TSG-RAN WG 1#4 TSGR1#4(99) 371

19 - 20 April 1999

Yokohama, Japan

Agenda Item:

Source: Golden Bridge Technology, Inc.

Title: Procedures Associated with Access and Operation of UL CPCH and the Associated DLDCCH

Document for: Decision

Procedures associated with Access and Operation of Uplink Common Packet Channel and the associated Downlink Dedicated Control Channel

Introduction

FIG. 1 illustrates the UE access-burst signal transmitted from the UE to the Node B on the Uplink Common Packet Channel (UL-CPCH). It also demonstrates the operation of the DL Dedicated Control Channel (DL-DCCH) that is paired with the UL-CPCH.

Timing information

UTRAN (Node B) transmits frame-timing signal using the Synchronization Channel (SYCH). The UE synchronizes to the SYCH Channel and retrieves frame-timing information from the SYNCH Channel. The frame-timing information includes the timing for when the UE can transmit an access-burst signal. Using the frame-timing information, the UE sets up a transmission timing schedule. The UE divides the frame time duration into a number of access-time slots. The duration of a time slot is defined as half the duration of an access slot. The UE starts the transmitting an access-burst signal at the beginning of an access-time slot. The frame-time reference of the UE is not necessarily the same as the frame-time reference of the Node B due to propagation delays.

UL-CPCH Random Access procedures

The access-burst signal of FIG. 1 is composed of UE-preamble signals, UE-power-control signals, and UE-pilot signals, respectively, transmitted in time, at increasing power levels. The power from UE- preamble to UE-preamble increases according to the power values P0, P1, P2,… . The power values are increasing according to their index. That is, P0< P1< P2… . The combination of UE-preamble signals, UE-power-control signal, and UE- pilot signals, and the message portion of the transmission constitute the access-burst signal. The power level of the UE-power-control signal and the UE-pilot signal may be at a proportion of the power level of the UE-preamble signal.

The combination of UE-preamble signals, UE-power-control signals, and UE-pilot signals is followed by the data portion. Thus, the access-burst signal also may include a data part. The data may include message information, or other information such as signaling, etc. The data is preferably concatenated to, or is part of, the access-burst signal. However, the data may be sent separately from the access-burst signal.

As shown in FIG.1, an UE-power-control signal, which is a time portion of the access-burst signal, is transmitted first in time during the time interval between UE preamble signal to UE pilot signal. The UE-preamble signal is a time portion of the access-burst signal, as shown in FIG. 1. A UE-pilot signal is transmitted second in time during the time interval between UE-power control signal and the data portion of the burst.

The UE-power-control signal is for power control of a dedicated downlink channel. The Node B transmits the dedicated downlink in response to detecting the UE- preamble signal transmitted by the UE. The UE- pilot signal allows the UTRAN to measure the received power from the UE, and consequently power control the UE using power control information transmitted from UTRAN to the UE.

Phase 0: Preamble transmission and detection

Within an access-burst signal, the UE continuously transmits a UE-preamble signal, followed by a UE-power-control signal, and followed by a UE-pilot signal. The Node B receiver searches for the transmission of the UE-preamble signals. The preamble structure is the same as the Random Access Channel. At a predetermined time instant after the Node B detects a UE-preamble signal, the Node B starts transmitting a NB-preamble signal as shown in FIG. 1. The UE, after every transmission of a UE-preamble signal, tunes its receiver to receive the BS-preamble-pilot signal. The NB-pilot signal transmission timing offset is the NB-preamble-pilot signal at the known time instant. The spreading code used by the Node B to transmit the NB-preamble-pilot signal is tied to the type of UE-preamble signal, which the UE transmitted.

Phase 1: UE Power Controlling the Node B:

The UE starts the reception process of the BS-preamble-pilot signal whether the NB-preamble-pilot signal is transmitted or is not transmitted. The UE does not make an effort to determine if the NB-preamble-pilot signal were transmitted or not. The reception of the NS-preamble-pilot signal enables the UE to measure the signal quality of the transmitted NB-preamble-pilot signal. This quality measure could be, for example, the received signal-to -noise-ratio (SNR), or probability of error, due to the reception of the NB-preamble-pilot signal by the UE.

