R&S®EB510 HF monitoring receiver for gapless shortwave radiomonitoring

Even in the age of Internet and worldwide satellite communications, employing communications links in the shortwave range remains attractive because of the great advantages offered. As a result, there is still a high demand for radiomonitoring tasks in the shortwave range. This article provides several examples that illustrate how the R&S®EB510 HF monitoring receiver can be used universally for these applications.

R&S®EB510 HF monitoring receiver

Today, shortwave communications is still attractive because long distances can be bridged without requiring costly infrastructure (see box on page 77). As a result, there is still a high demand for radiomonitoring in the shortwave range. The compact, highly sensitive R&S®EB510 HF monitoring receiver (Fig. 1) is ideal for shortwave radiomonitoring because it covers the frequency range from 9 kHz to 32 MHz. It offers realtime bandwidths up to 32 MHz and digital I/Q data up to 5 MHz. With its excellent HF characteristics (including direct sampling with low phase noise), powerful digital signal processing and a variety of useful functions (such as different scan modes and multichannel demodulation), it covers virtually all radiomonitoring tasks. It can be used as a sensor node, as a handoff receiver, as a standalone radiomonitoring receiver, in frequency management and for many other applications.

Fast, high-resolution frequency scan

Due to its realtime bandwidth of 32 MHz, the receiver makes active transmitters visible in the HF spectrum at a glance. For higher resolutions (step sizes < 10 kHz) the panorama scan option (R&S®EB510-PS) is available. It allows users to refine the resolution to 0.1 kHz, regardless of the frequency range of interest. Finer resolutions boost sensitivity, extend the dynamic range and ensure greater immunity to signals in adjacent channels. This makes it possible to capture more signals in the spectrum (Fig. 2).

Fig. 1 R&S®EB510 HF monitoring receiver with front panel.

Fig. 2 Top: Fixed frequency mode (FFM) within the realtime bandwidth of 32 MHz at a resolution of 10 kHz. Bottom: Panorama scan (PS) mode with resolution refined to just 1 kHz captures more emissions (highlighted in red).

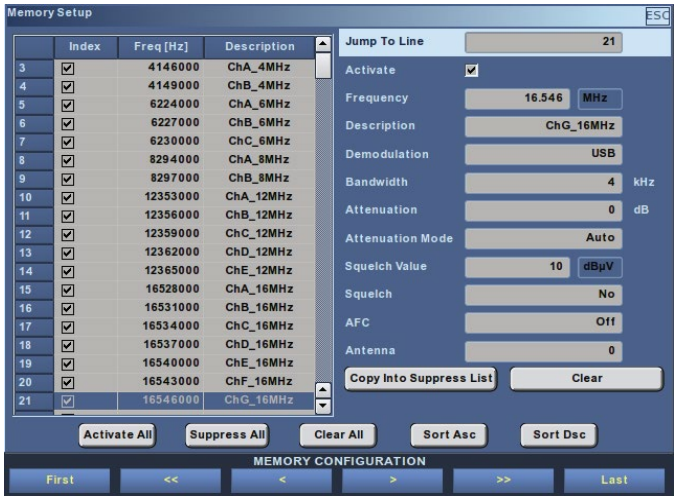


Fig. 3 Frequency storage settings menu.

Versatile R&S®EB510: example applications

Radiocommunications monitoring using memory scan

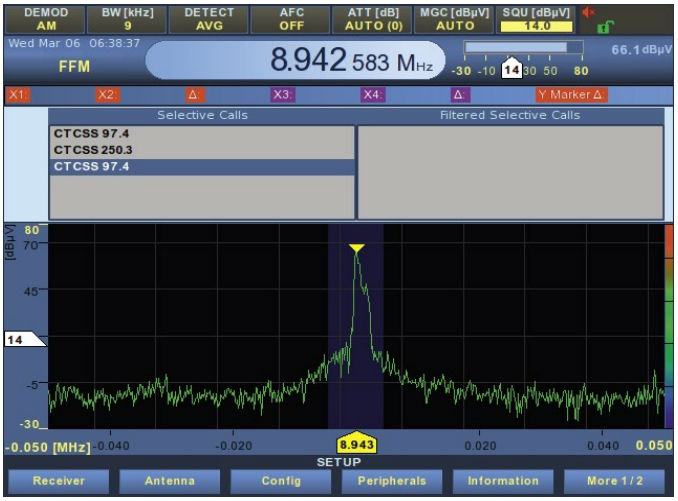
Shortwave communications is subjected to a variety of influences, including fluctuations in the altitude and intensity of ionized layers, periods of heavy solar activity or seasonal effects. This is why users must select the appropriate frequencies when establishing a radio link depending on the time of day, season of the year and the distance to be bridged. To facilitate this task under such extremely diverse conditions, the R&S®EB510 provides up to 10 000 programmable memory locations for storing the frequencies of interest. These frequencies can then be recalled at a scan speed of 1600 channels/s. Every memory location is defined with the frequency, an individual description, the demodulation mode and bandwidth, the attenuation and the squelch values (Fig. 3). Stored frequencies can be copied into a suppression list so that they are excluded from the scan.

