SIERRA WIRELESS
HEART OF THE WIRELESS MACHINE™

MP215 Modem

Installation Configuration and User's Guide

Revision 1.0
Part Number: 2110036
June 1998

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Because of the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the Sierra Wireless modem are used in a normal manner with a well-constructed network, the Sierra Wireless modem should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Sierra Wireless, Inc., accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Sierra Wireless modem, or for failure of the Sierra Wireless modem to transmit or receive such data.

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Consult our webpage for up-to-date product descriptions, documentation, application notes, firmware upgrades, troubleshooting tips, and press releases:

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1. Overview

1.1. CS-CDPD

The MP215 is a radio modem that supports CS-CDPD operation. CS-CDPD is a specification for doing CDPD communications over a circuit-switched cellular AMPS connection, and is described in detail in the CDPD Implementor Guideline Part 1024 published by the CDPD Forum (now the Wireless Data Forum). Like CDPD, CS-CDPD is a specialized service that must be available from a cellular carrier in order for modem operation to be possible.

Basic CS-CDPD operation works as follows: the MP215 dials a pre-configured 1-800 number and establishes a circuit-switched cellular connection to a carrier's CS-CDPD modem bank. A connection is then established with the carrier's CS-CDPD router (a CMDIS), and the modem is registered on the CDPD network. Regular IP-based data communication is now possible. Whether the modem is connected via CDPD or CS-CDPD is transparent to the application at either end of the communication link. After data transfer is complete, the cellular connection is dropped, but the MP215 remains registered with the CDPD network. In the event that data needs to be routed to or from the modem, either the network or the MP215 initiates a cellular call and the data link is re-established.

1.2. MP215 Operating Modes

The MP215 can be configured to operate as a CS-CDPD-only modem, a CDPD-only modem, or an Autoswitching-modem that detects which service is available and automatically switches from one service to the other, with preference for CDPD. Autoswitching requires that various timers in the MP215 be configured and reliable since operation of the modem is dependent on them. These timers are pre-configured in the factory for optimum performance. Input from the cellular carrier, system integrator, and Sierra Wireless is recommended if changes to these timers are desired.

1.3. MP215 Host Interface

The MP215 is not completely backwards compatible with existing Sierra Wireless CDPD modems, as the nature of CS-CDPD operation makes this unfeasible. The major differences relate to behavior in response to AT-commands. Section 9 of this document describes how the host interface varies from the Sierra Wireless standard.

1.4. MP215 Wireless Expert and Watcher

Wireless Expert is a utility designed by Sierra Wireless that provides a simple and easy way to configure the MP215, as well as Windows95 or NT-based computers that are to be connected to it. It automatically installs definition files, creates registry files, and configures stacks. The modem can also be manually configured via AT-commands. Watcher is a Sierra Wireless Utility that permits simple operation and observation of the MP215 via a user-friendly GUI.

2. MP215 Installation

Instructions are provided here for installing the modem in a vehicle, connecting an antenna, connecting the vehicle power supply to the modem, and connecting the serial cable.

2.1. Installing the Modem in a Vehicle

1. Choose a convenient mounting location in the vehicle.
2. Mark the location of the mounting holes as appropriate for your installation.
3. Drill the holes.
4. Mount the unit using appropriate sized screws.

2.2. Installing the Cellular Antenna

Follow these guidelines when choosing and connecting a cellular antenna:

- Use an antenna suitable for the cellular band of frequencies (824-896MHz) with TNC connector and matched for 50-ohm impedance.
- If necessary, use a 50-ohm antenna cable for connecting the modem to the antenna.
- Locate the antenna to allow as free a radiation pattern as practical.
- Connect the antenna using a TNC connector.

2.3. Connecting the Serial Cable

The MP215 has a standard 9-pin D-type modem (DCE) pinout and can be used with readily available modem cables. The connections are detailed in Section 3.1.

2.4. Connecting the Power Supply

Use the fused power harness that is provided as part of your installation kit to connect to a 12V negative ground vehicle. The connection details are given in Section 3.2.

2.5. Warranty Registration

Product registration is important because it ensures that you will stay up to date on product upgrades and accessories and receive warranty service and technical support. Please be sure to register your modem by either sending in the Warranty card, using the Warranty registration feature of Watcher, or via our webpage.

