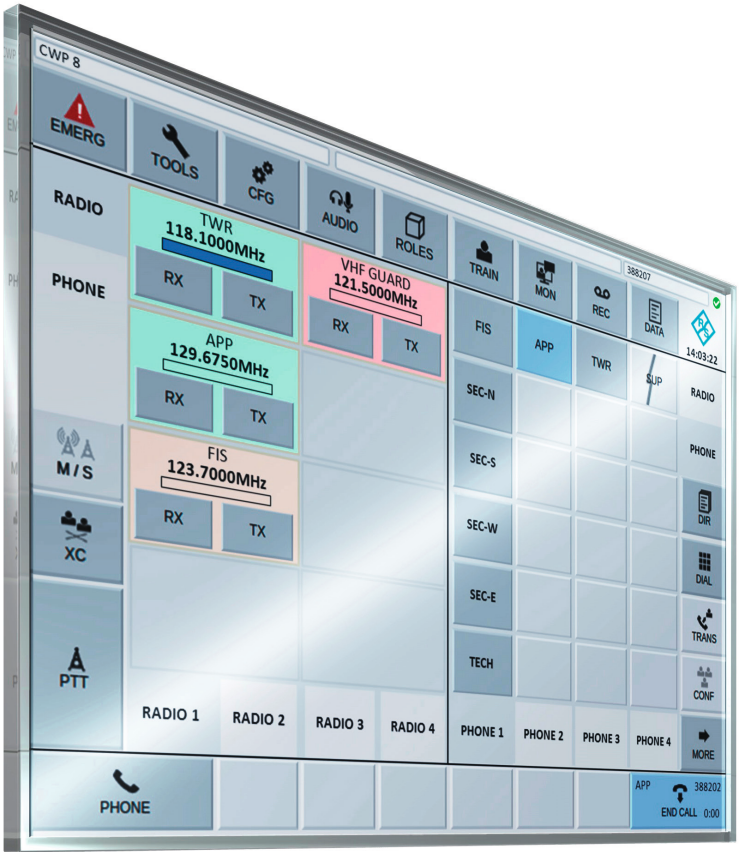
R&S®VCS-4G
IP-Based Voice Communications System
Next-generation ATC communications



ROHDE&SCHWARZ

Secure Communications

Product Brochure | 06.00

R&S®VCS-4G IP-Based Voice Communications System

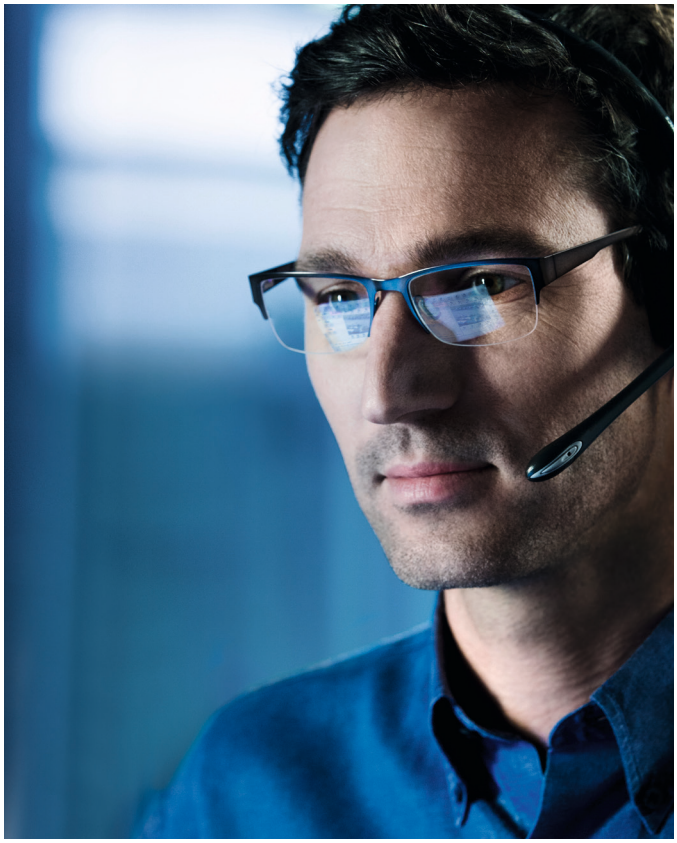
At a glance

The R&S®VCS-4G IP-based voice communications system is a flexible and cost-effective solution for all ATC voice communications needs. It meets established requirements for availability, reliability and safety in ATC as well as the growing need for dynamic ATC scenarios with network-based sharing and distribution of operational resources. Built on state-of-the-art, future-ready technology, the R&S®VCS-4G ensures protection of investment and also provides next-generation ATC features, such as a virtual center and "ATC in the trusted cloud".

The R&S®VCS-4G has been designed especially for civil ATC and air defense (AD) deployments. It enables full-featured radiocommunications between air traffic controllers and pilots, including specific radio remote control operations if required. For ground-to-ground communications, it also provides the full range of ATC/AD features with extensive interworking to conventional analog and digital VCSs and other related air traffic management (ATM) systems such as voice recorders. Additional voice services such as intercom, telephony and IP PABX are supported too. One of the key advantages of this fully IP-based communications system is its very high scalability. It allows system deployments ranging from a single controller working position (CWP) to full-scale area control centers (ACC) using the same technology and type of equipment. Additionally, the system has been designed to provide full redundancy, including distributed deployment over various sites for geographic redundancy.

Traditionally, VCS solutions were based on a centralized architecture centered around a TDM-based voice switch constituting a single physical entity located in a specific place. In contrast to this, the R&S®VCS-4G solution follows a modern distributed approach typical for IP-based solutions. Voice switching functionality is a built-in capability of each deployed R&S®VCS-4G component (CWPs, telephony and radio gateways, VCS gateways, radio servers and VoIP telephony servers). Consequently, voice communications are spread out geographically without a central, single point of failure that would bring the entire system down. R&S®VCS-4G components can be combined like building blocks around a fully redundant engineered IP LAN infrastructure to achieve the best fit for customer needs. The resulting system is a scalable, fault-tolerant solution for nonblocking voice switching based on state-of-the-art IP network technology.

People rely on ATC controllers every day. And ATC controllers rely on R&S®VCS-4G.



The R&S®VCS-4G is a future-ready system with state-of-the-art ATC features that enhance overall performance and bring the latest functionality in contrast to conventional ATC operations.

The R&S®VCS-4G was the first full-IP VCS system to enter the ATC market in an operational environment. The first version became operational back in 2008. In addition to active involvement by Rohde&Schwarz in EUROCAE WG67 and related ETSI plug tests, this first operational deployment contributed to the acceptance of IP technology as the way to go for air traffic control systems. Today it is commonly accepted that modern technologies increase system safety and efficiency while keeping costs low. With its integrated portfolio of VoIP-based VCS systems and VoIP-based radios, Rohde&Schwarz has profound experience in providing reliable system solutions to replace increasingly aging conventional VCS installations.

