Introduction

This chapter contains periodic maintenance and performance test procedures for the WRH.

Periodic Maintenance

Periodic maintenance requirements are listed in Table 4-1, as well as the intervals at which the tasks should be performed.

Table 4-1 Recommeded Periodic Maintenance

Task	Interval	Action
Inspection of cables and connectors	12 months	Inspect power, RF and Fiber cables for signs of damage or wear (frayed insulation, cracks, punctures, etc.) Check connections to be sure they are tight.
	Optional	Perform cable sweeps.
Clean equipment	Clean as required depending on operating environment.	

Troubleshooting

The sections that follow contain a list of problems that could occur and a few suggested actions that can correct the problem. If the suggested corrective action does not eliminate the problem, please contact your Powerwave field representative or help line for further instruction.

Clearing Alarm Faults

Table 4-2 contains a list of those alarms which can be generated in the WRH. Critical, Error and Warning alarms can be sent automatically from a WRH to OM-Online and/or OMS, stored and then viewed. These can be viewed in the Alarm window.

Table 4-2 Alarm Troubleshooting

ID	Alarm Text	Alarm Unit	Alarm	Description
1	Power	PSU	Critical	PSU1 in the cabinet does not work properly. A sum signal from the PSU1 indicates that at least one voltage output has dropped. If no mains breakdown relay is used, then the alarm will also be sent at mains breakdown.
			Ceasing	PSU1 in the cabinet works properly again. Ceasing is sent if the PSU1 works at start-up, and there is a corresponding critical PSU1 alarm logged in the Events log. The WRH will restart when the power is back and this alarm will be sent.

		PSU	Critical	PSU2 in the cover does not work properly. A sum signal from the PSU2 indicates that at least one voltage output has dropped. If no mains breakdown relay is used, then the alarm will also be sent at mains breakdown.
			Ceasing	PSU2 in the cover works properly again. Ceasing is sent if the PSU2 works at start-up, and there is a corresponding critical PSU2 alarm logged in the Events Log. The WRH will restart when the power is back and this alarm will be sent.
		FON	Error	The FON 10 Volt charger voltage is below limit. Suggested remedy: Replace the FON
			Ceasing	The cause of the alarm has ceased.
2	WRH restart	CU	None	Power on start, or user ordered reboot. Logged to indicate a normal power up, or a restart ordered by the operator.
			Warning	Software error restart, 1st – 7th time. Restart 1st to 7th time during a 14 day period. The counter is reset every 14th day, counted from power up.
			Error	Software error restart 8th – 10th time. Restart 8th to 10th time during the 14 day period. At the 11th time, the SW bank will be blocked and not used anymore until a user ordered reset is performed, or power is switched off/on.
3	Mains breakdown	External	Critical	The mains power is gone. Used with an external relay indicating mains breakdown. The external relay should be connected to External Alarm 1 and the WRH configured to indicate this alarm. If no relay is used, a mains breakdown will be reported as a PSU fault.
			Ceasing	The mains power is back. Sent if there is a corresponding critical mains breakdown alarm logged in the Events Log. The WRH will restart when the power is back.
4	Alarm reset	CU	None	Alarm reset by the user. All alarms are reset. The cause of the alarm will be re-evaluated and reported, if still active.
5	Local bus error	CHA #, BSA#	Error	Error when communicating on the bus. The CU has no contact with the CHA or BSA PCBA, which is taken out of service.
6	Main bkd w backup	External	Error	Used to indicate that the mains is no longer available. WRH is powered by external battery backup unit. Suggested remedy: Check the mains power.
			Ceasing	The cause of the alarm has ceased.
7	Err in AD-converter		Warning	The analog-to-digital converter on the CU PCBA does not give reliable values.
8	New unit detected		None	Compared to the last power on, the CU has recognized at least one additional hardware unit.

