

Agenda Item: 7.1
Source: Nokia
Title: Signaling for Uplink Outer Loop Power Control
Document for: Approval

1 Introduction

This contribution proposes the UTRAN signaling necessary to support the uplink outer loop power control function.

2 Discussion

2.1 General

The Uplink Outer Loop Power control is used to control the quality of the data transmission in the Uplink. The quality is monitored in the SRNC, using a quality indicator parameter carried in the user plane by the UL DCH FP frame, and the result is the modification of the target Eb/No (Energy per bit over the noise spectral density of the DCPCH) in the Node B. The target Eb/No is used by the fast UL power control (= Node B commands the UE to increase or decrease the UL power level in order to meet the required Eb/No).

2.2 Quality estimation

The total quality of the data transmission is monitored after the combining of all UL branches, because the diversity combining is a mean to achieve the target quality.

The basic estimation of quality is based on the monitoring of the erroneous Transport Block rate (the UL frames contains the result of the air interface CRC). Other means of estimation the quality of the UL transmission may be possible, and may be based on an additional 'Frame Reliability Information' that is transported by the UL DCH FP frame (this may be required by DCH with demanding QoS requirements). The definition of the 'Frame Reliability Information' is FFS.

Anyway it is not specified by the standard which and how many DCHs the SRNC shall monitor in order to estimate the quality of the UE-UTRAN connection, and all the DCHs FP frames need to carry the result of the air interface CRC check. This allows flexibility in the implementation of the outer loop power control algorithm.

2.3 Eb/No setpoint modification

The modification of the target Eb/No shall be carried out with in-band signaling from SRNC to Node-Bs, using an apposite field in the DL DCH data frame. If necessary (=there are no DL data frame to be sent) a control frame is used. The field in the data frame specifies the increase or decrease of the current level of the Eb/No. Thus the FP DL frame does not indicate the absolute

value of the Eb/No setpoint, but only its variation (for example with 'up' or 'down' command), and the correspondent steps shall be defined when the RL is setup by the relevant RNSAP/NBAP procedures. The efficient implementation of the outer loop power control requires to the step upwards of the Eb/No setpoint to be bigger than the step down, because there is a need to increase sensibly the quality of the connection when it is under the acceptable level; and, on the other end, the decrease of the quality level must be slower.

The Eb/No setpoint modification command is the same for all the RL. This is due to the fact that the quality is estimate over one, combined, data stream and to the fact that inband signaling does not always allow to address single RL, because of diversity.

The Eb/No setpoint modification command may be carried by any of the DCH of one UE-UTRAN connection. The DCH carrying the commands may be the DCH carrying the SRB, or any other DCH (for example the DCH with most demanding QoS). Thus the Node B shall be capable to accept Eb/No setpoint modification commands from any of the DCH allocated to the UE-UTRAN connection, and the DCH FP structure shall have always the capability to carry Eb/No setpoint modification commands (for example the SRNC will include the Eb/No setpoint modification command in the DCH that is currently transmitting data in DL, in order not to use unnecessary control frames).

2.4 Initialization of the Eb/No setpoint

The initial value of the Eb/No setpoint to be used as reference by the UL fast power control is defined during the RL setup procedure. Additional parameters to be specified in the RL setup message are:

- Maximum allowed Eb/No setpoint
- Minimum allowed Eb/No setpoint
- Eb/No adjustment parameters

When a DCH is added, modified or removed from the Radio Links, there may be the need to set a new Eb/No setpoint and also to change the above mentioned parameters. Thus the relevant RNSAP/NBAP procedures must have that capability.

In addition there may be a need to redefine or re-initialize the Eb/No setpoint during the connection: for example after that a SHO branch id added or removed. This is done via L3 signaling with the Outer Loop Power Control procedure (RNSAP and NBAP), used by SRNC to set a new quality target to the radio links. The procedure is used also to ensure that all the RLs are using the same quality target reference because FP frames may be lost, thus Eb/no setpoint of the different radio links may drift away each other if not reinitialized.

It is FFS if the Outer Loop Power Control procedure is used to modified also the minimum and maximum Eb/No setpoint and the adjustment steps.

3 Proposals

3.1 Modification to S3.23 and S3.33

Include the following parameters:

Information element	Reference	Type
Uplink Eb/No Setpoint		M/O
Uplink Eb/No Adjustment parameters		M/O
Uplink Maximum Eb/No		M/O
Uplink Minimum Eb/No		M/O

in the following messages:

NBAP (Ref. [S3.33]): RL SETUP, RL ADDITION, RL RECONFIGURATION, RL RECONFIGURATION REQUEST and OUTER LOOP POWER CONTROL

RNSAP (Ref. [S3.23]): RL SETUP, RL ADDITION, RL RECONFIGURATION and RL RECONFIGURATION REQUEST and OUTER LOOP POWER CONTROL

(Note: the information elements are mandatory (M) in the RL SETUP messages, optional (O) in the other messages (if not specified, the existing value is assumed). The Uplink Eb/no setpoint is mandatory in the OUTER LOOP POWER CONTROL

The parameters shall be mentioned also in the procedure description.

3.2 Modifications in S3.27

1. Include sections 2.1, 2.2 and 2.3 in [S3.27], under section 6.3 (headings may be removed).
2. Replace the third bullet point in 7.1.2, [S3.27], with the following
 - *CRC result bits: results of the air interface CRC check performed on the MAC PDUs (Transport Blocks). There is one bit for each Transport Block in the Transport block Set.*

Same change shall be reflected in the table with the frame structure

3. In the message structure in section 7.1.2 [S3.27], the parameter *Outer Loop Power Control*, shall be renamed *Eb/No Setpoint Control Information (Eb/No CI)*.

4 References

[S3.23] *RNSAP Protocol*, v.0.0.2. source Editor

[S3.33] *NBAP Protocol*, v.0.0.2. source Editor

[S3.27] *Iur/Iub interface user plane protocol for DCH data streams*, v.0.0.2. source Editor