



# Base Node Installation Guide

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# Supported Hardware

This guide covers the following base node models:

Base Node (6 GHz)	G1BN5ASI002
Base Node (5 GHz)	G1 BN5AS1002
Base Note (CBRS, Cat B)	G1-BN3ASI001

## More Information

You can download the latest base installation guide at the following URL:

[https://www.taranawireless.com/bn\\_manual](https://www.taranawireless.com/bn_manual)

Information about configuration is in the [G1 Administration Guide](#).

You can find additional information and videos at the [Tarana support page](#).

# Safety and Warnings

Tarana G1 equipment is designed for installation and use by trained professionals and requires adherence to all relevant regulatory, safety, and telecom industry best practice guidelines for outdoor radios.

Failure to observe these safety precautions may result in personal injury or damage to equipment.

## General Warnings

Failure to observe these safety precautions may result in personal injury or damage to equipment.

- Follow all warnings and instructions marked on this product.
- Use standard safety guidelines when mounting. Installation and maintenance procedures must be followed and performed by trained personnel only.
- Before unmounting the product, disconnect power input to reduce the risk of hazards.
- Do not exceed 60 VDC of input to the device.
- Do not open the device. Opening the device by anyone other than authorized Tarana repair personnel voids the warranty.
- Do not stack anything on the radome.
- Dust covers must be installed on all connectors when not in use.
- Cable ends must be protected from weather if not connected to the device.
- When the SPF+ port is used, this is a Class 1 laser product. Invisible laser radiation can be emitted from the aperture of the port when no fiber is connected; therefore, avoid exposure to laser radiation and do not stare into open apertures.

## FCC Information

- The general population / uncontrolled limit for maximum permissible exposure (MPE) is 1 mW/cm<sup>2</sup>. To meet this MPE requirement, the operator must be at a distance of 10.2 in or 26 cm away from the radome cover of the system.
- The operation of this device is prohibited on oil platforms, cars, trains, boats, and aircraft.
- Operation of transmitters in the 5.925-7.125 GHz band is prohibited for control of or communication with unmanned aircraft systems.

## Exposure Safety

The general population uncontrolled limit for maximum permissible exposure (MPE) is 1 mW/cm<sup>2</sup>. To meet this MPE requirement, the operator must be at a minimum distance away from the radome cover of the system. Refer to the following table for additional information:

Model	Description	Regulatory Domain	Regulatory Standard	Minimum Separation Distance (cm)	Professional Installation Required
G1BN6ASI002	6 GHz Base Node	FCC (USA)	FCC 47 CFR Part 2.1091	26	Yes
		ISED (Canada)	RSS-102	26	Yes
G1BN5ASI002	5 GHz Base Node	FCC (USA)	FCC 47 CFR Part 2.1091	20	Yes
		ISED (Canada)	RSS-102	20	Yes
		CE (European Union)	EN 50665: 2017	55	Yes
G1-BN3ASI001	3.6 GHz Base Node (CBRS)	FCC (USA)	FCC 47 CFR Part 1.1307	96	Yes

Reference: 47 CFR §1.1307 and 47 CFR §2.1091



### NOTE

All base nodes require professional installation.

## General Health and Safety Information

The following table summarizes general health and safety topics.

Topic	Explanation
Flammability	The equipment is designed and constructed to minimize the risk of smoke and fumes during a fire.
Hazardous Materials	No hazardous materials are used in the construction of this equipment.
Hazardous Voltage	The G1 system meets global product safety requirements for safety extra-low voltage (SELV) rated equipment.
Safety Signs	External warning signs or other indicators on the equipment are required.
Surface Temperatures	The external equipment surfaces become warm during operation, due to heat dissipation. The temperatures reached are considered hazardous.

**WARNING! HEAVY EQUIPMENT. SEE INSTALLATION INSTRUCTIONS BEFORE LIFTING.**

The Tarana base node weighs ~20 kg (~42 lbs.).

Use proper lifting techniques for lifting heavy equipment. Be sure to follow all established local practices and safety precautions when hoisting the equipment.

Keep knees bent, back as straight as possible, and the load close to the body.



## Health and Safety Warning

- All personnel must comply with the relevant health and safety practices when working on or around the G1 radio equipment.
- The G1 system has been designed to meet relevant US and European health and safety standards.
- Local safety regulations must be used if required. Safety instructions in this section should be used in addition to the local safety regulations. In the case of conflict between safety instructions stated herein and those indicated in local regulations, mandatory local norms will prevail. Should local regulations not be mandatory, then safety norms herein will prevail.

## Warning Labels

<p>WARRANTY VOID</p> <p>DO NOT BREAK THE TAMPER SEALS ON HARDWARE. OPENING THE DEVICE BY ANYONE OTHER THAN AUTHORIZED TARANA REPAIR PERSONNEL WILL VOID THE WARRANTY.</p>
<p>WARNING</p> <p>Making adjustments and/or modifications to this equipment that are not in accordance with the provisions of this User Guide, the Installation Guide or other supplementary documentation may result in personal injury or damage to the equipment, and may void the equipment warranty.</p>
<p>AVERTISSEMENT</p> <p>Tout réglage ou modification faits à cet équipement hors du cadre édicté par ce guide d'utilisation ou par toute autre documentation supplémentaire pourraient causer des blessures ou endommager l'équipement et peut entraîner l'annulation de sa garantie.</p>
<p>WARNUNG</p> <p>Die an diesen Geräten gemachte Einstellungen und/oder Änderungen, welche nicht gemäß dieser Bedienungsanleitung, oder gemäß anderen zusätzlichen Anleitungen, ausgeführt werden, können Verletzungen oder Materialschäden zur Folge haben und eventuell die Garantie ungültig machen.</p>
<p>ATENCIÓN</p> <p>Llevar a cabo ajustamientos y/o modificaciones a este equipo, sin seguir las instrucciones provistas por este manual u otro documento adicional, podría resultar en lesiones a su persona o daños al equipo, y anular la garantía de este último.</p>
<p>警告 對本设备进行不符合本用户指南，安装手册，或其他补充文件规定的调整和/或修改可能會导致人身伤害或设备损坏，并可能导致失去设备的保修。</p>

## General Hazards

Refer to the following table for general hazards.

Topic	Explanation
Chassis Earthing	The base node chassis must be connected directly to the DC supply system earthing conductor, or to a bonding jumper from an earthing terminal bar, or bus to which the DC supply system earthing is connected.
Protection from RF Exposure	<p>When installing, servicing or inspecting an antenna always comply with the following:</p> <ul style="list-style-type: none"> <li>• Locate the antenna such that it does not infringe the RF Exposure Limit Distance, relating to the Compliance Boundary General Public. (See Exposure Safety table)</li> <li>• Stay aware of the potential risk of RF exposure and take appropriate precautions.</li> <li>• Do not stand in front of or look into an antenna without first ensuring the associated transmitter or transmitters are switched off.</li> <li>• At a multi-antenna site ask the site owner or operator for details of other radio services active at the site and for their requirements/recommendations for protection against potentially harmful exposure to RF radiation.</li> <li>• When it is not possible to switch transmitters off at a multi-antenna site and there is potential for exposure to harmful levels of RF radiation, wear a protective suit.</li> </ul>
Fiber Optic Cables	<ul style="list-style-type: none"> <li>• Handle optical fibers with care. Keep them in a safe and secure location during installation.</li> <li>• Do not attempt to bend them beyond their minimum bending radius.</li> <li>• Protect/cover unconnected optical fiber connectors with dust caps.</li> </ul>
Grounding Connections	Reliable grounding of the base node chassis must be maintained.
Mains Power Supply Routing	Base node DC power is not to be routed with any AC mains power lines. They are also to be kept away from any power lines which cross them.
Maximum Ambient Temperature	The ambient temperature range for the base node is -40 degrees C to 55 degrees C. To ensure correct operation and to maximize long term component reliability, ambient temperatures must not be exceeded. Operational specification compliance is not guaranteed for higher ambients. The base node must be mounted in such a way as to permit the vertical free flow of air through its cooling fins.
Mechanical Loading	When installing the base node on a tower, ensure that the tower is securely anchored. Ensure that the additional loading of devices will not cause any reduction in the mechanical stability of the tower.
Power Supply Connection	The base node operates from a nominal -54 VDC power supply.
Power Supply Disconnect	An appropriate power supply disconnect device should be provided as part of the installation.
Rack Mount Temperature Considerations	The base node is designed to operate in an outdoor environment with no significant obstructions in front of the radome. Do not install the base node in a closed or multi-unit rack assembly, because such a closed rack would impede the propagation of the RF signals. The maximum ambient temperature applies to the immediate operating environment of the base node.

# G1 Network Architecture

The G1 network architecture consists of the following elements:

- Tarana Base Node (BN): Base nodes are deployed at the site tower, elevated to provide coverage and line-of-sight advantages to remote nodes.
- Tarana Remote Node (RN): Remote nodes are deployed at the subscriber site and do not require line-of-sight coverage from the base node.
- Tarana Cloud Suite (TCS): TCS is the cloud-based management and monitoring platform. Because it is cloud-based, administrators can access it from any device.
- Tarana API: Administrators can use APIs to access TCS data and make it available to third-party portals and support systems.

Planning and deploying a Tarana G1 network is straightforward. When you connect base nodes to power and a backhaul path, they automatically contact and register with the TCS management platform over an encrypted connection. With a frequency reuse of 1, you can install multiple base nodes on the same frequency at a single location (referred to as a cell), arranged in sectors. A collection of base nodes at a single location is a site. There can be multiple cells at a site. When operating in a licensed spectrum, deploying a single-channel cell can reduce licensing fees.

When you connect a remote node to a power source, it automatically finds the base node with the best link quality and generates a list of alternate base nodes within range, called a neighbor list. After discovering and connecting to the appropriate base node, the remote node uses beamforming to optimize its signal path to its associated base node. Beamforming creates a main RF lobe that points toward the receiving antenna and creates RF nulls in the direction of interference sources. Interference sources can include self-interference from the operator's equipment or other nearby devices. After the remote node and base node adjust the RF link power and signal, the remote node registers and authenticates with the network.

After you deploy the base and remote node, the pair monitor and adjust the link parameters to maintain a high quality link in both directions while rejecting interference from interference sources.

When you deploy a single base node, it can support up to 250 concurrent remote node connections. When you deploy a cell of four base nodes, the cell can support up to 1000 remote nodes distributed evenly at 250 per base node.

For more information on planning and deployment, see the [Network Planning and Deployment Guide](#).

# Preparation

Make sure you have all the required items before beginning the installation. Verify the contents of the Tarana-supplied hardware.

## Tools

- 13mm combination wrench
- Torque wrench
- T30 Torx driver
- Crimping tool (6 AWG)
- Spirit level or adjustable digital level / angle finder
- An accurate tool to confirm azimuth or heading. A cell phone's compass is adequate but more accurate tools are preferred.