As a professional system designed for voice communications in ATC/AD, the R&S®VCS-4G offers the following:

- Radiocommunications between air traffic controllers and airplane pilots via HF, VHF and UHF radios
- Telephone communications with external analog and digital telephone networks via a large variety of interfaces (FXO, FXS, LB, E&M, ISDN BRI, E1, ATS-R2, ATS-N5, ATS-QSIG, etc.)
- Intercom and telephone communications for internal users with direct, indirect and hotline/instantaneous access
- Legal recording capabilities at the CWPs, telephony and radio interfaces (IP or analog/digital)
- Customization of graphical user interface and system infrastructure
- Interconnection/interworking with additional ATM systems or third-party services

In the past, ATC authorities interconnected their VCSs and radio sites via narrowband transmission lines. However, telecommunications service providers are increasingly phasing out their leased line services. As a result, the European Organization for Civil Aviation Equipment (EUROCAE) proposed the ED-137 standard for the use of IP in ATC voice communications. This standard was defined jointly by EUROCAE, ATC authorities and ATC equipment manufacturers. The R&S®VCS-4G already adheres to this EUROCAE standard. Moreover, the R&S®VCS-4G has been designed as a true IP solution that takes full advantage of IP technology to provide a cost-effective, future-ready VCS solution.

Key facts

- End-to-end IP technology from the CWP all the way to the radio while addressing increased safety requirements
- EUROCAE ED-137 adherent solution enabling interworking with other vendors' equipment or neighboring ANSPs
- Large portfolio of gateways to support different migration scenarios from TDM to VoIP
- Distributed system architecture to provide high availability and cost-effective, pay-as-you-grow scalability
- Support for modern services beyond pure voice communications (e.g. video, text messaging, SCADA interworking)
- High flexibility and customizability to specifically meet different operational needs
- Intelligent leveraging of market-leading commercial off-the-shelf (COTS) products for reduced system costs
- Tight integration with Rohde&Schwarz radios (e.g. status monitoring, specific radio remote control operations)
- Single central monitoring system with integrated view of R&S®VCS-4G components and Rohde&Schwarz radios

R&S®VCS-4G IP-Based Voice Communications System

Benefits and key features

State-of-the-art, future-ready technology for protection of investment

- EUROCAE ED-137 based, field-proven technology
- High availability through distributed system architecture
- Nonblocking system capacity
- Future-ready technology

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Reduction of system costs

- One partner from the microphone to the antenna
- Pay-as-you-grow scalability
- Integrated IP PABX functionality
- Intelligent leveraging of commercial off-the-shelf hardware and software
- Shared network infrastructure for voice and data services

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Smooth integration into existing ATM systems

- Safeguarding capital investment in radio infrastructures
- Interworking with conventional voice communications systems and the PSTN
- Flexible support of any deployment scenario
- Compatible with all network topologies (enhanced star or ring)

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Comprehensive system management

- Easy to deploy, manage, upgrade and extend
- Hot swappable interface cards
- Advanced fault management and system diagnostics
- Central monitoring of R&S®VCS-4G components and Rohde&Schwarz radios

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Custom system solutions

- Flexible CWP concept and customizable touchscreen interface
- Sophisticated ATC role concept
- Monitoring and control of radio status information directly at CWPs
- Various additional applications available to improve situational awareness
- Interworking with existing telephony systems

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Next-generation ATC features

- Smooth migration to an overall IP-based ATC solution
- Sharing of resources
- Virtual center concepts
- Geographic redundancy
- Integrated use of third-party systems and equipment

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State-of-the-art, future-ready technology for protection of investment

EUROCAE ED-137 based, field-proven technology

The R&S®VCS-4G adheres to the latest EUROCAE ED-137 standard which defines the use of voice over IP (VoIP) communications in ATC networks. The system's innovative architecture migrates intelligence away from the network core to peripheral equipment, thereby increasing availability and reliability. For instance, each CWP of the R&S®VCS-4G has the built-in computing power needed to enable nonblocking, interruption-free communications with other R&S®VCS-4G components. No TDM-based central node is present in the system. As a result, no central point of failure can bring down the entire system or limit the communications capacity of the system.

During more than a decade of operation in public and private telecommunications networks, VoIP technology in general has proven its capability to provide high-quality, reliable communications – even in safety-critical environments. The same success story is currently unfolding for VoIP in ATM.

High availability through distributed system architecture

There is no single point of failure within the R&S®VCS-4G architecture. A fault of a particular R&S®VCS-4G device does not affect operation of other devices in the system. Each R&S®VCS-4G device has two redundant Ethernet interfaces that can be used to connect the device to two different Ethernet switches. The two physical interfaces act as one redundant logical IP interface connecting the device to the rest of the R&S®VCS-4G IP network. By deploying Ethernet switches in redundant pairs, two independent paths to the IP backbone are available. If one Ethernet switch fails, operation continues unaffected over the second switch.

Redundant R&S®VCS-4G devices need not necessarily be installed at the same physical site. They can be distributed geographically over various sites to increase overall system availability. In the event of a complete failure at one site (fire, earthquake, hurricane, etc.), network operation will continue without interruption by using the backup components at the other sites.

The R&S®VCS-4G is designed to offer 24/7 continuous operation without any interruption in voice communications. Within the R&S®VCS-4G system, failures are isolated starting at the subsystem level (CWPs, servers, Ethernet switches) down to the interface card that handles external interfaces without affecting communications of other devices. All equipment is modular for easy, direct replacement of components. The design of the R&S®VCS-4G system provides quick access to equipment modules for minimal routine maintenance inspection, cleaning or replacement. Replacing single R&S®VCS-4G devices does not impact overall VCS operations. Furthermore, all R&S®VCS-4G components are equipped with dual power feeds.

