Courier M2M 3G Cellular Modem

USR3500

Getting Started

R24.0796.00

Important Notice

Due to 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 are used in a normal manner with a well-constructed network, the 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. Neither Sierra Wireless nor USRobotics accepts any responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the modem, or for failure of the modem to transmit or receive such data.

Safety and Hazards

Do not operate the modem in areas where cellular modems are not advised without proper device certifications. These areas include environments where cellular radio can interfere such as explosive atmospheres, medical equipment, or any other equipment which may be susceptible to any form of radio interference. The modem can transmit signals that could interfere with this equipment. Do not operate the modem in any aircraft, whether the aircraft is on the ground or in flight. In aircraft, the modem **MUST BE POWERED OFF**. When operating, the modem can transmit signals that could interfere with various onboard systems.

Note: Some airlines may permit the use of cellular phones while the aircraft is on the ground and the door is open. Modems may be used at this time.

The driver or operator of any vehicle should not operate the modem while in control of a vehicle. Doing so will detract from the driver or operator's control and operation of that vehicle. In some states and provinces, operating such communications devices while in control of a vehicle may be an offence.

Limitations of Liability

This manual is provided "as is". Neither Sierra Wireless nor USRobotics makes any warranties of any kind, either expressed or implied, including any implied warranties of merchantability, fitness for a particular purpose, or noninfringement. The recipient of the manual shall endorse all risks arising from its use.

The information in this manual is subject to change without notice and does not represent a commitment on the part of Sierra Wireless or USRobotics. EACH OF SIERRA WIRELESS AND USROBOTICS AND THEIR RESPECTIVE AFFILIATES SPECIFICALLY DISCLAIM LIABILITY FOR ANY AND ALL DIRECT, INDIRECT, SPECIAL, GENERAL, INCIDENTAL, CONSEQUENTIAL, PUNITIVE OR EXEMPLARY DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS OR REVENUE OR ANTICIPATED PROFITS OR REVENUE ARISING OUT OF THE USE OR

INABILITY TO USE ANY SIERRA WIRELESS PRODUCT, EVEN IF SIERRA WIRELESS AND/OR USROBOTICS AND/OR THEIR RESPECTIVE AFFILIATES HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES OR THEY ARE FORESEEABLE OR FOR CLAIMS BY ANY THIRD PARTY.

Notwithstanding the foregoing, in no event shall Sierra Wireless or USRobotics and/or their respective affiliates aggregate liability arising under or in connection with the Sierra Wireless/ USRobotic product, regardless of the number of events, occurrences, or claims giving rise to liability, be in excess of the price paid by the purchaser for the Sierra Wireless /USRobotics product.

Customer understands that neither Sierra Wireless nor USRobotics is providing cellular or GPS (including A-GPS) services. These services are provided by a third party and should be purchased directly by the Customer.

Patents

This product may contain technology developed by or for Sierra Wireless, Inc.

This product includes technology licensed from QUALCOMM®.

This product is manufactured or sold by Sierra Wireless, Inc. or its affiliates under one or more patents licensed from InterDigital Group and MMP Portfolio Licensing.

Copyright

Trademarks

USRobotics®, Courier™ and the USRobotics logo are registered trademarks of USRobotics.

Sierra Wireless®, AirPrime®, AirLink®, AirVantage® and the Sierra Wireless logo are registered trademarks of Sierra Wireless.

Windows® is a registered trademark of Microsoft Corporation.

QUALCOMM® is a registered trademark of QUALCOMM Incorporated. Used under license.

Other trademarks are the property of their respective owners.

Contact Information

Web:	http://www.usr.com/contact

Consult our website for up-to-date product descriptions, documentation, application notes, firmware upgrades, and troubleshooting tips: http://www.usr.com/support/3500

Document History

Version	Date	Updates
1.0	9/25/13	Creation
1.1	11/1/2013	First review edits

Contents

List of Figures

List of Tables

1.   Overview

The USR3500 is a programmable modem bundled with our USRobotics Courier M2M Open AT application. The USR3500 industrial grade USB and serial modem supports penta-band 3G HSPA+ with dual antenna receive diversity and quad band 2G GSM/GPRS/EDGE. It offers audio capabilities, GPS, digital I/O, and an expansion card interface that accepts an Ethernet adaptor card (available separately).

The Courier M2M Open AT application is a robust software platform that enables the modem to communicate with remote servers and hosts without the need of an intelligent host controlling the modem. Key features include cellular module control, bearer management, device management, GPS device control, and asset tracking functionality.

The USR3500 is capable of integrating with many leading cloud application and management services. Refer to http://www.usr.com/support/3500 for details.

For information regarding programming capabilities available through the Courier M2M application, refer to the Courier M2M Application Guide at http://www.usr.com/support/3500.

2.   Packaging

2.1.   Contents

The table below summarizes the list of items delivered with the USR3500.

Table 1.   Included contents with the USR3500
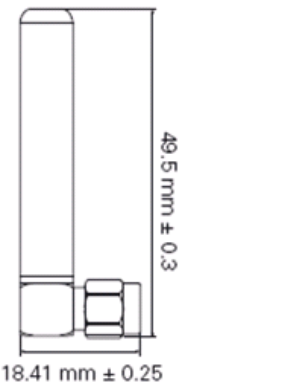
Standard Package
Penta Band Antenna
Universal Power Supply
Serial Data Cable
Mounting Brackets
Quick Installation Guide

2.2.   Accessories

This section describes the standard accessories included with the USR3500.

2.2.1.   Antenna
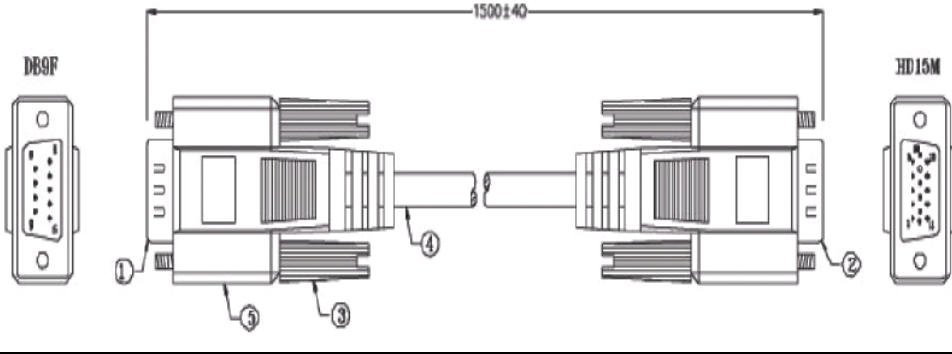
Table 2.   Antenna Description

49.5 mm ± 0.3 18.41 mm ± 0.25	• Antenna Size W x L x H (18.4 x 8.0 x 49.5mm) • Frequency Range supported: 850 / 900 / 1800 / 1900 / 2100 MHz • Connector SMA (Male)

Refer to Chapter 8 USR3500 Accessories for more information.