## Customer-Supplied Equipment

- Power cable - a 2-wire outdoor rated cable of suitable size for the cable run, or as per local code
- Ground wire (6 AWG)
- Two Ethernet cables - shielded CAT5e / CAT6 - one indoor-rated and one outdoor-rated
- PC laptop with admin rights
- TCS user ID with admin rights

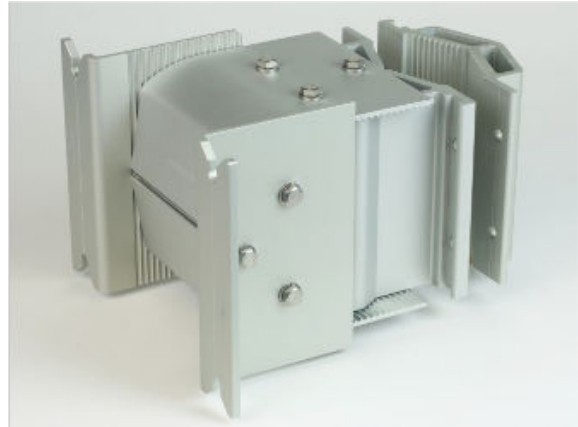
## Tarana Hardware Peripherals

- AC power supply (optional)
- Harting DC pigtail
- Harting optical cable
- Harting RJ45 cable
- Lightning and surge protection devices
- Base node radio unit (16.4 x 21 x 4.6 in; 41.7 x 53.3 x 11.6 cm)

- Base node mounting kit

## Base Node Mounting Kit Contents

- (4) M8 bolts: 1.25 x 120 mm
- (4) M8 bolts: 1.25 x 80 mm
- (4) M8 bolts: 1.25 x 25 mm
- (4) M-8 nuts: 1.25 mm
- (8) M-8 washers, wedge-lock
- (1) Base node pole-mount bracket assembly



## Surge Protectors



### NOTE

Tarana recommends that you assemble and test all power and surge protector cables in the lab prior to installation in the field.

Two models of DC Defender surge protectors are available. Use model 1101-1027 (item B) when the cable size used to power the base node is 10 AWG or larger.

- A: DC Defender (DC Surge Protector) with Mounting Kit: 1101-1110



- B: DC Defender (DC Surge Protector): 1101-1027. Pole Mount Kit: 1000-1164



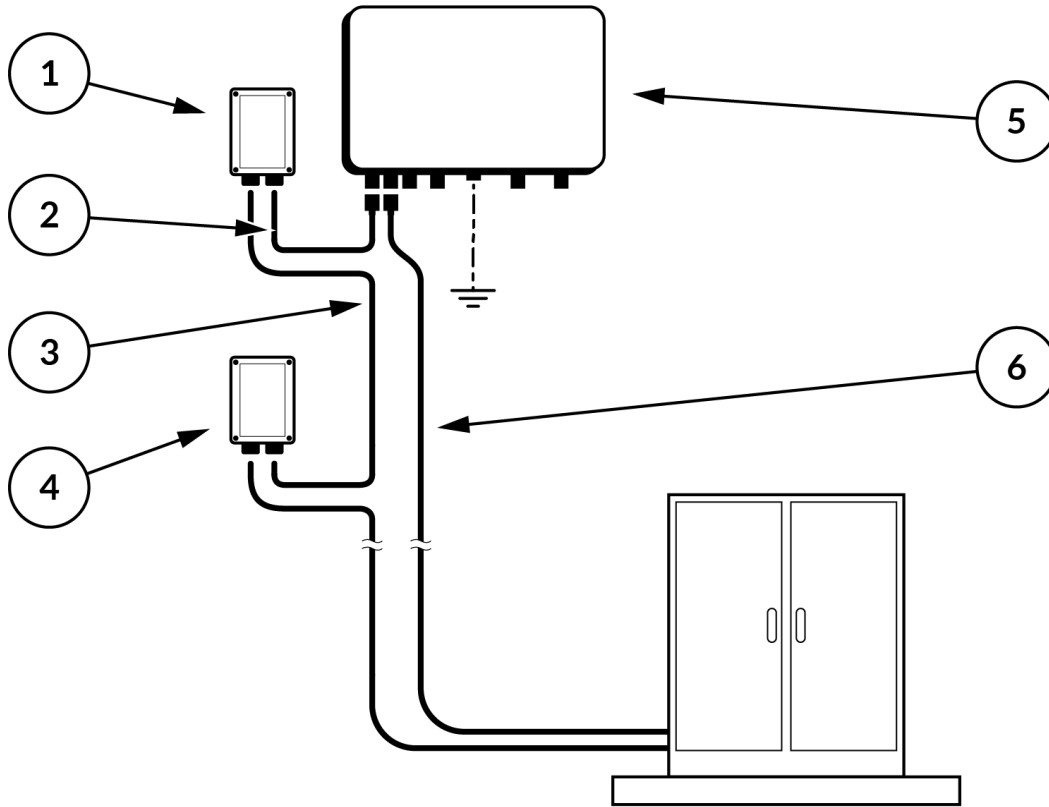


You can find the manufacturer installation instructions and data sheet for these devices at these URLs:

- 1101-1110 Installation Guide:  
[https://www.transtector.com/Images/Downloadables/Guides/1101-1110\\_Install\\_Guide\\_US.pdf](https://www.transtector.com/Images/Downloadables/Guides/1101-1110_Install_Guide_US.pdf)
- 1101-1110 Data Sheet:  
[https://www.transtector.com/Images/Downloadables/Datasheets/1101-1110\\_datasheets\\_US.pdf](https://www.transtector.com/Images/Downloadables/Datasheets/1101-1110_datasheets_US.pdf)
- 1101-1027 Installation Guide:  
[https://www.transtector.com/Images/Downloadables/Guides/1101-1027\\_Install\\_Guide\\_US.pdf](https://www.transtector.com/Images/Downloadables/Guides/1101-1027_Install_Guide_US.pdf)
- 1101-1027 Data Sheet:  
[https://www.transtector.com/Images/Downloadables/Datasheets/1101-1027\\_datasheets\\_US.pdf](https://www.transtector.com/Images/Downloadables/Datasheets/1101-1027_datasheets_US.pdf)
- Mounting Kit Installation Guide:  
[https://www.transtector.com/Images/Downloadables/Guides/1000-1164\\_Install\\_Guide\\_US.pdf](https://www.transtector.com/Images/Downloadables/Guides/1000-1164_Install_Guide_US.pdf)
- Mounting Kit Data Sheet:  
[https://www.transtector.com/Images/Downloadables/Datasheets/1000-1164\\_datasheets\\_US.pdf](https://www.transtector.com/Images/Downloadables/Datasheets/1000-1164_datasheets_US.pdf)

Refer to this illustration:

## Base Node Installation Guide



Reference	Description
1	DC Defender TVS device placed physically near the base node
2	Power cable from DC Defender to base node. The recommended length of this section of cable is between 30 and 100 cm (1.0 - 3.3 ft.).
3	Power cable between DC Defender devices. The recommended length of this section of cable is 3 m (10 ft).
4	Secondary DC Defender TVS device.
5	Base node
6	Fiber data line; fiber does not require TVS protection.

In addition to surge protectors, Tarana recommends that customers in high lightning-prone areas further protect base nodes by installing two DC Defender transient voltage suppression (TVS) devices in the physical proximity of the base node, separated by roughly 10 feet, keeping the power cable between the DC Defender closest to the base node as short as reasonable. You should also install a third TVS device at the equipment cabinet.

Tarana also recommends that the copper Gigabit Ethernet port not be permanently wired while the base node is on the tower as this increases the risk of damage in high lightning prone areas.

# Base Node Power Requirements



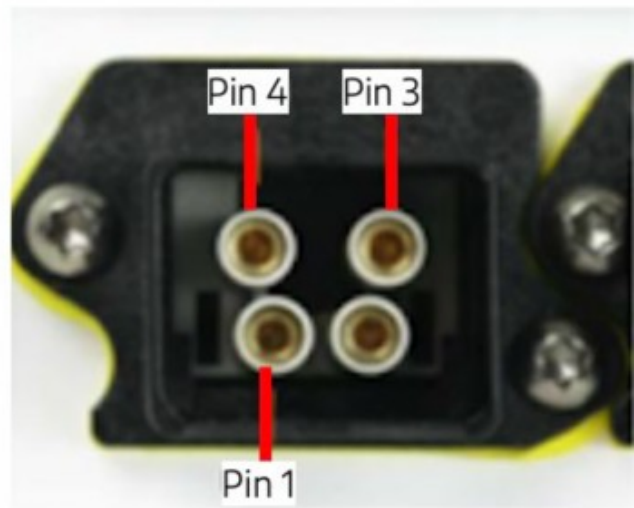
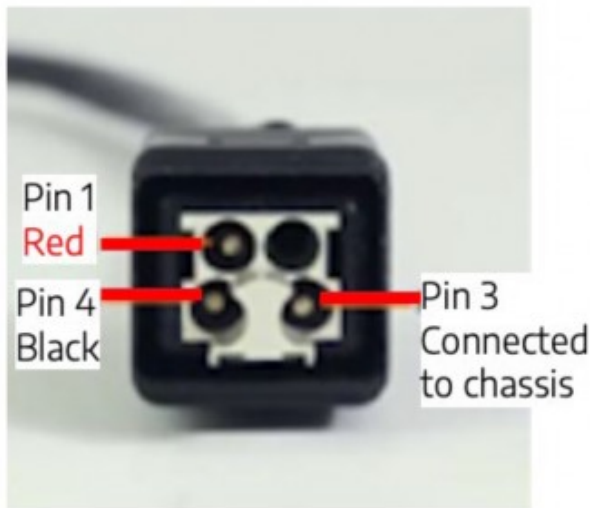
## IMPORTANT

Tarana recommends that you power on the base node and set up an initial configuration before you mount it on the vertical asset.

The base node requires power and a connection on a data port to access the Tarana Cloud Suite (TCS). The voltage required is -48 VDC supplied on the Harting power connector through the power port only. You can provide -48VDC either from the site or from the Tarana AC/DC outdoor-rated power adaptor, using AC power from the site. Whichever option you choose, you must terminate the DC power cable with a Harting Push-Pull, quick-disconnect, IP67 rated connector, with the pinouts shown below.

- Pin 1 is +48V compared to pin 4, or pin 4 is -48V compared to pin 1.
- Pin 1 and pin 4 are isolated from the chassis ground.
- Pin 3 is connected to the chassis ground inside the device.

You must connect Pin 1 of the Harting connector to the higher potential conductor of the base node power supply.



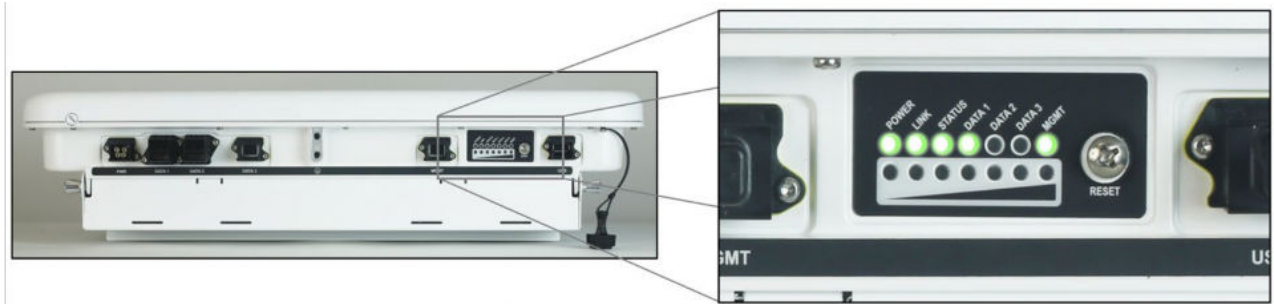
### Power Connector Cable View and Chassis View

To turn on the unit, apply power. The typical power draw is 275W. The max power draw is ~330W.

