



## System Protocol

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### 1. Overview

This document describes the operation of various “System Protocol” commands which work with Raveon’s data radio modems. Most all versions of modems support these System Protocol features. The M7, M8, and M6 models support them, even when in the M21 and M22 Tech series enclosures.

The radio modem is capable of operating in two alternative modes, the “normal” data transmission/reception mode, and the COMMAND mode. By “normal” mode, this is the mode where two or more modems exchange data over-the-air. This is the mode the modem is in when it power on, and is normally used to send data over a radio channel.

Using Raveon’s WMX protocol, RPR and other commands can be executed even when not in the command mode.

When the modem is in the COMMAND mode (send **+++** to enter this mode), the user may:

1. **Issue RF Test commands useful for tuning and testing the modem.** Certain commands are provided to allow the user to key the transmitter and send various test patterns.
2. **Review the current configuration using various AT commands.** All MODEM settings may be reviewed using various AT commands. The **ATSH** or **SHOW** command will cause the modem to output an overview of all of its major parameters.
3. **Modify the current configuration using various AT commands.** The user may change ID codes, packet length, data rates, etc, using the AT commands when the MODEM is in the COMMAND mode.
4. **Read MODEM statistics using certain AT commands.** These statistics are read using the ATST command, and are used to monitor the operation of the modem. The signal-strength history of previous receptions may also be displayed using the **ATHS** command.
5. **Issues Remote Procedure Requests (RPRs).** While the modem is in the COMMAND mode, certain RPR commands allow the user or user application

to request other modems in the system (via an over-the-air request), to execute commands or provide information. Users may “Ping” other modems, request other modems statistics, history, RSSI, and configuration data. RPRs are issued in the “background”. Using Raveon’s WMX protocol, RPR commands and others can be executed even when not in the command mode.

Note, that if no valid commands are received within 60 seconds, the modem will exit the COMMAND mode, and automatically return to the “normal” mode of operation. This timeout period is configurable via the **ATCT** xxxx parameter, with xxxx ranging from 100 to 60000 msec.

The following 5 sections describe the features of the COMMAND mode.

## **2. Radio Test Related Commands**

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### **2.1. RF Test Commands**

**These command are for bench testing only. Not for use in the field.**

The following commands may be entered when the modem is in the command mode. They allow a technician to measure various RF parameters such as power output, deviation, and frequency. The modem must be in the COMMAND mode to execute these commands. (Enter +++ at the keyboard to put unit into COMMAND mode.)

<b>ATTD x</b>	Various transmit test routines. 0 = Go back to normal mode. Stops the test. 1 = Random data transmit. 2 = Hop up/down one channel 3 = Force PLL to fast lock mode 4 = Transmit all 0s 5 = Transmit all 1s 6 = Enable the test points on the PCB. 7 = Transmit CW on center of channel 8 = Transmit preamble (101010 pattern)
<b>SHOW</b>	Display an overview of the configuration.
<b>ATST</b>	Display statistics of how the modem is working.
<b>AT\$5</b>	Display RSSI DAC reading. A number will scroll the reading until another character comes in the serial port. The number displayed is the reading of the DAC level of the RSSI.
<b>ATRQ</b>	Display the current RF level of any signal on the receiver’s frequency. The value returned is in dBm.

## **2.2. Packet Counter**

The packet counter mode will output packet count statistics once per minute. It will output the number of packets received in the last minute as well as the running total.

**ATPE**                Begin counting and displaying the packet counters every minute

**ATPE 1**             Reset the packet counters back to zero

**ATPE 2**             Stop counting and displaying packet counters

Upon power up, the packet counter feature is always disabled.

## **3. Modem Configuration Commands**

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See the Quick Start and *Technical Manual* for information regarding the commands that a particular mode can execute.

## **4. Remote Procedure Request (RPR)**

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### **4.1. RPR Overview**

Modems with firmware D3 and above have over-the-air diagnostics capabilities. When the modem is in the COMMAND mode, some commands may be issued that are intended for use on other modems in the system. The modem connected to the command user's device will send the command to the intended modem over-the-air on the currently selected channel.

The remote modem will process the requested command (whether or not it is in its COMMAND mode) and then transmit its response back to the requesting modem. Depending upon baud-rate, the command, and the system configuration, the response may take some time to execute. The requesting modem will time-out after 5 seconds if a response does not come back.

RPR commands are generally used to interrogate remote modems, and find out their internal statistics, operation parameters, and how they were configured.