The initial power level of the NB-preamble-pilot signal is determined by the Node B prior to transmission. As a result of the NB-preamble-pilot signal reception, the UE determines if the SNR of the received NB-preamble-pilot signal were above or below a previously defined SNR level of the UE (UE-SNR-level). If the UE demodulator, or processor, likely decides that the transmitted NB-preamble-pilot signal is received at an SNR well below the previously defined UE-SNR-level.

While measuring the received SNR of the NB-preamble-pilot signal, the UE transmits power control commands using the UE-power-control signal. If the SNR of the received NB-preamble-pilot signal, measured by the UE, fell below the previously defined UE-SNR-level, then the UE sends a "increase" signal, e.g., a 1-bit, to the Node B, commanding the base station to increase the transmitting power level of the NB-preamble-pilot signal, measured by the UE, fell above the previously defined UE-SNR-level, the UE will send a "reduce" signal, e.g., a 0-bit, to the Node B commanding the Node B to reduce the transmission power level of the NB-preamble-pilot signal. This process continues for the time duration of the UE-power-control signal. If the Node B had detected the UE-preamble signal, then the power of transmitted NB-preamble-pilot signal is adjusted by the UE to bring the measured SNR of the received NB-preamble-pilot close to the predefined UE-SNR-level.

As a result of this procedure, the Node B will transmit the L1 ACK message, at the appropriate power level to the UE. The duration of this phase is an optimization parameter.

Second phase: Node B transmits L1 ACK message:

After a predetermined time interval from detecting of the UE-preamble signal, the Node B transmits an acknowledgment message. The time of transmission as well as the code structure of the acknowledgment message is received to detect the acknowledgement message.

Third phase: Node B begins power controlling the UE:

At the same time, the UE starts transmitting the UE-pilot signal, which the Node B is able to receive since the Node B knows the transmission time as well as code structure of the UE-pilot signal. If the UE did not detect an acknowledgment transmitted by the station, then the UE assumes that the UE's previously transmitted UE-preamble signal is not detected by the Node B. In such a case, the UE will set up for transmitting the next transmission of the acknowledgement message, then the remote station decodes the message.

From the decoded message, the UE decides if the decoded acknowledgement message is a positive or negative acknowledgement. If the acknowledgement message were determined to be negative, then the UE stops all transmissions. The UE starts again at a later time by going to a predetermined back-off process. If the acknowledgement message were determined to be positive, then the UE continues transmitting the UE-pilot signal.

The Node B receives the UE-pilot signal and determines if the received SNR of the received UE-pilot signal were above or below a predetermined NB-SNR-level. If the measured received SNR of the UE-pilot signal were below the predetermined NB-SNR-level, then the Node B commands the UE to increase the transmitting power of the UE, by sending an "increase" signal, such as a 1-bit command, to the UE. If the measured received SNR of the UE-pilot signal were above the predetermined NB-SNR-level, then the Node B commands the UE to decrease its transmission power by sending a "reduce" signal, such as a 0-bit command, to the UE. These commands could be transmitted via a set of DPCCH-pilot symbols followed by a few power DPCCH-power-control symbols.

During the first two time slots, additional power control commands are transmitted between consecutive DPCCH-power-control symbols and DPCCH-pilot symbols as shown in FIG> 1. The transmission of these power control commands brings the power level of the transmitted UE-pilot signal close to the predefined NB-SNR-level. As a precaution, the total amount of power change for both the UE and the Node B might be limited to a predetermined maximum value. This value could be either fixed or broadcasted by the Node B.

At the end of this phase, the UE is power controlled by the Node B. The duration of this phase and TPC rate is an optimization parameter.

Phase four: Collision detected and data transmission:

Since the UE received a positive acknowledgement from the Node B and UE completed the transmission of the UE-pilot signal, the UE transmits a UE-collision-detection field. Followed by a message carrying data information. The UE-collision-detection field is received by the Node B and transmitted back to the UE at the following transmitted time slot as a NB-collision-detection field. If the NB-collision-detection field, received by the UE, matched the UE-collision detection field transmitted by the UE, then the UE continues transmitting the remaining message.

