AirLink XR80/XR90

Hardware User Guide

41114042
Rev 7

SIERRA WIRELESS®

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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 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 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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Revision History

Revision number	Release date	Changes
1	March 2021	Created
2	May 2021	General update
3	September 2021	Updated Regulatory Information—unique separation distances for XR80/XR90
4	October 2021	Updated Table 1-2 (part numbers: DC cable, Serial cables; AC adapter specs) Updated Step 5—Connect the Data Cables (added USB-C content) Updated Table 2-12 (reformatted; added LED examples) Added chapter: Router Reboot/Reset Updated Table 4-10 (removed channel 10/11 40 MHz support) Updated Table 4-14 (regions) Corrected Table 4-19 (marked last device as “non-” Wi-Fi XR80) Updated Indoor Use Restrictions list—added UK Added appendix: Thermal Protection Added appendix: Repair Added appendix: USB-C Network Connection

Revision number	Release date	Changes
5	July 2022	Updated Table 1-1 (expanded power consumption details) Updated Table 1-2 (added antenna FAQ references, added new accessories, removed preliminary MG90/XP70 to XR antenna adapter); removed references to adapter throughout document Updated Warranty Updated Step 1—Connect Optional XP 5G Cartridge(s) (added power down content) Updated Step 2—Insert the SIM Cards (added power down content) Updated Step 4—Connect the Antennas (added FAKRA replacement kit reference) Updated Step 2—Insert the SIM Cards (clarified SIM types and slot/module combinations) Updated Table 2-12 (Added Wi-Fi slow flashing purple, and Green chase) Updated Configure and Monitor Remotely with AirLink Management Service (removed ALEOS reporting statement) Updated Table 4-3 (indicated unsupported Wi-Fi ranges for Canada, clarified serial port cable types) Updated Table 4-9 (clarified as Wi-Fi channel chipset support), added Table 4-12 (Global Wi-Fi channel support) and Table 4-13 (North American Wi-Fi channel support) Updated Table 4-13 (Indicated unsupported Wi-Fi ranges for Canada, clarified band support restrictions) Updated number of supported Wi-Fi clients, added Table 4-8 Updated Table 4-16 (Tx power values, notes) Updated XR Router and XP 5G Cartridge Labels and Select Label Contents (added 5G cartridge label details) Added ALMS Registration Added Radio Module Registration Updated Important Information for Users in Canada and the United States Moved antenna separation content to Antennas from Accessories. Updated DC Power Cable Updated I/O Cable Updated Vehicle Bus Cables (description, added example) Updated Repair (added FAKRA replacement kit details) Updated Web Site Support (registration)
6	August 2022	Replaced “AirLink Antennas” with “Sierra Wireless Antennas” Updated Cellular Radios (Added Known Issue about Cellular LED behavior after AirLink OS 3.0 to 3.1 upgrade; Table 4-14 (noted AirLink OS band support))

Revision number	Release date	Changes
7	June 2023	Replaced “XR Series” references with “XR80/XR90” Removed notes indicating GPIO configuration support was pending a future firmware release. GPIOs are now configurable. Updated Figure 2-23 (Corrected wording) Updated Table 2-12 (added Cellular LED behavior for unrecognized SIM using Generic radio module firmware) Updated Wi-Fi (content reorganization, updated Wi-Fi channel support) Updated Table 4-1 (Added additional EN certifications) Reformatted and separated Supported Bands table into Table 4-14 and Table 4-15; Updated footnote wording; Added AirLink OS 4.1 support for additional bands subject for XR routers with IMEIs starting with “351”. Updated Figure 4-6 (removed LPWA IMEI from label) Clarified serial RS-232 serial cable DB9 connector type as female

Contents

1: Introduction to the XR80/XR90

This hardware user guide is for Sierra Wireless® AirLink® XR80/XR90 5G High Performance Multi-Network routers. Features and specifications described in this user guide apply to all router variants unless otherwise noted.

As part of the AirLink Performance series, AirLink XR80/XR90 routers are purpose-built to provide secure, always-on connectivity for mission-critical and business applications in public safety, transit and field services. AirLink XR80/XR90 routers deliver superior reliability and uninterrupted operation in harsh mobile environments.

Seamless integration with the AirLink Management Service (ALMS) enables simplified, remote and real-time insight and control of connected mobile assets and mission-critical applications, and supports vehicle tracking, telemetry and asset management applications.

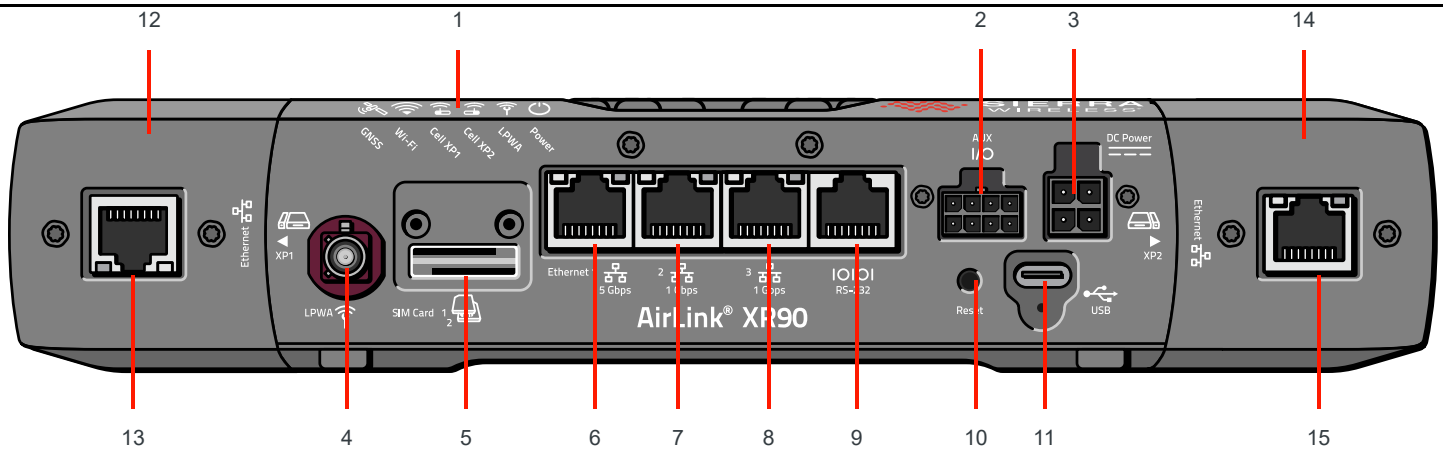
Note: Throughout this document, "XR" (if used by itself) refers to all XR80/XR90 routers.

1.1 Key Features

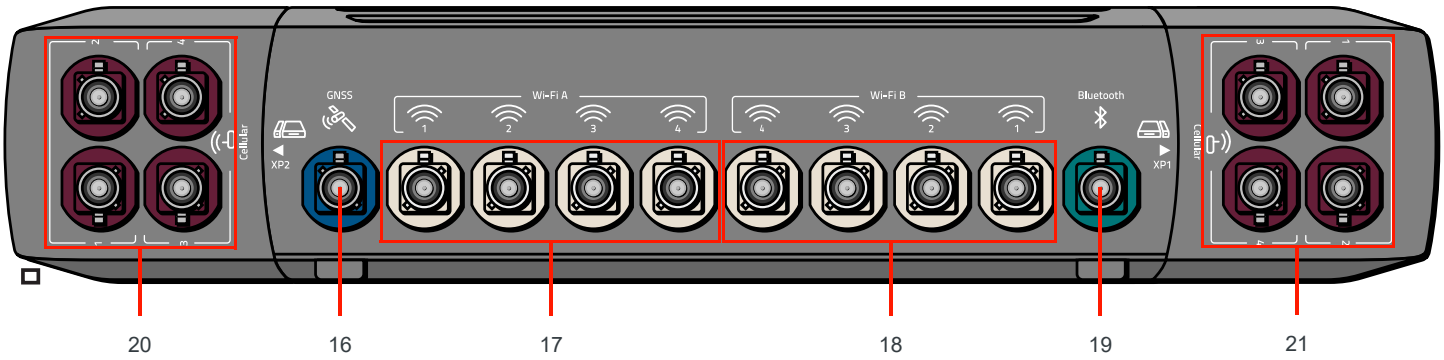
- 5G (non-mmWave) >2 Gbps with 4G/3G fallback
- Optional expansion cartridges (cartridge includes cellular radio module and Ethernet port)
- Wi-Fi:
  - XR90—Dual independent 4×4 MIMO Wi-Fi 6
  - XR80—4×5 MIMO Wi-Fi 6
- Ethernet (LAN/WAN):
  - Main router ports: 1×5 Gbps, 2×1 Gbps
  - XP 5G Cartridge(s) port: 1×1 Gbps
- Direct vehicle bus (CAN bus) interface (OBD-II (J1979)/J1939))
- 5 configurable GPIOs
- USB-C connector: USB 3.1 Gen 1 (SuperSpeed 5 Gbps)
- Assisted GNSS with inertial navigation and dead reckoning
  - Precision mobile events reporting (via NMEA/TAIP streaming) at 1 second intervals allows for detailed network and connectivity analysis.
- Active link policies to optimize WAN connections for quality, cost, and performance

Router features and functionality are configured locally via the XR router's AirLink OS user interface or remotely via ALMS. For details, refer to *[3] AirLink OS User Guide*.

1.2 Description

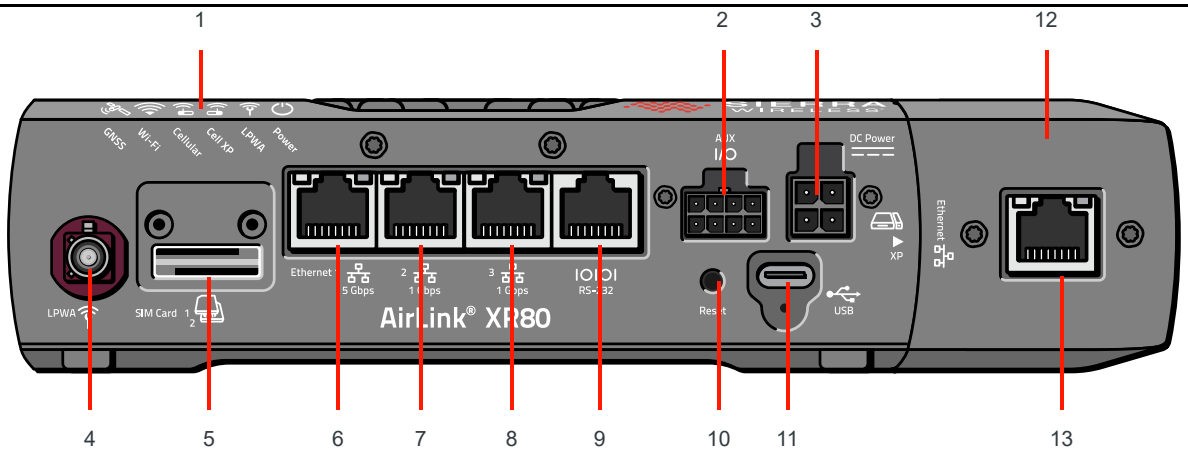


1— LEDs (see LED Behavior on page 46)
2— Auxiliary I/O (see Step 7 (Optional)—I/O Configuration on page 37)
3— DC power (see Router Power Connector on page 31)
4— LPWA antenna (see Step 4—Connect the Antennas on page 25)
5— Dual mini-SIM 2FF card slots (see Step 2—Insert the SIM Cards on page 20)
6— Ethernet 1 (5 Gbps) RJ-45 port (see Ethernet on page 59)
7— Ethernet 2 (1 Gbps) RJ-45 port (see Ethernet on page 59)
8— Ethernet 3 (1 Gbps) RJ-45 port (see Ethernet on page 59)
9— RS-232 Serial connector RJ-45 port (see Serial Port on page 60)
10— Reset button (see Configuration Reset on page 53)
11— USB type-C locking port (see USB on page 59)
12— XP1 Expansion Cartridge (see Step 1—Connect Optional XP 5G Cartridge(s) on page 18)
13— XP1 Ethernet (1 Gbps) RJ-45 port (see Ethernet on page 59)
14— XP2 Expansion Cartridge (see Step 1—Connect Optional XP 5G Cartridge(s) on page 18)
15— XP2 Ethernet (1 Gbps) RJ-45 port (see Ethernet on page 59)



16— GNSS antenna connector (see Step 4—Connect the Antennas on page 25)
17— Wi-Fi A antenna connectors (1–4) (see Step 4—Connect the Antennas on page 25)
18— Wi-Fi B antenna connectors (1–4) (see Step 4—Connect the Antennas on page 25)
19— Bluetooth antenna connector (see Step 4—Connect the Antennas on page 25)
20— XP2 cartridge cellular antenna connectors (1–4) (see Step 4—Connect the Antennas on page 25)
21— XP1 cartridge cellular antenna connectors (1–4) (see Step 4—Connect the Antennas on page 25)

Figure 1-1: XR90 Connectors, LEDs and SIM Card Holder



1— LEDs (see LED Behavior on page 46)
2— Auxiliary I/O (see Step 7 (Optional)—I/O Configuration on page 37)
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5— Dual mini-SIM 2FF card slots (see Step 2—Insert the SIM Cards on page 20)
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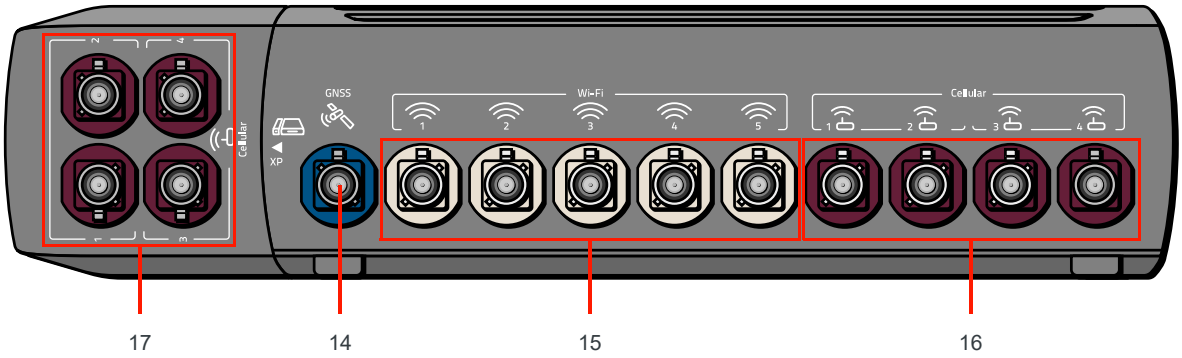
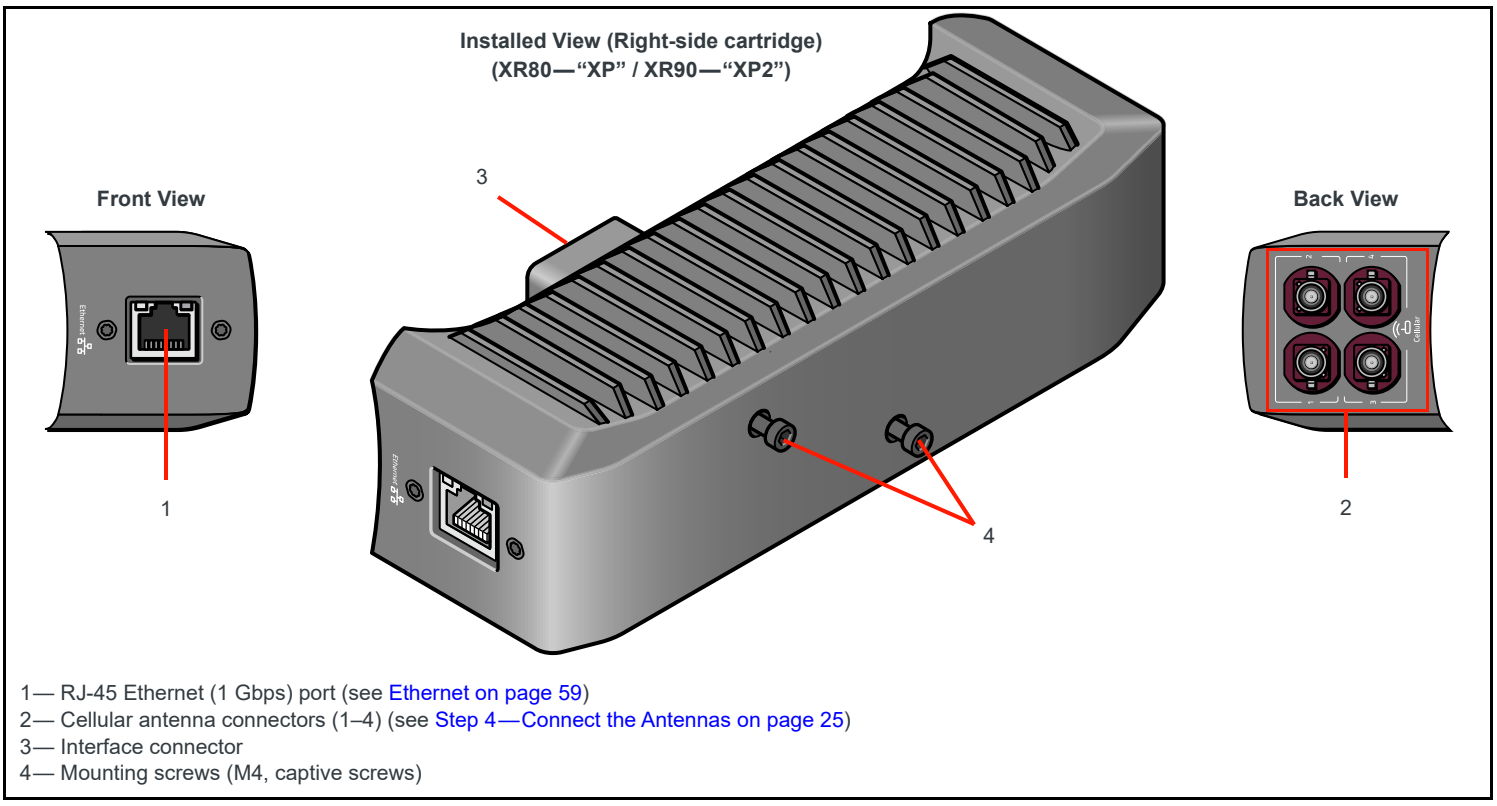
8— Ethernet 3 (1 Gbps) RJ-45 port (see Ethernet on page 59)
9— RS-232 Serial connector RJ-45 port (see Serial Port on page 60)
10— Reset button (see Configuration Reset on page 53)
11— USB type-C locking port (see USB on page 59)
12— XP1 Expansion Cartridge (see Step 1—Connect Optional XP 5G Cartridge(s) on page 18)
13— XP1 Ethernet (1 Gbps) RJ-45 port (see Ethernet on page 59)



14— GNSS antenna connector (see Step 4—Connect the Antennas on page 25)
15— (XR80 Wi-Fi routers only) Wi-Fi antenna connectors (1–5) (see Step 4—Connect the Antennas on page 25)
16— Cellular antenna connectors (1–4) (see Step 4—Connect the Antennas on page 25)
17— XP 5G Cartridge cellular antenna connectors (1–4) (see Step 4—Connect the Antennas on page 25)

Figure 1-2: XR80 Connectors, LEDs and SIM Card Holder



1— RJ-45 Ethernet (1 Gbps) port (see Ethernet on page 59)
2— Cellular antenna connectors (1–4) (see Step 4—Connect the Antennas on page 25)
3— Interface connector
4— Mounting screws (M4, captive screws)

Figure 1-3: XP 5G Cellular Cartridge ("XP"/"XP1"/"XP2")

1.3 Power Consumption

Table 1-1: Sample Power Consumption Scenarios[a]

Scenario	Notes	XR80				XR90	
		Non-Wi-Fi		Wi-Fi			
		No cartridge	Cartridge[b]	No cartridge	Cartridge[b]	1 cartridge[b]	2 cartridges[b]
Standby		55 mW					
Idle with radio attached and connected (0 dBm)	• 1 x 5GBASE-T Ethernet connected (idle) • 2 x 1000BASE-T Ethernet connected (idle) • (Cartridge) 1-2 x 1000BASE-T Ethernet connected (idle) • (Wi-Fi) 2.4 GHz 4x4 (idle) • (Wi-Fi) 5 GHz 4x4 (idle) • (Wi-Fi) 5 GHz 4x4 (idle) • USB virtual Ethernet port connected (idle) • Serial port connected • GNSS enabled	11 W	15 W	21 W	25 W	23 W	27 W

Table 1-1: Sample Power Consumption Scenarios[a] (Continued)

Scenario	Notes	XR80				XR90	
		Non-Wi-Fi		Wi-Fi			
		No cartridge	Cartridge[b]	No cartridge	Cartridge[b]	1 cartridge[b]	2 cartridges[b]
Max Power with radio attached and connected (23 dBm)	• 1 x 5GBASE-T Ethernet connected (max traffic) • 2 x 1000BASE-T Ethernet connected (max traffic) • (Cartridge) 1-2 x 1000BASE-T Ethernet connected (max traffic) • (Wi-Fi) 2.4 GHz 4x4, 802.11ax, 23.5dBm (max traffic) • (Wi-Fi) 5 GHz 4x4, 802.11ax, 23.5dBm (max traffic) • (Wi-Fi) 5 GHz 4x4, 802.11ax, 23.5dBm (max traffic) • USB virtual Ethernet port connected (max traffic) • Serial port connected • GNSS enabled	19 W	28 W	45 W	54 W	51 W	60 W
Inrush Current		4.75 A @ 12 V (Averaged over 500 µs)					

a. All measurements taken at 25°C
b. While in operation, each cartridge consumes 9 W (nominal).

1.4 Accessories

Table 1-2 lists accessories that are included with the XR router or are available for purchase from Sierra Wireless.

Table 1-2: XR80/XR90 Accessories[a]

Part	Part Number	Description
Included with XR router purchase		
LPWA antenna	6001401	1×1 LTE cable antenna (2 m, adhesive mount) for embedded LPWA cellular radio For best practice guidelines in selection, capabilities and use of LPWA antennas, refer to *[6] AirLink XR Series Router Antenna FAQ*.
Locking DC power cable	6001406	Length—3 m (10 ft)
Available for separate purchase from Sierra Wireless		
XP 5G Cartridge	1104757	Optional 5G cartridge that can be used with XR80 LTE, XR80 5G and XR90
Sierra Wireless Antennas	For XR80/XR90 antenna packages, visit www.sierrawireless.com/router-solutions/antennas/	5G sub-6 GHz, 2.4 GHz, and 5 GHz Wi-Fi antennas for various XR80/XR90 configurations For best practice guidelines in selection, capabilities and use of cellular, Wi-Fi, BT, and GNSS antennas, refer to *[6] AirLink XR Series Router Antenna FAQ*.
I/O cable	6001004	AUX I/O 8-pin data cable

Table 1-2: XR80/XR90 Accessories[a] (Continued)

Part	Part Number	Description
J1939 Y-Cable	6001192	Vehicle bus cable
OBD-II (J1979) Y-cable	6001204	Vehicle bus cable
Mounting bracket	6001350	Mounting bracket for easy vehicle installation and removal Includes bracket, screws, nuts, standoffs, etc.
Universal AC power adapter	6001372	Universal AC voltage power supply with three regional mains connectors
RS-232 serial cable (RJ45 to dual DB9)	6001409	RJ45 to dual DB9 female serial cable
RS-232 serial cable (RJ45 to single DB9)	6001410	RJ45 to single DB9 female serial cable
DIN rail mounting bracket	6001433	Mounting bracket for horizontal or vertical installation on a DIN rail
XR FAKRA replacement kit	6001440	Kit containing a variety of FAKRA replacement connector caps for XR80/XR90 routers and XP 5G Cartridges
MG90 to XR adapter bracket	6001456	XR mounting bracket that attaches to an existing MG90 mounting bracket

a. Subject to change.

1.5 Warranty

XR routers include a 1-year warranty that can be optionally extended to 5 years.

For complete warranty details, refer to the Sierra Wireless End-User Warranty for AirLink Products, available at https://www.sierrawireless.com/legal/terms.

2: Installation and Startup

This chapter describes:

- How to connect, install and power on the XR80/XR90 router
- Front panel LEDs
- I/O functionality

Note: Field wiring and connections in hazardous locations must be connected as per applicable Class II electrical codes.

Note: The XR router installation must be done by a qualified technician.

2.1 Out of Box—Quick Start

One year of access to ALMS is included in the XR router's purchase price. Use ALMS to register, configure, manage and monitor your XR router (or XR router fleet).

Refer to *[4] AirLink XR90 Quick Start Guide*/*[5] AirLink XR80 Quick Start Guide*) for instructions on registering and preconfiguring your XR router.

2.2 Tools and Materials Required

- Phillips screwdriver—#1 (to remove SIM card cover)
- Hex key (Allen wrench)—3 mm (if installing/removing XP 5G Cartridges)
- Wrench—8 mm (if installing an optional bracket mount)
- SIM card(s) provided by your mobile network operator for your 5G cellular modem(s)—XR routers support 1–2 5G cellular modems (SKU-dependent).
- Power supply—See Table 1-2 on page 15 for part numbers. (Note— A DC power cable is supplied by Sierra Wireless.)
- Multi-element antenna(s) appropriate for your XR router. See Table 1-2 on page 15 for suggested antennas, and Table 2-1/Table 2-2 on page 27 for FAKRA antenna connector details.
- Optional:
  - RJ45 to DB9 female cable for RS-232 port. See Serial Port on page 60 for details.
  - 8-pin auxiliary I/O connector cable
  - OBD-II (J1979) or J1939 vehicle bus cable

Caution: *The XR router is rated for use in extreme environments. If the XR router is to be used in these environments, make sure to use cables designed and specified for this use to avoid cable failure.*

2.3 Installation Overview

Typical installations are performed as follows:

- Step 1—Connect Optional XP 5G Cartridge(s) on page 18.
- Step 2—Insert the SIM Cards on page 20.
- Step 3—Mount and Ground the Router on page 21.
- Step 4—Connect the Antennas on page 25.
- Step 5—Connect the Data Cables on page 29.
- Step 6—Prepare Power Connection on page 30.
- Step 7 (Optional)—I/O Configuration on page 37.
- Step 8 (Optional)—Connect the Vehicle Bus Cable on page 44.
- Step 9—Power on the Router on page 45.
- Step 10—Software Configuration on page 50.

The following sections describe these steps in detail. Read these sections carefully before performing the installation.

Important: *The default local AirLink OS password is printed on the XR router label (Figure 4-6 on page 77).*

- *Before installation, make sure to record the default password and store it in a secure place.*
- *For security, make sure to change the password after logging in to the AirLink OS.*
- *If the XR router is later reset to factory defaults, the password may also be reset to the default. For details, see Reset to Factory Default or Custom Template Settings on page 54.*

2.4 Step 1—Connect Optional XP 5G Cartridge(s)

The XR80/XR90 base unit supports connection of optional XP 5G expansion cartridges (2 for XR90, 1 for XR80).

