R&S®M3AR
Software Defined Radios
VHF/UHF
Transceiver Family for
Airborne Communications
R&S®M3AR
Software Defined Radios

At a glance

The software defined, multiband-capable airborne transceivers of the R&S®M3AR family feature a modular design and state-of-the-art technology. This leads to high MTBF values and a long life. The compact and lightweight transceivers offer high performance, making them suitable for operation in all types of aircraft, including unmanned aerial vehicles. Different waveforms are available, which can be installed at any time to provide interoperability in a variety of operational scenarios.

Rohde & Schwarz satisfies the most demanding requirements of a multitude of airborne platforms. The R&S®M3AR transceivers are in operation around the world and feature high reliability even under extreme environmental conditions. The outstanding MTBF values ensure low maintenance effort and high availability.

A variety of optional EPM (ECCM) methods are available. For instance, the R&S®SECOS frequency hopping method with integrated encryption can be installed in parallel with HAVE QUICK I/II.

The R&S®M3AR family consists of the R&S®MR6000A in an ARINC 600 housing and the R&S®MR6000R/R&S®MR6000L, both of which are ARC-164 form & fit compatible. The R&S®MR6000L is equipped with a local control panel while the R&S®MR6000R is remote-controlled. All R&S®M3AR radios can be remote-controlled via the MIL-STD-1553B data bus, as well as by the R&S®GB6500 control unit. The R&S®MR6000R or R&S®MR6000L can serve as a form, fit and function (F3) replacement for legacy AN/ARC-164 radios.

Key facts

- Frequency range from 30 MHz to 400 MHz
- Compact and lightweight with high transmit power (up to 20 W in AM mode and up to 30 W in FM mode)
- EPM (ECCM): HAVE QUICK I/II, SATURN, R&S®SECOS
- Approved for jet and propeller aircraft as well as helicopters and unmanned aerial vehicles
- Embedded NATO or R&S®SECOS encryption
- Suitable for communications with military and civil air traffic control (e.g. 8.33 kHz channel spacing or offset carrier receive operation)
R&S®M3AR
Software Defined Radios
Benefits and key features

Outstanding radio parameters
- Excellent RF characteristics
- Frequency bands from 30 MHz to 400 MHz
- Frequency-agile pre-/postselector for best co-site behavior (R&S®MR6000A)

Secure communications
- EPM (ECCM) methods for anti-jam communications
- Tap- and spoof-proof communications through integrated voice and data encryption
- Wideband interface for external encryption devices (e.g. ELCRODAT 4-2, KY58, KY100)

Flexible range of applications
- High power for secure communications even during very-low-level flights and higher altitude instrument flying
- Preset concept permits flexible participation in various networks through simple change of the preset
- Suitable for fixed- or rotary-wing aircraft operated by the air force, army and navy
- Flexible integration through different interfaces (MIL-STD-1553B data bus, RS-485, ARC-164) or front panel control

Low maintenance effort
- Powerful built-in tests (BIT) for error detection and diagnostics
- High reliability due to a robust design and high-quality components

Obsolescence-proof investment
- Software can be adapted to changing standards without hardware modifications
- State-of-the-art technology ensures long product life

Radios from Rohde & Schwarz for the army, air force and navy.
Outstanding radio parameters

Excellent RF characteristics
Despite its compact design, the R&S®M3AR radio family offers excellent RF characteristics, even under harsh environmental conditions. The R&S®M3AR transceivers are compatible with common military and civil communications standards.

The receiver features excellent sensitivity, high crossmodulation immunity, selectivity and suppression of strong interference signals. The transmitter is optimized for low spurious emissions and the suppression of wideband noise.

Frequency bands from 30 MHz to 400 MHz
The aviation sector has special applications that must be supported by radiocommunications systems. Civil aviation requires the following frequency ranges:
- 108 MHz to 117.975 MHz, AM (receive only)
- 118 MHz to 136.975 MHz, AM, with additional 8.33 kHz channel spacing

In military aviation, the following frequency ranges are important:
- 30 MHz to 87.975 MHz, FM
- 225 MHz to 399.973 MHz, AM and FM

Civil maritime communications require the FM frequency range from 156 MHz to 173.975 MHz.

The range from 137 MHz to 155.975 MHz is used, for example, for a variety of mobile radio services in both AM and FM.

The R&S®M3AR family of transceivers covers all of these frequency ranges in AM and/or FM, depending on the application. Without multiband capability, a separate transceiver would be needed for each frequency band, which would create not only additional costs but also significantly more integration effort.

Frequency-agile pre-/postselector for best co-site behavior (R&S®MR6000A)
The fast frequency hopping filter effectively reduces wideband noise during transmission. In receive mode, unwanted signals are suppressed by the filter, thus preventing negative effects such as crossmodulation, blocking or desensitization.

The excellent co-site behavior permits the parallel use of multiple radio lines in a minimum of space, which is frequently the case with reconnaissance and transport aircraft.
Secure communications

EPM (ECCM) methods for anti-jam communications
Electronic protective measures (EPM) protect radio links from electronic countermeasures (ECM) such as jamming. Frequency hopping is an EPM (ECCM) method that is available as an option in all R&S®M3AR radios. The NATO frequency hopping method HAVE QUICK I/II and the state-of-the-art SATURN method are integrated in the R&S®M3AR family in line with STANAG 4246 and STANAG 4372. These methods ensure a jam-free radio link.

