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Abstract

In this document we suggest possible solutions to handle abnormal situations for CPCH. Especially the proposal mainly focuses on emergency stop [1]. Nevertheless Node B can use this method to relieve overload condition by either off-loading some of the capacity or uniformly reducing the data rate of all UEs. This tool can also be used to manage short-time CPCH capacity and interference variation at the base node level.

1. Introduction

In the current CPCH procedures, if the UE PHY detects loss of the DPCCH on the DL during CPCH data transmission, it aborts CPCH transmission on the UL and reports the error to MAC. In [1], Node B can use this feature as a mechanism to implement an emergency "stop" to handle temporary capacity overloads at the cell.

In our point of view, as for emergency stop, the current scheme is not reliable, because the UE detecting loss of the DL DPCCH for CPCH cannot realize the reason of the disconnection whether by emergency stop or by out-of-synchronization.

Meanwhile, according to the out-of-synchronization handling mechanism in [2], when a UE cannot get any reliable TPC command, the UE adjust the UL power until N_out_synch_frames_2 frames. If N_out_synch_frames_2 frame is detected to be out-of-synchronization, the UE shall maintain the output power level, controlled by inner loop power control, constant while out-of-synchronization state lasts or until N_out_synch_frames_1 reached when the transmission shall be turned off. In this case, the UE detects the loss of DPCCH on the DL, the UE may raise the UL power continuously until N_out_synch_frames_2 frames, which produces interference. This mechanism is made for the case of bad physical channel condition, so if Node B uses this method as an emergency stop, it may cause some delay and interference. Because UE should wait until N_out_synch_frames_1 frames before disconnecting the CPCH, and may increase its power until N_out_synch_frames_2 frames.

By the problems above, we can recognize that another different emergency stop scheme should be used. This document introduces novel method to deal with abnormal situation including emergency stop.

2. Proposal

In this proposal two alternatives are introduced as follows.

Alternative I: Emergency stop standalone mode

Alternative I is only for emergency stop. The mode is that for this purpose Node B transmits specific bit pattern on the empty part of DL DPCH of spreading factor 512. The specific bit pattern (e.g. all 1s) indicates

that UE should cease its CPCH transmission. For this usage, TFCI field on DL DPCCH and data field on DL DPDCH can be used in table 1. The bit pattern are not channel-encoded and interleaved. They are just directly mapped onto DPCH and then they are channelised, scrambled and modulated subsequently. Node B sends the command to UE slot by slot.

Table 1. Slot Format #0 and #1 of current DPDCH and DPCCH fields [3]
(Slot format #0 is currently used for CPCH transmission)

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Slot	DPDCH Bits/Slot		DPCCH Bits/Slot			Transmitted slots per radio frame N_{Tr}
					N_{Data1}	N_{Data2}	N_{TPC}	N_{TFCI}	N_{Pilot}	
0	15	7.5	512	10	0	4	2	0	4	15
1	15	7.5	512	10	0	2	2	2	4	15

The procedure of alternative I is as follows:

1. RNC RRC requests ‘emergency stop’ to Node B L1.
2. Node B L1 sends CPCH terminating command to UE L1 by the pre-designated bit pattern on DL DPCH
3. UE L1 indicates to UE RRC that it received CPCH terminating command
4. UE RRC requests the termination of CPCH transmission to UE L1.
5. UE L1 terminates CPCH transmission
6. Node B detects the loss of CPCH transmission and then indicates it to Node B RRC
7. Node B RRC requests the termination of DL DPCCH to Node B L1.
8. Node B L1 terminates DL DPCCH transmission.

Alternative II: Emergency stop and CPCH down-link control mode

Alternative II is for emergency stop and CPCH down-link control. With CPCH down-link control, Node B can relieve overload condition by either off-loading some of the capacity or uniformly reducing the data rate of all UEs. TFCI encoding can be used for this purpose. In CPCH down-link control, input bits of TFCI encoder specify RRC commands, by which Node B can control UL CPCH transmission.

Emergency stop can work with CPCH down-link control. It is basically similar to alternative I. But since, in this alternative II, CPCH down-link control command uses TFCI field, emergency stop command can be sent only in DL DPDCH field. Consequently, since alternative II uses both TFCI and data field, slot format #1 in table 1 is preferable.

The procedure of emergency stop in alternative II is the same as that in alternative I. But in alternative II Node B can send terminating-related command (e.g. the cause of the termination and information for the next action of UE) with CPCH terminating command. The procedure of CPCH down-link control in alternative II is as follows:

1. RNC RRC requests fast CPCH down-link controlling to Node B L1.
2. Node B L1 sends CPCH controlling command to UE L1 by the pre-designated bit pattern on DL DPCH TFCI field
3. UE L1 indicates to UE RRC that it received CPCH controlling command
4. Then UE RRC controls the CPCH channel according to the received command.

3. Recommendation

As we mentioned above, it is beneficial to use new format of DL DPCH with TFCI field and/or data field in order for Node B to control CPCH. Hence, we recommend the method above as CPCH controlling method mainly for abnormal situation handling.

Reference

[1] GBT, “CPCH Access Procedures”, R2-99H82

[2] 3GPP RAN TS 25.214 V3.1.0, “Physical layer procedures (FDD)”

[3] 3GPP RAN TS 25.211 V3.1.0, “Physical channels and mapping of transport channels onto physical channels (FDD)”