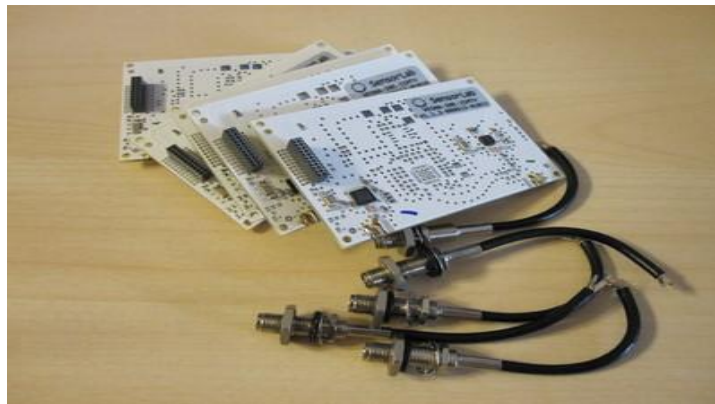


DETERIORATING RADIOS

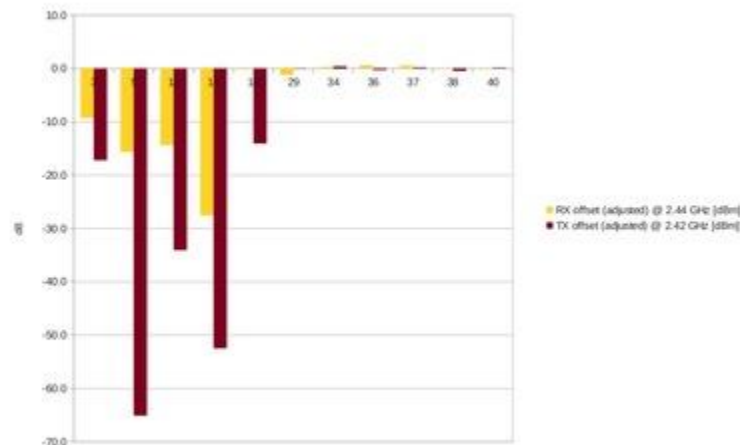
If you've been following my writings (or if you've been at my recent talk in Kiberpipa) you probably remember that the department of Institute Jožef Stefan I work for has built an out-door test bed for cognitive radio experiments. In practice this means 50 or so VESNA boards with my experimental spectrum sensing radio hardware mounted in weather-proof plastic boxes on public light poles.

Since June, when the first batch of VESNAs was mounted, something curious has happened with the radio hardware. 2.4 GHz transceivers based on the Texas Instruments CC2500 integrated circuit degraded significantly on receiver sensitivity and transmit power. In some cases to such a degree that they became practically useless for any research work. In fact, this was discovered when we could not explain experimental results we were getting from some of VESNA nodes and started doubting that our equipment is functioning properly.



Since this hardware has been exposed for several months to daily temperature and humidity variations (boxes aren't airtight) and the antennas are mounted externally, my first guess was that perhaps the antenna connector oxidized or the coaxial cable deteriorated.

Here's a plot of receiver sensitivity and maximum transmitter power variations for a sample of VESNA nodes. First five from the left have been mounted out-doors in the test bed, while the other six have been deployed in-doors in the Institute. All printed circuit boards are from the same batch, and hence have exactly the same hardware and approximately the same number of operating hours. 0 dB here means nominal sensitivity and transmit power.



It's quite obvious that nodes from outside have a significantly larger deviation from typical values.

What's interesting is that transmit power and receiver sensitivity didn't change consistently, which as far as I can see contradicts the theory that this is due to some simple attenuation on the path between the transceiver IC and the antenna.

In fact, you have to replace both the circuit board and the short coaxial cable to the antenna to restore the original characteristics. This can only mean that both of these are responsible for the problem. Regarding the transceiver, I can't think of any environmental effect that would deteriorate a silicon chip inside a sealed plastic package in this way. I think more likely suspects are the balun circuit and the few other external passive components that might have absorbed moisture or got affected by temperature variations.

Source: https://www.tablix.org/~avian/blog/archives/2012/11/deteriorating_radios/