3. External Interfaces

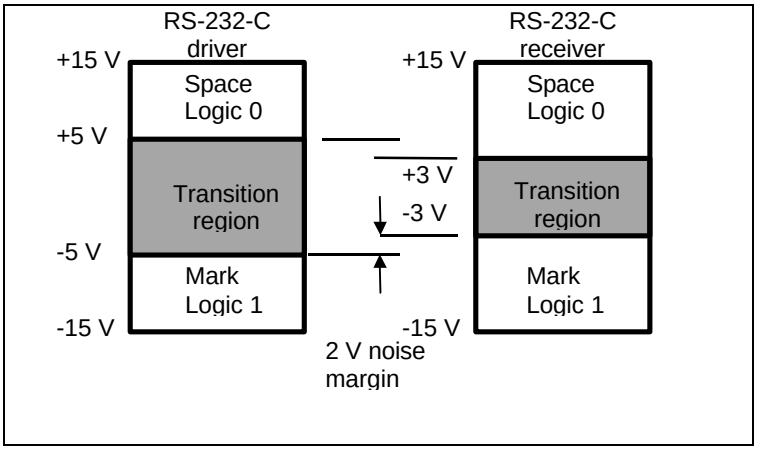
This section describes the Serial Host Interface, the Power Supply Interface, Modem Status Indicator, Speaker Interface and RF Antenna Connector.

Figure 3-1 MP215 (front view)

3.1. Host interface

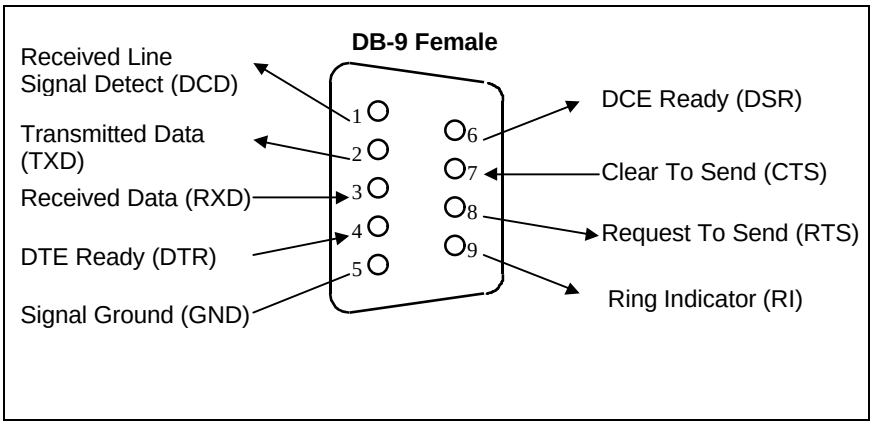
The MP215 connects to a host through a DB9 (female) connector using the RS-232-C serial interface standard with a maximum signaling rate of 57.6 kbps. The RS-232-C specification voltages for receiver and driver are shown in Figure 3-2.

Figure 3-2 RS-232-C Voltage Specifications



The MP215 is configured as a DCE (Data Communications Equipment) and the DB-9 connector uses the standard pin designations as shown in Figure 3.3.

Figure 3-3 Modem DB9 Pin Designation

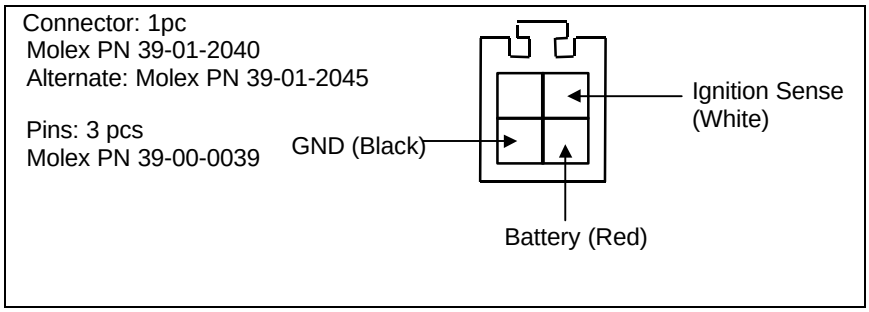


3.2. Power Supply Interface and On/Off Control

The power supply connector for the MP215 is a Molex Connector P/N: 39-29-1048. The pin designation for the mating connector (Molex P/N: 39-01-2040 or 39-01-2045, pins Molex P/N: 39-00-0039) is given in Figure 3-3.