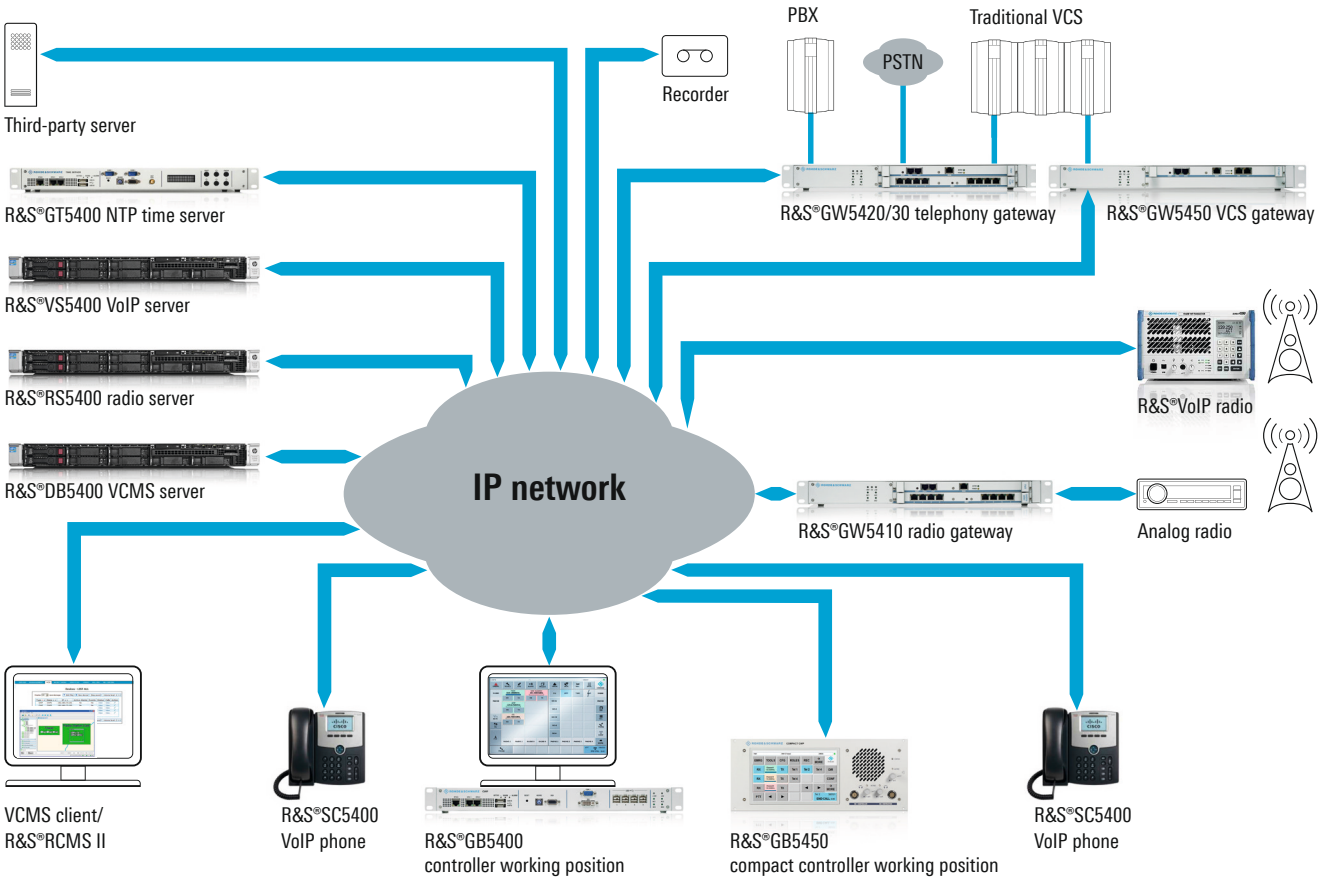
Nonblocking system capacity

Each R&S®VCS-4G component provides its own built-in call routing intelligence and switching power required to ensure nonblocking air-to-ground and ground-to-ground communications. Classic TDM-based VCSs have to rely on a central switch matrix, which usually has a hardware limit for the number of calls that can be handled in parallel. If all input/output ports are used or the switch matrix is full, the next call will be rejected. As the R&S®VCS-4G does not include any such TDM-based switch matrix, there is no hardware limit that blocks the next call after the maximum capacity has been reached.

Future-ready technology

The R&S®VCS-4G features a future-ready, distributed architecture. It is in line with the latest industry requirements and contributes to modernizing air traffic control by making use of IP technology engineered at its best. Due to its flexible and distributed network design and extensive configuration possibilities, the R&S®VCS-4G supports dynamic sharing of radio and telephony resources. This feature permits the subsequent implementation of modern operational concepts for ATC such as load balancing, resource sharing, geographic distribution, virtual center and remote tower. This reduces risks and costs for future redesign and migrations in any ATC project from the very beginning.

Full-range communications solutions for ATC/AD



Reduction of system costs

One partner from the microphone to the antenna

The Rohde&Schwarz product portfolio provides solutions for all ATC voice communications needs – from the CWP microphone to the radio and the antenna system. This eliminates complex and costly integration work and helps ATC authorities to keep project risks to a minimum. The R&S®VCS-4G also supports third-party radios with E&M, E1 or VoIP interfaces in line with customer requirements.

Pay-as-you-grow scalability

TDM-based systems rely on one or more centralized switching nodes to route voice information between the CWPs and the radios. In contrast, the R&S®VCS-4G with its distributed network intelligence does not require a central switching entity. All intelligence and computing power needed to provide nonblocking communications services is already built into each CWP. A single CWP communicates directly with a large number of VoIP radios, without depending on the services of other R&S®VCS-4G components.

As a result, ATC authorities no longer need to invest in large system cores from the start. All that is needed to get up and running with the R&S®VCS-4G is the relevant number of CWPs, a configuration and management server, an engineered IP connection and IP-enabled radios. Additional components can be added at a later stage as the need for more capacity arises. This helps to optimize operational costs and reduce the required capital investment. In the case of a pure IP infrastructure from the CWP to the VoIP radio, even the investment in radio gateways can be saved.

Integrated IP PABX functionality

The VoIP telephony server from the R&S®VCS-4G portfolio can be used to provide IP PABX functionality to the ATC network, replacing or extending existing private automatic branch exchanges (PABX). VoIP telephony services to COTS IETF SIP-compliant phone terminals for connection to internal and external telephony destinations are supported.

IP PABX functionality can be added at any time to an existing R&S®VCS-4G system and share the same engineered IP network infrastructure with regular ATC services. Configuration and management is carried out by the existing R&S®VCS-4G control and monitoring system (VCMS).

Intelligent leveraging of commercial off-the-shelf hardware and software

When designing the R&S®VCS-4G, strong emphasis was placed on making intelligent use of COTS products where appropriate. Standard Ethernet switches and VoIP phones can be used within the R&S®VCS-4G. Other R&S®VCS-4G components are based on professional server platforms from industry-leading manufacturers. A wide selection of touchscreen monitors is available in different sizes, integration formats (desktop or console integration), brightness (standard or sunlight-readable high brightness) and touch technologies (capacitive or resistive). Customers benefit from cost-effective, commercially available state-of-the-art products.

Shared network infrastructure for voice and data services

Many ATM systems are already using engineered IP networks to transmit data, such as radar and flight plan information. Using established IP network engineering techniques, these networks can be reused or extended to also handle realtime services such as voice. Sharing the same IP-based network for voice and data creates synergies in procurement, operation and maintenance, all of which leads to significant savings in CAPEX and OPEX.

