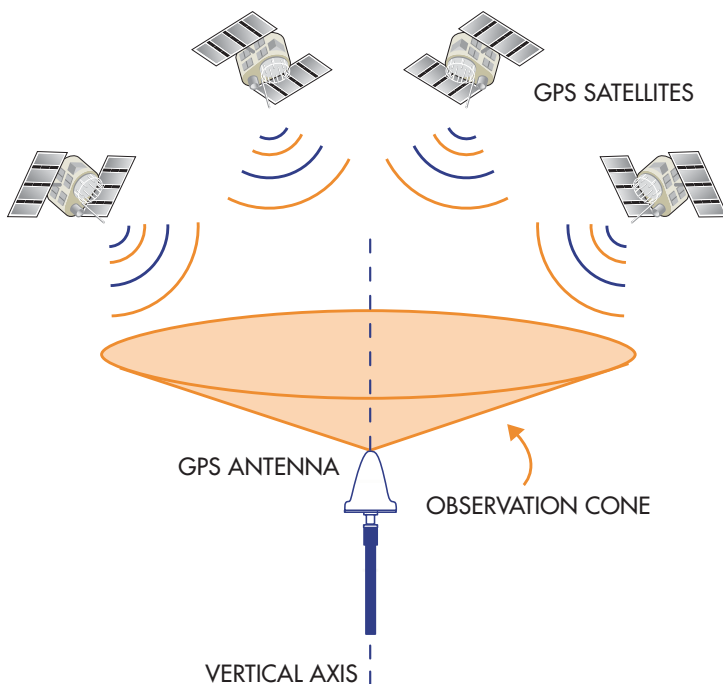


GPS Antenna Installation Guide – TF2

Introduction

This application note describes the main steps of a successful GPS antenna installation for an Epsilon Clock:

- Where to install the antenna
- How to evaluate the signal attenuation due to cables between the antenna and the GPS timing receiver
- How to choose cable type



Where to Install the GPS Antenna

The antenna must be located in place with direct view of GPS satellites.

Usually the best place is on the roof with a clear view of the sky and free of obstructions such as other buildings. It is important to avoid proximity with high power transmitter which could radiate energy at GPS L1 frequency (1575.42 ±1.023 MHz).

Usually the exact coordinates of GPS antenna is unknown and the GPS timing receiver will determine this location automatically. In that nominal case a proper sky visibility is required: a vertical observation cone in open view of a semi-angle higher or equal to 65° (optimum at 85°) is recommended.

Note: Sometimes the antenna location is known with accuracy (± 1 m) and can be entered into the GPS timing receiver. In that case the sky visibility requirement can be reduced: a semi-angle higher or equal to 55° in open view is enough.

How to Evaluate the Signal Attenuation

Cables are required to connect antenna to GPS timing receiver. Two types of cables are mostly used. The cable attenuation is proportional to length. Typical attenuations at 1575 MHz are:

Cable Type	RG58 (KX15)	RG213 (KX4)
Attenuation	0.9 dB/m	0.35 dB/m

Once the cable path is defined between antenna and GPS timing receiver the length is estimated and the attenuation as well. Epsilon Clock standard cables are (with typical attenuation, connectors included for 0.5 dB):

Cable Length	Cable Type (& Attenuation)	
	RG58/KX15	RG213/KX4
10m	9.5 dB	4 dB
25m	23 dB	9.5 dB
50m	No Cable	18 dB
100m	No Cable	35.5 dB

Furthermore, we strongly recommend to protect the GPS timing receiver with lightning protection. This protection must be installed at the cable entrance into the building with a proper earth/ground connection. The lightning protection attenuation is typically 1 dB (see our Application Note: GPS lightning protection.)

How to Choose Cable Type

To ensure correct GPS signal reception, the overall system of antenna/cable/protection (and line amplifier/splitter, if used) requires a relative gain that must be higher than 15 dB and preferably less than 30 dB to avoid signal saturation.

The gain at the receiver is the sum of :

- Antenna gain (G1)
- Line amplifier gain, if any (G2)
- Lightning protection loss (G3)
- Cable losses (G4)
- N-N adapter loss, if used (G5)



Line Amplifier



Lightning Protection

Then global gain of installation must be $15 \text{ dB} \leq G1 + G2 + G3 + G4 + G5 \leq 30 \text{ dB}$