NOTE	The naming convention and signal flow is with respect to the modem not the PC (host) side. This means that TXD on the modem side is RXD on the Host Side and vice versa. The directions of the arrows indicate signal flow into the pin or signal flow out of the pin. For example, the pin labeled TXD has the signal flowing out of the pin and the arrow pointing away from the pin.

Figure 3-4 Power Connector Pin-out (cable side)

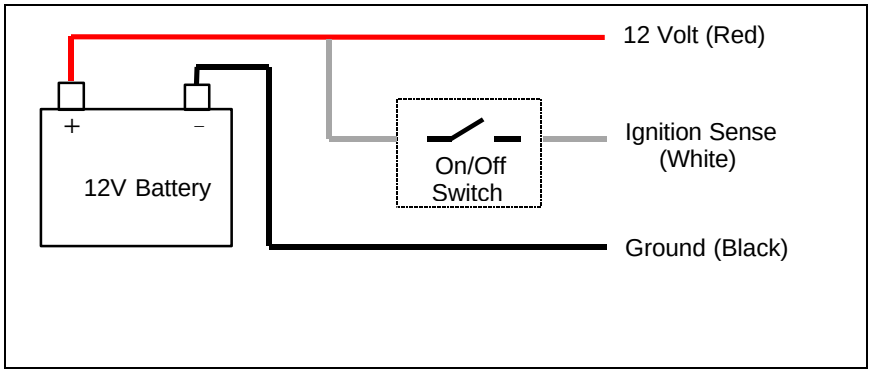


The MP215's power on/off is controlled by the ignition sense line. When this line is pulled high (5V - 16 V) the modem will power on. When this line is pulled low (less than 2 volts) the modem will power off. The modem shuts down (under software control) when the ignition sense line is pulled low. The modem will gracefully shut down by de-registering. This avoids potential data loss. This switch-off process typically takes several seconds to be completed.

The recommended power supply connection is shown in Figure 3-5: The *12 volt* line should be directly connected to the positive (+) terminal of the battery and the *Ground* line directly to the negative terminal. The *Ignition Sense* line can be connected to either the electronic ignition switch of the vehicle or an external toggle switch. The current draw of the *ignition sense* line is less than 1 mA

⚠ CAUTION	Failure to implement a controlled switch off as indicated in Figure 3-5 (or similar) can cause problems, such as NEI reset when the 12-volt power is removed.

Figure 3-5 Power Supply Connection Diagram



CAUTION	The MP215 is designed for negative ground vehicles and will not function in a positive ground vehicle.

3.3. Modem Status Indicator

The front panel of the MP215 has a single green LED indicator. The LED has several functions as outlined in Table 3-1 LED Indications. The LED is flashed when the modem's receiver has picked up a channel in either AMPS mode or CDPD mode. *Note that it does not indicate that the modem is registered on the network, just that a valid channel has been acquired.*

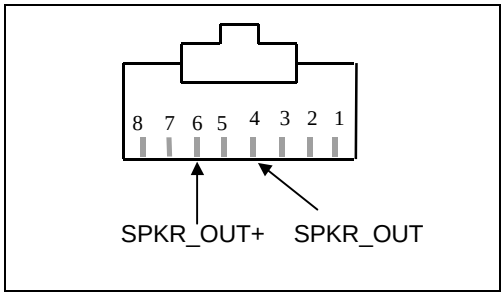
Table 3-1 LED Indications

LED Action	Meaning
Off	Modem power off
On solid	Modem power on
On flashing	Modem acquired a channel (CDPD or AMPS)

3.4. Speaker

The MP215 comes equipped with a speaker connection. The speaker output is particularly useful for Circuit Switched Cellular operation (AMPS) to provide audible connectivity information such as network messages or dial tones and can be an effective debug tool for connectivity problems. The speaker output provides 1/10 watt into an 8-ohm load

Figure 3-6 MP215 Revision 3 audio jack pin configuration - looking into MP215 RJ45



NOTE	Any unused pins should be left unconnected.

Mating Connector Suggestions

A suitable mating connector is: AMP P/N 5-554739-3. This connector requires a crimping tool to mate with a flat 8-way cable.

Alternatively, several suppliers provide a pre-fabricated cable and plugs, such as the Digi-Key IDC modular cable assemblies range.

