

# **Cellular Data Modem**

## **User Guide**



Oregon RFID  
2421 SE 11th Ave  
Portland, OR 97214  
(503) 788-4380  
(866) 611-7087 toll free fax  
<http://www.oregonrfid.com>  
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# Cellular Data Modem with GPS

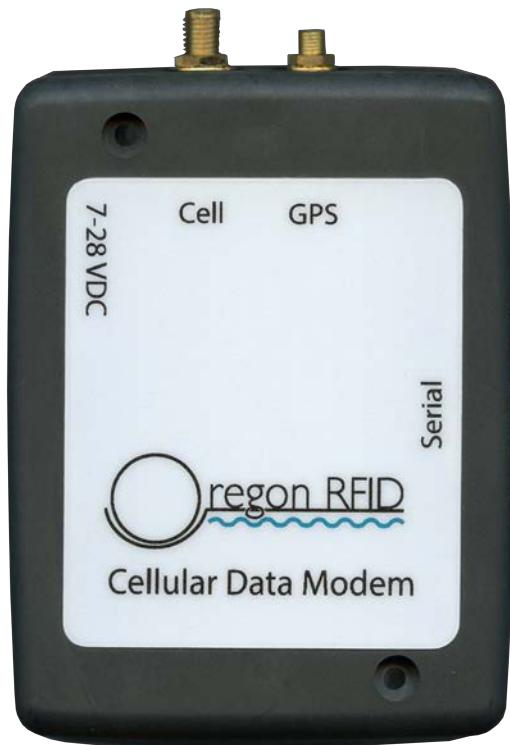
The Oregon RFID Cellular Data Modem allows wireless remote access to our HDX PIT tag readers. Short Message Service (SMS) text messages are sent to the reader using a cell phone or computer to check the system status, change a setting or request a report.

The reader automatically sends an alert when the supply voltage is low, the reader restarts or a problem occurs. Log files of detection records are sent periodically by email or on request.

Access can be limited to 10 phone numbers to prevent unauthorized use.

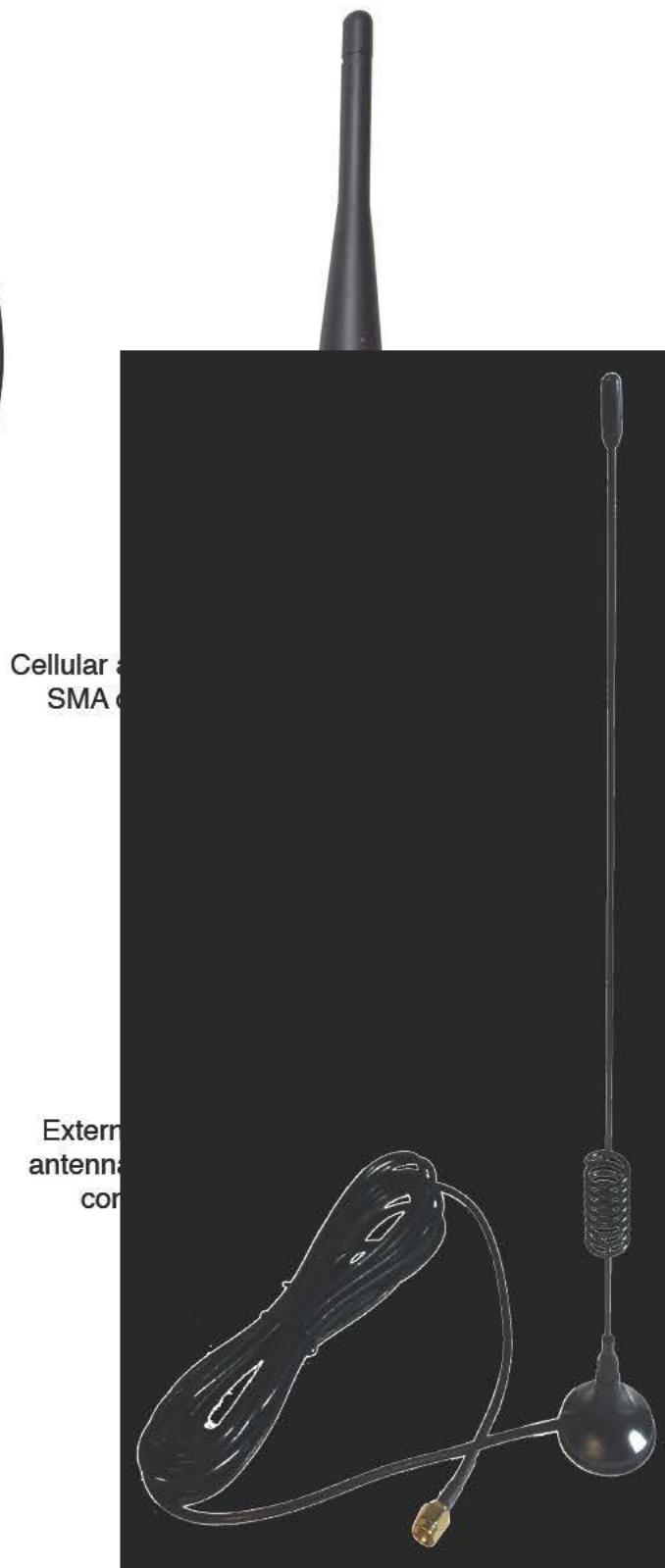
The modem can be used worldwide on GSM/GPRS/HPSA+ networks and has FCC and CE certifications. A GPS receiver provides an accurate time reference for the datalogger clock.

