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Use of spreading factor 512 in UTRA FDD downlink

Introduction

The spreading factor 512 was discussed in the last WG1 meeting and there were basically some study items listed with respect the need of spreading factor 512. This contribution addresses the necessity of spreading factor 512 from Layer 1 point of view. The main points covered are:

- Applicability of spreading factor 512 for power control purposes and link maintenance
- Operation in soft handover
- Uplink needs for spreading factor 512

Spreading factor 512 for power control purposes

It has been proposed to use a common channel approach for providing the power control for users with little downlink activity but uplink transmission needs to save on the spreading codes. The use of spreading factor 512 has the following benefits with respect to the power control in common channel

- Usable in all scenarios, including adaptive antenna solutions and feeback Tx diversity schemes
- Unlike a common channel, can be power controlled.
- Can carry also other signaling than layer 1 signaling
- Usable in SHO if desired to be used.
- When downlink transmission needs increase, can carry the higher layer signaling to change to a channelisation code from spreading factor 512 to a different one for increased transmission capacity
- For handover etc. critical signaling, the signaling delay is not dependent on the number of users as with common channel approach.

Operation of spreading factor 512 in soft handover

The spreading factor 512 was mentioned during the email discussion for Ad Hoc 7 to have potentially a problem with soft handover as the timing adjustment would have to be done with steps of 512 chips as well, leading to potentially longer power control delay and larger buffering at UE.

This would be indeed the case if spreading factor 512 would be used without restrictions in all cases. Thus it is proposed that following rules would be applied, as proposed during the Ad Hoc 7 discussions over the reflector before the last WG1:

- When connection is initiated, SF 512 is used without restrictions.
- If connection is desired to be in soft handover, the cells added to the active set would use only the other pair of the of spreading factor 512.
- This allows to adjust the timing of the new cells with accuracy of 256 chips.

This strategy allows to introduce SF with no impact for buffering in SHO and also no additional penalty for power control delay in SHO due increased timing difference of different cells.

In general it must be noted that it is very unlikely that SHO would be largely required for services fitting to this category. Still having SF 512 in the downlink will allow this possibility if operator considers such a feature necessary based on the practical network and service experince, depending on the amount of SF 512 codes in soft handover. Thus a low rate dedicated channel is much more versatile than a common channel for layer 1 control being limited only to specific scenarios.

Uplink needs

As in the uplink direction we have no channelisation code shortage and it is only transmitted power that matters, it is not proposed to introduce spreading factor 512 for the uplink. From the data rate point of view similar effect can be achieved with repetition when signal format actually looks identical to spreading factor 512, if something that would be desired from the e.g. FDD PRACH point of view.

Conclusions

It is proposed that the spreading factor 512 for downlink is maintained in the current 3GPP specification with a suitable solution for providing downlink power control with especially uplink oriented data solutions. The use of spreading factor 512 would be naturally up to an operator from the infrastructure side and would be a service dependent feature at the terminal side for this kind of uplink only type applications.