Multichannel monitoring

When equipped with the R&S®EB510-DDC option, the receiver has three digital downconverters (DDC). In combination with the main demodulator, it can monitor up to four signals at the same time (Fig. 4). For demodulation, users can apply master settings to all channels or assign different settings to individual channels – e.g. bandwidth and demodulation mode – to make it possible to demodulate the audio content. All the channels (or just some of them) can be output via LAN and recorded for subsequent classification (using the R&S®GX430 PC-based signal analysis and signal processing software, for example).

Fig. 4 Simultaneous monitoring of up to four signals.

Fig. 5 Display of a communications link using the CTCSS method.



Selective call identification

Selective calling is typically used in mobile land-based or ship-based radiocommunications. This feature makes it possible to address a subset of receivers or to establish a link directly to a specific radio. This prevents interference from other radio traffic on the same channels. The receiver automatically displays received selective call standards and permits the results to be filtered based on specific selective call types.

The R&S®EB510-SL selective call option allows the R&S®EB510 to decode and display numerous selective calling methods: CCIR1, CCIR7, CCITT, EEA, EIA, EURO, DCS, DTMF, CTCSS, NATEL, VDEW, ZVEI1 and ZVEI2. The example in Fig. 5 shows a recorded signal that is coded using the continuous tone-coded squelch system (CTCSS). The frequencies of the two applied tones are 97.6 Hz and 250.3 Hz (numbers 13 and 51).

Summary

With its large realtime bandwidth and innovative gapless signal processing with no blind time, the R&S®EB510 HF monitoring receiver detects low probability of intercept (LPI) signals or frequency hopping and radar signals, and it can demodulate numerous analog transmissions (AM, FM, USB and LSB). Its interface compatibility allows the R&S®EB510 to be integrated easily and efficiently into existing systems and to replace older receivers, such as the R&S®ESMB and the R&S®EB200.

Nellie Pang; Peter Kronseder

Advantages of shortwave communications

In the shortwave range (3 MHz to 30 MHz), communications links can be established over short distances and also over very long distances. In addition to direct line of sight (LOS), there are two other propagation methods: via ground wave and via sky wave.

Within the HF range with its comparably low frequencies and consequently long wavelengths, ground waves can pass through liquids such as sea water as well as solid obstacles.

Multiple reflections between the ground and the ionosphere permit sky waves to cover large distances, even reaching the other side of the globe under favorable conditions. When establishing radiocommunications links under sky wave propagation conditions, users must understand the influences that result from the ionosphere and solar activity and must know what frequencies are suitable based on the season, the time of day and the distance to be bridged.

Shortwave communications systems are easy to deploy and do not require complicated network infrastructures. Typically employed in long-range communications, frequencies in the HF range are used for air-to-ground voice communications as well as for air traffic management, marine communications and the dissemination of meteorological information.

Key features of the R&S®EB510

- Frequency range from 9 kHz to 32 MHz
- Realtime bandwidth (IF spectrum) of up to 32 MHz and parallel demodulation with bandwidths from 100 Hz to 5 MHz
- Fast panorama scan with up to 60 GHz/s across entire frequency range
- High-speed frequency and memory scan with up to 1600 channels/s
- Polychrome IF spectrum for reliable detection of overlain pulsed signals

R&S®EB510 HF monitoring receiver without front panel for remote control via LAN.