

**Trimble Geodetic Antennas—  
A solution for every application**



 **Trimble**  
GNSS GEODETIC  
ANTENNAS



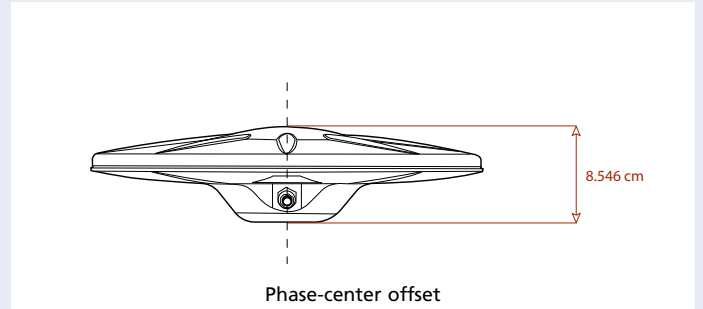
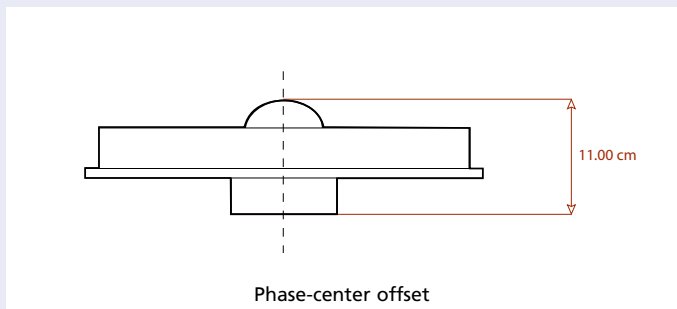
The choice is yours. Trimble provides two GNSS antennas for geodetic applications. Both solutions deliver long term performance with proven accuracy and reliability. No matter what your needs are, Trimble has an antenna that will work for you.

### TRIMBLE GNSS CHOKE RING ANTENNA

Minimum tracking elevation..... 0 Degrees  
 Practical tracking elevation..... <5 Degrees  
 Supported positioning signal bands..... L1/L2/L5/G1/G2/G3/E1/E2/  
 E5ab/E6/Compass  
 Supported SBAS signal bands..... WAAS, EGNOS, QZSS, Gagan,  
 MSAS, OmniStar  
 Phase-center accuracy..... 2 mm or better  
 Phase-center repeatability..... <1 mm  
 Maximum phase-center eccentricity..... .2 mm  
 Antenna gain..... 50 dB ±2dB  
 LNA features..... Advanced filtering to reduce interference by  
 high power out-of-band transmitters  
 LNA signal margin..... 13 dB  
 Supply voltage..... 3.5 V DC to 20 V DC  
 Supply current (maximum)..... 125 mA  
 Power consumption (maximum)..... .440 mW  
 Dimensions..... 38 cm diameter x 14 cm height  
 15 in diameter x 5.5 in height  
 Weight..... 4.3 kg (9.5 lb)  
 Element type..... Phase-ripple-tested Dorne & Margolin AIL C-146  
 Polarization..... Right-hand circular  
 Axial ratio..... .2 dB at Zenith  
 Voltage Standing Wave Ratio..... 2.0 maximum  
 Left-hand circular polarization (LHCP)..... 20 dB minimum  
 RoHS compliant..... No  
 Multipath mitigation technologies... LHCP rejection and 1/4 wave choke  
 ring ground plane  
 Ground plane design..... JPL designed 1/4 wave choke ring  
 Coaxial connector..... N Female  
 External radome required..... 59314 available  
 NGS model available..... Yes  
 NGS model with radome available..... Yes  
 Shock rating... Demonstrated to survive a repeated 1 m (3.28 ft) drop  
 onto plywood over concrete (all edges)  
 Vibration rating..... 4.3 GRMS, random vibration profile;  
 Z axis only  
 Humidity..... 100% humidity proof, fully sealed  
 Temperature  
 Operating..... -40 °C to 70 °C (-40 °F to 158 °F)  
 Storage..... -40 °C to 70 °C (-40 °F to 158 °F)  
 Mounting thread..... .5/8"-11 Female

