

Deployment Guide for Trilliant SecureReach® Access Point 10 (AP-R10)

Document Number: PL-0098A

Revision: 1.3

Date: January 29, 2025

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General Company and Solution Information: <https://trilliant.com/>

Trilliant Headquarters: Tel:+1 919.495.6111

Solution and Customer Support Portal: <https://trilliant.com/support/>

Note: Make all requests for Solution support or RMA processing through the web portal. If you do not have a Support Portal login and password, or you need your credentials reset, contact Trilliant Support using the email address below.

E-mail: support@trilliant.com

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Chapter 1: Safety and Compliance

This chapter provides safety and compliance information for installers. Before installing and operating a Trilliant SecureReach® Access Point 10 (AP-R10), read the instructions in this document.

The following logo displayed on the nameplate refers to this document.



Figure 1: Nameplate logo referring to this document

Safety information

The caution statements, warning conventions, and warning messages in this section apply to this product and manual.

Trilliant strongly urges that you always follow all locally approved safety procedures and safety instructions when working around high voltage lines and equipment.

The instructions in this manual are not intended as a substitute for proper training in or adequate experience with safely operating the equipment described. Only competent technicians who are familiar with this equipment should install or service it. A competent technician:

- is thoroughly familiar with these instructions.
- is trained in industry-accepted high- and low-voltage safe operating practices and procedures.
- is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.
- is trained in the care and use of protective equipment such as flash clothing, safety glasses, face shields, hardhats, rubber gloves, hot sticks, etc.

The following are important safety instructions. To safely install and operate this equipment, be sure to read, understand, and follow all caution and warning notices and instructions marked on the product or included in the documentation.



Warning: Hazardous voltage. Contact with hazardous voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high- and low-voltage lines and equipment.



Warning: The AP-R10 is designed to be operated in accordance with normal safe operating procedures. These instructions are not intended to supersede or replace existing safety and operating procedures. Read all instructions before installing or servicing the AP-R10.

Compliance notices

This device complies with requirements for the United States, Canada, and international requirements, as shown in Table 1.

Table 1: Compliance Requirements

Compliance Standard	Description
General	<ul style="list-style-type: none"> CE and UKCA Mark (pending)
EMC (Electromagnetic Compatibility)	<ul style="list-style-type: none"> FCC Part 15 Subpart B, Class B Industry Canada ICES-003 / NMB-003 Class B EN 301 489-1, EN 301 489-3 EN 55032, EN 55035
Radio Operation	<ul style="list-style-type: none"> FCC Part 15 Subpart C Industry Canada RSS-247 EN 300 440
FCC and Industry Canada Device IDs	<ul style="list-style-type: none"> FCC ID: TMB-APR10 IC: 6028A-APR10
Safety	<ul style="list-style-type: none"> UL 62368-1 CSA-C22.2 No. 62368-1 EN 62368-1
RF Safety	<ul style="list-style-type: none"> FCC Part 2.1091 Industry Canada RSS-102 EN 62311

Enclosure	<ul style="list-style-type: none"> • NEMA Type 4X / IP66
Environmental	<ul style="list-style-type: none"> • Thermal: IEC 60068-2-1 /-2 /-14 • Humidity: IEC 60068-2-30 • Salt spray IEC 60068-2-11

Modification statement

Trilliant has not approved any changes or modifications to this device by the user. Any changes or modifications not expressly approved by Trilliant could void the user's authority to operate the equipment.

Trilliant n'approuve aucune modification apportée à l'appareil par l'utilisateur, quelle qu'en soit la nature. Tous changements ou modifications qui ne sont pas approuvés par Trilliant peuvent annuler le droit d'utilisation de l'appareil par l'utilisateur.

Interference statement

This device complies with Part 15 of the FCC Rules and Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie 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, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

FCC Class B digital device notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Wireless notice

CAUTION: This device is intended for use in a controlled environment. Installation and operation of this transmitter must be performed in accordance with the provided instructions, and any antenna used with this transmitter must be installed to provide a separation distance of at least 20 cm (7.9 in) from all persons. End users must be provided with specific operating and installation instructions to satisfy RF exposure compliance requirements.

ATTENTION: Cet appareil est destiné à être utilisé dans des environnements contrôlés. L'installation de cet équipement et son fonctionnement doivent être conformes aux instructions fournies, et toute antenne utilisée avec cet émetteur doit maintenir une distance de séparation d'au moins 20 cm de toute personne pendant le fonctionnement. Les instructions d'installation fournies contiennent les informations requises pour satisfaire aux exigences de conformité en matière d'exposition aux RF.

Transmit antenna statement

This radio transmitter IC: 6028A-APR10 has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Le présent émetteur radio IC: 6028A-APR10 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.

Under Innovation, Science and Economic Development regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by ISED. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

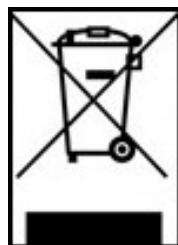
Conformément à la réglementation d'Innovation, Sciences et Développement économique Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Innovation, Sciences et Développement économique Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Table 2 Approved Antenna Types

Type	Gain	Impedance	Connector type	Radiation Pattern
Dipole	9 dBi	50 Ohms	N-type (F)	Omni-Directional

Waste Electrical and Electronic Equipment Directive (WEEE)

Collection and disposal of old equipment

*Figure 2: Symbol for used electrical and electronic products*

This symbol on the products, packaging, and/or accompanying documents means that used electrical and electronic products should not be mixed with general household waste.

For proper treatment, recovery, and recycling of old products, it is recommended to perform a factory reset before disposal, then take them to applicable collection points, in accordance with your national legislation and the Directives 2012/19/EU.

By disposing of these products correctly, you will help to save valuable resources and prevent any potential negative effects on human health and the environment which could otherwise arise from inappropriate waste handling.

For more information about collection and recycling of old products, please contact your local municipality, your waste disposal service, or the point of sale where you purchased the items.

Information on disposal in other countries outside the European Union

This symbol is only valid in the European Union. If you wish to discard these items, please contact your local authorities or dealer and ask for the correct method of disposal.

European Union and European Free Trade Association (EU & EFTA) compliance notices

This equipment may be operated in the countries that comprise the member countries of the European Union and the European Free Trade Association. These countries, listed in the following paragraph, are referred to as The European Community throughout this document:

AUSTRIA, BELGIUM, BULGARIA, CROATIA, REPUBLIC OF CYPRUS, CZECH REPUBLIC, DENMARK, ESTONIA, FINLAND, FRANCE, GERMANY, GREECE, HUNGARY, IRELAND, ITALY, LATVIA, LITHUANIA, LUXEMBOURG, MALTA, NETHERLANDS, POLAND, PORTUGAL, ROMANIA, SLOVAKIA, SLOVENIA, SPAIN, SWEDEN, ICELAND, LIECHENSTEIN, NORWAY, and SWITZERLAND.

Chapter 2: Overview

Description

The AP-R10 is a core component of the Trilliant SecureReach® network. It provides the functionality of an RF transceiver, a data processor, and a data router. The RF transceiver operates in the unlicensed 2.4 GHz ISM band on one of thirty-eight 1 MHz channels (and up to forty-one channels in some regulatory domains). The AP-R10 utilizes Time Division Duplexing and Direct Sequence Spread Spectrum with a proprietary Random Phase Multiple Access (RPMA) modulation technique.

The maximum transmit power of the AP-R10 transceiver (at the antenna connector) is 30 dBm (1 Watt). The maximum permissible transmit power is determined by the regulatory requirements of the country where the AP-R10 will be installed. GPS is used for timing and synchronization.

All endpoint devices designed with Trilliant SecureReach® technology communicate directly with the AP-R10 installed on existing communication towers, rooftops, streetlights, substations, and other elevated sites to collect data or control the endpoint devices.

AP-R10s are weatherproof with an IP66 rating and can be installed indoors or outdoors. This document focuses on the installation, configuration, and maintenance of the AP-R10. For hardware kits specific information, see the installation manuals for each of them.



Figure 3: Trilliant SecureReach® AP-R10

Included parts

Each AP-R10 comes with the following kit and parts:

Table 3: Included parts

Kit	Item	Qty
Mounting HW kit	• Screw, 5/16-18 x 3/4", Hex Cap, Flanged, 18-8 Stainless Steel	4
	• Mounting bracket for Access Point, Stainless Steel	2
RJ45 Backshell	• Backshell for RJ45 plug, Alu Bayonet, Plastic strain relief, IP68, for cable OD 6-13 mm	1

Hardware Kits and Accessories

The following kits and accessories can be ordered separately. See Appendix D for more details about the kits.

Table 4 Kits and Accessories

Part	Part Number	Description
PSU-R100, Power Service Unit	AL-0623A	PSU-R100, Power Supply Unit for AP-R10, 120/240 VAC, w/ GPS and WAN Antennas, battery
Pole Mount Kit	DK-0045A	Pole Mount Kit for Access Point, 12" Strut Channels, Bands 12" ID + HW, Stainless Steel
Rack Mount Kit, Indoor	DK-0046A	Rack Mount kit for AP-R10, Indoor, w/ Passive POE, GPS antenna, Mounting bracket
GPS Antenna	207-0009-00	ANTENNA, GPS, LIGHTNING PROTECTED, 40dB, 50 Ohms, 1575.42 +/-10 MHz, -40/+85C
2.4 GHz Antenna	207-0010-00	OMNI ANTENNA 2.4 GHZ, 9dBi, N-type female conn, w/ 2x U-Bolt mounting HW
Lightning Protector	EV-0057A	Lightning protector, Quarter Wave, N-Male to N-Female, 2.3-2.7 GHz 20kA

Referenced Documents

For additional information related to the Trilliant SecureReach® Access Point 10, see How to Contact Trilliant at the beginning of this document and refer to the following guides:

- **DS100028TN_Trilliant SecureReach® AP-R10 Datasheet_v1.0**
Detail about product specifications, characteristics, and requirements for the AP-R10.
- **EMS CCS v3.1 User Guide v3.1 (PU-0049A)**
Instruction on using the Element Management System (EMS) to manage and monitor the AP-R10. This document should be used for AP-R10 day-to-day operations and monitoring.

Chapter 3: Prepare for Installation

Additional Required Equipment

The installation requires the following additional parts and supplies.

