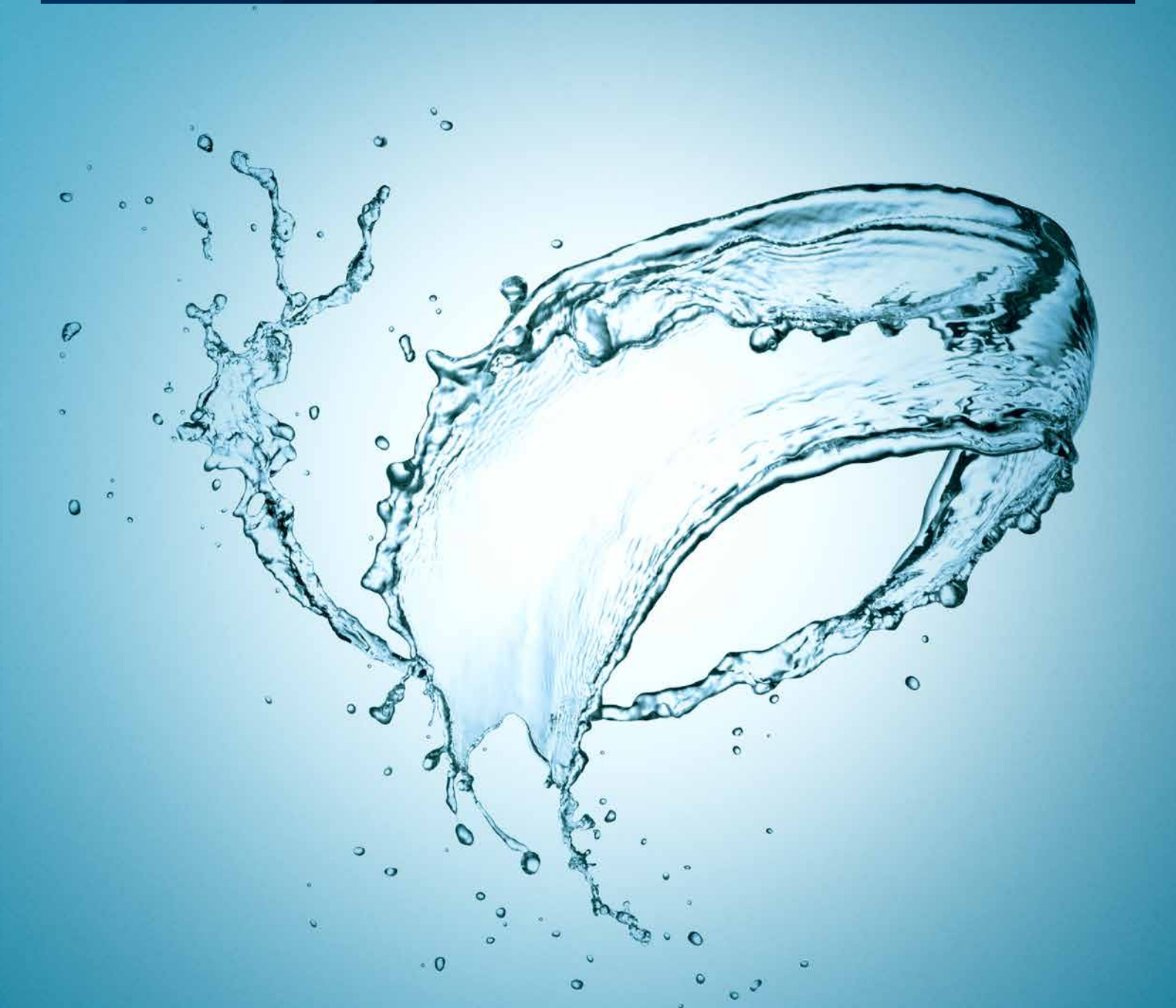
ROHDE&SCHWARZ
Make ideas real

REDEFINING THE FUTURE OF HF WIDEBAND COMMUNICATIONS

Maximum performance and unmatched reliability
with liquid cooling technology from Rohde&Schwarz



OFF TO NEW SHORES

The new reality for beyond line of sight communications

High frequency (HF) beyond line of sight (BLOS) communications technology is undergoing a renaissance. It is one of the few technologies that provides reliable connectivity between any two points on the planet. For instance, ship-to-shore communications are designed to help naval vessels maintain reliable connectivity while offshore, giving them access to real-time data and voice communications when not in range of coastal systems. Another application is long-range radio link coverage for pilot-controller voice communications (ATC).