If a <CR> is entered into the requesting modem while it is waiting for a remote response, it will then abort the request and not send the time-out message if the remote request does not come back. Even when a <CR> is entered, if the response is received from a remote modem, the modem that initiated the RPR will output the response.

To disable a radio modem from processing Remote Procedure Requests, set the **ATRV** command to 1 to disable the execution of RPRs. **ATRV 1** will disable RPR execution. The modem can still request RPRs from other modems. **ATRV 0** enables RPR execution, and is the default setting in M series products.

### **4.2. Remote Procedure Request (RPR) Protocol**

For one modem to request a remote modem to execute a command, the RPR requesting modem must be in the COMMAND mode or using serial WMX

protocol. A modem is put into the command mode using the **+++** sequence per the *Data Radio Modem's Technical Manual*. Section 5.3 describes the various RPR commands that are available.

To aid the system in detecting the reception of an RPR response message as opposed to a normal data transmission, the standard ASCII Start of Text and End of Text characters are used. The first character is a Start of Text character (ASCII 02). This is followed by the phrase "<STATUS>". Each line in the status transmission is terminated with an ASCII carriage return (0D) and line feed (0A).

When a Radio Modem receives an RPR response message back from the remote modem that executed the RPR, it will output the message in the following general format:

<b>&lt;STX&gt;</b>	Start of text ASCII Char. (03).
<b>&lt;RPR&gt;</b>	The Phrase "<REPLY>" in ASCII characters, followed by an ASCII <CR> and <LF>.
<b>FROM=1234</b>	The Phrase "FROM=" followed by the 4-digit ID of the modem that sent the RPR response, and then a <CR> <LF> sequence.
<b>RSSI=-76</b>	The RPR response text. This may be one parameter, a list of parameters, or other information as dependent upon the RPR command issued. See section 5.3 for a description of the RPR responses.
<b>&lt;/RPR&gt;</b>	The Phrase "</REPLY>" in ASCII characters, followed by an ASCII <CR> and <LF>. This phrase may be used to determine the end of the RPR message.

All RPR responses end with a <CR><LF> sequence. For example, the line <REPLY> is actually sent as: **< R E P L Y >** <CR> <LF> <EOT>

### 4.3. Remote Procedure Request Commands

The following RPR commands are supported. All RPR commands, except the PING command must be preceded with the text **RPR** (space)..

#### PING

**PING xxxx** Send a "PING" to modem xxxx where xxxx is 0000 thru FFFE. A PING is a short request transmitted over the air to another modem that tells the remote modem to answer back with a short status packet.

*Example: PINGs remote modem 1234.*

PING 1234	<i>User enters request to PING station 1234</i>
<REPLY> FROM=1234 RSSI=-76 </REPLY>	<i>Response back from remote modem 1234 indicates that the RSSI of this modem, as received by modem 1234 was -76dBm.</i>

A modem will respond to a PING request if its ID exactly matches the ID specified in the ping. The Address Mask in the modem pinged is not used to

determine if it should respond to a PING. As long as all modems in a system each have a unique ID, then any individual modem may be PINGed.

### RPR ATVR

**RPR xxxx ATVR** Request the software version of remote modem xxxx where xxxx is 0000 thru FFFE.

*Example: Request the software version from modem 1234.*

RPR 1234 ATVR	User enters request to station 1234
<RPR> FROM=1234 ATVR=D2 </RPR>	Response back from remote modem 1234 indicates that the modem's firmware is verion "D2".

### RPR ATVB

**RPR xxxx ATVB** Request the DC input voltage of remote modem xxxx where xxxx is 0000 thru FFFE.

*Example: Request the DC input voltage from modem 1234.*

RPR 1234 ATVB	User enters request to station 1234
<RPR> FROM=1234 ATVB=12520 </RPR>	Response back from remote modem 1234 indicates that the modem's dc input voltage is 12525mV (12.520 volts)

### RPR ATBD

**RPR xxxx ATBD** Request the serial port baud rate of remote modem xxxx where xxxx is 0000 thru FFFE.

*Example: Request the serial port baud rate from modem 1234.*

RPR 1234 ATBD	User enters request to station 1234
<RPR> FROM=1234 ATBD=3 </RPR>	Response back from remote modem 1234 indicates that the modem's baud rate setting is 3 (9600 bps)

### RPR ATAT, RPR ATBT, and RPR ATCT

**RPR xxxx ATAT** Request the serial port time-out parameters of remote modem xxxx where xxxx is 0000 thru FFFE.

*Example: Request the serial port timeout from modem 1234.*

RPR 1234 ATAT	User enters request to station 1234
<RPR> FROM=1234 ATAT=500 </RPR>	Response back from remote modem 1234 indicates that the modem's AT before-time period is set to 500mS.