- A 10/100 IP-over-Ethernet connection with 350 Kbps minimum throughput for backhaul to the Trilliant SecureReach® gateway.
- An active Power-over-Ethernet (PoE) injector that combines power and data over the same Ethernet cable.
- In the case of passive PoE only being available, a DC power source capable of supplying 48 VDC at a minimum of 25 Watts to the PoE injector. For extended PoE cables closer to 100 feet, a 56 VDC power supply is recommended.
- A 2.4 GHz Lightning Surge Protector.
- A GPS antenna and 50 ohms Low Loss coaxial cable.
- A 2.4 GHz antenna and 50 ohms Low Loss coaxial cable.
- Mastic Tape, conformable, suited for corrosion application, wide and low temperature stability: such as 3M 2229 or equivalent, 3.18 mm (1/8 in.) thick, 25 mm (1 in.) wide.
- Electric Tape, All-weather/UV resistant, wide and low temperature stability, such as 3M Scotch Super 33+, 3M Scotch Super 88 or equivalent.
- Site-specific mounting hardware

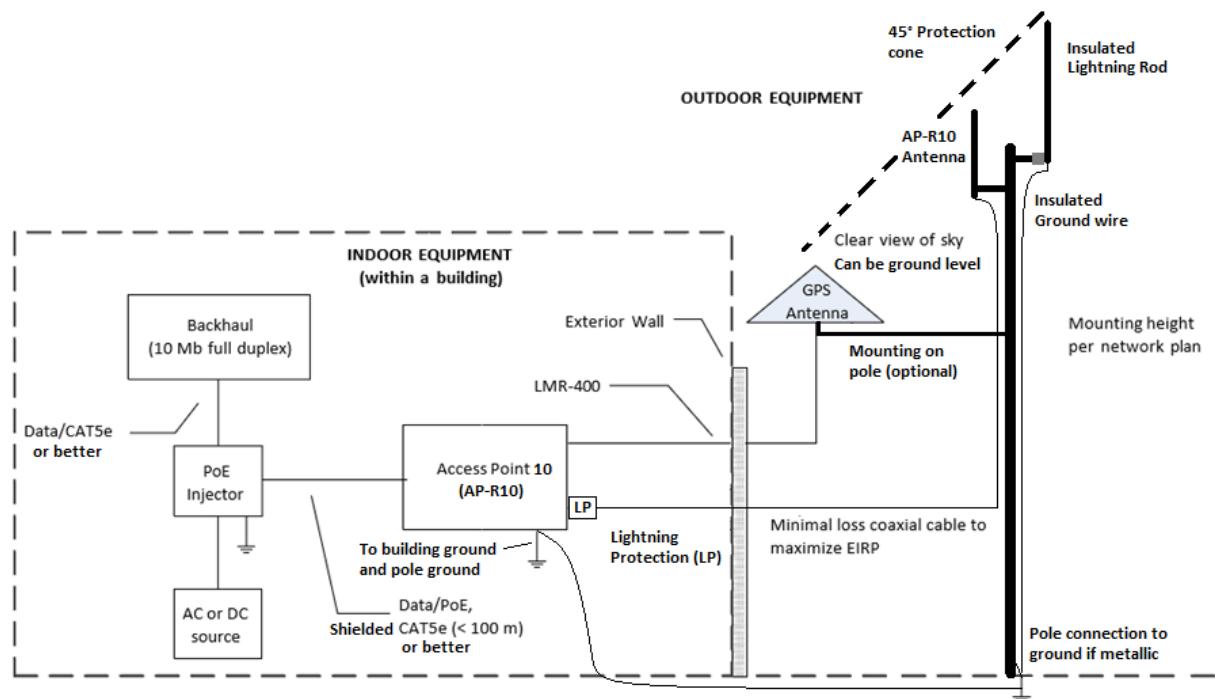


Figure 4: High Level Diagram for Indoor Site Installation of AP-R10 and Equipment

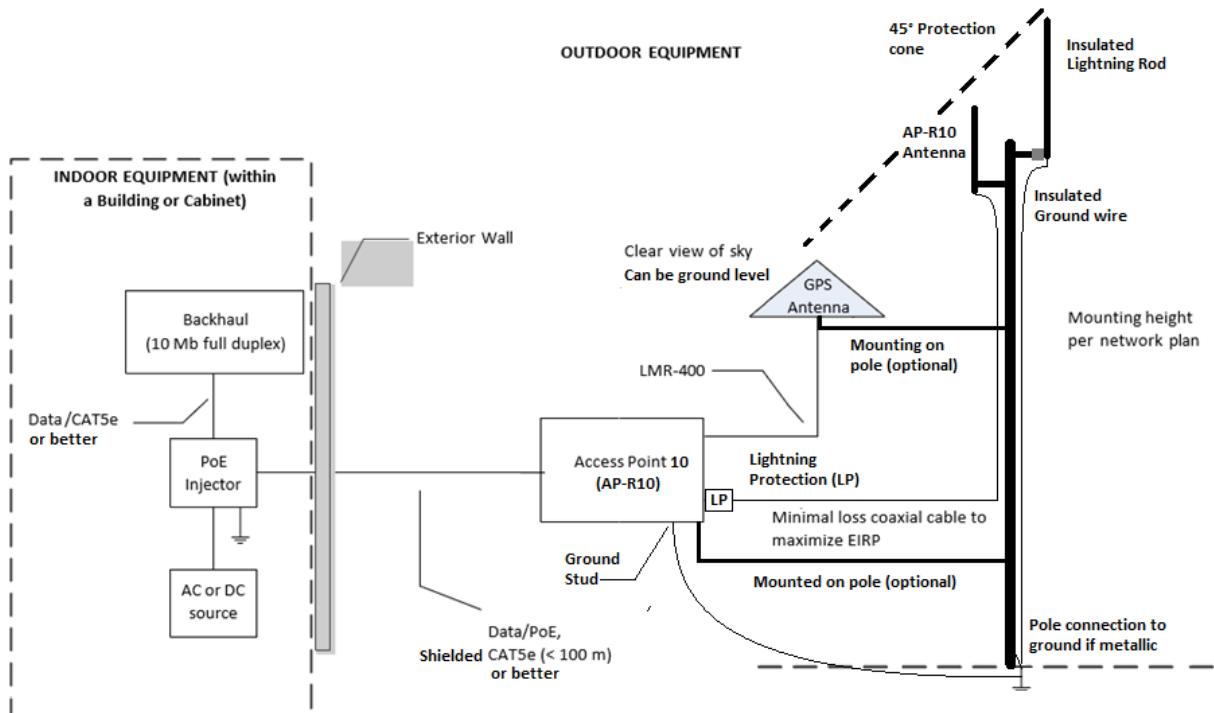


Figure 5: High Level Diagram for Outdoor Site Installation of AP-R10 and Equipment

Considerations

Before installing an AP-R10 at a new location, several network design and configuration decisions must be made. Please contact Trilliant to conduct a comprehensive design to determine the optimal AP-R10 locations. The following high-level considerations should be taken into account.

Network Planning

Network planning is critical to a successful AP-R10 installation and the reliable operation of the Trilliant SecureReach® network. The following issues must be addressed in the network planning and design process.

- Determine network coverage requirements.
- Establish network reliability requirements.
- Select and approve site and antenna locations.
- Select the appropriate AP-R10 antennas.
- Predict Trilliant SecureReach® network coverage with a propagation model.
- Select the AP-R10 antenna cable type, determined by cable length, to minimize loss.
- Assign AP-R10 channel (frequency) and reuse code.

Network Configuration

The following AP-R10 network configuration settings must be determined by your network planning and network operations teams and provided for AP-R10 configuration. These settings can be set via the AP-R10 web interface (shown in Chapter 7:) or in EMS (refer to the EMS CCS v3.1 User Guide v3.1 (PU-0049A)), except as noted below:

- Site Name



Note: The site name is for reference only and is not set in the AP-R10 or in EMS.

- AP-R10 ID.
- System ID.
- Client or Server mode operation.
- Static or DHCP IP address assignment.
- AP-R10 IP address, if static.

- Netmask setting.
- Default router.
- DNS servers.
- NTP servers.
- Server port number.
- IP Address.
- Gateway port number.
- Channel assignment.
- Reuse Code (Allows AP-R10 coexistence on the same channel).

Backhaul

Backhaul is the interconnection of the AP-R10s in a network to the back-office systems including the Trilliant SecureReach® gateway and the element management system. The backhaul method to be used must be determined for each AP-R10 prior to installation. Common backhaul methods include the following:

- Wireless IP service providers.
- Ethernet infrastructure.
- Fiber



Note: A 10/100 Mb IP over Ethernet connection with a minimum throughput of 350 Kbps is required. A throughput of 512 Kbps or higher is recommended.

Chapter 4: Installation Prerequisites and Considerations

Before starting the actual physical installation of an AP-R10, it is very important to complete the prerequisite tasks outlined in this chapter as well as take into account the installation considerations indicated.

Information gathering templates are provided in the appendices of this document.

Installation Prerequisites

Site Survey

A site survey should be conducted prior to installation for all AP-R10 sites. The site survey provides detailed, site- specific, information required to plan an AP-R10 installation and should be documented. See “Appendix A: Site Survey Worksheet” for a Site Survey Worksheet template. A copy of this completed worksheet should be provided to the Network Planning team and used to prepare the required site drawings and a Scope of Work document if required.

A site survey provides:

- Site name.
- AP-R10 ID.
- Site street address or other location.
- Site access information.
- Landlord contact information.
- Specific landlord requirements.
- Latitude.
- Longitude.
- Site type (building, tower, pole, or other).
- Height of existing structure.
- AP-R10 and equipment mounting locations.
- AP-R10 antenna mounting location and height.
- Antenna line length required.
- GPS antenna mounting location.
- GPS antenna cable length.

- AP-R10 power type, commercial power, 48 VDC, solar solution or other power.
- Distance to available power.
- Photos of site including antennal location, AP-R10 location, and the overall site.
- Other site-specific information.
- Available backhaul.