Rohde & Schwarz also developed the R&S®SECOS frequency hopping method, which provides reliable protection against active jamming even at high flight speeds. It can also encrypt voice and data transmissions up to 16 kbit/s. R&S®SECOS has been tried and tested around the world for many years. This method can be integrated in Rohde & Schwarz transceivers in parallel with HAVE QUICK I/II, thus providing the flexibility to participate in national and international missions. When using the R&S®SECOS or SATURN frequency hopping method, voice communications are compressed by means of a CVSD vocoder and then transmitted digitally.

Tap- and spoof-proof communications through integrated encryption
To protect radio links from tapping and spoofing, the information being transmitted can be encrypted. With the R&S®MR6000A from the R&S®M3AR family, Rohde & Schwarz was the first manufacturer to offer embedded NATO encryption. This eliminates the need for an additional external encryption device. The R&S®MR6000A therefore saves space, reduces weight and is easy to install in the aircraft. The R&S®MR6000A is interoperable with external crypto devices such as the KY57, KY58, KY99, KY100 and ELCRODAT 4-2.

The powerful R&S®SECOS encryption method developed by Rohde & Schwarz is available for all transceivers in the R&S®M3AR family. To load the encryption keys, different protocols are provided. When using the R&S®SECOS method, the encryption keys can be encrypted and transmitted over non-secure lines (black key loading). For NATO encryption keys, the R&S®MR6000A with integrated crypto module uses the DS-101 interface for black key loading.

Wideband interface for external encryption devices (e.g. ELCRODAT 4-2, KY58, KY100)
All R&S®M3AR radios conform to STANAG 4204 and STANAG 4205 and can be connected to external encryption devices. This permits the use of state-of-the-art frequency hopping methods with legacy encryption devices, so that systems such as the KY88, which is widely used by NATO, can be combined with HAVE QUICK I/II for instance.

Besides world-class airborne transceivers, Rohde & Schwarz also offers encryption devices that are certified for the highest German and NATO classification levels. The ELCRODAT 4-2 and the R&S®MMC3000 are external encryption devices that can be used with all R&S®M3AR radios for establishing secure radio links.

Reliable and secure communications in TDMA data mode using R&S®SECOS
Flexible range of applications

High power for secure communications even during very-low-level flights and higher altitude instrument flying

Especially with helicopters, high transmit power is important because of the need for effective communications between two-aircraft formations and flights during tactical flying missions near the ground.

When flying under instrument flight rules, long distances occur between the aircraft and the air traffic control stations. In this case, the receiver must be able to detect and process even weak radio signals and output them with good audio quality.

Although lightweight and compact, R&S®M3AR transceivers deliver outstanding transmit power of up to 20 W in AM mode and up to 30 W in FM mode. This ensures quality communications links for aircraft operating near the ground, as well as between transmitters and receivers that are located far apart. During formation flying and for on-ground radio checks however, the transmit power can be stepped down in order to reduce self-generated electromagnetic radiation and as a result minimize susceptibility to reconnaissance.

Preset concept permits flexible participation in various networks through simple change of the preset

Presets are used to save the operational parameters (e.g. frequencies and encryption keys) that are required to participate in an encrypted network such as R&S®SECOS. Prior to a mission, the required presets can be set up using the R&S®RNMS3000 network management software from Rohde & Schwarz. This PC-based, centralized planning and preparation of operational parameters ensures consistent presets among individual radio network participants and well-organized frequency management.

The operational parameters for R&S®SECOS, SATURN, HAVE QUICK I/II and encryption keys are loaded via a fill interface. The desired preset is selected via the display of the radio and remote control unit.

The R&S®M3AR radios contain two separate memory areas, each of which can hold 100 presets, so that a sufficient number of presets is available even for longer missions.

Due to the preset concept, simply changing the preset number provides error-free switching between radio networks during flight, even in critical situations.

Depending on how the transceiver is integrated in the aircraft (e.g. operation through a central unit via the MIL-STD-1553B data bus), the presets can be identified by intuitive, recognizable names such as “EDDM TWR” or “Squad A” that are shown on the display of the radio and remote control unit.

R&S®MR6000L – intuitive and simple operation

Display

TAKE button

SQUELCH ON/OFF ACKNOWLEDGE

Mode switch

Keypad

Fill interface

VOLUME knob
Suitable for fixed- or rotary-wing aircraft operated by the air force, army and navy

Military aircraft place a variety of demands on the radio with respect to environmental impacts such as g-force, vibration and temperature range. Furthermore, army, air force and navy airborne platforms must sometimes support special applications in the various frequency ranges. The R&S®M3AR offers a wide bandwidth to support a variety of applications.

For the navy for example, a Link 11 interface in line with STANAG 5511 was integrated in the R&S®MR6000A, as well as sonobuoy functionality and a guard receiver for monitoring channel 70 of the Global Maritime Distress Safety System (GMDSS), so that digital selective call (DSC) signals can be received.

The tactical VHF range, including a 40.5 MHz guard receiver, was integrated in the entire R&S®M3AR product family for communications with ground troops. The high transmit power of up to 30 W in FM mode and the excellent receiver characteristics ensure reliable communications links even during very-low-level flights.

Flexible alternatives for operating the radios

Flexible integration through different interfaces (MIL-STD-1553B data bus, RS-485, ARC-164) or front panel control

The R&S®M3AR radio family can be flexibly integrated in an aircraft. The R&S®MR6000L with local control panel is easily installed directly in the cockpit.

