

**Taste of Research**  
**Gough Yumu LUI**  
**Engineer's Log Book**

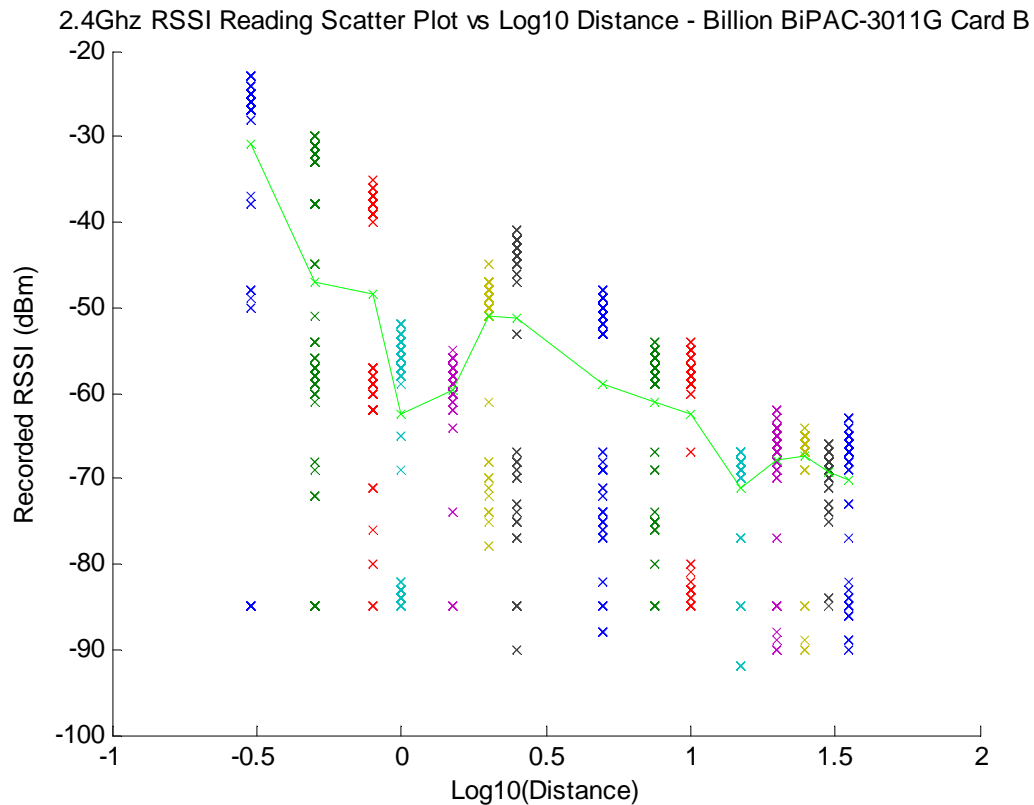
**Week 9**

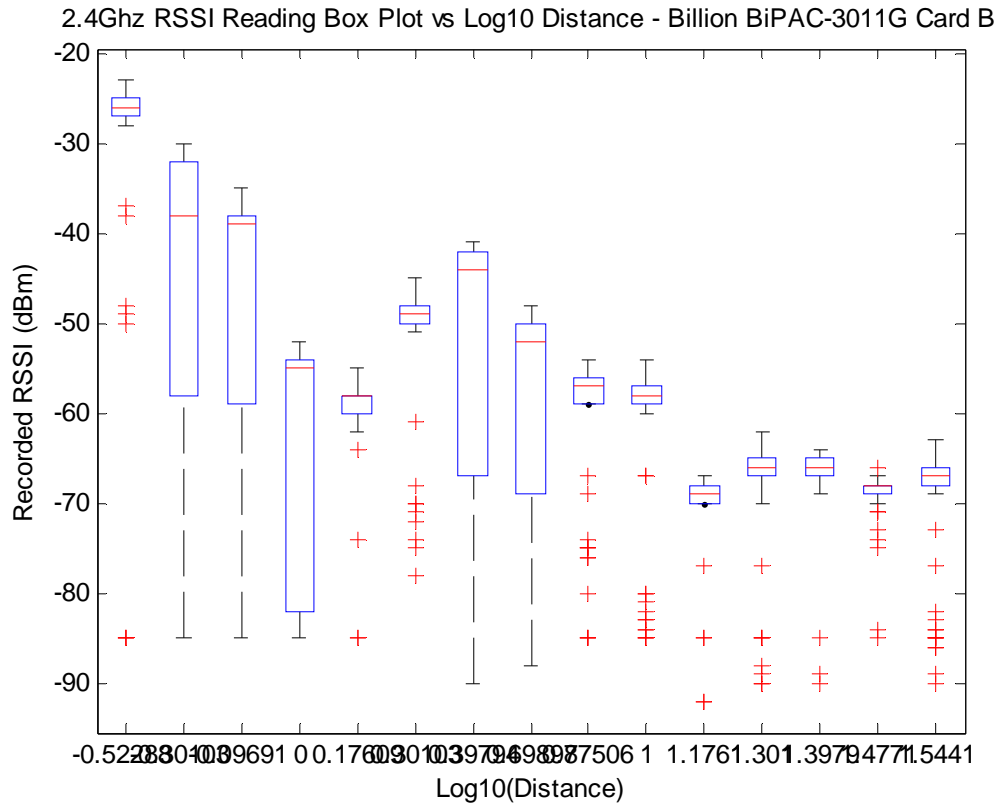
- Sunday 23<sup>rd</sup> January 2011

It's Sunday again, and I'm spending some extra time analyzing data again.

Results for Billion BiPAC3011G – Card B show unusual scattering of points and high variance on some points. Sample numbers are irregular as well. This card might need to be retested since the lowest sample number is 106.

Distance	2.4Ghz
0.3m	177
0.5m	206
0.8m	211
1m	194
1.5m	160
2m	188
2.5m	202
5m	190
7.5m	174
10m	168
15m	106
20m	157
25m	130
30m	149
35m	168

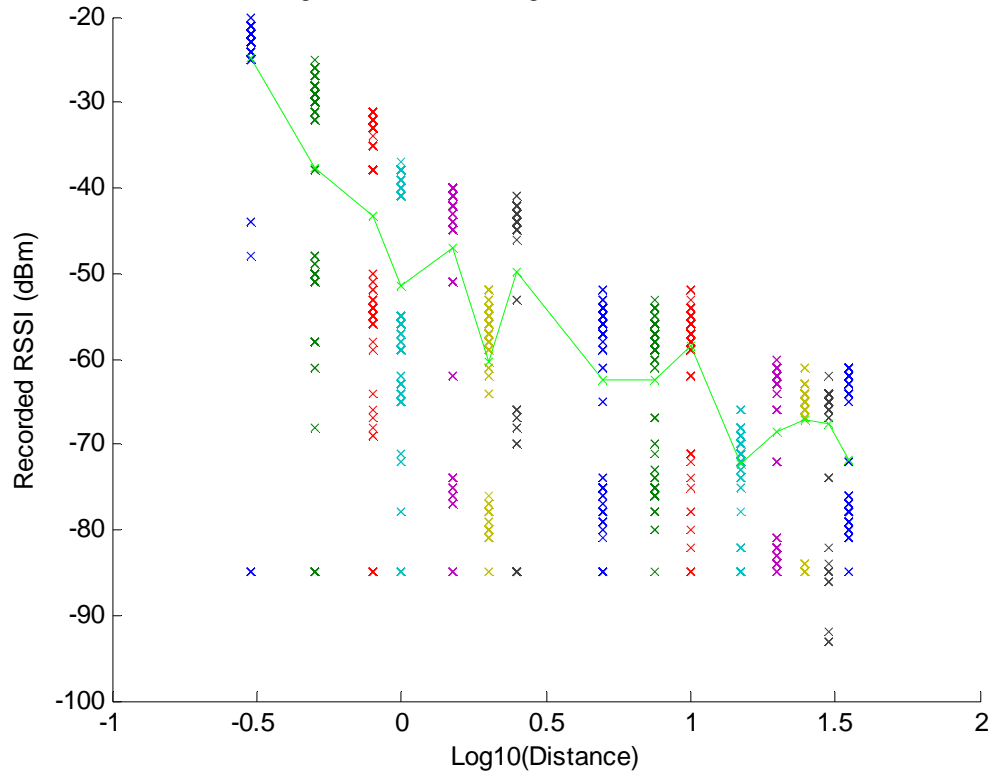




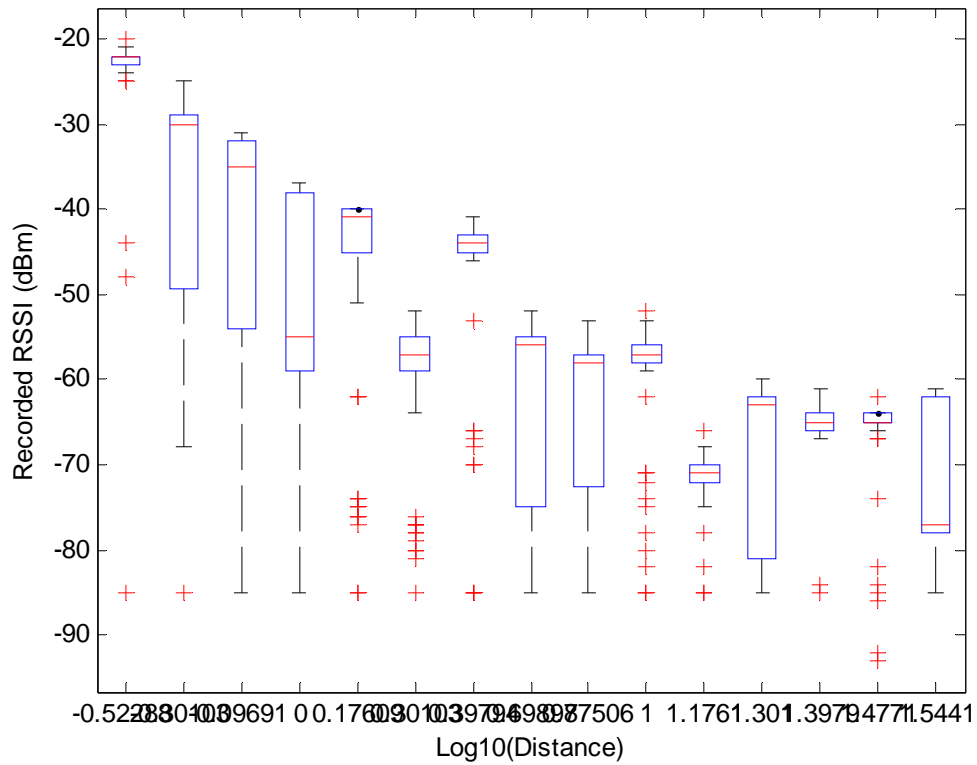
Results for Billion BiPAC3011G – Card C shows much the same issue for some reason. This maybe a driver related problem, but this didn't affect Card A for some reason. Maybe interference related. The trends are slightly different as well.

