SPECTRUM ANALYZER SETTINGS – Professional RF Interference Measurement

Methods for Interference Measurements

Before or during radio planning / installation, a site survey could be helpful in order to identify and avoid possible RF interferences or constructive obstructions. Important during the check for environmental noise is to make sure that all representative noise sources are switched on, e.g. all suspicious electronic equipment which may be used day-to-day in this environment.

The easiest method to localize radio disturbances is to use an appropriate EnOcean based handheld RSSI field level indicator.

To evaluate and localize potential interference (noise) sources in detail, a handheld Spectrum Analyzer could be helpful. This Application Note specially refers to the noise measurement settings by using a handheld spectrum analyzer (SA).

RF Interference measurement with Spectrum Analyzer

1) Basic recommendations and settings by using a Spectrum Analyzer. Please also consult your particular SA operating instructions.
   a) Use always a reference antenna (e.g. λ/4, magnetic base mounted onto a metal ground plate) to obtain comprehensible results.
   b) For measurements of noise floor, always use an appropriate external LNA with a known, higher gain (> +20…40 dB) and switch off the SA internal preamplifier (Setup/Hardware). Don‘t forget to consider LNA additional gain by evaluating the real noise floor level.
   c) Make sure that there is no attenuation switched on at the spectrum analyzer.
   d) Central Frequency (CF) at the working frequency = e.g. 868.3 MHz
   e) Recommended Resolution Band Width (RBW) = 300 kHz
   f) Recommended Video bandwidth (VBW) = 300 kHz
   g) Recommended SPAN = 1 MHz
   h) Recommended TRACE = MAX HOLD
   i) REF LEVEL = -40 dBm* (to be optimized according the particular amplifier settings and maximum expected input signal level).
   j) RANGE = 10 dB/div
   k) DETECTOR = MAX PEAK (AUTO)
   l) Sweep Time (SWT) = AUTO
   m) The sampling time is subject to personal assessment of the environment and its potential interfering noise sources.

2) Analyze and Evaluation. In the following please look at the two (Fig. 1 and Fig. 2) typical "uncritical" screen shot examples for comparison:

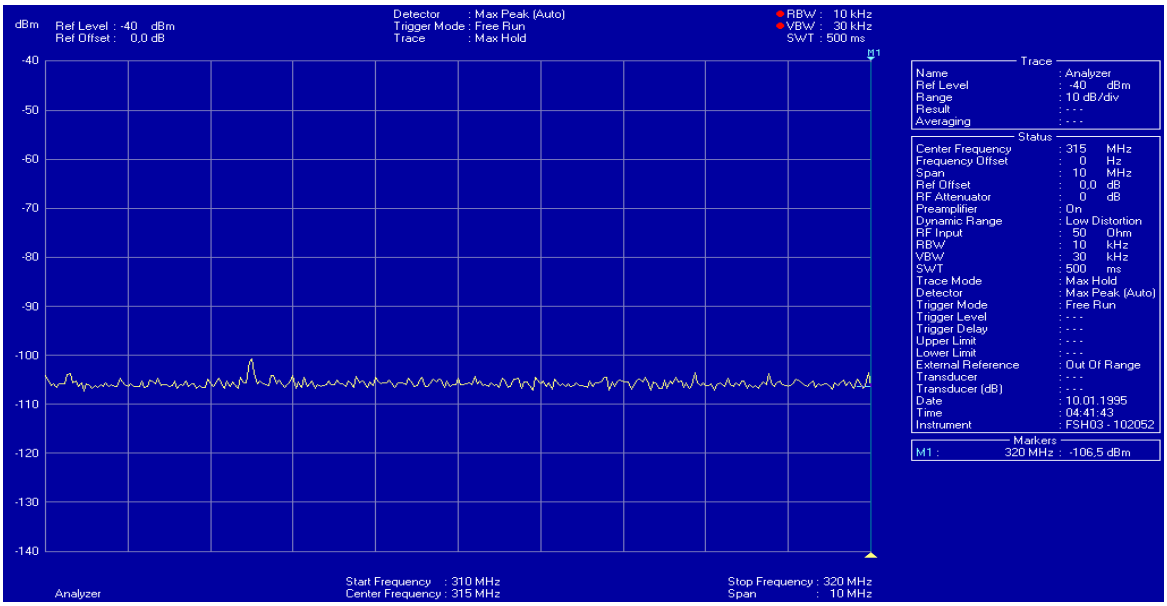

Fig. 1: Typical site survey without preamplifier

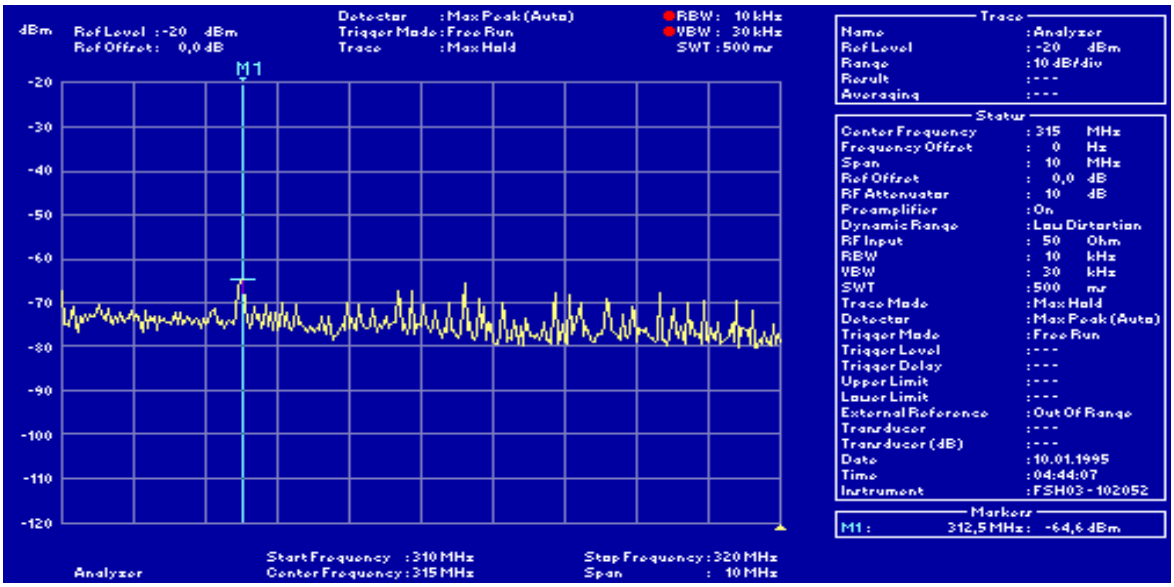

Fig. 2: Same survey with additional external preamplifier. Please note the higher floor level due to the additional external preamplifier (preamplifier gain: +37 dB)

Please also check the particular harmonics and "mirror frequencies" (caused by intermediate frequencies due to receiver own local oscillators and mixers) of the working frequency. Critical noise can accordingly be excluded if no peaks higher than typically –100 dBm within ± 1 MHz range at working frequency and about -60 dBm around the above mentioned additional frequencies, e.g. for 315.0 MHz: at 629.4 MHz and 944.163 MHz, see Fig. 3.