Alternatively, the R&S®MR6000L offers remote control capability via the MIL-STD-1553B data bus, through the R&S®GB6500 control unit or by means of an RS-485 serial interface in conjunction with the applicable Rohde & Schwarz protocol. An optional ARC-164 serial or parallel interface is available for both the R&S®MR6000R and R&S®MR6000L, which ensures simple “form, fit and function” replacement of existing AN/ARC-164 radios.

The R&S®MR6000A and R&S®MR6000R series are designed for installation in the avionic bay. They can be remotely controlled via the MIL-STD-1553B data bus or by using the R&S®GB6500 control unit via the RS-485 interface. A maximum of three R&S®GB6500 units can control up to five R&S®M3AR transceivers over a system bus. This provides the flexibility to implement a variety of operational concepts that are optimized for the aircraft, which improves crew resource management (CRM).

The R&S®MR6000L and R&S®GB6500 displays are suitable for conventional night flights as well as flying with night vision goggles (NVG).
Low maintenance effort

Powerful built-in tests (BIT) for error detection and diagnostics
The three types of built-in tests (PBIT, CBIT and IBIT) aid the user in checking the functionality of the device and determining if, and where appropriate, what type of errors exist. BIT results can be viewed on the display or polled via the MIL-STD-1553B data bus.

The power-on BIT (PBIT) is a short self-test that is executed each time the device is powered on.

The continuous BIT (CBIT) checks the functionality and performance of the radio during operation. This test continuously polls the status messages of the individual modules.

The initiated BIT (IBIT) is activated by the user and runs a complete transmit and receive test loop. Because this test interrupts operation of the radio, it is usually carried out only during maintenance activities.

Two types of status messages are provided to guide the user as to what action to take. If a warning is generated, the radio can still be operated, but should be checked as soon as possible. Error messages indicate that the radio can no longer be operated and must be serviced.

If one of the built-in tests identifies a defective module, the device should be sent to an authorized service center for maintenance or repair. As a final step, the device is tested in accordance with the applicable specifications to make sure it functions properly. The R&S®TS6030 is a system for carrying out corrective maintenance and automatic test runs (I-level support and test equipment). It therefore provides a fast and cost-effective way to keep the R&S®M3AR family of transceivers up and running. Because Rohde & Schwarz can incorporate its worldwide leading know-how from the field of test & measurement into the area of airborne transceivers, customers have a first-class solution from a single source.

High reliability due to a robust design and high-quality components
The R&S®M3AR family of transceivers features a robust design and high-quality components. The result is high MTBF. The R&S®M3AR transceivers are tested in accordance with various military and civil standards such as MIL-STD-461, MIL-STD-810 and RTCA/DO-160. For instance, Rohde & Schwarz airborne transceivers can be operated in temperatures ranging from -40°C to +71°C. To prevent damage, the devices automatically continue to operate at reduced power if overheating occurs. When the temperature normalizes, the device automatically returns to the original power level without manual intervention.

The military aviation sector demands a high level of device reliability, particularly in extreme environmental conditions. Whether they are exposed to high g-forces in jet aircraft or to heavy vibrations in helicopters and transport aircraft, R&S®M3AR transceivers were designed for such operating environments. This is a key reason why the R&S®M3AR is deployed by air force, army and navy airborne units around the world.
Software can be adapted to changing standards without hardware modifications
All software components and updates can be loaded in the radio by an authorized service center using the R&S®ZS6000 radio loader. Modifications can be made or functionalities can be added without having to change the hardware. The current software status can be queried via the MIL-STD-1553B data bus.

State-of-the-art technology ensures long product life
The R&S®M3AR family of transceivers features a modular design and is manufactured with SMD technology. The high quality and workmanship of the components that are used ensure a high MTBF and in general a long product life cycle. This minimizes the impact of discontinued components, reduces stockkeeping and streamlines logistics.

The multiband, multimode and multirole capabilities of the R&S®M3AR provide the flexibility to deploy the device in various frequency ranges with different waveforms, as well as in a multitude of scenarios and missions. Instead of multiple radios to support different applications, only one device is required. Logistics and training effort is significantly reduced as a result.
The R&S®MR6000A, which comes in a standard housing in line with ARINC 600, is the most powerful radio in the R&S®M3AR family.

The R&S®MR6000R, one of the world’s most compact and lightweight airborne transceivers, is designed for installation in the avionic bay and can be remotely controlled.

The R&S®MR6000L, extremely powerful despite its compact dimensions, can be installed in the cockpit as a replacement for legacy AN/ARC-164 radios with local control panel, for example.
The R&S®MR6000A, the most powerful radio in the R&S®M3AR family, features RF power of up to 20 W in AM mode or 30 W in FM mode. It is a radio with an integrated crypto module and embedded NATO encryption algorithms. The elimination of the external encryption device and cabling saves valuable space and weight in the aircraft.

The integrated pre-/postselector minimizes susceptibility to interference and improves co-site behavior. This is particularly important since there is limited space for antennas on aircraft fuselages. In addition, the antennas are usually very difficult to decouple. The solution integrated in the R&S®MR6000A saves the cost of additional approvals and integration of external filters.