2.2.2.   Serial Data Cable

Table 3.   Serial Data Cable Description

- Length: 1.5M
- Connection: DB9F (PC) to HD15M

2.2.3.   Two Mounting Brackets

Please refer to section 5.1 Mounting the USR3500 for more information regarding the mounting brackets.
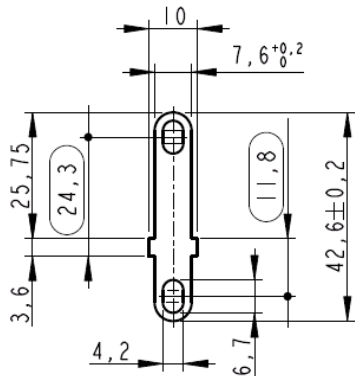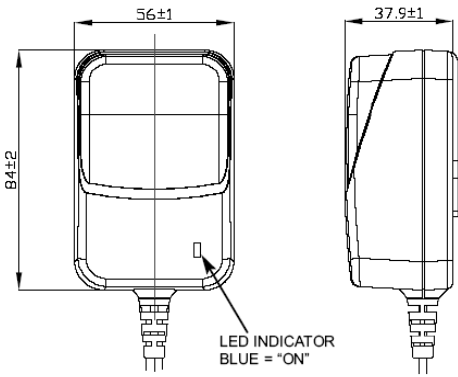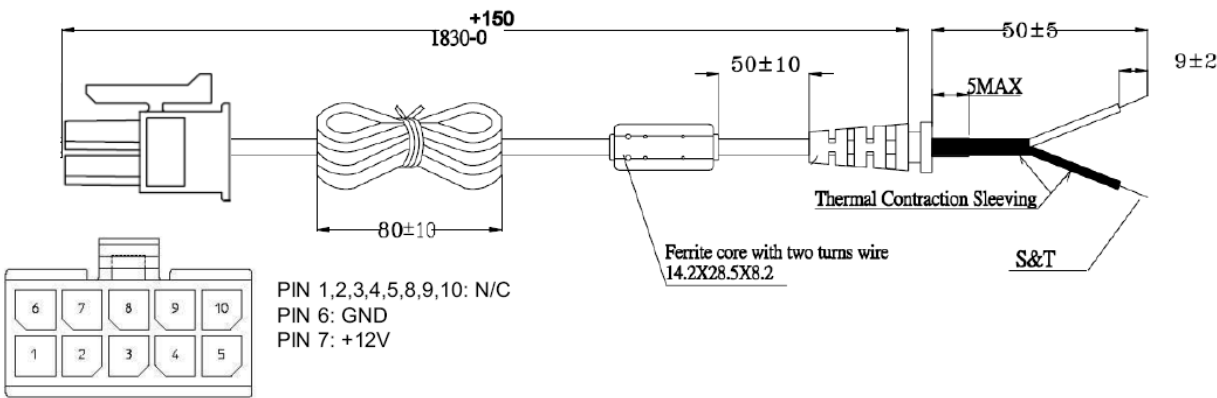
Figure 1.   Mounting Bracket Dimensions

2.2.4.   Power Supply

Table 4.   Power Supply Description

PIN 1,2,3,4,5,8,9,10: N/C
PIN 6: GND
PIN 7: +12V

- Input Voltage   100-240VAC
- Output Voltage   12VDC
- Output Current   2.08A, No Minimum Load required
- Output Power (Rated)   25W MAX

3.   Hardware

3.1.   Overall Dimensions

Figure 2.   USR3500

Table 5.   USR3500 Physical Dimensions

Length	89 mm
Width	60 mm
Thickness	30 mm
Weight	125g

3.2.   Connections

- 10-pin Micro-Fit Power Supply Connector
- USB Interface
- 15-pin Sub-D Serial Interface
- SIM Interface
- Antenna Interface
  - SMA Main
  - SMA Diversity
  - GPS

3.3.   Interfaces

3.3.1.   External Interfaces

- Power Supply
- 3V/1V8 SIM Interface
- USB Device Interface
- Serial Port (UART1)
- ON/OFF
- 1 Interrupt (multiplexed in the Microfit connector)
- Reset
- Audio Interface
- 2 GPIOs
- LED Status Indicator

3.3.2.   Internal Expansion Interface

- 1 Secondary Serial Port (UART2)
- 6 GPIOs
- 2 SPI Bus
- 1 ADC
- 1 PCM
- 1 Interrupt
- Reset access to the embedded module
- 2.8V supply from the USR3500

- 4V supply from the USR3500
- 2.8V Digital supply from the embedded module
- 1.8V Digital supply from the embedded module
- Access to 4.75 to 32V DC-IN

3.4.   Environmental Compliance

3.4.1.   RoHS Directive Compliant

The USR3500 is compliant with RoHS Directive 2011/65/EC which sets limits for the use of certain restricted hazardous substances. This directive states that "from 1st July 2006, new electrical and electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE)".

3.4.2.   Disposing of the Product

This electronic product is subject to the EU Directive 2002/96/EC for Waste Electrical and Electronic Equipment (WEEE). As such, this product must not be disposed of at a municipal waste collection point. Please refer to local regulations for directions on how to dispose of this product in an environmental friendly manner.

4.   Features

This section details the features available on the USR3500.

4.1.   Features

Refer to the table below for the list of basic features available on the USR3500.