To install optional cartridge(s):

1. Make sure the XR router is powered down.

   Important: *Always power down the router before adding or removing an XP 5G Cartridge or SIM. Hot plugging/unplugging is not supported.*

2. Use a 3 mm hex key (Allen wrench) to remove the cartridge cover panel (or a cartridge that is being replaced).
   (Note—If the panel is equipped with Phillips-head screws, use a Phillips #1 screw-driver.)

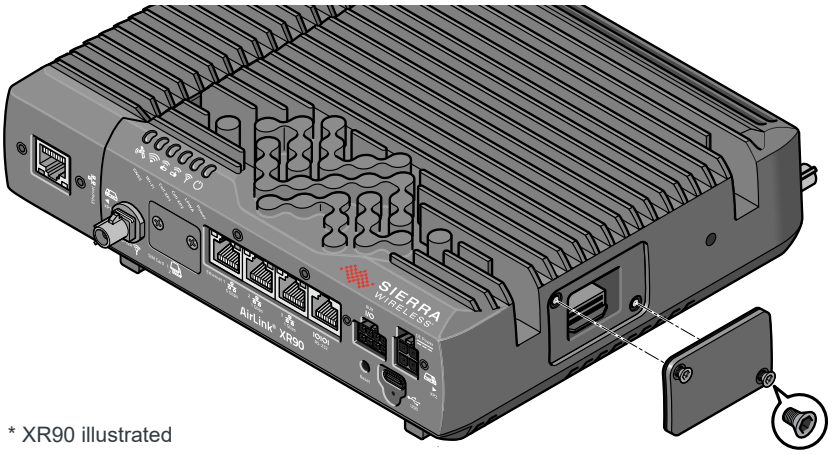


Figure 2-1: Removing Cartridge Cover Panel

3. Position the XP 5G Cartridge beside the XR router, with the antenna connectors facing the rear. (Note—XP 5G Cartridges can be installed on either side of XR90 routers, and on the right side of XR80 routers.)

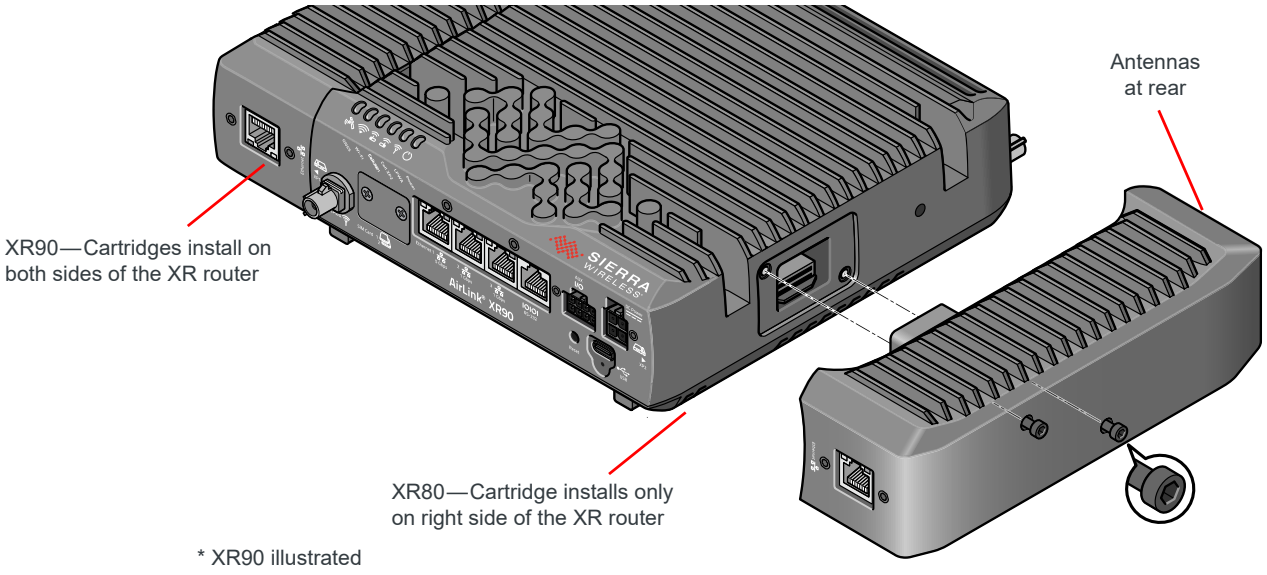


Figure 2-2: Installing an Optional XP 5G Cartridge

4. Carefully push the cartridge into the XR router.
5. Use a 3 mm hex key to tighten the cartridge's captive mounting screws.

Important: *Make sure to tighten the XP 5G Cartridge screws as recommended in Screw Specifications. Under-tightening screws can lead to improper operation.*

2.5 Step 2—Insert the SIM Cards

The XR router has two mini-SIM (2FF) card slots located behind a removable plate on the front of the XR router as shown in Figure 2-3 on page 21.

Use mini-SIMs with the XR router—adapters for micro-SIMs or nano-SIMs are not recommended.

By default, the SIMs correspond to the cellular modules as follows:

- XR90:
  - SIM 1 (Upper slot)—XP1 cartridge radio module
  - SIM 2 (Lower slot)—XP2 cartridge radio module
- XR80:
  - SIM 1 (Upper slot)—Internal radio module
  - SIM 2 (Lower slot)—XP cartridge radio module

Note: SIM slot assignments are software-configurable in the AirLink OS.

If the SIM card(s) are not already installed, insert them before connecting any external equipment or power to the XR router.

To install the SIM card(s):

1. Make sure the XR router is powered down.

   Important: *Always power down the router before adding or removing a SIM or XP 5G Cartridge. Hot plugging/unplugging is not supported.*

2. Remove the SIM card cover—Use a #1 Phillips screwdriver. (Note—The cover uses 'captive' screws.)
3. Orient the SIM card(s), as shown in Figure 2-3. (Upper SIM—Gold contacts face-down; Lower SIM—Gold contacts face-up)

   Make sure to use the correct SIM slot(s):
   - If the XP 5G Cartridge is on the left side of the router (or if the SIM is for the internal radio module in an XR80), use the upper slot.
   - If the XP 5G Cartridge is on the right side of the router, use the lower slot.
4. Gently slide the SIM cards into their slots until they click into place.

   (To remove a SIM card, press it in until it clicks, then release it. Gently grip the SIM card and pull it out.)

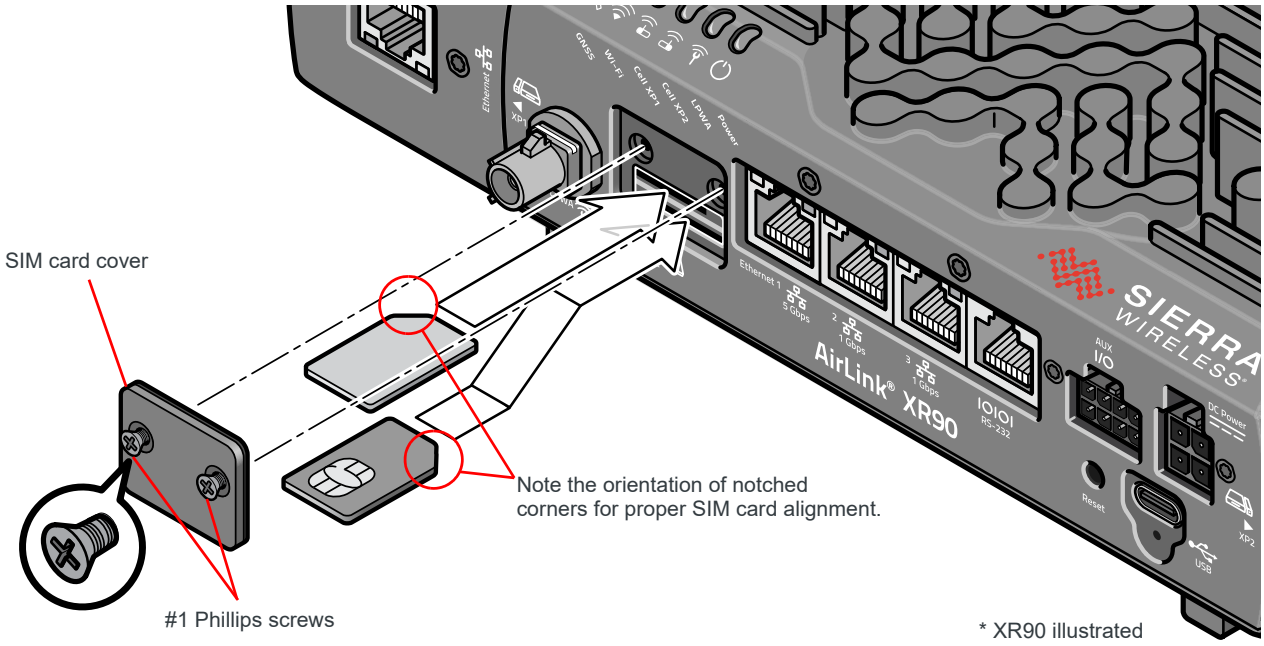


Figure 2-3: Installing the SIM Cards

5. Replace the SIM card cover.

Important: *Do not over-tighten the screws (see Screw Specifications on page 61). This could strip the threads inside the XR router, which will prevent the cover from re-attaching.*

2.6 Step 3—Mount and Ground the Router

The XR router can be mounted directly onto a flat surface, or attached to a mounting bracket to allow easy mounting/dismounting on flat or vertical surfaces.

Sierra Wireless strongly recommends that you always ground the router using the unpainted mounting hole (grounding point) shown in Figure 2-7 on page 24.

Note: See the Mechanical Specifications on page 72 for the XR router's dimensions, including mounting hole positions.

The XR router should not be mounted in the driver's area of the vehicle or in areas where it can distract the driver. Mount it in accordance with accepted after-market practices and materials.

While mounting the XR router, make sure the power source is OFF (e.g. power cord is disconnected, vehicle ignition is off, etc.).

Mounting recommendations and requirements:

- Provide easy access to connect all components (cables, antennas, accessories, etc.) and perform maintenance—leave sufficient space in front of, behind, and above the unit.
  Typical locations for vehicle installations include under the deck lid or on the floor-board of the vehicle's equipment storage.

- Cables must not be constricted, close to high electrical currents, or exposed to extreme temperatures.
- Make sure front panel LEDs are easily visible.
- Make sure the installed XR router has adequate airflow to dissipate heat.
- Protect the XR router from direct exposure to the elements (sun, rain, dust, etc.).
- Protect the XR router from contact with people, cargo, tools, equipment, etc.

Note: If the XR router is vehicle-mounted, it should not be in the driver's area of the vehicle or in areas where it can distract the driver. Mount it in accordance with accepted after-market practices and materials.

The XR router has 4 mounting holes, as shown in Figure 2-4. For mounting screw specifications, see Screw Specifications on page 61.

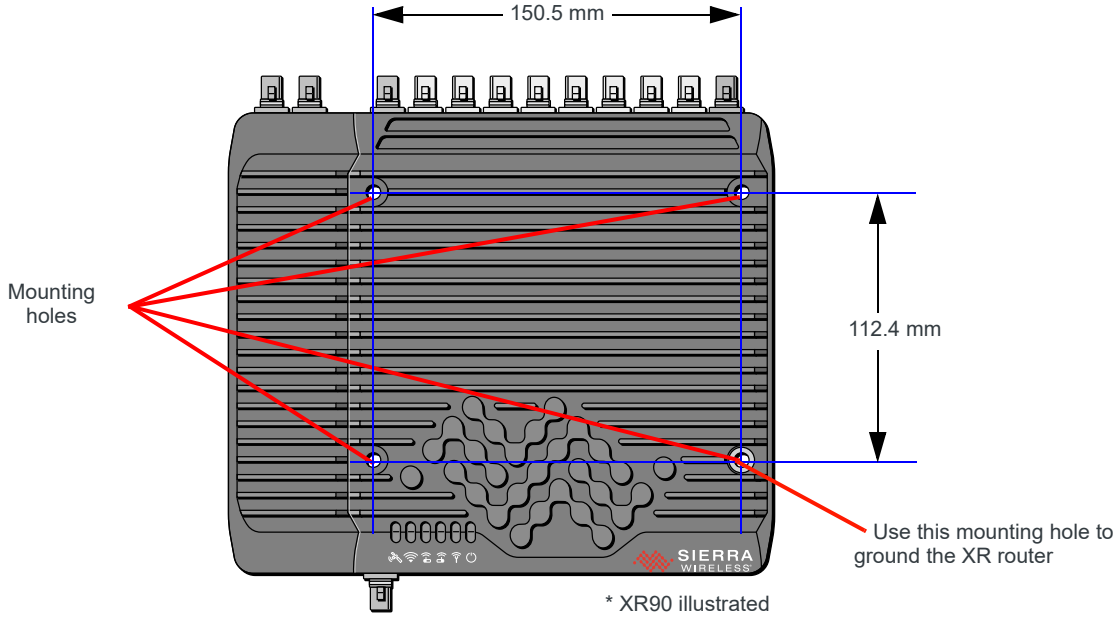
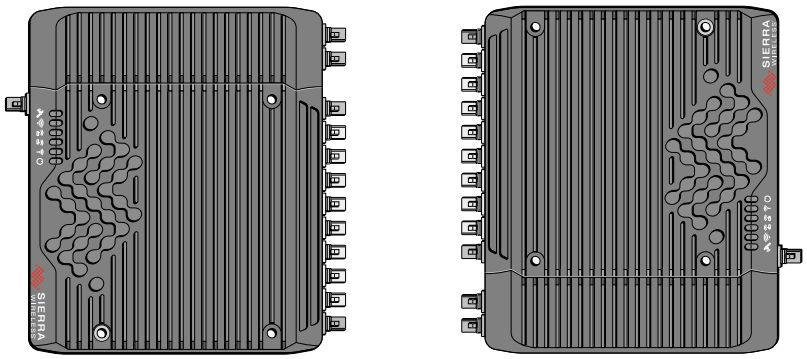


Figure 2-4: XR Router Mounting Holes

Note: When mounting the XR router in a location that could be exposed to rain (e.g. in a vehicle door panel, which would expose the XR router when the door is opened), mount the XR router facing left to right. (i.e. antenna and other ports are inserted from the side), as shown in Figure 2-5.



* XR router with one cartridge illustrated

Figure 2-5: Recommended Orientations for Inclined/Vertical Mounting

2.6.1 Flat Surface Mount

To mount the XR router on a flat surface, use M5 pan head screws with split washers (for details, see Screw Specifications).

2.6.2 Bracket Mount

An optional quick mounting bracket (Part #6001350, available from Sierra Wireless) allows the XR router to be easily mounted/dismounted.

The mounting bracket is supplied with four M5 hex-head screws that can be used to attach the bracket to a mounting surface via pre-tapped holes, and two thumbscrews to connect the router to the bracket. (Note: If the hex-head screws are not appropriate for the mounting surface material (substrate), use an alternate router mounting screw type—see Screw Specifications on page 61.)

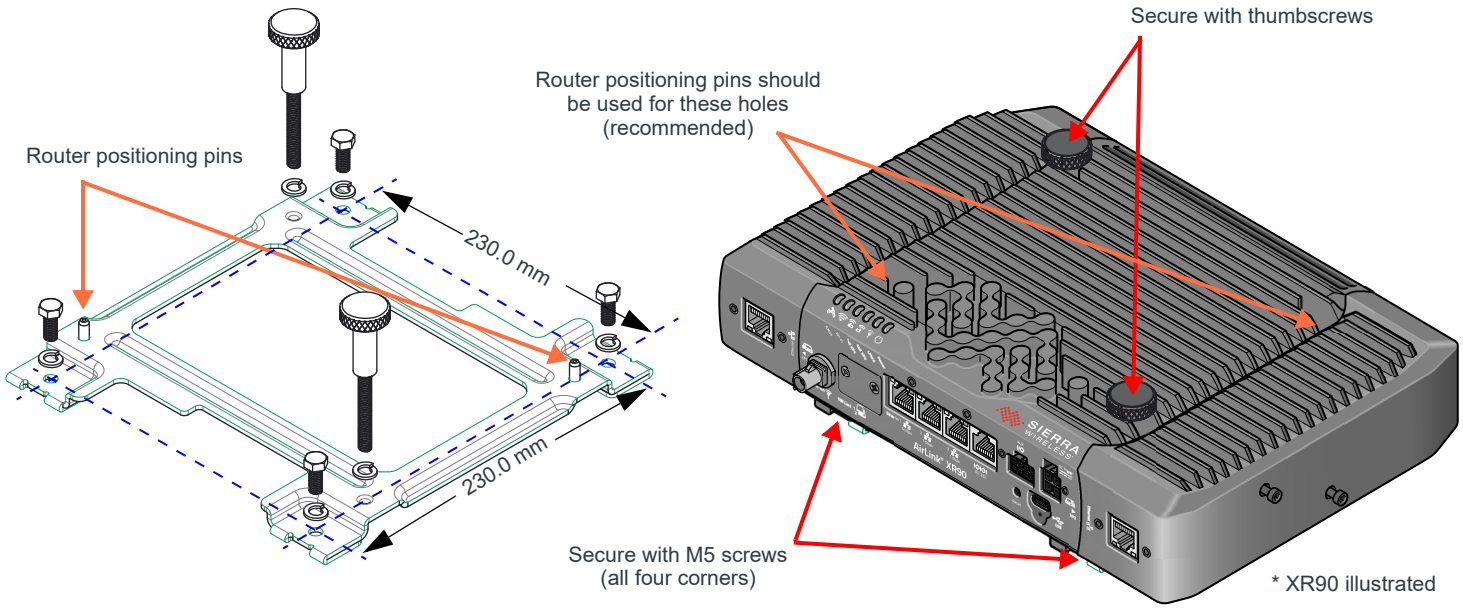


Figure 2-6: XR80/XR90 Bracket Mounting Installation Example

Attach the bracket to the mounting surface and install the XR router:

1. Position the bracket on the mounting surface.
2. Secure the bracket with the four supplied M5 hex-head screws.
3. Position the XR router on the bracket— the bracket's positioning pins fit into two of the XR router's mounting holes. For best results, the module should be grounded (see Grounding the Router, below)), so use the holes indicated in Figure 2-6 for positioning pins and thumbscrews (one thumbscrew uses the unpainted mounting hole).
4. Secure the XR router using the two supplied thumbscrews in the remaining mounting holes.

2.6.3 Grounding the Router

For DC installations with a fixed "system" ground reference, Sierra Wireless strongly recommends always grounding the XR router to the system ground reference.

To ensure a good grounding reference, either:

- Attach the XR router to a grounded metallic surface
- Connect one end of a short 18 AWG or larger gauge wire to the unpainted mounting hole (see Figure 2-7) and connect the other end to your main grounding point. (e.g. for a vehicle-mounted XR router, ground to the vehicle chassis)

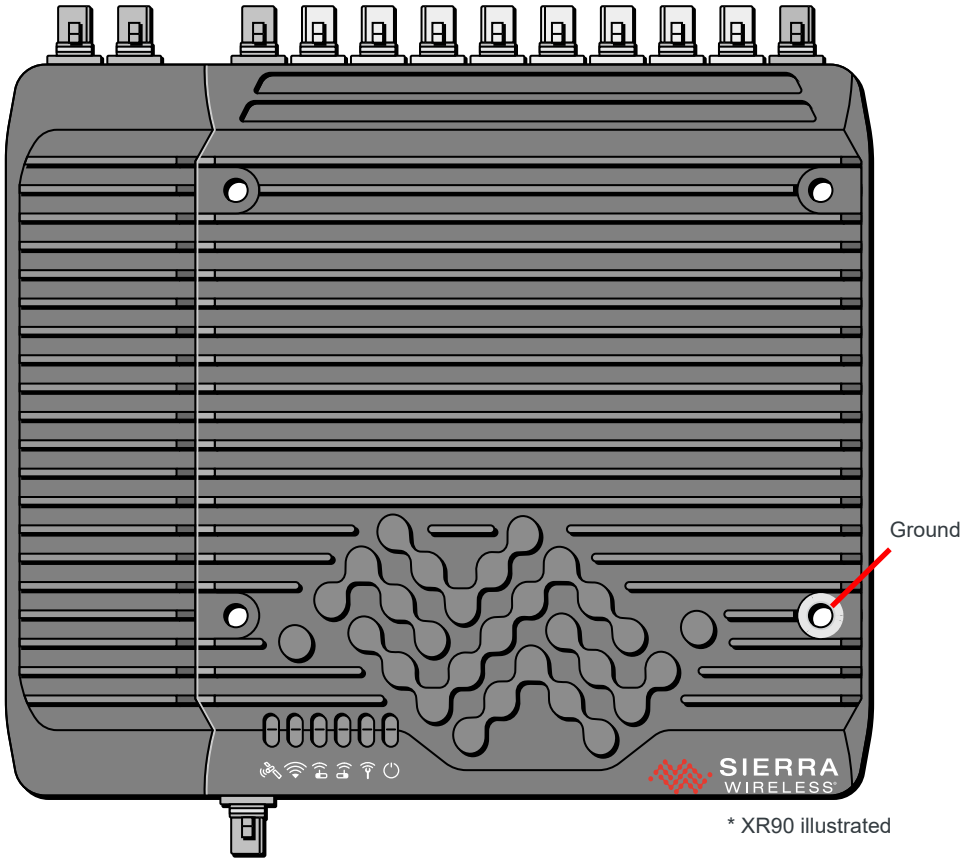


Figure 2-7: Ground Connector

2.7 Cabling—Best Practices

2.7.1 Cable Routing for Vehicle Installations

Sierra Wireless recommends separating the XR router's antenna, data and power cables from other wiring in the vehicle, and routing them away from sharp edges.

2.7.2 Cable Strain Relief for High-Vibration Installations

Sierra Wireless recommends using cable strain relief for installations in high-vibration environments.

Place the cable strain relief within 200 mm (8") of the XR router to reduce the mass of cable supported by the XR router's connectors (power, antenna, etc.) under vibration. Ideally, the strain relief mounting for the cables should be attached to the same object as the XR router, so both the XR router and cables vibrate together. Strain relief should be mounted such that it does not apply additional stress on the connectors (i.e. the cables should not be taut and should not pull the connectors at an angle).

2.7.3 Cable Management

Proper cable management eliminates unnecessary installation complications, allows for ease of maintenance, and prolongs cable longevity.

The following practices are recommended for cable installation:

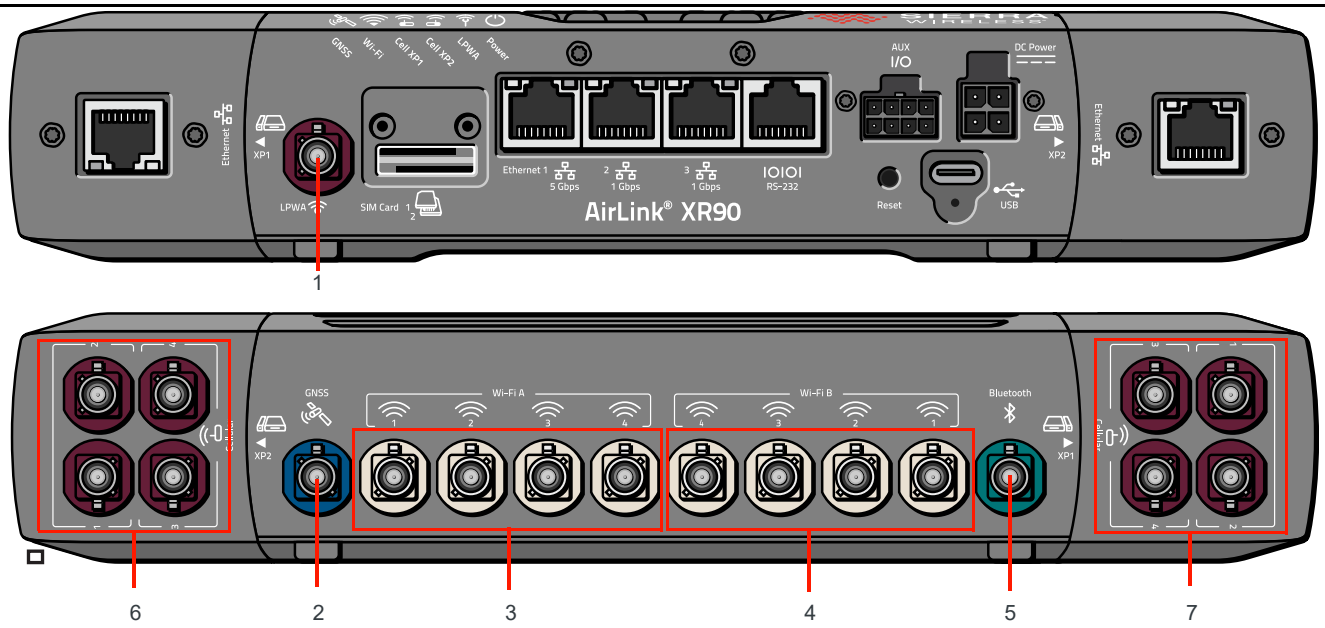
- Label all cables that attach to the XR router. For example: "GNSS", "Wi-Fi A", "Ethernet to Device X", etc.
- Protect the cables using a proper cable conduit.
- Secure each cable connected to the XR router via a permanent fixture.

2.8 Step 4—Connect the Antennas

Warning: *The XR router is not intended for use close to the human body. Antennas should be at least 8 inches (20 cm) away from the operator or bystanders.*

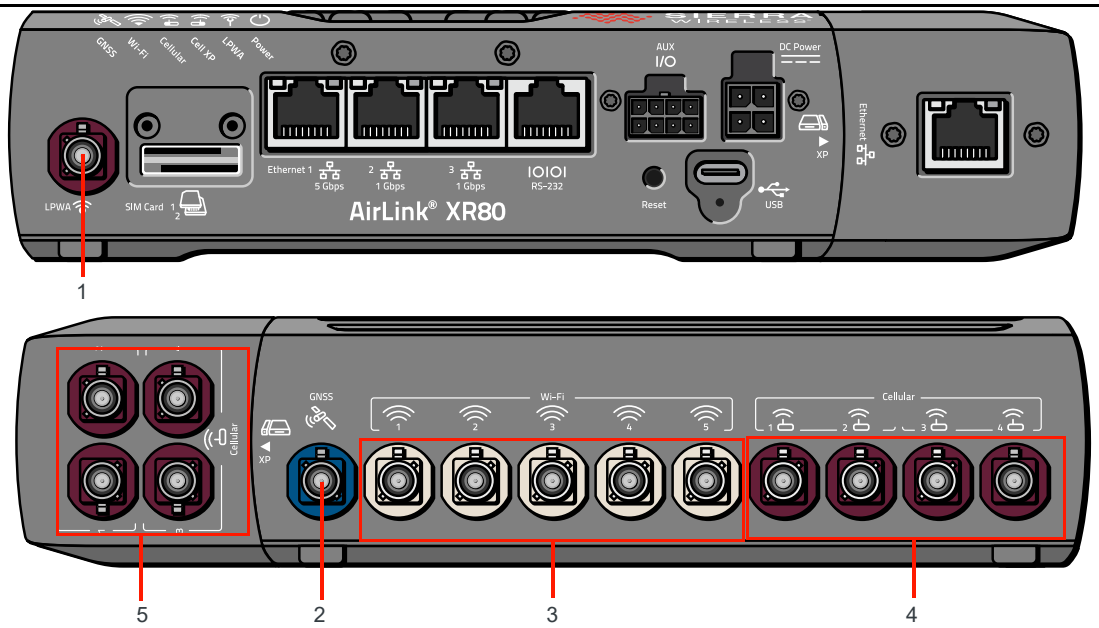
The XR router uses FAKRA connectors for all antenna connections (Cellular, LPWA, Wi-Fi, Bluetooth, GNSS).