With its wideband capability and power output of 5 kW or 10 kW, the new liquid-cooled transmitters are ideally suited for use in shore stations for ship-to-shore communications to reach ships at anytime and anywhere at sea.

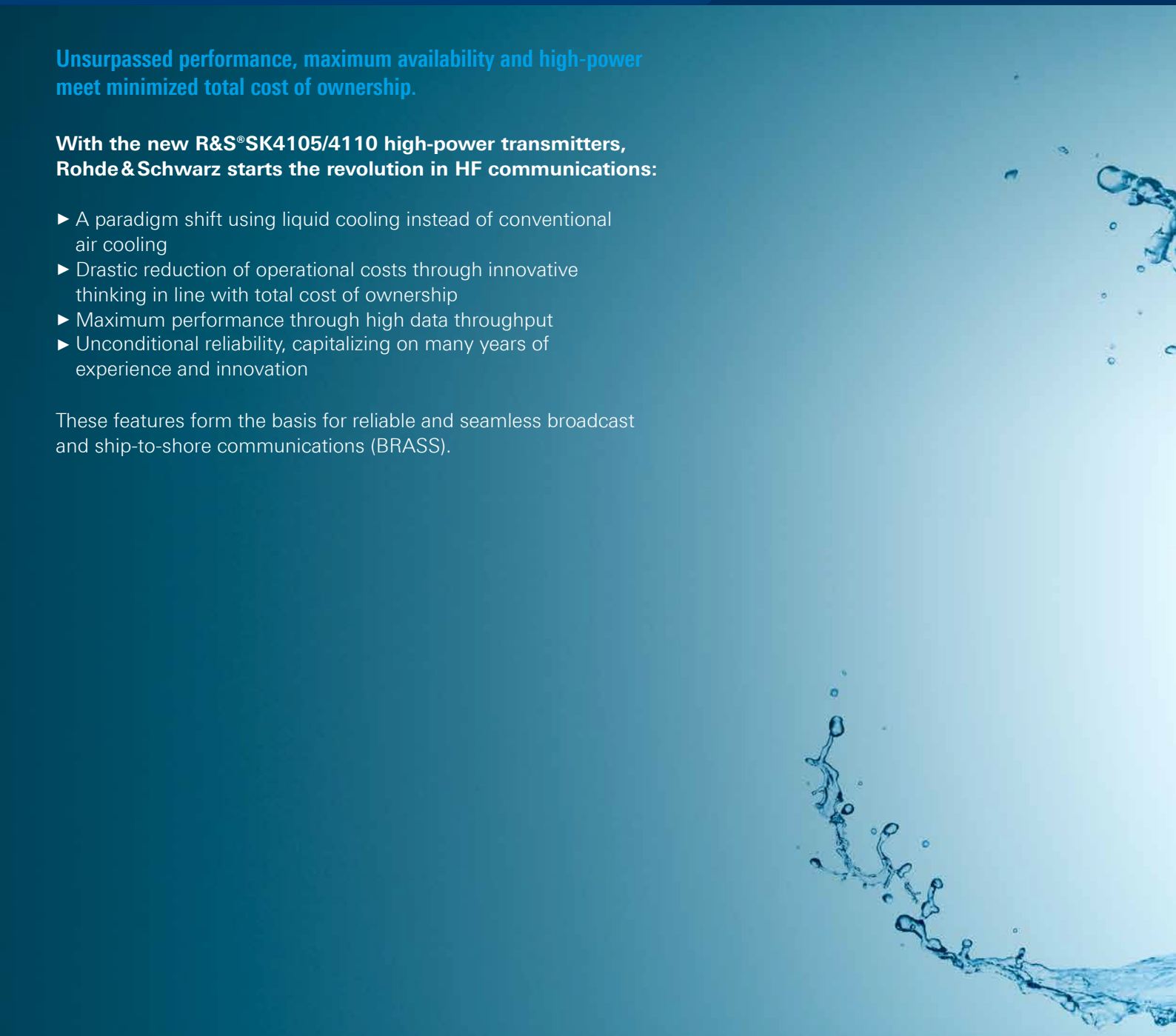
THE NEW REALITY: ROHDE&SCHWARZ

Unsurpassed performance, maximum availability and high-power meet minimized total cost of ownership.