Distance	2.4Ghz
0.3m	169
0.5m	197
0.8m	201
1m	214
1.5m	197
2m	191
2.5m	186
5m	197
7.5m	191
10m	192
15m	175
20m	134
25m	120
30m	142
35m	158

2.4Ghz RSSI Reading Scatter Plot vs Log10 Distance - Billion BiPAC-3011G Card C

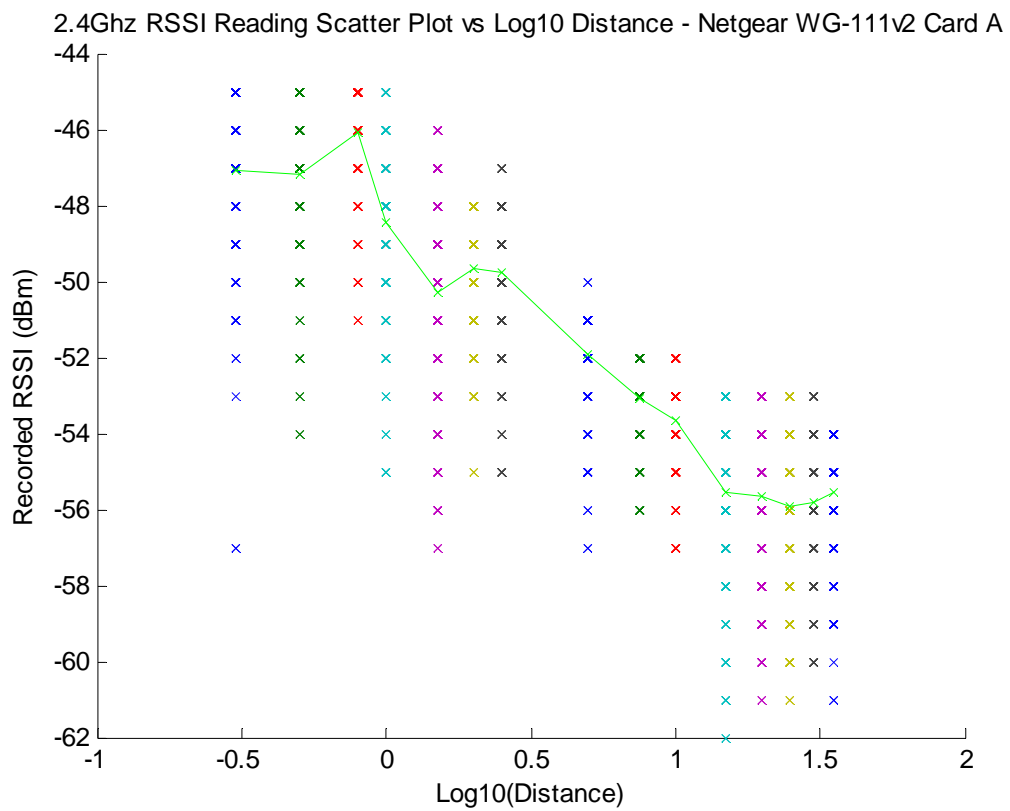


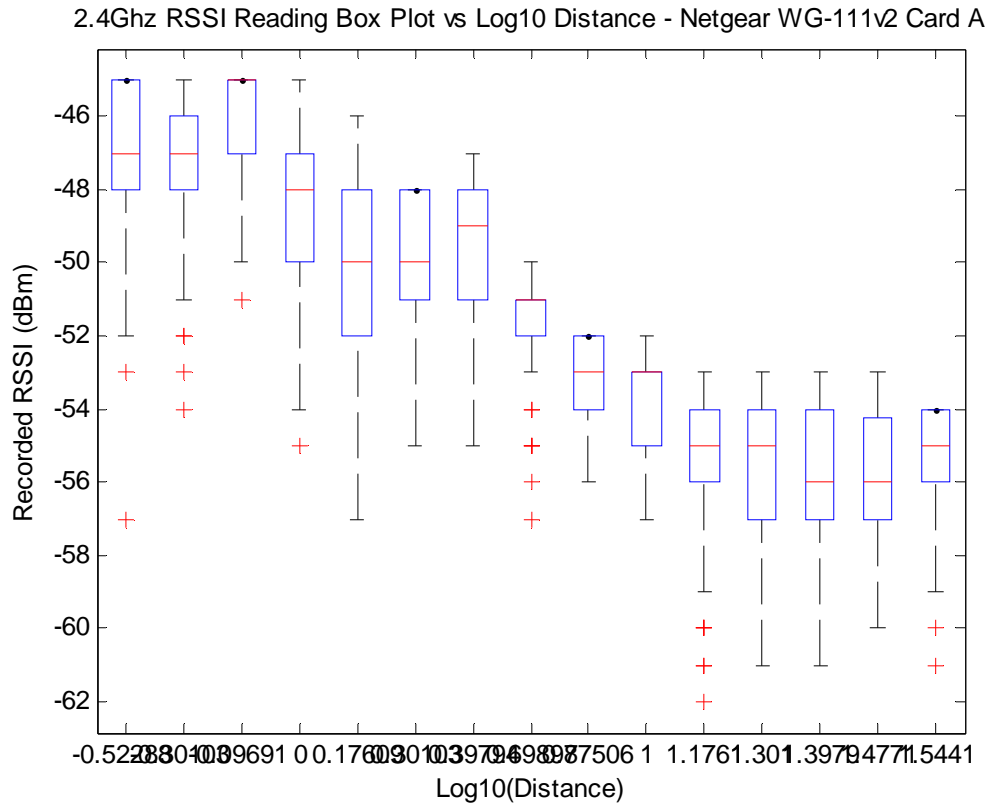
2.4Ghz RSSI Reading Box Plot vs Log10 Distance - Billion BiPAC-3011G Card C



Results for Netgear WG111v2 – Card A are much more reasonable.

Distance	2.4Ghz
0.3m	224
0.5m	223
0.8m	223
1m	223
1.5m	221
2m	223
2.5m	219
5m	218
7.5m	225
10m	225
15m	224
20m	215
25m	216
30m	219
35m	215

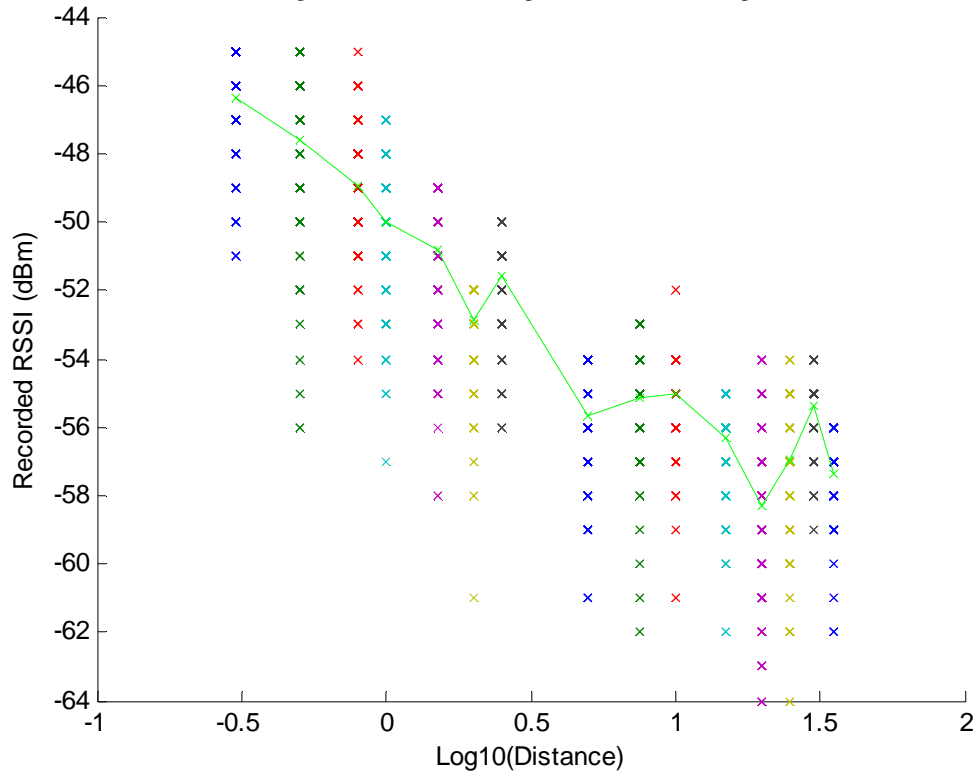




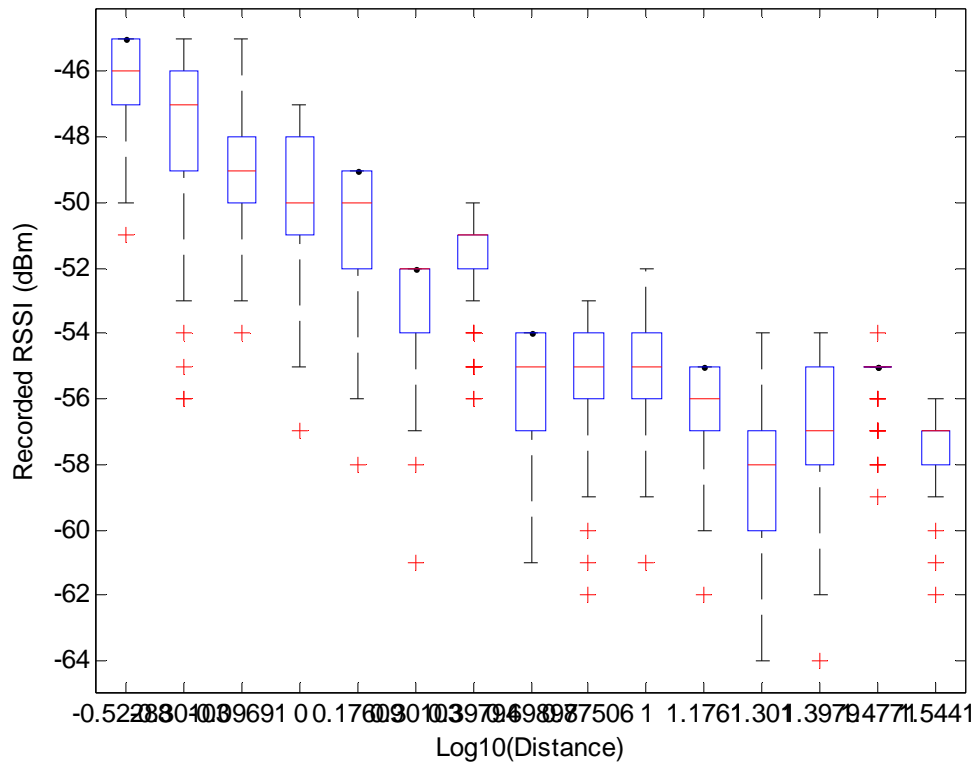
Results for Netgear WG111v2 – Card B are also reasonable, however, it's evident that the trend is slightly different between the two cards.

