CERTIUM® LOCATE ATC LOCATION SYSTEM

Immediate and reliable identification of calling aircraft

Product Brochure | Version 01.00

ROHDE&SCHWARZ

Make ideas real

AT A GLANCE

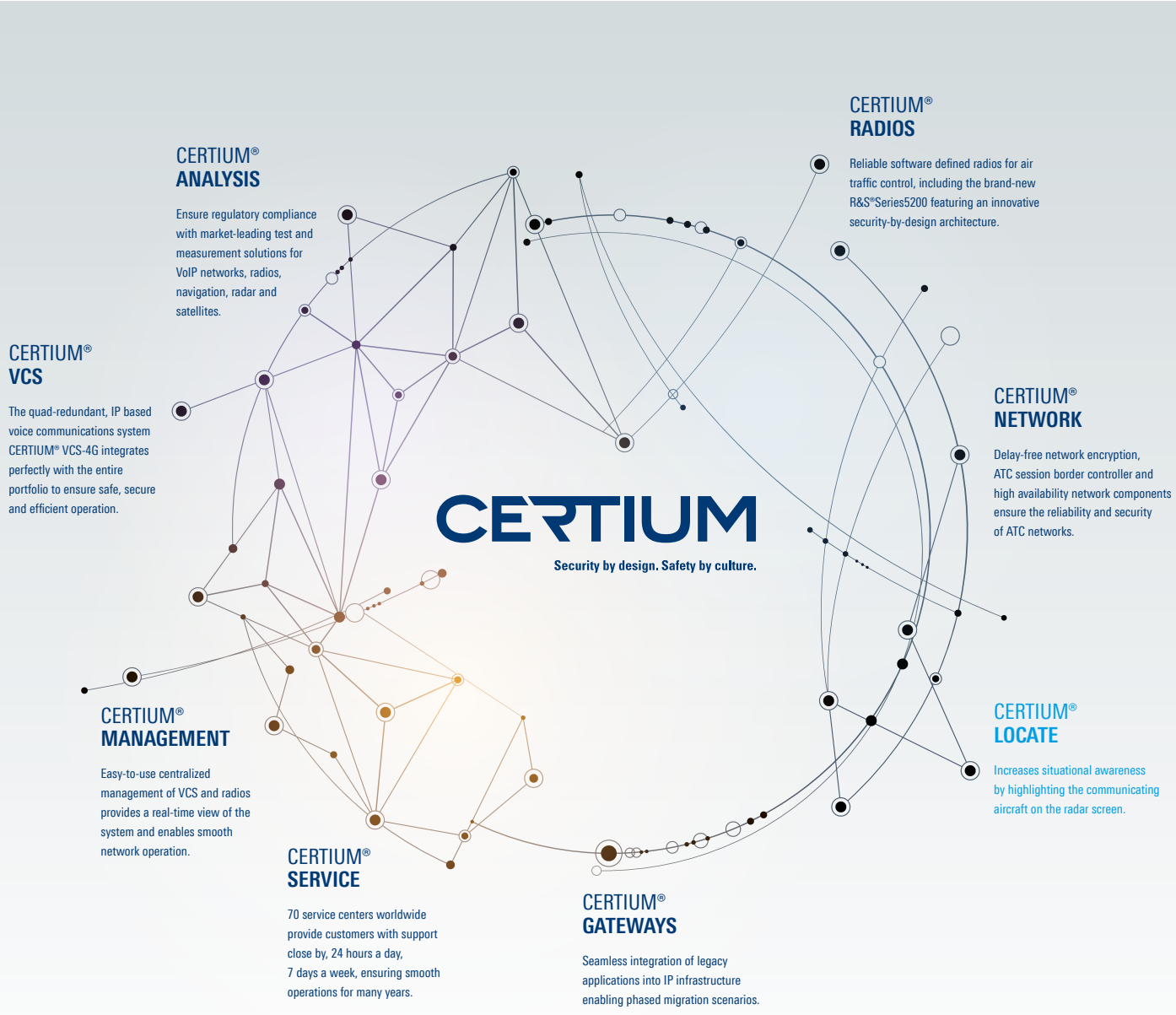
The CERTIUM® LOCATE ATC location system is a turnkey solution for locating calling aircraft based on their radiocommunications. It enables immediate and reliable aircraft identification on the radar screen to increase situational awareness and reduce call-sign confusion.