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9	Inst. unit lost		Error	Compared to the last power on, the CU lacks at least one hardware unit.
10	EEPROM error	CU	Error	EEP read or write fail. Data cannot be written or read from the EEPROM on the CU PCBA. User parameters are stored in the EEPROM.
11	Log memory fault		Error	Log memory fault. Indicates that the log memory on the CU PCBA is faulty. The WRH will not work. Not available in all CU software versions.
12	High temperature	CU	Warning	The CU PCBA temperature is higher than 90°C.
			Ceasing	The CU PCBA temperature has fallen below 90°C.
13	REFO error		Error	AR: Significant REFO drift or error detected by CU. ALR: Low level from REFO detected by CU.
14	Ext refo error		Warning	Suggested remedy: Check the reference source and the cables.
15	CU battery fault	CU	Warning	CU RAM battery fault. The battery for the RAM on the CU PCBA has a voltage outside the normal 2.7 to 3.5 Volt. An alarm may be initiated at start-up if the WRH has been stored out of power for a long time. Suggested remedy: Ensure jumper P3 on the CU PCBA is mounted to charge the battery.
			Ceasing	The cause of the alarm has ceased.
16	SW load error	CU	Error	Software load error. An error has occurred during a software load process. The flash memory does not contain a proper software. Suggested remedy: Check the CU software using the OM-Online SW Manager. Do NOT restart the WRH.
17	Log cleared	CU	None	Log memory has been cleared. The check sum in the Events Log memory is faulty. The log is cleared. Can be caused of a bad RAM battery backup or low voltage to the RAM.
18	RTC restarted	CU	None	The time is changed by the operator (logged to keep track of changes made to the RTC).
			Warning	Time reset to 1994-01-01. The RTC was unable to keep track of the time and did a reset. Suggested remedy: Ensure jumper P3 on the CU PCBA is mounted to charge the battery.
19	RTC error		Error	RTC does not operate. The CU has detected an error in the RTC operation which makes the time unreliable. Suggested remedy: Replace the CU PCBA.
20	Door open alarm	External	Config	The door has been open 30 seconds without disabling the alarm.
			Ceasing	The door has been closed 30 seconds, or the alarm is disabled.

21	External alarm 1	External	Config	External alarm input EA1 active more than 1 second.
			Ceasing	External alarm input EA1 no longer active.
22	External alarm 2	External	Config	External alarm input EA2 active more than 1 second.
			Ceasing	External alarm input EA2 no longer active.
23	External alarm 3	External	Config	External alarm input EA3 active more than 1 second.
			Ceasing	External alarm input EA3 no longer active.
24	External alarm 4	External	Config	External alarm input EA4 active more than 1 second.
			Ceasing	External alarm input EA4 no longer active.
30	No modem found	Remote ctrl	None	No modem found, that is no answer is returned on a poll string to the modem.
33	No connection	Remote ctrl	None	No connection at callback. The WRH has tried to call as many times as stated in the alarm call settings. No connection was established.
			Warning	No connection at alarm call. The WRH has tried to call as many times as stated in the alarm call settings. No connection was established. This alarm does not generate a new attempt to report alarm by alarm call.
34	Login failed		None	Invalid WRH password.
35	Remote connection	Remote ctrl	None	Modem connection to OM-Online opened. Not logged on CU2. Login Registry gives the same function and more information about CU2.
36	Modem init failed	Remote ctrl	None	Initiation string to modem not OK. The initiation string sent to the modem is not OK. The string may contain commands not recognized by the modem. An alarm might be sent anyway. Suggested remedy: Check the modem using the OM-Online or OMS modem debugger.
37	Remote timeout	Remote ctrl	Warning	The time limit of 20 minutes is exceeded without extending the timer. The modem connection is terminated by the WRH.
38	PIN code failed	Remote ctrl	Warning	The PIN code sent to MS is incorrect. To unlock the MS/SIM card, the PUK code will probably be needed.
			Ceasing	The cause of the alarm has ceased.
39	No phone detected	Remote ctrl	Warning	When using a PC-card together with the MS, the alarm indicates contact with the PC-card, but MS is not present or turned off. Note: A Nokia MS does not power-up after power failure. Suggested remedy: Ensure the cellular phone is connected.