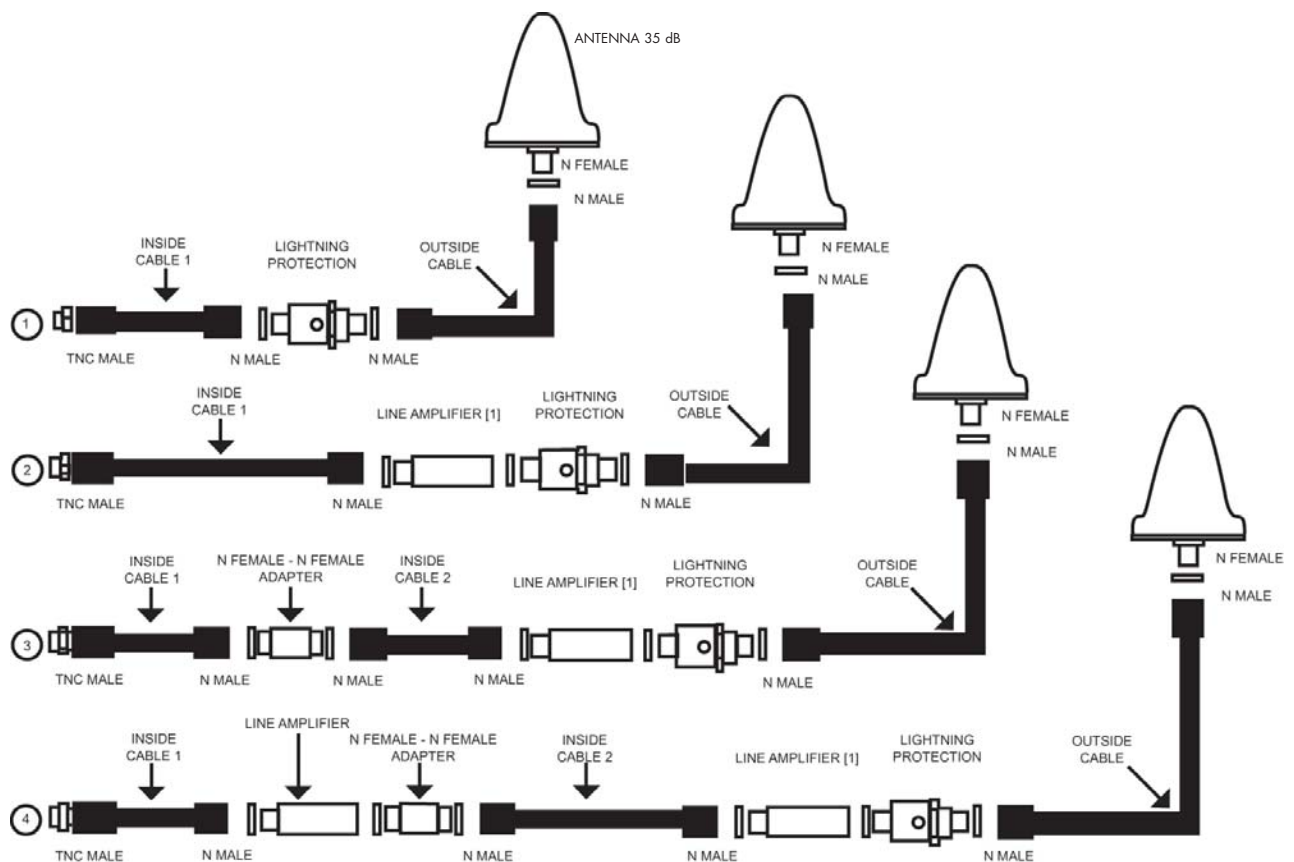
G1 values: Antenna recommended by Spectracom: $G1 = +35 \text{ dB}$

G2 values: If one line amplifier: $G2 = +23 \text{ dB}$

G3 value: With recommended and lightning protection: $G3 = -1 \text{ dB}$

G4 values: Usually 2 or 3 cables are required as shown in drawing below. Depending on cable type and possible use of line amplifier, different combinations of standard cables proposed by Spectracom can be used while above equation requirement is met. The cable connector type (N male or TNC male) depends on the mating connector of the accessory (N female) or GPS timing receiver (TNC female).

G5 value: If one N-N adapter is used: $G5 = -0.5 \text{ dB}$ (use of this adapter is explained in drawing below)



The recommended maximum bend radius is 100 mm (RG213) and 20 mm (RG58).

If no "lightning protection" device is used, for instance when a lightning conductor is already properly installed on the roof to protect the GPS antenna, the line amplifier may be installed outside the building directly connected to the antenna.



Description of 4 Installation Types

Total Cable Length						
Outside Building	Inside Building	Install Type	Outside Cable	Inside Cable 1	Inside Cable 2	Total Gain (dB)
10 m	10 m	1	RG58/KX15 10m N-N	RG58/KX15 10m N-TNC		15
10 m	25 m	1	RG213/KX4 10m N-N	RG213/KX4 25m N-TNC		21
10 m	50 m	2	RG58/KX15 10m N-N	RG213/KX4 50m N-TNC		29.5
10 m	75 m	3	RG58/KX15 10m N-N	RG213/KX4 50m N-TNC	RG213/KX4 25m N-N	19.5
10 m	100 m	2	RG213/KX4 10m N-N	RG213/KX4 100m N-TNC		17.5
10 m	125 m	4	RG58/KX15 10m N-N	RG213/KX4 25m N-TNC	RG213/KX4 100m N-N	25.5
25 m	10 m	1	RG213/KX4 25m N-N	RG58/KX15 10m N-TNC		15
25 m	25 m	1	RG213/KX4 25m N-N	RG213/KX4 25m N-TNC		15
25 m	50 m	2	RG213/KX4 25m N-N	RG213/KX4 50m N-TNC		29.5
25 m	75 m	3	RG213/KX4 25m N-N	RG213/KX4 50m N-TNC	RG213/KX4 25m N-N	19.5
25 m	100 m	4	RG58/KX15 25m N-N	RG213/KX4 50m N-TNC	RG213/KX4 50m N-N	21
25 m	125 m	4	RG213/KX4 25m N-N	RG213/RX4 100m N-TNC	RG213/KX4 25m N-N	25.5