Automatic recognition of calling aircraft

CERTIUM® LOCATE assists air traffic controllers to identify aircraft on the radar screen quickly and reliably. The system automatically recognizes aircraft, making it easier for controllers to verify the call sign ID during radio transmissions. This additional information also helps reduce mental pressure on air traffic controllers. Besides, knowing the location or direction of incoming radio calls is indispensable in order to provide navigation aid to small airplanes or during emergency and rescue situations.

Excellent system performance and high availability

Precise direction finding (DF) results and sophisticated location algorithms ensure accurate geolocation, which is an essential prerequisite for reliable aircraft identification. As the complete CERTIUM® LOCATE solution comes from a single source, all system components are harmonized to deliver outstanding system performance. High availability is achieved by using reliable components and advanced redundancy configurations.



Scalable and flexible system configuration

Starting with a single direction finder for approach traffic handling, CERTIUM® LOCATE can be scaled up to systems with multiple direction finders for safe en-route traffic control. For airports with a single direction finder, the direction of arrival (DOA) of aircraft is displayed on the radar screen. Larger solutions include a location server to geolocate calling aircraft for reliable identification.

Secure by design

Critical communications infrastructures and the reliable identification of calling aircraft require a high level of IT security. State-of-the-art security systems and measures like firewalls, system hardening and security monitoring protect the CERTIUM® LOCATE solution from outside intruders and malware. User access control management and secure system components safeguard against cyber-attacks and ensure reliable operation.

Role in the CERTIUM® ecosystem

CERTIUM® is an advanced ATC communications suite that increases safety and efficiency beyond existing standards. All CERTIUM® products are seamlessly integrated into a single portfolio. Although each single CERTIUM® product is easy to integrate with third-party systems, users benefit most by combining it with other CERTIUM® products.

The CERTIUM® LOCATE solution is the perfect match for CERTIUM® VCS, CERTIUM® RADIOS and CERTIUM® MANAGEMENT.

BENEFITS

Increasing situational awareness

- Reliable identification of calling aircraft
- Minimizing call-sign confusion
- Homing service and rescue missions

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Scalable solutions

- Scalable from a single direction finder to a countrywide geolocation system
- Direction of arrival for approach traffic
- Geolocation for area control centers

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Superior ATC direction finder

- Exceptional performance and DF accuracy
- High sensitivity to detect weak signals
- Outstanding immunity against reflections
- Small footprint

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Geolocation solution

- Central location server with advanced location algorithms
- Central administration ensures consistent configuration
- Recording and replay of all direction finding and location results
- Shadow mode for training and test systems

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Large coverage area and precise geolocation

- Exceptional location accuracy and coverage range
- Scalable coverage area

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Flexible system integration

- One partner throughout your project
- Standard interface to ATM systems
- Suppression of ground transmissions
- IP based data communications
- High availability
- ICAO and ED-109A compliance

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Reduced operational and lifecycle costs

- Remote administration
- System event logging
- SNMP interface for system monitoring
- Extensive self-test capabilities
- Service level agreements

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Secure by design

- Operating system hardening
- Security monitoring
- Secure communications

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INCREASING SITUATIONAL AWARENESS

Flight sectors and the airspace around airports are becoming increasingly busy places. Air traffic controllers need to be able to precisely identify calling aircraft.

Reliable identification of calling aircraft

Air traffic controllers listen to the call-sign ID of calling aircraft and have to identify it on the radar screen. Secondary radar and automatic dependent surveillance broadcast (ADS-B) provide additional flight information while not identifying calling aircraft. Today, listening to the call-sign ID is the only way to find out who is talking. CERTIUM® LOCATE provides the direction of arrival and the geographic location of calling aircraft based on their radio transmissions. The bearing lines and geographic location of calling aircraft are automatically displayed on the radar screen.

