Antenna Selection and Installation

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Introduction to Selecting Antennas

Note Before you install the Cisco IR1800 router on a table, wall, or DIN rail, install the antennas on the pluggable module. It is difficult to install the antennas after the router is installed.

This chapter contains information about selecting antennas for the IR1800 router.

The P-LTE-xx or P-LTEA-xx cellular modules have three RF SMA(f) connectors on the pluggable module. Two connectors, Main and Div (Diversity), are used to connect to the 4G/LTE modem. The third connector is used for GPS. The Diversity port is also referred to as an Aux connector.

The P-LTEAP18-GL module has four RF SMA(f) connectors. Two connectors are Primary (Main) supporting Uplink and Downlink, and two connectors are secondary supporting downlink MIMO.

The P-5GS6-GL module has five RF SMA(f) connectors, of which four support 4G LTE / 5G FR1 and one supports GPS.

Antenna Installation Best Practices

The optimal site location for antennas for 4G routers and cellular modules plays a significant role in determining the overall cellular link performance. Routers located at the farthest coverage points might have 10 to 50 percent of the bandwidth available compared to routers located closer to the cellular base station tower, away from obstructions, and with an unobstructed view of the cellular tower.

Because antennas transmit and receive radio signals over the air, the signal propagation and antenna performance may be adversely affected by the surrounding environment, including physical obstructions. Radio frequency (RF) interference may also occur between wireless systems located close to each other, especially if the

antennas of these systems are located close to each other. Interference may also occur when antennas are in close proximity to cable clutter or other sources of radio interference.

Follow these guidelines to ensure the best possible performance:

- When you use cellular antennas such as 3G UMTS, 4G/LTE, 4G/LTEA (LTE Advanced), and 5G NR FR1 with a modular router and a pluggable module, try to mount the antennas a certain distance away from the router. For example, in indoor deployments, an appropriate extension cable and antenna stand can be utilized. For outdoor installations, choose a suitable outdoor antenna, and mount it away from obstructions such that the antennas have a direct view of the cellular tower. The antenna's performance, and therefore that of the router, will not be optimal if mounted directly on a pluggable module. Primary reasons for possible degradation of performance include:
  - The router antenna's view of the cellular base station tower being obstructed by Ethernet cables, power cables, USB cables, and walls.
  - Possible coupling of digital noise from inside the router to the antenna when unshielded Ethernet cables are used.
- Keep antennas away from electrical and signal cable clutter. Metal conductors inside cables may block an antenna's view of the base station. Additionally, unshielded (and even shielded cables in some cases) may radiate signals that interfere with RF signal reception.
- We recommend that all the cellular antennas for the IR1800 are oriented vertically to ensure polarization match. While polarization of the signal may change because it is reflected from obstructions, when the view is unobstructed, vertical polarization is optimal.

Note When cellular FDD Band 5 is deployed with 3G WCDMA, 4G/LTE, or 4G/LTEA C/A, such as with P-LTE-US or P-LTEA-EA pluggable modules on certain carriers, ensure that both the Main and Aux cellular antennas are physically separated from the IR1800 chassis by a minimum of 5 feet (1.5 meters). This is applicable only to the P-LTE-xx receiver operation in Band 5 in a narrow 875-MHz frequency range. No significant effect has been observed on the P-LTE-xx cellular Band 5 receiver when antennas are separated from the chassis by more than 5 feet (1.5 meters). This information does not apply when the receive signal does not overlap 875 MHz, such as when operating on other bands, or other frequencies within FDD Band 5.

- For optimal MIMO performance, set the cellular Main and Aux antennas apart by at least 20 inches (50 cm). At the lowest LTE frequency of 617 MHz, 20 inches represents 1 wavelength. Spacing of half (or 0.5) wavelength or 10 inch (25 cm) results in good MIMO performance.
- Setting the Main and Aux LTE antennas less than 10 inches apart may result in significantly reduced MIMO performance.
- Placing the antennas too close to each other, for example 3 inches, results in the antennas significantly detuning from their original designed performance because of antenna coupling.
- Wherever possible, mount the IR1800 router with the pluggable LTE module and the antenna where the cellular base station or tower are within sight and without physical obstructions. Barriers along the line of sight between the router and the local base station degrades the wireless radio signals. Install the IR1800, pluggable modules, and antennas above floor level in office environments, or near the ceiling, for better performance because most obstructions tend to be near the floor level.

- The density of the materials used in a building's construction determines the number of walls the signal must pass through while still maintaining adequate coverage. Consider the following before choosing the location for installing the antenna:
  - Paper and vinyl walls have very little effect on signal penetration.
  - Solid and precast concrete walls limit signal penetration to one or two walls without degradation of coverage.
  - Concrete and wood block walls limit signal penetration to three or four walls.
  - A signal can penetrate five or six walls constructed of drywall or wood.
  - A thick metal wall or wire-mesh stucco wall causes signals to reflect back and causes poor penetration.
- Avoid mounting an antenna next to a column or vertical support. This might create a shadow zone and reduce the coverage area.
- Keep the antenna away from reflective metal objects such as heating and air-conditioning ducts, large ceiling trusses, building superstructures, and major power cabling runs. If necessary, use an extension cable to relocate the antenna away from these obstructions.

This radio transmitter [IC:2461A-WPWIFI6] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed in this guide, with the maximum permissible gain indicated. Antenna types that are not included in this list and have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with the IR1800 Series router.

