

All doors in flight.
Terrestrial air
navigation test
and measurement
solutions.



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.

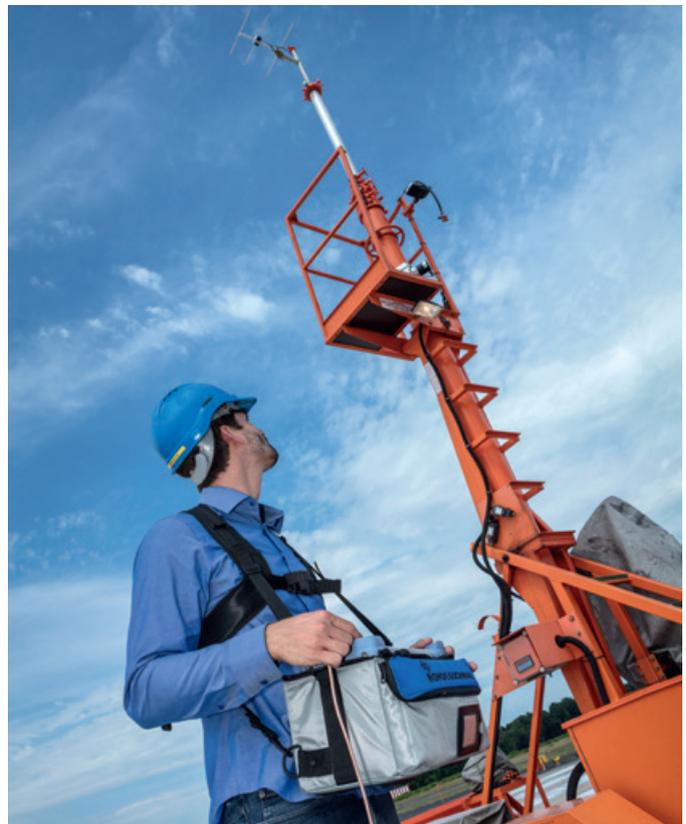
Rohde & Schwarz ILS/MB solutions include:

- 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®SMBV100A and R&S®SMA100A 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.

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®SMBV100A and R&S®SMA100A signal generators)



Application example:

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



Ground based augmentation system

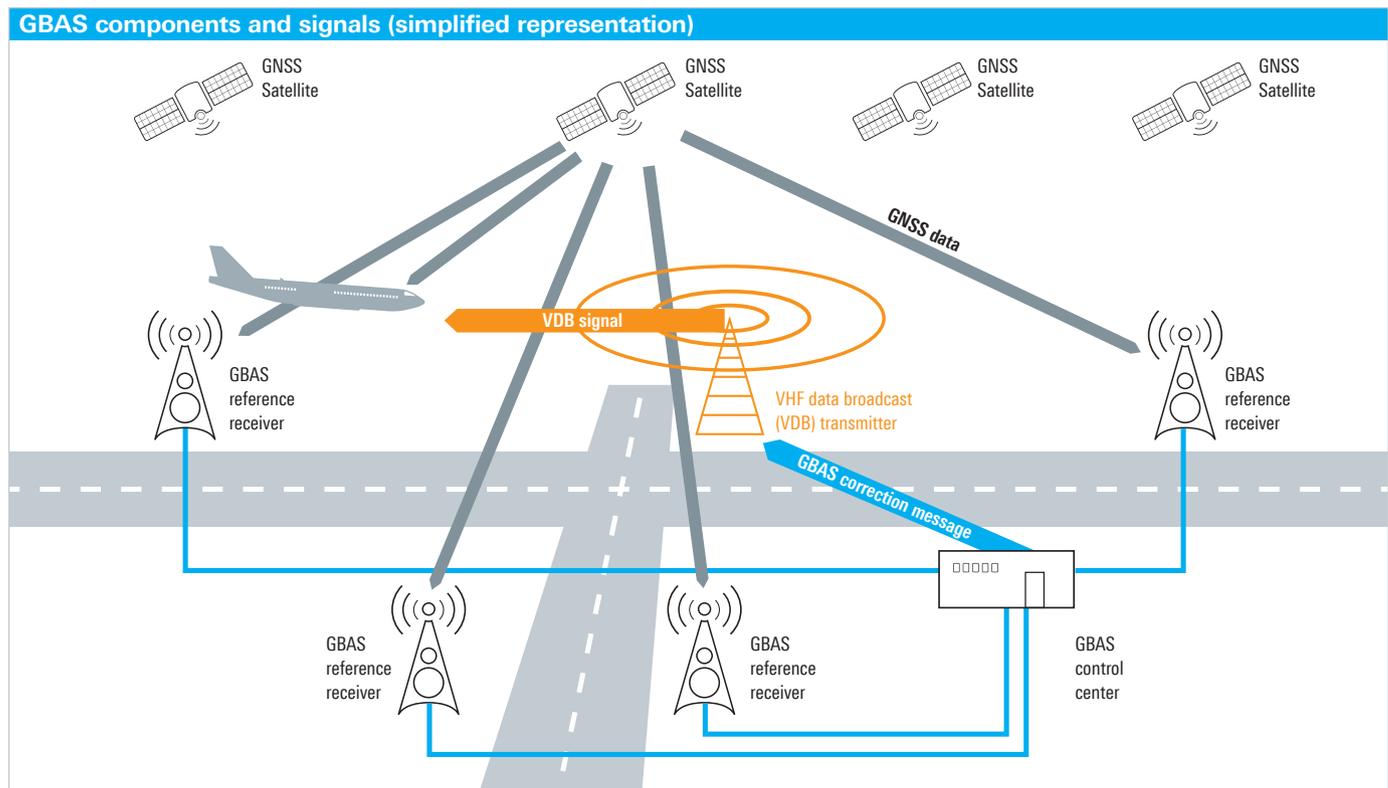
The ground based augmentation system (GBAS) is a landing system that transmits GPS corrections via a VHF data link (VDL) to approaching planes. The ground equipment consists of reference GNSS receivers at exactly defined positions around the airport, a GBAS ground station and a VHF data broadcast transmitter.