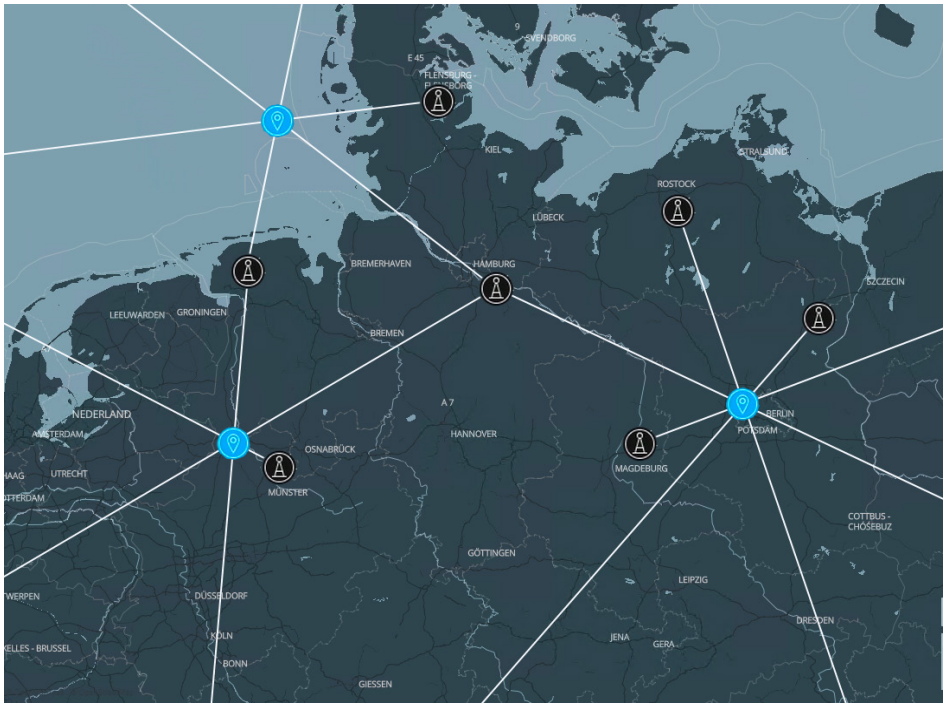
Minimizing call-sign confusion

Growing traffic density and shortage of labor impose high load and stress on air traffic controllers. Additional factors such as similar call signs and poor voice quality often require special attention, adding to the strain. The automatic display of direction and location information on the radar screen helps air traffic controllers identify calling aircraft reliably, avoiding call-sign confusion and saving time. CERTIUM® LOCATE also makes it easier for controllers to handle the growing workload and increases safety by helping detect misunderstandings and readback errors faster.

Homing service and rescue missions

CERTIUM® LOCATE monitors all radio transmissions within the coverage area, including those from small airplanes and aircraft below radar. This information is crucial in supporting aircraft pilots in critical situations, e.g. on search and rescue missions. CERTIUM® LOCATE assists in identifying additional problems such as misconfigured aircraft transponders.

Map display on administration console with live results for three aircraft.



SCALABLE SOLUTIONS

Rohde&Schwarz provides scalable, turnkey solutions based on the company's standard products. Starting with a single direction finder, the CERTIUM® LOCATE system can be expanded to a countrywide geolocation solution with multiple direction finders for upper area control.

Scalable from a single direction finder to a countrywide geolocation system

CERTIUM® LOCATE offers versatile solutions based on Rohde&Schwarz standard products available in suitable configuration packages. Starting with a single direction finder, the system can be expanded with additional direction finders and location servers to a high-availability countrywide ATC location system. Small adaptations can be made to accommodate customer-specific requirements. A single direction finder at an airport provides the direction of arrival and homing for calling aircraft. Combining two or more direction finders allows accurate geolocation of calling aircraft. Rohde&Schwarz solutions are scalable; a single direction finder might be used for handling local approach traffic and for upper area control simultaneously. Adding further direction finders will increase the coverage range.