With the new R&S®SK4105/4110 high-power transmitters, Rohde&Schwarz starts the revolution in HF communications:

- A paradigm shift using liquid cooling instead of conventional air cooling
- Drastic reduction of operational costs through innovative thinking in line with total cost of ownership
- Maximum performance through high data throughput
- Unconditional reliability, capitalizing on many years of experience and innovation

These features form the basis for reliable and seamless broadcast and ship-to-shore communications (BRASS).



REVOLUTIONIZES HF COMMUNICATIONS

LONGEVITY THROUGH LIQUID COOLING

Due to their improved performance, the new HF high-power transmitters required an innovative cooling system to compensate for additional waste heat. The new R&S®SK4105/4110 transmitters from Rohde&Schwarz are the first transmitters in the 5 kW to 10 kW power range to use liquid cooling rather than forced-air cooling.

Liquid cooling offers incredible performance no other cooling system can match. Internal electronics are not exposed to harsh environmental conditions, and heat from the transmitters is contained in the liquid and thus fully controllable, enabling re-use.

By combining their long experience in liquid cooling technology from the broadcasting and media market with decades of expertise in HF/BLOS communications, the experts at Rohde&Schwarz combined unprecedented power (5 kW or 10 kW) with maximum reliability.

Benefits of liquid cooling at a glance

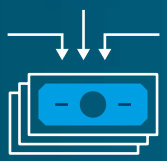
- Significantly reduced maintenance costs
- Highest reliability maintaining communications at all times
- No single point of failure for transmitter stations
- Longer service life of entire systems due to reduced thermal load

MINIMAL COSTS THROUGH TOTAL COST OF OWNERSHIP

The high-power, liquid-cooled HF transmitters were designed and developed with a constant focus on minimizing total cost of ownership and maximizing system availability. Liquid cooling technology reduces capital expenditures (CAPEX) and operational expenses (OPEX).

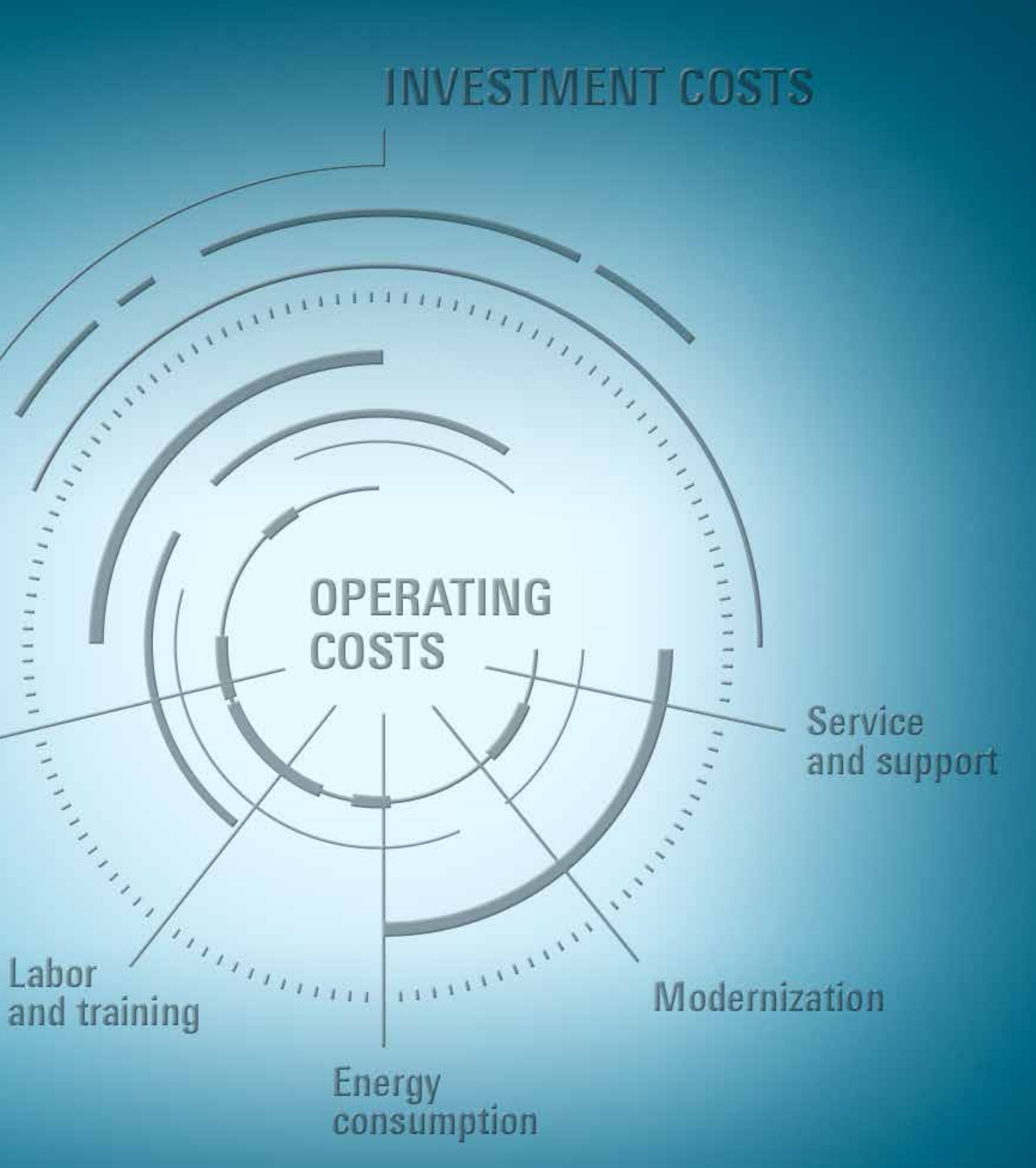
Reduced OPEX:

- Heat is not only optimally dissipated, but also fully controllable so it can be reused efficiently – e.g. by heating a building with waste heat, for instance.
- Less maintenance due to fewer mechanical components, and expendable parts – in contrast to forced-air cooling, no filter for drying and desalination of ambient air is needed
- Reduced maintenance and power consumption because forced-air cooling is not needed
- Power consumption for air conditioning is reduced because less heat is released into the transmitter room; 70-80% of the heat is dissipated directly out of the room through liquid cooling.



Reduced CAPEX:

- No replacement transmitters running in standby mode are needed, due to increased reliability.
- Selected replacement modules can be used in both transmitters.
- Simplified installation (hose vs. duct)
- No additional forced-air cooling equipment needed, be cause no air is drawn in from outside, dried, desalinated, and transported to the transmitter for cooling.
- The external air conditioning system can be dimensioned much smaller because less air conditioning power is required.


INVESTMENT COSTS
OPERATING COSTS
Service and support
Modernization
Energy consumption
Labor and training

HIGHEST RELIABILITY AND MAXIMUM AVAILABILITY

The HF high-power transmitters feature a long service life and low failure rates by minimizing thermal load on all transmitter components, thanks to liquid cooling. There is no single point of failure because each transmitter has its own self-sufficient cooling system, and the internal electronics are not exposed to harsh environmental conditions, such as damp, salty air. The transmitters have a sustainable carbon-footprint.

R&S®SK4105 and R&S®SK4110 provide critical module redundancy in the form of uninterruptable transmission and operation in case of a power supply failure or HF output stage failure. Further features include remote monitoring and configuration as well as initial error analysis and an optional uninterruptible power supply (UPS) for minimum downtime, i.e. the transmitter will not shut off even after power failure of the entire station or due to excessive voltage fluctuations.