AP-R10 Configuration

The AP-R10 configuration should be documented and provided to the Network Operations Team prior to the start of the installation. See “Appendix B: AP-R10 Configuration Worksheet” for the AP-R10 Installation Configuration worksheet template. This worksheet provides the information required to configure the AP-R10 and includes the following information:

- Site name.
- AP-R10 ID.
- Deployment Region ID.
- Backhaul type.
- AP-R10 antenna gain
- AP-R10 antenna azimuth.
- AP-R10 antenna cable type
- AP-R10 antenna cable length
- AP-R10 antenna cable loss
- Channel assignment.
- Reuse code.
- Installation considerations.
- AP-R10-R10 IP Address type, Static or Dynamic.
- AP-R10 IP Address assignment, if static.
- Default router.
- Network mask.
- DNS servers.
- NTP servers.
- Client or server mode of operation.

- Gateway or IP address.
- Gateway port number.
- Server port.

Installation Considerations

When planning a new AP-R10 installation, the following items must be considered.

Grounding

AP-R10s have a grounding stud 1/4-20 UNC, designed for grounding the chassis. (See Figure 6: AP-R10 Grounding).

The lug to attach to the stud is a crimp-style connector, Burndy # YA6C (or equivalent). The crimp connector sizing would be selected based on ground wire gauge. Nominally, this is #6 stranded wire for establishing a solid earth ground to guard and protect against lightning.



Figure 6: AP-R10 Grounding Stud

AP-R10 Antenna

The AP-R10 antenna should be mounted at a location that minimizes physical obstructions between the antenna and the endpoints with which it will be communicating. Rooftop installations create the largest concern in this area. Antenna placement and height are very important to maximize network performance. The AP-R10 antenna should be securely mounted in a vertical position. Top mounting the antenna to a tower or mast is preferred. When the antenna is side mounted to a tower or

mast a 36" (1 m) or greater standoff bracket is required. The AP-R10 antenna cable is connected to a type-N female connector on the AP-R10.

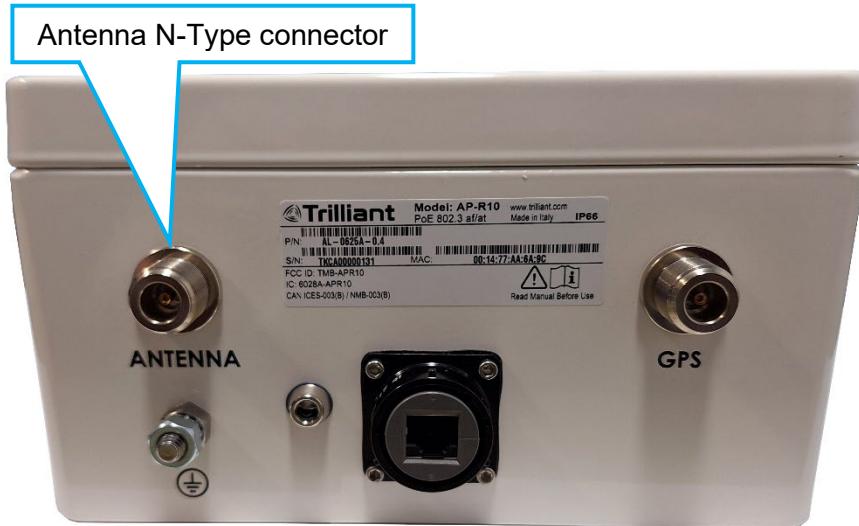


Figure 7: AP-R10 Antenna connector

AP-R10 Antenna Cable

A 50-ohm low loss coaxial cable is used to connect the antenna to the AP-R10. The type of cable is selected based on the length of the cable run and network design requirements, to reduce the attenuation.

The Antenna feeder cable should be of the highest quality possible and the total insertion loss including all reducers, filters, tails and connectors should not exceed 3dB

Table 5: Attenuation at 2.5 GHz for Common Types of Cables and application

Model Size	Nominal Size	dB/30 m (dB/100 ft)	dB/100 m (dB/328 ft)	Application based on the length
LMR-400	.40 inch	6.7	22	Up to 10 m (33 ft)
LDF4-50A	½ inch	3.7	12.1	10 m (33 ft) to 20 m (66 ft)
AVA5-50	⅜ inch	2.0	6.6	20 m (66 ft) to 30 m (98 ft) + Jumpers
AVA6-50	1¼ inches	1.5	4.8	Up to 30 m (98 ft) + Jumpers

The antenna cable should always be attached to the tower or other structure with clamps at the spacing recommended by the manufacturer. It is also very important to maintain the minimum bending radius recommended by the manufacturer to avoid kinking the cable during installation.

When using an antenna cable larger than 12,7 mm (½ in), jumpers with N-type male connectors and coax cable LMR-400 or LDF4-50A, typically 1 to 2 m (3 to 6 ft) long, should be installed between the antenna cable and both the antenna and the AP-R10 to minimize the chance of damage to their connectors.

The AP-R10 and the antennas both have N-Type female connectors.



Note: All outdoor antenna cable connections must be weather sealed in an appropriate manner.

GPS Antenna

The GPS antenna provides timing signals to the AP-R10. It should be mounted so that it has a clear view of the sky. A mounting location should be chosen that minimizes shadowing from trees or structures. The AP-R10 should normally see a minimum of four satellites as shown on the AP-R10's home web page.



Note: The GPS antenna should be mounted at least one meter, horizontally, away from the AP-R10 antenna or other transmitting antennas to minimize the chance of interference.

In normal operation, the AP-R10 requires GPS synchronization for precision timing of all nodes on the network.

To provide a reliable GPS signal, the AP-R10 has a built-in GPS receiver which requires an externally connected GPS antenna. The GPS antenna connects to the AP-R10 using a N-Type male connector.

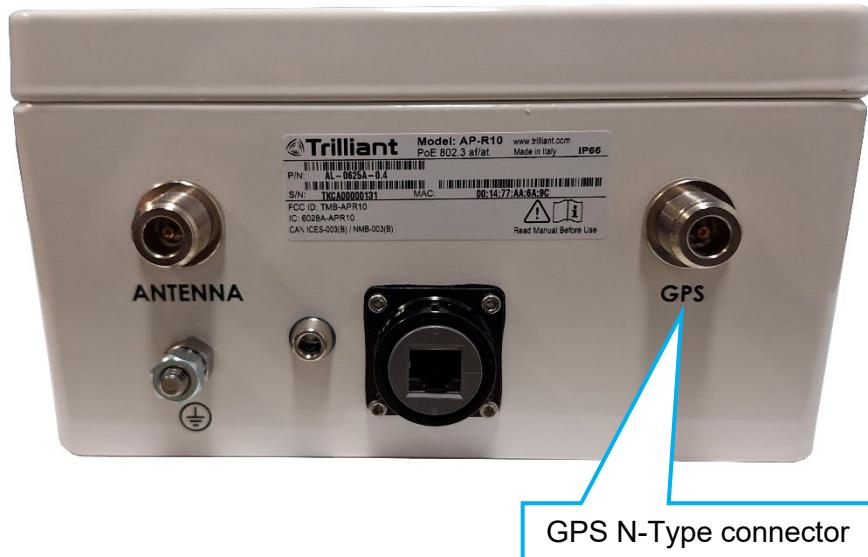


Figure 8: AP-R10 GPS connector

Trilliant recommends using the Trilliant # 207-0009-00 for the following reasons:

1. This GPS antenna has a low noise, high gain amplifier which is well-suited to address cable attenuation when the GPS antenna mounting location requires a long length of cable. Up to a 20 dB cable loss is acceptable when using this high gain antenna.
2. This GPS antenna provides integrated, onboard, lightning protection that minimizes the need for a downstream, inline surge suppressor. If using an external surge suppressor, it must be a “DC pass-through” type.
3. This GPS antenna comes with a ground connector connected to the shield of the coaxial cable. Therefore grounding can be done through the shield then the AP-R10 grounding as shown in General Grounding Guidelines section.



Figure 9: GPS antenna Trilliant # 207-0009-00



Note: Most GPS antennas have a Low Noise Amplifier (LNA) that requires power from the AP-R10. The AP-R10 supplies 5 V at up to 75 mA. If this current is exceeded, the AP-R10 detects the excess current and shuts down its GPS power supply. When this occurs, the AP-R10 sends a GPS antenna fault message back to the EMS. The AP-R10 must be power cycled to restore power to the GPS antenna.

Antenna Cable Lightning Protector and Grounding

A Lightning Protector must be installed at the location shown in the table below, and must be connected with a 13.3 mm² (6 AWG) or larger stranded wire to an appropriate ground for lightning protection when connected at the entrance of an enclosure. No ground wire is required when connected to the Access Point 10. Trilliant recommends the Lightning Protector Trilliant # EV-0057A.

In most tower installations the outer shield of the AP-R10 antenna cable is grounded through the mounting pipe and the coaxial cable shield. The mounting pipe for the antenna should be grounded using a 33.2 mm² (#2 AWG) if it is not attached to a grounded structure.

Table 6: RF Surge Protector Installation Locations

AP-R10 Location	Surge Protector Location
Indoor and Outdoor	Antenna connector of the Access Point 10
Outdoor Inside Enclosure	Entrance to the enclosure

AP-R10 Power Requirement

The AP-R10 should be powered over the Ethernet port using an active 802.3at Power Sourcing Equipment (PSE). When the PoE is at a distance from the AP-R10, it may be required to use additional lightning protection for the PoE, consult PoE specifications and requirements. The AP-R10 has internal protection therefore does not require additional protection.

Ethernet Cable

The Ethernet cable connection to the AP-R10 provides both data and DC power. The maximum Ethernet cable length is 100 meters (328 feet). A high-quality Cat5e or Cat6 cable with Shielded Twisted Pair (STP) connected at both ends and solid conductors is

essential. For outdoor installations, use UV and weather-resistant cables, or run the cable inside a plastic conduit to protect it from the elements.

It is very important that connectors be shielded and specified for the cable being used. As an example, if using shielded Cat5e solid conductor cable, the connectors should be specified for shielded Cat5e solid conductor cable. Some connectors are specified for both solid and stranded conductors. Always use an RJ45 crimping tool that is specified for use with the connectors being used.

During the installation of the Ethernet cable, the bending radius of the cable should never be less than four times its diameter. The Ethernet cable should not be deformed by tightly cinched cable ties.

After the Ethernet cable has been installed and the RJ45 connectors attached the cable must be tested and proper operation verified, with a two pieces Ethernet test device, prior to connecting the AP-R10 or PoE injector.