Direction of arrival for approach traffic

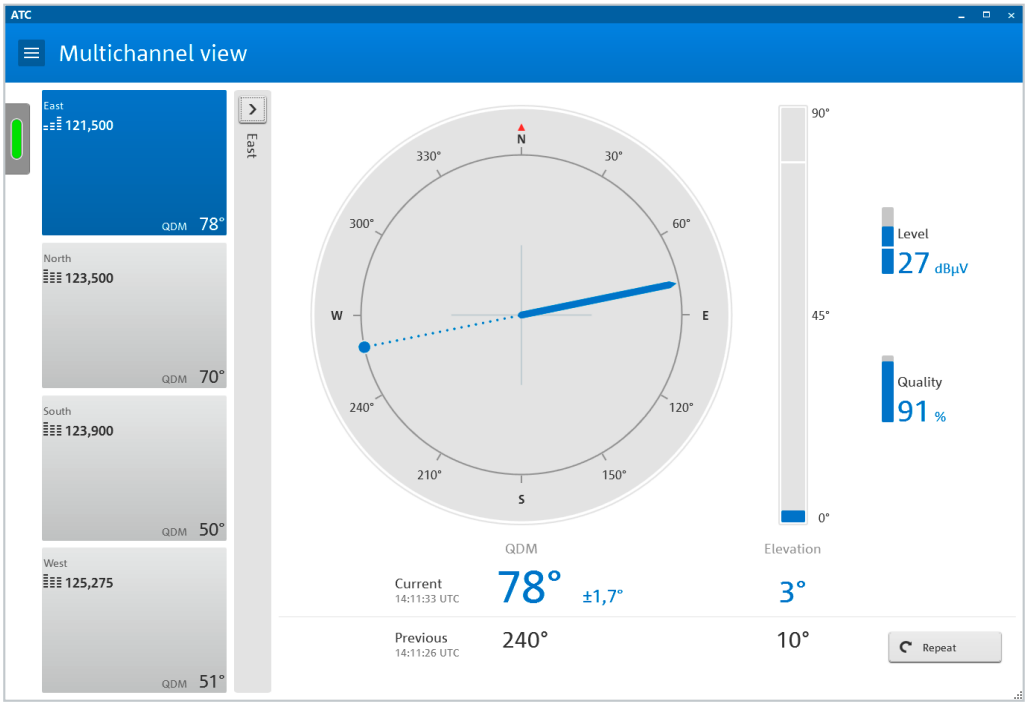
Air traffic controllers appreciate the benefits of bearing lines being displayed on their radar screens, indicating the direction of arrival of an incoming radio call and enabling them to verify the call-sign ID. Additional control panels independent of the radar screens are available for air traffic controllers. The control panels display the compass rose of a radio direction finder with configurable display modes, as well as multiple frequency channels and the health status of the direction finder.

A single direction finder at or near an airport is sufficient to deliver the direction of arrival. Different default configurations are available to provide the required number of frequency channels and the necessary DF accuracy.

Geolocation for area control centers

Increasing air traffic load and the need to cover large areas require advanced solutions to determine the accurate geographic locations of calling aircraft based on their radio transmissions. Combining multiple CERTIUM® LOCATE direction finders connected to a central CERTIUM® LOCATE location server enables geolocation of aircraft for many flight sectors in parallel. Location results are forwarded to ATM systems and displayed as intersecting bearing lines or as target circles on a radar screen.

Direction of arrival of an incoming radio call displayed on a radar screen.



SUPERIOR ATC DIRECTION FINDER

Rohde&Schwarz has a long-standing reputation as a supplier of high-performance ATC direction finders. The new generation of CERTIUM® LOCATE direction finders meets all expectations. Reliable and accurate DF information even in challenging environments is the key to trustworthy identification of calling aircraft.

Exceptional performance and DF accuracy

The CERTIUM® LOCATE direction finders simultaneously process up to 32 frequency channels within the civil VHF airband, with four channels configurable out of band up to 450 MHz. High system DF accuracy of typically 0.5° RMS and response time of less than 500 ms are provided for each channel.

Each channel can be remotely configured ad hoc from the administration panel thanks to the remote management capabilities implemented throughout the CERTIUM® ecosystem.

Direction finder in standard configuration.

High sensitivity to detect weak signals

The maximum distance between aircraft and the DF site is primarily determined by the aircraft's radio transmission power and the DF sensitivity of the system on site. The R&S®ADD095 wide-aperture VHF DF antenna with nine active antenna elements achieves a system DF sensitivity of 2 µV/m, delivering accurate bearing results even for weaker radio signals transmitted over long distances.

