

R&S® SERIES 5200 AIR TRAFFIC CONTROL RADIOS

Future-proof, reliable, and easy-to-use technology

White paper | Version 01.00 | Dennis-Peter Merklinghaus

ROHDE & SCHWARZ

Make ideas real



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The R&S®Series5200 air traffic control radios from Rohde & Schwarz blend the company’s robust design philosophy, exacting research and development and uncompromising production standards. The result is a radio that is highly reliable, simple to use and easy to upgrade.

Rohde & Schwarz has been involved in air traffic control (ATC) communications for 60 years, starting in the late 1960s and continuing unabated to the present day. Over the years its products have successively been modernized with new systems entering the marketplace. Having launched its R&S®Series5200 in 2020, Rohde & Schwarz introduced one of the most advanced ATC radios on the market.

1 HISTORY

Rohde&Schwarz' first ATC radio was the R&S®XT3030, launched in the 1970s. Such is its reliability that some are believed to still be in service today. The Rohde&Schwarz XT3030 was followed by the R&S®Series200. Many countries still rely on the R&S®Series200 for their ATC needs. This radio was one of the first radios equipped with synthesizer frequency tuning. It supported 8.33 kilohertz channel spacing and could be remote controlled. The R&S®Series200 was joined by the R&S®Series4200 radio. More than 30 000 of these radios have been deployed around the world. It is highly likely that readers will have travelled on an aircraft, which received its ATC transmissions from a R&S®Series4200 radio. It was one of the first ATC radios equipped with an internet protocol (IP) interface, enabling Voice-over-IP (VoIP) communications. The R&S®Series4200 radios also support a very high frequency (VHF) datalink.

The Rohde&Schwarz XT3030, R&S®Series 200 and R&S®Series4200 are the backbone of the Rohde&Schwarz ATC radio expertise. Although they are from different eras, they have several characteristics in common. These include low life cycle costs, long operational lives, reliability and state-of-the-art technology.

Moore's law has made an important contribution to Rohde&Schwarz' evolution of its ATC radios. Moore's law is named after Gordon Moore, an engineer and co-founder of the Intel Corporation. In 1965 he predicted that the number of transistors housed on a single chip would double every two years. This had two effects: It allowed electronic devices to become physically smaller as they used less space to house the components they needed to perform their tasks. Today's smartphones can perform infinitely more functions than a similar sized pocket calculator of the 1980s. Secondly, as individual chips could house yet more transistors the chips themselves could perform yet more tasks. In summary, Moore's law lets electronics get smaller while doing more.

Why is Moore's law relevant to the evolution of Rohde&Schwarz' ATC radios? It is obvious how the capabilities of the company's radios kept evolving as new systems were developed and produced. When the R&S®Series4200 debuted in 2006, it could do more than the R&S®Series200. In 2020 Rohde&Schwarz launched the R&S®Series5200. This radio has multiple, isolated IP interfaces. Security is at the heart of the design and new features required by the user can easily be added to the radio.

R&S®Series5200 Transceiver



2 PHILOSOPHY

Rohde&Schwarz' ATC radio design philosophy rests on three pillars: Security, reliability and simplified maintenance.

Rohde&Schwarz follows a strict "security by design" approach for all mission-critical components. Multiple layers of redundancy including an innovative quad-redundant voice communications system (VCS) architecture ensure uninterrupted availability. Secure communications has been a core competence of Rohde&Schwarz for many decades. The company is a leading IT security company that protects digital assets of critical infrastructures around the world and provides approved solutions for classified communication levels. Safety is a vital part of the company's DNA. As an independent, privately owned enterprise/group, Rohde&Schwarz does not have to think in terms of quarterly results, it can plan sustainably for the long term.

Device reliability is obvious but imperative for this highly safety driven environment. Reliability reduces the time needed to perform radio maintenance. Any maintenance that is needed can be performed easily and quickly. Reliability also means that the user needs fewer spare parts helping reduce logistics costs. The radio's hardware remains the same over its lifetime. This helps reduce logistics burdens and costs. A stable platform means there is no need for expensive hardware upgrades to add new functions to the radios. Furthermore, it eliminates the need for highly skilled maintenance personnel. Any radio maintenance can be performed quickly without error. Device reliability is furthermore assured using very strict research and development (R&D) gates. Potentially critical issues are anticipated in advance. If these issues are not solved at the beginning, the product does not enter production. The company also insists on the highest standards during manufacture. Meanwhile, suppliers follow strict rules to deliver components at the highest quality required by the company.