Rohde & Schwarz GBAS solutions include:

- Ground measurements / monitoring at airports (R&S®EVS300 ILS / VOR analyzer)
- Flight inspection, e.g. coverage measurements (R&S®EVS300 ILS / VOR analyzer)
- Signal generation for receiver tests, e.g. multi-mode receivers (R&S®SMBV100A signal generator)

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).

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®SMBV100A signal generator and R&S®NRP-Z81 power sensor)
- Verification of DME transponders in test laboratories (R&S®SMBV100A signal generator and R&S®NRP-Z81 power sensor, R&S®RTO / RTE / RTM oscilloscopes)

Application example:

Sensitivity measurement of a

DME station with

R&S®EDST300 TACAN/DME Station Tester



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 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®EVS300 ILS/VOR 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®SMA100A signal generator	●	●	●		●				
R&S®SMBV100A signal generator	●	●	●	●	●				
R&S®CMA100A 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 nav aids:

	R&S®EVSG1000 VHF/UHF Airnav/Com Analyzer	Portable signal level and modulation analyzer specifically designed for commissioning and servicing ILS, 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, VOR and marker beacon ground stations during startup, maintenance and servicing and analyzes ATC COM signals.
	R&S®EVS300 ILS/VOR analyzer	Portable and battery powered level and modulation analyzer designed especially for starting up, checking and maintaining ILS, VOR, MB and GBAS systems.
	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.

Further documentation available

Brochures and data sheets:

Find more information on www.rohde-schwarz.com (e.g. search for "EVS300") 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

	R&S®SMA100A signal generator	Signal generator for all common types of analog modulation (AM, FM, φM, PM) and special types of modulation (ILS, VOR, MB and DME).
	R&S®SMBV100A signal generator	Vector signal generator with NavAids options for ILS, VOR, MB, DME and GBAS.
	R&S®CMA100A radio test set	Radiocommunications tester for radio systems in the 100 kHz to 3 GHz range. R&S®CMA-K130 for ILS/VOR 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.

Service and support

Service that adds value

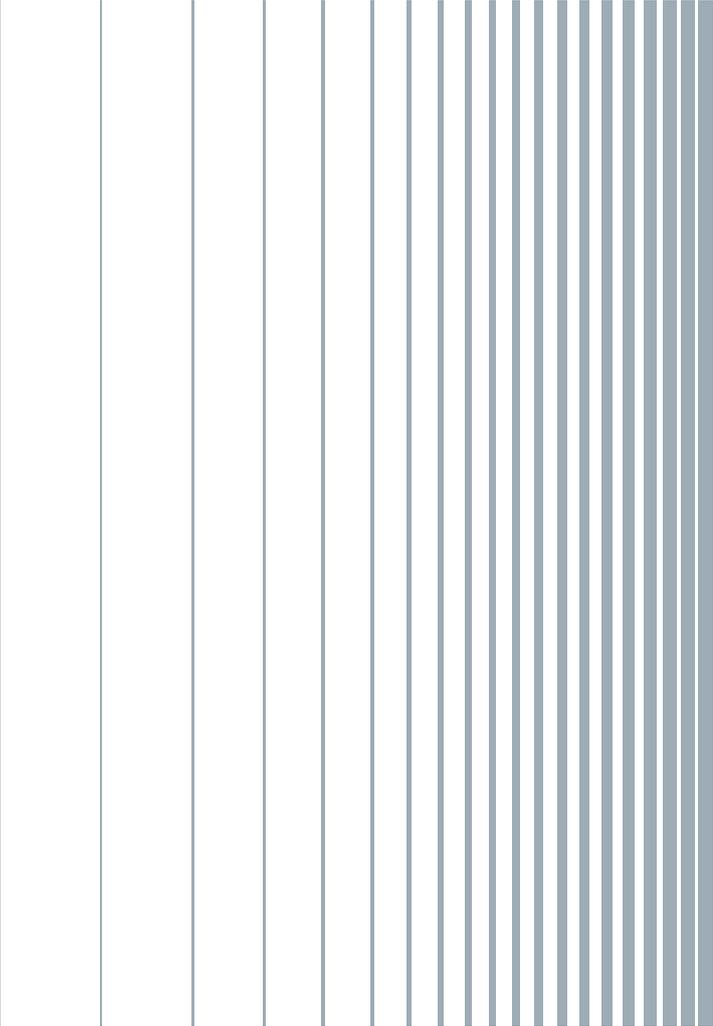
- ▮ Worldwide
- ▮ Local and personalized
- ▮ Customized and flexible
- ▮ Uncompromising quality
- ▮ Long-term dependability

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 personally 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 de-

signed 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.



About Rohde & Schwarz

The Rohde & Schwarz electronics group is a leading supplier of solutions in the fields of test and measurement, broadcast and media, secure communications, cybersecurity, and radiomonitoring and radiolocation. Founded more than 80 years ago, this independent global company has an extensive sales network and is present in more than 70 countries. The company is headquartered in Munich, Germany.

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