Experimentation on 4G srsLTE

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1. INTRODUCTION

SrsLTE is a free and open-source 4G LTE software suite. With this, you can build an end-to-end software radio mobile network. The srsLTE suite includes: srsUE - a complete SDR LTE UE (User Equipment) application, srsENB - a complete SDR LTE eNodeB (Basestation) application and srsEPC - a light-weight LTE EPC (Core Network) implementation with MME, HSS and S/P-GW .

First , we have to run srsEPC, then we run the srsENB which is connected with the srsEPC and creates a local LTE cell and last srsUE connects to the LTE network that we created with the srsENB and provides a standard network interface with high-speed mobile connectivity. Both srsENB and srsUE, to transmit and receive radio signals over the air requires SDR hardware such as the Ettus Research USRP.

2. METHODOLOGY

For the experiments I used NITOS testbed and nodes with USRP B210 and USRP X310. For both USRPs, I changed various parameters values at the configuration values. First, both at eNB and UE configuration files I tried different values for tx and rx gain and after several experiments I ended up with tx_gain = 80 and rx_gain =50. Then all the parameters changed were from enb configuration file. Another parameter was dl_earfcn. EARFCN uniquely identify the LTE band and carrier frequency

and is independent of channel bandwidth. The results of the experiments below are with dl_earfcn = 3400 (2565.0 - 2685.0 MHz). I also ran some tests with dl_earfcn 1575, but the results are pretty much the same. Also, I enabled srsgui ([gui] enable = true) to have real-time plots (screenshots below). Lastly , I tried various values for n_prb and for mcs. The n_prb parameter , Number of Physical Resource Blocks, was given the values 25, 50, 75 and 100 and with this parameter I changed the bandwidth. Then , for each of those values I tried different values of both uplink and downlink mcs. Downlink mcs was pdsch_mcs and uplink mcs was pusch_mcs and they were given the values 8, 16 and 24 to change the modulation scheme.

3.RESULTS

At the tables below, you can see the results of each experiment (measured in Mbits/second) for dl_earfcn = 3400, tx_gain = 80, rx_gain = 50 and different values of n_prb and mcs (same value for both pdsch and pusch mcs).

USRP B210 :
I used nodes 055 and 056, both of them are equipped with USRP B210. I run the srsEPC at node 055 on one terminal and then srsENB at node 055 on another terminal. Then, at node 056 I run srsUE.
Then I open two new terminals ,one at node 055 and one at node 056. To send downlink traffic I used the command “iperf -s -u -i 1” at node 056(UE) and the command “iperf -c 172.16.0.2 -u -i 1 -b 100M -t 10” at node 055(eNB).

On the terminal that runs srsENB I was watching info such as the rnti, the downlink and uplink bitrate and the block error rate , so I took my results for downlink from there . Lastly, I send uplink traffic using the command “iperf -s -u -i 1” at node 055(eNB) and the command “iperf -c 172.16.0.1 -u -i 1 -b 100M -t 10” at node 056(UE).

n_prb	25		50		75		100	
mcs	downlink	uplink	downlink	uplink	downlink	uplink	downlink	uplink
8	3.46	2.76	6.92	6.17	10.6	9.14	14.1	13.5
16	7.65	6.12	15.2	13.5	22.9	19.8	30.5	29.2
24	13.4	10.5	27.1	24.3	40.4	34.0	54.8	50.9

USRP X310:

I used nodes 083 with USRP B210 and a node with USRP X310. I run the srsEPC at the node with the USRP X310 on one terminal and then srsENB at the node with the USRP X310 on another terminal. Then, at node 083 I run srsUE.

Then I open two new terminals ,one at node 083 and one at the node with the USRP X310 . To send downlink traffic I used the command “iperf -s -u -i 1” at node 083(UE) and the command “iperf -c 172.16.0.2 -u -i 1 -b 100M -t 10” at the node with the USRP X310(eNB).

