One for all: compact antenna system for broadband radiomonitoring

The new R&S®AU600 active omnidirectional receiving antenna system is unique in the market. It is targeted primarily at regulatory authorities that perform spectrum monitoring in line with ITU recommendations. However, other users involved in broadband radiomonitoring in the VHF, UHF and lower SHF ranges can also benefit from this system. The R&S®AU600 is the first single system to cover the frequency range from 20 MHz to 8 GHz and to provide simultaneous interception of vertically and horizontally polarized signals.

Fig. 1: The R&S®AU600 active omnidirectional receiving antenna system is built to handle horizontally as well as vertically polarized signals. It covers an unrivaled range for such antennas from 20 MHz to 8 GHz. The system can be controlled by the R&S®OSP120 open switch and control platform (top device in figure) or the R&S®OSP130 (bottom).
Compact and rugged
The antenna system with its four antennas has a total height of only 102 cm. It weighs approx. 17 kg (Fig. 1). The protective radome is built from acrylonitrile styrene acrylate (ASA) to ensure high impact resistance and resistance to atmospheric conditions but without degrading the RF characteristics of the antennas. The system is designed to withstand wind speeds up to 275 km/h.

Fig. 2 shows the system with the radome removed. A broadband biconical antenna 1 at the tip handles vertically polarized signals from about 800 MHz. Underneath is a vertically polarized active dipole 2 for the frequency range from 20 MHz to 1 GHz which can be switched to passive mode. Horizontally polarized signals below 1 GHz are received by the active quadruple loop antenna 3. It can also be switched to passive mode. For horizontally polarized signals from about 800 MHz, another biconical antenna is used. While it has a vertical physical orientation, the specially designed polarization filter 4 allows broadband rotation to the desired polarization.

The signals from all four antennas are fed to a switch module in the flange. Along with the necessary solid-state switches, the switch module contains bandstop filters, low-noise amplifiers (LNA) and diplexers for connecting the received signals to either two RF sockets or just a single RF socket (Fig. 3).

Key features
- Outstanding field strength sensitivity ranging to –45 dBμV/m (referred to 1 Hz bandwidth and 0 dB S/N)
- Excellent circularity of azimuthal radiation pattern
- Very good polarization decoupling of 17 dB (typ.) broadband
- Amplifiers with large-signal immunity and outstanding second-order and third-order intercept points
**System with two receivers**

Fig. 4: Typical application with two monitoring receivers.

**Application examples**

Fig. 4 shows a typical application. In a system with two monitoring receivers (e.g. R&S®ESMD), horizontally and vertically polarized signals can be received simultaneously in the frequency range from 20 MHz to 8 GHz. The power supply and antenna switching functionality are provided by the R&S®OSP120 open switch and control platform, which is equipped with the R&S®OSP-B158 plug-in module. The control signals are transmitted via a differential interface to minimize susceptibility to external interference. Cable sets are available in lengths up to 50 m with rugged MIL-STD connectors at the antenna end.

If only a single receiver is available, the user can of course switch between horizontal and vertical polarization within the antenna system.

**Control functions**

The antenna system allows individual settings for optimal adaptation to the current receiving situation. Fig. 5 shows some possible settings. For example, the low-noise amplifiers (LNA) can be activated or deactivated independently for each polarization in the frequency range above 800 MHz. The active antennas for the lower frequency range can also be individually set for each polarization plane. Plus, the R&S®AU600 allows selection of bandstop filters for the GSM / UMTS, WLAN / LTE band 7 frequency ranges as well as of additionally installed customer-specific bandstop filters. For control purposes, either the R&S®OSP120 base unit with monitor interface or the R&S®OSP130 base unit with display and control panel can be used. Switching is performed as follows:

- With a PC connected via LAN using software supplied with the R&S®OSP base units
- Via SCPI commands generated by control software (e.g. MATLAB®, LabVIEW or a TCP/IP client)
- With the control panel on the R&S®OSP130 base unit
Bandstop filters simplify location selection

Selection of an appropriate location for a radiomonitoring system can be complicated when conflicting factors must be reconciled. For example, the height of the antenna above ground plays an important role in determining the antenna’s range or geographic coverage. In densely built-up areas, the roofs of the highest buildings are ideal while in rural areas, any accessible peaks or hills are favored.

However, this can generate conflicts with spectrum users who also need to install their transmitting antennas at such prominent locations. In order to reduce potential interference to the receiving system right at the antenna, the R&S®AU600 has two integrated, switchable bandstop filters for the most common competing bands (GSM / UMTS and WLAN / LTE band 7). Fig. 6 illustrates the typical stopband suppression of over 25 dB with the integrated GSM / UMTS filter. For frequencies produced by other potential interferers, application-specific bandstop filters can be integrated into the R&S®AU600 (Fig. 7).

Fig. 6: The bandstop filter for GSM / UMTS has stopband attenuation of over 25 dB.

Fig. 7: Bottom of antenna flange (cover plate removed) with room for two application-specific filters.

Summary

The R&S®AU600 from Rohde&Schwarz is an all-in-one solution for frequency monitoring from 20 MHz to 8 GHz. This currently unrivaled product offers excellent control flexibility combined with outstanding bandwidth and ease of use, even in interference-prone environments, to satisfy almost any requirement.