ALL DOORS IN FLIGHT. TERRESTRIAL AIR NAVIGATION TEST AND MEASUREMENT SOLUTIONS.

ROHDE&SCHWARZ
Make ideas real

OVERVIEW

Civil aviation and military operations depend on accurate distance, location and direction measuring systems for public safety and military mission success. Failures of these systems may place lives at immediate risk. Terrestrial air navigation systems such as landing systems or en-route navigation systems require unique test and measurement capabilities. With demonstrated experience in this field, Rohde & Schwarz provides test solutions to cover every need from design, development and production to operational maintenance.

Suitable solutions

Terrestrial navigation systems are subject to regular inspection and maintenance in the field. For these measurements, Rohde&Schwarz offers complete laboratory quality measurement solutions in portable, lightweight, weather-protected, battery-powered form factors.

- Ground and flight inspection of terrestrial navigation signals with lightweight instruments that offer a high degree of accuracy and fast measurement speeds
- Spectrum and signal analysis in development, production and maintenance
- Signal generation and simulation for accurate and repeatable test signals needed for receiver test and calibration
- Power measurement using standalone sensors that can be operated with a laptop and require only simple test setups yet deliver highly accurate measurement results
- Easy-to-use handheld cable and antenna analysis for setup and maintenance of antenna sites

Test and measurement equipment is the key to the proper functioning of navigational aid (navaid) systems.

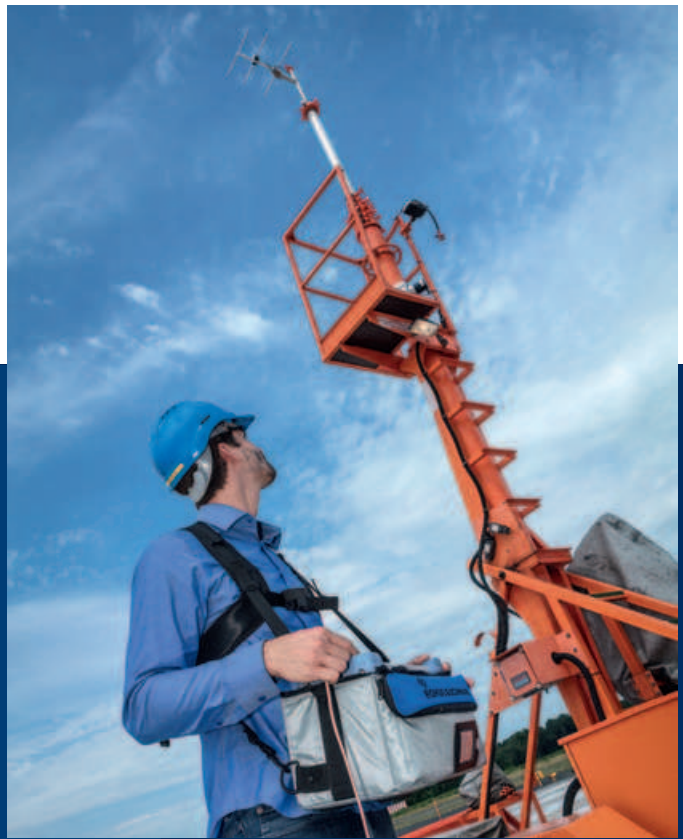
INSTRUMENT LANDING SYSTEM / MARKER BEACON

The instrument landing system (ILS) provides aircraft pilots with landing approach data relative to the ideal landing course. Marker beacon (MB) receivers decode audio data and provide signaling output to identify one of three marker beacons installed near the runway.

Rohde&Schwarz ILS / MB solutions include:

- Field measurements at airports, e.g. runway measurements (R&S®EVSG1000 VHF/UHF Airnav/Com Analyzer)
- Conducted measurements on installations (R&S®EVSG1000 VHF/UHF Airnav/Com Analyzer, R&S®RTO / RTE / RTM oscilloscopes)
- Flight inspection (R&S®EVSF1000 VHF/UHF Nav/Flight Analyzer)
- Vector voltmeter measurements for ILS antennas (R&S®FSH handheld spectrum analyzer, R&S®ZVH handheld cable and antenna analyzer)
- Lab measurements and calibration for ILS/MB sources, e.g. ramp testers (R&S®FSW signal and spectrum analyzer with R&S®FSW-K15)
- Signal generation for receiver tests, e.g. on-board equipment (R&S®CMA180 Radio Test Set, R&S®SMBV100B and R&S®SMA100B signal generators)
- Interference analysis (R&S®FPH and R&S®FSH handheld spectrum analyzers)
- Cable measurement (VSWR, DTF & Return loss) (R&S®FSH handheld spectrum analyzer, R&S®ZPH and R&S®ZVH handheld cable and antenna analyzers)