Weather Sealing the AP-R10 PoE Connector

The Amphenol RJF21B female RJ-45 receptacle on the AP-R10 is IP66 rated. To ensure a complete fluid and dust free connection, please use the corresponding Amphenol backshell (Trilliant P/N HJ-0156A) that comes with the AP-R10.



Figure 10: RJ45 Backshell

To install the backshell:

- If they are not yet assembled together, firmly screw the plastic strain relief cable gland on the metal shell.



Figure 11: Metal coupling shell with strain relief cable gland

- Run the coax cable through the gland, followed by the backshell, and connect the coax cable to the AP-R10.



Figure 12: Coax cable through backshell items

- Secure the bayonet style backshell to the AP-R10.



Figure 13: Bayonet Backshell installed

- Screw in the gland on the backshell until the gasket is fully compressed on the cable.



Figure 14: Gland installed and gasket compressed

Outdoor Installation Hardware

All outdoor installation hardware such as mounting brackets, pipe clamps, u-bolts, bolts, nuts and washers should either be galvanized or stainless steel. This reduces deterioration due to corrosion, oxidation, and rust.

Weather Sealing Antenna System Connections

All exposed antenna system connectors must be sealed against moisture using industry standard techniques.

The RF N-Type connectors used in this product are weather- resistant.

However, sealing the connection will prevent water from entering the connector, and will also prevent UV radiation from degrading the connectors over time.

Weatherproof the RF connector joint by using a conformable and durable mastic tape. Add electrical tape over it to protect the mastic tape from UV radiation.

- Recommended tapes:
 - Mastic tape: Moisture and environmental seal tapes such as 3M 2229
 - Electrical tape: All weather/UV resistant vinyl tapes such as 3M Scotch Super 33+ or 3M Scotch Super 88.



Note: Always apply tape at temperatures above 32 °F / 0 °C so that the tape can stretch elastically and will seal properly. Do not stretch the tape to the point where it distorts. Only apply enough pressure to smoothly wrap the tape over the connector, using your hands to smooth each wrap of tape to ensure proper adhesion. Always cut the tape with a sharp knife, and never break off segments by stretching it.

- Tips for correctly wrapping the tape:
 - When wrapping tape over a connector, make sure to wrap it in the same direction as when tightening the connector.
 - For vertical runs, always wrap the final wrap from the bottom to the top, overlapping ~50% of the width of the tape.
 - When wrapped in this way, water will run down across the edges of the tape without entering under the wrapped tape.
- See the example figure below:



Figure 15: Weather sealing antenna example

Chapter 5: AP-R10 Installation

AP-R10 and Ancillary Equipment

The AP-R10 installation includes installing the AP-R10 itself and the ancillary equipment listed below:

- AP-R10.
- AP-R10 mounting bracket.
- AP-R10 antenna.
- AP-R10 antenna cable (50 ohm coaxial cable).
- AP-R10 antenna cable RF lightning protector.
- GPS antenna.
- GPS antenna cable (50 ohm coaxial cable).
- Compatible 802.3at PoE injector or hardware kit.
- Site-specific power solution providing 802.3at PoE, if not using the one of the hardware kit.
- Backhaul equipment.
- Site-specific mounting hardware.



Note: Trilliant recommends that a backup power solution be utilized to power the AP-R10 in the event of a power failure. The backup power solution should be designed to meet customer requirements for the number of hours of backup power.

AP-R10 Installation Configurations

The small size of the AP-R10 (9.1"(231 mm) H x 8.1" (206 mm) W x 4.5"D (114 mm)) and light weight allows for many installation configurations. For basic AP-R10 specifications, refer to "Appendix C: Basic AP-R10 Specifications". The AP-R10 is designed to be installed indoors or outdoors. It may be mounted in any position indoors but should be mounted with its connectors facing down when installed outdoors. The AP-R10 may be installed in an equipment cabinet with its ancillary equipment if desired.

Types of installation configurations include:

- Outdoor non-penetrating roof mounts on building.

- Indoor or outdoor wall attachment.
- Pipe mounting.
- Tower mounting.
- Utility pole mounting.

Hardware Kits Configurations

Trilliant offers pre-configured hardware kits. For details, refer to Appendix D: Description of optional hardware kits.

General Grounding Guidelines

The following grounding information is provided as a guideline when installing the AP-R10 in any configuration. Where grounding wires are used, use 13.3 mm² (6 AWG) stranded wire for establishing a solid earth ground.

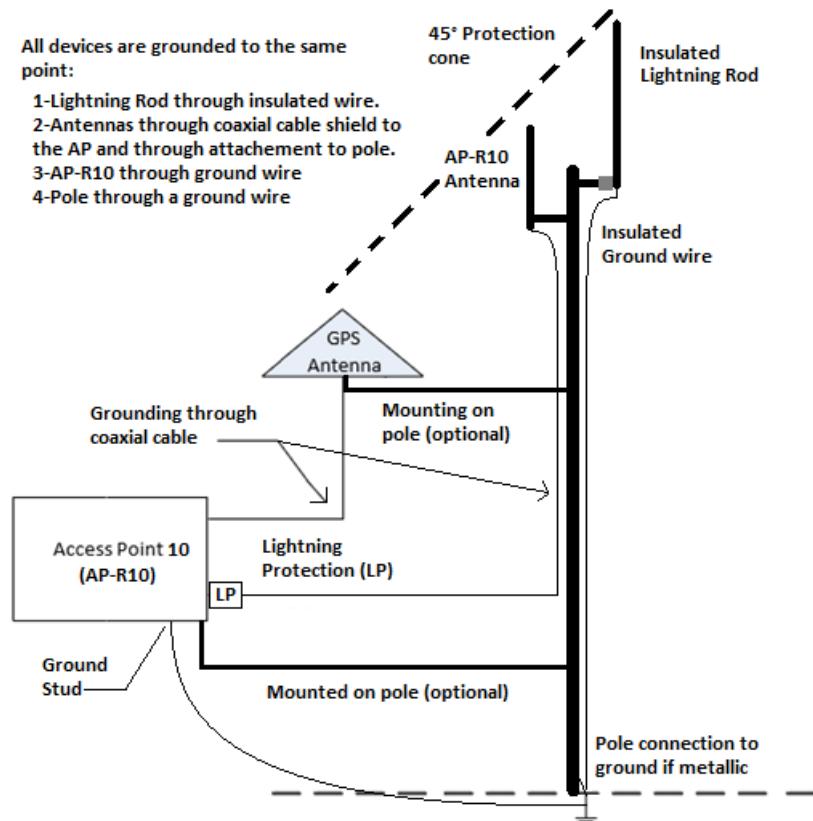


Figure 16: High Level Grounding Diagram

AP-R10 Mounting Details

AP-R10s are typically mounted using one of the following methods described below:

AP-R10 Mounting Tabs

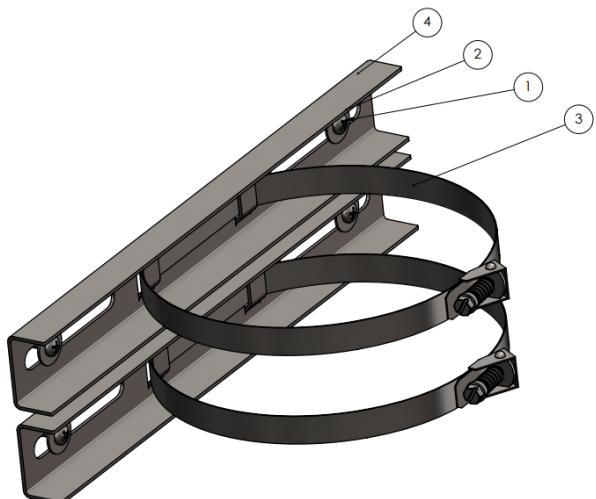
The AP-R10 is supplied with four mounting tabs that facilitate attaching the AP-R10 to a wall, in a cabinet, or to a strut channel, if required. The mounting tabs are attached to the AP-R10 by the installer using four provided 13 mm (1/2 inch) hex head bolts.



Figure 17: AP-R10 with Mounting Tabs Installed

AP-R10 Pipe or pole Mount Option

Trilliant offers an optional pipe/pole mount DK-0045A kit for the AP-R10.



1. Screw 5/16-18 x 3/4 in, 13 mm (1/2 in) Hex Cap, S.S., Qty=4
2. Flat washer # 5-16 in, S.S., Qty=4
3. Conduit clamps 5 to 30 cm (2 to 12 in) ID, S.S., Qty=2
4. Strut channel 30 cm (12 in) long, S.S., Qty=2

Figure 18: Pole Mount kit DK-0045A

To install the kit:

- Secure the 2 strut channels at the back of the AP-R10 using the 4 screws and washers supplied with the kit.
Note: the 4 mounting tabs supplied with the AP-R10 are not used in this case.
- The unit can now be installed on a pole or pipe using the 2 conduit clamps also supplied with the kit. They are good for 5 to 30 cm pole diameter. Longer straps could be used for larger poles.

Outdoor AP-R10 Installations

The AP-R10's enclosure is IP66 rated and may be installed outdoors in a secure location. When installing the AP-R10 outdoors the flowing requirements must be observed:

- The AP-R10 must be mounted with the connectors facing down toward the ground.
- The Trilliant approved backshell (see *Figure 9 to Figure 13*) must be used to weather seal the AP-R10's PoE connector. The installation Weather Sealing the AP-R10 PoE Connector must be followed.
- The RF surge protector and the AP-R10 enclosure must be grounded using 13.3 mm² (6 AWG) or larger, stranded, insulated conductors connected to a nearby grounding point. A ground wire with a 6,35 mm (1/4") ring terminal may be placed on the grounding stud.
- The RF and GPS antenna connections to the AP-R10 and the RF surge protector must be completely weather sealed with wireless industry approved methods. See the section "Weather Sealing the AP-R10 PoE Connector" in Chapter 4::

Chapter 6: Hardware Installation Verification

Power Verification

Monitor the LED and refer to **Table 7: LED Behavior**.