Table 6.   USR3500 Basic Features

Features	Description	
Courier M2M Open AT Application	- AT command programmable - Allows standalone operation - Platform for embedded applications - HTTP - SMS - Email - GPS	
Standard	850MHz / 900 MHz - E-GSM compliant - Output power: class 4 (2W) - Fully compliant with ETSI GSM phase 2 + normal MS	1800 MHz / 1900MHz - Output power: class 1 (1W) - Fully compliant with ETSI GSM phase 2 + normal MS
GPRS	- Class 10 - Class 12 - PBCCH support - Coding schemes: CS1 to CS4 - Compliant with SMG31bis - Embedded TCP/IP stack	
EGPRS	- Class 10 - Class 12 - PBCCH support - Coding schemes: MCS1 to MCS9 - Compliant with SMG31bis - Embedded TCP/IP stack	
Interface	- RS232 (V.24/V.28) Serial interface supporting: - Baud rate (bits/s): 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800 and 921600 - Autobauding (bits/s): from 1200 to 921600 2 General Purpose Input/Output gates (GPIOs) available 1.8 V / 3 V SIM interface - AT command set based on V.25ter and GSM 07.05 & 07.07	

Features	Description
SMS	• Text & PDU • POINT TO POINT (MT/MO) • Cell broadcast
Data	• Data circuit asynchronous • Transparent and Non Transparent modes • Up to 14,400 bits/s • MNP Class 2 error correction • V42.bis data compression
UMTS Data Transfer	BAND I, II, V, VI, VIII (2100/1900/850/800/900) up to 384kbits/s
HSXPA	• BAND I, II, V, VI, VIII (2100/1900/850/800/900) • HSDPA Cat 10 up to 14.4Mbits/s • HSUPA Cat 6 up to 5.76Mbits/s
Audio	• Echo cancellation • Noise reduction • Full Rate, Enhanced Full Rate, Half Rate operation and Adaptive Multi-Rate (FR/EFR/HR/AMR) Dual Tone Multi Frequency function (DTMF).

4.2.   Supported Bands

The USR3500 is a quad band EGSM900/DCS1800/GSM850/PCS1900 that also supports penta band UMTS/HSPA (WCDMA-FDD) 2100/1900/850/800/900 (Band I, II, V, VI and VIII). Band selection is done automatically without having to switch manually using AT commands.

Refer to sections 6.4 Checking the Band Selection and 6.5 Switching Bands for more information regarding switching bands.

4.3.   Expansion Interface

The USR3500 offers a 50-pin expansion interface. It is an additional interface for customers who wish to expand their application features by simply plugging in a card through the mating connector of the interface.

Refer to the Reference Guide at http://www.usr.com/support/3500 for more information about the expansion card supported by the USR3500.

4.4. Over-Voltage and Over-Current Protection

4.4.1. Power Supply Input

The USR3500 power supply input is protected against transient voltage peaks over +32V. When the input voltage exceeds 32V, the supply voltage is automatically disconnected in order to protect the internal electronic components from over-voltage.

The optional 6-wire cable accessory protects the USR3500 from continuous over-current by a 2A/250V slow break fuse directly bonded into the cable.

4.4.2. Electrostatic Discharge

The USR3500 withstands ESD according to IEC 1000-4-2 requirements for all accessible parts, except for the RF connector which withstands ESD as follows:

- +/- 8kV of air discharge
- +/- 4kV of contact discharge

4.4.3. Main Serial Port

The USR3500's RS232 serial port connection is internally protected against electrostatic surges on its lines by ESD protection and it also has the following filtering guarantees:

- EMI/RFI protection on both input and output
- Signal smoothing

5. Using the USR3500

5.1. Mounting the USR3500

The mounting brackets help hold and secure the USR3500 on a support.

Figure 3.   Mounting Brackets

To mount the USR3500 on its support, fasten it using the mounting brackets as shown in the figure below.
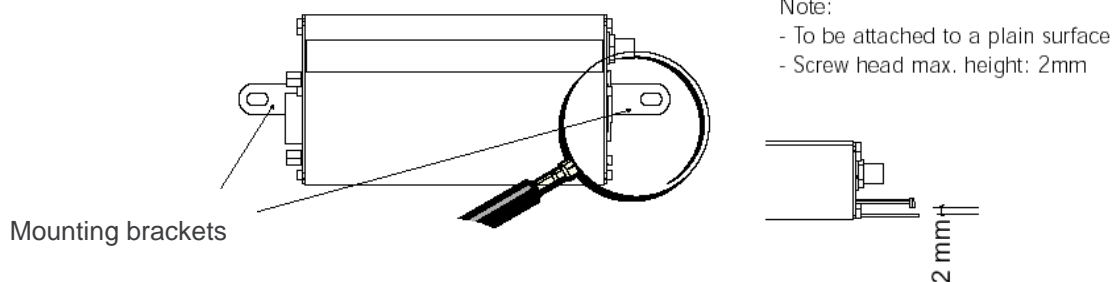
Figure 4.   Mounting the Modem

5.2.   Setup

To set up the Modem, follow the procedures below.

1. Insert the SIM card into the SIM card socket. (Refer to Inserting the SIM Card and Extracting the SIM Card for more details on how to insert and extract the SIM card from the USR3500.)
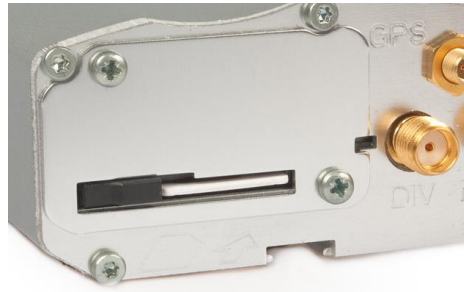
2. Slide the SIM lock switch to lock the SIM card in the USR3500.
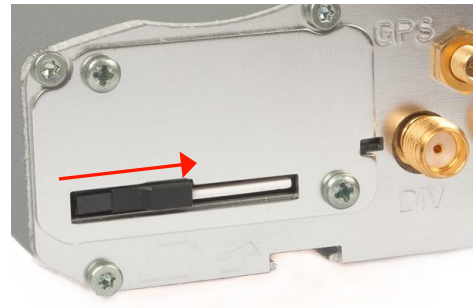
3. Connect the main antenna to the main RF connector.

4. Connect the serial cable to the USR3500.

5. Plug the external power supply into the USR3500 and connect to an AC power source.

Refer to section 6.10 Main AT Commands for the list of commands used to configure the USR3500.

Note: For automotive applications, it is recommended to connect the DC-IN line of the USR3500 directly to the positive terminal of the battery.

5.2.1.   Inserting the SIM Card

In order to insert the SIM card into the USR3500, follow the procedures below:

1. Prepare the SIM card in the correct position as shown in the figure.

2. Slide the SIM card into the SIM holder.

3. Use a tool to help push the SIM card into the SIM holder. Push the SIM card all the way in until you hear a clicking sound.