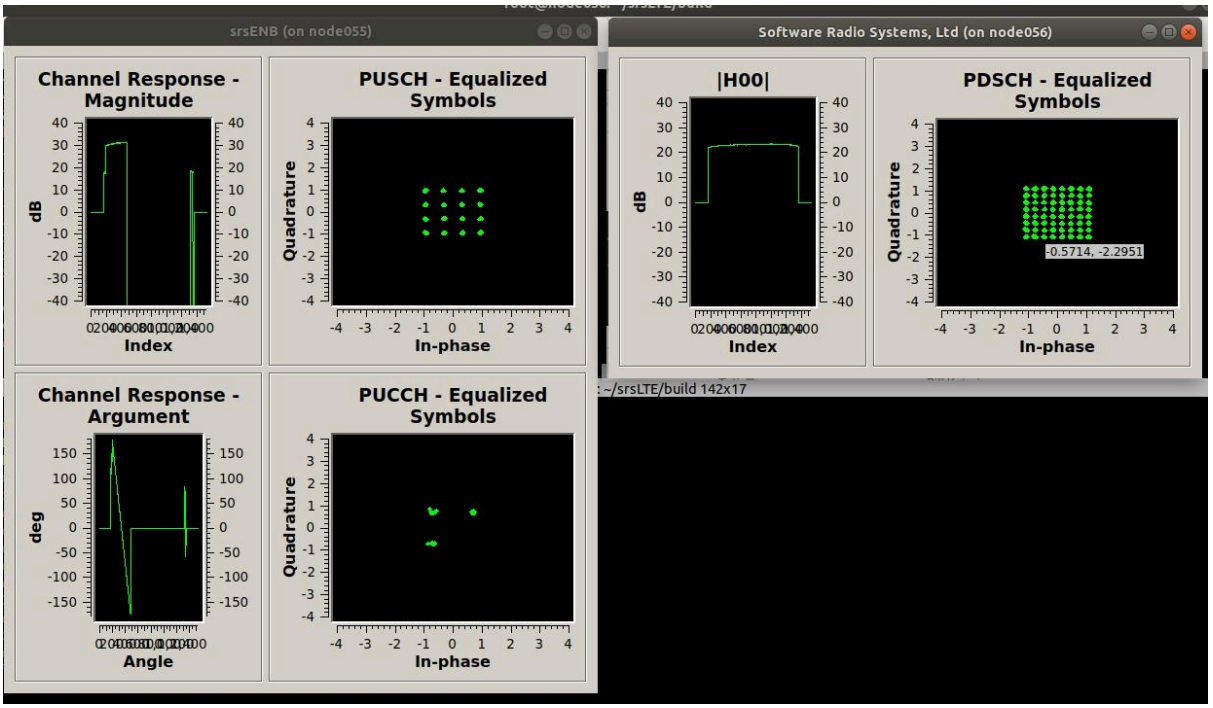
On the terminal that runs srsENB I was watching info such as the rnti, the downlink and uplink bitrate and the block error rate , so I took my results for downlink from there . Lastly, I send uplink traffic using the command “iperf -s -u -i 1” at the node with USRP X310(eNB) and the command “iperf -c 172.16.0.1 -u -i 1 -b 100M -t 10” at node 083(UE).

I also tried running srsEPC and srsENB at node 083 and srsUE at the node with USRP X310 but the results were the same.

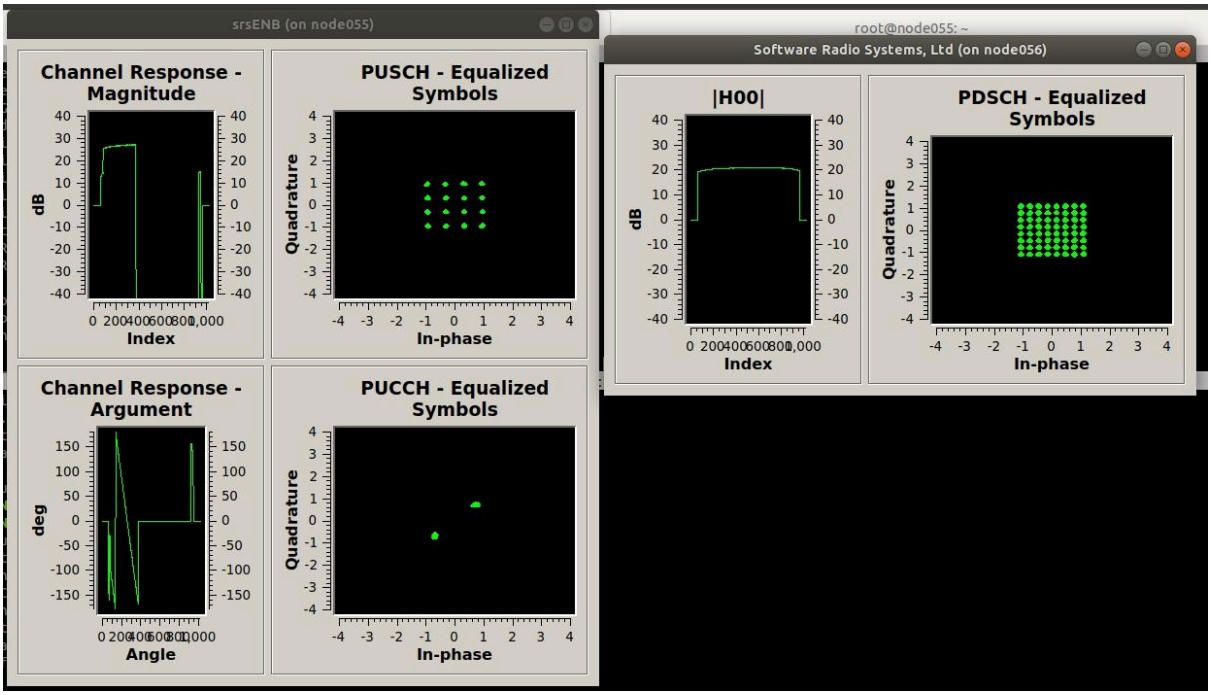
n_prb	25		50		75		100	
mcs	downlink	uplink	downlink	uplink	downlink	uplink	downlink	uplink
8	3.46	2.76	6.92	6.17	10.6	9.14	14,1	13.5
16	7.66	6.12	15.2	13.5	22.9	19.9	30.4	29.2
24	13.4	210kbits(97 % bler)	27.1	no packets sent, 100% bler	40.4	no packets sent 100% bler	54.8	loses connection