Speaker Suggestions

The speaker output is sufficient to drive a small magnetic transducer such as the *DB Products Ltd. MDX01C Magnetic Transducer*. We recommend that you connect the speaker output to a miniature active speaker such as the *Archer Mini Amplifier Speaker, Model # 277-1008C* to provide increased audio levels for use in noisy environments.

3.5. I/O Connector

The 8-pin I/0 connector (located on the right hand side of the MP215's front plate) is not used by the MP215.

3.6. RF Antenna Connector

The antenna connector on the MP215 is a standard TNC female, 50 ohm connector and should be used with a 50 ohm Cellular antenna with a bandwidth from 824 MHz - 894 MHz and 0 dB gain. These are available from multiple suppliers in various configurations (e.g. magnetic mount, hard-mount, direct connection to the modem).

If the cable loss between the modem and antenna is greater then 2 dB, it is acceptable to use a 3 dB gain antenna as the ERP will be within the 36 dBm +2/-4 dB limit. 2dB loss results when using approximately 15 feet or RG-58 co-axial cable.

The antenna should be mounted well away from any objects that may 'shield' it from receiving signals. A roof top location is best. The antenna location may be adjusted based on experimentation, using the RSSI reading displayed by the Watcher application.

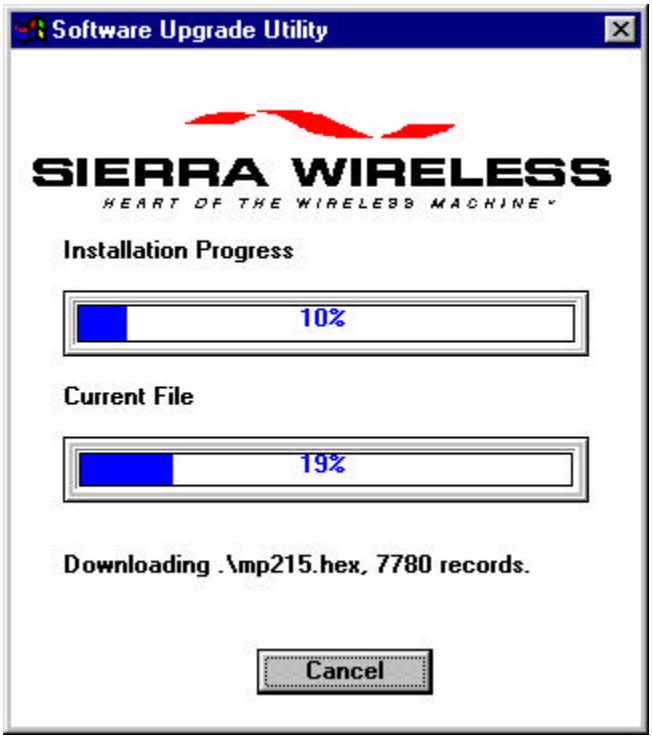
4. Installing MP215 Firmware and Utility Software

The MP215 will be shipped with diskettes or CD-ROMs containing MP215 firmware, as well as the Wireless Expert and Watcher utilities. The latest firmware release will be pre-loaded in the modem.

As new releases of firmware become available, they can be downloaded from the Sierra Wireless website (www.sierrawireless.com), or can be shipped in diskette form on request.

4.1. Installing MP215 Firmware

To reload or install new MP215 firmware, connect your PC to the MP215's serial port using a standard serial cable, and provide power to the MP215. Load the MP215 firmware diskette or CD-ROM in your PC and run the setup.exe program. The upgrade utility will request you power cycle the modem, but is otherwise fully automated. The on-going progress of the installation will indicated in a window similar to the one below.



4.2. Installing Wireless Expert and Watcher Software

To install Wireless Expert/Watcher software on your PC, load Disk 1 or the CD-ROM in your PC and run the setup.exe program. The install process is fully automated.

5. Configuring the MP215 With Wireless Expert

For Windows and NT users, basic MP215 configuration can be done via the Wireless Expert utility. (Note that Wireless Expert does *not* permit configuration of auto-switching operational timers, or all S-registers.) Configuration of all other parameters must be done via AT-commands and requires the use of a terminal emulation program such as Hyperterm. Provisioning via AT-commands is detailed in Section 4.

5.1. Setup

1. Prepare the MP215
    - Ensure a cellular antenna is connected to the MP215.
    - Connect your PC to the MP215 using a serial cable connected to the PM215's serial port.
    - Ensure power is applied to the MP215.