Outstanding immunity against reflections

CERTIUM® LOCATE covers the entire frequency range up to 450 MHz with a single DF antenna. The direction finder uses the correlative interferometer DF method. It is based on measuring the phase differences between consecutive antenna elements of a circular array DF antenna, permitting the use of wide-aperture antennas that offer high immunity to reflections and feature high DF accuracy and sensitivity.

Moreover, the antenna's excellent large-signal immunity as a result of sophisticated preselection avoids problems with nearby transmitters.

Small footprint

CERTIUM® LOCATE direction finders are compact, fully integrated and weatherproof for outdoor installation. Temperature control, IP router, power supply and GPS antenna are integrated in the direction finder. The system is complete with a narrowband or wideband DF antenna with integrated lightning protection on top of the mast and further add-ons such as an outdoor uninterruptible power supply (UPS) and obstruction lights. The compact design with all components mounted on the mast eliminates the need for a dedicated shelter, minimizing both footprint and costs.

GEOLOCATION SOLUTION

Multiple CERTIUM® LOCATE direction finders connected to a CERTIUM® LOCATE location server deliver accurate geolocation information for calling aircraft.

Central location server with advanced location algorithms

The central location server receives bearing results from all connected direction finders, computes the geolocation data and forwards it to ATM systems. Smart algorithms improve the location accuracy and ensure consistent results. Clear separation of radio calls from different aircraft and the capability to suppress ground transmissions are standard features in the CERTIUM® LOCATE system, ensuring precise results with minimal delay for calling aircraft.

Central administration ensures consistent configuration

Configuration and monitoring of a CERTIUM® LOCATE system solution, including the location server and all connected direction finders, are carried out on the administration console.

The administration console provides a map display with live results from the direction finders and location plots of the calculated geographic positions of calling aircraft.

Recording and replay of all direction finding and location results

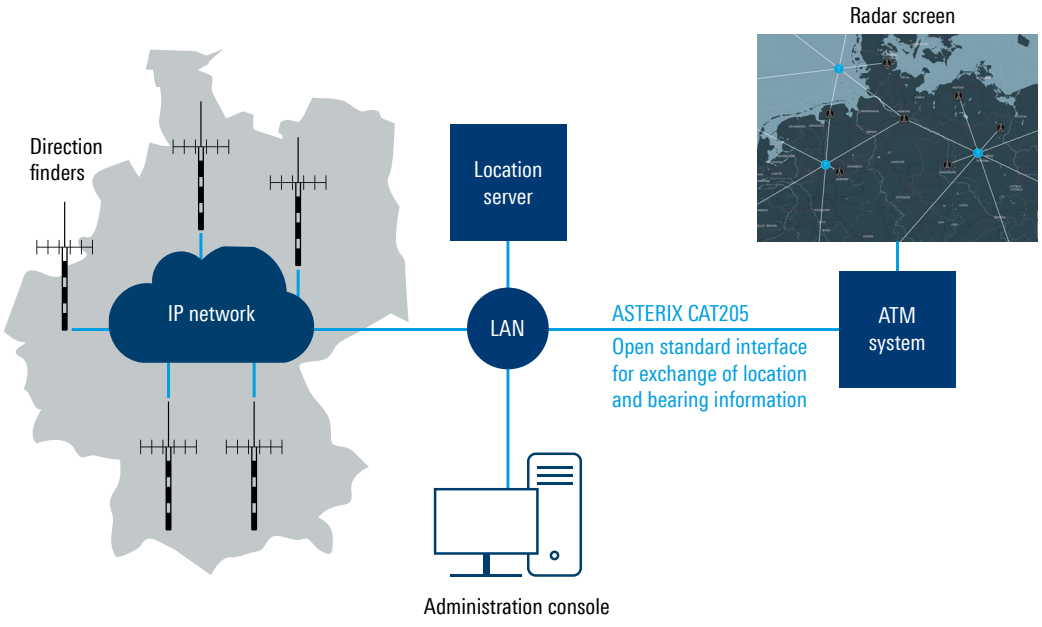
All azimuth results, calculated locations and data forwarded to ATM systems are recorded for later evaluation. This information is used for incident management and further analysis of geolocation results.