### **RPR ATNB, and RPR ATNS**

**RPR xxxx ATNB** Request the serial port parameters.

*Example: Request the number of stop bits*

RPR 1234 ATNS	User enters request to station 1234
<RPR> FROM=1234 ATNS=1 </RPR>	Response back from remote modem 1234 indicates that the modem's serial port uses one stop bit.

## **4.4. RPR Error Responses**

If an invalid RPR request is transmitted, the modem will output an error message that can be used to determine the source of the error.

### **Wrong or invalid ID**

If a modem sends and RPR request to a remote modem with an ID that does not exist in the network, is out of range, turned off, or has the RPR feature disabled, the modem will respond by outputting a TIMEOUT message from its serial port after about 5 seconds of not receiving a response from the remote modem.

For Example:

RPR 1234 ATVR	User enters request to modem with ID 1234 for its software version. If a modem with 1234 does not exist in the system.
TIMEOUT<CR><LF>	Response back from remote modem 1234 indicates that the modem's serial port uses one stop bit. CR = ASCII 10, LF=ASCII 13.

### **Invalid Request**

If a modem sends and RPR request to a remote modem, and it is an invalid request, the remote modem will response with an RPR\_ERROR\_1 message. This is typically due to a "typo", an invalid RPR command, or an invalid parameter.

It is formatted in the same way as a valid RPR message, except the parameter is the phrase RPR\_ERROR\_1.

For Example:

<code>RPR 1234 ATXX</code>	<i>User enters an invalid request to remote Modem with ID 1234. (ATXX is not a valid command)</i>
<code>&lt;RPR&gt; FROM=1234 RPR_ERROR_1 &lt;/RPR&gt;</code>	<i>Response back from remote modem 1234 indicates that it received the request, and could not process it.</i>

### **Unable to Execute the Request**

If a modem sends an RPR request to a remote modem, and the remote modem understood the command but could not execute it, the remote modem will response with an RPR\_ERROR\_2 message. This is typically due to an invalid parameter in the command.

The response is formatted in the same way as a valid RPR message, except the parameter is the phrase RPR\_ERROR\_2.

For Example:

<code>RPR 1234 ATNS 3</code>	<i>User enters request to remote Modem with ID 1234 to change the number of stop bits to 3 (1 or 2 are the only valid parameters).</i>
<code>&lt;RPR&gt; FROM=1234 RPR_ERROR_2 &lt;/RPR&gt;</code>	<i>Response back from remote modem 1234 indicates that it received the request, and could not process it.</i>

## **5. Statistics Provisions**

### **5.1. Overview of Diagnostics**

Internal to the radio modem, is a powerful 32-bit microprocessor. Along with handing all aspects of radio modulation and demodulation, the microprocessor also maintains an extensive array of diagnostic information.

This section details the diagnostic information available, and describes how to use the information to optimize or troubleshoot a wireless network.

### **5.2. Reading the Diagnostic Information**

Radio Modem diagnostic information is read using AT commands, while the unit is in the Command Mode. Refer to the section “User Serial Port Commands” to learn how to put the modem into the Command Mode.

To see a general overview of how the modem has been operating, use the **ATST** command (status request command), without any parameter. The radio modem

will respond with a list of certain operation statistics that it maintains. All statistics start counting at 0 when the unit is first powered on. The **ATST 9** command can be used to reset all statistics back to 0.

Other operation and configuration statistics are available using the **ATST x** command, with a parameter to specify the desired statistic. The following table describes the various statistics available.

### 5.3. **Status and Statistics Command**

AT Command	Command Description	Response
<b>ATST</b>	<b>General Communication Statistics</b> – This command will cause the modem to output a table of various operational statistics.	Statistics overview screen
<b>ATST9</b>	<b>Reset Statistic Counters</b> – All statistic counters will be reset to 0.	OK
<b>ATST1</b>	<b>GPS related statistics</b> – Returns various statistics related to the operation of the –GX version of the product.	Low-level statistics screen
<b>ATST2</b>	<b>Low-level internal statistics</b> – Returns various low-level statistics. These are subject to change in various firmware revisions.	Low-level statistics screen
<b>ATST3</b>	<b>Compile date and time</b> – Returns the data and the time that the firmware was compiled.	Date and time
<b>ATST4</b>	<b>Run Time</b> – Returns the amount of time that the modem has been powered up and running.	Time running

See the radio modem's Technical Manual for detailed information on the Status and Statistics responses.

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