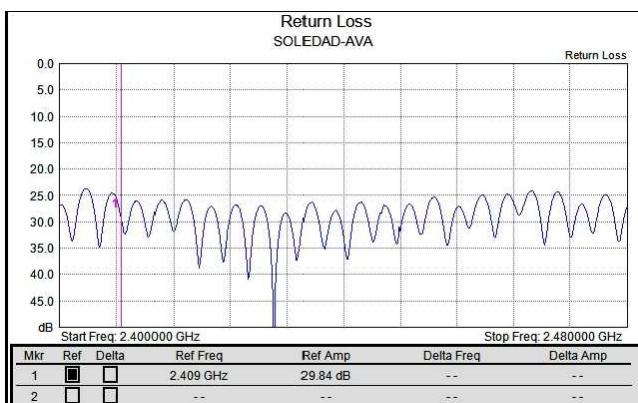
AP-R10 Antenna and GPS Cable Test

Prior to connecting the cable to the AP-R10 antenna and GPS antenna connectors, verify continuity between center pins and verify that neither cable is shorted. Verify that cable connections are free of moisture, dirt or deformation.

Antenna System Sweep Testing

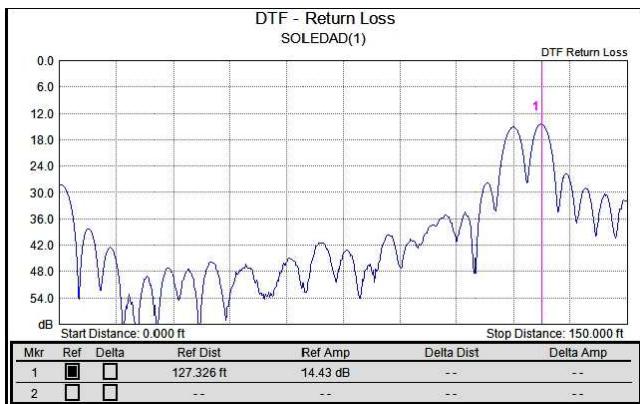
The combined antenna system (including the antenna, cables, and lightning protector) should be “sweep tested” for Return Loss and Attenuation using an antenna analyzer such as an Anritsu Site Master™. The antenna system should be swept across the frequencies of interest, 2.400 GHz – 2.500 GHz. The Return Loss should be greater than 17 dB across the frequency range and the total attenuation should be as low as possible, generally less than 3 dB.

If the Return Loss is not acceptable, the antenna should be disconnected and the antenna line should be terminated with a 50 ohm load. The Return Loss test should be repeated. If the antenna line Return Loss is now greater than 20 dB and is flat across the frequency range, the antenna should be replaced. If the Return Loss is not acceptable, the antenna cable system should be tested using the Distance to Fault (DTF) capability in the antenna analyzer to locate the problem.



- Measurement is required to be > 20 dB for coaxial cable and connectors.
- Overall return loss with antenna should be > 17 dB.

Figure 19: Return Loss



- Measurements should be taken with the antenna as well as with a 50Ω terminating load.
- Type and length of coaxial cable should be recorded for each run.

Figure 20: Distance to Fault

Grounding

Verify that the mounting hardware, AP-R10, antenna cable, and lightning protector are properly grounded.

Connector Weather Sealing

Verify that all outdoor connectors are properly weather sealed.

Mounting Hardware

Verify that all mounting hardware is tight and secure.

LED Behavior

The AP-R10 has one bicolor LED: green and red.



Figure 21: Bottom side with LED

Table 7: LED Behavior

Status	Description
Red solid	During all the power up sequence (around 30 sec)
Green flashing	After power up and Ethernet has connected, the LED will be green, flashing 3-second on 3-second off for 45 seconds.
Green blinking	After the initial sequence the LED will blink on to indicate traffic on the backhaul.

Chapter 7: AP-R10 Software Configuration via Web Interface

The AP-R10 web interface can be accessed with a web browser connected locally at the data port of the PoE injector or remotely through the backhaul network. Trilliant recommends that you use one of the following internet browsers when using the AP-R10 web interface:

- Microsoft Edge.
- Mozilla Firefox® any version.
- Google Chrome™ any version.

Initial AP-R10 Network Configuration Prior to Installation

The AP-R10 is shipped with the following factory default IP Network Settings:

- IP Address: 192.168.1.1
- Netmask: 255.255.255.0
- Default Router: 192.168.1.254

This section covers the minimum IP network configuration required to establish remote connectivity with the AP-R10. This configuration must be performed prior to AP-R10 installation or on-site immediately following the physical AP-R10 installation. In most cases, it is strongly recommended that the initial configuration be performed prior to installation.

See below 3G/4G Wireless Backhaul Modem or Customer Backhaul Modem. Initial AP-R10 Network Configuration for 3G/4G Wireless Backhaul Modem

When activating the 3/4G wireless modem, a static IP address is required from the wireless carrier. The LAN side of the 3G modem can be configured to support the default IP network settings of the AP-R10. This avoids the need to change these default settings in the AP-R10. After the AP-R10 is installed, a connection to the AP-R10 can be established using the IP address of the 3/4G modem and the AP-R10 can be configured remotely.

Initial AP Network Configuration for Customer Backhaul Modem

The default IP network settings for the AP-R10 must be changed to allow connection to the AP-R10 over the customer's IP network. To make these changes, perform the following steps:

1. Log into the AP-R10 as described below.
2. After successfully logging into the AP-R10, select "Admin" in the upper right corner of the screen.
3. From the Admin menu, select the Network submenu.
4. Make changes to the IP address, Netmask, and Default Router, see Network Configuration Submenu section.
5. When you have completed the changes, be sure to click on the Save button and then click on the Reboot Access Point button.
6. After these changes are made and the customer's firewall and routers have been properly configured, the AP-R10 can be remotely configured.

Login

The AP-R10 has a factory default IP Address of 192.168.1.1 which allows connection to the AP-R10 configuration page using https protocol on port 443.

To access the AP-R10 configuration page, ensure the following:

- You are on the same subnet with the AP-R10 or your router can route to the AP-R10 IP address. The AP-R10's default router setting is 192.168.1.254.
- You have access to port 443 on the firewall.

1. Open the web browser.
2. In the address bar of the browser, type <https://192.168.1.1>. A dialog box opens that looks similar to the following:

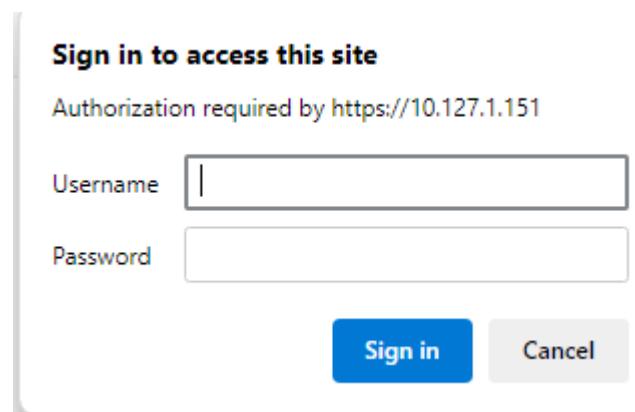


Figure 22: Username and Password Prompt

3. Enter the default User Name and Password.
 - a. User Name: admin
 - b. Password: onramp
4. Click the Log In button. After the log in, Trilliant recommends changing from the default password to a personalized password.

AP-R10 Web Pages

After logging in you will see the AP-R10's home page.

GPS Signal Information

GPS Location (Latitude, Longitude) (35.830894,-78.766945)			
Sat ID	Azimuth	Elevation	C/N ₀
3	250	37	36
4	60	44	37
8	187	1	0
9	60	15	23
16	210	77	32
26	44	65	38
27	163	21	0
28	77	26	32
29	40	9	17
31	54	52	37
32	137	6	27
44	233	32	32

Figure 23: AR-R10 Home page

The following information is displayed on the top of the Home Page and all other web pages. Access Point ID, current date, software and firmware versions and site name.

Additionally, there is a “status box” that provides AP-R10 status, network status, Gateway ID, backhaul state and mode, RF and GPS state.

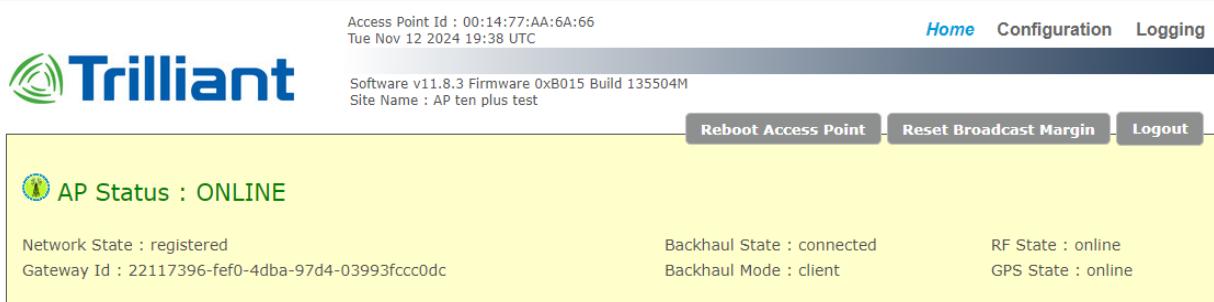


Figure 24: AP-R10 status box

Home Page GPS

The Home Page also displays GPS signal information and is the initial submenu displayed after logging in (shown below).

GPS Signal Information

GPS Location (Latitude, Longitude) (33.014244,-117.094604)			
Sat ID	Azimuth	Elevation	C/N ₀
7	313	53	36
6	61	23	33
20	177	9	31
19	109	27	38
3	81	34	35
13	69	76	41
28	216	15	33
23	120	55	38
16	40	19	34
8	282	31	35
10	282	36	40
5	324	2	19

Figure 25: GPS Signal Information

If the GPS antenna is connected to the AP-R10, then GPS information is shown.



Note: GPS status verification MUST occur after completion of physical AP-R10 installation.

The columns on this screen are defined in the following table. The rows show the number of GPS satellites to which the AP-R10 receiver is currently locked. Five satellites

are required for GPS synchronization but a minimum of nine satellites are required for reliable operation.