## Base Node Installation Guide

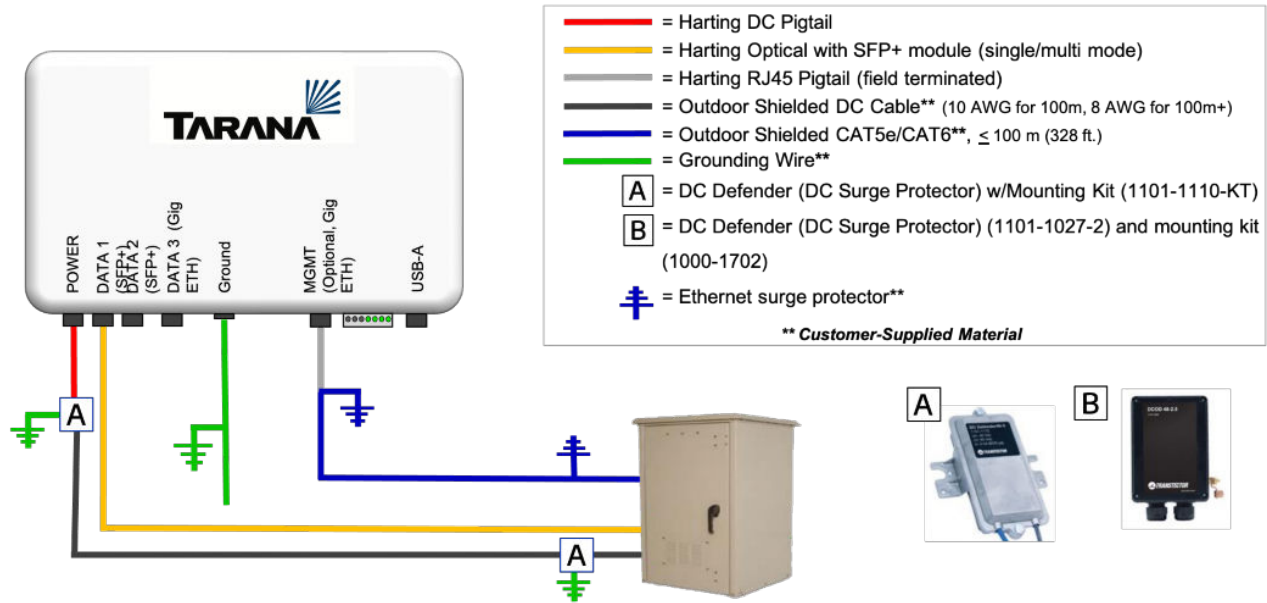
When you apply power, the base node goes through a boot and initialization process. This takes about 5 - 7 minutes. A set of LEDs on the bottom edge of the base node cycles through patterns and colors while this takes place.

For more information about LED behavior see the section on Device LED Lights in the [G1 Administration Guide](#).



# Power Connections

The base node requires power and a data connection for operation. All connectors must use Harting Push-Pull connector and be IP67-compliant. Required voltage is -48 VDC, supplied by the Harting connector.



## NOTE

If you use a cable size 10 AWG or larger to power the base node, "B" replaces all instances of "A".

## Set Up the Initial Configuration

Before you mount the base node on the vertical asset (a tower, water tower, grain elevator, or something similar), connect its power and data ports and set up its initial configuration.

Use a Harting Push-Pull Ethernet cable assembly plugged into the MGMT port on the Base Node. Harting Ethernet cable assemblies for this purpose are available through Tarana.



### IMPORTANT

Do not use a standard Ethernet cable in this port. It makes removing the cable difficult and you could damage the port.

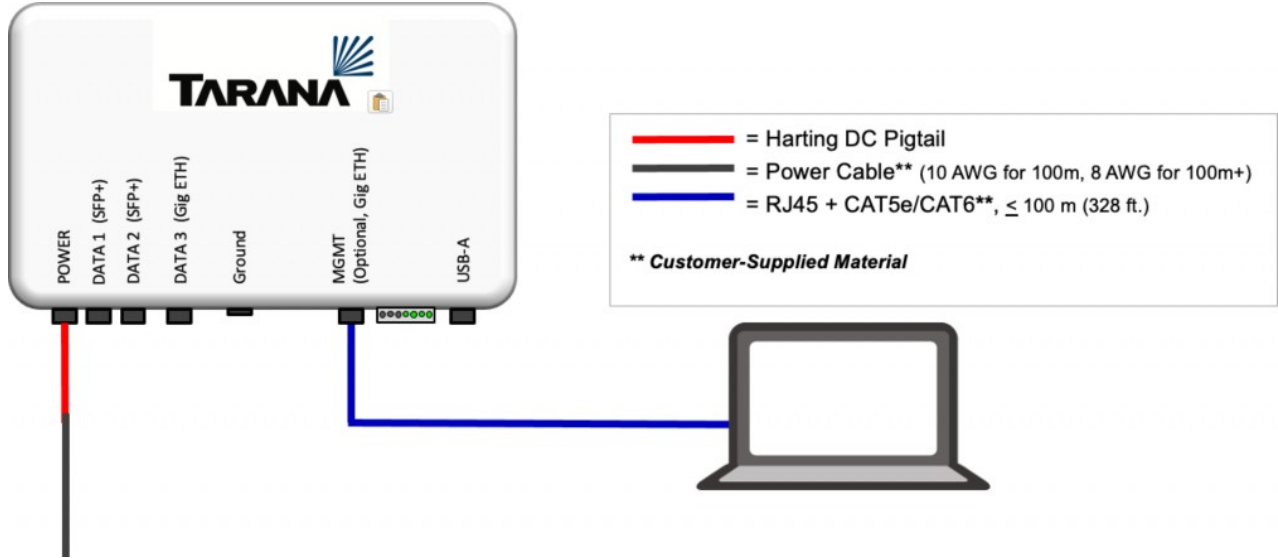
DATA1 and DATA2 are optical SFP+ interfaces. Devices connected to these data ports must support SFP+ (10Gbps) or the ports will not come up. Tarana offers an industrial-temperature SFP+ module for data connection at the base node on the vertical asset. This SFP+ module is MEF certified with an extended temperature range of -40° to +85°C. DATA3 is a copper interface that supports only 1Gbps. Devices connected to DATA3 must be Gigabit Ethernet or the port will not come up.



### NOTE

Only one of the three data ports can be active at a time.

The base node communicates with TCS through one of the data ports. The MGMT port is for initial configuration. Optionally, you can use this port for on-site management, also known as Out of Band (OOB) management.



## Connect to the Management Port

1. Connect a laptop to the MGMT Gigabit Ethernet port of the base node.
2. On the laptop, assign a static IP address in the same subnet as the default IP of the MGMT port. This example uses 192.168.10.10 with a subnet mask of 255.255.255.0.



3. The MGMT port has a default IP of 192.168.10.2/24 with no VLAN. Enter this address into a web browser to access the base node's web interface. Google Chrome is the supported browser.  
`https://192.168.10.2`
4. To bring up the base node's web interface, enter the default login **admin** and password **admin123**.





You can also assign a management IP statically or with a DHCP server if there's a DHCP server on the network.

DHCP isn't enabled by default and you must enable it through the base node's web UI. You can't enable DHCP for both the in-band management and out of band management interfaces.

## Configure the Base Node

This procedure is for the 5 GHz and 6 GHz base nodes. For CBRS, see [CBRS Installations \(page 30\)](#) for additional information.

If you're configuring the base node pre-deployment in a lab, it helps to keep it close to a window so it can get a GPS sync with satellites.

# Base Node Installation Guide

BN0002 

### Setup

#### System

Hostname	<input type="text" value="BN0002"/>	Operator ID	<input type="text" value="40"/>
Country	<input type="text" value="South Africa"/>		
Carrier 0 Freq	<input type="text" value="3400"/> MHz	Carrier 1 Freq	<input type="text" value="3440"/> MHz

#### Data

Interface	<input type="text" value="Data1 - 10G"/>		
Data VLAN	<input type="text" value="3000"/>	Tagged Data VLAN	<input checked="" type="checkbox"/> (Enabled)
Enable DHCP Relay Agent	<input type="checkbox"/> (Disabled)	Remote/Circuit Identifier Type	<input type="text" value="Serial Number"/>

#### In-band Management

IP/prefix	<input type="text" value="10.18.4.2/24"/>	Enable DHCP	<input type="checkbox"/> (Disabled)
Mgmt VLAN	<input type="text" value="102"/>	Tagged Mgmt	<input checked="" type="checkbox"/> (Enabled)

#### Out-of-band Management (optional)

IP/prefix	<input type="text" value="192.168.10.2/24"/>	Enable DHCP	<input type="checkbox"/> (Disabled)
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#### Network/Services

Mgmt Default Gateway	<input type="text" value="10.18.4.1"/>	Cloud URL	<input type="text" value="registration.preprod.cloud.taranawireless.cor"/>
NTP Server(s)	<input type="text" value="2.pool.ntp.org,1.pool.ntp.org,0.pool.ntp.org"/>	DNS Server IP(s)	<input type="text" value="8.8.8.8"/>

**INSTALLATION PARAMETERS**

Use the base node's web UI to configure this information:

- Enter the Hostname, following these rules:

Hostname must be from 1 to 63 characters long. Valid characters are ASCII(7) letters from a to z, A to Z, digits 0 to 9, hyphen, and underscore. It may not start or end with a hyphen. Consecutive hyphens (2 or more) are not allowed. Hostname is case-sensitive. Not allowed: spaces, special characters, periods.

- For in-band management (on one of the data ports), enter a static IP within the subnet of the LAN gateway or enable DHCP to have a DHCP server give the base node an IP address. For DHCP Option 82, see DHCP Option 82 Support in the [G1 Administration Guide](#).



### NOTE

If DHCP is enabled for the in-band management IP Address, you can't use it for the out-of-band management address.

- Tarana recommends that you configure the Data VLAN on the data port, though it's not required. You can change the default Data VLAN using the base node's Web UI. For information about using VLANs in a G1 network, see VLANs and Quality of Service in the [G1 Administration Guide](#).
- Enter the Mgmt Default IP gateway. This is the gateway for the in-band management IP address you configured in Step 1. It must be on the same subnet as the In Band Management IP address.
- Enter the Cloud URL for the TCS system associated with this operator.  
If you have 5 GHz and add 6 GHz, the URL is  
`registration.cloud.taranawireless.com:443`.  
If you have 3 GHz devices (CBRS), and add 6 GHz, the URL is  
`registration.trial.cloud.taranawireless.com:443`.  
If you have all three, use `registration.trial.taranawireless.com:443`.
- By default, the NTP Server is set to **2.pool.ntp.org,1.pool.ntp.org,0.pool.ntp.org**. You can configure this parameter using an IP address or FQDN. This parameter cannot be left blank, but by default, the NTP is not used because the base node uses GPS for synchronization.  
If you need this value for lab testing (when the base node doesn't have a view of the sky for GPS synchronization), contact Tarana Support for assistance.
- Verify the connection to TCS by confirming that the Hostname appears in green text at the top of the screen.
- Select **Installation Parameters** to verify the values, You can edit **Tilt, AGL Height, Height Uncertainty, and Azimuth**.

The screenshot shows a dialog box titled "INSTALLATION PARAMETERS" with a globe icon and a close button (X). It contains the following fields:

Parameter	Value	Unit
Latitude	37.411705	°
Longitude	-121.915016	°
Tilt	-0.7	°
AGL Height	50.0	m
AGL Height Uncertainty	1.0	m
Azimuth	89.2	°

At the bottom, there are two buttons: "CANCEL" (grey) and "CONFIRM" (blue).



### IMPORTANT

Height and uncertainty must be entered by the professional installer or operator. Installers are obligated to verify the accuracy of the height during the configuration of the device.

- **Tilt:** Vertical angle, measured in degrees, from the horizon (0 degrees).
- **AGL Height:** Installed height above ground level (AGL).
- **AGL Height Uncertainty:** The potential margin of error in determining the antenna height in relation to the ground level.
- **Azimuth:** Horizontal angle of device installation as measured clockwise from north.
- Unmute the radio by setting the Radio Control toggle to **Connected**.



### NOTE

For safety, radios are muted by default. After you verify the base node is functioning, you must mute the radio until after the base node is installed on site.