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			Ceasing	The cause of the alarm has ceased.
40	Battery fault	RCU, FON charger	Error	The backup battery on the RCU or the FON PCBA does not work properly. Suggested remedy: Check cables or replace battery.
			Ceasing	The cause of the alarm has ceased.
41	RF block-ing	Chan-nel #, UL/DL	Error	Constant carrier, PA off. Uplink carrier has been con-stantly above 27dBm more than 10 seconds.
			Ceasing	The cause of the alarm has not been detected for 10 seconds.
42	Antenna isolation	BSA #, Chan-nel #, UL/DL	Warning	Low antenna isolation. The antenna isolation is lower than the gain set. Gain is reduced by 10dB – 13dB below the oscillation point. Suggested remedy: Decrease gain or increase antenna isolation.
			Error	Low antenna isolation at lowest gain. The gain has been reduced as much as possible but the oscillation still remains. The amplifier is turned off. Suggested remedy: Decrease gain or increase antenna isolation.
			Ceasing	Normal operation again, that is no oscillation can be detected 13dB above the gain set.
44	Low sta-bility mar-gin	Chan-nel #, UL/DL	Warning	MRX has detected that antenna isolation is below the gain set. The gain is reduced 10– 13dB below oscilla-tion point. Suggested remedy: Decrease the gain or increase the antenna isolation.
			Ceasing	The cause of the alarm has ceased.
48	Battery backup fault	Exter-nal	Error	If a battery backup unit alarm is connected to external alarm 2, then the operator can configure the WRH to display this alarm when the battery backup unit indi-cates alarm.
			Ceasing	The cause of the alarm has ceased.
50	Fiberopti-cal error	FOT fiber optics	Config-urable	If a fiber unit alarm is connected to external alarm 3, then the operator can configure the WRH to display this alarm when the fiber optical unit indicates alarm.
			Ceasing	The cause of the alarm has ceased.
55	R2R Queue full	CU	None	R2R transmit queue is full, messages are lost. Sug-gested remedy: Check configuration and cables.
56	R2R Node lost	CU	None	An R2R node is lost. Suggested remedy: Check if node is still connected and operating.
			Warning	An R2R node is lost. Suggested remedy: Check if node is still connected and operating.
57	R2R HW Error	RIA	Error	R2R HW failure because the CU cannot read the MAC-ID of the RIA PCBA or any other HW error in the R2R logic. Suggested remedy: Replace the RIA PCBA.

		BSC R2R	Error	R2R HW failure because the CU cannot read the MAC-ID or any other HW error in the R2R logic. Suggested remedy: Replace the WRH.
		FON R2R FO	Error	R2R HW failure because the CU cannot read the MAC-ID or any other HW error in the R2Rlogic. Suggested remedy: Replace the FON PCBA.
60	Low traffic activity	RSSI Statistics	Warning	No signal strength on the channel was above the limit set longer than the time set in the configuration, indicating possible problems with service antenna. The area that the WRH is servicing may be covered by another stronger WRH or BTS. Suggested remedy: Ensure that the antennas and the cellular phone work in the area to be covered, and that WRH supported channels are used.
			Ceasing	The cause of the alarm has ceased.
61	No BCCH detected	RSSI Statistics	Warning	Signal strength on the BCCH channel was below the limit set longer than the time set in the configuration, indicating possible malfunction in the BTS or donor antennas. Suggested remedy: Ensure that the WRH is configured to the BCCH channel and that the signal from the BTS has enough strength.
			Ceasing	The cause of the alarm has ceased.
65	Gain reduction	Channel #, UL/DL	Warning	The gain is reduced below the limit. The gain is reduced because the output power has been above the MPC limit more than the preset limit allows.
			Ceasing	The cause of the alarm has ceased.
66	Over-power alarm	Channel #, UL/DL	Warning	Input power too high, output power above maximum limit.
			Ceasing	The cause of the alarm has ceased.
70	Bad table alarm	CU	Error	Requested table contains incorrect information (SW error).
71	Table not found	CU	Error	Requested table not found in the database (SW or calibration error).
72	Table database error	CU	Error	Table database not found (calibration error).
80	Antenna SWR alarm	Donor antenna, service antenna	Error	Too low antenna return loss, caused either by cables, connectors, or antenna problems. Suggested remedy: Check antenna and cables.
			Ceasing	The cause of the alarm has ceased.

