WARWICK WIRELESS
LIMITED

X7220 DUAL REDUNDANT BASE STATION

INDEX

1.0 FEATURES

- Operates on international licensed and licence free radio bands.
- RF Bands: 147MHz to 174MHz VHF
                400MHz to 500MHz UHF
                868MHz to 920MHz UHF
- Conforms to ETSI 300-220, ETSI 300-113, ETSI 300-683, MPT1329.
- Two Independently X7200HP Radio Modems in hot standby.
- 17 selectable radio channels.
- RF Power 1W and 5W
- RS232/RS485 serial Interface with baud rates of 1,200 to 38,400.
- Service and monitoring RS232/RS485 serial port.
- Remote monitoring and configuration of outstation modems.
- Addressable individually and globally.
- On-line AT commands for network control.
- Variable Data Packets and error checking mode.
- 1U, 19 inch rack mounted enclosure.

The X7220-2 Dual Redundant Base Station consists of two X7200 Radio Modems, two power supplies and an independent monitoring system. Only one Radio Modem is operational at any time with the other in hot standby. If any of the monitored parameters such as bit error rate, RF Power, RF sensitivity, Power Supply should exceed there pre-set limits then the second X7200 will be brought into service and the fault reported via the monitoring serial port and a relay contact closing. The in service radio modem will be changed automatically after a pre-set duty time.

A 4K buffer memory is provided on each radio modem so that data can be passed asynchronously between the host and modem without the need for handshaking. The CTS output signal on the communication port can be used for flow control in duplex 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 and should be set to a lower value where possible for the best radio propagation.

The set up menu of the X7220-2 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 from the serial serves and monitoring port. The menu configuration is permanently stored on EEPROM.

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

The X7220-2 Dual Redundant Base Station is housed in a 19 inch rack and can be powered from 240V power source.

2.0 SPECIFICATION

ABSOLUTE MAXIMUM RATINGS
Storage Temperature .... -30 to +85 Celsius
Operating Temperature .... -10 to +55 Celsius

DIMENSIONS X7220HP UHF 1- 5W .... 1U 19 Inch rack

ELECTRICAL CHARACTERISTICS	MIN	TYPICAL	MAX	DIMENSION	NOTE
Frequency Range	458.500		458.950	MHz	UK
	400.000		480.000	MHz	World
	147.000		174.000	MHz	Si
Channels		17			
Channel Separation	12.5	25.0	25.0	KHz	
Start up Time	5.0	10.0	30.0	mSecs	With $ Selected
Modulation		F3D, F1D			
Power Supply	12	24	30	Vdc	110V, 240Vac
TRANSMITTER					
RF Power X7220HP	1		5	W	
Data Input RS232	-10		10	V	
Data Input RS485	0		5	V	
Frequency Deviation		+/- 3.0		KHz	25KHz Channel
Modulation Rate	DC		10.0	Kbps	
Supply Current	0.89	3.1	3.2		Amps
RECEIVER					
IF Frequencies		45/455		MHz	
Sensitivity		0.9		μV	
Bandwidth	+/- 7.5	KHz			
Data Output RS232	-10		10	V	
Data Output RS485	0		5	V	
Carrier Detect	-10		10	V	
Supply Current	80	90	105	mA	
Supply Current Standby	0.005	0.007	0.01	mA	

3.0 INTERFACES

3.1   Communication Port 9 Way D Type Connector RS232/RS485

1		ALARM CONTACT	OUTPUT
	6	ALARM CONTACT	OUTPUT
2		RS232 RD RECEIVE DATA	INPUT
	7	-VE RS485	INPUT/OUTPUT
3		RS232 TD TRANSMIT DATA	OUTPUT
	8	CTSI	OUTPUT
4		NU	
	9	+VE RS485	INPUT/OUTPUT
5		0V	INPUT

PIN 1 AL1   Voltage free, normally open contact
PIN 2 RD   RS232 Receive serial data from host
PIN 3 TD   RS232 Transmit serial data to host.
PIN 4 NU   Not Used
PIN 5 OV   0V common for host.
PIN 6 AL2   Voltage free, normally open contact
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 Service Port 9 Way D Type Connector RS232/RS485

1		NOT USED	
	6	CONFIGURATION MODE	INPUT
2		RS232 RD RECEIVE DATA	INPUT
	7	-VE RS485	INPUT/OUTPUT
3		RS232 TD TRANSMIT DATA	OUTPUT
	8	NOT USED	
4		NU	
	9	+VE RS485	INPUT/OUTPUT
5		0V	INPUT

PIN 1 NU   Not Used
PIN 2 RD   RS232 Receive serial data from host
PIN 3 TD   RS232 Transmit serial data to host.
PIN 4 NU   Not Used
PIN 5 OV   0V 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 NU   Not Used.
PIN 9 +VE   RS485 Bi-directional data.