Smooth integration into existing ATM systems

Safeguarding capital investment in radio infrastructures

Safeguarding investments made in existing radio infrastructures is a key issue when designing the migration to a VoIP system. The R&S®VCS-4G allows ATC authorities to continue working with their installed base of conventional radios by providing different types of radio gateways for interworking with non-VoIP radios. Interworking with radios with analog or E1 audio interfaces is supported. Subsequent migration to an all-IP ATC infrastructure with VoIP radios requires minimum financial investment because existing R&S®VCS-4G CWPs, servers and Ethernet switches can be reused. The VoIP-based radios only need to be configured in the R&S®VCS-4G VCMS server as newly available resources and connected to the existing IP infrastructure.

Interworking with conventional voice communications systems and the PSTN

Because ATC communications systems do not operate as islands, they need to connect with private automatic branch exchanges (PABX), the public switched telephone network (PSTN) as well as with other voice communications systems. While the family of R&S®VCS-4G telephony gateways interconnects the VoIP VCS with conventional communications networks, the R&S®VCS-4G VCS gateway interfaces conventional voice communications systems to modern VoIP-based radios. Gateways are available with various capacities and a wide range of transmission and signaling methods to enable optimal adaptation to the prevailing interworking requirements. This facilitates smooth migration of conventional communications solutions to VoIP.

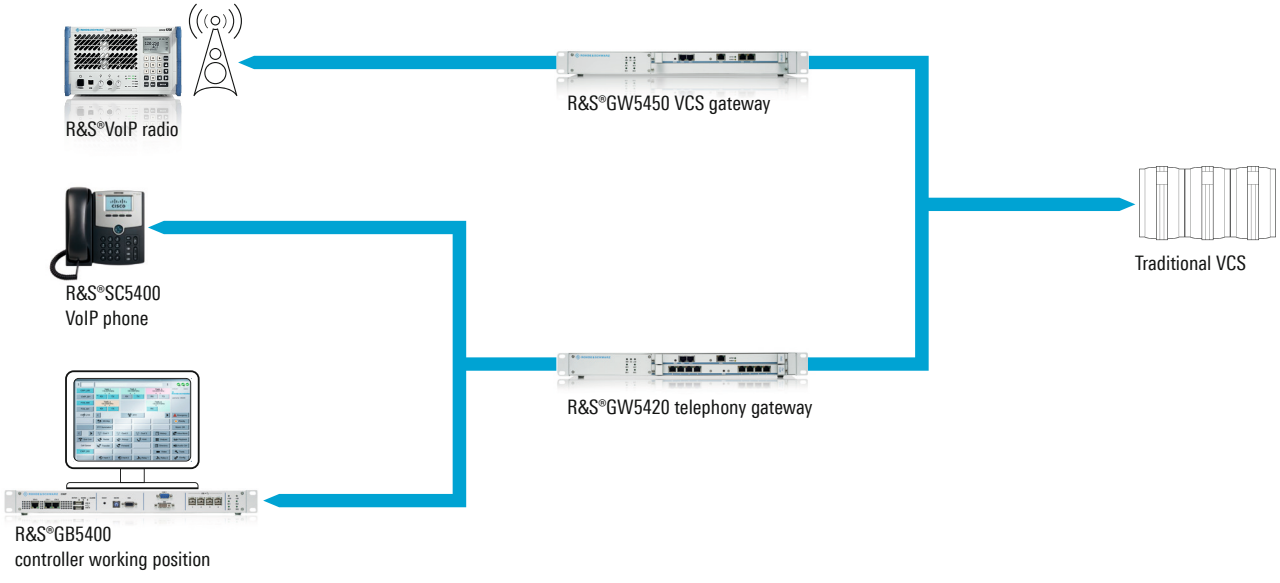
Flexible support of any deployment scenario

Featuring a distributed architecture, the R&S®VCS-4G supports different deployment scenarios meeting diverse requirements by air navigation service providers (ANSP) for their ATC infrastructure. With its very high level of scalability, the system supports deployments ranging from a single CWP to full-scale ACCs using the same technology and equipment type. Furthermore, the use of IP technology makes it possible to implement deployments with all equipment located at the same site as well as geographically fully distributed scenarios providing an advanced, geographically redundant VCS network.

Compatible with all network topologies (enhanced star or ring)

The R&S®VCS-4G uses the field-proven set of Internet protocols for voice and data transmission. Based on this well established technology, it is independent of any specific network topology (ring or star) or network size. The only network requirement is an IP connection engineered to handle realtime services such as voice. This concept is supported by available COTS devices allowing the ANSP to extend its IP infrastructure to any location, e.g. carrying IP over optical fiber or an synchronous digital hierarchy (SDH) ring in place.

R&S®VCS-4G system solution with legacy interworking



Comprehensive system management

Easy to deploy, manage, upgrade and extend

Using the R&S®VCS-4G control and monitoring system (VCMS), the R&S®VCS-4G components can conveniently be configured and monitored via a modern user interface. Using a web-based interface to the VCMS, a service engineer can configure, monitor and maintain R&S®VCS-4G devices locally and remotely using a standard PC with web browser over a secure network access to the R&S®VCS-4G system. Upon completion, the system configuration is stored on the VCMS server and transferred to the affected system components in an orderly manner.

Hot swappable interface cards

To facilitate maintenance as much as possible, gateways are equipped with hot swappable interface cards. The cards can be safely replaced during operation without interfering with ongoing operations on other interface cards or causing electrical damage to the system. Interface cards that have been replaced retrieve their configuration automatically from the VCMS and become operational again.

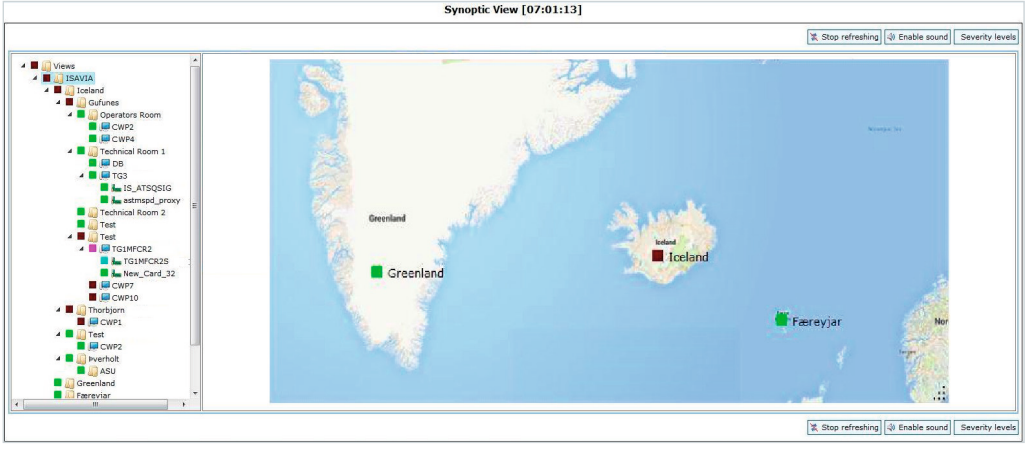
Advanced fault management and system diagnostics

Each R&S®VCS-4G device has built-in test functionality that continuously monitors the device status to immediately identify any malfunctions and their severity level. Faults are instantly displayed on the central VCMS management system by different means: as an event in an alarm list or as an event in the Synoptic View, providing the controller with a geographical layout showing where and on which device the event took place. An email will be sent to inform the system administrator that a new event has occurred. All events are stored in the VCMS management system and in the devices' local log files. The summarized system status can be sent to an umbrella monitoring system via SNMP.