4. Slide the SIM lock switch to lock the SIM card in the USR3500.
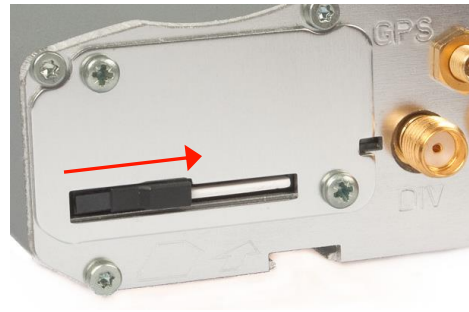
5.2.2.   Extracting the SIM Card

In order to extract the SIM card from the USR3500, follow the procedures below:

1. Open the SIM lock switch by sliding it to the left.
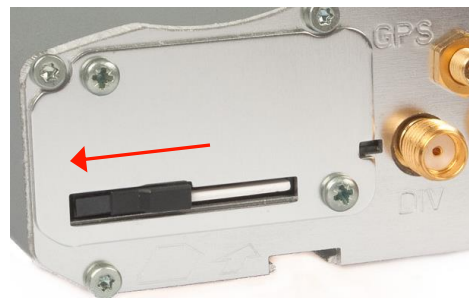
2. Use a tool to further push the SIM card into the SIM holder. Push until you hear a clicking sound.

3. The SIM card should spring out a little bit after the clicking sound.

4. Extract the SIM card from the USR3500.

5.3.   Operational Status

The USR3500's operational status is defined by a red LED, which is located between the back plate and the secondary RF interface.

Status LED
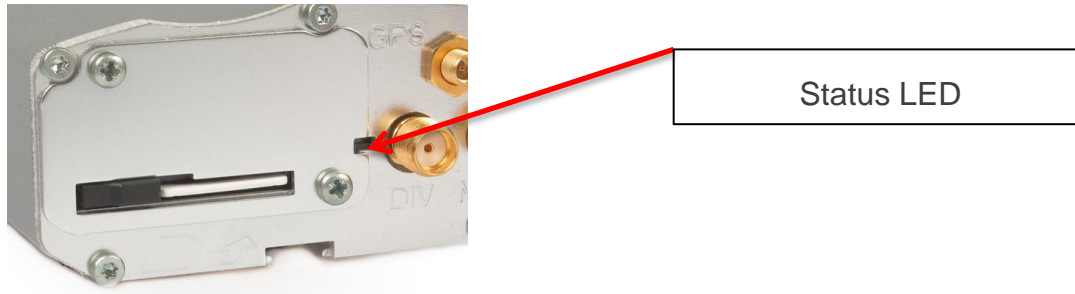
If the LED of the USR3500 is flashing slowly, the modem is switched ON and is registered in a network (Idle mode). Refer to the Reference Guide at http://www.usr.com/support/3500 for more information about the LED status indicator.

6.   Communicating with the USR3500

After setting up the USR3500, communications can be established by directly sending AT commands to the device using terminal software such as HyperTerminal for MS Windows. The following subsections describe how this is done.

For more information about the AT commands described in the following sub-sections, refer to the AT Commands Interface Guide at http://www.usr.com/support/3500.

6.1.   Communications Testing

To perform a communications test after the USR3500 has been setup using the RS232 serial port connection, do the following:

- Connect the RS232 port between the external application COM port (DTE) and the USR3500 (DCE).
- Configure the RS232 port of the DTE as follows:
  - COM port: 1 (commonly used port for PC serial)
  - Bits per second: 115200 bps
  - Data bits: 8
  - Parity: None
  - Stop bits: 1
  - Flow control: Hardware
- Using a communication software such as HyperTerminal, enter:

  AT↵

- When communications have been established, the USR3500 will respond with an "OK", which is displayed in the HyperTerminal window.

If communications cannot be established with the USR3500, do the following:

- Check the RS232 connection between the application (DTE) and the USR3500 (DCE).
- Check the configuration of the COM port used on the DTE.

Refer to the table below for other AT commands that can be used after getting the USR3500 started.

Table 7.   Basic AT Commands to Use with the USR3500

AT Command	Description
AT+CGMI	To check if the serial port is OK The USR3500 will respond with "Sierra Wireless" when it is OK.
AT+CPIN=xxxx	To enter a PIN code, xxxx (if activated)
AT+CSQ	To verify the received signal strength
AT+CREG?	To verify the registration of the USR3500 on the network

6.2.   Verifying the Received Signal Strength

The USR3500 only establishes a call if the received signal strength is strong enough. Using a communication software such as HyperTerminal, enter **AT+CSQ** to check the received signal strength. The response returned will follow the format *+CSQ: <rssi>, <ber>*

> where: <rssi> = received signal strength indication, and <ber> = channel bit error rate.

Refer to the table below for the description of the <rssi> values returned.

Table 8.   <rssi> Value Description

<rssi> Value	Description
0 – 10	Received signal strength is insufficient
11 – 31	Received signal strength is sufficient
32 – 98	Not defined
99	No measure available

6.3.   Verifying the Network Registration

Using a communication software such as HyperTerminal, enter **AT+CREG?** to verify the network registration of the USR3500. Refer to the table below for the list of main responses returned.

Table 9.   AT+CREG? Main Reponses

AT+CREG? Response	Description
AT+CREG: 0, 0	Not registered
AT+CREG: 0, 1	Registered on the home network
AT+CREG: 0, 5	Registered on a roaming network

If the USR3500 is not registered on the network, do the following:

- Check the connection between the USR3500 and the antenna.
- Verify the signal strength to determine the received signal strength (Refer to section 6.2 Verifying the Received Signal Strength).

6.4. Checking the Band Selection

Using a communication software such as HyperTerminal, enter **AT+WMBS?** to check the band selection of the USR3500. Refer to the table below for the list of main responses returned.

Table 10.   AT+WMBS? Main Reponses

AT+WMBS? Response	Description
AT+WMBS: 0, x	Mono band mode 850MHz is selected
AT+WMBS: 1, x	Mono band mode extended 900MHz is selected
AT+WMBS: 2, x	Mono band mode 1800MHz is selected
AT+WMBS: 3, x	Mono band mode 1900MHz is selected
AT+WMBS: 4, x	Dual band mode 850/1900MHz is selected
AT+WMBS: 5, x	Dual band mode extended 900/1800MHz is selected
AT+WMBS: 6, x	Dual band mode extended 900/1900MHz is selected
AT+WMBS: 7, x	Quad-band mode 850/900E (extended)/1800/1900MHz is selected

Where:

When x = 0, the band has not been modified since the last boot of the USR3500;

When x = 1, the band has been modified since the last boot of the USR3500, and will have to be reset in order to take any previous modification(s) into account.