- Select **Save Config**.
- Mute the radio by setting the Radio Control toggle to **Muted**.

### Notes

- These values are reserved and you can't use them as any part of a G1 network:
  - Reserved VLANs: 4092, 4093, and 4094
  - Reserved IP subnets: 172.27.0.0/18, 10.240.0.0/12
- The Data VLAN (optional but strongly recommended in a production environment) and the Management VLAN (optional) are on the data port. They must be separate VLANs.
- On the switch north of the base node, the IP subnet associated to the Data VLAN entering the base node's data port must be different from the In-band Management IP subnet.
- Out-of-band management is optional. If you use it, you must configure it to use a different IP subnet as In-band management.
- You can't use DHCP for both In-band and Out-of-band management IP addresses.
- For DHCP with Option 82 to function properly the following must be true:
  - You must configure the client device to request an IP address via DHCP.
  - You must configure the base node to act as a DHCP relay and it must have the required sub-options, such as the Agent Circuit ID or Agent Remote ID configured. In a Tarana network, the Agent Circuit ID identifies the remote node, and the Agent Remote ID identifies the base node. In Tarana Cloud Suite (TCS), the Agent Circuit ID and Agent Remote ID are combined in a single control labeled Remote / Circuit Identifier Type, which can use either the MAC address or the serial number of the devices.
  - You must configure the DHCP server to accept and respond to DHCP Option 82. Because the base node defines the Option 82 values using lower case, configure the DHCP server accordingly.
  - For more about DHCP with Option 82, see the [G1 Administration Guide](#)
- These IP ports must be open in order to allow the base node to reach TCS:

- 443 (TCP for HTTPS)
- 53 (UDP for DNS)
- 123 (UDP for network time)

Also, the TCS URL(s) used by the G1 devices should be in a permit / allow list so all Tarana devices can connect to TCS.

- Once you've completed the initial deployment, don't use the web UI for configuration changes. Configuration settings in TCS overwrite web UI settings. To avoid misconfiguration, always use TCS once the device is registered and connected to TCS. TCS flags configuration mismatches with an alarm.

## CBRS Installations

For CBRS installations, a certified professional installer (CPI) is required to sign off on the installation parameters. Be sure the installer has edited their user profile in TCS to include the CPI-ID and CPI certificate.

The Operator must be configured with the FCC OR-ID and SAS information. Edit these parameters with TCS in Admin > Network Configuration.

When you configure the base node, the Cloud URL for CBRS installations is:  
`registration.trial.taranawireless.com:443`.

Use the device's Web UI to verify the latitude, longitude, and tilt (received from the GPS unit on the base node) and the height and azimuth. For CBRS installations, height should be measured above ground level (AGL) in meters. After this is done, the CPI enters their CPI-ID in its field and selects **Confirm**. The base node isn't able to access the spectrum until this is done.

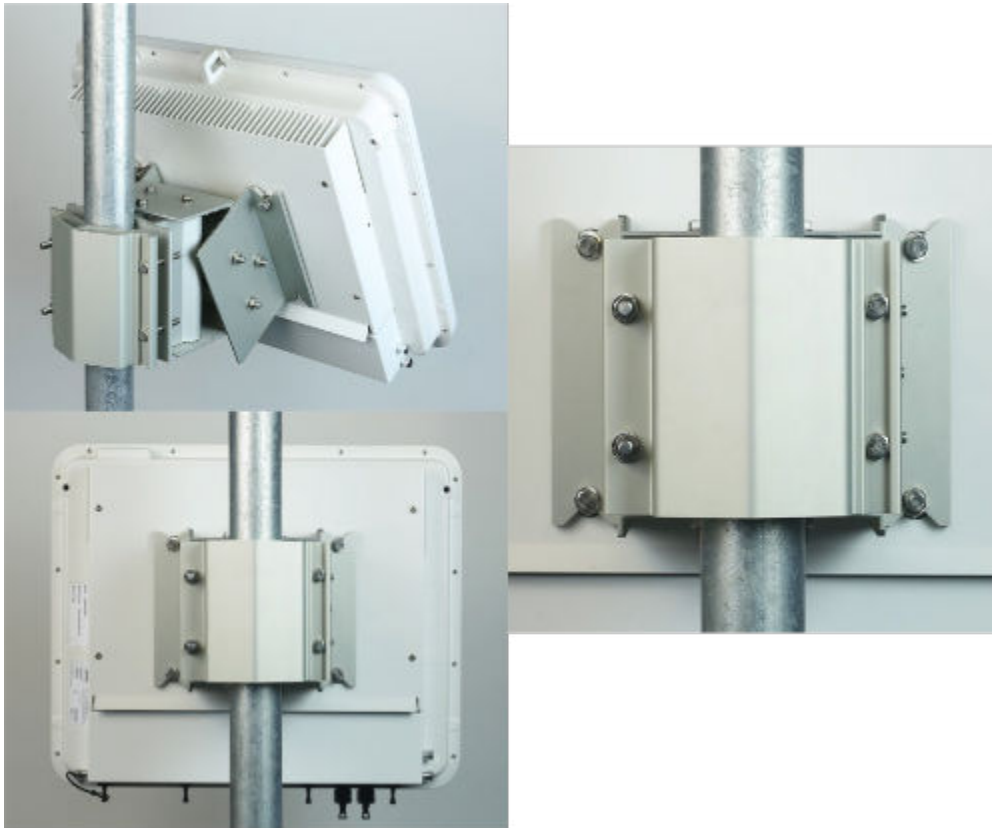
## Mount the Base Node

The base node mount is a saddle clamp that's adjustable in azimuth and tilt.



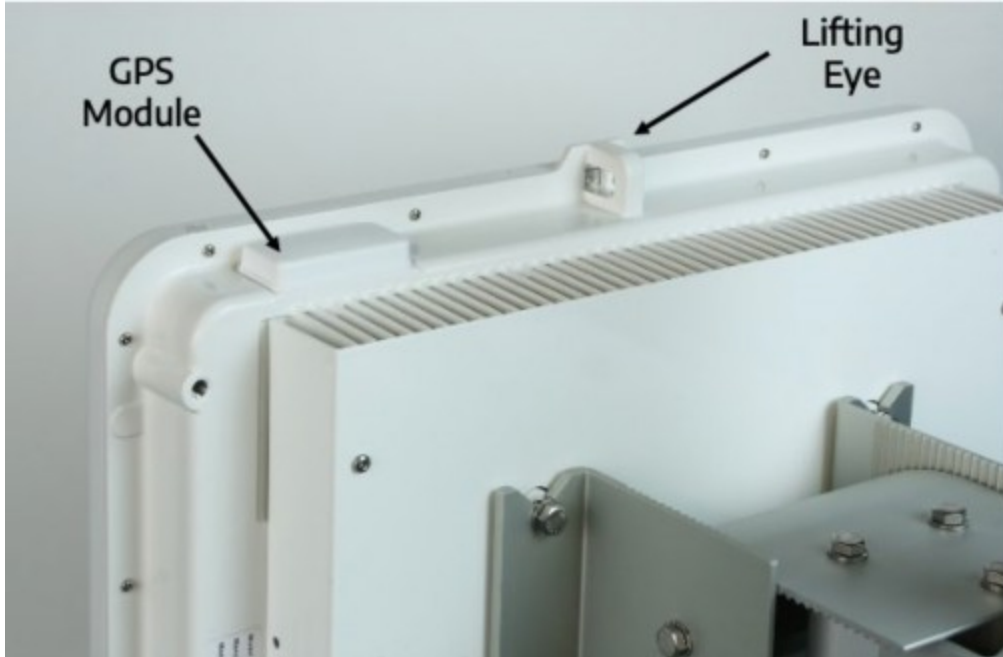
### NOTE

The hardware supplied for pole mounting and adjustment have a pre-applied anti-seize, dry film coating. There's no need to apply anti-seize lubricant to these fasteners.



### NOTE

The maximum load on the lifting eye is 100 lbs. (45 Kg).



## Assemble the Pole-Mount Bracket

1. Measure the pole diameter to determine which length of M8 bolt to use to hold the base node bracket to the pole.

The pole diameters listed below are Outside Diameter (OD), not Nominal Diameter (ND).

For poles 60.3 mm – 101.6 mm (2 3/8" – 3 1/2"), use (4) M8 1.25 x 80 mm bolts.

For poles 101.6 mm – 127 mm (3 1/2" – 5"), use (4) M8 1.25 x 120 mm bolts.

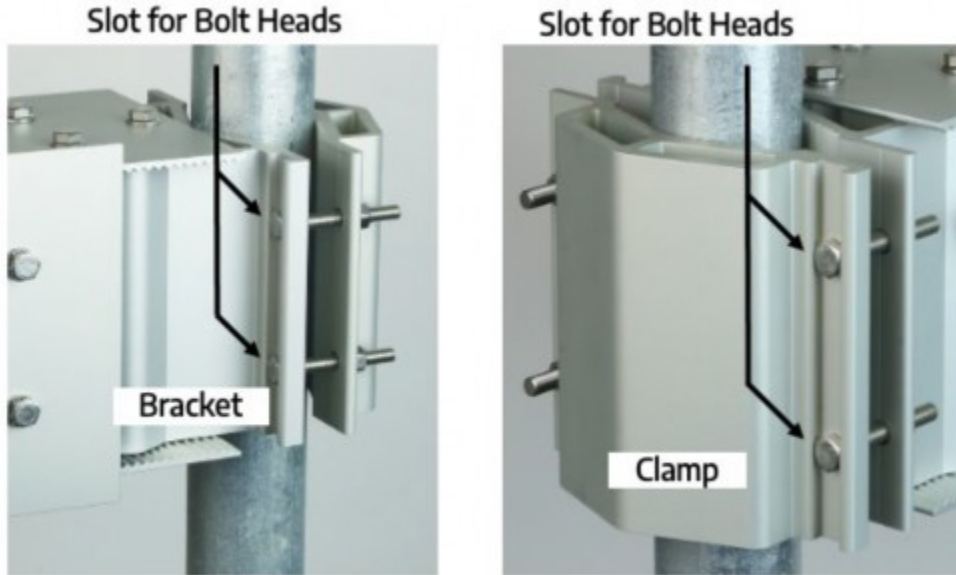


Measure pole diameter (95mm in this example)

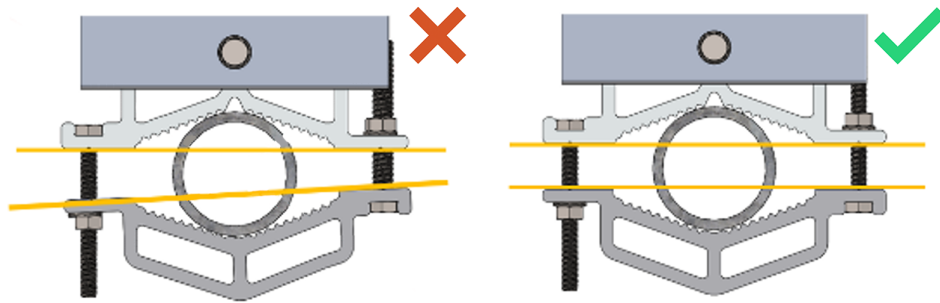
2. Install the base node bracket on the pole. There are slots for the bolt heads on both the bracket and the clamp.



3. Insert the bolts on the right side of the clamp and thread on the nuts.
4. Insert the bolts on the right side of the bracket and thread on the nuts.



5. Gradually engage (4) bolts ensuring clamp halves stay parallel to each other and are spaced evenly on either side of the clamp.