Table 8: Fields on the AP-R10 Screen

Column Heading	Description
Sat ID	The Sat ID column provides the name of the GPS satellite to which the AP-R10 is locked or is tracking.
Azimuth	The Azimuth is the direction of a GPS satellite, measured clockwise around the observer's horizon from north. Azimuth and altitude or elevation are usually used together to give the direction of an object in the topocentric coordinate system.
Elevation	The elevation (sometimes called altitude) is the angle at which we see the satellite when we look up into the sky.
C/N₀	Carrier to Noise (C/N ₀) density ratio is the ratio of the carrier or signal power to the white-noise spectral density. For the AP-R10 GPS receiver to lock to the GPS satellite, the C/N ₀ should be greater than 20 dB-Hz.

AP-R10 Network Configuration

To configure AP-R10 network information, select *Configuration* on the Home Page upper right.

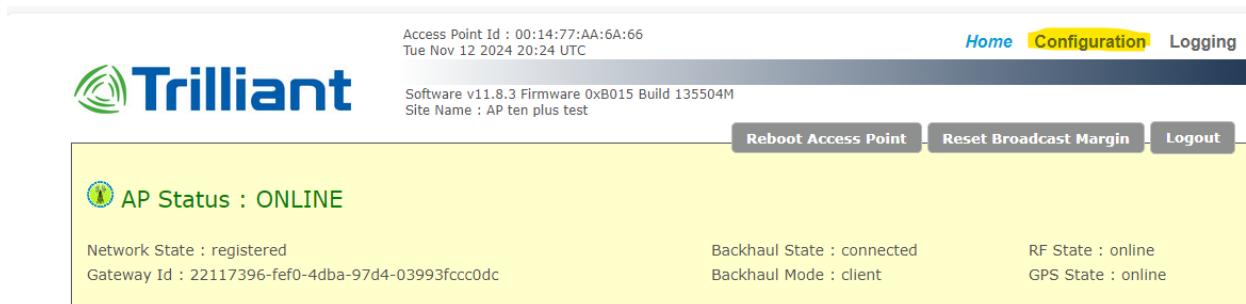


Figure 26: Configuration selection

The AP-R10 will display the Configuration page. Network configuration is done from this page.

Network Configuration Submenu

The Network Configuration screen (shown below) allows you to change the AP-R10 IP address, netmask, and default router as well as other network configuration parameters such as Ethernet speed and MTU, duplex mode, and DNS and NTP servers.

Network Configuration

IPv4 Settings

Automatic (DHCP) Manual (Static IP)

IP Address: 10.127.1.151

Netmask: 255.255.240.0

Default Router: 10.127.0.1

Ethernet Speed: Auto

Duplex Mode: Auto

Ethernet MTU: 1340

DNS Servers: 10.125.4.1, 10.125.4.2

NTP Servers: 0.pool.ntp.org, 1.pool.ntp.org

Save

Figure 27: Network configuration screen

The following table defines the fields on this screen.

Table 9: Fields on the Network Configuration Screen

Field	Description
IPv4 Settings	Currently the AP-R10 only supports two IP settings for TCP/IP Versions: <ul style="list-style-type: none"> Automatic (DHCP): This setting is used to request a dynamic IP address from a local DHCP server. Manual (Static IP): This setting is used for configuring a fixed IP address.
IP Address	IP address of the AP-R10 (e.g., default is 192.168.1.1)
Netmask	The default is 255.255.255.0.
Default Router	The default is 192.168.1.254.

Field	Description
Ethernet Speed	The speed at which data travels over the Ethernet connection. Setting options are: Auto, 10 Mbit, and 100 Mbit. The default setting is “Auto” which monitors the connection and displays the current speed.
Duplex Mode	Setting options are: Auto, Half-Duplex, and Full-Duplex. The default setting is “Auto” which displays the current duplex mode.
Ethernet MTU	The largest frame size that can be transmitted over the network. The default setting is 1500 bytes. Messages longer than the Ethernet MTU indicated in this field must be divided into smaller frames.
DNS Servers	<p>The IP address of the DNS server can be set in this text field. Multiple DNS servers can be configured for an AP-R10 by separating the IP addresses of each DNS server with a comma when entering them into the text field.</p> <p>The following DNS server addresses are the defaults:</p> <ul style="list-style-type: none"> ○ 208.67.222.222 ○ 208.67.220.220 ○ 8.8.8.8 ○ 8.8.4.4
NTP Servers	<p>The AP-R10 should be configured with valid NTP servers for correct time synchronization. If the AP-R10 is not configured, it may have problems connecting to the Gateway using SSL. The following NTP server addresses are the defaults:</p> <ul style="list-style-type: none"> ○ nist1-nj.ustiming.org ○ nist1-atl.ustiming.org ○ nist1-la.ustiming.org ○ nist1-sj.ustiming.org ○ nist1-lv.ustiming.org ○ time.nist.gov <p>As with DNS server configuration, multiple NTP server IP addresses can be entered into this text field separated with commas.</p>

Backhaul Config Submenu

The Backhaul Configuration screen (shown below) displays configuration parameters that need to be set at the time the AP-R10 is deployed.

Backhaul Configuration

Control Socket Mode	<input checked="" type="radio"/> Server <input type="radio"/> Client
Control Server Port Number	2021
Gateway IP Address	10.127.1.236
Gateway Port Number	5051
Keep-Alive Interval (in seconds)	5

Save

Figure 28: Backhaul configuration screen

The following table defines the fields on this screen. After you make any changes, click on the **Save** button.



Note: If you disable the RF, the AP-R10 is still connected to the Gateway.

Table 10: Fields on the Backhaul Configuration Screen

Field	Unit	Description
Control Socket Mode	N/A	<p>Options for this field are as follows:</p> <p>Server: When the AP-R10 is set to work in Server mode, it listens for a TCP connection with the Gateway on port number 2021. See descriptions below for setting the following fields.</p> <p>Client: When the AP-R10 is set to work in Client mode, the AP-R10 requests service from the Gateway. See the field descriptions below for setting the following fields.</p>
Control Server Port Number	N/A	<p>The port number when the AP-R10 is set to Server mode. When the AP-R10 is in Server mode, this field should be set to 2021. The AP-R10 listens on port 2021 for a TCP connection with the Gateway. Ensure that port 2021 is allowed on the firewall in your network.</p>
Gateway Hostname/IP Address	N/A	<p>For Server mode, this field is grayed out and not accessible. For Client mode, the Gateway IP Address should be entered here.</p>

Field	Unit	Description
Gateway Port Number	N/A	For Server mode, this field is grayed out and not accessible. For Client mode, this field should be set to 5051. Ensure that port number 5051 is allowed on the network firewall.
Keep-Alive Interval	Seconds	The number of seconds allowed for the interval where the AP-R10 checks the link to the network to determine whether the link is still “alive” or broken.

This is the extent of AP0+ configuration that can be done at the AP-R10 web interface. Further configuration must be accomplished via the EMS Gateway.

EMS configuration of AP-R10

Once the AP-R10’s network and backhaul configuration is completed reboot the AP-R10 and it will attempt to connect to the EMS Gateway.

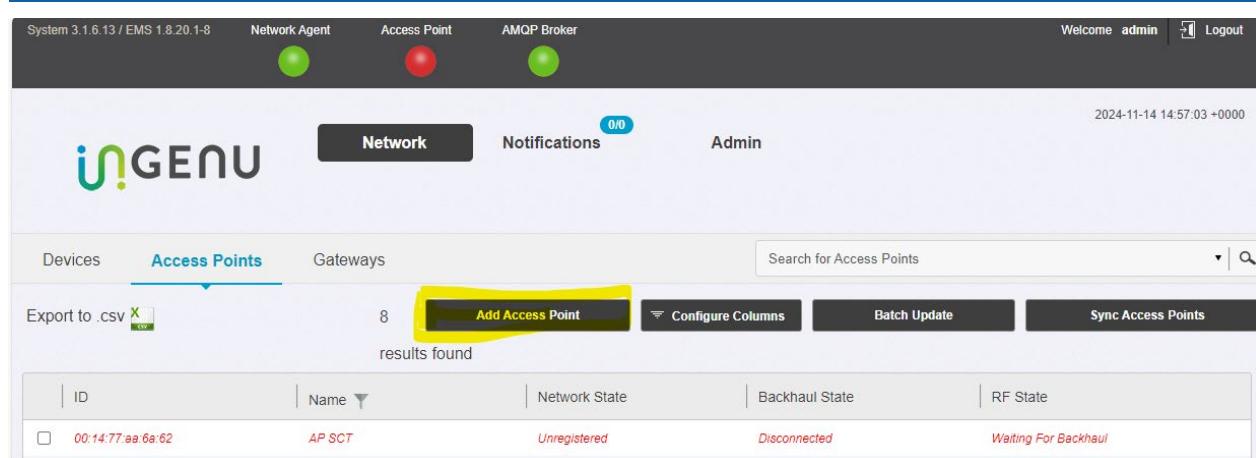
Log onto the EMS Gateway to complete the AP-R10 configuration. Once logged on select *Access Point*.

The screenshot shows the Unigeno EMS configuration interface. At the top, there are status indicators for Network Agent (green), Access Point (red), and AMQP Broker (green). The top right shows the user is logged in as 'admin'. The main navigation bar includes 'Network', 'Notifications (0/0)', and 'Admin'. Below the navigation, there are tabs for 'Devices', 'Access Points' (which is selected and highlighted in yellow), and 'Gateways'. A search bar is present. The main content area shows a table with 24 results. The columns are: Node ID, Name, Configured Device Type, Operating Device Type, Network State, and Last Join AP. A 'Configure Columns' and 'Edit node properties' button are located at the top of the table. A 'Add 1.x Devices' button is also visible on the page.

