Transportable Monitoring and Direction Finding Systems R&S TMS

Versatile solutions for spectrum monitoring

Increasingly complex monitoring tasks

Modern monitoring systems include fixed, mobile and portable stations. In many cases, however, this does not serve the purpose or is uneconomical, and new solutions are required (e.g. if interference only occurs only once every few weeks as described in the box on page 48).

Transportability means flexibility

The new transportable solutions from Rohde & Schwarz are optimized for mobile use at rapidly changing sites with unknown radio scenarios. They are designed for monitoring and direction finding in accordance with ITU recommendations from 20 MHz to 1.3 GHz (with an extendable range from 10 kHz – DF 500 kHz – to 3 GHz). All measurement tasks can be performed either automatically (scheduled) or interactively.

The equipment is accommodated in portable racks for ease of transportation and protection out-of-doors. Not more than two persons are needed to carry the portable rack, which is also true for the antennas.

Hardware and software are ready for use on delivery and ensure fast on-site setup. It is simply a matter of installing the antennas, connecting the cables and switching on. Measurements can be performed for an unlimited period of time, as the stations can be powered not only

For 15 years, Rohde & Schwarz has enjoyed market success with the Spectrum Monitoring and Management Systems R&S ARGUS-IT [1] and the predecessor R&S TS9965. The new transportable monitoring and direction finding systems complete the successful equipment and meet a host of additional requirements.

FIG 1  R&S TMS200 with options; here used as a fixed monitoring station with Antennas R&S ADD195 (left) and R&S HE309 / HF902.
Some interfering emissions occur only very rarely (e.g. once every few weeks). However, the radio service affected may be so important that it is absolutely essential to eliminate the interferer. Pilots, for example, might find that the reception of navigation information is disturbed when they overfly specific areas, which poses a threat to life. In such a case, the affected frequency has to be monitored over a long period of time. The technical parameters of all emissions received must be measured and automatically compared to previous data to filter out known stations (tower or aircraft) as far as possible so that only information on “suspicious” emissions is passed on to the appropriate monitoring station personnel.

If the interferer is not within the receive range of the fixed monitoring stations, these stations cannot be used for signal identification. On the other hand, mobile systems normally cannot be operated unattended for an extended period of time and independently from AC supply. These restrictions affect all monitoring tasks that require long-term measurements beyond the receive range of the fixed or remote-controlled monitoring stations and for which the permanent presence of control staff is too resource-intensive or too costly.

The R&S TMS 100 (FIG 2) includes the Miniport Receiver R&S EB200, the Digital Direction Finder R&S DDF195, the compact System Process Controller R&S SPCC and a communication unit in a portable rack. The system can be connected to an antenna and provides network connection via a dialled or leased PSTN line, an ISDN line or a GSM / GPRS900 / 1800 link.

In contrast to the R&S TMS 100, the R&S TMS 200 comprises a Switch Unit R&S ZS129A1 in the portable rack instead of the system process controller and the communication unit, to which up to 12 antennas can be connected (FIG 1). The equipment is controlled from the System Notebook R&S SPCN outside the rack. This has the advantage that the controller can be taken to the office for data evaluation after measurements have been completed.

The R&S TMS 200 is linked to the network by the Transportable Communication System TMS-C which accommodates all facilities required for communication as well as auxiliary equipment (FIG 3).

Additional equipment is available to adapt the systems to different requirements. This includes antennas for different frequency ranges and polarizations, communication equipment for setting up PSTN, ISDN and GSM / GPRS connections, compass, GPS receivers and software packages.

Example: Special tasks require flexible and mobile solutions

This is where transportable monitoring systems come into their own. They can perform all the measurement tasks usually associated with fixed or remote-controlled monitoring stations and have the extra advantage of being much more cost-effective and capable of being relocated rapidly. This means that the coverage area of a network of fixed and remote-controlled monitoring stations can be expanded exactly as needed.

