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| **Agenda Item:** | **AH14** |
| **Source:** | **GBT** |
| **Title:** | **UE and Base Node Functional and hardware Requirements** |
| **Item for:** | **Discussion and Approval** |

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## Introduction

In this contribution, we outline the functional and hardware requirements to support the CPCH in the UE and Node B.  The baseline UE and Node B must support RACH and FACH for UEs in Cell_FACH State.  The minimal baseline UE is severely limited in the uplink due to the limited capacity of the RACH.  The minimal UE will not be DCH capable and thus will have no other uplink options.  CPCH provides added uplink capacity for control & signaling as well as user data for UE in Cell_FACH State. Since the additional UE hardware to support CPCH is minimal while the added uplink capacity is significant. it is recommended that CPCH be added to enhance the RACH capability for  the base-line UE.

## Discussion

**UE Functional Requirements:**

1. UE shall monitor the BCCH initially to extract the CPCH parameters.
2. UE shall monitor the Status Broadcast Channel for a brief period just prior to each CPCH access [10-20 ms]. This period could be as short as 2 access slots if a flexible Status Broadcast periodicity is adopted by WG1.
3. UE shall select an available (not currently in use)  CPCH channel and corresponding signature for CPCH access.  UE's channel selection algorithm is left as manufacturer implementation.
4. UE shall request access to the selected CPCH channel by transmitting preambles in the access and collision detection phase of the CPCH access protocol in the designated sub-channel access slots, using different preamble codes for each phase.
5. UE shall comply with the CPCH timing relationships specified in 25.211
6. UE shall execute designated backoff delays and retransmissions if CPCH channel access is denied.
7. UE shall demodulate AICH and receive FACH while in the access and collision detection phase, using different AICH channelization codes for each phase.
8. UE shall receive FACH and DL-DPCCH [no data] while transmitting UL-CPCH as specified for the requested CPCH channel.

9. UE shall detect loss of DL-DPCCH in the downlink direction and abort transmission upon detection of such a condition.
10. UE shall relinquish the UL-CPCH channel after transmitting for the designated maximum period.

Node B Functional Requirements:

1. Node B shall maintain CPCH channel status table indicating availability of each CPCH channel.
2. Node B shall periodically transmit the CPCH channel status table on the CPCH Status Broadcast Channel.
3. Node B shall receive the AP and CD preamble scrambling signatures in series in the designated sub-channel access slots.    [NOTE: The Base Node is required to receive AP and CD signatures for CPCH and RACH. There might be some sharing between the two in the time or signature domain. The worst case scenario is when there is no sharing at all. In that case a separate CPCH receiver capable of receiving CD and AP preambles [all 16 for each]. This means two separate Gold codes with 16 signatures for each.
4. Node B shall comply with the timing relationships specified in 25.211
5. Node B shall allocate the available CPCH resources in the base Node to the UEs. The Base Node is in control of the resources and in the access phase generates the AICH_ack or AICH_nak based on current CPCH channel status.
6. Node B shall transmit multiple AICH responses to UE access requests in the designated access slots.          [NOTE:  To resolve collisions in the CD phase, Node B may only allocate a single CPCH channel at a time, by transmitting an AICH_ack.  Multiple AICH_naks may be transmitted in each access slot.  The maximum number of simultaneous AICH transmissions is not specified.]
7. Node B shall perform the Collision Detection and resolution in the CD phase and allocate the requested CPCH channel to a single UE if that channel is currently available.  Node B shall update the CPCH channel status table to indicate that the requested CPCH channel has been allocated and is now unavailable.
8. Node B shall receive the UL-CPCH, transmit the DL-DPCCH as specified for the requested CPCH channel. [NOTE: The maximum number of simultaneous UL-CPCH channels which the Node B is required to receive is not specified.  It is assumed that the Node B will have sufficient resources to simultaneously receive all the CPCH channels, which RNC has allocated to the CPCH sets in use at this Node B.  The maximum number of CPCH channels per CPCH set is 16.  The maximum number of CPCH sets in use at any Node B is not specified.]
9. Node B shall detect end of the UL-CPCH message when there is no transmission in the UL direction. Node B shall update the CPCH channel status table to indicate that the allocated CPCH channel has now become available.

**UE Delta Hardware Requirements:**

1. UE shall receive FACH and DL-DPCCH simultaneously.
2. UE shall detect loss of DL-DPCCH in the downlink direction and abort transmission upon detection of such a condition.
3. UE shall receive the CPCH Status Broadcast Channel.
4. The UE shall receive with a SF of 512.

**Node B Delta Hardware Requirements:**

1. Node B shall periodically transmit the CPCH channel status table on the CPCH Status Broadcast Channel.
2. The Node B shall include 0 to N additional RACH transceivers for CPCH access control. A RACH tranceiver is defined as an UL access preamble receiver with a DL AICH transmitter. A Node B with 0 additional RACH transceivers may partition access slots and signatures and thereby use the same RACH transceiver for RACH and CPCH.
3. Node B shall include 1 to N CPCH transceivers for CPCH messages. A CPCH transceiver is defined to be a DL DPCCH transmitter with an UL DCH receiver for UL CPCH reception. In order to simultaneously use each CPCH channel in the CPCH set assigned to the Node B, the Node B should include 1 CPCH transceiver for each CPCH channel in the set.
4. Node B shall detect loss of pilot bits in the UL-CPCH message when there is no transmission in the UL direction.

## Proposal

The minimal baseline UE is severely limited in uplink capacity. It is proposed to include CPCH to enhance the RACH as a baseline UE capability. As shown in the discussion, above, the additional hardware requirements to support CPCH is minimal. In this way CPCH can be used as an enhanced RACH for signaling and user data purposes in the uplink.