The collected call data records can be analyzed and graphically represented with a dedicated tool.

Central monitoring of R&S®VCS-4G components and Rohde&Schwarz radios

The R&S®RCMS II software application suite is available to remotely control R&S®Series4200, R&S®M3SR Series4400 and R&S®M3SR Series4100 radios. It also provides monitoring for these Rohde&Schwarz radios and R&S®VCS-4G components. SNMP-capable devices can also be monitored, so that in ATC installations based on Rohde&Schwarz radios and the R&S®VCS-4G VCS, all components can be conveniently monitored from a single central system. Service engineers only need one tool to monitor all important devices in their ATC voice communications network, including radios, CWPs and other SNMP-capable devices, such as supported Ethernet switches. This results in cost reduction due to less equipment and lower training efforts, as there is no need to install multiple types of monitoring software for different types of equipment



R&S®VCS-4G Synoptic view.

Custom system solutions

Flexible CWP concept and customizable touchscreen interface

Due to the modular design of the R&S®VCS-4G controller working position, it can be equipped with touchscreens of various sizes and touch technologies to satisfy different operational requirements. The touchscreens can be installed as a desktop model or can be integrated into the ATC console, as required by the customer. For system installations at sites with space constraints, the compact CWP provides an all-in-one compact design without compromising on features.

The intuitive GUI of the R&S®VCS-4G CWP allows controllers to concentrate on the job at hand. In addition to its default configuration, the GUI supports fast and flexible customization. Colors, buttons and layout can be easily adapted to the operational needs of specific ATC scenarios.

Sophisticated ATC role concept

The R&S®VCS-4G incorporates a sophisticated concept for ATC roles, including the assignment of specific functional roles to individual controllers. As part of this feature, a role-specific configuration is loaded when a controller signs in at a CWP. The GUI is then automatically customized according to the profile downloaded for the controller in question. Roles can become active or phased out depending on the time of day or other operational criteria. Controlled handover and delegation of roles is supported.

Monitoring and control of radio status information directly at CWPs

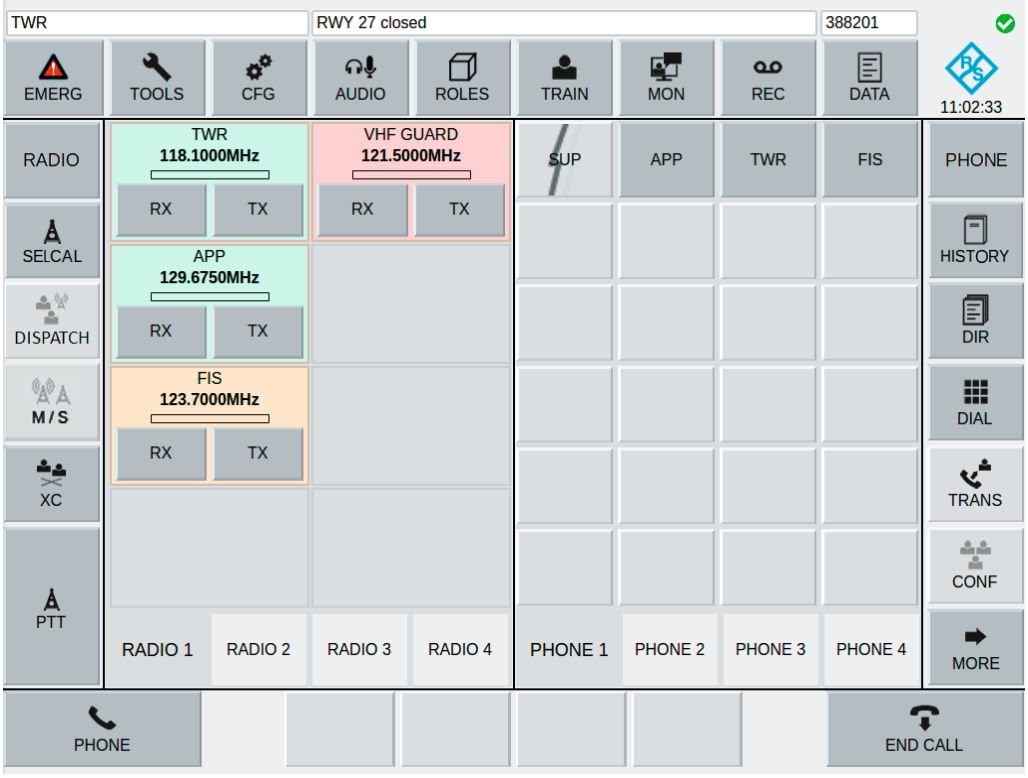
The R&S®VCS-4G features remote control and monitoring of ATC radios directly integrated into the GUI of CWPs. This provides air traffic controllers with a graphical indication of radio channel availability, increasing situational awareness and allowing the controller to take appropriate actions in the case of radio malfunction. Remote control and monitoring functionality is currently supported for R&S®Series4200, R&S®M3SR Series4400 and R&S®M3SR Series4100 radios in fixed frequency mode, as well as for radios compliant to latest EUROCAE ED-137, Volume “Supervision” and supporting the generic SNMP radio MIB. For these radios, air traffic controller can monitor the radio status and perform remote control operations, such as selection of the active frequency from a predefined list. Support for extended remote control operations and other radio types can be integrated according to project-specific requirements.

Various additional applications available to improve situational awareness

The R&S®VCS-4G supports integration of additional applications beyond pure voice communications, e.g. to provide improved situational awareness to the controller. To this end, a variety of IP-based multimedia applications can be integrated into the CWP. For example, live video surveillance can be displayed on the CWP monitor to provide an overview of otherwise hidden parts of the airport. This additional information can help to solve safety-critical requirements. Access to supervisory control and data acquisition (SCADA) devices for remote control of selected third-party devices (e.g. door locks, on/off power switches) can be integrated into the GUI of the CWP.