The modem requires a SIM card (not included) that is obtained from a cellular network provider.



## Antennas and power

The kit includes cellular and GPS antennas plus a power cable.



# Cellular Data Service Provider

Before using the modem you need to have an account for mobile radio services from a cellular service provider (phone company).

There are two distinct types of cellular data modems, GSM (Global System for Mobile Communications) and CDMA (Code Division Multiple Access). GSM is used by a majority of carriers worldwide while CDMA is used primarily in the US (primarily Sprint) and in Japan.

Cellular providers worldwide who offer GSM services are available here: [https://en.wikipedia.org/wiki/Category:Lists\\_of\\_mobile\\_phone\\_companies](https://en.wikipedia.org/wiki/Category:Lists_of_mobile_phone_companies)

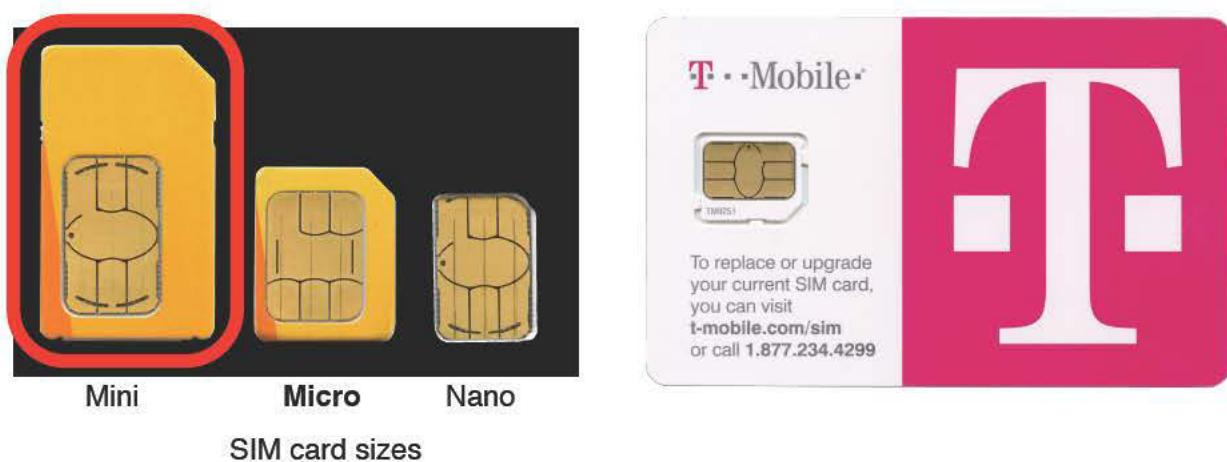
In the United States, AT&T and T-Mobile offer GSM service. Many resellers (Cricket, MetroPCS) also use GSM.

## SIM card

GSM cell modems require a Subscriber Identity Module (SIM card) from a cellular service provider. The SIM identifies the account and authorizes a phone to connect to a provider's equipment.

Some providers also use PINs to enable a SIM card before use.

SIM cards are available in different sizes. The cellular modem uses mini SIM cards.



# **SIM Card Types**

A provider will associate the SIM card with a service packages depending on the intended use.

- voice minutes (none needed for the modem)
- number of SMS messages
- data usage (for email, file transfers)

SMS is used by the modem to send and receive text messages with the reader. The modem sends log files by email and the monthly internet data limit should be large enough to handle the volume of information the reader generates. No voice minutes are needed

## **Types of accounts**

A smartphone account will usually work with the modem. SIM cards for tablets usually include lots of data data but may not allow SMS messages. Check with the cellular service provider to see what is included before selecting the account.

## **Fixed IP address**

A SIM can have a fixed IP address for a monthly fee. A fixed IP address is a unique internet number that allows contacting the modem much like making a phone call. A direct internet connection can be made with interactive data access using a terminal program.