The replay mode allows replaying and monitoring recorded information on the map of the administration console or forwarding it to an ATM training system. Quick selection of time frame and replay speed helps focus on events of interest.

Shadow mode for training and test systems

Training and test systems can use azimuth results generated by real direction finders rather than relying on simulated data. In shadow mode, results from active direction finders are retrieved for training and test purposes, while DF configuration changes are blocked. Only the settings of the training system itself can be modified for training and test scenarios.

Standard components and open interface of geolocation solution



LARGE COVERAGE AREA AND PRECISE GEOLOCATION

Rohde&Schwarz is an established supplier of geolocation solutions for airports and ANSPs around the world. When combining multiple direction finders to cover large areas and deliver precise location information, the flight sectors to be included as well as minimum flight levels must be taken into account.

Exceptional location accuracy and coverage range

Rohde&Schwarz direction finders deliver precise azimuth results, providing high location accuracy even for weak radio transmissions and aircraft traveling at larger distances. The coverage range at different flight levels mainly depends on the DF sensitivity and the radio transmission power. The typical coverage range can be significantly exceeded depending on environmental and geographic conditions.

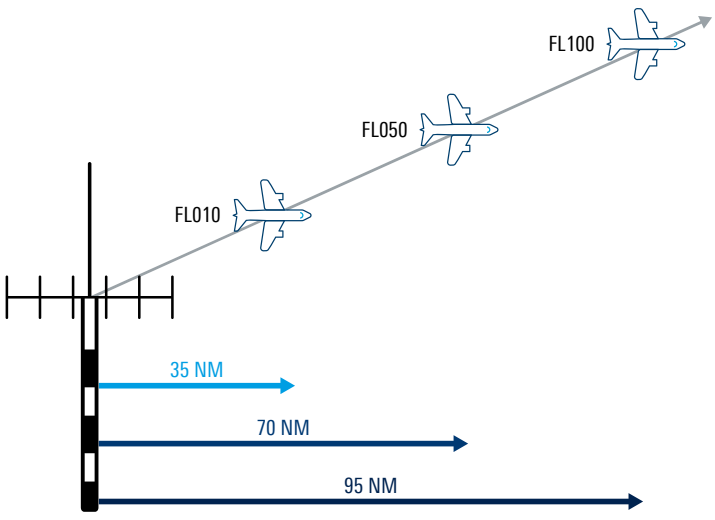
Location accuracy is further improved by considering only the most relevant DF results in the calculation. Filter settings allow adapting the calculation process and prioritizing direction finders for particular flight sectors or airports. CERTIUM® LOCATE delivers accurate geolocation results to unambiguously separate aircraft flying side by side.

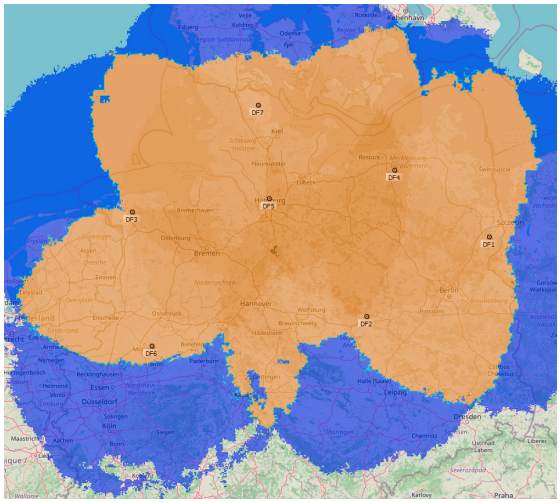
Scalable coverage area

A single direction finder covers a large area including multiple flight sectors. Direction finders at airports can be simultaneously used for approach traffic control and upper area control. Further direction finders at remote elevated sites or on top of telecommunications masts can be added to increase the coverage area and enhance system redundancy.

The coverage range varies with altitude and radio transmission power. The recommended direction finder positions are determined based on coverage prediction calculations. Typically, a spacing of 75 NM to 95 NM between direction finders is suggested as a general estimate for complete coverage.

Minimum coverage range at different flight levels





Colors indicate the coverage area:
orange for geolocation, blue for direction of arrival.