Interworking with existing telephony systems

Besides the latest EUROCAE ED-137, the R&S®VCS-4G supports IETF VoIP protocols for standard IP telephony. Interworking with any IETF SIP-compliant telephony terminal and IP PABX system is supported. The connection between the R&S®VCS-4G and a third-party IP telephony system can be configured in several modes (e.g. trunk, client) depending on the actual deployment scenario and customer needs. Interworking to conventional telephony systems is ensured by gateways with a wide selection of analog and digital interface cards.



Example of the R&S®VCS-4G GUI.

Next-generation ATC features

Smooth migration to an overall IP-based ATC solution

International groups and projects such as SESAR (Single European Sky ATM Research Program) and NextGen (Next Generation Air Transportation System of FAA) promote modern, efficient and safer unified ATC networks where all ATC participants have shared access to information and resources.

As aging conventional ATM systems are increasingly replaced with IP-capable technologies, a key requirement in advanced projects like SESAR or NextGen is the migration of all ATM systems and services to a fully IP-based network-oriented solution. The result is more efficient sharing of information, services and resources. Eventually, this will lead to an intelligent distributed ATC cloud that offers all stakeholders efficient and safe access to shared assets.

The R&S®VCS-4G solution has been designed as an all-IP system that explicitly builds on open and interoperable industry standards from established standardization bodies such as EUROCAE and IETF. This approach ensures smooth integration of the R&S®VCS-4G solution in any IP-based overall ATC solution.

Sharing of resources

Load balancing and resource sharing are key objectives of all currently ongoing major ATC evolution initiatives. These two concepts are a prerequisite for increased efficiency in future ATC operations. The fully IP-based architecture of the R&S®VCS-4G takes full advantage of the flexibility of IP technology to natively support advanced concepts for ATC such as resource sharing and VCS collaboration in the cloud over an engineered IP transport network. Such scenarios are unrealistic with conventional VCS technology. However, today they become increasingly important and feasible in modern ATC operations – especially with air-to-ground and ground-to-ground communications widely supported and enhanced by the use of IP technology.

In the visionary spirit of "ATM in the trusted cloud", the R&S®VCS-4G supports sharing of radios and telephony lines by multiple VCSs regardless of their actual location and without the need for additional VCS equipment. All resources – local and remotely shared over the engineered IP network – show the same operational behavior and offer the same set of features to the controller.

For example, radios normally used by a single ATC center can be remotely accessed over the engineered IP transport network by other voice systems located at other ACCs. As shown in the figure, signaling and voice traffic from ATC center 2 does not pass through ATC center 1 and is therefore not related to any of its operational aspects. Even if ATC center 1 goes completely offline, ATC center 2 can still ensure business continuity.

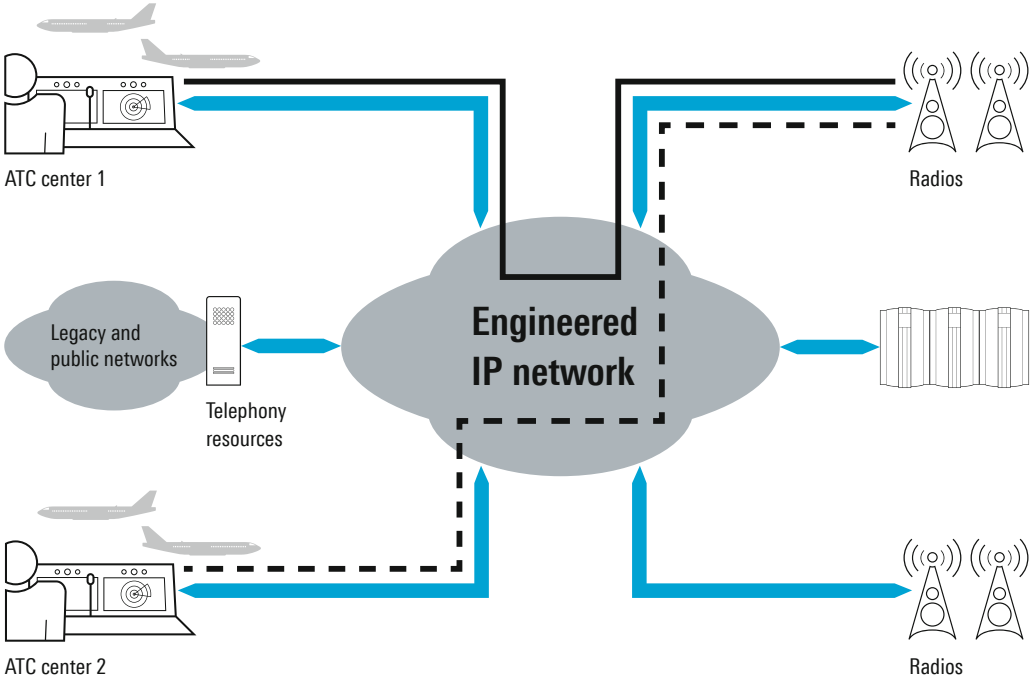
The R&S®VCS-4G allows ANSPs to go even one step further. Feeling continuous pressure to optimize their cost structure, ANSPs increasingly consider consolidation of ATC facilities. Assuming a network scenario as presented in the figure, ATC center 2 could completely take over the tasks of ATC center 1 because it has full access to all relevant air-to-ground and ground-to-ground resources over the common engineered IP network.

Virtual center concepts

To optimize safety and cost structures and to further improve the ATC services to airlines, the concept of resource sharing can evolve into the advanced concept of virtual centers: Two originally independent centers are defined as mutual backup for each other with an engineered IP network as the common link between them. In case of catastrophic events at one center, the second center can take over the communications operations of the disabled facility, using the still unaffected air-to-ground and ground-to-ground resources. Virtual centers bring substantial economic benefits to the ANSP community.