Application example:
Measurement of ILS glideslope signals with trailer-mounted telescopic mast and R&S®EVSG1000
Preparation of an ILS glideslope measurement drone with R&S®EVSF1000 aboard



VHF OMNIDIRECTIONAL RADIO RANGE / DOPPLER VOR

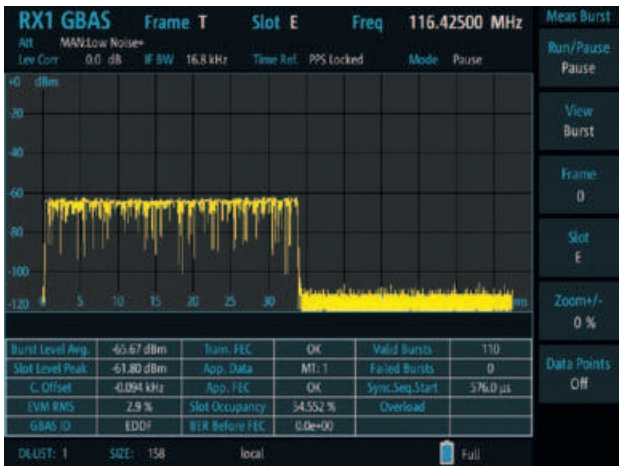
VHF omnidirectional radio range (VOR) – conventional VOR (CVOR) and Doppler VOR (DVOR) – operate at VHF frequencies of 108 MHz to 118 MHz to provide aircraft with a bearing to the ground station location.

Application example:
Bearing measurement on a terminal VOR with R&S®EVSG1000

Rohde&Schwarz VOR solutions include:

- Ground measurements and monitoring (R&S®EVSG1000 VHF/UHF Airnav/Com Analyzer)
- Flight inspection, e.g. orbit measurements (R&S®EVSF1000 VHF/UHF Nav/Flight Analyzer)
- Interference analysis (R&S®FPH and R&S®FSH handheld spectrum analyzers)
- Cable measurement (VSWR, DTF & Return loss) (R&S®FSH handheld spectrum analyzer, R&S®ZPH and R&S®ZVH handheld cable and antenna analyzers)
- Lab measurements and calibration for VOR sources, e.g. ramp testers (R&S®FSW signal and spectrum analyzer with R&S®FSW-K15)
- Signal generation for receiver tests (R&S®CMA180 Radio Test Set, R&S®SMBV100B and R&S®SMA100B signal generators)

GROUND BASED AUGMENTATION SYSTEM

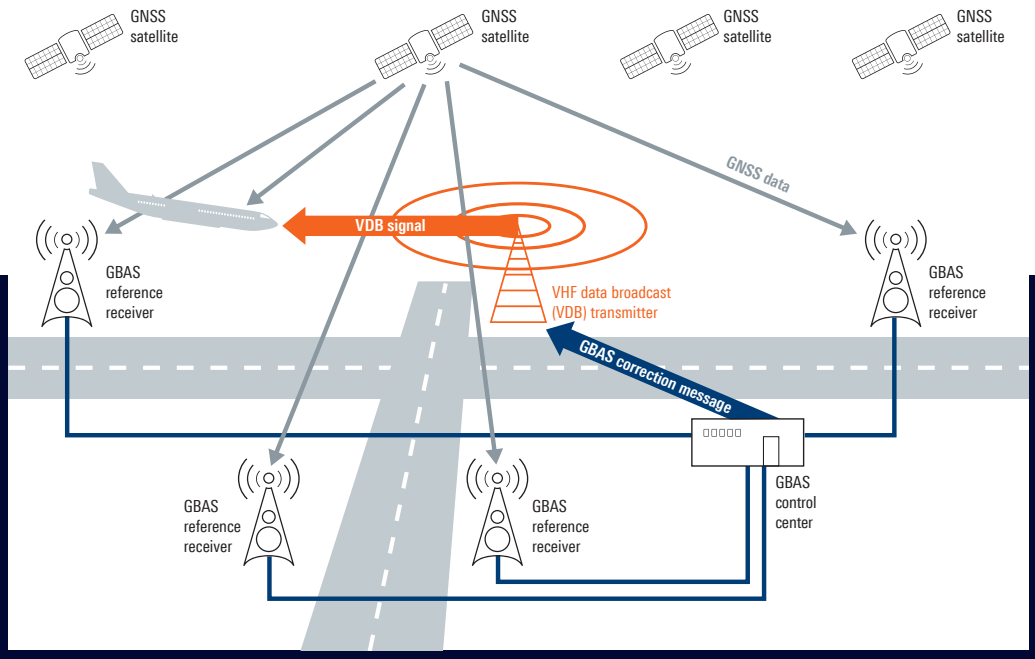


GBAS burst view with R&S®EVSG1000 plus R&S®EVSG-K4 GBAS analysis option

The ground based augmentation system (GBAS) is a landing system that transmits GPS corrections via a VHF data link (VDL) to approaching planes. The ground equipment consists of reference GNSS receivers at exactly defined positions around the airport, a GBAS ground station and a VHF data broadcast transmitter.