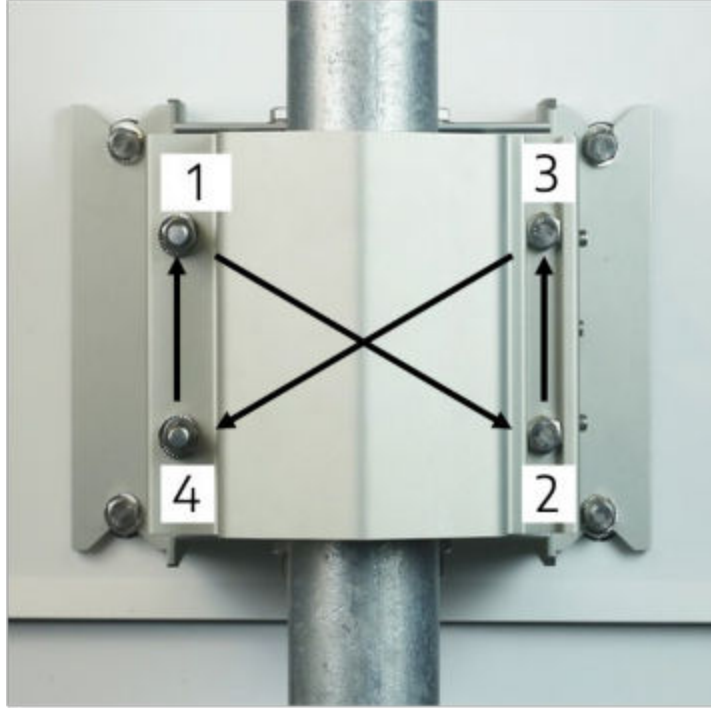


6. With the clamp in the final position, torque 4 bolts with incremental steps at approximately 40%, 70%, and 100% of full torque rating while ensuring the brackets stay parallel.

Follow the torque sequence 1-2-3-4 shown below to torque all bolts to values of approximately 40% (6 N-m/ 4.4 lb.-ft).

Continue with the same sequence for all bolts at approximately 70% (10 N-m/ 7.4 lb.-ft).

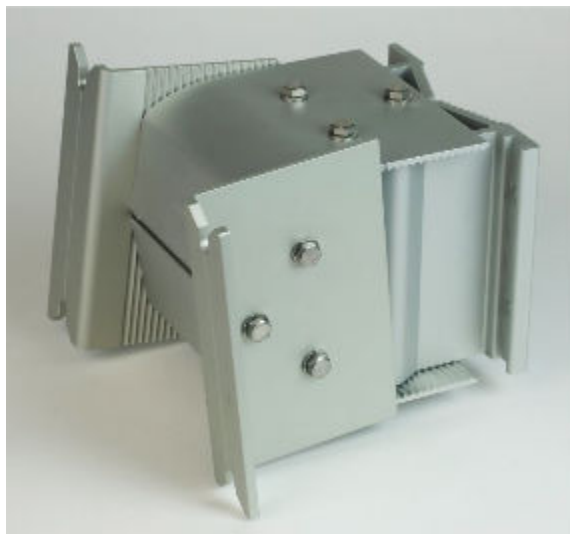
Repeat the torque sequence for all bolts until each bolt is stabilized at 15 N-m/ 11 lb.-ft).



## Adjust the Bracket Ears

Tarana recommends that you install the base node bracket to the pole before attaching the base node to the bracket.

1. Register the tilt adjustment to the upper limit. This ensures that the flange ears where the base node attaches are aligned properly.
2. Snug the tilt adjustment bolts enough to hold bracket ears firmly while mounting the base node.



Twisted Bracket Ears



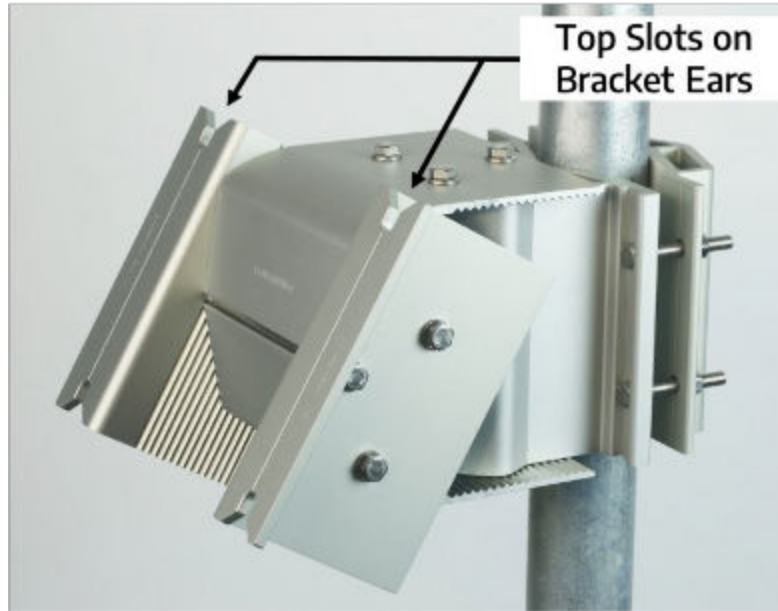
Aligned Ears in High-Tilt Position

## Attach the Base Node to the Bracket

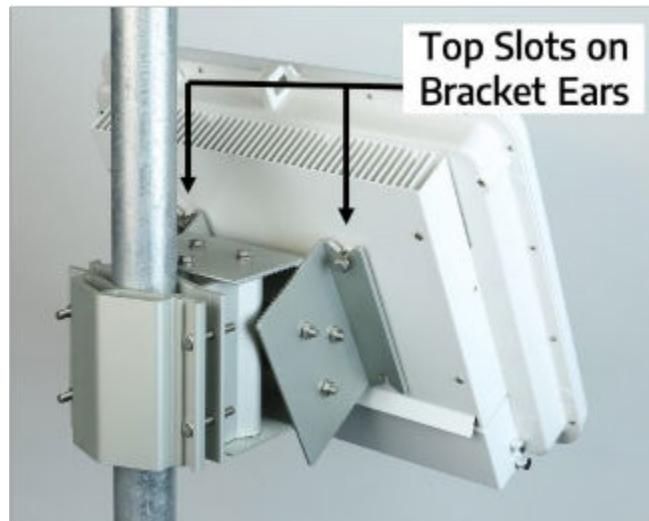
1. Install 2 M8 x 25mm bolts with wedge lock washers in the top holes on the back of the base node as shown below. Partially thread the bolts into the chassis halfway (~12mm). This provides a sufficient gap for the bolt heads and washer to slide into the top slots on the bracket ears.



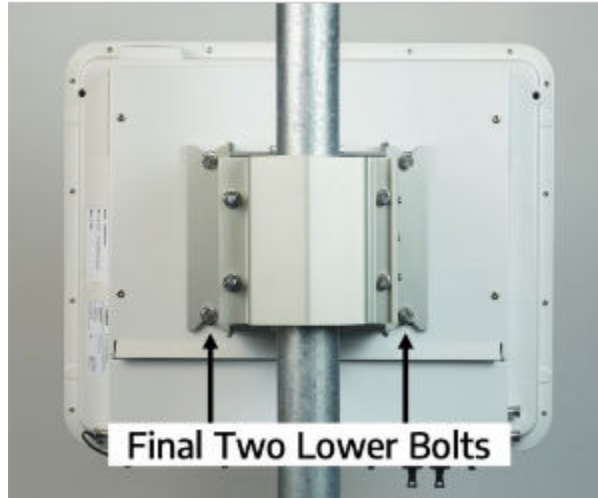
These 2 bolts slide into the top slots on the bracket ears.



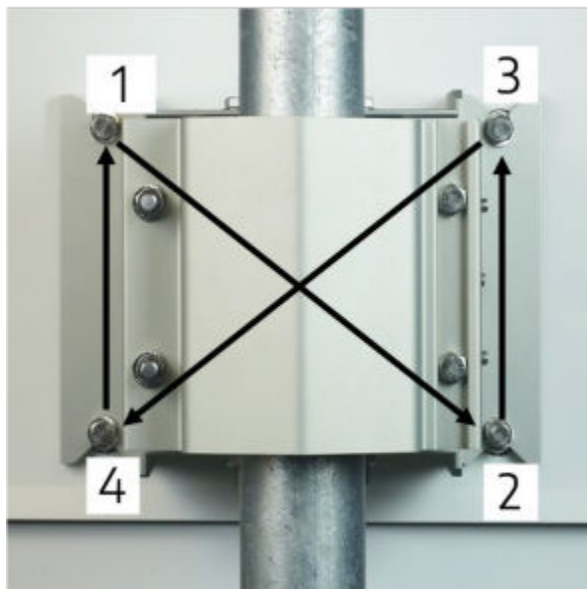
2. Slide the base node into the top slots in the bracket ears using the partially-installed bolts from Step 1. Make sure that the wedge lock washers are on the outside of the bracket and not between the base node and the bracket.



3. Install 2 M8 x 25 mm bolts with wedge lock washers in the two remaining lower slots on the bracket ears. Make sure that the wedge lock washers are on the outside of the bracket and not between the base node and the bracket.



4. Torque all 4 of these bolts using the same torque sequence demonstrated earlier.
  1. With the clamp in the final position, torque the 4 bolts with incremental steps at approximately 40%, 70%, and 100% of full torque rating.
  2. Follow the torque sequence shown to torque all bolts to values of approximately 40% (6 N-m/ 4.4 lb.-ft).
  3. Continue with the same sequence for all bolts at approximately 70% (10 N-m/ 7.4 lb.-ft).
  4. Repeat the torque sequence for all bolts until each bolt is stabilized at 15 N-m/ 11 lb.-ft.



## Aim Antenna

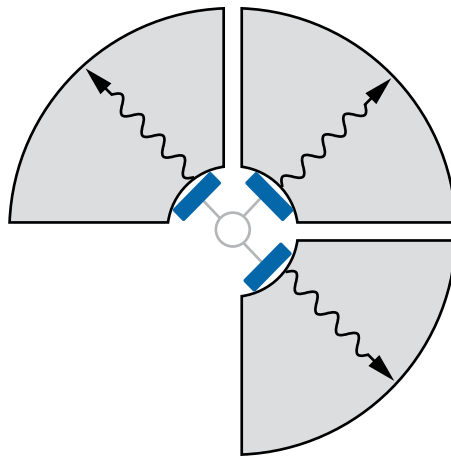
The base node has a 90-degree field of view. Adjust the azimuth as appropriate to the network design.



### NOTE

You must set and torque the azimuth before you adjust the tilt. If you do these steps in reverse, the torque setting for the tilt may not be accurate. This can cause the mount to lose tilt adjustment after some temperature cycles or vibration and lead to a tower climb or service disruptions.

This image shows a vertical asset site with three base nodes. Each base node and any connected remote nodes form a sector. The remote nodes inherit parameter values from the base node they're connected to.



## Adjust the Azimuth

Adjust the azimuth by loosening 3 bolts on top of the bracket assembly as seen below. Torque the 3 M8 x 180mm in a gradual triangular pattern.



### NOTE

The total adjustable azimuth is 60 degrees.

1. Follow a clockwise torque sequence to torque all bolts to values of approximately 40% (6 N-m/ 4.4 lb.-ft).
2. Continue with the same sequence for all bolts at approximately 70% (10 N-m/ 7.4 lb.-ft).

3. Repeat the torque sequence for all bolts until each bolt is stabilized at 15 N-m/ 11 lb.-ft.



### Adjust the Tilt

Adjust the tilt only after you've adjusted the azimuth.

1. Adjust the tilt to the desired angle using a digital level with < 0.2-deg accuracy.
2. Torque the 3 M8 x 180mm in a gradual triangular pattern.



#### NOTE

The total adjustable tilt is  $\pm 20$  degrees.