Distance	2.4Ghz
0.3m	227
0.5m	225
0.8m	223
1m	222
1.5m	221
2m	221
2.5m	219
5m	219
7.5m	223
10m	225
15m	221
20m	218
25m	219
30m	220
35m	219

2.4Ghz RSSI Reading Scatter Plot vs Log10 Distance - Netgear WG-111v2 Card B

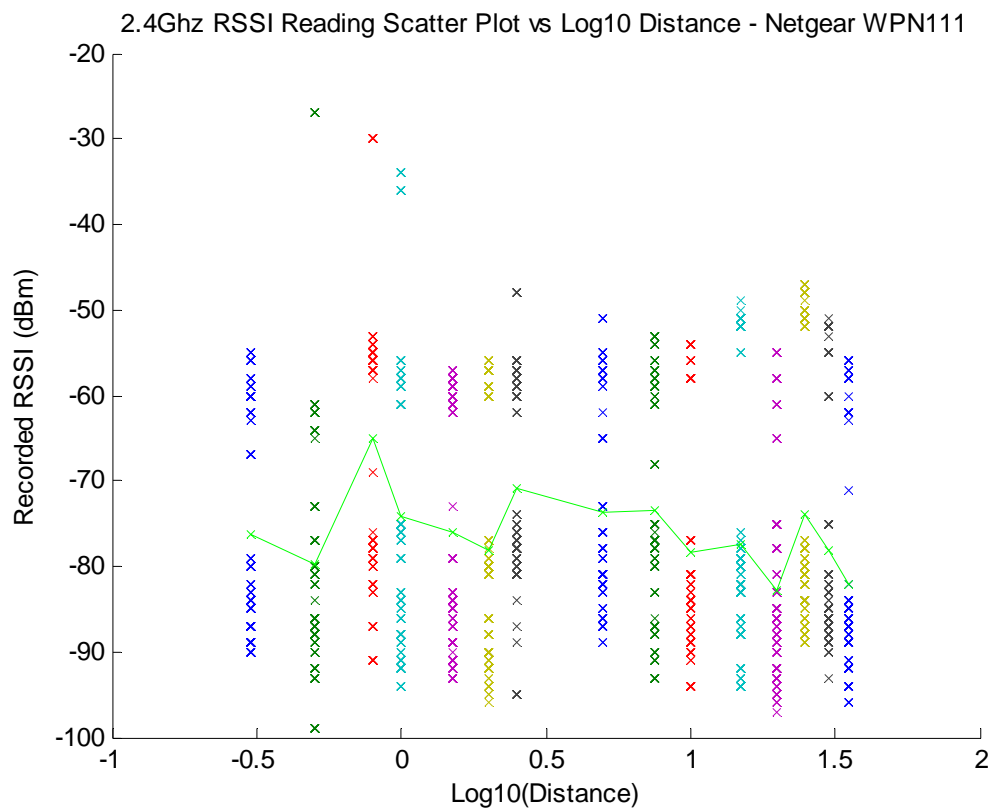


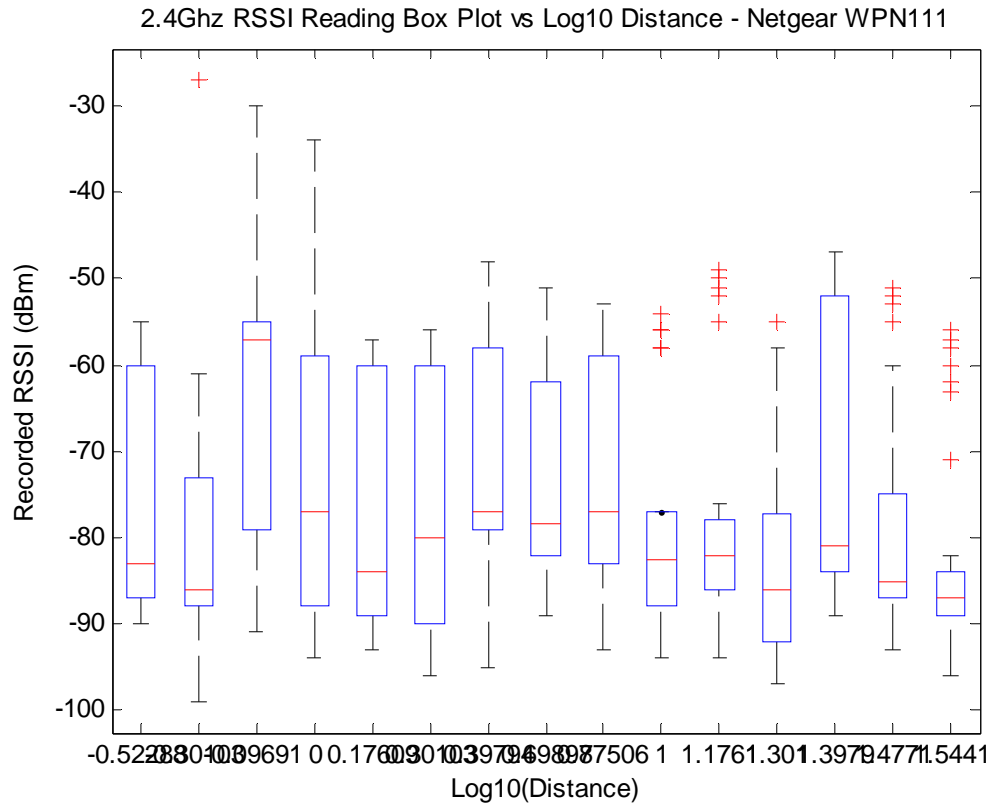
2.4Ghz RSSI Reading Box Plot vs Log10 Distance - Netgear WG-111v2 Card B



Results for Netgear WPN111 are as before – it's useless for positioning.

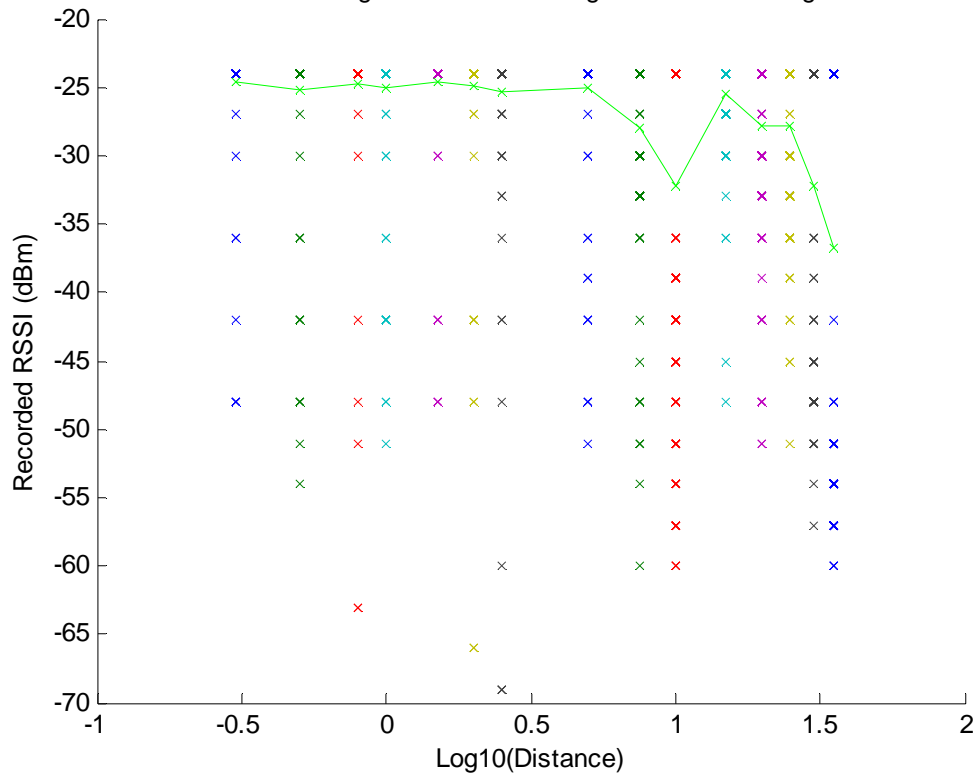
Distance	2.4Ghz
0.3m	211
0.5m	209
0.8m	207
1m	205
1.5m	200
2m	197
2.5m	193
5m	190
7.5m	217
10m	212
15m	207
20m	201
25m	197
30m	193
35m	189



