Analysation of Link Adaptation with LTE-analyser tool

**1 abstract**

Link adaptation in LTE has different modulation and coding schemes, which will vary dependent on the channel condition. What we want to analyze is

* Is the best modulation and coding scheme chosen for the for the current SNR/CQI of the channel.
* Gives the Block Error Rate (BLER) at 10% the highest throughput

When the analysis is done we will both have shown that an analysation of this kind of problem is possible with our developed tool, and that the BLER at 10% and the switching between MCS’s is justified.

**2. Motivation and Problem formulation:**

The reason why we do this analysis is

1. To show that an analysis is made possible with our developed tool
2. To evaluate the performance of link adaptation

What we will do in this analysis is to look at the relation between MCS (modulation and coding scheme), throughput and BLER. The analysis will focus on following tasks.

* Which is the optimal MCS for each SINR and CQI value in the sense of throughput?
* How far from the theoretical maximum throughput are you at each MCS with the UE?
* At which SINR/CQI does the MCS Value change, when should it change if you want to optimize throughput?
* Is the BLER error rate at 10 % optimal in a throughput sense? What is the system throughput performance with 5% or 15% BLER?
* How is throughput increasing/decreasing when you are at the edge of the modulation. I.e. when you switch between QPSK and 16QAM, and 16QAM and 64QAM.

**4. expected outcome from the analysis**

There should be a linear dependency between the MCS values and throughput. The higher MCS value the better throughput (in the reference trace, where the enoodeB choose MCS).

In the reference trace there should always be higher or equal throughput for the MCS x > MCS y. So the average throughput when the UE is running at MSC = 20 should be higher or equal than the average throughput when the UE is running at MCS = 19, and that throughput should be higher than when it runs at MCS = 18, according to the MCS table.

The enodeB shall switch the MCS such that the BLER is around 10%. The BLER should always be around 10% except when you are at MCS = 0 or 28, Then the MCS is capped

The Block error rate at 10% should give highest throughput

How far is the UE from its theoretical peak throughput for each MCS when it has BLER = 0%.

The enodeB should switch MCS such that the throughput is increasing.

The optimal MCS should be used at each SINR / CQI. (Notification, there are more than one MCS value per CQI value in the downlink, not for the uplink).

**5. Tasks to do for the analysis**

5.1 task to be done before we are able to do the analysis

1. Make sure that the optional tab works, so that we can look att say throughput/MCS.

5.2 Tasks to do for the analysis

**Collect data**

Do 30 DL-traces with the propsim plugged in, 29 traces shall be when one MCS is hardcoded to enodB (Imcs 0-28) and one shall be when the enodeB chooses the MCS for the transmission. Choose a static channel mode with either 4x2 MIMO or 2x2 MIMO. Use a UE that supports MIMO. Start the Channel SINR at a level where you have 100% BLER and slowly increase the SINR until you have a BLER at 0%.

Do the same for uplink but instead of 30 traces to 24 (MCS = 0..22). the mode should be 1xN SIMO/SISO, where N = 1..4.

**Analyzing the data**

Use the plugin tool we have created to analyze the data. Read all the log files and and save all the graphs.

Load the data and create two extra graphs in the advanced graph tab. One Throughput / BLER graph and one Throughput Per MCS.

Analyze the data according to the problem formulation.

**6 information to be acquired before the analysation**

In LTE Link adaptation we have 28 different MCS (modulation and coding schemes) in downlink, 22 different in uplink. What modulation and coding are assigned to each number.

Svar: look at test instructions or description, if not the MCS value are there we ask, system people.

How do we know which MCS we should run at each cqi ??????? Maybe this analysis is more suitable in uplink?