Note—A FAKRA connector replacement kit (PN 6001440) containing a variety of FAKRA connector caps for XR80/XR90 routers and XP 5G Cartridges is available from Sierra Wireless. For replacement instructions, refer to Replacing Broken FAKRA Connectors on page 92.



1— LPWA antenna
2— GNSS antenna connector
3— Wi-Fi A antenna connectors (1–4)
4— Wi-Fi B antenna connectors (1–4)
5— Bluetooth antenna connector
6— XP2 cartridge cellular antenna connectors (1–4)
7— XP1 cartridge cellular antenna connectors (1–4)

Figure 2-8: XR90 Connectors, LEDs and SIM Card Holder



1— LPWA antenna
2— GNSS antenna connector
3— Wi-Fi antenna connectors (1–5)
(On XR80 Wi-Fi routers only)
4— Cellular antenna connectors (1–4)
5— XP cartridge cellular antenna connectors (1–4)

Figure 2-9: XR80 Connectors, LEDs and SIM Card Holder

Table 2-1: XR90 FAKRA[a] Antenna Connector Types

Panel	Module	Connectors	Color	Key	Description
Front	Radio	LPWA	Claret-Violet (Purple) 	D	Low power wide area radio used for Sierra's out-of-band management solution
XP1	Radio	Cellular 1–4	Claret-Violet (Purple) 	D	5G cellular radio (four antenna cables required)
XP2	Radio	Cellular 1–4	Claret-Violet (Purple) 	D	5G cellular radio (four antenna cables required)
Rear	Wi-Fi	Wi-Fi A 1–4	Beige 	I	Tri-band Wi-Fi. For details, see Wi-Fi on page 64.
Rear	Wi-Fi	Wi-Fi B 4–1	Beige 	I	Tri-band Wi-Fi. For details, see Wi-Fi on page 64.
Rear	GNSS	GNSS	Signal-Blue (Blue) 	C	GNSS
Rear	Bluetooth	Bluetooth	Water-Blue (Teal) 	Z	Bluetooth

a. The antenna's female FAKRA connectors are color-coded to match the XR router's male FAKRA connectors, and the connectors are 'keyed' to ensure only the correct antenna types are connected. (e.g. purple female FAKRA connectors will not connect to the XR router's beige Wi-Fi male FAKRA connectors)

Table 2-2: XR80 FAKRA[a] Antenna Connector Types

Panel	Module	Connectors	Color	Key	Description
Front	Radio	LPWA	Claret-Violet (Purple) 	D	Low power wide area radio used for Sierra's out-of-band management solution
Rear	Radio	Cellular 1–4	Claret-Violet (Purple) 	D	5G cellular radio (four antenna cables required)
XP	Radio	Cellular 1–4	Claret-Violet (Purple) 	D	5G cellular radio (four antenna cables required)
Rear	Wi-Fi[b]	Wi-Fi 5–1	Beige 	I	Dual-band Wi-Fi (five antenna cables required). For details, see Wi-Fi on page 64. *Note: Wi-Fi connectors are only on Wi-Fi-enabled XR80s.*
Rear	GNSS	GNSS	Signal-Blue (Blue) 	C	GNSS

a. The antenna's female FAKRA connectors are color-coded to match the XR router's male FAKRA connectors, and the connectors are 'keyed' to ensure only the correct antenna types are connected. (e.g. purple female FAKRA connectors will not connect to the XR router's beige Wi-Fi male FAKRA connectors)
b. Included only on XR80 Wi-Fi routers

For regulatory requirements concerning antennas, see Regulatory Information on page 79.

Note: When selecting and installing the antennas, you must follow the maximum dBi gain guidelines specified by the radio communications regulations of the Federal Communications Commission (FCC), Industry Canada, or your country's regulatory body.

To install the antennas:

1. For vehicle installations, mount the antenna unit(s) on the vehicle (typically multi-element units):
   - Follow the antenna unit's recommended installation instructions.
   - Use appropriate cable strain relief. (See Cable Management on page 25.)
   - When mounting antenna unit(s) containing WAN/WLAN cellular antennas, make sure there is at least 20 cm between the antenna(s) and the user or bystanders during normal operation.
   - If the unit includes a GNSS antenna, make sure it has a good view of the sky (at least 90°).

   Note: If single-element antennas are installed, see Table A-1 on page 83 for recommended antenna separation.

2. Connect the cables from the antenna units to corresponding connectors on the XR router:
   a. On the rear panel:
      - If expansion cartridge(s) are used, connect the corresponding cellular antenna's four purple female FAKRA connectors to the cartridge's "Cellular 1–4" male FAKRA connectors.
      - If used, connect the GNSS antenna's blue female FAKRA connector to the "GNSS" male FAKRA connector.
      - XR90 routers:
        - Connect the first Wi-Fi antenna's four beige female FAKRA connectors to the "Wi-Fi A 1–4" male FAKRA connectors.
        - Connect the second Wi-Fi antenna's four beige female FAKRA connectors to the "Wi-Fi B 4–1" male FAKRA connectors.
        - If used, connect the Bluetooth antenna's teal female FAKRA connector to the "Bluetooth" male FAKRA connector.
      - XR80 Wi-Fi routers:
        - Connect the Wi-Fi antenna's five beige female FAKRA connectors to the "Wi-Fi 1–5" male FAKRA connectors.
        - Connect the main cellular antenna's four purple female FAKRA connectors to the XR router's "Cellular 1–4" male FAKRA connectors.
   b. On the front panel, connect a single cellular antenna's purple female FAKRA connector to the "LPWA" male FAKRA connector. (Note—If using an LPWA cellular paddle antenna that attaches directly to the connector, make sure the antenna is not subjected to lateral forces that could damage the connector. Otherwise, a cabled antenna available from third party antenna vendors should be used.)

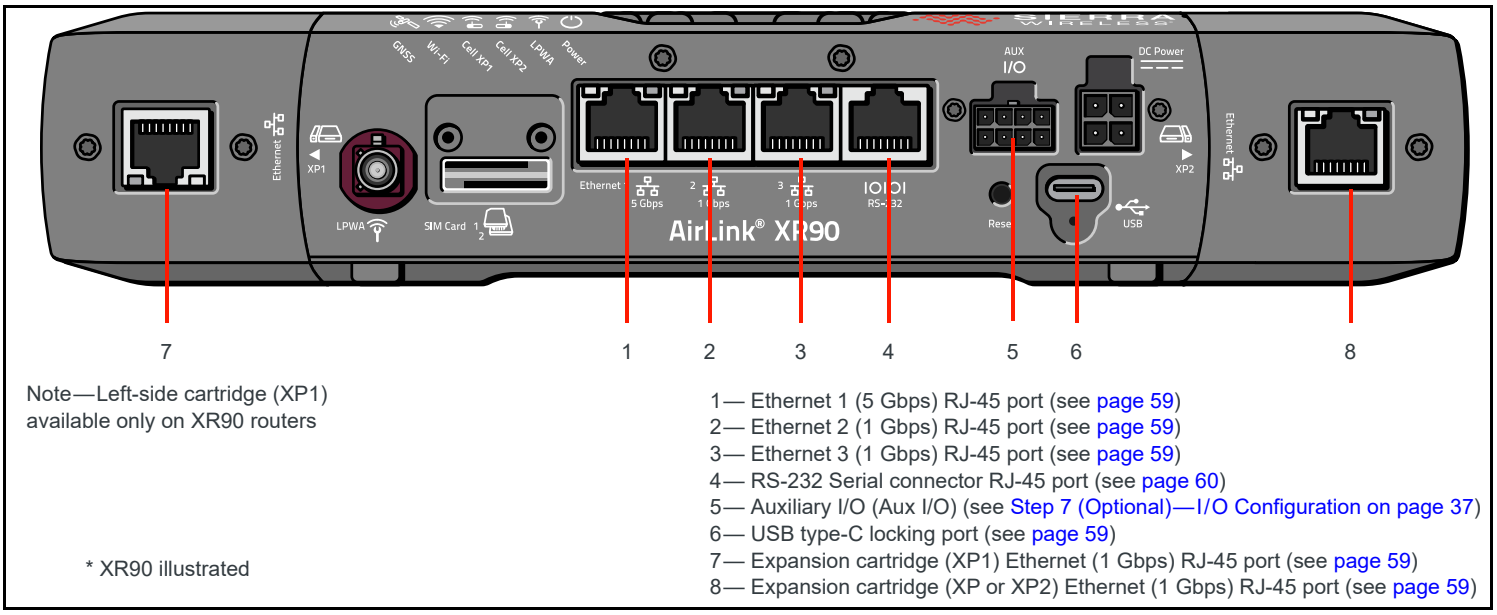
Note: If the antenna units are located away from the XR router, keep cables as short as possible to minimize loss. Route the cables to protect them from damage or being snagged or pulled. There should be no binding or sharp corners in the cable routing. Excess cabling should be bundled with appropriate strain relief, and not pull on the XR router connectors.

For recommended antenna separation, see Antenna Separation on page 83.

*Note: If any of the FAKRA connectors on the XR80/XR90 break, see Replacing Broken FAKRA Connectors on page 92 for repair instructions. (Reminder: **Carefully** remove/insert the locking clip ("cap lock") when replacing a broken connector to avoid breaking the clip.)*

2.9 Step 5—Connect the Data Cables

The XR router includes several required and optional connections on the front panel.



Note—Left-side cartridge (XP1) available only on XR90 routers

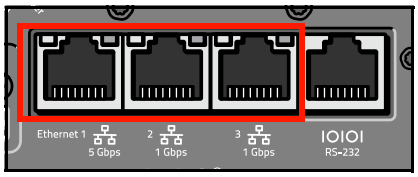
* XR90 illustrated

1— Ethernet 1 (5 Gbps) RJ-45 port (see page 59)
2— Ethernet 2 (1 Gbps) RJ-45 port (see page 59)
3— Ethernet 3 (1 Gbps) RJ-45 port (see page 59)
4— RS-232 Serial connector RJ-45 port (see page 60)
5— Auxiliary I/O (Aux I/O) (see Step 7 (Optional)—I/O Configuration on page 37)
6— USB type-C locking port (see page 59)
7— Expansion cartridge (XP1) Ethernet (1 Gbps) RJ-45 port (see page 59)
8— Expansion cartridge (XP or XP2) Ethernet (1 Gbps) RJ-45 port (see page 59)

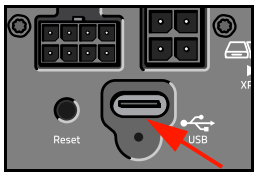
Figure 2-10: Data Cable and Accessory Connectors

To connect data cables and accessories to ports on the XR router's front panel:

1. Connect at least one computer to the XR router to enable access to the router's AirLink OS, using either of the following methods:
   - Ethernet—Use an Ethernet cable to connect the computer to any Ethernet port on the front panel (Ethernet 1, Ethernet 2, Ethernet 3). (By default, all ports are enabled for LAN connection.)
     See Ethernet on page 59 for cable requirements.



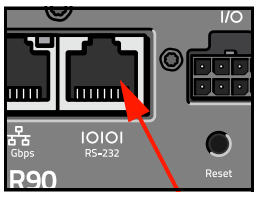
- USB—Use a data-capable USB-C cable to connect the computer to the USB type-C locking port. Plug the cable into the USB port and then, if using a USB locking cable, tighten the jack screw finger-tight. (Make sure the cable is data-capable; some USB-C cables are power only.)

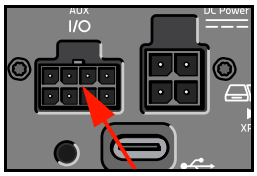
  When the router is first powered on, the router will enumerate a virtual Ethernet port as described in USB-C Network Connection on page 95.

Note: After the XR router is set up, specific Ethernet ports can be reconfigured in the AirLink OS for WAN use (Network > General > Mode).

2. Optionally, in the RS-232 serial port, insert a supported RJ45 to DB9 female cable (available from Sierra Wireless (see Table 1-2 on page 15) or other vendors), and then connect appropriate device(s) to the port.

   The port supports a 4-wire and 2-wire serial interface. See Serial Port on page 60 for cable requirements.
3. Optionally, in the AUX I/O 8-pin port, insert an Auxiliary I/O data cable. For details, see Step 7 (Optional)—I/O Configuration on page 37.

4. Optionally, if the USB type-C locking port is not already connected to a computer, connect a supported USB cable/device (e.g. USBnet (Windows Ethernet) adapter, USB-serial adapter). For USB port details, see USB on page 59.
   a. Plug the USB cable/device into the USB port.
   b. If using a USB locking cable, tighten the jack screw finger-tight.

2.10 Step 6—Prepare Power Connection

The XR router can be powered via:
- DC power cable—The XR router is provided with a 3 meter (10 ft.) DC power cable.
- AC power adapter—An optional AC adapter is available from Sierra Wireless—see Table 1-2 on page 15.

If the optional AC adapter is being used to power the XR router, go to Step 7 (Optional)—I/O Configuration.

If the DC power cable is being used to power the XR router:

1. Review the subtopics in this section to familiarize yourself with the XR router's power requirements, wiring options, etc.
2. Install the router using an appropriate method for Vehicle Installations on page 32 or Fixed Installations on page 36.

Warning: *Electrical installations are potentially dangerous and should be performed by personnel thoroughly trained in safe electrical wiring procedures.*

2.10.1 Operating Voltage

The XR router's operating voltage range is 7–36 V.

By default, the XR router is factory-configured with low voltage standby mode enabled and the standby voltage set to 9 V.

If low voltage standby mode is enabled, the startup voltage must be greater than the configured standby voltage, otherwise the XR router will boot and enter standby mode. After booting, if the operating voltage drops below the standby voltage (for a configured duration (delay)), the XR router enters standby mode.

To disable/enable low voltage standby mode, or to change the settings (e.g. to allow the XR router to operate at a lower voltage without entering standby mode, or to change the delay value), use the AirLink OS (System > MCU > Voltage Threshold).

For more information, refer to *[3] AirLink OS User Guide*.

2.10.2 Fusing

For DC installations, Sierra Wireless recommends fusing the power input using a 15–20 A (max), fast blow fuse, recommended to have no more than ±10% derating over the operating temperature range.

2.10.3 Router Power Connector

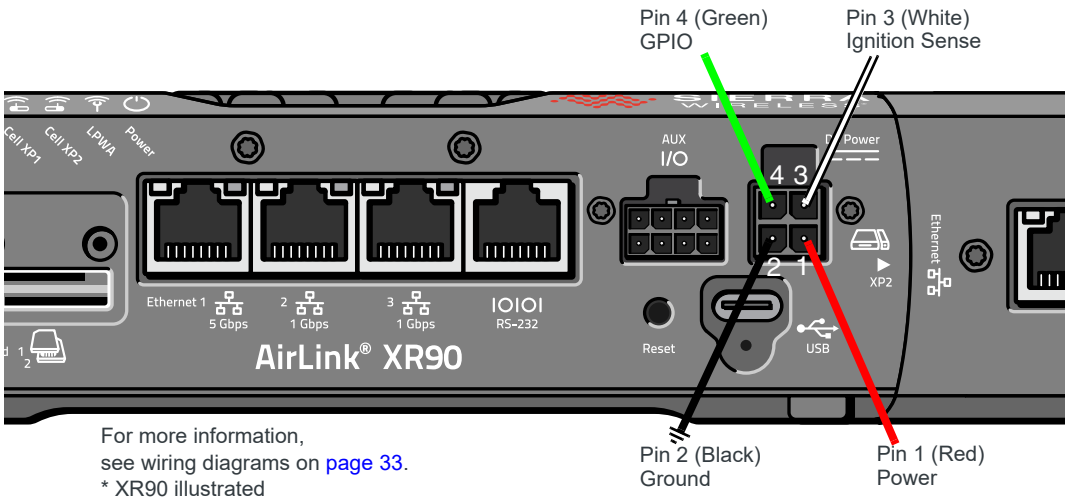


Figure 2-11: DC Power Cable Connections (Colors indicate DC cable wire colors.)

Table 2-3: XR Router Power Connector Pin and DC Power Cable Wires

Pin	Name	DC Cable Wire Color	Description	Type
1	Power	Red	Main power supply for XR router *Note: To use a control line (such as a vehicle ignition line) to turn the XR router on/off, Sierra Wireless strongly recommends that you connect the control/ignition line to Pin 3 (Ignition Sense) and apply continuous power on Pin 1.*	PWR
2	Ground	Black	Main XR router ground	PWR
3	Ignition Sense	White	Enables the XR router power state to be controlled by vehicle ignition. The XR router is: • On, when this pin is connected to power through a vehicle's ignition, or tied to pin 1 (Power) • Off or in standby, when the pin is either open-circuit or grounded For correct telemetry operation in vehicle installations, this pin must be connected to the vehicle ignition. *Note: Sierra Wireless recommends always connecting this pin to the vehicle ignition and, if required, disable ignition in the AirLink OS (System > MCU > Power Management) so the XR router does not shut down when the vehicle ignition is turned off.* *Note: If the pin is not connected to vehicle ignition, it MUST be tied to the power supply (pin 1). (For example, in the optional AC adapter cable, pin 3 is tied to pin 1 inside the cable.)*	I
4	GPIO	Green	General purpose input/output—Typical uses include: • User configurable digital input/output—Connect to a switch, relay, or external device. • Analog input to detect low voltage. For more information, see Step 7 (Optional)—I/O Configuration on page 37.	I/O

2.10.4 Vehicle Installations

For vehicle installations, the XR router's power supply cable must be connected to the vehicle's fuse box, and installed along the vehicle wall, always inside the vehicle cabin and must not cross the vehicle's firewall protection. Always follow the vehicle manufacturer's recommendations for electrical accessories connections. All components used in the electrical connection to the vehicle should be UL Listed or equivalent.

For operating voltage details (including software configuration) and fusing recommendations, see Operating Voltage on page 31 and Fusing on page 31.

2.10.4.1 DC Voltage Transients

The XR router has built-in protection against vehicle transients including engine cranking (down to 5.0V) and load dump (up to 200V), so external power conditioning circuits are not needed. For details, see Industry Certification for Vehicles on page 55.

2.10.4.2 Connect the XR Router to a Vehicle's Electrical System

For vehicle installations, connect the XR router to the vehicle's electrical system:

1. Make sure the vehicle is turned off.
2. Remove the key from the ignition.
3. Disconnect the vehicle's battery:
   a. Disconnect the negative terminal **first**.
   b. Disconnect the positive terminal.
4. Connect the black (Ground) wire on the DC power cable to the vehicle chassis.
5. Make sure the XR router is grounded. (See Step 3—Mount and Ground the Router on page 21.)
6. Use a 15–20 A, fast blow fuse, recommended to have no more than ±10% derating over the operating temperature range, to connect the red (Power) wire on the DC power cable to the vehicle's fuse box. (See Figure 2-12.)
7. Connect the white wire (Ignition Sense) on the DC power cable to the ignition signal from the vehicle.
8. Connect the DC power cable to the XR router.
9. Reconnect the vehicle's battery:
   a. Connect the positive terminal **first**.
   b. Connect the negative terminal.

2.10.4.3 Wiring Diagrams (Vehicle Installation Wiring Methods)

Table 2-4 summarizes typical vehicle installation wiring methods. Refer to the methods for wiring diagrams and details for connecting the supplied DC cable to your power supply.

Table 2-4: Vehicle Installation Wiring Methods Summary

Installation Method	Description
Vehicle Installation—Recommended Basic Method on page 34	XR router operates while engine is running. Optional delayed shutdown can be used to maintain network connection for short periods while the engine is shut off.
Vehicle Installation—Timer-Driven Activation	XR router wakes periodically for a configured duration, then returns to standby mode.
Vehicle Installation—Shore Power	XR router continues operating when engine is shut off, via shore power supply, such as in a maintenance bay.

Vehicle Installation—Recommended Basic Method

For most vehicle installations, Sierra Wireless recommends connecting the white Ignition Sense wire to the vehicle's ignition switch, as shown in Figure 2-12.

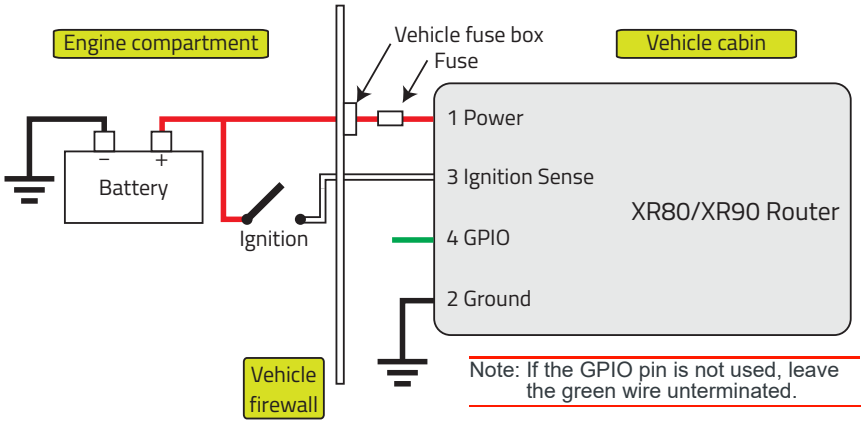


Figure 2-12: Vehicle Installation Wiring Diagram—Recommended Basic Method

This installation method allows the XR router to operate with the vehicle:

- When the vehicle ignition is off, the XR router is in standby mode.
- Optionally, a delayed shutdown can be configured to keep the XR router on for a specified time after the vehicle's ignition shuts off, For example, a delayed shutdown is especially useful for maintaining a network connection while the vehicle's engine is shut off for short periods, such as in a delivery vehicle. For more information, refer to *[3] AirLink OS User Guide*.

Connect the DC cable's wires as follows:

- Red (Pin 1—Power)—Connect to the power source. Include a 15–20 A, fast blow fuse, recommended to have no more than ±10% derating over the operating temperature range, in the input power line. Sierra Wireless recommends using a continuous (unswitched) DC power source. Connect the power through the vehicle's fuse box.
- Black (Pin 2—Ground)—Connect to the vehicle battery's negative terminal, or ground. For details, see Step 3—Mount and Ground the Router on page 21.
- White (Pin 3—Ignition Sense)—Sierra Wireless recommends connecting the white wire to the vehicle ignition to turn on the XR router (or wake from standby mode), or to turn off the XR router (or enter standby mode).

Important: *To protect the XR router, do not remove the power source (e.g. do not disconnect the power cable) while the router is on. Uncontrolled shutdowns may result in unexpected operations/behavior when power is reapplied. For example, telemetry data could be lost, which will adversely impact ALMS Advanced Mobility Reporting (AMR) reports.*

- Green (Pin 4—GPIO)—Leave the green wire (GPIO) unconnected if GPIO functionality is not required. Otherwise, connect the GPIO as described in Step 7 (Optional)—I/O Configuration on page 37.

2.10.4.4 Vehicle Installation—Timer-Driven Activation

For installation in vehicles where the XR router must be active at specific time intervals (e.g. to report vehicle status), the vehicle ignition can be connected to the XR router's I/O pin (as shown in Figure 2-13) and a timer can be configured in the AirLink OS to turn the XR router on at the required interval for a configured duration (e.g. 20 minutes once every 24 hours when the ignition is off). When the duration expires, the XR router switches to standby mode. For more information, refer to *[3] AirLink OS User Guide*.

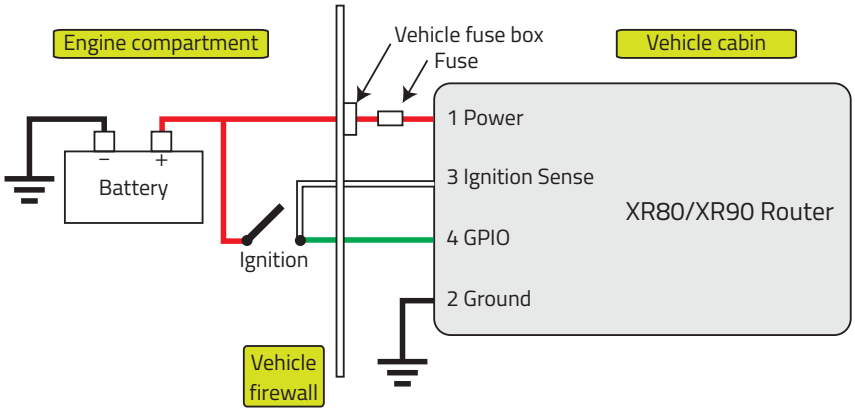


Figure 2-13: Vehicle Installation Wiring Diagram—Timer-driven Activation

Connect the DC cable's wires as follows:

- Red (Pin 1—Power)—Connect to the power source. Include a 15–20 A, fast blow fuse, recommended to have no more than ±10% derating over the operating temperature range, in the input power line. Sierra Wireless recommends using a continuous (unswitched) DC power source. Connect the power through the vehicle's fuse box.
- Black (Pin 2—Ground)—Connect to the vehicle battery's negative terminal, or ground. For details, see Step 3—Mount and Ground the Router on page 21.
- White (Pin 3—Ignition Sense)—Connect to the vehicle ignition to enable accurate ALMS Advanced Mobility Reporting (AMR) (e.g. trip reports) and improve reliability of the GPS anti-jitter feature,

  and

  Disable ignition in the AirLink OS (System > MCU > Power Management) so the XR router does not shut down (or enter standby mode) when the vehicle ignition is turned off.
- Green (Pin 4—GPIO)—Connect to the vehicle's ignition.

2.10.4.5 Vehicle Installation—Shore Power

A shore power supply can be used to operate the XR router while the vehicle ignition is off and the vehicle is in a facility with a shore power supply (e.g. parked in a maintenance bay), as shown in Figure 2-14.