Advanced technology is at the heart of delivering a stable platform. This ensures the company's products stay on the market for a long time. Flexible hardware architecture that can be easily reconfigured to address future requirements, is at the heart of Rohde&Schwarz' ATC radios. Sufficient hardware is housed in the radios to support future requirements as they emerge. Rohde&Schwarz also has a very efficient obsolescence management process. The company tracks and replaces any component which is at risk to become obsolete. As a result, Rohde&Schwarz ensures product form, fit and function over a very long time. Simplified maintenance is designed into the product at the development stage, ensuring the radio is largely maintenance free. For example, the R&S®Series5200 can self-calibrate its oscillator. Simplicity is at the heart of the radio's configuration, which is supplied with a highly intuitive graphical user interface.

3 RESEARCH AND DEVELOPMENT

The R&S®Series5200 continues the strong legacy of the R&S®Series4200, yet it is a completely new radio developed from scratch. This allowed the company not only to take advantage of new technology, but also of new design and manufacturing methods. An iterative process was used to continually improve the radio during this stage.

Rohde&Schwarz adopts a system-on-a-chip (SoC) approach. This plays a key role in future proofing the radios. The system-on-a-chip is the brain of the product. It includes several processor cores and programmable logic. Peripherals can be connected directly to the chip and could include a digital-to-analog converter, or the card where the radio software is stored, for example. The processors are flexible so that they can accept new features, while the programmable logic is closer to the hardware.

Externally, the radio has several interfaces to use existing and new installations. The R&S®Series5200 is a direct replacement for the R&S®Series4200. As a result, the R&S®Series5200 can be connected directly to an existing ATC infrastructure, which had used the R&S®Series4200 with minimal hassle. The R&S®Series5200 can be set to compatibility mode and will work right away.

The design is safe and secure: Dedicated IP separation is built in the R&S®Series5200. The radio uses a hardened Linux operating system and SE-Linux architecture. The latter is open source architecture, which is widely being used in very secure environments. The R&S®Series5200 software was developed to EUROCAE ED-109A software integrity assurance guidelines. R&S®Series5200 radios are easy to upgrade with new features. This might not be so important if the radio is being used at a small airport where firmware can be easily swapped in and out. If the user is at a larger airport or ATC centre, the transmission and reception stations may be some distance away. Therefore, the radio can be updated from a secure web browser or using Rohde&Schwarz management software. Once prototype radio and software are developed, they undergo a strict approval process. A small number of initial production radios is then subjected to exhaustive testing. This highlights additional problems not seen on the prototype radios. These problems are then solved before clearance is given from research and development, quality assurance and production. Only then the radio can enter full production.

4 PRODUCTION

Every radio component, either produced by Rohde&Schwarz, or sourced from suppliers goes through demanding tests. The first step Rohde&Schwarz takes when embarking on the design of any solution, is to understand customer needs and requirements. Only then the production starts.

Functional component tests are executed in the factory. All parameters of the radio's components undergo these tests. Once components are tested and deemed functional, the radios are assembled and subjected to an electrical safety test. Radios then undergo a burn-in test in a climatic chamber. They are activated and cooled down to -25°C . The radios are then warmed up to $+40^{\circ}\text{C}$ while continuing to operate. This cycle is performed multiple times mimicking the radio's ageing process. It helps engineers discover any hidden issue in any of the radio's components. They are recognized by the radios deviating from normal behavior. This process removes any – and all – of the radio's hidden problems.

Once the burn-in tests are complete, the radio is subject to a complete functional test. All its parameters are tested along with its interfaces. This ensures that the radio meets all the correct requirements. The last software tests are then performed to ensure the radio is working as it should be, for when it reaches the user. These processes are applied to every single radio that Rohde&Schwarz produces.

5 CONCLUSIONS

Six decades of ATC radio research, design and development in close interaction with its customers worldwide has made ATC from Rohde&Schwarz a trusted partner throughout the industry. An uncompromising approach built on a solid foundation of security, reliability, and simplified maintenance is central to the company's philosophy. At the same time, Rohde&Schwarz provides users with a 'future proof' radio, easy to upgrade during its life. These approaches have culminated in the realization of the R&S®Series5200 ATC radio. This radio supports the exacting demands of air traffic controllers and will continue to do so for many years hence.

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.

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