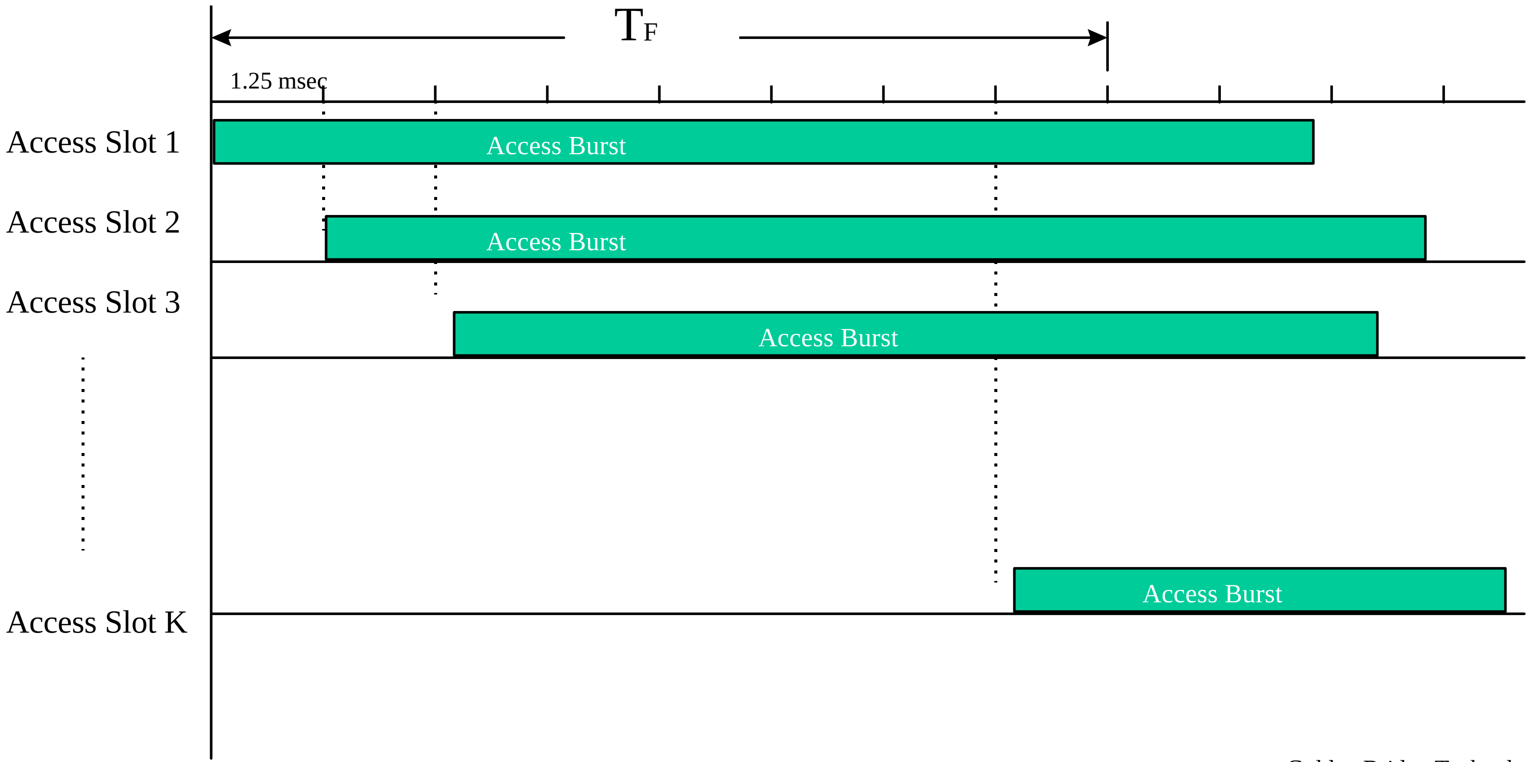
The Node B continues to power control the UE by continuously transmitting DPDCH-pilot signals and DPDCH-power control signals. If the NB-collision-detection field did not match the transmitted UE-collision-detection field, then the UE decides that its transmission collided with the transmission by another UE trying to access the Node B at the same time using the same UE-access-burst signal code structure and stop any transmission until a later time.

