Demonstrator

The SoL receiver demonstrator comprises a 2x2 active antenna array, RF front-ends for GPS/Galileo L1/E1/E5a signal reception and baseband digital signal processing. The signals are down converted, digitized and processed in real-time mode. For further investigations on signal processing and beamforming, the signals are also recorded for off-line processing. The device will be able to demonstrate the direction of arrival estimation, adaptive beamforming and multipath/interference suppression as well as the resulting improvements for ranging, positioning and integrity determination.

The GALANT receiver has been successfully tested in the GALILEO Test Environment (GATE) in Berchtesgaden. Adaptive beamforming and interference suppression have been shown in real time with a mobile terminal.

Test of DLR's SoL receiver demonstrator

Technical data of receiver demonstrator

- Real-time operation
- Two by two E1/E5 antenna array
- Digital beamforming (after correlation)
- DOA estimation for satellite, spoofer, multipath and jammer
- Online calibration
- GPS/Galileo L1/E1 PVT
- GPS/Galileo L5/E5 tracking
- Up to 16 multi-antenna tracking modules
- 20 correlators per multi-antenna tracking module
- FDAF (Frequency Domain Adaptive Filtering)

DLR at a glance

DLR is Germany´s national research center for aeronautics and space. Its extensive research and development work in Aeronautics, Space, Transportation and Energy is integrated into national and international cooperative ventures. As Germany´s space agency, DLR has been given responsibility for the forward planning and the implementation of the German space program by the German federal government as well as for the international representation of German interests. Furthermore, Germany's largest project-management agency is also part of DLR.

Approximately 6,500 people are employed at thirteen locations in Germany: Koeln (headquarters), Berlin, Bonn, Braunschweig, Bremen, Goettingen, Hamburg, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Stuttgart, Trauen and Weilheim. DLR also operates offices in Brussels, Paris, and Washington D.C.

DLR **Deutsches Zentrum für Luft- und Raumfahrt** e.V.
in der Helmholtz-Gemeinschaft

Institute of Communications and Navigation

Postfach 1116
82230 Wessling-Oberpfaffenhofen

Dr.-Ing. Achim Dreher
Telephone: +49 (0)8153 28-2314
Email: achim.dreher@dlr.de

www.DLR.de

Information

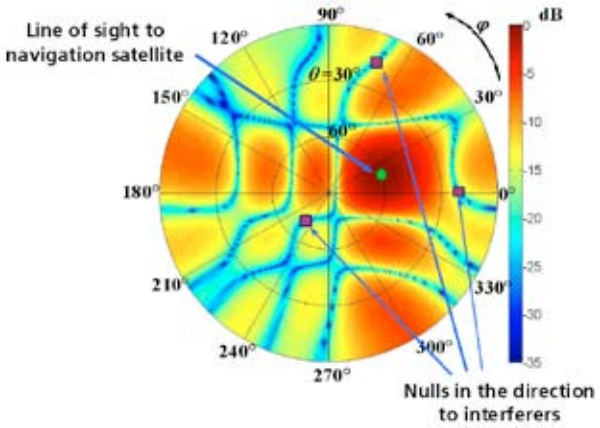
GALANT

Galileo Antenna

DLR

Project Overview

Future navigation services provided by upcoming global navigation satellite systems like Galileo will require corresponding improvements on the navigation receiving systems. Interference and multipath signals can cause serious performance degradations that cannot be tolerated for Safety-of-Life applications. To overcome this problem, new beamforming and signal-processing algorithms will be employed. They enable a more accurate and reliable navigation solution by suppressing interference and multipath signals and improving the reception of useful line-of-sight satellite signals. For the development and testing of these algorithms and in order to demonstrate new applications the Institute of Communications and Navigation builds up a GNSS receiver demonstrator with improved capabilities for interference and multipath mitigation by utilization of array antenna processing techniques. The aim is to develop a complete Safety-of-Life receiver system including array antenna, RF front-end, digital signal processing, navigation solution and integrity assessment.

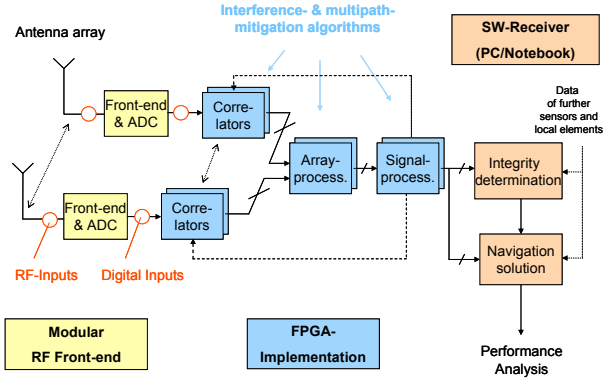


Antenna pattern resulting from adaptive beamforming

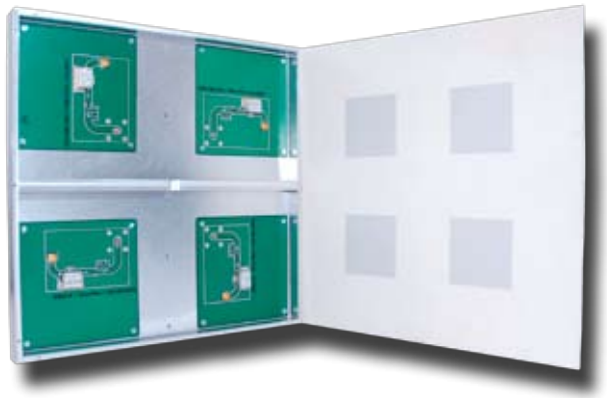
Architecture

To detect the directions of arrival (DOA) of more than 12 navigation satellites and form each antenna pattern independently, the employment of digital beamforming (DBF) is very well suited. Therefore, the signal of each antenna element passes through a complete RF front-end, IF circuits and AD converters before the antenna pattern is generated by processing the data from all elements.

The front-end is designed to operate in the L1/E1 and E5a frequency bands. It is equipped with a multifrequency active antenna element in microstrip technology with circular polarization (RHCP) and two isolated ports. The antenna exhibits a high suppression of the cross-polar component and a very broad beam characteristic to obtain good scanning capabilities down to the horizon.



Architecture of receiver demonstrator



Active antenna array

RF front-end with four equipped channels