of the X8200 Radio Modem without notification and has no responsibility for the installation and operation of the equipment by third parties.

Doc: X82 V 1.1

10.0 STATEMENT OF OPINION

STATEMENT OF OPINION

KTL Reference: 4C0034 : Certificate no. 1834

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Notified Body statement of opinion in accordance with Annex IV of EC Council Directive 99/5/EC, The Radio Equipment and Telecommunications Terminal Equipment Directive)

Apparatus	
Product name	X7200 / X8200 Radio Modem
Product type	To be used for integration into electronic products / systems to facilitate the transmission of data
Manufacturer :	**Statement of Opinion issued to :**
Warwick Wireless Limited The Manor Acton Flamville Leicestershire LE10 3AQ United Kingdom	Warwick Wireless Limited The Manor Acton Flamville Leicestershire LE10 3AQ United Kingdom

Conformance Assessment Procedures

The apparatus has been assessed by KTL in accordance with the conformance assessment procedures specified by :

Regulation 9(c) and Schedule IV of the United Kingdom Statutory Instrument 2000 No. 730, *The Radio Equipment and Telecommunications Terminal Equipment Regulations 2000* (implementing Annex IV of the EC Council Directive 99/5/EC The *Radio Equipment and Telecommunications Terminal Equipment Directive*)

Documentation Supplied

Technical Construction File (TCF)

This statement of opinion is based on assessment of the Technical Construction File (TCF) by KTL :

TCF no : WWL-TCF-003 dated 20th February 2003

1. Laboratory Accreditation Services Ltd. t/a KTL has been appointed as a United Kingdom Notified Body by the Department of Trade and Industry.
2. KTL is also a UKAS Accredited Test Laboratory, number 0971.
3. This declaration is issued subject to KTL's standard terms and conditions, copies of which can be obtained from www.ktl.com.
4. This Certificate is issued in accordance with The UK Regulations (SI 2000 No. 730, which form the UK implementation of the EC Council Directive 99/5/EC).
5. On placement of the product on the European market, the marking of this product must include KTL's Notified Body number.
6. This statement of opinion is limited to the products listed and identified previously.
7. KTL is the trading name of Laboratory Accreditation Services Ltd.

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