Figure 29: EMS configuration page

From this page select the *Add Access Point* button:

Deployment Guide for Trilliant SecureReach® Access Point 10



System 3.1.6.13 / EMS 1.8.20.1-8 Network Agent Access Point AMQP Broker Welcome admin Logout 2024-11-14 14:57:03 +0000

INGENU

Network Notifications 0/0 Admin

Devices Access Points Gateways Search for Access Points

Export to .csv X 8 Add Access Point Configure Columns Batch Update Sync Access Points

results found

ID	Name	Network State	Backhaul State	RF State
00:14:77:00:68:62	AP SCT	Unregistered	Disconnected	Waiting For Backhaul

Figure 30: EMS configuration for Access Point 10

This will bring up a new page that will allow you to add the AP-R10 to the system:

Figure 31: Adding AP-R10 to system

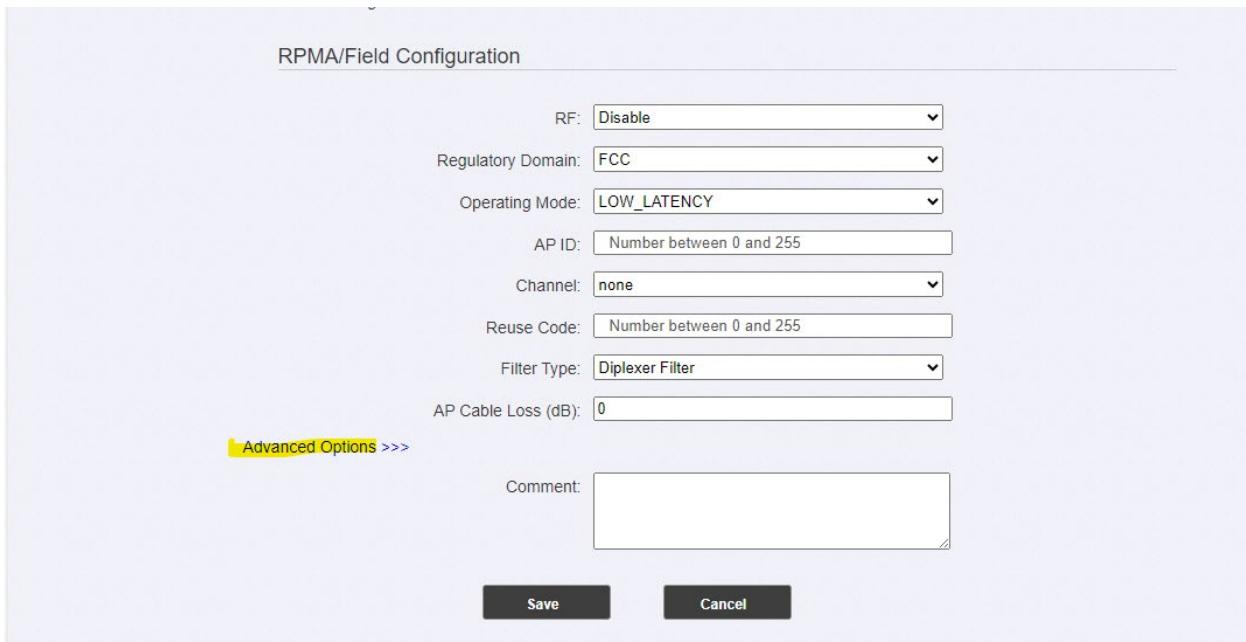
The following table defines the fields on this screen.

Table 11: Fields on the Configuration Screen

Field	Unit	Description
MAC Address	Decimal	AP-R10 MAC address.
Name	string	AP-R10 name, max number of characters is 254.
Description	string	Max characters 254.

Field	Unit	Description
AP-R10 Web page URL	string	AP-R10 web page URL, example https://AP_IP_address .
Broadcast Service Domain	N/A	Select AP-R10 service domain from configured list.
RF	N/A	Enable/Disable.
Regulatory Domain	N/A	The regulatory domain where the AP-R10 is deployed. The regulatory domain limits the maximum transmit power for the AP-R10.
Operating Mode	N/A	Select between High Coverage or Low Latency.
AP-R10 ID	decimal	ID for this AP-R10, number between 0 and 255.
Channel	Decimal	The channel on which the AP-R10 communicates. Range is 1 – 41.
Reuse Code	Decimal	Different Reuse Codes allow two AP-R10s to operate on the same Channel and System ID without interference. Range is 0 – 255.
Filter Type	N/A	There is no cavity filter in the AP-R10

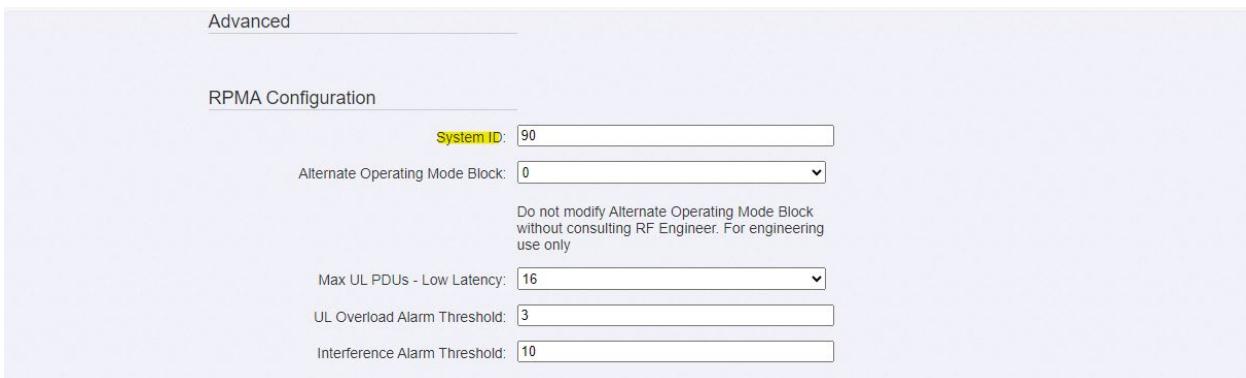
Once the selections for these fields have been made, select *Advanced Options*.



The screenshot shows the 'RPMA/Field Configuration' screen. It includes fields for RF (set to 'Disable'), Regulatory Domain (FCC), Operating Mode (LOW_LATENCY), AP ID (Number between 0 and 255), Channel (none), Reuse Code (Number between 0 and 255), Filter Type (Diplexer Filter), and AP Cable Loss (dB) (0). Below these is a link to 'Advanced Options >>>'. A 'Comment' text area and 'Save' and 'Cancel' buttons are also present.

Figure 32: Advanced Options

This will give access to more options. Specifically, the *System ID* must be set.



The screenshot shows the 'Advanced RPMA Configuration' screen. It includes a 'System ID' field set to 90, an 'Alternate Operating Mode Block' dropdown set to 0, and three other fields: 'Max UL PDUs - Low Latency' (16), 'UL Overload Alarm Threshold' (3), and 'Interference Alarm Threshold' (10). A note states: 'Do not modify Alternate Operating Mode Block without consulting RF Engineer. For engineering use only'.

Figure 33: Setting system ID

Table 12: Description of System ID fields

Field	Description
System ID	The System Identification number. Range is 0 – 255.
Alternate Operating Mode Block	For RF engineering use only. Do not modify Alternate Operation Mode Block without consulting RF engineer.

Field	Description
Max UL PDUs – High Coverage	Maximum number of PDUs allowed on the uplink. Range is 4 – 512. The default setting is 16. Depends on High Coverage or Low Latency.
UL Overload Alarm Threshold	This alarm triggers when the threshold for uplink capacity has been reached. Range is 0 – 31.
Interference Alarm Threshold	This alarm triggers when the threshold for interference on the uplink has been reached. Range is 0 – 31.

Other values for *Field Configuration* and *Backhaul Config* can be set on this page.

Field Configuration

Target Excess SNR (dBm):

Unlock Force Scan Day Setting

Force Scan Day:

Online Duration Without GPS Fix(sec):

Backhaul Config

Phy Info Reporting Period:

Phy Info Period in seconds is : 929

Log Level:

Keep Alive Interval:

Online duration without Backhaul Connection (seconds):

Figure 34: Field and Backhaul configurations

Table 13: Description of Fields and Backhaul Configuration

Field	Description
Target Excess SNR (dBm)	The default setting is 1 dB. Contact Trilliant prior to changing this parameter.

Field	Description
Force Scan Day	The date to perform a Force Scan.
Online Duration Without GPS Fix (sec)	The length of time allowed for the AP-R10 to remain online without GPS fix. The default is 600 seconds.
Phy Info Reporting Period	Time period (in seconds) of the AP-R10 sending phy statistics to EMS.
Log Level	<p>Set the log level for the AP-R10.</p> <p>Critical: Only shows critical log information.</p> <p>Error: This setting shows error and critical log information.</p> <p>Warning: This setting shows warning, error, and critical log information.</p> <p>Informational: This setting shows informational, warning, error, and critical log information.</p> <p>Debug: This setting shows debug, informational, warning, error, and critical log information.</p>
Keep Alive Interval	The number of seconds allowed for the interval where the AP-R10 checks the link to the Gateway to determine whether the link is still <i>alive</i> or broken.
Online duration with Backhaul Connection (seconds)	The length of time allowed for the AP-R10 to stay online while not being connected to backhaul connection.

AP-R10 Communication Troubleshooting

Before you leave the installation site, contact your network operations center (NOC) to verify that the AP-R10 is online and successfully communicating. If remote communication with the AP-R10 is not possible, perform the following steps:

1. Manually configure the following on a laptop:
 - The IP address of the Ethernet port.
 - Netmask setting.
 - The Default Router setting.

2. Unplug the backhaul connector from the data port of the PoE and connect the laptop to that port.
3. Verify that you can locally log in to the AP-R10.
 - o If you can successfully log in, further testing of the backhaul and its configuration is needed.
 - o If you cannot log in, check the IP setting of your laptop.
4. If no problems are found, refer to Chapter 8:

The figure below illustrates a method for detailed on-site debugging of an AP-R10 installation. The Ethernet hub allows the user to “sniff” Ethernet traffic between the backhaul port and the AP-R10 to troubleshoot and resolve any issues.