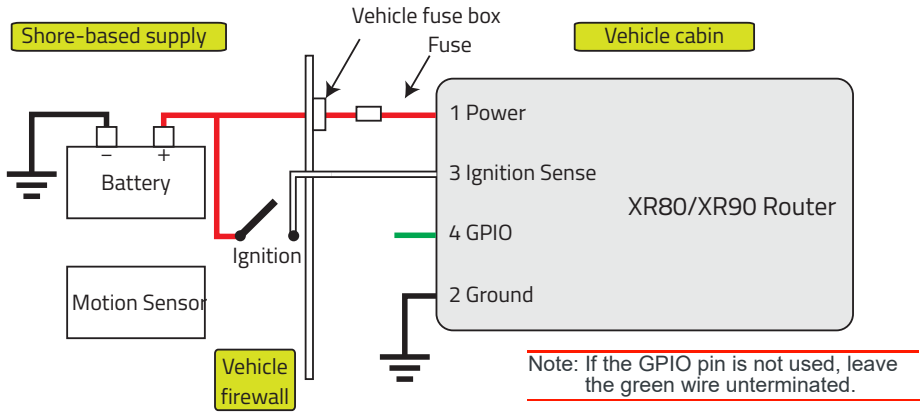


Figure 2-14: Vehicle Installation Wiring Diagram—Shore Power

Connect the DC cable's wires as follows:

- Red (Pin 1—Power)—Connect to the power source. Include a 15–20 A, fast blow fuse, recommended to have no more than ±10% derating over the operating temperature range, in the input power line. Sierra Wireless recommends using a continuous (unswitched) DC power source. Connect the power through the vehicle's fuse box.
- Black (Pin 2—Ground)—Connect to the vehicle chassis ground. For details, see Step 3—Mount and Ground the Router on page 21.
- White (Pin 3—Ignition Sense)—Connect to the vehicle ignition to enable accurate ALMS Advanced Mobility Reporting (AMR) reporting (e.g. trip reports) and improve reliability of the GPS anti-jitter feature,

  and

  Disable ignition in the AirLink OS (System > MCU > Power Management) so the XR router does not shut down (or enter standby mode) when the vehicle ignition is turned off.
- Green (Pin 4—GPIO)—Leave unconnected if GPIO functionality is not required. Otherwise, connect the GPIO as described in Step 7 (Optional)—I/O Configuration on page 37.

2.10.5 Fixed Installations

For operating voltage details (including software configuration) and fusing recommendations, see Operating Voltage on page 31 and Fusing on page 31.

2.10.5.1 Wiring Diagram (Fixed Installation Basic Wiring Method)

For fixed installations without I/O, connect the wires as shown in Figure 2-15.

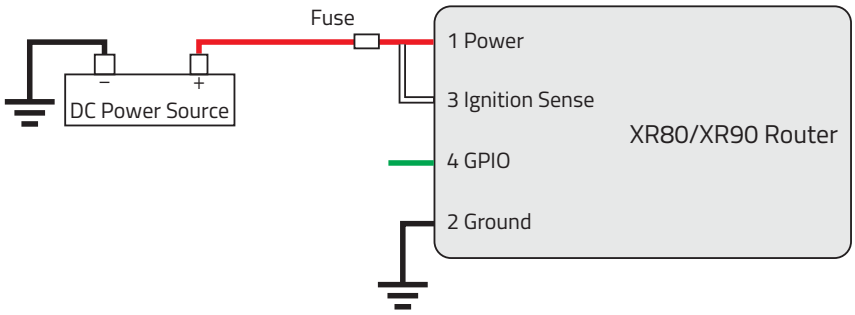


Figure 2-15: Fixed Installation Wiring Diagram—Basic Method (no I/O)

Connect the DC cable's wires as follows:

- Red (Pin 1—Power)—Connect to the power source. Include a 15–20 A, fast blow fuse, recommended to have no more than ±10% derating over the operating temperature range, in the input power line. Sierra Wireless recommends using a continuous (unswitched) DC power source.
- Black (Pin 2—Ground)—Connect to ground. For details, see Grounding the Router on page 24.
- White (Pin 3—Ignition Sense)—Tie to the red wire (Power) before the fuse (i.e. on the XR router side of the fuse).
- Green (Pin 4—GPIO)—Leave unconnected if GPIO functionality is not required. Otherwise, connect the GPIO as described in Step 7 (Optional)—I/O Configuration on page 37.

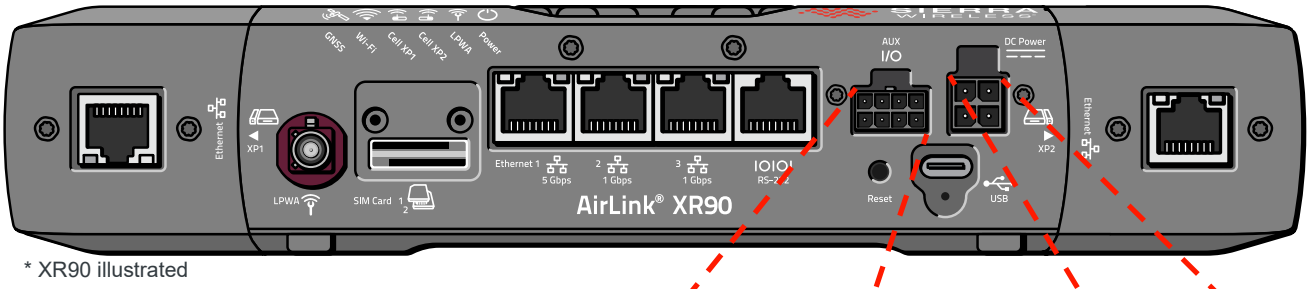
2.11 Step 7 (Optional)—I/O Configuration

The XR router has five I/O pins available for digital input/output configuration:

- Power connector—Pin 4 (GPIO)
- Auxiliary I/O connector—Pins 2, 3, 6, and 7 (Digital and/or analog inputs)

For details on configuring, monitoring and interacting with these I/Os, refer to *[3] AirLink OS User Guide*.

2.11.1 I/O Pins

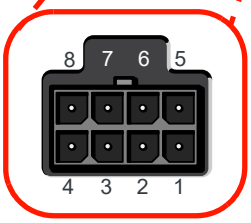


* XR90 illustrated

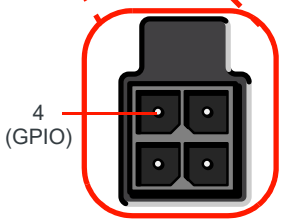
Auxiliary I/O Connector Pin Functionality

Pin 8 GND	Pin 7 DIG_{IN2} / A_{IN2}	Pin 6 DIG_{IN3} / A_{IN3}	Pin 5 CAN-L[a]
Pin 4 CAN-H[a]	Pin 3 DIG_{IN4}	Pin 2 DIG_{IN5}	Pin 1 GND

a. Reserved for vehicle bus cable. See page 89. Do not use with the Aux I/O cable.



Auxiliary I/O Connector



DC Power Connector

Figure 2-16: I/O Pin-out for Auxiliary I/O Connector and Power Connector

Table 2-5: I/O Pin-out Configuration

Location	Pin—Wire Color	I/O Functionality					Other Functionality
		Digital In	Analog In	Digital Out	Pull-up	GND	
Power Connector (DC Power Cable, included)	4—Green	✔	✔	✔	✔	–	–
Aux I/O Connector (I/O Cable, SKU# 6001004)	6—Yellow	✔	✔	–	✔	–	–
	7—Gray	✔	✔	–	✔	–	–
	2—Orange	✔	–	–	✔	–	–
	3—Purple	✔	–	–	✔	–	–
	1—Black	–	–	–	–	✔	–
	8—Black	–	–	–	–	✔	–
	4—NC	–	–	–	–	–	✔ (CAN-H)
	5—NC	–	–	–	–	–	✔ (CAN-L)

You can use these pins as:

- Pulse counters—See Figure 2-17 on page 39.
- Digital inputs—See Digital Input on page 40.
- High side pull-ups/dry contact switch inputs—See High Side Pull-up / Dry Contact Switch Input on page 40.

- Analog inputs
  (See Table 2-11 on page 43 and Figure 2-22 on page 43.)
- Low side current sinks—See Low-Side Current Sink Output on page 41.
- Digital outputs/open drains—See Digital Output/Open Drain on page 42.

Note: The I/O pins can be configured in the AirLink OS or ALMS to either (a) trigger standby mode, or (b) sink current or to pull up the voltage.

Note: During bootup, the I/O settings remain in their default state—the internal pull-up resistor is disabled, and output current sink switch is open. After bootup, any custom I/O settings are applied. This may take approximately 30 seconds after the XR router is restarted or powered on.

You can use AirLink OS Custom Reports (Services > Telemetry > Custom Reports) to monitor the states of the I/O pins and generate reports—when states change (e.g., when a switch is opened or closed, at fixed intervals, when specific states are true, etc.).

2.11.2 Pulse Counter

You can connect any GPIO pin to a pulse counter.

Note: The digital pulse counter is not available in Standby mode.

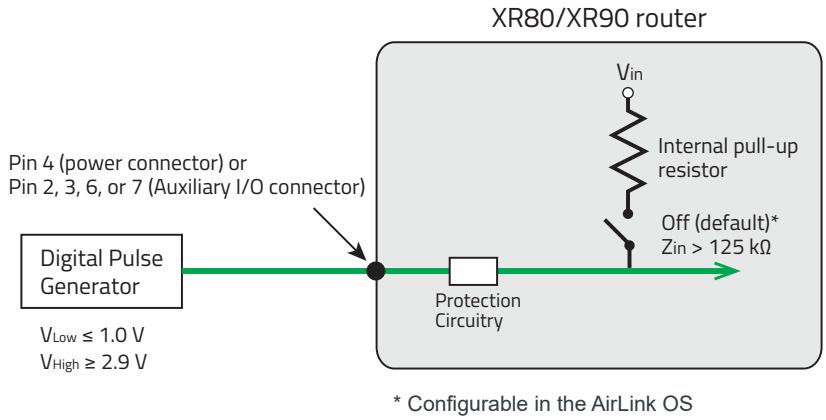


Figure 2-17: Digital Input / Pulse Counter

Maximum frequency: 140 Hz

Duty cycle: 20–80%

Note: Values may vary, depending on signal noise.

Table 2-6: Pulse Counter

Pull-up	State	Minimum	Typical	Maximum	Units
Off	Low	—	—	1.0	V
	High	2.9	—	Vin	V

2.11.3 Digital Input

Any GPIO pin can be used as a digital input to detect the state of a switch (such as a vehicle ignition), or to monitor an external device (such as a motion detector, a remote solar panel, or a remote camera).

The power connector GPIO (pin 4) digital input can also be used with the standby timer. While in Standby mode, the digital input will act as a wakeup function to wake the XR router for a configured length of time. (Note that the digital inputs on the I/O connector do not have this functionality.)

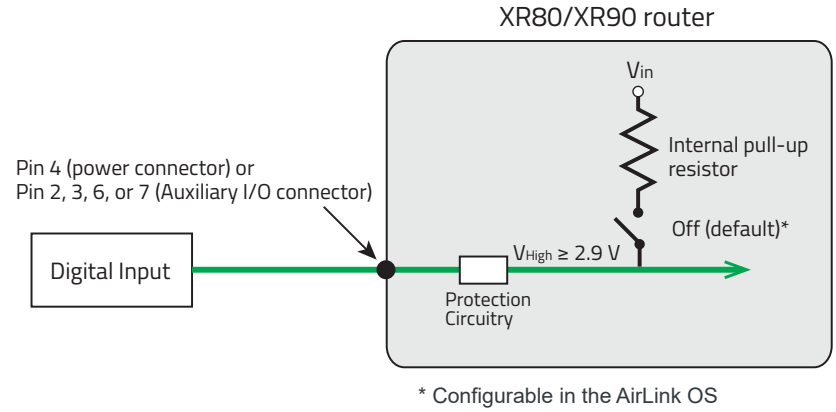


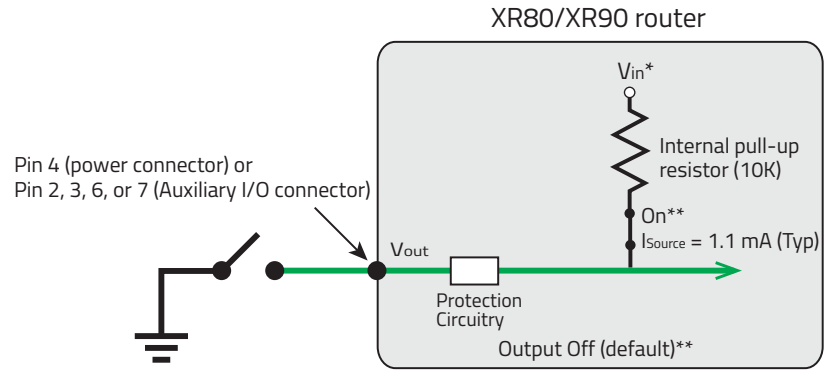
Figure 2-18: Digital Input

Table 2-7: Digital Input

Pull-up	State	Minimum	Typical	Maximum	Units
Off	Low	—	—	1.0	V
	High	2.9	—	V_{in}	

2.11.4 High Side Pull-up / Dry Contact Switch Input

You can connect any GPIO pin to a dry contact switch, such as an alarm relay. While in Standby mode, the dry contact switch input will not be acted upon if it changes state.



*Depending on the load, this value can range from Vin to Vin - 2.5 V.

** Configurable in the AirLink OS

Figure 2-19: High Side Pull-up / Dry Contact Switch Input

Table 2-8: High Side Pull-up / Dry Contact Switch Input

	Minimum	Typical	Maximum	Units	Comments
Source Current (I_{Source})	0.6 (V_{in} = 7 V)	1.1 (V_{in} = 12 V)	3.5 (V_{in} = 36 V)	mA	Maximum current the voltage input can provide (depends on V_{in})
V_{out}	V_{in} - 2.5	—	V_{in}	V	The voltage on Pin 4 when the high side pull-up is enabled (depends on V_{in} and power consumption)

2.11.5 Low-Side Current Sink Output

The power cable GPIO pin can be connected to a low-side current sink output, for example to drive a relay.

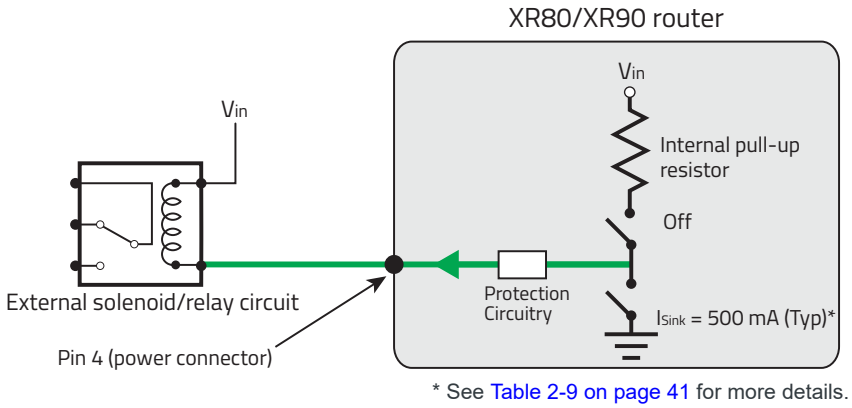


Figure 2-20: Low Side Current Sink

If using the low-side switch, make sure to keep the internal pull-up disabled.

Table 2-9: Low Side Switch Operational Ranges (Recommended)

State	Minimal	Typical	Maximum	Units	Comments
On	300 (@ 70°C)	500 (@ 25°C)	950 (@ -30°C)	mA	Sink Current (I_{Sink})

Note: The XR router protection circuitry has a high-impedance (~200 kΩ) path to ground. If the GPIO is connected to 12 V, there will be a small current flow (~100 μA) into the GPIO during bootup. This flow is countered if the internal pull-up resistor (10 kΩ) becomes active, and only after bootup. Depending on your application, you may need to install an external pull-up resistor (10 kΩ) to nullify the small input current flow for the first 30 seconds during bootup.

Note: If the GPIO stops working, the overcurrent protection circuitry may have been triggered, which disables the affected GPIO. To re-enable the GPIO, remove the cause of the overcurrent.

2.11.6 Digital Output/Open Drain

The power cable GPIO can be connected to a digital output/open drain, for example to drive an external digital input.

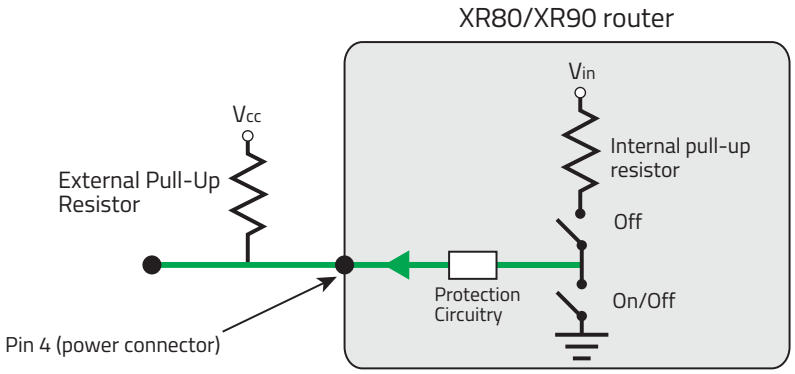


Figure 2-21: Digital Output/Open Drain

Table 2-10: Digital Output / Open Drain

Pull-up	State	Minimum	Typical	Maximum	Units	Comments
Off	Off	Open Circuit	—	—	—	—
	Active Low	—	—	0.5	V	5 mA ≤ 5 V

2.11.7 Analog Input

Three GPIOs are available for use as analog inputs:

- Power connector pin 4 (GPIO)
- Auxiliary I/O connector pins 6 and 7

Any analog input GPIO can be connected to an analog sensor. As an analog input (voltage sensing pin), the XR router monitors voltage changes in small increments. This enables monitoring of equipment that reports status as an analog voltage.

When used with a sensor to transform values into voltages, an analog input GPIO can monitor measurements like temperatures, sensors, or input voltage.

Supported theoretical input voltages (referenced to ground) are:

- Power connector GPIO: 0–36V
- Auxiliary I/O GPIOs: Either 0–5V or 0–10V. The AirLink OS is used to select the monitored voltage range. For low input voltages, 0–5 V provides better accuracy.

Note: The lowest guaranteed detectable voltage for each analog input is 0.5V (voltages from 0–0.5V are not detected accurately).

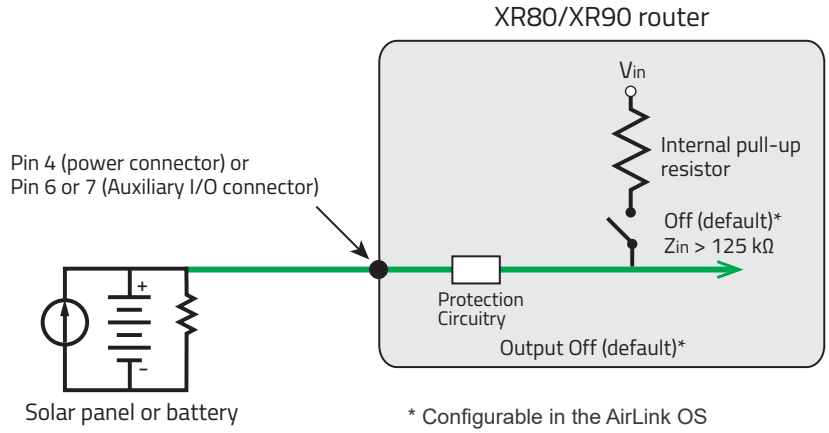


Figure 2-22: Analog Input

Table 2-11: Analog Input Specifications

Pull-up	Specification	Min	Typ	Max	Units	Comments
Off	Input range	0.5	—	Power (pin 4): 36	V	Input voltage will cap at the maximum (i.e. over-voltage will be limited to the maximum)
				Aux I/O (pins 6/7): 5 or 10	V	Maximum is software-selectable. Low range (0–5) provides greater accuracy than high range (0–10)
	Input accuracy	-1.5%	0.50%	1.5%	—	—

Data sampling is handled by a dedicated microcontroller. In order to filter noisy signals, twenty measurements are taken over a 250 ms interval. The measurements are averaged to generate a sample. If the change since the last sample is significant, a notification is sent to the CPU for updating the current value displayed in the AirLink OS and for use by AirLink OS Custom Reports (Services > Telemetry > Custom Reports).

Changes are considered significant if the change is 200mV or more (when the range of monitored voltage is 0–5 V) or 350 mV or more (when the range of monitored voltage is 0–10 V). If there has not been a significant change to the parameter being monitored, the CPU reads a sample every 2.5 minutes, which detects small changes.

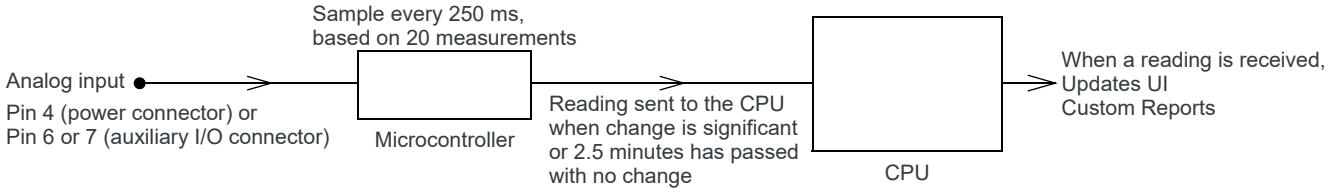


Figure 2-23: Analog Input Sampling and Reading

Note: The same method is used to sample the input voltage and the internal board temperature for AirLink OS Custom Reports. The significant changes are 300 mV for the input voltage and 1ºC for the board temperature.

2.12 Step 8 (Optional)—Connect the Vehicle Bus Cable

For vehicle installations, the XR router collects vehicle data through an OBD-II (J1979) or J1939 connection from the vehicle's diagnostic port to the XR router's Aux I/O port. (Cables for both connection types are available separately from Sierra Wireless. See Vehicle Bus Cables on page 89.)

After Vehicle Data Collection is enabled in the AirLink OS, the XR router sends data to ALMS.

Note: The XR router does not require a separate scanner for reporting of vehicle telemetry data. Do not connect an additional scanner or other device to the vehicle bus during normal operation. When doing vehicle maintenance that requires connecting a diagnostic tool, it is recommended to disable Vehicle Data Collection on the XR router.

To connect the XR router with a vehicle bus cable:

1. Ensure that both the XR router and the vehicle are powered off.
2. Locate the OBD-II (J1979) or J1939 port in the vehicle. The OBD-II port is an electrical socket most commonly located under the vehicle dashboard on the driver's side near the center console.
3. Attach the OBD-II (J1979) or J1939 connector on the cable to the port in the vehicle.
4. Route the cable through the vehicle to where the XR router is mounted.
5. Connect the 8-pin connector on the vehicle bus cable to the Auxiliary I/O port on the XR router.
6. Power on the XR router. Check that the Power, GNSS, and all cellular LEDs indicate expected states (see LED Behavior on page 46).
7. Configure the XR router to enable accurate reporting of vehicle telemetry, vehicle behavior, and dead reckoning—for details, refer to *[3] AirLink OS User Guide*.

2.12.1 Dead Reckoning Calibration

The XR router's inertial sensors must be calibrated before dead reckoning can function. Calibration begins automatically when the XR router is turned on for the first time in a vehicle, or (only if necessary) after the XR router is:

- powered off
- shut down to OFF mode
- rebooted
- disconnected and reinstalled in a different orientation.

For optimal calibration, the vehicle should:

- be driven in open-sky conditions, with a good GPS signal
- undergo several left and right turns
- be stopped and started several times in a straight line—braking for and accelerating away from stop signs, for example.

The calibration process can take from 5–20 minutes once the vehicle is in motion, depending on driving conditions.

The XR router's dead reckoning calibration status is shown via:

- Power LED—If Dead Reckoning is enabled and a satellite fix is available, the LED will solid green if calibrated, or solid yellow if not calibrated.
- AirLink OS—DR CALIBRATION Status is shown under Services > Location.

2.12.1.1 Recalibration after Router Reinstallation

If the XR router's installation orientation is changed or the XR router is moved to a new installation location (e.g. moved to a different vehicle), dead reckoning must be recalibrated:

- If the XR router is installed in a different vehicle and connected to the vehicle's OBD-II (J1979) or J1939 port, the XR router detects that the VIN has changed and dead reckoning recalibration occurs automatically.
- Otherwise (i.e. the installation orientation is changed, or installed in new location without connecting to an OBD-II (J1979) or J1939 port):
  - **a.** In the AirLink OS, go to Services > Location and change the GNSS Firmware Selection Mode to Manual.
  - **b.** Install the GNSS Only firmware.
  - **c.** Change the GNSS Firmware Selection Mode back to Automatic. The XR router reloads the Dead Reckoning firmware and automatically recalibrates.

2.13 Step 9—Power on the Router

The XR router's factory default configuration enables it to establish a WAN connection if an appropriate SIM card is installed and the APN is configured correctly.

Note: Additional configuration is always recommended.

To power on the XR router:

1. Apply power to the system—turn on the ignition (if wired to vehicle's electrical system) or connect the optional AC power adapter to the front panel DC power connector.

   The XR router powers up in approximately 60 seconds.

   - If the LEDs begin flashing in sequence, a XR router update is in progress. DO NOT REMOVE POWER.
   - While turning on, the Power LED is solid yellow, then turns solid green when powered up, and other LEDs begin to display their regular behavior. For more information on the LED patterns see LED Behavior on page 46.

   Note: The first time the XR router is powered on (i.e., a new router being used for the first time), it uses an available Internet connection to connect to ALMS, complete its registration, and apply any preconfigurations done when the router was registered with ALMS (for details, refer to [4] AirLink XR90 Quick Start Guide/[5] AirLink XR80 Quick Start Guide).

   Note: If a computer is connected to the router via USB-C, the router will enumerate a virtual Ethernet port as described in USB-C Network Connection on page 95.

2. If the XR router does not start automatically:
   a. Make sure:
      - The power connector is plugged in and supplying sufficient voltage. (The XR router will boot in standby mode if the voltage is too low—see Operating Voltage on page 62 for details.)
      - Ignition Sense (pin 3) is connected to the battery or power source (see Step 6—Prepare Power Connection on page 30 for details).
   b. Press (< 5 seconds) and release the Reset button on the front panel.
3. Test the XR router—Connect a test device (for example, a PC) to the XR router LAN via Ethernet—use any Ethernet port (Ethernet 1–3) on the router. (All ports are factory configured for LAN access.)

   For configuration/usage instructions, refer to *[3] AirLink OS User Guide*.

The XR router is now ready for use.

