

## TDMA WiFi implementation comparison

To test throughput, iperf utility under Ubuntu 12.04 is used.

Iperf is launched with settings to report throughput every 5 seconds.

To check throughput in UDP mode, bidirectional test is used with maximal bandwidth to have less than 0,1% drops and reordering

To check throughput in TCP mode, unidirectional test is used.

To align TCP throughput in CSMA/CA mode to TDMA mode, the maximal unidirectional throughput divided with 2.

The command samples

```
iperf -c SERVER_IP_ADDRESS -i5 -t50 -r
```

```
iperf -c SERVER_IP_ADDRESS -i5 -t50 -u -d -bBANDWIDTH_IN_MB
```

Testbed is configured for 2 nodes in the network.

CNS3000 CPU based board (Gateworks Laguna GW2388-4) with 128/256Mb of RAM.

Radio is Doodle Labs DL435-30.

(<http://www.doodlelabs.com/products/radio-transceivers/sub-ghz-range/420-450-mhz-dl435-30/>)

Frequency 422,5MHz. Two devices with omnidirectional antennas (3Db) in the real city environment.

Distance around 100 meters with some objects in the Frenel zone. Automatic power settings.

Channel width	RSSI	Timeslot size	TCP						UDP
			BS->CPE			CPE-BS			
			max	min	avg	max	min	avg	
5	50-54		2,17	1,88	2,01	1,89	1,18	1,29	1
10	52-58		3,57	3	3,12	2,84	1,5	2	4
20	50-56		5,4	3,5	4	3,55	2,1	2,9	3
5	51-55	34	3,86	3,24	3,58	3,98	3,36	3,64	3
10	52-57	18	6,37	6,25	6,31	6,71	6,29	6,5	6
20	51-57	12	9,32	6,05	8,33	6,92	5,87	6,44	5
5	51-56	30	3,85	3,38	3,58	4,19	3,36	3,65	3
10	52-58	16	6,27	6,07	6,16	6,71	5,87	6,42	6
20	51-57	9	10,1	9,52	9,93	11,7	11,1	11,5	9
5	51-55	18	3,91	3,67	3,8	4,4	3,15	3,73	3
10	52-58	12	7	6,51	6,84	7,13	6,5	6,87	6
20	51-57	8	5,11	2,76	3,56	13	9,65	12,1	2
5	51-56	12	3,55	3,09	3,29	3,57	2,73	3,25	2
10	53-58	8	6,31	6,15	6,22	6,5	5,87	6,18	6
20	50-58	6	4,48	3	3,41	2,94	2,52	2,78	2

CSMA/CA (AP-Client) mode

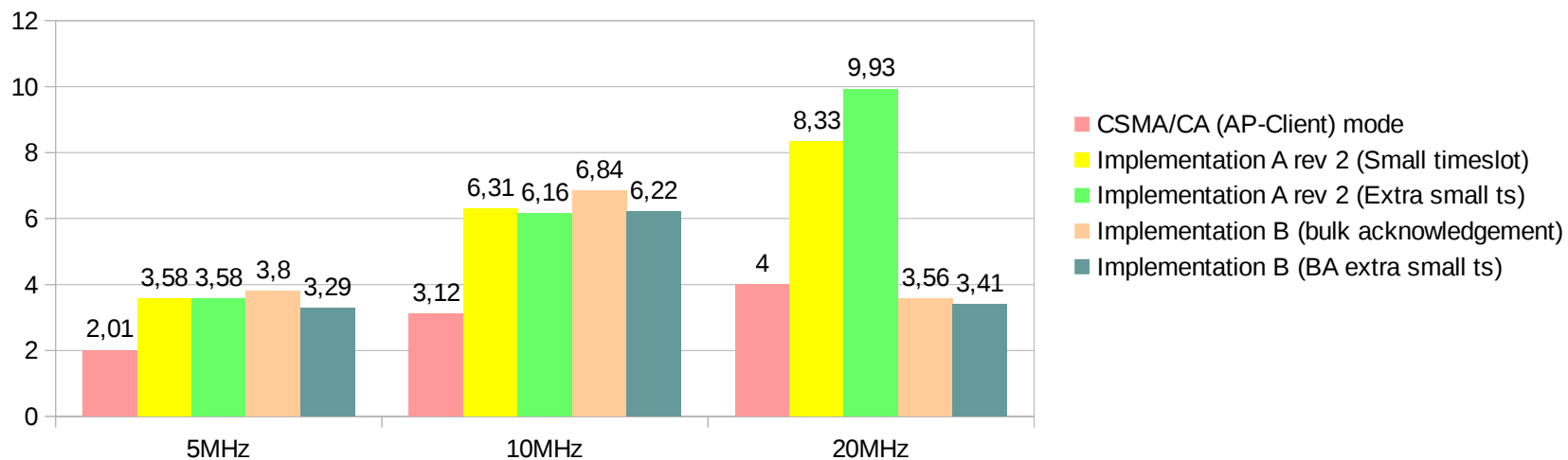
Implementation A rev 2 (Small timeslot)