2. Start Wireless Expert
    - Normally Wireless Expert is found in the Watcher folder of the Programs folder in the Start menu.

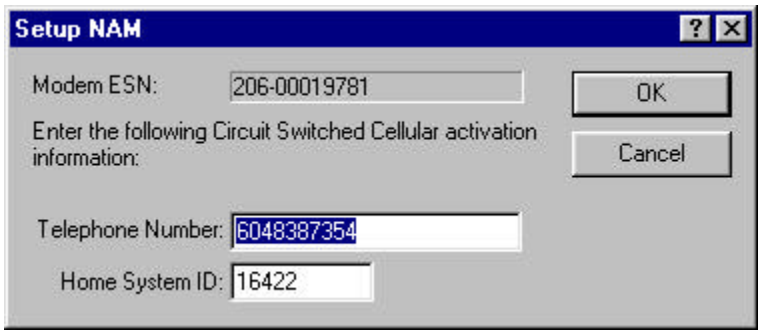
3. Select MP215 from the Modem List screen.

5.2. AMPS Provisioning

The Modem is configured for AMPS operation, including NAM (cellular number) and CS-CDPD Dial Code (1-800 number), from the following screen:

Programming the NAM (the MP215's cellular number)

- Click on 'Setup' beside the NAM window. The following screen will appear:



- Enter the phone number and home system ID, as provided by your cellular carrier, and click OK.

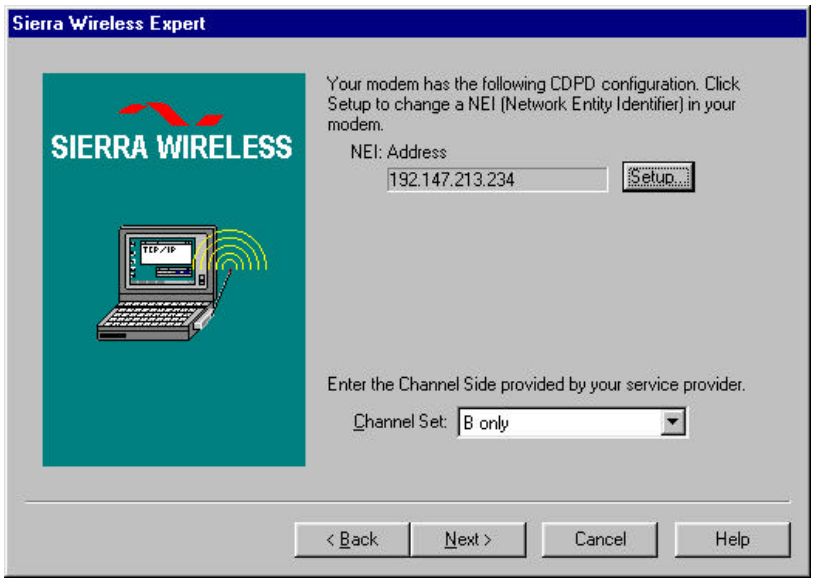
5.3. Programming the Dial Code

Click on setup beside the Dial Code window. A window similar to the one above will appear. Enter in the 1800 number and system ID as provided by your CS-CDPD service provider, and click OK.

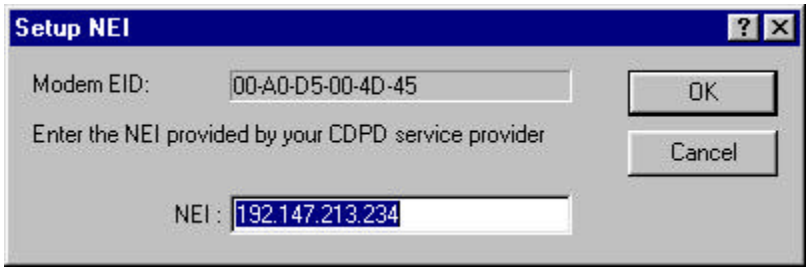
5.4. CDPD provisioning

NEI and Side Preference

The MP215's NEI (IP address) and Channel Side preference are configured via the following Wireless Expert screen:



To provision the NEI, click on the Setup button, and the following window shown below will appear. Enter the IP address, as provided by your CDPD service provider, and click OK.



To provision the side preference, determine from your carrier which channel side preference is required and use the drop down menu to select the correct preference.