To solve the interference described above, a transportable monitoring station could be positioned directly below the air-traffic route concerned, e.g. on the approach track to the runway. All aircraft emissions would then come from the same direction and could be filtered out by the monitoring software. Emissions from the tower can also be filtered out. This ensures that the transportable monitoring station will alert the control station only when a “foreign” signal is detected. If the interference occurs again after a period of time and no alarm is given, the monitoring station is not in the receive range of the interferer and must be relocated. However, if the interfering signal is picked up, the monitoring station can be moved in the direction of the source, and the filter for triggering the alarm can be set to characteristic features such as the frequency offset. The transportable monitoring station can thus be positioned closer and closer to the interferer with a minimum of staff until a vehicle can be used for exact location.
The R&S TMS110 and R&S TMS210 include the Monitoring Receiver R&S ESMB instead of the R&S EB200 used in the R&S TMS 100 and R&S TMS 200.

Host of applications

The versatility of the new transportable systems allows them to be used as attended and unattended fixed stations, mobile stations or even portable monitoring stations.

Operation as attended fixed monitoring station

The key advantage of transportable systems over fixed monitoring stations is that once the assigned tasks at a site are completed, a transportable system can be moved and quickly set up again. Owing to the system’s compact design, it can even be installed on roofs or in difficult terrain. The antennas can be mounted to the tripod by means of special adapters (FIG 1). Depending on the task to be performed and on the frequency range and polarization of the signals to be measured, one or more monitoring or DF antennas are connected to the system.

The main advantage of fixed monitoring stations over transportable systems is that heavy, bulky equipment can be used, e.g. a large antenna array for HF direction finders. If this is not necessary, a transportable system is a cost-effective alternative.

Operation as unattended fixed monitoring station

Operation of attended and unattended fixed stations is much alike except that routers and modems are integrated in the unattended station for remote control. Analog or digital dialled or leased lines or GMS/GPRS 900/1800 links with a data rate of at least 9.6 kbit/s (FIG 4) are used for communication.
A central control station can be created from a PC, a router and a modem with appropriate software or even from a transportable system that contains the necessary communication equipment.

Operation as mobile monitoring station
The transportable system can be installed in all kinds of vehicles (FIG 5). The portable rack containing the equipment can easily be fastened to the vehicle with four screws. Special adapters are used to mount the DF and monitoring antennas to the vehicle roof.

A GPS receiver and compass can be added to the system so that location and direction finding can be performed automatically. The mobile system in a vehicle can, of course, also be remote-controlled, usually via GSM/GPRS900/1800 links.

The system can also be operated while the vehicle is moving. In this case, an antenna capable of withstanding the resulting forces — e.g. the R&S ADD195 — has to be installed on the vehicle roof.

Operation as portable monitoring system
Due to its modular design, the transportable system can also be used as a portable monitoring station. All that has to be done is to remove the Receiver R&S EB200 from the portable rack and connect it to a hand held directional antenna. The system fits into a convenient carrying bag that also protects the unit against the weather (FIG 6). The receiver is powered by an easily replaceable battery set attached to its base. A spare battery set is integrated in and charged by the transportable system.
Reliable software

With Monitoring Software R&S ARGUS [2], all the equipment can be controlled and operated interactively via virtual front panels (FIG 7), or automatic, program-controlled measurements can be performed. The software records and displays the RF and IF spectra in different graphical representations. A comprehensive statistical evaluation of measurement results can be performed in accordance with the standards and recommendations of ITU-R. Measurement results, their definitions and statistical analyses can be documented in reports.

Geographic Information Software R&S MapView shows the site of the direction finder, current DF bearing and the position of the source of interference on a digital map.

Audio Software R&S AllAudio [3] is used in the system to record, replay and distribute the audio signals of the receiver. Recorded signals are stored by the controller in an audio database. The operator can set bookmarks during recording and replay in order to quickly find the recording later on. Comments can also be added.

Summary

Because of their exceptional versatility, the transportable monitoring systems are a cost-effective alternative to fixed and mobile monitoring systems. They ideally complement existing monitoring networks, as they can be easily transported and set up and allow unattended measurements and monitoring to be performed over an unlimited period of time. Another advantage is that countries just starting with frequency monitoring can use the transportable systems as a cost-effective alternative to fixed and mobile monitoring stations.

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