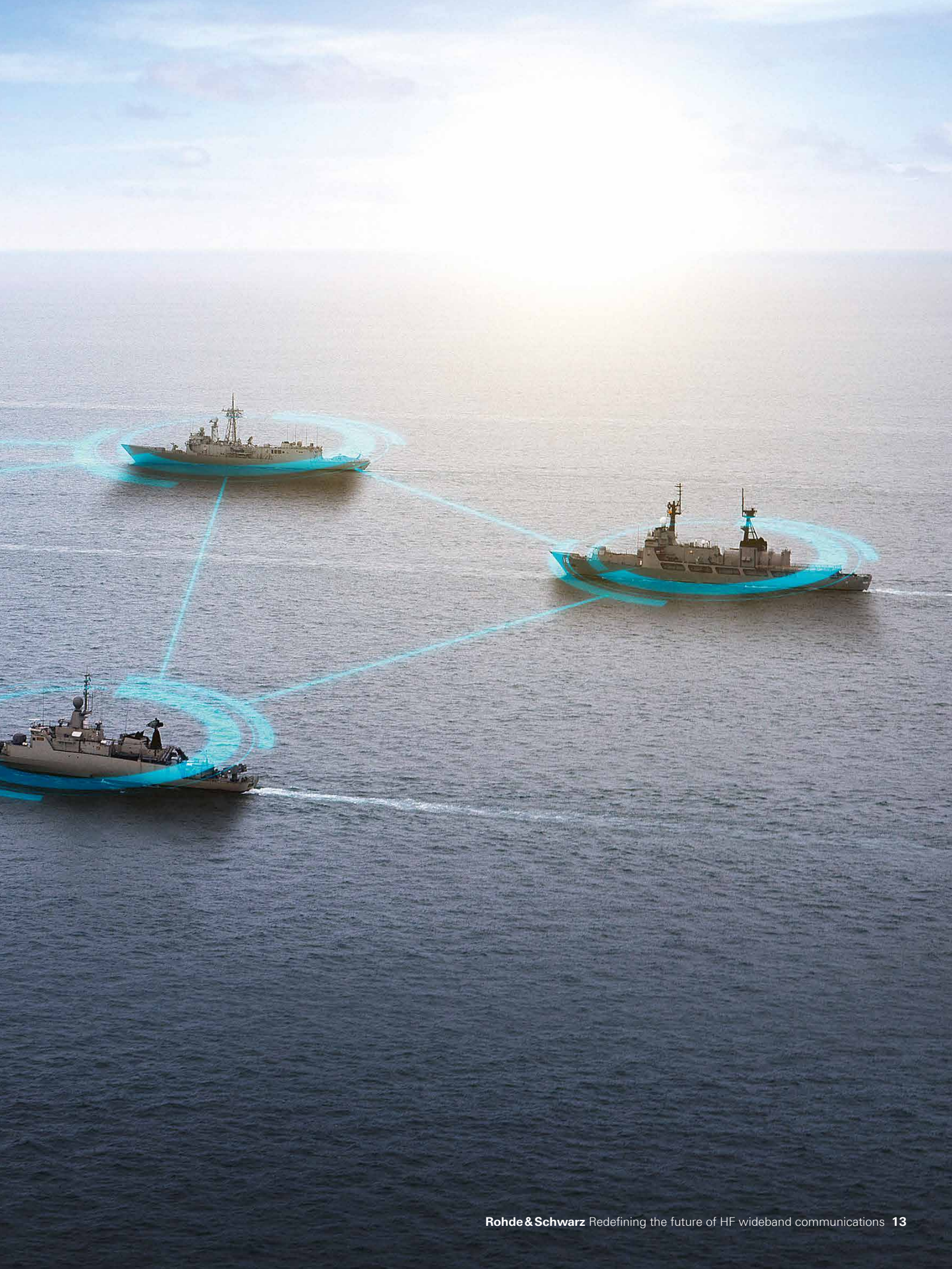
Rohde&Schwarz has proven the reliability of liquid cooling in TV broadcasting operations for 25 years.
This sector places a high demand on availability. Interrupting transmissions could have a direct financial impact for an operator, particularly if this results in a loss of advertising revenue.