In addition, the R&S®MR6000A is marked by numerous integrated features designed to support a multitude of applications:

- Choice of frequency hopping methods: HAVE QUICK I/II, SATURN or HAVE QUICK I/II and R&S®SECOS in a single device
- In addition to the mandatory functions defined in STANAG 4372 (SATURN), the following are also available: ATEC, PTEC, TOD beacon (TX, RX), system messages, data modes, hailing, relay (clear & cipher voice and data), transmitter break-in, time delay compensation, split synchronization, data message, etc.
- Embedded NATO or R&S®SECOS encryption
- Link 11 interface in line with STANAG 5511 and MIL-STD-188-203-1A
- Additional guard receiver for the 40.5 MHz, 121.5 MHz, 243.0 MHz and 156.525 MHz distress frequencies
- Integrated pre-/postselector
- Tactical VHF frequency range for communications with ground troops (i.e. expanded frequency range from 30 MHz to 399.975 MHz)
- Transmission and reception of digital selective call (DSC) signals from the Global Maritime Distress and Safety System (GMDSS)
- Sonobuoy command
- Direction finding and homing support for locating transmitters in the VHF and UHF ranges
- Option of loading encrypted NATO encryption keys via the DS-101 interface (black key loading)
- Option of loading encrypted R&S®SECOS encryption keys (black key loading)
- Immunity to VHF broadcast transmitter interference in line with ICAO and ED-23B
- Low noise figure for excellent receiver sensitivity in AM and FM mode
- High transmit power of 20 W (AM) and 30 W (FM)
- High dynamic range and crossmodulation immunity in line with ARINC 716
- Ideal selectivity and spurious response immunity
- Remote control via RS-485 interface and applicable Rohde & Schwarz protocol (used by the R&S®GB6500 for example), MIL-STD-1553B data bus or a combination of both

R&S®MR6000A.
These two radios, which come in ARC-164 housings, differ in that the R&S®MR6000R is designed for installation in the avionic bay and is remotely controlled, while the R&S®MR6000L is installed in the cockpit and is controlled via a local control panel. Despite weighing less than 4 kg, the R&S®MR6000R and R&S®MR6000L series offer outstanding reception and transmission performance.

The R&S®MR6000L display comes with a choice of white, red or NVG-compatible illumination.

The R&S® MR6000R/L series have the following features:

- Choice of frequency hopping methods: HAVE QUICK I/II, SATURN or HAVE QUICK I/II and R&S®SECOS in a single device
- Embedded R&S®SECOS encryption
- Additional guard receiver for the 40.5 MHz, 121.5 MHz and 243.0 MHz distress frequencies
- Tactical VHF frequency range for communications with ground troops (i.e. expanded frequency range from 30 MHz to 399.975 MHz)
- Direction finding and homing support for locating transmitters in the VHF and UHF ranges
- Option of loading encrypted R&S®SECOS encryption keys (black key loading)
- Immunity to VHF broadcast transmitter interference
- High transmit power of 10 W (AM) and 15 W (FM)
- Remote control via RS-485 interface and applicable Rohde&Schwarz protocol (used by the R&S®GB6500 for example), MIL-STD-1553B data bus or a combination of both
- Legacy ARC-164 radios can be replaced with the optional ARC-164 serial or parallel interface without additional integration effort
R&S®GB6500 remote control unit
The R&S®GB6500 can operate all series of the R&S®M3AR family and connects to the radio via the RS-485 interface. A maximum of three R&S®GB6500 units can control up to five R&S®M3AR transceivers via the RS-485 bus. The radios can also be controlled via the MIL-STD-1553B data bus. The R&S®GB6500 can serve as a backup in this case.

The remote control unit is suitable for installation in cockpits in line with MS25212. Like the R&S®M3AR transceivers, the R&S®GB6500 remote control unit was qualified in line with military environmental and EMC standards such as MIL-STD-461 and is therefore suitable for use in aircraft.

The R&S®GB6500 display is suitable for conventional night flights as well as flying with night vision goggles (NVG). The haptics of the controls were optimized for aircraft conditions so that the device switches are easy to press and regulate when wearing gloves. This also makes them easy to operate under harsh flying conditions.

The R&S®GB6500 has separate switches for settings that must be frequently or quickly changed in flight:
- Operating mode (transmitting with/without distress frequency monitoring, ADF, transmitting on a distress frequency)
- Deletion of all loaded keys
- Squelch ON/OFF
- Volume control
- Allocation of radio control
- Transmission of a tone

Presets are selected via the keypad. The submenus contain additional settings that can be performed via the control pad. Settings can be made quickly using the user-friendly menu structure without focusing too much of the pilot's attention on the radio controls.

The R&S®GB6500 user interface is identical to that of the R&S®MR6000L, which simplifies crew training.
Mounting trays and mating connector sets

The mounting trays for the R&S®MR6000A and R&S®MR6000R series optimize the mechanical integration of the radios in the aircraft and make it easy to install and remove the radios. There are two versions of the R&S®KR6010 for the R&S®MR6000R: mounting tray (standard) and cooling tray. The cooling tray improves the heat dissipation of the radio, which is important at higher operating temperatures and longer transmit cycles.

Since the R&S®MR6000L is installed directly in the cockpit, a mounting tray is not required.

To connect the radios to the cable harness in the aircraft, Rohde & Schwarz offers the appropriate mating connector set for each series of the R&S®M3AR family.
R&S®BA6000 base station adapter
The base station adapter comes in two versions: the R&S®BA6000L for the R&S®MR6000L radio with local control panel, and the R&S®BA6000R for the remotely controlled R&S®MR6000R radio.

The base station adapter is used for demonstration and training purposes, as well as for test and verification applications in the lab. It features the following interfaces:
- Low-temperature connector for 100 V to 240 V AC power supply
- Connector for 28 V DC power supply
- Two MIL-STD-1553B data bus connectors
- One RS-232-C interface
- One 37-pin X1 and one 37-pin X3 interface
- Antenna connector
- NF 7 connector for a microphone or headset on the front side of the adapter
- Integrated loudspeaker

The base station adapter also has a fan for cooling the radio.