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90	FON power alarm	FON RF	Error	A DC voltage on a FON PCBA is out of range. Suggested remedy: Replace the FON PCBA.
			Ceasing	The cause of the alarm has ceased.
91	FON TxStable alarm	FON RF	Error	Laser transmitter control loop voltage out of range. Suggested remedy: Replace the FON PCBA.
			Creasing	The cause of the alarm has ceased.
92	FON RxLevel alarm	FON	Warning	Received optical level is below any of the two limits (one for Warning and one for Error). Suggested remedy: Check optical cables.
			Error	Received optical level is below any of the two limits (one for Warning and one for Error). Suggested remedy: Check optical cables.
			Ceasing	The cause of the alarm has ceased.
93	FON SPI alarm	FON F2F	Error	The SPI bus connection to the RF modem does not work properly. Suggested remedy: Replace the FON PCBA.
97	No GPS signal	GPS	Warning	The GPS device cannot find any satellites. If active antenna is used, then the power supply for it can be faulty or wrongly configured. Suggested remedy: Check the GPS antenna and cables. If an active antenna is used, then the jumper switch should be set accordingly.
			Ceasing	The cause of the alarm has ceased.
98	No GPS device	GPS	Error	The GPS device cannot be detected although an adapter PCBA is mounted. Suggested remedy: Check the GPS PCBA.
			Ceasing	The cause of the alarm has ceased.
99	GPS Antenna power	GPS	Error	The power supply to the GPS antenna is faulty or there is a power supply to a passive antenna. Suggested remedy: Check the GPS antenna and cables. If an active antenna is used, then the jumper switch should be set accordingly.
			Ceasing	The cause of the alarm has ceased.
100	Startup error	CHA #	Error	A hardware error is detected on the PCBA at powering up.
101	Synthesizer fault	CHA #	Error	Unlocked synthesizer. The frequency synthesizer is unlocked and the transmission can take place on an unknown frequency.
102	Volt Reg. fault	CHA #	Error	DC voltage missing. A DC voltage to an analog part of the PCBA is missing.
103	PA fault	CHA #	Error	Low power amplifier gain. The PA PCBA has too low output power for the RSSI and gain set. Not available in all CU software versions.

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104	Param R/W error	CHA #	Error	EEPROM read or write failure on the PCBA.
105	High temperature	CHA #	Warning	The CHA PCBA temperature is higher than 85°C.
			Error	The CHA PCBA temperature is higher than 95°C.
			Ceasing	The CHA PCBA temperature has fallen below 70°C.
110	SW incompatibility	MRX	Error	The MRX and CU software is not compatible. Suggested remedy: Check the software versions and replace the incompatible one.
120	Startup error	BSA #	Error	A hardware error is detected on the BSA PCBA at powering up.
121	Synthesizer fault	BSA #	Error	Unlocked synthesizer. The frequency synthesizer is unlocked and the transmission can take place on an unknown frequency.
122	Volt Reg fault	BSA #	Error	A DC voltage to an analog part of the PCBA is missing.
123	PA fault	BSA #	Error	Low power amplifier gain. The PA PCBA has too low output power for the RSSI and gain set. Not available in all CU software versions.
124	Param R/W fault	BSA #	Error	EEPROM read or write failure on the BSA PCBA.
125	High temperature	BSA #	Warning	The BSA PCBA temperature is higher than 85°C.
			Error	The BSA PCBA temperature is higher than 95°C and the power is turned off.
			Ceasing	The temperature has fallen to below 70°C and the power is turned on again.
126	High PSU voltage	BSA #	Critical	The PA supply voltage is too high. Suggested remedy: Ensure that correct PSU is used.
127	Unsupported PA- type	BSA #	Error	The ID of the mounted PA PCBA is not expected by the BSA PCBA. Suggested remedy: Ensure that correct PA PCBA is used.
128	BA HW alarm	BA #	Error	A HW error on the BA PCBA has been detected.
			Ceasing	The BA PCBA is working properly after failure.
129	PA Undervoltage alarm	PA/BA #	Error	PA voltage level below alarm limit. Suggested remedy: Check the PSU.
			Ceasing	The cause of the alarm has ceased.
		BSC, UL/DL	Error	PA voltage level below alarm limit. Suggested remedy: Check the PSU.
			Ceasing	The cause of the alarm has ceased.

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245	Not In Allowed Area	CU	None	WRH is moved from the operating area and the RF HW is switched on or off.

Remarks:

The Door open alarm requires an optional door switch described in the P33 Alarm Port section in Chapter 5.

The Main power breakdown alarm requires a relay not included in the WRH (see Main Power Breakdown Relay in Chapter 3).

Channel #, UL/DL WRH channel number (1-4) at channel selective operation, uplink or down-link.

BSEL #, UL/DLWRH channel number at band selective operation, uplink or downlink.

BA #BA PCBA number for high power operation.

BSA #BSA PCBA number for band selective operation.

CHA #CHA PCBA number for channel selective operation.

CSA #CSA PCBA number for channel selective CDMA operation.

FONFON PCBA for fiber optic communication.

PAPA PCBA for channel selective or band selective operation.