FUTURE-PROOF INVESTMENT THROUGH HF WIDEBAND CAPABILITY

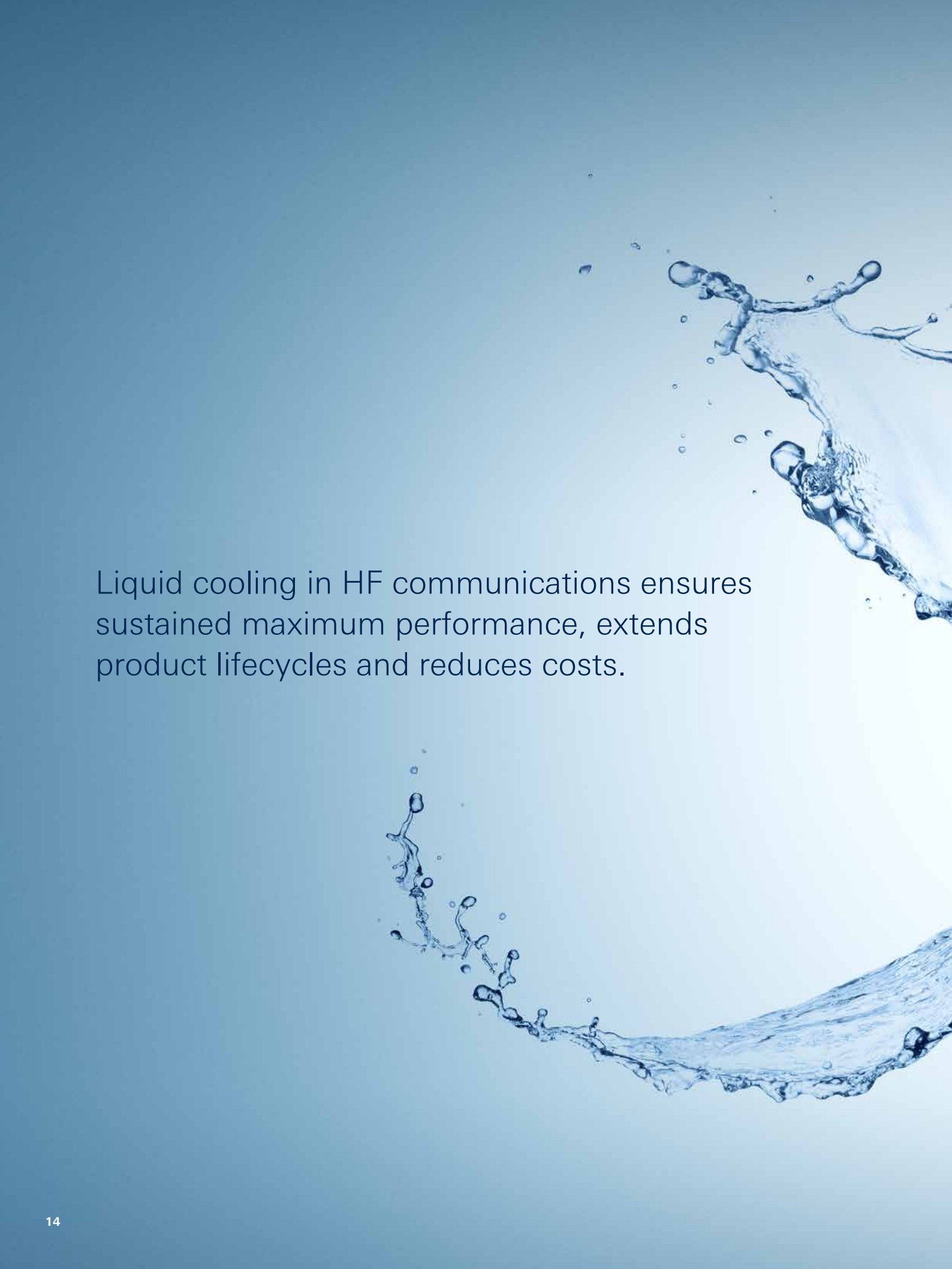
A key component of the R&S®SK4105/4110 HF high-power transmitters is the exciter of the tried and tested R&S®M3SR Series4100 family. This radio family is deployed worldwide and has sold thousands of units, not only to navies of the world, but also in the air traffic control market.

R&S®M3SR Series4100 is a powerful radio platform that can be extended at any time. This helps to provide a safe, future-ready investment. The architecture of the R&S®M3SR Series4100 radio supports not only commonly used transmission methods but also new standards like HF wideband and ALE 4G. New waveforms can be integrated as needed via software upgrade. This ensures that future requirements for this system component can be met easily.