### ZEPHYR GEODETIC 2 GNSS ANTENNA

Minimum tracking elevation..... 0 Degrees  
 Practical tracking elevation..... <3 Degrees  
 Supported positioning signal bands..... L1/L2/L5/G1/G2/G3/E1/E2/  
 E5ab/E6/Compass  
 Supported SBAS signal bands..... WAAS, EGNOS, QZSS, Gagan,  
 MSAS, OmniStar  
 Phase-center accuracy..... 2 mm or better  
 Phase-center repeatability..... <1 mm  
 Maximum phase-center eccentricity..... .2 mm  
 Antenna gain..... 50 dB ±2 dB  
 LNA features..... Advanced filtering to reduce interference by  
 high power out-of-band transmitters  
 LNA signal margin..... 13 dB  
 Supply voltage..... 3.5 V DC to 20 V DC  
 Supply current (maximum)..... 125 mA  
 Power consumption (maximum)..... .440 mW  
 Dimensions..... 34.3 cm diameter x 7.6 cm height  
 13.5 in diameter x 3 in height  
 Weight..... 1.36 kg (3 lb)  
 Element type..... Dual four-point-feed patch  
 Polarization..... Enhanced right-hand circular  
 Axial ratio..... .2 dB at Zenith  
 Voltage Standing Wave Ratio..... 2.0 maximum  
 LHCP rejection at boresight..... 20 dB minimum  
 RoHS compliant..... Yes  
 Multipath mitigation technologies... LHCP rejection and resistive  
 ground plane  
 Ground plane design..... Trimble Stealth resistive  
 Coaxial connector..... TNC Female  
 External radome not required..... 46291-00 available  
 NGS model available..... Yes  
 NGS model with radome available..... Yes  
 Shock rating..... MILSTD-810-F to survive a 2 m (6.56 ft)  
 drop onto concrete  
 Vibration rating..... MIL-STD-810-F  
 on each axis  
 Humidity..... 100% humidity proof, fully sealed  
 Temperature  
 Operating..... -40 °C to 70 °C (-40 °F to 158 °F)  
 Storage..... -40 °C to 70 °C (-40 °F to 158 °F)  
 Mounting thread..... .5/8"-11 Female



Trimble geodetic antennas mitigate multipath in different ways. Both provide the accuracy and performance required for the most rigorous applications.

## **TRIMBLE GNSS GEODETIC ANTENNAS— NOW YOU HAVE A CHOICE**

### **TWO PROVEN ANTENNAS TO ACHIEVE GEODETIC ACCURACY AND LONG-TERM PERFORMANCE**

Critical to the value of any GNSS network are the antennas that keep constant watch on GNSS satellite signals. Trimble geodetic antennas provide network operators with the assurance of long-term operation and unsurpassed performance.

Trimble offers two styles of antennas designed for geodetic applications—the Trimble Zephyr Geodetic 2 Antenna and the Trimble GNSS Choke Ring Antenna. Both options are proven to deliver the exacting performance that network operators demand to ensure long-term success. In addition, two unique antenna designs provide the flexibility to reach a wide range of operational goals.



*Trimble GNSS Choke Ring Antenna*



*Trimble Zephyr Geodetic 2 Antenna*

## **SETTING THE GEODETIC STANDARD**

All Trimble GNSS geodetic antennas conform to strict standards of consistency and performance to deliver the best possible low elevation tracking.

Trimble geodetic antennas meet or exceed phase-center eccentricity standards of 2 mm, and offer industry-leading multipath mitigation. Trimble's geodetic-quality antennas maximize positioning performance and consistency through tightly-controlled manufacturing practices, extensive testing and innovative engineering.