The R&S®VCS-4G with its full IP system architecture and distributed infrastructure based on the latest ED-137 standard supports resource sharing and synchronization between different voice communications systems at different geographic locations as a prerequisite for virtual centers. Hence, R&S®VCS-4G is the ideal key building block in any virtual center concept for air traffic control center or tower applications, making the ATC in the trusted cloud reality

Principle of ATC resource sharing



Geographic redundancy

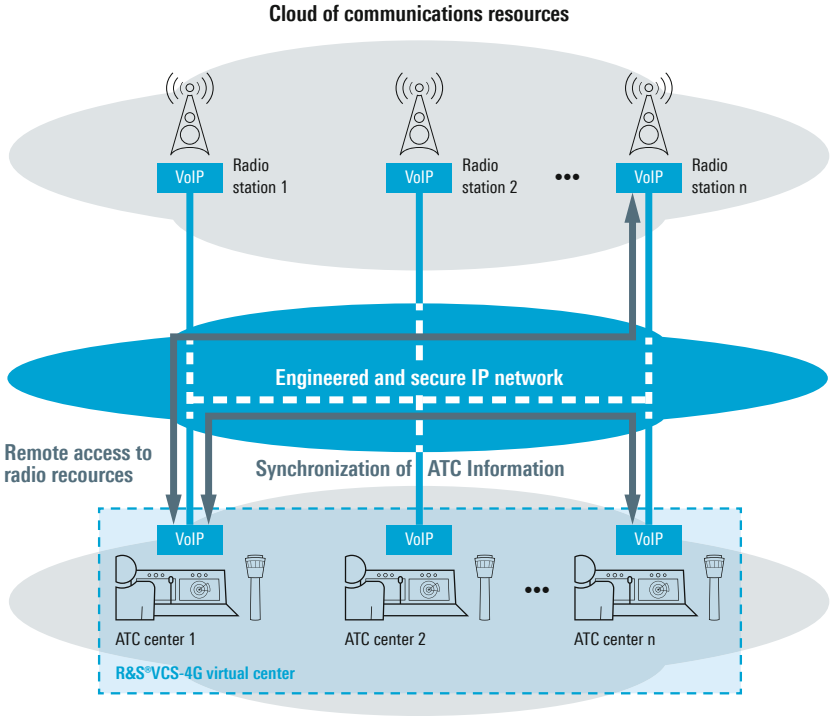
Safety is a major concern in ATC operations. Geographic redundancy provides additional resilience against failure because main and standby elements are situated at geographically different locations. A catastrophic event at one location does not automatically affect the other location.

The R&S®VCS-4G is based on a distributed architecture where all system components connect to a common engineered IP transport network. ATC equipment can be split between distinct locations but since it is still connected by the same layer 2 network, it will continue to function as one voice communications system. Complete failure of a geographic location (e.g. fire, power outage) will only impact the local resources, allowing the overall distributed system to continue functioning.

Integrated use of third-party systems and equipment

The R&S®VCS-4G supports voice services and data applications. All content is carried as payload in IP packets over an engineered IP transport network. Hence, the same infrastructure and devices can be shared to support and integrate different types of applications and services, e.g. integration into other airport surveillance systems. One possible scenario is an R&S®VCS-4G CWP which is integrated into the controller surveillance display (A-SMGCS) of an airport. In this case, the controller can select radio channels from the surveillance display without having to change displays for radio channel selection and without losing eye contact with the airport surveillance screen.

R&S®VCS-4G Virtual Center concept



Cloud of ATC information (roles, available resources, flight status…)

Summary of design principles

State-of-the-art, future-oriented technology

The R&S®VCS-4G solution has been designed to meet highest reliability, availability and safety requirements for ATC. The design of the R&S®VCS-4G solution builds on the relevant EUROCAE standards for VoIP in ATM as well as EUROCONTROL and ICAO recommendations while using latest state-of-the-art technology. The system's distributed architecture, with processing power for call control and media handling built into each device, provides high scalability and a nonblocking solution installed at various geographic locations.

High reliability and availability

The R&S®VCS-4G has been developed using modern hardware and software concepts that offer multiple levels of hardware and software reliability. This ensures the high standard of availability and safety essential for mission-critical systems. The system and its underlying network have been designed to make use of the advantages that truly distributed IP technology brings to mission-critical voice and data communications.

High flexibility and system scaling

Based on modern system concepts and a distributed IP-based architecture, the R&S®VCS-4G offers significantly more flexibility in system design, deployment and maintenance than previous technologies.

Due to the resulting high scalability, R&S®VCS-4G installations can range from only a few CWPs with basic voice communications capabilities for small local airports to full-scale ACCs with access to extended air-to-ground and ground-to-ground communications networks that control large national or international airspaces.

Redundant R&S®VCS-4G devices can be collocated in the same rack/equipment room or installed in different geographic locations to increase reliability and protection against disastrous events.

Easy maintainability

Where applicable, the R&S®VCS-4G leverages advantages of industry-leading COTS equipment to build the system. Standard connectors and interfaces are used to connect R&S®VCS-4G devices and accessories. This results in easy installation and maintenance of the system as well as considerable cost savings in technical training for maintenance personnel. Furthermore, the use of IP/VoIP technology in the R&S®VCS-4G network allows standard network and system monitoring devices to be used without the need to purchase additional proprietary monitoring hardware and software.

VoIP
Communications Solutions

Use cases

Area control centers (ACC)

The R&S®VCS-4G is designed for deployments in ACCs requiring a large number of operator working positions. The system's scalability and distributed network architecture allow the implementation of ACCs with optimized infrastructure footprint while providing highly reliable interworking with other communications systems and geographic redundancy. Remote radio sites are connected to the ACC through suitable redundant wide-area connections.

Last resort systems

Last resort or emergency systems are another typical use case for the R&S®VCS-4G. Since the main VCS and the last resort system usually must be two different systems in terms of technology and supplier, the use of the R&S®VCS-4G provides full isolation between the main VCS and the last resort VCS. With its IP-distributed approach, the R&S®VCS-4G can operate as a last resort system completely independently of a conventional TDM-based main backup VCS system, for example.

Towers

Due to the technology-inherent high scalability of the R&S®VCS-4G, all sizes of tower installations can be supported with the same system solution. Smaller airports and mobile towers can be equipped very efficiently to provide maximum technical performance at an optimized price/performance ratio while using a minimum of equipment and installation space. For large tower installations, such as in international airports that require a high number of CWPs to configure and maintain, the same R&S®VCS-4G solution can be expanded to meet highest requirements with regard to configuration, flexibility and redundancy.

Remote tower operation

The R&S®VCS-4G is ready to be integrated into a remote/virtual tower solution that allows control of remote airports for reasons of resource optimization or geographic backup. Due to the full IP system architecture and distributed infrastructure, the R&S®VCS-4G supports shared access to remote radio and telephony resources. These features allow towers to be remotely operated from another geographic location. Such VCS installations make it possible to control airports with low traffic without having a complete ATC crew present at the actual location.

Shelters and mobile towers

In addition to the standard deployment of voice communications systems in buildings and towers, requests for shelter and mobile tower installations are becoming more frequent. Application scenarios range from cost-optimized ATC tower systems to semi-mobile emergency systems and AD. The challenge is to fit all the necessary equipment, e.g. radios, VCS, radar screens, into very space-constrained shelter environments while still providing full ATC/AD services without any functional compromises. Purely IP-based communications solutions such as the R&S®VCS-4G are the perfect answer to such challenges because the installation can be reduced to just the required components, i.e. CWPs, control and monitoring system, radios and an engineered IP infrastructure between them.

