Testing WiFi Signal Strength and Bandwidth

Since a major part of the results of the project, determining the signal strength and the bandwidth of the WiFi hotspot provided by the drone is a vital part of the project. When we designed a test for this we decided to take into consideration the possibility that the orientation of the drone would affect the WiFi signal. We decided to repeat our signal strength tests at either different orientations, separated by 45 degrees, to ensure we would detect any deviations based on orientation.

We decided to measure the signal strength and bandwidth from five different distances where the furthest away distance would be the limit of connecting to the hotspot. The signal strength was measured through the use of the *Xirrus WiFi Inspector* software and the drone was rotated to test the signal strength at different orientations. The bandwidth was tested through connecting to www.speedtest.net/sv/ and performing a test.

Results

Signals are recorded in dBm. Angels are counted with the top of the phone as 0 degrees, increasing clockwise around. Speed is tested with an angle of 0 degrees and are averages of five separate tests.

	Zero Distance	3.3 meters	6.6 meters	10 meters	13.3 meters
Signal Strength	5 bars	3 bars	3 bars	2 bars	1 bar
0 degrees	-45 dBm	-71 dBm	-76 dBm	-79 dBm	-81 dBm
45 degrees	-43 dBm	-70 dBm	-72 dBm	-74 dBm	-81 dBm
90 degrees	-44 dBm	-65 dBm	-72 dBm	-74 dBm	-77 dBm
135 degrees	-47 dBm	-62 dBm	-70 dBm	-70 dBm	-76 dBm
180 degrees	-46 dBm	-65 dBm	-76 dBm	-73 dBm	-75 dBm
225 degrees	-43 dBm	-68 dBm	-71 dBm	-70 dBm	-74 dBm
270 degrees	-45 dBm	-70 dBm	-73 dBm	-77 dBm	-79 dBm
315 degrees	-50 dBm	-71 dBm	-80 dBm	-78 dBm	-80 dBm
Speed Test					
Up	15.37 Mbps	7.39 Mbps	1.83 Mbps	0.55 Mbps	FtC
Down	25.91 Mbps	2.43 Mbps	0.11 Mbps	0.08 Mbps	FtC
Ping	67 ms	70 ms	78 ms	71 ms	89 ms

FtC: Failed to Connect – could not run test (also failed to connect to google.se).
Most likely cause: Time Out

dBm

dBm stands for “decibel milliwatts” (in this case) and is a way to measure power.

Formula: P(dBm) = 10 · log10(P(W) / 1mW)
where
P(dBm) = Power expressed in dBm
P(W) = the absolute power measured in Watts
mW = milliWatts
log10 = log to base 10

If a dBm value is negative then the “higher” number is less powerful (-80 dBm is less powerful than for example -60 dBm).

Interpreting the Results

The results indicate the signal strength tends to be stronger from the sides of the phone, rather than from one of the ends. This could be caused by the placement of the internal WiFi unit (in case it's in the middle of the phone for example, which would make it easier for the signals to propagate from the sides which have less materials and electronics to disturb the signal).

The effective range of the WiFi is approximately 10 meters. Beyond 10 meters the connection becomes unreliable due to disconnects and time-outs. This is definitely of interest during future work as it would be very beneficial to increase the WiFi range to make the drone able to cover a greater area. This could be done by utilizing an antenna rather than the built in unit of the phone. When considering this a primary concern would be battery life as an antenna easily could affect the battery life notably.