Implementation A rev 2 (Extra small ts)

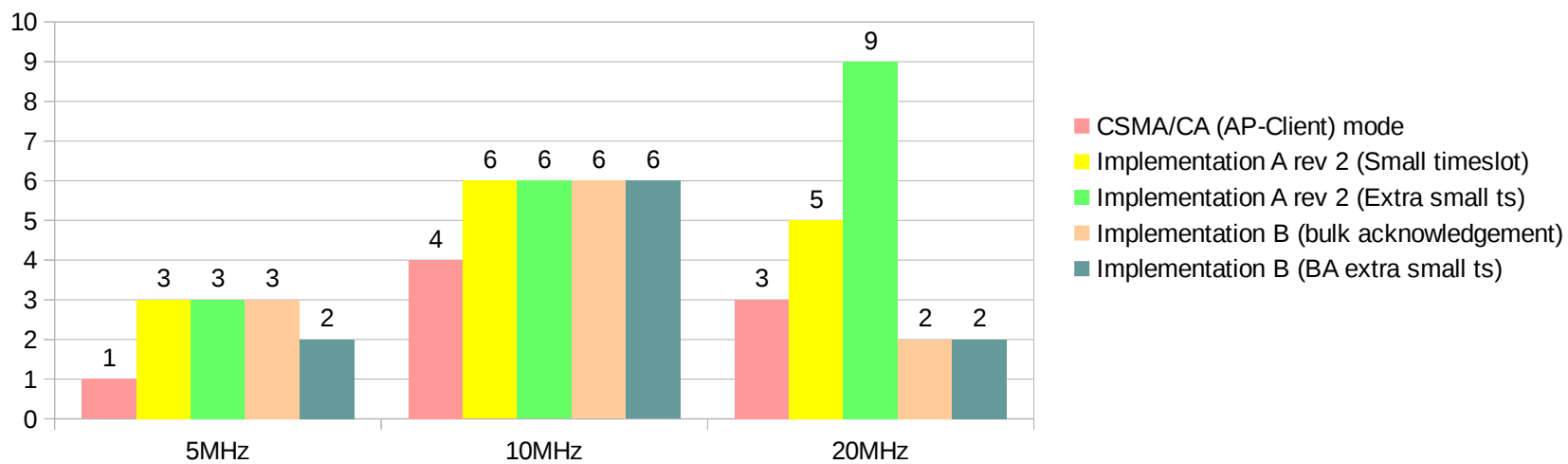
Implementation B (bulk acknowledgement)

Implementation B (BA extra small ts)

### TCP throughput per node



### UDP throughput per node



## Conclusion

The link is established in real very noised city environment. The city environment has many noise sources in 400-450MHz band, That causes dramatical results with channel width in 20Mhz.

The throughput for the TDMA modes is better than in CSMA/CA (acces point and station) modes;  
Especially for channel widths in 5 and 10MHz (better sensetivity and less noises).

TDMA modes with individual acknowledgements have better or similar throughput than modes with group (bulk) acknowledgements, owing to less noises influence.

For low noised environments, the throughput will be aligned to the published results for the 802.11a hardware.