Applications for spatial averaging complying with EN 50492

The Selective Radiation Meter SRM-3006 from Narda Safety Test Solutions has been specially developed for environmental and safety measurements in electromagnetic fields. Using isotropic measuring antennas, the instrument covers the entire frequency range from 9 kHz to 6 GHz. It can therefore be used equally well to investigate safety in the near field region of long wave transmitters, make measurements on radio and TV broadcast transmitters, and determine exposure levels caused by the latest generation of mobile telecommunications services.

EN 50492, the *Basic standard for the in-situ measurement of electromagnetic field strength related to human exposure in the vicinity of base stations*, describes a method of spatial averaging in section 9.2.1.3 that is designed to record the exposure level of the human body to electromagnetic radiation as realistically as possible. For this, at least three separate measurements must be made at the point of highest field strength, the so-called hot spot. The number of measurements can be increased to six to reduce measurement uncertainties (Figure 1).

The field strength is measured isotropically at each measurement location. If a single-axis antenna is used, the isotropic result for each measurement location must be determined from the three spatial components using the following relationship:

$$E_i = \sqrt{E_{i_x}^2 + E_{i_y}^2 + E_{i_z}^2} \quad \text{or} \quad H_i = \sqrt{H_{i_x}^2 + H_{i_y}^2 + H_{i_z}^2}$$

The results for each measurement location are averaged by taking the square root of the sum of the squares, i.e.:

$$E_{spatial\ averaging} = \sqrt{\frac{\sum_{i=1}^{N} E_i^2}{N}} \quad \text{or} \quad H_{spatial\ averaging} = \sqrt{\frac{\sum_{i=1}^{N} H_i^2}{N}}$$

Too complicated? Not at all. If you use the **SRM-3006** with its **isotropic measuring antennas** and its **Spatial Averaging** function, you can forget the math!

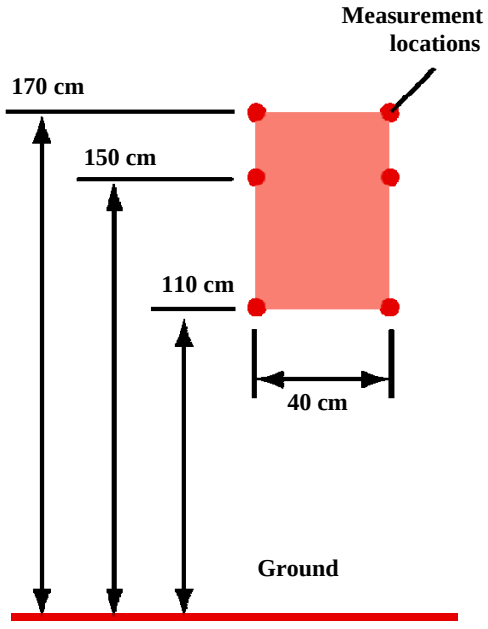

Figure 1: Six measurement locations roughly correspond to the volume of the human body.

Spatial Averaging with the SRM-3006

First, find the location where the field strength is highest. You can do this by comparing the instantaneous measurement values (Result Type: *Act*) with the maximum values (Result Type: *Max*). The *Beep on new Maximum* function, a special feature of the SRM-3006 Spectrum Analyzer, can help you here.

Next, set the SRM-3006 to Result Type: *Spatial Averaging / Discrete*, place the isotropic measuring antenna in one of the specified measurement locations, and start the measurement. When equipped with an isotropic antenna, the SRM-3006 automatically determines the isotropic value and saves it at the touch of a button (*Add Value* softkey).

Now make the other measurements at the other locations one after the other. The SRM-3006 automatically displays the spatial average result as soon as you have saved the result for the last prescribed measurement location.