Rohde&Schwarz GBAS solutions include:

- ► Ground measurements / monitoring at airports (R&S®EVSG1000 VHF/UHF Airnav/Com Analyzer)
- ► Flight inspection, e.g. coverage measurements (R&S®EVSF1000 VHF/UHF Nav/Flight Analyzer)
- ► Signal generation for receiver tests, e.g. multi-mode receivers (R&S®SMBV100B signal generator)



GBAS components and signals (simplified representation)

Application example: 24/7 measurement of GBAS level and monitoring of pseudo-range correction values on GBAS stations

DISTANCE MEASURING EQUIPMENT

Distance measuring equipment (DME) is a transponder-based radio navigation technology used to determine the slant range of an aircraft (DME interrogator) to a ground station (DME transponder).

Application example:
Sensitivity measurement of a DME station with R&S®EDST300 TACAN/DME Station Tester

Rohde&Schwarz DME solutions include:

- Commissioning and regular maintenance of DME stations (e.g. conducted and/or radiated measurements) e.g. main delay measurements or on-channel peak power and frequency measurements (R&S®EDST300 TACAN/DME Station Tester)
- Cable measurement (VSWR, DTF & Return loss) (R&S®FSH handheld spectrum analyzer, R&S®ZPH and R&S®ZVH handheld cable and antenna analyzers)
- Flight inspection and far field monitoring, e.g. simultaneous measurements of ten DMEs (R&S®EDS300 DME / pulse analyzer)
- Signal generation for interrogator / receiver tests (R&S®SMBV100B signal generator and R&S®NRP-Z81 power sensor)
- Verification of DME transponders in test laboratories (R&S®SMBV100B signal generator and R&S®NRP-Z81 power sensor, R&S®RTO / RTE / RTM oscilloscopes)

TACAN

TACAN is the military version of DME. In addition to the distance information, it provides the user with the bearing to the ground or shipborne station. The method used for distance measurement is identical to DME, allowing TACAN to be used for civilian planes (e.g. for RNAV).

Rohde&Schwarz TACAN solutions include:

- Conducted and radiated measurements (R&S®EDST300 TACAN/DME Station Tester, TACAN option R&S®EDST-K1 and test antenna R&S®EDST-Z1)
- Cable measurement (VSWR, DTF & Return loss) (R&S®FSH handheld spectrum analyzer, R&S®ZPH and R&S®ZVH handheld cable and antenna analyzers)
- Power measurements (R&S®NRP power sensors)
- Flight inspection, e.g. orbit measurements (R&S®EDS300 DME / pulse analyzer and TACAN option R&S®EDS-K1)
- TACAN time domain analysis (R&S®EDST300 TACAN/DME Station Tester, R&S®EDS300 DME / pulse analyzer, R&S®RTO / RTE / RTM oscilloscopes)

Application example:
Azimuth, peak power and distance measurement during orbital flight around a TACAN ground installation

TERRESTRIAL AIR NAVIGATION – APPLICATION OVERVIEW:

	ILS	VOR	MB	GBAS	DME	TACAN	Antenna measurement	Cable measurement	Interference measurement
R&S®EVSG1000 VHF/UHF Airnav/Com Analyzer	●	●	●	●					
R&S®EVSF1000 VHF/UHF Nav/Flight Analyzer	●	●	●	●					
R&S®EDS300 DME/Pulse analyzer					●	●			
R&S®EDST300 TACAN/DME Station Tester					●	●	●		
R&S®FSW-K15 VOR/ILS Measurements	●	●							
R&S®FSH handheld spectrum analyzers							●	●	●
R&S®ZVH handheld cable and antenna analyzers							●	●	
R&S®FPH handheld spectrum analyzers									●
R&S®ZPH handheld cable and antenna analyzers								●	
R&S®SMA100B signal generator	●	●							
R&S®SMBV100B signal generator	●	●	●	●	●				
R&S®CMA180A radio test set	●	●	●						
R&S®NRP-Z81 power sensor					●	●			
R&S®RTO/RTE/RTM oscilloscope					●	●			