3.3 <u>LED Indicators</u>

Eight LED's on the front of the modem indicate the following states:

Transmit Data 1	Green	On when modem 1 is transmitting data.
Receive Data1	Green	On when a RF carrier of greater than 0.9uV is detected
PSU 1	Red	On when Modem 1 power supply is good.
Fail 1	Red	On when a fault is detected in Modem 1
Data 2	Green	On when modem 2 is transmitting data.
Receive Data 2	Green	On when a RF carrier of greater than 0.9uV is detected
PSU 2	Red	On when Modem 2 power supply is good.
Fail 2	Red	On when a fault is detected in Modem 2

3.4 <u>Fuses</u>

Fuse 1	1 Amp Fuse for modem 1 PSU
Fuse 2	1 Amp Fuse for modem 1 PSU

3.5 <u>Program Switch</u>

Three way switch for changing the parameters of both modem 1 and modem 2.

Central	Run
Right	Program modem 1
Left	Program modem 2

3.6 <u>Alarm Reset</u>

Resets alarm states

3.7 <u>Antenna Connections</u>

Two 50 ohm, N-Type Sockets.

Antenna 1	Socket for Antenna 1
Antenna 2	Socket for Antenna 2

3.8 <u>Power Supply</u>

Three pin plug for 240V mains power supply is

4.0 <u>OPERATION</u>

When power is applied to the Dual Redundant Base Station all the monitored parameters are checked along with the LED's. If no faults are found modem 1 is enabled. The Duty Cycle Timer is enabled and this then cycles the two modems according to the time set in the service menu. (1 to 48 Hours)

If a fault is detected in the operational modem then the Fault LED will light, the Fault Relay will energise, an error code will be set in the service menu and the alternative modem will be selected.

A transmission is started by sending data to RD (pin 2) on the serial communication port. The operational 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.

The modem will then transmit a repeater command byte, if set, and a transmitter address byte followed by the data that has been placed in the buffer memory. 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 repeater command is decoded or the repeater mode set in the configuration menu then the data will be stored and then re-transmitted.

The best results are obtained from the radio modem by setting the transmission speed to the slow setting and the baud rate to either 4800 or 9600.

5.0   GETTING STARTED

5.1   Basic Connection on the communication and service ports

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

240V ac

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 240V power supply to the radio modem.

Configure a PC in Microsoft Windows Hyper Terminal, Procom or any other terminal package with the following settings:

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

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 modem connected to the PC in the repeater mode with the address mode switched off. This will command the distant modem to repeat back the characters sent to it.

6.0 <u>CONFIGURATION</u>

6.1 <u>Communication Port Menu</u>

The Communication Port Menu is displayed by connecting a PC configured at the Baud Rate set previously (Factory set at 9600).

Use the three position Program Switch to select either Modem 1 or Modem 2

Press the Alarm Accept button then type $ and then press the Esc key. The following menu should then appear.

Repeat the above procedure with the Program Switch set to the alternative position.

After exiting the menu return the Program Switch to the vertical position and press the Alarm Accept button.

Warwick Wireless Ltd			Warwick Wireless Ltd		
X7200-2 Radio Modem V1.0			Advanced Menu		
	Local	Remote		Local	Remote
			Return to Main Menu	N	N
Advanced Menu	N	N	Enable AT Instructions	N	N
Modem ID	00	01	TX Priority	N	N
Baud Rate	9600	9600	Display Journal	N	N
Parity	N	N	Packetise Data	N	N
Odd/Even	E	E	Number of Retries	05	05
RF Power	5	5	Packet Size	256	256
RF Channel	17	17	Logger Mode	N	N
Key Transmitter	N	N	Enable Remote Access	N	N
RSSI	N	N	Access Remote	N	N
Txmitter Speed	S	S	Enable Repeater Path	N	N
Address Mode	N	N	Set Repeater Path	00	00
TX Address	00	00			
RX Address	00	00	Local	M01 M02 M03 M04 M05 M06 M07 M08	
RF Sensitivity	50	50		M09 M10 M11 M12 M13 M14 M15 M16	
Restore Defaults	N	N			
Exit without Save	N	N	Remote	M01 M02 M03 M04 M05 M06 M07 M08	
Save & Exit	N	N		M09 M10 M11 M12 M13 M14 M15 M16	

The menu parameters are change by pressing any of the four Arrow Keys

<u>Main Menu</u>

Advanced Menu: Pressing the right Arrow Key will display Advanced Menu   .