2.13.1 LED Behavior

2.13.1.1 Main Unit LEDs

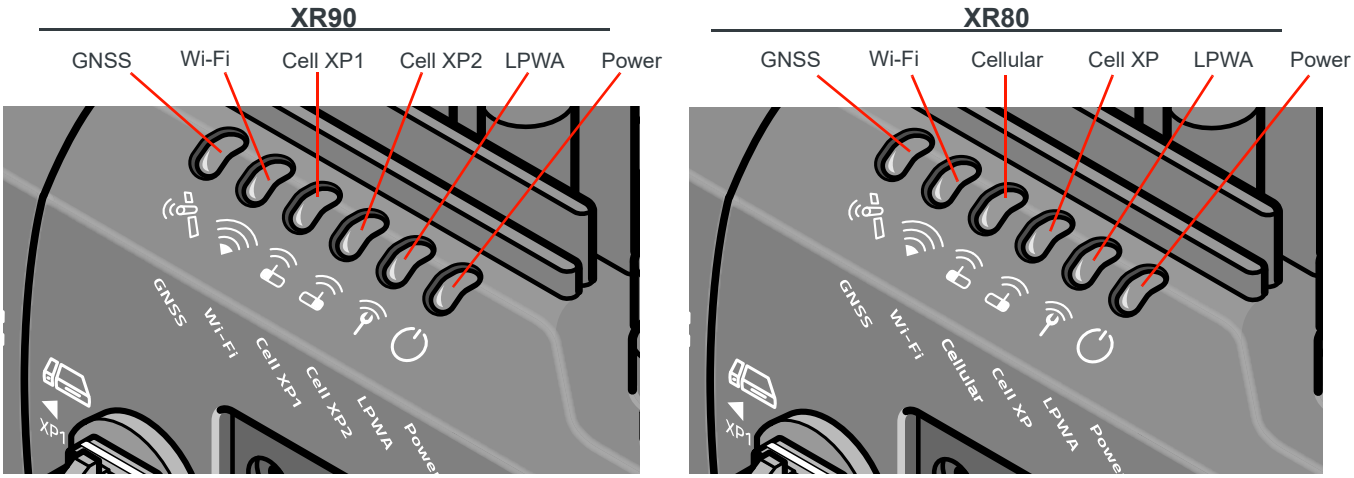


Figure 2-24: XR Router LED Status indicators (front panel)

2.13.1.2 LED Patterns

The XR router's LEDs display six device statuses (see Table 2-12)—GNSS, Wi-Fi, two Cellular radios, LPWA, and Power using a variety of pattern types and colors:

- Solid—Single color, always on
- Fast flashing—One color on for 0.2 s, then off or another color for 0.2 s
- Slow flashing—One color on for 0.25 s, then off or another color for 0.75 s
- Pulse—One color on for 0.5 s, then a 0.2 s pulse off or another color
- Chase—All LEDs on in sequence for 0.2 s each, from left to right, continuously

Table 2-12: LED Behavior

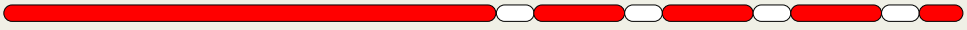
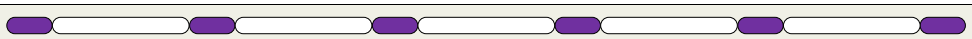
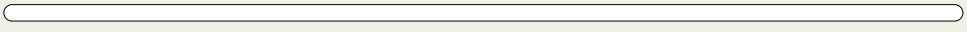
GNSS	
Solid Green	
Satellite fix is available and Dead Reckoning[a] is enabled and calibrated[b] or Satellite fix is available and Dead Reckoning is disabled	
Solid Yellow	
Satellite fix is available and Dead Reckoning is enabled, but not calibrated	
Solid Red	
Searching for a satellite fix	
Fast Flashing Red	
(Forthcoming) GNSS antenna is open or shorted. *Note: Antenna may appear to be connected, but current draw is too high or too low.*	
Slow Flashing Red	
(Forthcoming) GNSS antenna is disconnected. *Note: Current draw is below predefined threshold.*	
Off	
GNSS is off/disabled	
Wi-Fi	
Solid Green (pulse off with activity)	
Connected in client mode (good signal) with traffic *Note: If AP also has traffic at same time, LED displays the client status (i.e. displaying a connected Depot is the priority).*	
Slow Flashing Green	
Wi-Fi client is enabled but not connected, and no AP is enabled.	
Solid Yellow (pulse off with activity)	
Connected in client mode (fair signal) with traffic *Note: If AP also has traffic at same time, LED displays the client status (i.e. displaying a connected Depot is the priority).*	
Solid Red (pulse off with activity)	
Connected in client mode (poor signal) with traffic *Note: If AP also has traffic at same time, LED displays the client status (i.e. displaying a connected Depot is the priority).*	
Solid Purple (pulse off with activity)	
AP with traffic, and Wi-Fi client enabled but no connection or AP with traffic, and Wi-Fi client disabled	
Slow Flashing Purple	
Wi-Fi client is enabled but not connected, and AP is enabled.	
Off	
No Wi-Fi enabled (no AP, no Wi-Fi client)	

Table 2-12: LED Behavior (Continued)

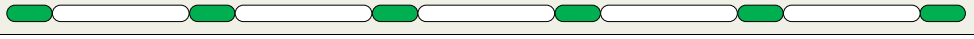
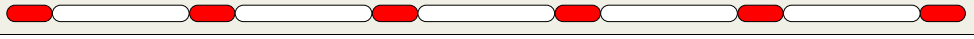
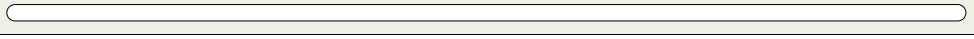
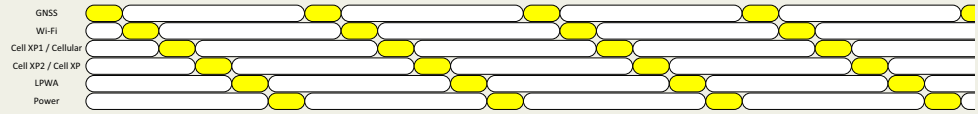
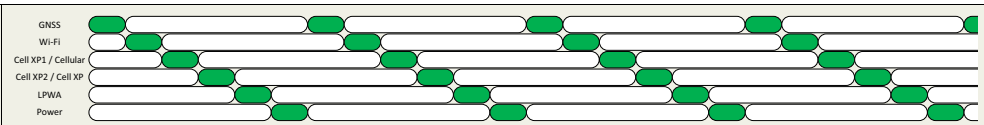
(XR90) **Cell XP1 / Cell XP2** (XR80) **Cellular/Cell XP**	
Solid Green (pulse off with activity)	
Connected to a 4G/3G network with a good connection (equivalent to 4–5 bars). Pulsing off for activity.	
Slow Flashing Green	
Connecting to a 4G/3G network	
Solid Purple (pulse off with activity)	
Connected to a 5G network with a good connection (equivalent to 4–5 bars). Pulsing off for activity.	
Slow Flashing Purple	
Connecting to a 5G network	
Solid Yellow (colored pulse with activity)	
Connected to a network with a fair connection (equivalent to 2–3 bars). During activity, RAT (5G or 3G/4G) is indicated by a pulse color: • Green pulse—4G/3G • Purple pulse—5G	
Solid Red (colored pulse with activity)	
Connected to a network with a poor connection (equivalent to 1 bar). During activity, RAT (5G or 3G/4G) is indicated by a pulse color: • Green pulse—4G/3G • Purple pulse—5G	
Slow Alternating Flashing Red/ Yellow	
Connected to a network with an unrecognized SIM using Generic radio module firmware.	
Slow Flashing Red	
Note: No network connection **Important:** *For certain carriers, a known issue exists when upgrading from AirLink OS 3.0 to 3.1 that may cause the Cellular LED to flash when connected and passing traffic. See Cellular Radios on page 68 for details.*	
Off	
No expansion cartridge installed	
LPWA	
Solid Green (pulse off with activity)	
LPWA connected to a network and ALMS with a good connection (equivalent to 4–5 bars). Pulsing off for activity.	
Slow Flashing Green	
Connecting to a network	
Solid Yellow (pulse off with activity)	
Connected to a network and ALMS with a fair connection (equivalent to 2–3 bars). Pulsing off for LPWA activity.	
Solid Red (pulse off with activity)	
Connected to a network and ALMS with a poor connection (equivalent to 1 bar). Pulsing off for activity.	

Table 2-12: LED Behavior (Continued)

Slow Flashing Red	
No network connection	
Off	
LPWA module powered off	
Power	
Solid Green	
XR router operating normally with ignition on	
Fast Flashing Green	
XR router is rebooting after Reset button pressed for <5 seconds (or reset from the AirLink OS)	
Solid Yellow	
• XR router is booting or • XR router is thermally throttled—one or more of CPU, cellular radio, and Wi-Fi radio has exceeded threshold. When operating temperature returns to normal, LED returns to solid green. (For additional details, see Thermal Protection on page 91.)	
Fast Flashing Yellow	
XR router is rebooting and being reset to factory defaults, after Reset button is pressed for 20–40 seconds	
Solid Red	
Power is present, but the XR router is not running (e.g. ignition is off, XR router is in standby mode, etc.) *Note: If the XR router is in standby mode, the Power LED will be solid red only if the AirLink OS Standby LED setting is enabled (System > MCU > Power Management), otherwise the LED will be Off. (By default, the setting is enabled.)*	
Fast Flashing Red	
XR router is rebooting and being reset to the default template, after Reset button pressed for 5–20 seconds**.**	
Slow Flashing Red	
XR router is not operating because operating temperature range is exceeded (i.e. thermal shutdown). (For additional details, see Thermal Protection on page 91.)	
Fast Alternating Flashing Yellow/ Red	
Reset button held > 40 seconds, canceling the reset action and rebooting normally when released. (i.e. if pressing reset >5 seconds and you decide that the XR router should do a regular reboot (not a reset to default template or factory defaults), continue pressing Reset until the LED alternates Yellow and Red flashes.)	
Off	
• No power or • XR router is in standby mode and the AirLink OS Standby LED setting is disabled (System > MCU > Power Management).	

Table 2-12: LED Behavior (Continued)

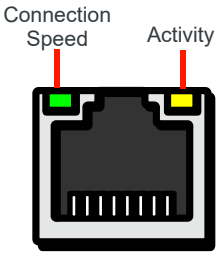
 All LEDs	
Yellow LED chase	
Software update in progress (e.g. XR router firmware update, etc.) **Important:** *Do not turn off the power while the update is in progress.*	
Green LED chase	
Radio module firmware update in progress. (For details, refer to *[3] AirLink OS User Guide*.)	

a. Dead reckoning is enabled by default, but can be disabled in the AirLink OS.
b. Dead reckoning calibration occurs occasionally during driving and takes several minutes to complete.

2.13.1.3 Ethernet LEDs

Each Ethernet connector has two LEDs that indicate speed and activity. When looking into the connector:

- Activity—The right LED indicates the link status:
  - Solid Amber—Link
  - Blinking Amber—Activity
  - Off—No link
- Connection Speed—The left LED indicates the Ethernet connection speed:
  - Ethernet 1:
    - Solid Green—1–5 Gbps (i.e. Gigabit or greater)
    - Off—10/100 Mbps
  - Ethernet 2, Ethernet 3, Cartridge Ethernet:
    - Solid Green—1000 Mbps (Gigabit)
    - Off—10/100 Mbps



2.14 Step 10—Software Configuration

You can configure the XR router using:

- AirLink OS (the XR router's web interface)
- AirLink Management Service (cloud-based application)

2.14.1 Configure locally with AirLink OS

To access the AirLink OS:

1. Connect to the XR router through a LAN connection (e.g. a configured Ethernet port or Wi-Fi connection).

2. Open a browser window and enter https://airlink./ or 192.168.1.1, and bypass any certificate notifications in your browser.

Note: It takes the XR router from 1 to 2 minutes to respond after power up.

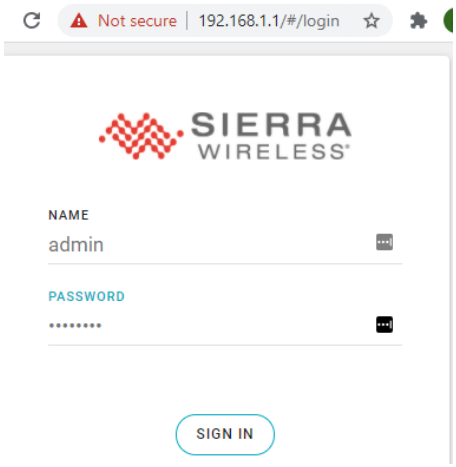


Figure 2-25: AirLink OS login window

3. Enter the default administrator User name and Password and click SIGN IN.
   - User Name: *admin*
   - Password: *(printed on the XR router label)*

Note: For system security, ensure that you change the default password as soon as possible.

4. Configure the XR router as required—for details, refer to *[3] AirLink OS User Guide*.

2.14.2 Configure and Monitor Remotely with AirLink Management Service

AirLink Management Service (ALMS) allows remote management of all your routers from one user interface.

Some of its features include:

- Centralized, remote monitoring for all your AirLink routers
- Continuous status monitoring of important health data such as signal strength
- Location monitoring, including world map views
- Configure individual routers or use templates to perform batch configurations of your AirLink routers
- Single-click over-the-air firmware updates to all your routers
- Compatible with all carriers or mobile network operators

Note: To create an ALMS account, visit www.sierrawireless.com/products-and-solutions/routers-gateways/alms/register.

To configure your XR router:

1. Open a browser window, connect to AirVantage (e.g. na.airvantage.net, eu.airvantage.net), and log in to ALMS. Your ALMS account Dashboard is displayed.
2. Select Monitor > Systems to display your registered devices.
3. Find your XR router in the list, then click the router name to display the system details.
4. Click the Configuration button to display the configuration interface.
5. Make and save any required configuration changes. These changes will be applied to the XR router the next time it connects to ALMS.

For help with ALMS, view the user guide at doc.airvantage.net/alms.

3: Router Reboot/Reset

3.1 Rebooting/Resetting the Router

The XR router can be rebooted or reset using hardware and software methods. Supported reboot/reset methods include:

- Hard reboot
- Reset configuration to custom template
- Reset configuration to factory defaults

3.1.1 Hard Reboot

To perform a hard reboot of the XR router using:

- Hardware—On the front of the unit, press the Reset button and release in <5 seconds.
- AirLink OS—Go to System>Admin>Reboot and click REBOOT NOW.

The XR router will reboot and the Power LED pattern will be fast flashing green until the XR router is operating normally.

3.1.2 Configuration Reset

The XR router's configuration can be reset to a custom (user-defined) template or to factory defaults. The reset functionality (type and activation method) are configured through the AirLink OS.

3.1.2.1 Set Configuration Reset Functionality

To define the Reset functionality:

1. In the AirLink OS, go to System>Admin>Reset Settings.
2. Select the RESET CONFIGURATION TYPE to use when a configuration reset is performed:
   - Use Factory Defaults—XR router will be reset to the standard factory configuration. All user customizations will be lost.
   - Use Custom Template—XR router will be reset to the customized configuration in the CURRENT TEMPLATE (e.g. a template containing fleet-standardized settings). To use a different template, click SET TEMPLATE and load a different file.
3. Select the reset activation method:
   - Reset allowed via AirLink OS and the XR router's Reset button—Select (enable) RESET BUTTON.
   - Reset allowed via AirLink OS only—Deselect (disable) RESET BUTTON.
4. Click Save.

3.1.2.2 Reset to Factory Default or Custom Template Settings

To reset the XR router to the configured RESET CONFIGURATION TYPE using:

- AirLink OS:
  - **a.** Go to System>Admin>Reset Settings and click RESET SETTINGS.
  - **b.** Click RESET SETTINGS to confirm.
- XR router Reset button (if enabled)
  - Reset to template—Press the Reset button and release after 5–20 seconds.
  - Reset to factory defaults—Press the Reset button and release after 20–40 seconds.

Important: *If Reset is pressed > 5 seconds and you do not want to reset to a template or to factory defaults,* ***continue holding*** *the Reset button for > 40 seconds and then release. The XR router will do a normal hard reboot and no configurations will change.*

4: Router Specifications

This chapter describes the XR80/XR90 router specifications, RF band and Tx power specifications, Wi-Fi support, and mechanical specifications.

4.1 Certification and Interoperability

Note: Certifications listed below are achieved, in progress, or pending.

Table 4-1: Certification and Interoperability Specifications

Emissions/ Immunity	• FCC • IC • CE (Including EMC Test case for vehicle installation EN301489) • RCM
Safety	• CB Scheme • UL 60950
Industry Certification for Vehicles	• EN 50155/EN 45545/EN 60695 (Rolling stock) • E-Mark (72/245/EEC, 2009/19/EC) • ISO7637-2 for 12 V/24 V systems • SAE J1455 (Shock & Vibration)
Environmental Compliance	• RoHS 2011/65/EU (RoHS 2) • WEEE • REACH • Prop 65 (California)
GSM/UMTS Certifications	• PTCRB • GCF-CC • RED

4.1.1 Reliability

- MTBF (Ground Benign, 25°C):
  - XR90 with one XP 5G Cartridge—166,514 hours (19.0 years)
  - XR80 Wi-Fi—186,228 hours (21.3 years)
  - XR80 non-Wi-Fi—208,379 hours (23.8 years)
- MTBF calculations are performed per Telcordia “Reliability Prediction Procedure for Electronic Equipment” document number SR-332, Method 1, Issue 3

4.1.2 Environmental Testing

Table 4-2: Environmental Testing Specifications

Test Method	Category	Description
MIL-STD-810G Test method 514.6 Composite Wheeled Vehicle	Vibration	Frequency range: 10 Hz–150 Hz Spectrum level: 2.24G on all axes for 8 hours/axis Operating mode: powered on
MIL-STD-810G Test method 516.6-I Procedure I—Functional Shock	Mechanical Shock	Half-sine 40G, 15–23 ms, (±X, ±Y, ±Z directions, 10 times per axis) Operating mode: powered on
SAE J1455 (Shock and Vibration) for heavy-duty vehicles	Shock/Vibration/ Electrical	• Vibration: Section 4.10.4.2 Cab Mount • Shock: Section 4.11.3.4 Operational Shock • Electrical: 12 and 24 V systems Section 4.13.1—12 and 24 V Section 4.13.2—SAE J1113-11 Level 3
MIL-STD-810G Test methods 501.5, 502.5	Temperature	Rugged category: -30° to +70°C 2-hour soak each temp high/low 3 cycles ramp ≤ 3°C/minute Operating mode: powered on
MIL-STD-810G Test method 507.5	Humidity	10×48-hour cycles: • 4-hour ramp to 60°C (95% humidity), hold 8 hours • 4-hour ramp down to 30°C (85% to 95% relative humidity), hold 21 hours • 1-hour ramp down to 20°C, hold 4 hours • 1-hour ramp up to 30°C, hold 5 hours Operating mode: powered on
IEC 60529	Water Resistance[a]	Subject to spraying water. Water sprayed at an angle up to 60° on either side of the vertical for 10 minutes. Operating mode: unpowered
IEC 61000-4-2	Electrostatic Discharge	±2 kV, ±4 kV, ±6 kV, ±8 kV (Contact and Air) ±15 kV (Air at antenna connector) Operating mode: powered on
IEC 60068-2-32	Free Fall Test	1 m drop height 6 drops onto concrete, 2 per axis: X, Y, Z Operating mode: unpowered *Note: Test conducted with FAKRA connectors protected by a bracket.*
IEC 60068-2-70 Part 2, Test Xb	Marking	The markings are rubbed with water for 10 cycles, then with lubricating oil for 10 cycles. Operating mode: unpowered
ISTA 2A 2001 Test categories 1, 4, 5, 6	Package	*Note: Pending testing.* In shipping packaging. Cargo vibration and drop test.

a. Ingress Protection (IP) rating—IP64

4.1.3 Mobile Network Operator Certification

Note: Certifications listed below are achieved, in progress, or pending.

- AT&T
- Verizon Wireless
- T-Mobile USA
- Bell Mobility
- Rogers
- Telus
- Telstra
- Other major network operators pending

4.1.4 Network Technology

5G sub-6 GHz, LTE Cat-M1, LTE Cat-NB1, LTE-A Pro, LTE, HSPA+

For product-specific lists of supported bands, see Cellular Radios on page 68.

4.1.5 Host Interfaces

Table 4-3: Host Interface Specifications

Antennas

Antenna connectors (male FAKRA connectors)

XR90 main unit:

- LPWA
- GNSS
- Wi-Fi A (4 connectors)—Used for Access Point or WAN.
- Wi-Fi B (4 connectors)—Used for Access Point or WAN.
- Bluetooth

XR80 main unit:

- LPWA
- GNSS
- Wi-Fi (5 connectors)—Wi-Fi equipped XR80 only. Used for Access Point or WAN.
- Cellular (4 connectors)

XP 5G Cartridge(s):

- Cellular (4 connectors)

Antenna cabling

- Avoid tight bends
- VSWR < 1.3 and 50 Ω for all frequencies listed below:

Antenna Elements	External Cable Type	Supported Frequencies (MHz)	Notes
4G/5G (All ports)	CS32	617–802	
		824–960	
		1710–2690	
		3300–5925	
Wi-Fi (All ports)	CS32	2400–2483	
		5150–5835	Not supported in Canada: • 5150–5350 MHz • 5600–5650 MHz
		5925–7125	
GNSS	CS29 FR	1559	
		1575.42	
		1606	

Antenna gain

- Cellular—Refer to *[2] Sierra Wireless EM919X/EM7690 Product Technical Specification* and *[1] Sierra Wireless HL780x Product Technical Specification*
- 2.4/5 GHz Wi-Fi=3 dBi
- 2.4 GHz BT=3 dBi

Table 4-3: Host Interface Specifications (Continued)

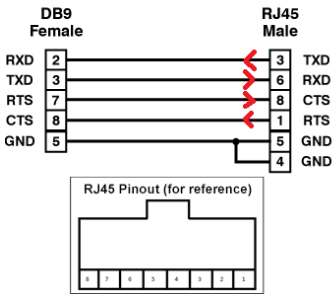
USB	*Note: Do not use the USB ports in a potentially explosive environment.* • USB 3.1 Type C (female) port, complies with USB Version 3.1 specification. USB 3.1-compliant Type C cable must be used to ensure correct operation. • USB client and host modes support (software-selectable; default—Client) • Current (Host mode)—4.5 W (5V @ 0.9 A) • Port supports use of USB-C connector with integrated thumbscrew  *Figure 4-1: USB Type C Connectors (Locking and Regular)* • The AirLink OS Software Configuration User Guide contains the details of USB mode configuration and driver installation.

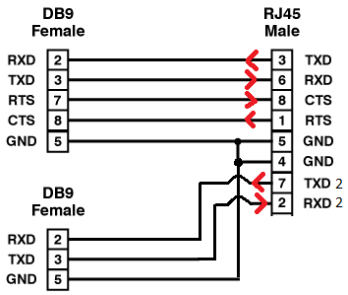
Ethernet	• RJ45 Ethernet ports:
	  ◦ Main unit:
	  ▪ 1×5 Gbps (5GBASE-T/2.5GBASE-T/1000BASE-T/100BASE-TX/10BASE-Te)
	  ▪ 2×1 Gbps (10/100/1000 Base-T)
	  ▪ GigE RJ45 Ethernet ports
	  ◦ XP 5G Cartridge(s):
	  ▪ 1×1 Gbps (10/100/1000 Base-T)
	• Cable requirements:
	  ◦ Maximum cable length for any port and cable type: 100 m
	  ◦ Cable categories (recommended minimums):
	  ▪ Cat 5e—Data rates 10/100/1000 Mbps
	  ▪ Cat 6—Data rate > 1 Gbps
	  ◦ 5 Gbps port (i.e. Ethernet 1):
	  ▪ Bundled cables—< 20 m (Cat 5e); 20–100 m (Cat 6A)
	  ▪ Unbundled cables—< 75 m (Cat 5e); 75–100 m (Cat 6)
	  ◦ 1 Gbps ports—< 100 m (unshielded Cat 5e)
	• IEEE 802.3 Ethernet specification for 5 Gbps and 1 Gbps speed (Gigabit Ethernet) with fallback to 100 or 10 Mbps (Cat 5e or Cat 6 cable is required for Gigabit Ethernet)
	• (XR80) IEEE 1588 Precision Time Protocol (PTP) support (planned for future support)
	• Auto-crossover support
	• Configurable link speeds
	• Auto-negotiation detects the speed of the connecting device

Table 4-3: Host Interface Specifications (Continued)

<table>
<tr><td>Auxiliary Input</td><td>• 8-pin connector providing 4 GPIOs and 2 signals for Vehicle Bus cable. For details, see Step 7 (Optional)—I/O Configuration on page 37.</td></tr>
<tr><td>Serial Port</td><td>
• RJ45 (8-pin) RS-232 (DCE) connector
• 1×4-wire serial port via RS-232 serial cable (PN 6001410, RJ45 to single DB9 female)
or
1×4-wire and 1× 2-wire serial ports via dual serial cable (PN 6001409, RJ45 to dual DB9 female)

Table 4-4: RJ45 Connector Pin-out
<table>
<tr><th>Name</th><th>Pin</th><th>Description</th><th>Type</th></tr>
<tr><td>RTS</td><td>1</td><td>Ready To Send (4-wire port)</td><td>OUT</td></tr>
<tr><td>RXD_2</td><td>2</td><td>Receive Data 2 (2-wire port)</td><td>IN</td></tr>
<tr><td>TXD</td><td>3</td><td>Transmit Data (4-wire port)</td><td>OUT</td></tr>
<tr><td>GND</td><td>4</td><td>Main GND. Connected internally to BOARD GND.</td><td>—</td></tr>
<tr><td>GND</td><td>5</td><td>Main GND. Connected internally to BOARD GND.</td><td>—</td></tr>
<tr><td>RXD</td><td>6</td><td>Receive Data (4-wire port)</td><td>IN</td></tr>
<tr><td>TXD_2</td><td>7</td><td>Transmit Data 2 (2-wire port)</td><td>OUT</td></tr>
<tr><td>CTS</td><td>8</td><td>Clear To Send (4-wire port)</td><td>IN</td></tr>
</table>

Single serial port cable


Dual serial port cable


• Used for connecting serial devices and configuration
• Complies with the EIA RS-232D specification for DCE equipment
• Configurable baud rate (up to 256 kbps)
• Configurable to half or full duplex
• “Wake-on” functionality[a]— Connected serial device can wake the XR router by asserting RTS serial line (e.g. wakes the XR router when the serial device wants to send data)
</td></tr>
</table>

a. Feature planned for future update

4.1.6 SIM Card Interface

The XR router provides a SIM card interface with the following characteristics:

- 2×mini-SIM (2FF) slots—One for each installed 5G radio module
- 1.8 V/3.3 V
- Interface is compliant with the applicable 3GPP standards for USIM.

4.1.7 General Purpose Input/Output

The XR router provides several GPIOs on the following connectors:
- Power connector—1×Configurable I/O pin
- RS-232 serial connector—4×GPIO. (A supported RJ45 to DB9 female cable must be used.) For details, see Serial Port on page 60.

For details, including suggested uses, see I/O Pins on page 38.

4.1.8 Power Adapter

The XR router uses a 4-pin power adapter connection:
- Pin 1—Power
- Pin 2—Ground
- Pin 3—Configurable ignition sense
- Pin 4—Configurable GPIO (digital I/O, analog input, current sinking), with a pull-up enable

4.1.9 Reset

The XR router can be reset via hardware (manual reset button on front panel) or software (via the AirLink OS). For details, see Set Configuration Reset Functionality on page 53.