Below, you can also see some screenshots from the plots with the USRP B210. On the left part of the image, you can see the plot from the eNB and on the right the plot from the UE.

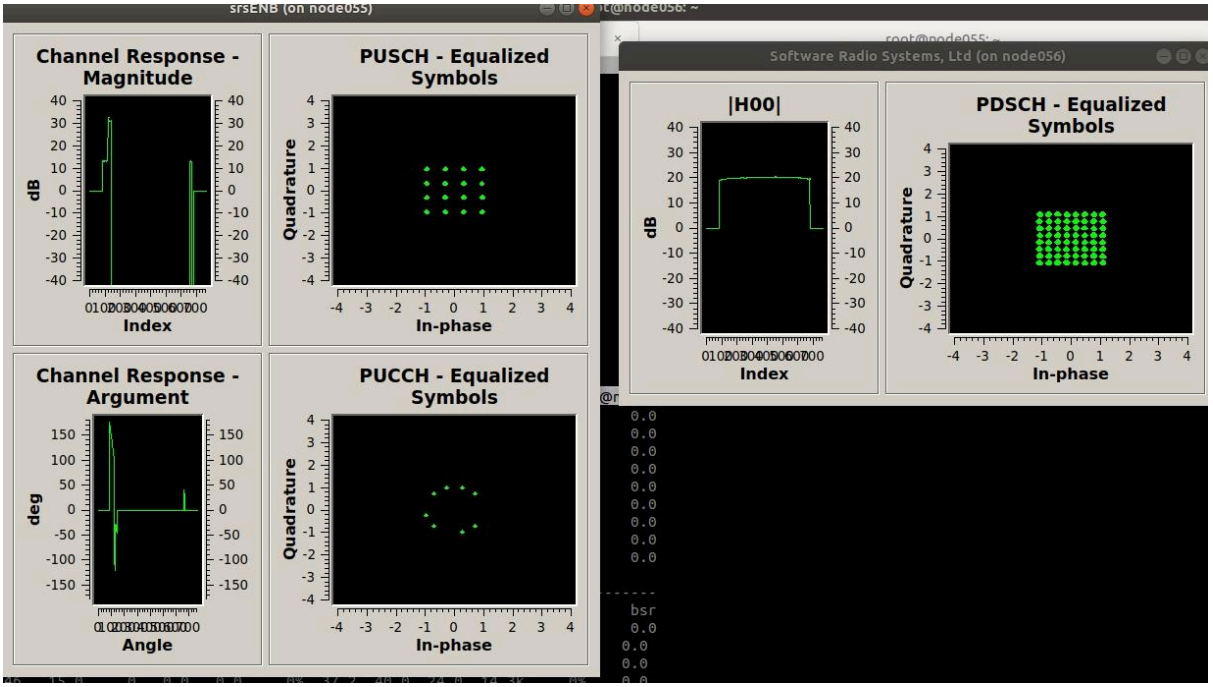
n_prb = 100, mcs = 24



n_prb = 75, mcs = 24



n_prb = 50, mcs =24



n_prb = 25, mcs =24