## **Dynamic IP address**

Without a fixed IP address, each time the modem connects a number is selected from the provider's pool (DHCP). This allows the modem to initiate sending email and transfer files but since the address changes it cannot be called to connect.

# Installing the SIM card

Open SIM connector by sliding to the Unlock position and lifting it up.  
Slide the SIM card into the opened door of the connector, close the door  
and slide the latch to the Lock position



Unlock



Lock



# Connect Antennas and Power



Twist on the the cellular antenna  
and push the GPS antenna  
connector on until it clicks.



Connect the power cable to a 7 to 28 volt power source. It can share the same power source with the reader. The + voltage is marked on the end of the wire with a piece of red shrink wrap. The + wire also has a pattern on it:

**Make certain the + and - polarity are correct before applying power! If the wires are reversed it will destroy the modem. Use a voltmeter to verify.**

The + should be the pin in the center and - is the outside barrel of the 2.1 mm connector.

# Configuring the Modem for a Carrier

## Carrier settings

When setting the modem up, this information is needed from the cellular service provider:

Access point name (APN)	_____
login name	_____
password	_____
PIN (some carriers use one)	_____

It is best to get this information from the provider since they may have multiple APNs for different classes of service (business, consumer, embedded). However sometimes phone store sales people do not understand what you are asking for. The APN information for many cellular providers listed by country can be found at:

<http://wiki.apnchanger.org>

## Email settings

Data that is too large for SMS text messages such as cataloguer files are sent by email. The account often needs to be associated with the SIM card.

email address	_____
account name	_____
mail server	_____

The account name is usually the email address without the @ and domain name.

# Configuring the Modem for a Carrier

Connect a computer to the datalogger using a terminal program such as Hyperterminal, Putty, Tera Term or terminal. Configure the cell modem using the CM command.

Enter email account information to use to use for sending detection log files and upload histories

```
>CME myname@mysite.com  
>CMN myname  
>CMS smtp.mysite.com  
>CMP password
```

The CMC commands are specific for a cellular service provider. Scripts for other providers are shown below.

```
>CMC0 AT&F1  
>CMC1 AT+CMEE=2;+CREG=2  
>CMC2 AT#USERID=WAP@CINGULARGPRS.COM  
>CMC3 AT#PASSW=CINGULAR1  
>CMC4 AT+CGDCONT=1,IP,wap.cingular,0.0.0.0,0,0  
>CMC5 AT#ENS=1  
>CMC6 AT+CMGF=1  
>CMC7 AT+CNMI=2,2  
>CMC8 AT$GPSP=1  
>CMC9 AT&W0;&P0
```

A call list of up to 10 phone numbers can be stored. If this feature is enabled (B=1) then only calls from these numbers will be accepted.

The first number on the list will receive alert messages.

```
>CMB1 only allow listed phone numbers  
>CM#0 +15551234567  
>CM#1 <blank>  
>CM#2 <blank>  
>CM#3 <blank>  
>CM#4 <blank>  
>CM#5 <blank>  
>CM#6 <blank>  
>CM#7 <blank>  
>CM#8 <blank>  
>CM#9 <blank>
```

The CMZ command saves the settings in EEPROM and reloaded on startup.

```
>CMZ
```

Enter the time difference (-12 to + 12) between local time and UT. The clock does not automatically change for daylight savings time.

```
>TD-7
```

# Cellular Provider Scripts

## Configuring the modem with the CMC command

The CMC command has 10 entries for a list of commands that are sent to the modem on startup to configure the modem. The characters in **purple** below will depend on the cellular service provider of the SIM card.

## Some CMC scripts

These are scripts for configuring the modem for some common cellular data providers.

<b>AT&amp;T</b>	CMC0 ATE0;&F1 CMC1 AT+CMEE=2;+CREG=2 CMC2 AT#SELINT=2 CMC3 AT#USERID= <b>WAP@CINGULARPRS.COM</b> CMC4 AT#PASSW= <b>CINGULAR1</b> CMC5 AT+CGDCONT=1,IP," <b>wap.cingular</b> ",0.0.0.0,0,0 CMC6 AT#ENS=1 CMC7 AT+CMGF=1;AT+CNMI=2,2 CMC8 AT\$GPSP=1 CMC9 AT&W0;&P0
<b>T-Mobile</b>	CMC0 ATE0;&F1 CMC1 AT+CMEE=2;+CREG=2 CMC2 AT#SELINT=2;#AUTOBND=2 CMC3 AT#USERID= CMC4 AT#PASSW= CMC5 AT+CGDCONT=1,IP," <b>epc.tmobile.com</b> ",0.0.0.0,0,0 CMC6 AT+CMGF=1;AT+CNMI=2,2 CMC7 AT\$GPSP=1 CMC8 AT&W0;&P0 CMC9 AT
<b>Swisscom</b>	CMC0 ATE0;&F1 CMC1 AT+CMEE=2;+CREG=2 CMC2 AT#SELINT=2;#AUTOBND=2 CMC3 AT#USERID= CMC4 AT#PASSW= CMC5 AT+CGDCONT=1,IP," <b>gprs.swisscom.ch</b> ",0.0.0.0,0,0 CMC6 AT+CPIN="0000" CMC7 AT+CMGF=1;AT+CNMI=2,2 CMC8 AT\$GPSP=1 CMC9 AT&W0;&P0