4.1.10 LEDs

The XR router includes six LEDs:
- GNSS
- Wi-Fi
- Cell XP1 (XR90) or Cellular (XR80)
- Cell XP2 (XR90) or Cell XP (XR80)
- LPWA
- Power

For details, see page 46.

4.1.11 Screw Specifications

- XP 5G Cartridge captive screws (M4x52; hex (Allen) head)—Torque to 13 ± 1.2 kgf/cm (11.3 ± 1.0 in-lb)
- XP 5G Cartridge cover plate screws (M4x8; Phillips head or hex (Allen) head)—Torque to 9.0 ± 0.5 kgf/cm (7.8 ± 0.4 in-lb)
- SIM cover captive screws (M3x6; Phillips head)—Torque to 6 ± 0.75 kgf/cm (5.2 ± 0.65 in-lb)
- Router mounting screws, customer-supplied. Recommendation: M5, pan head, used with split washers (e.g. Bossard BN 762)
  - Screw length depends on mounting surface material (substrate):
    - Minimum: 35 mm; Typical: 40 mm
    - Example: For direct mounting against a wood surface, use an M5 pan head wood screw with sufficient length to penetrate the wood substrate (e.g. minimum 40 mm, but longer if necessary).

- Torque specification will vary by screw head/plating/class. For a pan head, Philips/Torx, Zn plated, class 4.5 screw, torque to ~20 kgf/cm (~17.7 in-lb)

4.1.12 Operating Voltage

The XR router has the following operating voltage requirements/features:

- Input voltage: 7–36 V
- The maximum ripple voltage to guarantee analog input accuracy is 100 mVpp.
- Tolerates voltage drop to 5 VDC without resetting during engine cranking (SAE J1113)
- By default, the XR router is factory-configured with low voltage standby mode enabled, which causes the XR router to enter Standby mode when the voltage is < 9 V.

  To disable/enable low voltage standby mode, or to change the low voltage limit, change the settings in the AirLink OS (System > MCU > Voltage Threshold) For more information, refer to *[3] AirLink OS User Guide*.

4.1.13 Power Specifications

Table 4-5: DC Power Supply Specifications

Pin	Name	Specification	Parameter	Minimum	Maximum
1	VCC	Voltage range	VCC	7 V	36 V

Table 4-6: On/Off Control Specifications

Pin	Name	Input Impedance (Typ)	Specification	Parameter	Minimum	Maximum
3	On/Off control, Ignition Sense (Input only)	125 kΩ	Input low state voltage (maximum)	V_{IL}	—	1.0 V
			Input high state voltage (minimum guaranteed)	V_{IH}	2.5 V	V_{in}

*Note: If you do not connect this pin to the ignition, you **MUST** connect it to the positive terminal of your power supply or battery. The XR router looks for a qualified voltage on this pin as part of the power up sequence. If it doesn't see it, the XR router will not turn on. If you are using a Sierra Wireless AC power adapter, the connection is inside the cable.*

4.1.14 Conducted Electrical Transients

- Compliant to ISO 7637-2:2004:
  - Load dump specifications—Test Pulses 5a, 5b
  - Inductive load transient specifications—Test Pulse 1
  - Harness transient specifications—Test Pulses 2a, 2b, 3a, 3b
  - Cranking specification—Test Pulse 4
- Tolerates +200 V/-600 V spikes
- Uninterrupted operation during brownouts down to 5V

4.2 GNSS Technology

Table 4-7: GNSS Specifications

Satellite channels	Maximum 48 tracking channels and 2 fast acquisition channels Active antenna support
Constellations	• GPS/DGPS (Differential GPS) • GLONASS • Galileo • BeiDou • QZSS
Protocol	Streamable NMEA 0183 V3.0 and TAIP output
Acquisition time (Time to first fix)	• Hot start: 1 second • Cold start: 30 seconds
Sensitivity	Indoor sensitivity (tracking mode): -162 dBm
Accuracy	Horizontal position accuracy (CEP50%, 24h static, antenna mounted above roof): <2 m
Forwarding	Local and remote forwarding via TCP or UDP
Dead reckoning	Tethered and untethered

4.2.1 Protocols

For supported software protocols (network, routing, etc.), refer to *[3] AirLink OS User Guide*.

4.3 Vehicle Area Networking (LAN)

- Support for all on-board devices (wired and wireless)
  - Wi-Fi 6 on FAKRA
  - 5G Ethernet on RJ45 (1 port)
  - 1G Ethernet on RJ45 (2 ports, plus one 1G Ethernet RJ45 port per expansion cartridge)
  - Bluetooth on FAKRA
  - Serial RS232 on RJ45 (2 ports)
  - USB 3.0 on Type C (female)
- Compatibility
  - Supports Wi-Fi certified devices
  - Supports major operating systems

4.4 Security

The XR router can secure all data transmitted to and from the local environment without the need for VPN client software on devices.

- WLAN Security and Authentication
  - WPA3 Personal (Enterprise in future release)/WPA2 Enterprise and Personal
- Firewall and DMZ
- Encryption and VPN
  - IPSec including LAN to LAN, Host to LAN, IKEV2, MOBIKE
  - FIPS-140-2 option
- Authentication and Accounting
  - RADIUS/TACACS+/LDAP integration

4.5 Wi-Fi

- Configurations:
  - XR90—Wi-Fi 6:
    - 4x4 MIMO (5 GHz) + 4x4 MIMO (5 GHz) + 4x4 MIMO (2.4 GHz)
    - Configurable as AP or Wi-Fi client
  - XR80—Wi-Fi 6:
    - 4x4 MIMO (5 GHz) + 4x4 MIMO (2.4 GHz) + 1x1 (5 GHz, Wi-Fi client Rx only)
    - Configurable as AP and Wi-Fi client concurrently
- Access points:
  - 4 SSIDs with separately configurable security, bandwidth, and QOS
  - WPA2/3 Enterprise (RSA) with AES encryption
  - The number of supported simultaneous connections (Table 4-8) across the four SSIDs is router and interface dependent.

Table 4-8: Wi-Fi APs—Maximum Supported Client Connections

Router	Max across all APs	Maximum per AP			
		Wi-Fi A 5GHz (AP mode)	Wi-Fi B 5GHz (AP mode)	Wi-Fi AP 2.4GHz	Wi-Fi AP 5GHz
XR90	256	128	64	64	n/a
XR80	256	n/a	n/a	128	128

- Wi-Fi channel support:
  - Supported frequencies—2.4 GHz, 5 GHz
  - The XR router's chipset provides chipset support for the 5 GHz Wi-Fi channels listed in Table 4-9.
  - XR router-specific Wi-Fi channel support is SKU-dependent (North American, Global). See Table 4-10.

    Note that AirLink OS 4.0.17 enables increased Wi-Fi channel support via device geolocation, which enables use of additional specific channels when the XR router is operating in supported countries (Table 4-11).

Table 4-9: Wi-Fi Channels (Chipset Support)[a] — 5 GHz Operation

Channel	Freq. (GHz)	Channel Width 20 MHz	40 MHz	80 MHz
36	5.180	Y	—	—
38	5.190	—	Y	—
40	5.200	Y	—	—
42	5.210	—	—	Y
44	5.220	Y	—	—
46	5.230	—	Y	—
48	5.240	Y	—	—
52	5.260	Y	—	—
54	5.270	—	Y	—
56	5.280	Y	—	—
58	5.290	—	—	Y
60	5.300	Y	—	—
62	5.310	—	Y	—
64	5.320	Y	—	—
68[b]	5.340	Y	—	—
70[b]	5.350	—	Y	—
72[b]	5.360	Y	—	—
74[b]	5.370	—	—	Y
76[b]	5.380	Y	—	—
78[b]	5.390	—	Y	—
80[b]	5.400	Y	—	—
84[b]	5.420	Y	—	—
86[b]	5.430	—	Y	—
88[b]	5.440	Y	—	—
90[b]	5.450	—	—	Y
92[b]	5.460	Y	—	—
94[b]	5.470	—	Y	—
96[b]	5.480	Y	—	—
100	5.500	Y	—	—
102	5.510	—	Y	—
104	5.520	Y	—	—
106	5.530	—	—	Y
108	5.540	Y	—	—
110	5.550	—	Y	—
112	5.560	Y	—	—
116	5.580	Y	—	—
118[b]	5.590	—	Y	—
120[b]	5.600	Y	—	—
122[b]	5.610	—	—	Y
124[b]	5.620	Y	—	—
126[b]	5.630	—	Y	—
128[b]	5.640	Y	—	—
132	5.660	Y	—	—
134	5.670	—	Y	—
136	5.680	Y	—	—
138	5.690	—	—	Y
140	5.700	Y	—	—
142	5.710	—	Y	—
144	5.720	Y	—	—
149	5.745	Y	—	—
151	5.755	—	Y	—
153	5.765	Y	—	—
155	5.775	—	—	Y
157	5.786	Y	—	—
159	5.795	—	Y	—
161	5.805	Y	—	—
165	5.825	Y	—	—
167[b]	5.835	—	Y	—
169[b]	5.845	Y	—	—
171[b]	5.855	—	—	Y
173[b]	5.865	Y	—	—
175[b]	5.875	—	Y	—
177[b]	5.885	Y	—	—
181[b]	5.905	Y	—	—

a. For implemented channel support, see Table 4-10.
b. Channels under approval

Table 4-10: Wi-Fi Channel Support[a] for non-Geolocated and Geolocated[b] Routers

	Wi-Fi Channel	Frequency (GHz)	North America SKU[c] Channel Support by Region[b] US	Canada / Mexico	Global SKU[b] Channel Support by Region Rest of World	Australia	Channel Width 20 MHz	40 MHz	80 MHz	Notes
2.4 GHz	1	2.412	Y	Y	Y	Y	Y	–	n/a	
	2	2.417	Y	Y	Y	Y	Y	–		
	3	2.422	Y	Y	Y	Y	Y	Y		
	4	2.427	Y	Y	Y	Y	Y	Y		
	5	2.432	Y	Y	Y	Y	Y	Y		
	6	2.437	Y	Y	Y	Y	Y	Y		
	7	2.442	Y	Y	Y	Y	Y	Y		
	8	2.447	Y	Y	Y	Y	Y	Y		
	9	2.452	Y	Y	Y	Y	Y	Y		
	10	2.457	Y	Y	Y	Y	Y	–		
	11	2.462	Y	Y	Y	Y	Y	–		
	12	2.467	–	–	Y	Y	Y	–		
	13	2.472	–	–	Y	Y	Y	–		
	14	2.484	–	–	Y	–	Y	–		

Table 4-10: Wi-Fi Channel Support[a] for non-Geolocated and Geolocated[b] Routers (Continued)

	Wi-Fi Channel	Frequency (GHz)	North America SKU[c] Channel Support by Region[b]		Global SKU[b] Channel Support by Region		Channel Width			Notes
			US	Canada/Mexico	Rest of World	Australia	20 MHz	40 MHz	80 MHz	
5 GHz	36	5.180	Geolocated only	–	Y	Y	Y	Y[d]	Y[d]	Channels 52–144 are available only if DFS (Dynamic Frequency Selection) is enabled[e]
	40	5.200	Geolocated only	–	Y	Y	Y			
	44	5.220	Geolocated only	–	Y	Y	Y	Y[d]		
	48	5.240	Geolocated only	–	Y	Y	Y			
	52	5.260	Geolocated only	–	Y	Y	Y	Y[d]	Y[d]	
	56	5.280	Geolocated only	–	Y	Y	Y			
	60	5.300	Geolocated only	–	Y	Y	Y	Y[d]		
	64	5.320	Geolocated only	–	Y	Y	Y			
	100	5.500	Y	Y	Y	Y	Y	Y[d]	Y[d]	
	104	5.520	Y	Y	Y	Y	Y			
	108	5.540	Y	Y	Y	Y	Y	Y[d]		
	112	5.560	Y	Y	Y	Y	Y			
	116	5.580	Y	Y	Y	Y	Y[f]	Y[df]	Y[df]	
	120	5.600	Geolocated only	–	Geolocated only	–	Y			
	124	5.620	Geolocated only	–	Geolocated only	–	Y	Y[d]		
	128	5.640	Geolocated only	–	Geolocated only	–	Y			
	132	5.660	Y	Y	Y	Y	Y	Y[d]	Y[d]	
	136	5.680	Y	Y	Y	Y	Y			
	140	5.700	Y	Y	Y	Y	Y	Y[d]		
	144	5.720	Y	Y	Y	Y	Y			
	149	5.745	Y	Y	–	–	Y	Y[d]	Y[d]	
	153	5.765	Y	Y	–	–	Y			
	157	5.786	Y	Y	–	–	Y	Y[d]		
	161	5.805	Y	Y	–	–	Y			
	165	5.825	Y	Y	–	–	Y	–	–	

a. Wi-Fi channels available for use in AirLink OS 4.0.17
b. Geolocation is supported for specific countries. See Table 4-11.
Y—Supported for non-geolocated and geolocated routers; Geolocated—Supported only when router is successfully geolocated to a country in Table 4-11.
c. North America routers are for use in the US, Canada and Mexico only. Global routers are for use outside of North America, where certified for sale/operation.
d. 40 MHz is available if both 20 MHz channels are available; 80 MHz is available if both 40 MHz channels are available.
e. When DFS is enabled, the Channel Availability Check (CAC) process requires 1–10 minutes (region-dependent) to make sure the channel is clear (no radar or other traffic) before broadcasting is enabled on the channel.
f. Wi-Fi channel 116 width is limited to 20MHz in Australia.

Table 4-11: Geolocation Support (by Country)

Albania [AL]	Cyprus [CY]	Iceland [IS]	Monaco [MC]	Slovakia [SK]
Andorra [AD]	Czech Republic [CZ]	Ireland [IE]	Montenegro [ME]	Slovenia [SI]
Australia [AU][a]	Denmark [DK]	Italy [IT]	Netherlands [NL]	Spain [ES]
Austria [AT]	Estonia [EE]	Latvia [LV]	North Macedonia [MK]	Sweden [SE]
Belgium [BE]	Finland [FI]	Liechtenstein [LI]	Norway [NO]	Switzerland [CH]
Bosnia and Herzegovina [BA]	France [FR]	Lithuania [LT]	Poland [PL]	United Kingdom [UK]
Bulgaria [BG]	Germany [DE]	Luxembourg [LU]	Portugal [PT]	United States of America [US]
Canada [CA][a]	Greece [GR]	Malta [MT]	Romania [RO]	

a. No additional Wi-Fi channels are opened for use on routers that are geolocated to Australia or Canada.

- Performance specifications:

Table 4-12: Wi-Fi Link Speed (Theoretical Maximum)[a]

Technology	Frequency	MIMO	Channel Width		
			20 MHz	40 MHz	80 MHz
Wi-Fi 6	2.4GHz	4 × 4	600 Mbps	1200 Mbps	—
	5 GHz	4 × 4	600 Mbps	1200 Mbps	2400 Mbps

a. Actual data throughput may vary.

Table 4-13: Wi-Fi Total Radiated Power (TRP) and Total Isotropic Sensitivity (TIS)

Transmitter				
Frequency	**Technology**	**Bandwidth**	**Modulation**	**TRP (dBm/chain)**
2.4 GHz	802.11b	20 MHz	1 Mbps	23.3
	802.11ax	20 MHz	MCS11	14.3
5 GHz	802.11ac	20 MHz	MCS0	23.3
	802.11ax	20 MHz	MCS11	14.3
Receiver				
Frequency	**Technology**	**Bandwidth**	**Modulation**	**TIS (dBm/chain)**
2.4 GHz	802.11b	20 MHz	1 Mbps	-97.3
	802.11ax	20 MHz	MCS11	-63.3
	802.11n	20 MHz	MCS7	-76.3
5 GHz	802.11ac	20 MHz	MCS0	-93.8
	802.11ac	20 MHz	MCS8	-72.3
	802.11ac	20 MHz	MCS10	-65.3
	802.11ax	20 MHz	MCS0	-93.8
	802.11ax	20 MHz	MCS11	-63.8

4.6 Bluetooth Support

Note: Support planned for a future AirLink OS update.

The XR90 provides the following Bluetooth functionality:

- User-selectable Bluetooth 4.x Classic or Bluetooth LE

4.7 Cellular Radios

Known Issue—LED behavior after upgrade from AirLink OS 3.0 to 3.1

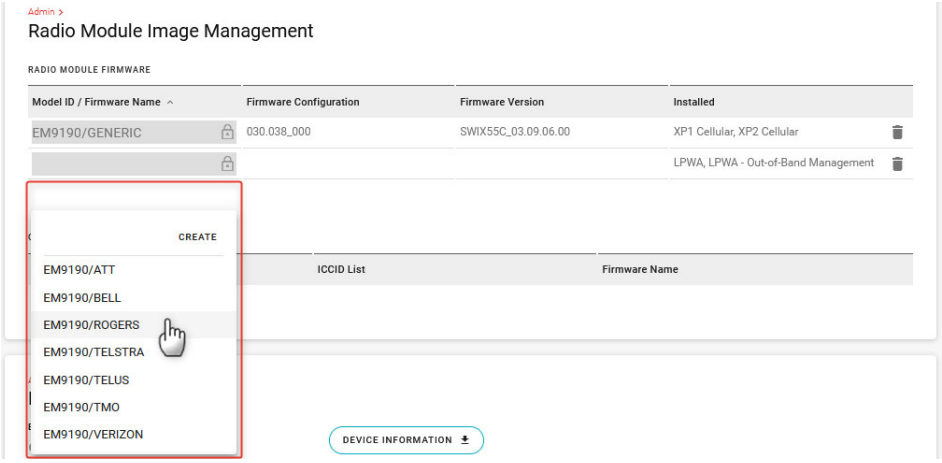
Note: This issue is resolved in AirLink OS 4.1.

As described in the AirLink OS 3.1 Release Notes, after upgrading an XR80/XR90 router from AirLink OS 3.0 to 3.1, the Cellular LED may flash red even though the Cellular interface is connected and passing traffic. This is caused by a radio module firmware mismatch after the update.

To restore normal LED operation:

1. Manually add your radio module/carrier name to the Radio Module Firmware table at Admin>Radio Module Firmware Image Management—Click an empty field in the Model ID/Firmware Name column and then select your radio module/carrier name.

   e.g.,



2. Repeat the upgrade to AirLink OS 3.1. The router will reboot and apply the correct radio module firmware.

(The AirLink OS 3.1 Release Notes is available at source.sierrawireless.com/resources/airlink/software_reference_docs/release-notes/airlink-os-release-notes/)

4.7.1 ALMS Out-of-band Management

XR80/XR90 routers are provisioned with an HL7800 LPWA radio module that provides always-on access to ALMS for out-of-band management (OOBM) **in supported regions**:

- North America
- Global (excluding Japan, Australia, New Zealand)
  Note— ALMS OOBM support is planned for Japan, Australia and New Zealand.

OOBM is used to connect over-the-air with ALMS via the HL7800 when no WAN connections of any type (Cellular, Wi-Fi, Ethernet) are available. This out-of-band connection allows ALMS to be used to manage the router.

For example, cellular WAN connections may not be available for a variety of reasons, including cellular network issues, missing SIMs, incorrect APNs, or other issues. In some cases, OOBM can be used to repair misconfigured WAN connections instead of requiring a truck-roll or repair depot visit.

4.7.2 Cellular Radio Band Support

XR80/XR90 routers contain one or two EM9190 radio modules and one HL7800 radio module. The installed modules are indicated by the FCC IDs printed on the label (Figure 4-6 on page 77) on the bottom of the XR router, and in AirLink OS (Status/Monitoring > System > Radio Module).

Table 4-14 and Table 4-15 identify the supported bands for both radio module types.

Note: For EM9190 radio modules, bands n7, n8, n12, n20, n25, n38, n40, n48 and B43 are supported only on AirLink OS 4.1 or later on XR80 / XR90 routers manufactured with an IMEI starting with "351". Routers with an IMEI starting with "350" do not support these bands regardless of the AirLink OS version.

To achieve the best possible cellular performance and reliability, XR80/XR90 5G routers must be connected to 4x4 MIMO 5G cellular FAKRA-based antennas that support the full cellular frequency range of 600 MHz to 6 GHz. For details, refer to *[6] AirLink XR Series Router Antenna FAQ*.

Important: *If all required antennas are not used, cellular performance and reliability will be compromised and will in some cases prevent any network connection. For example, band n41 requires all four antennas to be connected otherwise the band is not usable.*

For detailed RF and power specifications, refer to *[2] Sierra Wireless EM919X/EM7690 Product Technical Specification* and *[1] Sierra Wireless HL780x Product Technical Specification*, available on source.sierrawireless.com.

Table 4-14: Supported Bands[a,b] — EM9190

EM9190	1	2	3	4	5	6	7	8	9	12	13	14	17	18	19	20	25	26	28	29	30	32	34	38	39	40	41	42	43	46	48	66	71	77	78	79
5G Sub6	Y	Y	Y	—	Y	—	Y[c]	Y[c]	—	Y[c]	—	—	—	—	—	Y[c]	Y[c]	—	Y	—	—	—	—	Y[c]	—	Y[c]	Y[d]	—	—	—	Y[c]	Y	Y	Y	Y	Y
4G LTE	Y	Y	Y	Y	Y	—	Y	Y	—	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y[e]	Y[f]	Y	Y	Y	Y	Y	Y	Y	Y[c]	Y[g]	Y	Y	Y	—	—	—
3G	Y	Y	—	Y	Y	Y	—	Y	Y	—	—	—	—	—	Y	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

a. In AirLink OS 3.1 or later, all 5G bands support non-standalone (NSA) and standalone (SA) modes when running radio module firmware based on revision 03.09.06 or 03.09.11.
b. Cellular radio band support is identical for North American and Global XR router variants.
c. Indicated bands are supported on AirLink OS 4.1 or later on XR80/XR90 routers manufactured with an IMEI starting with "351". Routers with an IMEI starting with "350" do not support these bands regardless of the AirLink OS version.
d. Band n41 is usable only if all four cellular antennas are connected.
e. Downlink only
f. Downlink only. B30 Tx is disabled by default.
g. LTE-LAA B46 downlink only

Table 4-15: Supported Bands—HL7800[a]

HL7800	Technology	1	2	3	4	5	8	9	10	12	13	17	18	19	20	25	26	27	28	66
LTE	Cat-M1	Y	Y	Y	Y	Y	Y	Y[b]	Y[b]	Y	Y	Y[b]	Y	Y	Y	Y	Y	Y	Y	Y
	Cat-NB1	Y	Y[c]	Y	Y[c]	Y[c]	Y	Y[b]	Y[b]	Y[c]	Y[c]	Y	Y	Y	Y	Y[c]	Y[c]	Y[b]	Y	Y[c]

a. The HL7800 module is dedicated for use with ALMS—see ALMS Out-of-band Management on page 68.
b. Will be supported in a future HL7800 release.
c. To ensure FCC compliance near NB band edges, Cat-NB1 supported TX channel ranges do not include outer channels. Refer to *[1] Sierra Wireless HL780x Product Technical Specification* for details.

4.7.3 Carrier Aggregation

The EM9190 supports LTE-A carrier aggregation and 5G EN-DC (E-UTRAN New Radio - Dual Connectivity). For details, refer to *[2] Sierra Wireless EM919X/EM7690 Product Technical Specification*.

4.8 Conducted Tx Power

4.8.1 EM9190 Conducted Tx Power

Table 4-16: Conducted Tx Power[a] (EM9190)

Band		Conducted Tx Power	Notes
5G			
FR1 Sub-6G Bands	n2, n5, n48, n66, n77	+23.7 dBm +0.8/-2.2 dB	Power Class 3
	All other bands	+23 dBm ±1.5 dB	
LTE			
LTE B3, B7, B41, B42		+23 dBm +1.8/-1.0 dB	Power Class 3
B41 HPUE		+25 dBm±1 dB	Power Class 2 (B41 standalone mode only)
LTE all other bands		+23 dBm±1 dB	Power Class 3
UMTS			
All bands (12.2 kbps)		+23.5 dBm ±1 dB	Connectorized (Power Class 3)

a. Tx power is based on no maximum power reduction (MPR) configuration as 3GPP defined. For configurations that require MPR or additional MPR, refer to 3GPP for the power reduction.

4.8.2 HL7800 Conducted Tx Power

Table 4-17: HL7800 Conducted Tx Max Output Power Tolerances — LTE[a]

LTE Bands	Min	Typ	Max	Units	Notes
All bands	21.5[b]	23	24.5	dBm	Power class 3

a. Under normal operating conditions (25°C)
b. Additional power reduction is applied to the lowest and highest supported channels for each band — for details, refer to [1] Sierra Wireless HL780x Product Technical Specification.

