Radios

Notes on types of radios used by sensorgnomes and by the motus network.

Funcubedongles

Agile USB radios from funcubedongle.com

"Pro" model (discontinued 2012)

- presents as USB 1.0 Audio device
- I/Q sampling at fixed rate of 96 kSPS

"Pro Plus" model

- presents as USB 1.0 Audio device
- I/Q sampling at fixed rate of 192 kSPS, but versions of firmware are available with sampling at 96 or 48 kSPS
- SAW filter in 2m band, which covers telemetry tags at 166 and 150

Calibration

A USRP-E with WBX daughter board was used to generate a continuous wave at 166.380 MHz with various amplitudes and output gains. At each setting, power was measured using a Marconi 6960 RF meter (after calibrating this device to its own internal signal source). The maximum output power reading of 21.29 dBm corresponds reasonably well to the advertised maximum power output of the WBX daughterboard (100 mW = 20.0 dBm).

Signal was fed through short coax cable and calibrated attenuators into the funcubedongle running the 48 kSPS firmware. The funcubedongle was plugged into a laptop.

The funcubedongle was set to listen at 166.376 MHz, so that the expected spectral peak would appear near 4 kHz.

Audacity was used to record the audio stream from the funcubedongle and to measure spectral peaks.

The peak estimation algorithm used by the sensorgnome is very similar to that of audacity.

Results are attached, and show that with the default settings used by the funcubedongle on a sensorgnome, a pulse
(or tag detection) with signal strength ***sig=0*** corresponds to an incoming power of approximately -50 dBm,
and that the sig scale tracks dBm with reasonable linearity. i.e. sig=-10 corresponds to ~ -60 dBm, and so on.
The low-end of the scale of detections from SG data is roughly sig = -80 dB (max), so this corresponds to approximately
-130 dBm. (On the sensorgnome, detections come from peak extraction using a 120-sample FFT window).

TODO: redo this calibration with the USRPE generating a tag-like sequence of pulses, and pull the sig values directly
from the raw SG data.