DNS Configuration

Wireless Expert permits you to automatically program the DNS address into the Windows Dial-up Networking configuration via the screen shown below. Simply click on the Change button and enter the IP address of your CDPD service provider's DNS into the window that appears.

6. Configuring the MP215 via AT Commands

6.1. Configuring the MP215 for CSC mode

To configure the MP215 for AMPS operation, the modem must first be in CS-CDPD mode:

AT+WS181=1	Places the MP215 into CS-CDPD mode

Programming the NAM

It is possible to program up to two NAM's on the MP215.

AT+WVESN (optional)	Displays the ESN (to confirm you're programming the right modem)
AT+WS178=<n>	Selects NAM to be programmed
<n>=1 or 2	
AT+WPNAM? (optional)	Displays current NAM
AT+WPNAM=<number>,<homesysid>	Programs the NAM

Programming the CS-CDPD Modem Bank Dial Code

AT+WPCSDC=<number>	programs the modem bank dial code

6.2. CDPD Provisioning

To configure the MP215 for CDPD operation, the modem must first be put into CDPD mode:

AT+WS181=0	Places modem in CDPD mode

Programming the NEI

Note the MP215 will support only 1 NEI

AT+WPEID (optional)	Displays modem's EID (to confirm you're programming the right modem)

AT+WPCURNEI (optional)	Check the current NEI
AT+WPNEI=<NEI>	Programs the NEI

Programming the Channel Side Preference

AT+WS174=n — Programs CDPD side preference,

Where values for n are:

1: A-side preferred

2: B-side preferred

3: A-side only

4: B-side only

Programming the SPINI (optional)

AT+WPSPNI=<SPNI ID>	Programs the SPNI. Up to 10 different SPNI's permitted.
AT+WPSPNI? (optional)	Confirm value of SPNI

6.3. Autoswitch Provisioning

This section describes how to configure a group of timers that are configurable via S registers. These timers have significant impact on the behavior of modem and should not be changed from default settings without consultation with your CS-CDPD service provider and Sierra Wireless.

Maxidle Timer

The Maxidle Timer defines the maximum call inactivity time. If a cellular call is established and no data is transferred for this interval, the call is terminated.

Syntax:	AT+WS192=<maxidle>
Mode:	CS CDPD
Default:	45 seconds
Minimum value:	15 seconds

Autocheck Timer

The Autocheck Timer defines how often to check whether CDPD service is available. The Autocheck Timer is active only while in idle, or suspended in CS CDPD mode, i.e., no call is established.

	Syntax:	AT+WS250=<autocheck>
	Mode:	AUTO
	Default:	300 seconds (5 min)
Max value:	3600 seconds (1 hour)	

Maxcdpdscan Timer

The Maxcdpdscan Timer defines how long to allow the modem to search for CDPD channels during an AUTO mode check. If CDPD service is not found within this time interval, the driver switches back to CS CDPD mode.

Syntax:	AT+WS251=<maxcdpdscan>
Mode:	AUTO
Default:	90 seconds
Max value:	600 seconds (10 minutes)

Maxcdpdlost Timer

The Maxcdpdlost Timer defines the tolerance to temporary losses of CDPD coverage. If CDPD service is lost continuously for this amount of time, the driver automatically switches to CS CDPD mode.

Syntax:	AT+WS252=<maxcdpdlost>
Mode:	AUTO
Default:	90 seconds
Max value:	3600 seconds (1 hour)

CDPDPresence Timer

The CDPDPresence timer defines the period for which CDPD must be present to prevent a switch from CDPD to CS-CDPD.

Syntax:	AT+WS254=<cdpdPresence>
Mode:	AUTO
Default:	15 seconds
Max value:	60 seconds

7. Operating the MP215 via Watcher

The Watcher utility will permit the user to select the operational mode of the MP215. Note that unlike versions of Watcher for other Sierra Wireless modems, no further configuration of the MP215 can be performed. However Watcher also permits the user to monitor modem status, RF channel and signal strength (note signal strength is not available in CS-CDPD mode).

7.1. MP215 Operating Modes

The MP215 can be run in one of four modes.

1) CDPD Mode

This mode provides regular CDPD service.

2) CS-CDPD

This mode provides CS-CDPD service, i.e. CDPD protocol over a conventional AMPS call.