## **WHICH ANTENNA IS RIGHT FOR YOU?**

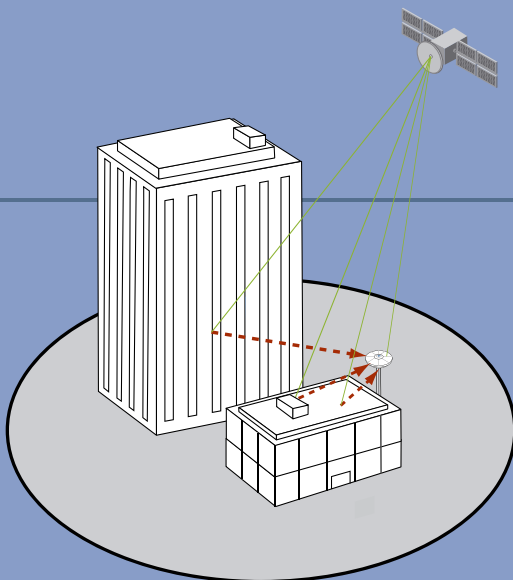
The choice of what kind of antenna you ultimately choose is driven by your operational needs. Depending upon your priorities, it may become clear that one antenna style is a better fit for your particular application. For example, are you running a network or performing a geodetic campaign? Does an external organization dictate the antenna style that you must use? Are size and weight important considerations for installation or long-term deployment? Although there are many different factors to consider and evaluate before making this important decision, Trimble has a solution that will meet your precise needs.

## TRIMBLE GNSS CHOKE RING ANTENNA

Originally conceived in the mid 1980s, the choke ring's ground plane has been widely adopted by the scientific community. The Trimble GNSS choke ring ground plane uses the Jet Propulsion Labs (JPL) design, which is considered the standard of scientific geodetic antenna ground planes. In addition to updating the electronics to improve low-noise amplification and GNSS tracking, Trimble has modernized the GNSS choke ring antenna so that it can track all existing and proposed public GNSS constellations. These include GPS, GLONASS, Galileo and Compass.

The Trimble GNSS Choke Ring antenna includes a Trimble-exclusive Dorne & Margolin quad-dipole element. A standard by which all other geodetic antennas are judged, the D & M element serves as the control in published relative antenna models. The design is also proven to offer excellent long term stability.

To ensure the best possible performance, Trimble requires that the element manufacturer conduct supplemental performance testing and provide proof of passing on all Trimble GNSS Choke Ring antenna elements. As a final step to guarantee geodetic performance, all assembled choke ring antennas undergo additional Trimble-exclusive precision rotation testing to verify a phase-center eccentricity of no more than 2 mm. Every Trimble GNSS Choke Ring antenna comes with a certificate displaying the rotation test results specific to that antenna.



## TRIMBLE ZEPHYR GEODETIC 2 ANTENNA

In the years following the launch of the choke ring antenna, Trimble developed an alternative means to achieving geodetic-quality results. Design goals included increasing accuracy and eliminating the frequency-dependent ground plane design. First produced in 2001, the GPS-capable Trimble Zephyr Geodetic antenna is the high-performance result of these efforts.

Then, in 2006, Trimble released the next generation with the GNSS-capable Zephyr Geodetic 2 antenna. Consistently delivering phase-center eccentricities of less than 1 mm, the Zephyr Geodetic 2 antenna's performance guarantees that even in a large network, all stations will be capable of delivering accurate, repeatable measurements. This is not the only advanced feature of the Trimble Zephyr Geodetic 2 antenna—it also offers the unique Trimble Stealth™ ground plane. This resistive ground plane consumes unwanted signals before they can reach the receiving element and corrupt measurements. This modern, high-technology approach to multipath mitigation is more compact than the original choke ring design and allows for the use of an integrated, low-profile radome over the entire antenna element and ground plane assembly. The Trimble Zephyr Geodetic 2 antenna's design reduces wind loading and antenna weight so that a lighter mounting structure can offer geodetic-quality results while minimizing environmental impact.