These features make the HF high-power transmitters a future proof investment. The components of these transmitters are software defined, which enables easy retrofitting of new functions or waveforms. R&S®M3SR Series4100 already includes HF wideband functionality to establish long-range data links on up to 48 kHz channel (MIL-STD-188-110D and MIL-STD-188-141D), Link22 (in line with MIL-STD-188-203-1A) and BRE1TA (BRE2TA ready). It is designed for bandwidths of up to 200 kilohertz.



Liquid cooling in HF communications ensures sustained maximum performance, extends product lifecycles and reduces costs.



Robert Träger
Senior System Architect
HF Radios

THE ROHDE&SCHWARZ EVOLUTION OF HF

HF communications is in our DNA
Only those with experience of the past can face the challenges of the future.

2022

R&S®SK4105 and R&S®SK4110
HF high-power transmitter systems

- 5 kW and 10 kW output power in standard 19" racks
- Fourth generation of HF data communications with ALE-4G
- HF modem with up to 240 kbit/s and 48 kHz channel bandwidth
- Minimal total cost of ownership thanks to innovative liquid cooling technology

1990s

R&S®XK516 HF airborne transceiver

- Civil aviation approved 400 W HF transceiver
- Antenna tuning unit R&S®FK516
- Approved for HF data link in line with ARINC

R&S®XK2000 HF radio family

- Second generation of HF data communications with ALIS and automatic link establishment (ALE) in line with MIL STDs
- Data rate of up to 5.4 kbit/s
- Power classes: 150 W, 500 W, 1 kW and 4 kW (HF broadband)

1970s

R&S®VK20 HF transmitter

- Tube transmitter
- Output power of 20 kW
- Frequency range of 1.5 MHz to 30 MHz

1950s

First shortwave tube transmitters:
R&S®SK010 / SK050 / SK080 / SK1 (100 W to 1 kW)

- Stationary and mobile versions
- First synthesizer, i.e. oscillating crystals no longer need to be changed
- Modulation types: AM/FM, tactile radio (Morse), (radio)telephony.

2000s

R&S®M3SR Series 4100 HF software defined radio family

- Power classes: 150 W, 500 W, 1 kW and 4kW (HF broadband)
- Third generation of HF data communications with ALE-3G
- Frequency hopping capability, embedded software COMSEC
- HF House

1980s

R&S®HF850 HF radio family

- First generation of microprocessor-controlled transceivers
- Frequency hopping capability
- Automatic link setup communications processor R&S®GP853 controls RF connections with a data rate of up to 2.4 kbit/s
- R&S®ALIS HF modem with automatic channel selection and link setup (proprietary Rohde&Schwarz ALE standard)

1960s

R&S®XK401 HF transceiver

- First transistorized transceiver
- Introduced frequency shift keying (FSK)
- First HF data modem

TRUSTED PARTNER THROUGHOUT THE PROJECT LIFECYCLE, AND SERVICES

Reliability is one of the greatest advantages of new technology. It sharply reduces the need for servicing.

Maintaining complex technologies requires dedicated employees and consumes time and resources. The technical experts at Rohde&Schwarz offer professional maintenance, repair and overhaul (MRO) services throughout the entire lifecycle, including cyber resilience, from a single source. Through many years of experience, expertise and reliability, Rohde&Schwarz stands for trusted partnership.

To guarantee the highest possible customer independence and thus maximum transmitter availability and reliability, Rohde&Schwarz offers worldwide dedicated service and support for the HF high-power transmitters.

Additionally, customers can receive custom-tailored training from Rohde&Schwarz experts to the individually requested level, so that they can conduct independent troubleshooting and replace defective modules and components at any time on site. Required spare parts are immediately available, which means that the system can be kept in continuous operation without downtime for maintenance and service, and that saves costs.

In the event of a malfunction, Rohde&Schwarz technical experts can repair the defective component at any maintenance level. A service and support hotline assists customers with troubleshooting and repair procedures. In addition to training materials, comprehensive system documentation is provided.

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

Information Security Management System
ISO/IEC 27001

Certified Quality Management
AQAP-2110

Rohde&Schwarz training

www.training.rohde-schwarz.com

Rohde&Schwarz customer support

www.rohde-schwarz.com/support

PD 5216.4579.62 | Version 01.01 | November 2022 (nk)
Redefining the future of HF wideband communications

5216.4579.62 01.01 PDP/PDW 1 en