Enter **AT+WUBS?** to check the UMTS-FDD band selection.

Table 11.   AT+WUBS? Main Reponses

AT+WUBS? Response	Description
AT+WUBS: y, x	Where: - y = Band frequency configuration (bit field) in HEX format. Refer to the AT Commands Interface Guide at http://www.usr.com/support/3500. - x = Reset flag (0 means the band(s) have not been modified since the last boot of the USR3500, and 1 means the band(s) have been modified since the last boot and that the USR3500 will have to be reset in order to take any previous modification(s) into account.

Enter **AT+WWSM?** to check the existing cellular network status of the USR3500. Refer to the table below for the list of main responses returned.

Table 12.   AT+WWSM? Main Reponses

AT+WWSM? Response	Description
AT+WWSM: 0	GSM digital cellular system (GERAN)
AT+WWSM: 1	Universal Terrestrial Radio Access Network (UTRAN) only
AT+WWSM: 2, x	3GPP systems (both GERAN and UTRAN) Where if x is: • 0 = automatic • 1 = GERAN preferred • 2 = UTRAN preferred

6.5.   Switching Bands

Use the **AT+WMBS** AT Command to change the band setting of the USR3500 and switch between EU and US bands and vice versa. Refer to the following table for the list of **AT+WMBS** parameters that can be used and their corresponding description.

Table 13.   AT+WMBS Band Selection

AT+WMBS Command	Description
AT+WMBS=0,x	Switch to mono band mode 850MHz
AT+WMBS=1,x	Switch to mono band mode extended 900MHz
AT+WMBS=2,x	Switch to mono band mode 1800MHz
AT+WMBS=3,x	Switch to mono band mode 1900MHz
AT+WMBS=4,x	Switch to dual band mode 850/1900MHz
AT+WMBS=5,x	Switch to dual band mode extended 900/1800MHz
AT+WMBS=6,x	Switch to dual band mode extended 900/1900MHz
AT+WMBS=7,x	Switch to quad band mode 850/900E (extended)/1800/1900MHz

Where:

When x = 0, the USR3500 will have to be reset to start on the specified band(s);

When x = 1, the band switch is effective immediately. However, this mode is forbidden while in Communication mode and during the USR3500's initialization.

Use **AT+WUBS** to change the UMTS-FDD band setting of the USR3500.

Table 14.   AT+WUBS Band Selection

AT+WUBS Command	Description
AT+WUBS=y, x	Where: • y = Band frequency configuration (bit field) in HEX format. • x = Optional reset parameter (0 means the USR3500 will have to be reset to start on the specified band(s), and 1 means the band switch is effective immediately. Note that x=1 is forbidden while in Communication mode and during the USR3500's initialization. Refer to the document AT Commands Interface Guide at http://www.usr.com/support/3500.

Use **AT+WWSM** to change the cellular network setting of the USR3500. Refer to the table below for the list of main responses returned.

Table 15.   AT+WWSM Cellular Network Setting

AT+WWSM Command	Description
AT+WWSM=0	GSM Digital Cellular System (GERAN)
AT+WWSM=1	Universal Terrestrial Radio Access Network (UTRAN) only
AT+WWSM=2,0	3GPP systems (both GERAN and UTRAN); automatic network
AT+WWSM=2,1	3GPP systems (both GERAN and UTRAN); GERAN preferred
AT+WWSM=2,2	3GPP systems (both GERAN and UTRAN); UTRAN preferred

6.6. Checking the PIN Code Status

Using a communication software such as HyperTerminal, enter **AT+CPIN?** to check the PIN code status. Refer to the table below for the list of main responses returned.

Table 16.   AT+CPIN Main Responses

AT+CPIN Response	Description
+CPIN: READY	The PIN code has been entered.
+CPIN: SIM PIN	The PIN code has not been entered.

6.7. Echo Function

If no echo is displayed when entering an AT Command, it could mean either of the following:

- The "local echo" parameter of your communication software (HyperTerminal) is disabled.
- The USR3500 echo function is disabled.

To enable the USR3500's echo function, enter the AT Command **ATE1**.

When sending AT Commands to the USR3500 using a communication software such as HyperTerminal, it is recommended to:

- Disable the "local echo" parameter of your communication software.
- Enable the USR3500's echo function (use the **ATE1** command).

In a machine-to-machine communication with the USR3500, it is recommended to disable the USR3500's echo function (using the **ATE0** AT command) in order to avoid useless embedded module processing.

6.8. Enabling/Disabling the Flash LED

The USR3500 has a red LED indicator that shows the status of the GSM network. It is possible to disable this LED during Sleep mode in order to reduce power consumption. Using a communication software such as HyperTerminal, enter:

- **AT+WHCNF=1,0**   to deactivate Flash LED
- **AT+WHCNF=1,1**   to activate Flash LED

Note: You will need to restart the USR3500 for the new setting to take effect.

6.9. Firmware Upgrade Procedure

The firmware upgrade procedure is used to update the firmware embedded in the USR3500. This procedure consists of downloading the firmware into internal memories through the RS232 serial port available on the 15-pin SUB-D serial connector. Refer to the Courier M2M Application Guide at http://www.usr.com/support/3500 for more information regarding this procedure.

6.10. Main AT Commands for the USR3500

The table below lists the main AT Commands required for starting the USR3500. For other available AT Commands, refer to the AT Commands Interface Guide at http://www.usr.com/support/3500.

Table 17.   Main AT Commands used for the USR3500

Feature/Function	AT Command	Response	Description
Check network registration	AT+CREG?	+CREG: 0,1	The USR3500 is registered on the network.
		+CREG: 0,2	The USR3500 is not registered on the network; registration attempt is ongoing.
		+CREG: 0,0	The USR3500 is not registered on the network; no registration attempt has been made.
Enter PIN code	AT+CPIN=xxxx (xxxx = PIN code)	OK	PIN code accepted.
		+CME ERROR: 16	Incorrect PIN code (with +CMEE = 1 mode*).
		+CME ERROR: 3	PIN code already entered (with +CMEE = 1 mode*).
Check the selected band	AT+WMBS?	+WMBS: <Band>,<ResetFlag> OK	The currently selected band mode is returned.
Switch bands	AT+WMBS=<Band>	OK	Band switch is accepted; the USR3500 has to be reset for the change to be effective.
	AT+WMBS=<Band>,0	OK	Band switch is accepted; the USR3500 has to be reset for the change to be effective.
	AT+WMBS=<Band>,1	OK	Band switch is accepted and the GSMS stack has been restarted.
	AT+WMBS=<Band>	+CME ERROR: 3	Band selected is not allowed.
Receive a call	ATA	OK	Answer the call.