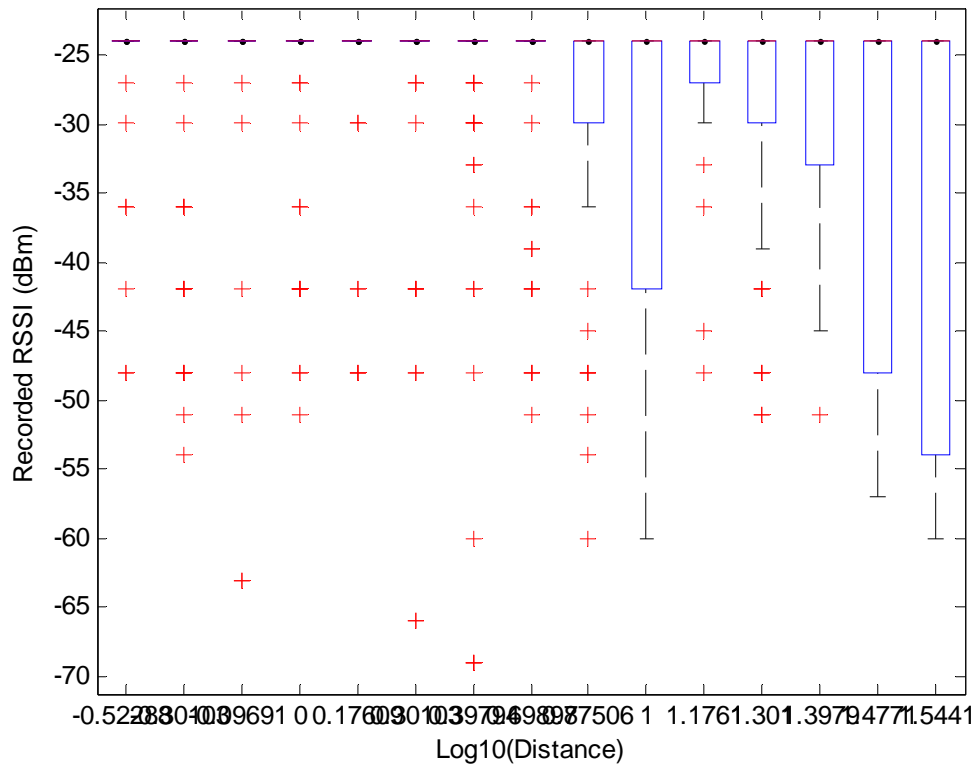




2.4Ghz RSSI Reading Scatter Plot vs Log10 Distance - Netgear MA101

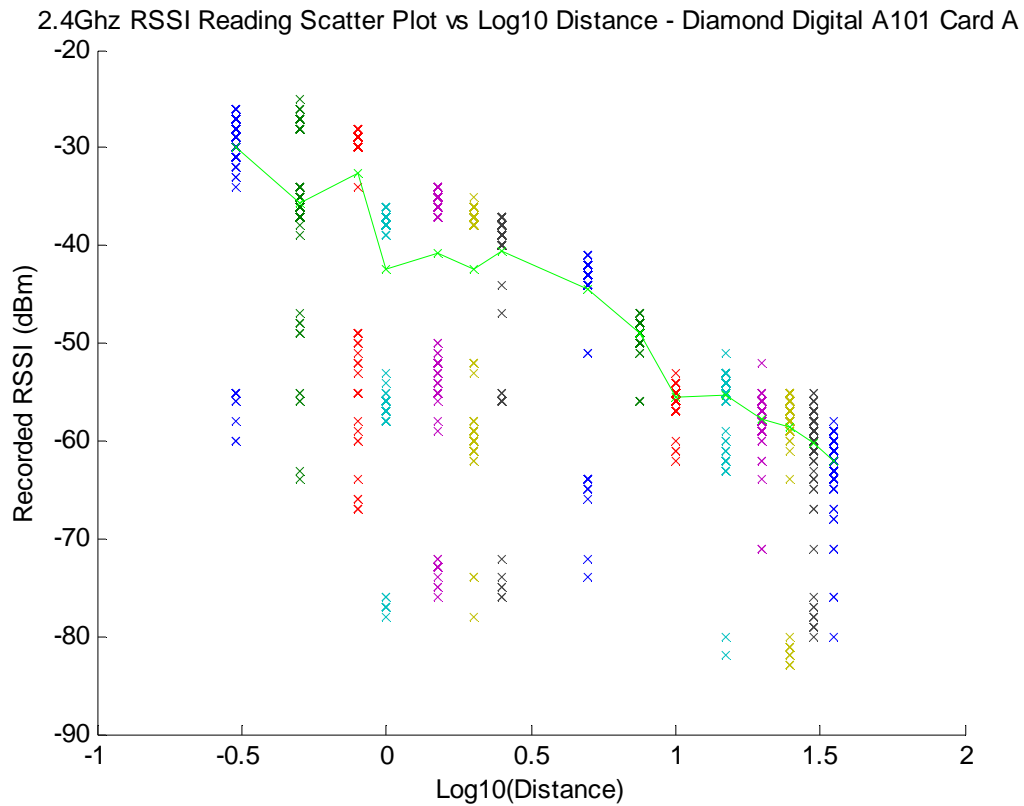


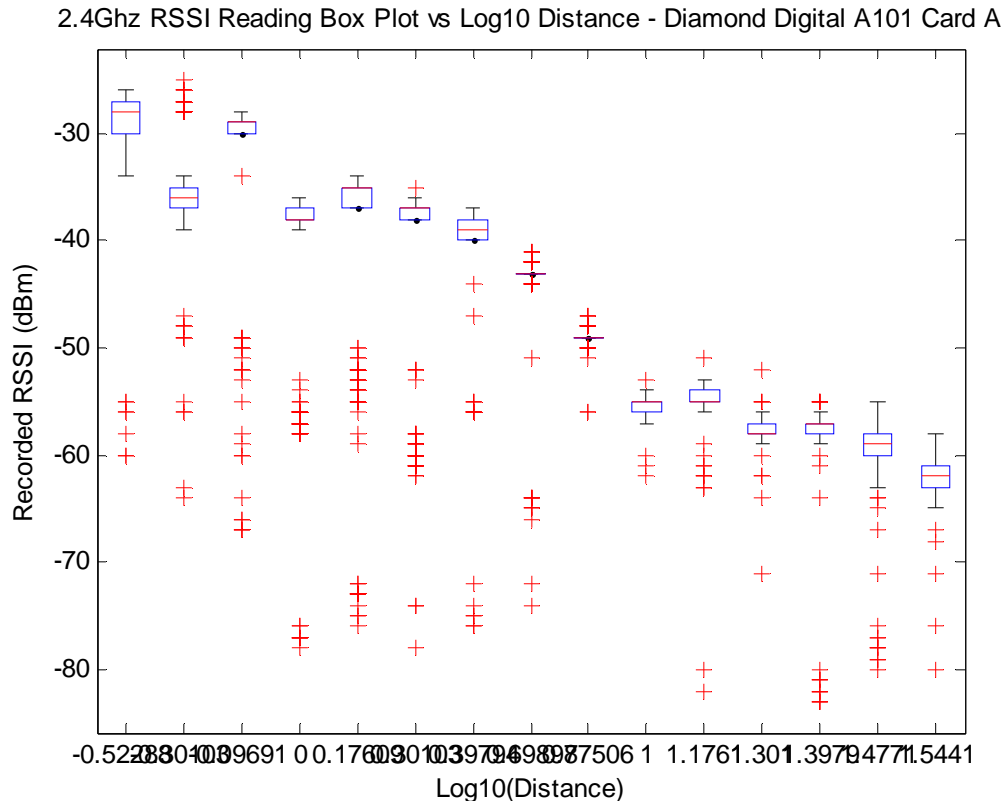
2.4Ghz RSSI Reading Box Plot vs Log10 Distance - Netgear MA101



Results for Diamond Digital A101 – Card A. There is quite a bit of noise but the trend is almost that of a straight line.

Distance	2.4Ghz
0.3m	228
0.5m	228
0.8m	218
1m	222
1.5m	228
2m	225
2.5m	222
5m	223
7.5m	222
10m	227
15m	214
20m	220
25m	221
30m	219
35m	214





Results for Diamond Digital A101 – Card B not available as the data was not correctly copied from the laptop.

- Monday 24<sup>th</sup> January 2011

Today, I looked on the BenQ laptop and found those results for the Diamond Digital A101 Card B sitting on the hard drive which was a relief. That way, we don't need to test it again. Today would be the last day of outdoor testing and would conclude all testing. Today, we tested the Nokia N95 and the Android Mobile Phone. We also tried to test the Roving Networks Wi-Fi Tag but unfortunately, it gave us problems continually.

The Wi-Fi tag took extra preparation in the form of an extra access point which we were running dedicated to relaying data from the tag back to a logging program written in Java. I had to use my own laptop initially, and so I had to install Java first in order to get the application running. Unfortunately, when it was running on my laptop, it was very slow and unstable with an irregular number of returned results. The worst part was that it kept freezing after a scan for minutes which rendered our testing impossible. It would not even restart if tracking was disabled and re-enabled – the only way to revive it was to physically reboot the tag. Unfortunately, then, it would fail just after minutes.

After requesting help from Thomas, he went to program something and try and improve the performance. We noted that using his laptop running Windows 7, the scan rate was much much faster. Unfortunately, the issue still persisted, with the tag unable to report anything after 4 or 5 minutes running. It was discovered there was a loose connection on the battery snap connector – so Thomas replaced it with another snap. Still, the tag refused to co-operate. We hypothesized that it was due to the heat that the tag stopped working, but then, despite the weather turning cloudy, the tag still refused to co-operate. A decision was made to abandon testing of the tag and pack up – and just in time as the rain began to fall just as we made it back indoors.

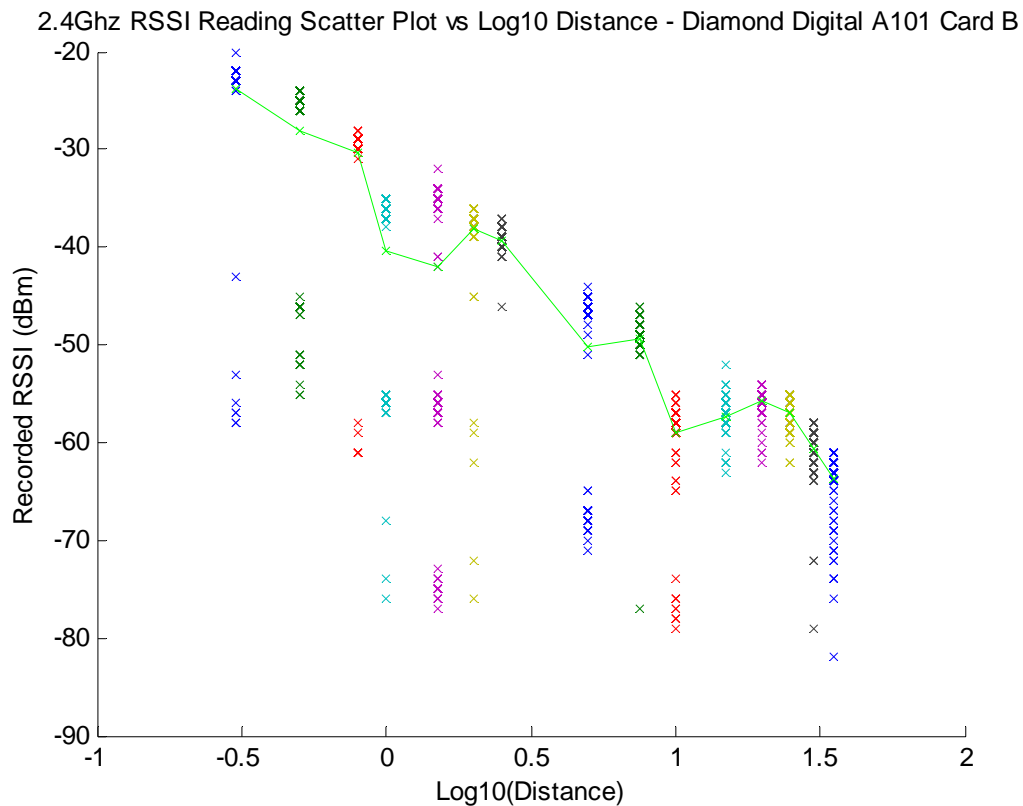
I hooked all the batteries to charge and returned all of the cones. I managed to haul all of my equipment home as well. From now on, all of the work will be done at home since it's pretty much all data analysis and report writing. I have rescheduled the next meeting to Wednesday to align with Poster Workshop Two so that I can minimize the amount of time spent on travelling.

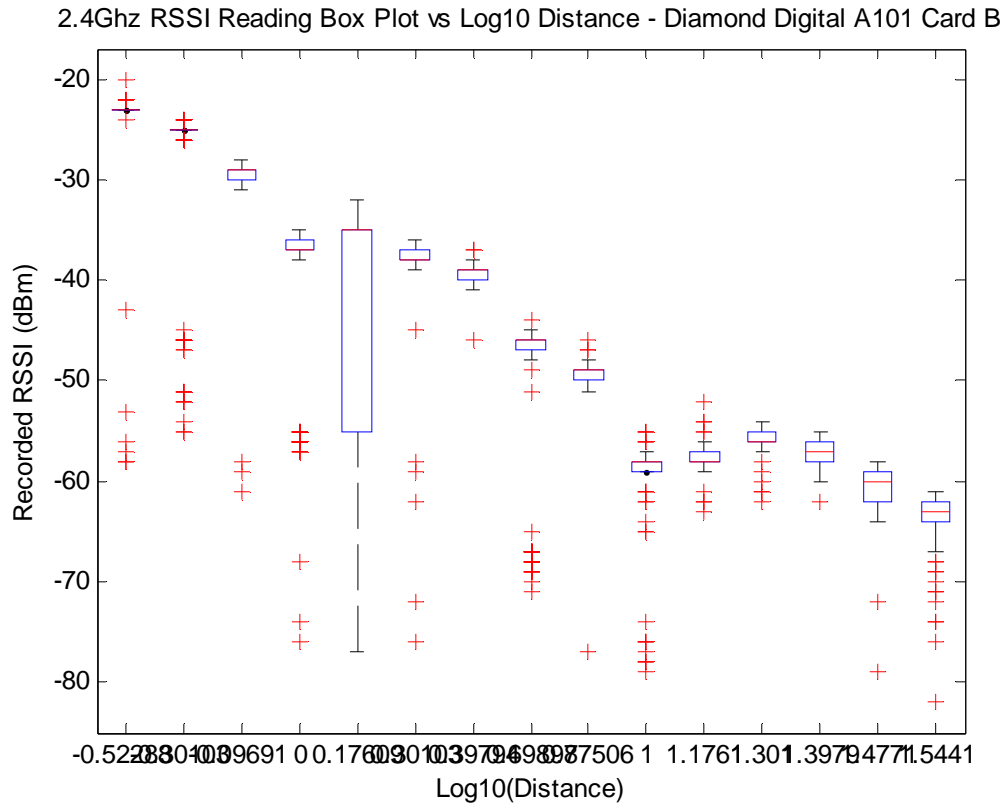
- Tuesday 25<sup>th</sup> January 2011

Today, I spent the day analyzing the last sets of data which I collected over the last few days.

