ANTI-JAMMING GPS ANTENNA SYSTEM

GPS (Global Positioning System) is the first and most commonly used comprehensive satellite-based navigation system in the world. GPS basically use two main frequency bands that are L1 band for both military and civilian users and GPS L2 band for only military users.

GPS signals arrive to earth with very low power. Even low power transmitters can jam the GPS receiver that is located from transmitter with sufficient distance. By investigating Figure 1 that shows the Jamming-to-Signal Ratio vs Distance Between Jammer and Receiver, it can be stated that even a jammer with 10 mW output power can jam the GPS civil receiver from 1 km.

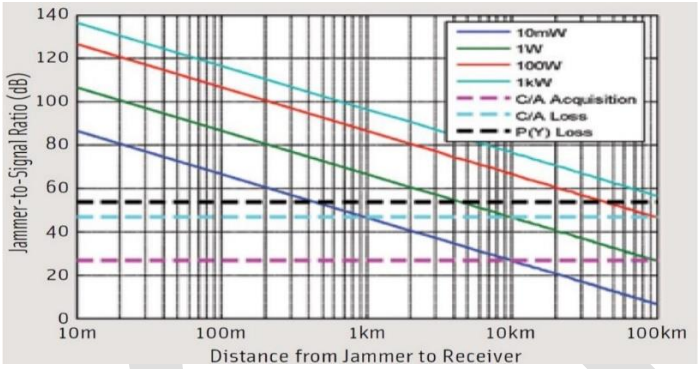

Figure 1 GPS jammer performance graph.

The increase in GPS jamming incidences threatens the positioning services in both civilian and military usage, seriously. Therefore, the protection from GPS jammers becomes crucial for almost all systems that need navigation.

The most effective and popular technique to overcome GPS jamming problem is suppression of GPS jammers by using array signal processing techniques. By using antenna arrays, a flexible gain pattern can be obtained after array signal processing as shown in Figure 2.

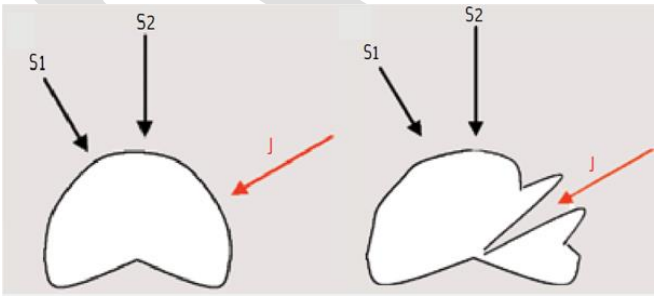

Figure 2 Single antenna pattern vs Antenna array pattern

RST has developed an Anti-Jamming GPS Antenna System that is composed of Active Antenna Array and Electronic Unit. System is not a GPS receiver. It works as a jamming protection unit that is employed in front of the GPS receiver. It takes GPS signals by 4 antennae and retransmits it from one processed channel.

The manufactured and qualified Active Antenna Array, which has a size of 17 cm x 17 cm x 5 cm and shown in Figure 3, is mainly responsible for the reception, amplification, and filtering of GPS L1 Band signals and make spatial filtering possible with array concept. It includes 4-element antenna array and RF front end with 33 dB active gain for each element on one PCB. Array elements are identical and have right-hand circular polarization. GPS Antenna System is robust to environmental conditions with hermetically sealed integrated radome and metallic box.

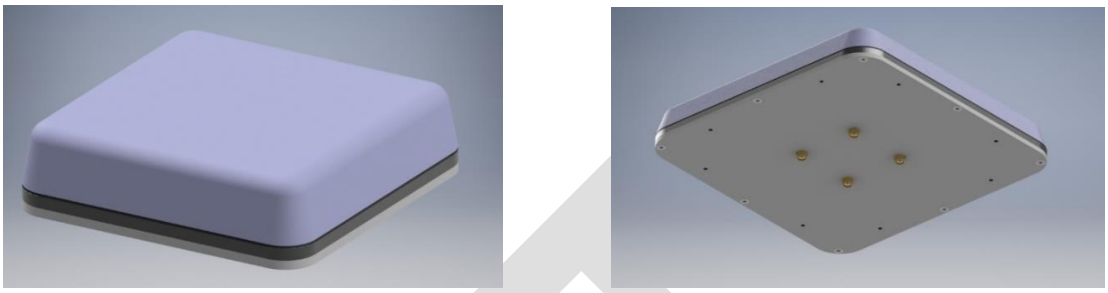

Figure 3 Anti-Jamming GPS Antenna System – Active Antenna Array (Left:Top, Right:Bottom).

The Electronic Unit, that is shown in Figure 4, is basically responsible for the array signal processing and beam steering. It has 4 RF input ports and 1 RF output port. When a jammer signal is detected a new array pattern is constituted and signal power levels at the output of Electronic Unit has power values according to new antenna pattern.

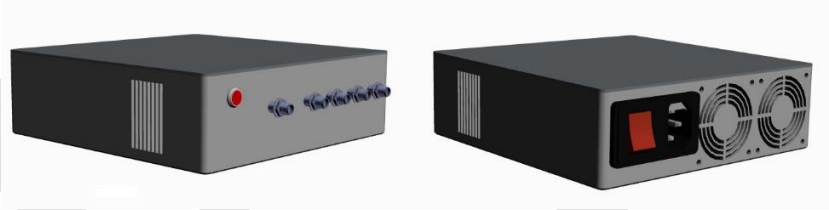

Figure 4 Anti-Jamming GPS Antenna System – Active Antenna Array (Left: Front, Right: Rear)

The Anti-Jamming GPS Antenna System provides 35 dB jamming suppression for jammers in GPS L1 band. By this way, standard GPS receiver immunity is significantly increased as shown in Table 1.

Table 1 Jamming Resistance Performance

	Maximum Effective Range (Standard GPS Receiver)	Maximum Effective Range (GPS Receiver with GPS Anti-Jamming Performance)
10 mW	1 km	18 m
1W	10 km	180 m
100 W	100 km	1.78 km
1 kW	316 km	5.62 km

In conclusion, the Anti-Jamming GPS Antenna System developed by RST is a very effective GPS jamming protection unit for L1 band. The main units of the system can either be used together or in separate fashion, with other vendor units. The System is designed according to mechanical requirements of various environments. With nearly 35 dB jamming suppression

performance, the jamming immunity of existing GPS receivers can be increased significantly and the continuity and reliability of positioning services can be protected.