R&S®ZK6000 maintenance connection box
The maintenance connection box is for performing maintenance on the radio outside of the aircraft by means of a standard RS-232-C serial interface. Various maintenance tasks can be carried out such as calibrating the synthesizer with maintenance software or getting an error report readout. The maintenance connection box is available in two versions: the R&S®ZK6000A with connectors for the R&S®MR6000A, and the R&S®ZK6000L/R for the R&S®MR6000L and R&S®MR6000R series.

R&S®CP6000 radio commander
The R&S®CP6000 radio commander is PC software that serves as a tool for integrating airborne transceivers into aircraft. This program can be used to control the radio via the MIL-STD-1553B data bus or the RS-485 interface. For control via the MIL-STD-1553B data bus interface, a suitable PCMCIA card is necessary. Rohde & Schwarz can recommend a specific model upon request.

R&S®ZS6000 radio loader
The R&S®ZS6000 radio loader program is primarily for loading the radio with the necessary software in production environments and at authorized service centers. It also allows the synthesizer to be calibrated during maintenance. The software communicates with the radio by means of an RS-232-C interface.
**Frequency bands of the R&S®M3AR radios**

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>AM/FM</th>
<th>AM</th>
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<tr>
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<tr>
<td>400</td>
<td>AM/FM</td>
<td>AM/FM</td>
<td>Guard RX</td>
</tr>
</tbody>
</table>

**Flexibility during training exercises and missions**

During a mission, military jets, helicopters and propeller aircraft must communicate with a variety of partners that use different frequency ranges. This requires flexible radio systems that can reliably support flight crews in all phases of a mission, from start to landing. By using airborne transceivers from Rohde & Schwarz, crews have a reliable partner on board at all times.

**Civil and military air traffic control as well as information services (108 MHz to 136.975 MHz and 225 MHz to 399.975 MHz, AM)**

So that military aircraft can also fly in international civil airspace without any restrictions, they must be equipped with appropriate communications systems.

The R&S®M3AR transceivers are developed and tested in line with military and civil standards. The excellent receiver sensitivity and high transmit power consistently ensure high-quality radio links with civil or military air traffic control.

In the upper airspace in various countries, an additional 8.33 kHz channel spacing is required, which in the future has to be implemented in offset carrier mode like the 25 kHz spacing already used. This places high demands on the radios, particularly when signals are weak. Apart from excellent receiver characteristics, the R&S®M3AR features a flexible carrier override option, which can be set via the MIL-STD-1553B data bus. This improves sensitivity in offset mode when flying at high altitudes.

Information services such as automatic terminal information service (ATIS) can be received in the 108 MHz to 136.975 MHz frequency range. To avoid incorrect operation, for air navigation services the 108 MHz to 117.975 MHz frequency range is receive only and the 108 MHz to 136.975 MHz frequency range can only be used in AM mode.

Military air traffic control uses the 225 MHz to 399.975 MHz frequency range with 25 kHz channel spacing.

To enable unrestricted movement in civil and military airspaces, both frequency ranges are required.

The R&S®M3AR transceivers offer the flexibility to use civil as well as military air traffic control frequencies with the corresponding channel spacing. Furthermore, reception is also possible in offset carrier mode with 25 kHz and 8.33 kHz channel spacing. An additional guard receiver makes it possible to monitor not only the 121.5 MHz and 243 MHz distress frequencies of civil and military aviation, but also of the 40.5 MHz tactical VHF band. The R&S®MR6000A can also monitor the 156.525 MHz maritime distress frequency. The guard receiver has a mode for constantly scanning the frequencies and locking onto the corresponding receive frequency.
Versatile applications in the UHF range with airborne radios from Rohde & Schwarz

**VHF combat net radio (30 MHz to 87.975 MHz, FM)**
Ground forces use this frequency range to send and receive tactical information in the form of voice or data messages. So that aircraft, particularly army helicopters, can provide effective support to forces on the ground, they must be equipped with an interoperable communications system.

The R&S®M3AR family supports the 30 MHz to 87.975 MHz tactical VHF frequency range and can thus switch to a specific frequency in this range when required. The R&S®MR6000A also features embedded NATO encryption for interoperability with NATO partner combat net radio equipment.

**Maritime radio (156 MHz to 173.975 MHz, FM)**
This frequency range is particularly important for naval aircraft, to enable communications with civil boats, ships and harbor authorities. All R&S®M3AR series support the maritime band in line with international and U.S. frequency tables. When needed, the R&S®MR6000A also monitors the maritime distress frequency on channel 70 of the GMDSS (156.525 MHz).

**Military airborne radiocommunications (225 MHz to 399.975 MHz, AM and FM)**
Military aircraft rely on the UHF radio band for air-to-air as well as air-to-ground communications for exchanging tactical information with various units.

Military operations are increasingly reliant on radio data capability. Aircraft crews also require mission-critical information in digital form in order to significantly improve situational awareness, for instance. The R&S®M3AR transceivers support radio data transmission with up to 16 kbit/s in different waveforms.

NATO uses the HAVE QUICK I/II and SATURN frequency hopping methods in the UHF range, which can be optionally combined with encryption. These NATO methods can be integrated in the R&S®M3AR transceivers upon request to ensure international interoperability.