4.9 GNSS Supported Bands

Table 4-18: GNSS Bands Supported

Band	Frequency
GPS	1575.42 MHz
GLONASS	1602 MHz
Galileo	1575.42 MHz
BeiDou	1561.098 MHz
QZSS	1176.45–1575.42 MHz

4.10 Mechanical Specifications

Table 4-19: Mechanical Specifications

<table>
<tr><td>Dimensions</td><td>
<table>
<tr><th>XR router</th><th>Width[a] (mm)</th><th>Length[a] (mm)</th><th>Height[a] (mm)</th><th>Weight (kg)</th></tr>
<tr><td>XR90 (no XP 5G Cartridges)</td><td>171</td><td>218[b]</td><td>54</td><td>2.06</td></tr>
<tr><td>XR90 (+1 XP 5G Cartridge)</td><td>220</td><td>218[b]</td><td>54</td><td>2.64</td></tr>
<tr><td>XR90 (+2 XP 5G Cartridges)</td><td>268</td><td>218[b]</td><td>54</td><td>3.22</td></tr>
<tr><td>XP 5G Cartridge</td><td>62</td><td>202[b]</td><td>54</td><td>0.58</td></tr>
<tr><td>XR80 Wi-Fi (no XP 5G Cartridges)</td><td>171</td><td>218[b]</td><td>54</td><td>2.00</td></tr>
<tr><td>XR80 non-Wi-Fi (no XP 5G Cartridges)</td><td>171</td><td>218[b]</td><td>54</td><td>1.80</td></tr>
</table>
a. Length, width, and height rounded up to the next whole number.
b. Includes FAKRA antenna connector(s)
</td></tr>
<tr><td>Housing</td><td>Ruggedized powder-coated aluminum.</td></tr>
<tr><td>RoHS</td><td>Complies with the Restriction of Hazardous Substances Directive (RoHS). This directive restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment.</td></tr>
</table>

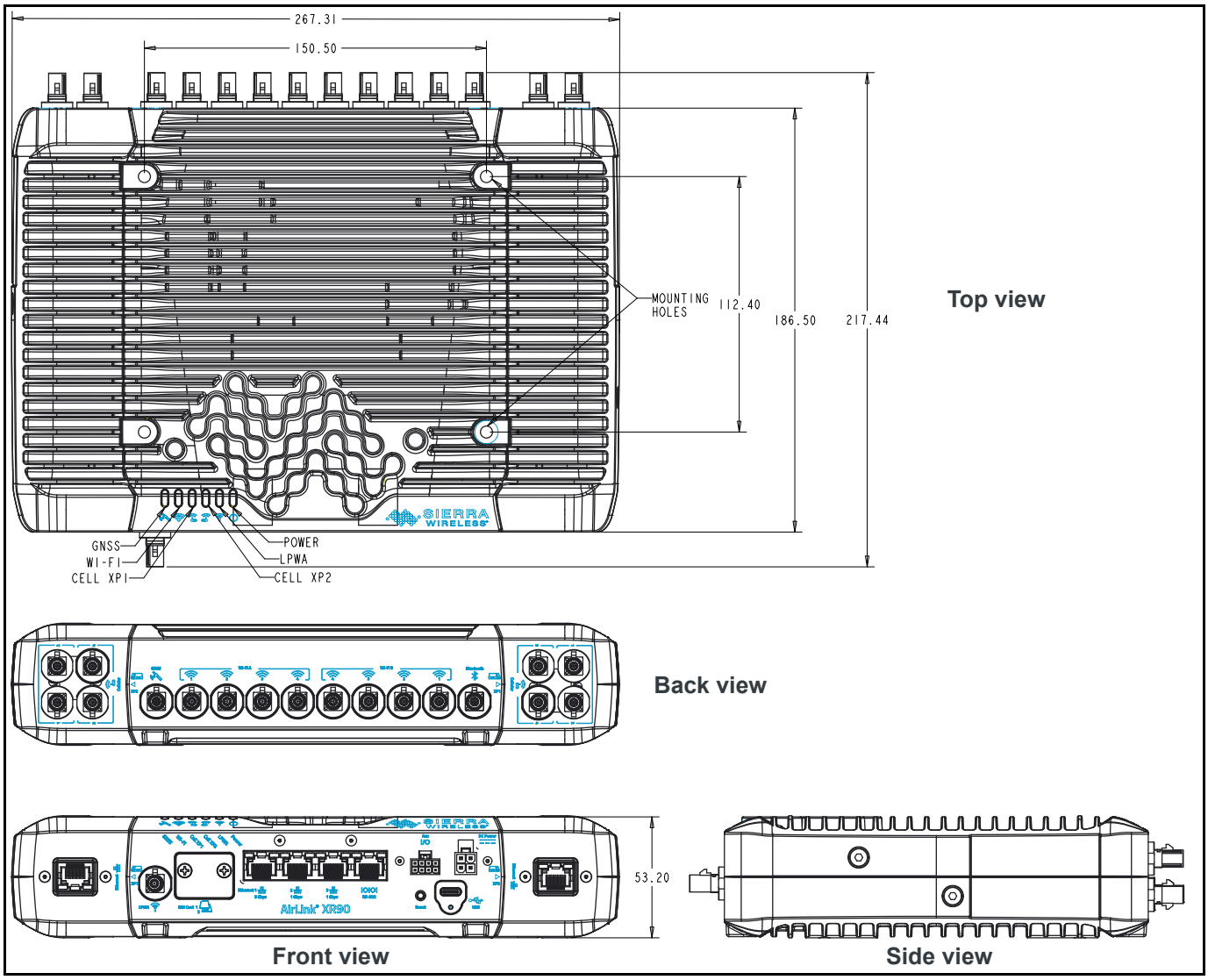
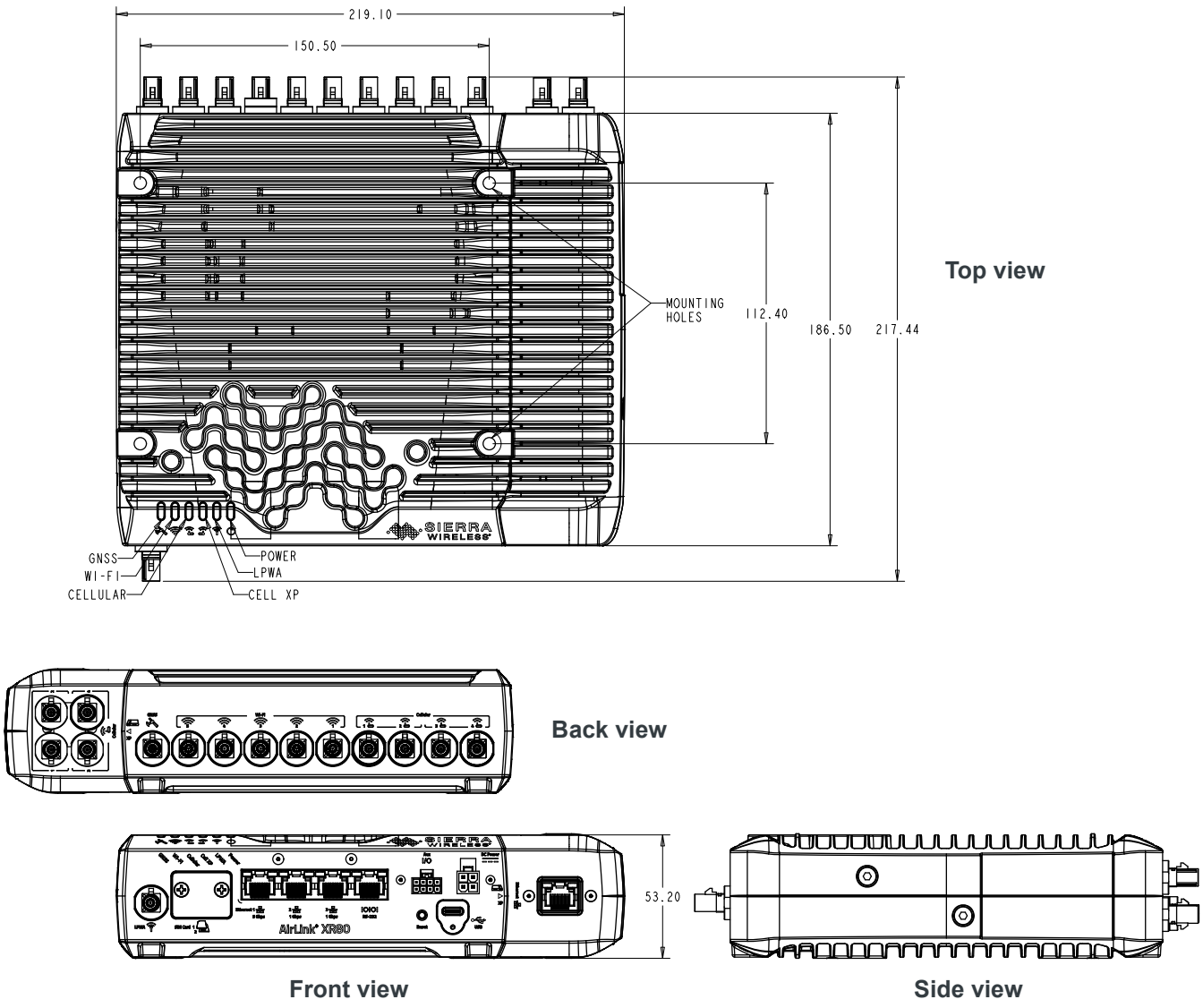


Figure 4-2: XR90 Mechanical Dimensions



Note: Indicated dimensions are for an XR80 with an optional XP 5G Cartridge installed. The XR80 (with Wi-Fi) and XR80 (no Wi-Fi) base routers (i.e., no cartridge) have the same overall dimensions shown in Figure 4-4. (Note that the Wi-Fi router variant includes five additional FAKRA connectors on the back panel for Wi-Fi.)

Figure 4-3: XR80 (with Wi-Fi) Mechanical Dimensions

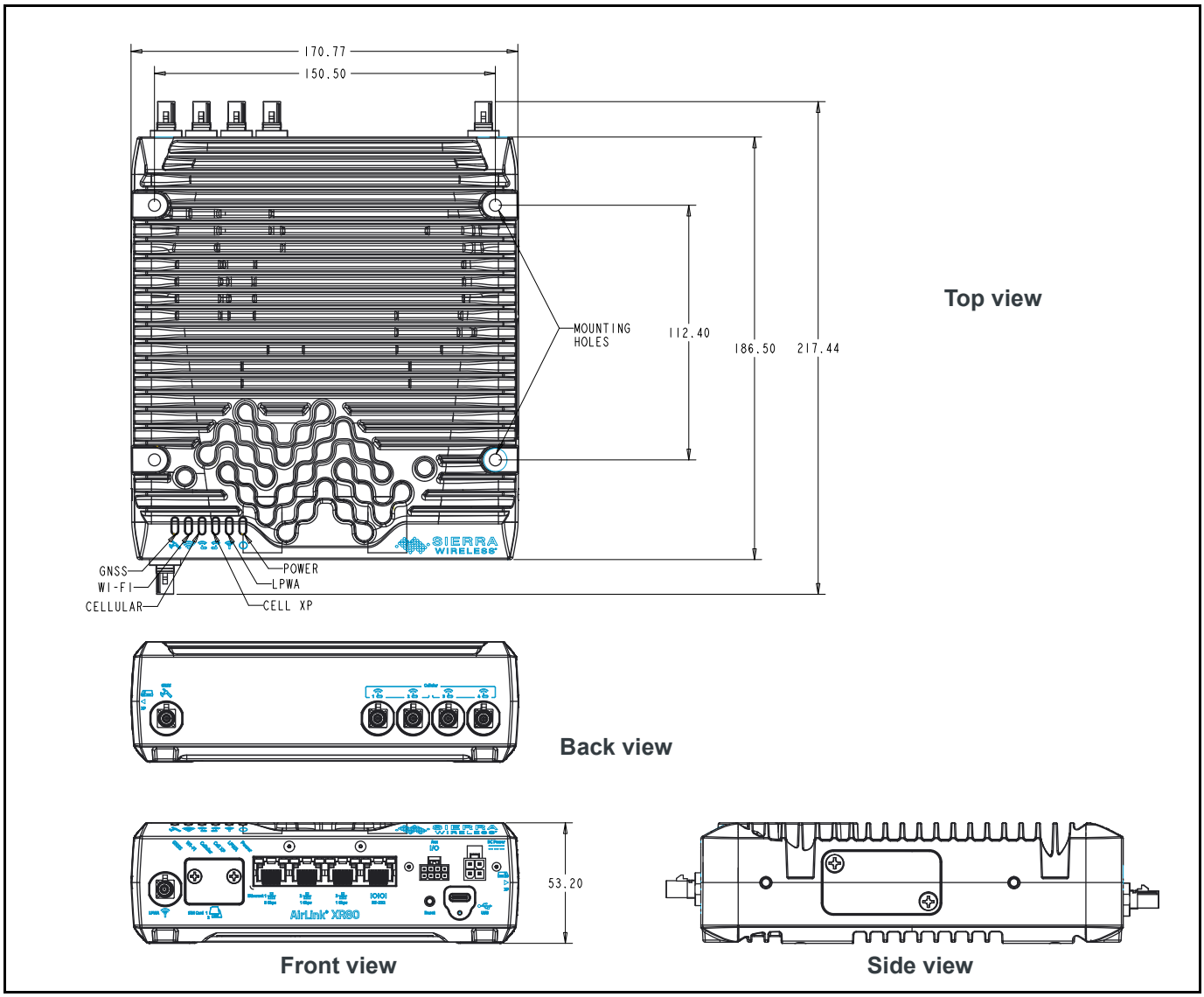


Figure 4-4: XR80 (no Wi-Fi) Mechanical Dimensions

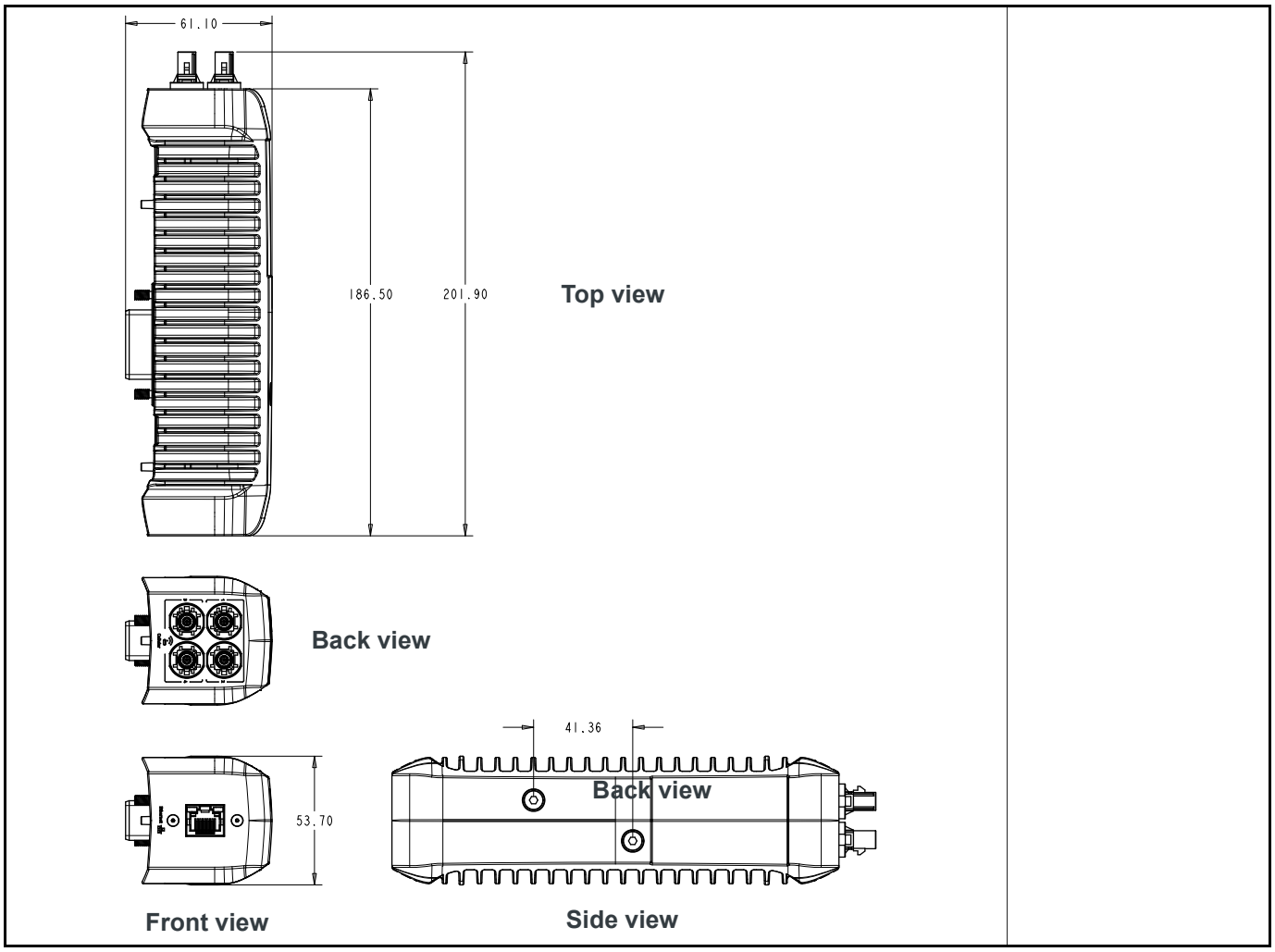


Figure 4-5: XP 5G Cartridge Mechanical Dimensions

4.11 XR Router and XP 5G Cartridge Labels

The XR router label (located on the router base) and XP 5G Cartridge label (located on the cartridge base) contain important information, including (but not limited to) the items in Table 4-20.

Table 4-20: Select Label Contents

Content	Label Text	Device Label		
		X80	XR90	XP 5G Cartridge
QR code (contains Serial Number, IMEIs, password, SKU, UPC, ALMS Registration Code)	No label	Y	Y	Y
Default password for AirLink OS	“Default Password”	Y	Y	—
Serial number	“S/N”	Y	Y	Y

Table 4-20: Select Label Contents (Continued)

Content	Label Text	Device Label		
		X80	XR90	XP 5G Cartridge
ALMS Registration Code	"REG CODE"	Y	Y	—
IMEIs				
Internal cellular radio module	"IMEI — INT"	Y	—	—
XP 5G Cartridge	"IMEI"	—	—	Y
LPWA radio module (**Note**—The LPWA IMEI is not included on the label for newer XR routers.)	"IMEI — LPWA"	Y	Y	—
	Important—Do not use the LPWA IMEI to register your XR router with a carrier. For details, see Radio Module Registration on page 78.			
Certifications				
FCC/IC IDs for each radio module	"FCC ID" "IC"	Y	Y	Y
Other certifications (e.g., CE, RoHS, UL, etc.)	Icons only, no text	Y	Y	Y

Figure 4-6: Sample XR Router Label

Figure 4-7: Sample XP 5G Cartridge Label

Note: Label contents will vary by SKU.

4.11.1 ALMS Registration

To register an XR80 or XR90 router with ALMS, use the serial number (“S/N”) and ALMS registration code (“REG CODE”) that are printed on the router label and can also be captured using the QR code on the label to minimize errors.

4.11.2 Radio Module Registration

Some carriers may require your router to be registered for use on their networks.

Note: The XR80/XR90 router’s LPWA module is pre-registered with the Sierra Wireless global IoT network and cannot be registered with another carrier.

If your carrier requires your router to be registered, use the appropriate cellular module IMEIs from the router and cartridges:

- To register an XR80 4G or 5G (i.e., internal cellular module):
  - Use the “IMEI — INT” number on the XR80 device label (Figure 4-6)

    and
  - If an XP 5G Cartridge is installed, use the “IMEI” number on the cartridge label
- To register an XR90, use the “IMEI” numbers on the XP1 and (if installed) XP2 cartridge labels (Figure 4-7).
- To register a separately-purchased XP 5G Cartridge (PN 1104757), use the “IMEI” number on the cartridge label (Figure 4-7).

Note: Make sure to use the correct SIM slots on the XR80/XR90 router for the cellular radio(s). For details, see Step 2—Insert the SIM Cards on page 20.

5: Regulatory Information

5.1 Important Information for Users in Canada and the United States

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This device has been tested and certified using the antenna model(s) listed below:

- XR90: Panorama Antennas LGMQM4-6-60-24-58
- XR80: Panorama Antennas LGMPM4FKJ-6-60

Non-certified antennas are not permitted for use with the XR90 or XR80 platform.

Antennas must be installed such that the following separation distances are maintained:

- XR90:
  - Minimum 20 cm between the WiFi-A and WiFi-B antennas
  - Minimum 20 cm between the antennas and the user
- XR80:
  - Minimum 20 cm between the antennas and the user

Warning: *This product is only to be installed by qualified personnel.*

Warning: *Changes or modifications to this device not expressly approved by Sierra Wireless could void the user's authority to operate the device.*

This device can operate in collocation with cellular radios not exceeding the specifications in the following table.

Table 5-1: Collocated Devices—Antenna Gain and Radio Transmitter Specifications

Band	Tx Freq Range (MHz)	Max Time-Avg Cond Power (dBm)	Antenna Gain Limit (dBi)	Source-based Time-Avg Max EIRP (dBm)
WCDMA Band 2	1850–1910	24.5	4	28.5
WCDMA Band 4	1710–1755	24.5	3.5	28.0
WCDMA Band 5	824–849	24.5	1.5	26.0
LTE B2	1850–1910	24.0	4	28.0
LTE B4	1710–1755	24.0	3.5	27.5
LTE B5	824–849	24.0	1.5	25.5
LTE B7	2500–2570	24.8	4.5	29.3
LTE B12	699–716	24.0	1.5	25.5
LTE B13	777–787	24.0	1.5	25.5
LTE B14	788–798	24.0	2	26.0
LTE B17	704–716	24.0	1.5	25.5
LTE B25	1850–1915	24.0	4	28.0
LTE B26	814–849	24.0	2	26.0
LTE_B30	2305–2315	24.0	0	24.0
LTE_B38	2570–2620	24.8	4.5	29.3
LTE B41	2496–2690	24.8	3	27.8
LTE B41-HPUE	2496–2690	26.0	3	29.0
(Canada only) LTE_B42/43	3550–3650	24.8	-1.8	23.0
LTE B48	3550–3700	24.8	-1.8	23.0
LTE B66	1710–1780	24.0	3.5	27.5
LTE B71	663–698	24.0	1	25.0
5G NR n2	1850–1910	24.5	4	28.5
5G NR n5	824–849	24.5	1.5	26.0
5G NR n41	2496–2690	24.5	3	27.5
5G NR n66	1710–1780	24.5	3.5	28.0
5G NR n71	663–698	24.5	1	25.5
(Canada only) 5G NR n77/n78	3450–3650	24.5	-1.5	23.0
(US only) 5G NR n77/n78	3450–3650 3700–3900	24.5	5.5	30.0

5.2 Important Information for Users in the European Union and the United Kingdom

Hereby, Sierra Wireless, Inc. declares that the radio equipment types XR80 5G and XR90 5G are in compliance with Directive 2014/53/EU, Directive 2011/65/EU, and UK's Radio Equipment Regulations 2017 and Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012.

The full text of the EU/UK declaration of conformity is available at the following internet address: https://source.sierrawireless.com/resources/airlink/certification_and_type_approval/XR_Series_ce_declaration_of_conformity/

The XR80/XR90 router displays the CE and UKCA marks.

CE UKCA

5.2.0.1 Indoor Use Restrictions

	Countries with indoor-use restrictions on operation in 5150 to 5350 MHz:						
	AT	BE	BG	HR	CY	CZ	DK
	EE	FI	FR	DE	EL	HU	IE
	IT	LV	LT	LU	MT	NL	PL
	PT	RO	SK	SI	ES	SE	UK(NI)
	IS	LI	NO	CH	TR		

	UK

Pursuant to Article 10(10) of Directive 2014/53/EU, the pictograms displayed above will be displayed on the packaging of Sierra Wireless XR80/XR90 products that are restricted (in the countries identified) to indoor use only when operating in the 5150–5350 MHz frequency range.

Caution: *To comply with EU regulations limiting human exposure to electromagnetic fields, a minimum separation distance between the antenna and the user's body must be maintained at all times—20 cm for the XR80 5G, 28 cm for the XR90 5G.*

5.2.0.2 WEEE Notice

If you purchased your Sierra Wireless XR80/XR90 router in Europe, please return it to your dealer or supplier at the end of its life. WEEE products may be recognized by their wheeled bin label on the product label.

A: Antennas

A.1 Antenna Separation

When installing single-element antenna units, refer to Table A-1 for recommended antenna separation distances.

Recommended antenna separations are related to band frequency/wavelength.

Table A-1: Recommended Antenna Separation

Service	Frequency (MHz)	Wavelength (λ) (mm)	Antenna Separation	
			Best (=1/2 λ) (mm)	Good (=1/4 λ) (mm)
5G Sub6	600	500	250	125
	650	462	231	115
	700	429	214	107
	750	400	200	100
	800	375	188	94
	850	353	176	88
	900	333	167	83
	950	316	158	79
	1700	176	88	44
	1800	167	83	42
	1900	158	79	39
	2000	150	75	38
	2100	143	71	36
	2200	136	68	34
	2300	130	65	33
	2400	125	63	31
	2500	120	60	30
	2600	115	58	29

Service	Frequency (MHz)	Wavelength (λ) (mm)	Antenna Separation	
			Best (=1/2 λ) (mm)	Good (=1/4 λ) (mm)
5G Sub6	2700	111	56	28
	3300	91	45	23
	3400	88	44	22
	3500	86	43	21
	3600	83	42	21
	3700	81	41	20
	3800	79	39	20
	3900	77	38	19
	4000	75	38	19
	4100	73	37	18
	4200	71	36	18
	4400	68	34	17
	4600	65	33	16
	4800	63	31	16
	5100	59	29	15
	5500	55	27	14
	5900	51	25	13
	—	—	—	—

Table A-1: Recommended Antenna Separation (Continued)

Service	Frequency (MHz)	Wavelength (λ) (mm)	Antenna Separation	
			Best (=1/2 λ) (mm)	Good (=1/4 λ) (mm)
LTE	600	500	250	125
	650	462	231	115
	700	429	214	107
	750	400	200	100
	800	375	188	94
	850	353	176	88
	900	333	167	83
	950	316	158	79
	1450	207	103	52
	1500	200	100	50
	1700	176	88	44
	1800	167	83	42
	1900	158	79	39
	2000	150	75	38
	2100	143	71	36
WCDMA	850	353	176	88
	900	333	167	83
	1700	176	88	44
	1800	167	83	42
	1900	158	79	39
	2100	143	71	36
LTE	2200	136	68	34
	2300	130	65	32
	2400	125	63	31
	2500	120	60	30
	2600	115	58	29
	2700	111	56	28
	3400	88	44	22
	3500	86	43	21
	3600	83	42	21
	3700	81	41	20
	3800	79	39	20
	5100	59	29	15
	5500	55	27	14
	5900	51	25	13
	—	—	—	—
WLAN[a]	2.4G	125	63	32
	5.2G	57	29	15

a. Wi-Fi/Cellular separation distance should be whichever value (Wi-Fi or Cellular separation) is largest for the applicable band.

B: Accessories

B.1 DC Power Cable

Table B-1: DC Power Cable

Part Number	6001406

① 1 UL2464 16AWGx2C + 20AWGx2C PVC jacked cable

② • 2 Molex female crimp terminals /AWG 18-24, 600V, phosphor bronze tin-plated (part number TY4281TPH-A)
• 2 Molex female crimp terminals/AWG 16, 600V, phosphor bronze tin-plated (part number TY4281TGH-AE-DH)

③ 1 Molex male 2×2P Ph: 4.2 mm housing, 600V, 13 A max, PA66 black UL94V-O (part number TY4281HN0-2X02-M0-C1 or Digi-Key part number WM13487-ND Molex 0039013045 CONN RCPT HSG 4POS 4.20MM)

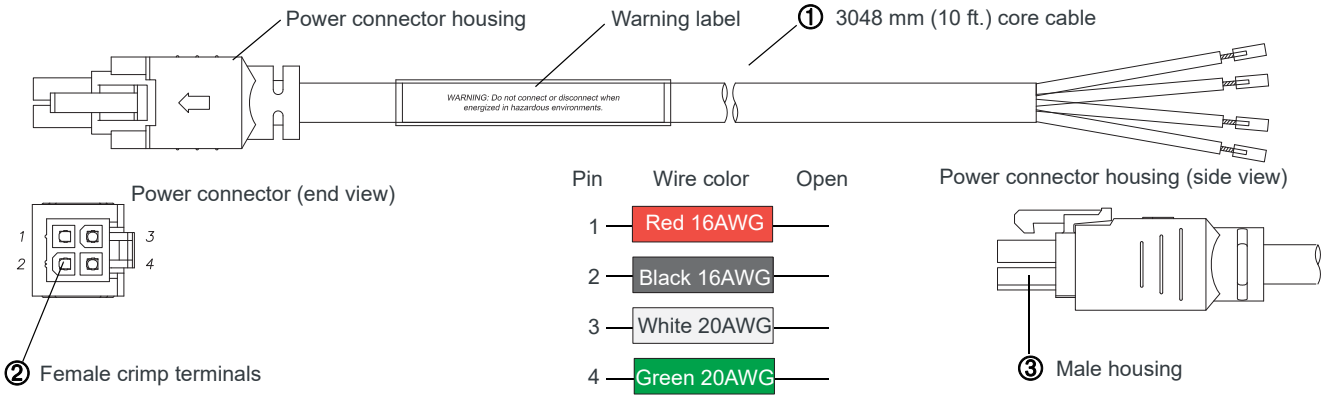


Figure B-1: DC Cable Specifications

B.2 AC Power Adapter (Black Connector)

Table B-2: AC Power Adapter

Part Number	6001372

B.2.1 AC Adapter Input

Table B-3: Input Specifications

	Minimum	Typical	Maximum
Input Voltage	90 VAC	100–240 VAC	264 VAC
Input Frequency	47 Hz	50/60 Hz	63 Hz

Note: Input voltage range is 90 VAC to 264 VAC. Maximum input current is 2000 mA at 100–240 VAC.Inrush current will not exceed 115 A at 100–240 VAC input and maximum load from a cold start at 25°C.

