Applications of UMTS mode

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.

In *UMTS P-CPICH Demodulation* mode (option), or *UMTS* for short, the Selective Radiation Meter decodes all the scrambling codes present in a selected UMTS frequency channel. In this way, it can determine and list separately the contribution of each individual cell to the overall field exposure level. It also calculates the sum of these contributions. Using a settable extrapolation factor, you can then determine the worst-case situation, which would occur if all the traffic channels were fully loaded. The SRM-3006 also displays the analog measured value. This corresponds to the actual field exposure integrated over the complete 5 MHz UMTS frequency channel.

The ease of switching between *Spectrum Analysis* and *UMTS P-CPICH Demodulation* modes opens up some useful features. Here are some examples:

Oveview measurement with Spectrum Analysis

Spectrum analysis gives an overview of the UMTS frequency range, and shows precisely which UMTS frequency channels within the 5 MHz grid are occupied:

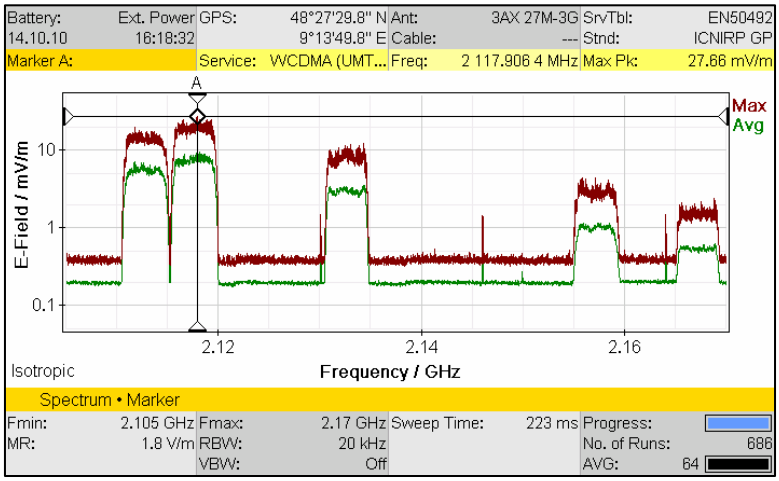

Figure 1: Spectrum Analysis of the UMTS frequency range. The high resolution (RBW = 20 kHz) was selected to make the almost rectangular spectral distribution within each UMTS frequency channel visible. The Peak Marker can be used to determine the maximum value (Marker A), but because the resolution bandwidth is only 20 kHz, this will not be the entire channel power.
For a correct measurement of channel power in Spectrum Analysis mode, a resolution bandwidth of 5 MHz corresponding to the spectral width of a UMTS frequency channel is ideal.

Determining the total channel power

The measurement using a resolution of 20 kHz shown in figure 1 yields a precise display of the frequency channel spectrum. The measurement is, however, easier if the resolution bandwidth is set to 5 MHz, corresponding to the width of a UMTS frequency channel. The channel power can then be read off directly using the Peak Marker:

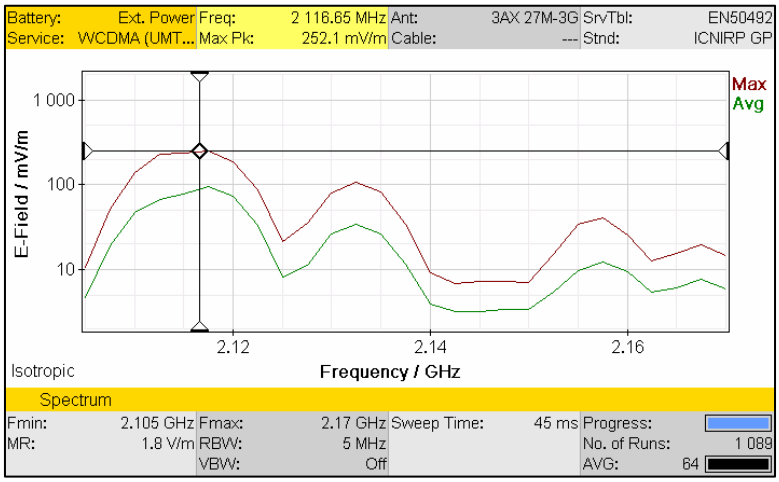

Figure 2: Spectrum Analysis of the UMTS frequency range using a low resolution (RBW = 5 MHz). The channel power can now be read off directly using the Peak Marker. A special algorithm ensures that the peak marker is placed exactly on the channel maximum.

