Measurements on LEDs on a rainy Sunday

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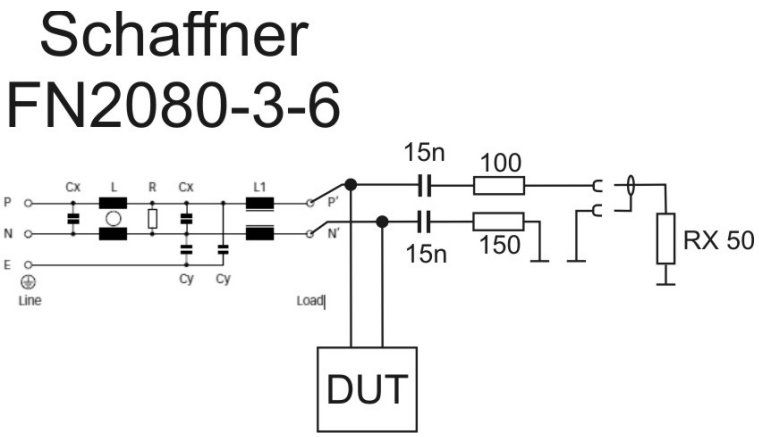
Introduction
Energy saving lights may cause harmful disturbances to radio services especially on the low frequencies of the HF spectrum. Therefore it seem necessary to investigate the topic closer and on a rainy Sunday, I took some LEDs, used in my own house, into my shack. The results were interesting, because I could find some lights not causing any noise at all, but other introduced high levels of HF disturbance voltage to the mains port.

Measurement setup
The easiest way to assess the amount of disturbance votage introduced into the mains by an EUT (Equipment under test) is to test it on an AMN (Artificial Mains Network). The AMN has a 50 Ohm output port, where a test receiver, spectrum analyzer or other receiver can be attached. An example of a professional AMN ist given in picture 1.

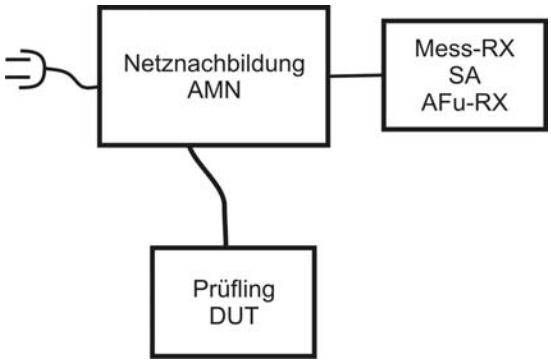
Picture 1: AMN Rohde&Schwarz ESH3-Z5

Since a real AMN is rather expensive, measurements can also be performed using a homebrew alternative which is shown here.



Picture 2: Homebrew AMN

A measurement receiver with AV and QP-Detector would be nice, however a Spectrum analyzer or even a SDR with a fairly large spectrum display can be used. I use a Perseus SDR, which can display 1,6 MHz at the same time and the measurement can be recorded as WAV-File.



Picture 3: Measurement setup

Findings

Some LED lights do not even increase the noise floor (which is at –100 dBm meaning 27 dBµV) like this one. The frequency spectrum goes from 500 kHz to 2100 kHz.

Others do, here an example

We are looking at a level of –30 dBm representing about 97 dBµV, a measurement that could strongly indicate a violation of the limit, if proper emc lab conditions were used.

However the following LED substitute for a 60 W regular build really broke all records. The noise is peaking to about –10 dBm, thus leading to a mains voltage disturbance of abt. 117 dBµV. In the vicinity of the lamp in a proper mains installation with is asymmetry, the reception of AM-Stations is highly unlikely.

Conclusion

It is worth taking a much closer look at the emissions of those new LED lights, which save energy, but at the same time obvious pollute part of the spectrum in some cases. Interested fellow radio friends and/or EMC groups in members societies, who might have better understanding and better measurement equipment are invited to follow this example. I have learned, that we need a much more structured approach, than can be achieved on a Sunday, but the topic is serios.