Le présent émetteur radio [IC:2461A-WPWIFI6] a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

Supported Antennas for the IR1800 Series Router

The following tables list the antennas supported for IR800 Series router.

Note Wherever 4G LTE is mentioned in antenna RF port designations, the antennas will also support 5G NR in the same bands and ports, even though documentation may refer to the antenna as LTE. For details of which bands each antenna supports, please consult the detailed information for each antenna.

Pluggable Interface Modules

PIM	Module PID	Antenna Selection Single Port PID
LTE CAT4	P-LTE-GB P-LTE-NA P-LTE-VZ P-LTE-IN P-LTE-AU P-LTE-MNA	2 x LTE(4G) antennas LTE-ANTM2-SMA-D
LTE CAT6	P-LTEA-LA P-LTEA-EA	2 x LTE(4G) antennas LTE-ANTM2-SMA-D
LTE CAT18	P-LTEAP18-GL	4 x LTE(4G/5G) antennas LTE-ANTM2-SMA-D
4G LTE / 5G FR1	P-5GS6-GL	5G-ANTM-SMA-D

Wi Fi Modules

WIM	Module PID	Antenna Selection Single Port PID
Wi-Fi 6 (6th Gen/ .11ax)	WP-WIFI6-x	2x dual-band Wi-Fi (2.4/5 GHz) OR 4x single-band Wi-Fi (2x 2.4 GHz and 2x 5 GHz) W-ANTM2050D-RPSMA

Indoor Antennas

Antenna	PID	Antenna Specifications
Indoor LTE	LTE-ANTM2-SMA-D	Antenna Type: Dipole Frequency Band: 617-960 MHz 1400-1700 MHz 1710-2690 MHz 3400-3900 MHz 5150-6000 MHz Connector: SMA (m)

Antenna	PID	Antenna Specifications
Indoor 5G	5G-ANTM-SMA-D	Antenna Type: Dipole Frequency Band: 617-960 MHz 1400-1700 MHz 1710-2690 MHz 3400-3900 MHz 5150-6000 MHz Connector: SMA (m)
Indoor Wi-Fi	W-ANTM2050D-RPSMA	Antenna Type: Dipole Frequency Band: 2400-2500 MHz 5150-5850MHz Connector: RP SMA (m)

Outdoor Antennas

Antenna	PID	Antenna Specifications
Mast-Mounted Outdoor 4G, CBRS	ANT-4G-OMNI-OUT-N	Antenna Type: Dipole Frequency Band: 698-960 MHz 1695-2690 MHz 3400-3800 MHz Connector: N-type (f)
Mast-Mounted Outdoor 5G, FR1	ANT-5G-OMNI-OUT-N	Antenna Type: Dipole Frequency Band: 617-960 MHz 1448-1511 MHz 1695-2690 MHz 3300-4200 MHz 5150-7125 MHz Connector: N-type (f)

Outdoor and Transportation Antennas

Antenna	PID	Antenna Specifications	Notes
3-in-1 (LTE, GPS) Vehicle Mount/Fixed Infrastructure	4G-LTE-ANTM-O-3-B	Antenna Type: Multi-Element Connectors: 4G LTE (2x) TNC (m) GPS SMA (F)	Antennas will require proper TNC to SMA adapters. Location services supported only in areas with GPS coverage.
3-in-1 (LTE, GPS) Vehicle Mount/Fixed Infrastructure	ANT-3-4G2G1-O	Antenna Type: Multi-Element Connectors: 4G LTE (2x) TNC (m) GPS SMA (m)	Antennas will require proper TNC to SMA adapters. Location services supported only in areas with GPS coverage.
5-in-1 (LTE, Wi-Fi, and GPS) Vehicle Mount/Fixed Infrastructure	ANT-5-4G2WL2G1-O	Antenna Type: Multi-Element Connectors: Connectors: LTE (2x) TNC (m) GPS SMA (m) Wi-Fi (2x) RP-TNC (m)	Antennas will require proper TNC to SMA adapters. Location services supported only in areas with GPS coverage.
7-in-1 (LTE, Wi-Fi, and GPS) Low-Profile Transportation **Note** Antenna is GNSS capable.	ANT-7-5G4WL2G1-O	Antenna Type: Multi-Element Connectors: LTE (4x) SMA (m) GPS (1x) SMA (m) Wi-Fi (2x) RP-SMA (m)	—
9-in-1 (LTE, Wi-Fi, and GPS) Low-Profile Transportation	5G-ANTM-O-4-B	Antenna Type: Multi-Element Connectors: LTE (4x) SMA (m) GPS (1x) SMA (m) Wi-Fi (4x) RP-SMA (m)	Requires ground disk (5G-ANTM-GD) with nonmetallic surface deployment.

Supported Extension Bases and Cables

Antenna Type	Antenna PID	Cable PID	Extension Base
Indoor (cellular)	LTE-ANTM2-SMA-D	CAB-L240-10-SM-TM CAB-L240-15-SM-TM CAB-L240-20-SM-TM	LTE-AE-MAG-SMA
Indoor (Wi-Fi)	W-ANTM2050D-RPSMA=	—	—
Outdoor (cellular)	ANT-4G-OMNI-OUT-N ANT-5G-OMNI-OUT-N	CAB-L240-10-SM-NM	—