Determining the contributions of individual cells

The measurements mentioned so far could all be made using *Spectrum Analysis* mode. The *UMTS P-CPICH Demodulation* option, though, is essential for determining the contributions of individual cells within a UMTS frequency channel, because the cells do not differ in their frequencies but only in their encoding. One P-CPICH (Primary Common Pilot Channel) for each cell is embedded in the multiplex signal. This channel is transmitted continuously at a constant power level. Each cell has its own P-CPICH with its own scrambling code. The SRM-3006 decodes the P-CPICH and uses the scrambling codes to match the measured field strength to the relevant cell.

Switching from *Spectrum Analysis* mode to *UMTS* is simple: Just press the softkeys Extras -> Go to: UMTS. The SRM-3006 uses the spectrum analysis center frequency in the formula Fcent = (Fmin + Fmax)/2, or uses the active marker position, i.e. Fcent = Fmarker. Some fine manual adjustment may be necessary, since the center frequency for the demodulation must be set to an accuracy of 100 kHz. If the service

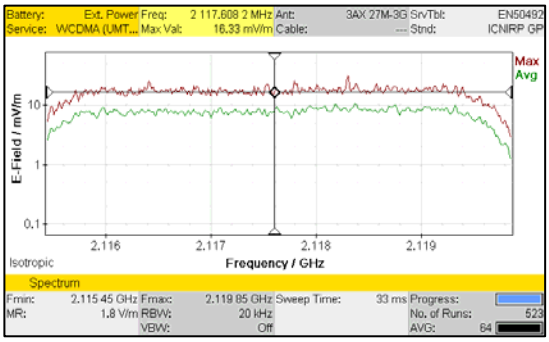

Figure 3: To find the center frequency, zoom in to one UMTS frequency channel from the spectrum shown in figure 1. Adjustment of the marker is then much easier. Nevertheless, some manual adjustment to the actual center frequency may be necessary in UMTS mode.

provider specifies the center frequency, it is more convenient to directly enter this value numerically. The SRM-3006 automatically sets the resolution bandwidth to 3.84 MHz, corresponding to the UMTS channel filter 3-dB bandwidth.
Here is the result of a *UMTS P-CPICH Demodulation*:

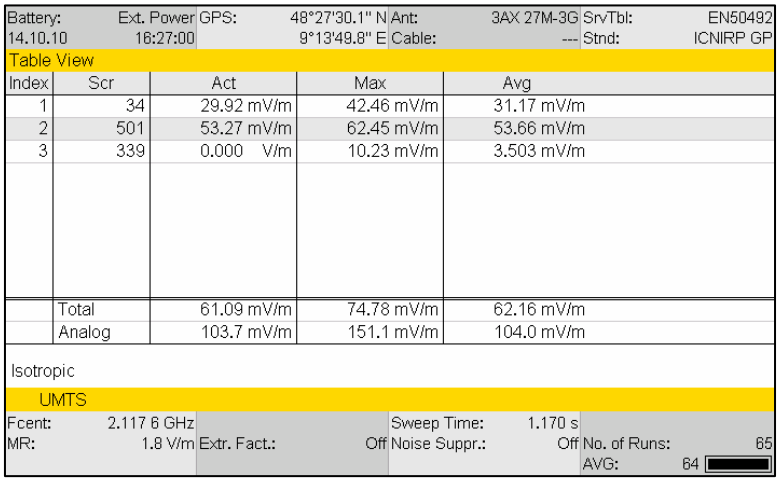

Figure 4: The SRM-3006 has detected three cells within the UMTS frequency channel. It displays the instantaneous values (Act), maximum values (Max), and average values (Avg) of the P-CPICHs. The penultimate line (Total) shows the sum of the demodulation results. The last line (Analog) shows the corresponding analog measurement values.