The results for the Diamond Digital A101 Card B are as follows:

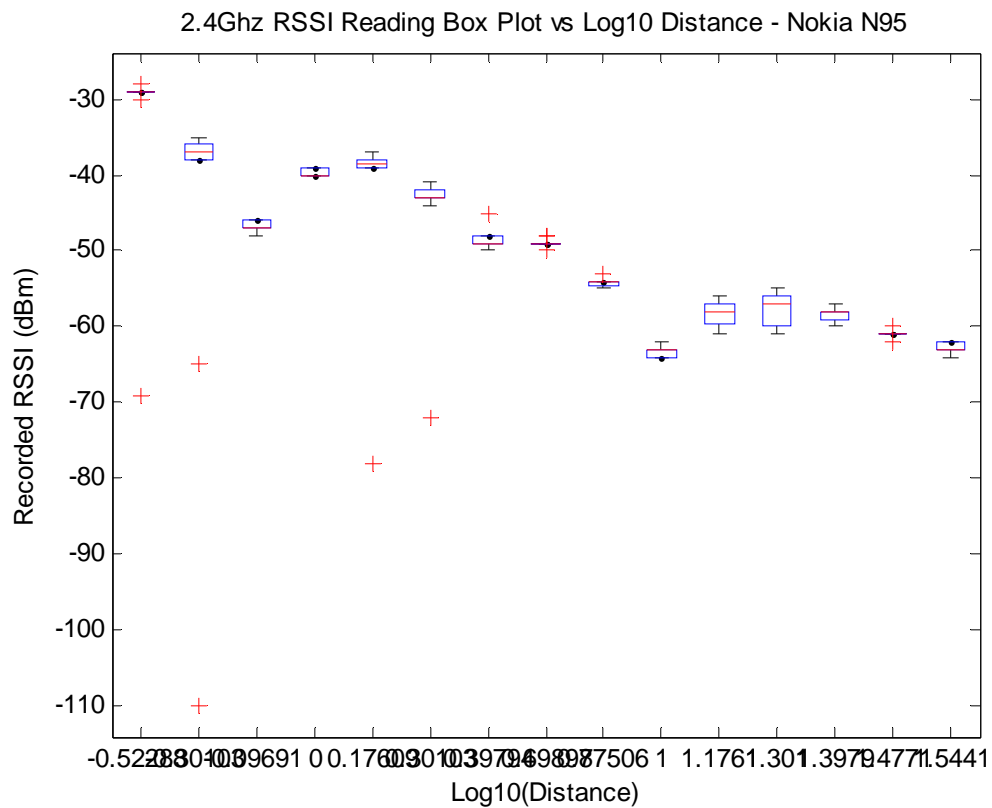
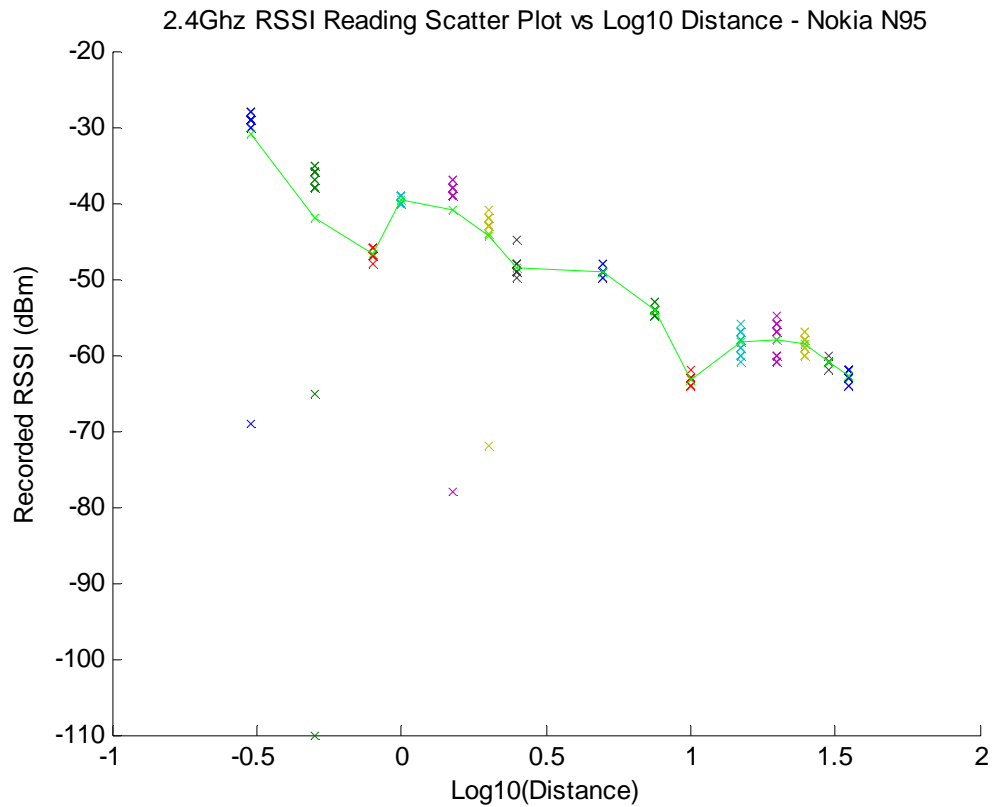
Distance	2.4Ghz
0.3m	212
0.5m	217
0.8m	225
1m	225
1.5m	226
2m	211
2.5m	214
5m	210
7.5m	226
10m	227
15m	224
20m	222
25m	230
30m	213
35m	201





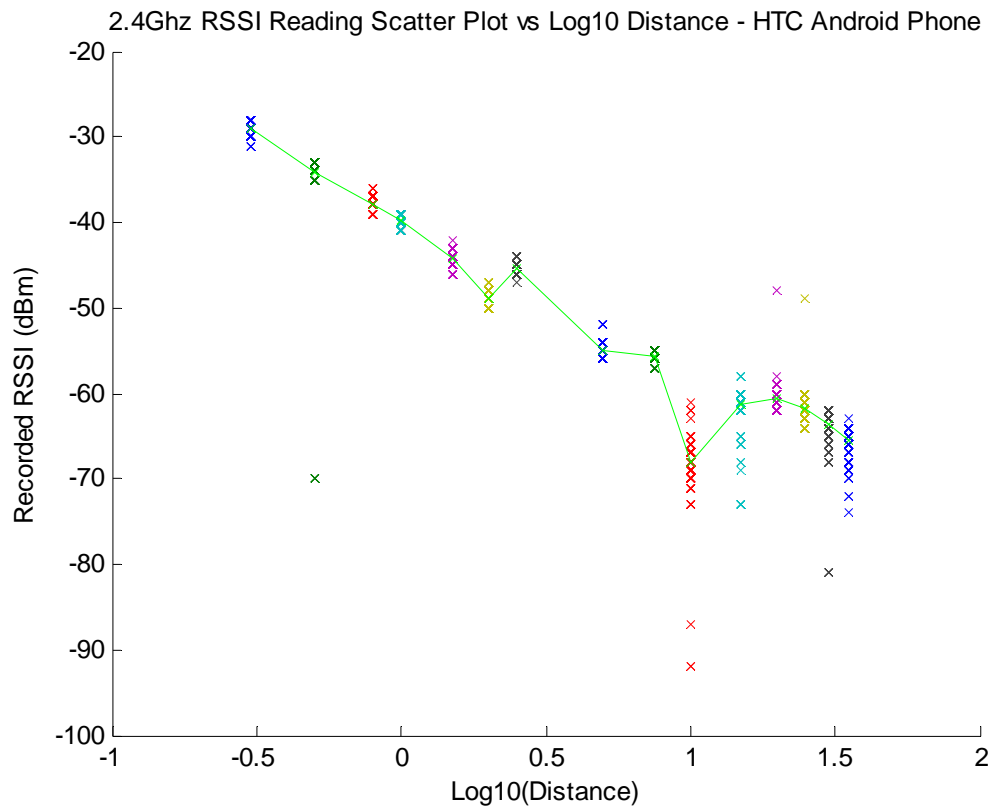
The results for the Nokia N95 are as follows:

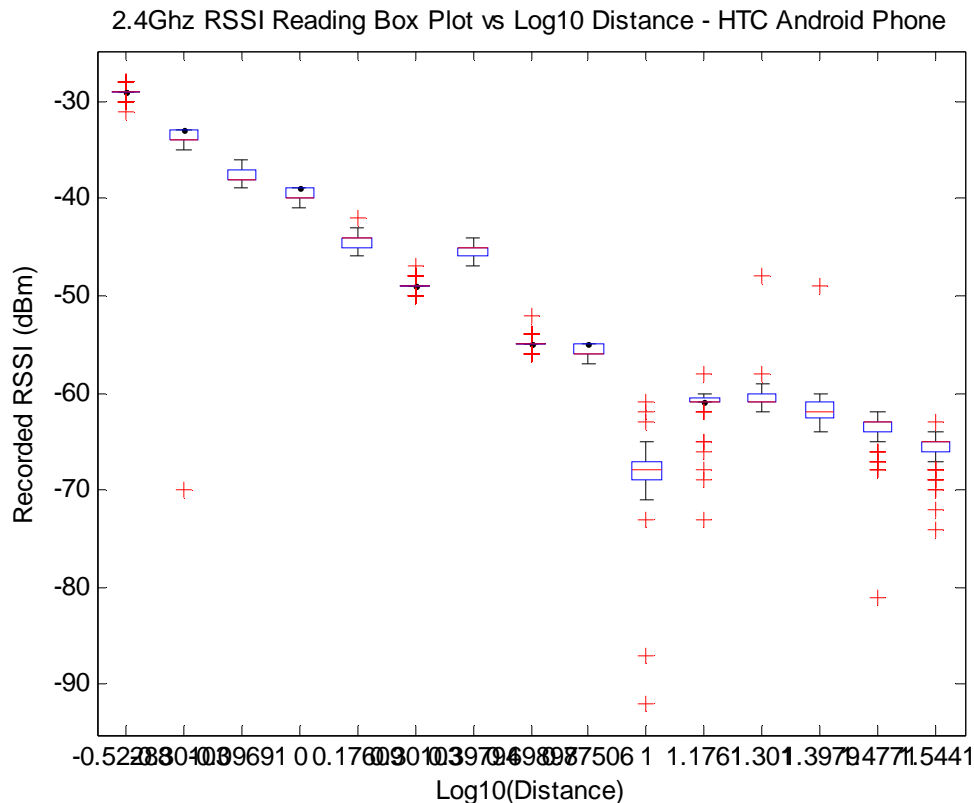
Distance	2.4Ghz
0.3m	20
0.5m	19
0.8m	15
1m	17
1.5m	16
2m	17
2.5m	15
5m	18
7.5m	20
10m	12
15m	15
20m	17
25m	15
30m	12
35m	17



The results for the Android Phone are as follows:

Distance	2.4Ghz
0.3m	430
0.5m	397
0.8m	417
1m	416
1.5m	403
2m	382
2.5m	350
5m	344
7.5m	338
10m	340
15m	312
20m	330
25m	344
30m	333
35m	354





I've also produced a `plotalloutdoor.m` which plots all the outdoor trends from all tested cards (see following page). It is a lot more closer to a straight diagonal line as the tests were done outdoors – the trends for the MA101 and WPN111 are notably still useless. The BiPAC3011G shows big variances in trend for some reason. Unfortunately, it's very hard to read the data off the graph with all the cards plotted together, but I can't think of any better way with as few figures as possible to show all of the data.