R&S®SECOS can operate on any number of frequencies in the entire UHF range. Up to 128 participants can exchange information over a TDMA network. R&S®SECOS supports both voice and data, features embedded encryption and can optionally be installed in parallel with HAVE QUICK I/II. Switching between the methods is made possible by simply changing the preset.

The R&S®MR6000A features a Link 11 interface for participating in tactical data links in the UHF range in line with STANAG 5511 and MIL-STD-188-203-1A.
Outstanding RF characteristics and co-site filter for multiple applications on a single platform

Because communications is vital for operating reconnaissance and transport aircraft, they must be equipped with a variety of radios. Apart from equipment for voice communications with air traffic control and tactical radio via HAVE QUICK I/II for pilots, the aircraft must have the appropriate equipment to support a variety of applications.

Link 11 is a widely deployed solution for exchanging tactical data with naval units in combined missions. On airborne platforms, the air operational picture can be exchanged via R&S®SECOS using the TDMA method, which significantly improves situational awareness. For legacy platforms that lack modern radio data capability, HAVE QUICK I/II can be used for voice communications.

The radios can be flexibly controlled via the MIL-STD-1553B data bus or the R&S®GB6500 remote control unit.

The outstanding RF characteristics of the R&S®MR6000A with integrated co-site filter allow the simultaneous use of multiple radio links in confined spaces and with small antenna spacing.
Rohde & Schwarz – leader in radio-communications for decades

Rohde & Schwarz is a leading global supplier of professional HF, VHF and UHF radios. For decades, governments and military organizations have put their trust in products from Rohde & Schwarz to ensure reliable and secure voice and data communications.

Rohde & Schwarz has been developing airborne transceivers for demanding radiocommunications applications since 1968. Many of these analog transceivers are still being deployed today by scores of armed forces. After decades, they continue to provide reliable radiocommunications as proof of the quality, reliability and robustness of Rohde & Schwarz products. The R&S®M3AR family of products has been deployed around the world since 2000 and has proven its value.

As a supplier of highly secure radiocommunications systems as well as versatile test and measurement equipment for all aspects of radiocommunications, Rohde & Schwarz possesses the comprehensive expertise to meet any test requirement, from conventional analog communications systems to state-of-the-art digital R&S®M3AR transceivers.

Transceivers from Rohde & Schwarz provide secure VHF/UHF communications for the Eurofighter Typhoon.
As a supplier of airborne transceivers for the following platforms (extract), Rohde&Schwarz boasts extensive experience at the international level:

- A109 LUH
- A400M
- EMB-145 AEW&C
- Eurofighter Typhoon
- F-16
- F-4 Phantom
- FENNEC
- JAS-39 GRIPEN
- Mi-8, Mi-17, Mi-24
- MIRAGE III, MIRAGE V
- SEAKING
- SOKOL W-3A
- SU-30 MKM
- SUPER LYNX
- TIGER and NH 90 helicopters
- TORNADO
R&S®MR6000E for the Eurofighter Typhoon

The Eurofighter Typhoon, the result of multinational cooperation at the European level, will take on the future tasks of the air force. It goes without saying that in the area of secure radiocommunications, know-how from Rohde & Schwarz will be deployed.

The R&S®MR6000E, developed especially for this aircraft, establishes the encrypted air-to-air voice radio link and in addition will be used for voice communications with air traffic control. It supports the SATURN and HAVE QUICK I/II frequency hopping methods in line with STANAG 4372 and STANAG 4246. SATURN uses a 16 kbit/s voice encoder for high-quality voice communications. The R&S®MR6000E has a distinctive L-form and in addition to a MIL-STD-1553B data bus also features an optical interface in line with STANAG 3910 for the Eurofighter Typhoon.
## Ordering information

### R&S®MR6000A (extract of available equipment)
**ARINC 600 housing – remote control**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Type</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency bands: 30 MHz to 88 MHz, 108 MHz to 174 MHz, 225 MHz to 400 MHz; fixed frequency; interfaces: RS-485, MIL-STD-1553B trafe coupling; audio output: 600 Ω</td>
<td>R&amp;S®XM6023</td>
<td>6134.6400.62</td>
</tr>
<tr>
<td>Frequency bands: 30 MHz to 88 MHz, 108 MHz to 174 MHz, 225 MHz to 400 MHz; EPM (ECCM): HAVE QUICK III; interfaces: RS-485, MIL-STD-1553B trafe coupling; audio output: 600 Ω</td>
<td>R&amp;S®XM6123</td>
<td>6134.4008.67</td>
</tr>
<tr>
<td>Frequency bands: 30 MHz to 88 MHz, 108 MHz to 174 MHz, 225 MHz to 400 MHz; EPM (ECCM): R&amp;S®SECOS 5/16 voice and data; interfaces: RS-485, MIL-STD-1553B trafe coupling; audio output: 600 Ω</td>
<td>R&amp;S®XM6423D</td>
<td>6134.6800.67</td>
</tr>
<tr>
<td>Frequency bands: 30 MHz to 88 MHz, 108 MHz to 174 MHz, 225 MHz to 400 MHz; EPM (ECCM): R&amp;S®SECOS 5/16 voice and data; interfaces: RS-485, MIL-STD-1553B trafe coupling; audio output: 600 Ω</td>
<td>R&amp;S®XM6523D</td>
<td>6134.7207.62</td>
</tr>
<tr>
<td>Frequency bands: 30 MHz to 88 MHz, 108 MHz to 174 MHz, 225 MHz to 400 MHz; EPM (ECCM): SATURN, HAVE QUICK III; COMSEC: embedded NATO; interfaces: RS-485, MIL-STD-1553B trafe or direct coupling; audio output: 150 Ω or 600 Ω</td>
<td>R&amp;S®XM6923L</td>
<td>6134.xxxx.yy</td>
</tr>
</tbody>
</table>

