TSG RAN Working Group 1#9 **TSGR1#9 (99)i34**
Dresden, Germany
November 30-December 3, 1999

Agenda Item: **AH14**
Source: **GBT**
Title: **CPCH Status Broadcast Proposal and CR020 25.214**

Document for **Approval**

CPCH Status Broadcast proposal

A method to broadcast status information to indicated the status of every CPCH in a CPCH set in a cell. Status in a sense of availability or non-availability of a single CPCH or a data rate.

Method

There are several ways of achieving this. The periodicity of the broadcast could be either constant or variable. The Status information could be either Busy or Free. It is also possible to transmit both Free and Busy. When Real time monitoring methods a re deployed, it makes sense to broadcast Busy and Free. However, when non-real time [periodic] broadcast method is deployed, then it is perhaps best to only broadcast either Free or Busy. At low loading condition, the system can afford to transmit more information and the channel utilization is not a major issue. At high loading condition, it is advantageous to transmit less information if possible and increase channel utilization by decreasing the possible "gap periods" in CPCH channel usage.

Based on the above-mentioned considerations, it is best to transmit the Free indication periodically. Let's assume that the negative CD-ICHs can be assigned to each CPCH. Transmission of any of these negative CD-ICHs indicates that the particular CPCH is Free. If there are N1 CPCH channels and N2 channels are Free, we only need to transmit N2 Free-AICHs out of N1. If downlink capacity is a concern, then N2 Free messages should be transmitted within the original fixed constant period [e.g. 20 ms]. In the W-CDMA context, each message is sent over the access slot which is 1.333 ms. Each AICH message is 1 ms long. There are 15 access slots in 20 ms.

At low loading conditions, UTRAN may decide to only make a subset of the CPCH channels available based on the demand.

To indicate to the UE where the cycle ends [in case of a variable period], it is possible to have an OFF cycle where nothing is transmitted before repeating the new cycle. This reduces any signaling overhead that may be needed to update UEs knowledge on the changing periodicity. This allows fast adaptation to changing resource availability at the Base Node. UE shall also commence each cycle every two frames.

Some examples:

For example if there are 3 Free messages to be sent in the entire 20 ms, then the Base Node will transmit in the following manner:

F1F2F3-F1F2F3-F1F2F3----F1F2F3- …

If there is a change and a channel becomes busy [CPCH #2], then the sequence changes to:

F1F3-F1F3-F1F3-F1F3-F1F3-F1F3-…

This fits perfectly in the 20 ms timing structure.

CPCH Status Indication Channel (CSICH)

In order to specify and detail the above-mentioned concept, we introduce the CPCH Status Indication Channel (CSICH) in the downlink direction. This channel is a broadcast channel. The UE will only monitor this channel prior to packet transmission.

The CSICH is a Status broadcast channel used to carry Free Indications (FI). Free Indicator FI_i corresponds to signature *i* which corresponds to a PCPCH.

Figure 22 illustrates the frame structure of the CSICH. Two CSICH frames of total length 20 ms consist of 15 *access slots* (AS), each of length 20 symbols (5120 chips). Each access slot consists of two parts, an *Free-Indicator* (FI) part and an empty part.

The FI-part of the access slot is generated the same manner as the AI part of the AICH. The empty part of the access slot consists of 4 zeros. The phase reference for the CSICH is the CPICH.

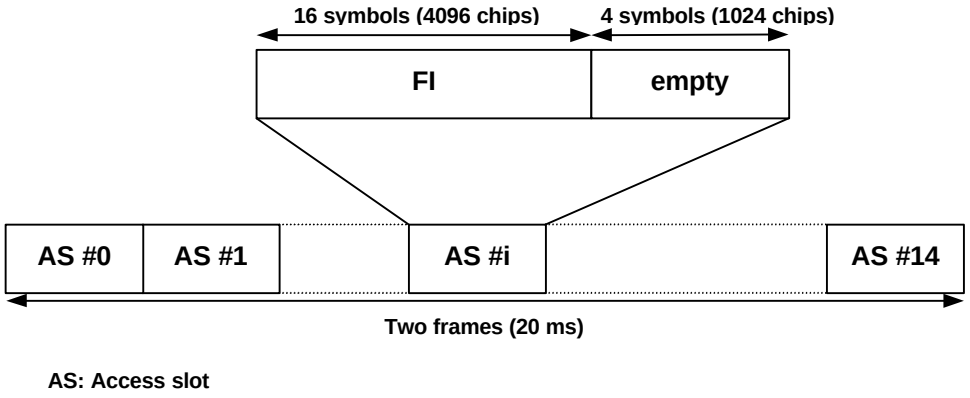

Figure 22: Structure of CPCH Status Indication Channel (CSICH)

The Free Indicators will be broadcast on CSICH consecutively starting from AS#0. After all indicators are sent, there will be a OFF period equivalent to an Access Slot. The new cycle begins after the OFF period.