B.2.2 AC Adapter Output

Table B-4: AC Power Adapter Output Specifications

	Minimum	Typical	Maximum	Test conditions
Output Voltage	22.8 VDC	24.0 VDC	25.2 VDC	0 ~ 3.75 A loading

B.2.3 AC Adapter Environmental Specifications

Table B-5: AC Power Adapter Environmental Specifications

Operating	
Operating Temperature	0°C ~ 40°C (operates normally)
Relative Humidity	10% ~ 90%
Altitude	Sea level to 2,000 meters
Vibration	1.0 mm, 10–55 Hz, 15 minutes per cycle for each axis (X, Y, Z)
Non-operating	
Storage Temperature	-30°C ~ 70°C
Relative Humidity	10% ~ 90%
Altitude	Sea level to 2,000 meters
Vibration and Shock	MIL-STD-810D (Method 514, Procedures X (i.e. I, II, III, and IV))

B.2.4 AC Adapter Reliability and Quality Control

AC Power Adapter MTBF

When the power supply is operating within the limits of this specification, the MTBF is at least 250,000 hours at 25°C (MIL-HDBK-217F).

Note: For XR router MTBF, see *Reliability on page 35**.*

B.2.5 AC Adapter Safety Standards

The power supply is certified with the following international regulatory standards:

Table B-6: AC Power Adapter Safety standards

Regulatory Agency	Country or Region	Certified	Standard
UL	USA	Approved	UL60950-1
CUL	Canada	Approved	CSA C22.2 NO.60950-1
CE	Europe	Meet	EN62368-1
CCC	China	Approved	GB4943
SAA	Australia	Approved	AS/NZS 60950
FCC	USA	Approved	PART 15 CLASS B

B.2.6 AC Adapter EMC Standards

The power supply meets the radiated and conducted emission requirements for EN55032, FCC Part 15, Class B, GB9254.

B.2.7 AC Adapter Hazardous Substances

- EU Directive 2011/65/EU “RoHS”
- EU Directive 2012/19/EU “WEEE”
- REACH

B.2.8 AC Adapter Energy Efficiency

The AC adapter complies with International Efficiency Levels, as shown in Table B-7.

Table B-7: AC Adapter Energy Efficiency

Supplied Input	No-load Power Consumption	Average Active Mode Efficiency	International Efficiency Level
115/230 VAC, 60/50 Hz	Less than 0.21 W	Greater than 88%	VI

B.3 I/O Cable

The AirLink auxiliary I/O cable is unshielded and terminated on one end, and designed for use with the AirLink XR80/XR90, MP70, and LX60.

Table B-8: I/O Cable

Part Number	Description[a]	Length	Connector
6001004	XR/MP/LX I/O Cable	2 meters	8-pin Molex Micro-Fit connector

a. The description used by vendors for this cable may indicate some combination of XR, MP, or LX model. However, these cables are intended for XR80/XR90, MP70, and LX60 routers.

Table B-9: I/O Cable Pin-out

I/O Cable Pin	Wire Color	Function	Notes
1	Black	Ground	Shorted to Pin 8 with 22AWG
2	Orange	IO4_IN	
3	Purple	IO3_IN	
4	Not connected		
5	Not connected		
6	Yellow	IO2_IN_A	
7	Gray	IO1_IN_A	
8	Black (22AWG)	Ground	Shorted to Pin 1 with 22AWG

① 1 UL2464 20AWGx5C unshielded, PVC black cable. Outer diameter 5.80 mm

② • 5 Molex Micro-Fit 3.0 female crimp terminals: AWG 20-24, 600V, HSM copper tin-plated (part number 430300001)
• 1 Molex Micro-Fit 3.0 female crimp terminal: AWG 18, 600V, HSM copper tin-plated (part number 458070003)

③ 1 Molex male 8 circuit Micro-Fit 3.0 receptacle housing (part number 430250800)

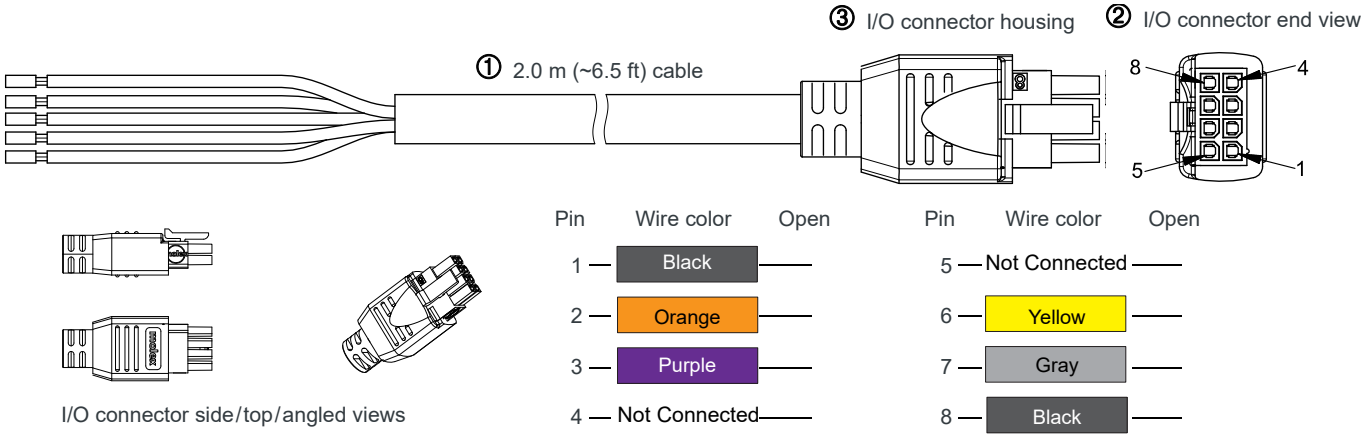


Figure B-2: IO Cable Specifications

B.4 Vehicle Bus Cables

The vehicle bus interface cables are shielded and terminated, and designed for use with the AirLink XR80/XR90, MP70, and LX60.

Table B-10: Vehicle Bus Cables

Part Number	Description[a]	Length	Connector
6001204	OBD-II (J1979) Y-cable	5 meters	OBD-II
6001192	J1939 Y-cable	5 meters	Deutsch 9-pin Type I/II

a. The descriptions used by vendors for these cables may indicate only MP70 and/or LX60. However, these cables are intended for XR80/XR90, MP70, and LX60 routers.

Table B-11: Vehicle Bus Cable Pin-outs

J1939 Pin	OBD-II Pin	XR router I/O Pin	Function
C	6	4	CAN-H
D	14	5	CAN-L
A	5	8	Ground

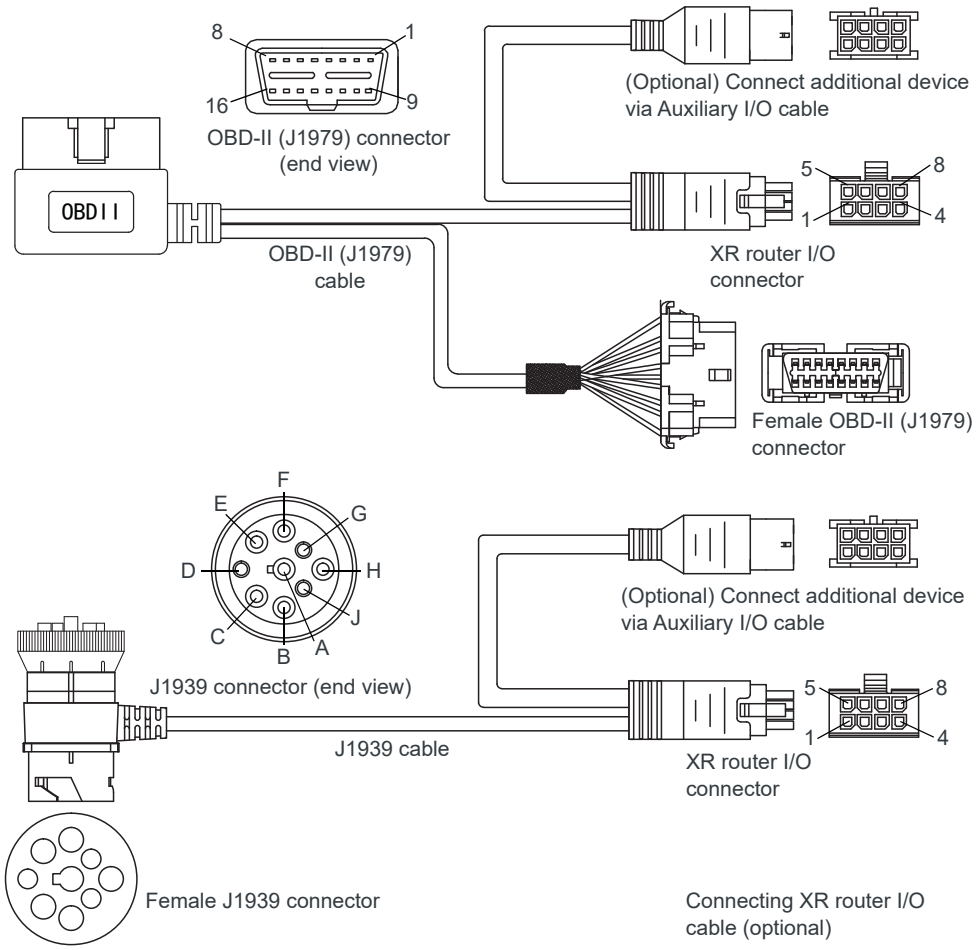


Figure B-3: Vehicle Bus Y-Cables

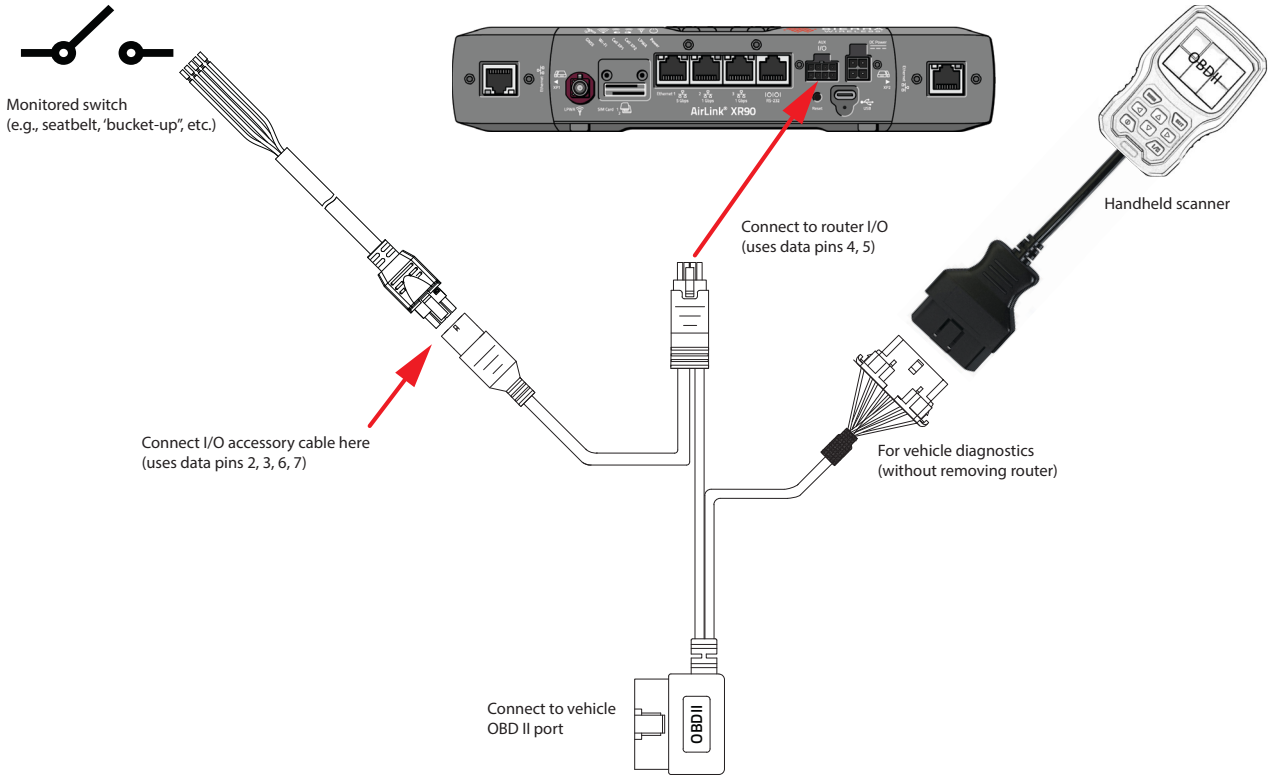


Figure B-4: Vehicle Bus OBD-II Y-Cable Example

C: Thermal Protection

XR80/XR90 routers employ a number of thermal protection schemes in hardware and software.

When an XR80/XR90 router is operating at, or near, its high temperature limits, these thermal protection schemes may be triggered to ensure the router can continue to safely operate with possibly reduced throughput on one or more WAN or LAN interfaces.

D: Repair

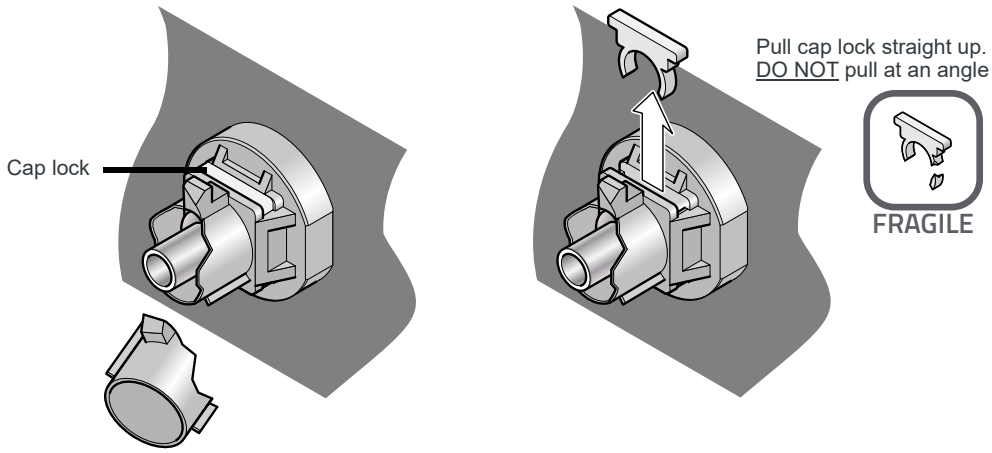
D.1 Replacing Broken FAKRA Connectors

A replacement kit (PN 6001440) containing a variety of FAKRA connector caps for XR80/XR90 routers and XP 5G Cartridges is available from Sierra Wireless. This kit includes:

Qty	Item	Key	Usage
Connectors			
3	Claret-Violet (Purple) 	D	LPWA Cellular
3	Beige 	I	Wi-Fi
1	Signal-Blue (Blue) 	C	GNSS
1	Water-Blue (Teal) 	Z	Bluetooth
Cap locks (locking clips)			
8			For use with all connectors

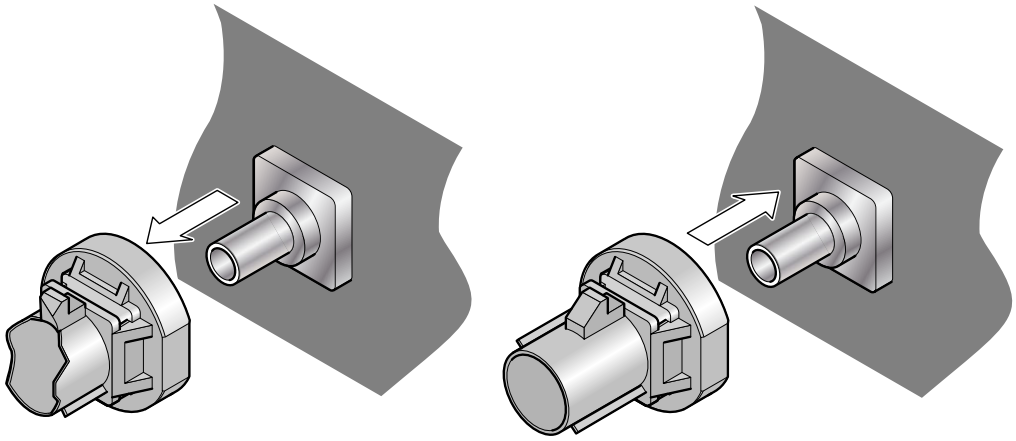
To replace a broken FAKRA connector cap on the XR80/XR90 router:

1. **Carefully** remove the cap lock (locking clip) from the broken connector cap—Make sure to pull the lock straight out of the connector, otherwise the lock's arm(s) may break if pulled out on an angle. (Suggestion—Use needle-nose pliers to grip the sides of the lock.)

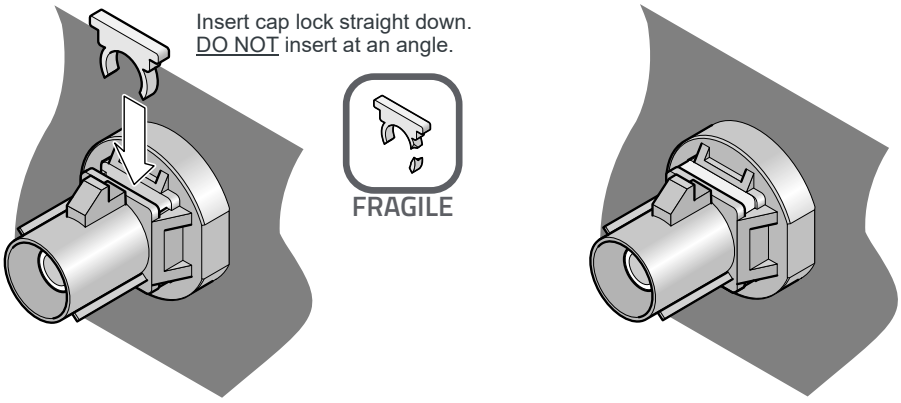


Note: Carefully remove/insert cap lock—the cap lock 'arms' are very easy to break.

2. Pull the broken connector cap off the router and replace with a new cap—make sure the new cap has the same orientation as the original cap.



3. **Carefully** insert the cap lock—Use tweezers or needle-nose pliers to hold the lock dead-center on the top bar and insert the lock straight into the locking slot. Make sure the lock is flush with the cap edge after insertion.



A FAKRA connector replacement kit is available for purchase from Sierra Wireless (part #6001440). This kit includes:

Qty	Item	Key	Usage
Connectors			
3	Claret-Violet (Purple) 	D	LPWA Cellular
3	Beige 	I	Wi-Fi
1	Signal-Blue (Blue) 	C	GNSS
1	Water-Blue (Teal) 	Z	Bluetooth
Cap locks (locking clips)			
8			For use with all connectors

E: USB-C Network Connection

The XR80/XR90 router's front panel USB-C port can be used as a virtual Ethernet port to connect a Windows 10 (or later) or macOS computer to the router.

Note: In the examples below, the router is configured with the default LAN address 192.168.80.0/24 and IPv6 is enabled.

E.1 Windows 10 (or later)

1. Make sure the Windows computer has an active internet connection.
2. Connect the computer to the router using a data-capable USB-C cable and, if using a locking cable, tighten the jack screw finger tight.

   (Note that some USB-C cables are power-only and will not transmit/receive data.)
3. Wait for the automatic virtual COM port setup to complete—The computer displays a notice while setting up the port, and another notice when the installation is complete, as shown in Figure 5-1.

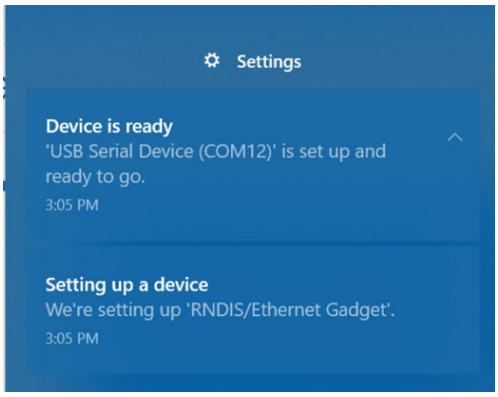


Figure 5-1: USB-C Installation—Windows Setup Notifications (Windows 10 shown)

4. Go to Windows Update and check for Optional Updates, then select and install the "Acer Incorporated - Other Hardware - USB Ethernet/RNDIS Gadget".

   (Note that this update may not be available if your computer uses an internal corporate Windows update server.)

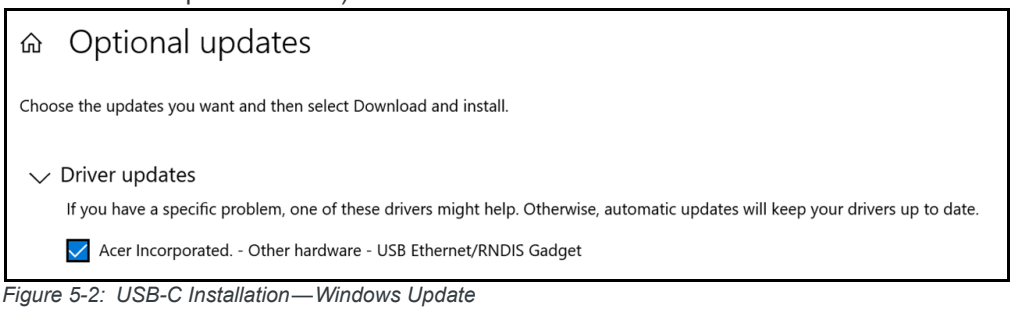


Figure 5-2: USB-C Installation—Windows Update

5. Confirm that the device has installed—Use Device Manager to verify the “USB Ethernet RNDIS Gadget” has been added to the Network adapters list.

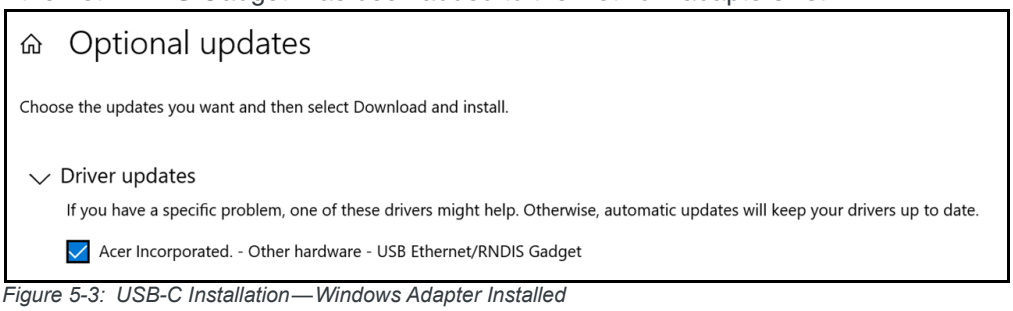


Figure 5-3: USB-C Installation—Windows Adapter Installed

6. Confirm the network is available and the adapter has been assigned IP address(es)—Open a Command prompt window and type "ipconfig".

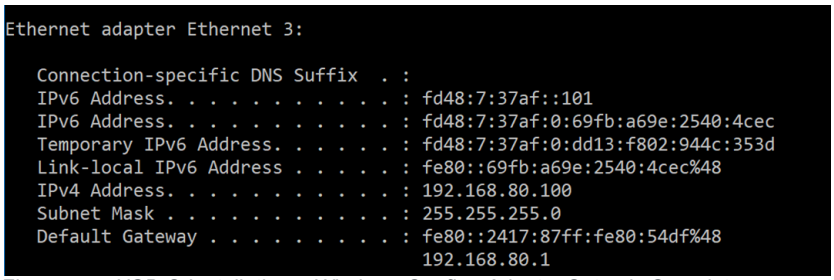


Figure 5-4: USB-C Installation—Windows Confirm Adapter Setup is Complete

E.2 macOS Big Sur

Note: This procedure was tested on macOS 11.2.3.

1. Make sure the macOS computer has an active internet connection.
2. Connect the computer to the router using a data-capable USB-C cable and, if using a locking cable, tighten the jack screw finger tight.

   (Note that some USB-C cables are power-only and will not transmit/receive data.)
3. In System Preferences, open the Network center and confirm the RNDIS/Ethernet Gadget appears and is connected.

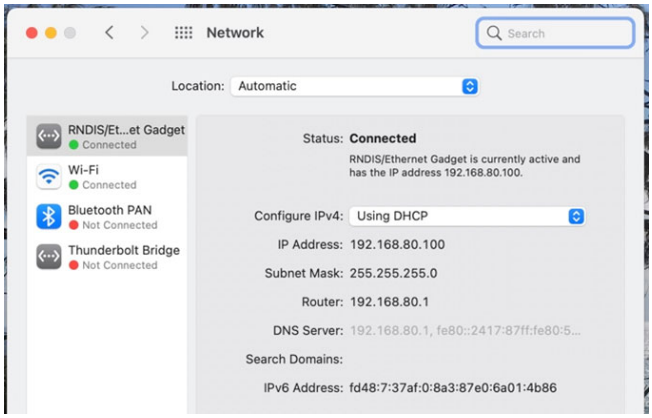


Figure 5-5: USB-C Installation—macOS Adapter Setup Complete

F: References

For more details, several references can be consulted, as described below.

F.1 Web Site Support

For the latest AirLink XR Series router documentation, go to https://source.sierrawireless.com. Click **sign up** to receive product updates and to download product documentation.

F.2 Reference Documents/Pages

[1] Sierra Wireless HL780x Product Technical Specification
Reference #41113770

[2] Sierra Wireless EM919X/EM7690 Product Technical Specification
Reference #41113174

[3] AirLink OS User Guide
Reference page: source.sierrawireless.com/airlinkos

[4] AirLink XR90 Quick Start Guide
Reference #5305868

[5] AirLink XR80 Quick Start Guide
Reference #5306266

[6] AirLink XR Series Router Antenna FAQ
Reference #41114374