- Thursday 27<sup>th</sup> January 2011

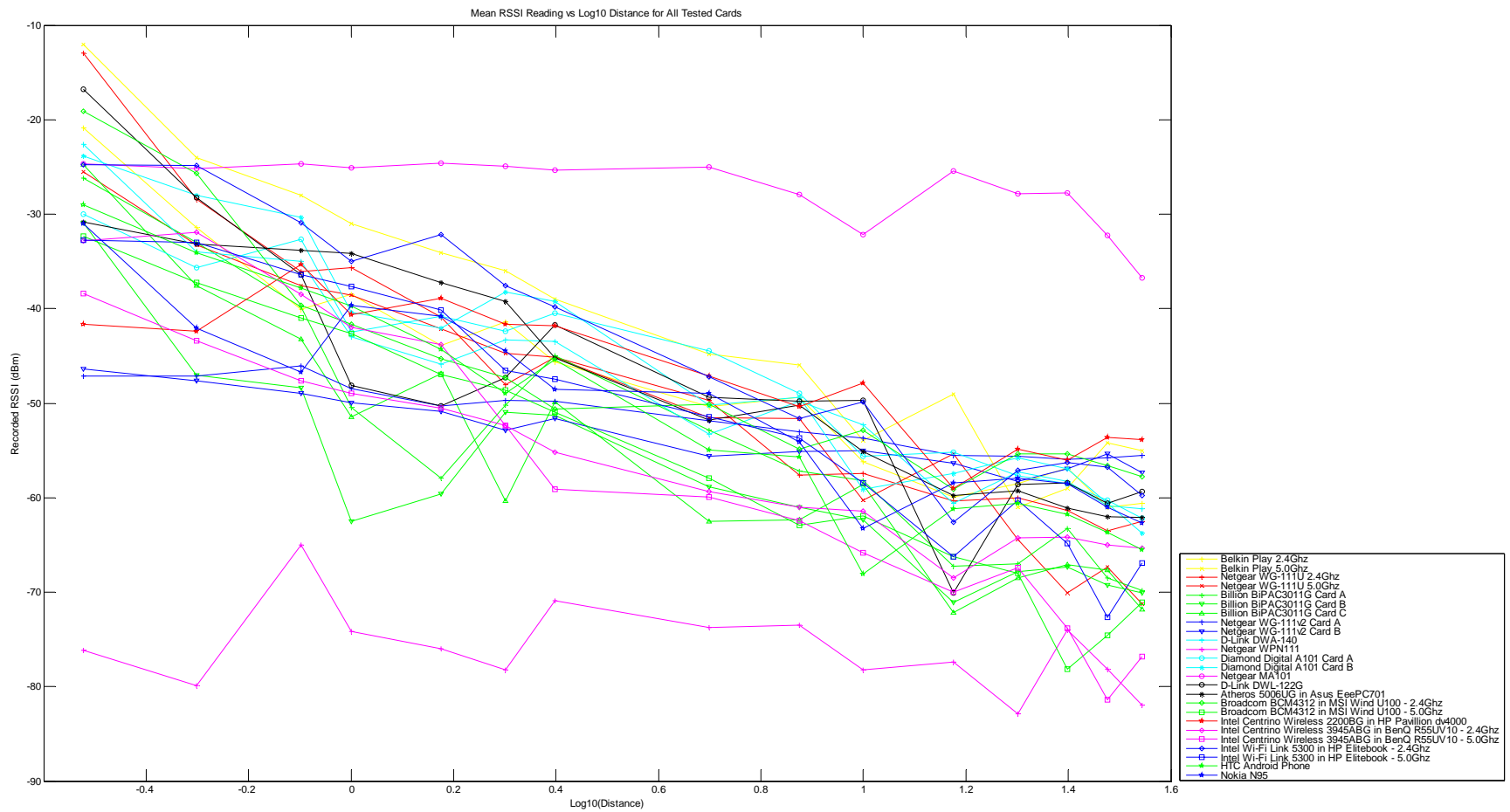
Attended the poster workshop one. Pam Mort showed us a few examples of posters and it was our job to critique them and decide what we should do to make sure our poster looks professional. It was very interesting to note that the poster should be extremely brief and should have very few words and instead be dominated by figures which are easy to understand at a glance. Also noted was that there should be a speech to go with the poster which should only be two minutes long and refer to the poster. There's also another different speech – an acceptance speech which we should use to thank people and briefly go over the poster. I need to keep these points in mind while I draft my poster. Another key point is the title must be descriptive. By the next workshop, we should have prepared some visuals and a draft poster with a draft speech which we will be rehearsing. Sounds like I will need a week to perfect it. As of today, I have already started a draft poster, which is mostly empty, but has the important headings laid out.

I also returned the key to SNAP lab to Binghao as I forgot to do that on Monday.

- Friday 28<sup>th</sup> January 2011

Today, I decided to distill the data into a tabulated form including means, modes, standard deviations for both indoors and outdoors. See the following pages for the actual data. The data is specified to one decimal point only. As the table will be very big, the data has been split over multiple tables. I had to learn how to use the file operations in matlab to be able to produce the table. The three columns – Me = mean, SD = standard deviation, Mo = mode. It took a long time to summarize the data – though I have a suspicion that the mode is less descriptive but better fitting. To test this, I've now got plot all for modes instead of means.





**Indoor Testing Data Summary Table 1 of 4**

Distance	Belkin Play						Netgear WG111U						Billion BiPAC3011G Card A			Billion BiPAC3011G Card B			Billion BiPAC3011G Card C		
	2.4Ghz			5Ghz			2.4Ghz			5Ghz			Me	SD	Mo	Me	SD	Mo	Me	SD	Mo
	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo									
30cm	-24.0	7.7	-24	-12.1	0.3	-12	-12.5	1.1	-13	-25.2	0.4	-25	-27.3	11.7	-24	-29.2	11.8	-26	-34.8	18.3	-26
50cm	-32.4	9.0	-31	-24.0	0.0	-24	-21.8	4.3	-26	-33.5	0.6	-33	-39.6	11.8	-38	-40.5	11.6	-38	-40.8	13.6	-38
80cm	-34.0	5.3	-34	-28.1	0.3	-28	-32.3	7.9	-31	-38.3	0.5	-38	-41.8	12.3	-38	-44.3	12.8	-38	-44.7	15.6	-38
1m	-37.1	6.1	-36	-30.0	0.0	-30	-38.0	1.3	-37	-36.5	0.6	-36	-42.3	13.2	-38	-44.5	16.3	-38	-38.0	7.4	-38
1.5m	-40.5	6.7	-39	-33.0	0.1	-33	-39.4	10.8	-36	-40.0	0.9	-40	-51.8	9.9	-46	-58.1	8.0	-54	-51.7	9.2	-49
2m	-38.0	6.5	-37	-36.2	0.4	-36	-44.4	1.3	-43	-40.9	0.6	-41	-57.4	13.4	-50	-50.2	6.1	-48	-49.4	9.2	-47
2.5m	-46.9	5.4	-46	-38.0	0.0	-38	-43.2	1.6	-42	-46.6	0.8	-46	-43.1	5.1	-43	-45.7	1.2	-46	-44.4	6.9	-44
5m	-43.4	5.6	-43	-41.0	0.8	-41	-57.1	3.8	-56	-51.1	0.5	-51	-45.1	4.7	-45	-46.3	6.3	-46	-48.1	8.4	-46
7.5m	-43.9	3.8	-44	-46.8	0.7	-47	-56.4	1.6	-58	-50.6	0.9	-50	-55.7	11.0	-50	-53.6	8.6	-50	-55.2	10.2	-51
10m	-51.0	0.9	-51	-46.1	0.4	-46	-60.4	0.9	-60	-54.9	0.5	-55	-59.8	4.9	-59	-66.2	3.4	-65	-64.5	4.1	-63
15m	-47.0	5.3	-46	-43.6	0.6	-44	-59.7	1.9	-59	-56.7	1.9	-56	-57.5	9.6	-54	-59.9	10.2	-55	-56.0	6.6	-54
20m	-54.4	5.1	-53	-53.9	1.1	-54	-66.8	3.1	-65	-66.5	1.4	-67	-65.7	4.1	-65	-66.8	2.5	-67	-63.3	5.2	-62
25m	-52.0	5.8	-52	-44.6	0.7	-44	-54.2	1.7	-55	-54.7	1.0	-54	-55.2	5.2	-54	-57.1	4.1	-57	-59.2	11.0	-54
30m	-52.5	4.1	-51	-48.4	1.5	-48	-72.8	3.0	-74	-57.3	0.7	-57	-58.6	6.7	-56	-61.5	4.3	-60	-58.1	4.3	-56
35m	-52.3	4.3	-52	-59.3	1.2	-59	-56.0	1.6	-55	-66.9	1.8	-67	-61.6	12.7	-53	-58.8	9.2	-55	-56.5	10.2	-52

**Indoor Testing Data Summary Table 2 of 4**

Distance	Netgear WG-111v2 Card A			Netgear WG-111v2 Card B			D-Link DWA-140			Netgear WPN111			Diamond Digital A101 Card A			Diamond Digital A101 Card B			Netgear MA101		
	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo
30cm	-45.5	0.8	-45	-45.4	0.8	-45	-26.6	11.6	-23	-70.4	17.8	-81	-38.2	13.1	-31	-27.4	6.5	-26	-24.8	5.1	-24
50cm	-46.0	1.2	-45	-45.9	1.8	-45	-35.0	13.8	-31	-58.2	21.0	-61	-38.4	10.4	-34	-30.6	4.2	-30	-25.1	3.8	-24
80cm	-47.5	1.7	-46	-46.2	1.5	-45	-36.9	9.5	-35	-49.9	23.8	-39	-31.0	3.3	-31	-28.3	2.9	-28	-25.7	6.0	-24
1m	-49.0	1.7	-49	-45.7	1.0	-45	-36.7	1.2	-33	-67.0	14.7	-79	-37.4	7.2	-36	-39.9	10.5	-34	-24.5	3.4	-24
1.5m	-50.3	1.6	-49	-47.2	1.5	-46	-43.5	8.3	-41	-65.7	16.1	-77	-36.9	5.4	-36	-34.2	0.5	-34	-24.9	4.6	-24
2m	-52.5	1.3	-52	-48.9	1.4	-48	-44.2	7.5	-41	-73.1	11.2	-79	-48.3	11.7	-41	-46.1	5.1	-46	-26.0	7.4	-24
2.5m	-49.4	1.1	-49	-47.6	1.2	-47	-47.5	6.3	-45	-59.8	16.6	-40	-44.5	1.6	-44	-45.8	2.4	-46	-24.1	1.1	-24
5m	-51.5	1.1	-51	-48.8	1.2	-48	-46.7	5.4	-45	-54.2	12.6	-44	-47.0	3.9	-46	-45.3	9.5	-41	-25.0	4.7	-24
7.5m	-52.6	1.1	-52	-51.8	0.7	-52	-51.0	3.2	-51	-65.4	9.0	-66	-50.2	7.4	-47	-48.4	3.2	-48	-25.0	3.8	-24
10m	-54.3	1.1	-54	-52.6	0.7	-53	-52.4	6.9	-51	-66.8	2.6	-67	-46.2	1.2	-46	-45.5	2.7	-46	-32.9	12.8	-24
15m	-54.9	1.2	-54	-55.6	1.0	-56	-54.3	4.5	-54	-58.3	9.8	-58	-47.8	2.6	-47	-44.9	1.6	-45	-24.6	3.4	-24
20m	-54.7	0.8	-54	-53.3	0.6	-53	-58.6	4.2	-58	-52.6	9.3	-49	-65.0	3.3	-65	-62.9	3.5	-65	-24.6	3.3	-24
25m	-52.5	1.1	-52	-51.8	0.9	-52	-51.2	5.5	-49	-43.2	9.1	-40	-56.2	1.6	-56	-50.1	1.6	-49	-24.4	2.9	-24
30m	-54.6	0.9	-54	-54.0	0.5	-54	-55.3	4.1	-54	-50.9	3.9	-50	-61.0	2.5	-60	-59.2	2.4	-59	-30.6	11.3	-24
35m	-53.6	0.8	-53	-52.2	0.6	-52	-55.7	4.7	-54	-63.1	7.7	-61	-62.1	3.3	-60	-56.3	1.8	-56	-32.0	11.3	-24