Extrapolation to maximum output power

The difference between the total and analog values shown in figure 4 among other things occurs because the values obtained by decoding only capture the P-CPICH, whereas the analog values include the pilot channels and the traffic channels.

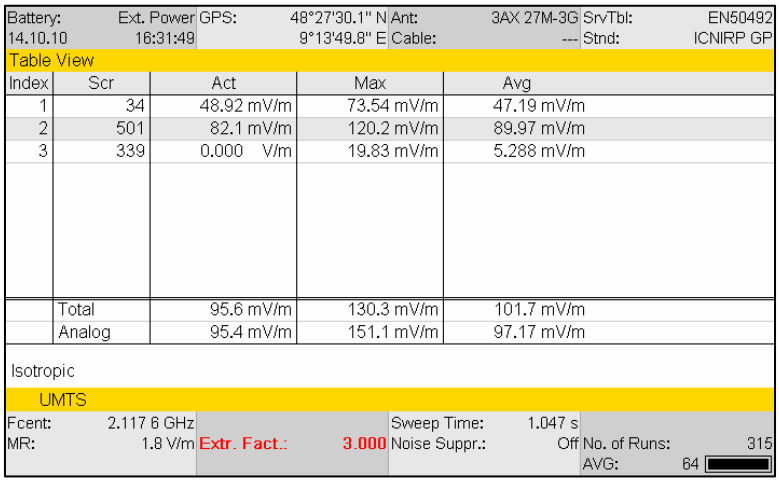

Figure 5: Extrapolation using the factor 3. European standard EN50492 makes the assumption in Annex I.3 that the P-CPICH power is 10 % of the total power at full load traffic. The power level of the P-CPICH should therefore be extrapolated by 10 dB to determine the full load power; this would correspond to extrapolating the field strength by the factor √10 = 3.162. This value, too, can be set exactly on the SRM-3006.

If the maximum ratio of traffic channels to P-CPICH is known (the service provider knows this), you can use the extrapolation factor (Extr. Fact) to determine the field exposure level that would occur if all traffic channels were fully loaded. This is important when assessing safety in the vicinity of UMTS antenna sites.

Determining the degree of coverage

Although it is desirable for safety's sake to keep the field exposure level as low as possible, a certain field strength is necessary to ensure a reliable connection. In particular, the differences in field strength between different cells within the same frequency channel must not be too large. For this reason, service providers measure the ratio of the P-CPICH field strengths to the total analog field strength measurement. The SRM-3006 displays the Pilot to Analog ratio directly in dB:

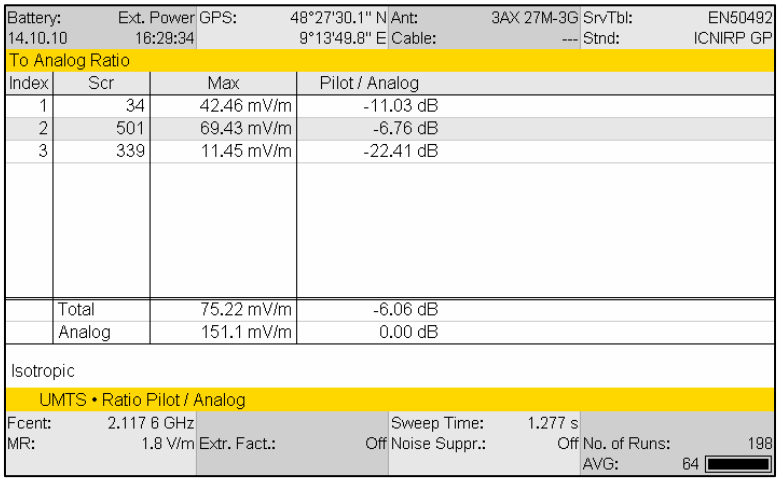

Figure 6: Measuring the degree of coverage of three UMTS cells with direct display of the Pilot to Analog ratio in dB.

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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