### R&S®MR6000L (extract of available equipment)
**ARC-164 housing – local control**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Type</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency bands: 108 MHz to 174 MHz, 225 MHz to 400 MHz; fixed frequency; interfaces: RS-485; illumination: white; display: red; audio output: 600 Ω</td>
<td>R&amp;S®XT6010</td>
<td>6126.0888.52</td>
</tr>
<tr>
<td>Frequency bands: 30 MHz to 88 MHz, 108 MHz to 174 MHz, 225 MHz to 400 MHz; EPM (ECCM): HAVE QUICK III; interfaces: RS-485; illumination: NVG (green A); display: green; audio output: 600 Ω</td>
<td>R&amp;S®XM6110</td>
<td>6141.6502.58</td>
</tr>
<tr>
<td>Frequency bands: 30 MHz to 88 MHz, 108 MHz to 174 MHz, 225 MHz to 400 MHz; EPM (ECCM): R&amp;S®SECOS 5/16 voice and data; interfaces: RS-485, MIL-STD-1553B trafe coupling; illumination: NVG (green A); display: green; audio output: 150 Q</td>
<td>R&amp;S®XM6412D</td>
<td>6141.7750.18</td>
</tr>
<tr>
<td>Frequency bands: 30 MHz to 88 MHz, 108 MHz to 174 MHz, 225 MHz to 400 MHz; EPM (ECCM): R&amp;S®SECOS 5/16 voice and data; interfaces: RS-485, MIL-STD-1553B trafe coupling; illumination: NVG (green A); display: green; audio output: 150 Q</td>
<td>R&amp;S®XM6512D</td>
<td>6111.7000.13</td>
</tr>
<tr>
<td>Frequency bands: 30 MHz to 88 MHz, 108 MHz to 174 MHz, 225 MHz to 400 MHz; EPM (ECCM): SATURN, HAVE QUICK III; interfaces: RS-485; illumination: NVG (green A); display: green; audio output: 150 Q</td>
<td>R&amp;S®XM6910</td>
<td>6111.4701.03</td>
</tr>
</tbody>
</table>

### R&S®MR6000R (extract of available equipment)
**ARC-164 housing – remote control**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Type</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency bands: 108 MHz to 174 MHz, fixed frequency; interfaces: RS-485, MIL-STD-1553B trafe coupling; audio output: 600 Ω</td>
<td>R&amp;S®XU6013</td>
<td>6141.7509.62</td>
</tr>
<tr>
<td>Frequency bands: 30 MHz to 88 MHz, 108 MHz to 174 MHz, 225 MHz to 400 MHz; fixed frequency; interfaces: ARC-164 serial; MIL-STD-1553B trafe coupling; audio output: 150 Q</td>
<td>R&amp;S®XM6013</td>
<td>6111.2750.42</td>
</tr>
<tr>
<td>Frequency bands: 30 MHz to 88 MHz, 108 MHz to 174 MHz, 225 MHz to 400 MHz; fixed frequency; EPM (ECCM): preplanned, update via software installation; interfaces: RS-485, MIL-STD-1553B trafe coupling; audio output: 150 Q</td>
<td>R&amp;S®XM6013P</td>
<td>6111.8007.12</td>
</tr>
<tr>
<td>Frequency bands: 30 MHz to 88 MHz, 108 MHz to 174 MHz, 225 MHz to 400 MHz; EPM (ECCM): HAVE QUICK III; interfaces: RS-485, MIL-STD-1553B trafe coupling; audio output: 150 Q</td>
<td>R&amp;S®XM6113</td>
<td>6111.7752.17</td>
</tr>
<tr>
<td>Frequency bands: 30 MHz to 88 MHz, 108 MHz to 174 MHz, 225 MHz to 400 MHz; EPM (ECCM): R&amp;S®SECOS 5/16 voice and data; HAVE QUICK III; interfaces: RS-485, MIL-STD-1553B trafe coupling; audio output: 600 Ω</td>
<td>R&amp;S®XM6413D</td>
<td>6111.7500.67</td>
</tr>
<tr>
<td>Frequency bands: 30 MHz to 88 MHz, 108 MHz to 174 MHz, 225 MHz to 400 MHz; EPM (ECCM): R&amp;S®SECOS 5/16 voice and data; interfaces: RS-485, MIL-STD-1553B trafe coupling; audio output: 600 Ω</td>
<td>R&amp;S®XM6513D</td>
<td>6111.6756.62</td>
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</tbody>
</table>
# Software upgrade

<table>
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<tr>
<th>Designation</th>
<th>Type</th>
<th>Order No.</th>
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<tbody>
<tr>
<td>EPM (ECCM) method (R&amp;S®M3AR)</td>
<td></td>
<td></td>
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<tr>
<td>EPM (ECCM) Software: HAVE QUICK I</td>
<td>R&amp;S®GS6000</td>
<td>6113.0503.02</td>
</tr>
<tr>
<td>EPM (ECCM) Software: HAVE QUICK I/II</td>
<td>R&amp;S®GS6000</td>
<td>6113.0503.03</td>
</tr>
<tr>
<td>EPM (ECCM) Software: SATURN/HAVE QUICK I/II</td>
<td>R&amp;S®GS6000</td>
<td>6113.0503.04</td>
</tr>
<tr>
<td>EPM (ECCM) Software: SATURN/HAVE QUICK I/II; enhanced functionality (with additional STANAG 4372 options)</td>
<td>R&amp;S®GS6000</td>
<td>6113.0503.14</td>
</tr>
<tr>
<td>EPM (ECCM) Software: R&amp;S®SECOS 5/16 TDMA (DPP)</td>
<td>R&amp;S®GS6000</td>
<td>6113.0503.10</td>
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# Accessories

