

# GPS Antenna Installations Best Practice



## GPS Installation Excellence

### Introduction

Global Positioning System (GPS) signals are now extensively used in many Positioning, Navigation and Timing (PNT) applications. Critical infrastructure, in particular, often utilises GPS signals and whether this is for testing, timing or repeating the GPS signal inside a building, this necessitates fixed antenna installations outside buildings or cabinets.

### Highly Specialised Skill

Chronos has been installing GPS antennae for many years with thousands of installations worldwide. One outcome from the [SENTINEL](#) research project, was a



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document drawing on this expertise entitled 'Criteria for the Installation of GPS Antenna on Static Infrastructure'. GPS installations are a highly specialised skill and this Application Note highlights the key features of best practice, illustrating this with some extreme examples of bad practice.

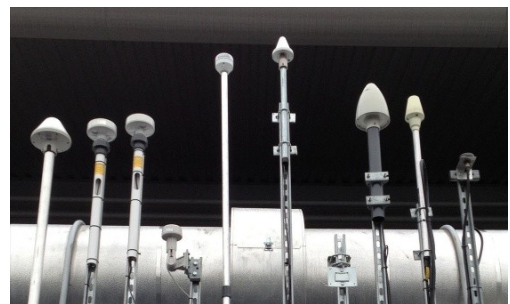
### Antenna Location

Since the 32 GPS satellites are approx. 12,000 miles away in space it seems obvious that GPS antennae should be mounted with a clear 360° sky view and well away from each other. However this simple requirement is often ignored resulting in degraded performance.

The case for 360° view is obvious; the case for mounting too close together less so. Externally mounted antennae are subject to extreme weather conditions ranging from intense heat to rain and snow.

### Degradation

Over time, the antenna housing or cables and connectors may degrade which can affect the way the antenna behaves. The antenna receives the native GPS signal from the sky, it is then amplified and passed to the receiver somewhere in the building. Sometimes, weather extremes will degrade the electronics resulting in the amplified signal being reflected back through the antenna and impacting other GPS antennae in close proximity. Nearby timing receivers may now start to exhibit relatively large time changes. These time variations could be many hundreds of nanoseconds. This can easily be avoided by ensuring that the antennae are placed well apart from each other and not as shown here.



GPS antennae placed too close together

Surprisingly, 360° sky view is frequently ignored. North facing walls are often used giving even less satellite view.



GPS antennae without 360° sky view

APPLICATION NOTE

# GPS Antenna Installation Best Practice

## Busy Roof Space

Busy roof space can also be a problem with other systems such as line-of-sight radio links and electrical installations including air conditioning equipment radiating relatively high power or wideband interference.



Photo courtesy of BT

## Pole Sharing



Installations need to be continuously checked for “squatters”. After you have installed your antenna on its shiny new pole—with 360° view, someone else may want to install some radio equipment. This example shows a 2.4GHz point to point link. Note lack of lightning protection.

## Antenna Cable Runs

Since the signal from the antenna is generally at GPS L1 (1.575GHz) cables deployed should be appropriate low loss typically LMR400 or equivalent and they should not be subjected to tight bends, clipped too tightly that the screen is crushed or run beside 3 phase or high voltage cables. Cable runs up to a few 100m have been successfully deployed by Chronos installers. Many companies have 17th Edition electrical installers. This qualification is not suitable for, or relevant to installing low loss RF cabling.

## Lightning Protection

Lightning protection is primarily for the protection of life and to minimise damage to connected equipment. Antennae should be mounted lower than the building

lightning conductor and directly connected to an approved ground point. Lightning arrester technology should be fitted to points of entry and exit to and from the building. Any external distribution boxes and lightning protection enclosures should be rated to at least IP66. These photographs show the devastating effect of poorly installed equipment. The antenna was mounted at the very highest point of a building and when lightning did strike, the entire installation completely vaporised!



## GPS Repeaters

Installing repeater technology is another area that must be undertaken by skilled personnel with RF gain and link budget experience; particularly where multiple repeaters are to be located near to each other such as in an aircraft hangar. If two repeaters are working from separate roof antennae, and installed too close to each other, the receiver might simultaneously receive the GPS signal from the separate locations. This is an example of “Meaconing” and the navigation receiver will become confused and may in certain circumstances cease to function.



GPS repeaters should never be installed outside where there is natural sky view of GPS satellites. Yet one international airport did just this to assist passenger bus location under a low terminal building. The asset management personnel in the control tower were horrified to see the bus “apparently” drive through two parked planes!

## GPS Repeater Licensing

Various documents have now been published regarding the use and installation of GPS repeaters.

Ofcom has established a light licensing regime in the UK and Chronos can assist customers who wish to deploy indoor repeaters with the licensing process to ensure that the repeater complies with the Wireless Telegraphy Act.

[Download](#)

Various documents relating to the Ofcom repeater standardisation process can be found on our web site [here](#).

## Installations Expertise

The Chronos Installation team has considerable experience in conducting site inspections and installing GPS equipment throughout the world for both military and civilian applications.

For expert advice on all aspects of GPS products and installations contact Chronos:

Email: [sales@chronos.co.uk](mailto:sales@chronos.co.uk)

Tel: +44 (0) 1594 862200