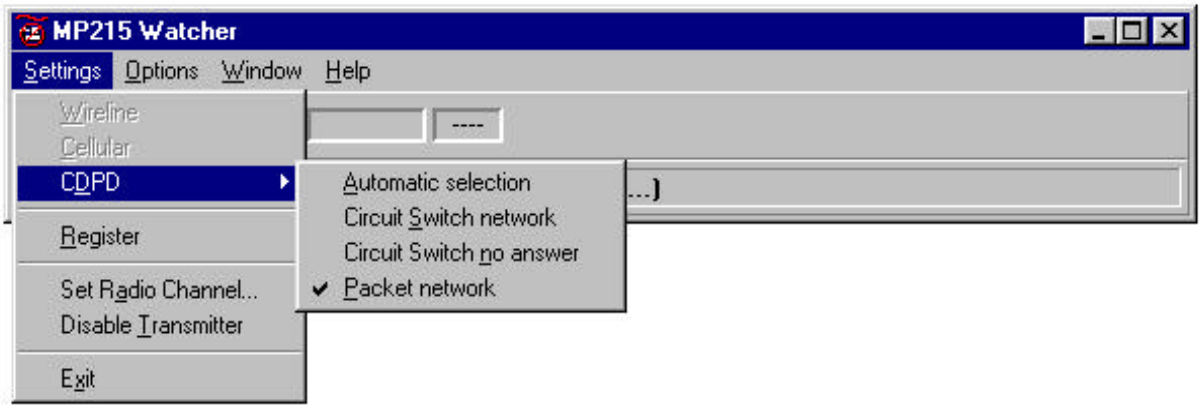
3) CS-CDPD, No Answer

This mode provides CS-CDPD service but does not answer incoming calls (auto-answer disabled).

4) AUTO

In this mode the MP215 automatically switches between CDPD and CS-CDPD modes depending on CDPD service availability. If both services are available it will choose CDPD. While in CS-CDPD mode, and idle, it will periodically check if CDPD service is available.

These operating modes can be selected via the CDPD list in the Settings menu:



Where Automatic Selection is Auto Mode, Circuit Switch Network is CS-CDPD mode, and Packet Network is CDPD mode.

8. Operating the MP215 via AT Commands

The MP215 can be programmed to operate in one of its four modes, configured via Register WS181, as follows:

1) CDPD Mode (WS181=0).

This mode provides regular CDPD service

2) CS-CDPD (WS181=1)

This mode provides CS-CDPD service, i.e. CDPD protocol over a conventional AMPS call.

3) CS-CDPD, No Answer (WS181=5)

This mode provides CS-CDPD service but does not answer incoming calls (auto-answer disabled).

4) AUTO (WS181=3)

In this mode the MP215 automatically switches between CDPD and CS-CDPD modes depending on CDPD service availability. If both services are available it will choose CDPD. While in CS-CDPD mode, and idle, it will periodically check if CDPD service is available.

The AT command to control operational modes operates as follows:

AT+WS181=<n> Set service preference

AT+WS181? Query service preference

Where n =

0 CDPD mode

1 CS-CDPD mode

3 AUTO mode

5 CS-CDPD, No-answer Mode

9. Host Interface

9.1. General Description

The MP215 supports both a SLIP and AT-command interface.

For a complete list of AT commands, the user should reference the Sierra Wireless Modem User Guide and the AT-Command Extension R2.5.2 reference guide, which describe the AT and extended AT commands that the MP200 family of products support.

Note however that *the MP215 is not fully backward compatible with other members of the MP200 family* and the differences in AT commands supported and responses to them are discussed here.

The fact that the MP215 has both CDPD and CS-CDPD modes, coupled with the nature of running CDPD over a circuit-switched cellular connection, requires that the response to some commands will differ depending on the mode the modem is in.

Another major behavioral difference the MP215 has over other MP200-family products is that *the modem will not be on-line connected if the host DTE port is in the AT-command idle state*, i.e. waiting for an AT command. An idle host DTE port means that that the modem is waiting for another AT command to be entered, and is not currently executing a command.

All normal operations are performed as needed only when the host DTE port is in a SLIP session, or during the execution of an AT command. (Being in an active SLIP session can be thought of as executing the ATD or ATO command, which runs until the SLIP session is terminated).

This means that if the host DTE port is idle, the MP215 will:

- Not answer an incoming AMPS call
- Not originate an outgoing AMPS call
- Not monitor network status nor switch sub-modes between AMPS and CDPD.
- Not attempt to register (or re-register on timer expiry)
- Maintain its current registration status (e.g., registered/suspended).