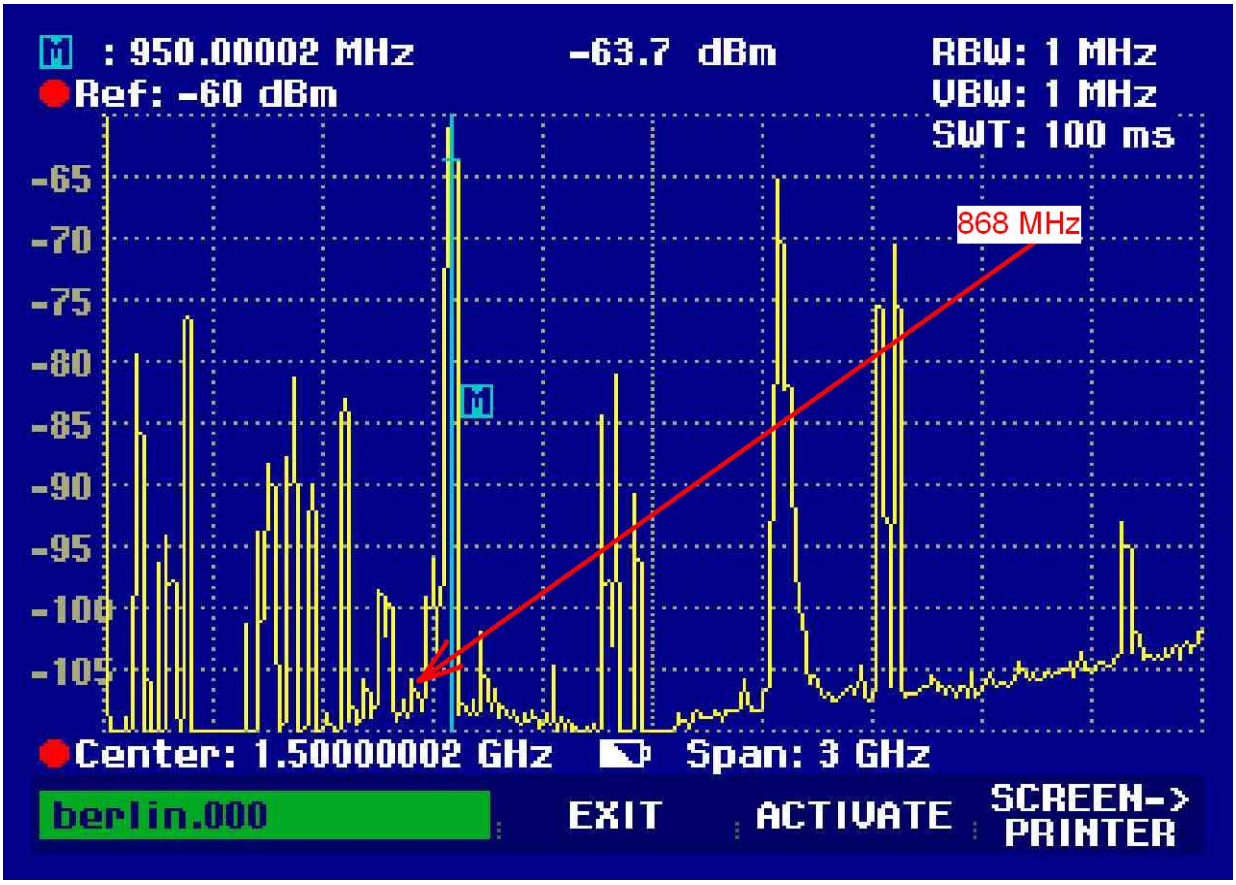

Fig. 3: Very strong jammer sample recorded near a wide band power radio transmitter with directive antenna. Very clear to see here are the high levels around the 150, 600, 950, 1400, 1900, 2200 MHz frequency range.

To analyze other perturbations outside of the working frequency, set the spectrum analyzer to the observed peak frequency as CF, in sample mode (not MAX HOLD) and use the time domain setting zero SPAN to analyze the repetition rate and the duration time of the noise source.

Note also that higher noise figures do not automatically interfere with EnOcean radio. You need to determine the frequency, typical duration and repetition rate of these peaks. Rare noise or occasional short RF signals are not critical. High repetition rate of these signals could however cause interference on a statistical basis. Final statement is in such cases only possible in terms of averages and probabilities.

Some Background to EnOcean Telegrams

All EnOcean Telegrams consists out of three to five identical (redundant) sub telegrams, transmitted within a short time period with varying delays between. Number of the sub telegrams as well as their transmission timing is chosen in order to minimize possible effects of distracting noise and to optimize communication redundancy. For a proper function it is sufficient the reception of one single sub telegram.

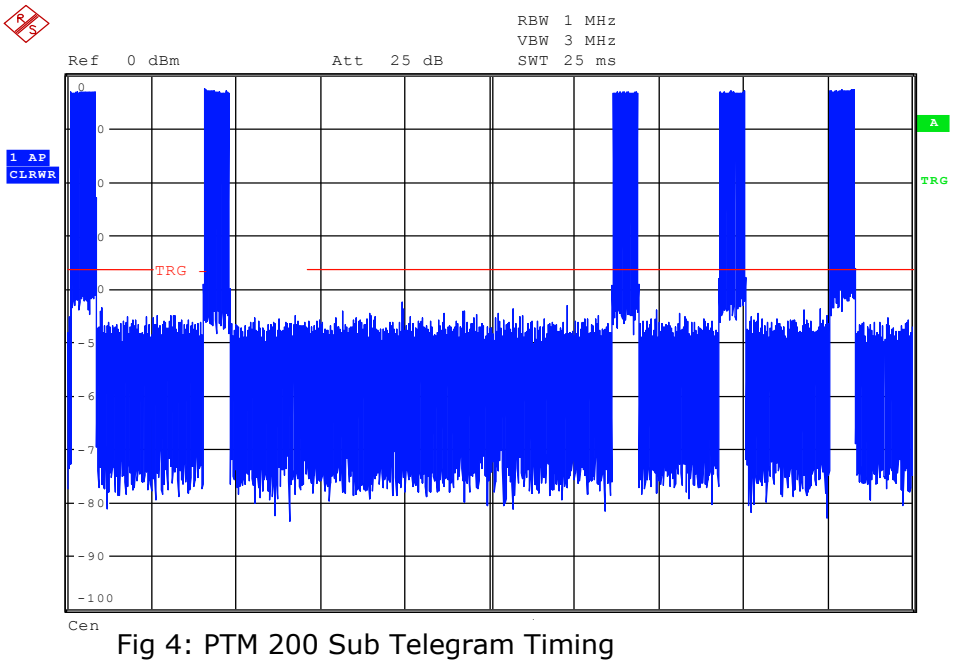

Fig 4: PTM 200 Sub Telegram Timing

Figure 4 shows the timing sequence of one typical PTM 200 switch telegram: each of the five sub telegrams is about 0.7 ms long. The delay between the first and second sub telegram is 4 ms. After a minimum delay of 8 ms a third sub telegram with an additional pseudorandom delay of 0, 2, 4 or 6 ms is send. After the third sub telegram, up to 2 additional sub telegrams with fixed timing may follow, dependent on the available energy.