The impact on the Physical Layer procedure:

The CPCH status capture procedure in the physical layer is:

1) Node B continuously broadcasts CPCH status by transmitting CD-AICH_naks with signatures that correspond to currently available (free) CPCH channels.

2) The UE MAC function requests CPCH status from physical layer by sending a PHY-Status-REQ primitive indicating a request to receive the broadcast CPCH status from Node B.

3) Upon receipt of a PHY-Status-REQ primitive requesting CPCH status, the UE obtains CPCH status by receiving any CD-AICH_naks which may be transmitted by Node B. In each access slot the UE:

   a) Attempts to receive a CD-AICH_nak in the next access slot.

   b) If a CD-AICH_nak is not received in the current access slot, continues from step a) above.

   c) If a CD-AICH_nak is received, the UE lists in the CPCH status table the CPCH transport channel ID which corresponds to the signature received in the CD-AICH_nak.

   d) If this CPCH transport channel ID is already listed in the CPCH status table, the UE removed the duplicate CPCH transport channel ID from the CPCH status table and proceeds to step 4) below.

e) If this CPCH transport channel ID is not already listed in the CPCH status table, the UE continues from step a) above.

4) The UE sends a PHY-Status-IND primitive to UE MAC including as a parameter the CPCH status table created in step 3) above.

Advantages:

UTRAN can minimize the transmission of Free-AICHs at low loading condition and at the same time is forced to transmit a minimal number of available CPCH channels at high loading condition.

1. Normally, there will be a few Free messages transmitted over the Status Broadcast Channel. This leads to shorter monitoring period within the 20 ms time-frame.
2. Transmission of few Free messages also leads to less gap time in the CPCH channel utilization.
3. It is also possible to only transmit these messages once every 20 ms, reducing any impact on downlink capacity.
4. It is also possible to continually transmit the Free messages as described above and let the UE monitor for 2 periods. This will reduce the error rate on the Free-AICH to BER ^{2}. For example if the operating point was 0.1, then it will reduce to 0.01.
5. At low perdiocity such as 2.66 ms-4.99 ms, the UE power consumption due to monitoring will be minimum.
6. At low periodicity, the throughput delay performance of the CPCH access method with channel monitoring will be near optimum.

Recommendation

Adopt the CPCH Status Broadcast method described in this contribution.

3GPP TSG RAN WG1 (Radio) Meeting #9
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Document R1-99i34
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.214	CR	020	Current Version:	V3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	WG1#9	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)*

(U)SIM		ME		UTRAN / Radio	X	Core Network	

Source: GBT **Date:** 24 Nov 1999

Subject: Support the channel monitoring for CPCH Access

Work item: TS25.214

Category: *(only one category shall be marked with an X)*

F	Correction		**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: To introduce the changes needed to support the channel monitoring for CPCH access.

Clauses affected: 6.2

Other specs affected:

Other 3G core specifications		→ List of CRs:	
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:

6.2 CPCH Access Procedures

For each CPCH physical channel in a CPCH set allocated to a cell the following physical layer parameters are included in the System Information message:

- UL Access Preamble (AP) scrambling code.
- UL Access Preamble signature set
- The Access preamble slot sub-channels group
- AP- AICH preamble channelization code.
- UL Collision Detection(CD) preamble scrambling code.
- CD Preamble signature set
- CD preamble slot sub-channels group
- CD-AICH preamble channelization code.
- CPCH UL scrambling code.
- CPCH UL channelization code. (variable, data rate dependant)
- DPCCH DL channelization code.([512] chip)

NOTE: There may be some overlap between the AP signature set and CD signature set if they correspond to the same scrambling code.

The following are access, collision detection/resolution and CPCH data transmission parameters:
Power ramp-up, Access and Timing parameters (Physical layer parameters)

1) N_AP_retrans_max = Maximum Number of allowed consecutive access attempts (retransmitted preambles) if there is no AICH response. This is a CPCH parameter and is equivalent to Preamble_Retrans_Max in RACH.

2) $P_{RACH} = P_{CPCH}$ = Initial open loop power level for the first CPCH access preamble sent by the UE.

   [RACH/CPCH parameter]

3) ΔP_0 = Power step size for each successive CPCH access preamble.

   [RACH/CPCH parameter]

4) ΔP_1 = Power step size for each successive RACH/CPCH access preamble in case of negative AICH. A timer is set upon receipt of a negative AICH. This timer is used to determine the period after receipt of a negative AICH when ΔP_1 is used in place of ΔP_0.

   [RACH/CPCH parameter]

5) T_{cpch} = CPCH transmission timing parameter: This parameter is identical to PRACH/AICH transmission timing parameter.

   [RACH/CPCH parameter]

NOTE: It is FFS if ΔP_0 for the CPCH access may be different from ΔP_0 for the RACH access as defined in section 6.1.

The CPCH status capture procedure in the physical layer is:

1) Node B continuously broadcasts CPCH status by transmitting CD-AICH_naks with signatures that correspond to currently available (free) CPCH channels.