1. Torque the bolts in a clockwise pattern.
2. Torque all bolts to values of approximately 40% (6 N-m/ 4.4 lb.-ft).
3. Continue with the same sequence for all bolts at approximately 70% (10 N-m/ 7.4 lb.-ft).
4. Repeat the torque sequence for all bolts until each bolt is stabilized at 15 N-m/ 11 lb.-ft.

# Base Node Installation Guide





# Connect the Data Ports

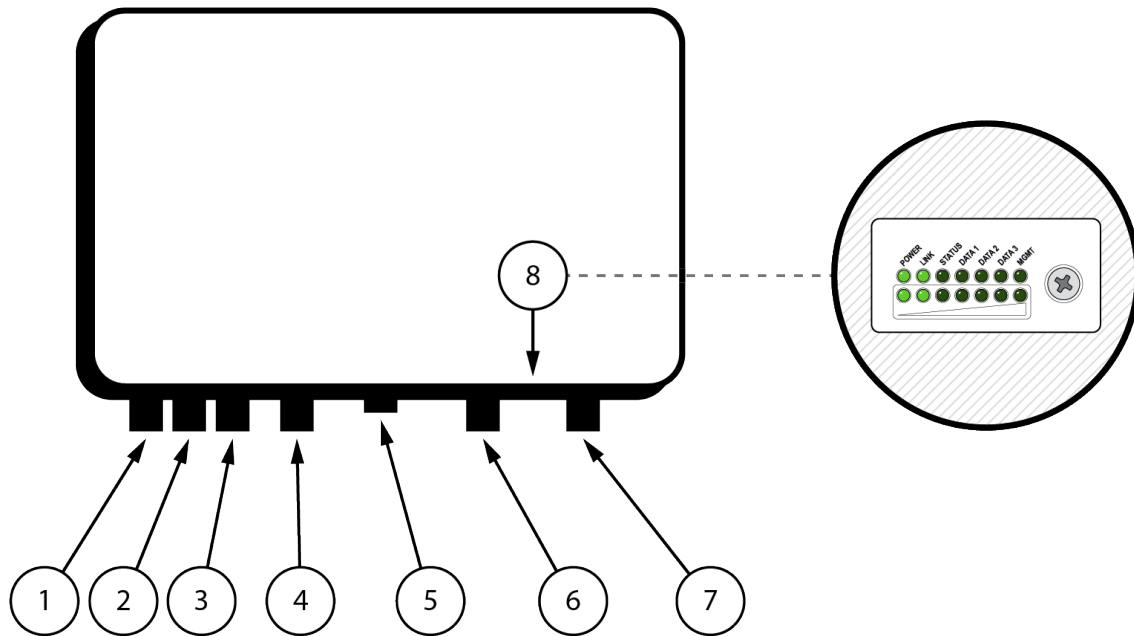
There are three options for a data connection: two SFP+ ports (DATA 1, DATA 2), and one Gbps Ethernet port (DATA 3). For in band management, the default IP address for these ports is 192.168.11.2. The default data VLAN is 2000.

For initial configuration and (optional) OOB management, an Ethernet connection on the MGMT port is required. The default IP address for this port is 192.168.10.2 with no VLAN.



## NOTE

Don't use the Reset button at this time.



Index	Description
1	Power
2	Data1 (SFP+)
3	Data2 (SFP+)
4	Data3 (Gbps Eth)
5	Ground screw hole
6	MGMT (Optional Gig Eth)

Index	Description
7	LED display and reset button
8	USB-A

## Connect Base Node Power

Tarana recommends that you install the physical connections to the base node after it's properly mounted and aimed and that you perform these steps in the order described. Refer to the diagram on the previous page.

1. Pre-assemble the Harting DC pigtail + upper lightning arrester with attached ground wire + Belden 5240F1 or equivalent + lower lightning arrester. Tarana recommends that you assemble and lab-test these items before installation onto the base node mounting site.
2. Install the ground wire (6 AWG) onto the base node enclosure.
3. Install the Harting DC pigtail assembly into the power port. You can use the LEDs on the bottom side of the base node to verify operation (see [Boot the Device \(page 45\)](#)).

If the device doesn't power on, make sure that the polarity is correct.

For on-site OOB management, follow these additional steps:

1. Pre-assemble the Harting RJ45 pigtail + upper lightning arrester + ground wire + shielded CAT5e/CAT6 + lower lightning arrester for OOB management connection. Tarana recommends that you assemble and lab-test these items before installation onto the base node mounting site.
2. Install the Harting RJ45 pigtail assembly into MGMT Gigabit Ethernet of the base node for OOB management.

## Ground the Chassis

Install the ground wire only after aiming and final torque of all related fasteners.

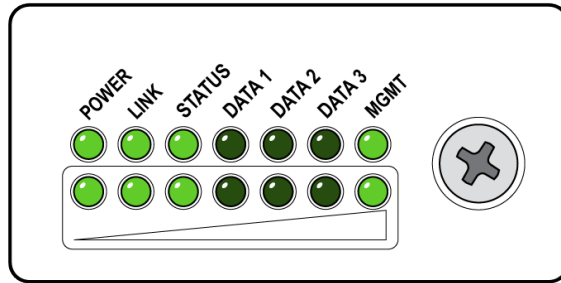
1. Attach the ground system to the chassis. There are 2 stainless M6 screws and ground lug provided in a bag taped to the base node radome. Use these to attach a 6 AWG (13 mm<sup>2</sup>) ground wire to the base node.
2. You must use the provided ground lug for the base node. Torque the screw to 6 N-m (4.5 lb.-ft). Make sure the ground wire doesn't interfere with antenna adjustment.

Additional local electrical codes and ordinances may apply to grounding. Compliance in this area is the responsibility of the installation company.



# Boot the Device

When you apply power, the base node goes through a boot and initialization process. This takes about 5 - 7 minutes. A set of LEDs on the bottom edge of the base node cycles through patterns and colors while this takes place.



At the end of this period, the LEDs show one of these normal operation states.

State	Power	Link	Status
Power off	Off	Off	Off
Startup <sup>a</sup>	Red (blinking)	Off	Off
Initial boot loader	Amber (solid)	Amber (solid)	Amber (solid)
Linux booting	Green (blinking)	Off	Off
Linux booted	Green (solid)	Any color or state	Off
Radio not initialized	Green (solid)	Off	Off
Radio initializing	Green (solid)	Amber (blinking)	Green (solid)
Waiting for GPS lock / spectrum allocation	Green (solid)	Red (blinking)	Green (solid)
Radio calibration	Green (solid)	Amber (solid)	Green (solid)
Operational (no remote nodes connected)	Green (solid)	Green (blinking)	Green (solid)
Operational (remote nodes connected)	Green (solid)	Green (solid)	Green (solid)
Radio muted (no link)	Green (solid)	Red (solid)	Any color or state
Factory reset	Amber (blinking)	Amber (blinking)	Amber (blinking)

<sup>a</sup>May indicate a hardware failure if the base node stays in this state for more than approximately 1 minute.



## NOTE

Do not use the base node's reset button.

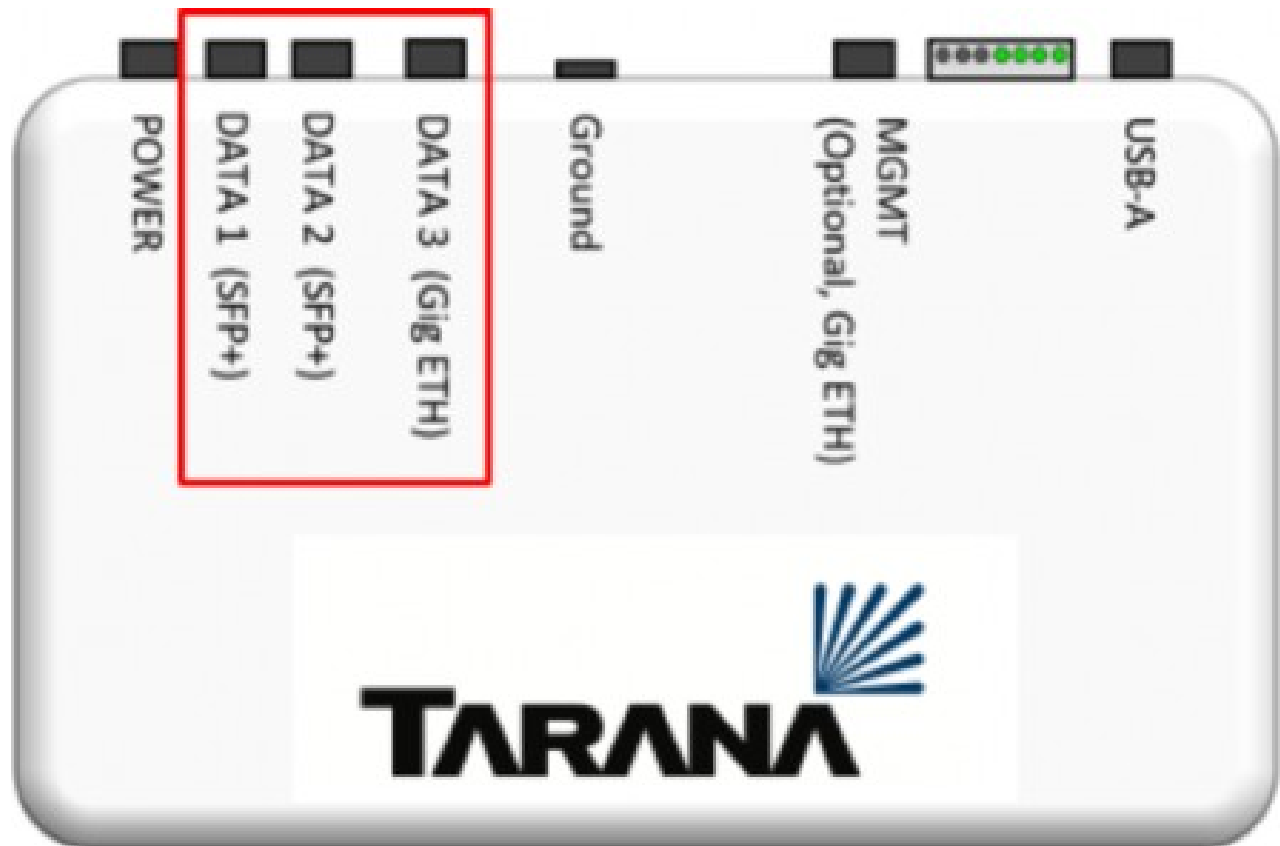
For more information about LED behavior see the section on Device LED Lights in the [G1 Administration Guide](#).

## Connect Management Paths Using Web UI

In-band Management refers to managing the base node using the physical data ports (DATA1, DATA 2, DATA 3). You can access the base node's web UI by using the default in-band management IP of 192.168.11.2 in a browser as `https://192.168.11.2`

An in-band management IP address can also be assigned statically or by a DHCP server if there is a DHCP server on the network. DHCP is disabled by default and you must enable it through the web UI. If DHCP is used for the in-band management IP address, you must use a static address for the out-of-band management address (if used).