Field Replaceable Units

The following units can be replaced in the field on-site by a qualified technician with experience maintaining RF equipment:

- FON
- PSU
- WRH

FON

To replace a FON PCBA, proceed as desribed in the Table 4-3.

Table 4-3 FON Replacement Procedure

Step	Action
1	Open WRH door and secure
2	Locate power connector on FON and remove connector from PCBA
3	Verify all cables on FON are labeled before disconnecting, then disconnect all cables
4	Remove screws securing FON PCBA to FOU and remove PCBA
5	Replace FON PCBA in reverse order and apply power
6	Connect PC to OM Online port, login to FON and verify configuration and IP address. **NOTE:** Make sure 'Fiberoptical' classmark in the FON Status window is checked, otherwise FON will not be operational.
7	Close WRH door and secure

PSU

To replace a PSU, proceed as desribed in the Table 4-4.

Table 4-4 PSU Replacement Procedure

Step	Action
1	Open WRH door and secure
2	Disconnect main power plug from PSU
3	Disconnect power cable bundle from PSU
4	Loosen screws securing PSU using a 5mm Allen key and remove. NOTE: screws are designed to not be removed completely from PSU.
5	Replace PSU in reverse order and apply power
6	Close WRH door and secure

WRH

To replace a WRH, proceed as desribed in the Table 4-5.

Table 4-5 WRH Replacement Procedure

Step	Action
1	Open WRH door and secure
2	Disconnect main power plug from PSU
3	Verify all cables connected to WRH are labeled before disconnecting, then disconnect all cables
4	Remove mounting screws from bottom legs of WRH and loosen mounting screws in top legs
5	Close and secure door
	WARNING: A fully loaded WRH can weigh 96lbs. Lifting of the WRH should be done by two people. Do not attempt to carry the WRH up a ladder.
6	Lift the WRH off the mount hinges
7	Replace WRH in reverse order
8	Connect PC to OM Online port and verify configuration. For Fiber Optic installations, verify IP address. **NOTE:** Make sure 'WRH On' classmark in the BSEL Status window is checked, otherwise the WRH will not be operational.
9	Close WRH door and secure

Return For Service Procedures

When returning products to Powerwave, the following procedures will ensure optimum response.

Obtaining an RMA

A Return Material Authorization (RMA) number must be obtained prior to returning equipment to the factory for service. Pease contact our Repair Department at 1-714-466-1000 to obtain this number, or FAX your request to 1-714-466-5800. Failure to obtain this RMA number may result in delays in receiving repair service.

Repackaging for Shipment

To ensure safe shipment of the unit, it is recommended that the original package designed for shipping the unit be reused. If it is not available, contact Powerwave's Customer Service Department for packing materials.

Options

This chapter describes the following optional accessories available for the Powerwave WRHs:

• Remote Control Unit (RCU) including the old RCU for GSM 900/1800/1900
• Repeater-to-Repeater Link (R2R) for WRH operations
• Traffic Statistics
• Battery Backup
• 7/16" DIN Connectors
• Operation and Maintenance System (OMS)

Remote Control Unit (RCU)

The RCU provides remote control of Powerwave WRHs. It contains an integrated mobile phone, modem and power supply backup. The RCU is installed in the bottom front of the cabinet, on top of the PSU as illustrated in Figure 4-1.
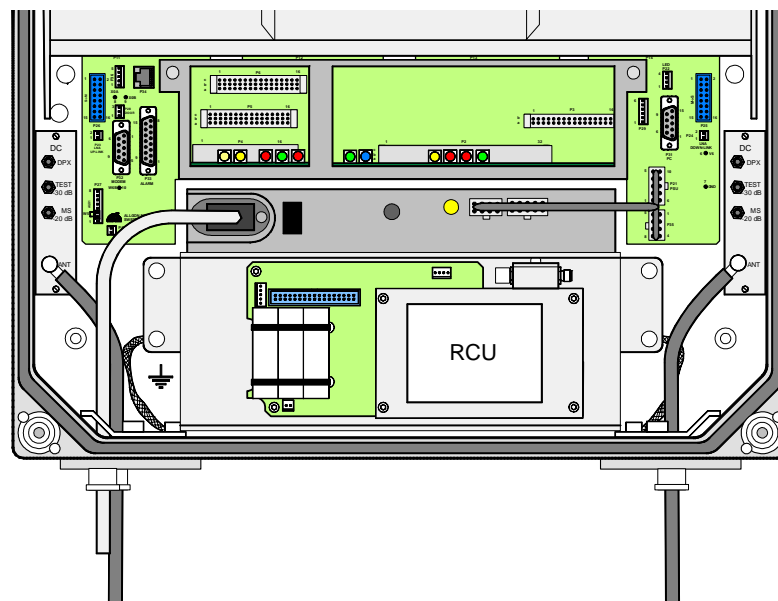