4) The UE MAC function requests CPCH status from physical layer by sending a PHY-Status-REQ primitive indicating a request to receive the broadcast CPCH status from Node B.

5) Upon receipt of a PHY-Status-REQ primitive requesting CPCH status, the UE obtains CPCH status by receiving any CD-AICH_naks which may be transmitted by Node B. In each access slot the UE:

   a) Attempts to receive a CD-AICH_nak in the next access slot.

   b) If a CD-AICH_nak is not received in the current access slot, continues from step a) above.

   c) If a CD-AICH_nak is received, the UE lists in the CPCH status table the CPCH transport channel ID which corresponds to the signature received in the CD-AICH_nak.

   e) If this CPCH transport channel ID is already listed in the CPCH status table, the UE removed the duplicate CPCH transport channel ID from the CPCH status table and proceeds to step 4) below.

   e) If this CPCH transport channel ID is not already listed in the CPCH status table, the UE continues from step a) above.

4) The UE sends a PHY-Status-IND primitive to UE MAC including as a parameter the CPCH status table created in step 3) above.

The CPCH -access procedure in the physical layer is:

1) The UE MAC function selects a CPCH transport channel from the channels available in the assigned CPCH set The CPCH channel selection includes a dynamic persistence algorithm (similar to RACH) for the selected CPCH channel.

2) The UE MAC function builds a transport block set for the next TTI using transport formats which are assigned to the logical channel with data to transmit. The UE MAC funtion sends this transport block set to the UE PHY function for CPCH access and uplink transmission on the selected CPCH transport channel.

3) The UE sets the preamble transmit power to the value $P_{CPCH\_}$ which is supplied by the MAC layer for initial power level for this CPCH access attempt.

4) The UE sets the AP Retransmission Counter to N_AP_Retrans_Max (value TBD).

5) The UE randomly selects a CPCH-AP signature from the signature set for this selected CPCH channel. The random function is TBD.

6) The UE Derives the available CPCH-AP access slots in the next two frames, defined by SFN and SFN+1 in the AP access slot sub-channel group with the help of SFN and table 7 in section 6.1. The UE randomly selects one access slot from the available access slots in the next frame, defined by SFN, if there is one available. If there is no access slot available in the next frame, defined by SFN then, randomly selects one access slot from the available access slots in the following frame, defined by SFN+1. Random function is TBD

7) The UE transmits the AP using the MAC supplied uplink access slot, signature, and initial preamble transmission power.

8) If the UE does not detect the positive or negative acquisition indicator corresponding to the selected signature in the downlink access slot corresponding to the selected uplink access slot, the UE:

   a) Selects the next uplink access slot from among the access slots in the CPCH-AP sub-channel group, as selected in 4.1. There must be a minimum distance of three or four access slots from the uplink access slot in which the last preamble was transmitted depending on the CPCH/AICH transmission timing parameter. [NOTE: Use of random function here to select access slot is FFS for RACH and CPCH.].

   b) Increases the preamble transmission power with the specified offset ΔP . Power offset ΔP_0 s is used unless the negative AICH timer is running, in which case ΔP_1 is used instead..

   c) Decrease the Preamble Retransmission Counter by one.

   d) If the Preamble Retransmission Counter < 0, the UE aborts the access attempt and sends a failure message to the MAC layer.

9) If the UE detects the AP-AICH_nak (negative acquisition indicator) corresponding to the selected signature in the downlink access slot corresponding to the selected uplink access slot, the UE aborts the access attempt and sends a failure message to the MAC layer. The UE sets the negative AICH timer to indicate use of ΔP_1 use as the preamble power offset until timer expiry

10) Upon reception of AP-AICH, the access segment ends and the contention resolution segment begins. In this segment, the UE randomly selects a CD signautre from the signature set and also select one-CD access slot sub-channel from the CD sub-channel group supported in the cell.and transmits a CD Preamble, then waits for a CD-AICH from the Node B.

11) If the UE does not receive a CD-AICH in the designated slot, the UE aborts the access attempt and sends a failure message to the MAC layer.

12) If the UE receives a CD-AICH in the designated slot with a signature that does not match the signature used in the CD Preamble, the UE aborts the access attempt and sends a failure message to the MAC layer.

13) If the UE receives a CD-AICH with a matching signature, the UE transmits the power control preamble $\tau_{cd\text{-}p\text{-}pc\text{-}p}$ ms later as measured from initiation of the CD Preamble. . The transmission of the message portion of the burst starts immediately after the power control preamble.

14) During CPCH Packet Data transmission, the UE and UTRAN perform inner-loop power control on both the CPCH UL and the DPCCH DL.

15) If the UE detects loss of DPCCH DL during transmission of the power control preamble or the packet data, the UE halts CPCH UL transmission, aborts the access attempt and sends a failure message to the MAC layer.

16) If the UE completes the transmission of the packet data, the UE sends a success message to the MAC layer.