# Writing Cellular Provider Scripts

## CMC scripts

CMC scripts use AT commands to configure the modem. The format depends on the cellular service provider. Variations of them can be used to write scripts for other providers.

Connect the modem directly to the terminal program at 115200 baud and type them in one at a time. If no errors appear it will probably work.

These are the commands used in the scripts above. More than one can be put on the same line, separated by a semicolon.

In the above scripts, only Swisscom has a PIN. AT&T has a special ENS command that is not used by the others.

ATE0	echo off
AT&F1	factory reset settings
AT#SELINT	select AT command set
AT#AUTOBND	automatic band selection
AT+CGDCONT	define PDP context (packet data protocol)
AT#ENS	enhanced network selection (1=AT&T)
AT+CMGF	SMS message format
AT+CNMI=	send new message indications
AT\$GPSP=	power GPS on/off
AT&W0;&P0	save settings
AT+CPIN=	enter SIM PIN
AT+CMEE=	enable error reporting
AT+CREG=	enable network registration reports

## Enabling Modem Mode

After the modem settings are loaded, type “MO” to switch to modem mode, then remove the cable from your computer and plug it into the modem. A few seconds after the reader and modem are connected there will be a long red Status light and a beep to indicate it has connected to the modem. If the beep repeats every few seconds then it hasn’t successfully connected. Restart the modem and reader to start over.

```
>mo  
MO on  
  
AT  
AT
```

When in modem mode the reader will not respond to typed commands and will send the text “AT” while trying to establish contact with the modem.

## Disabling Modem Mode

You can disable modem mode and return to the command line by moving the serial cable from the modem to a computer and typing MO again at 115200 baud. The datalogger will return to 57600 baud.

# Sending Commands

The cellular carrier will tell you the phone number associated with the SIM card. Send the text “HE” to the modem to receive the list of commands. It takes a few seconds for the command to reach the modem and for a message to return.

**HE**

```
ST Status
TR Last tags
NO Notify next tag
CG Change setting
MX Mux order
UH Upload History
UP Upload file
CM Configure Modem
ON Timer
```

The ST commands returns the status of the reader.

**ST**

```
Status of RFID
10.8 scans/second
3.0 2.6 2.6 2.6
HDX Mux: 1234
13.4 Volts Amps: Rx 0.21
Tx 0.38 0.39 0.39 0.40
EA 0.29
Noise: 0 0 0 0
Synch off
31C / 87F
```

The TR commands returns the last tag seen on each antenna, the time since it was seen and the number of tags seen since midnight.

**TR**

```
ORFID
1 18:27 21 HA 900_228000004953
2 01:20 18 HA 900_228000004959
3 22:16 7 HA 900_230000002950
4 10:13 5 HA 900_226000078821
```

Text messages can be sent after the next detection occurs.

**NO**

NO12  
Notify enabled for antenna(s) 12  
  
Tag detected on A1 2015-08-30  
12:17:59.92 HA  
900\_230000002950  
  
Tag detected on A2 2015-08-30  
14:38:08.88 HA  
900\_226000074284

The CG and MX commands are used to change the reader parameters and scan sequence.

**CG**

Reader settings  
CGA4 mux with 4 antennas  
CGC50 charge period 50ms  
CGP50 duty cycle pause 50ms  
CGS0 synch mode: none

**MX**

Mux seq: 1234

The UH command requests the upload history report to be sent by email to the specified account.

**UH**

History sent to [myname@mysite.com](mailto:myname@mysite.com)

The UP command requests the detection log file to be sent by email to the specified account.

**UP**

Log file sent to [myname@mysite.com](mailto:myname@mysite.com)

The ON command sets a timer to turn the reader on and off. The timer is disabled with the command “ON 0 0”. This is the response from the command “ON 5:00 21:00”

**ON**

On at 5:00, Off at 21:00

# Automatic Messages

The modem will send notifications of problems and changes in status to the phone number CM#0 in the configuration list.

Reader ORFID stopped  
2015-09-03 01:43  
Low voltage: 9.7V 0.3A (10.0V)

Reader ORFID started  
2015-09-03 09:22.  
Database file opened.