Feature/Function	AT Command	Response	Description
Initiate a call	ATD<phone number>; (Do not forget the « ; » at the end for « voice » call)	OK	Communication established.
		+CME ERROR: 11	PIN code not entered (with +CMEE = 1 mode*).
		+CME ERROR: 3	AOC credit exceeded or communications is already established.
Hang up	ATH	OK	
Communication has been lost		NO CARRIER	
Store the parameters in EEPROM	AT&W	OK	The configuration settings are stored in EEPROM (non-volatile memory).
Start Courier M2M application	AT+WOPEN=1	OK	

*   The command AT+CMEE=1 switches to a mode that enables a more complete error diagnostic.

6.11. IP Data Connection

Enter **AT+WOPEN=1** to start the Courier M2M application. A startup banner will display. Use **AT+WOPEN=0** to stop the application.

Lib Version 1.9.1
Courier M2M Wireless Device
Application Started

To use IP data services, you need to configure an APN. Your cellular account needs to have data services, and the cellular provider must provide you with an APN string.

Example: Enter **AT$CGDCONT=1,"m2m.apn.com"** to set the APN.

Note: The APN string: "m2m.apn.com" is a sample. Do not use.

Use **AT+CGREG?** to verify GPRS registration.

AT+CGREG?
+CGREG: 0,1
OK

A response with 0,1 indicates that your device is registered on the GPRS network. A response of 0,0 would indicate not registered. Once you are registered, Courier M2M will automatically activate a PDP context. Enter **AT$IP** to verify the device's IP address.

AT$IP
$IP: "<deviceID>",0,"203.0.113.1"
OK

Refer to the Courier M2M Application Guide at http://www.usr.com/support/3500 for more information regarding data connections.

7. Troubleshooting the USR3500

This section of the document describes possible problems that might be encountered when using the USR3500 and the corresponding solutions.

For additional troubleshooting information, refer to the support page at http://www.usr.com/support/3500

7.1. No Communications with the USR3500 through the Serial Port

If the USR3500 does not respond to AT commands through the serial port, refer to the table below for possible causes and the corresponding solutions.

Table 18.   No Communications with the USR3500 Through the Serial Port

If the USR3500 returns	Then ask	Action
Nothing	Is the USR3500 powered correctly?	Make sure that the external power supply is connected to the USR3500 and provides a voltage within the range of 4.75V to 32V.
	Is the serial cable connected at both sides?	Check the serial cable connection.
	Does the serial cable correctly follow the pin assignments? Refer to the Reference Guide at http://www.usr.com/support/3500 for more information about the serial cable pin assignments.	Connect the cable by following the pin assignments as given in the Reference Guide.
Nothing or non-significant characters	Is the communication program properly configured on the PC?	Ensure that the settings of the communication program are compatible with the settings of the USR3500. The USR3500 factory settings are: • Data bits = 8 • Parity = none • Stop bits = 1 • Baud = 115200 bps • Flow control = hardware
	Is there another program interfering with the communication program (i.e. conflict on communication port access)?	Close the interfering program.

7.2.   Receiving "ERROR"

The USR3500 returns an "ERROR" message (in reply to an AT command) in the following cases:

- The AT command syntax is incorrect. In this case, check the command syntax (refer to the AT Commands Interface Guide at http://www.usr.com/support/3500).
- The AT command syntax is correct, but was transmitted using the wrong parameters

Enable the verbose error report method to see the error codes associated with the command syntax.

- Enter the **AT+CMEE=1** command in order to change the error report method to the verbose method, which includes the error codes.
- Re-enter the AT command which previously caused the reception of an "ERROR" message in order to get the Mobile Equipment error code.

When the verbose error report method is enabled, the response of the USR3500 in case of error is either:

- +CME ERROR: <error result code>

   or

- +CMS ERROR: <error result code>

Refer to the AT Commands Interface Guide at http://www.usr.com/support/3500 for more information on the error result code description and further details on the **AT+CMEE** command.

Caution: *It is strongly recommended to always enable the verbose error report method to get the Mobile Equipment error code (enter the **AT +CMEE=1** command).*

7.3.   Receiving "NO CARRIER"

If the USR3500 returns a "NO CARRIER" message upon an attempted call (voice or data), refer to the following table for possible causes and their corresponding solutions.

Table 19.   Receiving a "No Carrier" Message

If the USR3500 returns	Then ask	Action
"NO CARRIER"	Is the received signal strong enough?	Refer to section 6.2 Verifying the Received Signal Strength to verify the strength of the received signal.
	Is the USR3500 registered on the network?	Refer to section 6.3 Verifying the Network Registration to verify the network registration.
	Is the antenna properly connected?	Refer to the Reference Guide at http://www.usr.com/support/3500 for more information about the USR3500's antenna requirements.
	Is the band selection correct?	Refer to section 6.5 Switching Bands for more information about switching between bands.
"NO CARRIER" (when trying to issue a voice communication)	Is the semicolon (;) entered immediately after the phone number in the AT command?	Ensure that the semicolon (;) is entered immediately after the phone number in the AT command. e.g. ATD######;
"NO CARRIER" (when trying to issue a data communication)	Is the SIM card configured for data calls?	Configure the SIM card for data calls. (Ask your network provider if necessary).
	Is the selected bearer type supported by the called party?	Ensure that the selected bearer type is supported by the called party.
	Is the selected bearer type supported by the network?	Ensure that the selected bearer type is supported by the network. If still unsuccessful, try selecting the bearer type using the AT command: **AT+CBST=0,0,3**

If the USR3500 returns a "NO CARRIER" message, you may retrieve the extended error code by using the AT Command **AT+CEER**. Refer to the following table for the interpretation of extended error codes.