Yet another benefit of the Stealth ground plane is its frequency-independent performance. It mitigates unwanted signals throughout the rapidly-expanding GNSS spectrum.

The Trimble Zephyr Geodetic 2 antenna is designed to receive all existing and proposed public GNSS signals, including GPS, GLONASS, Galileo and Compass. In addition, these antennas are used in the highest-accuracy IGS reference frame networks where only the best possible long-term performance is accepted.



## Proper Antenna Placement

Geodetic antennas are designed to provide accurate measurements even in imperfect conditions, but this does not mean that a geodetic antenna will give peak performance no matter where it is deployed. Therefore, selecting the best possible location for a reference antenna is very important because the measurements will be relied upon for many years.

## MANAGING MULTIPATH

The extended ground plane of a geodetic antenna is intended to stop all multipath signals that come from near or below the horizon. These unwanted signals often reflect off of more than one surface and many have right-hand circular polarization (RHCP) characteristics that the antenna will readily accept. With a conventional metal disk ground plane, unwanted signals can actually strike the top of the ground plane, or its edge, at a shallow angle. Those signals then propagate along the surface of the plane and are easily conducted directly into the receiving element. This is called a surface wave. An effective geodetic ground plane must block below-horizon signals from entering the element while also prohibiting surface waves.

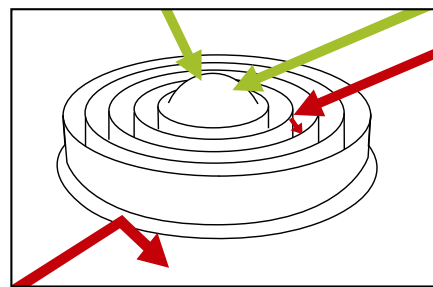
Trimble's JPL-designed choke ring and Stealth ground planes both accomplish these tasks, but in very different ways. The

choke ring antenna reflects signals that come from below. For signals that would otherwise be captured as surface waves, the choke ring draws these signals into the choke channels where they repeatedly reflect and encounter other reflected signals until they lose all energy or are reflected away from the receiving element.

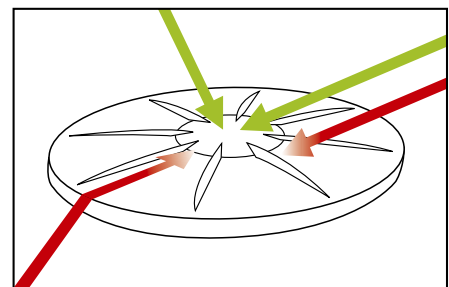
The Trimble Stealth ground plane uses electrical resistance rather than frequency-tuned rings to keep unwanted signals from reaching the antenna element. With its resistive ground plane, signals that strike the plane from any direction are drawn into the Stealth plane. Here, they encounter increasing electrical resistance, which rapidly converts their radio energy into tiny amounts of harmless heat. The signals lose all energy before they can reach the element and cause interference.

### GROUND PLANES AND MULTIPATH SIGNALS

- Signals striking at shallow angles attempt to create surface waves
- Signals from below the horizon must be eliminated



1) Choke Ring weakens multipath signals



2) Zephyr Geodetic 2 consumes multipath signals

Desirable signals are shown in green; undesirable signals are shown in red.

The following are very basic requirements for an antenna installation. Note that some governing bodies require significant additional features in an antenna monument and its location.

- The antenna mount must be stable in changing weather conditions and temperatures. By definition, a reference antenna should not move.

- The antenna sky view should be clear to the horizon within a 100 m radius to reduce multipath signal interference.
- The antenna should be a minimum of 1.5 m above nearby signal reflectors to reduce multipath signal interference.
- There should not be any high-power transmitting antennas within 300 m to prevent RF interference.



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