**Indoor Testing Data Summary Table 3 of 4**

Distance	D-Link DWL-122G			Atheros 5006UG			Broadcom BCM4312						Intel Centrino 2200BG			Intel Centrino 3945ABG					
							2.4Ghz			5Ghz						2.4Ghz			5Ghz		
	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo
30cm	-23.4	1.0	-24	-30.5	5.9	-25	-21.0	3.8	-20	-33.2	0.4	-33	-38.7	14.4	-21	-30.8	15.1	-24	-42.7	1.8	-44
50cm	-30.3	0.9	-30	-31.0	6.6	-27	-28.6	7.2	-26	-41.0	0.1	-41	-30.8	10.4	-24	-32.4	14.2	-29	-41.0	4.4	-37
80cm	-36.7	0.9	-36	-33.3	3.7	-32	-35.7	4.8	-34	-42.7	0.5	-43	-33.7	9.7	-27	-341.5	16.1	-34	-46.7	2.6	-49
1m	-33.9	1.9	-34	-32.6	4.7	-36	-40.5	4.8	-40	-44.0	0.2	-44	-30.4	6.0	-27	-41.7	14.6	-36	-49.4	0.9	-50
1.5m	-47.9	1.1	-48	36.1	2.7	-36	-43.5	4.1	-42	-46.8	0.4	-47	-31.2	6.6	-27	-39.7	5.9	-40	-50.9	0.7	-51
2m	-61.4	2.4	-62	-39.9	6.2	-43	-42.6	2.9	-42	-50.0	0.2	-50	-34.6	8.2	-31	-44.1	5.2	-45	-51.4	1.9	-53
2.5m	-41.8	2.5	-42	-42.9	7.4	-39	-41.1	1.5	-41	-50.0	0.2	-50	-38.3	6.6	-35	-47.0	8.7	-44	-58.0	1.7	-56
5m	-49.9	1.2	-50	-44.5	6.7	-38	-52.2	2.9	-52	-63.1	0.5	-63	-39.5	4.4	-37	-63.0	4.1	-64	-56.8	1.7	-55
7.5m	-50.3	1.5	-50	-49.6	5.8	-44	-44.9	4.4	-43	-63.0	0.1	-63	46.8	2.2	-46	-61.0	7.6	-66	-59.3	1.6	-58
10m	-51.9	1.5	-52	-56.2	3.7	-57	-51.4	3.4	-51	-63.3	0.5	-63	-44.1	5.4	-42	-59.3	6.8	-63	-58.6	4.8	-64
15m	-50.9	1.6	-52	-59.0	2.5	-58	-52.8	1.5	-52	-56.1	0.6	-56	-46.6	3.2	-46	-59.2	5.8	-63	-63.2	5.7	-57
20m	-51.9	2.2	-52	-58.5	2.6	-59	-51.9	1.5	-52	-70.9	1.2	-71	-48.1	2.4	-48	-63.3	5.2	-61	-64.2	2.9	-61
25m	-50.5	1.9	-50	-54.8	3.2	-53	-53.8	2.6	-54	-62.2	0.5	-62	-44.7	5.2	-42	-61.3	3.7	-61	-69.9	1.1	-70
30m	-50.8	1.8	-50	-58.6	3.5	-60	-52.7	1.3	-52	-62.1	0.4	-62	-44.6	3.4	-43	-59.1	5.6	-63	-66.6	1.8	-67
35m	-51.1	1.8	-52	-53.5	3.5	-52	-51.8	2.4	-51	-67.3	2.2	-69	-43.3	5.5	-40	-56.7	5.4	-54	-72.1	4.9	-67

**Indoor Testing Data Summary Table 4 of 4**

Indoor Testing Data Summary Table 4 of 4															
Distance	Intel Wi-Fi Link 5300N						HTC Android Phone			Nokia N95			Roving Networks Wi-Fi Tag		
	2.4Ghz			5Ghz											
	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo
30cm	-24.4	18.1	-13	-32.7	0.7	-33	-25.7	0.7	-26	-27.9	10.7	-25	-34.1	0.8	-34
50cm	-27.9	19.9	-16	-34.1	3.5	-37	-31.5	3.0	-31	-36.5	12.3	-34	-45.2	4.2	-45
80cm	-36.3	20.0	-22	-36.3	2.5	-33	-35.6	2.2	-35	-39.6	8.6	-38	-46.5	4.5	-46
1m	-33.7	17.9	-22	-36.9	3.2	-34	-38.7	0.5	-39	-42.3	16.9	-38	-44.6	7.1	-43
1.5m	-31.4	14.7	-27	-41.4	2.1	-44	-43.8	3.8	-43	-37.9	0.2	-38	-47.0	0.3	-47
2m	-39.6	16.9	-33	-43.3	2.1	-45	-50.8	0.8	-51	-41.0	8.8	-39	-44.4	6.9	-43
2.5m	-41.7	13.8	-38	-46.9	2.5	-47	-45.9	0.6	-46	-47.8	0.7	-48	-51.3	9.6	-49
5m	-35.4	2.3	-35	-51.8	2.8	-54	-54.8	0.7	-55	-48.6	14.9	-45	-53.9	7.7	-52
7.5m	-47.1	10.2	-41	-54.0	4.7	-48	-52.5	2.6	-52	-47.9	0.6	-48	-53.6	6.6	-52
10m	-41.4	7.7	-39	-55.5	4.2	-50	-54.7	0.9	-54	-52.7	2.1	-52	-54.3	7.7	-52
15m	-52.3	9.9	-49	-50.1	1.6	-51	-58.2	1.1	-57	-48.3	4.8	-47	-58.2	4.0	-58
20m	-58.6	8.4	-53	-60.2	2.6	-62	-67.1	3.2	-68	-56.0	2.3	-56	-61.1	5.3	-60
25m	-49.3	10.6	-42	-63.2	1.7	-63	-60.6	1.8	-60	-49.5	1.2	-49	-58.8	1.8	-58
30m	-50.8	12.6	-42	-60.3	1.8	-60	-63.1	2.5	-63	-53.6	0.9	-53	-59.0	5.8	-57
35m	-44.7	11.6	-38	-59.1	2.8	-56	-61.2	3.4	-60	-50.6	3.0	-49	-60.7	1.2	-60

**Outdoor Testing Data Summary Table 1 of 4**

Distance	Belkin Play						Netgear WG111U						Billion BiPAC3011G Card A			Billion BiPAC3011G Card B			Billion BiPAC3011G Card C		
	2.4Ghz			5Ghz			2.4Ghz			5Ghz			Me	SD	Mo	Me	SD	Mo	Me	SD	Mo
	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo									
30cm	-20.9	14.1	-15	-12.0	0.0	-12	-12.9	3.4	-13	-25.5	0.5	-25	-26.2	11.4	-22	-30.9	15.5	-26	-24.7	11.0	-22
50cm	-31.4	11.2	-29	-24.0	0.2	-24	-28.4	9.9	-27	-33.3	0.4	-33	-33.0	6.8	-31	-47.0	16.9	-31	-37.6	15.2	-29
80cm	-40.1	7.8	-38	-28.0	0.1	-28	-36.0	10.5	-32	-37.6	0.6	-37	-39.8	6.3	-38	-48.4	13.0	-38	-43.2	14.6	-32
1m	-38.5	10.3	-36	-31.0	0.0	-31	-35.6	0.7	-36	-38.5	0.6	-38	-50.4	9.0	-48	-62.5	12.6	-54	-51.5	12.5	-38
1.5m	-43.9	7.5	-43	-34.0	0.2	-34	-40.9	1.0	-40	-42.2	0.8	-42	-58.0	5.9	-57	-59.6	5.1	-58	-46.9	12.5	-40
2m	-41.4	4.8	-40	-36.0	0.0	-36	-48.0	8.1	-45	-44.7	0.8	-44	-50.2	7.3	-48	-51.0	7.0	-48	-60.3	9.2	-56
2.5m	-45.6	9.9	-43	-39.0	0.0	-39	-45.1	1.3	-44	-45.2	0.7	-45	-45.0	7.9	-42	-51.3	14.4	-42	-49.9	13.8	-44
5m	-50.4	4.3	-49	-44.8	0.4	-45	-49.7	1.3	-50	-51.5	0.6	-51	-52.9	3.5	-53	-58.8	12.4	-50	-62.5	10.8	-54
7.5m	-49.4	9.2	-47	-46.0	0.0	-46	-57.6	4.0	-56	-51.6	0.5	-52	-57.2	5.7	-56	-61.0	8.4	-57	-62.4	8.3	-57
10m	-56.2	9.5	-53	-54.0	0.2	-54	-57.4	3.5	-56	-60.2	0.6	-60	-58.2	5.8	-59	-62.3	10.2	-58	-58.6	6.6	-56
15m	-59.9	9.0	-56	-49.1	0.6	-49	-60.4	1.0	-61	-55.4	0.5	-55	-67.2	2.7	-66	-71.1	6.7	-68	-72.2	4.4	-71
20m	-58.5	10.4	-54	-61.0	0.0	-61	-60.0	1.0	-60	-64.5	0.7	-64	-67.0	2.8	-66	-67.9	6.4	-66	-68.5	9.4	-62
25m	-56.8	7.3	-55	-59.0	0.0	-59	-61.3	1.3	-61	-70.1	0.9	-70	-63.2	4.2	-62	-67.3	5.3	-65	-67.1	6.3	-65
30m	-61.0	8.2	-58	-54.2	0.5	-54	-63.5	3.9	-61	-67.3	0.8	-68	-68.5	1.6	-68	-69.2	3.3	-68	-67.6	7.6	-65
35m	-60.6	6.9	-59	-55.0	0.0	-55	-62.5	1.4	-61	-71.3	0.8	-71	-69.8	1.7	-69	-70.1	7.7	-67	-71.8	8.1	-78