FLEXIBLE SYSTEM INTEGRATION

Rohde&Schwarz as a trusted partner supports you through all phases of your project and ensures that your objectives are met quickly and comprehensively.

One partner throughout your project

The complete system including direction finders and system software has been developed by Rohde&Schwarz based on the company's longstanding expertise in building radiolocation systems. Our experienced system engineers and project managers ensure implementation of a turnkey solution and project completion on time. This includes comprehensive acceptance testing and hands-on training for engineers and maintenance staff to ensure smooth system handover.

Standard interface to ATM systems

CERTIUM® LOCATE is designed for seamless integration into existing ATM systems. Results are forwarded to ATM systems using an ASTERIX CAT205 open standard interface for the exchange of direction and location information, ensuring vendor independence. Legacy protocols are also available for the straightforward replacement of obsolete direction finders.

Suppression of ground transmissions

Direction and location information for an ATC tower's own radio transmissions shall not be displayed for the air traffic controller. This is achieved by activating ground transmission suppression (GTS), which receives information about ground radio activities via TTL interfaces.

IP based data communications

All data communications between system components and ATM systems are IP based. Existing IP infrastructure will be used. Advanced features like redundant IP infrastructure, optional VPN support and load sharing over physical links are usable.

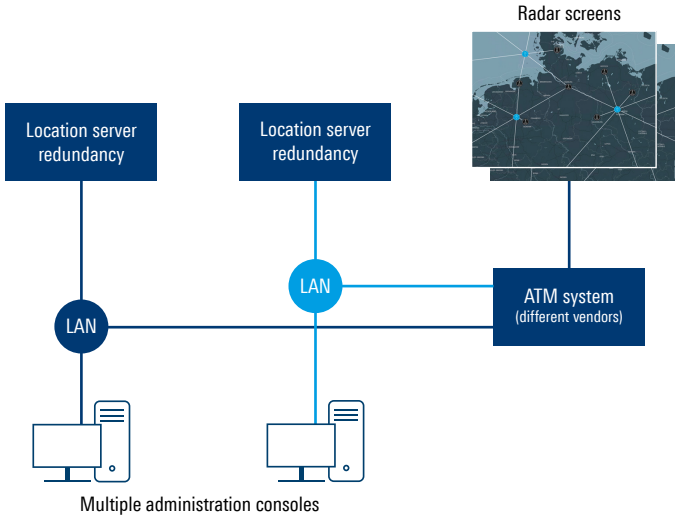
High availability

First of all, high system availability requires high reliability of all critical components. Rohde&Schwarz components are designed for long-term reliability to minimize failures and downtime. High availability for the complete system is also ensured by hot-standby redundancy for the central location server, additional administration consoles and redundant IP connectivity. Additional DF sites can be set up to reduce the impact of a complete DF site failure.

ICAO and ED-109A compliance

CERTIUM® LOCATE was designed to comply with ICAO Annex 10 and the regulations of the German Federal Supervisory Authority for Air Navigation Services (BAF). It was developed in line with EUROCAE ED-109A (air traffic management systems software integrity assurance).

High-availability redundancy concept



REDUCED OPERATIONAL AND LIFECYCLE COSTS

CERTIUM® LOCATE comes with comprehensive remote control capabilities and provides simplified replacement of defective components, minimizing maintenance efforts. Regular system calibration is obsolete with the new generation of direction finders.

Remote administration

Every direction finder within the CERTIUM® LOCATE system can be configured and monitored from a remote administration panel or a central administration console. The intuitive GUI facilitates simple and user-friendly central management and gives authorized administrators full access to the system status and settings. All system configurations can be stored, modified and reloaded within seconds.

System event logging

CERTIUM® LOCATE offers comprehensive system event logging to detect potential issues early on and analyze problems quickly. Configuration changes are recorded to verify their potential impact and keep track of modifications. The system's logging format is human readable for straightforward processing using standard or custom-specific tools.

SNMP interface for system monitoring

System messages and the overall system status are forwarded to central monitoring systems via SNMP. The service teams in charge are notified of problems immediately.