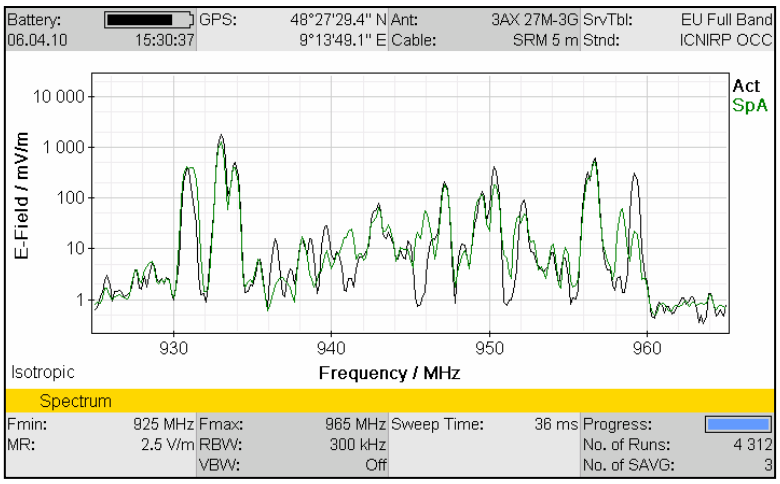

Figure 2: Example of an analysis of the GSM-900 spectrum using Spatial Averaging. The values at specific frequencies can be read off numerically using the marker. The SRM-3006 can also automatically list the highest values with their corresponding frequencies in the Peak Table.

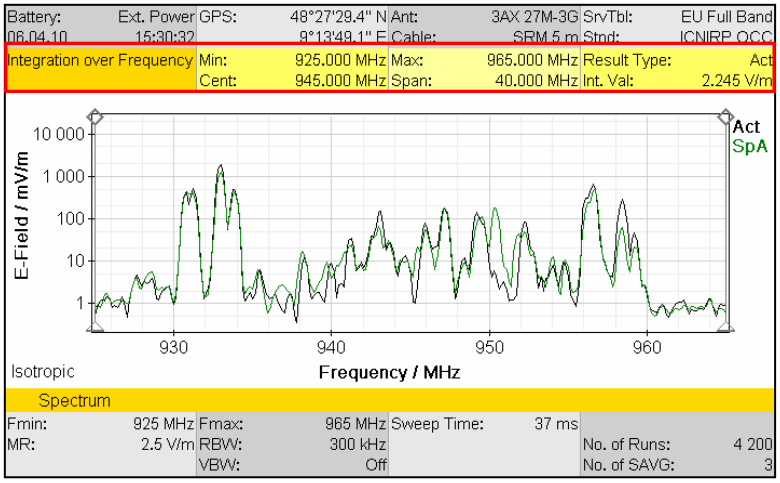

Figure 3: You can use the Integration over Frequency function to determine the overall exposure by integrating the GSM-900 frequency range. This value, too, can be read off numerically as shown here (area outlined in red).

Spatial Averaging can be used in *Safety Evaluation*, *Spectrum Analysis* and *Level Recorder* modes. Each step in the procedure is described in detail in section 12 of the operating manual.

You can also use single-axis antennas for *Spatial Averaging*, but the measurement is much more time-consuming. You will have to make three separate measurements at each measurement location, using a tripod and an appropriate antenna holder to ensure the necessary accuracy in positioning the antenna. The SRM-3006 provides support for this process by automatically calculating the isotropic value for each measurement location from the three separate results and then averaging these values, thus automatically determining the spatial average value.

EN 50492 is a harmonized European Standard and is available as BS EN 50492 from The British Standards Institution.

Technical Notes from Narda Safety Test Solutions

These notes report, in no particular order, on the possible applications of Narda measuring equipment. Typical applications for the Selective Radiation Meter SRM-3006 are safety measurements on

- **Radio and TV transmitters (AM, FM, DAB, DVB-T)**
- **Mobile phone stations (GSM-900, GSM-1800, UMTS, CDMA, W-CDMA, LTE)**
- **Wireless communications networks (WiFi, WLAN, WiMAX, DECT, ZigBee, Bluetooth)**
- **Radio controls using ISM frequencies**

The Technical Notes are found on www.narda-sts.de under Literature ▶ High Frequency

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