Common Packet Channel with a Dedicated Downlink Channel

Golden Bridge Technology

3GPP TSG RAN WG1 Meeting #3

Timing Diagram of Access Burst Transmission



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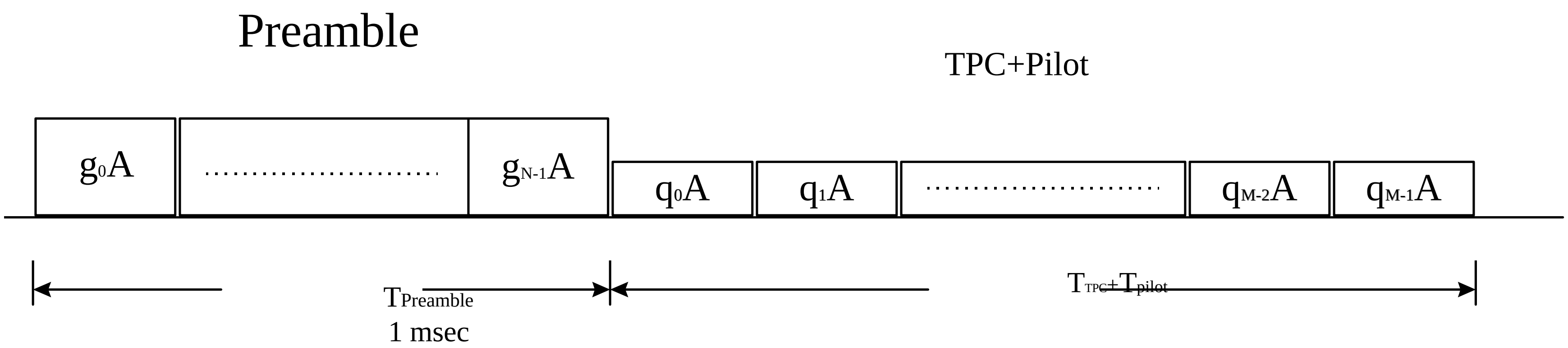
Preamble Format with TPC and Pilot



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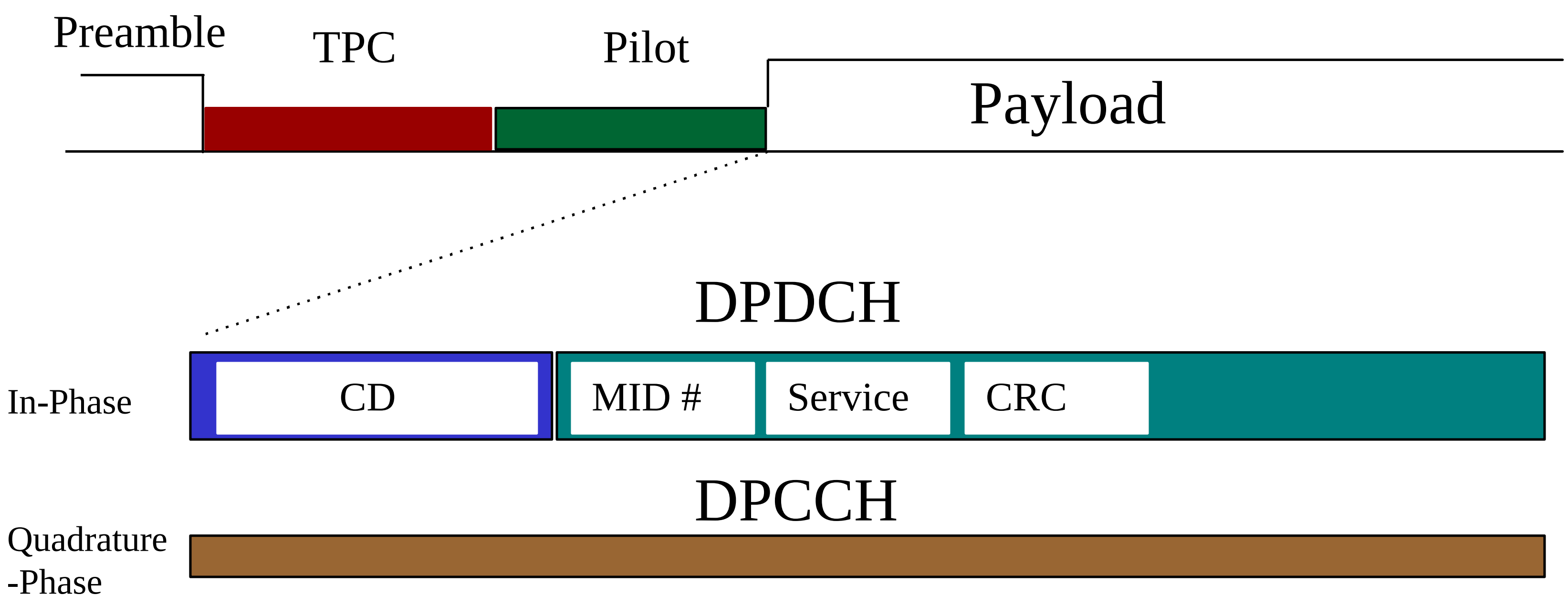
Frame Format of CPCH Data Payload