Figure 4-1 RCU in the WRH cabinet

The RCU is connected to P130 on either an RCI or FON. A jumper is required between pins 1 and 2 on the RCI if the P130 cable connector is disconnected. If a main power failure occurs, the unit has a battery with enough capacity for sending a number of alarms.

Previous RCU versions have been replaced by the current type. The WRHs are compatible with the previous version. Differences apply to the connections of the previous version where data was transferred between the WRH and the RCU via the P32 modem port on the DIA and was powered via the P27 auxiliary port on the DIA.

RCU for Radio Communication

The RCU antenna for a radio modem is connected to the BS antenna via the uplink DC, provided the RCU and the WRH operate in the same cell system. Otherwise, the modem must have a separate antenna. Data is transferred between the WRH and the RCU via the P130 modem port on the RCI or FON. The RCU is also powered via the same port and has a battery with enough capacity to send a number of alarms if a main power failure occurs.

RCU for Telephone Line Communication

The land line version uses a telephone line connected to a terminal block on the RCU. A free strain relief bushing at the bottom of the WRH is used for the external telephone line cable.

Repeater-to-Repeater Link (R2R)

This section briefly describes the R2R network. Node configuration for the R2R network is described in the OM-Online User's Manual.
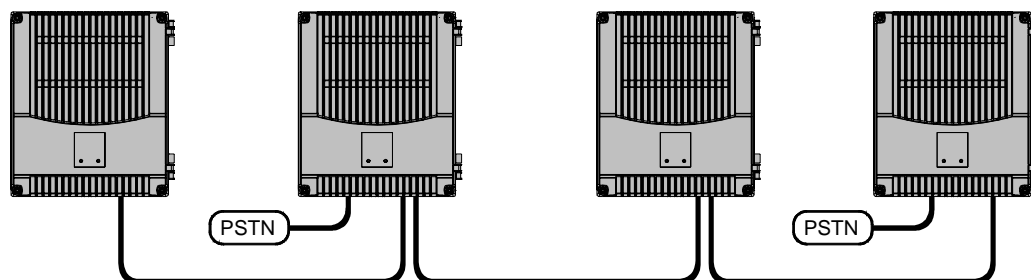

Figure 4-2 R2R network

The R2R network is a Powerwave specific WRH network that can handle up to 13 nodes, one or several of which being gateway WRHs for communication with OM-Online or OMS via modem. Powerwave WRHs produced after January 2005 have the R2R functionality. WRHs produced prior to this date can be upgraded with an R2R network kit provided the WRHs meet the following requirements:

Hardware

DIA PCBA K105/1 version R2A or higher

RIA PCBAThe RIA PCBA is required if the K105/1 DIA PCBA has a version lower than R3A.

CU PCBA K103/2 version R1A or higher

Software

CUS A102 02/1 version R3A or higher

Information for upgrades is located in the R2R, WRH to WRH Link Kit, Installation Guide. (part # VD202 91/EN).

Protocol

Sliding Window (SLW) is a Powerwave specific protocol developed for the R2R network. The SLW protocol and the IP protocol do not support each other and they cannot be mixed in any node.

Traffic Statistics

Traffic statistics are available for channel selective EDGE/GSM 900, GSM 1900 and DCS/PCN 1800 WRHs, provided the WRHs have the latest CU software version, the latest CU and CHA PCBAs, and an OMS is used to poll and view the statistics.

Battery Backup (BBU)

Battery backup is available with a Powerwave BBU battery backup. The BBU has an exterior similar to the WRH.

7/16" DIN Connectors

A 7/16" DIN connector kit is available for all the Powerwave WRHs. This kit includes 7/16" antenna connectors for UL and DL antennas mounted on two WRH cable inlet flanges and cables and connectors for connection to the DCs inside the WRH.

Operation and Maintenance System (OMS)

OMS is a Powerwave software package for WRH fleet management. Multiple modems can be used for several incoming and outgoing parallel activities, such as alarm reception, radio parameter configuration, software downloading and scheduling activities.