Modem ID   A user defined ID number can be set. This is used in to set up a Repeater Chain, in the Remote Access Mode and with the ATA instruction.

Baud   Baud Rate 1.2K to 38.4K can be set. Factor set at 9600 Baud

Parity	Enable Parity
Odd/Even	Odd, Even or No Parity can be selected .
RF Channel	On of 17 RF Frequency can be selected.
Key Transmitter	The transmitter carrier can be switched on. A distant modem can them use the RSSI bar graph to check the signal strength.
RSSI	Displays a Bar Graph of Relative Signal Strength.
Txmitter Speed	Sets the transmission speed: S = 5Kbps, F= 10Kbps
Address Mode	Enables Modem Address. This can be used in with the ATT Instruction to pass data to specific modems.
TX Address	Set Transmitter Address.
RX Address	Set Receiver Address.
RF Sensitivity	Sets the Receiver Sensitivity
Restore Defaults	Set Factory Defaults.
Exit without Save	Return to Modem

Advanced Menu

Return to Main Menu	Display Main Menu by pressing the left Arrow Key
Enable AT Instructions	AT instruction are enabled. The modem will act on AT instruction present as the first set of characters in a data string.
TX Priority	Data will be transmitted when RF noise is present at the receiver.
Display Journal	Used for test diagnostics.
Packetise Data	Data is formed into packets with error detections and Acknowledgments. When the modem has received a full packet of data or at the end of a data string CTS is taken low to suspend data from the host.
Number of Retries	Sets number of retries
Packet Size	Sets the number of bytes in the packet size.
Logger Mode	Data will be stored in the modems memory until interrogated by a Distant Modem
Enable Remote Access	Allows distant Modem to change settings.
Access Remote Modem	Displays settings of remote
Engage Rpt Path	Enables the data repeater path entered below.
Set Repeater Path	Sets the Modem ID numbers of the required repeater path.

6.2 <u>Service Port Menue</u>

The Service Port Menu is displayed by connecting a PC configured at the Baud Rate set previously (Factory set at 9600) and pressing the $ Key followed by the Esc Key.

Note that the monitor and control unit will not operate when the menu is displayed.

<table>
<tr><td>

Warwick Wireless Ltd
X7200-2 Radio Modem V1.0

Advanced Menu	**N**
Status	**DRBS OK**
Baud Rate	**9600**
Parity	**N**
Odd/Even	**E**
RF Power (mW)	**N**
RF Channel	**Not Used**
Key Transmitter	**Not Used**
RSSI	**N**
Txmitter Speed	**S**
Address Mode	**Not Used**
TX Address	**Not Used**
RX Address	**Not Used**
Restore Defaults	**N**
Exit without Save	**N**
Save & Exit	**N**

</td><td>

Warwick Wireless Ltd
Advanced Menu

Return to Main Menu	**N**
Enable AT Instructions	**Not Used**
TX Priority	**Not Used**
Modem of Operation	**1+2**
Duty Cycle	**1**
Packetise Data	**Not Used**
Number of Retries	**Not Used**
Packet Size	**Not Used**
Enable Remote Access	**N**
Alarm Code	**00**
Enable Repeater Path	**Not Used**
Set Repeater Path	**Not Used**

</td></tr>
</table>

The menu parameters are change by pressing any of the four Arrow Keys

<u>Main Menu</u>

Advanced Menu: Pressing the right Arrow Key will display Advanced Menu   .

Modem ID   A user defined ID number can be set. This is used in the Repeater Chain and also in the Remote Access Mode.

Baud   Baud Rate 1.2K to 38.4K can be set. Factory set at 9600 Baud

Parity   Enable Parity

Odd/Even   Odd, Even or No Parity can be selected .

RF Power   Displays a Bar Graph of transmitter RF Power.