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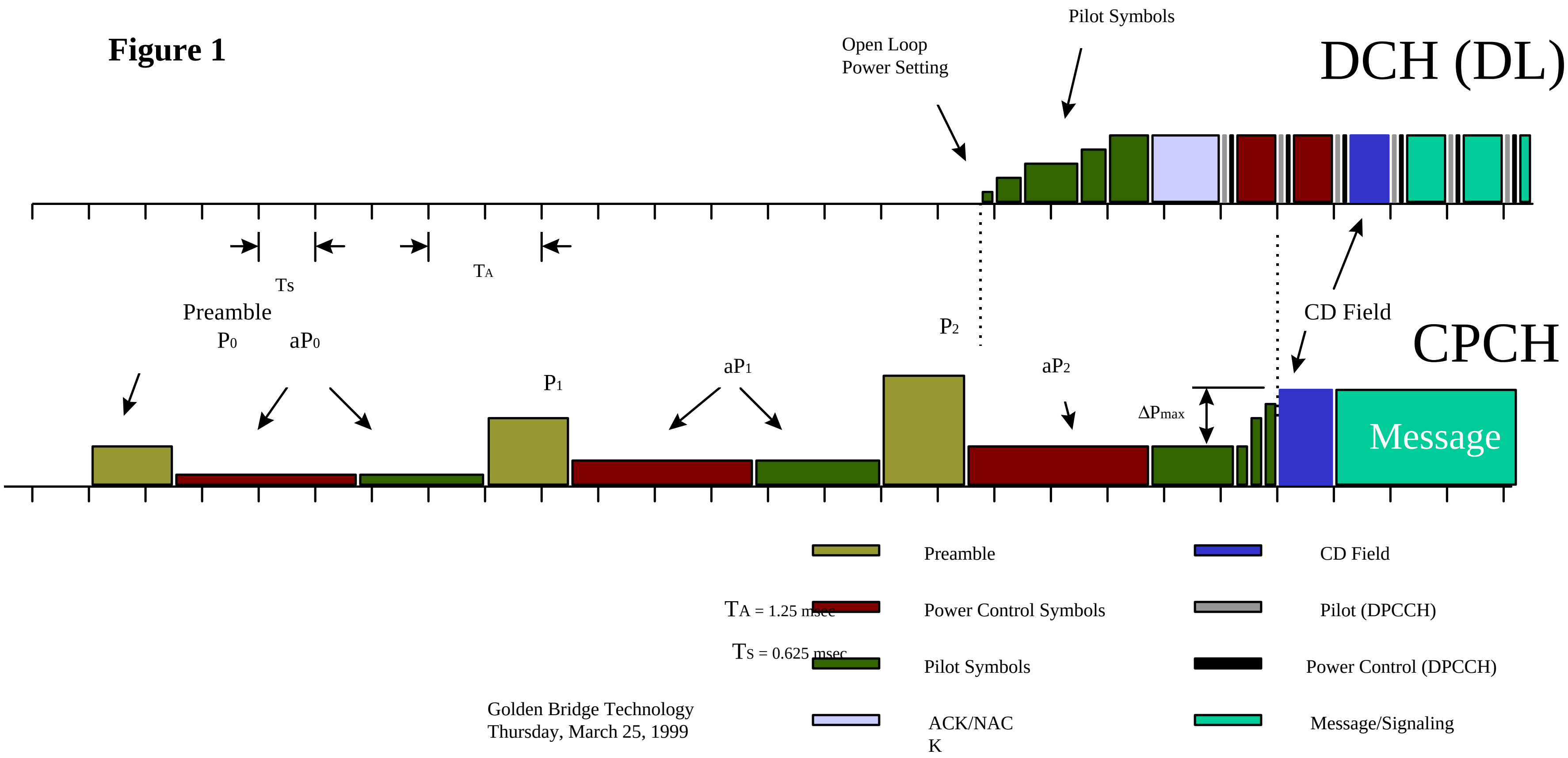
Common Packet Channel (CPCH) Access Burst Format and its Associated Downlink Dedicated Physical Channel

Figure 1



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