Table 20.   Extended Error Codes

Error Code	Diagnosis	Hint
1	Unallocated phone number	
16	Normal call clearing	
17	User busy	
18	No user responding	
19	User alerting, no answer	
21	Call rejected	
22	Number changed	
31	Normal, unspecified	

Error Code	Diagnosis	Hint
50	Requested facility not subscribed	Check your subscription. (Is data subscription available?)
68	ACM equal or greater than ACMmax	The credit of your pre-paid SIM card has expired.
252	Call barring on outgoing calls	
253	Call barring on incoming calls	
3, 6, 8, 29, 34, 38, 41, 42, 43, 44, 47, 49, 57, 58, 63, 65, 69, 70, 79, 254	Network causes	Refer to the AT Commands Interface Guide at http://www.usr.com/support/3500 for further details or call your network provider.

For all other codes and/or details, refer to the documents listed in section 10.1 Firmware Documentation.

8. USR3500 Accessories

8.1. Optional Accessories

The following optional accessories are available for use with the USR3500:

- 6-wire cable accessory with IO (DC IN, GND, Vref, GPIO25/INT1, GPIO35, ON/OFF) Refer to the following table for the color-coding of the 6-wire cable accessory.
- Diversity and GPS antennas
- Ethernet expansion card (Refer to the Reference Guide at http://www.usr.com/support/3500 for more information about the card.)

8.1.1. 6-wire Cable Accessory

Table 21.   6-wire Cable Accessory Description
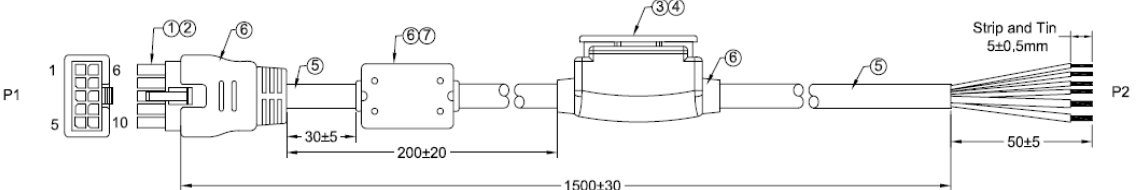
•	Length	1.5M
•	Connection	10-pin Microfit female connector to 6-wire open ends
•	Fuse	2A/250V slow break fuse

Table 22.   6-Wire Cable Accessory Color Coding

IO	Cable Accessory Color
DC-IN	RED
GND	BLACK
VREF	GREEN
GPIO35	ORANGE
ON/OFF	YELLOW
GPIO25/INT1	BROWN

Note: The above items are ONLY considered as optional accessories of the USR3500. They are NOT considered as part of the USR3500.

8.1.2.　GPS Antenna

Table 23.　GPS Antenna Description

Mechanical	Weight	< 110 grams
	Size	49x39x14mm
	Cable	RG174/U 3meters
	Connector	MMCx m. right angle
	Mounting	Magnetic base
	Housing	Black
Dielectric Antenna	Center Frequency	1575.42MHz ± 3 MHz
	V.S.W.R	1.5 : 1
	Band Width	±5 MHz
	Impedance	50Ω
	Peak Gain	> 3dBic Based on 7x7cm ground plane
	Gain Coverage	> -4dBic at –90°< 0 < +90°(over 75% Volume)
	Polarization	RHCP
LNA / Filter	LNA Gain (without cable)	28dB (typical)
	Noise Figure	1.5dB
	Filter Out Band Attenuation (f0=1575.42 MHZ)	7dB Min f0+/-20MHZ 20dB Min f0+/-50MHZ 30dB Min f0+/-100MHZ
	V.S.W.R	< 2.0
	DC Voltage	3.0V to 5.0V
	DC Current	10mA Max

9.   Safety Recommendations

9.1.   General Safety

For the efficient and safe operation of your programmable modem, please read the following information carefully.

It is important to follow any special regulations regarding the use of radio equipment due in particular to the possibility of radio frequency (RF) interference. Carefully follow the safety advice given.

Switch OFF your programmable modem:

- When in an aircraft. The use of cellular telephones in an aircraft may endanger the operation of the aircraft, disrupt the cellular network and is illegal. Failure to observe this instruction may lead to suspension or denial of cellular telephone services to the offender, or legal action or both,
- When at a refueling point,
- When in any area with a potentially explosive atmosphere which could cause an explosion or fire,
- In hospitals and any other place where medical equipment may be in use.

Respect restrictions on the use of radio equipment in:

- Fuel depots,
- Chemical plants,
- Places where blasting operations are in progress,
- Any area where the use of a cellular telephone is forbidden or dangerous.
- Any other area where you would normally be advised to turn off your vehicle engine.

Turn your modem OFF when in any area with a potentially explosive atmosphere. It is rare, but your modem or its accessories could generate sparks. Sparks in such areas could cause an explosion or fire resulting in bodily injuries or even death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include below decks on boats and areas where the air contains chemicals or particles, such as grain, dust, or metal powders.

Do not transport or store flammable gas, liquid, or explosives, in the compartment of your vehicle which contains your modem or accessories.

Before using your modem in a vehicle powered by liquefied petroleum gas (such as propane or butane) ensure that the vehicle complies with the relevant fire and safety regulations of the country in which the vehicle is to be used.

There may be a hazard associated with the operation of your USR3500 close to inadequately protected personal medical devices such as hearing aids and pacemakers. Consult the manufacturers of the medical device to determine if it is adequately protected.

Operation of your USR3500 close to other electronic equipment may also cause interference if the equipment is inadequately protected. Observe any warning signs and manufacturers' recommendations.

The USR3500 is designed for and intended to be used in "***fixed***" and "***mobile***" applications:

"***Fixed***" means that the device is physically secured at one location and is not able to be easily moved to another location.

"***Mobile***" means that the device is designed to be used in other than fixed locations and generally in such a way that a separation distance of at least 20 cm (8 inches) is normally maintained between the transmitter's antenna and the body of the user or nearby persons.

The USR3500 is not designed for nor intended to be used in portable applications (within 20 cm or 8 inches of the body of the user) and such uses are strictly prohibited.

9.2.   RF Safety

9.2.1.   General

Your GSM modem is based on the GSM standard for cellular technology. The GSM standard is spread all over the world. It covers Europe, Asia and some parts of America and Africa. This is the most used telecommunication standard.

Your GSM modem is actually a low power radio transmitter and receiver. It sends out and receives radio frequency energy. When you use your GSM application, the cellular system which handles your calls controls both the radio frequency and the power level of your cellular modem.