VCS simulator and training systems

With its full set of ATC functions, extremely small footprint, excellent scalability and high flexibility in GUI customization, the R&S®VCS-4G is an excellent platform for simulator and training systems. The smallest simulator/training system may comprise only one CWP and one simulated air-to-ground/ground-to-ground communications line with pay-as-you-grow guarantee for later extensions. Sharing the same IP infrastructure for voice and data applications (e.g. radar and flight plan data) creates significant synergies in procurement, operation and maintenance of the complete simulator/training system, all of which leads to significant cost savings.

System components

Standard controller working position (CWP)

From the CWP, the air traffic controller can select radio channels as well as telephony and intercom services. The full feature set provided by conventional ATC voice communications systems is supported: frequency cross-coupling, short-term recording, conferencing, call queuing, role-based user profiles, etc. The CWP platform is fully future-ready and supports new IP-based services such as data and multimedia.

Compact controller working position (cCWP)

The compact CWP is a small form factor CWP, providing functionalities similar to those of the standard controller working position. Its compact design makes it the perfect solution for system installations at sites with space constraints without compromising on features. It features full integration of a touchscreen, processing unit, audio unit and speaker in a single compact chassis.

R&S®VCS-4G control and monitoring system (VCMS)

The VCMS server is used to configure, manage and monitor all the Rohde&Schwarz devices in the system from a single central point via a modern web-browser-based frontend. When air traffic controllers sign in at a CWP, their specific configuration is downloaded from the VCMS database. Even if the VCMS temporarily goes offline, the system will continue to operate in its current state. For highest availability, the VCMS server can be operated in a redundant main-standby configuration.

VoIP telephony server

The VoIP telephony server provides a full range of VoIP telephony features, e.g. IETF SIP-based VoIP telephony including supplementary services such as call holding/forwarding for IETF SIP-based COTS phones. It is also possible to connect the VCS to a VoIP PBX via IP-based trunk lines. For highest availability, the VoIP telephony server can be operated in a redundant main-standby configuration.

Radio server

The radio server is a supplementary element in the R&S®VCS-4G system architecture. Its task is to reduce the bandwidth consumed by multiple, identical VoIP channels when connecting several CWPs to the same radio. This is especially useful for bandwidth-limited links to remote radio sites. In such scenarios, the radio server acts as a VoIP traffic concentrator and establishes single SIP and RTP sessions with each radio, independent of how many CWPs are connected to the radio. For highest availability, the radio server can be operated in a redundant main-standby configuration.

Radio and telephony gateways

The family of radio and telephony gateways converts VoIP-based communications signals for call control and media information to conventional analog signals, and vice versa. These gateways allow air traffic controllers to communicate with radios that have an analog audio interface or with participants on PABX or PSTN extensions and conventional VCS stations. Interfaces cards of type E&M, FXS, FXO, LB, ISDN, E1, ATS-R2, ATS-N5, ATS-QSIG and other formats are available.

VCS gateway

The VCS gateway converts analog and digital audio signals from a conventional VCS to audio signals for modern VoIP-based radios, and vice versa. To this end, the gateway provides interfaces of type E&M and E1 for the conventional VCS and of type ED-137 for the VoIP-based radio.

The VCS gateway allows leveraging of a future-ready, ED-137 adherent VoIP radio infrastructure early in the migration process while still benefiting from maximum reuse of the installed base of conventional VCSs.

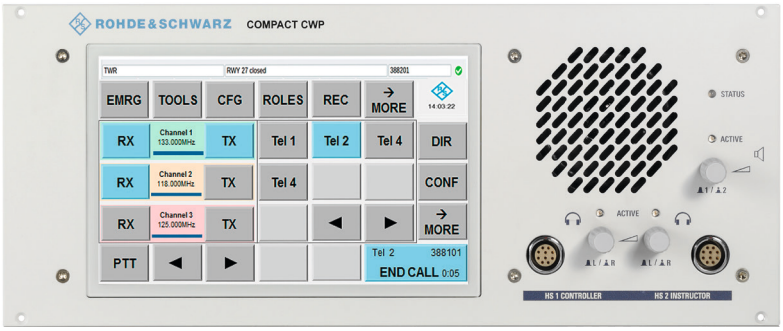
Time server

The time server is a supplementary element in the R&S®VCS-4G system architecture. Its task is to provide all devices in the network with a central time reference via the well-known IETF network time protocol (NTP). The input to the time server is a highly accurate time signal provided by its internal GPS module. The benefit of having device-internal clocks synchronized is that service engineers can conveniently compare events in the system log of different devices that all use the same synchronized timestamps. Existing IETF-standards-compliant NTP servers can be reused by the R&S®VCS-4G.

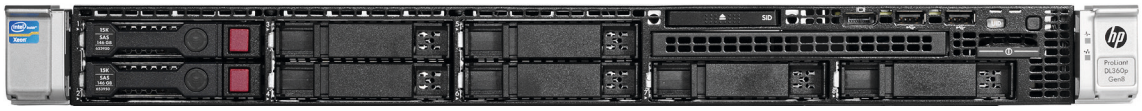
Ethernet switch

Ethernet switches are used to connect R&S®VCS-4G devices on the transport network level. Various models for different deployment scenarios are available. All switches are professional COTS products from leading manufacturers.

R&S®GB5400 standard controller working position.



R&S®GB5450 compact controller working position.



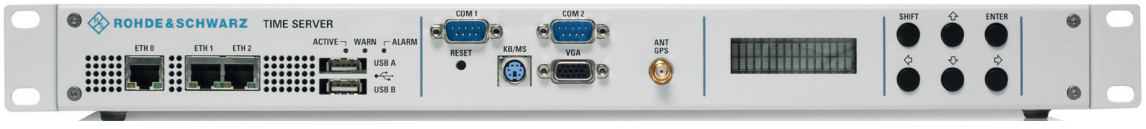
R&S®VCS-4G server platform for VCMS, VoIP telephony server and radio server.

R&S®GW5410 radio gateway (1 HU).

R&S®GW5420 telephony gateway (1 HU).

R&S®GW5420 telephony gateway. (2 HU).

R&S®GW5450 VCS gateway.



R&S®GT5400 NTP server.

For data sheet, see PD 5214.5010.22 and www.rohde-schwarz.com

Service that adds value

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

About Rohde&Schwarz

The Rohde&Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, radiomonitoring and radiolocation. Founded more than 80 years ago, this independent company has an extensive sales and service network and is present in more than 70 countries. The electronics group is among the world market leaders in its established business fields. The company is headquartered in Munich, Germany. It also has regional headquarters in Singapore and Columbia, Maryland, USA, to manage its operations in these regions.

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
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AQAP-2110

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