

Satellite Tracking Antenna AS809

Radiomonitoring LEO communication satellites

Rohde & Schwarz has developed a broadband microwave antenna to be used for varied monitoring tasks in future satellite communications. This antenna can receive signals emitted by fast-moving LEO (low earth orbiting) satellites in addition to signals from geostationary satellites.



FIG 1
Satellite Tracking
Antenna AS809
for 1 to 18 GHz
Photo 41 722/9

The end of this millennium is seeing the rise of a new form of global communication, which makes use of satellites. This form of communication involves portable terminals that allow blanket worldwide coverage and thus supplements local terrestrial networks such as GSM. When planning this type of communication, various satellite configurations were considered. Initially considerations focused on the frequently used geostationary satellites, ie satellites orbiting at the rotational speed of the earth. When viewed from the earth, these GEO (geostationary earth orbiting) satellites appear to be stationary in the sky. However, this state of equilibrium is only possible at a distance of around 36,000 km from the earth, so the terminals used must

have directional antennas, and a transmission power of around 25 W. A very compact terminal of this type is Satphone SP1600 from Rohde & Schwarz [1], which is the size of an attaché case. The use of terminals the size of mobile phones is only feasible with satellites orbiting the earth at a distance well below 36,000 km. Successful communication systems so far have used MEO (medium earth orbiting) satellites flying at medium altitudes (approx. 10,000 km) and LEO satellites orbiting at low altitudes (approx. 1000 km).

Space radio service monitoring

For space radio service monitoring [2] these latest developments bring about the need for satellite receive antennas

capable of tracking satellites at low altitudes. The **most important tasks in monitoring LEO satellites** are:

- monitoring the radio frequency spectrum in order to detect and identify satellite emissions,
- allocating frequency bands and supervising their use,
- determining satellite position and orbit stability,
- measuring and documenting the characteristics of satellite emissions,
- examining radio interference caused by satellites,
- examining radio interference caused by ground facilities,
- detecting unauthorized transponder use.

Rohde & Schwarz has been offering favourably priced antenna and receiving systems [3] for this range of tasks for some time. Non-geostationary satellites, on the other hand, must be continuously tracked while measurements are being performed. In addition, unknown satellites have to be tracked down and their orbits determined. Rohde & Schwarz has now developed and successfully put into operation a receiving system that meets these requirements.

Monitoring system with Antenna AS809

At the heart of the monitoring system for LEO satellites is Antenna AS809, which allows polarization-independent tracking according to the monopulse principle – ie independent of the type of signal being dealt with (FIG 1). The antenna reflector and the positioning system were developed in cooperation with Vertex, the former Krupp Industrie-technik. Reflectors may be 8 to 11 m in diameter.

The frequency range is 1 to 18 GHz, but thanks to the high-precision reflector it may also be extended to cover the VHF and mm ranges. The antenna is part of the fully processor-controlled Radiomonitoring System RAMON [4], whose receiving components allow a



FIG 2 Receive components of Radiomonitoring System RAMON serve for processing data provided by Antenna AS809. Photo 41 515/4

no-gap conversion of a wide frequency band to the intermediate frequency range 70 MHz (FIG 2).

A glance at the specifications of Satellite Tracking Antenna AS809 will reveal that the antenna has plenty of reserve for future LEO communication systems.

Dr. Klaus Rieskamp

REFERENCES

- [1] Böhler, U.: Shortwave radio or satellite communication? News from Rohde & Schwarz (1995) No. 149, pp 57–59
- [2] ITU Spectrum Monitoring Handbook 1995, chapter 4.1
- [3] Schiller, M.; Sigl, G.: Antenna AC002B5 and Receiving System EA002B5 – Processor-supported monitoring system for 0.1 to 18 GHz. News from Rohde & Schwarz (1995) No. 147, pp 7–9
- [4] Ehrichs, R.; Holland, C.; Klenner, G.: Radiomonitoring System RAMON – Customized radiomonitoring from VLF through SHF. News from Rohde & Schwarz (1996) No. 151, pp 19–21

Condensed data of Satellite Tracking Antenna AS809

Diameter	≤11 m
Frequency range	1 to 18 GHz
Bandwidth	50 kHz to 40 MHz
Polarization	V/H linear, RHCP/LHCP
Signal channel	independent of tracking
Side-lobe suppression	using extra antenna
Tracking	3-channel Σ/Δ monopulse
Search	antenna for sector and spiral search
Angular speed	<15°/s (azimuth) / <7.5°/s (elevation)
Angular acceleration	<7°/s ²
Power consumption	approx. 60 kVA

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