9.2.2.   Exposure to RF Energy

There has been some public concern about possible health effects of using GSM modems. Although research on health effects from RF energy has focused on the current RF technology for many years, scientists have begun research regarding newer radio technologies, such as GSM. After existing research had been reviewed, and after compliance to all applicable safety standards had been tested, it has been concluded that the product was acceptable for use.

If you are concerned about exposure to RF energy there are things you can do to minimize exposure. Obviously, limiting the duration of your calls will reduce your exposure to RF energy. In addition, you can reduce RF exposure by operating your cellular modem efficiently by following the below guidelines.

9.2.3.   Efficient Modem Operation

For your GSM modem to operate at the lowest power level, consistent with satisfactory connection quality:

Do not hold the antenna when the modem is « IN USE ». Holding the antenna affects connection quality and may cause the modem to operate at a higher power level than needed.

9.3.   Vehicle Safety

Do not use your USR3500 while driving, unless equipped with a correctly installed vehicle kit allowing 'Hands-Free' Operation.

Respect national regulations on the use of cellular telephones in vehicles. Road safety always comes first.

If incorrectly installed in a vehicle, the operation of the USR3500 could interfere with the correct functioning of vehicle electronics. To avoid such problems, make sure that the installation has been performed by qualified personnel. Verification of the protection of vehicle electronics should form part of the installation.

The use of an alert device to operate a vehicle's lights or horn on public roads is not permitted.

9.4.   Care and Maintenance

Your USR3500 is the product of advanced engineering, design and craftsmanship and should be treated with care. The suggestion below will help you to enjoy this product for many years.

Do not expose the USR3500 to any extreme environment where the temperature or humidity is high.

Do not use or store the USR3500 in dusty or dirty areas. Its moving parts can be damaged.

Do not attempt to disassemble the modem. There are no user serviceable parts inside.

Do not expose the USR3500 to water, rain or beverages. It is not waterproof.

Do not abuse your USR3500 by dropping, knocking, or violently shaking it. Rough handling can damage it.

Do not place the USR3500 alongside computer discs, credit or travel cards or other magnetic media. The information contained on discs or cards may be affected by the embedded module.

The use of third party equipment or accessories not authorized by USRobotics may invalidate the warranty of the modem.

Contact USRobotics in the unlikely event of a modem failure.

9.5.   Your Responsibility

This USR3500 is under your responsibility. Please treat it with care, respecting all local regulations. It is not a toy. Therefore, keep it in a safe place at all times and out of the reach of children.

Remember your Unlock and PIN codes. Become familiar with and use the security features to block unauthorized use and theft.

10. Reference Documents

The documents referenced herein are provided by USRobotics. Visit the USRobotics website at http://www.usr.com/support/3500 for the latest documentation available.

10.1. Firmware Documentation

[1]   AT Commands Interface Guide

[2]   Customer Release Notes for Firmware 7.52 A1

10.2. Ethernet Card Documentation

[3]   Ethernet Card User Guide

10.3. Firmware Upgrade Documentation

[4]   Courier M2M Application Guide

11. List of Abbreviations

Abbreviation	Definition
AC	Alternating Current
ACM	Accumulated Call Meter
AMR	Adaptive Multi-Rate
AT	ATtention (prefix for Wireless CPU® commands)
CLK	Clock
CMOS	Complementary Metal Oxide Semiconductor
CS	Coding Scheme
CTS	Clear To Send
dB	Decibel
dBc	Decibel relative to the Carrier power
dBi	Decibel relative to an Isotropic radiator
dBm	Decibel relative to one milliwatt
DC	Direct Current
DCD	Data Carrier Detect
DCE	Data Communication Equipment
DCS	Digital Cellular System
DSR	Data Set Ready
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi-Frequency
DTR	Data Terminal Ready
EEPROM	Electrically Erasable Programmable Read-Only Memory
EFR	Enhanced Full Rate
E-GSM	Extended GSM
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
ESD	ElectroStatic Discharges
ETSI	European Telecommunications Standards Institute
FIT	Series of connectors (micro-FIT)
FR	Full Rate
FTA	Full Type Approval
GCF	Global Certification Forum
GND	Ground
GPIO	General Purpose Input Output
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
HR	Half Rate
HSDPA	High Speed Downlink Packet Access

Abbreviation	Definition
HSPA	High Speed Packet Access
HSUPA	High Speed Uplink Packet Access
I	Input
IEC	International Electrotechnical Commission
IES	Internal Expansion Socket
IESM	Internal Expansion Socket Module
IMEI	International Mobile Equipment Identification
I/O	Input / Output
LED	Light Emitting Diode
MAX	MAXimum
ME	Mobile Equipment
MIC	MICrophone
Micro-Fit	Family of connectors from Molex
MIN	MINimum
MNP	Microcom Networking Protocol
MO	Mobile Originated
MS	Mobile Station
MT	Mobile Terminated
NOM	NOMinal
O	Output
Pa	Pascal (for speaker sound pressure measurements)
PBCCH	Packet Broadcast Control Channel
PC	Personal Computer
PCL	Power Control Level
PDP	Packet Data Protocol
PIN	Personal Identity Number
PLMN	Public Land Mobile Network
PUK	Personal Unblocking Key
RF	Radio Frequency
RFI	Radio Frequency Interference
RI	Ring Indicator
RMS	Root Mean Square
RTS	Request To Send
RX	Receive
SIM	Subscriber Identification Module
SMA	SubMiniature version A RF connector
SMS	Short Message Service
SNR	Signal-to-Noise Ratio
SPL	Sound Pressure Level
SPK	SpeaKer

Abbreviation	Definition
SRAM	Static RAM
TCP/IP	Transmission Control Protocol / Internet Protocol
TDMA	Time Division Multiple Access
TU	Typical Urban fading profile
TUHigh	Typical Urban, High speed fading profile
TX	Transmit
TYP	TYPical
UMTS	Universal Mobile Telecommunications System
VSWR	Voltage Stationary Wave Ratio

12. Product Labeling

A product label is located at the back of the USR3500 and provides additional information about the modem.

The labels provide the following information:

- Serial number and barcode
- Product Name
- Model number
- WEEE logo
- Qualcomm CDMA logo
- CE marking
- Product Name
- FCC ID
- IC number
- A-Tick logo, N24480
- Open AT logo
- IMEI number and barcode