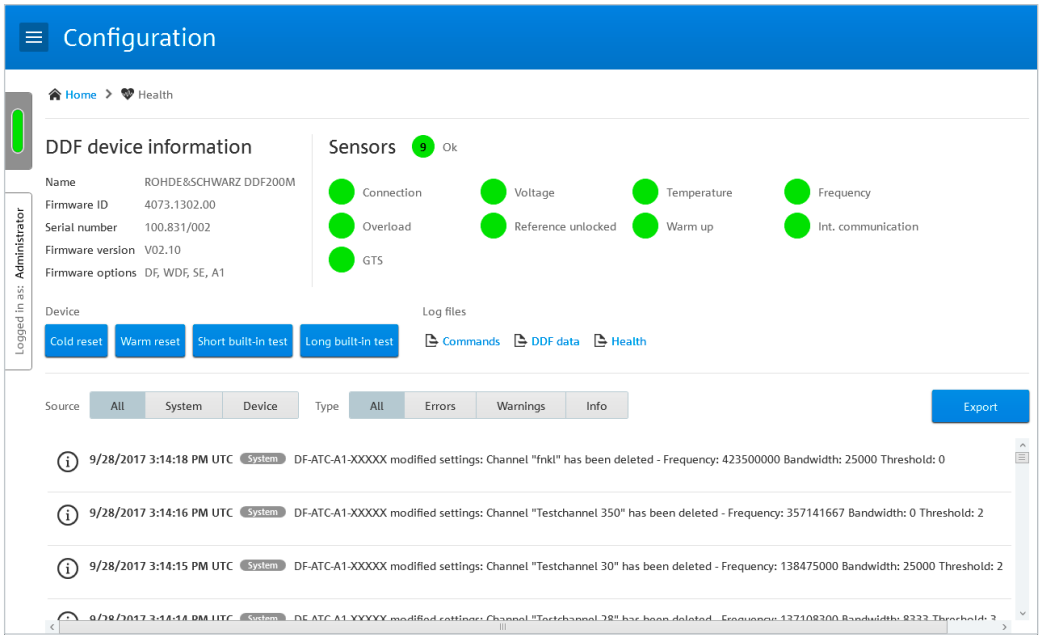
Extensive self-test capabilities

Self-test capabilities play an important role in detecting upcoming or concealed issues early on and solve problems quickly. The direction finder continuously checks more than 170 test points in a background process and compares results with reference values. If one of these test points is outside the nominal value range, the system automatically generates an error notification. Multiple system sensors constantly monitor the overall system status. Additional manual self-tests enable further verification and diagnostics.

Service level agreements

CERTIUM® LOCATE is designed for low operational and maintenance costs. Service level agreements for long-term maintenance and customer support ensure reliable and straightforward operation for many years to come. Issues are addressed quickly, and adequate obsolescence management ensures long term availability.

System self-test and status/event overview.



SECURE BY DESIGN

Cybersecurity plays a paramount role throughout the lifecycle of a CERTIUM® LOCATE system as it is vital to ensure secure and reliable system operation. Recommendations and standards provided by internet security organizations are applied to protect against cyberattacks.

Operating system hardening

The operating system and application software have been designed applying state-of-the-art software hardening techniques. Unnecessary services have been disabled, and necessary services configured in a secure manner. This greatly reduces the system's total attack surface by minimizing the number of attack vectors and preventing unauthorized access.

Security monitoring

Sophisticated access control and security group policies grant access only to authorized users with defined user rights. Security logging is provided to track all changes for further analysis of selected individual situations. Regular security updates and active antivirus software protect against all kinds of malware and phishing attacks.

Secure communications

Secure communications is ensured through the use of VPN infrastructure for all LAN/WAN IP connections. Only necessary IP ports can be accessed; all other ports are blocked by firewalls or NAT routers to safeguard against attacks from the outside.

Trustworthy and reliable communications every step of the way.

Service that adds value

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

Rohde&Schwarz

The Rohde&Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test&measurement, technology systems and networks&cybersecurity. Founded more than 85 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and 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 training

www.training.rohde-schwarz.com

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PD 5216.2801.12 | Version 01.00 | June 2022 (jr)
CERTIUM® LOCATE ATC Location System
Data without tolerance limits is not binding | Subject to change

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5216.2801.12 01.00 PDP/PDW 1 en