However, once the host DTE port enters a SLIP session or during the execution of the AT+WPREG command, normal operations will resume. In particular, if auto-registration is selected, the MP215 will perform the necessary operations to register the NEI with the network according the mode of operation selected by the +WS181 register.

When a SLIP session is terminated, or AT+WPREG completes, any CSC call in progress will be dropped immediately, rather than waiting for the call-idle timer to expire. The MP215 returns to the call-suspended state (if registration was successful). Note the MP215 returns to the AT-command state, regardless of whether packet-CDPD or circuit-CDPD is the current mode of operation.

Also note that except for ATD, ATO and AT+WPREG, there are no other commands that require the radio modem to go online (e.g. originate a CSC call, or enter CDPI state) to complete the command.

Lastly, as some AT-commands are only supported in a specific operational modes, and as the behavior of the modem in response to a command can vary depending on the modem's operational mode, *it is the user's responsibility to ensure the modem is in the appropriate mode for the AT command about to be issued.* Therefore, it is up to the host to ensure WS181 is set to the appropriate mode before issuing an AT command.

9.2. AT Command Specifics

Below is a list of AT commands that differ in use or response from the commands described in the Modem User Guide and the AT Wireless Extension R2.5.2 Guide. Any special operation or restriction is noted.

Note that for all other registers or commands not mentioned,

- WS181 must equal 1 for MP210/CSC registers/commands
- WS181 must equal 0 for MP200/CDPD registers/commands.

There are several other commands and registers in the PCCA STD-101 XANX-L specification for CDPD and CSCDPD modems. If not explicitly mentioned here, they are not supported.

Legend:

- Command — The AT command
- WS181 — The required state of WS181 register (defines the operational mode). If blank, it means don't care or not applicable. Otherwise an ERROR response will result if WS181 is not in the specified state.
- Notes, Exception — Special notes, including how the command executes. "Not supported" means the command will return an ERROR response.

AT Commands

Command	WS181	Notes, Exceptions
A		Not supported
D		Enters SLIP state. Dial numbers and modifiers ignored. Enables auto-select and auto-registration operations
Fn		Not supported
Hn		Value ignored.
In		I5 reports Processor Board firmware date-rev string I7 reports "C" I8 reports MP210 ATI5 response
On		Exactly same as command ATD
Zn	0	Reloads current Novram defaults for this mode.
Zn	1	Reloads current Novram defaults for this mode.
Zn	3	Reloads current Novram defaults for current mode as per 0,1 above.
&Cn		Not supported. &C1 is implicit default
&Dn		&D1 not supported. &D0 and &D2 supported as expected.
&Fn	0	Reloads factory defaults <n> for this mode
&Fn	1	Reloads factory defaults <n> for this mode
&Fn	3	Not supported
&In		Not supported
&Kn		Not supported. &K3 is implicit default.
&Rn		Not supported
&Sn		Not supported
&W	0	Saves current settings for this mode.
&W	1	Saves current settings for this mode.
&W	3	Not supported.

\Gn		Not supported.
\Jn		Not supported. \J0 is implicit default.
\Qn		Not supported. \Q3 is implicit default.
+FCLASS=		Not supported. +FCLASS=0 is implicit default.
+WPCSDC=		New for MP215
+WPDEREG		Goes online per +WS181
+WPEID	0	
+WPNAM=	1	
+WPNAM?	1	
+WPNEI=		+WS197 index not currently supported
+WPNEI?		+WS197 index not currently supported
+WPREG		MP215 switches modes as necessary specified by +WS181, does registration actions. When complete, or timed-out, terminates further operations.
+WPSPNI	0	
+WVESN	1	

S-registers and +WS registers

Register	WS181	Notes, Exceptions
S0..S5		Not supported
S112		Not supported. S112=0 is implicit default.
+WS45		+WS45=3 only is supported
+WS46		+WS46=4 only is supported
+WS60..WS74		Not supported
+WS173		Auto-reg actions suspended while host DTE port idle
+WS174	0	Note CSC side preference is controlled by +WPNAM
+WS176		Not supported
+WS181		New for MP215
+WS192		New for MP215
+WS197		Not supported
+WS201		Not supported
+WS202..WS211		Not supported
+WS250		New for MP215
+WS251		New for MP215
+WS252		New for MP215-
+WS254		New for MP215