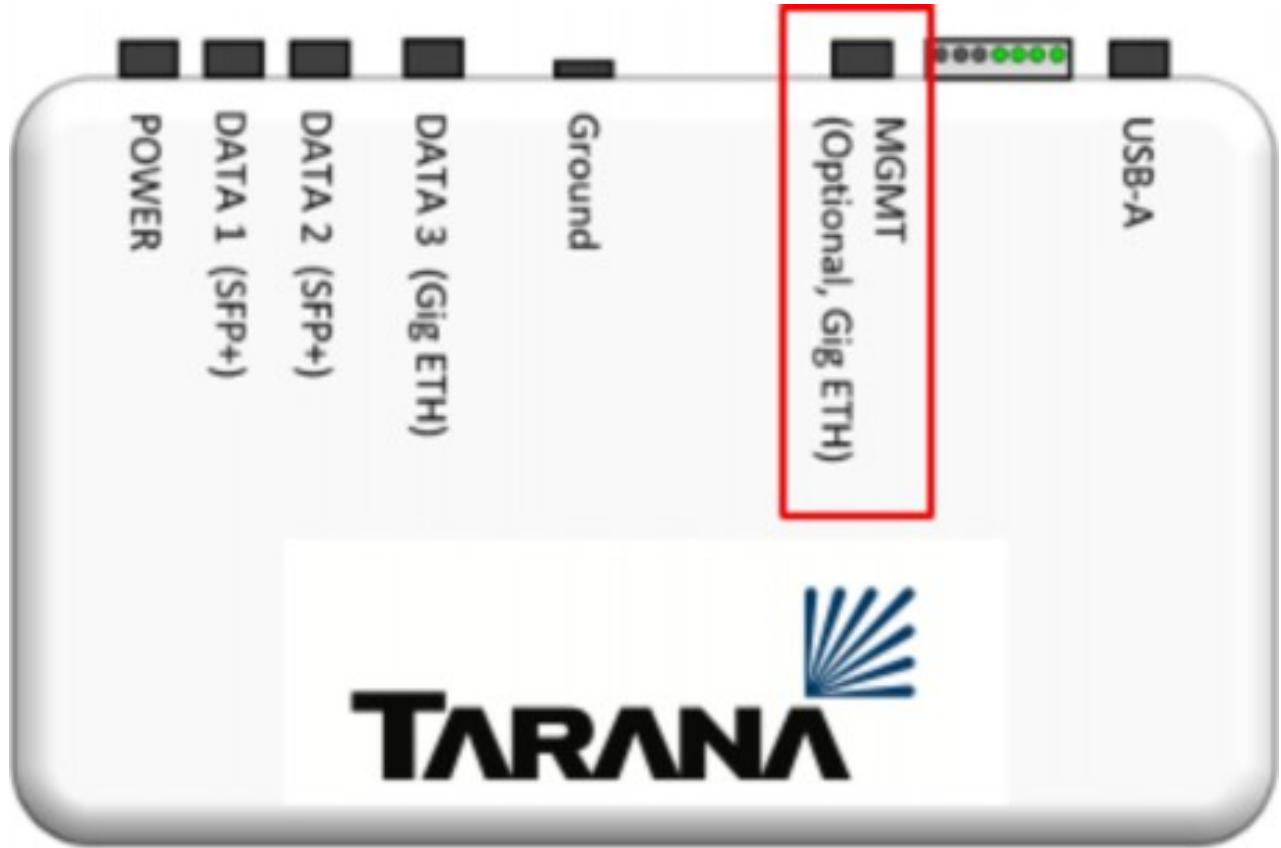
Optionally, you can assign in-band management traffic to a VLAN.



Out-of-Band (OOB) Management refers to managing the base node using the physical MGMT port. You can access the base node's web UI by using the default OOB IP of 192.168.10.2 in a browser window as `https://192.168.10.2`.

An OOB management IP can also be assigned statically, or by a DHCP server if there is a DHCP server on the network. DHCP is disabled by default and you must enable it through

the web UI. If DHCP is used for the out-band management IP address, a static address must be used for the in-band management address.



# Verify Base Node Connection to Tarana Cloud Suite (TCS)

To verify the base node is accessible from TCS, use an Internet connection external to the base node. This can be done from the NOC.



## NOTE

The base node communicates to TCS across Data Port 1, 2, or 3. One of those ports must be connected to the Internet for the base node to contact TCS. Data Ports 1 and 2 are 10 Gbps only. Data Port 3 is 1 Gbps only.

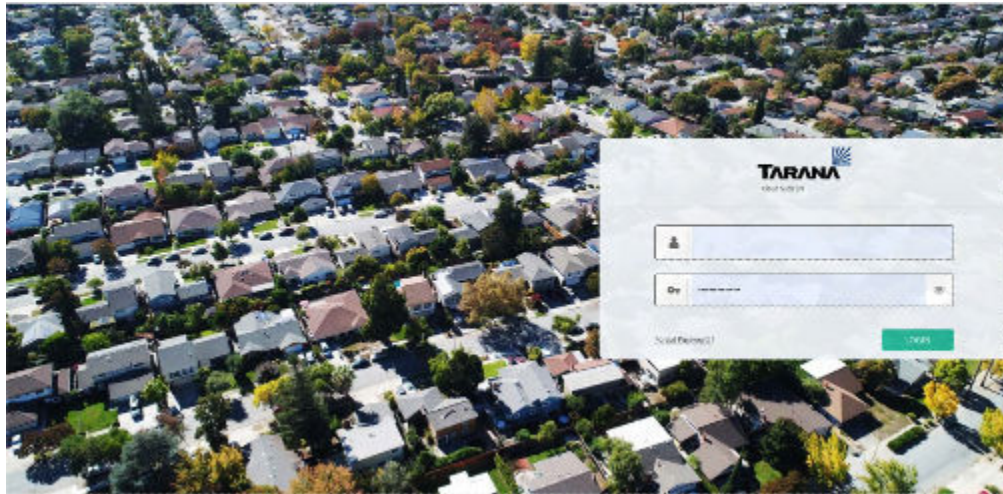
1. Log in to the Tarana Cloud Suite (TCS) using the username and password provided by the network administrator and the appropriate URL:

For 5 and 6 GHz operation:

<https://portal.cloud.taranawireless.com>

For 3 GHz / CBRS operation:

<https://portal.trial.cloud.taranawireless.com>



2. Select **Devices** in the left navigation pane and select BN to view the list of base nodes.
3. Verify the base node is online as indicated by its Serial Number in green text.



# Base Node Installation Guide

Serial Number	Hostname	Software Version	Boot Reason	System Up... (d h m s)	First ...	Mgmt IP	Notes
S001T1182705...	Config1-Se...	2.100.004...	Warm Boot	0d 8h 48m 49s	26 Apr 2...	192.168.1...	
S126F2224005...	sector10	1.911.001...	Warm Boot	19d 21h 8m 8s	18 Apr 2...	192.168.1...	



## NOTE

If the base node doesn't appear in the Devices page, it may not have been assigned to a Sector in TCS. Under Admin > Network Configuration, check if this base node is listed in the BN Devices: Unassigned folder. The base node must be assigned to a Sector before a remote node can associate to it. To make this change, you must be a TCS user with OP Admin role rights.

For more information on Network Configuration, see the [G1 Administration Guide](#).

# Unmute Radios

Unmute radios by selecting the **Configuration** icon in the upper right corner of the window. Select **Configure Network Parameters**. Select **Transmit**, then **Done** to enable the radios on this base node.

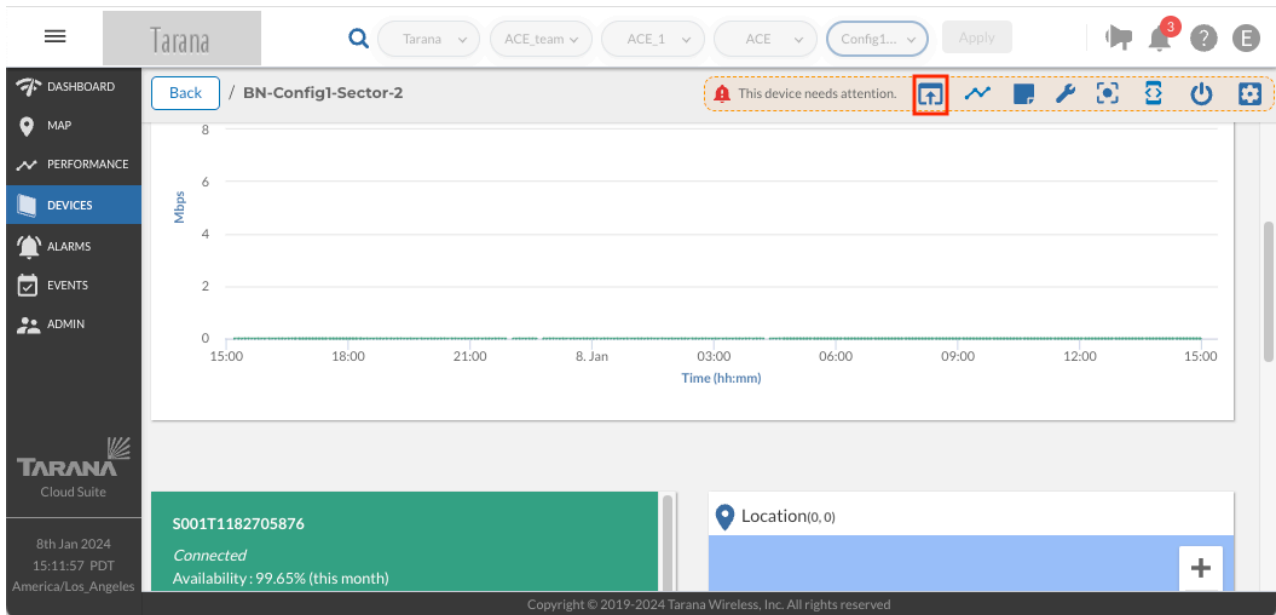
You must be logged in as a NOC Operator or OP Admin to perform this action.

# Check Device Diagnostics

If something isn't working as expected, check the Diagnostics page. This provides information. Other diagnostics are available from TCS. From the device page, select the **Diagnostics icon** (🔧).

For more information about troubleshooting, see the Troubleshooting section in the [G1 Administration Guide](#).

From TCS, login to the base node's web UI. You must be logged in as a NOC Operator or OP Admin to perform this action.



# Beamwidth Reference

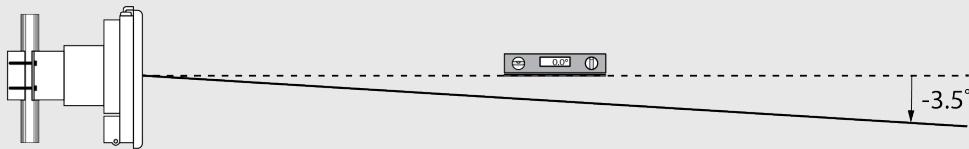
Refer to the following table of horizontal and vertical beamwidths for base nodes.

	3 GHz CBRS	5 GHz	6 GHz
3 dB Horizontal Beamwidth	68°	64°	60°
6 dB Horizontal Beamwidth	98°	98°	95°
3 dB Vertical Beamwidth	12.5°	8.5°	6.8°
6 dB Vertical Beamwidth	17°	11.8°	9.7°



## ELECTRICAL TILT

3 GHz base nodes have an electrical tilt of -3.5°. This means that when the 3 GHz base node is aimed parallel to the ground, the actual beam center is angled toward the ground by 3.5°.



Refer to the following table of horizontal and vertical beamwidths for remote nodes

	3 GHz CBRS	5 GHz	6 GHz
3 dB Horizontal Beamwidth	63°	58°	66°
6 dB Horizontal Beamwidth	95°	83°	97°
3 dB Vertical Beamwidth	17.6°	14°	12.1°
6 dB Vertical Beamwidth	24.3°	19.5°	16.4°

# Regulatory and Compliance Information

This section contains information regarding safe and correct base node installation.

You can find current declarations of conformance at the following URL:

<https://www.taranawireless.com/legal/#declarations-of-conformity>

## UNII Band Support

Refer to the following table to determine whether the device supports the following UNII bands in your regulatory domain. It applies only to 6 GHz base nodes. 5 GHz base nodes operate in UNII bands 1 and 3.