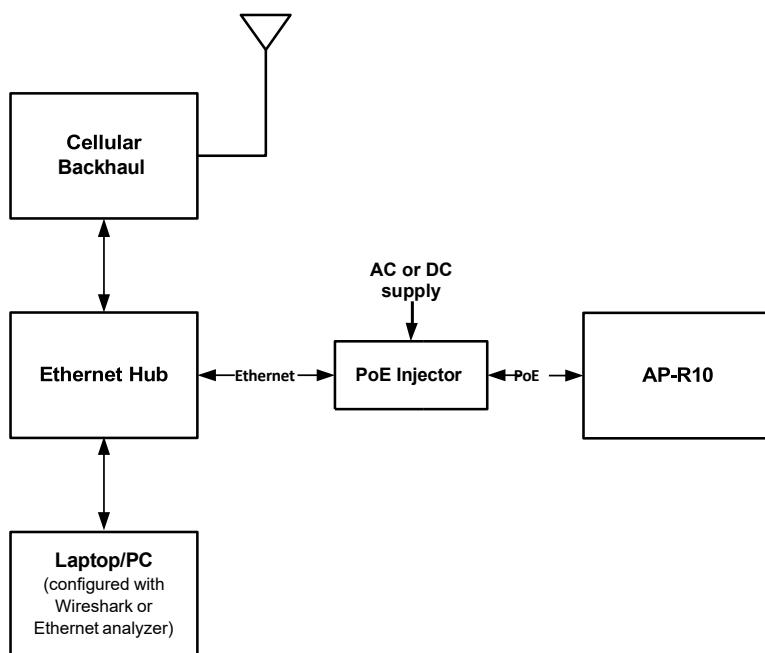


Figure 35: Sample Method for On-site Debugging of an AP-R10 Installation

Chapter 8: Troubleshooting Guidelines

Use the following table to help troubleshoot a problem.

Table 14: Troubleshooting Guide

Problem	Action
AP-R10 does not power up (Status LED is not illuminated or flashing upon power up)	<ul style="list-style-type: none"> When the AP-R10 is first powered up, the Status LED illuminates or flashes. If not, check the Ethernet cable and connector for damage. Verify that the PoE injector is connected properly (i.e., the AP-R10 is connected to Data + Power side). Verify that a nominal voltage of 48 VDC is present at the power connector of the PoE. Verify that the PoE injector is not defective by substituting another known working PoE. Verify that the backhaul cable from the Data connector on the PoE injector is connected to a router, backhaul device, or laptop that is powered up. Connectivity is not required but the port must be active. <p>Contact Trilliant for assistance.</p>
AP-R10 does not acquire GPS	<ul style="list-style-type: none"> Verify that the GPS antenna cable and the AP-R10 antenna cable are connected and have not been swapped. If the connectors were swapped, it is necessary to power cycle the AP-R10. Disconnect both ends of the GPS. Verify continuity and that the cable is not shorted. Verify the GPS antenna is not defective by substituting a known working GPS antenna. Power cycle the AP-R10. <p>Contact Trilliant for assistance.</p>
Link problem	<ul style="list-style-type: none"> Is the Link LED blinking? If not, check the Ethernet cable and connector for damage. Verify that the PoE injector is connected to the WAN. Connect a properly configured laptop to the data port on the PoE, as described in chapter 8, and attempt to log into the AP-R10. If successful, troubleshoot the backhaul. <p>Contact Trilliant for assistance.</p>

Chapter 9: Preventive Maintenance

The recommended preventive maintenance schedule for the AP-R10 is shown in the following table.



Note: Do NOT open the AP-R10 enclosure as doing so voids the product warranty.

F

Task	Frequency
1. Verify that all connections are tight and secure.	Annually
2. Verify that there is no visible damage to any wires or cables.	Annually
3. Ensure that the exposed connectors are properly sealed against weather conditions.	Annually
4. Verify that the AP-R10 door screws are tight and that the warranty seal is in place.	Annually
5. Verify that all required grounds are connected and tight.	Annually
6. Verify that all mounts and the bracket are securely attached.	Annually

Appendix A: Site Survey Worksheet

Site Survey	Required Information	✓ Completed
Site name		
AP-R10 ID		
Site street address or other location information		
Site access information		
Landlord contact information		
Specific landlord requirements (Attach another sheet if there is significant information)		
Latitude		
Longitude		
Site type (building, tower, pole, or other)		
Height of existing structure		
AP-R10 equipment mounting location		
AP-R10 antenna mounting location and height		
Antenna line length required		
GPS mounting location		
GPS line length		
AP-R10 power type, commercial power, or solar solution		
Distance to commercial power, if available		

Site Survey	Required Information	✓ Completed
Photos of site including antennal location, AP-R10 location, and overall site (attach all photos to this worksheet)		
Other site-specific information		

Appendix B: AP-R10 Configuration Worksheet

AP-R10 Configuration Parameter	Required information	✓ Completed
Site name.		
AP-R10 name.		
AP-R10 ID.		
Deployment Region ID.		
AP-R10 physical configuration (Outdoor, indoor, standalone, in cabinet, or other).		
AP-R10 antenna gain.		
AP-R10 antenna down tilt.		
AP-R10 antenna cable type.		
AP-R10 antenna cable length.		
AP-R10 antenna cable loss.		
Backhaul type.		
Backhaul configuration information.		
AP-R10 Static or DHCP IP address (Static or Dynamic?).		
AP-R10 IP address.	(Default: 192.168.1.1)	
Netmask setting.	(Default: 255.255.255.0)	
Default router.	(Default: 192.168.1.254)	
DNS servers.		
NTP servers.		
AP-R10 Socket mode - Server or Client.		

AP-R10 Configuration Parameter	Required information	✓ Completed
Server port number.		
Gateway IP address.		
Gateway port number.	(Default: 5051)	
SNMP server address.		
Channel assignment.		
Reuse Code.		

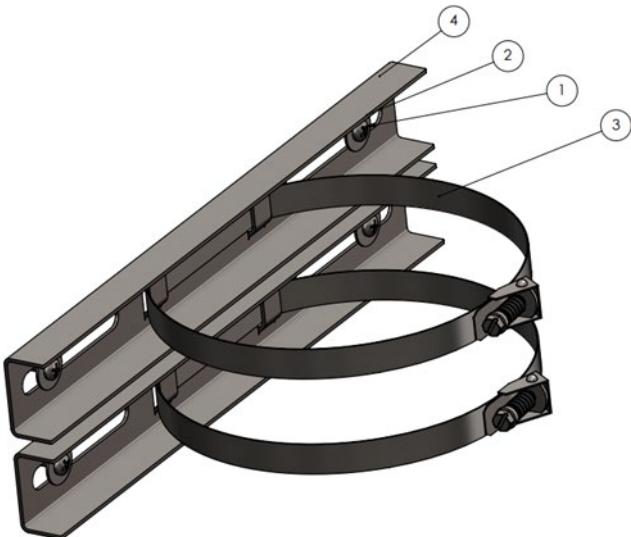
Appendix C: Basic AP-R10 Specifications

The following table provides the basic specification information for the AP-R10. For detailed product specifications, refer to the AP-R10 data sheet.

Parameter	Specification
Size	250 mm H x 202 mm W x 111 mm D (9.8" H x 7.9" W x 4.4" D)
Maximum Weight	3,7 kg (8.1 lbs)
Operating Environment	Outdoors or indoors
Enclosure	NEMA Type 4X / IP66
Operating Temperature Range	-40°C to +70°C
Power Source Voltage Range (PoE)	802.3af/at
Antenna Connector	N-Type, female
GPS Connector	N-Type, female
GPS Antenna Type	Powered
Data and Power Connector	RJ45
GPS Power	5VDC @ 75 mA maximum over coaxial cable

Appendix D: Description of optional hardware kits

DK-0045A: Pole Mount Kit for Access Point, 12" Strut Channels, Bands 12" ID + HW, Stainless Steel



1. Screw 5/16-18 x 3/4 in, 13 mm (1/2 in) Hex Cap, S.S., Qty=4
2. Flat washer # 5-16 in, S.S., Qty=4
3. Conduit clamps 5 to 30 cm (2 to 12 in) ID, S.S., Qty=2
4. Strut channel 30 cm (12 in) long, S.S., Qty=2

Figure 36: Pole Mount kit DK-0045A

DK-0046A: Rack Mount Kit, Indoor

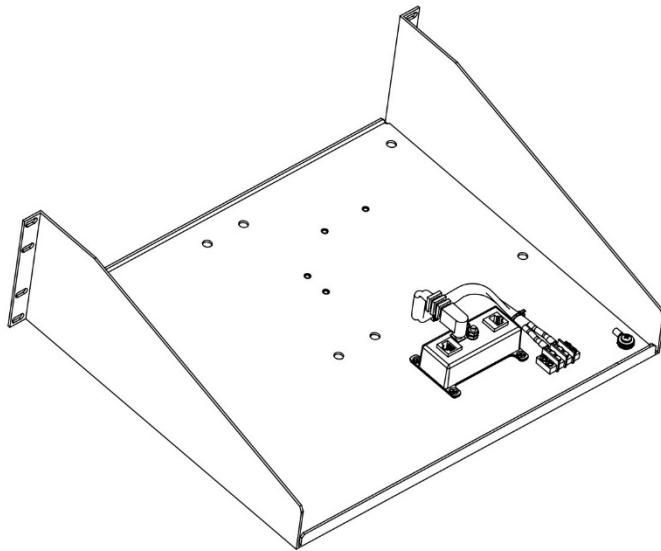


Figure 37: Rack Mount Kit DK-0046A

Includes the following major items:

- A 48 cm (19 in) aluminum rack 3RU shelf
- A passive 48V PoE Injector, with AC/DC Power supply (North America plug)
- A 40dB GPS antenna
- A Lightning protector, N-Male to N-Female
- A CAT5 shielded cable, 30 cm (12 in) long

PSU-R100 (Pending)

Appendix E: Abbreviations and Terms

Abbreviation /Term	Definition
AP-R10	Access Point. The RPMA component geographically deployed over a territory.
DL	Downlink
DNS	Domain Name System
DTF	Distance to Fault
DVM	Digital Voltmeter
EIRP	Equivalent Isotropically Radiated Power
EMS	Element Management System. The network component that provides a concise view of controls and alarms on the RPMA network.
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission
FIPS	Federal Information Processing Standards
GPS	Global Positioning System
GW	Gateway
IC	Industry Canada
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPsec	Internet Protocol Security
NID	Node ID
NIST	National Institute of Standards and Technology

Abbreviation /Term	Definition
Node	The wireless RPMA Radio module developed by Trilliant that integrates with OEM sensors and communicates sensor data to an Access Point.
NTP	Network Time Protocol
PV	Photovoltaic
RF	Radio Frequency
RFID	Radio Frequency Identification
RPMA	Trilliant's proprietary wireless communication technology and network.
RSSI	Receive Signal Strength Indicator
SSL	Secure Socket Layer
STP	Shielded Twisted Pair
TCP	Transmission Control Protocol
UL	Uplink
UTP	Unshielded Twisted Pair