**Outdoor Testing Data Summary Table 2 of 4**

Distance	Netgear WG-111v2 Card A			Netgear WG-111v2 Card B			D-Link DWA-140			Netgear WPN111			Diamond Digital A101 Card A			Diamond Digital A101 Card B			Netgear MA101		
	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo
30cm	-47.1	2.1	-45	-46.4	1.5	-45	-22.6	12.6	-19	-76.1	13.1	-89	-30.0	6.4	-28	-23.9	5.8	-23	-24.6	3.5	-24
50cm	-47.2	1.9	-45	-47.6	2.3	-47	-34.0	13.6	-29	-79.9	14.5	-86	-35.6	5.6	-36	-28.0	8.0	-25	-25.2	4.9	-24
80cm	-46.1	1.4	-45	-48.9	1.7	-48	-35.0	9.8	-33	-65.0	16.1	-55	-32.6	9.3	-29	-30.3	5.4	-29	-24.7	4.5	-24
1m	-48.4	2.1	-48	-50.0	1.9	-50	-43.0	6.9	-41	-74.2	16.4	-88	-42.4	10.0	-37	-40.4	8.5	-36	-25.1	4.3	-24
1.5m	-50.3	2.6	-49	-50.8	1.9	-49	-45.9	9.6	-43	-76.0	14.0	-89	-40.8	10.9	-35	-42.0	12.5	-35	-24.6	3.5	-24
2m	-49.7	1.5	-48	-52.9	1.4	-52	-43.3	8.2	-41	-78.2	13.1	-80	-42.4	10.0	-37	-38.2	4.5	-37	-25.0	5.1	-24
2.5m	-49.8	1.8	-48	-51.6	1.4	-51	-43.5	9.0	-41	-70.9	11.8	-78	-40.5	6.9	-39	-39.3	0.9	-39	-25.3	6.2	-24
5m	-51.9	1.3	-51	-55.6	1.8	-54	-53.3	8.3	-51	-73.7	11.3	-81	-44.4	5.8	-43	-50.2	8.4	-46	-25.0	4.3	-24
7.5m	-53.1	1.3	-52	-55.1	1.7	-54	-49.8	7.7	-47	-73.5	12.8	-77	-49.0	1.1	-49	-49.3	2.0	-49	-27.9	6.2	-24
10m	-53.7	1.3	-53	-55.0	1.3	-54	-52.3	6.8	-51	-78.3	13.3	-81	-55.6	1.0	-55	-59.1	4.0	-58	-32.2	11.6	-24
15m	-55.6	1.9	-54	-56.3	1.4	-55	-60.6	5.6	-60	-77.4	13.5	-82	-55.2	3.3	-55	-57.4	1.2	-58	-25.4	2.9	-24
20m	-55.6	1.9	-54	-58.3	2.3	-57	-57.3	6.8	-56	-82.9	10.7	-75	-57.7	1.7	-58	-55.8	1.0	-56	-27.8	5.8	-24
25m	-55.9	1.9	-54	-57.0	1.9	-57	-58.3	5.8	-56	-74.0	14.8	-84	-58.5	5.5	-58	-56.9	1.3	-56	-27.8	5.2	-24
30m	-55.8	1.7	-55	-55.4	1.0	-55	-60.8	6.5	-58	-78.2	13.5	-86	-60.3	4.6	-60	-60.6	2.2	-60	-32.2	11.3	-24
35m	-55.6	1.5	-55	-57.4	1.2	-57	-61.2	6.0	-60	-82.0	12.7	-87	-62.2	2.6	-61	-63.7	2.8	-63	-36.8	15.0	-24

**Outdoor Testing Data Summary Table 3 of 4**

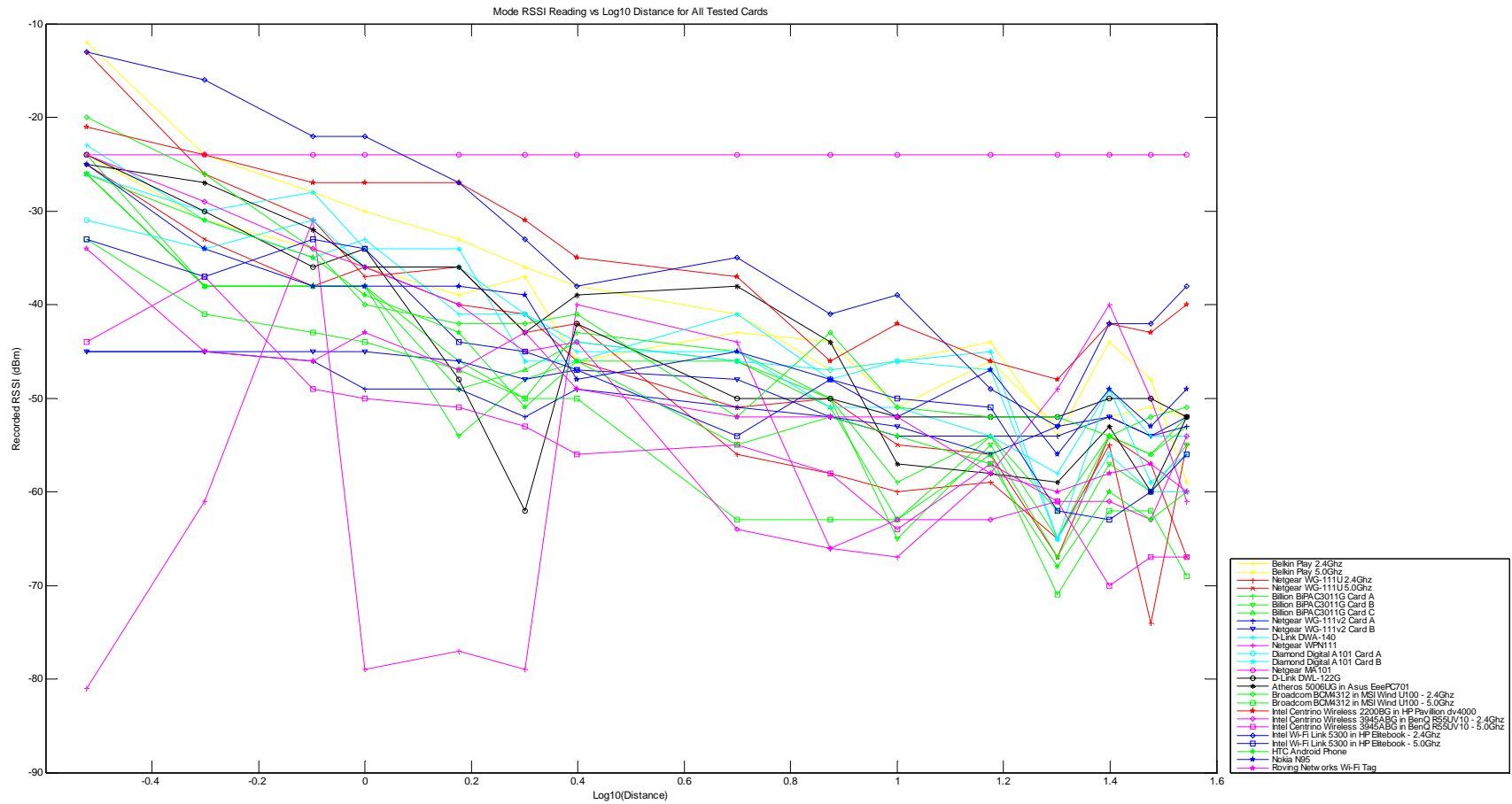
Distance	D-Link DWL-122G			Atheros 5006UG			Broadcom BCM4312						Intel Centrino 2200BG			Intel Centrino 3945ABG					
							2.4Ghz			5Ghz						2.4Ghz			5Ghz		
	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo
30cm	-16.8	2.4	-16	-30.8	2.7	-32	-19.1	8.0	-18	-32.3	0.5	-32	-41.6	14.4	-54	-32.8	14.6	-26	-38.4	2.1	-40
50cm	-28.3	0.8	-28	-33.2	6.8	-30	-25.7	5.3	-24	-37.3	0.4	-37	-42.4	13.8	-55	-31.9	12.4	-27	-43.4	4.8	-48
80cm	-36.4	0.9	-36	-33.9	3.8	-33	-39.7	3.4	-39	-41.0	0.4	-41	-35.3	10.0	-27	-38.4	12.6	-36	-47.7	3.2	-51
1m	-48.1	1.6	-48	-34.1	4.7	-34	-41.6	1.5	-41	-42.6	0.5	-43	-40.6	13.0	-29	-42.0	12.5	-38	-49.0	1.3	-49
1.5m	-50.3	1.5	-50	-37.2	2.7	-38	-45.3	2.2	-45	-47.0	0.2	-47	-38.9	9.4	-33	43.8	10.7	-39	-50.6	0.5	-51
2m	-47.3	1.0	-48	-39.3	4.0	-39	-47.3	2.0	-46	-48.6	1.6	-48	-41.6	7.3	-36	-52.4	10.0	-51	-52.4	1.0	-53
2.5m	-41.7	2.2	-42	-45.2	3.4	-47	-50.6	1.6	-50	-51.0	0.1	-45	-41.9	4.7	-39	-55.2	10.0	-47	-59.1	1.6	-61
5m	-49.4	1.5	-48	-51.7	2.9	-53	-50.1	1.5	-50	-58.0	0.7	-58	-47.2	6.8	-43	-59.3	6.6	-56	-59.9	2.1	-61
7.5m	-49.8	1.6	-50	-50.2	4.7	-46	-54.9	1.1	-54	-62.9	0.6	-63	-50.4	3.3	-50	-61.1	6.6	-58	-62.4	1.8	-61
10m	-49.7	1.0	-50	-55.1	2.5	-55	-52.8	1.0	-52	-61.9	0.5	-62	-47.9	7.0	-45	-61.5	5.3	-61	-65.8	3.2	-63
15m	-70.1	0.8	-70	-59.8	3.1	-57	-59.1	1.8	-59	-66.2	0.7	-66	-59.0	2.9	-59	-68.5	4.0	-65	-70.0	2.0	-72
20m	-58.6	1.7	-58	-59.3	2.4	-61	-55.4	1.1	-55	-68.0	0.4	-68	-54.8	6.6	-52	-64.2	4.0	-61	-67.4	1.0	-68
25m	-58.4	0.9	-58	-61.1	2.3	-61	-55.3	0.9	-55	-78.1	1.0	-78	-56.0	8.6	-51	-64.2	3.6	-63	-73.8	1.0	-73
30m	-60.6	1.0	-60	-62.0	4.1	-62	-55.6	1.0	-57	-74.6	0.7	-75	-53.6	6.7	-51	-65.0	4.1	-65	-81.4	0.8	-82
35m	-59.4	1.0	-60	-62.1	2.4	-60	-57.7	1.1	-58	-71.1	0.8	-71	-53.9	7.2	-50	-65.4	4.4	-63	-76.9	1.8	-75



**Outdoor Testing Data Summary Table 4 of 4**

Outdoor Testing Data Summary Table 4 of 4												
Distance	Intel Wi-Fi Link 5300N						HTC Android Phone			Nokia N95		
	2.4Ghz			5Ghz								
	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo	Me	SD	Mo
30cm	-24.8	20.0	-13	-32.8	1.5	-33	-29.0	0.6	-29	-31.0	9.0	-29
50cm	-24.9	16.9	-16	-33.0	3.7	-34	-34.1	3.7	-34	-42.1	17.7	-36
80cm	-30.9	18.4	-19	-36.4	2.5	-39	-37.8	0.5	-38	-46.7	0.6	-47
1m	-35.0	18.7	-22	-37.6	2.7	-40	-39.7	0.7	-40	-39.6	0.5	-40
1.5m	-32.2	13.1	-25	-40.1	2.3	-42	-44.3	0.6	-44	-40.8	9.9	-39
2m	-37.6	14.2	-30	-46.5	3.1	-48	-49.0	0.6	-49	-44.5	7.1	-43
2.5m	-39.8	12.0	-32	-47.4	2.6	-44	-45.4	0.6	-45	-48.5	1.1	-49
5m	-47.2	12.3	-38	-51.5	2.3	-53	-55.0	0.7	-55	-49.0	0.5	-49
7.5m	-51.7	13.2	-42	-53.7	2.9	-57	-55.7	0.6	-56	-54.1	0.6	-54
10m	-49.9	12.4	-41	-58.4	2.9	-57	-68.1	2.7	-67	-63.3	0.6	-63
15m	-62.6	6.9	-61	-66.2	1.9	-65	-61.2	1.9	-61	-58.4	1.5	-57
20m	-57.1	9.9	-51	-60.2	2.8	-57	-60.6	1.0	-61	-57.9	2.1	-57
25m	-56.2	8.7	-50	-64.9	1.4	-65	-61.8	1.2	-62	-58.5	1.0	-58
30m	-56.7	9.5	-53	-72.7	1.1	-74	-63.7	2.2	-63	-61.0	1.4	-61
35m	-59.8	8.4	-57	-66.9	2.5	-64	-65.5	1.4	-65	-62.7	0.7	-63

## Indoor Mode Plot-all



## Outdoor Mode Plot-all

