

## Multi-Directional Antenna

Invented by: *Tasuku Teshirogi, Akira Okuyama*  
(Japan Radio Co., Ltd.)



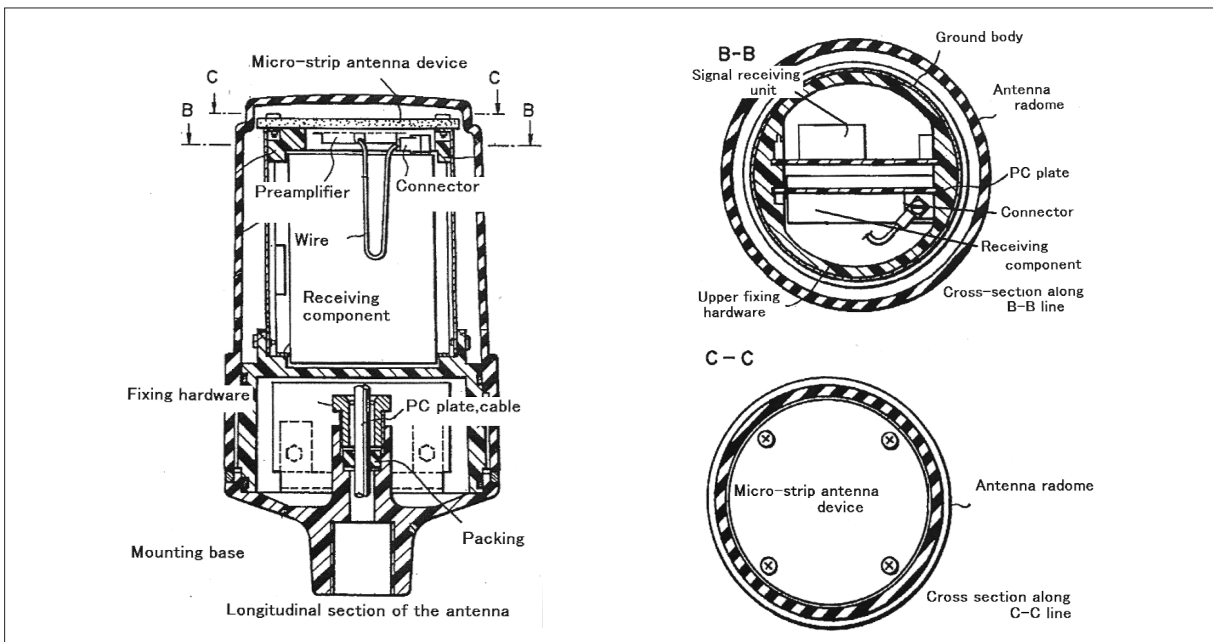
External view of the developed antenna

### Technological Outlines

This antenna has been developed to provide omnidirectional communication with orbiters such as GPS satellites.

It features a nearly flat antenna device and a conductive ground body extending from the mounting conductor for the antenna device in the opposite direction to the antenna itself.

Electric current generated in the mounting conductor and the antenna device runs along the ground body. The gain of the antenna beam (in the direction nearly parallel to the device) is thereby improved. Hemisphere-based omnidirectionality is also enabled, with gain maintained during operation, up to the desired elevation angle. In particular, this antenna is expected to contribute to the compact size and improved electric performance of an apparatus having this antenna in its transmitter or receiver.



## Background

CRL received the following inquiry in 1991 from JRC regarding the application of the micro-strip antenna(MSA) to GPS use on ships.

“MSA offers remarkable advantages over the conventional 4-wire helical type antenna in terms of cost. It is, however, difficult to maintain the necessary levels of gain during operation - up to – 20 degrees or so in elevation. Does CRL have any ideas as to how to solve this problem?”

An antenna with uniform directivity capable of receiving signals from the hemisphere of up to – 20 degrees or so in elevation while maintaining constant gain is required. This is because ships sway during the reception of GPS signals.

CRL thus proposed an antenna with the MSA on a metallic cylinder. Installing a receiver inside the cylinder, we have eliminated the preamplifier that was a necessary component of the conventional antenna and replaced the high-frequency cable with twisted-pair cable. The structure of the receiver has been successfully simplified and its manufacturing cost has been thereby reduced. JRC has made several prototypes of this antenna based on CRL’s initial concept and has subsequently experimented on prototypes, varying the relevant parameters. CRL’s radio reflection-free room was used in the test, and the prototypes showed better performance than expected. A joint patent application for this concept was filed by CRL and JRC.

## Commercialization

After the joint patent application for the concept was filed, JRC commercialized the antenna for use in GPS receivers in ships at home and overseas. The sales data of this MSA antenna is shown in the table below. More than 28,000 antennas have been sold, with sales totaling about 80 million yen, and with licensing fees reaching about two million yen a record high among CRL’s patent licensing products. Currently, CRL is considering a technology transfer that will result in future sales in excess of these amounts.

Year	1993	1994	1995	1996	1997	Total
Units	17,358	6,473	4,020	68	2	27,921
Sales(yen)	49,209,920	18,350,920	11,396,720	192,760	5,640	79,155,960
Licensing fee(yen)	1,230,248	458,773	284,918	4,819	141	1,978,899

Patents Obtained by CRL may be used for a fee.  
Please contact CRL Intellectual Property Group  
for information on patent licensing and technical  
data.