ROHDE & SCHWARZ ANALYZERS, CABLE AND ANTENNA TESTERS AND GENERATORS FOR NAVAIDS:

	**R&S®EVSG1000** **VHF/UHF Airnav/Com Analyzer**	Portable signal level and modulation analyzer specifically designed for commissioning and servicing ILS, GBAS, VOR and marker beacon ground stations and for analyzing ATC COM signals.
	**R&S®EVSF1000** **VHF/UHF Nav/Flight Analyzer**	Signal level and modulation analyzer for installation in flight inspection aircraft. It performs measurements on ILS, GBAS, VOR and marker beacon ground stations during startup, maintenance and servicing and analyzes ATC COM signals.
	**R&S®EDST300** **TACAN/DME Station Tester**	Portable and battery powered TACAN/DME station tester designed for commissioning, testing and servicing pulsed terrestrial navigation systems.
	**R&S®EDS300** **DME/Pulse analyzer**	DME/TACAN analyzer for installation in flight inspection systems and for far field monitoring tasks.
	**R&S®FSW-K15** **VOR/ILS Measurements**	The R&S®FSW-K15 is a firmware application that adds functionality to perform VOR/ILS measurements to the R&S®FSW.
	**R&S®FSH and R&S®FPH handheld spectrum analyzers**	Rugged handheld spectrum analyzer designed for use in field and service. Special option for vector voltmeter measurements (R&S®FSH-K45).
	**R&S®ZVH and R&S®ZPH handheld cable and antenna analyzers**	Rugged, handy cable and antenna analyzer designed for use in installation and service. Special option for vector voltmeter measurements (R&S®ZVH-K45).
	**R&S®RTO/RTE/RTM oscilloscope**	Time domain measurements and pulse shape analysis on DME transponders.
	**R&S®SMA100B signal generator**	Signal generator with excellent SSB phase noise for all common types of analog modulation (AM, FM, φM, PM). Option SMAB-K25 allows precise generation of ILS / VOR signals.

	**R&S®SMBV100B** **signal generator**	Vector signal generator with AVIONIC options for ILS, VOR, MB, DME and GBAS. The ARB function of the SMBV100B allows also to „play out" recorded IQ files (e.g. of NavAids scenarios) to do stability tests on board receivers.
	**R&S®CMA180A** **radio test set**	Radiocommunications tester for radio systems in the 100 kHz to 3 GHz range. R&S®CMA-K130 for ILS, VOR and MB signal generation.
	**R&S®NRP-Z81** **power sensor**	Wideband power sensor for time domain analysis and automatic pulse analysis for DME applications and universal use.

Further documentation available

Brochures and data sheets:
Find more information on www.rohde-schwarz.com (e.g. search for "EVSG1000") or take a look at the "Solutions/ Aerospace & Defense/Avionics & Navigation" section

Application notes:
- ▶ Test of DME/TACAN transponders
- ▶ Aeronautical radio navigation measurement solutions
- ▶ Verify your avionics navigation equipment

SERVICE AND SUPPORT

With a dedicated, global service network and 24-hour availability, Rohde&Schwarz offers its customers comprehensive support worldwide. Support offerings range from detailed consultation before, during and after purchase to application support, calibration services, product upgrades, seminars and customized training courses. We attach great value to the technical expertise of our local sales engineers, who answer customer questions person- ally and in detail.

Rohde&Schwarz products are used in demanding applications where reliability is as important as accuracy. High equipment availability is vital in production for ensuring continuous, profitable operation. Our services are designed to maintain both high availability and high accuracy over the long term in order to protect our customers' investments. Services include globally accessible, high-end calibration routines to allow on-site calibration as well as product maintenance in the form of updates or upgrades. Most of our equipment is platform-based to allow adaptation to changed requirements and new technologies, even after years of use.

Our service offerings flexibly meet specific user requirements. On request we develop service strategies in close cooperation with our customers to optimally cater to their needs. Sustained customer benefit is paramount to us.

Service that adds value

- Worldwide
- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

Rohde&Schwarz

The Rohde&Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

Sustainable product design

- Environmental compatibility and eco-footprint
- Energy efficiency and low emissions
- Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

Rohde&Schwarz customer support

www.rohde-schwarz.com/support

PD 3607.1588.62 | Version 03.01 | March 2020
All doors in flight. Terrestrial air navigation test and measurement solutions.
Data without tolerance limits is not binding | Subject to change

3607158862
PD 3607.1588.62 | Version 03.01 PDP 1 en