<table>
<thead>
<tr>
<th>Designation</th>
<th>Type</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mating connector sets (R&amp;S®M3AR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mating Connector for R&amp;S®MR6000R; without MIL bus</td>
<td>R&amp;S®ZR6000</td>
<td>6085.0215.02</td>
</tr>
<tr>
<td>Mating Connector for R&amp;S®MR6000R; with MIL bus</td>
<td>R&amp;S®ZR6000</td>
<td>6085.0215.03</td>
</tr>
<tr>
<td>Mating Connector for R&amp;S®MR6000L; without MIL bus</td>
<td>R&amp;S®ZR6000</td>
<td>6085.0215.04</td>
</tr>
<tr>
<td>Mating Connector for R&amp;S®MR6000L; with MIL bus</td>
<td>R&amp;S®ZR6000</td>
<td>6085.0215.05</td>
</tr>
<tr>
<td>Mating Connector for R&amp;S®MR6000R with R&amp;S®Ci6000F; without MIL bus</td>
<td>R&amp;S®ZR6000</td>
<td>6085.0215.06</td>
</tr>
<tr>
<td>Mating Connector for R&amp;S®MR6000R with R&amp;S®Ci6000F; with MIL bus</td>
<td>R&amp;S®ZR6000</td>
<td>6085.0215.07</td>
</tr>
<tr>
<td>Mating Connector Set for R&amp;S®MR6000A</td>
<td>R&amp;S®ZR6000A</td>
<td>6113.8033.02</td>
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<tr>
<td>Mating Connector Set for R&amp;S®GB6500</td>
<td>R&amp;S®ZR6500</td>
<td>6087.1025.02</td>
</tr>
<tr>
<td>Remote control units (R&amp;S®M3AR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remote Control Unit; control interface: RS-485; illumination: white; display: yellow</td>
<td>R&amp;S®GB6500</td>
<td>6087.0012.31</td>
</tr>
<tr>
<td>Remote Control Unit; control interface: RS-485; illumination: white; display: red</td>
<td>R&amp;S®GB6500</td>
<td>6087.0012.32</td>
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<tr>
<td>Remote Control Unit; control interface: RS-485; illumination: NVG (green A); display: green</td>
<td>R&amp;S®GB6500</td>
<td>6087.0012.33</td>
</tr>
<tr>
<td>Remote Control Unit; control interface: RS-485; illumination: red; display: red</td>
<td>R&amp;S®GB6500</td>
<td>6087.0012.34</td>
</tr>
<tr>
<td>Remote Control Unit; control interface: RS-485; illumination: NVG (green B); display: green</td>
<td>R&amp;S®GB6500</td>
<td>6087.0012.35</td>
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<tr>
<td>Trays (R&amp;S®M3AR)</td>
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<tr>
<td>Mounting Tray for R&amp;S®MR6000A</td>
<td>R&amp;S®KR6000A</td>
<td>6133.8345.02</td>
</tr>
<tr>
<td>Mounting Tray for R&amp;S®MR6000R</td>
<td>R&amp;S®KR6010</td>
<td>6131.5426.02</td>
</tr>
<tr>
<td>Cooling Tray for R&amp;S®MR6000R</td>
<td>R&amp;S®KR6010</td>
<td>6131.5426.03</td>
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<tr>
<td>Service and maintenance tools (R&amp;S®M3AR)</td>
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<tr>
<td>Base Station Adapter for R&amp;S®MR6000L (local control)</td>
<td>R&amp;S®BA6000L</td>
<td>6121.6513.02</td>
</tr>
<tr>
<td>Base Station Adapter for R&amp;S®MR6000R (remote control)</td>
<td>R&amp;S®BA6000R</td>
<td>6121.6520.02</td>
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<tr>
<td>Maintenance Connection Box for R&amp;S®MR6000A</td>
<td>R&amp;S®ZK6000A</td>
<td>6131.3686.02</td>
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<tr>
<td>Maintenance Connection Box for R&amp;S®MR6000L/R</td>
<td>R&amp;S®ZK6000L/R</td>
<td>6131.3681.02</td>
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<tr>
<td>Radio Commander</td>
<td>R&amp;S®CP6000</td>
<td>6026.9026.20</td>
</tr>
<tr>
<td>Radio Loader Software Update</td>
<td>R&amp;S®ZS6000</td>
<td>6026.9032.05</td>
</tr>
<tr>
<td>Test system for radio equipment of the R&amp;S®M3xR family</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-Level Special Test Equipment (I-STE for R&amp;S®M3AR, R&amp;S®M3SR, R&amp;S®M3TR)</td>
<td>R&amp;S®TS6030</td>
<td>on request</td>
</tr>
</tbody>
</table>
About Rohde & Schwarz

Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

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For data sheets, see
PD 0758.1141.22 (R&S®MR6000A)
PD 0758.0845.22 (R&S®MR6000UL/R)
PD 0758.1212.22 (R&S®GB6500)
and www.rohde-schwarz.com

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PD 0758.1970.12 | Version 04.00 | February 2009 | R&S®M3AR
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