**The picture shows the design of MASTER: the individual RF- and IF-outputs on the right hand side and GPS / Galileo simulator boxes on the left hand side**

## DLR at a glance

DLR is Germany´s national research center for aeronautics and space. Its extensive research and development work 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 5,100 people are employed in DLR´s 27 institutes and facilities at nine locations in Germany: Koeln-Porz (headquarters), Berlin-Adlershof, Bonn-Oberkassel, Braunschweig, Bremen, Goettingen, Lampoldshausen, Oberpfaffenhofen, and Stuttgart. DLR also operates offices in Brussels, Paris, and Washington, D.C.

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Information

# MASTER

Multi-output Advanced Signal Test Environment for Receivers

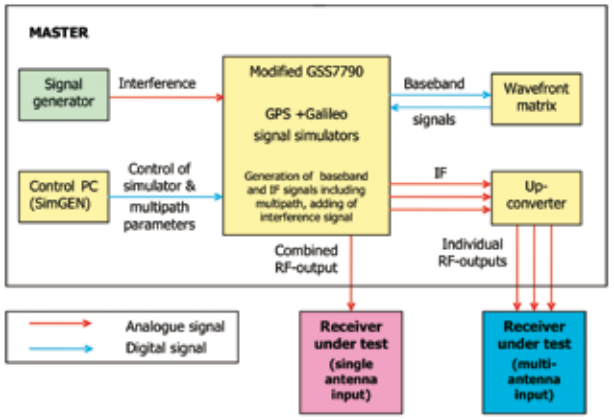
# MASTER

DLR's Multi-output Advanced Signal Test Environment for Receivers (MASTER) is a unique and powerful hardware simulation tool for testing and quality assessment of global navigation satellite system (GNSS) receivers.
Heart of the system are two modified Spirent GSS7790 Galileo and GPS constellation simulators, which provide all GPS (L1, L2, L5) and Galileo (E1, E5, E6) satellite signals at RF, IF and baseband level. The user has full control over the satellite orbit definitions with respect to a user-specified location or track, date and time and over all main effects influencing the quality of real navigation satellite signals: orbit and clock errors, ionosphere, troposphere, multipath and interference. Specific signal components as data and pilot channel, navigation data, pseudo random noise (PRN) code and sub-carrier for binary offset carrier (BOC) signals can be individually selected.

For simulation of multi-antenna receivers, MASTER can add spatial information to the baseband signals by utilization of a digital processing matrix (wavefront matrix), which is an own development by DLR. Additional interference signals can be generated by an external programmable signal generator and overlaid to the satellite navigation signals.

# Typical Applications

- Testing of Galileo and GPS receivers in a quasi realistic environment under controlled and repeatable conditions
- Advanced testing of specific multipath and interference mitigation techniques
- Testing of combined GPS/Galileo Receivers
- Controlled Reception Pattern Antenna (CRPA) system testing
- Testing of multiple antenna receivers for heading and attitude determination




Scheme of simulation system

# Key Features

- Simultaneous simulation of GPS and Galileo constellations
- Generation of 48 independent channels on up to 4 different frequencies simultaneously (e.g. 12 x Galileo E1, 12 x Galileo E5 and 12 x GPS L1 + 12 x GPS L2)
- Generation of existing and future GPS and Galileo signals:
  - GPS L1 C/A + P code + M-noise
  - GPS L2 C/A or P code + L2C + M-noise1
  - GPS L5
  - Galileo E1 BOC(1,1) + BOC(15,2.5) noise1
  - Galileo E5 AltBOC(15,10), including E5a and E5b
  - Galileo E6 BPSK(5) + BOC(10,5) noise signal1
- Complete flexibility over test scenarios using comprehensive SimGEN for Windows® software:
  - Definition of user tracks, speed and acceleration
  - Individual satellite power adjustments
  - GPS and Galileo satellite constellations
  - Scenario setup by GUIs and/or user action files
  - Various models for multipath
  - Simulation of atmosphere, orbit and clock errors
  - Free definition of antenna pattern
- Class leading accuracy, fidelity and reliability
- SBAS (WAAS/EGNOS/MSAS) support at L1
- Individual RF, IF and baseband signal outputs
- Combined RF-Outputs for Galileo and GPS
- Interference Simulation