Key Transmitter Not used

RSSI   Displays a Bar Graph of Relative Signal Strength.

Txmitter Speed Not used

Address Mode	Not used
TX Address	Not used
RX Address	Not used
Restore Defaults	Set Factory Defaults.
Exit without Save	Return to Modem

Advanced Menu

Return to Main Menu	Display Main Menu by pressing the left Arrow Key	
Enable AT Instructions	Not used	
TX Priority	Not used	
Mode of Operation	Selects one of the following:	Modem 1 in continuous use, Modem 2 in continuous use Modem 1 and Modem 2 cycling on the set Duty Cycle
Duty Cycle	Selects the time in hours for each modem to be operational. (1 to 48 Hr)	
Packetise Data	Not used	
Number of Retries	Not used	
Enable Remote Access	Not used	
Alarm code	One of the following alarm codes are displayed:	

No fault	00
Bit error rate high 1	11
PSU fail 1	12
RF power fail 1	14
Bit error rate high 2	21
PSU fail 2	26
RF power fail 2	24
Dual RF power fail	75
Dual PSU	73

Engage Rpt Path	Not used.
Set Repeater Path	Not used

7.0 **RADIO TRANSMISSION**

7.1 Radio Frequency

Hex Channel	RF Channel	Tx RF Frequency	RxRF Frequency		SW5	SW4	SW3	SW2	SW1
02H	1	440.825 MHZ	445.825MHz	ON	ON	ON	ON	OFF	
04H	2	440.850 MHZ	445.850MHz	ON	ON	ON	OFF	ON	
06H	3	440.875 MHZ	445.875MHz	ON	ON	ON	OFF	OFF	
08H	4	440.900 MHZ	445.900MHz	ON	ON	OFF	ON	ON	
0AH	5	440.925 MHZ	445.925MHz	ON	ON	OFF	ON	OFF	
0CH	6	440.950 MHZ	445.950MHz	ON	ON	OFF	OFF	ON	
0EH	7	440.975 MHZ	445.975MHz	ON	ON	OFF	OFF	OFF	
10H	8	440.000 MHZ	446.000MHz	ON	OFF	ON	ON	ON	
12H	9	440.025 MHZ	446.025MHz	ON	OFF	ON	ON	OFF	
14H	10	440.050 MHZ	446.050MHz	ON	OFF	ON	OFF	ON	
16H	11	440.075 MHZ	446.075MHz	ON	OFF	ON	OFF	OFF	
18H	12	440.100 MHZ	446.100MHz	ON	OFF	OFF	ON	ON	
1AH	13	440.125 MHZ	446.125MHz	NOT USED FOR TELEMETRY					
1CH	14	440.150 MHZ	446.150MHz	ON	OFF	OFF	OFF	ON	
1EH	15	440.175 MHZ	446.175MHz	ON	OFF	OFF	OFF	OFF	
20H	16	440.200 MHZ	446.200MHz	NOT USED FOR TELEMETRY					
22H	17	440.225 MHZ	446.225MHz	OFF	ON	ON	ON	OFF	

7.2. Serial Port Channel Change

The RF channel can be changed by sending an ATX instruction to the serial port when the Address Mode has been selected

ATXn

where n is the Hex Channel Number shown in the table above.

If the menu letter is set to A, then the RF frequency would be set to 458.525MHz when the modem is switched on. This can be modified to say 458.650MHz by sending the following four hexadecimal characters to the serial port:

A	T	X	0C
41	54	58	0C

No more data must be sent to the port for 20mSec while the radio sets the new frequency. CTS will be brought low and then high to indicate the modem is busy.

7.3   Radio Propagation

When installing a X7220 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.

7.4   Antennas

Two antenna sockets are provided. For the best results each antenna should be mounted half a wavelength apart.

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 on both modems to see if they are set to the same RF frequency.

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 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.

8.4 Radio Path

The radio path can be tested by configuring the transmitting modem to the Repeater Mode.

Exit the configuration menu and transmit a character from the dumb terminal

This will be echoed back from the distant modem if there is a good transmission path.

8.5 <u>HELP LINE NUMBER   + 44 (0) 1455 233616</u>

9.0 <u>WARNING</u>

Warwick Wireless Limited reserve the right to change the design or specification of the X7220 Radio Modem without notification. In addition Warwick Wireless Limited take no responsibility for the installation and operation of the radio modem.

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