UNII Band	FCC (USA)	ISED (Canada)
UNII-3	Yes	Yes
UNII-4	No	Yes
UNII-5	Yes	Yes
UNII-6	No	Yes
UNII-7	Yes	Yes

## Regulatory Standard

Compliance Domain	Regulatory Standard
Safety	EN IEC 62368-1:2020+A11:2020, 3rd Edition  IEC 60950-22:2016 for use in conjunction with IEC 60950-1:2005, AMD1:2009, AMD2:2013  IEC 60529, Edition 2.2 - 2013-08  IEC/EN 60950-22
Radio Approvals	FCC Part 15 Subpart E §15.407  RSS 247  FCC Part 96  WINNF-TS-0122 Version V1.0.2
EMI and Susceptibility	ISED ICES-003 Issue 6 Class B  FCC 47 CFR FCC Part 15 Subpart B Class B  CAN ICES-3(B)/NMB-3(B)
RF Exposure	FCC 47 CFR FCC Part 1.1307  RSS 102

## FCC Statement (US Deployment)

This device complies with FCC Part 15 rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation.

The operation of this device is prohibited on oil platforms, cars, trains, boats, and aircraft.

Operation of transmitters in the 5.925 - 7.125 GHz band is prohibited for control of or communications with unmanned aircraft systems.

Modifications not expressly approved by Tarana Wireless Inc. could void the user's authority to operate the equipment.



### NOTE

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 or more 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.

This device complies with FCC RF exposure limits. This equipment should be installed and operated with a minimum distance between the radiator and user as defined in the Exposure Safety table. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

## Industry Canada Statement (Canada Deployment)

This Class B Digital apparatus meets all the requirements of ICES-003.

To satisfy IC RF exposure requirements for RF transmitting devices, a safe distance must be maintained between the antenna of this device and persons during device operation as referenced in the Exposure Safety table.

This device has been designed to ensure that radio frequency emissions are maintained within the band of operation under all normal operating conditions listed in this manual.

The operation of this device is prohibited on oil platforms, cars, trains, boats, and aircraft.

Operation of transmitters in the 5.925-7.125 GHz band is prohibited for control of or communications with unmanned aircraft systems.

This device complies with Industry Canada RSS standard(s). Operation is subject to the following two conditions:

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

The antenna height shall be determined by the installer or operator of the standard-power access point or fixed client device, or by automatic means. This information shall be stored internally in the device. Provision of accurate device information is mandatory.

The user manual shall also include instructions for the installer or user to input the antenna height as part of device registration.

Modification not expressly approved by Tarana Wireless, Inc., could void the user's authority to operate the equipment.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Dans l'ordre de satisfaire les réglementations des appareils qui émettent par radio, une distance minimum, spécifiée par la table d'exposition, entre les antennes et l'opérateur doit être maintenue durant les opérations de radio.

Ce dispositif a été conçu pour veiller à ce que les émissions de radiofréquences sont maintenus dans la bande de fonctionnement dans toutes les conditions normales de fonctionnement figurant dans ce manuel.

L'utilisation de cet appareil est interdite sur les plateformes pétrolières, les voitures, les trains, les bateaux et les avions.

L'utilisation d'émetteurs dans la bande 5,925 - 7,125 GHz est interdite pour contrôler ou communiquer avec des systèmes d'aéronefs sans pilote.

Cet appareil est conforme la norme d'Industrie Canada RSS (s). Son fonctionnement est soumis aux deux conditions suivantes:

- Cet appareil ne peut pas causer d'interférences, et.
- Cet appareil doit accepter toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

La hauteur de l'antenne doit être déterminée par l'installateur ou l'opérateur du point d'accès, sous tension standard, ou du dispositif client fixe, ou par des moyens automatiques. Ces informations doivent être stockées dans l'appareil. La mesure de la hauteur doit être obligatoirement précise.

Le manuel d'utilisation doit également inclure des instructions permettant à l'installateur ou à l'utilisateur de saisir la hauteur de l'antenne durant l'installation de l'appareil.

Tarana Wireless, Inc. n'approuve aucune modification apportée à l'appareil par l'utilisateur, quelle qu'en soit la nature. Tout changement ou modification peuvent annuler le droit d'utilisation de l'appareil par l'utilisateur.

## EU and UK Statement

### DECLARATION OF CONFORMITY



Operating Frequency Band: 5725 MHz – 5785 MHz

Maximum output power: 36 dBm/20 MHz

Hereby, Tarana Wireless Inc. declares that the 5.8 GHz Base Node is in compliance with Directive 2014/53/EU and UK Radio Equipment Regulations 2017 (SI 2017/1206).

The full context of the EU declaration of conformity is available at the following URL:

<https://www.taranawireless.com/legal/#declarations-of-conformity>

### Recycling

The crossed out wheeled bin symbol on your product and/or accessories means that the item is classified as electrical and electronic equipment. Such items should not be mixed



with general household waste, and must be taken to dedicated collection points at the end of their working life for proper treatment, recovery and recycling. This way you help save valuable resources and promote recycling of materials.



## Resolution 680: Brazil

Regulamento Anatel sobre equipamentos de Radiocomunicação de Radiação Restrita (Resolução nº 680): “Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados – Para maiores informações, consulte o site da Anatel <https://www.gov.br/anatel/pt-br/>.

## Base Node Homologation Country List

Base node model G1BN5ASI002

- Argentina (Enacom)
- Australia (RCM)
- Barbados (MIST)
- Botswana (BOCRA)
- Brazil (ANATEL)
- Burkina Faso (ARCEP)
- Cameroon (ART)
- Canada ISED (RSS-247)
- Colombia (CRC)
- Congo, Democratic Republic of (ARPTC)
- Congo, Republic of (ARPCE)
- Costa Rica (SUTEL)
- Dominican Republic (INDOTEL)
- Eswatini (ESCCOM)
- Ghana (NCA)
- Hong Kong (OFCA)
- Indonesia (SDPPI)
- Kenya (CAK)
- Liberia (LTA)
- Libya (ACI)
- Malaysia (SIRIM)

- Mexico (NOM-019 and NOM-208)
- Mozambique (INCM)
- Namibia (CRAN)
- New Zealand (RSM)
- Nigeria (NCC)
- Oman (TRA)
- Paraguay (CONATEL)
- Peru (MTC)
- Philippines (NTC)
- Saudi Arabia (CITC)
- Senegal (ARTP)
- South Africa (ICASA)
- Togo (ARCEP)
- UAE (TDRA)
- Uganda (UCC)
- Uruguay (URSEC)
- USA FCC (Part 15E)
- Venezuela (CONATEL)

Base node model G1BN6AHB012

- USA FCC (U-NII-3; U-NII-5/7 pending)

## CBRS Required Information

The Tarana base node must be installed by a certified professional installer (CPI) as defined in Section 96.39 and 96.45 of FCC part 96 requirements. The base node is Classified as a Category B CBSD (Citizen Broadband Radio Device), which requires the following information be recorded and uploaded as part of the CPI process per section 96.45.

The FCC regulates CBRS devices (CBSDs) and categorizes them as Category A or Category B devices. CBSD categories are defined in 47 CFR Part 96 Section 96.3:

<https://www.ecfr.gov/current/title-47/chapter-I/subchapter-D/part-96/subpart-A/section-96.3>

The FCC also records or monitors several parameters to manage the CBRS spectrum. The following table describes the parameters that are required for CBRS Category A and B devices.

Parameter	Description	Required for Category B Devices
Geographic Location	Latitude and longitude values of the device	Yes
Antenna Height (AGL)	Height of the installed device above the ground	Yes
CBSD Class	Refers to the Category (A or B) of the device	Yes
Requested Authorization Status	PAL (priority access license), a paid service with higher access priority or GAA (general authorized access), which is has no licensing costs but is a lower priority than PAL.	Yes
FCC ID	Unique identifier for CBRS transmitters, issued by the FCC	Yes
Call Sign (PAL Only)	Unique identifier for CBRS stations, issued by the FCC	Yes
User Contact Information	User name, email, phone number	Yes
Air Interference Technology		Yes
Serial Number	Device serial number	Yes
Sensing Capability		Yes
Limited to Outdoor Operation	Lower-power devices can operate indoors or outdoors. Higher-power devices cannot operate indoors and must operate outdoors only.	Yes
Antenna Gain	The gain of an antenna is related to its directionality.	Yes
Antenna Beam Width	The beam of highly directional antennas has two properties: the beam height is the vertical angle that contains the beam; the beam width is the horizontal angle that contains the beam.	Yes
Antenna Azimuth	The compass direction of the antenna in decimal degrees, where 0 degrees is true north.	Yes
Antenna Tilt Angle		Yes

# Warranty

Tarana warrants that commencing from the date of shipment to you (and in case of resale to you by a Tarana partner, commencing not more than 90 days after our original shipment), and continuing for a period of twelve (12) months, the hardware will be free from defects in material and workmanship under normal use. This limited warranty is not transferable. Your sole and exclusive remedy and our entire liability under this limited warranty will be, at our option, shipment of a replacement or a refund of the purchase price, if you notify us of the defect within the warranty period and return the hardware to us freight and insurance prepaid. Parts used in replacement may be new or reconditioned. Our obligations are conditioned upon the return of affected hardware in accordance with our then-current standard Return Material Authorization (RMA) procedures. This limited warranty does not cover (a) damage resulting from (i) use in other than the wireless transport applications defined in our product documentation; (ii) use not in accord with applicable spectrum regulations; (iii) handling, testing, installation, operation, maintenance, service, repair, alteration, modification, or adjustment outside of practices and conditions defined in our product documentation; (iv) other general misuse, accident, liquid intrusion, or neglect; (v) unauthorized radio connection to equipment not supplied by us; (vi) illegal or unauthorized alteration of software or firmware; (vii) acts of nature (such as lightning) or performance failure of other equipment (including electrical transients and over/under voltage); (b) scratches, discoloration, or other cosmetic damage to surfaces that do not affect operation; (c) normal and customary wear and tear; and (d) any product where serial number, revision level, part number, date code, warranty data, tamper-proof seals, or quality assurance decals have been removed or altered.

**DISCLAIMER:** Except as specified above, all express or implied conditions, representations, and warranties including, without limitation, any implied warranty or condition of merchantability, fitness for a particular purpose, non-infringement, satisfactory quality, non-interference, accuracy of informational content, or arising from a course of dealing, law, usage, or trade practice, are hereby excluded to the extent allowed by applicable law and are expressly disclaimed by us. To the extent an implied warranty cannot be excluded, such warranty is limited in duration to the express warranty period. This disclaimer and exclusion will apply even if the express warranty set forth above fails of its essential purpose.

Tarana products are not designed, intended, or certified for use in communication systems for, or relating to (a) weapons or weapons systems, (b) nuclear facilities, (c) air traffic control or other mass transportation systems, (d) life support systems or other medical devices, (e) applications where electrical sparks could trigger explosions or fires, or (f) any other systems, devices or applications in which the failure of the product to operate as intended may lead to death, bodily injury, or catastrophic property damage (each an “Unauthorized

Use”).. Many of such Unauthorized Uses would require specific industry certification which has not been sought or obtained for the Tarana products.

**LIABILITY.** Tarana will not be liable for any special, incidental, indirect, or consequential damages (including lost profits or property damage) arising out of or relating to the sale of the goods to you or your possession, installation, use, operation or repair of the goods, even if the goods are nonconforming, defective, infringing, delayed, or not delivered, and even if Tarana has been advised of the possibility of such damages. You agree to indemnify and hold us harmless from any claims, suits, demands and causes of action arising out of or relating to your possession, installation, use, operation or repair of the goods. Notwithstanding any other provisions of this document, in no event will our total liability in connection with or relating to the goods exceed the amount you have paid us for the goods.