TSG-RAN Working Group 1 meeting #18 *TSGR1(01)0159*
Boston, USA, Jan. 15 - 18, 2001

Agenda Item: AH21

Source: Siemens AG

To: TSG RAN WG1

Title: The use and generation of the information fields transmitted in the FPACH

Document for: Decision

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1. Summary

The 1.28 Mcps TDD option has different a random access procedure as in 3.84 Mcps TDD. The FPACH is used in 1.28 Mcps TDD option only by the Node B to answer the SYNC-UL to the UE. This paper describes the use and generation of the information fields transmitted in the FPACH in the 1.28Mcps TDD option. It is generated form R1-01-0091 using the information related to TS25.224.

2. Introduction

The SYNC-UL sequence in UpPCH is used for the initial uplink synchronisation and power control as well as indicating the UEs wish to have a random access. The UE randomly selects one of the 8 possible SYNC-UL signatures of the cell it wants to access to and sends it on the UpPCH physical channel.

Then the UE determines the timing and the Tx power level (open loop procedure) for the UpPCH and transmits the selected signature on the UpPCH.

Once the Node B detects the UpPCH transmission from an UE, the arrival time and the received interference power on the PRACH are known. The Node B determines the transmit power command and received timing position and sends them to the UE within the next four frames through the FPACH (in a single burst/sub-frame message) to acknowledge the UpPCH signature. Note that the FPACH also contains the signature reference (the used UpPCH signature) and the relative sub-frame number (number of sub-frames passed after the reception of the acknowledged signature) in order to allow the UEs to identify that the FPACH message is the response to their UpPCH.

Once the UE receives the above mentioned physical signalling from the chosen FPACH (i.e. the FPACH which is associated to the selected signature), its UpPCH sequence has been accepted by the Node B. Then the UE will readjust its timing and power level and send the RACH on the PRACH channel corresponding to the FPACH exactly two frames later. In this step, the RACH sent to Node B by UE will have high synchronisation precision.

3. Proposal

We propose to add following paragraphs in the working CR for TS25.224 as the use and generation of the information fields transmitted in the FPACH in the 1.28Mcps TDD option.

---------- Beginning of text proposal for working CR for 25.224----------

5.6.2.1. The use and generation of the information fields transmitted in the FPACH

The Forward Physical Access CHannel (FPACH) is used by the Node B to carry, in a single burst, the acknowledgement of a detected signature with timing and power level adjustment indication to a user equipment.

Table X reports the content description of the FPACH information fields.

Table X: FPACH information fields description

Information field
Signature Reference Number
Relative Sub-Frame Number
Received starting position of the UpPCH ($UpPCH_{POS}$)
Transmit Power Level Command for RACH message
Reserved bits

The length and coding of the information fields is explained in TS25.221 sub-clause 6.3.3.1.

5.6.2.1.1 Signature Reference Number

The *Signature Reference Number* field contains the number of the acknowledged signature.

The user equipment shall use this information to verify whether it is the recipient of the FPACH message.

5.6.2.1.2 Relative Sub-Frame Number

The *Relative Sub-Frame Number* field indicates the current sub-frame number with respect to the sub-frame at which the acknowledged signature has been detected.

The user equipment shall use this information to verify whether it is the recipient of the FPACH message.

5.6.2.1.3 Received starting position of the UpPCH ($UpPCH_{POS}$)

The *received starting position of the UpPCH ($UpPCH_{POS}$)* field indirectly indicates to the user equipment the timing adjustment it has to implement for the following transmission to the

network. The network computes the proper value for this parameter, based on the correlation instant to the acknowledged signature from the UpPCH according to the following rules:

$$UpPCH_{POS} = UpPTS_{Rxpath} - UpPTS_{TS}$$

where

$UpPTS_{Rxpath}$: time of the reception in the Node B of the SYNC_UL to be used in the uplink synchronization process

$UpPTS_{TS}$: time instance two symbols prior to the end of the DwPCH according to the Node B internal timing

This information shall be used by the UE to adjust its timing when accessing the network.

The UE can use the *received starting position of the UpPCH (*$UpPCH_{POS}$*)* to estimate the propagation delay ($T_{propagation\ delay}$) according to the following law:

$$T_{propagation\ delay} = (UpPCH_{adv} + UpPCH_{POS} - 8*16\ T_c)/2$$

where:

- $UpPCH_{adv}$ is the difference between the RX timing (received DL at UE) and initial TX timing (transmitted UL at UE) of a UE for UpPCH transmission (timing advance of the UpPCH);
- T_c is the Time chip duration.

The timing advance for the RACH $RACH_{ADV}$ is $2* T_{propagation\ delay}$.

5.6.2.1.4 Transmit Power Level Command for the RACH message

This field indicates to the user equipment the power level to use for the RACH message transmission on the FPACH associated P-RACH.

The network sets this value based on the measured interference level (I) (in dBm) on the specific PRACH and on the desired signal to interference ratio (SIR) (in dB) on this channel as follows:

Transmit Power Level Command for the PRACH ($PRX_{PRACH,des}$*) ~~= SIR + I - Z~~*

~~where Z is a corrective constant taking into account some receiver parameters like for example the antenna gain.~~

$PRX_{PRACH,des}$ is the desired receive power level on the PRACH.

The UE shall add to this value the estimated path-loss to compute the power level to transmit for the PRACH.

---------- End of text proposal for working CR for 25.224 ----------